DAIO Defense AI Observatory

Overcoming the Long Shadow of the Past

Defense AI in Japan

Motohiro Tsuchiya

DAIO Study 24|23

Ein Projekt im Rahmen von

dtec.bw
Zentrum für Digitalisierungs- und Technologieforschung der Bundeswehr

Finanziert von der Europäischen Union
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About the Defense AI Observatory

The Defense AI Observatory (DAIO) at the Helmut Schmidt University in Hamburg monitors and analyzes the use of artificial intelligence by armed forces. DAIO comprises three interrelated work streams:

- Culture, concept development, and organizational transformation in the context of military innovation
- Current and future conflict pictures, conflict dynamics, and operational experience, especially related to the use of emerging technologies
- Defense industrial dynamics with a particular focus on the impact of emerging technologies on the nature and character of techno-industrial ecosystems

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Content

1 Executive Summary

Since the end of World War II, Japan has not had a full-fledged military, but only Self-Defense Forces (SDF) for the sole purpose of defensive defense. Hesitancy exists in society, especially in academia, to research and develop technologies that could be diverted to military use. This has created a long shadow of the past in which public opinion, strategic culture, and the academic-industrial ecosystem mutually reinforce each other not to directly address defense technologies. However, with the recent deterioration of the national security environment around Japan, such hesitance is weakening, and research and development of technologies that can be applied to defense purposes is now being conducted, also in cooperation with partners like the United States, the United Kingdom, and others.

Discussions about artificial intelligence (AI) for defense purposes began in earnest around 2022, with descriptions found in government and defense ministry documents, and budget appropriations beginning to be made. However, the budget size is miniscule and no special organization for defense AI exists. In addition, there is no plan to use defense AI in earnest in defense operations, and it is merely positioned as one of the technologies that are attracting widespread attention. Attempts to deepen the knowledge of AI among SDF personnel have only just begun.

2 Thinking About Defense AI

A search of the database of the *Nihon Keizai Shimbun (Nikkei)*, the most widely read newspaper by Japanese businesspeople, shows that the first article in which the words "artificial intelligence" (AI) and "defense" appear simultaneously was on 12 May 2014.[1] After that, there are some reports on AI use on defense equipment and cyber defense.

Contrary to these public reports, aeronautical and space science journals discussed defense AI much earlier. In 1983, Tamotsu Sakamoto of the 3rd Research Institute of the National Defense Agency's Technical Research Headquarters published a paper titled "On Navigation Using Artificial Intelligence Search Methods."[2] However, when this paper was written, deep learning was not yet in use.

A paper with a similar perspective was published in 1990. In their paper Akira Soga and Hideo Nakashima wrote, "artificial intelligence application systems, including expert systems, have been studied and developed overseas, especially in the United States, under the Strategic Computing Program (SCP) and other programs. In contrast, in Japan, research and development tends to be conducted mainly for industrial applications."[3] The paper focused on systems for use on manned aircraft, and it does not examine the use of autonomous AI to control current unmanned aircraft.

Japan's defense policy is called "exclusively defensive defense." The Japanese constitution after World War II does not allow Japan to have full-fledged military forces and the Japanese nation clings to peace-oriented diplomacy. The so-called Yoshida Doctrine, which was named after Prime Minister Shigeru Yoshida, was the basis of Japan's diplomacy, defense policy and economic policy. The doctrine guided the Japanese government to allocate more resources towards the economy while keeping lower defense spending under the nuclear umbrella based on the Japan-U.S. Security Treaty. That combination of policies enabled Japan to recover quickly from the destruction of World War II. This situation has been changing step by step as threat perceptions are altered by external incidents. However, there is a strong long shadow of the past in the use of technologies for defense purposes.

After the end of World War II, a general understanding emerged to avoid research on military-related technologies. Consequently, Japan has been reluctant to discuss military applications of new technologies, including AI. The Science Council of Japan was established in 1949, soon after the end of World War II. The following year, in 1950, the Council issued a "Statement of Determination to Never

1 "FY2012 AI Budget, Focus on Development Infrastructure: 200 Billion Yen, Doubled (24年度AI予算、開発インフラに重点 倍の2000億円視野)."
2 Sakamoto, "On Navigation Using Artificial Intelligence Search Methods."
3 Soga/Nakashima, "Application of Artificial Intelligence to Aircraft Navigation Devices and Problems."

Follow Scientific Research for the Purpose of War," and in 1967 it issued a "Statement of No Scientific Technology for Military Purposes." This post-World War II atmosphere was based on the reflection that the academic community, including universities, had been mobilized for war.

However, with the outbreak of the Korean War in 1950, the General Headquarters of the Allied Forces (GHQ) decided to change the policy of demilitarization of Japan, and in August 1950, paramilitary organizations called the Japan Police Reserve Corps and the Coastal Safety Force were established by GHQ. The Police Reserve Corps was reorganized as the National Safety Forces in 1952 and reorganized as the Ground Self-Defense Force in 1954. At the same time, the Coastal Safety Force became the Maritime Self-Defense Force, and the Air Self-Defense Force was newly organized. The three Self-Defense Forces were not full military forces like those of other countries, but rather constitutionally based organizations with an exclusively defensive defense purpose. It took 53 years for the Defense Agency, which oversaw the Self-Defense Forces (SDF), to become a ministry as the Ministry of Defense in 2007.

Defense spending, but not military spending, subsequently increased as Cold War tensions rose, and there were calls for more defense equipment. However, the response of the Science Council of Japan and universities was weak, and there was no atmosphere of active cooperation, even for the sake of exclusive defensive defense.

When the Cold War ended with the Malta Summit, the fall of the Berlin Wall in 1989, and the dissolution of the Soviet Union in 1991, calls for an expansion of the defense industry weakened.

However, in 1998, when North Korea launched a Taepodong missile and it passed over Japanese territory, the North Korean military threat was rapidly recognized and came to be known as the "Taepodong Shock." Simultaneously, China's gradual military buildup began to be viewed as a cause for concern. By that time, voices denying the existence of the SDF had weakened in Japanese society; rather, the development of defense forces on an appropriate scale was considered essential. Nevertheless, there was a political consensus that defense spending should be limited to 1% of GDP, and this was maintained until recently.

However, when the second Shinzo Abe's administration was formed in 2012, threats by North Korea and China became more obvious and the Abe administration set up "proactive pacifism" as a matter of defense policy. In December 2013, the Abe administration approved the National Defense Program Guidelines (NDPG). The document states:

> From the aspect of security, it is necessary to utilize civilian technology effectively also in the field of security through regularly assessing the trend in science and technology including information related to technological development as well as consolidating the capabilities of the government, industry and academia. Under such recognition, the Ministry of Defense will strive to make effective use of civilian technology that can also be applied to defense (dual-use technologies), by enhancing partnerships with universities and research institutes, while strengthening technology control functions to prevent the outflow of advanced technologies.[4]

However, the 2013 National Defense Program Guidelines contained no mention of AI. Yet, while a shift towards defense technologies in government and academia is occurring, the debate over artificial intelligence gradually coincided. The first Defense Program Guidelines that mentions AI were released in December 2018, also under the Abe administration, indicating that:

> Due to advances in military technologies, a variety of threats can now easily penetrate national borders. States endeavor to develop weapons that leverage cutting-edge, potentially game-changing technologies. They also engage in research of autonomous unmanned weapon systems equipped with artificial intelligence (AI).[5]

It also stated that one of the measures to strengthen the basis of human resources is to "make focused investments through selection and concentration in important technologies including artificial intelligence and other potentially game-changing technologies."[6]

In response to the 2018 National Defense Program Guidelines, the Ministry of Defense showed plans to introduce AI to use it to automate cyber defense, translate military and defense-related data, and manage equipment (determine repair points and the need to replace parts).[7]

The National Defense Program Guidelines were renamed the National Defense Strategy when it was released four years later in December 2022. There is a reference to AI in the following statement:

> Furthermore, rapid advances in science and technology are fundamentally changing the nature of security, and countries are developing advanced technologies that could be so-called game changers, transforming the future face

4 National Defense Program Guidelines for FY 2014 and beyond, p. 28.
5 National Defense Program Guidelines for FY 2019 and beyond, pp. 3-4.
6 Ibid., p. 24.
7 "Expanding AI Deployment for Cyber Defense in Equipment Repair (サイバー防衛にAI導入拡大　装備品補修で)."

> of warfare. Among these, China is rapidly promoting technological innovation and its application to the military under the name of "military-civilian fusion development strategy," and in particular is accelerating the enhancement of military capabilities based on unmanned assets utilizing artificial intelligence (AI). These trends are causing fundamental changes in traditional military structures and ways of fighting.[8]

In the "Defense Buildup Program" announced with the 2022 National Defense Strategy, a more in-depth description of AI can be found.[9] First, as a response to information warfare, including in the cognitive domain, the Plan states:

> In addition, the following functions will be developed: automatic collection and analysis of open-source information using artificial intelligence (AI), which will enable continuous collection and analysis of information on trends in each country; automatic collection of information on social networking sites, etc., to determine the authenticity of information communicated by each country; and future forecasting functions for estimating the security situation.[10]

In relation to command, control, and information-related functions, the plan seeks to "accelerate decision-making through the use of Artificial Intelligence (AI), etc., while strengthening the resiliency of the network." In about ten years, the report continues, Japan will "reinforce information gathering and analysis capabilities through the use of AI, etc., while enhancing the system for persistent information gathering and sharing."[11]

Colonel Hiroshi Ito, who worked in cyber defense in the Japan Ground Self-Defense Force, notes that AI will be used in all kinds of weapons in the future.[12] AI will extend human intellectual capabilities as an aid to humans and will play the role of a calm responder on behalf of humans. He points out that at present AI has five advantages:

1. Can learn
2. Able to handle a wide variety and large volume of data
3. Has high processing speed
4. Can share what it has learned with other Ais
5. Has no human error.

8 National Security Strategy.
9 Defense Buildup Program.
10 Ibid., p. 15.
11 Ibid., p. 51.
12 Ito, "New Battlefield Brought About by the Latest Weapons and their Impact on International Politics," pp. 68-70.

The destination, he says, is the unmanned battlefield. However, there are concerns about autonomous weapons, and he appeals for an urgent debate on laws, ethics, and policies to shape the development of this technology. This debate should be "human-centric" with AI elevating, not controlling or dominating human capabilities, as Japan's Ambassador to the United Nations underlined in November 2023.[13] In line with this position, Japan signed the Political Declaration on Responsible Military Use of AI and Autonomy and joined a US-led initiative to regulate defense AI in November 2023.[14] The government also decided to set up a new organization in 2024 to "explore AI security issues, including the risk of civilian AI technology being diverted for military purposes."[15]

The 2023 Defense White paper mentions AI nineteen times (including in the headlines). It is mentioned in the defense policy descriptions of AUKUS, Australia, China, India, the United States, and Russia. The section that mentions AI the most is Section 1 "Trends in Science and Technology Expanding to Information Warfare" in Chapter 4 "Trends in Space, Cyber, and Electromagnetic Fields, Information Warfare, and Other Issues for the International Community." It covers about half a page and describes the defense applications of AI in various countries and internationally. However, there is little explanation of Japan's own defense use of AI. After reiterating the items presented in the " Defense Buildup Program," the following statement is made in the "Efforts to Enhance Intelligence Analysis and Other Functions" section:

> In order to win battles in a situation in which the battle situation will become more rapid and complex in the future, it is necessary to establish a system that enables real-time information sharing by making maximum use of various means, including artificial intelligence (AI), and further strengthening capabilities such as information gathering and analysis, and to continuously and more accurately grasp the intentions and capabilities of countries surrounding our country.[16]

On 25 August 2023, the Japanese government held the first meeting of "the Council of Ministers Concerned with Research and Development and Public Infrastructure Development that Contribute to Strengthening the Comprehensive Defense Systems."[17] Among R&D for civilian use, nine areas, including AI and cyberattack countermeasures, were designated as "key technology issues" that

13 Ishikane, "Statement at the event for the Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy."
14 Dominguez, "Japan joins U.S.-led effort to regulate military use of AI." For more on Japan's approach to AI regulation, see also: Habuka, "Japan's approach to AI regulation and its impact on the 2023 G7 Presidency" and Hinata-Yamaguchi, "Military AI in Japan and South Korea," pp. 208-210.
15 Yasoshima/Hirosawa/Nagao, "ChatGPT, other AI to be studied for military risk by new Japan body."
16 Defense White Paper 2023, p. 308.
17 "The First Meeting of the Council of Ministers Concerned with Research and Development and Public Infrastructure Development that Contribute to Strengthening the Comprehensive Defense Systems," 2023.

will contribute to strengthening the defense system, and the government confirmed its policy to work on them across ministries and agencies (Table 1). At the meeting, the chairman, Chief Cabinet Secretary Hirokazu Matsuno, emphasized the importance of "breaking down the stove-piping between ministries and agencies and strengthening the comprehensive defense system in order to efficiently utilize the resources and capabilities of our entire nation.[18]

Table 1: Key Technology Issues

Field	Contents
Energy	New energy sources, high-performance energy storage, high-power energy projection, etc.
Sensing	Establishment of high-precision positioning, navigation, and time measurement methods; high-precision sensing of people, objects, and the environment; higher performance sensing than conventional methods (quantum sensing, biosensing, etc.), etc.
Computing	High-speed, high-efficiency new principle computing (quantum, optical, brain-type, etc.), high-efficiency arithmetic processing of huge amounts of data, etc.
Data processing	Highly accurate prediction of the future, advanced artificial intelligence, improvement, and enhancement of cognitive abilities (including medical care), etc.
Telecommunications	Establishment of high-speed, high-capacity, highly secure, and high-performance information and communication device technologies (e.g., communication devices that can be used in space, etc.)
Information security	Efficient and continuous detection, prevention, and response to cyber attacks, enhancement of cyber resilience, advanced cryptography (quantum cryptography, high-performance cryptography, etc.), etc.
Material	Creation of new materials (including medical materials), establishment of advanced manufacturing and processing methods, etc.
Unmanned and autonomous	Unmanned and autonomous machines, advanced human-machine interfaces, group control and distributed control among multiple, manned, and unmanned machines, etc.
Machine	Highly functional and high-performance mechanical structure, establishment of hypersonic flight technology, long-duration, and long-distance navigation, etc.

Source: "Regarding initiatives that contribute to strengthening the comprehensive defense system (Research and Development)."

18 Ibid.

3 Developing Defense AI

The Japanese government's defense policies are presented in three defense documents: the National Security Strategy, the National Defense Strategy, and the Defense Buildup Program.[19] The Ministry of Defense is responsible for their implementation, but the Acquisition, Technology & Logistics Agency (ATLA) is responsible for the technical aspects. ATLA's Technology Strategy Department conducts the Short-term Demonstration Project for New Technology. It is a project to "demonstrate the effectiveness of advanced technologies that are at the level of practical use in civilian applications by bringing together civilian engineers and operators in order to promptly solve problems faced by units and to promote their practical use in a short period of about three years." The project also aims to "reduce defense product prices and maintenance costs by using the results of this project in civilian markets, etc."[20] Table 2 provides an overview of the projects related to AI launched within this framework.

Table 2: AI Projects Launched by Acquisition, Technology & Logistics Agency

Focus	Year	Bidder	Contract Volume
Construction of a tool for analyzing automatic vessel identification devices using artificial intelligence	2018	Unknown	
Streamline system maintenance and management operations using artificial intelligence	2019	unknown	
Automatic generation of training data for identification of satellite images by artificial intelligence	2020	IHI Jet Service	Less than JPY6M (around €38k)
Fully automated aeronautical weather observation using artificial intelligence	2020	Hitachi	JPY44M (around €277k)
Construction of a support system for creating exercise scenarios using artificial intelligence	2021	Hitachi	Around JYP10M (around €63K)

Source: ATLA, "Information Related to a Bid Result."

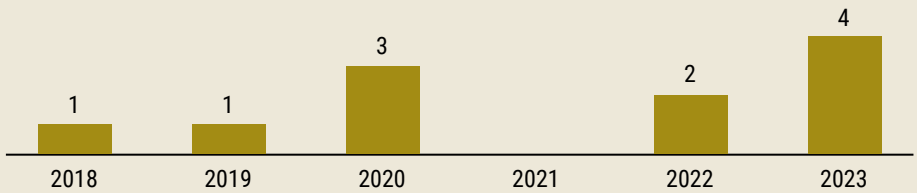
19 National Security Strategy; National Defense Strategy; and Defense Buildup Program.
20 "Short-term Demonstration Project for New Technology."

ATLA began the "Security Technology Research Promotion System" in FY2015, which recruits and funds research and development through an open application process.[21] The launch of this system caused a major stir. This is because the Japanese academic community had been reluctant to research and develop technologies that could be diverted to military use, but the Ministry of Defense and ATLA decided to break that trend and provide its own R&D funds for technologies that could lead to defense capabilities. In FY2017, 109 applications were received, of which 58 (53%) were from universities and other institutions, 22 (20%) from public research institutions, and 29 (27%) from companies.[22]

However, because applications to the Security Technology Research Promotion System stirred controversial media coverage, the number of applications in FY2016 decreased to 44, with 23 (52%) from universities, 11 (25%) from public research institutions, and 10 (23%) from companies.[23] In FY2017, however, the numbers returned, with 104 applications.[24]

The first research on AI under this program appeared in FY2018. Natsuki Matsunami of Mitsubishi Heavy Industries, Ltd. was awarded the "Basic Research on Problem Coping by Collaboration of a Very Small Number of Humans and AI."[25] Mitsubishi Heavy Industries is one of Japan's largest defense contractors. In FY2019, the development of AI to understand human states was included in "Development of a method for estimating latent brain dynamics and elucidation and control of mental state transitions," for which Eiji Uchibe of Advanced Telecommunications Research Institute International (ATR) was awarded the contract.[26] Since then, a total of eleven studies on defense AI have been launched (Figure 1).

Figure 1: Number of Studies Related to AI in the Research Promotion System for Security Technology



Source: "Security Technology Research Promotion System."

21 "Security Technology Research Promotion System."
22 2015 Security Technology Research Promotion Program Overview of Applications.
23 2016 Security Technology Research Promotion Program Overview of Applications.
24 2017 Security Technology Research Promotion Program Overview of Application.
25 Fiscal Year 2018 Newly Adopted Research Projects.
26 FY2019 Security Technology Promotion System (Secondary Recruitment) Application/Adoption Overview.

Despite a marginal number of applications, ATLA has shown strong interest in AI-related research. 31 research themes were listed by ATLA for the FY2023 open call, including the following twelve that directly refer to AI in the title or description:[27]

- Fundamental research on sequential decision-making AI architectures that can build trust in unknown environments
- Basic research on AI to realize accurate predictions from all kinds of information
- Fundamental research on AI architecture with robustness in unknown environments
- Basic research on the improvement of cognitive and communicative functions through brain science
- Basic research on human cognitive support for multiple unmanned aircraft operation and control
- Basic research on cognitive security
- Basic research on security that automates protection against unknown attacks on wireless communications and cyber kill chain fragmentation
- Basic research on magnetic sensor technology
- Fundamental research on technologies for understanding materials and objects in the ground or on the seafloor
- Basic research to significantly improve the performance of unmanned underwater and surface vessels and underwater vehicles
- Basic research to significantly improve the performance of aircraft and unmanned aerial vehicles
- Basic research to significantly improve the performance of vehicles and unmanned vehicles

It is important to note that none of these calls and the respective projects are directly weapons-related. With a sense of aversion to military-related research still lingering, researchers remain reluctant to directly engage in military technology research. Against this backdrop, open calls are being made for technologies that are less military in nature but still applicable to defense.

In addition to this funding for external research, development is also taking place within ATLA. At the Agency's Technical Symposium 2019, AI was mentioned in three of the 16 oral sessions and 23 poster session summaries, thereby covering, among other things, the following topics:

27 "About Research Themes Related to Public Offerings in 2023."

- Taisuke Katayama, "R&D Vision: Achieving Multidimensional Integrated Defense Capability and Beyond"
- Masataka Okubo, "An Attempt to Introduce Artificial Intelligence (AI) into Ship Design (Demagnetizer Gear Design)"
- Toshiro Kamitani, Hiroka Sano, and Kenji Hamano, "Target Categorization from Synthetic Aperture Radar Images"

According to Okubo's report, the work that had been done by skilled technicians was replaced by AI, and tens of millions of verifications can now be done in three to four hours, a significant time saving. Kamitani's report examined the possibility of using AI to classify radar images.[28] These reports are also being used within ATLA to meet actual defense needs.

While Japan's defense AI development priorities are still emerging, the SDF seems to have a primary interest in defense AI for C4ISTAR,[29] unmanned systems, and cybersecurity.[30] In all these fields, defense industrial expertise is important to develop solutions that meet the future defense AI needs of the SDF. Japanese defense companies[31] are working on AI, although not necessarily for defense equipment. The demand for Japanese defense companies comes primarily from the civilian sector. AI is being developed for such civilian demand, and there is a high possibility that such technology and knowledge will be applied to defense equipment if necessary.

Moreover, Japan also looks at international cooperation to develop emerging technologies and AI.[32] In August 2023, Craig Martell, Chief Digital and AI Officer, US Department of Defense, visited Japan, Singapore, and South Korea to discuss opportunities to "deepen cooperation associated with data, analytics, and the responsible deployment of AI."[33] These talks mirror long-standing bilateral interests in jointly advancing dual-use technology cooperation.[34] To this purpose both countries signed a "project arrangement" in late December 2023 to jointly develop AI for the use of Unmanned Aerial Vehicles (UAV) "that will be used in a 'loyal wingman' role alongside" the Global Combat Air Program (GCAP).[35] US-Japanese defense AI cooperation could become even more relevant should Japan join trilateral cooperation with Australia and the UK in the AUKUS framework.[36]

28 "ATLA Technology Symposium 2019."
29 C4ISTAR: Command, Control, Computers, Communication, Intelligence, Surveillance, Target Acquisition, and Reconnaissance.
30 Hinata-Yamaguchi, "Military AI in Japan and South Korea," p. 205.
31 For an in-depth assessment of the difficulties currently Japan's defense industry, see also: Ouq/Ogi/Inoue, Comparative Study of Defense Industries, pp. 5-9.
32 In this context it is also important to understand that the Japanese government eased existing arms export regulations in December 2023. For more, see: Reuters, "Japan prepares missile shipments after easing arms export curbs."
33 Vincent, "Pentagon's digital and AI chief works to deepen US tech ties in visits to Singapore, South Korea and Japan."
34 Tajima, "Japan, US to promote cooperation on dual-use technologies."
35 Kadidal/Kumar, "Japan to develop AI with US for 'Loyal Wingman' UAVs."
36 For more on this, see also: Warren/Hunt/Warren, "AI cooperation between Australia, Japan, and the United States."

The most recent agreement of Japan and Australia on joint research for the use of unmanned underwater vehicles for mine detection could be interpreted as another indicator supporting this interpretation. And this project could also potentially open doors for collaborative AI research.[37]

In parallel to technology cooperation with the US, Tokyo and London have been extending technology ties as well. In May 2023, both nations adopted the "Hiroshima Accord," which outlines a strategic technology partnership, and renewed a science and technology agreement to cooperate on innovation and new technologies.[38] Expanding science and technology bonds are relevant given trilateral cooperation with Italy on the GCAP[39] and recent developments in Japan's strategic environment. In view of both aspects General Jim Hockenhull, Commander of the UK Strategic Command, recently underlined that by "using both the Japanese and the UK industrial base, (both nations) can generate even greater and even better capabilities, which play a part in any deterrence approach."[40]

In addition, Japan also engages with France on AI cooperation. According to ATLA, bilateral research cooperation includes mine-countermeasure technologies, with AI being used to "identify targets from images obtained by mine detectors."[41]

In view of developing new defense capabilities with the help of AI and other emerging technologies, the MoD and the Ministry of Economy, Trade, and Industry seem serious to tap into Japan's vibrant technology ecosystem. In mid-2023 representatives from both ministries met with experts from around 200 startup companies covering AI, cybersecurity, and space applications. Follow-on meetings are reportedly scheduled.[42] This initiative builds on earlier efforts aimed at launching collaborative initiatives to involve startups working on AI in defense solutions for the SDF.[43]

37 "Japan, Australia agree on joint research on mine-detecting UUV."
38 "The Hiroshima Accord;" Evenstad, "UK renews tech and science deal with Japan."
39 Chuter, "Move over, Tempest."
40 Kitado, "Cutting-edge tech key to deter Taiwan conflict: UK military officer."
41 Majumdar, "Smart forces," p. 25.
42 Prosser, "Japan aims to boost defense industry with 200 startups."
43 Hinata-Yamaguchi, "Military AI in Japan and South Korea," p. 203.

4 Organizing Defense AI

In 2016, at the direction of Prime Minister Shinzo Abe, the Japanese government created the Strategic Council for AI Technology, which brings together the wisdom of industry, academia, and government and eliminates organizational silos.[44]

On 31 March 2017, the Council released the "Artificial Intelligence Technology Strategy" presenting a three-phased approach: First, data-driven AI utilization will progress in each domain by around 2020; second, general use of AI and data will progress beyond the boundaries of individual domains by around 2025; and third, each domain will be connected in a complex manner by around 2030, creating an ecosystem.[45]

Two years later, the Council released the "Strategic Action Plan for Artificial Intelligence Technology."[46] The plan aimed at promoting AI involving a diverse set of ministries – Ministry of Internal Affairs and Communications, the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Economy, Trade and Industry, the Cabinet Office, the Ministry of Health, Labor and Welfare, the Ministry of Agriculture, Forestry and Fisheries, and the Ministry of Land, Infrastructure, Transport and Tourism – the action plan primarily targeted the industrial use of AI whereas AI for defense was not considered.

Based on this strategy, AI research was to be conducted at three national research institutes:

- First, in April 2017 the National Institute of Information and Communications Technology (NICT) established the AI Science Research and Development Promotion Center)[47]. However, NICT is a research institute under the Ministry of Internal Affairs and Communications (MIC) and does not conduct defense-related research, apart from cybersecurity.
- Second is the Artificial Intelligence Research Center (AIRC) of the National Institute of Advanced Industrial Science and Technology (AIST).[48] The center studies the application of artificial intelligence to the manufacturing, service, medical and nursing care, and security sectors. However, there does not appear to be any research focused on defense or military applications. The applications mentioned for the security sector are automatic explanation functions for videos and evacuation guidance during disasters.[49]
- Third is the Center for Advanced Intelligence Project (AIP) of the National Institute of Physical and Chemical Research (RIKEN). The Center has three

44 "Strategic Council for AI Technology."
45 Artificial Intelligence Technology Strategy.
46 Strategic Action Plan for Artificial Intelligence Technology.
47 Kidawara, "AI Science Research and Development Promotion Center."
48 For more information, see: https://www.airc.aist.go.jp/en/ (last accessed 30 January 2024).
49 For more information, see: https://www.airc.aist.go.jp/en/utility/ (last accessed 30 January 2024).

research groups: the Generic Technology Research Group, the Goal-Oriented Technology Research Group, and the Artificial Intelligence in Society Research Group.[50] However, these groups do not appear to be conducting research directly related to defense.

On 11 June 2019, the Japanese government, via the Integrated Innovation Strategy Promotion Council, released "AI Strategy 2019: AI for People, Industry, Region, and Government."[51] The document focuses on education and industry; again defense applications were not considered. Two years later, in June 2021, the Japanese government published the "AI Strategy 2021," but again, the Ministry of Defense's efforts were not explicitly mentioned. In response to this AI Strategy 2021, the AI Strategy Executive Council established the "New AI Strategy Study Council." The "AI Strategy 2022" was the first capstone document to refer to AI in relation to security with the following statement:

> In view of the increasingly complex international situation and changes in socio- economic structures, various initiatives are being considered for important technologies including AI from the perspective of economic security. Therefore, it is necessary to coordinate related measures so that the government as a whole can effectively prioritize them.[52]

However, this refers to economic security (or geo-economics), not military security. The following statement was also included:

> Pursue fusion of AI and Japan's strengths to address challenges unique to Japan ([1] health, medical care, and nursing care; [2] agriculture; [3] infrastructure and disaster prevention; [4] transportation infrastructure and logistics; [5] regional revitalization; [6] manufacturing; and [7] security).[53]

Attached to the 2022 strategy was a "List of AI Strategy 2022 Initiatives," in which the Ministry of Defense included a section on "Promoting Research on the Application of AI Technology to Contribute to the Defense of Japan."[54] This is the first documents that brings AI and defense together and underlines the Japanese government's growing awareness of addressing this issue.

According to the AI Strategy 2022 progress report published in April 2023, the Ministry of Defense is addressing defense AI by bringing in experts from the outside and stepping up training efforts. In addition, the Ministry also intends to

50 For more information, see: https://www.riken.jp/en/research/labs/aip/ (last accessed 30 January 2024).
51 AI Strategy 2019: AI for People, Industry, Region, and Government.
52 AI Strategy 2022, p. 3.
53 Ibid., p. 27.
54 List of AI Strategy 2022 Initiatives.

enhance the capabilities of equipment used by the SDF, including detection and identification.[55]

On 11 May 2023, the Japanese government held the first meeting of the AI Strategy Council of experts together with the relevant Ministers. Prime Minister Fumio Kishida attended the first meeting. About two weeks later, the Council met again, discussed several topics and issues. Among others, the following statement is noteworthy:

> AI is also an important tool in global issues such as security, disaster management, and global warming countermeasures, and our country needs to work on technological innovation together with like-minded countries.[56]
>
> There is an argument that the use of AI is important in security-related matters as well, but it should be handled flexibly, for example by leaving it for discussion by specialized departments, depending on the need for information management. [57]

In general, Japan's AI focus rests with industrial applications and educational efforts. Research to advance defense AI has only just started in 2022. Although no dedicated institutions addressing AI within the defense establishment have yet been created, the 2022 National Security strategy indicates the willingness of the Ministry of Defense to "establish a mechanism to aggregate military information" and urges the intelligence and policymaking departments to "enhance information management analysis."[58]

55 Progress of AI Strategy 2022.
56 "Provisional Argument of Issues Concerning AI," p. 6.
57 Ibid., p. 16.
58 Majumdar, "Smart forces," p. 25.

5 Funding Defense AI

No summarized data has been released on the Japanese government's AI budget. According to the *Nihon Keizai Shimbun*,[59] the Japanese government has summarized its basic policy and budget for policies related to generative AI for the FY2024 budget estimates. The government will focus on the development of infrastructure for the development of AI, including supercomputers and high-quality data, and will create a foundation for research and development in Japan to reduce its dependence on foreign countries for AI development.

The government's overall AI-related budget was approximately JPY100bn (or €630M) in the initial budget for FY2023. The government is considering doubling the budget to JPY200bn (€1.26bn) in FY2024. The basic policy has three pillars to strengthen the research and development infrastructure for generative AI by developing of data centers with supercomputers, developing high-quality AI training data, and creating generative AI that can be used in scientific research.

In March 2023, the Ministry of Defense included a section on defense AI in its budget.[60] The overall amount spent on defense AI is JPY 6.58bn (€41.4M), or around 0.096% of the total FY2023 defense budget of JPY 6.8219trn (€42.9bn). The defense AI budget encompasses the following items:

- Development of functions for automatic collection and analysis of public information using AI: JPY2.2bn (€13.9M)
- Research on speeding up decision making using AI: JPY4.3bn (€27M)
- Utilization of external forces for AI implementation: JPY50M (€0.32M)
- Training of AI human resources by providing AI training courses: JPY30M (€0.19M)

In addition to this, part of the "Project for Establishment of System for Strengthening Production Base of Defense Equipment, etc." (JPY36.3bn or €226M) will be used to "implement efficiency improvement of defense equipment manufacturing process, etc. through introduction of advanced technologies such as 3D printer technology and AI technology." Thus, the exact size of the defense AI budget is not publicly known as spending on AI in other budgets, for example on cybersecurity, needs to be considered as well.

59 "FY2012 AI Budget, Focus on Development Infrastructure: 200 Billion Yen, Doubled (24年度AI予算、開発インフラに重点 倍の2000億円視野)."
60 Defense Programs and Budget of Japan (1); Defense Programs and Budget of Japan (2).

6 Fielding and Operating Defense AI

In April 2022, the Ministry of Defense held a presentation entitled "AI Initiatives in the Ministry of Defense."[61] The document states, that:

> In the field of national defense, AI technology is expected to be utilized for faster and more efficient information processing, situational assessment, operational planning, and high-level search and rescue using unmanned aircraft, etc. Many countries including China and the United States are actively investing in R&D related to AI technology as it could change the future of warfare.

The Ministry of Defense also believes that AI technology can be a game changer and that it is necessary to make focused investments and realize its implementation in defense applications as soon as possible. In this regard, the document also illustrates two practical examples illustrating exemplary lines of effort that the SDF are interested in:

- The first example refers to research on AI-based radio image identification technology. This research is to study the technology to automate the identification of radar images using AI to efficiently conduct constant and continuous information gathering and warning monitoring activities. By automating the deciphering and identification of radar images, which requires skill, it is expected to reduce the burden on units and improve mission efficiency.
- The second example refers to a study of the components of an unmanned submersible monitoring machine. This will involve research on autonomous monitoring technology and sensor systems. The plan is to apply AI technology to decisions about the behavior of underwater vehicles used for long term surveillance.

In addition to these two examples, the Ministry's presentation also discusses additional initiatives summarized in Table 3.

61 AI Initiatives in the Ministry of Defense.

Table 3: AI Efforts of the Japanese Ministry of Defense

Specific Target	Initiatives	Details of Initiatives
Construct a digital twin that will be the basis to use AI	Promotion of digital transformation (DX) in research and development of equipment, etc.	To introduce a digital twin, a digital thread and others and to strengthen the necessary governance at each level of design, numerical analysis, and experiments in research and development of equipment
	Promotion of research and development to use the human digital twin for education, training, and diagnosis	To build a human digital twin based on behavioral and neurological data and neuroscientific findings and to promote research and development for applications in education, training, and diagnostic treatment.
Reinforce the governance to promote the introduction of AI in government agencies and enhance and improve administrative functions	Support of consideration of AI use by AI advisors and contribution to activities of SDF	To hire external AI advisors to promote AI use at each agency, to get advices on AI use policy, governance for operation and verification, and operational plan, and to examine AI-related governance issues, aspects of human resource management, use of data
	Conduct a basic AI training course to promote the use of AI in activities of SDF	To offer basic training on IT literacy, AI, and data science, as well as practical training on AI image processing to the staff of each organization to promote AI use
Pursue of fusion of Japan's advantages and AI to deal with challenges unique to Japan	Promote research on the application of AI technology that contributes to Japan's defense	To conduct research on the use of AI technologies in command and control, detection and identification, automation, and logistical support to advance SDF capabilities and equipment

Source: AI Initiatives in the Ministry of Defense.

7 Training for Defense AI

We were unable to find any direct documentation of how the Ministry of Defense and the SDF are training for the advent of defense AI. However, the SDF does recruit publicly for senior positions and mentions AI in current job openings as the examples illustrated in Table 4 and published in August 2023 highlight.

Table 4: Job Openings Related to AI at Japan's Self-Defense Forces

Force	Department	Section	Summary
Maritime Self-Defense Force	Aircraft	Aeronautical equipment (underwater acoustic/non-acoustic systems) / artificial intelligence	Research and development of underwater acoustic systems/non-acoustic systems. AI, technical guidance, and supervision of companies, etc.
	Technical Information Analysis	Artificial Intelligence	Research and development related to AI, technical guidance, and supervision of companies, etc.
Air Self-Defense Force	Weather	R&D	Research and development of AI technology, weather forecasting technology using numerical simulation, etc., and supervision and guidance related to weather forecasting and weather policies, etc.

Source: Recruitment Requirements for Maritime Self-Defense Force Officers and Air Self-Defense Force Officers.

A public notice issued by the Ministry of Defense in December 2022 indicated a competitive bid to implement basic training for AI related to human resources development.[62] This initiative exemplifies the Ministry of Defense's effort to recruit instructors from the private sector to help train the Ministry of Defense and the SDF.

62 "Implementation of Basic Training for AI (Artificial Intelligence) Human Resource Development."

In addition, the Department of Information Engineering at the National Defense Academy, which trains many of the Self-Defense Forces officers, offers AI as an elective compulsory subject.[63] Associate Professor Hiroshi Sato specializes in research and educational activities in evolutionary computation and artificial intelligence.[64]

At a more general level, Air SDF LTC Kenshi Kamitakahara, who belongs to the Operational Theory Laboratory of the Aviation Research Center, a research institute within the Air SDF, recently touched upon another aspect related to training: the lack of data. In view of using machine learning related to defense equipment he underlined the need to "collect as much data as possible and extract high quality data from it."[65] In another paper, he focused on AI and defense simulations and argued that "AI for defense simulations is considered to be the most technically challenging area, as decisions to be made based on the simulation results are extremely critical."[66]

63 "Department of Computer Science."
64 For more information, see: https://www.nda.ac.jp/~hsato/ (last accessed 30 January 2024).
65 Kamitakahara, "Challenges in Applying Artificial Intelligence to Defense Equipment: Especially Machine Learning (人工知能の防衛装備品への適用における課題–特に機械学習について–)."
66 Kamitakahara, "Challenges in Applying Artificial Intelligence to Defense Simulations: Limitations of Applying Machine Learning to Strategic Simulations (防衛用シミュレーションへの人工知能の適用に関する課題–戦略シミュレーションへの機械学習適用の限界–)."

8 Conclusion

Although Japan is often recognized as one of the most technologically advanced countries, there is still strong hesitance to the use of technology for defense purposes. Universities and other research institutions are not necessarily active in R&D for defense uses.

On the other hand, interest in AI is growing, as in other countries. However, this interest is skewed toward educational and industrial applications. The defense industry is working on AI across the board, but Japan's defense industry has a large proportion of civilian demand, and there are aspects of the industry that are not necessarily for defense use. If necessary, they will be applied to defense applications, but they are not actively promoted as AI for defense.

The Ministry of Defense is gradually beginning to show interest in AI, as highlighted by a growing number of public documents referring to AI published since December 2022. Although still small, dedicated defense spending on AI is ticking up.

In general, Japan is a latecomer on the growing international defense AI scene – with no major achievements yet to see. However, the security environment surrounding Japan is worsening, and China's military spending is increasing remarkably. China has also pointed out that it will use and incorporate AI for military purposes. Thus, for Japan to respond to what is going on in its strategic neighborhood, next-generation technologies are indispensable to expand its defense capabilities. In this regard, AI and other technologies are of strategic importance.

In so doing, ATLA is Japan's core organization to develop defense AI. ATLA should promote defense AI initiatives that reflect the strategic thinking of the Prime Minister's Office and the Ministry of Defense. In response, the academic community, including national and private universities, and the private sector should deepen their cooperation. Japan's unique post-World War II political environment should not be ignored. As the path toward war should be avoided, stepping up research and development efforts to the benefit of new technologies is indispensable to deter current and future threats.

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