Chairperson's Summary

The National Institute for Defense Studies (NIDS) held the International Symposium on Security Affairs in virtual format on December 8, 2021. The theme was "Technological Innovation and Security: The Impact on the Strategic Environment in East Asia." This symposium was intended not only to foster security dialogue but also to improve research quality, stimulate interaction, promote mutual understanding among the international public and experts, and contribute to security policy.

The symposium was divided into two parts. Session 1 examined technological innovation and security from the perspectives of the United States (U.S.), Japan, and China and Session 2 from the perspectives of Australia, Singapore, and Russia. In addition, a keynote speech was delivered between the two sessions. Each session consisted of presentations by panelists followed by discussion and Q&As with panelists.

Below is a summary of the symposium's Session 1, keynote speech, and Session 2, in that order. In Session 1, presentations were made from the "Perspectives of the U.S., Japan, and, China" by Mr. Bryan Clark (Senior Fellow & Director, Center for Defense Concepts and Technology, Hudson Institute), Dr. Fujita Motonobu (Policy Coordinator; Technology Policy Office; Technology Strategy Division; Department of Technology Strategy; Acquisition, Technology and Logistics Agency [ATLA]), and Dr. Tai Ming Cheung (Director, Institute on Global Conflict and Cooperation [IGCC], University of California). Mr. Iida Masafumi (Head; America, Europe, and Russia Division; NIDS) conducted the discussion with the panelists.

The first speaker, Mr. Clark, gave a presentation titled "Technological Innovation and Security: A U.S. Perspective." He discussed the transition from the "era of craftsmen," in which a small number of soldiers used handmade weapons, to the "era of homogeneity and scale" characterized by the Industrial Revolution and mechanization, and now to the "era of heterogeneity at scale." He described that civilian technological innovation is bringing an end to the industrial era as we know it, a period in which weapons manufacturing ability has been the deciding factor in victory or defeat.

He noted that the Chinese People's Liberation Army (PLA) is pursuing modernization, and industry-driven innovation has reached its pinnacle. He further noted that China has the capacity to produce weapons in large quantities, and that the scale of the PLA now surpasses that of U.S. allies.

He noted that, meanwhile, the U.S. military is attempting to incorporate artificial

intelligence (AI) and autonomous systems. Called decision-centric warfare or Mosaic Warfare, this approach is characterized by decision-making in the field, which creates more options and therefore widens the scope of decisions while delaying the enemy's decision making. He pointed out that forces are being distributed based on these concepts, and that distribution is increasing the options available to commanders. Integrating unmanned platforms with manned platforms is an example of this warfare. Other examples include the space domain, where the U.S. military is shifting from a small number of large satellites to constellations of low earth orbit satellites. In addition, he said the U.S. military is attempting to leverage human command and machine control to make full use of its distributed forces. The combination of human command and machine control, in which machines propose options, is already in practical use in the Air Force's refueling. AI is also assisting in decision making. He noted the U.S. military is working to increase options leading to escalation, stating that distributed forces would enable moving up and down the escalation ladder, and that conversely, adversaries would be unable to respond unless various countermeasures are taken.

The second speaker, Dr. Fujita, offered a Japanese perspective in his presentation entitled, "Potential Impact of Advanced Technologies on Future Contested in Asia-Pacific." He explained that the significance of state investments in technology lies in its use as a means of inter-state competition, and that concentrated investment in a particular technology was a statement of national intent. While there is no stable definition of emerging technologies, for the purposes of his presentation, he referred to technologies that have a broad impact on doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) as emerging technologies.

He pointed out that Japan's Ministry of Defense (MOD) has released two strategic documents regarding technology. One is the Strategy on Defense Production and Technological Bases, formulated in 2014, which he said is characterized by its provision for agile selection of acquisition methods. The other document is the Defense Technology Strategy, formulated in 2016, which he said is distinct for its presentation of investment portfolios. Group 1 portfolios represent fields in which Japan always has superiority over other countries, such as advanced material technologies, and in which MOD will actively invest resources. Group 2 corresponds to fields in which Japan will be at a strategic disadvantage without a certain technological footing, and in which MOD will invest a certain amount of resources. The investment of resources in this group will be important from the perspective of maintaining the supply chain as well. Group 3 represents fields where technology is being developed by the private sector on its own initiative, and in

which MOD will not actively invest but will keep abreast of the trends.

Dr. Fujita then pointed out that MOD's research and development (R&D) budget over the past 30 years has fluctuated significantly due to big projects. He said MOD is presented with a new challenge—whether to continue investing in the development of a specific platform, or to prioritize investments in acquiring and strengthening capabilities in new domains such as space, cyber, and electromagnetic, or to increase the budget to realize both.

Lastly, he discussed the potential impact of individual technology fields on the Asia-Pacific region. He said electromagnetic spectrum (EMS) technology, especially directed energy weapons, could increase our options in the gray zone, while EMS management poses a major challenge in the application of this technology. He noted that Intelligence, Surveillance and Reconnaissance (ISR) technologies, including space technology, are essential for decision making from the strategic to the tactical levels, and simultaneously, that deception and concealment technologies will likely make advances to counter such technologies. He expected that cyber technology measures to keep equipment operational will become critical, and that unmanned and manpower-saving technologies will complement or partially replace conventional manned platforms. In addition, he noted that hypersonic technology shortens the response time of the side being attacked. He described that digital technology will become key in quantitatively forecasting the impact of emerging technologies, that simulations of electromagnetic warfare will become possible on calculators, and that digital technology will serve as a bridge between R&D departments and users.

The last speaker, Dr. Cheung, gave a presentation titled, "The Rise of the Chinese Techno-Security State and its Strategic Implications," for a Chinese perspective. He highlighted Xi Jinping's remarks that the nation's development will be achieved through innovation and that technological development is the most critical area. Dr. Cheung noted that the Xi administration places focus on linking innovation and security. He refers to states that prioritize these aspects as "techno-security states," and explained that this term applies not only to China but also to the U.S.

He noted that the Xi administration is accelerating the building of a techno-security state. It has formulated and promoted the National Security Strategy, the Innovation-Driven Development Strategy, Xi's Thought on Military Strengthening in the New Era, the Military-Civil Fusion Development Strategy, and economic securitization, aimed at strengthening China's military in the new era which includes achieving defense modernization by 2035 and becoming a world-leading military power by 2050. He

stated that, while military-civil fusion is still in its early stages, China perceives it must secure its entire economy in response to wide-ranging confrontations with the U.S., with emphasis on protecting China's economy from external threats, especially from a technological perspective.

He identified five factors in comparing the U.S. and Chinese techno-security states. First is the perception of external threats. He noted that China has viewed the U.S. as a techno-security threat since the late 1990s, while the U.S. has taken longer to view China as a serious techno-security concern. Second is leadership and management coordination, which he said is top-down in China and bottom-up in the U.S. Third is governance regime, where China relies on penalties to ensure compliance with laws and regulations, whereas the U.S. leverages incentives and rewards to ensure compliance with laws and regulations by the private sector. Fourth is hybridization. He said China is in the early stages of military-civil fusion, while the U.S. is in the mature stage of public-private hybridization. Fifth is dependence vs. primacy. He noted that China aims to secure technological self-reliance but remains highly dependent on foreign technology and know-how, while the U.S. has secured self-reliance and is exporting technology to other countries.

His overall assessment of the early 2020s was that China is more strongly motivated and politically committed to building techno-security capabilities, and that the U.S. advantage is gradually eroding.

Session 1's discussion began with comments and questions from Mr. Iida regarding the three presentations. He asked Mr. Clark a question regarding innovation and operations, respectively. Noting that the U.S. is transitioning from a centralized to a decentralized model of innovation, while China is pursuing state-led military innovation under a military-civil fusion policy, Mr. Iida asked whether China's distinctive approach to innovation is effective and whether the decentralized approach of the U.S. has advantages over China's approach in military technology innovation. With regard to operations, he wondered whether the U.S. did not have ethical barriers to granting a certain degree of decision-making authority to AI, and asked about the current and future prospects for military use of AI in the U.S.

Mr. Iida had two questions for Dr. Fujita. His first question concerned the advantages and disadvantages of China's approach, noting that China determines which technologies to invest in based on predictions about the future way of war, while Japan makes investment decisions taking the current technology as the starting point. His second question asked which technologies Japan should invest in considering Japan's

strategic environment and technological potential.

Dr. Cheung was asked about China's approach to technological development. Mr. Iida questioned the sustainability of the system that allows for state-led mobilization, such as the top-down model and military-civil fusion, and asked whether China's approach is effective for generating true innovations that are not advances in existing technologies. Regarding Dr. Cheung's remark about the declining U.S. advantage relative to China, Mr. Iida asked whether China's policies offer any lessons for the U.S. to regain its advantage and what factors could slow down the pace of Chinese innovation.

Mr. Clark noted that both the U.S. and China are developing the same technologies, such as hypersonic weapons and AI, but that the U.S. is developing them under a decentralized model with operators taking the initiative. He said the U.S. model makes it easier to draw on the insights of operators compared to the Chinese approach, which develops technologies by working backwards from future warfare projections. He described the U.S. model as an operations-focused model and China's as a technology-focused model.

Dr. Fujita, in answer to the first question, explained that the approach of Japan's Defense Technology Strategy is based on self-analysis. He said that if the self-analysis is appropriate, then Japan can make maximum use of the strengths of its technological bases. A disadvantage of this approach is inefficient capacity building when the needs of operators do not match the strengths of the technological bases. In order to prevent such a situation, he stressed the importance of dialogue between operators and the R&D community. He stated that the Chinese approach leads to efficient investment if the intelligentized warfare concept is materialized; however, a disadvantage of this approach is that investment becomes inefficient if the battle concept turns out to be erroneous. In response to the second question, Dr. Fujita stated that given Japan's geographical environment and demographics, it is important to have maritime autonomous systems. He emphasized that the key to their successful development is promotion of open system architecture that enables the participation of various actors.

Dr. Cheung noted that China's approach has allowed it to catch up with the technologies of other countries in a few decades, namely, by absorbing foreign technologies into both the military and civilian sectors and making further advancements domestically. President Xi Jinping, meanwhile, seeks to achieve innovation indigenously and has been reorganizing China's R&D structure, including the major research institutes. In addition, Dr. Cheung pointed out that China is focusing attention on a range of emerging technologies, motivated by the Xi regime's strong sense of urgency to

keep up with other countries, and that China is investing resources to lead technological innovation. Regarding what the U.S. can learn from China, he mentioned state-market balance. He explained that China has a state-led model as opposed to the market-led model of the U.S., and that the U.S. has an appropriate balance without excessive state intervention in the market.

From the audience, Dr. Fujita was asked whether costs and climate change are taken into account in defense equipment development. Mr. Clark was asked if the current air tasking cycle of the U.S. could be modified for the purposes of decentralized operations involving flexible and rapid decision making.

Dr. Fujita responded that cost is an important factor given the severe fiscal situation and that equipment development must be cost efficient. He stated that climate change had not been a major consideration, but that with the recent intensifying debate, the diversion of technology for climate change measures has been considered during the R&D process.

Mr. Clark mentioned that AI is already helping to speed up the air tasking cycle, noting that AI-assisted decision making can shorten a cycle of about 18 hours to a few hours. He also pointed out that AI's use is critical to enhancing human creativity through AI-assisted decision making. In fact, he said, a human can sometimes make a decision more quickly than AI because it presents too many choices and the computer does not have adequate resources. He thus pointed out that AI is not a replacement for humans but rather a tool to help humans become more creative.

For the keynote speech, Dr. Sunami Atsushi (President, Sasakawa Peace Foundation [SPF]; Executive Advisor to the President & Director, Science for RE-designing Science, Technology and Innovation Policy [SciREX] Center, National Graduate Institute for Policy Studies [GRIPS]) delivered an address titled, "Technological Innovation and Security: Japan's Innovation Strategy Based on Technological Patriotism." Dr. Sunami stated that a country must possess two systems to become a science and technology great power, and that these systems enabled the U.S. to establish techno-hegemony in the 20th century. They are: (1) a system of universities and for introducing their achievements to society through industry-academia collaboration; and (2) a system of mass production. He said that China today also possesses these two systems, and that the U.S. and China are engaged in a contest for supremacy as advanced technology giants.

In addition, Dr. Sunami made the point that advanced science and technology is important for expanding a country's sphere of activities into outer space, cyberspace, and other domains where humans have not yet expanded their sphere of activities, and that

possessing science and technology for this purpose will enable nations to occupy a key position in security. He noted that most advanced science and technology is dual-use: most advanced science and technology is dual-use technology, which transforms society and also has a critical role in security and a direct impact on military strategy. Against this backdrop, he explained that mission-type R&D, in which the state allocates resources to science and technology development based on societal issues and national interest needs, has become mainstream globally, and that nations are focusing investment especially in advanced technologies related to climate change and security and in technological infrastructure that support future industries. Furthermore, he noted that many of the special technologies that give rise to major changes do not fit the business models of private companies, that the government must strategically take the lead in developing emerging technologies which will be game changers, and that mission-type technology development has become the mainstream.

Dr. Sunami noted that the Biden administration is working to secure critical technologies by taking measures, such as the Executive Order on America's Supply Chains and the Innovation and Competition Act, and strengthening collaboration with allies. China, in contrast, through government-led resource allocation, is gradually establishing a national innovation system that produces advanced technologies without depending on foreign countries, aiming to become a world-leading manufacturing power by the 100th anniversary of China's founding in 2049. He expected Beijing to create a system similar to the U.S. innovation system, albeit China's largely government-led system differs in form and approach from the U.S. system which has the private domain at its core. He stated that Japan must also build a corresponding innovation system, and to this end, underscored the importance of industry-academia collaboration, including cooperating with universities on the development of dual-use technologies, and of establishing a system for the management of intellectual property and sensitive technology information. In order to develop advanced technologies with limited resources, he said that Japan needs to collaborate with other countries and establish a collaborative system for developing emerging and dual-use technologies with the U.S., Europe, and other partners. He concluded that frameworks such as bilateral cooperation, Five Eyes + Japan, and QUAD can serve as a platform for cooperation on the social implementation of advanced technologies, such as AI, quantum, and space technologies, and that this requires overcoming the challenges to cooperation, such as information and technology management and collaborative strategy formulation.

In Session 2, presentations were made from the "Perspectives of Australia, Singapore,

and Russia" by Dr. Malcolm Davis (Senior Analyst, Australian Strategic Policy Institute [ASPI]), Dr. Michael Raska (Assistant Professor, S. Rajaratnam School of International Studies [RSIS], Nanyang Technological University), and Dr. Ivan Danilin (Head, Department of Science and Innovation, Institute of World Economy and International Relations [IMEMO], Russian Academy of Sciences). Mr. Akimoto Shigeki (Senior Fellow, Policy Simulation Division, NIDS) conducted the discussion with the panelists.

Dr. Davis gave a presentation titled "Technological Change and Future Security in the Indo-Pacific: An Australian Perspective." Dr. Davis began by providing the strategic context of the current era of heightened uncertainty. He then discussed Australia's latest strategic documents, which recognize that the strategic competition between the U.S. and China will be the principal factor that defines the Indo-Pacific region, that high intensity military conflict between the two countries is becoming more likely, and that the traditional defense posture assumption of a ten-year warning time before a direct attack against Australia is no longer applicable. Regarding the strategic context, Dr. Davis emphasized the importance of AUKUS and QUAD as cooperative frameworks for the development and implementation of emerging military-related technologies. He noted that AUKUS, in particular, is a cooperative framework that goes beyond the sharing of submarine technology that is drawing attention, and that through cooperation on AI, quantum, cyber, hypersonic, space, and other technologies, AUKUS is expected to contribute to Australia's long-range strike capability and domestic manufacturing capacity. He expressed his hopes for QUAD in realizing cooperation on military-civil dual-use technologies, especially in the aforementioned areas. Furthermore, he expressed the view that Australia has entered an era which requires capabilities to project forces from the mainland to distant regions, such as Guam, the South China Sea, and the Taiwan Strait, in order to shape the regional situation, deter threats, and respond when deterrence fails.

Dr. Davis then discussed the impact of emerging technologies on future warfare. One of the specific issues he stressed was that the pace of development of emerging technologies and the pace of consideration of their future warfare uses at the concept level diverged from the actual pace of the equipment procurement cycle, pointing to the need to accelerate the procurement cycle. Dr. Davis noted that the future multi-domain operations environment will require human-machine teaming, predicting that the faster speed of operations and their increasing complexity will exceed the ability of human processing. In addition, he forecasted that China and Russia will have comparable capabilities, and noted the need to assume warfighting in circumstances where military

and technological advantages are undermined. As AI and autonomous systems take on a greater role, the nature of human involvement becomes a dilemma. Dr. Davis said it was necessary to consider the balance between delegation to autonomous systems and human intervention, as well as the risk of China, Russia, and other countries with different ethics than the West leading the introduction of autonomous systems. Concerning tangible trends, he mentioned transformation of space into a warfighting domain and the development of hypersonic and long-range strike weapons, and cited the need to strengthen the resiliency of space capabilities and directed energy weapons to counter these developments.

Lastly, Dr. Davis addressed the issue of civil-military fusion. He said while it is known that civil-military fusion is important given that the private sector is leading the development of emerging technologies, the traditional procurement system once again poses as an obstacle. He raised the question of whether democracy or authoritarianism is advantageous for civil-military fusion.

Dr. Raska made a presentation titled "Defense Innovation and the Future of Conflicts in East Asia." First, he discussed what changes have taken place. Dr. Raska stated that the security environment in East Asia has become ever more complex, and that existing major flashpoints have become increasingly interconnected, embedded in the strategic competition between the U.S. and China. Furthermore, he expressed the view that the relationship between technology, innovation, and national strength is changing, namely, innovation through revolutionary technology has become a source of national strength, resulting in a race for technological dominance between not only the U.S. and China but also among many countries and bringing an end to the West's hegemony over emerging technologies. In addition, he noted that the starting point for innovation in emerging technologies has shifted to the private sector rather than the military, and thus the competition over technology is also a contest for the ability to use private sector technology for military purposes. Dr. Raska refers to the ongoing military transformation with these characteristics as "AI RMA (Revolution in Military Affairs)," arguing that its context is similar to previous transformations but that the actual characteristics differ from before. In this context, he explained that Singapore is also transforming its military, motivated not only by the aforementioned security environment but also by domestic circumstances, such as the declining birthrate, as well as the country's desire to increase strategic independence by reducing technological dependence on foreign countries. Lastly, Dr. Raska pointed out that the nature of warfare is likewise changing, noting that automated warfare, featuring heavy use of high-tech capabilities such as human-machine

teaming and cyber capabilities, will coexist with new forms of hybrid or gray zone conflicts that mainly use low-tech military capabilities.

Secondly, Dr. Raska discussed what has not changed. Specifically, he noted that the uncertainty and complexity of war, which Carl von Clausewitz termed as fog and friction, will remain; that the effects of new innovations are relative to the capabilities of the opponent and therefore the cycle of evolving technological, operational, and organizational countermeasures will repeat itself; and that it is humans who control technology and humans will continue to make the decision to resort to war.

Lastly, Dr. Raska discussed what should change. He stated that measures should be taken in leveraging innovation, such as providing incentives to use previously underutilized resources such as universities and the private sector. He also pointed out the need for institutional agility in the bureaucracy, noting that faster and more creative use of innovation depends on the ability to embrace change by the government bureaucracy. He concluded that it is important to address the international governance of emerging technologies to ensure competition over technology does not go out of control.

Dr. Danilin gave a presentation titled "Beyond Technology: Political Economy of the U.S.-China Digital Conflict and Its Global and Regional Implications." Dr. Danilin began by providing an overview of the market conditions of information and communication technologies (ICT), explaining that a small number of countries account for a considerable share of this global market. He pointed out that there is significant division of labor and interdependence in the ICT industry supply chain, noting that China's ICT industry with a rapidly growing presence is heavily dependent on imports of high-tech components from the U.S. and other countries and that the U.S. still has superiority in the number of citations in cutting-edge technical papers and so on. He perceived that China is still on the path to becoming a leader in research and technology. China's leadership is concerned about this dependence and aims to restructure the global value chain and gain advantage in future markets under techno-nationalism. Dr. Danilin pointed out that such behavior is not unique to China and that it is shared more or less by emerging economies.

Dr. Danilin explained that the U.S. response to China's digital rise dates back to the mid-2010s, i.e., it did not begin during the Trump administration and still continues in the Biden administration. He discussed that the strategic containment of China is supported by several logics, such as defense, economic security, and politics, which in turn make this policy sustainable. He then stated that the U.S. measures are familiar ones that have been seen in the past. At the same time, he pointed out that similarity with past

cases is limited as the situation of the U.S.-China confrontation is different from that of the technological competition between the U.S. and the Soviet Union or between Japan and the U.S., which was biased toward either the military or the economy.

Dr. Danilin noted that the political economy of the ongoing technology competition is characterized by a strong logic to securitize digital technology. That is, the discourse of technological innovation, combined with geopolitics and domestic conditions, has led to the perception of digital and high-tech markets as "strategic resources," to the interpretation of emerging technologies as crucial structural and institutional power, and to the use of the actions of companies and others as tools for projecting power.

Lastly, Dr. Danilin discussed the global and regional impacts of such technology war. He viewed that the perception of digital technology as part of a non-cooperative game will increase the likelihood of conflict and create blocs that will force countries to decide which of the conflicting camps to join. At the same time, he pointed out that ICT technology and the Internet market cannot be completed in a single country, making globalization inevitable, and expressed hope that this will provide a type of buffer against geopolitical conflict.

In the Session 2 discussion, discussant Mr. Akimoto asked the following questions regarding the three presentations. He asked Dr. Davis about the implications for the technology innovation policies of AUKUS and QUAD, Dr. Raska about the future of the technology innovation ecosystem and prospects for international cooperation, and Dr. Danilin about the implications of the "Thucydides' trap" (a metaphor mentioned in his presentation) in the technology competition.

Dr. Davis stated that the key domain where AUKUS will bear fruit most quickly, before the submarines to be deployed in the 2030s, is R&D of quantum, AI, cyber, hypersonic, and other emerging technologies. He noted that QUAD also offers more room for cooperation on R&D of dual-use emerging technologies than traditional military cooperation, and conveyed the importance of deepening cooperation between AUKUS and QUAD on these common tasks. Citing the ongoing U.S.-Australia technical cooperation on unmanned underwater vehicles as an example, Dr. Davis noted that the impacts of developing such emerging technologies and their implementation in the defense sector should be considered, specifically, the impacts on postures based on traditional equipment requiring deployment time, such as submarines.

Dr. Raska noted that developing future defense capabilities solely in cooperation with the traditional defense industry will become difficult in a region like East Asia, where interstate security rivalries and economic interdependence coexist and the security

environment could change dramatically with rapid technological innovation. For this reason, he stressed the need for defense authorities in each country to strive to build relationships with startups and other emerging players and create a collective defense innovation ecosystem that transcends the traditional defense industry. In this regard, Dr. Raska highlighted the critical importance of institutional and organizational foundations that will enable defense authorities to absorb and apply innovative technologies and ideas flexibly and quickly.

Dr. Danilin responded that the "Thucydides' trap" metaphor refers to a situation in which techno-nationalism amidst the U.S.-China competition or the competition between democracy and authoritarianism spills over into global market activities for high-tech technologies, making mutual cooperation and negotiations (for the pursuit of economic gain and the R&D of high-tech technologies) impossible. While the present U.S.-China technological competition debate tends to emphasize the superiority in emerging technologies as the source of national competitiveness, he noted that on the contrary it is necessary to understand the negative aspects of the current competition as described above.