

Strategy on Defense Production and Technological Bases

Toward strengthening the bases to support defense forces
and ‘Proactive Contribution to Peace’

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Ministry of Defense, Japan

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1. Context of formulation of strategy on defense production and technological base

(1) Context of formulation of strategy on defense production and technological base and the place of this strategy

Most of Japan's defense production and technological base was lost at the end of WWII. The newly established JSDF (Japan Self-Defense Forces, established in 1954) was dependent on US deliveries and leases of defense equipment by the U.S., but Japan strived to strengthen its defense production and technological bases by license production and indigenous production, and research and development of major defense equipment, through government-industry cooperation based on the basic guideline for production and development of defense equipment (so-called *kokusanka-hoshin* (guideline for indigenous development/production)¹) of 1970.

On the other hand, in the 25 years since the 1990s after the end of the Cold War, the environment surrounding defense equipment has changed dramatically, such as severe fiscal situation and rises in per unit cost and maintenance/sustainment cost as equipment became increasingly sophisticated and complex, as well as the growing competitiveness of foreign companies.

To quote the National Security Strategy, which was adopted for the first time by Japan in December 2013: 'In order to develop, maintain and operate defense capability steadily with limited resources in the medium- to long-term, Japan will endeavor to engage in effective and efficient acquisition of defense equipment, and will maintain and enhance its defense production and technological bases, including through strengthening international competitiveness.'

Based on this strategy, the National Defense Program Guidelines for FY 2014 and beyond (NDPG) stipulates that the Ministry of Defense will formulate a strategy that sets forth its future vision for Japan's defense production and technological bases as a whole in order to maintain and reinforce such bases without delay.

The Ministry of Defense (MOD) presents this strategy as a new guideline to replace the guideline for indigenous development/production and to set out the direction for maintaining and strengthening defense production and technological bases, in order to strengthen the foundation to support defense forces and 'Proactive Contribution to Peace.'

Defense production and technological bases are integral components that support defense forces through research and development, production, operation, maintenance and upkeep of equipment, and such bases contribute to latently enhance deterrence and maintain and enhance bargaining power. In addition, defense equipment, which is supported by these bases, can become a means by which to contribute to world and

¹ 'Basic guideline for production and development of defense equipment, improvement of defense industry and promotion of research and development (July 16, 1970)'

regional peace and stability through defense equipment and technology cooperation. Furthermore, applying results gained from defense-related projects to commercial technology can have a positive ripple effect on the entire industry, and such bases have the potential to lead the improvement of industrial and technological capability.

As such, given that maintaining and strengthening defense production and technological bases can be considered as defense policy for ensuring independence of security as well as having characteristics of industrial policy in the sense that production of defense equipment has a positive ripple effect on economic activity by private companies, MOD and other related ministries must cooperate to flesh out the contents of this strategy.

As with the NDPG, this strategy will guide Japan's policy regarding defense production and technological base over the next decade. Considering rapid developments in the security environment and state of defense production and technological bases, however, this strategy will be revised as necessary after necessary reports to the National Security Council.

(2) Characteristics of defense production and technological bases

Japan's defense production and technological bases have unique characteristics which are different from bases of foreign states and other industrial bases of Japan.

First, Japan does not have state-owned armament production facilities. MOD's defense equipment is dependent on private defense industries for most bases of defense production, technology, maintenance and sustainment.

Specialized and advanced skills, technology and facilities are required for research and development (R&D) of defense equipment. As such, certain predictability is required for investing in these infrastructures to respond to defense demand. Once lost, recovery would require a long time and enormous cost. In addition, defense equipment is basically produced by a broad and multi-layered network of companies under MOD prime contractors, many of which are small and medium-sized enterprises. At the same time, overseas transfer of defense equipment and technology to some destinations² were forbidden pursuant to the Prime Minister Eisaku Sato's remarks at the Diet in 1967 (the Three Principles on Arms Exports). In addition, because of the policy guideline by the Miki administration in 1976, arms exports to substantially all areas were not permitted, as a result of not promoting arms exports regardless of the destination. Since then, Japanese defense industry's market has been limited to domestic defense demand.

Considering these characteristics, unlike civilian industries that satisfy commercial

² Arms exports to the following countries or regions shall not be permitted: (1) Communist bloc countries, (2) countries subject to "arms" exports embargo under the United Nations Security Council's resolutions, and (3) countries involved in or likely to be involved in international conflicts.

demand, the maintenance and strengthening of defense production and technological bases and defense industries that support Japan's defense capability cannot be left to market mechanisms and competition; to supplement this appropriately, MOD and other relevant ministries must cooperate and take necessary measures.

(3) Change of security environment surrounding defense production and technological bases

Amid the increasingly severe security environment surrounding Japan, Japan needs to efficiently develop a highly effective joint defense force and strengthen its posture for preventing and responding to various situations. In addition, in order to ensure Japan's national interests and to fulfill our responsibility in the international community, proactive actions are necessary, for a "Proactive Contribution to Peace" based on the principle of international cooperation.

Japan's defense production and technological bases, one of the domestic foundations for achieving these goals, faces challenges such as weakening of production and technological bases and changes in the international security environment such as realignment of European/US defense industry and advances in international joint development and production projects. At the same time, there are changes in the system, such as the overseas transfer of defense equipment and technology based on Three Principles on Transfer of Defense Equipment and Technology³ adopted in April 2014.

(i) Weakening of defense production and technological bases

Advances and increasing complexity in recent defense equipment have raised per unit cost and maintenance/sustainment cost. Amid the decrease in defense budget until FY 2012, increasing per unit cost and maintenance/sustainment cost has increased pressure on the procurement budget and caused a decrease in units procured. Such decrease has caused a decrease in quantity of work and resulted in curbing recruitment of young technicians and reduced opportunities for training. As a result, it has caused problems regarding retaining and training skilled technicians and passing on skills and techniques. As a result of decrease in units procured, some companies, including small and medium enterprises, cannot cope with the reduced procurement units and have pulled out of the defense business.

³ Principle 1: Clarifying cases where transfers are prohibited, overseas transfer of defense equipment and technology will not be permitted when: (1) it violates obligations under treaties and other international agreements that Japan has concluded, (2) it violates obligations under UNSC resolutions, (3) it is destined for a country party to a conflict.

Principle 2: Limiting cases where transfers may be permitted to the followings, conducting strict examination and ensuring transparency: (1) transfer which contributes to further active promotion of peace contribution and international cooperation, (2) transfer which contributes to Japan's security.

Principle 3: Limiting cases where appropriate control regarding extra-purpose use and third party transfer is ensured.

When it comes to MOD's R&D budget, which is a resource for maintaining the technological base of companies, advances in defense equipment have also increased R&D costs, but the R&D budget's share in the defense budget has remained the same level in recent years.

Since the MOD's R&D projects are necessary to maintain and enhance the technological capability of companies, trends in R&D budget and presence or absence of R&D projects will affect the training of technicians and maintenance of technological bases in the area of defense equipment in which maintenance of technological base cannot be expected by only civilian demand.

(ii) Realignment of European/US defense industry and advances in international joint development and production projects.

Since 1990s, in the wake of defense budget's peak out accompanying the end of the Cold War, European/US defense industry has expanded its scale and improved its competitiveness through cross-border restructuring and consolidation. In addition, due to technological innovation and rising development costs of defense equipment, even major European/US states have difficulty maintaining and strengthening all areas of defense production and technological bases individually, from the perspective of both finance and technology. As a result, international development and production has become the standard for such equipment as aircraft.

On the other hand, Japan's basic policy has been to deal with overseas transfer of defense equipment and technology in a careful manner in accordance with the Three Principles on Arms Exports and the collateral policy guideline. These policy guidelines have played a certain role as Japan has been following the path of a peace-loving nation. However, Japan was left behind by these changes in the environment due to unique conditions such as the Three Principles on Arms Exports and the collateral policy guideline. Some areas of Japanese defense technology, such as advanced defense systems like cutting edge fighter aircraft and missile defense systems, now greatly lag behind the U.S. as a result.

(iii) Adoption of Three Principles on Transfer of Defense Equipment and Technology

As above mentioned, since arms exports to substantially all areas were not permitted, the Government has repeatedly taken exemption measures depending on the necessity of each case. In December 2011, overseas transfer of defense equipment for cases related to peace contribution and international cooperation and cases regarding international joint development and production of defense equipment that contribute to Japan's security were made exceptions of the Three Principles on Arms Exports and the collateral policy

guideline on the premise that strict control is in place.

Under Three Principles on Transfer of Defense Equipment and Technology, which were adopted by the cabinet this year, transfers which contribute to further active promotion of peace contribution and international cooperation and contribute to Japan's security may be permitted where appropriate control is ensured, in line with consolidating the policy guidelines comprehensively with consideration of past exemption measures and defining cases where transfers are prohibited.

Appropriate overseas transfer of defense equipment and technology contributes to further active promotion of the maintenance of international peace and security through timely and effective implementation of contribution to peace and international cooperation such as international peace cooperation. Such transfer also contributes to strengthening security and defense cooperation with Japan's ally, the United States, as well as with other countries. Furthermore, international joint development and production projects have become the international standard as a way to improve the performance of defense equipment and to deal with rising development and production costs, and they contribute to maintaining and strengthening Japan's defense production and technological bases, thereby contributing to enhancement of Japan's defense capability.

Henceforth, in order to maintain and strengthen Japan's defense production and technological bases, the above changes in environment being taken into account, and acquisition means appropriate for the characteristics of each defense equipment must be strategically selected and appropriate measures enhanced and strengthened.

2. Goals and significance of maintaining and strengthening defense production and technological bases

Through maintaining and enhancing defense production and technological bases, MOD intends to (1) Ensure sovereignty of security, (2) Contribute to latently enhance deterrence and maintain and enhance bargaining power, and eventually (3) Contribute to advance domestic industry driven by highly sophisticated technology.

(1) Ensure sovereignty of security

It is important to acquire defense equipment satisfying performance requirements based on operational concepts which conform to Japan's geographical characteristics and policy. As such, when conditions regarding cost and delivery schedule can be met, acquisition from indigenous companies which are familiar with Japan's circumstances is desirable. In addition, indigenous bases are bases to realize operational support, such as maintenance, sustainment, improvement, repair, technological support and supplying of parts necessary

for the defense forces to exert their capabilities.

Maintaining indigenous bases is necessary to procure defense equipment which requires protection of classified information and is difficult to obtain from overseas since other countries limit exports due to security reasons.

MOD will ensure sovereignty of security through maintaining a certain defense production and technological bases which can deliver defense equipment domestically and provide operational support bases for maintenance and sustainment.

(2) Contribute to latently enhance deterrence and maintain and enhance bargaining power

As mentioned above, maintaining defense production and technological bases means ensuring the supply source of defense equipment. At the same time, the mere existence of bases affects Japan's security positively and externally.

Japan's manufacturing industry was the driving force behind Japan's reconstruction and development after WWII and its advanced industrial bases and technological bases are world-renowned. The defense production and technological bases that Japan's defense industry possesses contribute to latently enhance deterrence, by possessing industrial capability sufficient to build up defense forces in a timely manner at Japan's will.

Furthermore, when MOD acquires defense equipment through imports from abroad, it can negotiate advantageously on price by maintaining certain bases domestically and showing the possibility of indigenous development. In order to implement international joint development and production projects with other states, it is necessary to maintain domestic bases which are on par with the capability of other countries. In addition, if Japan possesses technological advantages that are competitive internationally, it can negotiate on favorable conditions.

In this manner, maintaining and strengthening defense production and technological bases contribute to latently enhance deterrence and maintain and enhance bargaining power.

(3) Contribute to advance domestic industry driven by highly sophisticated technology

Defense industry is an integral architecture industry driven by highly sophisticated technology, and needs a broad range of supporting industries. Its stable activity provides domestic employment and is expected to have a positive economic effect on local and national economy. In addition, amid spread of dual-use technology and increasing borderlessness between defense technology and civilian technology, the synergistic effect of both technologies is expected even more.

Henceforth, in order to maintain and strengthen defense production and technological bases, MOD will promote measures to utilize civilian technology. In line with this,

promotion of applying results gained from defense-related projects to commercial technology can be expected to lead the improvement of industrial and technological capability, and have a positive ripple effect on the entire industry.

Taking these three goals and significance into consideration, MOD will maintain its defense production and technological bases which has been developed until now, in tandem with streamlining and optimizing defense equipment acquisition.

3. Basic stance for promoting measures

MOD intends to promote necessary measures based on the following basic viewpoints: (1) Establish long-term government-industry partnerships, (2) Strengthen international competitiveness, (3) Ensure consistency with effective and efficient acquisition of defense equipment.

(1) Establish long-term government-industry partnerships

Defense industry must invest in specialized technology, technicians and facilities to fulfill the specialized needs required. In addition, due to Japan's peculiar circumstances under the 'Three Principles on Arms Exports and the collateral policy guideline,' the buyer was limited to MOD in principle.

Therefore, in order to maintain and strengthen defense production and technological bases, matters cannot be left entirely to market mechanisms; MOD should take necessary measures to supplement this appropriately, by establishing appropriate and long-term partnerships between the public and private sectors with a feeling of tension and due regard to fairness and transparency. Through showing the future direction of equipment policy, the environment should be improved so defense industries can have more future predictability and can invest, conduct R&D and train personnel from a long-term perspective. At the same time, defense industries must continuously work to enhance governance and compliance, while MOD must take measures to build appropriate relationships with defense industries.

(2) Strengthen international competitiveness

In Europe and the US, giant and competitive companies with sophisticated technology and ample funds have emerged as a result of large-scale and cross-border restructuring and consolidation of defence industries. Such companies provide highly advanced defense equipment systems throughout the world.

As the security environment changes rapidly, there is no other way but to import defense equipment in some areas in which Japanese defense industry is less advanced or does not

produce. Under these circumstances, Japan's defense industries must strengthen their international competitiveness to respond to changes in the environment and survive.

As opportunities for technology transfers through licensed productions have been decreasing in recent years, to nurture areas in which Japan has a comparative advantage internationally, and supplement the less advanced or missing areas as needed, these advantages and disadvantages need to be clarified and R&D projects, international joint development and production, and utilization of dual-use technologies should be conducted strategically and appropriately.

(3) Ensure consistency with effective and efficient acquisition of defense equipment

To maintain and enhance defense production and technological bases, appropriate benefits for defense industries which allow reinvestment should be secured. At the same time, MOD needs to respond without fail to appropriate operational demands by JSDF, the user of defense equipment, and also pursue at most efficiency in the procurement.

4. Methods of defense procurement

MOD currently acquires defense equipment through various ways such as domestic development, licensed production and imports. Methods of defense procurement directly affect defense production and technological bases. To maintain and enhance defense production and technological bases effectively and efficiently, henceforth appropriate acquisition methods, including international development and production, which can be implemented agilely and flexibly based on the newly formulated Three Principles on Transfer of Defense Equipment and Technology, must be selected according to the characteristics of each defense equipment. Below follows the basic guideline for acquisition of defense equipment.

(1) Areas in which domestic development is desirable

Domestic development is an acquisition method that links directly to maintaining and enhancing defense production and technological bases. As such, for defense equipment for which domestic technology can meet the conditions regarding SDF performance requirements, operational support, lifecycle cost and delivery schedule, domestic development should be basically selected. Performance requirements for some defense equipment cannot be revealed without endangering Japan's national security, making it inappropriate to rely on imports in such areas. When procurement through imports is difficult due to such reasons, domestic development should be basically selected. On the other hand, it is necessary to bear in mind that domestic development is accompanied by risks regarding technology and cost overruns in development and procurement.

(2) Areas in which international joint development and production is desirable

The merits of international joint development and production are as follows:

1. Improvement of domestic technology through gaining access to advanced technology possessed by participating nations;
2. Strengthened alliances and friendly relations and improved interoperability of defense equipment as mutual interdependence rises among participating nations;
3. Reduced development and production costs and shared risks among participating nations.

Considering the strengths and weaknesses of Japanese technology, if the above-mentioned merits of international joint development and production can be sufficiently achieved, procurement through international joint development and production will be considered.

Since participating nations' various opinions affect the project, enormous effort is often required to coordinate and manage the project among participating nations. There is also the possibility that Japan's performance requirements will not be fully met since it is necessary to decide requirements by integrating the needs of participating nations. It is also accompanied by risks regarding technology and cost overruns in development and procurement.

(3) Areas in which licensed production is desirable

When the required technology to satisfy MOD's performance requirements regarding the defense equipment is not available in Japan, and domestic development cannot be achieved for the near term or development would require huge cost, and in addition, defense production and technological bases need to be maintained within Japan to ensure an operational support base, such as maintenance and upkeep of defense equipment, licensed production will be pursued. Licensed production is selected only when it is difficult to select international joint development and production in terms of cost and schedule. When licensed production is selected, efforts should be made to ensure that technology is accumulated within Japan so that domestic development can become an option in the future.

Compared with imports, procurement costs tend to be high, and licensing conditions sometimes make it difficult to adapt defense equipment procured through licensed production to meet Japan's unique requirements. In addition, opportunities for technology transfers through licensed production have been inclined to decrease in recent years.

(4) Utilizing civilian goods

Where the required technology for defense equipment is not dedicated solely to defense

needs and civilian technology can meet performance requirements, MOD will promote utilization of output of civilian technology through further promotion of adjusting civilian goods to defense equipment specifications.

In such cases, from the perspective of maintenance and upkeep, it is necessary to bear in mind that there is a possibility that parts availability will dry up since the life-cycle of civilian goods is relatively shorter than that of defense equipment in order to match market needs quickly.

(5) Imports

Imports will be selected for:

1. Functions and defense equipment in which the technology possessed by Japanese defense production and technological bases lags behind but acquisition during a certain time period is required, and the performance, life-cycle cost and delivery schedule meets MOD's requirements.
2. Equipment that is procured in small quantities or is unique.

When a defense equipment is expected to become strategically significant in the future, MOD will consider domestically possessing a basis for continuous technological research as well as maintenance and upkeep in order not to lose a potential domestic technological base which may allow future domestic development. It is necessary to bear in mind risks of procurement cost overruns, delivery delays and concerning maintenance and upkeep continuation due to the providing state's convenience.

5. Measures for maintaining and strengthening defense production and technological bases

To maintain and enhance defense production and technological bases, various acquisition methods which meet each defense equipment's characteristic should be combined and measures for maintaining and enhancing bases promoted. In doing so, first, MOD will identify the specific strengths and weaknesses of Japan in all technological areas regarding defense equipment. Second, considering the trends in defense technology, MOD will ascertain the direction of required technology by anticipating the functions and performances which future defense equipment will require, and take measures, such as supporting companies, universities and research institutions which possess required production and technological bases, while emphasizing appropriate balance and efficiency, considering the country's severe fiscal condition.

Henceforth, based on these approaches, MOD will promote measures to (1) Improve the contract system, (2) Measures regarding R&D, (3) Defense equipment and technology cooperation, (4) Measures regarding defense industry organization, (5) Strengthen MOD's structure, and (6) Measures in cooperation with relevant ministries.

(1) Improve contract system

The state of contracts regarding defense equipment strongly affects business judgment and activity, such as investment decisions and investment recovery regarding human resources and facilities. As such, considering the characteristics of defense industry, the contract system should be improved as follows in order to establish long-term government-industry partnerships and ensure consistency with effective and efficient acquisition of defense equipment.

(i) Utilize negotiated contracts

Since 2006, the Japanese government has reaffirmed the policy that made it a rule to open tendering for public procurement including defense procurement from the perspective of ensuring competitiveness and fairness⁴. As such, although MOD decided to make open tendering a principle, the process became a dead letter since many open tendering cases resulted in only one application or bid due to the character of defense equipment.

As such, MOD has increased the cases in which negotiated contracts can be used, for example when competitiveness cannot be expected due to legal restrictions and the characteristics of projects, and when companies work to reduce costs by utilizing MOD's systems.

To allow for prompt and efficient acquisitions and improve predictability for defense industry, while ensuring transparency and fairness, parties available for negotiated contracts will continue to be sorted and clarified, and utilization will be promoted.

(ii) Introduce longer-term contracts (multi-year procurements)

Due to the fiscal law, the upper limit for length of contract for public contracts is 5 years in principle. When it comes to defense equipment procurement, longer-term contracts will enhance predictability for companies and lead to lower procurement costs as companies can conduct stable and efficient facility investment and personnel distribution as well as pursue economies of scale regarding procurement of parts and materials, so the introduction of longer-term contracts will be studied.

(iii) Establish flexible systems for accepting orders such as joint ventures

⁴ Following the collusive bidding case on bridge construction (June 2005), collusive bidding initiated by the Defense Facilities Administration Agency (exposed in January-February 2006), and the scandals regarding negotiated contracts with Defense Facilities Technology Foundation and Public Association for Construction Services, the Ministry of Finance issued the notice 'Making public procurement more accountable' in August 2006. As a result, MOD decided to shift the method of procurement to a more competitive one, such as open tendering except for cases of licensed production equipment.

In order to acquire technologically appropriate defense equipment and enhance defense production and technological bases, MOD had selected contractors on the basis of the ‘Minister’s Direction⁵.’ However, after 2006, considering the objective of the ‘Making public procurement more accountable’ notice, MOD had basically been refraining from selecting contractors based on the ‘Minister’s Direction.’ On the other hand, considering the technological capability of defense industry in Europe and U.S where defense industries strengthen competitiveness through repeated restructuring and consolidation, it is necessary to take measures to make use of the strengths of each company. Hence MOD will consider establishing a better system for accepting orders, while ensuring transparency and fairness. It will utilize a company selection process that enables companies to bring together the most advanced technology of each and allows MOD to acquire internationally competitive defense equipment, as well as frameworks such as joint ventures as necessary.

In doing so, MOD will study the utilization of concepts from the ‘Minister’s Direction’ which was implemented in the past.

(iv) Decrease procurement cost and improve companies’ incentives to reduce cost

Defense procurement is unique in that many defense equipment do not have market prices; hence it is necessary to decrease procurement costs and improve companies’ incentives to reduce cost at the same time. Therefore, MOD has tried to decrease procurement costs by requiring return of excessive profit after implementing contracts, based on cost audit contracts by which actual cost is audited and final price is confirmed based on actual cost.

On the other hand, the provision requiring return of excessive profit has been pointed out as not serving as an incentive to reduce cost, since return is required after making a payment and accounting at the end of a business year. As such, considering realization of effective defense procurement, MOD will study other contract measures that would encourage incentives for companies to reduce cost more. In addition, MOD will build a database regarding defense equipment procurement, which is necessary for calculating appropriate procurement cost by itself and ensure it can account for appropriateness of contract price, through cooperation with companies. MOD will also study contract scheme under which an equipment project can be halted if initial cost estimate is exceeded by actual cost in the course of project management.

⁵ Minister’s Direction: Based on ‘instructions regarding implementation of procurement of defense equipment and services (1974),’ Director General of Japan Defense Agency (‘Defense Minister’ after transition to Ministry in 2007) selects contractors before contract when permissions regarding production based on laws or acquiring license are required or it is necessary to establish an appropriate structure for aircraft development.

(v) Enhance project management throughout the equipment's life-cycle

In order to ensure the performance of defense equipment required by MOD and SDF, at an appropriate cost and without delay throughout the life-cycle of defense equipment, MOD will develop a system that allows for unified project management throughout the equipment's life-cycle, from equipment design to eventual disposal, by establishing an IPT (Integrated Project Team) under a Project Manager for acquisition of major defense equipment.

(2) Measures regarding Research and Development (R&D)

Ever since the end of the war, Japan has maintained and enhanced defense production and technological bases by introducing technology through licensed production and Japan's own R&D. R&D projects have a primary role in developing defense equipment which conforms to Japan's geographical characteristics and policy. In addition, it contributes to strengthen international competitiveness of Japan's defense industry and maintain and enhance the technological capability of companies. At the same time, advances in defense equipment have also increased R&D costs. In light of the increasingly tough fiscal conditions, it is necessary to promote more effective and efficient R&D.

At the same time, it is important to take measures which emphasize appropriate balance and efficiency by trying to assess an overall picture of which companies and universities possess defense production and technological bases applicable to defense equipment in which areas, and match importance and potential of these areas.

(i) Formulate a R&D vision

MOD will formulate a vision which sets the future direction for medium- to long-term R&D of major defense equipment, and present a future concept for defense equipment and a R&D roadmap for it. As a result, it will achieve effective and efficient R&D and raise predictability for companies.

Regarding the selection of target defense equipment of R&D, it is necessary to consider future approach to fighting based on joint operations, result of capability assessments, changes in battle field technics, and select ones which can be major defense equipment in approximately 20 years. In addition, it is necessary to consider trends in defense technology, such as smart technology⁶, networking⁷, and unmanned operations, and select the defense equipment for which technological bases should be developed and enhanced.

Furthermore, MOD will publish a formulated R&D vision, share medium- to long-term

⁶ Smart technology: To collect information by using information and communications technology and have advanced control and processing capability by computers.

⁷ Networking: Organically linking multiple and different defense equipment systems through data links.

R&D plan with defense industry, raise the predictability for companies, promote stable and efficient facility investment and personnel distribution and try to realize more effective and efficient R&D based on the R&D vision.

(ii) Develop ability to survey technological information including civilian advanced technology

Under circumstances in which the difference between defense technology and civilian technology is getting smarter, in order to achieve effective and efficient defense equipment, it is necessary to appropriately introduce from the outside civilian advanced technology (potential new products) which can be applicable to defense technology.

To promote utilization of dual-use technology and nurture research in companies for advanced defense equipment, MOD will expand its survey area of civilian advanced technology, improve its ability to survey technological information, and formulate and publish a medium- to long-term strategy on technology (Medium- to Long-Term Defense Technology Outlook).

(iii) Strengthen cooperation with universities and research institutes

Some of Japan's universities and research institutes have internationally prominent technology and research environment. However, compared with the U.S. and other nations, cooperation between MOD and these institutions is not necessarily advanced. Henceforth, MOD will proactively utilize civilian technology applicable to defense equipment through improving cooperation with research institutes of independent administrative agencies and universities.

(iv) Cooperation with and utilizing R&D programs including those that cover dual-use technology

In order to promote utilization of dual-use technology efficiently, in line with strengthening cooperation with universities and research institutes, it is necessary to utilize specific R&D programs led by the government. In December 2013, the Act on Enhancement of Research and Development Capacity⁸ was amended, providing for necessary distribution of resources considering the importance of promoting R&D regarding Japan's security. Henceforth, MOD will closely follow domestic advanced technology development programs promoted by other ministries such as 'ImPACT,' which started in 2014, and promote cooperation proactively by utilizing R&D outputs which can

⁸ Act on Enhancement of Research and Development Capacity and Efficient Promotion, etc. of Research and Development, etc. by Advancement of Research and Development System Reform. (Act No.20, 2008)

be used as dual-use technology.

(v) Fund advanced research with promising output for defense

Based on a competitive funds⁹ model, MOD will study its own funding system for finding unique research in universities and independent administrative agencies and nurturing promising research, which deserve notice for potential application to defense equipment, while aiming at utilizing these outputs in the future.

(vi) Strengthen cooperation with overseas organizations

In order to utilize technology regarding defense equipment and dual-use technology that will allow effective maintenance and enhancement of technological bases, MOD will promote international cooperation, such as information sharing and joint research.

(3) Defense equipment and technology cooperation

As above mentioned, based on the Three Principles on Transfer of Defense Equipment and Technology announced in April 2014, MOD will take necessary measures under the government's leadership to proactively and strategically promote defense equipment and technology cooperation such as international joint development and production, in order to contribute to maintaining and enhancing defense production and technological bases as well as peace contribution and international cooperation.

(i) Deepen defense equipment and technology cooperation with the United States

After the signing of the Exchange of Notes concerning the Transfer of Military Technologies to the United States of America in 1983, Japan and the United States have promoted cooperation based on this agreement and ensuing Exchange of Notes concerning the transfer of Arms and Military Technologies to the United States of America. Henceforth, Japan will deepen bilateral cooperation regarding equipment and technology through the Science & Technology Forum¹⁰ which is an occasion for exchange of views regarding issues of equipment and technology.

Regarding joint development of SM-3 block IIA being advanced by Japan and the U.S., MOD will take necessary measures, after evaluating the transition to the production and

⁹ Competitive funds: Capital investors invite research and development subjects widely and research and development funds are allocated to researchers after evaluation by multiple evaluators including specialists from the perspective of science and technology.

¹⁰ In May 1980, then administrative vice-minister Watari and US Undersecretary of Defense for Research and Engineering of Department of Defense Perry agreed to establish the Systems and Technology Forum (S&TF), where those responsible for equipment and technology of each country can routinely exchange opinions in order to establish close communication. The first S&TF was held in September 1980 and 26 meetings have been held up to August 2013.

deployment phase, including the necessary state of required domestic production bases, and considering maintaining and enhancing Japan's defense production and technological bases.

Regarding the F-35A fighter MOD started to acquire from FY2012, aircrafts manufactured by domestic companies are scheduled to be acquired after FY 2013. In FY2013, Final Assembly and Check Out (FACO) process will start for fuselages, and domestic industrial participation in manufacturing for engine and radar parts will also start. In addition, FACO of engines was included in the FY2014 budget. Participation by Japanese companies in manufacturing for FY2015 and beyond is being considered taking into account factors such as the significance of domestic industrial participation, like maintaining and strengthening defense production and technological bases, the situation regarding coordination with the U.S. and other governments, and the financial condition of Japan.

In addition, in order to facilitate defense equipment and technology cooperation in the future, MOD will engage in coordination for a framework regarding reciprocal defense procurement¹¹ which the U.S. has signed with allies and friendly countries for the purpose of standardization of defense equipment and promoting interoperability.

(ii) Establish new defense equipment and technology cooperation

Japan and the UK concluded an agreement concerning the joint development of defense equipment in July 2013 and began a cooperative research project concerning chemical and biological protection technology. Between Japan and France, frameworks for dialogues on cooperation in the field of defense equipment and export control were established in January 2014 and negotiations regarding an agreement concerning transfer of defense equipment and technology were started in May 2014. Henceforth, based on these frameworks, MOD will strengthen international competitiveness of defense industries through building and deepening cooperative relationships regarding defense equipment and technology with major European countries with competitive defense industries.

In addition, Japan and Australia reached a substantial conclusion of negotiations on an agreement for bilateral cooperation in the field of defense equipment and technology in June this year and are now preparing for a joint research project on marine hydrodynamics which is scheduled to start in FY 2015. Australia and other friendly countries in the Asia Pacific region, such as India and Southeast Asian countries, have interests and expectations regarding defense equipment and technology cooperation with Japan. MOD will

¹¹ The U.S. has formulated Reciprocal Defense Procurement Memorandum of Understanding (RDP MOU) with 23 countries including major European countries in order to promote mutual procurement of defense equipment more efficiently.

proactively build cooperation in the fields of non-traditional security such as maritime security, disaster relief and anti-piracy efforts.

(iii) Contributing to international logistics systems

In recent years, global frameworks have been established regarding not only development of defense equipment but also for interchange of parts among countries which use common defense equipment in maintenance and sustainment, such as the Autonomic Logistics Global Sustainment (ALGS¹²) of F-35.

Under such circumstances, MOD will expand contribution to international logistics, in particular as a logistics foothold of the Asia Pacific region, through supplying parts, making use of Japanese companies' strengths (sensors, parts such as semiconductors, composite materials, advanced materials, high quality and punctual manufacturing, etc.) and experience in licensed production between companies.

(iv) Improving bases for defense equipment and technology cooperation

Promoting new defense equipment and technology cooperation requires a framework for cooperation. Given that recent international joint development and production involve multiple countries, in order to raise the predictability of partner countries and defense industries as well as promote cooperation, MOD will formulate a framework which will enable the transfer of defense equipment, with nations that are likely to become partners in international joint development and production.

In addition, MOD will study the postures and systems for smoothly promoting cooperation under government commitment and oversight throughout the life-cycle of transferred defense equipment, since information possessed by MOD regarding coordination with partner countries about their transfer conditions or issues concerning education, training, maintenance and upkeep regarding the operation of defense equipment, may need to be transferred to partner countries and relevant companies.

(v) Promote application of defense equipment to civilian use

Promotion of application of defense equipment to civilian use¹³, in line with contributing to maintain and strengthen defense production and technological bases and expanding the

¹² ALGS: The multinational logistics support system of F-35 under which all user countries pass on components to each other under centralized management by the U.S. government, from the perspective of thorough cost reduction. Through participation in this system, each country can obtain components and services swiftly in need from a common inventory pool managed by the U.S. government.

¹³ Through adapting defense equipment to civilian use, defense companies develop, produce and sell as their company's product, products for foreign governments, other ministries, local governments and private companies based on technological output gained through development of defense equipment.

market for defense equipment, is also expected to lower defense procurement costs due to volume efficiency.

Until now, MOD has provided other ministries with NBC equipment, such as chemical protection suits and the mobile Field Communication Network applied Software Defined Radio. Regarding overseas, MOD established a working group regarding the US-2 amphibious rescue aircraft with the Indian government, which is considering acquisition of amphibious search and rescue aircraft, and is studying the multifaceted utilization of outputs of development.

Henceforth, in order to promote application of defense equipment to civilian use for foreign governments, other ministries, local governments and private companies, MOD will strengthen its organizations and systems as well as cooperation with relevant ministries. In addition, MOD will develop arrangements regarding use of technology-related materials possessed by the MOD in areas other than aircraft¹⁴ in a way that benefits both companies and the government.

(vi) Technology control and information security

Henceforth, in order to strengthen cooperation among the government, industry and academia and promote defense equipment and technology cooperation internationally, it is necessary to evaluate the sensitivity and strategic value of defense technology and protect those technologies that should be protected as strengths of Japan. In addition, MOD needs to evaluate the sensitivity and strategic value of dual-use technology, keeping in mind the effect on Japan's security, and strengthen technology control functions by avoiding risks of conversion to weapons in concerned countries through cooperation with relevant countries.

Henceforth, MOD will promote cooperation with METI and contribute to strict examination and appropriate control under the Three Principles on Transfer of Defense Equipment and Technology. When an information security agreement, a common base for sharing sensitive technology information that needs protection, and patent exceptions¹⁵ are needed, MOD will consider the issue through cooperating with relevant ministries as needed.

¹⁴ Regarding aircraft developed by the MOD, rules regarding process of use of technology-related materials and calculation fee for their usage have already been formulated, with procedures for usage of technology-related materials formulated in April 2011 and procedures for calculation of usage fee formulated in June 2012. As a result, the procedures for paying a constant rate of usage fee from companies to government when companies obtain profits from adapting defense equipment to civilian use were formulated.

¹⁵ For example, as part of secret protection laws, many advanced countries have adopted a system of secret patents. Under this system, based on the decisions of defense-related ministries, secret technology from the perspective of security are not disclosed after patent application.

(4) Measures regarding defense industry organization

Regarding characteristics of Japanese defense industrial organizations, there are no giant defense contractors in Japan, unlike in Europe and the U.S. Generally, the share of defense business within the company's overall business is low and do not command the attention of top executives. In addition, compared to Europe and the U.S., restructuring and consolidation of defense industry has not advanced in Japan. Added to that, some companies have exited the defense business, after considering profitability and growth potential. As a result, the problem regarding maintenance of supply chain of defense production and technological bases is a concern. Under such circumstances, MOD will promote top-level executives' understanding of the significance of defense industry. In addition, restructuring and cooperation¹⁶ of defense industry organizations, such as project tie-ups and merging related sections, is effective for defense companies from the perspective of strengthening international competitiveness through mutual complementarity with other companies, and for MOD from the perspective of effective and stable defense procurement. As such, it is necessary to consider the future of defense industry organization.

(i) Promote understanding of significance of defense business and industry

MOD will improve the environment so that top-level executives appropriately understand and evaluate not only the profitability of defense business but also the significance of defense business, such as the fact that it is an important factor which supports Japan's defense forces. In addition, it will promote the Japanese people's understanding of the significance of defense industry in contributing to our security, through utilizing the Defense White Paper and other means

(ii) Maintain resilient supply chains

Defense industry is composed of multi-layered supply chains under a prime contractor. If a company that possesses technology and skills which cannot be replaced by other companies exits the defense business, the supply chain will be cut. As such, the government will assess the supply chains of major defense equipment through cooperation with prime contractors, and take measures to maintain them. In so doing, by considering supply chains from the phase of development, MOD will build resilient defense production and technological bases. In addition, MOD will study necessary security measures, such as to prevent intrusion of spyware into supply chains.

Furthermore, in order to realize efficient maintenance and sustainment and logistics in

¹⁶ Methods of cooperation include consolidation, joint cooperation, co-parent company, joint venture, and consortium.

both peacetime and in emergencies within the limited defense budget, MOD will study the future of maintenance and sustainment and logistics through expanding PBL contracts¹⁷ which utilize the know-how of supply-chain management possessed by private companies.

(iii) Defense industrial organizations and applications of contract systems.

Production of defense equipment requires significant accumulations of technology and capital due to its characteristics. Under such circumstances, excessive price competition by similar multiple companies may weaken defense production and technological bases, since the profit of successful bidders will decrease and unsuccessful bidders will face a situation where they need to reallocate human resources and bear lower facility operating rates.

In such areas, MOD will consider streamlining defense industrial organizations by utilizing a company selection system which enables companies to bring together their strengths and narrowing down potential contractors by concluding multi-year contracts.

(5) Strengthen MOD's structure

Under the severe security environment, MOD is working on reforming the work and future organization of MOD in order to prevent scandals, secure civilian control and ensure that the SDF operates more actively and efficiently.

As part of MOD reform, in order to enhance project management throughout the equipment's life cycle as an organization and contribute to optimization of defense buildup and maintain and enhance defense production and technological bases, structural reorganization is being considered to combine equipment acquisition related departments of internal bureau, each staff office, TRDI (Technical Research and Development Institute) and EPCO (Equipment Procurement and Construction Office) , possibly into an affiliated agency.

In this reform, in addition to enhancing project management throughout the equipment's life cycle, MOD must consider, in cooperation with related ministries, an appropriate way and organizational structure to ensure implementation of measures set forth in this strategy such as defense equipment and technology cooperation.

MOD will study enhancing inspection functions for realizing fairer procurement and training of personnel for project management and procurement.

(6) Measures through cooperation with relevant ministries

Other than studying contract systems and research and development measures, in order

¹⁷ PBL (Performance Based Logistics) contract: a long-term contract for a comprehensive scope of work, signed based on not number of parts and workload but the performance of services, such as maintenance of availability, reduction in maintenance time and ensuring stable stocks.

to strengthen defense industries, MOD needs to consider supporting measures utilizing other ministries' measures. For example, it would be effective to strengthen cooperation with the Ministry of Economy, Trade and Industry in utilizing various tax preferences and subsidies, and implement measures which would allow defense industries including small and medium enterprises to make use of such supporting schemes. In addition, MOD will study and take necessary measures, including utilizing supporting measures such as fiscal investments and loans to facilitate measures such as the transfer of defense equipment that would contribute to maintaining and enhancing defense production and technological bases.

MOD will also continue to review the legal restrictions regarding defense industries.

6. Courses of action for each area of defense equipment

In this section, the state of defense production and technological bases of major defense equipment areas (Land-based equipment, Supplies, Warships and Vessels, Aircraft, Ammunitions and Explosives, Guided Missiles, Communication Electronics, Command and Control Systems, Unmanned Equipment and Cyber Security and Space) will be analyzed. Then, based on guidelines regarding maintaining and enhancing defense production and technological bases as mentioned above and priorities in strengthening the SDF posture as laid out in the NDPG, MOD will try to raise predictability for companies and show MOD's guidelines for the future direction of maintaining and enhancing defense production and technological bases and procurement of defense equipment for each area.

(1) Land-based equipment

(i) State of defense production and technological basest

Land-based equipment, such as ground vehicles and firearms, consist of a wide variety of defense equipment and is supported by Japanese advanced industrial capability. Compared with the prices of similar equipment in foreign countries, Japanese ones are relatively expensive due to Japan's unique situation such as low-volume production. However, Japan possesses bases which enable it to manufacture technically advanced defense equipment. In addition, since many companies are specialized in defense demand, the amount of MOD/SDF procurement directly affects these companies' business and the bases they possess.

With regard to technical level, this area is advanced, as represented by the Type10 tank. In particular, technology regarding small-sized, low fuel consumption and high output power devises (including transmission devices) and autoloading are high internationally. In addition, fire control systems which allow for fire during slalom traveling and multi-target simultaneous tracking, have a high level of capability and are utilized for mobile combat vehicles currently under development.

Regarding amphibious vehicles, although Japan has an advantage in the area of some elemental technology, it does not have bases to develop and manufacture an entire vehicle.

When it comes to fire arms, Japan possesses international-standard production bases for many kinds of small firearms and cannons, established through licensed production. In addition, it possesses the bases for domestic development and production of some small firearms, such as rifles.

(ii) Course of action

Tanks and cannons: to maintain and pass on expertise and skill so one can respond to unforeseen future changes in the environment, MOD will make an effort to maintain an

appropriate level of defense production and technological bases by building on Japan's high international standard. In addition, MOD will try to establish defense production and technological bases of land-based equipment in response to changes in our security environment, such as mobile combat vehicles which enable SDF to respond to various situations quickly and flexibly.

Wheeled ground vehicles: MOD requires wide-ranging functions and performance; as such, this area tends to limited production of diversified products. MOD will try to maintain and enhance their defense production and technological bases by achieving effective and efficient acquisition of defense equipment through further standardization of defense equipment and the development of product families.

Henceforth, in order to respond to invasion on remote islands, MOD will reinforce areas in which Japan lags behind as needed, such as amphibious functions which are increasingly important, and promote defense equipment and technology cooperation by making use of Japan's strengths. In addition, MOD will try to maintain bases by maintaining and passing on expertise and skills through efforts such as raising predictability for companies.

(2) Supplies

(i) State of defense production and technological bases

In this area, there are various kinds of defense production and technological bases of defense equipment, from individual equipment to equipment for units. Based on these bases, MOD is able to acquire supplies which are specialized in defense demand, such as bulletproof jackets, to ones which utilize civilian technology, such as clothing. In particular, Japan has an advantage in material technology, such as fibers.

(ii) Course of action

Considering human engineering suitability to Japanese physical features, and the safety and morale of JSDF members, given that most supplies are familiar to individual SDF members, in order to continue to acquire from domestic companies, MOD will try to promote measures for raising predictability for companies for maintaining bases. In addition, MOD will study the possibility of applying defense equipment to civilian uses and defense equipment and technology cooperation in areas such as chemical protection equipment in which Japan holds an advantage.

(3) Warships and Vessels

(i) State of defense production and technological bases

Japan's shipbuilding bases are built on the capability of domestic shipbuilding yards' bases, which possess quality control, cost reduction and process management capability

cultivated by a long history, as well as small and medium sized subcontractors which possess advanced specialized technology. In addition, technological bases for military ships are different from ones for civilian ships, so the amount of MOD/SDF procurement directly affects the situation of bases.

Destroyers are built with high tensile steel, which is light weight and has high mechanical strength, and require high density outfitting compared with civilian ships. Destroyers utilize advanced design and building technology regarding weapons such as cannons, firing systems and sensors, which are not required for civilian ships.

When it comes to submarines, specialized technology which can cope with high water pressure environments is required. For example, submarines utilize super high tensile steel and higher density outfitting than for destroyers and are built on design and building technology which is completely different from ones for civilian ships, and through cooperation with specialized subcontractors for parts and components of submarines. As such, for its production, in addition to bases for surface ships, specific bases for submarines are necessary.

This area has advanced technology internationally and Japan has advantages in high tensile steel thin plate technology and welding technology regarding building of destroyers, super high tensile steel technology and welding technology regarding building of submarines, and high density outfitting technology, technology regarding appropriate system integration between battle command system and varieties of sensors systems regarding general shipbuilding.

In addition, subcontractors which are the bases of production of specific parts are one of the advantages.

(ii) Course of action

From the perspective of gaining and maintaining maritime supremacy, warships and vessels are important defense equipment that play an important role in defending the seas surrounding Japan and securing maritime traffic by conducting various operations, such as persistent ISR and anti-submarine operations, effectively.

Surface ships: Although some countries export warships and transfer technology, it is difficult to acquire the most advanced equipment. As such, in order to respond to new technology such as stealth capabilities, it is necessary to maintain and enhance production and technological bases composed of multiple prime contractors.

Destroyers: Paying attention to maintain and enhance bases of shipbuilding and maintenance in order to effectively conduct various operations, thereby facilitating agile response in such areas as the defense of the seas surrounding Japan, the security of maritime traffic, and international peace cooperation activities MOD will study the

possibility of bulk purchase of ships whose designs are standardized. On this occasion, contract systems will be reconsidered with a view to achieve lower prices.

Submarines: MOD continues to intend to increase the number of submarines to 22 in order to strengthen the posture for conducting persistent long-range ISR and detect any signs of developments at an early stage and hence ensure security of the sea and airspace surrounding Japan.

As Japanese submarine-building technology is internationally high and is an advantage of Japan, MOD will continuously maintain and enhance current bases by promoting R&D capability upgrades.

Maintenance and upkeep: To maintain and increase availability of ships, while considering financial limitations, MOD will consider more effective overhaul and repair to the extent possible.

MOD will promote defense equipment and technology cooperation in various areas, such as maritime security, by making use of Japanese strengths.

(4) Aircraft

(i) State of defense production and technological bases

After the end of WWII, Japan established defense production and technological bases for aircraft through domestic development, licensed production and international joint development and production.

Fighter aircraft: Japan jointly conducted development and domestic production of F-2 with U.S after licensed production of F-4, etc. However, domestic production of F-2 finished in 2011.

Regarding F-35A, which MOD started to procure in FY2012, the range of industrial participation in its production is limited since Japan did not join international joint development as a partner country due to restrictions imposed by the Three Principles on Arms Exports. As such, the task lies in maintaining relevant companies' investment of management resources in defense business from the perspective of maintenance and enhancement of defense production and technological bases.

In terms of international competitiveness, although some spare parts and materials have strengths internationally, when considered as a system as a whole, Japan does not have relative strengths.

Transport aircraft, patrol aircraft, amphibious rescue aircraft and helicopters: Through the accumulation of technology by licensed productions, domestic development of some models has been realized and their technology is at an international standard.

Advances in technology and rising development costs have made international development and production the standard for aircraft. The internationalization of logistics

including maintenance and sustainment is expected to be promoted.

(ii) Course of action

From the perspective of gaining and maintaining air superiority, in order to strengthen overall its air defense capability, MOD will promote acquisition of F-35A.

F-35A: MOD will strategically promote Japanese industrial participation in the production of F-35A in terms of maintaining and sophisticating defense production and technological bases and coordinating with related nations regarding establishing a regional maintenance hub for the Asia Pacific region in Japan.

The MOD will promote strategic studies including empirical research to accumulate and enhance fighter aircraft-related technologies in Japan so as to keep the option for development of next-generation fighter aircraft, including the possibility of international joint development, to replace the F-2 when it retires.

Transport aircraft and amphibious rescue aircraft: MOD will promote multifaceted utilizations of outputs of development, such as adjusting defense equipment to civilian use and defense equipment and technological cooperation. In addition, regarding rotorcraft (helicopters), based on the technology developed by introduction of overseas technology through licensed production and domestic development, MOD will consider international development and production as an option, looking at both civilian demand and defense demand.

Measures to improve efficiency in maintenance and upkeep of aircraft, such as new contract systems like PBL and international logistics systems such as ALGS of F-35, are already under way. MOD will study necessary measures to promote measures by Japanese companies.

(5) Ammunitions and Explosives

(ii) State of defense production and technological bases

Japan has domestic defense production and technological bases, including for licensed production. The bases of this area are specialized on defense demand and many companies rely heavily on defense demand. As such, the amount of MOD/SDF procurement directly affects these companies' business and the bases they possess.

Regarding production of ammunitions and explosives, different companies tend to be in charge of different manufacturing processes, such as production of shells, propellants, fuses and loading and set up; hence the supply chain is composed of major companies mutually complementing each other. As such, there is a risk that incidents and bankruptcy of one company may affect the whole industry of this area.

Defense production and technological bases of torpedoes are maintained in a stable state

through continuous procurement, research and development. Regarding technology, Japan is strong internationally in power propulsion technology which realized a high speed and silent torpedo engine, wide-banding of acoustic sensors of the guidance control function, and guidance control technology using acoustic image processing.

(ii) Course of action

Ammunitions and explosives are bases for the capacity to continue battles, and it is vital to maintain their production and technological bases in order to secure sovereignty of security. MOD will try to achieve efficient procurement, and maintain bases which can ensure the continued procurement of substantial amounts of ammunitions and explosives from domestic companies, and acquire (in tandem with various procurement methods) necessary amounts to respond to various situations. In addition, measures for raising future predictability for both government and industry will be studied and necessary measures will be taken.

Regarding torpedoes, MOD will continue to conduct R&D on further quietening of propulsion systems, wider bandwidth of guidance control functions, and response to shallow-waters, and try to improve the capability and technological bases of torpedoes.

(6) Guided Missiles

(i) State of defense production and technological bases

Japan increased its technological capability through imports soon after the end of WWII and licensed production. Although prices are relatively high due to low-volume production etc., compared with the prices of similar defense equipment in foreign countries, Japan possesses defense production and technological bases which allows for domestic development of many kinds of guided missiles.

Regarding technological bases, Japan has internationally advanced guided technology and propulsion technology due to Japan's technology regarding semiconductors, infrared sensors and solid rockets and through joint R&D with the U.S. In addition, there are no civilian demands in this area; as such, defense specific technology development and production bases are needed and the amount of MOD/SDF procurement directly affects the situation of bases.

(ii) Course of Action

To respond to improved capability of threats quickly and keep technological advantages, MOD will maintain and enhance bases to enable continued domestic development of certain kinds of guided missiles.

To strengthen its air defense capabilities, MOD will promote a technical review of

next-generation surface-to-air guided missiles with a view to replace the functions of the GSDF middle-range surface-to-air guided missile and the ASDF PATRIOT surface-to-air guided missile. In addition, in order to respond to new threats and secure effective operations, MOD will formulate a R&D vision for technical review of future guided missiles, including propulsion devices such as solid rocket motors required for extending the range of guided missiles.

Since cases of international development and production have increased in this area, MOD will select efficient means for acquisition including the possibility of joining international joint development as circumstances require, considering the improvement of interoperability with allies and friendly nations. Regarding SM-3 Block IIA, MOD will continue to promote joint development with the U.S., and considering maintaining and enhancing defense production and technological bases, MOD will study the transition to production and deployment and take necessary measures.

(7) Communication Electronics, Command and Control System

(i) State of defense production and technological bases

Communication electronics area, as represented by radar installations, data communication devices and command control systems, is a strategically important area which is the center of ISR, information gathering and command and control capability.

A number of domestic companies possess sophisticated development and production capability as a result of efforts to improve technological capability regarding defense equipment in the context of rich civilian demand.

Japan was the first to practically apply the active phased array radar, which has now become mainstream for defense equipment, for combat aircraft use. In addition, Japan has international high technological capability regarding radar and sonar, such as a dual-band infrared sensor and high output semiconductors, for which Japan's technology level is internationally high.

Technology for optical fiber acoustic detectors and wide-band sound transducers, which is used for towing sonar for submarines and active sonar for destroyers, is at an internationally high level.

Command and control system technology has much in common with that of civilian information-processing systems. A number of domestic companies possess sophisticated development and production capability through efforts to improve technological capability regarding systems in the context of rich civilian demand.

(ii) Course of action

Improvement of ISR and intelligence capability is strategically important for Japan's

defense, and depends to a large extent on technological capability of communication electronics.

MOD will conduct focused R&D regarding advanced technology based on defense demand, such as improved detection capability of fixed warning and control radar systems and improved detection capability through utilizing multiple sonars simultaneously. In addition, MOD will maintain and enhance technological bases by pursuing applicability of civil advanced technology.

Regarding future command and control systems, systems which are suited to network-data centric warfare, such as integrated systems for facilitating joint operations, strengthening functions which support the decision-making of commanders, will be required. Considering these points, MOD will utilize the civilian technological bases which are developing rapidly regarding technology to develop integrated systems and data processing technology, to enable timely overhauls of systems to reflect the latest technology.

From the perspective of maintaining and enhancing defense production and technological bases, MOD will promote defense equipment and technological cooperation and adjusting defense equipment to civilian use. This will be done in areas in which Japan is strong and technologies are based on defense demand, such as software defined radio technology and radar technology utilizing high output semiconductors.

(8) Unmanned Equipment

(i) State of defense production and technological bases

Japan has sophisticated civil technological bases in the area of unmanned rotorcraft for agriculture and observance and remote control unmanned equipment for rescue. When it comes to defense, although MOD has conducted R&D for unmanned equipment, such as robots for explosive ordnance disposal through utilizing civil technology, examples of application are limited. For fixed wing unmanned aircraft, although MOD has attempted to accumulate technology regarding autonomous flight control system and others through domestic development, Japan lags far behind advanced countries in this area.

(ii) Course of action

This area potentially has a large impact on future military strategy and the balance of military power.

Although JSDF possess few unmanned defense equipment at this time, development of this area has advanced internationally. As such, it is necessary for Japan to try to improve technological bases proactively. However, compared with other defense equipment areas, many of the required functions and performance and operation methods are yet unspecified.

As such, considering future battlefield techniques, trends in defense technology, such as smart technology and networking, and joint operations, MOD will formulate a R&D vision in order to give direction to unmanned equipment, such as autonomous future unmanned aircraft, and conduct research proactively in order to improve technological bases.

Many research institutions possess sophisticated civilian technology in this area, so MOD will try to raise the level of unmanned equipment related technology through promoting cooperation with other research institutions regarding element technology research in the area of robots and unmanned equipment which can be used for defense purposes.

Some states have conducted advanced research and development regarding unmanned equipment and operated them, so MOD will try to increase the sophistication of its technological base at an early stage through promoting defense equipment and technology cooperation with these countries, such as joint R&D.

(9) Cyber Security and Space

(i) State of defense production and technological bases

Cyber security and space are areas in which MOD has strengthened measures in recent years. Since the risk surrounding cyberspace is becoming more severe as illustrated by more complex and sophisticated cyber attacks, improving response capability to cyber attacks has become important. Space has also become an important area in order to strengthen information gathering and ISR. Considering these circumstances, MOD has responded to defense demand, also by utilizing civil technology.

(ii) Course of action

Cooperating with measures to improve response capabilities against cyber attacks and guidelines for space development and use of space in MOD, MOD will study the future of defense production and technological bases which will be necessary in the future in terms of defense of Japan.