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31 October 1980

Japan Report

(FOUO 29/80)

STATUS OF DEFENSE INDUSTRY

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STATUS OF DEFENSE INDUSTRY

Tokyo NIHON NO BOEI SANGYO [JAPAN'S DEFENSE INDUSTRY] in Japanese 23 Aug 79 pp 1-217

[Book by Kazuo Tomiyama]

CONTENTS

[Text] 1. The Other Defense Issue

The debate on the defense issue has attracted increasing attention in recent years, centering on the argument for promotion of arms export, the move to abolish the defense spending ceiling (under 1 percent of the GNP for the time being), the "emergency" legislation, etc. In his policy speech at the Diet in January 1978, former prime minister Fukuda became the first postwar prime minister to present the defense issue as a separate item on the agenda. The debut of the "hawk" prime minister added intensity to the defense debate, while the strong influence of the arms producing trend in industry coinciding with the shift to a low-growth economy became an underlying factor.

Also, relative to the recent signing of the Japan-China peace treaty and normalization of U.S.-China relations, the U.S.-Japan mutual security pact is undergoing a different kind of appraisal. When the Chinese leaders adopted a positive attitude towards Japan's defense capability with a forward-looking evaluation regarding the U.S.-Japan security pact, Japanese reformist groups were somewhat perplexed. As such concern towards the defense issue increases, the more important it becomes to accurately understand the nature of our defense industry.

Since early 1979 the people have been suspicious regarding the question of importing the Grumman E-2C as an early warning plane (AEW). The previous "Lockheed affair" was greatly shocking as a display of "the suspicious behavior of a prime minister." It concerned the sale of passenger planes to private enterprise which revealed the close union between government officials and the business community, as well as manipulation of government officials by politicians pressing for vested rights. A similar case occurred in late 1978, when the U.S. Securities Exchange Commission (SEC) indicted the Douglas Aircraft Company regarding aircraft sales. The recent case involved more serious problems based on doubts surrounding government purchases of military aircraft. In the process of clarifying those doubts, there is strong suspicion that politicians may have played a role in the purchase of the F-4EJ fighter plane and the selection of the about-to-be-imported J-15. The search for the truth depends on the turn of future events, but the overall picture could be buried without clarification except for partial revelations.

Nothing is so corrupt as competition over sales of military aircraft. It involves the structural factor of common interests between three parties: the producer whose operations cannot make ends meet without selling his aircraft somewhere; the trading company which seeks to negotiate a "good deal" at substantial gains; and the politician who is unable to "sustain his level of spending" without vested rights through connections with such business firms. The problem is not confined to only certain companies, but constitutes a common and latent factor among all of today's specializing munitions enterprises.

Since 1950, Japan has in reality taken the road to rearmament and is doing so today. Moreover, its weapons are now largely produced domestically. Undeniably Japan depends highly on the U.S. and Europe for its aircraft. But concerning the scale of its defense industry as a whole, it rates among the world's most productive nations. The defense debate cannot be understood by isolating it from such realities of the defense industry. Nonetheless, in comparison to the mounting interest in the defense debate towards such specific issues as the import of military aircraft, public awareness towards the defense industry cannot be said to be very high in general. It is impossible to understand the essential nature of the defense industry by merely taking up the industry's individual problems as they occur and then forgetting about them later.

There are very few documents which explain Japan's defense industry as a whole. There are quite a few which explain the present holdings of arms and equipment, but they merely refer to the stockpiles of Japan-made and imported arms. Those which refer to the industry are often limited to listings of principal weaponry and main contractors. We know that the production of main arms and equipment is concentrated in a few enterprises. On the other hand, it should be realized that, while the enterprises deeply involved in the defense industry may limit their production to specialized military uses, their numbers are considerable. It cannot be definitely stated whether even such basic facts, such as the variety of arms and their producers, have been sufficiently made clear.

This treatise aims to outline Japan's defense industry on the basis of such circumstances. The objective is first and foremost the defense industry as it exists today. It does not refer to conditions prior to World War II and it limits the period under survey to the post-1950 era. Without denying the technical and business connections to the previous era, minimal reference is made to it. Also, foreign munitions industries and the import of equipment are mentioned only in the context of their relationship to Japan's defense industry.

II. Nature of Defense Industry

1. Enterprise Groups that Surround Defense Agency

It seems that the term "defense industry" is more often used in a broader sense than that of the weapons industry or munitions industry. Yet it is not easy to describe an industry which has a certain cohesiveness as a defense industry.

In Japan arms export has not been recognized in principle, and limits to the size of the defense industry are determined by the amount of procurement set by the Defense Agency. Since imports (mostly aircraft, missiles, etc.) are included in the procurement, the size of the defense industry can be generally assumed to be total procurements less imports. Of course, this is the so-called "general framework" and includes not only arms but also provisions and clothing. Therefore, there is quite a variety in content. Leaving aside

analyzing the contents, we shall first take a look at the overall framework and the enterprises concerned.

A good portion of the Defense Agency's procurement budget is set by the Central Procurement Office (CPO). Three methods used by the CPO are: general competitive bids, designated competitive bids and free option contracts. In terms of cost, designated bids and free option contracts play a large role. But the greatest number of enterprises are involved in general competitive bids. At any rate, in order to participate in the CPO bids, the bidders must be registered as qualified companies.

The goods procured by the Defense Agency and the firms consigned are numerous. Generally speaking, the only fact being pointed out is that procurements are concentrated in a certain number of business establishments (the tendency is conspicuous regarding main weapons). But the fact must not be overlooked that many other companies supply various equipment although in smaller quantities.

We will take a look at the "qualified companies" listed by the CPO. In 1978 there were 2142 suppliers listed (See Table II-1).

Table II-1: Qualified Suppliers (1978)

(Category)	(Producer)	(Seller)	(Total)
Weapons	13	2	15
Electric Communications	240	45	285
Military Supplies	263	142	405
Textile Goods	173	60	233
Leather Goods	14	3	17
Rubber Goods	31	4	35
Ammunition	15	0	15
Chemical	57	29	86
Sanitation	107	142	249
Food Provisions	38	19	57
Fuel	26	27	53
Ships	96	4	100
Machinery	251	94	345
Vehicles	50	13	63
Aircraft	52	5	57
Imports	0	104	104
Transportation/Labor	0	7	7
Leases	0	14	14
Consignments	0	2	2
Total	1,426	716	2,142

(Date: "General State of the Central Procurement Office")

Lack of space requires omitting concrete details concerning these supplies. However, a concrete description of each category will be provided in order to clarify the extent of these enterprise groups. Since our emphasis here is on domestic industries, we will begin with the producers.

First, in the "weapons" category, there are 13 companies, including Nissei Machine Works, Ishikawa Seisakusho, Kobe Steel, Shin Chuo Kogyo, Nittoku Metal Industry, Japan Steel Works and Howa Machinery.

In the "electric communications" category, there are 240 companies. The principal suppliers are Ikegami Tsushinki, Iwasaki Tsushinki, Oki Electric Industry, Shin Kobe Electric Machinery, Tateishi Electric Machinery, Shibaura Engineering Works, Shiba Electric, Shinko Electric, Sumitomo Electric Industries, Tokyo Keiki, Toshiba, Toyo Tsushinki, Toyo Electric Manufacturing, Nippon Aviotronics, Nippon Electric, Victor Co of Japan, Hitachi, Fujitsu, Fuji Electric, Furukawa Electric, Matsushita Communications Industrial, Matsushita Electric Industrial, Matsushita Electronics Corp, Mitsubishi Electric Corp, Meidensha Electric Manufacturing, The General Co, Yaskawa Electric Manufacturing, Yokogawa Electric Works, Mitsubishi Precision, Aiwa, Tokyo Electric Chemical Industries, Oki-Univac Kaisha, Hishiden Special Machinery and Kanegafuchi Chemical Industry.

In the "supplies" category, there are 263 companies which handle office machines and instruments, kitchen appliances and utensils, and illumination and photographic equipment and materials. They include Gakushu Kenkyusha, Canon, Sekisui Chemical, Nippon Light Metal, Fuji Photo Film, Ricoh, Asahi Optical, Nikkatsu Corp, Tokyo Electric, Aichi Tokei Denki, Citizen Watch, Hitachi Thermal Appliances, Idemitsu Petrochemical, Sunwave Industries, Dantani Plywood, Shochiku Motion Pictures, Toho Motion Pictures, Toei Motion Pictures, Pilot Pen and Fuji Xerox.

There are 173 companies in the "textile goods" category which include all major companies in the cotton spinning and synthetic fiber trades. They include Asahi Chemical Industry, Asahi-Dow, Kanebo, Kurabo Industries, Kuraray, Kureha Chemical Industry, Teijin, Toyobo, Toray Industries, Unitika, Nissin Spinning, Fujikura Parachute, Mitsubishi Rayor and Mitsukoshi Sewing. The "leather goods" category has 14 companies which supply shoes and bags. They include Otsuka Shoe, Toyo Cloth and Nippon Shoe.

The "rubber goods" category lists 14 companies. The chief suppliers are Kokoku Chemical Industries, Sumitomo Rubber Industries, Toyo Rubber Industry, Nippon Goodyear, Okamoto Riken Gomu, Bridgestone Tire and Yokohama Rubber.

There are 15 companies in the "ammunition" category, including Asahi Seiki Manufacturing, Ricoh Watch, Japan Carlit, Nippon Kayaku and Daikin Kogyo.

As many as 57 companies are listed in the "chemical" category, including Kansai Paint, Shinto Paint, Onoda Cement, Nippon Paint, Nippon Oils and Fats, Riken Keiki Fine Instruments, Showa Highpolymer, Sumitomo-3M and Fujikura Kasei.

The "health and sanitation" category lists 107 companies which supply mainly medicines and medical care (therapeutic) equipment. They include Eisai Co, Olympus Optical, Kyowa Hakko Kogyo, Shionogi & Co (pharmaceutical), Tanabe Seiyaku, Daiichi Seiyaku, Takeda Chemical Industries, Sharp Corp, Yamanouchi Seiyaku, Meiji Seika, Toyo Tanabe, Konishiroku Photo Industry and Hitachi Medical Corp.

The "provisions" category lists 38 companies including Daiichiya Bakery, Cupie Co, Taiyo Fishery, Morinaga Milk Industry, Snow Brand Milk Products, Morinaga & Co and Takasaki Ham Co. There are 26 companies in the "fuel" category centering on petroleum products. Included are Teikoku Oil, Hokkaido Colliery & Steamship, Idemitsu Kosan, Maruzen Oil, Mitsubishi Oil and Showa Oil Co.

Included in the 96 companies in the "ships" category are Ishikawajima Harima Heavy Industries, Kawasaki Heavy Industries, Sasebo Heavy Industries, Nippon Kokan, Hakodate Dock, Hitachi Shipbuilding & Engineering, Mitsui Shipbuilding & Engineering, Mitsubishi Metal, Yamaha Motor, Yanmar Diesel Engine, Hokushin Electric Works, Ebara Manufacturing, Mitsubishi Steel Manufacturing, Sumitomo Shipbuilding & Machinery, Nippon Steel, Mitsubishi Chemical Industries and Kurushima Dockyard Co.

The 251 companies in the "machinery" category rate second only to the "supplies" category. They include Ikegai Iron Works, O-M Seisakusho, Nippon Nogaku, Ishii Iron Works, Mitsui Seiki Kogyo, Sumitomo Metal Industries, Furukawa Mining Co, Fuji Robin Industries, Riken Seiki Machine Works, Nippondenso, Sanyo Electric, Toyoda Machine Works, Hitachi Koki and Tokyo Keiso Co.

The "vehicles" category lists 50 companies which include Isuzu Motors, Caterpillar Mitsubishi, Komatsu International Manufacturing, Komatsu Ltd, Suzuki Motor, Tokyu Car Corp, Toyo Kogyo, Toyoda Automatic Loom Works, Nissan Motor, Honda Motor, Tadano Iron Works, Nippon Trailmobile, Nippon Sharyo Seizo and Yanase Co.

Finally, there are 52 companies in the "aircraft" category. They include Showa Aircraft Industry, Shin Meiwa Industry, Mitsubishi Heavy Industries and Japan Aircraft Manufacturing. More details will be given later. Kawasaki Heavy Industries and Ishikawajima Harima Heavy Industries also belong here, but are already listed in the "ships" category.

As the foregoing lists show, the "qualified suppliers" are numerous and varied. Most of the top companies of the various industries are listed. In addition to these 1,426 companies (only 174 have actually been named, while some 1,250 companies have been omitted). There are some 700 companies which handle sales. Not a few among the sales firms were formerly distribution divisions of manufacturing concerns and have become independent enterprises (e.g. Toyota Motor Sales, Mitsubishi Motor Sales, etc.). It is evident therefore that, in addition to the aforementioned producing companies, a considerable number of enterprises have the capability of supplying products

through their directly affiliated but independent firms. And, of course a large number of producing companies are affiliated with general sales firms. Also, the aforementioned producers often have their own chain companies or cooperating companies. The defense industry is thus widely and deeply involved in Japan's industrial activities.

There is a total of some 104 "qualified suppliers" which deal in imports. In the mainstream are the general trading firms which are also specialized enterprises dealing in the import of special equipment. Examples are C Itoh & Co, Sumitomo Corp, Nissho Iwai Co, Marubeni Corp, Mitsui & Co, Mitsubishi Corp, Kanematsu Gosho, Toyo Menka, Nissho Iwai Aerospace Co and C Itoh Aviation Co. The products imported by these companies often include important equipment, but this should be considered as a separate issue from defense production.

Among the "qualified suppliers" are the dealers who principally render services concerning the distribution of goods to the Defense Agency, such as transportation, storage and packaging. There are also dealers who lease and rent computers, etc. We have so far given an outline of the variety of businesses receiving procurement orders from the Defense Agency, and the variety is considerable. (See Note) Herein lies a basic problem in analyzing the defense industry or munitions industry.

Note: In addition to the aforementioned procurement items, the Defense Facilities Administration Agency handles new construction, repairs and management of facilities. The participating firms are listed as "registered contractors for construction projects." This could probably be included under munitions in a broad sense, but since there is no space to give details, our figures will be limited to general items. The "registered contractors for construction projects" include 5,509 companies for complete projects and 6,153 companies for special projects, or a total of 11,662 companies. "Participants in design, planning and supervision" include 149 companies for complete projects and 685 companies for special projects, or a total of 834 companies. The grand total includes 12,496 companies (FY75).

2. Nature of Defense Industry Productivity

Definition of "Military Use"

Procurement goods may be divided into ordinary commercial products and specialized "frontal equipment" for military purposes. Defense needs in the broad sense or munitions usually pertain to procurements as a whole, but quite often they pertain only to specialized frontal equipment.

Clearly, only specialized equipment for war purposes are not sufficient to maintain an army. Therefore, any defense industry which is the base of military power should include, in addition to production of specialized equipment for war purposes in a narrow sense, broader production for war support. Although both types could be defined as defense industries, there is clearly a distinct difference between the two.

In other words, specialized war equipment have the following characteristics: (1) Since they are specialized toward military objectives, their use is not of a general nature. And even when converted to general use, they are extremely limited in scope. (2) The relationship between supply and procurement is limited to special enterprises. It is an exclusive relationship which begins at the trial manufacture stage when the Defense Agency seeks to import specific equipment, and once the equipment is imported the relationship does not change fundamentally as long as the equipment is under use. Such a military-industrial relationship will be discussed later with respect to actual equipment.

Consequently, there are specific suppliers organized to provide specific categories of equipment such as firearms, tanks, aircraft, etc. But the distinction between specialized products for military use and those for non-military use is not an absolute one, and sometimes industrial products for general use are diverted to military use. It is quite important to note this potentiality of general industrial products.

In analyzing the defense industry, we are apt to emphasize the typical aspects of the industry in the narrow sense. But it is also necessary to bear in mind the fringe industries or the latent potentiality of converting them to military purposes. Typical examples of general industrial products being used intact for military purposes are jeeps and trucks (of course, some are produced as military vehicles). However, as we have seen during the Vietnam war, products by Japanese makers of electric machinery were used as parts and components for TV-guided weapons, and general industrial products are modified or converted for military use.

Even materials researched and developed for purely peaceful purposes have the potential of being converted to military use. In Japan, R&D of observation rockets has been conducted since 1955 as a space development project (more accurately, a research group was formed and began activities in 1954). In April of the same year, the Tokyo University Production and Technical Research Institute began launch tests on the "Pencil" rocket (See Note 1). It was quite primitive compared to today's rocket quality, but rocket research is basically research in transport methods and, depending on the means of transport, rockets could be used for either military or peaceful purposes. Therefore, rockets were later involved in the issue of "arms export." For instance, in April 1967 the Tokyo University rockets which were being exported to Yugoslavia and Indonesia became an issue at the Diet as having the capability of being converted as weapons. The rocket satellites launched by Tokyo University and the National Space & Development Agency today are capable of carrying tactical warheads. This does not mean R&D is being conducted for such military purposes. Rather, regardless of the subjective goal of research, we point to the cold fact that the end result could be development of the rocket as a transporting device and conversion to military purposes. We emphasize that awareness of this fact would contribute towards vigilance against such conversions (See Note 2).

Note 1: The test launch of the "Pencil" rocket was conducted in the weapons test launch pit of the firearms producer, Shin Chuo Kogyo Co. Hideo Itogawa,

director of the research project, was formerly in charge of military aircraft (the Model 97 [M97] carrier-based attack plane) developed at the Nakajima Aircraft Mfg Co. This could be regarded as a good example of technology and knowhow being utilized for defense-related purposes.

Note 2: For example, the launch rocket called the "N-rocket" could now put a 130-140 kg satellite into orbit. The modified version (N-II rocket) is being developed with the goal of launching a 350 kg satellite into orbit. The domestic production ratio of the N-rocket is slightly above 50 percent. But the company in charge of its production is the same company which produces military rockets.

Latent Defense Industry Productivity

Let us develop the subject further and discuss the latent capability of today's so-called "peacetime industries" in turning to militarization. Japan's industries have concentrated on heavy chemical industrialization during the era of high economic growth, and productivity in potential weaponry has increased. The development of the machine industry in a broad sense (manufacture of general industrial machinery, transport machinery and precision equipment) underscores this point. To understand this, one need only to recall the role played by the American car industry during World War II. The American car makers supplied 20 percent of all U.S. munitions with the production of 5,950,000 firearms (47 percent of the national volume of machine guns and 56 percent of all carbine rifles); 2,810,000 tanks and military trucks (57 percent of all tanks); and 27,000 finished aircraft. Moreover, the majority was achieved through conversion of existing facilities dating back to 1942. In other words, a nation's latent defense productivity is closely related to its economic and industrial capabilities. This is one reason why any inclination of the economy and industry towards defense production must be cautioned and forestalled.

The same logic applies to national wealth. When one realizes that there are in Japan today 30 million cars, including more than 10 million trucks, the possibility exists that they may be used for military mobilization under unusual circumstances. The police forces and Maritime Safety Agency (MSA) have greater potential in becoming militarized. In fact, the mine sweeping forces of the Maritime Safety Agency were deployed in the Korea Sea in 1950 to support activities of the American Far East fleet and suffered casualties in ships and human lives. This fact had been reported only piecemeal and was then confirmed by the then director of the MSA in 1978. (See Note)

Note: It was reported in Takeo Okubo's book, "Roaring Days At Sea." (1978) The book deals at length with the process leading to the establishment of the MSA, but a more interesting fact is that the book treats the MSA function as a partial takeover of the old Imperial Navy with the U.S. Coast Guard as its ideal. It includes a memoir by a participant in the Korean War.

In today's society, many things are latently capable of being converted to military use. But a realistic analysis would point to those industries

which are involved in the production of special equipment for military use, based on sufficient understanding of their latent capabilities.

3. Present State of Defense Production

Scale and Items of Procurement

The present combat capability of the Defense Agency (Self Defense Forces) is viewed as being far superior to that of the "Imperial Army and Navy" during World War 2. The fact was generally accepted that, when the third 5-year buildup plan was completed, the Self Defense Force combat strength surpassed the old Japanese armed forces. During the present fourth buildup plan, seven years later, the SDF has become yet more powerful.

Table II-2: Defense Agency Procurement By Categories

(Unit: 100 million yen; Item)

(Category)	(1973) (Items)	(1973) (Cost)	(1975) (Items)	(1975) (Cost)	(1977) (Items)	(1977) (Cost)
Weapons	300	453.8	235	238.3	258	505.1
Communications	2,811	426.5	2,230	506.9	2,433	540.6
Supplies	1,816	62.1	1,386	74.7	2,143	107.3
Textile Goods	470	42.5	400	52.6	387	57.0
Ammunication/Chemical	409	130.0	321	150.4	370	198.7
Fuels	1,472	112.0	1,914	253.7	1,723	334.1
Ships	124	113.0	99	465.2	64	552.1
Machinery	760	24.9	539	25.8	460	50.4
Vehicles	297	187.2	269	251.0	285	266.2
Aircraft	1,058	1,155.5	914	1,443.0	818	1,523.1
Trial Products	63	81.6	78	93.0	66	104.0
General Imports	839	148.9	445	90.3	522	117.7
FMS	120	159.6	88	80.8	96	160.3
Total	10,539	3,097.6	8,918	3,725.7	9,625	4,516.6

(Defense Agency Data)

The difference is not in manpower. The decisive factor for the difference in combat strength between the old military forces is the difference in equipment. Whether it concerns arms, tanks, battleships or aircraft, the efficiency of the frontline equipment in each category is significant. Also, most of the equipment is produced domestically. It signifies great progress in Japan's productivity.

The ratio of the defense industry to Japan's overall manufacturing industry is the lowest among the advanced industrial nations. Even in terms of defense production in the broad sense, the ratio to general industrial exports is only between 0.3 to 0.4 percent. But aside from this ratio, in terms of the absolute volume of defense productivity or in terms of combat strength resulting from its equipment, the level of Japan's defense productivity ranks among the world's leaders. Therefore, it behooves us to understand its conditions accurately.

Whenever the state of Japan's defense productivity is questioned, the first data to be cited are the itemized procurement figures, the procurement record of principal suppliers (usually the top 20 companies) and the principal items of procurement (recent figures show each item in excess of 1 billion yen). Such data are of course elemental and important. The itemized procurement figures (See Table II-2) show the procurement scale and a breakdown of figures by items. Of course, by items we mean not individual products but a cumulation by category. At the same time, a general procurement outline is indicated. For example, according to the table, the procurement of aircraft ranks at the top. Second position is divided between communications equipment, ships and weapons, depending on the year. Also, the procurement of fuels and vehicles is tabilized from year to year, while the figures for ammunition and chemical equipment (despite heavy reliance on munitions needs) are not so stable.

Arms Manufacturers

Data concerning the suppliers of defense procurement is provided by the Table on Shifts in Defense Agency Procurement Orders to Principal Suppliers (See Table II-3) and the Table on Principal Items of Procurement (See Table II-4). The tables show that suppliers of expensive equipment such as aircraft, ships and electronic machinery and equipment rank at the top.

Table II-3: Shifts in Defense Agency Procurement Orders to Principal Suppliers

(Unit: 100 million yen)

(Ranking Order) (1973)	(Company Name)	(Amount)
1	Mitsubishi Heavy Industries	611.9
2	Mitsubishi Electric Corp	363.7
3	Ishikawajima Harima	308.3
4	Kawasaki Heavy Industries	203.8
5	Toshiba	111.9
6	Shin Meiwa Industry	83.4
7	Nippon Electric	54.4
8	Komatsu Ltd	53.3
9	Hitachi	50.7
10	Sumitomo Shoji	40.0
11	Fuji Heavy Industries	39.2
12	Shimadzu Seisakusho	39.1

(Ranking Order)	(Company Name)	(Amount)
13	Nippon Koki Kogyo	32.5
14	Nissho Iwai	28.9
15	Mitsubishi Precision	27.1
16	Tokyo Keiki	26.1
17	Japan Steel Works	24.9
18	Isuzu Motors	24.4
19	Daikin Kogyo	24.4
20	Nissan Motor	21.9
(1975)		
1	Mitsubishi Heavy Industries	911.8
2	Ishikawajima Harima	564.5
3	Kawasaki Heavy Industries	218.6
4	Mitsubishi Electric Corp	207.7
5	Nippon Electric	91.3
6	Toshiba	82.4
7	Shin Meiwa Industry	64.3
8	Japan Steel Works	61.2
9	Komatsu Ltd	54.7
10	Fuji Heavy Industries	52.3
11	Shimadzu Seisakusho	45.6
12	Hitachi Shipbuilding	41.2
13	Nippon Oil	40.8
14	Nippon Koki	38.3
15	Tokyo Keiki	33.8
16	Hitachi	30.8
17	Oki Electric	30.1
18	Daikin Kogyo	29.4
19	Maruzen Oil	27.1
20	Mitsubishi Motor Sales	27.1
(1977)		
1	Mitsubishi Heavy Industries	973.7
2	Kawasaki Heavy Industries	395.6
3	Ishikawajima Harima	364.5
4	Mitsubishi Electric	349.0
5	Toshiba	127.3
6	Sumitomo Heavy Machinery	116.7
7	Nippon Electric	105.2
8	Shin Meiwa Industry	88.8
9	Komatsu Ltd	83.8
10	Mitsui Shipbuilding	65.0
11	Hitachi	64.0
12	Nippon Oil	60.9
13	Fuji Heavy Industries	56.6

(Ranking Order)	(Company Name)	(Amount)
14	Japan Steel Works	52.6
15	Shimadzu Seisakusho	50.8
16	Nissan Motor	44.8
17	Nippon Koki	44.3
18	Oki Electric	43.6
19	Tokyo Keiki	35.9
20	Hitachi Shipbuilding	34.5

(Date: From Defense Agency)

A look at Mitsubishi Heavy Industries' figures for FY77 shows a total of some 97.4 billion yen allocated mostly to large orders as follows: approximately 11 billion yen for tanks (45 tanks of two M74 types); approximately 9.4 billion yen for a mine sweeper vessel (1); approximately 4.2 billion yen for HSS-2B type aircraft (4); approximately 19.7 billion yen for F-4EJ fighter planes (12); and approximately 19 billion yen for F-1 support fighter planes (18).

Figures for Kawasaki Heavy Industries show a total of some 39.6 billion yen, broken down into approximately 14.3 million yen for one (1) submarine; approximately 3.4 billion yen for main machinery carried on one (1) defense escort vessel; and approximately 6.3 billion yen for two (2) C-1 transport planes. In the case of Ishikawajima Harima Heavy Industries, out of a total of some 36.5 billion yen, about 20.2 billion yen is allocated to aircraft engines (73 turbo engines) alone. Similar cases are seen with respect to Mitsubishi Electric Corp and Toshiba.

The top companies share the bulk of total procurement. But the following two points must be emphasized. (1) Although these companies supply procured goods directly to the Defense Agency, in many cases they mobilize a large number of parts makers to produce the goods. (2) In addition to the top suppliers, there are numerous companies which supply specialized equipment for military use.

The defense industry has a broad base. Nonetheless, in tracing its ramifications one should not vaguely confuse its extensions with industry or the economy at large. The main equipment consists mostly of assembled products and systematized products. Numerous suppliers of parts, machinery and instruments participate in their manufacture. Sometimes their organizational structure takes the form of parent company-subcontractor in a vertical relationship. In other cases they are interlinked in a horizontal relationship. The true relationships of these industries have hitherto not been made very clear. Even the conditions of domestic equipment production have not been understood concretely in terms of actual equipment. This is not only due to the complexity of their makeup, but perhaps also to the emphasis put only on certain companies or certain equipment. The defense industry should be understood in terms of a single and whole industry.

Table II-4: The Defense Agency's Principle Items of Procurement (FY77; each item in excess of 1 billion yen)

(Procuring Office)	(Item)	(Quantity)	(Cost) Unit: 100 mil. yen	(Contractor)
GSDF Staff Office				
	Modified "Hawk" guided missile system components (1)	1 set	93.6	Mitsubishi Electric Corp
	M74 tanks	25	58.3	Mitsubishi Heavy Industries
	M74 tanks (equipped with noctovision sights)	20	51.5	" " "
	Modified "Hawk" guided missile system components (2)	1 set	46.0	Toshiba
	M73 large trucks	355	18.1	Isuzu Motor
	155 mm howitzers	10	16.6	Japan Steel Works
	105 mm HMI howitzer shells	40,926	13.1	Komatsu Ltd
	105 mm tank gun mounts	48	12.7	Japan Steel Works
	Short-range SAM induction shells (test shells)	1 set	12.3	Toshiba
	M75 105 mm adhesion shells Type 2	12,248	12.0	Komatsu Ltd
	M75 mobile 155 mm howitzers	10	11.0	Mitsubishi Heavy Industries
MSDF Staff Office	Submarine (8089)	1	142.5	Kawasaki Heavy Industries
	Defense escort ship (2201)	1	116.5	Sumitomo Heavy Industries
	Mine layer ship (1002)	1	93.5	Mitsubishi Heavy Industries

(Procuring Office)	(Item)	(Quantity)	(Cost)	(Contractor)
MSDF Staff Office	Defense escort ship (1226)	1	64.8	Mitsui Shipbldg
	Ocean environmental survey system (1)	1 set	48.3	US Navy Dept
	HSS-2B type aircraft	4	42.1	Mitsubishi Heavy Industries
	US-1 type aircraft	1	33.6	Shin Meiwa Industry
	Main machy for defense escort ship (2201)	1	33.5	Kawasaki Heavy Industries
	PS-1 type aircraft	1	27.2	Shin Meiwa Industry
	Medium minesweeper (350)	1	24.0	Hitachi Shipbldg
	Instruments for ship-to-ship missile SSM system	1 set	23.5	US Navy Dept
	Medium minesweeper (351)	1	12.4	Nippon Kokan
	P-2J overhaul	11	16.0	Kawasaki Heavy Ind
	Main batteries for subs	For 1 sub	13.5	Yuasa Battery
	Short-range SAM system and components for target indicator system	1 set	13.5	US Navy Dept
	Batteries for subs	4 sets	12.4	Nippon Denchi
	Parts/supplies for mine layer ship	1 set	12.3	US Navy Dept
	Main machy (gas turbine for defense escort ship 1226)	for 1 ship	10.4	Kawasaki Heavy Ind
	Parts/materials for SSM system	1 set	10.2	US Navy Dept
ASDF Staff Office	F-4EJ aircraft	12	196.7	Mitsubishi Heavy Ind
	F-1 support fighter planes	18	190.0	Mitsubishi Heavy Ind

ASDF Staff Office	TF40-1H1-801A turbo fan engines (for aircraft)	36	106.4	Ishikawajima Harima
	AIM-7E missiles	180	82.0	Mitsubishi Elect Corp
	C-1 transport planes	2	62.9	Kawasaki Heavy Ind
	J79-1H1-17 turbojet engines (for aircraft)	24	56.5	Ishikawajima Harima
	TF40-1H1-801 turbo fan engines (for maintenance)	13	38.8	" "
	Original parts for F-1 engine (Japan-made)	1 set	34.2	" "
	Firing control systems JA-APQ-120	12	29.5	Mitsubishi Elect Corp
	Original parts for F-4EJ engine	1 set	16.8	Ishikawajima Harima
	Original parts for F-4EJ airframes (Japan-made)	1 set	20.8	Mitsubishi Heavy Ind
	Original parts for F-1 airframe	1 set	20.8	" " "
	T-2 (late model) flight simulator	1	20.2	Mitsubishi Precision
	Stabilized 3-dimension radar system FPS-2	1 set	16.8	Nippon Electric
	Firing control systems J/ANG-12	18	16.5	Mitsubishi Elect Corp
	T-3 primary trainer planes	12	12.2	Fuji Heavy Industries
	Inertial navigation systems J/ASN-1	18	11.8	Japan Aviation Electronics
	JT8D-M-9 turbofan engines (for aircraft)	4	11.4	Mitsubishi Heavy Ind
	Periodic repairs for F-104F aircraft/frames	25	11.2	" " "

	Periodic repairs for F-104EJ/DJ aircraft & airframes	23	10.5	Mitsubishi Heavy Ind
ASDF Staff Office	20 mm regular shells	649,937	10.0	Nippon Koki Kogyo
	AIM-9J-1 missiles	135	10.0	US Air Force Dept
Defense Agency Technical R&D Inst	2nd-stage trial manufacture of shortrange ASM projectile	1 set	31.0	Mitsubishi Heavy Ind
	New type OH communication system (XJ/FRQ-501)	1 set	10.1	Nippon Electric

III. Revival and Growth of Defense Industry

1. Beginning With Special Procurement

The resumption of Japan's defense industry after the war actually coincided with the beginning of rearmament in 1950. It was triggered by the breakout of the Korean War. But at the outset, the resumption of defense production was not directly related to Japan's rearmament.

The Korean War and Special Procurement

The Korean War began on 25 Jun 50. In July of the same year, SCAP commander-in-chief Gen MacArthur sent a letter to Prime Minister Yoshida urging rearmament and the increase of Maritime Safety Agency personnel. On receipt of the letter, the Police Reserve Corps Act was promulgated and implemented in August of the same year. It was the first step toward rearmament linked to the present Self Defense Force (the MSA increased its personnel by 8,000 men). The duty of the Police Reserve Force was "to maintain peace and order in Japan and to maintain public safety." The following September (1951), the peace treaty with Japan was signed and at the same time the U.S.-Japan joint security pact was concluded. These two treaties became effectice on 28 Apr 52. Almost simultaneously (on 26 April), the Maritime Police Force was established within the already existent Maritime Safety Agency. It was the predecessor of the present Maritime Self Defense Force.

At any rate, Japan's military forces, which thus made a fresh start, were to be equipped with arms provided by the US armed forces. Of course, they were hardly the most advanced weapons, but were surplus arms produced and left over from World War II. On the other hand, since immediately after the outbreak of the Korean War, "special procurements" brought relief to Japan's economy which was suffering from the so-called "Dodge inflation." Textile products constituted much of "special procurement," but the volume of arms-related production was also considerable. Thus US-made arms were provided to Japan's military forces and Japan-made weapons were supplied to the American armed forces which were fighting the Korean War.

Japan's defense production thus made a new start through the formula of "special procurement." "Special procurement" was directly pegged to the Korean war, but the arms produced were not directly related to Japan's rearmament. However, there is no denying the fact that it helped to foster the revival of Japan's defense industry. The chief suppliers of firearms, etc, for the Defense Agency today made their debut during that time. We will expand on this point with data obtained from the Economic Deliberation Agency.

"During the first year (July 1950-June 1951), special procurement contracts totalled approximately 329 million dollars (goods - 230 million dollars; services - 99 million dollars). Textiles led with 62.53 million dollars of 27 percent of total goods. During the first half of the year, contracts for jute bags (used for sandbags) constituted an overwhelmingly large share, but in the last half woolen blankets, cotton cloth and clothing increased for seasonal reasons. Transport machinery was second, totalling 43.99 million dollars. They consisted mostly of trucks, while railroad freight cars, steam locomotives and other rolling stock and batteries made up the rest. Metal products were third, totalling 35.03 million dollars. They included large contracts for napalm tanks, aircraft fuel tanks, barbed wire poles, metal frame buildings, oil drums (55-gallon) and fuel tanks (165-gallon). These items reflected the fierceness of the war going on. Among service-related contracts, repairs occupied the largest share, totalling 39.6 million dollars. Auto repairs were conspicuous, while ship and engine repairs were also significant."

(From the OFFICIAL GAZETTE 10 May 54. Underlined portions are by the citer)

This indicates that wars are not only conducted with weapons, but also consume various goods. At the same time, it should be noted that, already by this time, "metal products" such as napalm tanks had appeared on the scene. The napalm bomb was one of the most important weapons used by US armed forces during the Korean War. The special procurement of napalm tanks totalled 7.3 million dollars for the entire Korean War.

"Special procurements during the second year (July 1951 - June 1952) totalled 331 million dollars or almost the same as the first year (goods - 246 million dollars; services - 85 million dollars). Among the goods, metal products led with 45.19 million dollars - including large orders for barbed wire, barbed wire poles and steel building materials; and oil drums were also ordered in large quantities. Weapons-related orders constituted an over-whelming majority. On the heels of new contracts for shuttlecock bombs and parachute flare bombs for the air force, orders began to come in for complete (finished) weapons late in this period and attracted great attention. Orders for textile goods were less than the first year, but the procurement worth 44.72 million dollars equalled the orders for metal products."

(From the OFFICIAL GAZETTE 10 May 54)

Toward the end of the period -- in other words, when the peace treaty with Japan became effective -- the emphasis of procurement by the US armed forces shifted to finished weapons. Prior to this, a General Command directive on 8 Mar 52 served notice that the production and repairs of weapons and aircraft would be possible by permission from the General Command hdqtrs. Accordingly, on 8 Apr 52 the Japanese Government revised and implemented the "Potsdam Ministerial Decree" (joint decree by the ministries of MITI, Transportation, Education and Agriculture) controlling production of arms, aircraft, etc., thus opening the way to systematic arms production. Whereas arms production had previously been "contraband," (See Note) it could now be conducted openly.

Note: The companies involved at this time were Shin Meiwa Industry, Fuji Industries, Shin Mitsubishi Heavy Industries, Kawasaki Heavy Industries, et al.

The financial community also moved adroitly to meet the new situation. The Federation of Economic Organizations ("Keidanren")--hoping for US military aid, the buildup of Japan's defense strength and U.S.-Japan economic cooperation following the signing of the peace treaty--formed the "Nichibei Keizai Teikei Kondankai" (Japan-U.S. economic cooperation deliberation society) in February 1951. As procurement orders for finished weapons entered full swing, the society was reorganized as the "Keizai Kyoryoku Kondankai" (Economic cooperation discussion society) and the "Defense Production Committee" was established as one of its subcommittees in August 1952. There were two other subcommittees under the "discussion society" which barely functioned. The defense production committee has subsequently been active as a central organization representing the financial community within the defense industry.

Full-scale Arms Production

The procurement of finished weapons entered full sway after May 1952. The Korean war was already drawing to an end (the ceasefire treaty was signed in July 1953), and "special procurements" for the Korean War shifted to MSA assistance and overseas special procurement. However, in Japan the total picture is not clear--whether the arms and ammunition and repaired vehicles ordered under "special procurement" were shipped to the Korean peninsula by the U.S. armed forces, or whether they were left in Japan or Southeast Asia, or exported to the NATO countries. (See Note)

Note: It has been confirmed that the ammuniton procured from Japan during this period was stockpiled and used in the Vietnam War.

Also, 18 weapons-related companies actively invested in facilities until the end of 1954, with the bulk reportedly financed through capital increases and internal reserves. Except for those who depended on self-capitalization, the majority have relied on state (national) capital. Those financed by the Export-Import Bank were Komatsu Ltd, Osaka Metal Industry, Nippon Oils & Fats, Asahi Chemical Industry and Dai Nippon Celluloid Co. Those financed by MSA wheat funds were Takano Precision Industry, Asahi-Ohkuma Industry, Toyo Seiki, Toyo Chemical Industry and Japan Steel Works. (The MSA pact was signed on 1 Mar 54 and became effective 1 May. The wheat funds were allocated systematically to defense-related industries.)

We will next look at the production of finished weapons under "special procurement." The amount of orders on finished weapons which Japan received from the U.S. armed forces from May 1952 to June 1957 reached 52 billion yen (144.6 million dollars).

In US FY52 (which began in July of the previous year and ended in June 1952. The actual special procurements took place during the 2 months of May and June, since the peace treaty became effective in April of that fiscal year), and special procurements totalled some 5.5 billion yen. The main items were as follows:

4.2 inch mortars (528, by Osaka Kiko Co)
81 mm mortar shells (630,000, by Osaka Metal Industry and Komatsu Ltd)
4.2 inch mortar shells (360,000, by Komatsu Ltd)
Flare bombs for 81 mm mortars (32,000, by Nippei Industrial Co)
Smoke bombs (70,000, by Komatsu Ltd)

In US FY53, orders almost quadrupled from the previous year and totalled 20.7 billion yen. The breakdown by companies was as follows:

Kobe Steel Works (various types 105 mm howitzer shells - 750,000)

Komatsu Ltd (155 mm howitzer shells - 260,000;
4.2 inch mortar shells - 270,000)

Osaka Metal Industry (various types 81 mm mortar shells - 800,000;
57 mm recoilless gun shells - 110,000)

Daido Steel Co (various types 60 mm mortar shells - 280,000)

Nippon Kentetsu (3.5 inch rocket shells - 475,000)

Howa Machinery (hand grenades - approximately 1.2 million)

Nippei Industrial Co (bazookas, bayonets, grenade throwers for rifles, anti-tank land mines and 12.7 mm rifle ammunition - quantity unknown)

Japan Steel Works (57 mm recoilless guns - 837)

Sumitomo Metal Industryes (75 mm recoilless gun shells - 198,000)

During US FY54, contracts increased to 22.8 million yen. Followup orders for items being supplied constituted a major portion. But there were also new items on order and the chain of ammunition producers was virtually complete during this period. A major role was played towards that end by the Weapons Manufacture Act established in August 1953 and government coordination of enterprises based on a permit system.

New orders were received for the trial manufacture of 81 mm mortars (24, by Howa Machinery) and 75 mm recoilless guns (16, by Japan Steel Works), as well as the following:

7.7 mm rifle bullets (122 million, by Asahi-Ohkuma Industrial and Toyo Seiki Co)

4.2 inch mortar smoke bombs (10,000, by Komatsu Ltd)

155 mm howitzer smoke bombs (25,000, by Komatsu Ltd)

3.5 inch rocket smoke bombs (22,000, by Nippon Kentetsu)

Smoke grenades (quantity unknown, by Howa Machinery)

105 mm howitzer shells with clock fuses (571,000, by Kobe Steel Works)

155 mm howitzer shells with clock fuses (89,400, by Komatsu Ltd)

81 mm howitzer shells with time fuses (8,000, by Osaka Metal Ind)

The production chain formed to supply these orders is shown in Table III-1. It is evident that it was comprised of companies which subsequently supplied ammunition to the Defense Agency.

Table III-1: Production Chain for Supply of Ammunition

Rifles and pistols - *Asahi Ohkuma Industrial, Toyo Seiki

Cannon shells - *Osaka Metal Industries, "Komatsu Ltd, Daido International, Sumitomo Metal Industry, Kobe Steel Works

Rocket shells - *Osaka Metal Industries, Nippon Kentetsu

Fuses - *Osaka Metal Industries, Takano Precision Industries, Aichi Tokei Denki, Sanoh Industrial, Shin Chuo Industry, Eikosha, Dowa Metal Industries

Cannon shell cartridges - *Osaka Metal Industries, Kobe Steel Works

Smokeless gunpowder - *Asahi Chemical Industry, *Dai Nippon Celluloid, *Nippon Oils & Fats

TNT - *Nippon Oils & Fats, Mitsubishi Chemical Industry, Mitsui Chemical

RDX - *Showa Kayaku Kogyo

Gunpowder charges - *Showa Kayaku

Notes: (1) *denotes companies supplying directly to the Defense Agency.
(2) Most of these companies are suppliers today.
(3) The company names were in use in 1954.

Several companies produced relatively simple items like cannot shells. From 1954 to 1955, the Osaka Metal Industries (present Daikin Kogyo Co), Kobe Steel Works and Komatsu recorded the production of 1 million shells each. Celebrations were held (twice) to commemorate the achievements at which the presidents of Kobe Steel Works (Chohei Asada) and Komatsu Ltd (Yoshinori Kawai) gave speeches. (See the Keidanren's "Ten Year History of the Defense

Production Committee," pp 81-83). President Asada announced that Kobe Steel's ammunition contracts "did in fact reach 44 million dollars (15.84 billion yen)" and he continued:

"We have decided to supply the various parts and components, each according to our special fields in order to provide finished shells. In other words, Kobe Steel has supplied the shell frames, Shinko Metal Industry the cartridges, Mitsubishi Chemical Industry the TNT explosives, Dai Nippon Celluloid the discharge powder, Takano Precision Industry the regular fuses and clock fuses, Sanyo Kako and Chugoku Kayaku the powder charges and assembly, and Hishimori Industry the fiber containers, respectively. Also, we have asked for the cooperation of such outstanding producers in their respective fields as Eikosha, Nippon Kayaku Kogyo and Sanoh Kogyo in order to complete the production chain."

(Underlined portions by citer)

The payments received are described as having "equally benefitted Kobe Steel and its affiliated companies, as well as a large number of subcontractors, and also contributed to the revival of Japan's defense industry." (ditto) President Kawai of Komatsu Ltd expressed pride in having supplied 38 million dollars (13.68 billion yen) worth of goods and services. He then went on to express irritation at the lack of large orders for the future: "In any case, we have succeeded in completing one of our projects without mishap. Today, one company alone has the capacity of easily producing large gauge gun shells at the rate of 1 million annually, and it is not impossible to produce 5 million in an emergency.

As far as ammunition is concerned, we are able to comply with the demand in the Southeast Asian countries, in addition to fulfilling Japan's defense needs.

We are not only without regrets for having engaged in this project, but we have also built a vast export industry for Japan. We have offered job opportunities for a great mass of workers, provided work for a great number of small and medium businesses, and have in effect built a bulwark for the nation's defense."

(Underlined portions by citer)

Another element which played an important role in "special procurement" was repairs performed as part of "services." Special procurement repairs were performed on many items, among which automobiles and other vehicles constituted the greatest share in the early stage. Fuji Jidosha, Shin Nippon Aircraft, Victor Auto, Bridgestone Tire, Mitsubishi Nippon Heavy Industries (Tokyo plant), ditto (Kawasaki plant), Showa Aircraft Industry, Sagami Industries, Komatsu Ltd, Hino Diesel, Japan Steel Works (Akabane plane) and ditto (Musashi plant) utilized former military facilities in meeting orders. The income from repairs for such vehicles was considerable, but often contained an element of uncertainty from the standpoint of business management.

The demand for aircraft-related repairs had a different kind of importance. In July 1952 immediately after the peace treaty became effective, orders were received for the dismantling and repair of light communication planes, and this became the first step in the revival of the Japanese aircraft industry. (The recipient of these orders was Showa Aircraft Co). Subsequently, orders were received for the repair of fighter planes and training craft (Kawasaki Aircraft Co and Shin Mitsubishi Heavy Industries), engine overhaul (Showa Aircraft Co), and repair of flight instruments, auxiliary instruments and communication devices (Tokyo Aircraft Instrument, Tokyo Keiki, Japan Radio, Shinko Electric, Japan Aviation Electronics Industry and Kayaba Industry).

Table III-2: Japan's Arms Exports (1956-68)

(Year)	(Client)	(Item)	(Quantity)	(Cost: in dollars)
1956	Burma	6.5 mm rifle bullets	899,000	84,150
1957	Burma	6.5 mm rifle bullets	100,000	8,570
	Taiwan	M91 torpedoes	20	500,000
	Brazil	9 mm pistols	1	45
	S. Vietnam	Rifle bullets	24,000	6,480
	S. Vietnam	Rifle ammunition plant	1	950,000
1958	S. Vietnam	Rifle bullets	24,000	7,200
1959	Indonesia	Firing control system	1 set	83,000
1960	Indonesia	Machine gun parts		36,200
	India	Practice mines	2	12,975
1961	Indonesia	Machine gun parts		125,100
1962	USA	Pistols	about 800	9,300
1963	USA	Pistols	" 3,000	37,500
	Indonesia	Machine gun parts		24,000
1964	USA	Pistols	" 5,000	66,000
1965	Thailand	Hunting rifles	5,000	540,000
	Thailand	Rifle bullets	2,500,000	230,000
	USA	Pistols	about 7,000	97,000
1966	Thailand	Hunting rifles	5,000	540,000
	USA	Pistols	about 8,000	132,000
1967	USA	Pistols	" 12,000	
1968	USA	Pistols	" 15,000	

(Source: KOKUBO, August 1970 edition)

From 1953 to 1954, jet aircraft repairs were added. Through this experience it became possible to learn new techniques concerning hitherto unfamiliar jet airframes and engines (F-86 jet fighters and T-33 jet trainers, on which orders were received by Mitsubishi Heavy Industries and Kawasaki Aircraft Co). In 1955, the overhaul of F-86D all-weather fighters (by Japan Aircraft Mfg Co) and repairs for the navy twin-engine planes and flying boats (by Shin Meiwa Industry) were added. It thus became possible to comply with orders for repairs in virtually every field. This proved to be of great value later in the production of jet aircraft.

Since the detailed progress of subsequent "special procurement" is not the purpose here, it will be omitted. Eventually, with the decline of "special procurement," arms exports were limited to a trickle of small firearms for Southeast Asia and the United States. Known Japanese arms exports after 1956 were as indicated in Table III-2. The costliest in dollar terms was the rifle ammunition plant exported to South Vietnam in 1957 and, symbolically, it was merely a second-hand surplus facility belonging to Toyo Seiki Co. (The facilities of the Asahi Ohkuma Industry Co were sufficient for supplying similar needs in Japan. Also, although not shown in the table, a new rifle ammunition facility was shipped to the Philippines in FY68.)

2. Evolvement of Equipment Development

Establishment of the Self Defense Force and Its Equipment

Japan's armed forces which made a new start as the Police Reserve Force subsequently organized its system at a steady pace. Soon after the peace treaty with Japan became effective, the National Security Agency was established (August 1952), the Police Reserve Force was renamed as the National Security Force and the aforementioned Maritime Police Force was renamed as the National Police Force. It thus became a unified organization. On 8 Mar 54 the so-called MSA agreement was signed. On the same day, the "two Self Defense Force Law resolutions" (the Defense Agency establishing resolution and the Self Defense Force Law resolution) were submitted to the Diet. The two SDF laws went into effect on 1 Jul 54. By virtue of the laws, the previous Security Agency was renamed the Defense Agency, the Security Force became the Ground Self Defense Force (GSDF), the Police Force was reorganized as the Maritime Self Defense Force (MSDF) and the Air Self Defense Force (ASDF) was newly established. Thus the Self Defense Force, consisting of the ground, sea and air services, was organized as a single entity.

The main duties of the SDF are defined as "the defense of Japan against direct and indirect invasion, as well as the maintenance of public order as necessary." Whereas the Police Reserve Force defined its purpose as "the maintenance of public order," the SDF put primary emphasis on resistance against "invasion." This could be said to clarify the military nature of the SDF.

The equipment of the SDF (the terms "SDF" or "Defense Agency" will be omitted in later references to the period following the advent of the Police Reserve Force, unless it is necessary in explaining the various systems.) consisted mostly of those provided by the US armed forces in the early stage. This is clear from the record of weapons procurement. (See Table III-3)

Table III-3: Record of Equipment Procurement (unit: 100 million yen)

(Fiscal Year)	(Domestic Procurement)	(General Imports)	(Onerous Aid)	(Free Aid)	(Total)
1950-61	5,907	266	253	5,234	11,661
1962	975	76	41	204	1,296
1964	1,120	70	60	81	1,332
1966	1,396	126	55	59	1,636
1968	2,425	124	194	1	2,745
1970	2,308	156	51	0	2,515
1972	3,477	358	117	0	3,951
1974	4,372	152	89	0	4,613
1976	5,197	166	122	0	5,486
1977	5,846	222	194	0	6,261

Note:
1. Figures for domestic procurement, general imports and onerous aid were based on original contracts. Figures for free aid were based on equipment received.

2. Free aid includes lend-lease ships. Receipt of free aid ended with FY69.

(Data) Based on Defense Agency data.

During the 12 years from 1950 to 1961, the cumulative total for domestic procurement was 590.7 billion yen, comprising about 1/2 of total procurements. Most of the remainder consisted of free aid. This covers a 12-year span and the ratio of free aid was greater retroactively. At first, all equipment was provided by the United States. Even today, there is quite a volume of remaining equipment provided to the GSDF and MSDF in their formative years (mostly firearms).

Equipment procured by the Defense Agency from Japan's own defense industry was virtually nonexistent from 1950 to 1953. During the years 1954-56, it amounted to several hundreds of million yen annually; in 1957 it rose to 1.15 billion yen; in 1958 to 1.57 billion yen; and in 1959 to 5 billion yen.

As for the defense industry, it responded to the reorganization of the Police Reserve Force as the Security Force, and further as the SDF, and it sought a market to replace special procurements. But, because of the defeat in the

war and the subsequent vacuuous state of the nation, and also because of the technological gap and competition from U.S. surplus weapons, things did not work out smoothly for the industry.

Role of the Defense Agency's Technical R&D Institute

Meanwhile, the SDF's plans for technical surveys and research on weapons, ships, aircraft, provisions and facilities moved forward quite early in its formative stage. Concurrently with the establishment of the National Security Agency, the Agency's Technical Research Institute was formed as its subsidiary. Preparations for it had been made for more than a year since July 1951. The NSA's Technical Research Institute emphasized (1) research on standardization of equipment; (2) improvement of existing equipment and (3) uniformity of materials and standards for parts and components. Much of the research was conducted for remodeling purposes. Principal items of R&D were machine gun mounts for vehicles, snow tractors, radio equipment for vehicles, materials for parachutes, heavy snow plows, practice shells for mortars, magnetic materials, radar testing systems and high tensile steel (for ship structures). The NSA Technical Research Institute was reorganized as the Defense Agency Technical Research Institute in July 1954. It became the Technical Research & Development Institute in May 1958 when the 1st defense buildup plan began and it assumed an important role in equipment development for the Defense Agency.

The divisions of the Defense Agency directly involved in R&D are: (1) the Internal offices, (2) Technical R&D Institute, (3) GSDF staff office, (4) MSDF staff office and (5) ASDF staff office. Details concerning these offices will be omitted, but of course the Internal Bureau, centering on the defense division and the materiel division, plays the most important role. The Technical R&D Institute coordinates R&D affairs for the ground, maritime and air branch forces, while the R&D themes are actually determined by the Internal Bureau and the Equipment Inspection Conference.

The reason for focusing attention on the Technical R&D Institute is because it plays a major role in the domestic equipment production. The production consists of using technology developed and imported from foreign countries on the one hand, and the use of technology by Japan itself on the other. The latter, including equipment technology, is tagged as "genuinely Japan-made" and originated mostly from themes adopted by the Technical R&D Institute. More will be explained later concerning the relationship between Japan-made equipment and R&D by the institute. However, prior to that, an extremely important fact must be pointed out concerning the development methods of the institute. That is, during the R&D process, trial manufacture is as a rule consigned to private enterprise.

When the results of trial manufacture are translated into standardization and deployment of equipment, the companies in charge of trial manufacture almost invariably are selected as the actual producers, resulting in a close union between industry and the military. Therefore, it is of major concern to the companies how they can relate to the Technical R&D Institute at the trial manufacture stage (or even at a prior stage). Very little has been clarified thus far regarding these relations.

In any case, it is our view that activities of the institute are significant as prior indicators of domestic equipment production. It is also possible to forecast the future of Japan's equipment from the present ongoing R&D. Moreover, the presence of private enterprise is inseparable from such forecasts.

Progress of R&D

Changes have also occurred in R&D themes. It can be said that there are qualitative differences between the simple firearms adopted in the early stage and those of the present. Here is a brief explanation of the trends.

(a) R&D During the 1st Five-Year Defense Buildup Plan

A look at the period prior to the 1st buildup plan (up to FY57) indicates that equipment procurement was by no means conducted systematically, but R&D was initiated in such areas as aircraft, guided missiles and communications equipment, where Japan was generally lagging. The principal items were bulletproof steel plates, 105 mm recoilless guns and ammunition, miniaturized communications equipment components, reciprocal pulse jet engines and light metal ship structures (FY54); long-range air defense radar, snorkel apparatus, medium size tanks, guided projectiles, antisub torpedoes (FY55); armored tractor vehicles, medium-range jet fighter planes; supersonic projectiles and gas turbines (FY56); 155 mm howitzers; UHF communications equipment, forklift apparatus, induction mines and air-to-air rockets (FY57).

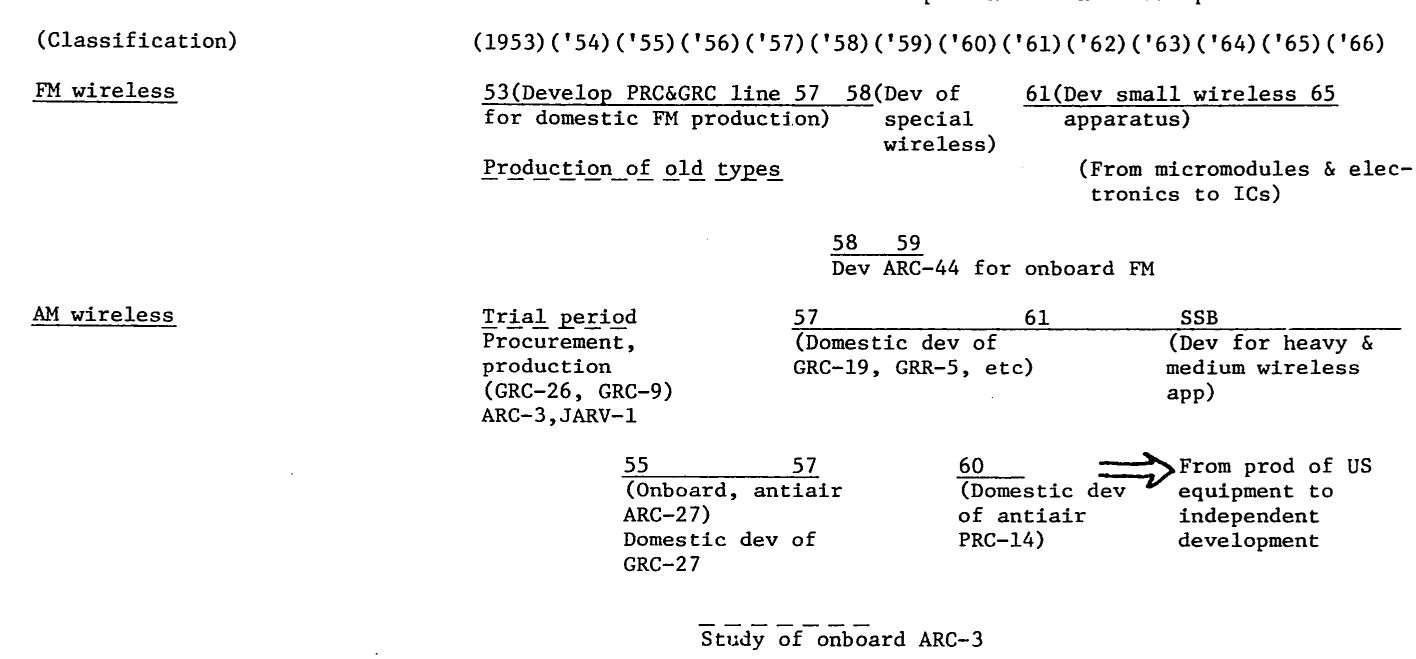
Chart III-1: R&D During Early Period (Part 1)

(Classification)	(1953) ('54) ('55) ('56) ('57) ('58) ('59) ('60) ('61) ('62) ('63) ('64) ('65) ('66)
	1st Buildup Plan / 2nd Buildup Plan
Aircraft	
Intermediate jet trainers	T-1A/B 56 — 58 — — For T-1B and P-2J aux engine
Liaison planes	L-19E 56 — 57 — — — Domestic production, Modification study
J3 engines	J3-3 type 55 — 58 J3-7 63 — 66
P-2J antisub patrol planes	Domestic production 65 — 66; Modification study
Unmanned aircraft	53 Unmanned plane — 57 — — — — — 60 HiSpeed target p 1 64 — — —
Missiles	
M30 rockets	55(Large) 57(200mm) 59 60(300 mm) 62 (M67/30 type) — — —
Antitank rockets	56 — — 57(M64 antitank missile) 62 — — — —
SAMs	(Ericon, TLRM, medium&large rockets, guidance sys, TSAM studies; Domestic production of SAM parts; basic study and trial 55 manufacture of short SAM)
AAMs	56 (AAR) 58 (AAM-I) 62 — — — (AAM-II)
Land weapons & vehicles	
Snow tractors	53 (M60-3t, M61 large) — 58
Mobile recoilless guns	54 (M60 106 mm) — 59
Tanks	— — 55(Medium, special, M61) 59 (2 cycle engine, etc) 64(New type M74)
Armored trucks	56 — 57 (M60 armored)

(Classification)	1st Buildup Plan (1953)('54)('55)('56)('57)('58)('59)('60)	2nd Buildup Plan ('61)('62)('63)('64)('65)'(66)
Land weapons & vehicles		
155 mm mortars	54 ———	61 _ _ _
105 mm light howitzers	57 ———	62 _ _
105 mm howitzers	56 ——— 58 (105 mm mobile howitzer also trial manufactured during 1957-58)	
155 mm howitzers	56 ——— 58	
Mobile mortars	56 ——— 58 (M60 81 mm & 107 mm mortars)	
Machine guns & rifles		
Machine guns	56(M62 7.62 mm guns) 60 _ _ _ _ _	
Rifles		62 ——— 63(M64 7.62 mm rifles)
Radar		
Medium range radar	57 (No.1 JTPS-P6 ground radar) ———	
Short range radar		62 (No.2 JAN/PPS-4 ground radar)
Antiaircraft radar		65(JTPSP5 radar)
Fixed 3-dimension radar		62(JFPS-1) ———
Ships		
Ships	———	Ship designs ———

Note: ——— Development period _ _ _ _ Research/trial manufacture, survey & testing period

Chart III-2: R&D During Early Period (Part 2)



1st Buildup Plan — 2nd Buildup Plan

(Classification) (1953)('54)('55)('56)('57)('58)('59)('60)('61)('62)('63)('64)('65)('66)

Wire conveyance equipment

- Old models (Procurement/prod of TC series(CF-1, CF-2)) – – –
- 55 (Domestic dev of small & new TTC series) 60
- (New S-4 cable, TCC-3,4,7,8,11,14)
- – – – – (Domestic dev of field exchanger, interphone)
- 60 (Dev heavy, medium, light conveyances) 65
- – – – – – (Dev of control apparatus for connection of wire and wireless equipment) ⇒ Domestic dev of KDD Type

Wireless relay equipment

- – – Old models (Procurement/prod of TR, SV series) – – – –
- 58 (Domestic dev of CRC-10, TRC-24) 59 – – – – –
- 55 (Dev 7500 MH2 relay system) 57
- 60 (Dev heavy, medium & light wireless conveyances) 65
- ⇒ (Independent development of KDD Type)

Note: ________ Development period — – – – – – Period of research/trial manufacture, survey and testing

The following is a review of the main themes by time periods. FY58 was the beginning of the 1st defense buildup plan (in May of that year the Technical Research Institute was reorganized as the Technical R&D Institute). As far as R&D themes were concerned, Charts III-1 and III-2 show that among aircraft items the intermediate jet trainer and the J3 engine continued to be taken up, while missile and rocket related items continued to be active themes through the 2nd buildup plan. As for development of land weapons and vehicles, many items were terminated during the 1st buildup plan. Among wireless communications equipment, it is evident that much progress was made during the 1st buildup plan.

(b) R&D During the 2nd Defense Buildup Plan

R&D policy during the 1st buildup plan (FY62-66) may be boiled down to two points. They are (1) first, to establish the base for a defense system which could effectively counter localized invasion through the use of conventional weapons and, (2) second, to promote technological R&D in order to contribute to the enhancement of defense power. Principal themes were those tied to mainline equipment enhancing mobility, the application of electronic technology and the domestic production of various types of rockets and missiles and the F-104J.

(c) R&D During the 3rd Defense Buildup Plan

R&D policy during the 3rd buildup plan (FY67-71) was (1) to promote technical R&D and contribute to the advancement of modern equipment and Japan's technological level, and at the same time to domestically produce appropriate equipment and cultivate the defense base; (2) to conduct R&D on various types of missiles, equipment and materials, such as advanced training planes, radar-equipped warning devices, transports and other aircraft, and shortrange SAMs; and to strengthen the technical R&D structure. Characteristically, domestic equipment production has been pushed vigorously to the forefront and the content of equipment has been advanced to a high level. In July 1970, the Defense Agency's policy on the defense industry was set as follows:

(1) Basic policy on equipment production and development

(a) Defense strength from the standpoint of equipment is based on the nation's industrial strength, centering on its manufacturing industry, and as such attention will be focused on the buildup of the production system. (b) Independent development and domestic production of equipment will be promoted. (c) The development capability and technology of private enterprise will be utilized for the development and production of equipment. (d) The development and production of equipment will be promoted on the basis of planning with attention to efficiency, economy and safety. (e) Positive efforts will be made to import and establish the principle of competition for the development and production of equipment.

(2) Buildup Policy for Defense Industry (details omitted)

(a) Induction of the principle of fair competition; (b) procurement based on fair prices; (c) efforts to ensure fair production scales; (d) discretion

regarding arms export; (e) thorough procedures regarding industrial secrets; (f) establishment of appropriate defense production standards; and (g) development and production by domestic industries.

(3) Policy for Promotion of R&D

(a) To implement priority R&D (it is necessary for the time being for development to be centered on aircraft, guided weapons, and electronic machines and instruments). (b) To establish a long-range plan for R&D (to draft a longrange development plan based on Japan's defense concept and to implement it systematically. In drafting the plan, to avoid overlapping and gaps between the three service branches and to give consideration to each category of equipment in line with duties from the standpoint of efficient development). (c) To broaden possible options for R&D (to strive for improvement of the R&D base and the options for equipment development; to push necessary measures for securing funds in order to actively elicit new concepts and designs). (d) To improve development capabilities by introducing the principle of competition (to adopt an appropriately competitive formula for each stage of design and trial manufacture; to maintain fair competition; to cultivate areas with a less competitive base in order to render them more competitive; to secure development funds enabling a plurality of companies to engage in competitive trial manufacture of items requiring trial manufacture). (e) To revert the results of development to national ownership (to separate development/trial manufacture from mass production and equipment consigned to private enterprise. The results of R&D consigned to private enterprise will be promoted on the principle of reversion to national ownership. Towards that end, fair payment of costs for the design and trial manufacture consigned to private enterprise will be guaranteed at the various stages.) (f) To consolidate and perfect the development system (to give important consideration to the various branches of national R&D; to strive to firm up development planning, testing, inspection capability, ample facilities and a flexible development system). (g) To make a thorough evaluation of R&D (to be thorough in evaluations and take decisive measures for continuation or termination of R&D). (h) To ensure technological and information capability (details omitted). (i) To secure R&D personnel (details omitted).

To what extent are the foregoing policies being implemented? What is clear is that the policy regarding the development and production of equipment in "mainly utilizing the development and technological capabilities of private enterprise" reflects the actual conditions existing today. But it can also be said that the introduction of the principle of competition is hardly being implemented, especially concerning principal equipment.

Now for a look at the principal R&D themes during the 3rd buildup plan. The renovation of such conventional weapons as mobile howitzers, new armored trucks and tow vehicles is noteworthy. (See Charts III-3 and III-4).

Chart III-3: R&D During 3rd-4th Buildup Plans (Part 1)

(Classification)	2nd Plan (-1966)	3rd Buildup Plan (1967)	(1968)	(1969)	(1970)	(1971)	4th Buildup Plan (1972)	(1973)	(1974)	(1975)	(1976	Post 4th Plan (1977-)
Aircraft												
Antisub patrol planes	63-65,	66 (PS-1)		68	_ _ _							
Medium transports	_ _ _	66		(C-1)			70	_ _ _				
Supersonic jet trainers		_ _ _	67		(T-2)			71	_ _ _			
Antisurface support fighters							_ _	72 (Modified FS-T2)		74	_ _	
Guided missiles												
Close range SAMs	_ _ _	66 (Trial manufacture)	_ _ _ _ _				69	(Short SAM)				76 (Test) _
Short range SAMs		_ _ _	67					(Short SSM)			74	_ _
Medium antitank missiles												76 (Medium anti-tank missile)
AAMs		_ _	66			(AAM II)				73	_ _ _	
Close range antiship missiles							_ _ _	73		(ASM)		
Maritime												
Main diesel machinery for defense ships			67								76	_ _
Hydrofoil craft			67			71						
High speed homing torpedoes					70							

Note: _____ Development period _ _ _ _ Research/trial manufacture, survey & test period

Chart III-4: R&D During 3rd-4th Buildup Plans (Part 2)

(Classification)	2nd Plan (-1966)	3rd Buildup Plan (1967)	(1968)	(1969)	(1970)	(1971)	4th Buildup Plan (1972)	(1973)	(1974)	(1975)	(1976)	Post 4th Plan (1977-)
Ground weapons & vehicles												
New model tanks	64					71						
New armored trucks		67		69								
105 mm mobile howitzers			68		70							(including ammunition)
155 mm mobile howitzers				69			72					(including ammunition)
Tow tractors				69	70							
New tank recovery vehicles							72			75		
New snow tractors								73				
Communications/Electronics												
Field ADPS			68				72					
New communications methods (New conveyance)							72			75		
(New electronic exchanger)								73			76	
(Terminals								73			76	
Antigun radar			68	(RADA)			72					
Information system for low altitude				69				73				
Instruments/materials for battle front surveillance (Noctovision)					70		72					(for battlefield surveillance)
(Infrared ray)												
Instruments/materials for electronic gear												

Note: _____ Development period - - - Research/trial manufacture, survey & test period

(4) R&D During the 4th Defense Buildup Plan

The R&D policy goals for the 4th buildup plan (FY72-76) were:

1) "To promote technical R&D, contribute to advancement of modern weapons and the level of domestic technology, and at the same time to foster appropriate domestic arms production and to nurture the nation's defense base;" and 2) "to conduct R&D on various types of equipment in order to improve the functions of various missiles, electronic machinery and instruments, as well as antisub patrol planes and early warning planes; also, to strengthen the technical research system." The decisions of the National Defense Council includes a passage which reads, "To conduct R&D on electronic machines and instruments to improve the function of various missiles, including the air-to-ship missiles, and the antisub patrol and early warning aircraft."

During the post-4th buildup era, the new tanks have been completed; the development of the sonic surveillance system and a fan engine for small planes has been added; and R&D on the shortrange SAM, antipersonnel (fragmenting) land mine, new snow tractor and fixed underwater sonic buoy (LQT-4) is being conducted.

The "items of technical R&D implemented" by the Technical R&D Institute have totalled several hundred items annually, and the cumulative total has reached more than 8,000 items. Since it is impossible to list them all here, they have been listed by categories (See Table III-4). The important aspects of the defense industry are trial manufacture and consignment. They constitute important tie-ins to domestic equipment production of equipment because, aside from domestic production through foreign license, Japan's independent development has depended almost entirely on this process.

Table III-4: Figures on Implementing Technical R&D

(Year)	(Items)	(Trial manufacture)	(Consignment)	(Tech. tests)	(House tests)	(House Research)	(Special research)	(Div. research)
1952	60	-	-	-	-	-	-	-
1953	193	-	-	-	-	-	-	-
1954	349	-	-	-	-	-	-	-
1955	389	-	-	-	-	-	-	-
1956	475	-	-	-	-	-	-	-
1957	428	-	-	-	-	-	-	-
1958	625	119	62	138	71	235	-	-
1959	599	85	33	170	78	233	-	-
1960	635	71	53	136	76	299	-	-
1961	663	117	55	112	50	329	-	-

1962	442	72	37	111	58	164	-	-
1963	336	68	26	85	48	97	12	-
1964	328	50	13	70	44	124	9	18
1965	341	52	11	69	43	123	14	29
1966	318	41	9	54	34	142	7	34
1967	273	50	7	61	31	81	6	37
1968	246	42	13	51	39	70	8	23
1969	286	52	11	55	43	82	9	34
1970	259	41	11	60	18	85	8	36
1971	265	47	8	74	16	83	5	32
1972	246	49	21	52	16	80	-	28
1973	251	42	22	48	18	90	-	31
1974	254	52	20	37	20	97	-	28
1975	234	37	20	36	29	86	-	26
1976	233	44	14	33	31	86	-	25

Notes: 1. From 1961, figures for trial manufacture and consignments may be divided into "technical development" and "technical research. 2. For 1975, add 3 items; for 1976, add 2 items.

The R&D conducted by the Technical R&D Institute is a microcosm of the history of genuine Japanese equipment production. As for the nature of the technical development, we will furnish available data on the R&D period, year of standardization and deployment etc., as appended data. (See Appendix 2, p 185)

R&D and Private Enterprise

The postwar R&D in practice has been conducted by private enterprise. But it is the Defense Agency which judges and selects consignments to the private sector regarding the kind of R&D to be conducted. Therefore it is unthinkable to the Defense Agency authorities that the private sector would develop new equipment based on its own judgment, or to modify existing equipment. Nonetheless, the problem does exist and its handling is drawing attention.

For instance, Hitachi (Ltd) has on its own initiative spent 120 million yen to trial manufacture the "new high-speed tow vehicle." It seeks to fill the need for a modified version of the M5A1 tow vehicle now used in Japan. The M5A1 was provided by the US armed forces in the 1950s and is used for towing 155 mm howitzers and for transporting personnel and ammunition, but it is regarded as outdated. The new high-speed towing vehicle has a maximum speed of 56 km per hour (the M5A1's speed is 48.5 km) and exceeds the M5 (which has a cruising range of 242 km) with a range of 300 km. It is easy to

maneuver and carries a commercial engine which is cheap to produce. The functional test conducted at the GSDF's East Fuji maneuver grounds have reportedly proved its superior capability. Whether or not the two vehicle will result in being deployed will bear watching in the future. But if it should not be deployed because it has not been included in the Defense Agency's main line of development, it may arouse criticism towards the agency's inflexibility which refuses to adopt any R&D not "officially endorsed," regardless of its excellence. Conversely, if it were to be standardized or deployed, it would result in a major revision of deployment rules and would impact greatly on the future R&D of other equipment.

Hitachi's purpose in developing an original high-speed tow vehicle is quite clear. The company has the experience of consignments received from the Defense Agency and of having formally developed the M73 tow vehicle (trial manufactured and tested during 1969-72, standardized in 1973 and deployed in 1974). The M73 tow vehicle was intended to replace the U.S.-provided M4 tow vehicle and M8 vehicle. (See Note) If a new version replacing the M5 were to be standardized, the company could monopolize the field. Since these objectives are clear, the decision of the Defense Agency either way would cause repercussions.

Note: The M4 is an 18-ton vehicle used mainly for towing the 203 mm howitzer and the 155 mm cannon. The M8 is a 25-ton vehicle used mainly to tow the 75 mm antiaircraft gun and heavy artillery. The M73 could replace both vehicles. The M5 is a 13-ton vehicle.

There are other problems. This is because the handling of the 155 mm howitzer towed by the M5 is fluid. With the M75 155 mm mobile howitzer developed by Mitsubishi Heavy Industries now under procurement, it has put a condition on the need for tow vehicles, depending on how the equipment system is changed. The related equipment under procurement during FY79 includes 5 M73 tow vehicles and 26 M75-155 mm mobile howitzers.

3. Progress of Domestic Equipment Production

High Ratio of Domestic Production

There are several ways to obtain equipment. In the case of foreign-produced equipment, the first ones which come to mind are: (a) equipment provided free of onus (through the free supply plan of the U.S. Far East forces--the first equipment obtained for Japan's rearmament. This was followed by the united arms based on the military aid plan of the Japan-U.S. mutual defense agreement of 1954); and (b) the leased equipment (based on the 1952 and 1954 Japan-U.S. ship lease agreements). Then, (c) there are those obtained through payment, which are divided into those based on the FMS (Foreign Military Sales) formula used in direct inter-government transactions and general imports. In a broad sense, they are all imports. Domestically produced equipment are divided into (d) those produced by importing technology on foreign-developed equipment and (3) those produced on the basis of domestic technology.

By generally classifying the methods of obtaining equipment, it is clear that Japan started with (a) and gradually shifted to (c), (d) and (e). The majority of present procurement depends on (d) and (e). Also, domestically produced equipment is sometimes included in those provided by the U.S., especially in the case of vehicles.

However, depending on the type of equipment, some clearly have diverted from the general trend. We will briefly outline the modernization and domestic production of arms and equipment with this in mind.

The term "domestic equipment production" has a double edge. First, among the different procurement methods in the forms of grants, leases and imports in a broad sense, and domestic production, there is the macro change--whereby the proportion of domestic production increases. Secondly, individual items which had been procured from abroad in some form have shifted to domestic production. It must be pointed out that, within the second trend of shifting from foreign production to domestic production, there are two facets--domestic production through imported technology and substitution of imports with home-developed products. In the former case, the domestic products are basically identical to foreign products, with the producers merely changing hands. In the latter case, both the products and the producers have changed and may be classified as "genuine domestic production" (although they may be in many respects imitations of forerunner products).

The ratio of domestic arms production is high. But the nature of domestic production varies, depending on the type of equipment, and, in the case of guided weapons and aircraft, "genuine domestic products" are less in number and the proportion of imported technology is higher. The reason lies in the lag in Japan's R&D in these fields, and it is especially conspicuous in the lack of development in fighter planes on the world's top level. Nothing has been done to develop nuclear and hydrogen weapons, aircraft and guided missiles, which require vast sums of several hundred million to tens of billion yen. On the other hand, firearms and vehicles are being mass produced which compare with the world's best. This is not by any means characteristic of Japan's defense industry alone, but may be considered a common trait of Japan's industries in general.

Present State of Domestic Production

In the initial stage of domestic production, items of equipment provided (by the U.S.) were domestically produced without alteration, or they were partially modified, and none were worthy of pride in terms of technological achievement. But from the standpoint of progress in development, the provided items were either inconvenient for Japanese to handle due to physical differences, or unfit for Japanese roads and bridges, and not a few were both strategically and tactically inappropriate. This has left much room for more appropriate, domestically developed equipment.

We will attempt to outline present domestic production of the equipment used by the three branch services of the SDF--ground, sea and air--while adding some observations on their historical progress.

(I) GSDF Equipment

Among the three SDF branch services, the GSDF has the largest variety of equipment. The reason is, its sphere of action is more complex than that of the sea or air. We will explain those equipment in more detail.

We have prepared a series of data on the domestically produced "frontal equipment" by item and its supplier. But it is cumbersome to list them all here, so they have been lumped together by categories and listed in the addenda. (See Appendix 3) Our narrative here will be premised on the appended data which is used as reference.

(1) Firearms and Ammunition

As explained in the previous chapter, R&D for domestic production of firearms and ammunition began in the early stage. But it was only from the 2nd buildup plan (FY62-66) that it was reflected in actual equipment. It was in 1962 that the M62 7.62 mm machine gun and the M60 106 mm recoilless cannon began to be mass produced and delivered. In 1964, mass production began on the M64 7.62 mm rifle and M64 81 mm mortar. In 1967, the domestically produced antitank guided missile and the 106 mm recoilless cannot were deployed. Thus, standardization and deployment did not always coincide in point of time. However, since it is not our purpose here to explain the procedures for all equipment, they will be omitted.

We will take a look at the related items in this category which are not Japan-made. They are the 11.4 mm pistol, 11.4 mm submachine gun, 7.62 mm rifle (M1), 7.62 mm carbine (M1), 7.62 mm machine gun (2 types), 12.7 mm heavy machine gun, 89 mm rocket launcher, 60 mm mortar, 81 mm mortar, 107 mm mortar, 75 mm recoilless cannon, 75 mm howitzer, 203 mm howitzer, 155 mm cannon and 75 mm antiaircraft gun.

Many of the foregoing are losing their usefulness by being substituted with Japan-made firearms. But some of them are without substitutes and thereby retain certain usefulness. Also, the Japan-made 105 mm howitzer and 155 mm howitzer have been provided (procured and presented) by the U.S. armed forces.

The "Hawk" is a Japanese product based on imported technology during the 3rd buildup plan, but it was produced during the 2nd buildup plan on a cost-sharing basis. The procedures involved in the import of "Hawk" technology is reported to be fraught with suspicious factors.

As for ammunition, the technical level was improved during the "special procurement" period, and productivity was also high. Thus, with the exception of a few firearms, the item was supplied mainly through domestic production.

(2) Vehicles and Parts

The standards of vehicles and parts in Japan have reached a very high level. The non-domestic items are the M41 tank, 40 mm mobile antiaircraft cannon,

105 mm mobile howitzer (M52A1), 155 mm mobile howitzer, 13-ton tow vehicle (M5), 25-ton tow vehicle (M8), 18-ton tow vehicle (M4) and M3A1 armored truck. They are largely antiquated, and procurement of Japan-made items as replacements are under way.

Also, vehicles include, in addition to "frontal equipment," the 1/4-ton truck, M73 small truck, 3/4-ton truck (4x4), 3/4-ton rescue truck (4x4), M73 medium truck, 2 1/2-ton truck (6x6), 2 1/2-ton long truck (6x6), 2 1/2-ton dump truck (6x6), 2 1/2-ton covered truck, 2 1/2-ton fuel tank truck, 2 1/2-ton water tank truck, M73 large truck, 3 1/2-ton dump truck (all-purpose), 3 1/2-ton truck (with crane), 3 1/2-ton truck (for antiaircraft command use), 3 1/2-ton fuel tank truck (general use), 3 1/2-ton fuel tank truck (for aircraft), 4-ton truck (6x6), 4-ton wrecker (6x6 oil pressure type), 6-ton truck (6x6), M74 extra large truck, M73 extra large semitrailer tow vehicle and M73 extra large semi-trailer. These can be included in the same category as trucks or specially equipped vehicles. Other vehicles are: grader, oil pressure shovel, truck crane, small bulldozer, medium bulldozer, large bulldozer, bucket loader (with wheels), mobile compressor, concrete mixer, snow plow, rescue and firefighting truck, liquid sprayer, duster, etc. These are generally manufactured by designated companies, but they can also be included among construction machinery or specially equipped vehicles, and are not necessarily specialized for military use.

(3) Aircraft

Japan relies heavily on foreign technology for aircraft, but it has also made much progress in domestic production through imported technology. Although most products were imported in the early stage, there has been a subsequent shift to domestic production based on imported technology, and in the same category of aircraft, for example, there are still some foreign-made types in use. The first planes used by the GSDF--the L-16 model handed down from the U.S. armed forces in 1952--is now retired from service.

(4) Communications and Electronic Equipment

Remarkable progress has taken place in communications and electronic equipment. Similar phenomena have taken place in the defense industry. In the early stage, much of the equipment was handed down from the U.S. armed forces, but they are now being replaced with domestic-made products. There are a few which are modified versions of the types in use today by the U.S. forces. But in any case the level of domestic production is quite high.

(5) Munitions and Parts

There is a considerable amount of munitions and parts which do not fit the conventional concept of main equipment (weapons), but in reality play an important role in military activity. It is also noteworthy that there are many equipment which are used under the premise of an enemy attack, including such new weapons as chemical warfare weapons, biological weapons and nuclear weapons.

(II) MSDF Equipment

Ships play a large role in the MSDF, but the mammoth battleship is a thing of the past. There is a great difference in content between the early stage equipment and the present ones, but original technology is relatively far behind that of the GSDF.

(1) Ships

The equipment for ships will be discussed separately. Characteristically, there is a certain degree of functional specialization in the different types of defense ships such as the DDG (guided missile destroyer), DDH (helicopter carrying destroyer), DDA antiair destroyer), DDK (hunter killer destroyer) and DE (escort destroyer). There is also specialization influencing the types of ships such as the DDG, which is characterized by its antiair missile, and the DDH with its antisub helicopter. There is no room to go into detail on the functions of the various ships. Therefore, combat ships and support ships have been grouped according to their builders and are listed in the addenda. The production characteristics of the combat ships and support ships are: (a) a single type of vessel is sometimes manufactured by a plural number of shipbuilders, resulting in a certain degree of competition within limitations; (b) but the two important types--defense ships and submarines--are consigned to an established production chain; (c) if support ships are included, a considerable number of small and medium shipbuilders are also mobilized for production. Another important aspect regarding ship production concerns the kind of engines which propel them. The builders of engines do not always coincide with the builders of ship hulls. We will omit data concerning this aspect.

(2) Weapons On Board Ships

They are divided into antiair, sea-surface weapons and undersea weapons. Both types have seen great progress through the development of electronic technology. While domestic products have increased markedly, there are still considerable amounts of handed down products in use. The main carryovers are the 38 gauge 5 inch single mount guns (equipped on the "Harukaze" type vessels) and the ship-to-air guided "Tartar" missiles.

(3) Communications and Electronic Equipment

The majority is now Japan-made. As for the 3-dimensional radar, the Hughes (U.S.) products are in use.

(4) Aircraft

Genuine domestic planes are the PS-1 and its twin, the US-1. The remainder are virtually all domestic-made under imported technology. Among foreign makes, there is the Grumman antisub patrol craft S2F-1. Sixty (60) of these planes were provided and some of them are still in use.

(III) ASDF Equipment

The ASDF equipment includes, in addition to aircraft, onboard instruments, ground instruments, vehicles and rescue equipment. Domestic aircraft production is making progress, but depends on imported technology.

(1) Aircraft

Some have been domestically developed, but the fighter planes--the principal aircraft--are domestically produced under imported technology. Representative of foreign-made craft is the RD-4E scout plane. There are also those imported prior to domestic production under license.

(2) Onboard Instruments

While Japan-made products have increased, many still depend on imported technology. Some like the "Nasar" (phonetic) depend on imports. The content varies according to the type of aircraft (including parts) and it is difficult to pin down domestic production of onboard instruments. The data given here is only a portion of available data.

(3) Ground Instruments

The BADGE system, which is imported technology, is already becoming conspicuously outdated, and the efficiency gap between the E-2C and the F-15 has become a problem. Other instruments (radar, wireless equipment, etc.) are gradually being covered by domestic technology.

(4) Vehicles and Ground Instruments

Vehicles also play an important role for the ASDF. There are the general types of vehicles, rescue vehicles, supply vehicles, facility vehicles, towed vehicles and ground instruments, each with their respective functions. There are many foreign-made crash barriers, like the Swedish products.

(5) Rescue Equipment

These are important equipment for aircraft. Imported products, such as the rescue craft (LRU-3/P) and the crashproof helmet (HGU-8P) are in use. There are others which are omitted here.

IV. Actual State of Defense Industry

It is not simple to describe the actual state of the defense industry. We will give an outline of the major companies which are considered to represent the industry, and show that they are in fact supported by a large number of affiliated enterprise groups.

1. Role of Major Engerprise Groups in the Defense Industry

Issues concerning the defense industry are by no means confined to the major companies at the top level. But the fact is, prime available data deals for

the most part with those majors. The most useful reference from our viewpoint is the survey report issued periodically by the Keidanren. The most recent report is entitled, "An Analysis of the Present State of Japan's Defense Industry, and Its Treatment in the Future." The report reviews a cumulative total of 67 companies during May-June 1977.

The companies surveyed may be considered as Japan's representative defense-related enterprises. They could be classified as follows:

Aircraft and engines	- 8 companies	
Aircraft sales	- 16 "	
Ships	- 8 "	(11 dockyards)
Weapons	- 35 "	

The list includes specialized defense industrial companies, as well as non-specialized companies, and indicates the complexity and breadth of the defense industry. We will not attempt to describe every detail of the survey, but it is interesting to note the way in which the Keidanren categorizes the industry. We will review the industry roughly along those lines.

(1) Aircraft and Engines

There are 7 airframe makers and 3 engine makers. (Ishikawajima Harima Heavy Industries makes only engines; Mitsubishi Heavy Industries and Kawasaki Heavy Industries make both airframes and engines.) Among the principal types, Mitsubishi is the chief contractor for the F-4EJ fighter and also makes the advanced T-2 trainer plane and the F-1 support fighter. Following the F-4EJ, it has moved on to the production of the F-15. Kawasaki is the chief contractor for the C-1 transport. Shin Meiwa Industry makes the PS-1 antisub flying boat and the US-1 rescue craft. Fuji Heavy Industries produces the KM-2 and T-3. The other airframe builders do not have sole contracts for any particular models.

The Defense Agency's list of procurement orders for the chief contractors is given in later pages. (See Table IV-1) The aircraft industry is resuming its activity through the realization of 3 major projects: the 2 military aircraft F-15 and P-3C, and the joint international experimental plane YX.

Among the big 3 makers of aircraft engines, Ishikawajima Harima is gaining ground against the other 2 (it is the chief contractor for the F-15 and P-3C).

(2) Vendors

Vendor companies lead a generally unknown existence, staying in the shadows of the builders of complete aircraft. But they include such companies as Tokyo Keiki and Mitsubishi Precision, which rely heavily on defense needs and therefore play an important role. A survey reports that "vendors of aircraft engines are estimated to be in excess of 120 firms," thus coinciding with our estimate.

(3) Combat Ships

There are 3 groups of contractors: (a) the defense ship and special purpose ship group (Mitsubishi Heavy Industries-Nagasaki plant, Ishikawajima Harima Heavy Industries, Hitachi Shipbuilding & Engineering-Maizuru plant, Mitsui Shipbuilding & Engineering, Sumitomo Shipbuilding & Machinery, Sasebo Heavy Industries); (b) the submarine group (Mitsubishi H Ind-Kobe plant, Kawasaki H Ind); and (c) the mine sweeper and torpedo boat group (Mitsubishi H Ind-Shimonoseki plant, Hitachi Shipbldg-Kanagawa plant, Nippon Kokan). This grouping merely indicates the "jurisdictions" of main ship construction formed during the past 20 odd years. In addition to the main ships, many companies have participated in the construction of support ships.

During the 4th buildup plan, the construction rate of combat ships was less than 70 percent of the goal (the plan was to build 54 vessels totalling 69,600 tons; of which 37 vessels totalling 48,400 tons were built). The unfulfilled rate was high compared to the other areas of the defense industry. In Japan, the "King of the shipbuilding world," the Defense Agency's procurement was negligible in terms of quantity. Today, shipbuilding demand in general has declined, whereas the defense demand is considered desirable because of its stability. However, even during its heyday as the "king of shipbuilding," the combat ships built by Japan were rated reasonably high for their functional capacity but as relatively expensive by international standards.

Weapons

Weapons may be subdivided into the following groups: (1) ammunition, (2) vehicles, (3) rifles and cannons, (4) missiles and rockets, (5) explosives, (6) communications and electronic instruments, and (7) heat processed equipment.

Ammunition may be divided into metal components (shell cases and fuses), gunpowder and powder charges. Shell cases are made by 5 major firms: Asahi Seiki Manufacturing, Nippon Koki Kogyo, Daikin Kogyo, Komatsu Ltd and Howa Machinery. There are many fuse makers. Fuses for missiles and rockets and large and medium gauge cannons are made by: Nippon Denshi Kagaku Company, General Co, Ricoh Watch, and Daikin Kogyo. Gunpowder is made principally by: Asahi Chemical Industry, Nippon Oils & Fats, Daicel, Chugoku Kayaku, and Nippon Koki Kogyo. Powder charges are practically a monopoly of Chugoku Kayaku and Nippon Koki Kogyo.

Since such ammunition are expendables, stockpiling and supply are important from the standpoint of equipment use, and there are problems concerning the increase of stockpiles and domestic production versus import of foreign products.

There is a large number of vehicle makers, but the focus is on category A vehicles, such as combat vehicles and combat support vehicles (Mitsubishi H Ind, Komatsu, Hitachi, and Ohara Iron Works). As for armored vehicles,

procurement of the M73 model to replace the M60 began in FY73, while procurement of the M74 as replacement for the M61 began in FY74. The changeover from the old to the new models was conspicuous. Meanwhile, plans are underway to produce mobile cannons which will probably impact on the major producers. Among the support vehicles, the important ones are the tow vehicles, snow trucks, mobile bridges and tank retrievers.

Among the rifle and cannon makers, representative makers are: Howa Machinery which makes the M64 rifle, Nittoku Metal Industries which produces the M62 machine gun, and Japan Steel Works which manufactures large and medium gauge guns. Among these, the small gauge products are more durable and have greater deployment, so they are more susceptible to procurement cuts.

Regarding missiles and rockets--the 5 producers, Mitsubishi H Ind, Kawasaki H Ind, Mitsubishi Electric Corp, Toshiba, and Nissan Motors are main contractors with a large number of related enterprises in support. In the past the "Nike" (by Mitsubishi H Ind) and the "Hawk" (by Mitsubishi Electric Corp and Toshiba) were the principal products, but the time has come for the "Nike" to be replaced by the next generation missile. The "Hawk" will be modified. Also, deployment is approaching for the Japan-developed heavy MAT (antiship, antitank guided missile), the shortrange SAM and the ASM.

The chief producers of explosives (depth bombs, mines, torpedoes, bombs, land mines and launchers) are: Mitsubishi H Ind, Ishikawa Seisakusho, Hitachi Shipbldg & Engineering, Watanabe Iron Works, and Shin Chuo Kogyo. The explosives, like ammunition, are expendables and are therefore likely to be regarded more lightly than machines and instruments. Stockpiling and supply systems for explosives are also problems.

Communications and electronic machines and instruments are used for both wire and wireless communications and for ground, aircraft and vessel warning and reconnaissance. They are also widely used for firing systems, missile guidance, tactical command, navigation, aircraft flight control and ECM (radio jamming device). These function as the nuclei of many types of equipment. Among the many producers, the representative suppliers are: Mitsubishi Electric Corp, Toshiba, Nippon Electric, Fujitsu, Hitachi, Oki Electric, Hokushin Electric Works, Kokusai Electric and Japan Radio Co.

Among the heat processed products are smoke candles and signal candles, with the bulk supplied by Hosoya Kako and Nippon Koki Kogyo.

The Keidanren survey analyzes data concerning the number of direct projects, number of direct personnel, sustained productivity (minimum production capacity for weapons), technical projects, technical personnel, and key skilled personnel for each category of equipment. The companies surveyed represent only a tip of the defense industry. Aside from the monetary costs, there is a wide gap between the companies listed here and the actual number of companies involved.

2. Internal Structure of Defense Industry

Defense Industry Has a Broad Base

There are several dozens of top companies in the defense industry which supply mainline equipment. There are more than 2,000 companies waiting in line for Defense Agency orders. However, the principal items are not offered through competitive bids, but through optional contracts, and the aggregate optional contracts amount to 80 percent of total procurements.

While this is one aspect of the defense industry, it does not focus on the industry's internal structure. This point becomes clearer by comparison with other industries. For example, only 9 companies engage in the manufacture of passenger cars in Japan and 80 percent is built by the top 4 companies. Actually, however, it is impossible for the 9 companies to produce all the cars. They purchase parts and raw materials which account for 60-70 percent of all cars shipped out. There are actually more than 8,000 firms participating in the production of these parts.

The defense industry differs from the car manufacturing industry, in that the former is dependent on a large range of enterprises involved in supplying different products which meet its needs. It is therefore difficult to ascertain the number of enterprises involved. Nonetheless, it is possible to surmise that the majority of products involved in the manufacturing process is closely linked to the "machine industry." That is, many cooperating enterprises and partsmakers are involved in their production. In view of the fact that cars, ships and electrical machinery are dupplied to the Defense Agency, the defense industry can be seen as an industry with a broad base, including the machine industry in a broad sense. But since only a part of the machine industry is directed towards supplying defense demand, it would be unrealistic to equate the machine industry with the defense industry, or the chemical industry with the defense industry.

Despite this, there is no denying that a wide range of industries is involved albeit partially in the defense industry. When mainline equipment--that is, specialized equipment for military use--is produced in the same way as machinery is produced, many cooperating enterprises and parts makers become involved. Thus the true definition of the defense industry is the composite whole of such enterprises.

Even in the production of ammunition, which is simple in structure, at least 7 or 8 companies are involved directly, and if subcontractors are included, several dozen companies become involved. Such considerations would apply to virtually all mainline equipment. It is not easy to explain the interrelationships of cooperating companies, subcontractors and sub-subcontractors in the production process of industry in general. In the case of the defense industry, it is even more difficult. Surveys have been conducted at a fairly early stage, but none have been conducted recently. There is another reason for the difficulty in explaining actual conditions. That is, many of the enterprises which have a major impact on the defense industry are regarded as side businesses, or--to take agriculture as an example--they are second

class businesses. There is almost no company whose ratio of defense production to its total sales exceeds 10 percent. Under such conditions, although the company's relation to cooperating enterprises and subcontractors may be clear to some extent, those relations may not coincide with the relations of the cooperating enterprises and subcontractors in terms of defense production. As a result, it is possible to obtain only primary information regarding the top cooperating enterprises and subcontractors, and the problem of a more in-depth explanation awaits a solution.

Makers of Aircraft Parts

An airplane consists of 400,000 to 500,000 parts. In comparison, a passenger car consists of 20,000 to 30,000 parts. This is a considerably difference in necessary components.

Japan's first domestic passenger plane--the YS-11--is by its very nature not a military plane. Including two trial models, its production totalled 182 planes, and only 23 were delivered to the Defense Agency (the MSDF purchased 10 planes for use as transports and for inflight training; the ASDF bought 13 planes as transports and for flight inspection purposes). The Japan Aeroplane Manufacturing Co, which is a joint government-civilian venture, manufactured the plane, using a Rolls Royce engine, and at the outset of mass production it was delivered to the Ministry of Transportation and the Defense Agency (in March 1965). At any rate, there are still some interesting facts concerning its production.

As it is commonly known and as shown in Table IV-1, the YS-11 was produced in several separate components and assembled by Mitsubishi Heavy Industries. Of course, there was an enterprise group which supplied parts to those companies. The group consisted of the following. (See Table IV-2. The data on engines and propellors is not included.)

Table IV-1: Producers for the YS-11

Procurement by: Japan Aeroplane Mfg Co

Front and middle fuselages - Mitsubishi H Industries

Rear fuselage - Shin Meiwa Industry

Main wing/(Nasser) - Kawasaki H Industries

Tail wing - Fuji H Industries

Auxiliary wings/flags - Japan Aircraft Mfg Co

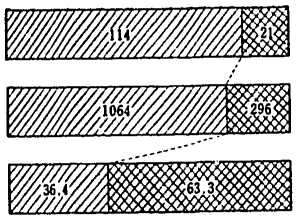
Honeycomb structure - Showa Aircraft Industry

Import and domestic procurement of engine/propellor/special equipment - Japan Aeroplane Mfg Co

Overall assembly - Mitsubishi H Industries

Table IV-2: Parts Suppliers for The YS-11

(Foreign companies) (Domestic companies)



(No of companies)

(No of items)

(Ratio of costs)

There were an estimated 135 suppliers involved. The number represents the delivery agents for parts, but there were also many other subcontractors under them.

Regarding Defense Agency-related aircraft production, figures have not been made public as in the case of the YS-11. But with Japan's lag in technological development of aircraft engines as a factor, technical assistance contracts for their production were concluded for main components, which provide one key to insights into related enterprises.

The role of defense demand in Japan's aircraft industry has been a decisive one. It has already been mentioned in Chapter III, that the demand for repairs of US military aircraft provided a breakthrough in the revival of the industry.

The productivity of aircraft for delivery to the Defense Agency through imported technology, such as the T-34 primary trainer ("Mentor"), T-33A jet trainer and the F-86F jet fighter, has been highly instrumental in its subsequent progress. The production periods, figures and suppliers of the three types of aircraft are given as follows:

T-34	1953-56	124 planes	(Beechcraft)
T-33A	1955-57	210 "	(Lockheed)
F-86F	1955-57	300 "	(North American)

The 3 main contractors were: Fuji H Ind for the T-34; Kawasaki H Ind for the T-33A; and Mitsubishi H Ind for the F-86F. But the policy was to use as many common components as possible for the T-33A and the F-86F. (The T-1, for which Fuji H Ind began trial manufacture from FY56, also adopted the policy of using these common parts. Incidentally, the outer structures of the F-86F and Boeing 707 were used as reference for the T-1).

The technical assistance contracts for domestic production of parts for the T-33A and the F-86F included 25 items. Tokyo Keiki, Nippon Electric, Toshiba, Mitsubishi Electric Corp, Tokyo Aircraft Instrument, Japan Aviation Electronic Industry, Seiritsu Industries, Hokushin Electric Works, Shinko Electric, Kayaba Industry, Yokogawa Koku Denki, Yokohama Rubber, Sumitomo Precision Products, Koito Mfg Co and Shimadzu Seisakusho signed technical

assistance contracts with more than a dozen U.S. companies such as Bendix Corp and ITT. The technological gap and the ramifications of related producers involved at the time could be perceived from the data available. Some like Mitsubishi Electric Corp signed 5 different assistance contracts, while Tokyo Keiki Kogyo (4), Tokyo Aircraft Instrument (2) and Sumitomo Precision Products (2) also signed multiple contracts. (See Note)

Note: The contracts signed by Mitsubishi Electric Corp were as follows: (1) UHF (ARC-27) production - Collins Radio Co; (2) range servo (RS-311 model) production - Servomechanisms Ins; (3) fuel booster pump production - Thompson Ramo Wooldridge Inc; (4) actuator and motor production - Hoover Electric Co; and (5) control stick switch, projector control and relay production - Guarcian Electric Mfg Co.

At least 100 and several score companies, including these firms, directly supplied parts for the production of a single type of aircraft, with still more companies providing supportive production. Of course, compared to the auto industry in Japan, its aircraft industry is much smaller in scale, and the parts makers are obliged to look for as many orders as possible. Therefore, although the main contractors may vary, the majority of the parts makers who receive subcontracts appear to overlap. It is also common for a parts maker to share in the contract work of a different main contractor than its own. This indicates that the parts makers maintain close cooperation with each other, although they remain competitors. Moreover, the Defense Agency plays no small role in their coordination.

Position of Aircraft Industry Within Defense Industry

It must be remembered that approximately three-fourths of the aircraft industry is based on defense demand. The cumulative total of main domestically produced aircraft supplied under contract to the Defense Agency between 1953-78 was indicated in Table IV-1. Most types and number of aircraft were developed by the U.S. Moreover, the balance between main contractors was stabilized over a long period. Also, there has been close cooperation.

A look at the main types of aircraft under the 4th buildup plan shows that Kawasaki H Industries cooperated with the main contractor, Mitsubishi H Industries, in producing the rear fuselage, main wing and tail wing for the F-4EJ. For the advanced T-2 trainer plane, Fuji H Industries cooperated with Mitsubishi in producing the rear fuselage, main wing and tail wing. Kawasaki is the main contractor for the medium transport C-1, but Mitsubishi cooperated on the middle fuselage, rear fuselage and tail wing, while Fuji built the outer wings and Japan Aircraft Mfg Co made the moving vanes and pods (engine housing). Thus 4 of the fuselage makers were involved in the production of the plane. (On other models, Fuji and Japan Aircraft cooperated with Shin Meiwa Industry on the PS-1; Japan Aircraft, Shin Meiwa and Fuji cooperated with Kawasaki on the P-2J.)

Table IV-1: Delivery of Main Aircraft to Defense Agency (Contract Base)

(Main contractor)	(Type of plane)	(Planes contracted)	(Period)	(Main developer)
Mitsubishi Heavy Industries	F-86F	300	1955-57	North American
	H-19(S-55)	41	1958-61	Sikorsky
	F-104J	210	1960-65	Lockheed
	F-104DJ	20	1960	Lockheed
	S-62	18	1962-69	Sikorsky
	HSS-2(S-61)	92	1962-78	Sikorsky
	MU-2(LR)	40	1966-78	Japan-developed
	F-4EJ	140	1969-77	McDonnell Douglas
	T-2	66	1969-78	Japan-developed
	F-1	59	1975-78	Japan-developed
	F-15	23	1978	McDonnell Douglas
Kawasaki Heavy Industries	H-13(BELL 47)	111	1953-70	Bell
	T-33A	210	1955-57	Lockheed
	P2V-7	48	1958-62	Lockheed
	V-107	95	1961-78	Boeing Bertel
	P-2J	83	1965-76	Domestic modification of P2V-7
	OH-6J	120	1967-77	Hughes
	OH-6D	10	1978	
	C-1	28	1971-77	Japan-developed
	P-3C	8	1978	Lockheed
Fuji Heavy Industries	T-34	124	1953-56	Beechcraft
	T-1	66	1956-62	Japan-developed
	L-19E	22	1957-59	Cessna
	KM-2	53	1961-78	Domestic modification of T-34A
	T-3	32	1976-78	Japan-developed
	HU-1B	90	1962-71	Bell
	HU-1H	59	1972-78	Bell
Japan Aeroplane Mfg Co	YS-11	23	1963-72	Japan-developed
	XC-1	2	1968	Japan-developed
Shin Meiwa Industry	PS-1	23	1965-77	Japan-developed
	US-1	6	1972-78	Japan-developed

It is impossible to obtain accurate figures on the number of aircraft parts makers, but the items produced by the top 130-140 companies are known. In the case of many of these companies, the bulk of their sales is in the aircraft-related industries. Therefore, not a few rely on defense demand for the majority of their sales. Among the top companies in the Defense Agency's procurement list, there is hardly any company which specializes in defense orders. On the other hand, there are some among the cooperating companies,

chain firms and subcontractors which specialize in certain fields and therefore rely on defense orders. Mitsubishi Precision is relatively high on the procurement list in volume and the bulk (about 2/3) of its sales meet defense demand. The company is a joint venture established in 1962 by a group consisting of Mitsubishi Electric Corp, Mitsubishi Heavy Industries, Mitsubishi Trading and Mitsubishi Bank, as well as the General Precision Co (U.S.-present Singer Co). Its products include the flight simulator, light plane trainer, cockpit procedure trainer, inertial navigation apparatus, Doppler radar flight meter, rocket position control device, etc. The amount of deliveries to the Defense Agency by the parent companies--Mitsubishi Electric Corp and Mitsubishi Heavy Industries--far exceed deliveries by Mitsubishi Precision, but since it is not a specialized company its delivery rate is rather low. Among the small and medium parts makers, not a few meet most of their sales through defense demand.

What has been observed here applies not only to the aircraft industry, but also to other industries. The more specialized an enterprise is, the more potential it has for concentrating on a specific area of demand.

Thus, with respect to aircraft-related affairs, we tend to focus only a limited number of companies at the apex of the industry. But it is important to be sufficiently aware of the full extent of its base.

Also, to add another point, the reliance on foreign technology, including parts technology, has continued up to the present. In the production of the F-104-J airframe, 36 technical assistance contracts were signed (Teijin Seiki, Furukawa Battery, Mitsubishi Rayon, Sakura Rubber, Mitsubishi Precision, Kanto Aircraft Instrument, Osaka Oxygen Industries, Showa Seiki, Tokyo Screw, Toyo Communications Equipment and Sumitomo Electric Industries were included), and 45 contracts were also signed for important technical assistance for the F-4EJ. A more noteworthy fact is that, for the production of the Kawasaki Heavy Industries' P-2J--a modified Japan-made version of a foreign developed plane--9 contracts were concluded for technical imports. Furthermore, 18 and 19 contracts were signed respectively for technical imports at the parts level for the domestic C-1 and T-2.

Another important point concerning aircraft technology is that Japan's engine technology for aircraft, including commercial planes, is conspicuously lagging. After the war, the only engines developed by Japan were the 3 types by Ishikawajima Harima Heavy Industries. The J3-3 and J3-7 turbojet engines, used for the SDF's T-1B and P-2J respectively are the only ones in practical use today. (See Note) The other planes--the commercial YS-11 and MU-2, and the military C-1, T-2, F-1, PS-1 and US-1--have been developed domestically, but the engine technology has been borrowed.

Note: There is the experimental JR engine developed jointly by Ishikawajima Harima, the Science & Technology Agency and the National Aerospace Laboratory.

The fact that equipment production is performed by a grouping of numerous enterprises organized around main contractor companies may be applied to other areas besides the aircraft industry. As the equipment becomes more sophisticated, the number of enterprises involved in a given item often

becomes considerably larger. In the case of the M74 tank which could be considered as Japan's representative military equipment, it was necessary to separate trial manufacture of such parts as the engine, transmission and control gear, mounting device, 105 mm tank gun, gun turret, gun stabilizer and armored materials from the trial manufacture of the overall tank in order to complete it. Many enterprises participated in the production of the respective parts. It was not built by Mitsubishi alone. The reason was that many different orders were involved basically at the development stage.

In the case of the M74 tank, aside from its basic characteristics--its weight of less than 38 tons, maximum speed exceeding 50 km per hour and its 105 mm main tank gun--it was required to be equipped with an oil pressure mounting device, a laser distance meter, a ballistic calculator, a turret stabilizer, etc. It was required to be amphibious and be equipped with noctovision for firing in darkness. Therefore, with Mitsubishi H Ind as the main contractor, Japan Steel Works was responsible for the 105 mm tank gun; Nippon Electric for the laser distance meter and Noctovision; Howa Machinery for the firing device, ammunition and smoke bombs; and Mitsubishi Electric Corp for the FCS (firing control system) and communications equipment. There were many other cooperating companies for the tank which took 10 years to complete.

With respect to other equipment also, progress has been made in systematization and complex functionization. Missiles have been divided into the missile frame, parts and components, ground systems (firing control system, firing apparatus) and accessory systems. Each segment has passed through the process of being broken down for research and development, trial manufactural, and final assembly.

Of course, virtually all the companies that participated in the R&D process continued to participate in the mass production as supporting enterprises or parts makers.

Therefore, the equipment production system consists of several thousand companies which cooperate under several dozen main contractors. However, the groupings do not necessarily apply in the case of all procured items, but only to the procurement of the so-called "frontal equipment."

V. Japan's Defense Industry From the International Viewpoint

1. Unique Characteristics of Japan's R&D

R&D Lacking in Most Advanced Fields

Generally speaking, the defense industry is the most technologically advanced industry. Therefore, its R&D is of great significance. But in the case of Japan, the ratio of R&D funds to the defense-related budget is extremely low. This is quite evident when compared with the ratios of R&D funds to defense budgets in the principal industrial nations.

In Japan, the defense-related R&D funds have been barely 1 percent or more of the defense budget for a long time. By comparison, the ratio is approximately 10 percent in the U.S., Britain and France. It is lower in West Germany, but still about 4 percent. Also, the absolute sizes of the budgets differ and the absolute amounts of R&D funds are vastly different. Japan's R&D is less than one-tenth of those of Britain and France, and less than one-one hundredth of the U.S.

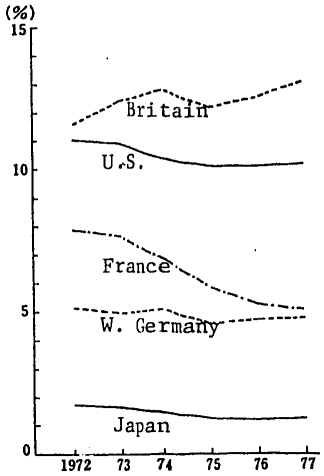
What does this difference in R&D funds signify? Also, what problems arise from this difference? It truly reflects the characteristics of Japan's defense R&D.

The greatest difference between Japan's R&D and that of the U.S., Britain and France is first discernible in the scope of R&D. In other words, in contrast to those countries, Japan does not directly produce nuclear weapons nor strategic weapons. It does not conduct R&D on machinery and instruments based on the hypothetical premise of being subject to nuclear attack. R&D on missiles and rockets are carried on earnestly in a sense, but long-range ICBMs and IRBMs intended to attack bases and cities in foreign countries are not its objectives. Such advance technology which requires vast R&D funds has not been its objective from the outset, nor is such R&D conducted presently. On the subject of aircraft, as in the case of missiles and rockets, the most advanced fighters and bombers are outside the scope of development in Japan, and only limited R&D goes on. Regarding chemical and biological weapons also, research is conducted only on areas where Japan is subject to attack by them and, although equipment to counter them are being developed, R&D on the weapons themselves are not. Thus, compared to Western nations and the USSR, the scope of Japan's defense R&D is relatively limited as far as the most advanced weapons are concerned.

The major reason for this is the nature of Japan's Self Defense Force. According to Japan's Constitution, it "does not possess military power." The interpretation that, by "limiting military power" it may possess "power for self defense," forms the basis for the SDF Law. There is a conflict of opinion on this point. But in any case, the SDF's combat strength is confined within a different framework from that of Western powers, and this limits its equipment as well. Therefore, the scope of R&D is narrowed down.

The design of the conventional submarine can easily be modified as a nuclear sub and in that sense may constitute a problem. The fighter plane with a refueling system and modified missiles which can be further remodeled to carry nuclear warheads can also be problems. However, they are all patterned after American designs or are developed by the U.S., and are not results of Japan's R&D.

Graph V-1: Comparison of R&D Funds by Nations (Ratio to Defense Spending)



Lack Original Development of Technology

The next point is the fact that Japan is highly dependent on foreign technology and that domestic production is continuing full swing under licensed technology. It is common knowledge that this trend frequently takes place concerning aircraft and missiles. Of course, it is not necessarily limited to defense-related equipment production, but often applies to many of the newer industries which grew during the era of high economic growth. The defense industry has depended on the import of licensed technology and has adeptly narrowed the technological gap.

The question of importing technology or initiating innovative development is a complex one with both pros and cons. But when the technological gap becomes too wide, independent development is likely to result in amateurish attempts, objectively speaking. In such a case, dependence on imported technology would be a great savings in time and costs if licensing is possible, and the results would be more reliable. Under given conditions, it cannot be denied that the acquisition and import of technology is preferable to independent development.

Despite this, a total lack of ongoing, independent development would result in serious problems. The import of technology is a process, whereby a technologically underdeveloped nation catches up with advanced nations and approaches advanced technical standards by skipping the process of trial and error. However, it does not mean true equalization of technical standards.

In other words, the learner is usually not equipped with the ability to surpass the acquired technology. Additionally, as the gap between technical standards becomes narrower, the importation of technology becomes gradually difficult. That is, although it may appear that identical equipment is being produced through licensed production, the technological content of certain parts and components is often kept secret.

Problems arising from lack of independent technological development do not end here. The defense equipment systems of individual countries, including the types and quantities of equipment, vary according to national conditions. A nation cannot be guaranteed import of equipment or licenses to produce equipment for its own needs. Therefore, it may often be left with a vacuum area in its equipment system.

Regarding individual items of equipment also, the ideal situation is to adapt them to the locale and personnel of the user nation. Such things as weight, size, functions, human strength required for manipulation, space, etc, are ideally achieved only through independent development.

Furthermore, although appropriate equipment may be developed and produced abroad, it is not always possible to import them or produce them under license. While that may be possible, they are more often inconvenient to repair and maintain than independently developed items.

The reasons for the inadequacy of independent technological development may be attributed to shortage of R&D funds. As stated before, Japan has not ventured into research fields where foreign countries have poured in huge sums. Therefore, mere comparisons of the ratio of R&D to overall defense funds and absolute levels of R&D funds cannot be said to be fair.

Japan's R&D funds are of course inadequate. But Japan is clearly making prudent choices in its expenditures and priority distributions.

The shifts in trial manufacture and consignment of funds may be divided into the following 6 areas: (a) aircraft-related area, (b) guided weapons, (c) firearms and vehicles, (d) ships and underwater weapons, (e) electronic machinery and instruments, and (f) others. The shifts in the emphasis at different times are easily discernible through these classifications. In each area there is a peak period of major projects and a wide-ranging changeover following a lull at the end of each peak period. At the same time the following trends may be pointed out: (1) The aircraft-related field enjoyed a high priority at one time (first priority during 1956-57 and 1965-71), but its priority is low today. (2) Guided weapons have taken over top priority. It was early regarded with importance, but the tendency has become more pronounced recently (top priority during 1958-62, 1972, 1974 and 1976-77). (3) Electronic machinery and instruments are second to guided weapons in importance, followed by ships and underwater weapons. (4) Firearms and vehicles were considered significantly important until about 1960, but they have subsequently been on the decline following an up-and-down period.

Japan's independent equipment development has been continued within the framework of such a distribution of priorities. It is a clear contrast to the Western distribution of priorities. In the respective priority areas, there appears to be no critical shortfall of R&D funds. But the following problems do exist. First, although it may be called priority distribution, a number of small allocations are made to several projects, so that concentrated development in a short period is impossible, and the period of development tends to be long range. Therefore, depending on the project, the results are sometimes mediocre despite the initial aim to develop the most advanced equipment. To avoid this, it becomes necessary to reset the goal in midstream.

Secondly, trial manufacture is generally consigned to the private sector, but the consignment is made to a specific company, and there is virtually no "competition" during the trial manufacture stage.

One exception among the mainline equipment is the M60 mobile 106 mm recoilless cannon. Komatsu Ltd, Mitsubishi Heavy Ind and Hino Motors competed for this caterpillar fitted vehicle during the proposal stage, but in the end it was Komatsu which was assigned. Nonetheless, during the first trial manufacture stage, Komatsu and Mitsubishi competed against each other. Of course, Mitsubishi had already been assigned to another caterpillar vehicle and the competition was intended as a kind of training for it.

In Japan, to be assigned to trial manufacture virtually means being assigned to mass production of an item (more will be explained on this later). In the U.S., trial manufacture and mass production are often completely separated. Recent examples show that, for the development of the GSRS (general support rocket system) for field artillery use which is attracting notice in the United States, the Boeing Aerospace Co and Vought Co are competing for its development and each company is spending 30 million dollars. As a result, the company with the superior product will be designated as the GSRS maker and it is now approaching decision time.

In the case of Japan, only one company is assigned to trial manufacture, so there is no data to compare and review the quality of the Defense Agency-private enterprise team's "achievement." There is no fear of huge sums being spent fruitlessly, but the safe R&D offers no guarantee of optimum results.

On the other hand, the system of consigning development to a single firm due to lack of R&D funds guarantees de facto consistency of development and mass production. What actually takes place is that the "development funds" are used as advanced payment and are added to the equipment price during the mass production stage and are thus recovered. In other words, the amount disbursed for the development stage is actually larger than the allocated defense R&D funds. Its size differs in each case, but in any case the final onus is not carried by the company, but is included in the procurement cost. In other words, the size of the actual R&D funds is the total of the original R&D allocation plus the funds which have been "diverted" from procurement funds.

Priority of Technological Imports Over Development

Two years ago, in June 1977, President Carter halted the procurement plan for the B-1 supersonic strategic bomber. The three prototypes for the supergiant aircraft with the variable wings were completed and tested, and the fourth prototype was under consideration, but the procurement was halted at this point. One reason was reportedly the production cost of 10 billion dollars per plane (the cost of one plane is roughly equivalent to Japan's total defense costs in 1978). It is characteristic of U.S. military weapons development that, after spending such huge sums, the weapon is buried without being deployed. The B-1 case is not exceptional but was merely added to the list of "ghost bombers" like the B-58 ("Hustler") and the B-70 ("Balkiri"?).

The fact that the goal of the B-1 was attained by the "cruise missile" was another reason for halting development of the B-1. There were 2 versions of the "cruise missile"--General Dynamic's "Tomohawk" and Boeing's "ALCM." From the standpoint of use, there were actually 6 versions, including those made public. Among them were the 3 versions of air-to-surface strategic missiles. If one of these is adopted, the other 2 would probably not be deployed for combat use. Such turns of fate are interesting from another point of view, but in any case the huge R&D funds have at least the appearance of being squandered. Notwithstanding this, many technological results are acquired in the process and they contribute directly or indirectly to the next R&D stage.

Of course, in Japan such great sacrifices are not made for R&D because that is not the objective of development from the outset. There were instances of development failures like the 155 mm mortar and the 105 mm light howitzer, but the sums are minimal (the development costs for the 155 mm mortar were about 100 million yen).

While aiming towards updating of present equipment through domestic production, large-scale development of independent technology has been avoided. The apparent position is to watch foreign developments and seek imports of their technology. As an example, there is the "Nike" missile. It was imported by the GSDF in 1963 (called the "Nike Ajax" at the time). Today, it is produced domestically through technical cooperation with the McDonnell Douglas Co, with Mitsubishi Heavy Industries in the forefront (Nike-J model). But it has already become outdated (it is weak against radio jamming), and U.S. production will end in 1980. In Japan, consideration is therefore being given to "post-Nike" measures.

However, domestic development of the successor to the present Nike--which can carry a nuclear warhead and whose "Hercules" model has a speed of Mach 3 with a range of 140-210 km--has been shelved from the beginning, in favor of either imported technology or a foreign product. It is unclear as to what type will actually be picked. The "Patriot" by the Raytheon Co, which developed the "Hawk" missile, appears to have the edge. Development of the "Patriot" began in 1976. It is superior in quality, with the possibility of attaining its development goal by mid-1980 at an estimated cost of 425 million dollars. To mass produce it, a supplemental budget in excess of

1 billion dollars is foreseen. This is not an extra-ordinary sum for the United States, but practically impossible in Japan's case. Incidentally, the cumulative total for Japan's trial manufacture and consignment of guided weapons during the 23 years from 1955 to 1977 was a mere 25 billion yen.

The characteristics of Japan's R&D for equipment may continue into the future. The defense industry urgently demands increases in R&D spending. The intent probably lies in the possibility of increased R&D resulting in shorter research periods, broader themes and more independent development. Also, in view of the historical and direct link between R&D and domestic production, the industry is seeking a substantive link between development and mass production.

The Defense Agency's Technical R&D Institute has initiated what it calls "thematic research," centering on the institute's unique technological research. The "3 major projects" which crystallizes the FY79 budget goals are as follows: (1) R&D on the CCV, (2) R&D on the portable SAM, and (3) an antiship and antiair search-and-spotter laser-radar experimental system. Surveys were conducted under consignment in 1978 concerning these items. The CCV was handled by Mitsubishi Heavy Industries; the portable SAM by Toshiba, Mitsubishi Electric Corp and Kawasaki Heavy Industries; and the laser-radar test system was handled by Mitsubishi Electric and Nippon Electric. They will enter the trial manufacture stage from FY79, and joint government-private enterprise teams will be formed for the respective items. Without delving into the development contents, a look at the FY79 budget indicates that the CCV budget is 3.4 billion yen, the portable SAM allocation is 430 million yen and the laser-radar system funds amount to 1.1 billion yen. These are appropriate as "major projects" for Japan.

Systematization of Equipment Lacks Consistency

The characteristics of Japan's R&D for equipment are as we have discussed so far. There is another problem from a comprehensive viewpoint. It is probably not unique to R&D, but it reflects the problems of the equipment structure itself. There are many points which indicate that inadequate consideration is given to the issue of what types of equipment are necessary for defense, and what types are not.

For example, the "Nike" and "Hawk" complement each other, but since they are deployed separately in the ASDF and GSDF, a subtle disparity is seen in the renewal plans. Conversion to a modified "Hawk" is in progress, but the "Nike" is destined to be succeeded by the model mentioned before. If the "Patriot" should be adopted, it will combine the functions of the "Hawk" and it is possible that the present conversion in progress to the improved "Hawk" will be dropped in the near future.

From the defense industry's standpoint, the question of what role the equipment it produces will play in the entire structure is a secondary issue. The lack of consistency in the equipment structure, including domestic and foreign products, is basically a reflection of the lack of consistency in the defense system. And the irregularity in the development and import of equipment tends to aggravate the situation.

Public attention is presently focused on the import of the E-2C. Ever since the most advanced Soviet aircraft first flew over Hokkaido, the inadequacy of Japanese aircraft in preventing low altitude approach by enemy aircraft has become evident, and the need to import the AEW (airborne early warning) as soon as possible has been urgently stressed. But merely importing the AEW could not solve the problem, since the BADGE system as a whole is not structured to fill such a need. Also, the present TAWCS (tactical air weapon control system) which is produced by the Hughes Co of the U.S. is open to criticism as a "cheap purchase."

Since in excess of 2,000 billion yen is dispensed annually for defense spending, the procurement and development of equipment should be conducted from a more systematic, comprehensive and long-range viewpoint. The problem of R&D costs and the choice between independent development and imported technology cannot be accurately evaluated without establishing basic guidelines.

2. Stable Arms Market

R&D With Minimum Risks

The defense industry is said to entail great risks with low profits--an industry which does not pay. Is this true? The logical basis for the argument that the defense industry has great risks is that its needs are entirely dependent on the national budget; that it cannot be converted to another direction in case of changes in procurement plans; that future plans are not always clear, etc. Also, the fact that R&D requires a considerable amount of time is another reason given. For instance, Keiichi Nagamatsu states in his recent book as follows:

"Since the volume of defense equipment production is stipulated by demand from the Defense Agency, there is the risk that its continuity cannot be determined as calculated by the enterprise." ("Japan's Defense Industry") As an example, Nagamatsu cites the numerous unfilled orders during the 4th defense buildup plan, and says, "The problems of insufficient redemption for investment in facilities has been the result." (ditto) This is indeed true.

However, throughout the history of the Defense Agency, a large residue of unfilled orders happened only during the 4th buildup plan. The goals and achievements generally coincided during the 3rd buildup plan. During the 1st buildup plan, orders for 12,000 tons in ships and some 150 planes for the ASDF were left unfilled. The reason was that the 1st buildup plan was overly dependent on the United States. Nagamatsu says, "Due to changes in the procurement plan and lack of clarity in future projections, risks concerning production facilities, technicians and skilled workers were always present." (ditto) But this point is unacceptable, because it depicts the special connections of the post-oil shock period as a general condition.

During the general recession of the post-oil shock period, the business community was affected by excess facilities due to the absolute decline of

production levels. It was by no means limited to the defense industry, but it extended to many industries, including the steel and shipbuilding industries--even creating the term "structural recession industries." Meanwhile, the profit ratio of the defense industry was higher than the industrial average, which indicates its relative prosperity. Nagamatsu's statement that, "Because numerous enterprises went into deficit during 1950 and 1951, there could be cases where the profit ratio of the defense industry becomes temporarily and relatively higher than that of general industry," (ditto) indicates the relatively small risks of the defense industry during the major recession when it did business with the nation. Of course, we by no means deny the impact of the shortfall in filled orders during the 4th build-up plan. We are opposed to the one-sided view that, compared to the other industries, the defense industry is full of risks.

R&D for equipment consumes much time. Moreover, if the equipment becomes obsolete, the procurement is halted. Therefore, one may fall into the delusion that those enterprises which participate in R&D for the defense industry must be motivated by some purpose of mission or "patriotism." Of course, it cannot be denied that individual business managers are motivated to some extent by such emotions. However, in today's economic society, it is clear that business management cannot survive on such emotions alone.

From the standpoint of the defense industry, it is nothing but a "myth." Certainly development of equipment requires long periods of time. The more advanced the equipment, the more probable the need for long-range R&D, and the Technical R&D Institute's data clearly supports this. At the same time, lengthy development periods are not limited to the defense industry. Only recently in Japan, auto makers developed a plastic gas tank which took 6 years. Also, in the U.S. today, vast sums of more than triple the cost of the Apollo program are being spent to develop a fuel-efficient car by 1985.

In general industry, there is no guarantee that procurement orders will be received for results of R&D. Also, under conditions where several companies conduct simultaneous R&D for similar goals, the danger is very strong for one company to be outperformed by another. Cases are actually common where one company's success in R&D nullifies development by other companies. In comparison, the development themes for R&D by the defense industry are selected in conjunction with deployment goals, and the results are virtually certain to be materialized. And, although they are generally in small amounts, consignment funds are disbursed by the Defense Agency for development. In form, development and mass production are separated and this becomes the basis which enables additional consignment funds to be issued so that ends can be met for the developer at the development stage. Also, apart from the survey stage, there is no chance at the development and trial manufacture stages for a plural number of companies to supply equipment separately for the same purpose. As a result, there is no competition.

Development and mass production are separate "in principle," but there is virtually no possibility for different companies to be in charge of an item at the development stage and the mass production stage. This is clear by looking at the relationship between development and mass production in the

past. From the standpoint of facilities involved and acquired technology, the company in charge of development is also favored to be placed in charge of mass production. Considering also the process of selecting the supplier, the more important the equipment the more optional the contract, and there is very little room for a "third party" to enter the picture.

By international standards, R&D spending in Japan is extremely low (this has already been explained), but it is offset at the mass production stage. The developer thinks nothing of spending in excess of the R&D allocation by the Defense Agency, and it is recovered through overcharges at the mass production stage. This fact shows that (1) from the developer's standpoint, development and mass production are handled inseparably; and (2) the cost of an item of equipment at the mass production stage actually includes a portion of the company's development costs. This means that, aside from the question of facilities and technology involved, it may be possible to produce the equipment at a lower cost by consigning it to another company. However, at this stage competition is no longer present, and the company receives unbudgeted R&D funds from the government. Therefore, the actual R&D funds far exceed the funds which have been made public.

Delivery With Continuity

Equipment is constantly undergoing improvement. Therefore, the newest and most advanced weapons eventually become "antiquated" and useless. Procurement for numerous items have been halted because they have become outdated and commonplace. As long as there is progress in technology, it is a fate no equipment can escape. Of course, depending on the type of equipment, there is a wide disparity in their historical longevity, but their fate is essentially the same.

Whenever the modification of equipment is planned, the supplier is doomed to lose his market. If the equipment cannot be transferred for use elsewhere, the procurement halt means the loss of markets and halt in production. Products made by the defense industry are destined for such a fate.

Of course, products becoming outdated is not a phenomenon unique to the defense industry. Among general industrial products, machinery often follow the same destiny. It is especially true regarding high technology equipment, such as commercial aircraft and electronic computers. Cars and agricultural machinery are regenerated (substituted with new generation products) over a long period.

The question is, what impact does this have on a specific company? The modification of defense equipment begins with the substitution of residual foreign equipment with new domestically developed equipment, and the typical pattern is to replace the previous equipment with newly developed equipment. During the process, the possibility arises for previous equipment to become useless due to the progress in other related equipment. The relation between the tow vehicle and the mobile cannon is typical. The mobile cannon consists of the tow vehicle and a cannon, and its improvement as a single unit is a

minus factor in the demand for tow vehicles. But, for the time being, let us look at the generation changes in identical equipment.

The transition from the M61 tank to the M74 tank will show that the main contractor for both models is Mitsubishi Heavy Industries. As we have seen before, if we look at the individual parts of the equipment, the procurement period for certain equipment is limited. But actually the company in charge of development for the next generation equipment and the company now producing it are often one and the same. The production of the equipment and the development of the next generation equipment are conducted simultaneously within the same company.

The M61 tank is, as the tag indicates, a tank standardized in FY61. Its mass production began in 1962 and it was procured as the central equipment for the GSDF until recently. The development of the M74 tank was started in FY64, only 2 years after the mass production of the M61 began, and the supply and development of the next generation tank were conducted simultaneously for 10 years. The Technical R&D Institute has already started developing the "post-M74" tank. (See Chart V-2).

Herein lies a close link between the Defense Agency and the private enterprise. The strengthening of this relationship also makes the entry of a "third party" difficult. When the next generation equipment is developed as planned and reaches the stage of delivery, procurement ends for the outdated equipment and shifts to the next generation. From the standpoint of the enterprise, the delivered products steadily increase in quality. The "halt in production" due to outdating means a loss of markets for its product, but in substance it usually coincides with "the beginning of new equipment production." As a result, the continuity of delivery is actually guaranteed.

Chart V-2: Examples of Continuity In Delivery

Mitsubishi H Industries: 1950====(M61 tank)===60 [61] 62 → (M74 tank) 64===73 [74] 75 →

Komatsu Ltd)
Ohara Iron Works): 1955===(61 type large snow plow) 60 [61] 62 →
(new snow plow) 73===77 [78] 79 →

Mitsubishi H Ind: 1963===(M70 tank recovery vehicle) 65 [70] 71 →
(new type tank recovery vehicle) 72===76 [78] 79 →

Komatsu Ltd)
Mitsubishi H Ind): 1955===(M60 armored car) 59 [60] 61 → (M73 armored car) 67===70 [73] 74 →

====development period [ ] standardized year = procured

From the standpoint of continuity of delivery, the situation is no different concerning equipment produced under license. Of course--taking aircraft as an example--from the time the F-86F fighter was supplied by Mitsubishi Heavy Industries, and including the F-104J and F-4EJ as well as the present F-15, there was virtually no possibility for the assigned company to be replaced. In the case of the antisub patrol plane also, Kawasaki Heavy Industries was assigned to the licensed production of the P2V-7, the development (domestic modification) of the P-2J and the development of the PXL. Although the PXL did not result in a domestically developed plane and was replaced by the Lockheed P-3C, the contractor for licensed production could not have been any other company than Kawasaki. Moreover, when it became certain that the change to the F-15 fighter would come later than originally planned, a supplemental order was issued for the F-4EJ in order to prevent a vacuum state in air defense. At the National Defense Council meeting of January 1969, when the domestic production of the F-4EJ was decided, a decision was made to produce 104 planes. During the 4th buildup plan, 24 more planes were added and 12 planes were further added for the post-4th buildup plan, thus exceeding the original plan by 140 planes.

3. Typically Japanese Joint Industrial-Military Complex

Some time has lapsed since the term "industrial-military complex" or "military-industrial complex" came into use. It first attracted attention in 1961 when President Eisenhower used the term "military industrial complex." In Japan, the term "industrial-military complex" is more often used, indicating that leadership is on the side of industry, while in the U.S. the military appears to be relatively more powerful. (See Note)

Note: J. K. Galbraith's book, "The Theory of The Military-Industrial Complex," (translated by Keishi Ohara and published by the Ogawa Co) was originally entitled, "How to Control The Military," and was subtitled as such in the translation. Berkley Rice's book, "This Is The Industrial Military Complex!," (translated by Tetsuya Ozeki and published by Jiji Tsushinsha) was originally entitled, "The C-5A Scandal: An Inside Story of The Military-Industrial Complex."

Role of Former Self Defense Force Officers

Japan's defense industry is closely affiliated with the armed forces in every aspect, from the R&D stage to delivery of equipment. This union is not confined merely to the industrial aspect which includes R&D, procurement and delivery, but the human connection also plays an important role.

"When the initial domestically produced jet trainer T1F2 (later changed to T-1A) made its maiden flight on 19 Jan 58, the flight log showed that the pilot was former Colonel Takaoka (present Mitsubishi H Industries consultant); the pilot of the accompanying plane was Lt Col Hidaka (present Fuji H Industries' company pilot). In the rear cockpit was Lt Col Taguchi (present production dept chief of Fuji's Utsunomiya plant)." (Quoted from Kiyoshi Ishizuka's "Development and Technical Characteristics of The T-1" in THE WORLD'S OUTSTANDING AIRCRAFT, May 1974)

This seemingly innocent passage is very interesting, because it reveals the ASDF officers who participated in the test flight of the military plane and their subsequent careers. The uniformed officers of the Defense Agency are, from top in order: major general, colonel, lieutenant colonel, major, captain, 1st lieutenant and 2nd lieutenant, with the total exceeding 30,000 officers. Therefore, the ranks of colonel and 1st col are not among the highest, and it is difficult to trace most of their whereabouts. But some are mentioned here. Aside from Mr Takaoka who switched from major general to Mitsubishi H Ind consultant, there is little data on the middle echelon officers and below who entered the defense industry.

A great number of high ranking officers of major general and above, who retired from the military, have entered defense industry-related trading companies and supplier firms. Nissho Iwai Co and its subsidiaries reportedly hired a total of 9 persons headed by 4 high ranking officers of the ASDF, including 1 general and 3 major generals. Sumitomo Shoji and Mitsui & Co also once hired former commandants of the Air Defense Command as consultant and part-time consultant. Whereas the trading companies welcome members of the ASDF because of the types of products they handle, the manufacturers accept officers who are closely affiliated with the equipment they manufacture. This distinction is quite clear.

The table shown below (Table V-1) shows the number of retired SDF generals, lieutenant generals and major generals hired by principal defense industry-related companies. The table indicates the number of generals presently hired by these companies. But it is not a cumulative total, and therefore does not show those who have retired since being employed. It shows 4 former chairmen of the Joint Staff Council, 2 chiefs of staff of the GSDF, 2 chiefs of staff of the MSDF and 4 chiefs of staff of the ASDF. The order of companies in the table coincides with the order in the 1976 survey of companies receiving procurement (the top 20 companies). Actually 3 companies--Nippon Oil, Maruzen Oil and Idemitsu Kosan--are omitted. The reason is, these oil companies do not supply specific specialized products, clearly differ from the other makers and have not hired retired defense officers.

The roles played by these former SDF officers are not immediately clear, but there is no doubt they form the connection between the enterprises and the Defense Agency. Their basic activity, relative to delivery of equipment, consists of quickly obtaining information as to where and what types of equipment are being discussed at the Defense Agency, and to influence the division or bureau concerned. In addition, they have personal contacts at every level of common interests between the companies and the Defense Agency. That is where their connections become useful.

Table V-1: General Officers Hired By Major Defense Enterprises

	(GSDF)	(MSDF)	(ASDF)	(Total)
Mitsubishi H Industries	4	10	6	20
Ishikawajima Harima H Ind	0	6	4	10
Kawasaki H Industries	3	6	4	13
Mitsubishi Electric Corp	5	2	3	10
Hitachi Shipbldg & Engr	0	2	1	3
Nippon Electric	3	3	3	9
Shin Meiwa Industry	0	3	0	3
Fuji H Industries	2	2	2	6
Toshiba	7	6	2	15
Japan Steel Works	2	1	0	3
Komatsu Ltd	2	0	0	2
Hitachi Seisakusho	2	3	2	7
Nippon Koki	1	2	0	3
Daikin Kogyo	1	2	1	4
Shimadzu Seisakusho	1	2	1	4
Nissan Motors	5	1	0	6
Mitsubishi Precision	0	1	4	5
Total (17 companies)	38	52	33	123

Note: Actively employed as of September 1978

According to the above table, it is clear that the major defense-related enterprises do not hire retired general officers without purpose. They are hired in direct relation to the equipment supplied by the companies. Since the equipment produced by Mitsubishi Heavy Industries extends to the ground, sea and air defense services, it hires generals connected to the respective items of equipment. Generally the same tendency applies in the case of Kawasaki H Ind, Mitsubishi Electric Corp, Nippon Electric, Toshiba, Hitachi, etc. Ishikawajima Harima's main fields of interest are engines and ships, so it does not hire GSDF generals, and Hitachi Shipbuilding also emphasizes ships. In the case of Shin Meiwa Industry, it clearly engages in production of naval planes. Conversely, Komatsu Ltd regards vehicles with importance and Mitsubishi Precision stresses aircraft. Japan Steel Works reflects its prime interest in large-gauge firearms.

"Defense Industry Family"

Of course, personal connections is not a question confined to retired high ranking military officers. As contacts at the "work-level" between the companies and the Defense Agency deepen, they develop into a union between the Defense Agency and several select enterprises, and the close exchange of information between them preclude the entry of any "third parties."

In fact, as far as the R&D of important equipment is concerned, the companies receiving the information and submitting proposals are always limited to several companies, depending on the type of equipment, and the outsiders are not consulted at all. In such a case, an outsider may join in submitting a proposal through certain maneuvers, but the maneuver is also the result of personal connections. Such maneuvers are possible at various levels.

Today, what may be called a "defense industry family" has been formed to produce various frontal equipment. As a result, competition has decreased considerably in comparison to other industries and the "family" functions as an exclusive group.

In Japan, however, the Defense Agency's authority is quite weak and important decisions concerning procurement are likely to be influenced by the will of outsiders. There are instances where it appears that a certain policy has been clearly influenced by the will of outsiders, but in most cases it is not true. While independent decision-making by the Defense Agency is maintained in form, the will of the individual companies is actually being implemented.

This complicated relationship between the Defense Agency, related government agencies and politicians sometimes becomes a "frontal issue," but it always remains as a deep undercurrent, and the public only learns about it post facto or through the grapevine.

Although the relations between individual defense-related companies, the Defense Agency and politicians tend to be regarded with deep suspicion, the activities of the business community as a whole purport to represent the interests of the entire defense industry.

The typical organization in that respect is the Defense Production Committee of the Keidanren to which we have already referred. The committee drafted a "Keidanren draft proposal" as soon as it was organized, which hypothesizes the steady buildup of defense power. (More accurately, it consists of a "draft proposal concerning the buildup of defense power" and "survey data concerning defense production.") The proposal failed to materialize, but subsequently the committee appeared in the role of leading the individual companies in several aspects. The domestic production of the F-86 and the T-33 was not the initiative of the then Shin Mitsubishi Heavy Industries and Kawasaki Aircraft Industries, but was carried out under the guidance of the U.S., the support of the Keidanren, and the followup by the Defense Agency and private enterprise. The shipbuilding programs also materialized through the Keidanren's leadership and negotiations with the Defense Agency.

The activity during the early stages is recorded in the "10 Year Annals," and Tetsuya Chiga writes about the later activity in "Testimony" (quoted later in this book), so we will not go into concrete details at this point. However, the later stages show the role of the Defense Production Committee changing gradually to one of coordination. Of course, in the meantime it continued to work towards domestic equipment production, stabilization of procurement prices and substantive buildup of the defense industry.

The industrial-military complex in Japan is the sum total of several different dimensions. From the standpoint of the defense industry, it is, first, a group--including political and government circles--whose interests coincide with those of individual companies. Secondly, it is a group which shares interests with industries and enterprises involved in specific fields (for example, aircraft, missiles and tanks). Thirdly, it is a group which shares interests with the entire defense industry. These elements coincide at times and conflict at other times, but at one stage or another they serve the defense industry. This is not necessarily so in a criminal sense, but because it involves a commonality of destiny, it is a union of inseparable elements.

Link Between Pre- and Post-War

The union between industry-enterprise and the military has a long history. Most of Japan's enterprises representing the defense industry did not enter weapons production when the postwar defense industry made a fresh start, but they were involved in munitions production before and during the war. Of course, the U.S. achieved remarkable technological progress during World War 2 and Japan's defense industry learned a great deal from the U.S. But, even while absorbing U.S. technology, the experiences of the past cannot be overlooked. In various ways Japan's postwar defense industry indicates an aspect of continuity, as well as an aspect of discontinuity, vis-a-vis the prewar and wartime eras.

If one recalls the early development of Mitsubishi Heavy Industries, it is easy to connect the present with it. There are cases, for instance, where a company which produced aircraft for the former (Imperial) armed forces is now--after many twists and turns--a division of an auto manufacturing company producing military planes and rockets. The various resources of technology, personnel and facilities of munitions companies are being utilized in the postwar buildup process.

For the development of the antisub flying boat PS-1 by Shin Meiwa Industry, the experiences of the "Type 2 flying boat" during the era of the Kawanishi Aircraft Mfg Co, centered on the technical group of Shizuo Kikuhara et al, are said to have been useful. The PS-1 itself was based on the design of the experimental flying boat UF-XS, which is a drastically modified version of the Grumman UF-1 ("Albatross"), and during that stage too, past experiences have been applied.

Neither is Toshiba an exception. When Toshiba's defense-related products of the prewar and wartime eras are compared with today's products (See Table V-2), it is clear that, while there has been subsequent progress in electrical and electronic technology, the areas under development were markedly similar. The propensity to establish specialized plants for munitions production, to hire numerous retired defense force officers and to strive aggressively for rights to deliver equipment by influencing politicians--all these traits have a long history.

Table V-2: Defense-related Products By Toshiba (compared with prewar and wartime eras)

(Prewar and wartime eras)

Wireless communications equipment - Army transmitters, wireless telephones, etc

Radiowave weapons - Radio altimeter, radar, air direction finder

Special weapons - Supersonic submarine detector, aerial magnetic detector, missiles (the war had ended when it was successfully tested)

Optical weapons - Gun sight meters

Electrical instruments - Electric propulsion motor for subs, electric propulsion motor for torpedoes, electric propulsion motor for special subs

Cartridges - Shell parts, cartridges

Others - Ultra shortwave killer ray (trial manufactured; unfinished), electric cannon (trial manufactured; unfinished), rocket engine (trial manufactured; unfinished)

(Postwar era)

Wireless equipment - Ground wireless equipment (wireless for vehicles, portable wireless), wireless equipment for aircraft (data link receiver for F-104J and F-4EJ)

Radar - Ground entry control apparatus (search radar, telemetry radar), antisub surveillance radar, anti-approach radar, phased eye radar (ground radiowave jamming device, antigun radar, short range SAM firing control device), weather radar, radiowave detector

Short range SAM - main contractor (for development of all systems)

Information processing systems - Antisub information processing system (tactical data general indication system), anti-air battle command supplemental system (for "Hawks"), inertial navigation system (for F-4EJ, etc)

Optical weapons - Optical gun sight system (for F-104J, F-4EJ), laser applying instrument

Others - Various training systems

Data - Excerpted from "Centennial History of Toshiba"

4. Internal Struggle Over Domestic Production

The final decisions concerning importation of equipment, aside from a pro forma sense, actually are often nebulous in many respects. Especially when foreign products are purchased, or when foreign-developed technology is imported for domestic production, there are often inexplicable points which sometimes become the topic of newspaper articles or "political issues." In the selection of equipment, to what extent does the Defense Agency use its own initiative? Probably only the parties concerned "understand" and the truth remains unclear. The "basis for selection" which is announced after the fact sounds quite suspicious.

We don't intend to write a so-called "inside story" here. But we think that there is some basis for the prevalent suspicion that accompanies the selection of foreign-developed equipment. As we have already explained, domestically developed equipment is tied to a long relationship between the Defense Agency and the enterprises, and it is often difficult to suddenly change this relationship. On the other hand, relations concerning equipment developed abroad occur at the very point of delivery, creating a situation where a plural number of companies compete actively with each other. At that point, actions which arouse suspicion are apt to occur. Moreover, in the case of aircraft and missiles, the cash transaction could be considerable, resulting in competitive moves to win rights.

Suspicion Surrounding the Import of Fighter Planes

We shall merely cite a few examples. First, the FX issue during the 2nd buildup plan. This is a successor plane to the F-86 and, from the 3 options--the Grumman F-11, the North American F-100 and the Lockheed F-104--the Grumman F-11 was "initially" selected on an informal basis (at the April 1958 National Defense Council).

Meanwhile, however, the Lockheed F-104 gradually came to the fore. At the time, (Shigejiro) Ino was Defense Agency director-general, Nobusuke Kishi was prime minister and Eisaku Sato was finance minister. The Grumman F-11 had been unofficially picked, but the feeling subsequently emerged that the F-104 might be utilized. It was slightly over a year since the F-11 was informally selected. During that time, there was considerable difference of opinion between Director General Ino and the Kishi-Sato brothers. Prime Minister Kishi and Finance Minister Sato appeared to prefer the F-104. On the other hand, Director General Ino contended that, from the standpoint of training, safety and other problems, the F-11 would be the natural choice from the F-86 to the next generation plane. However, in the end, it was

decided to start from scratch concerning the FX." (From the "Testimony on The Postwar Industrial History," chapter III, by MAINICHI SHIMBUN. This is the record of a dialogue in the form of a reply by Tetsuya Chiga to a question by Hiroshi Koyamauchi. In the following references, it will be referred to as the "Testimony".)

"Well, PM Kishi and Dir Gen Ino had opposing views. Dir Gen Ino resigned and Munenori Akagi became the new director general. They say that the successor plane was then returned to scratch, but the Grumman F-11 was dropped, which left only the F-100 and the F-104. The F-100's weight was slightly over 12 tons with a speed of Mach 1.4. It was the largest unit built. Therefore, there was a very strong demand among some in the defense industry to adopt the F-100." (From the "Testimony")

At the beginning, the Grumman F-11 was unofficially selected as the first stage FX plane. The F-11 selection was based on the decision made by Takeshi Sachi, the then ASDF chief of staff, as head of the survey group, and it appeared to reflect in large part the thinking of the ASDF staff at the time. However, subsequent events show the F-11 was not welcomed by the defense industry. There was a split into F-100 and F-104 factions, while the political circles gradually leaned toward the Lockheed plane.

(Koyamauchi) - "Prime Minister Kishi and Finance Minister Sato are amateurs concerning fighter planes. It is strange that amateurs should reverse decisions made by experts. Mr Chiga, who must have felt something to that effect."

(Chiga) - "You mean, you want me to say that? (laughter) Truthfully, I thought the F-100 was also a fine plane. However, the F-104 is somewhat like a cannon shell with wings attached, and I thought it was really something. But I did wonder whether it was all right. If the choice were made from a common sense viewpoint, I felt, the F-100 was preferable to the F-11. I could say that much." (From the "Testimony")

Regarding the first stage FX, Minoru Genda, then ASDF chief of staff, subsequently visited the U.S. in August 1959 as head of a survey team, and he drafted a report indicating the Lockheed F-104 was the proper plane. In November of the same year, the F-104 was officially picked at the National Defense Council. In March 1979, the issue was voluntarily referred to at the Upper House budget committee by Mr Genda, who had become a member of the Upper House from the LDP. According to Mr Genda, a telegram was received from a certain politician, requesting that "the Grumman be adopted for the good of the nation," while Mr Genda was in the midst of drafting a report by the survey team. We do not know the identity of the politician who was secretly politicking for Grumman. The public knows well what politicians were politicking for Grumman at the time. Incidentally, here is a portion of the passage in the "Testimony" which refers to the Genda survey team.

(Chiga) - "Genda visited the U.S. in August 1959, where he personally piloted the F-104 and returned home after deciding the plane was his choice. We heard a long tale of justification from Genda."

Suspicion has continued to surround the import of fighter planes whenever the question of a successor plane has come up. However, these questions are now being partially explained, so we do not intend to probe into them here.

Suspicion Surrounding the Import of Missiles

Let us move on to the problem of missiles. The "Hawk" is a well known SAM missile with a low altitude target. It was developed by the Raytheon Co of the U.S. in 1954 and was first imported during the 2nd buildup plan. It has been produced domestically since the 3rd buildup plan and, today, Japan is moving on to a modified version.

In contrast to the case of the aforementioned fighter planes, activity surrounding its import consisted not of "what to import," but of competition within the defense industry concerning "what company should be in charge of domestic production."

This question was also taken up at the February 1979 national Diet (Lower House budget committee) in connection with the problem of importing the E-2C. Former officer Osamu Umihara, who appeared as a witness, spoke generally as follows about the "Hawk" issue. Former PM Nobusuke Kishi sent a letter to President Adams of Raytheon, prior to the Defense Agency's decision, concerning the licensed production of the "Hawk", in which he recommended Toshiba. Umihara, who obtained a copy, remarked, "I thought it was strange from its content that, at the time, no production plan for the 'Hawk' had been sent anywhere. It was clearly stated in the present perfect tense that the order had been sent out." He called Kishi's secretary and gave him due warning, whereupon he subsequently received various pressures, according to reports.

In October 1967, an incident occurred in which Morita, chief of the Defense Agency's materiel bureau committed suicide. The day before his death, Morita talked with financial leaders at a discussion meeting on defense equipment production. After giving a general explanation of the 3rd buildup plan, he stated as follows:

"At this time, what I wish to ask all of the business leaders is not to be anxious to compete among your companies and groups for orders on equipment, but to cooperate towards orderly technical progress. Competition in a positive sense is fine, but I ask that you do not indulge in extreme competition." (From the "Testimony")

An elite bureaucrat from the Ministry of International Trade & Industry thus exposed part of the "extreme competition," but the fact that, in the end, Toshiba was consigned to the ground equipment production underscores the pressures being applied. Morita was responsible for the 1st stage decision regarding the domestic production of the "Nike" and the "Hawk." There was fierce competition among the enterprises over distribution of production

roles, and the background maneuvers were more than the materiel bureau chief could handle. Chiga discussed subsequent events as follows:

"He consulted with Kamaya (who succeeded him as materiel bureau chief) regarding roles by the companies in the 'Hawk' production. As a result, it was decided that Mitsubishi Electric Corp would produce the shell cases and Toshiba would be the main contractor for ground equipment. If the two firms were to share in the production, it would create a very complicated situation. So it was decided that each unit of the 'Hawk' would be assigned to a different contractor." (From the "Testimony")

In October 1967, the Japanese foreign minister and the U.S. ambassador to Japan exchanged official documents concerning Japanese production of the "Nike" and the "Hawk." They called for the production of 665 "Hawks" for 3 battalions (14 companies) in the initial stage, worth more than 49.45 billion yen. Since equipment several times the initial order could be expected to follow, it constituted the greatest factor for fierce competition. The production roles allocated to the companies were: shell cases by Mitsubishi Electric, ground equipment by Toshiba (a portion to Mitsubishi Electric) and combat command systems by Nippon Electric.

Suspicion Surrounding the PXL Issue

The problem of the new antisub patrol plane, called the PXL, was settled by adopting the Lockheed P-3C. The following decision was made at the December 1977 National Defense Council: "With respect to the new generation patrol plane, in order to replace the decrease and depreciation of the MSDF's present antisub patrol planes and to modernize the MSDF, 45 P-3C planes will be domestically produced after 1953 (a portion will be imported). Also, the concrete annual buildup will be implemented with due consideration for economic and financial conditions during the respective years, in coordination with other national policies."

In the case of the PXL, it was a contest between the direction toward genuinely domestic production and the direction toward import of foreign-developed aircraft or licensed production, with the aim to deploy an antisub patrol plane of higher caliber replacing the P-2J.

The Defense Agency disbursed development funds for FY70 and FY71, and also appropriated funds for FY72. In conjunction with the Defense Agency's position, Kawasaki Heavy Industries started work on a life-size model and came to the verge of completion. It was then decided to "discuss the problem of domestic production from scratch," and that is what actually happened.

A clause on the "buildup of the P-3C" was inserted in the "Defense White Paper" of 1978, and the "reasons for selecting the P-3C" were adroitly explained. We will not dwell on details here, but will merely quote the following famous lines:

"Impact on the operations of a certain aircraft industry--The aircraft industry is important as a key defense base and the nation should pay careful attention to its maintenance and cultivation. As far as the various proposals for originating aircraft units are concerned, the individual proposals for a domestically developed plane and for a hybrid (modified version) of a foreign make, and a proposal for a mix of the two types, are the best. On the other hand, the proposal to import the P-3C hardly contributes anything in this respect. But the proposal to domestically produce the P-3C under license calls for originating between 1.5 to 2 times the number of units, compared to the P-2J. Thus, it could impact considerably on aircraft industry operations." (Underlined portions are by citer)

This is one of the 5 reasons for selections listed in the "white paper." This specious passage could be said, on more careful scrutiny, to be nothing short of contradictory from the standpoint of logic. Judging from "the impact on aircraft industry operations," the licensed production of the P-3C is clearly better than importing the P-3C. However, a look at the initial passage shows that the superiority in the number of originated units is to be found not in the licensed production of the P-3C, but in the "individual proposals for a domestically developed plane and for a hybrid of a foreign make, and a proposal for a mix of the two types," which "surpass the P-3C is carefully avoided. From the standpoint of the number of units, the passage should have indicated that the licensed production of the P-3C was inappropriate.

However, by inserting the self-evident passage that license production contributes more to the aircraft industry than does imports, the issue is camouflaged. It says, "According to the proposal for licensed production of the P-3C, the production units would be 1.5 to 2 times more than the P-2J, and it could also impact considerably on aircraft industry operations." But there is no reason to compare units with the P-2J. Comparison should have been made not with the P-2J, but in connection with the 13 models which were candidates for selection at the primary stage for the next generation anti-sub patrol plane, to be reduced to 5 candidates.

Incidentally, if comparison was indeed made with the P-2J as contended, production units for the other models should also be compared with the P-2J, and in this respect the P-3C could not have been the outstanding choice.

Of course, the parties who compiled the "white paper" were well aware of the tradition and it need not have been pointed out by us. Therein lies the false pretences of the "white paper." In hindsight, it is true that the production of P-3C units surpassed the P-2J, but that could not have been the reason for its selection.

Actually, according to the Defense Agency document entitled "On The Selection of The Next Generation Antisubmarine Plane" published a year before the "white paper" (in September 1977), "the proposal for licensed production of the P-3C is not as good as the other proposals, excluding the P-3C import proposal, but it does call for 1.5 to 2 times the number of units compared to the P-2J."

The comparison here with the P-2J is also strange. The "white paper" purposely omits the inferiority of the P-3C, which is "not equal to the other proposals," and presents it in a positive light for selection. In September 1977, an objective evaluation was made to the effect that, "although the impact on aircraft industry operations will be inferior to that of the domestic development proposal, its contribution could be considerable." However, only one year later, such switches were rampant in the "white paper." In any case, there is no denying that, in the entire process concerning the PXL problem, there are too many portions which defy logic. It can only be understood in the light of competition over procurement allocations.

VI. Issues of the Defense Industry

1. Domestic Production Or Imports?

Regarding the problems of the defense industry, let us first look at the question of choice between domestic production and imports for equipment procurement. This will undoubtedly be a recurring topic for some time in the future.

Pluses and Minuses of Domestic Production Versus Imports

There are several options concerning methods of equipment procurement. There may not be agreement as to which is the best option.

In Japan today, there is little stockpiling of ammunition, and in most cases the supply reportedly could be exhausted in about a week. Therefore, since about 1978 an increased stockpile of ammunition has been urged. Concurrently, the question of whether to import ammunition, or to produce them domestically, has become a major issue. The industry has naturally stressed domestic production. But opinion within the Defense Agency has split. There were those who stressed the import formula, because imports were cheaper and maximum amounts could be stockpiled on a limited budget, and those who emphasized domestic production which would raise the level of domestic defense production and strengthen the defense industry base. Both views clearly have their reasons, but there was a divergence in their points of emphasis and no room for compromise.

The Defense Bureau supported stockpiling imported ammunition because of lower costs and it made sense. On the other hand, the Equipment Bureau stressed domestic production from the standpoint of lower prices based on larger procurement volume. But this was premised on a drastic increase in the ammunition budget. The budget failed to be increased and it was decided for the time being that FY79 ammunition procurement would continue to center on domestic production. It was interesting that, among the reasons for focusing on domestic production, the point was added that there was virtually no price difference between imported and Japan-made ammunition as the result of a survey.

However, this issue is related to the basic problem of equipment procurement. Therefore, let us look at the pluses and minuses of both imports and domestic products in general.

First, the imports. The pluses of importing equipment are, one, that they are generally lower in cost. Virtually all domestically produced equipment is higher in price. The reasons often cited are in effect differences of mass production, the comparatively short time in which most imports can be procured, and the avoidance of R&D expenses. There are also minuses such as the difficulty of maintaining secrecy regarding the functions of the equipment; the possibility, depending on the equipment, of facing operating difficulty and less than optimum balance between the functions and the place of use; and the uncertainty whether procurement can be obtained as desired. Also, the fact that related impact on domestic industries can hardly be expected.

In the case of domestic products, it is the exact opposite situation. The most emphasized point probably is the stability of supply in having the production base at home. Japan's defense industry has consistently stressed defense production capability as the key factor of defense strength.

Nonetheless, this is merely a general discussion, and each piece of equipment must be considered individually, whether imports or domestic production is preferable. There is a wide disparity in equipment technology between Japan and the world's military powers, including the United States. Therefore, one cannot say that all equipment should be developed independently or produced domestically. As pointed out previously, development of the most advanced fighter planes, for example, is more than Japanese technology can handle. (The development costs for the F-15 was about 500 billion yen.) Licensed production would also be higher in cost rates if the number of units is low. In the case of jet fighters, the volume is sizeable, so it is domestically produced under licensed foreign technology.

From such a viewpoint, the erstwhile PXL issue would lead to diverse conclusions. The fact is, as it was previously explained, the direction toward independent technology and domestic production was forcibly turned around in midstream, and a switch was made to the P-3C. Looking back at the chain of events and contemplating which was preferable--the independent development and domestic production of the PXL, or the production of the P-3C now in progress--probably the former would be relatively higher in cost from the standpoint of the price of the antisub patrol plane itself. But the difference could not be unexpectedly wide. The R&D costs constitute one factor for price rises during domestic development, but since 40-50 planes would be produced the price per unit might be unexpectedly low, notwithstanding a substantial cumulative price.

On the other hand, there are also minuses in production under foreign license. The reason is, the equipment itself is difficult to handle. In the case of the P-3C, it is doubtful whether the SDF could analyze and manage the data concerned on its own ability. If the SDF cannot analyze the data independently, it would lead to other problems.

There is the view in the case of the PXL that the overall opinion favors domestic development, and there was apparently a considerable basis for this view.

However, the fact that the Defense Agency authorities have already moved toward the "post P-3C" era is not without its problems from the standpoint of a balance in equipment. The development of the variable wing plane, begun in 1976 by Kawasaki Heavy Industries under a trial manufacture contract with the Technical R&D Institute, used the P-2V7 antisub patrol plane as its model. Kawasaki converted the pilot system to an electrical system and installed a device which automated flight control through an onboard computer. It has pilot functions similar to the P-3C and will probably be used for the time being for antisub patrol training purposes. However, the "post P-3C" may be considered as its ultimate goal. Even if domestic development of the plane is evolved smoothly, its domestic production would probably be accompanied by numerous problems.

The reason is, the induction of the P-3C will make progress and several hundred million yen will be spent on it by the mid-1980s. When the focus of attention was on the PXL, there was the possibility of deploying a domestically developed plane and it might have been a better choice from an overall viewpoint. However, at the point in time where the P-3C becomes deployed, the "post P-3C" procurement should not be started hastily while the durability of the P-3C still has not run out. But if the "post P-3C" procurement is delayed for a certain period, the P-3C procurement would reach its peak period around 1990. At that point, the question would arise whether or not the airframe might be outdated.

In any case, when the production of two competing items of equipment becomes possible through two methods of imported technology and independent development--the two methods cannot always be conducted smoothly. The point of development may not coincide with the point of procurement. Also, one item of equipment cannot be properly evaluated separately from the other item.

The issue of import or domestic production, therefore, would resolve itself, provided there is consistent policy concerning procurement of equipment, and the issue itself would be consistent from start to finish. If it is disrupted in midstream and an attempt is made to move along predetermined lines without correcting the disruption, a balanced situation would not be possible.

Dangers Inherent in Domestic Production

Returning to the previous issue of ammunition procurement, one reason the import of ammunition became the center of attention was the price factor. Another factor was, when concentrated, large amounts of procurement goes on at home, it results in idle facilities and surplus labor. The stability of procurement is important. Therefore, temporary and concentrated buildup of previously neglected ammunition stockpiles is not recommended whether through imports or domestic production. It is advisable to solve the problem by raising the level of procurement (through domestic production) over a period

of several years. Since the Defense Agency had been caught in a lull period between procurement for the licensed production of the F-15 and P-3C, it attempted to achieve the pending increase of ammunition stockpiles in one stroke. But this is not the right procurement method.

To further emphasize our point regarding equipment requiring vast development funds, such as the most advanced fighter planes--Japan is short on technology and lagging in development, but we oppose the view that even such equipment in use in Japan should be domestically produced. That is not to say Japan completely lacks the technology to produce them.

As technology becomes more coordinated and complex, and as development costs rise, Japan with its limited defense funds often finds itself facing cases which become too costly. Even in the U.S. there are cases where it is difficult to recover R&D costs solely on domestic demand. Therefore, sales are conducted worldwide in order to make ends meet. That is, the scale of development and production for some equipment is too large for Japan to handle alone. It must depend for such equipment, not on domestic development, but on imports and licensed production.

If an attempt is made to extend domestic production into such areas, the cultivation of new overseas markets (arms export) would become inevitable, and this could result in a runaway defense production. Japan should not domestically develop equipment for which it cannot make ends meet without depending on world markets.

It is quite clear that domestic production has greater impact than imports. We will discuss this point in the next chapter. But the greatest merit of domestic production is probably the fact that the supply system is stabilized. When equipment is necessary, nothing surpasses domestic production in terms of stable supply. Domestic production is not recommended in the case of the aforementioned equipment which is technically on an excessive scale, or equipment which in incompatible with the character of the SDF.

2. Impact of Defense Production

Macro Impact Difficult to Grasp

Let us consider the impact of defense production. The defense-related expenditures show that they are spent for a wide range of purposes. They can be broadly divided into two categories: personnel costs and provisions/-materials costs. Since SDF personnel and Defense Agency staffers are salaried employees, they receive pay based on set standards as national government employees. Their salaries constitute the largest item of defense-related spending and, together with provisions, more than half of total expenditures. It is not the salaries, but the cost of supplies, which concerns defense production in the narrow sense. The cost of supplies could be divided further into (a) purchase costs of equipment, (b) R&D costs, (c) facility construction costs, (d) maintenance costs, (e) military base operations costs, and (f) others.

According to the FY78 budget, equipment purchase costs were 325.8 billion yen and R&D costs were 17.4 billion yen, or 17.1 percent and 0.9 percent respectively of defense-related expenditures. These figures could be further broken down into costs for concrete equipment and R&D projects.

One method for understanding the macro impact of defense production is to chart an inter-industry relations table, treating defense production as one sector and measuring its impact by calculating the reverse matrix flow. It is a method applied by W. C. Leonchev (phonetic) to U.S. military expenditures during World War II. In Japan also, an inter-industry relations analysis was conducted on overall defense spending. However, such a macro analysis has difficulties. It is almost impossible to chart an inter-industry relations table on overall defense expenditures, or on defense production itself. Even the table drafted every 5 years by the Administrative Management Agency on joint projects with other agencies do not contain relevant data on the sectors concerned regarding input-output. It is compiled only on the basis of cumulative estimates. Therefore, as the breakdown by sectors is considered in detail, the margin of error in the estimates increases. So, despite attempts to coordinate them under "defense production," there is no evidence of actual conditions. Moreover, since procurement conditions change drastically, depending on the fiscal year, it would not be appropriate to take an estimate made one year and apply it to the following year. Especially in Japan, where defense related spending is below 1 percent of the GNP and defense production is less than one-fifth of that (in other words, less than 0.2 percent of the GNP), any attempt to coordinate several sectors under a single "defense production" umbrella would result inevitably in a wide margin of error in the estimates.

It is technically difficult to discuss macro impact of defense production in terms of volume. Moreover, its significance would conceivably be minimal. If there were someone knowledgeable in the concrete processes of defense production and he understood the international flow as well as inter-sector flow of equipment, materials and parts, an inter-industry relations table on defense production could be compiled with his cooperation. But, in reality, it would be extremely difficult to accurately figure out the rate of domestic production, the input by sectors, etc, for a single aircraft under licensed production, for example. Moreover, despite the feasibility of charting a fairly accurate inter-industry relations table, it would be doubtful whether it could be applied to policy.

Defense production, by its very nature, cannot be carried out by taking into consideration its direct and related impacts, or by making a comparative study of other expenditures such as public investments. There is probably a great deal of debate going on concerning the appropriate scale of defense spending. In any case, it is determined by personnel and equipment, and the volume of defense production is determined on a year-to-year basis. The related impact has certain value in terms of results, but it is not used as a goal or a judgment standard for policy making decisions. In Japan, it is sometimes contended by the defense industry, in relation to equipment procurement, that the impact of domestic production is greater than that of

imports. But if that point is stressed, it would become impossible to avoid the problem of choosing between defense production and other expenditures.

The government should not be indifferent to the impact of such spending. But this does not mean it must consider every item of expenditure in detail. It would suffice to pay attention to the appropriate sector or item concerned. In procuring equipment, adequate emphasis should be given to the function, price, supply system and technological standard of each item. The argument that everything must be domestically produced is not necessarily true. Of course, as a result of the improvement in Japan's industrial level in general and in the level of defense production--except for limited equipment in specific areas--domestic products have now become superior to imports. But macro impact must not be overly emphasized for equipment procurement, because there would be the danger of neglecting its more important aspects.

Far-reaching Impact of R&D on Industry

Since the defense industry is an advanced technology industry, its technological impact on general industry is considered important. In fact, the epochal progress of scientific technology and industrial technology is unfortunately often related to major wars. Even during peacetime, vast sums are invested for the improvement and renovation of equipment, and part of the resulting technological achievements is applied broadly to industry. This is considered to be one of the major characteristics of the defense industry.

However, this is strictly a general assumption, and the technological impact differs according to countries and on the equipment concerned. In Japan, since the scope of R&D for equipment is limited, the technological level of defense production cannot be said to be high in comparison to other sectors, as in Western nations. But since the results in several aspects of technological development by the defense industry are being utilized, we will take a brief look at them as we relate them to concrete equipment. The following items, (1) through (8) which are closely related to general industry, are excerpted from Technical R&D Institute data.

(1) Antisub flying boat PS-1 -

The development of a rescue flying boat (US-1), which utilizes the superior functions of the craft (takeoff and landing on water during rough weather), and a firefighting flying boat, which uses sea water as extinguisher. Goals: to apply the oil pressurized guidance system and automatic control technology to various types of automatic machinery and oil pressure machinery; to build a structure utilizing the welding process (light alloy, stainless steel and titanium alloy plates); and to develop an automobile driver training system (car trainer) utilizing ground training materials with a mock vision system.

(2) Medium Transport C-1 -

Application of technology which insures safety and dependability (multiplex driving and oil pressure systems; bird's-eye-view panel indicators for trouble detection) for rail rolling stock and automobiles; broad application of environmental testing technology pertaining to functional components.

(3) Supersonic advanced trainer T-2 -

The fuel gauge and liquid acidity gauge designed for it are applied to the LPG tanks of electric power companies. Also, the technology for production of cast iron windbreakers is applied to the manufacture of magnesium alloy wheels and engine parts for automobiles.

(4) R&D for ship hull materials and building materials

High tension steel, which was developed for use in submarine hulls, etc, are used for bridges, pressurized containers, ships, etc.; and aluminum alloy specifications for torpedoes are used intact by JIS (Japan Industrial Standards).

(5) R&D for aluminum alloy armor plates and lightweight structured materials -

The Al-Zn-Mg 3-dimension alloy, which was developed for the M73 armored vehicle, etc, is used as structural material for railroad cars, autos, bridges and buildings.

(6) R&D for radar and various control equipment -

The technology, which uses the computer to automatically process and indicate data from radar, was applied to the air traffic bureau's control radar. The technology for designing, manufacturing and operating the parabola antenna for the VHF long range radar has been useful in utilizing its successor-type antenna.

(7) Doppler radar and traffic control -

In conjunction with the development of missiles, the Doppler radar, which measures the velocity of a moving target, was built and is being used for traffic control on the freeway between Haneda Airport and downtown Tokyo.

(8) R&D for infrared instruments and pollution watch -

The R&D for missile tracking systems and noctovision firing systems are being used for pollution watch devices and surveillance equipment.

These are a few representative examples, and, if other small details are included, the technological impact of defense R&D on other areas could be considered to be quite extensive. Yet they are rather ordinary and unspectacular, and reflect the nature of Japan's defense R&D.

Technological Impact on Individual Enterprises

Nonetheless, they are important to the individual enterprises and cannot be taken lightly. For example, Mitsubishi Heavy Industries is Japan's representative defense contractor, as well as a producer of general machinery, whose aeronautical and space technology has reportedly impacted on automobiles, rolling stock and shipbuilding (machinery) in the following forms:

First, aerodynamics as software: [automobiles] - driving stability, chassis outline and internal flow; [rolling stock] - external form, windforce in overtaking other trains, and windforce inside tunnel; [shipbuilding/machinery] - large crane windforce.

Next, control technology: [automobiles] - simulators; [rolling stock] - simulators and high speed train position control; [shipbuilding] - simulators, hydrofoil automatic control, auto pilot for large ships and automatic control for plants.

Within structural and materials technology - monocock structure, magnesium alloy technology, hypertension steel, honeycomb structure, precision casting, FRP and organic glass have impacted on their related fields. (See Table VI-1)

Table VI-1: Impact of Structural & Materials Technology

(Aeronautical & Space Technology)	(Automobiles)	(Rolling Stock)	(Shipbuilding/ Machinery)
Monocock structure	Chassis for passenger cars & buses	General rolling stock/monorail/ ropeway car bodies	
Magnesium alloy	Mission case wheel		Machinery parts
Hypertension steel			Uranium centrifugal separator
Honeycomb structure	Refrigerator	Inner doors, floor panels	
Precision casting			Parts for general use gas turbine, parts for air compressor, parts for revolving stamps
FRP	Racing car body	Nose for stream line express locomotive, tram rooptop	Hulls for small ships, yachts & boats; plant components
Organic glass			Ship portholes

Table VI-2: Impact of Equipment Parts Technology

(Aircraft)	(Automobiles)	(Rolling stock)	(Machinery)
Disc brakes	Passenger cars	High speed trains	
Cerametallic lining	Large buses, clutch for fork lifts		Ships, general construction machinery, centrifugal separator brakes
Aluminum heat exchanger	Engine cooling system, oil cooling system, car A/C	Oil pressure brakes	Automated machinery for testing vibration
Airtight seal		Windows & doors for streamlined trains	Ship budge seal, nuclear reactor door
Rubber fuel tank	Auxiliary tank		Auxiliary tank for ocean fishing
Ball bearing		Bearings for streamlined trains	

We have looked thus far only at Mitsubishi Heavy Industries. Although the other companies may not be as wide-ranging as Mitsubishi, relative to the defense industry as a whole, their impact is considerable.

In Japan, there are comparatively few companies supplying exclusively to the defense industry. Most produce defense equipment as a side business, and they often absorb the technological impact of defense production within their own organization.

The firearms producer, Nittoku Metal Industry, excels in the manufacturing technology of machine guns, which have a large heat release area, and it is working on a plastic case for a glass TV braun tube bulb. The braun tube bulb is made by blowing heat-softened glass. The principle is very old, but a precision metal cast is used, applying high precision techniques used in manufacturing machine gun barrels. The plastic containers (for yogurt) for the Yakult Co are also made by Nittoku. It combines the ejection process with the blow process used for plastic material called polysthylene. The minute texture is the key to mass production and a superior metal cast is required.

The affinity between technology for caterpillared vehicles and technology for construction machinery like bulldozers (by Komatsu and Mitsubishi) requires further explanation.

Since the defense industry is thus pegged to the highest technology, its impact extends to other fields of industry and results in a general impact on industry as a whole. Moreover, much of the impact is received by the enterprises in charge of defense production, or their affiliates, and benefits their operations in the form of a "bonus" from defense production. This "bonus" cannot be ignored when reviewing the profitability of defense production, but it is actually being totally separated and deliberately ignored.

3. Profitability of Defense Industry

Does the Defense Industry Make Money?

Recently, the argument is often heard that "the defense industry doesn't make money." Is it true? According to our observations, the profits of the defense industry seems quite stabilized, compared to other industries. The variety of equipment is wide-ranging, but there has been no recent incidence of a defense enterprise in charge of frontal equipment going bankrupt.

When Japan resumed defense production on the basis of special procurement, companies receiving orders for production of ammunition--a principal product at the time--were behind in deliveries due to inadequate knowledge of quality control and inspection methods, and also due to the effects of financial belt tightening (prime contractors like Nippei Sangyo and Nippon Kentetsu, and their subcontractors, were included). As a result, they issued bad checks. (See Note) But in August 1953, after the arms manufacture act was passed, weapons production was put on a permit basis and the government adopted a policy of prior limitation on competition and protection of the enterprises.

Note: Orders were received by Nippei Sangyo for 12.7 mm bullets and 3.5 inch bazooka guns, while Nippon Kentetsu received orders for 3.5 inch rocket shells.

Recently, attention was focused on the management crisis of Sasebo Heavy Industries. It concerns the problem of a defense industry enterprise, but the principal cause of the crisis was the structural recession of the shipbuilding industry in general. Behind the support given to Sasebo Heavy Industries (due to efforts by the then prime minister) was the fact that, apart from the potential impact on the regional economy, the company was considered a prime battleship builder for the Defense Agency and an indispensable repair yard for nuclear ships, in addition to being a shipbuilder for the Sasebo naval base.

Profits for the defense industry are guaranteed by the system. In May 1962, a Defense Agency directive entitled, "Instructions concerning the computation of prearranged prices for procurement items," was issued. According to the directive, profits for defense equipment are viewed as "remuneration for the manufacture, sales and the conclusion of pertinent contracts, and compensation for costs incurred through the risks involved."

However, in reality, defense production is claimed to be in perennial deficit. Several surveys made in the past attest to this. According to the report of the Defense Equipment Industry Survey Committee (in the last half of FY66), the real rate of profits from sales were as follows: weapons - 2.1 percent; rolling stock - 3.9 percent; aircraft - 5 percent; electronic equipment - 0.7 percent; and ships - 8 percent. Also, according to the FY72 survey consigned to an outside organization, among the 212 items of contracted equipment during FY68-71, there were 165 items (78 percent) for which not even the aggregate cost price could not be recovered, and 127 items (60 percent) for which a deficit was expected from the outset.

There were many explanations regarding this state of affairs. Nagamatsu writes in his previously mentioned book about the situation in 1966 as follows:

"The reasons were (1) the sales per direct worker in the battleship sector was only 50-60 percent of the commercial ship sector; (2) the capital profit ratio of battleships was only one-half compared to commercial ships, due to the low turnover rate of battleships; (3) in determining the unit price for the budget, estimates were based on past achievements, and a vicious cycle of deficit orders resulted from rises in personnel costs and material expenses. Also, the adverse effects of low-priced orders due to initially excessive competition was conceivably another reason. Regarding the weapons sector, negative impact of the inadequate shipbuilding budget for weapons carried onboard was one of the main causes." (Nagamatsu in his previously mentioned book)

This certainly does not explain the operational principles of the defense enterprises on a long range basis. Of course, Nagamatsu does attempt to explain the "expected deficit orders" after FY68, relating it to the "side business" aspect of the enterprises.

"First, profit is a basic motive of business activity, and, in order to maintain and secure the operational base of an enterprise, the long range and stable maintenance of fair profit is indispensable. Despite this, the enterprise has been affected by budget inadequacies and has been forced to accept low-priced orders. Such a state of affairs is partially caused by the structural traits of Japan's defense industry, where the ratio of the company's defense sector to company sales remains generally below several percent.

Especially since the private sector in general during the period of high economic growth was quite active, it more than covered the deficit in the defense sector." (Nagamatsu. The underlined portions are by the citer)

This also is a specious explanation. There were probably many enterprises whose private sector in effect covered deficits in its defense sector. But there is no positive explanation as to why such enterprises become involved in the defense sector business. Why do they get involved in defense production, knowing that they will go into deficit? It cannot possibly be that an

enterpreneur with money to spare is motivated in becoming involved from some high sense of mission. Here the "deficit" itself must be re-examined and the logic of the enterprise's involvement in the defense industry must be scrutinized.

Prices Are Set High

The aim of business activity is profit gains. Whether that profit is short range or long range, there is no sense in producing without considering profit at all. Therefore, if the previously mentioned status survey of the defense industry is accurate, it must be concluded that there is something which cannot be measures by ostensible profits alone. Otherwise, enterprises engaged in the defense industry would be on a wrong course.

We think this raises several issues. One, whether the profits of the defense industry recorded in the ledgers should be taken at face value. As it has been pointed out, it is a general practice to recover R&D funds, which are already inadequate in the development stage, by adding the costs pro rata to the product unit price at the mass production stage. Consequently, the final price of the product is said to be equivalent to the manufacture price plus a fair profit. But, the question of the added-on fair profit aside, the prior price seems to be problematical. In computing costs, aside from material costs, to what degree are labor costs and capital spending accurately reflected? Or, are they a fair reflection of actual costs? These are also issues. For instance, the procurers apparently have little data by which to check whether the facilities investment by the enterprises are truly fair. No matter how carefully the fair profits are computed, they are only a component part of the price and do not prove that the price is correctly checked out. The price of the equipment is figured out by adding the profit ratio to the cost price. The formula is as follows:

Standard computation profit ratio = $\frac{(1)+(2)}{2}$ = Base gross capital profit rate x Capital composition ratio ÷ Operational gross capital turnover rate

(1) It represents the paidup capital profit ratio and (2) also represents the self-capital profit ratio as follows:

(1) Paid-up capital profit ratio =

$$\frac{\text{Internal reserves + taxes + dividends + bonuses}}{\text{Paid-up capital}}$$

$$\text{X } \frac{\text{Paid-up capital}}{\text{Operations gross capital}} \div \frac{\text{Gross price}}{\text{Operations gross capital}} \text{ X } 100$$

(Base paid-up capital profit ratio) x (Paid-up capital ratio) ÷ (Operations gross capital turnover rate)

(2) Self capital profit ratio -

$$\text{Base paid-up capital profit ratio} \times \frac{\text{Paid-up capital}}{\text{Self capital}}$$

$$\times \frac{\text{Self capital}}{\text{Operations gross capital}} \div \frac{\text{Gross price}}{\text{Operations gross capital}} \times 100$$

(Base self capital profit ratio) x (Self capital ratio)

÷ (Operations gross capital turnover rate)

According to Nagamatsu's explanation, "Concretely, the profit ratio has been computed by using the average profit ratio for all manufacturers during the past 9 years as the base, multiplying this base capital profit ratio by the capital composition ratios of all sectors of the various enterprises, and dividing it by the capital turnover rates of all sectors of the enterprises." We do not intend to make an issue of the formula here, but at any rate the profit ratio based on the average for all manufacturers is guaranteed by the system.

That is to say, in actuality, the system is partially without backbone, but it is not clear whether the profits are really small or not because of the "covert nature of prices."

The NIKKEI SANGYO SHIMBUN (27 Feb 76 issue) once compared domestically developed weapons and their ability to compete with foreign products. It was a comparison of world contract unit prices in FY73 and FY74. Whereas in the functional comparisons many Japan-made products were rated equal to the world's best or even surpassed them, Japan's unit prices for all products were rated internally noncompetitive, except for combat ships which were rated barely higher in price. In other words, there was not a single item which was equal to the world standard regarding unit price. Japan's industries became highly competitive during its era of high economic growth, centering on the heavy chemical industry. This means that only its defense industry lacks competitiveness. Could the reason be that, while the other industries spent many years in catching up and passing the advanced nations, only the defense industry was complacent with its stable market? Well, it seems that it was not the reason.

In a situation where the quality of the defense industry's products are said to be high compared to foreign products and yet the industry reportedly cannot make ends meet with its unit prices, the question could be posed as to whether entrusting such production to the defense industry is a problem from the standpoint of budgetary efficiency and stable procurement. It is asserted that, without the support of the home industries, key defense capability itself would be jeopardized. However, if the production level of the industry is conspicuously inferior to foreign industries, Japan would have no alternative except to depend on imports for its frontal equipment, and should therefore perhaps re-examine the very concept of key defense capability. A definite and clear answer to this paradoxical question should be forthcoming.

Regarding the fact that Japan's equipment products lack world competitiveness, its low mass production capacity is often pointed out. But, if so, in order to be able to produce equipment at internationally competitive prices, a greater volume of equipment must be purchased, or doors must be opened to arms export, which would pose a serious problem. The former choice would by no means bring good results from the standpoint of balance between personnel and equipment, or from the standpoint of procurement costs for equipment. The latter choice would eventually remove the ceiling on Japan's defense production and convert it to one of the world's arms factories.

We don't believe that Japan's equipment production system is far behind foreign systems. Therefore, we think the prices are actually set rather high. As we have already pointed out, there is the added-on cost of R&D and, although it does not apply to all equipment, we estimate that the real profit is sometimes higher than the announced profit. Nothing is so difficult to clarify as corporate profit. The difficulty in ascertaining real profit is not limited to the defense industry, but applies to other industries as well.

Table VI-3: World Competitiveness of Japan-made Equipment

(Item)	(Maker)	(Price)	(Caliber)
Model 64 rifle	Howa Machinery	x	*
" 62 machine gun	Nittoku Metal Industry	x	*
" 60 106 mm mobile recoilless cannon	Komatsu Ltd	x	***
" 74 105 mm mobile howitzer	Komatsu Ltd Japan Steel Works	x	*
" 75 155 mm mobile howitzer	Mitsubishi H Industries Japan Steel Works	x	**
" 75 130 mm mobile multi-barreled rocket launcher	Komatsu Ltd Nissan Motors	x	**
" 74 tank	Mitsubishi H Industries Japan Steel Works	x	**
" 73 armored vehicle	Mitsubishi H Industries Komatsu Ltd	x	*
" 73 tow tractor	Hitachi	x	*
" 61 large snow plow	Ohara Iron Works	x	*
" 70 mobile bridge	Hitachi	x	*

PS-1 antisub flying boat	Shin Meiwa Industries	x	**
US-1 rescue flying boat	Shin Meiwa Industries	x	**
C-1 medium transport	Kawasaki H Industries	x	*
T-2 supersonic advanced trainer plane	Mitsubishi H Industries	x	*
FS-T2 modified ground support fighter	Mitsubishi H Industries	x	*
Model 69 AAM-1	Mitsubishi H Industries	x	***
Long range radar (2 dimensional)	Nippon Electric	x	*
Stabilized 3 dimensional radar	Mitsubishi H Industries	x	*
Model 71 antiair radar (P5)	Mitsubishi H Industries	x	*
" 70 field special corps firing command system	Mitsubishi H Industries	x	***
Helicopter-carrying defense ship	Mitsubishi H Industries Ishikawajima Harima	xx	*
Missile-carrying defense ship	Mitsubishi H Industries	xx	*
Medium defense ship	Sumitomo H Machy Ind	xx	*
Small defense ship	Mitsui Shipbldg Hitachi Shipbldg	xx	*
Submarine	Mitsubishi H Industries Kawasaki H Industries	xx	*
Mine sweeper (medium)	Hitachi Shipbldg Nippon Kokan	xx	*
Torpedo boat	Mitsubishi H Industries	xx	*

Note: Asterisks indicate as follows: x..noncompetitive, xx..somewhat high rate, *..world standard, **..above world standard, ***..below world standard

Data: From NIKKEI SANGYO SHIMBUN survey (27 Feb 76)

Production Under Guarantee

With respect to the joint civilian-defense enterprises, not a few are compensating for the deficit in the defense production sector with their high profit sector(s). Yet that would not explain the motive for their becoming involved in defense production. It is more probably due to the business strategy of the enterprise as a whole, including its defense production.

It is based first on the fact that the profitability of defense production is not really bad. And, aside from this profitability, there are several merits from the standpoint of business operations.

The characteristics of the defense industry are its stability of procurement and continuity. This has already been mentioned. The suppliers are totally aware of the procurement volume for frontal equipment during a given period and of how long it will continue. To contend that, because of the wide fluctuations in the procurement plan in the 4th buildup period the procurement situation is always unstable, is to shut one's eyes to past reality. In fact, the determining of prices, which is a present issue, underscores this point.

".....Based on the absolute inadequacies of R&D spending, several serious problems have surfaced. First, the vicious cycle from the inadequacy of R&D funds → recovery at the mass production stage → rise in unit costs of independently developed equipment → higher rates → limitation of R&D. Without being able to secure appropriate R&D funds, it has become customary to seek recovery of shortfall amounts by multiplying costs at the mass production stage. And, even without doing so, the unit cost of the equipment which is produced in lesser quantity results in rising that much higher. From the defense industry's standpoint, it is natural to recover amounts which are not paid in full. On the other hand, from the viewpoint of the government finance office, domestic products are comparatively expensive and, since R&D is inevitably followed by mass production, R&D ends up being kept to a minimum. This in turn results in widening the technological gap between Japan and foreign nations." (By Nagamatsu in his book)

What is written here is the reality of the defense industry. Incidentally, in order that R&D costs "are recovered by multiplying costs at the mass production stage," a long range procurement goal must be made substantially clear. If, conversely, R&D costs are recovered for instance 2 or 3 years after the initial procurement and when the recovery period is passed, excessive recovery of R&D costs will result unless the price is lowered. Truthfully, we suspect that, although there is a long range procurement plan, this "excessive recovery" does exist, what with the addition of supplemental orders and continuing procurement beyond a stipulated period. In any case, the procurement plan is stable and ongoing beyond comparison with other industrial fields. Regarding the relationship between R&D and mass production also, the consistency between R&D and mass production--in the fact that "once R&D is conducted, mass production inevitably follows"--is guaranteed through the advanced payment of R&D costs.

Defense production is regarded as having a good future. Due to the convulsions in the economic and industrial environment before and after the oil shock, the ratio of equipment spending to overall defense spending took a nosedive because of gross miscalculation on the part of the defense industry. But with the slowdown in wage rises, there are signs of a reverse trend toward a higher ratio of equipment/supplies spending in proportion to defense-related spending. From the suppliers' viewpoint, despite the low ratio in comparison with other industries, it is only natural for them to focus on defense-related spending which has maintained a set rate within Japan's continuing high growth economy.

Another merit in becoming involved with the defense industry is that various related benefits could be expected. Among them is naturally included the technological impact mentioned in the previous chapter, and the policy of considering the impact on company operations as a whole without separating the defense production sector.

Why is the defense industry "forced to accept orders at lower prices because of a low budget?" There are only two answers to this question from the supplier's viewpoint. First, the supplier accepts them from a long range point of view--that, although it may accept orders at lower prices for the time being, it will lead to more favorable terms in the future. (Despite the fact that it may actually turn out to be a disappointment) Secondly, it is a judgment made from an overall management point of view. It may include a "secret deal" for orders in another sector, but that is not our concern here. In any case, without such merits, there could be no motive based merely on low prices and deficit production.

We must also distinguish between the supplier's motive and the actual passage of events. Otherwise, the rationale for the supplier's activity would shift with the changes in the economic environment.

The profitability of the defense industry is not so bad at all. But there are clearly vicissitudes in the use of equipment, and there are clearly declines in their relative status, regardless of efforts to improve them. Firearms are typical, and the wave of electronization is overtaking not only rockets and missiles, but also the majority of other equipment. In Japan, too, the fact that an electrical maker named Toshiba became the main contractor for the development of the short range SAME, instead of an airframe maker, reflects the change in trend. The defense industry will continue to grow amid such vicissitudes and electronization of equipment.

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VII. Defense Industry's Age of Uncertainty

1. Widening of Arms Market

Defense Industry Enters Mass Production

The defense industry is by no means a "gamble." It is a very sure market in what is called "an age of uncertainty." The period of systematic expansion of equipment under the 1st to 4th buildup plans having ended, we are now in what is called the "post-4th buildup" era and there is more planning than ever before. First, while R&D for equipment has so far been conducted with the Technical R&D Institute in the center, one equipment after another will now enter mass production. Of course, the demand for replacement of outdated equipment like the model 74 tank will increase.

For instance, the "Heavy MAT" antiship, anti-tank missile, which was developed jointly by Kasasaki Heavy Industries and the Technical R&D Institute, will enter mass production from FY79. It adopted the semi-mobile wire induction method, using the infrared ray and based on an extension of the M64 antitank missile. It has a long firing range and can also be used to destroy small landing craft. Kawasaki Heavy Industries, which developed the M64 antitank missile, naturally became the main contractor and built the airframe, rocket motor and control system, while Nippon Electric built the induction system. Following the mass production of this genuinely Japan-made missile, it has been confirmed that the mass production of the short range SAM and short range ASM will be realized soon.

R&D goes on constantly, and in FY78 a series of surveys and studies, as seen in Table VII-1, was consigned to private industry.

Table VII-1: R&D Consignments (A Portion)

(April 1978 - Early March 1979) (Unit: 1 million yen)

(Item)	(Funds)	(Supplier)
Medium antitank missile laser target system	35	Nippon Industrial
Trial mfg of reinforced plastic boat	319	Nippon Kokan
Studies on aircraft noise reduction	42	Ishikawajima Harima
Trial mfg of fuel battery for field use	41	Shin Kobe Electric Machy
Laser/radar studies	29	Nippon Electric
Trial mfg & study of bullet-proof ceramics	77	Mitsubishi H Industries

Research & trial mfg of M73 torpedo (modified)	49	Mitsubishi H Industries
Partial trial mfg of high speed homing torpedo	486	Mitsubishi H Industries
Research on laser/radar	29	Mitsubishi Electric Corp
Survey & study of CCV system	147	Mitsubishi H Industries
Operation panel for medium antisub missile guidance system control section	9	Toshiba
Research & trial mfg of oil pressure pump motor	104	Mitsubishi H Industries
Research on HTPB propulsion powder	34	Asahi Chemical Industries
Research & trial mfg of wind tunnel model for study of windforce forms	25	Mitsubishi H Industries
Research & trial mfg of laser radiant unit	17	Mitsubishi Electric Corp
Research & trial mfg of laser radiant unit	10	Toshiba
Gun turret for forward moving cannon	45	Japan Steel Works
Tank main gun and ammunition	74	Daikin Kogyo
Tank main gun and ammunition	20	Komatsu Ltd
Research & trial mfg of long range bomb (jet bomb)	76	Nissan motor
Research & trial mfg of high rate propulsion smokeless propulsion powder	72	Asahi Chemical Industries
Research & trial mfg of new anti-aircraft machine gun	786	Japan Steel Works
Survey & study of aircraft noise reduction measures	3	Ishikawajima Harima
Research & trial mfg of laser sight system	106	Toshiba

Research & trial mfg of laser sight system	156	Toshiba
Trial mfg of yellow phosphorus smoke bomb for 105 mm antitank gun	86	Komatsu Ltd
Research & trial mfg of electric signal transmission testing system	25	Hitachi
Research & trial mfg of graphic response indicator testing system	71	Hitachi
Research & trial mfg of cannon carrying vehicle	798	Howa Machinery
Research & trial mfg of cannon carrying vehicle	17	Mitsubishi H Industries
Research & trial mfg of cannon carrying vehicle	322	Komatsu Ltd

Table VII-2: Assignments for Aircraft Firms on 3 Projects (including partial estimates)

(Type)	(Maker)	(Assignment)	(Share)
F-15 fighter			
Airframe	Mitsubishi H Industries	main contractor	65%
Airframe	Kawasaki H Industries	secondary contractor for main wing, rear fuselage	35
Engine	Ishikawajima Harima	main contractor	60
Engine	Mitsubishi H Industries	subcontractor	20
Engine	Kawasaki H Industries	"	20
P-3C			
Airframe	Kawasaki H Industries	main contractor	60
Airframe	Mitsubishi H Industries	subcontractor for forward fuselage, rear fuselage	10
Airframe	Fuji H Industries	subcontractor for main wing	10
Airframe	Shin Meiwa Industries	subcontractor for nose, tail	10

Airframe	Japan Aircraft Mfg Co	subcontractor for nozzle, exhaust pipe	10
Engine	Ishikawajima Harima	main contractor	60
Engine	Mitsubishi H Industries	subcontractor	20
Engine	Kawasaki H Industries	subcontractor	20
YX			
Airframe	Mitsubishi H Industries	subcontractor for rear fuselage, baggage door	40
Airframe	Kawasaki H Industries	subcontractor for forward fuselage, center fuselage	40
Airframe	Fuji H Industries	subcontractor for main wing fairing	20

Table VII-3: Assignments for Makers of F-15 and P-3C

F-15	(Maker)	(Assignment)
	Mitsubishi Electric Corp	Firing control system; UHF wireless; automatic direction finder
	Toshiba	Lead computing gyro, inertial navigation system
	Nippon Electric	TACAN system
	Shimadzu Seisakusho	Headup display
	Hitachi	Data link receiver
	Tokyo Keiki	Radar indicator, attitude standards system, atmospheric elements computing system, radar warning system
	Toyo Tsushinsha	IFF interrogation system
	Nittoku Metal Industry	20 mm cannon
P-3C		
	Mitsubishi Electric Corp	UHF automatic direction measuring device
	Toshiba	Logic unit

P-3C	Nippon Electric	HF secret communication system (signal coder), signal coder for tactical use, auxiliary indicator, sonobuoy control system
	Shimadzu Seisakusho	Vacuum rapid transmitter, automatic magnetic detection compensator, signal converter
	Fujitsu	Tactical indicator
	Japan Radio Co	Sonobuoy receiver
	Nagano Nippon Radio	High warning system
	Taiyo Radio	Rescue wireless
	Kokusai Electric Co	HF secret coder (Vocoder)
	Koden Electronics Co	Telegraph code changer, data link coder
	Sumitomo Precision Indust	Propellers

The medium-term licensed production for the F-15 fighter and the P-3C antisub patrol plane also had a sure market. At present, 100 F-15s are slated to be built between 1980 and 1987, and 45 P-3Cs from 1981 to 1988. In the aircraft industry, plant investment and import of related technology are going on at a feverish pace, in anticipation of the materialization of the YX. The sharing of F-15, P-3C and YX assignments is shown in Table VII-2. Also, the main suppliers of related parts and components for the F-15 and P-3C are shown in Table VII-3. Some of the technological imports pertaining to the F-15 are as follows. Toshiba, which handles the inertial navigation system, signed a contract for licensed production with Litton Industries of the U.S. (These companies signed a similar contract for the F-4EJ.) Toshiba has signed a contract with General Electric for licensed production of the lead computing gyro (a component of the sighting system for missiles and cannons). Yokohama Rubber signed a technological import contract with the Goodyear Aerospace Co for the aircraft fuel tank, and another contract with the Federal Mogul Co and SSP Products Co for engine distribution tubes and ducts. Additionally, Daicel Ltd has signed a technical license contract with the Douglas Aircraft Co (U.S.) for an emergency escape system; Japan Aviation Electronics with General Electric for an automatic navigation system; Sakura Rubber Co with Registoflex (U.S.) for metal joints for aircraft; Nagoya Screw Co with Doetti (U.S.) for the manufacture of titanium screws; Tokyo Screw Mfg Co with High Share Co (U.S.) for similar screws; and Shin Showa Industry with the Sargent Fletcher Co (U.S.) for the manufacture of parachute tanks. Connections are thus being made at various levels for items ranging from screws to engines, and they will continue for some time. It is the same in the case of the P-3C.

On To the "5th Defense Buildup Plan"

Furthermore, the "post-4th buildup era" is actually moving on to the 5th buildup plan. In October 1976, the "outline of the defense plan" was decided at the National Defense Council meeting. It states, "Japan has hitherto gradually strengthened its defense strength through the policy-making and implementation of four buildup plans. But, in reviewing the present state of our defense strength from the standpoint of the previously mentioned concept, it is judged that in scale it generally coincides with our concept goal." It thereby manifests the judgment that the objective level had generally been attained by the end of the 4th buildup plan. Therefore, the intention was that there would be no further gradual and systematic arms buildup such as was seen by the end of the 4th buildup plan.

However, in April 1977, a "directive concerning the drafting of various defense plans" was issued, which analyzed and forecast defense conditions, including the qualitative direction of defense strength on a long range and medium-term basis, medium-term and fiscal year estimates of principal items pertaining to the equipping and maintenance of defense capability, and drafting procedures for annual plans concerning the implementation of defense strength. The "joint long defense estimate" for the period 1985-94, the "joint medium-term defense estimate" for the period 1980-84, and the "medium-term work estimate" have been drafted on the basis of this directive. The relationship between the respective plans is shown in a separate table (Table VII-4).

Table VII-4: Addenda on The Defense Plans System

(Joint Long Range Defense Estimate)

1. To cover a 10-year period, 8 years after the drafting year.

2. To be drafted every 3 years and reported to the director general.

3. To be reviewed as necessary for any year when no estimate is drafted.

(Joint Medium-term Defense Estimate)

1. To cover a 5-year period, 2 years after the drafting year.

2. To be drafted every 3 years, with approval by the director general.

3. To be reviewed for any year in which no estimate is drafted.

(Medium-term Work Estimate)

1. To cover a 5-year period, 2 years after the drafting year.

2. To be drafted every 3 years, with approval by the director general.

3. To be reviewed for any year in which no estimate is drafted.

(Annual Operations Plan)

1. To cover the year after the drafting year.

2. To be drafted every year, with the basic plan approved by the director general, and plan details to be reported to the director general.

(Plan Concerning Defense and Police for Fiscal Year)

1. To cover the year after the drafting year.

2. To be drafted every year.

3. Procedures, etc, to be decided separately.

The most important estimate is the "Medium-term work estimate." The current estimate totals 1,200 billion yen and includes the renewal of the BADGE system, preparations for the infusion of post "Nike" technology, and improvement of the mobility of ground troops. It actually constitutes the 5th buildup plan, and the defense industry contractors are busily responding to the prospects.

In comparison to the government's road building plan and other plans, the percentage of achieving the defense-related goals is high. No other market could be regarded as stable and secure.

2. Significance of Overall Limit on Defense Spending

Steady Increase in Defense Spending

Japan's defense-related spending is relatively low compared to the scale of its economy. At present, the defense budget is kept within the framework of "less than 1 percent of the GNP," but debate on this point has taken a sudden upturn since about 1977. Criticism has come from foreign countries which point out that one main reason for Japan's unparalled high economic growth rate is its low defense spending. The theory of a "free ride" on the U.S.-Japan security pact has emerged, stating that Japan has pursued only economic growth under America's defense umbrella. As a result of the "foreign pressures," some Japanese are urging an increase of the defense budget ceiling to 2 or 3 percent of the GNP.

There are many people who have the impression that Japan's defense spending is low. But the reason is because they think in terms of Japan's position as second among the capitalist countries in economic scale, and not in terms of its absolute wealth. The absolute figure for spending is not exactly low and, moreover, it has the highest growth rate among the principal nations of the world.

A look at the defense spending of the principal nations shows that the USSR and the U.S. are far ahead of the rest, and are maintaining a "balance based

on fear." China is in third place, while the fourth to sixth positions are held by West Germany, France and Britain. Japan is ninth, following Saudi Arabia and Iran, but the sequence could change, depending on the rate of exchange to the dollar. At this rate, it is only a matter of time before it will catch up with France and Britain.

The actual picture is as follows: Japan's ratio of defense spending to its GNP was about 1 percent from FY53 to FY66, and it has been less than 1 percent since FY67. In other words, it is lower than before. But a closer look will show that, although the ratio clearly declined until 1967, there was subsequently no broad downtrend and it hovered around 0.9 percent. That is, after 1967, the defense spending and GNP have generally expanded along parallel lines. (See Table VII-5)

Table VII-5: Shifts in Defense Spending (Units: 100 million yen, %)

(FY)	(GNP:initial estimate) (A)	(Defense Spending: initial estimate) (B)	(Defense Spending Ratio to GNP) (B/A)
1955	75,590	1,349	1.78
1960	127,480	1,569	1.23
1965	281,600	3,014	1.07
1970	724,400	5,695	0.79
1971	843,200	6,709	0.80
1972	905,500	8,002	0.88
1973	1,098,000	9,355	0.85
1974	1,315,000	10,930	0.83
1975	1,585,000	13,273	0.84
1976	1,681,000	15,124	0.90
1977	1,928,500	16,906	0.88
1978	2,106,000	19,010	0.90

Defense Spending Not Small

Defense spending has suddenly increased together with the GNP. Japan's 1 percent of the GNP is really equal to about 2 percent of the GNP in the principal European nations. If Japan's defense spending is set at 2 percent of its GNP, it will pass Britain and France to become fifth in the world. If it is set at 3 percent, it will pass West Germany to take fourth position and will be directly behind China which is in third place. This reality must not be overlooked in considering the general limit on defense spending vis-a-vis the GNP.

The ratio of each nation's defense spending to its GNP is determined by the extent of its equipment and the size of its armed forces. Therefore, it is not necessary for the ratios to the GNP to be on identical levels. In reality, the differences between nations are wide and varied.

In Japan's case, raising the present ratio to 2 percent of the GNP would be greatly unrealistic from the standpoint of its equipment. In other words, the largest items of expenditure in defense spending are personnel costs and supplies and, even though the overall defense budget limit may be raised, it would not be drastically increased if the levels of personnel and salaries remain unchanged. Therefore, any increase in budget would be diverted to supply costs, especially to increases in equipment. If the increased portion is used entirely for procurement of equipment, and the ratio of defense spending to GNP is increased to 2 percent, it would mean a procurement rise to no less than 7 times the present amount. Even if the present limit of under 1 percent of the GNP is raised by 0.1 percent to 1.1 percent, the procurement amount would double, provided the full limit is spent.

Considered in such terms, the present framework of defense spending is by no means small. And raising the limit means a drastic increase in equipment. Undoubtedly, the defense industry by itself would be unable to consume them fully, and it may even result in "black deal" purchases.

However, with respect to the defense industry, the problem lies in the content rather than in the overall limit to defense spending. Looking at the transition during the past 5 or 6 years, the rate of equipment procurement has taken a sharp downturn. This is due mainly to the rise in personnel costs and, fearing its effect, the defense industry is seeking to stabilize the equipment procurement ratio. West Germany seems to be concerned about this point and has urged Japan to take similar measures as it has.

The FY79 budget reflects the recent slowdown in the rise in personnel costs, while the ratio of equipment costs has conversely risen higher. Therefore, the relation between personnel and provisions costs to supplies and equipment costs has also changed in favor of the defense industry. Moreover, since there is still a difference of 0.1 percent (about 200 billion yen) short of the ceiling of 1 percent of the GNP, the argument for raising the overall defense budget ceiling above 1 percent can only be interpreted as a failure to recognize present realities.

3. Dangers of the Arms Export Proposal

Pressures for Arms Export

Japan has seldom exported arms during the past 10 years. Arms export is basically regulated by the 1949 Arms Trade Control Act, which stipulates that arms export requires approval by the Minister of International Trade and Industry. In principle, the following 3 categories are denied approval.

One, when directed toward a communist bloc country.

Two, when directed toward a country where arms export is banned by United Nations resolution.

Three, when directed toward a country which is a party, or has the possibility of becoming a party, to international conflict.

This decree is still valid today, 30 years later, as the 3 basic principles governing arms export, but its implementation has changed. Procurements for the Korean war were made in the form of "special procurements" and were not exports, but they violated the spirit of the decree. Although arms export were subsequently continued, they gradually decreased in volume.

In 1967, the export of Tokyo University's "Pencil rocket" to Yugoslavia became an issue in the Diet as possibly constituting arms export (21 April at the Lower House accounts committee). In his reply, Prime Minister Sato did not deny the possibility of the "Pencil rocket" being used for arms development, but indicated his view that it was not a weapon and he confirmed the 3 principles of the arms export control act. After 1967, pistols, ammunition and ammunition factories continued to be exported on an exceptional basis, but did not become a major issue. Japan's economy as a whole was enjoying the benefits of high growth, with no concern expressed over arms exports of insignificant amounts.

Changes in the industrial environment following the oil shock refocused attention on arms export. In 1974, a debate arose in the Diet in connection with Japan-South Korean economic cooperation. The unified stand of the Miki Cabinet at the time was as follows:

"In our opinion South Korea does not fall under the definition of an area affected by the 3 principles. However, from the standpoint of seeking a healthy development of foreign trade and the national economy, arms exports to South Korea have not been recognized in the past, nor do we intend to do so in the future."

This is an extremely important opinion. As seen from the context, the reason arms export to South Korea is not recognized is not because it is an area affected by the 3 principles, but it is due to the spirit of the trade control act. In other words, the opinion indicates that arms export is undesirable, not only towards target areas of the 3 principles, but also non-target areas.

By 1975, further pressures for arms export were applied successively by interested financial circles and financial leaders, with demands to soften the 3 principles. These pressures developed into a concrete issue in the form of a request to the government in December, by the Japan Aeronautic

and Space Industrial Association, to accelerate the export of the C-1 transport and the US-1 rescue flying boat. It also became the center of debate in the Diet. The series of replies by the government side reveal a subtle discrepancy regarding the scope and target areas of arms. (The Diet debate lasted from January to February of 1976.)

MITI minister Komoto confirmed the 3 principles concerning the target areas and stated as follows:

"Now, as to what constitutes arms, I believe that arms are used by military forces for direct combat. The types of arms are listed in the appendix of the export trade control act. Regarding those areas outside the jurisdiction of the 3 principles, the policy is to judge them case-by-case, based on Article 48 of the foreign trade control act. My judgment is that the US-1 and C-1 do not qualify as arms."

The US-1 is a modified version of the antisub flying boat PS-1. Their equipment show a general similarity in communications instruments, navigation instruments and radar. Whereas many instruments and machines of the PS-1 have been renovated since the first versions were built, the US-1 carries the latest models. Here is another of MITI minister Komoto's replies on a different day:

"I think that the antisub patrol plane is a weapon, but the US-1 was basically modified in design and used as a sea rescue vessel, so it is different from an antisub patrol plane. Although it has retained its previous design to some extent, it is a sea rescue boat. There is no intention on my part to actively sell weapons."

The words "basically modified in design" makes it sound as if it is a different aircraft, but the airframes and engines of both planes are practically identical, and the only difference between the two is that, while the antisub patrol plane carries a series of antisub electronic instruments and attack weapons, the sea rescue boat carries medical treatment equipment on board. In any case, this apparently did not answer the question as to "what constitutes arms?" The reason is, the US-1 is treated as frontal equipment by the Defense Agency.

"The Self Defense Forces law defines arms as including--in addition to firearms, gunpowder and swords--various machinery, instruments and apparatus whose direct objective is to kill humans or destroy objects as a method of armed struggle. Generally speaking, rolling stock, aircraft and ships are not treated as arms." (Defense Agency director general Sakata)

"There is a difference between the concept of arms as used by the Self Defense Force and the concept of arms defined by the 3 principles. The concept under the 3 principles apply to those used in direct combat by military forces. That is the unified opinion held in the past." (MITI minister Komoto)

Distortion of the Three Principles on Arms Export

Following this series of events, the government made public its unified opinion on 27 Feb 76. It is the most recent opinion of the government and consists of (1) the government's policy and (2) the definition of arms, as follows:

Government Policy

Regarding the export of "arms"--in view of the position of our country as a peace-loving nation, the government has faced the issue with caution in order to avoid enhancement of international conflict. It will continue to deal with the issue in the future, based on the following policy, and will abstain from accelerating exports.

(1) We shall not recognize export of "arms" to target areas referred to under the 3 principles.

(2) We shall refrain from export of "arms" to countries other than the target areas listed under the 3 principles, based on the spirit of the Constitution and the foreign exchange and trade control act.

(3) Regarding the export of facilities related to arms manufacture (Export trade control act, Appendix 1, Item 109), they shall be treated as "arms."

Definition of Arms

The term "arms" is used in various laws and statutes and in the execution of administration, and its definition should be interpreted according to the intent of the respective laws.

(1) In the 3 principles governing arms exports, "arms" refers to "equipment used by military forces and those supplied for direct combat use." Concretely, "arms" refers to those items among Items No 197 through No 205 in Appendix 1 of the export trade control act which come under this definition.

(2) Under the Self Defense Law, "arms" refers "--in addition to gunpowder, explosives and swords--various machinery, instruments and apparatus used directly to kill humans or to destroy objects as a means of armed struggle." Also included are defense ships, combat planes and tanks which carry firearms and primarily involve action for the purpose of killing humans or destroying objects as a means of armed struggle, according to this definition.

Let us examine this a bit further. The unified opinion of the government takes the same position as it does vis-a-vis South Korea, which was mentioned before, in that it refrains from arms export towards not only target areas under the 3 principles, but t wards other areas as well. It also makes clear that arms related facilities will be treated as arms. In essence, regardless of what the target areas are, the policy is to deny recognition of export of "arms," and the 3 principles governing arms export are more stringently

executed in practice than the text indicates. Additionally, since April 1978, the technological export of arms production also requires approval by the Minister of MITI.

However, according to the consensus of opinion the US-1 rescue flying boat and the C-1 transport have been interpreted as "non-arms" and approved for export. In Appendix 1 of the export trade control act, the rescue flying boat and C-1 transport are listed as non-applicable items.

Table VII-6: List of Arms Under The Three Principles Governing Arms Export

(Arms Export Control Law, Separate Table 1)	(Requiring Export Approval - Examples)		(Exceptions - Examples)
	(Arms - Used by military forces for direct combat)	(Others)	
197 - Guns/cannons/ammo (including those used for flares & smoke screens); also parts/components (except riflescopes)	Rifles, machine guns mortars, antiaircraft artillery and ammo	Hunting rifles, sharpshooting guns for sports use; BB guns, whaling harpoons and ammo	
198 - Explosives (except guns/cannons) and throwers or launchers; also parts & components	Hand grenades, bombs, torpedoes, missiles	Dynamite for commercial use	
199 - Gunpowder (except explosives) 200 - Explosive stabilizers	High power explosives for military use (TNT, etc)	Gunpowder for commercial use dynamite	
201 - Military vehicles & parts	Tanks, armored cars, mobile mortars		Trucks, jeeps
201-2 Combat ships, ship hulls and parts	Combat ships, defense ships, subs, torpedo boats		
201-3 Military aircraft, parts & components	Combat planes, bombers, antisub planes	Target planes	Rescue planes, transporters
202 Antisub network, anti-torpedo nets, floating cables for magnetic mine sweeping	Antisub nets, anti-torpedo nets, floating cables for magnetic mine sweeping		

203 Plate armor, combat helmets, bulletproof wear & parts	Plate armor, combat helmets, bulletproof wear
204 Military searchlights & control apparatus	Military searchlights
205 Bacteriological weapons, chemical weapons & radiation weapons for military use; sprayers, protectors, detectors & identifiers	Bacteriological, chemical & radiation weapons for military use

Tanks, armored cars and mobile mortars are listed as examples of "military vehicles and parts" which require approval for export, while trucks and jeeps are listed as exceptions. This is understandable when considering their stages of development, manufacture and functions. But there is no major difference between rescue flying boats/transports and combat planes/bombers/antisub patrol planes. In Japan, the rescue planes and transport were jointly developed by the Defense Agency and private enterprise, and they are intrinsically military in nature. Since even fireworks are not arms and yet require approval for export, the exception of rescue planes and transports is highly questionable. While taking the position of faithfully observing the export trade control act and strengthening control target areas as the result of broader interpretation, the unified opinion of the government could be regarded as actually leaving a large loophole.

In any case, the debate in the Diet has actually added fuel to the arms export issue. In 1978, the exposure of the smuggling of hand grenades to the Philippines created a sensation, indicating the danger of arms slipping out due to the slipshod procedures in granting export approval. However, that was not an issue involving a mainstream enterprise of the defense industry.

Dangerous Road to "Merchant of Death"

On 7 Jul 77, President Tabe of Mitsubishi & Co stated generally as follows at a press conference. "From the standpoint of economy in Japan's national budget, arms export should be encouraged. If arms can be mass produced for export, production costs will be lowered and bring defense expenditures down as well." Such statements as well as debates on the issue of the ceiling on defense-related spending began to be heard frequently at this time.

The purpose of the debate was to revise the 3 principles on arms export, based on the argument that arms export would economize on defense spending at home. Arms export means to the defense industry, above all else, the broadening of sales outlets to overseas markets. As a result, the industry's mass productivity would rise and the enterprises would increase their sales volume. To that extent, the argument is on fairly safe grounds. In some cases, perhaps mass productivity would rise, production costs would drop, and the drop would be reflected in lower prices. Also, the budget for the same volume of procurements would be more economical.

However, it is not clear whether things would work out so well. Arms exports would be accompanied by a similar increase in domestic arms production. But, depending on the relationship to arms procured domestically, the effect would not be the same in each case. In cases where different types of arms from those procured at home are exported, there is virtually no connection with mass production of home-consumed arms. Also, even when similar types of arms are exported, it is not simple to estimate the amount of exports required to bring an effective decrease in costs. Since the unit cost of materials does not vary greatly despite moderate increases in production volume, it is necessary to drastically decrease capital spending and, in order to do so, it would be necessary to greatly increase production volume. Arms export would at the moment merely increase the supplier's sales volume, but would not alter the prices of domestically consumed arms. To definitely decrease domestic prices, the export volume should closely approach the domestic procurement volume. Despite this, there is no guarantee of a drop in domestic prices. It is an exaggeration to surmise that an excuse is being prepared to the effect that "we are barely making ends meet by matching the volumes of domestic demand and exports?"

It is realistically a near impossibility for exports to lower domestic procurement prices. On the other hand, the drawbacks of conducting arms export cannot be ignored.

When arms export is carried out, its limits would be different from that of the domestic market. Aimed at world markets, exports would continue to expand. The domestic market would be overlooked, the enterprises would become merchants of death, and they might even create tensions in seeking opportunities to sell arms.

In the U.S. defense industry, not a few suppliers do a worldwide business. Depending on the equipment, there are some who make ends meet by selling not only in the U.S. market, but to the entire American bloc of nations. As a result, the dependence on export increases and it becomes difficult to make ends meet without exporting. But this is partly a result of postwar U.S. arms policy, and partly the result of the large-scale R&D conducted by the U.S. Many of its shortcomings are being pointed out. When the aspect of a merchant of death as a whole becomes strong, the interests of private enterprise are given priority over national interests, and indifference towards domestic equipment sometimes sets in when profits are low.

In our opinion, the caliber of some domestically produced equipment compares favorably with the most advanced equipment in the world. (An example is the model 74 tank) If export of such equipment is recognized, Japan would very shortly become the world's top supplier of the equipment. The ill effects which would result are only too clear in view of past examples.

VIII. The Constitution, Armed Forces and the Defense Industry

One of the focal points in the debate over the defense issue in 1978 was clearly the "emergency" legislation issue. Since the SDF's existence itself was based on the hypothesis of an "emergency," its history reveals a recurring study on "emergencies." When the study is not limited to tactical research within the SDF but develops into research on the hypothesis of mobilizing other government agencies, communities, enterprises and the general population, and further purports to underscore it legislatively, it becomes a serious political problem. Even so, the manner in which the "emergency" legislation issue was raised in 1978 could be said to be a remarkable "show of defiance" backed by the past 20 year history of rearmament and de facto existence of a powerful military, far exceeding the old Imperial Army and Navy.

The assertion was that a legal system was lacking, which would enable such a powerful military force to take sure and swift action in times of "emergency," and therefore there was no choice but to resort to "supralegal" action. Few people accepted this contention, but a considerable number agreed that a legal system was lacking. Nonetheless, a calm appraisal without being carried away by established facts would reveal that posing the problem was putting the cart before the horse. It is very clear that action to be taken by military forces in an "emergency" is not consistent with the current legal system which has the Constitution at its apex. The question is posed, in connection with the issue regarding bases, as to whether an SDF of such nature should be recognized under the present Constitution, and this should be the more orthodox approach to the debate from the standpoint of legal theory.

We do not propose to evolve legal theory here. But the present Constitution has clearly put a major restriction on SDF activity and equipment. Therefore, the Constitution is literally an "eyesore" for those who argue for a stronger SDF. The SDF itself was "forced" on us at its advent by the Occupation Forces. It was gladly accepted on the one hand, and attempts are being made on the other hand to revise the Constitution on the grounds that it was forced on us. It was rearmament with the condition that it was "for self defense," but it resulted in the lowest military spending among the advanced industrial nations, providing a factor for Japan's high rate of growth. Therefore, the low military spending was by no means a minus for the economy, but a big plus from a macroscopic point of view.

With the decline in economic growth, the economic role of government spending assumed added importance. There is the view that, as a link in that role, defense spending should be increased. However, as we have previously pointed out, it is not necessary to increase the rate of defense spending, judging from the present level of equipment. It will only lead in a dangerous direction. Of course, an increase in defense spending will result in a wider market. But, since it must be done with limited financial resources, it will not result in an increase of government demand as a whole. From a more microscopic viewpoint, it will result in expanding the demand of the defense-related

industry. However, an effective expansion of the market is possible only when the expansion is continued, and maintaining the expanded scale becomes a subsequent condition for preventing a narrowing of the market. The expansion of government demand due to increased spending becomes extremely costly. The present Constitution serves as an important brake on such meaningless expansion. The problem of revising the Constitution in a direct sense is a political and social problem, while on the other hand it is an economic problem. In that sense, it is extremely significant to protect the Constitution.

Nonetheless, we seem to be at a turning point where we should consider the defense problem in basic terms, even apart from legal theory. Judging from the many unfortunate events of the past, there cannot be any good resulting from war, regardless of the cause. In deciding what sort of defense image is good for Japan--for instance, when deciding that neutrality is preferable --we must think calmly about the question of armed neutrality or nonarmed neutrality vis-a-vis the changing world situation. Among the principal powers, there is no nation which really maintains unarmed neutrality.

In any case, it is time to re-examine Japan's defense image. Even aside from such a basic examination--for instance, when reappraising the BADGE system--it should not be simply a reappraisal of the individual component instruments or the system as a whole. We should question its position as a link in the defense concept. It is equally important to question whether all the equipment and systems are logical in the light of the present concept or the concept which is about to be reviewed.

There is an opinion that the deployment of the ground, sea and air SDF is not consistent. The same opinion is expressed with respect to equipment. Judging from the fact that defense demand, including not only frontal equipment but also other supplies, have reached the scale of approximately 1,000 billion yen per year, defense expenditures should be as logical and appropriate as possible.

It means that the rationale for the procurement of the product itself and the quantity should be questioned prior to the question of whether the prices of individual products are appropriate or not. Such a re-examination tends to be inadequate because of the close ties between the military and the industry. To the supplier, it is a secondary problem whether the delivered products are placed effectively within the entire equipment structure. Even if the product is out-of-date or virtually unrelated to the present activity, the supplier would close his eyes to the situation and work fervently to continue deliveries of the product. The mechanism to check this does not always function effectively.

Another problem concerning defense production is the problem of R&D. As it has already been pointed out, R&D spending in Japan is meager, and this results in conditions under which R&D becomes inseparable from mass production. Because of the difference in R&D areas, there is no need to spend huge funds for R&D as in other countries, but at least research funds are necessary which

can guarantee R&D separately from mass production. Furthermore, the infusion of the principle of competition at this stage is important from the standpoint of product quality, as well as to apply a brake on the ties between the military and industry.

ADDENDA

Appendix 1: Scale of Self Defense Force Equipment

(Item of Equipment)	(Holdings)
(I) Ground Self Defense Force	
(1) Firearms/Vehicles	
Rifles	220,400
Machine guns	6,700
M61 (Model 61) medium tanks, M74 medium tanks	690
M41 light tanks	100
M60 and M73 armored personnel carriers	640
75 mm, 105 mm, 155 mm and 203 mm howitzers	900
105 mm and 155 mm mobile howitzers	470
81 mm and 107 mm mortars (partially mobile	1,900
M75 130 mm mobile multibarrel rocket launchers	4
57 mm, 75 mm, 106 mm and mobile 106 mm recoilless cannons	1,100
30-type SSM rockets	
M64 antitank missiles	
35 mm double-barrel, 37 mm, 40 mm antiaircraft guns	260
"Hawk," modified "Hawk"	8.5 groups
(2) Aircraft	
L-19, LM-1/2 (trainers)	20
LR-1 (trainers)	7
V-107 (helicopters)	50
HU-1B (helicopters)	80
OH-6J (helicopters)	70
H-13 (helicopters)	50

(II) Maritime Self Defense Force

(1) Ships

Submarines	14
Destroyers (defense ships)	31
Asroc carrying helicopters (3)	(2)
Asroc carrying Tartars (SAMs)	(2)
Asroc carrying helicopters (2)	(4)
Asroc carrying	(9)
All-purpose	(12)
Training ships	(2)
Frigates (defense ships)	15
Arroc carrying	(11)
All-purpose	(4)
Coastal escort ships	12
Torpedo boats	5
Coast guard ships	9
Mine destroyers	32
Support ships	(3)
Coastal ships	(30)
Inlet sea ships	(6)
Tank landing ships	6

(2) Aircraft

P-2J, P-2V7, S-2F1 (patrol planes)	110
PS-1 (patrol planes)	18
KV-107 (helicopters)	7
HSS-2 (helicopters)	61
YS-11M (transports)	4
S-2FC (transports	1
US-1 (rescue helicopters)	3
S-61A (rescue helicopter)	1
S-62A (rescue helicopters)	8
YS-11T (trainers)	6
TC-90 (trainers)	5
B-65 (trainers)	30
T-34 (trainers)	8
KM-2 (trainers)	30
Bell 47 (trainers)	7
OH-6J (trainers)	4

(III) Air Self Defense Force	
F-4EJ (fighters)	109
F-104J (fighters)	168
F-86F (fighters)	111
F-1 (fighters)	18
T-1 (trainers)	57
T-2 (trainers)	55
T-3 (trainers)	18
T-33 (trainers)	184
T-34 (trainers)	47
C-1 (transports)	28
YS-11 (transports)	13
R-4E (scout planes)	14
MU-2 (rescue planes)	20
KV-107 (rescue planes)	22
S-62 (rescue planes)	26
"Nike"	6 groups

Appendix 2: R&D and Standardization/Deployment of Equipment

(Item)	(R&D Period)	(Standardization year)	(Remarks)
Controlled by Tech Dev Officer (for guided weapons)			
Guided weapons			
M64 antitank guided missiles	1956-63	'64	12-16 sets deployed to GSDF divisions & tank units (total 200 sets)
Controlled by Tech Dev Officer (GSDF)			
Firearms & Communications			
M60-gauge spot rifles	1957-60	'60	Sights for 106 mm recoilless guns

106 mm recoilless guns for M60 vehicles	1958-59	'60	Deployed to regular troops
M62 7.62 mm machine guns	1956-61	'61	" " " "
M63 land mines & antitank mines	1955-60	'62	
M63 fuses (types 1-3)	1959-62	'63	VT fuses for 75.90 mm antiaircraft guns & 50-gauge 3-inch guns
M64 106 mm antitank howitzers	1958-62	'64	For 106 mm recoilless guns
M64 7.62 mm rifles	1962-64	'64	Deployed to all troops as individual firearms
M65 fuses (types 1,2)	1959-64	'65	VT fuses for 105 mm, 155 mm and 203 mm
M67 antipersonnel mines (shock type)	1963-66	'67	
M67 30 rocket launchers; M68 30 rocket shells	1959-67	'68	Deployed to special troops
M68 106 mm recoilless gun adhesion shells	1963-66	'68	For 106 mm recoilless guns
M70 90 mm tank gun tracer antitank shells	1965-68	'69	For M61 tanks
M71 fuses (types 1-3)	1966-70	'71	CVT fuses for 105 mm, 155 mm, 203 mm and 54-gauge 5-inch guns
M72 antitank land mines	1966-69	'72	
M73 107 mm mortar jet bombs	1967-71	'72	For 107 mm mortars
M74 7.62 mm machine guns for vehicles	1968-73	'74	For mounting on M73 APC, M74 tanks
M74 mobile 105 mm howitzers	1968-72	'74	To equip regular troops; also develop long range
M75 105 mm adhesion howitzer shells	1971-73	'74	For M74 tanks

Complex shells	1967-74	'77	For type 30 rockets
Liquid ammunition	1971-77		
Grenade rifles & ammunition	1972-(79)		
Antipersonnel land mines (fragmentation)	1973-78		
Vehicles			
M60 3-ton snow vehicles	1953-59	'59	To equip troops in heavy snow areas
M60 mobile 106 mm recoilless guns	1955-59	'60	To equip regular troops
M60 armored cars	1956-59	'60	For 7 divisions & tank corps
M60 mobile 81 mm mortars	1956-59	'60	To equip 7 divisions
M60 mobile 4.2 inch mortars	1956-59	'60	To equip 7 divisions
M61 tanks	1950-60	'61	To equip tank corps
M61 large snowmobiles	1950-60	'61	For troops in heavy snow areas
M70 tank recovery vehicles	1963-65	'70	For tank corps
M73 armored trucks	1967-70	'73	To equip 7 divisions
M73 tow trucks	1969-71	'73	To equip special troops
New type tank recovery vehicles	1972-76	'78	
New snow vehicles	1973-77	'78	
New wheeled armored vehicles	1974-(80)		
Facilities/Supplies			
M62 vibrator tire rollers	1953-58	'62	To equip maintenance troops
M62 equally graded panel bridges	1955-60	'62	" " "
M62 small concrete mixers	1955-60	'62	" " "

M62 9 m^3 tow-type scrapers	1956-57	'62	To equip maintenance troops
M62 "gengaiki"	1958-61	'62	" " "
M64 rope launchers	1954-62	'64	" " "
M64 pontoon rafts	1957-60	'64	" " "
M66 ground resistance measurer	1955-60	'66	" " "
M67 tank bridges	1957-63	'67	To equip 7 divisions
M70 mine explosion devices (for personnel)	1962-68	'70	To equip regular troops & engineer corps
M70 mobile pontoon bridges	1965-68	'70	To equip engineer corps
M71 land mine detectors	1962-69	'71	To equip all troops
New ford crossing materials	1964-78		
Measuring detectors (radiowave)			
M65 radar system JAN/PPS-4	1962-63	'65	To equip reconnaissance & regular troops
M70 initial speed measuring device	1962-68	'70	For M70 FADC
M71 ground radar system JTPS-P6	1964-67	'71	To equip reconnaissance troops
M71 antiaircraft radar system JTPS-P5	1966-68	'71	To equip antiaircraft special troops
Low altitude information system	1973-76	'78	
Field information detection system	1970-78	(80)	
Data processing instruments			
M70 field sharpshooting control system	1962-68	'70	To equip sharpshooter troops
New field sharpshooting system	1976-(79)	(80)	

Communications devices			
M63 wireless JAN/PRC-14	1958-60	'63	To equip airborne troops
M63 30-circuit converter JSB-86/P	1957-60	'65	To equip all troops
M66 medium wireless JAN/GRC-N_1	1962-63	'65	To equip airborne troops
M67 heavy wireless JAN/GRC-N_3	1960-64	'65	" " " "
M67 diffusion receiver JTC-65	1960-62	'66	To equip communications troops
M60 wireless conveyor terminus system JMRC-C_1~C_3(R_1~R_3)	1960-67	'68	" " " "
M69 portable wireless JPRC-F_1~F_3	1961-66	'68	To equip all troops
M69 vehicle wireless JVRC-R_5~F_8	1961-66	'68	" " " "
Photo-electric devices			
M63 sharpshooting/maneuvering noctovision sights	1957-61	'63	Sharpshooting for 64 rifles Maneuvering-for tanks
M69 noctovision sights	1959-61	'69	Tank gun sights
M69 noctovision binoculars	1959-61	'69	For tank personnel
M70 laser distance gauger	1962-68	'70	For M70 FADC
M74 noctovision for maneuvering	1970-72	'74	For M74 TK
M74 dim light noctovision sights	1971-72	'74	For reconnaissance use
M75 ground infrared detectors	1971-72	'75	" " " "
M75 dim light noctovision sights (Type 1, Type 2)	1972-73	'75	Type 1 for 106 mm mobile recoilless guns Type 2 for rifles & machine guns
Meteorological devices			
M75 mobile ground wind measuring device	1969-73	'75	To equip special troops

Meteorological measuring device	1973-77	(79)	To equip special troops
Others			
M60 parachutes for airborne troops	1957-59	'60	To equip airborne troops
M62 protection masks	1960-61	'61	To equip all troops
M63 radiation service trucks	1953-61	'63	For chemical warfare troops
M63 smoke emitters	1961	'63	For regular & construction corps
M66 radial ray automatic alarms	1961-64	'66	To equip all troops
M57 pocket radial ray meter (B)	1963	'66	To equip all troops (Modified M57)
M68 glass linear measure	1962-66	'68	" " " "
Meter for M68 glass linear measure	1962-66	'68	" " " "
M69 radial measuring device SC-type	1963-67	'69	" " " "
M73 protection masks	1967-69	'72	" " " "
New type filters	1971-74	'78	
Airdrop equipment for heavy objects	1971-74	'78	
Controlled by Tech Dev Officer (for ships)			
Firearms & Ammunition			
High speed ammunition lift for 3-inch 50 caliber guns	1955-57	'58	To equip 3-inch 50-caliber gun carrying ships
Lower ammunition lift for 5-inch 54-caliber guns	1957-58	'58	To equip 5-inch 54-caliber gun carrying ships

Ships

Remote control system for subs	1960-61	'61	To equip "Ohshio" class submarines & later models
Research on demagnetization of engines	1954-61	'63	To equip M63 mine sweepers & later models
Special steel materials	1955-65	'59	For "Hayashio" class subs of 30 kg/mm^2 & above
		'61	For "Ohshio" class subs of 46 kg/mm^2 & above
		'67	For "Uzushio" class subs of 63 kg/mm^2 & above
Automatic control system for submarines	1955-68	'56	Automatic depth maintenance & control for "Oyashi" class subs & later models
		'64	Automatic course maintenance & control for "Harushio" class subs & later models
Automatic control systems for submarines	1955-68	'67	Automatic depth maintenance, automatic course maintenance, digital calculation & control method, analogue type movemnet indicator for "Uzushio" class subs & later models
Main machinery for high speed boats (24WZ engine)	1959-61	'67	Equipped on high speed boat Model 66 and torpedo boats of 1969 vintage & later models
Air purification system (MEA type)	1960-65	'67	For "Uzushio" class subs & later models

Direct current high tension medium circuit breaker	1963-64	'69	Equipped on subs of 1967 vintage & later models
Circuit breaker for subs (Built-in)	1964	'69	" " " "
Electromagnetic contactor for submarines	1964	'69	" " " "
Electric current source system for mine sweepers	1965-67	'70	Equipped on mine sweepers of 1967 vintage & later
High tension steel (NS90 type)	1970-74	'75	For use in 1975 vintage subs
Main diesel engines for ships	1967-76	'76	For supply ships (AOE)
Deepsea rescue ships	1972-75		Planned for 1978 or later
Engine trouble detector	1973-77		" " " "
Underwater weapons			
M68 antisub bomb launchers	1953-54	'63	For "kaze" class ("Harukaze," "Yukikaze"), PC ("Kamome," "Tsubame," "Misago," "Hayabusa")
M67 depth bombs	1954-55	'63	For "nami" class ("Ayanami," "Isonami," "Uranami," "Shikinami," "Takanami," "Ohnami," "Makinami"); "Ame" class ("Murasame," "Yudachi," "Harusame"); "Tsuki" class ("Akizuki," "Teruzuki"); PC class ("Kamome," "Tsubame," "Misago," "Hayabusa")
M54 torpedoes	1954-59		Without standardizing, permit obtained for use & trial manufacture, simultaneously with procurement

High speed homing torpedoes (G-RX2 system)	1970-(85)		
M70 mines (K-21)	1954-59	'66	Permit obtained for use from FY62 with full procurement
M70 mines (k022)	1954-59	'66	" " " "
M70 mines (K-24)	1954-59	'66	Permit obtained for use from FY63 with full procurement
New type mines (1) (B-X)	1968-78		
New types mines (2) (K-X)	1972-(79)		
Sonar mine sweeping equipment (S-2)	1961-68	'73	Deployment through temporary standardization from FY69
Measuring detectors (sound)			
Trial manufacture (TM) of M55 SS sea depth probe - Type 1: OQS-1	1953-55	'55	Equipped on torpedo boats No 1-8
TM of M56B sea depth probe Type 1: JQS-1	1956-58	'60	Equipped on sub "Oyashio"
TM of M56B sound detector Types JQO-1, JQO-3	1956-58	'60	JQO-1 for sub "Oyashio" JQO-3 for subs("Hayashio," "Wakashio," "Natsushio," "Fuyushio")
TM of 56U undersea telephone Type 1: ZQC-1	1956-58	'60	24 telephones for "Oyashio" & sub rescue ship "Chihaya"; remainder for defense ship "Akazuki" and others
TM of M56B underwater telephone Type 1:JQC-1	1956-58	'60	For subs("Oyashio," "Hayashio," "Wakashio"); sub rescue ship ("Chihaya")
TM of M56B underwater noise	1956-58	'62	For subs ("Hayashio," "Wakashio", "Natsushio", "Fuyushio")
Underwater attack command system SFCF-1	1954-59	'60	For defense ships ("Akazuki," "Teruzuki")

TM of M56S attack positioning control OQE-1	1956-57	'60	For defense ships of "Ayanami" class & "Umitaka" class
TM of M56S distance recorder Type 1: OQE-3	1956-57	'60	For defense ships of "Ayanami" class & "Umitaka" class
TM of M56S sea depth probe stabilizer Type 1: OQA-4	1956-57	'60	" " "
TM of M56S sea depth probe stabilizing meter Type 1: OQA-3	1956	'60	" " "
Mine detector ZQS-1	1958-59	'60	For medium mine sweepers "Atada," "Itsuki" & later models up to '64 vintage
M67 underwater stabilized sound detector LQO-3	1960-63	'67	For MSDF guard stations
Mine detector ZQS-2	1966-67	'70	For medium "Miyake" class mine sweepers of '68 vintage & later models up to '75 vintage
Controlled by Tech Dev Officer (for aircraft)			
Sonobuoy upright indicator for antisub aircraft	1972-74		
Sonar for helicopters	1974-78	(79)	High efficiency sonar for helicopter to be equipped on MSDF's antisub helicopter HSS-2B. To replace AN/ALQ-13A now under production with U.S. for use in seas near Japan to detect and chase subs. Now under full trial manufacture.
Controlled by Tech Dev Officer **(for ships)**			
Measuring detectors (radiowave)			
Mine surveillance radar	1962-65	'67	Following practical tests, deployed at Rokurento Is.

Radar for submarine	1973-74	'77	To be deployed on subs of 1975 vintage & later models
Controlled by Tech Dev Officer (for aircraft)			
Radar for antisub aircraft	1972-74		
Controlled by Tech Dev Officer (for ships			
ECM & ECCM			
Reverse detector for antisub planes	1972-74		
Wireless detector for subs	1973-75	'77	To be deployed on subs of 1975 vintage & later models
Wireless detector jamming device for surface ships	1975-78		
Navigation meteorological equipment			
Inertial navigation system	1973-(82)		To be deployed on subs of 1982 vintage & later models
Others			
Demagnetization automatic control system for subs	1960-66	'71	For sub "Uzushio" & later vintage up to 1975 models
Sensitivity correction device for magnetic measuring apparatus	1961-62	'67	Under use at temporary magnetic observation post
Stray magnetic field compensator	1968-69		Deployed on medium mine sweeper now equipped with direct current mine sweeping electric power source system

Controlled by Tech Dev Officer (for guided weapons)			
Guided weapons			
Short range ASM (XASM-1)	1973(79)		
Controlled by Tech Dev Officer (for aircraft)			
ECM & ECCM			
Onboard ECM system (XJ-ALQ-2)	1961-64	'65	Carried on T-33
ECCM training simulator (XJ-FLQ-1)	1962-64		
ECCM system for sight radar (for FPS-3)	1963-65	'67	Used in ASDF sight radar FPS-3
Special electronic tube (backward tube)	1963-65		
High efficiency ground wireless detector	1964-66		
Onboard radiowave jamming device (XJ/ALQ-3)	1966-69	'71	Used for training at air defense command flight squadron
Maintenance inspection device for onboard radiowave jamming device (XJ/ALQ-3)	1967-69	'71	" " " "
ECM evaluator (FLQ-3)	1969-71		
Ground radiowave jamming device	1969-73		
Onboard radiowave jamming device (XJ/ALQ-4)	1970-72	'73	Carried on F-104
Onboard radiowave jamming device (XJ-ALQ-6)	1976-78		
Navigation Weather Devices			
Aircraft lightning damage reducer	1969-76		
Aerial collision preventer	1972-75		
Lightning detector for ground use	1975-(81)		

Others

Ejection cartridge	1962-65	'68	Ejection system for use on F-104, F-86, T-33 & T-1 jets
Emergency escape system for T-1	1965-67	'68	Equipped on T-1
Fixed cycle electric power system	1971-77		
Onboard dust collector type 2	1974-77	'78	6 units deployed in ASDF in FY78 (planned)

Appendix 3: Present State of Domestically Produced Equipment

Equipment/Maker

I. GSDF Equipment/Maker

(1) Firearms and Ammunition

Model 64 (M64) 7.62 mm rifles - Howa Machinery

M62 7.62 mm machine guns - Nittoku Metal Industries
Gunsight goggles - Fuji Photo Film

M74 7.62 mm machine guns - Nittoku Metal Industries

M64 81 mm mortars - Howa Machinery

M60 106 mm recoilless guns - Japan Steel Works
Spot rifles - Howa Machinery

105 mm howitzer M]A1 - Japan Steel Works, Kobe Seisakusho

155 mm howitzer M1 - Japan Steel Works, Kobe Seisakusho

35 mm double-barrel cannons (L-90)

35 mm cannons - Japan Steel Works (developed by the Swiss Ericon Co)

Sharpshooting control system - Mitsubishi Electric Corp (developed by the Swiss Kontraves Co)

M67 Type 30 rocket launcher - Nissan Motor

M75 mobile multi-barrel 130 mm rocket launcher

Launcher/rocket shells - Nissan Motor

Chassis - Komatsu Ltd

M75 mobile ground windforce meter - Meisei Electric

M64 antitank miss-le - Kawasaki Heavy Industries

Antiair missile "Hawk"

Missile/company control center launcher/high voltage illuminator/radar - Mitsubishi Electric Corp

Pulse catching radar/CW catching radar/range measuring radar/roader - Toshiba (developed by U.S. Raytheon Co)

Antiair missile modified "Hawk" - Toshiba (developed by Raytheon)

7.62 mm NATO bomb - Asahi Seiki

7.62 mm (30 rifles/ammunition - Asahi Seiki

11.4 mm pistols/submachine gun ammuniton - Asahi Seiki

12.7 mm machine gun ammunition - Nippon Koki

12.7 mm spot rifle ammunition - Nippon Koki

130 mm rocket bomb - Nissan Motor

89 mm rocket bomb - Daikin Kogyo

30-type rocket bomb - Nissan Motor

Antitank missile - Kawasaki Heavy Industries

81 mm mortar shell - Daikin Kogyo

107 mm mortar shell - Komatsu Ltd

106 mm recoilless gun shell - Komatsu Ltd

37 mm howitzer shell - Daikin Kogyo

75 mm howitzer shell - Daikin Kogyo

105 mm howitzer shell - Daikin Kogyo, Komatsu Ltd

155 mm howitzer shell - Komatsu Ltd

203 mm howitzer shell - Asahi Chemical Industry, Daicel, Nippon Oils & Fats

76 mm tank gun shell - Daikin Kogyo

90 mm tank gun shell - Komatsu Ltd

105 mm tank gun shell - Komatsu Ltd

37 mm antiaircraft gun shell - Daikin Kogyo

35 mm antiaircraft gun shell - Nippon Koki

Land mine - Ishikawa Seisakusho

Esplosive materials - Chugoki Kayaku

Fuses (fire fuses) - Daikin Kogyo, Ricoh Watch, Nippon Electronic Instruments

Blank cartridge - Nippon Koki, Showa Kinzoku

(2) Vehicles/Facilities & Supplies

M61 tank

Chassis/engine - Mitsubishi Heavy Industries

M61 90 mm tank gun - Japan Steel Works

M74 tank - Mitsubishi Heavy Industries

M60 mobile 81 mm mortar - Mitsubishi H Industries, Komatsu Ltd

M60 mobile 107 mm mortar - Mitsubishi H Industries, Komatsu Ltd

M60 mobile 106 mm recoilless gun - Komatsu Ltd, Japan Steels Works, Howa Machinery

M74 mobile 105 mm howitzer/gun turret - Japan Steel Works

Gun chariot chassis - Komatsu Ltd

M75 mobile 155 mm howitzer

Gun/turret - Japan Steel Works

Chassis - Mitsubishi H Industries

M70 tank recovery vehicle - Mitsubishi Heavy Industries

M73 tow vehicle - Hitachi Ltd

M60 3-ton snowmobile (medium) - Komatsu Ltd, Ohara Iron Works

M60 armored truck - Komatsu Ltd, Mitsubishi H Industries

M73 armored truck - Mitsubishi H Industries, Komatsu Ltd

M97 tank bridge - Mitsubishi H Industries

M70 mobile pontoon bridge - Hitachi Ltd

Truck for panel bridge - Mitsubishi Motor

Truck for floating bridge - Mitsubishi H Industries

Foot bridge - Nippon Aluminum Industry

Panel bridge - Kisha Seizo

(3) Aircraft

L-19 E ("Soyokaze") - Fuji Heavy Industries (developed by U.S. Cessna Aircraft)

LM-1 ("Harukaze") - Fuji H Industries

LR-1 (MU-2D) - Mitsubishi H Industries

LR-1 (MU-DK) - Mitsubishi H Industries

T-34A ("Hatsukaze") - Fuki H Industries (developed by U.S. Beechcraft Co)

H-13KH ("Hibari") - Kawasaki H Industries

OH-6J

Airframe - Kawasaki Heavy Industries

Engine - Mitsubishi H Industries (developed by U.S. Hughes Co)

HU-1B ("Hiyodori")

Airframe - Fuji Heavy Industries

Engine - Kawasaki Heavy Industries (developed by U.S. Bell Co)

HU-1H ("Hiyodori") - Kawasaki H Industries (developed by U.S. Bell Co)
(Modified model of HU-1B)

V-107 ("Shirasagi")

Airframe - Kawasaki H Industries

Engine - Ishikawajima Harima Heavy Industries (developed by U.S. Boeing Bertel Co; engine by General Electric)

V-107A ("Shirasagi") - ditto (modified model of V-107)

(4) Communications & Electronic Instruments

M69 portable wireless (No 3) JPRC-F1 - Hitachi Ltd, Mitsubishi Electric Corp, Matsushita Communications

M69 portable wireless (No 2) JPRC-F2 - Matsushita Communications, Toyo Communications, Fujitsu Ltd

M69 portable wireless (No 1) JPRC-F3 - Toshiba, Toyo Communications, Nippon Electric

M69 vehicle wireless (TRR-type) JVRC-F6 - Nippon Electric, Hitachi, Toshiba, Mitsubishi Electric Corp, Fujitsu

Wireless conveyor No 3

Wireless apparatus - Nippon Electric, Fujitsu Ltd

Conveyor - Fujitsu Ltd

Wireless conveyor No 1 - Nippon Electric, Fujitsu Ltd

Ground wireless No 3 JAN/GRC-N1(SSB) - Nippon Electric Kawasaki Electric, Japan Wireless, Fujitsu Ltd

Wire connector - Toyo Tsushinki

Portable telephone No 1 JTA-T1 - Oki Electric

Exchange No 1 JSB-86-P - Fujitsu Ltd

Exchange No 2 JSB-22-PT - Nippon Electric, Fujitsu, Hitachi, Oki Electric, Adachi Electric

Telephone exchange JMTC-T12 - Adachi Electric, Hasegawa Electric

Onboard wireless JARC-F1 - Fujitsu Ltd

Onboard wireless JAN-ARC-2 - Nippon Electric

Onboard wireless JARC-A2, A3 - Nippon Electric

M65 radar JAN-PPS-4 - Fujitsu Ltd, Hitachi

M71 ground radar JTPS-P6 - Nippon Electric, Fujitsu Ltd

M72 antiapproach radar system JAN-MPQ-N 1 - Toshiba Electronics Systems

M71 antiair radar system JTRS-P5 - Mitsubishi Electric Corp

M71 landing guidance system (medium range) JGVS-V1 - Nippon Electric

M75 ground infrared system - Fujitsu Ltd

M63 noctovision system for maneuvering Type 1 - Nippon Electric

M63 noctovision system for sharpshooting Type B - Nippon Electric

M70 field special sharpshooter troops command system - Mitsubishi Electric Corp

Information feeder - Nippon Electric

M70 initial speed measuring device - Mitsubishi Electric Corp

M70 laser distance meter - Mitsubishi Electric Corp

Airfield control system JMRN-A1 - Kokusai Electric

(5) Supplies & Equipment

Water purification sets:

Filter - Sayama Seisakusho

Vortex pump - Tokyo Hatsudoki

Water tank - Ogawa Tent Co

Hospital tents - Teikoku Textile, Toyo Textile

Outdoor cooking sets No 1 (kitchen-on-wheels) - Shinsei Shoji, Netsu-Energi Kisetsu

Refrigerators/freezers - Hino Motors, Mitsubishi Motor

Outdoor washing machine sets - Shinsei Shoji, Netsu-Energi Kisetsu, Ogawa Tent Co

M60 parachutes for airborne troops (main parachutes/auxiliary parachutes - Fujikura Koso

Sling nets - Fujikura Koso

Sling belts - Fujikura Koso

Protective masks Type 3 - Shigematsu Seisakusho

Chemical protection gowns - Fujikura Rubber

Air masks - Kawasaki Heavy Industries

Flame protection gowns - Kuramoto Industry

Gas tester - Komei Rikagaku

Chemical protection truck - Mitsubishi Heavy Industries

Portable dye removers Type 2 - Marunaka Seisakusho

Dye removal truck:

Chassis - Isuzu Motors

Tank - Tokyo Sharyo

Portable sprayer - Sekiyu Sakuiki

Chemical heater (boiler/oil) - Nippon Muen Kogyo

Smoke sprayer Type 2 - Mitsui Seiki, Tochigi Fuji Sangyo

Portable weather gauge - Isuzu Motors

Portable linear measuring device & electric charger - Riken Seiki

Glass linear measuring device & meter - Toshiba

Linear factor gauge for company use Type 2 - Fuji Electric Machinery

Linear factor gauge for provisions - Fuji Electric Machinery

Linear factor gauge for regional use - Riken Keiki

Linear gauge Type 3 - Matsushita Electric Appliance Industry

II. MSDF Equipment

(1) Ships

(FY53)

Escort ship ("Harukaze") - Mitsubishi Shipbuilding, Nagasaki plant

" " ("Yukikaze") - Shin Mitsubishi Shipbuilding, Kobe plant

" " ("Akebono") - Ishikawajima Harima Heavy Industries

" " ("Ikazuchi") - Kawasaki Heavy Industries, Kobe plant

" " ("Inazuma") - Mitsui Shipbuilding, Tamano plant

Mine layer ("Tsugaru") - Mitsubishi Shipbuilding, Nippon plant

" " ("Erimo") - Uraga Senkyo

Mine sweeper ("Atada") - Hitachi Shipbuilding, Kanagawa plant

" " ("Itsuki") - Nippon Kokan, Tsurumi plant

" " ("Yashiro") - Nippon Kokan, Tsurumi plant

Torpedo boat (TB-1) - Hitachi Shipbuilding, Kanagawa plant

" " (TB-2) - Hitachi Shipbuilding, Kanagawa plant

" " (TB-3) - Mitsubishi Shipbuilding, Shimonoseki plant

" " (TB-4) - Mitsubishi Shipbuilding, Shimonoseki plant

" " (TB-5) - Higashi (also read Azuma) Shipbuilding

" " (TB-6) - Higashi (also read Azuma) Shipbuilding

(FY54)

Submarine chaser ("Kari") - Fujinagata Zosen

" " ("Kiji") - Ino Shipbuilding, Maizuru plant

" " ("Taka") - Fujinagata Zosen

" " (Washi") - Iino Shipbuilding, Maizuru plant

" " (Kamome") - Uraga Senkyo

" " ("Tsubame") - Kure Shipbuilding

" " ("Misago") - Uraga Senkyo

" " ("Hayabusa") - Mitsubishi Shipbuilding, Nagasaki plant

Torpedo boat (TB-7) - Mitsubishi Shipbuilding, Shimonoseki plant

" " (TB-8) - Mitsubishi Shipbuilding, Shimonoseki plant

" " (TB-9) - Sanders Row (Britain)

Mine sweeper (MS-1) - Hitachi Shipbuilding, Kanagawa plant

" " (MS-2) - Hitachi Shipbuilding, Kanagawa plant

" " (MS-3) - Nippon Kokan, Tsurumi plant

Special duty ship (High speed No 1) - Sumidagawa Zosen

Special duty ship (High speed No 2) - Sumidagawa Zosen

(FY55)

Escort ship ("Ayanami") - Mitsubishi Shipbuilding, Nagasaki plant

" " ("Isonami") - Shin Mitsubishi Shipbuilding, Kobe plant

" " ("Uranami") - Kawasaki H Industries, Kobe plant

" " ("Shikinami") - Mitsui Shipbuilding, Tamano plant

Mine sweeper ("Kasado") - Hitachi Shipbuilding, Kanagawa plant

" " ("Shisaka") - Nippon Kokan, Tsurumi plant

" " ("MS-4) - Nippon Kokan, Tsurumi plant

Special duty ship (High speed No 3) - Sumidagawa Zosen

(FY56)

Escort ship ("Murasame") - Mitsubishi Shipbuilding, Nagasaki plant

" " ("Yudachi") - Ishikawajima Harima

Submarine ("Oyashio") - Kawasaki Heavy Industries, Kobe plant

[OSP] Escort ship ("Akazuki") - Mitsubishi Shipbuilding, Nagasaki plant

" " " ("Teruzuki") - Shin Mitsubishi Shipbuilding, Kobe plant

(FY57)

Escort ship ("Harusame") - Uraga Senkyo

" " ("Takanami") - Mitsui Shipbuilding, Tamano plant

Subchaser ("Umitaka") - Kawasaki Heavy Industries, Kobe plant

" ("Ohtaka") - Kure Shipbuilding

Mine sweeper ("Kanawa") - Hitachi Shipbuilding, Kanagawa plant

" " ("Sakito") - Nippon Kokan, Tsurumi plant

" " ("Habushi") - Hitachi Shipbuilding, Kanagawa plant

" " (MS-5) - Nippon Kokan, Tsurumi plant

" " (MS-6) - Nippon Kokan, Tsurumi plant

Special duty ship (High speed No 4) - Mitsubishi Shipbuilding, Shimonoseki plant

1st Defense Buildup Plan (FY58-60)

(FY58)

Escort ship ("Ohnami") - Ishikawajima Harima

Escort ship ("Makiname") - Iino Shipbuilding, Maizuru plant

Subchaser ("Mizutori") - Kawasaki Heavy Indust, Kobe plant

Subchaser ("Yamadori") - Fujinagata Zosen

Mine sweeper ("Kohzu") - Nippon Kokan, Tsurumi plant

" " ("Tatara") - Hitachi Shipbuilding, Kanagawa plant

" " ("Tsukumi") - Nippon Kokan, Tsurumi plant

" " ("Mikura") - Hitachi Shipbldg, Kanagawa plant

Special duty ship (High speed No 5) - Mitsubishi Shipbldg, Shimonoseki plant

(FY59)

Escort ship ("Isuzu") - Mitsui Shipbldg, Tamno plant

Escort ship ("Mogami") - Mitsubishi Shipbldg, Nagasaki plant

Submarine ("Hayashio") - Shin Mitsubishi Shipbldg, Kobe plant

Submarine ("Wakashio") - Kawasaki Heavy Indust, Kobe plant

Subchaser ("Ohtori") - Kure Zosen

" ("Kasasagi") - Fujinagata Zosen

" ("Hatsukari") - Sasebo Senpaku

Mine sweeper ("Shikine") - Nippon Kokan, Tsurumi plant

" " ("Hirado") - Hitachi Shipbldg, Kanagawa plant

Sub rescue ship ("Chihaya") - Shin Mitsubishi Shipbldg, Nippon plant

(FY60)

Escort ship ("Amatsukaze") - Mitsubishi Shipbldg, Nagasaki plant

Submarine ("Natsushio") - Shin Mitsubishi Shipbldg, Kobe plant

Submarine ("Fuyushio") - Kawasaki Heavy Industries, Kobe plant

Mine sweeper ("Koshiki") - Hitachi Shipbldg, Kanagawa plant

" " ("Hotaka") - Nippon Kokan, Tsurumi plant

Oil feeder ship ("Hamana") - Uraga Senkyo

Torpedo boat (TB-10)-Mitsubishi Shipbldg, Shimonoseki plant

(FY61)

Escort ship ("Kitakami") - Ishikawajima Harima

Escort ship ("Oh-i") - Maizuru Heavy Industries

Submarine ("Ohshio") - Mitsubishi Shipbldg, Kobe plant

Subchaser ("Umidori") - Sasebo Heavy Industries

Subchaser ("Wakataka") - Kure Zosen

Mine sweeper ("Karato") - Nippon Kokan, Tsurumi plant

" " ("Hario") - Hitachi Shipbldg, Kanagawa plant

2nd Defense Buildup Plan (FY62-66)

(FY62)

Escort ship ("Yamagumo") - Mitsui Shipbldg, Tamano plant

Subchaser ("Kumataka") - Fujinagata Zosen

Mine sweeper ("Mutsure") - Hitachi Shipbldg, Kanagawa plant

Mine sweeper ("Chiburi") - Nippon Kokan, Tsurumi plant

Special duty ship (Fireboat No 41) - Higashi (also read Azuma) Zosen

(FY63)

Escort ship ("Takatsuki") - Ishikawajima Harima

Escort ship ("Makigumo") - Uraga Heavy Industries

Submarine ("Asashio") - Kawasaki Heavy Indust, Kobe plant

Subchaser ("Shiratori") - Sasebo Heavy Industries

Mine sweeper ("Otsu") - Nippon Kokan, Tsurumi plant

Mine sweeper ("Kudako") - Hitachi Shipbldg, Kanagawa plant

(FY64)

Escort ship ("Kikuzuki") - Mitsubishi Shipbldg, Nagasaki plant

Escort ship ("Asagumo") - Maizuru Heavy Industries

Submarine ("Harushio") - Mitsubishi Shipbldg, Kobe plant

Subchaser ("Hiyodori") - Sasebo Heavy Industries

Mine sweeper ("Rishiri") - Hitachi Shipbuilding, Kanagawa plant

" " ("Rebun") - Nippon Kokan, Tsurumi plant

Ice breaker ship ("Fuji") - Nippon Kokan, Tsurumi plant

(FY65)

Escort ship ("Mochizuki") - Ishikawajima Harima

" " ("Minegumo") - Mitsui Shipbldg, Tomano plant

Submarine ("Michishio") - Kawasaki Heavy Industries, Kobe plant

Mine sweeper ("Amami") - Nippon Kokan, Tsurumi plant

" " ("Urume") - Hitachi Shipbldg, Kanagawa plant

" " ("Minase") - Hitachi Shipbldg, Kanagawa plant

Special duty ship (High speed No 6) - Mitsubishi Shipbldg, Shimonoseki plant

(FY66)

Escort ship ("Nagatsuki") - Mitsubishi Shipbldg, Nagasaki plant

" " ("Natsugumo") - Uraga Heavy Industries

Submarine ("Arashio") - Mitsubishi Shipbldg, Kobe plant

Training ship ("Katori") - Ishikawajima Harima

Mine sweeper ("Ibuki") - Hitachi Shipbldg, Kanagawa plant

" " ("Katsura") - Nippon Kokan, Tsurumi plant

3rd Defense Buildup Plan (FY67-71)

(FY67)

Escort ship ("Murakumo") - Maizuru Heavy Industries

" " ("Chikugo") - Mitsui Shipbldg, Tamano plant

Submarine ("Uzushio") - Kawasaki Heavy Indust, Kobe plant

Ocean observation ship ("Akashi") - Nippon Kokan, Tsurumi plant

Training support ship ("Azuma") - Maizuru Heavy Industries

Sub rescue ship ("Fushimi") - Sumitomo Shipbldg & Machy, Uraga plant

Mine sweeper ("Takami") - Hitachi Shipbldg, Kanagawa plant

" " ("Io") - Nippon Kokan, Tsurumi plant

(FY68)

Escort ship ("Haruna") - Mitsubishi Shipbldg, Nagasaki plant

" " ("Ayase") - Ishikawajima Harima

" " ("Mikuma") - Mitsui Shipbldg, Tamano plant

Submarine ("Makishio") - Mitsubishi Shipbldg, Kobe plant

Mine sweeper ("Miyake") - Nippon Kokan, Tsurumi plant

" " ("Utone") - Hitachi Shipbldg, Kanagawa plant

(FY69)

Escort ship ("Aokumo") - Sumitomo Shipbldg, Uraga plant

" " ("Tokachi") - Mitsui Shipbldg, Tamano plant

Submarine ("Isoshio") - Kawasaki Heavy Indust, Kobe plant

Mine sweeper ("Awaji") - Hitachi Shipbldg, Kanagawa plant

" " ("Toshi") - Nippon Kokan, Tsurumi plant

Mine layer ship ("Soya) - Maizuru Heavy Industries

Mine tender ship ("Hayase") - Ishikawajima Harima

Torpedo boat (TB-11) - Mitsubishi Shipbldg, Shimonoseki plant

(FY70)

Escort ship ("Hiei") - Ishikawajima Harima

" " ("Iwase") - Mitsui Shipbldg, Tamano plant

" " ("Chitose") - Hitachi Shipbldg, Maizuru plant

Submarine ("Narushio") - Mitsubishi Shipbldg, Kobe plant

Mine sweeper ("Teuri") - Nippon Kokan, Tsurumi plant

" " ("Murotsu") - Hitachi Shipbldg, Kanagawa plant

Torpedo boat (TB-12) - Mitsubishi Shipbldg, Shimonoseki plant

Patrol boat (PB-19) - Ishikawajima Harima Craft

" " (PB-20) - " " "

" " (PB-21) - " " "

" " (PB-22) - " " "

Transport ("Atsumi") - Sasebo Heavy Industries

(FY71)

Escort ship ("Tachikaze") - Mitsubishi Shipbldg, Nagasaki plant

" " ("Akigumo") - Sumitomo Shipbldg, Uraga plant

" " ("Nyodo") - Mitsui Shipbldg, Tamano plant

Submarine ("Kuroishio") - Kawasaki Heavy Indust, Kobe plant

Mine sweeper ("Tashiro") - Hitachi Shipbldg, Kanagawa plant

" " ("Miyato") - Nippon Kokan, Tsurumi plant

" " (MS-7) - Hitachi Shipbldg, Kanagawa plant

" " (MS-8) - Nippon Kokan, Tsurumi plant

Torpedo boat (TB-13) - Mitsubishi Shipbldg, Shimonoseki plant

Patrol boat (PB-23) - Ishikawajima Harima/Craft

" " (PB-24) - " " "

4th Defense Buildup Plan (FY72-76)

(FY72)

Escort ship ("Teshio") - Hitachi Shipbldg, Maizuru plant

" " ("Yoshino") - Mitsui Shipbldg, Tamano plant

" " ("Kumano") - Hitachi Shipbldg, Maizuru plant

Submarine ("Takashio") - Mitsubishi Shipbldg, Kobe plant

Mine sweeper ("Takane") - Nippon Kokan, Tsurumi plant

" " ("Mutsuki") - Hitachi Shipbldg, Kanagawa plant

" " (MS-9) - Nippon Kokan, Tsurumi plant

" " (MS-10) - Hitachi Shipbldg, Kanagawa plant

Torpedo boat (TB-14) - Mitsubishi Shipbldg, Shimonoseki plant

Patrol boat (PB-25) - Ishikawajima Harima/Craft

" " (PB-26) - " " "

" " (PB-27) - " " "

Transport (small) ("Motobu") - Sasebo Heavy Industries

" (large) ("Miura") - Ishikawajima Harima

(FY73)

Escort ship ("Asakaze") - Mitsubishi Shipbldg, Nagasaki plant

" " ("Noshiro") - Mitsui Shipbldg, Tamano plant

Submarine ("Yaeshio") - Kawasaki Heavy Indust, Kobe plant

Mine sweeper ("Yokose") - Hitachi Shipbldg, Kanagawa plant

" " ("Sakate") - Nippon Kokan, Tsurumi plant

" " (MS-11) - Hitachi Shipbldg, Kanagawa plant

" " (MS-12) - Nippon Kokan, Tsurumi plant

Torpedo boat (TB-15) - Mitsubishi Shipbldg, Shimonoseki plant

Transport (large) ("Ojika") - Ishikawajima Harima

(FY74)

Escort ship ("Yugure") - Sumitomo Shipbldg, Uraga plant

Transport ("Satsuma") - Ishikawajima Harima

Mine sweeper ("Oh-umi") - Hitachi Shipbldg, Kanagawa plant

" " ("Fukue") - Nippon Kokan, Tsurumi plant

(FY75)

Escort ship (DDH-2403) - Ishikawajima Harima

Submarine (SS-8088) - Mitsubishi Shipbldg, Kobe plant

Mine sweeper (MSC-346) - Hitachi Shipbldg, Kanagawa plant

" " (MSC-347) - Nippon Kokan, Isogo plant

" " (MSC-348) - Hitachi Shipbldg, Kanagawa plant

Transport (LST-4103) - Sasebo Heavy Industries

(FY76)

Escort ship (DDH-2404) - Ishikawajima Harima

Mine sweeper (MSC-349) - Nippon Kokan, Isogo plant

Ocean observation ship (AGT-5102) - Mitsubishi Shipbldg, Shimonoseki plant

Supply ship (AOE-421) - Hitachi Shipbldg, Maizuru plant

(FY77)

Escort ship (DD-2210) - Sumitomo Shipbldg, Uraga plant

" " (DE-226) - Mitsui Shipbldg, Tamano plant

Submarine (SS-574) - Kawasaki Heavy Industries, Kobe plant

Mine sweeper (MSC-650) - Hitachi Shipbldg, Kanagawa plant

" " (MSC-651) - Nippon Kokan, Tsurumi plant

Mine layer ship (ARC-482) - Mitsubishi Shipbldg, Shimonoseki plant

(2) Support Ships

(FY53)

Water ship (YW-02, 03) - Iino Heavy Industries

Heavy Oil ship (YO-01, 108) - Hakodate Dock

" " " (YO-02) - Sasebo Senpaku

" " " (YO-106) - Iino Heavy Industries

" " " (YO-107) - Imariwan Heavy Industries

Lightweight oil ship (YG-01) - Iino Heavy Industries

" " " (YG-02) - Hakodate Dock

" " " (YG-03) - Sasebo Senkpaku

Lighter (YL-01) - Namura Zosen

(FY54)

Lighters (YL-02, 03, 04) - Hayashikane Zosen

" (YL-05, 06, 07) - Kure Zosen

Water ship (YW-04) - Iino Heavy Industries

" " (YW-05 to 09) - Kure Zosen

Transportation/communication ships (YF-2097 to 2109) - Former LCM-1001 to 1042

Mine layer ships (YAL-01 to 04) - Former LCU-2001 to 2006

Custodian ships (YAC-24 to 27) - Former LCM-1003 to 1038

(FY55)

Tugboats (YT-25 to 33) - Iino Heavy Industries

Heavy oil ships (YO-03 to 06) - Osaka Shipbuilding

Transport/communication ships (YF-1013, 1017, 1019, 1020) - Azuma Zosen

" " " (YF-2024, 2048) - Yokohama Yacht

Special duty ship (YAS-69) - Former "Erimo"

Custodian ships (YAC-29, 31) - Former DE "Akebono," former DE "Inazuma"

(FY56)

Special duty ships (YAS-56, 58) - Former "Atada," former "Yashiro"

Custodian ship (YAC-30) - Former DE "Ikazuchi"

1st Defense Buildup Plan (FY58-60)

(FY58)

Special duty ship (YAS-62) - Former "Shisaka"

(FY59)

Special duty ships (YAS-64, 65) - Former "Sakito," former "Habushi"

(FY60)

Special duty ships (YAS-66, 67, 68) - Former "Tsukumi," former "Mikura," former "Shikine"

(FY61)

Special duty ship (YAS-70) - Former "Hotaka"

Task ship (B-4001) - Ishihara Zosen (Ishihara Dockyard Co)

Cutters (C-5045, 5046) - Ishihara Dockyard

2nd Defense Buildup Plan (FY62-66)

(FY62)

Tugboat (YT-34) - Yokohama Zosen

" (YT-35) - Hayashikane Zosen

Water ship (YW-10) - Fujinagata Zosen

Heavy oil ship (YO-07) - Hayashikane Zosen

Light oil ship (YG-06) - Fujinagata Zosen

Lighter (YL-114) - Yokohama Zosen

" (YL-115) - Hakodate Dock

Special duty ship (YAS-71) - Former "Karato"

Task ship (B-4003, 4004) - Ishihara Dockyard

(FY63)

Tugboat (YT-36) - Yokohama Zosen

Water ship (YW-11) - Sasebo Heavy Industries

" " (YW-12) - Nippon Kokan, Asano plant

Heavy oil ship (YO-08) - Hayashikane Zosen

Lighter (YL-116) - Hakodate Dock

" (YL-117) - Namura Zosen

Special duty ship (YAS-63) - Former "Koshiki"

(FY64)

Tugboats (YT-37 to 39) - Yokohama Zosen

Heavy oil ship (YO-09, 10) - Hayashikane Zosen

Transport/communication ship (YF-1021) - Hitachi Shipbldg, Kanagawa plant

Task ship (B-4005) - Sumidagawa Zosen

Cutter (C-5075) - Ikezaki Sangyo

(FY65)

Tugboats (YT-40, 41) - Ishikawajima Zosen Kakoki

" (YT-42, 43) - Yokohama Yacht

Water ships (YW-13, 14) - Ujina Zosen

Heavy oil ship (YO-11) - Ujina Zosen

Lighter (YL-118) - Ishikawajima Zosen Kakoki

Transport/communication ship (YF-2060) - Ishihara Dockyard

" " " (YF-2061) - Yokohama Yacht

Cutters (C-5076 to 5083) - Ikezaki Sangyo

Trailer ships (T-6029 to 6033, 6036 to 6049) - Okazaki Zosen

(FY66)

Tugboats (YT-44 to 47) - Yokohama Yacht

Water boats (YW-15, 16) - Ujina Zosen

Lighter (YL-08) - Yokohama Yacht

Crane ship (YC-05) - Maizuru Heavy Industries

Transport/communication ship (YF-2062) - Ishihara Dockyard

" " " (YF-2091) - Yokohama Yacht

" " " (YF-2116) - Carried on the "Shiretoko"

Cutters (C-5084 to 5089) - Ikezaki Zosen

3rd Defense Buildup Plan FY67-71)

(FY67)

Tugboats (YT-48, 49) - Yokohama Yacht

Transport/communication ships (YF-2066, 2067) - Yokohama Yacht

Buoy layer ship (YV-01) - Yokohama Yacht

Special service ship (YAS-101) - Sasebo Heavy Industries

Trailer ships (T-6050 to 6053) - Okazaki Zosen

(FY68)

Crane ship (YC-06) - Watanabe Seikosho (Watanabe Steel Works)

Transport/communication ships (YF-2066 to 2071) - Yokohama Yacht

Buoy layer ship (YV-02 - Ishihara Dockyard

Training ship (YET-11) - Ando Tekkosho

Special duty ship (YAS-102) - Sasebo Heavy Industries

Cutters (C-5090, 5091) - Ikezaki Dockyard

Trailer ships (T-5064 to 6057) - Okazaki Zosen

(FY69)

Crane ship (C-07) - Watanabe Steel Works

Transport/communication ships (YF-2072 to 2074) - Yokohama Yacht

" " " (YF-2075) - Yoshiura Shipbldg

" " " (YF-2076, 2077) - Yamaha Motor Co

Buoy layer ship (YV-03) - Ishihara Dockyard

Cutters (C-5092, 5093) - Okazaki Zosen

Trailers (T-6058 to 6062) - Ikezaki Sangyo

Yacht (Y-7010) - Okazaki Zosen

(FY70)

Tugboat (YT-50 modified) - Yokohama Zosen

Transport/communication ship (YF-1022) - Nippon Aircraft Mfg

" " ships (YF-2078 to 2081) - Yokohama Yacht

" " " (YF-2082) - Ishihara Dockyard

Mine layer ship (YAL-01) - Ishikawajima Zosen Kakoki

Trailer ships (T-6063 to 6065) - Okazaki Zosen

Lighter (YL-119) - Yoshiura Shipbldg

(FY71)

Tugboat (YT-51) - Yokohama Yacht

Heavy oil ships (YO-12, 13) - Yoshiura Shipbuilding

Crane ship (YC-08) - Watanabe Steel Works

Transport/communication ship (YF-1023) - Nippon Aircraft Mfg

" " ships (YF-2083, 2087) - Yokohama Yacht

Special duty ship (YAS-103) - Sasebo Heavy Industries

Cutters (C-5094 to 5101) - Okazaki Zosen

Trailer ship (T-6066) - Okazaki Zosen

4th Defense Buildup Plan (FY72-76)

(FY72)

Tugboat (YT-52 modified) - Yokohama Yacht

Transport/communication ships (YF-1024, 1025) - Nippon Aircraft Mfg Co

Special duty ship (YAS-104) - Usuki Iron Works

Cutters (C-5102 to 5106) - Nanao Zosen

(FY73)

Crane ship (YC-09) - Watanabe Steel Works

Transport/communication ship (YF-1026) - Nippon Aircraft Mfg

" " ships (YF-2092 to 2095) - Ishihara Dockyard

Special duty ship (YAS-105) - Usuki Iron Works

Cutters (C-5108 to 5113) - Nanao Zosen

" (C-5103) - Ikezaki Sangyo

(FY74)

Tugboats (YT-53, 54) - Yokohama Yacht

Waste oil ship (YB-01) - Hashidate Zosen

" " " (YB-101) - Towa Zosen

Transport/communication ship (YF-2110) - Shimokita Tosaitei

" " ships (YF-2111 to 2115) - Ishihara Dockyard

Maintenance ships (YD-01, 02) - Yamaha Motor Co

Cutters (C-5114 to 5120) - Okazaki Zosen

Yachts (Y-7011 to 7015) - Okazaki Zosen

" (Y-7016, 7017) - Yamaha Motor Co

(FY75)

Tugboat (YT-55) - Yokohama Yacht

Heavy oil ship (YO-14) - Yoshiura Shipbuilding

Waste oil ships (YB-102, 103) - Towa Zosen

Transport/communication ship (YF-1027) - Nippon Aircraft Mfg

" " ships (YF-2117 to 2119) - Ishihara Dockyard

Task ships (B-4006 to 4103) - Nippon Aircraft Mfg

Cutters (C-5121 to 5123, 5127) - Okamura Zosen

(FY76)

Tugboat (YT-56) - Yokohama Yacht

Cutters (C-5128 to 5134) - Okamura Zosen

Yachts (Y-7108 to 7020) - Yamaha Motor Co

(FY77)

Tugboat (YT-57) - Yokohama Yacht

Waste oil ship (YB-104) - Towa Zosen

Transport/communication ship (YF-2120) - Yokohama Yacht

Task ship (B-4014) - Nippon Aircraft Mfg

Cutters (C-5135 to 5139) - Okazaki Zosen

Trailer ships (T-6067 to 6071) - Okazaki Zosen

(3) Arms Carried Onboard

54 gauge 5 inch rapid firing gun - Japan Steel Works

62 gauge 76 mm single barrel rapid firing gun - Japan Steel Works (developed by British Otto Co)

50 gauge 3 inch single barrel rapid firing gun - Japan Steel Works

50 gauge 3 inch single barrel gun - Japan Steel Works

Firing command system MK-57 - Japan Steel Works

" " " Type 1 - Mitsubishi Electric Corp

Depth bomb launcher (Y-gun) - Kobe Steel

" " dropping rail - Hitachi Shipbuilding

Hedge hog MK-10 - Japan Steel Works

M71 Bophos (?) rocket launcher - Mitsubishi Heavy Industries

Water surface launcher (FY65, 53 cm 4-barrel) - Watanabe Iron Works

M68 3-barrel short range torpedo launcher (HSO-301) - Watanabe Iron Works

ASROC - Mitsubishi Heavy Industries

Relay mines - Ishikawa Seisakusho, Hitachi Shipbuilding

Induction mines - " " " "

Sonic mine sweeping device - Hitachi Ltd

Sea prober - Nippon Electric, Hitachi Ltd

Underwater attack command system (SFCS) - Hitachi Ltd

Mine detector - Nippon Electric, Hitachi Ltd

Hydrophone - Oki Electric, Nippon Electric

Underwater telephone - Nippon Electric

Sounder - Nippon Electric

Log - Hokushin Electric Works, Tokyo Keiki

Position locator - Hokushin Electric Works, Tokyo Keiki

Periscope - Nippon Kogaku

Demagnetization device - Hitachi Ltd, Mitsubishi Electric Corp

Portable magnetic detector - Shimadzu Seisakusho, Minami Kogyo

LORAN receiver - Tokyo Keiki, Mitsubishi Electric Corp

(4) Communications/Electronic Equipment

HRC-110 wireless - Mitsubishi Electric Corp

HRC-106 " - Nippon Electric

HRC-107 " - Kokusai Electric

Sonobuoy system (carried on P-2J, PS-1, PSV-7)

Sonobuoy receiver - Japan Radio Co
Decibel recorder - Nippon Electric
Sonobuoy indicator - Japan Radio Co
Jurie(?) recorder - Hokushin Electric Works
BT recorder - Oki Electric Industry

HSQ-101 magnetic detector - Mitsubishi Electric Corp

AN-AQS-13A sonar - Nippon Electric

GCA (ground approach control) system NLPL-1 - Toshiba

Weather radar LPN-7 - Toshiba

Low speed target device - Nippon Electric

Antiair radar OPS-14 - Mitsubishi Electric Corp

SSB wireless ORC-20 - Kokusai Electric

ORC-19 wireless - Kokusai Electric

RRC-9 wireless - Mitsubishi Electric Corp

(5) Aircraft

Antisub patrol plane P2V-7 ("Owashi") - Kawasaki Heavy Industries (developed by U.S. Lockheed Co)

" " " P-2J - Kawasaki Heavy Industries (engine: modified version of P2V-7)

Antisub flying boat P2-1

Airframe - Shin Meiws Industry
Engine - Ishikawajima Harima Heavy Industries

Amphibious rescue plane US-1

Airframe - Shin Meiwa Industry
Engine - Ishikawajima Harima Heavy Industries

Target towing multipurpose plant S2F-U - Manufactured by (U.S.) Grumman Co; remodeled by Japan Aircraft Mfg

YS-11M-A (Type 300) transport - Japan Aeroplane Mfg (engine by British Rolls Royce Co)

Onboard operations training plane YS-11T-A - Japan Aeroplane Mfg (engine by British Rolls Royce Co)

Early training plane KM-2 ("Komadori") - Fuji Heavy Industries

Trainer plane Beech-65 ("Umibato") - Built by (U.S.) Beechcraft; modified by Shin Meiwa Industry

" " TC-90 - Built by (U.S.) Beechcraft Co; Shin Nippon Koku Seibi

Antisub patrol helicopter HSS-2 ("Chidori") - Mitsubishi Heavy Industries (developed by United Aircraft Co - U.S.)

Mine sweeping helicopter V-107A ("Shirasagi") - Kawasaki Heavy Industries; developed by (U.S.) Boeing Bertel Co

Rescue helicopter S-62 ("Raicho") - Mitsubishi Heavy Industries; developed by (U.S.) United Aircraft Co

Multipurpose plane S-61A ("Chidori") - Mitsubishi Heavy Industries; developed by (U.S.) Sikorsky Co

Early training plane Be-11-47G-2A ("Hibari") - Kawasaki Heavy Industries; developed by (U.S.) Bell Co

Early training plane OH-6J - Kawasaki Heavy Industries; developed by (U.S.) Hughes Co

III. ASDF Equipment

(1) Aircraft

C-1 transport - Kawasaki Heavy Industries

F-4EJ interceptor fighter

Airframe - Mitsubishi Heavy Industries

Engine - Ishikawajima Harima H Industries (developed by U.S. McDonnell Douglas Co; engine by U.S. General Electric Co)

F-104J interceptor fighter ("Eiko")

Airframe - Mitsubishi Heavy Industries

Engine - Ishikawajima Harima H Indust (developed by U.S. Lockheed Co; engine by General Electric)

F-86F daytime fighter ("Kyokko")

Airframe - Mitsubishi Heavy Industries

Engine - General Electric

Engine repairs - Kawasaki Heavy Industries (developed by U.S. North American Co)

F-1 support fighter

Airframe - Mitsubishi H Industries

Engine - Ishikawajima Harima H Indust (modified T-2)

F-104DJ jet trainer ("Eiko")

Airframe - Mitsubishi H Industries

Engine - Ishikawajima Harima H Indust (developed by U.S. Lockheed Co; engine by General Electric Co)

T-1A jet trainer ("Hatsutaka")

Airframe - Fuji Heavy Industries

Engine - Rolls Royce Co (engine repairs by Kawasaki H Ind)

T-1B jet trainer ("Hatsutaka")

Airframe - Fuji Heavy Industries

Engine - Ishikawajima Harima H Industries

T-2 supersonic advanced trainer - Mitsubishi Heavy Industries

T-3 early trainer - Fuji Heavy Industries (developed by U.S. Lye Cumming Co)

T-33A jet trainer ("Wakataka") - Kawasaki Heavy Industries (developed by U.S. Lockheed Co; engine by U.S. Allison Co)

T-34 recipro trainer ("Hatsukaze") - Fuji Heavy Industries (developed by Beechcraft Co; engine by Lye Cumming Co; engine repairs by Fuji Heavy Industries)

MU-2 rescue search plane

Airframe - Mitsubishi Heavy Industries

Engine - U.S. Air Research Co (engine repairs by Mitsubishi Heavy Industries)

YS-11P medium transport

Airframe - Japan Aeroplane Mfg Co

Engine - Rolls Royce Co

S-62 helicopter ("Raicho")

Airframe - Mitsubishi Heavy Industries

Engine - Ishikawajima Harima H Industries

V-107 helicopter

Airframe - Kawasaki Heavy Industries

Engine - Ishikawajima Harima H Indust (developed by U.S. Bertel Co)

(2) Onboard instruments

Optical sight (firing control system) - Toshiba TESCO (developed by General Electric Co)

Onboard clatter system (AN/ARN-52) - Nippon Electric

Onboard wireless (AN/ARC-552A) - Mitsubishi Electric Corp

Ally identification system (AN/APX-35) - Toyo Tsushinki

Rescue wireless (J/URC-2_ - Fujitsu Ltd

Onboard wireless (J/ARC-2) - Nippon Electric

Data link (ARR-662) - Nippon Seisakusho, Toshiba

Onboard wireless (AN/ARC-27) - Mitsubishi Electric Corp

(3) Ground Instruments

Automatic warning control system TAWCS (BADGE) - Nippon Electric, Nippon Aviotronics (joint venture of Nippon Electric and U.S. Hughes Co. Developed by Hughes Co)

Fixed 3-dimension radar (J/FPS-1) - Mitsubishi Electric Corp

Mobile 3-dimension radar (J/TPS-100) - Nippon Electric

Mobile wire communications system - Nippon Electric

O/H mobile multiple communications system (J/TRO-1) - Nippon Electric

Radar approach control system (RAPCON) (J/FPQ-3) - Nippon Electric

Wireless (JAN/GRC-27) - Kokusai Electric

Weather radar (J/FPH-1, 2, 3) - Japan Radio Co, Toshiba, Mitsubishi Electric Corp

Rawin receiver (JAN/GMD/1A) - Kobe Kogyo, Nippon Electric, Kokusai Electric, Meisei Electric

Hard Redome (?) - Sumitomo Electric Industries

Multiple communications system (J/FRQ-3) - Fujitsu Ltd

O/H multiple communications system (J/FRQ-8) - Nippon Electric

(4) Vehicles & ground instruments

Fuel supply truck - Hino Motors, Nissan Motor, Toyota Motor

" " " semitrailer - Tokyu Caro Corp

Demolition/rescue truck (3/4-ton 4x4 truck) - Toyota Motor

" " fire truck (A-MB-1, 2) - Tokyu Car Corp

Personnel carrier (4x4 TSD40B) - Isuzu Motors

Forklift - Komatsu Ltd, Nissan Motor, Shinko Electric, Toyo Electric Mfg

Ammunition operations truck - Hino Motors

Cargo loader - Genoa, Shinko Electric

Oil pressure wrecker (2C-48C) - Hino Motors

Crash crane (20-ton W25) - Mitsubishi Heavy Industries

Aircraft tow truck - Toyota Automatic Spinning Machine Co, Kato Seisakusho, Toyo Electric Mfg, Toyota Motor, Shinko Electric

Vacuum sweeper (HSD70) - Hitachi Ltd

" " (VRS-1) - Tokyu Car Corp

Road roller - Watanabe Machine Mfg Co

Semi trailer - Tokyu Car Corp, Fuji Car Mfg

Water truck - Isuzu Motors

Snowmobile - Komatsu Ltd, Ohara Iron Works

Snow plow - Mitsubishi Heavy Industries

Heavy duty snow plow (rotary-type) - Nissan Diesel Motor, Nippon Snow Remover Mfg Co

Residual snow remover (trailer-type) - Kato Seisakusho

Motor grader (snow plow attached) - Mitsubishi Heavy Industries

Generator set (E125-60K) - Toyo Electric Mfg, Shinko Electric

" " (KB8H) - Niigata Engineering Co, Meidensha Electric Mfg

Mobile crane (KM2, 3) - Mitsubishi Heavy Industries, Nissan Diesel Motor

Silencer (Fixed type for F104) - Mitsubishi Heavy Industries (developed by U.S. Air Logistic Co)

Noise muffler for F-4EJ (for airframe) - Ishikawajima Harima

" " " C-1 (for airframe) - Kawasaki H Industries

Portable silencer - Kawasaki Heavy Industries

Crash barrier (for F-86F, T-33) - Showa Aircraft Industry

(5) Rescue equipment

Automatic expansion equipment (life saving jacket) - Hosoya Fireworks Co

Life saving raft for 6 persons (JE-2B) - Mitsubishi Electric Corp

Life saving raft for 20 persons - Mitsubishi Electric Corp

Life saving raft for 1 person (JC-2B) - Fujikura Rubber Industry, Mitsubishi Electric Corp

Life saving raft for 2 persons - Fujikura Rubber Industry

Helmet - Mitsubishi Electric Corp

(6) Others

"Nike" - Mitsubishi Heavy Industries

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END