DEFENSE TECHNOLOGY STRATEGY

Towards Delivering Superior Defense Equipment and
to Secure Technological Superiority

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1. Background of Strategy

The security environment surrounding Japan has become increasingly severe, with various challenges and destabilizing factors becoming more tangible and acute. North Korea is further developing its nuclear weapons and ballistic missiles, and has repeated its provocative rhetoric and behavior towards Japan. China has been rapidly expanding and intensifying its activities in international waters and airspace including the East China Sea and South China Sea. Russia continues modernization of its armed forces, while increasing and expanding their military activities in the Asia–Pacific region and beyond.

Under such International situation and along with ongoing technological innovations, countries are focusing its resources in research and development (R&D) in order to materialize as fast as possible state-of-the-art technology that can be a game changer. For example, China continues to increase its military spending and is pursuing to acquire and promoting the development of systems such as new ballistic missiles, hypersonic weapons, stealth fighter aircrafts, unmanned aircrafts, anti-satellite weapons and indigenous global positioning navigation satellite. Russia is also continuing with development of its stealth fighter aircrafts, and is working to gain advanced technologies.

The United States (U.S.) recognizes that prevalence of state-of-the-art technologies in defense changes the way of combat and in order to maintain and expand its technological superiority the U.S. announced recently its "Third Offset Strategy"[1]. Through various projects funded by the U.S. Department of Defense (DOD) agencies, such as the Defense Advanced Research Projects Agency (DARPA), the U.S. is proactively investing in private companies and universities, enabling their advanced technologies to be introduced towards military use. In addition, the U.S. is carrying out research on the latest technologies such as high-power energy weapons, autonomous weapons, high-speed strike weapons etc. to strengthen its deterrence with conventional forces to counter threats, including those arising from the activities of major powers. Furthermore, in order to incorporate innovative commercial technologies into military field, the Defense Innovation Unit Experimental (DIUx) is working as a bridge between the U.S. DOD and the civilian sector.

There is no doubt that emerging technological innovations and its expansion has significant influence on the global security environment. In such circumstance where the security environment surrounding Japan is becoming increasingly severe, the Japanese government needs to make the most use of the nation's high technological capabilities in order to ensure the safety and peaceful living of its nationals in any contingencies. Various Japanese government policy guidelines state that these ideas are crucial for our national security.

The *National Security Strategy* approved by the Japanese Cabinet in December 2013 confirmed that from the viewpoint of national security, our high technological capabilities is the foundation of our nation's economic and defensive powers, and we need to take measures to strengthen it by further promoting and nurturing technologies including dual-use technologies.

[1] According to the Defense Innovation Initiative, announced by the U.S. Department of Defense in November 2014.

As the *National Defense Program Guidelines* (NDPG) and the *Medium Term Defense Program* (MTDP) for the Japanese Fiscal Year (JFY) 2014 to 2018 indicate that, it is necessary to generate more cooperation among the government, industry and academia for a defense buildup, and proactively utilize commercial technologies (i.e. dual use technologies). Furthermore, the MOD *Strategy on Defense Production and Technology Bases*[2] released in June 2014 states that there is a need for strategically implementing defense R&D based on Japan's comparative advantages.

From a science and technology policy viewpoint, the *5th Science and Technology Basic Plan*[3] (which approved by the Cabinet in January 2016), for the first time stated the need for R&D in order to address national security challenges. Specific issues and initiatives are outlined in the *Comprehensive Strategy on Science, Technology and Innovation 2016* (approved by the Cabinet in May 2016).

2. Defense Technology Strategy and MOD Technology Policy Objectives

(1) The relation between Defense Technology Strategy and other policies

Under the series of governmental policy guidelines including the *National Security Strategy*, in order to ensure sufficient and necessary level of quality in defense capabilities and to enhance deterrence and response capability, it is necessary for MOD to, under limited resources and also considering mid-to-long term defense posture, strengthen technologies regarded to be important in terms of national security ranging from innovative technology that can be game changers, to advanced technology that can be applied to existing defense equipment.

Based on the recognition the MOD formulates a Defense Technology Strategy to practically and effectively strengthen[4] technological capabilities, which are the basis of our nation's defense capabilities.

In this strategy, technological policy objectives within the MOD are set out and recent changes in the environment surrounding defense related technology are addressed as factors to be considered. Also taking these factors for consideration in mind, the strategy outlines the basic direction of various measures to be strategically implemented in order to achieve the objectives.

Although this strategy is based on the current NDPG which the policy spans generally for around a 10-year duration, R&D for defense equipment usually requires a longer time span, and in some cases it may take as long as 20 years from basic research stage to mass production. Therefore,

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[2] "Research and development promotion policy, defense industry development policy and basic policy related to the production and development of equipment (notice)" (BOKANSO No. 1535 1970.16.7), instead of the so-called "Domestic Production Policy," guidance is given in the direction of strengthening and maintenance of defense production and technology bases.

[3] Pursuant to Law on Science and Technology (1995 Act No. 130) based on the provisions of Article 9 Paragraph 1, a basic plan related to promotion of science and technology is formulated by the government almost every five years.

[4] In the Act for Establishment of Ministry of Defense (1954 Act No. 164) Article 36, it is stated that "The Acquisition, Technology & Logistics Agency, has a mission to aim for proper and efficient implementation of research and development, procurement, supply and management, while strengthening the foundation for the development and production of equipment, and promoting international cooperation"

this strategy envisages a roughly 20-year period in alignment with each technological R&D cycles, and hence, technological capabilities, which we aim to achieve under this strategy, can be a basis when preparing the future NDPG and MTDP.

Furthermore, while the *Strategy on Defense Production and Technology Bases* (released in June 2014) outlines the policy for further underlying the development of defense industry bases, this *Strategy for Defense Technology* outlines the fundamental policy direction of various measures related to strengthening technological capabilities.

(2) MOD technology policy objectives

In order to strengthen the technological capability, which is the basis of Japan's defense capability, and to make it more robust, MOD has set the following two primary goals. These goals are complementary and synergistic; promoting one goal leads to improvement the other, and pushing them will strengthen Japan's technological capabilities.

Ⅰ. Ensuring technological superiority

Our country's high technological capabilities underpin its economic and defense power. Not only does ensuring technological superiority against other countries is vital for our national security and contributes to strengthen defense power, but it also works as a prevention from technical surprises.[5] In addition, technological superiority can be a source of bargaining power, enabling our country to secure a leading position in international joint R&D. Needless to say, ensuring technological superiority can contribute to the delivery of superior defense equipment, as described below.

Ⅱ. Delivering superior defense equipment through effective and efficient R&D

It is necessary for the Acquisition, Technology & Logistics Agency (ATLA) to create advanced defense equipment that meets the operational needs of each Self-Defense Forces (SDF) and to ensure its flexible and rapid response to new threats and various contingencies. On the other hand, ATLA also needs to consider the upward trend in life cycle and R&D costs of sophisticated and complex defense equipment that needs to be controlled.

ATLA intends to create superior defense equipment effectively and efficiently, while ensuring consistency with the priorities of defense capabilities and cost-consciousness throughout the life cycle of the equipment. In addition, the creation of superior defense equipment can accumulate technological capabilities, and contribute to ensuring technological superiority and could eventually be a source of bargaining power towards other countries.

3. Challenges to Be Considered in Technology Policy

This section summarizes the issues that relate to recent changes in the environment

[5] Thus the 1957 successful launching, by the then-Soviet Union, of the first artificial satellite had a major impact on the United States. Rapid changes often reflect events in the security environment resulting from, for example, unexpected technological progress made by countries, such as was the case in the so-called Sputnik crisis.

surrounding defense-related technology, which is crucial to achieving the objectives mentioned in the previous section.

(1) Making technologies borderless and for dual-use

In recent years, borderlessness and dual-usage between defense and commercial technologies has progressed and it is anticipated that more innovation will be created when the two field of technology synergizes. Japan needs to look at not only existing technologies held by defense industry but also at the wide range and fields of commercial technologies and work towards developing it further, otherwise the chances of creating a truly advanced defense equipment will become more scarce.

The 5th Science and Technology Basic Plan states that "Recognizing that the fruit of science and technology has the potential to impact multiple areas, and the fact that research and development (R&D) findings in one area can be applied to others, it is important to make the functioning processes of innovation dynamic while skillfully capturing R&D findings.".

From the view of science and technology policies, we are bringing together the capabilities of the industries, the academia and the government to promote technological cooperation between the defense and commercial sectors. In addition, it is important not only to apply commercial technologies to defense (spin-on) but also to advance our nation's technological capabilities by carrying out proactive usage of commercial technologies that are applicable to the defense field, and to expand defense technologies into the commercial field (i.e. spinoff).

Therefore, it is becoming more crucial for Japan to create and strengthen state-of-the-art technologies that could be used in both defense and commercial fields, and to cooperate with relevant government ministries and the industry and academia in order to effectively and efficiently utilize the various technologies that Japan holds.

(2) Increase of international joint R&D, increased complexity and high-performance of defense equipment

Today, the complexity and performance of defense equipment are increasing, and there is a global trend towards increasing international joint R&D in defense equipment, for example, the F-35 Joint Strike Fighter and A400M transport aircraft. Not only does International joint R&D brings together superior technology from each participating countries and allows the possibility to share the R&D expenses, but it also contributes to the strengthening of cooperative relationship and joint operational capabilities in the security field with relative countries. In addition, we can hope to contribute to the regional stability by increasing the capability of likeminded nations who we share common values.

Although the *Strategy on Defense Production and Technology Bases, states* that we should indigenously make defense equipment which we should not rely on other states however, we will respond proactively towards international joint R&D, and also maintain and strengthen our defense production, technology bases, and constantly keep in mind not to fall behind global trends. We must

pursue effective and efficient forms of cooperation by fully analyzing Japan's technological capabilities and also establish a leading position by taking into account various aspects.

(3) Technology outflow risks in defense equipment and technology exports

Based on the Japanese Government's policy of the *Three Principles on Arms Exports*[6] etc., the export of defense equipment and technology had been banned with the exception of some cases, however The *Three Principles on Transfer of Defense Equipment and Technology* [7] was approved by the Cabinet in April 2014, and it is a comprehensive document of the policy relating to overseas transfer of defense equipment and technology. As a result, in the *Strategy on Defense Production and Technology Bases*, it is stated that, "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 conduct transfer of defense equipment and participate in international joint R&D, it is necessary to appropriately protect and utilize relevant intellectual property by having effective intellectual property control. In addition, we need to take into account technical perspectives as one of an indicator to evaluate the degree of impact a transfer of a defense equipment will have on our national security.

Even though when transferring a commercial application technology that is not a subject to the *Three Principles on Transfer of Defense Equipment and Technology*, it is necessary to take into consideration the possible impact to our national security if such technology where to be diverted and used for military purposes, and decide whether or not to permit a transfer. For this reason, it is important for MOD to maintain and further strengthen its close cooperative relationship with the Ministry of Economy, Trade and Industry (METI).

4. Specific Measures to be Promoted

Taking into account the points of consideration in the previous section, we considered the following various measures in order to achieve the technology policy objectives outlined in section two.

Firstly, it is necessary to comprehend the level of technology in our country as well as in other countries. By doing so, not only does it allows us to deepen our understanding of the superiority of technological bases in both Japan and in other countries, but also allows us to understand future trends and recognize the security-related value of the technology to Japan and its value to other countries.

Secondly, it is necessary to nurture steadily technologies to strengthen our country's technological base and aim for an effective and efficient development of advanced equipment. We

[6] "Three Principles on Arms Exports (response to House of Representatives Settlement Committee, 1967.21.4)" and "Government unified view related to arms exports (response to House of Representatives settlement committee, 1976.2.27)."

[7] National Security Council and Cabinet Decision (2014.4.1).

will determine the direction of medium-to-long-term R&D by establishing the concept for future defense equipment and draw a concrete R&D roadmap. At the same time, we will accumulate technological capabilities that makes acquisition of the appropriate defense equipment feasible by analyzing several alternatives such as domestic development or international joint development for the acquisition of an equipment.

In addition, it is necessary to protect our country's technology so to prevent unintentional drain towards other countries. Such unintended outflow of technology may hinder the continuation of peace and stability of the international community and technological superiority of Japan and lead to the exposure of Japan's defense capabilities.

Finally, from the viewpoint of utilizing intellectual property, we will establish relevant frameworks and systems for intellectual property control, which will enable us to decide appropriate management options of intellectual property such as entitling or classifying. In view of the above thinking, we laid out the following specific measures.

4.1 Grasping Technical Information Underpinning Various Measures

In order to create effective and efficient superior defense equipment and to ensure technical advantage, we will gather information given in (1) – (3) below by paying attention the three key points listed below.

- There are technological fields in which Japan has superior domestic bases compared with other counties, and if we continue our investment in those areas, we can maintain superiority in the future and these advanced technology fields may lead to increased bargaining advantage in such cases of international joint R&D.
- There are fields of technology in which currently, Japan does not have a superior technological footing compared with other countries, and if we do not continue our input of investment and maintain a certain level of technical capability, in the future we may be disadvantaged in the context of technological policy by not holding a certain technological capability.
- There are fields of technology where Japanese private sectors are actively pursuing R&D and where MOD does not need to contribute many resources. However we can effectively utilize such technologies for defense equipment purposes in the future by keeping updates of their progress.

(1) Grasping defense equipment-related science and technology trends

Regarding various science and technology (S&T) which support defense technology, we must grasp the status and trends in domestic and international S&T, including emerging state-of-the-art and dual-use technologies.

By grasping the S&T trends, it will allow us to deepen our understanding of the performance and capability of current domestic and international defense equipment, and grasp the trend of future defense equipment of other countries. In addition, it will help in the making of

the Medium-to Long-term Defense Technology Outlook, which will be mentioned later in this document.

Moreover, by understanding the advantage of our technological capabilities compared with other countries, it allows us to identify critical technology for Japan and may contribute to promoting international technology cooperation.

Since Ministries other than MOD have a larger role and responsibility for R&D investment in Japan's S&T, MOD will look at ways on how to efficiently collect technical information held by relevant ministries and research institutes, in cooperation with the National Security Council (NSC) and the Cabinet Office's Council for Science, Technology and Innovation.

(2) Understanding component technology, performance, and capability of defense equipment of Japan and other countries

We will grasp the future needs of technology of certain defense equipment by analyzing components performance and capability of defense equipment currently held by Japan and other countries based on the national security needs of the user countries.

This contributes to understanding the supply chain imperative to maintain superior technologies, and to conducting an analysis of alternatives prior to the development, which also takes into account the life cycle cost. In addition, when reviewing transfer of defense equipment and/or components including important technology, this also contributes to our deliberation on the sensitivity of certain technology by evaluating the degree of effect the transfer will have on the recipient country's capability advancements.

When grasping these technical information, it is important to understand and analyze the needs arising from the equipment user's national security status, therefore we will maintain a close and cooperative relationship with relevant Ministries and each branch of the Self-Defense Forces to gain their knowledge and support. In addition, we will need to collect a wide range of technical information domestically and internationally, so we will dispatch staff researchers overseas and make use of external resources as well as outsourcing technical survey to companies.

(3) Grasping future trends related to foreign defense equipment

From a technical point of view, we will make predictions targeting future international defense equipment trends. By considering the operational needs of the Self-Defense Forces and research and analysis based on such prediction, we will utilize the information to the effective and efficient delivery of leading defense equipment, and to formulate a R&D plan, which needs to be promoted to in the medium-to-long term.

4.2 Medium- to Long-term DTO Development

We will formulate a Medium- to Long-term Defense Technology Outlook (DTO) which describes perspectives of technology evolution that is expected to be established roughly within next 20 years and that can be applied to defense equipment. It also mentions about the fields of technology that

must be developed to ensure our country's technological superiority, in particular potentially game-changing technology areas that we should aim to acquire with the medium-to-long-term view.

By publicly releasing this outlook, it can be expected to promote the incorporation with advanced commercial technologies (utilization of dual-use technology) and foster commercial technologies which can be applied to defense equipment outside of the MOD (open innovation).

4.3 Approaches to Acquire the Most Cost-Effective Defense Equipment Under Project Management

On the occasion of acquiring defense equipment, the acquisition should be based mainly on domestic development that will be directly connected to foster and maintain defense production and technology bases of Japan in the case that such equipments are difficult to be introduce from overseas because we should not depend on other countries to introduce them. Taking this into account, it is important to analyze the multiple alternatives including international joint development from the viewpoints such as key performance, life cycle costs, technological maturity and risks, and also important to realize the most cost-effective defense equipment acquisition throughout the entire life cycle.

For this reason, in addition to grasping future trends of overseas defense equipment, we will promote activities to obtain the technical information through the use of external organizations, exchange of information with foreign countries, and to estimate the feasibility and overall performance of the future equipment systems by taking advantage of preliminary research and M&S[8]. This measure enables us to accumulate technological capabilities with a long-term view towards optimal acquisition in response to characteristics of defense equipment, and to bolster the structure for optimal equipment acquisition from an advanced, broad perspective.

Furthermore, to quickly respond to technological advancements, changes in the national security environment, and internationalization of equipment such as overseas transfers, we will promote activities to reduce the life cycle cost and will improve the quality of defense equipment under project management that administrates the life cycle from the planning stage to disposal of defense equipment with considerations and activities that are given below: standardizing and making commonalities of equipments, joint operations of defense equipment, and utilizing the development methods such as domestic development and international joint development. We also promote activities such as implementing appropriate follow-up for defense equipment after development, new proposals related to integration from a technical viewpoint, and R&D with consideration of the aspects such as commonality and extensibilities to enable the elemental technologies developed to be applied to other fields.

4.4 Research and Development for Defense Equipment of the Future

While the national security environment surrounding our nation has become increasingly severe,

[8] Modeling and simulation.

we will lead R&D resulting from our country's technological capabilities to resolve various issues of national security and Self-Defense Forces activities. In addition, we will continue to tackle R&D for important technologies, including innovative technology that can be a game changer and for which we should not depend on other countries. We will also give due consideration to the potential vulnerabilities of such innovative technology.

(1) Promotion of medium- to long-term R&D by "Technology R&D Vision"

The Technology R&D Vision reveals technical challenges that should be addressed for certain items that are considered to be major defense equipment in the future, in order to tackle advanced research systematically, on the basis of medium- and long-term viewpoints. The Technology R&D Vision presents defense equipment concepts and an R&D roadmap with an eye to prospect the future, so that the Vision can set the direction of medium-to long-term R&D.

In light of future combat methods based on the joint operation, capability estimation and changing environment of combat, the Technology R&D Vision is formulated for items that are needed to foster and improve technology bases, and that can be major defense equipment in Japan roughly within 15 to 20 years with anticipating defense technology trends such as smart, networking, and unmanned technologies.

We will publish the Technology R&D Vision in order to share the medium- and long-term R&D plan with defense industries in our country and to raise predictability for companies, so that we will endeavor to realize more effective and efficient R&D by promoting stable, efficient facility investment and staffing.

In the Technology R&D Vision, in order to maximize cost-effectiveness related to medium- and long-term R&D under severe financial circumstances, we will continue to match direction of so-called technology seeds and operational needs of the Self-Defense Forces; that is to match direction of R&D proposals from a technical point of view and required capabilities in the future in light of the national security environment.

In other words, revealing major technologies we should mainly tackle which will be critical for future defense equipment and efficient acquisition methods for these technology, we will continue to review defense equipment concepts flexibly and its R&D roadmap in response to the progress of research and changes in the national security environment. In this way, in terms of the necessary defense equipment and the details of its operation, we will continue to refine the specific function/performance and assumed role in a phased manner, from various perspectives such as technology, national security environment, and economy.

(2) R&D underpinning defense capability

The R&D, which is the basis of building defense capability, should be conducted steadily and quickly, based on the operational needs of the Self-Defense Forces or on anticipation of them.

In such R&D, in light of financial circumstances and the increasingly more severe national security environment, we have to recognize the importance of research in order to apply technology to the practical use of defense equipment, along with considerations of the matters such as cost-

effectiveness, technical dependency on foreign country, the delivery timeframe, and operational importance. For important technology, we will perform seamless resource allocation at each stage, from the initial research for development and up to incremental improvement of delivered equipment. Further, we will continue to make every effort to respond promptly to the operational needs of the Self-Defense Forces. Given the internationalization of the equipment and technology, we will also consider about strengthening technological bases of our country, in order to prevent the loss and outflow of key fundamental technologies to foreign countries.

To this end, we will codify the process from research phase to the phase that we can demonstrate the advanced technology, as defense equipment, which meets operational needs, and we will promote that R&D would be fully examined from the perspectives of functions and performance to be realized, timeframe and so on.

(3) Responding to rapid innovations of science and technology

The progress of innovation in the fields such as ICT,[9] Robotics, and AI[10] is significant, making it difficult to handle R&D through processes used for conventional defense equipment. In order to continue to respond quickly to the speed of technological development, we have to anticipate requirements in the years ahead, and consider the measures required to undertake effective, efficient R&D together with engineers and operators.

In such technical fields, our country has studied and implemented various R&D attempts by the private sector, where prototyping are conducted repeatedly in short period to realize technical and business ideas. Since incorporation of such attempts in the defense field may lead to the creation of defense equipment with features not previously existed, it is essential to have demonstration of new operating concepts together with operators in the implementation of R&D. From this point of view, we will continue to consider close cooperation between operators and engineers, including specialists outside of MOD as well.

(4) Strengthening technology cooperation with domestic and foreign institutes

Technology cooperation with domestic and foreign research institutes are beneficial to effective and efficient R&D and the delivery of superior defense equipment through utilization of advanced technology that ATLA does not have. In the situation that commercial technology is rapidly developing and fiscal conditions are severe, strengthening technology cooperation with other organizations, both in Japan and overseas, is an important measure for defense technology strategy, because it is difficult to conduct all of the necessary technological R&D by ourselves.

In promoting technology cooperation, depending on the respective R&D challenges and objectives, it is necessary to take into account following aspects such as the latest science and technology trends in Japan and overseas, the possibility of international joint R&D, and the maintenance and strengthening of the domestic technology base. In the commercial sector in

[9] Information and communication technology.
[10] Artificial intelligence.

particular, since there are many fields in which our country has high technological capabilities, we will promote more proactive cooperation with domestic research institutions, and we will achieve a complementary, synergistic improvement in our country's technological capabilities.

In addition, for technology cooperation with domestic research institutes—with understanding and respecting ways of thinking typically for each other's research activities and recognizing that they shall be performed on the basis of mutual and voluntary initiatives—results obtained through cooperation will continue to be properly published on consideration of the management of intellectual property generated as the same manner of handling of general academic research outcome, from the perspective of the expectations of the contribution to overall innovation in our country, not just the acquisition of superior advanced technology in the defense sector.

On top of this, in the conduct of international joint R&D, it is necessary for us to pursue a more effective and efficient form of cooperation by fully analyzing the technological capabilities of our country and establishing the high ground for our country from various aspects. Meanwhile, technology cooperation with other countries not only does signifies technical merits but also contribute to the establishment of, and strengthening of cooperation regarding the national security with partner countries. Since the formulation of the *three principles on transfer of defense equipment and technology*, expectations, that there will be technology cooperation with Japan have been increasing from some countries. With this point in mind, it is necessary to comprehensively judge a suitable form of cooperation in response to the partner, while bearing in mind the fact that limited resources can be devoted to technical cooperation.

To be specific response to the national security needs and technological capabilities of partner countries, in the case of performing traditional cooperation such as mutually beneficial international joint R&D and/or focusing on people-to-people exchanges with the acceptance of human resources, we will seek optimal form of cooperation for both countries with flexibility such as cooperation with other organizations outside the MOD, and beyond the bound by the form of previous cooperation.. At present, MOD will respond in the event of technology cooperation according to the countries and the regions listed below:

- A number of joint R&D projects are already being carried out with the U.S., and there is also exchange programs among engineers in situations where there are ongoing multiple joint R&D projects. The U.S. has more technological capabilities in terms of both military and commercial technology than other countries, and we will continue to cooperate as an assertive partner.

- European countries and Australia have comparative advantages compared with our country in specific technology fields. After grasping the characteristics and strengths of each country, we will proceed to build cooperative relationships in fields of technology where complementary, mutually beneficial relationships are expected.

- The region comprising ASEAN member states, and India among other countries are very important for our country's security. In recent years, in this region there have been growing expectations regarding technical cooperation with Japan. For this reason, we will remain active in terms of the cooperation with these countries, including support for operation and maintenance, with checking the background of partner countries' interest in the particular technique.

In abroad where there are numerous joint R&D projects carried out multilaterally, we will consider every possibility to make cooperation more effective and efficient for our nation, by continuous exchanges of opinions through a variety of channels, with gathering information on national technology strategy and related policies of each country.

4.5 Discovery and Promotion of Cutting-edge Technologies Expected to Be Used for Defense Applications

In order to promote development and installation of superior defense equipment, it is necessary to proactively make the most of newly emerging cutting-edge technological fields and to further improve Japan's technological capabilities in the field.

In FY2015, the MOD launched competitive research funding program called "Innovative Science and Technology Initiative for Security" to discover creative research activities conducted in universities, research institutes, companies, etc., which are expected to apply defense equipment in future and to promote promising research seeds. In addition, we will nurture germinal research to ensure Japan's technological superiority in cutting-edge technological field which requires large-scale investment.

Under this program, the research outcome is expected to be utilized in a wide variety of commercial applications from the viewpoint of making the most of defense R&D activities. As the competitive research funding program targets basic research field, in which the open discussion between researchers is essential to obtain superior research result (open innovation), the MOD will not restrict disclosure or publication of the outcome.

4.6 Appropriate Technology Control and Intellectual Property Utilization

(1) Technology control for appropriate technology transfers

We employ technology control to ensure the technological superiority of our country and to prevent incidents which disturb peace and stability of the international community as the result of improvement of the weapons performance in undesirable countries and regions through our defense equipment and technology outflow, in accordance with domestic and international export control regimes and frameworks, such as the *three principles on transfer of defense equipment and technology*, the *Foreign Exchange and Foreign Trade Act* (1949 Act No. 228) and the *Export*

Trade Control Order (1949 Cabinet Order No. 378).

In the case of examination of defense equipment transfer including international joint R&D, the ATLA will evaluate under the *three principles on transfer of defense equipment and technology* based on viewpoints as follows; the possible prevention of technology outflow, the difficulty of reverse engineering, technological superiority in comparison with other countries, technical significance, such as availability from other countries, possibility of exposing our country's defense capability, influence to our country's defense capability caused by the transfer. The MOD will provide the information to the organizations such as the National Security Council (NSC) and the Ministry of Economy, Trade and Industry (METI) to ensure appropriate and effective transfer of defense equipment and technology.

For dual-use technology, the MOD actively participate in the sensitivity evaluation of individual export examinations from the military aspect in cooperation with the METI. Furthermore, we will continue to participate in international export control regimes, such as the Wassenaar Arrangement along with the METI and the Ministry of Foreign Affairs (MOFA). We also continue to conduct dialogues related to dual-use and defense technologies with each country involved. And we will contribute to the prevention of technology outflow by appropriately updating the international control list, through the proposals and discussion of maintaining and strengthening defense production and technological bases, and sustaining stability of the areas surrounding Japan. In addition, we will improve the technology control of our nation and partner nations by strengthening cooperation and sharing information with such countries.

(2) Utilization of MOD intellectual property

The 5th Science and Technology Basic Plan and the *Intellectual Property Strategic Program 2016,* formulated by the Intellectual Property Strategy Headquarters in May 2016 emphasize the importance of appropriate choice of either acquiring intellectual property or concealing R&D outcome rights. Based on these trends, the ATLA will establish its own intellectual property management system which considers transfer of defense equipment, and promote the utilization of intellectual property.

In particular, on transfer of defense equipment, in order to realize the utilization of intellectual property at the transfer destination, the ATLA will review the traditional intellectual property management system which is based on the premise that only the MOD uses defense equipment. With accurately understanding the technology held by the public and private sectors of our nation from the view of the intellectual property ownership, when we make an assessment regarding to acquisitions of intellectual property rights for defense equipment, it is necessary to select the appropriate option such as disclosing or concealing the intellectual property based on the impact of national security and the possibility of utilization in the private sector.

In addition to the traditional ways of acquiring intellectual property rights and approving the private companies to use them, the ATLA will implement *the open and closed strategy*. As the open strategy intellectual property rights are not acquired but the R&D results proactively are disclosed and the technical progress can be encouraged, while as the closed strategy acquired

intellectual property rights are for exclusive use and not disclosed as trade secrets. We will carry out an examination considering the intentions of companies, and develop frameworks and systems to enable the appropriate management of intellectual property.

4.7 Enhancing R&D Infrastructure

(1) Fostering and Securing Human Resources as Connoisseur of Technology

To quickly discover our nation's superior commercial technology and utilize it as defense technology, it is necessary to have human resources as "*Connoisseur of Technology*" who can predict future technology trends and discern dual-use properties of commercial technology out of a vast amount of technical information adequately understanding the needs of defense technology. There is also a need of human resources who can foresee the technology which will be the important defense technology in the future, as well as the impact of technology outflow, taking account of future technology trends in foreign countries.

Since technology trends that should be foreseen include not only "growth through the ATLA investment" but also "growth through voluntary investment of the private sector" and "changes in international technical trends," various analytical skills are required, which overview the international and domestic technical trends by continuously investigating and gathering information about technical trends.

Although it is difficult to develop such human resources in a short time, we will continue to develop human resources by enhancing the technological capabilities of the ATLA staff and accumulating research achievements of research centers. In addition, through further cooperation with other parties, such as relevant ministries and research institutes, we will foster human resources as "*Connoisseur of Technology*" from the perspectives outside the ATLA. We also consider the utilization of outside knowledge resource such as private sector and retired Self-Defense Forces staffs.

In the small and medium-sized enterprises including venture companies as well as large companies, there are experts who are well versed in advanced technology. We will provide them a place for research collaborations with ATLA through variety of meetings such as symposia and seminars, and promote utilization of the community to recruit excellent human resources. It is getting important to cultivate project managers[11] who can manage advanced and large-scale R&D projects. In particular, we will strengthen development of human resources who are able to promote projects in view of both defense and commercial purpose technology.

Our nation's high technological capabilities have been supported not only by highly qualified human resources, but also by aspects like high manufacturing technology. It is necessary to overview technology trends in addition to collecting and analyzing a wide range of technical information such as human resources who are familiar with advanced technology in research institutes and private companies including venture companies, as well as the supply chain of products using the high

[11] This includes project managers who optimize notonly the projects themselves, but also multiple projects while maintaining the integrity of each project.

technology. We will consider the systems of continuously collecting and analyzing relevant technical information including utilization of external organizations.

(2) Affirmative information dissemination

As described above, it is necessary to improve the predictability of business for private sectors, and to promote the acquisition of superior commercial technology through publication of this strategy, the Medium-to Long-term Defense Technology Outlook, and the Technology R&D visions. We will actively disseminate such information. Through symposia held by the ATLA and exhibitions in Japan and overseas, we will continue to proactively disseminate information and conduct PR activities in order to enhance public understanding about the MOD technology policies.

(3) Technical contributions to meet security challenges

With a variety of technological capabilities that have been acquired through R&D, the ATLA directly contributes to various security challenges in a range of field activities conducted by the Self-Defense Forces, and it will lead to the improvement of the technological capabilities of staff as well as meeting the public mandate. In the situations such as remote reactor temperature surveys through infrared measurement at TEPCO's Fukushima Daiichi Nuclear Power Station immediately after the Great East Japan Earthquake, and the ongoing research and analysis of radioactive dust at high altitudes, including a special investigation after an underground nuclear test by North Korea, the ATLA's technological capability will also be directly utilized to meet challenges related to security in various situations in the future, and we will continue to contribute to ensuring the safety and security of our nation and people.

Based on specific measures mentioned above that should be promoted further, we will strengthen the collaboration with industry, academia, government, and agencies of the MOD, and enhance functionality of the related ATLA departments (policy planning department, development department, research centers, etc.).

5. Considerations

Under this strategy, it is important that the MOD policies and activities regarding the defense technology are carried out adequately. Furthermore, technological capabilities that are aimed at under this strategy will be a foundation of the development of a future National Defense Program Guideline and a future Medium Term Defense Program.

In addition, the strategies and their associated measures will be analyzed and evaluated by future implementation status. We bear in mind for the radical changes in the national security environment surrounding our country and remarkably fast progress of science and technology, and aim to appropriately and properly review these strategies and their associated measures by taking into account items such as a future National Security Strategy, National Defense Program Guideline, Medium Term Defense Program, operational needs, and changes in technology trends.