Foreign Policy
at BROOKINGS

Incorporating Unmanned Aerial Systems Into The Japan Air Self-Defense Force

Colonel Ryoji Shirai,
Japan Air Self-Defense Force
INTERNATIONAL SECURITY FELLOW

CENTER FOR 21st CENTURY SECURITY AND INTELLIGENCE

POLICY PAPER
September 2014

Foreign Policy
at BROOKINGS

The views expressed in this monograph are those of the author and do not reflect the official policy or position of the Government of Japan or Japan Ministry of Defense.

COVER PHOTO COURTESY OF THE U.S. AIR FORCE FLICKR, SENIOR AIRMAN NICHELLE ANDERSON
HTTPS://CREATIVECOMMONS.ORG/LICENSES/BY-NC/2.0/LEGALCODE

CONTENTS

ILLUSTRATIONS

ACKNOWLEDGMENTS

The author would like to thank Peter W. Singer, Tom "Boot" Hill, Col. Cyril Carcy, Grp. Capt. Jez Milne, Col. Pedro Renn, Wg. Cmdr. Phil Arms, Cmdr. Thomas King (USCG), Col. Kenneth Ekman (USAF), Col. Johnnie Johnson (USA), Krista Couture (NCTC), Cmdr. Robert DeBuse (USN), Col. Aaron Marx (ret., USMC), Cmdr. Greg Knepper (USN), and Maj. Gen. Atsushi Hikita for their helpful comments on this paper.

EXECUTIVE SUMMARY

This paper seeks to provide military policy makers and planners with constructive suggestions for the acquisition of Unmanned Aerial Systems (UAS) given the regional strategic environment in East Asia and Japanese military culture. The strategic environment around Japan has grown more complicated with the rapid expansion of military activity in the sea and airspace surrounding Japan, including incursions into Japanese territory.

One of Japan's most important military modernization plans is the Japan Air Self-Defense Force's (JASDF) replacement of the F-4 fighter jet with the Joint Strike Fighter (F-35). Although this requires considerable funding, JASDF also plans to acquire airborne radar and tanker aircraft. At the same time, JASDF must reinforce its ISR capabilities to keep watch over the East China Sea. If Japan pursues both fighter and ISR upgrades, it might create a military imbalance in the East Asian theater over the next decade and strain fiscal and human resources. Thus, Japan should focus on acquiring new systems that can be quickly deployed to the front and will cost less than conventional weapons. It must be UAS. This paper argues that UAS will fully support the modernization of the JASDF.

But which systems should Japan acquire and for which missions? The U.S. Air Force (USAF) model is pilot-based, but the U.S. Army also operates UAS equipped with sensors and weapons. JASDF should consider the USAF as a model and operate the same UAVs so it can fully benefit from American expertise. Nowadays, UAS not only provide intelligence with their sensors, but they also play a decisive role in combat. The USAF has improved the UAS contribution to joint warfighting operations. Given these developments, Japan must focus on Chinese and South Korean responses in case Japan starts to operate UAS and consider how to create a UAS culture both within and without Japan's borders.

In the end, I suggest three important concepts related to "doctrine, leadership and culture." It is critical that the doctrine highlight the need to adapt to increased missions without extra cost and overloads. When formulating UAV doctrine, Japan must include an operational concept for the future mission and alternative plans for delayed modernization programs. An autonomously controlled UAV such as UCAV could compensate for conventional air power. Second, in order to implement UAVs effectively, leaders must be fluent in UAV capabilities and have a future vision for UAV contributions to war. The JASDF also needs to create a new UAV culture. All JASDF members should learn about UAVs to help eliminate prejudices against them. The Japanese military should create a joint operations research team for UAVs in the Joint Chief of Staff, cooperate with the Joint UAS Center of Excellence to learn from U.S.

military expertise and enhance interoperability. The JASDF should also expand UAV culture outside their organization in order to execute ISR missions efficiently with allied forces. NATO already has these kinds of organizations, known as JCGISR and JCGUAV.

Furthermore, Japan has been forced to deal with the unilateral creation of the Chinese air defense identification zone. The JASDF must take into consideration the need to avoid an unexpected accident, such as a midair collision. We need to establish a risk-averting mechanism as well, such as a multilateral organization to resolve sensitive incidents and improve allied force interoperability.

CHAPTER ONE
Introduction

"…The idea of the future being different from the present is so repugnant to our conventional modes of thought and behavior that we, most of us, offer a great resistance to acting on it in practice."

—John Maynard Keynes
Some Economic Consequences of a Declining Population, 1937

"The military is expected to increase its use of robots to reduce exposure in high-risk situations and environments as well as the number of troops necessary for certain operations."

—*Global Trends 2030: Alternative Worlds*, December 2012

2014 is a significant memorial year for the world, as it marked the 100th anniversary of the start of World War I (WWI) on July 28, 1914. It was the beginning of a total war, which put many countries on a compulsory war footing. WWI was also a revolution in warfare, catalyzing advanced developments in technology. Japanese Imperial Army officers who were stationed as military attachés in European countries observed the Great War firsthand. When they returned to Imperial Japan, they started to reform their force structure, operational doctrine, and personnel system in order to be prepared for the next total war. However, 30 years later, their aggressive efforts resulted in the defeat of Japan via mass destruction. One of the primary reasons why the Imperial Japanese Military was defeated so decisively, and after such a long period of time, was that military leaders could not abandon their conventional ways of thinking about war even though they were aware that technology had changed enormously.

2014 is also a significant year for Japan because the Japan Air Self-Defense Force (JASDF) celebrated its 60th anniversary on July 1. Once the JASDF finishes celebrating, Japan will need to address serious security issues and challenges that will have important implications for the Japanese military's force structure in the coming years. Indeed, the strategic environment surrounding Japan has become more complicated and threatening to the regional security of East Asia. In April and December 2012, North Korea launched missiles presumed to be a part of a ballistic missile test. There has also been a rapid increase of Chinese activity in the sea and airspace around Japan. On September 5, 2013, JASDF fighters (F-15J) were scrambled to intercept an unknown

aircraft flying over the East China Sea. The JASDF pilots observed H-6 strategic bombers flying across the first island chain to the Western Pacific. And the next day, the Japanese Ministry of Defense asserted that Chinese UAVs were ready to be operated close to Japanese airspace. The rise of a Chinese blue-water navy in the East and South China Seas could make for tense relations reminiscent of the Balkan Peninsula 100 years ago. Historian Margaret MacMillan stated at a Brookings Institution panel event, "I think the South China Sea is very dangerous, partly because it's heating up."[1]

In reaction to these provocations, Japan has planned to increase its defense budget for the first time in 11 years. In addition, crucial security-related documents, such as an updated U.S. Quadrennial Defense Review (QDR) and the new Japanese National Defense Program Guidance (NDPG), are under review in their respective governments. And the modernization of the JASDF's force structure has already begun. One of the biggest projects is the replacement of the F-4 fighter jet with the Joint Strike Fighter (F-35). Although this program requires a massive amount of funding, the JASDF plans to acquire airborne radar and tanker aircraft as well. Moreover, the JASDF has to reinforce its intelligence, surveillance and reconnaissance (ISR) capabilities in order to provide greater intelligence over the East China Sea and to supplement its counter anti-access/area denial (A2/AD) assets.

If the JASDF pursues both of these objectives via conventional means, it might result in an imbalance of military forces in the East Asian theater over the course of the next decade as it takes significant time to complete such programs. Japan could run out of money and human resources in this ambitious pursuit. Therefore, the Japan Self-Defense Forces (JSDF) should focus on acquiring new technology, which could be faster deployed to the frontlines and may be cheaper than conventional weapons. These considerations call for developing unmanned aerial systems (UAS) to support the modernization of the JASDF's capabilities.

The JASDF has used the U.S. Air Force (USAF) as a model since its establishment. U.S.-made weapons and equipment such as fighters, cargo aircraft, and other weapons are critical assets to Japan. Japan should acquire and operate the same UAVs used by the USAF in order to take advantage of the U.S. military's expertise. But which system should Japan acquire to best fit its requirements? Nowadays, UAS not only provide intelligence via their advanced sensor capabilities, they also play a decisive role in combat. The USAF has improved its UAS contribution to joint warfighting operations. In light of this development, Japan needs to focus on managing UAS issues with China and South Korea before operating new technologies. The JSDF also need to consider how to create a distinct UAS culture. The USAF model for UAS is pilot-based, but the U.S. Army is also operating UAS equipped with sensors and weapons without pilots.

The purpose of this paper is to provide Japanese military policymakers and planners with constructive suggestions dedicated to implementing a UAS capability in

the JASDF while considering Japan's current strategic environment and national military culture, which currently frowns upon unmanned weapons as a result of negative public attitudes. First, I start by examining five basic questions regarding a potential acquisition of UAS by the JASDF. By addressing these questions, I will clarify the most appropriate UAS to implement for the current Japanese security environment. Second, I will assess these five considerations by answering the five basic questions through case studies of the U.S. military and other countries' air forces. Third, I will classify the most appropriate model of UAS to implement, including whether a pilot-based model or sensor-based model is best in order to clarify the essential characteristics of UAS that best match the specific features of Japan's unique mission and culture. Fourth, I will address how UAS should be operated in the Asia-Pacific theater. In other words, I will clarify how a UAS structure should be organized and operated to fulfill its ISR role and other future operations in the Japanese military. I will also address what the JASDF's leadership should do to address the unmanned revolution. Lastly, I will propose feasible, constructive, and conceptual courses of action to implement UAS in Japan. The main consideration is to avoid an enormous Japanese defense budget and manpower increase. Therefore, I will provide a UAS roadmap dedicated to modernizing Japanese ISR capabilities with limited resources and manpower, taking into account the current JASDF doctrine, education, personnel and organization.

Notes

[1] Margaret MacMillan, author, "Preventing Another Great War: Lessons From 1914," remarks made at the Brookings Institution, Washington, DC, November 7, 2013. From transcript http://www.brookings.edu/~/media/events/2013/11/7%20great%20war/20131107_macmillan_wwi_transcript.pdf, p 40.

CHAPTER TWO

Considerations for Implementing UAS Capabilities Into the JASDF

UAS:

1. *That system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft. Also called UAS.*[1]

2. *An unmanned aircraft system is defined as a system, whose components include the unmanned aircraft and all equipment, network and personnel necessary to control the unmanned aircraft.*[2]

"Unmanned Air Systems are far more than the platform and definitely are not self-determining or self-sufficient. They are designed by humans, controlled by humans, with operational decisions by humans."

—Air Marshal Geoff Brown, July 3, 2013

Background and Definition of UAS

The terminology related to unmanned aerial vehicles (UAVs) has evolved over time. In the early iterations of these systems, unmanned aircraft were called "drones." Later, they were identified as "UAVs." As UAVs became more popular, the term "remotely-piloted aircraft" (RPA) emerged in an attempt by the USAF to remind the public of the "man in the loop" interface. Finally, the most recent term to describe aircraft that operate without a pilot physically onboard is "unmanned aerial systems" (UAS). The term "Unmanned aircraft (UA)" is reserved only for discussing the aircraft portions of the system. This paper uses the acronym UAS to encompass all other terms including UAV, UA and RPA because it encompasses the entire system (vehicle, ground station, operating networks, etc.). The term UAS refers to all parts of the system, including sub-systems.

Japan's efforts to secure and utilize UAS began in 1984 when it operated a QF-104J, which took place nearly 20 years after the QF-104A's first successfully completed unmanned mission in the U.S. In 1986, Japan's attempt at manning the QF-104J was successful, and the JASDF was able to operate a remotely-piloted fighter aircraft. Currently, the JASDF is researching an unmanned reconnaissance system made by the Technical Research and Development Institute (TRDI). This autonomous system is

launched from an F-15 and is able to collect and gather data before returning to base automatically. This system is discussed in greater detail in Chapter Five of this paper, but it is important to note that this program has been developed for demonstration purposes only and needs more time and funding to become operational.

These programs aside, the JASDF has not addressed the question of UAS acquisition. Western countries have already taken for granted that UAS provide added value to Joint Force operations, especially for a counterinsurgency missions where they conduct strike missions with UAS. However, the JASDF is spending money for conventional weapons modernization even though it recognizes the need to invest in the UAS realm to better monitor threats in the Asia-Pacific.

FIGURE 1. Midterm Defense Program[3]

Following the new National Defense Program Guidelines and Midterm Defense Program, released at the end of last year, the Japanese Ministry of Defense (MOD) decided to acquire three UAVs in order to reinforce its ISR capabilities. As a result, many questions have arisen surrounding the incorporation of these new systems into the force structure. Why does the JSDF need an unmanned system? Who should operate the aircraft? How do the new systems fit into existing command and control (C2) architectures?

Considering the current UAS environment, if MOD wants to introduce UAS into the JASDF, it will need to address five basic questions.

- What kind of equipment should the JASDF acquire?
- For what purposes and missions should UAS be utilized?

- How should the JASDF organize UAS force structure?
- Who should control UAS, and what kind of training and personnel systems should the JASDF implement?
- Which service should be in charge of the UAS sector?

The purpose of this paper is to answer these five questions, taking into account U.S. and other allied expertise. This report will provide the most appropriate options able to match the JASDF commitment.

What Kind of Equipment Should the JASDF Acquire?

There are as many kinds of UAS as there are ways of operating them. In the U.S. military, each service operates different types of UAS depending on mission requirements. There are several criteria used to classify UAS: weight, altitude, range, operational use (remotely piloted aircraft or autonomous systems), and so on. Some UAS are similar to radio-controlled aircraft while others are operated remotely from a cockpit that closely resembles a real airplane or even a much more complex monitoring system. Moreover, other systems do not require any pilot input but just need a pre-programmed mission to fly automatically. In the near future, UAS will be able to execute their missions autonomously with artificial intelligence.

Different countries and agencies classify their UAS platforms in various ways. The UK joint doctrine classifies UAS by the platform's maximum gross takeoff weight.[4] The UK has created three classes of UAS: aircraft weighing less than 150 kilograms, between 150 kilograms and 600 kilograms, and greater than 600 kilograms. The Central Intelligence Agency categorizes UAVs in three ways: mini, tactical, and strategic.[5] Mini UAVs fly at low altitudes (0-3,000 meters), can remain aloft for a couple of hours, and operate at close range to their controller. The American UAV Raven falls into this category. Tactical UAVs fly at low-to-medium altitudes (3,000-10,000 meters), can remain aloft for several hours, and are limited to the line-of-sight of the controller (approximately 300 kilometers or less on land). The U.S. Army's Shadow UAV falls into this category. Strategic UAVs fly at medium-to-high altitudes (above 10,000 meters), can remain aloft for hours to days, and can operate at a long range from their controllers. The USAF Global Hawk (RQ-4) falls into this category.[6]

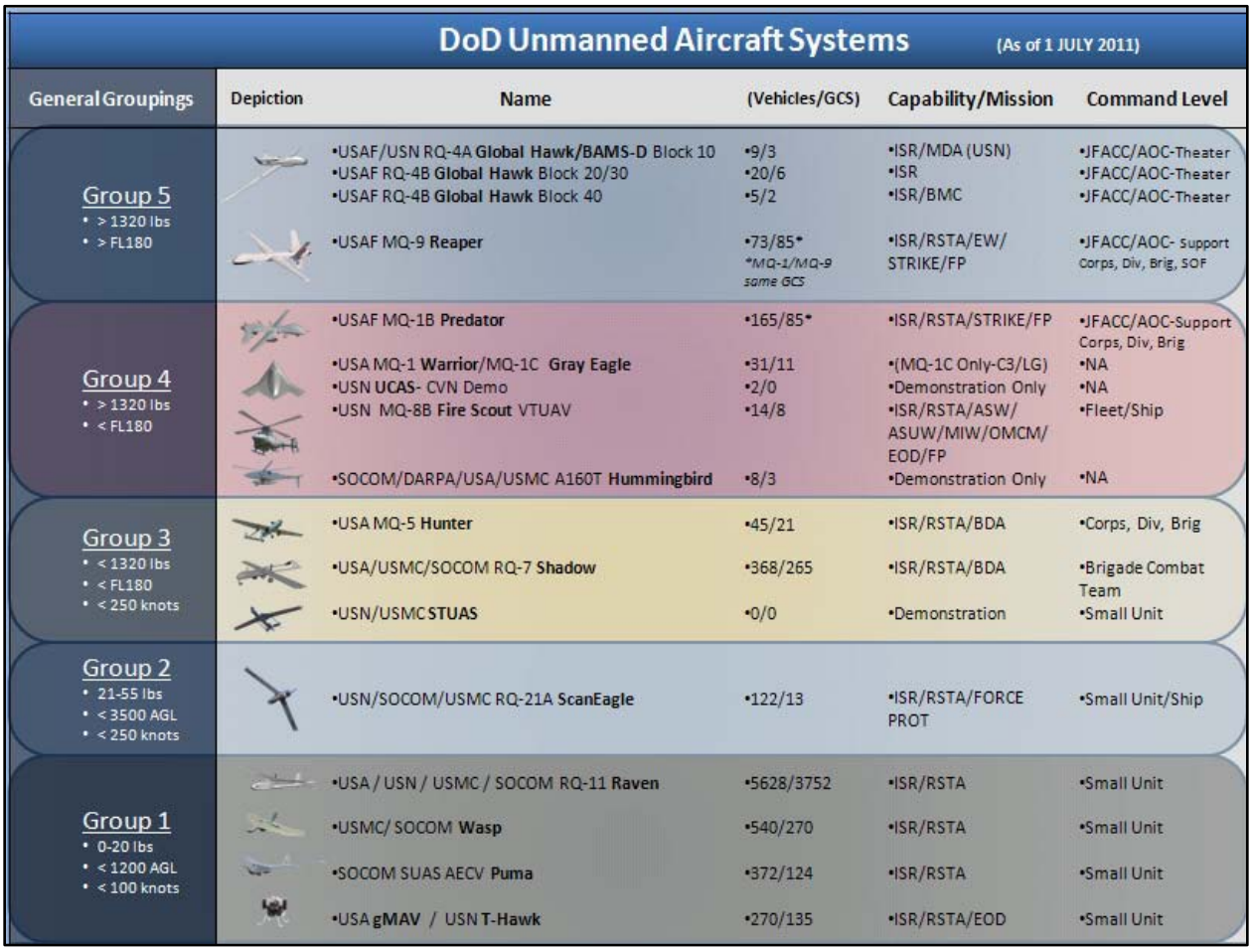
Considering UAS operations in constrained Japanese airspace, the JASDF should consider operational altitude in order to establish an appropriate classification. According to the Civil Aeronautics Law of Japan, airplanes must fly 500 feet above the ground and above any obstacle.[7] It may be permissible for a small UAS, such as ScanEagle operated by the Japan Ground Self-Defense Force, to fly below 500 feet. However, this UAV is not practical as a UAS because it does not offer enough of a bird's-eye view to detect targets. Acquiring line of sight on targets is the most important requirement for ISR missions in the southwestern area of Japan because of its islet areas. Sea-based UAS would also be useful in this particular area.

There is another important consideration for Japanese airspace: an excess of air traffic over the Japan Archipelago that limits UAS flight below 40,000 feet, where manned aircraft dominate. UAS should stay higher than 40,000 feet. Given these constraints, a high-altitude, long-endurance (HALE) system like the RQ-4 or a medium-altitude, long-endurance (MALE) system like the MQ-9 might be the best options for the JASDF. If the JASDF operates an RQ-4, it will need to identify a segregated area in which it is authorized to ascend to 40,000 feet. For example, Iotou airbase has a long runway and a large military mission area labeled "S" around the island, which can be used for the aircraft's climb. It might also be possible for a future RQ-4 platform to take off from an island that does not belong to Tokyo and Naha Flight Information Regions (FIR). Such a scenario could be achievable in the Mariana Islands, including Guam.

What about MALE systems like the MQ-1 (Predator) and MQ-9 (Reaper)? These UAS have flown more than two million hours and offer excellent cost-effectiveness – the average annual cost per flying hour of the RQ-4 is 10 times higher than MQ-9.[8] It is important to consider the issue of manpower as well. 24/7 Canadian patrol missions that utilize three RQ-4 units requires approximately 280 people. A MALE system such as the MQ-9 (Reaper) requires 171 people for a similar mission.[9] These UAS provide greater versatility for the military operations, and their strike capabilities especially make such UAS the most effective weapons for counterinsurgency and peacemaking operations. Considering the high number of UAS produced by General Atomics, logistical management is very efficient. However, if the JASDF invests in a MALE enterprise, the UAS base would be located on Japanese territory and could cause airspace issues. Considerations as to which UAS should be procured must take into account basing locations and transit times to areas of interest. Mini and Tactical UAVs may not be able to effectively navigate the area between the mainland and Okinawa because of extremely strong headwinds. One potential solution would be to utilize a strategic system that is integrated with tactical UAS that operate from either ships at sea or forward deployed bases.

Given Japan's political climate and the public's negative attitude towards the military, HALE may be the best option for implementing UAS into MOD. However, the procurement of MALE could best meet expanded mission sets in a cost-effective manner in the future. A demand for weapon systems could occur if the security environment evolves. The type of UAS is just as important as determining which missions are most critical for Japan.

FIGURE 2. Types of UAS (DOD Groupings)[10]



DoD Unmanned Aircraft Systems (As of 1 JULY 2011)

General Groupings	Depiction	Name	(Vehicles/GCS)	Capability/Mission	Command Level
Group 5 • > 1320 lbs • > FL180		•USAF/USN RQ-4A **Global Hawk/BAMS-D** Block 10	•9/3	•ISR/MDA (USN)	•JFACC/AOC-Theater
		•USAF RQ-4B **Global Hawk** Block 20/30	•20/6	•ISR	•JFACC/AOC-Theater
		•USAF RQ-4B **Global Hawk** Block 40	•5/2	•ISR/BMC	•JFACC/AOC-Theater
		•USAF MQ-9 **Reaper**	•73/85* *MQ-1/MQ-9 same GCS*	•ISR/RSTA/EW/ STRIKE/FP	•JFACC/AOC- Support Corps, Div, Brig, SOF
Group 4 • > 1320 lbs • < FL180		•USAF MQ-1B **Predator**	•165/85*	•ISR/RSTA/STRIKE/FP	•JFACC/AOC-Support Corps, Div, Brig
		•USA MQ-1 **Warrior**/MQ-1C **Gray Eagle**	•31/11	•(MQ-1C Only-C3/LG)	•NA
		•USN **UCAS**- CVN Demo	•2/0	•Demonstration Only	•NA
		•USN MQ-8B **Fire Scout** VTUAV	•14/8	•ISR/RSTA/ASW/ ASUW/MIW/OMCM/ EOD/FP	•Fleet/Ship
		•SOCOM/DARPA/USA/USMC A160T **Hummingbird**	•8/3	•Demonstration Only	•NA
Group 3 • < 1320 lbs • < FL180 • < 250 knots		•USA MQ-5 **Hunter**	•45/21	•ISR/RSTA/BDA	•Corps, Div, Brig
		•USA/USMC/SOCOM RQ-7 **Shadow**	•368/265	•ISR/RSTA/BDA	•Brigade Combat Team
		•USN/USMC **STUAS**	•0/0	•Demonstration	•Small Unit
Group 2 • 21-55 lbs • < 3500 AGL • < 250 knots		•USN/SOCOM/USMC RQ-21A **ScanEagle**	•122/13	•ISR/RSTA/FORCE PROT	•Small Unit/Ship
Group 1 • 0-20 lbs • < 1200 AGL • < 100 knots		•USA / USN / USMC / SOCOM RQ-11 **Raven**	•5628/3752	•ISR/RSTA	•Small Unit
		•USMC/ SOCOM **Wasp**	•540/270	•ISR/RSTA	•Small Unit
		•SOCOM SUAS AECV **Puma**	•372/124	•ISR/RSTA	•Small Unit
		•USA **gMAV** / USN **T-Hawk**	•270/135	•ISR/RSTA/EOD	•Small Unit

For What Purposes and Missions Should UAS be Utilized?

An unmanned aircraft is not limited by human performance or physiological restrictions. Therefore, extreme persistence and maneuverability are intrinsic benefits that can be realized by UAS. Given that these systems are unmanned, potential UAS operational environments can include contested and denied areas without exposing a crew to those risks. Indeed, a UAS would be the best solution for executing a 3D (dangerous, dirty, dull) mission. However, UAS with attack capabilities already operate worldwide day and night, sometimes attacking terrorist targets. And although there is human determination in the kill chain, there is still much debate over the ethics and morals of drone strikes. Given the relationship between man and machine, Japan needs to think carefully about why it wants to implement UAS and how it must balance conventional weapon systems accordingly.

UAS carry out any number of missions for various countries. They have been developed to carry cruise missiles; the USAF used drones for reconnaissance missions in Vietnam War; and Israel used drones for the same purpose in the Six-Day War. They

have been employed in the Global War On Terror (GWOT) because the military has been forced into Military Operations Other Than War (MOOTW) where the enemy, such as terrorists and their organizations, are non-state actors. Some UAS, like the MQ-9, combine attack and reconnaissance functions because in asymmetrical warfare many platforms must locate, pursue, and target individuals and small groups all at once. Nobody would disagree that a MALE system is useful for asymmetrical war and counterinsurgency versus a conventional weapon, but they could also be easily overcome in contested airspace. An unmanned combat air vehicle (UCAV) could ameliorate this concern.

Japan renounces war in its constitution, so the JSDF must focus on homeland defense. The JASDF in particular defends the air domain with a force structure focused on air defense and air domain vigilance. The JASDF's attack capabilities are also limited, and its surveillance capability is not perfect. In December 2012, the JASDF was convinced that a Chinese airplane, undetected by radar, violated Japanese airspace belonging to the Senkaku islets, demonstrating several weak detection areas against low-level targets around Japanese territory, including the East China Sea and Ogasawara islets. Japan is confronted by the threat of a missile attack from North Korea as well. Thus, it is essential for the JSDF to improve its ISR capabilities in order to prepare for aggressive actions initiated by China and North Korea.

Japan especially needs to prepare for China's use of UAVs, which became apparent in September 2013 when a Chinese UAV approached Japanese territory. It will become commonplace for Chinese UAVs, including ones operating on ships at sea, to approach Japan's air domain. In these cases, scrambling jet fighters is not a proportional response. The JASDF needs to consider UAS for that kind of alert mission in order to keep the situation from escalating. However, the JASDF must recognize that sensor performance over water is much different than over land, and it would be difficult to observe both missile sites on land and on vessels, in addition to airplanes operating in the maritime. At the same time, JASDF must be vigilant of North Korean nuclear threats, and it is essential that JASDF reinforce radar detection areas around remote islands as soon as possible. In light of these issues, Japan's primary mission would call for UAS to support sea-based ISR and signals intelligence (SIGINT) missions.

The JASDF should start thinking about ways to improve its capability against A2/AD by using UAS for air-to-air refueling (AAR) and cargo missions.[11] "UAS are presently designed primarily for ISR missions with an emphasis on Full Motion Video. However, consideration should be given to developing UAS capabilities on SIGINT platforms, as well as the employment of active jammers," says Tom Hill, a UAS expert.[12] Additional missions could support air-to-air refueling, but consideration must be given to how much fuel a UAV could pass to fighter aircraft. Cargo UAS have been successful for the U.S. Marine Corps in Afghanistan, utilizing a rotary helicopter converted for unmanned operations (K-Max). This is a very interesting concept that has a lot of merit and potential.

Given the current situation in East Asia, the JSDF should maintain a balance of conventional weapons relative to other countries, but they should not engage in an arms race. The JSDF should focus on what they need to do rather than what they want to do. They need to consider cost-effective and manpower efficient solutions for implementing a UAS as well. It is critical to think about the force structure and education and personnel systems required for UAS in order to maximize effectiveness.

How Should the JASDF Organize UAS Force Structure?

There are several options for developing a UAS force structure. One is to establish an independent squadron; the other is to transfer UAS troops to a manned aircraft squadron. The JASDF could procure the troops required for each mission, including reconnaissance, education and special forces, but cannot create units for each Ground, Maritime, or Air SDF as they do not have enough capacity (unlike the U.S. military). It is also inefficient to match the number of UAS troops to the number of missions since MOD would procure only a limited number of UAS. Therefore, the JSDF should establish an independent UAS squadron and impose on it all UAS missions. It is important for UAS force structure that the UAS organization include an education and training system that can supply enough human resources when missions are expanded – gathering the persons from each service is one of the options.

Another consideration is who will be using UAS equipment. When the JSDF starts operating UAS, they will be confronted with a large influx of requests for ISR. Small UAS will be most needed by ground forces, especially when they are working in direct support of their operations. Larger UAS provide much more detailed and persistent ISR data. Therefore, control of the UAS will depend on who has an immediate data need. It will be necessary to establish a control system and set priorities like an ISR Wing before deciding the force structure. Without initial priority setting, UAS would only be used by individual national authorities.

Other considerations for force structure are the size and location of the squadron. UAS squadrons should emulate Air Defense troops, such as those in the Direction Center, or airborne early warning squadrons that maintain constant vigilance. The control module should be located in the Air Combatant Command (ACC) because it can use UAS flexibly during a transition from peacetime to wartime. Since the ACC can control Air Tactical Wing, which is in charge of creating new battle concepts, it is reasonable for UAS to attach to ACC for future operations. As one of the founders of the USAF's UAS programs, General John Jumper has noted that the initial operating location is an ideal location for "good communication…between the old and the new."[13]

Who Should Control UAS, and What Kind of Training and Personnel Systems Should the JASDF Implement?

UAS operations can be classified into two types. One is a remotely piloted aircraft system that requires human assistance for operation; the other is an autonomous system that does not depend on human control. Although these systems must include human decision-making to accomplish their mission, UAS could affect human decision-making, like the cycle of observe, orient, decide and act (OODA loop). UAS can quickly supply accurate information to any level commander directly and in a continuous manner, allowing for faster decision making because he or she could observe and orient the situation in real-time. There is a pitfall in this loop, however. Too much real-time information might convolute decision cycles. The next stage in technology will be autonomous control, but it will take more time to develop artificial intelligence for military operations.

Each American military service's culture, methods and missions shapes its UAS operations and doctrine, ultimately influencing the core interface between human and unmanned systems. Because the U.S. Army mainly uses UAS as sensors for tactical missions, it cultivates UAS operators by training suitable individuals regardless of rank through special education and training courses. In contrast to the U.S. Army's educational system, the U.S. Air Force imposes the qualification of pilot on UAS operators because the USAF regards UAS as aircraft – not just sensor systems – even though some experts would contend that flying a UAV is not as difficult as flying an airplane.[14]

A HALE or MALE system could be operated by an individual who is not a pilot. This operator would be able to assist intelligence analysts and operational strategic commanders in understanding how UAS can best coordinate operations and sensors with all other manned assets.[15] Other countries have also recently set up special educational systems for UAS operators. For example, the Australian Air Force (RAAF) assigned experienced pilots as UAS operators to bolster its UAS squadron, but it still created new qualifications for UAS operators.

The JASDF compromises when it is forced to refer to UAS as airplanes, a result of the country's narrow airspace. Japan cannot operate UAS without the support of its civil aviation bureau, and the JASDF's leadership must concern itself with issues of culpability should a mishap occur between UAS and civilian aircraft. As long as humans operate aircraft, mistakes will undoubtedly take place, but errors need to be minimized by assigning pilots as UAS operators. Of course, the current East Asian strategic environment is one in which unpredictable UAV movement from the west could induce an escalation of military tensions. As a result, Japanese UAS operators should be qualified pilots and officers who can accept accountability in emergency situations.

It would be difficult to maintain sound management of UAS squadrons unless the Japanese military seriously explored a new personnel system, including career paths and promotions for UAS operators. One option is to gather experienced pilots from each service for a short rotational post, such as one or two years of temporary duty. Of course, there would need to be a core member, perhaps someone equivalent to the senior pilot in a B-1 officer's group, or simply an airman first class.[16] There is an additional consideration: Since a JASDF UAS squadron would adapt to any kind of mission, it should consist of aviation experts from the Air Force, maritime surveillance from the Navy, and targeting on the ground from the Army.

Which Service Should be in Charge of the UAS Sector?

UAS have diverse capabilities; they can be used for missions at the tactical, operational and strategic levels. And there are diverse opinions on how to apportion UAS among military services. The U.S. employs UAS in every operational theater, including at the battalion level, brigade level, and so on. In the U.S. military, which has both medium and large UAS types, like MQ-9 and RQ-1, the Air Force is the primary operator. In contrast, Israel operates UAS in a joint capacity. Thus, it is paramount that UAS be subordinate to the appropriate command and control authorities. UAS have the ability to satisfy any level of ISR request, to include highly confidential information, routine surveillance information, unexpected disaster information, etc. If the JSDF need to fulfill requests from all of the services, every branch will likely procure and maintain its own UAS. This is inefficient and would create problems like frequency saturation.

Tom Hill notes that:

> JASDF should be in charge of HALE and MALE; Maritime UAS by JMSDF; and small UAS supporting ground forces by JGSDF. The determination of who defines mission requirements would be best made by operational, on-scene commanders, but having interoperable datalinks, networks and standards should enable easier sharing of information among all services. In the initial stages of a conflict having the UAS controlled by the Joint Staff does have the advantages of combining intelligence from multiple sources to develop the required strategic and operational deployment of adversary forces.[17]

According to the midterm defense program, although MOD will procure three UAVs and allocate them to the Joint Force, the JASDF should be in charge of administration command (ADCOM) because of its expertise operating aircraft at high altitude cruising. It also controls a surveillance and vigilance system. However, the JASDF does not have the ability to conduct maritime surveillance and ground targeting. Therefore, joint operations are needed for Japan to meet budget and manpower constraints. Ultimately, the Joint Chief of Staff should be in charge of command and control for UAS operations, and the Air Combatant Commander responsible for monitoring Japan's air domain should have ADCOM for UAS.

Summary and Assumptions: What are the Best UAS for the JSDF?

There are many considerations for implementing UAS in the JASDF. The JASDF is already behind countries that have been operating UAS in their militaries for more than 20 years. It is difficult to catch up to new UAS technology and doctrine, but Japan can learn from the efforts and debates that military services experienced while constructing UAS for military operations. In East Asia, the security environment is changing quickly and there is a high level of uncertainty, leaving the JASDF little time to construct UAS platforms. The MOD stated that it has set aside approximately $2 million to study the procurement of UAS, but it should also seriously consider constructing and cultivating UAS rather than procuring previously developed systems.[18] This chapter examined what the JASDF needs to consider before implementing UAS. Procuring HALE or MALE systems for ISR missions and constructing piloted control systems and organizations under the Joint Chief of Staff would be reasonable choices for MOD. In the next section, this paper further seeks to understand the best solution for implementing UAS into the JASDF by looking at the U.S. military's and other countries' efforts to implement UAS.

Notes

[1] United States Joint Chiefs of Staff, "Joint Airspace Control," Joint Publication 3-52, May 20, 2010, http://www.dtic.mil/doctrine/new_pubs/jp3_52.pdf.

[2] United Kingdom Ministry of Defence, "The UK Approach to Unmanned Aircraft Systems," Joint Doctrine Noe 2/11, March 30, 2011, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33711/20110505JDN_211_UAS_v2U.pdf.

[3] John Saeki and Adrian Leung, "Japan's Military Shopping List," Agence France-Presse, December 17, 2013, https://sg.news.yahoo.com/photos/japan-39-military-shopping-list-photo-084135690.html.

[4] "The UK Approach to Unmanned Aircraft Systems."

[5] United States Government Accountability Office, "Nonproliferation: Agencies Could Improve Information Sharing and End-Use Monitoring on Unmanned Aerial Vehicle Exports," GAO-12-536, July 2012, http://www.gao.gov/assets/600/593131.pdf, p 4.

[6] Gary John Schaub, Jr., Kristian Søby Kristensen, and Flemming Pradhan-Blach, "Unmanned and Unarmed: On the Future of Unmanned Systems in the Danish Armed Forces" (Copenhagen: Center for Military Studies, 2014), p 5.

[7] "Ordinance for Enforcement of the Civil Aeronautics Act," Ordinance of the Ministry of Transport No. 56, July 31, 1952, http://www.schedule-coordination.jp/archives/arc_aviation_law/2009/Ordinance%20of%20Enforcement%20of%20CAA%20in%20EN.pdf.

[8] Ashley Boyle, "The US and its UAVs: A Cost-Benefit Analysis," American Security Project, July 24, 2012, http://www.americansecurityproject.org/the-us-and-its-uavs-a-cost-benefit-analysis/.

[9] "Unmanned and Unarmed," p 23.

[10] United States Department of Defense, "Unmanned Systems Integrated Roadmap FY2011-2036," 11-S-3613,

http://www.acq.osd.mil/sts/docs/Unmanned%20Systems%20Integrated%20Roadmap%20FY2011-2036.pdf, p 21.

[11] United States Air Force, "United States Air Force Unmanned Aircraft Systems Flight Plan," May 18, 2009, http://fas.org/irp/program/collect/uas_2009.pdf.

[12] Tom "Boot" Hill, interview by the author.

[13] Houston R. Cantwell, "Beyond Butterflies: Predator and the Evolution of Unmanned Aerial Vehicle in Air Force Culture" (thesis, School of Advanced Air and Space Studies, Maxwell Air Force Base, 2007).

[14] Hill, interview by the author.

[15] Ibid.

[16] "Beyond Butterflies."

[17] Hill, interview by the author.

[18] Ida Torres, "Defense Ministry to Spend for Research on Surveillance Aircraft," *Japan Daily Press*, August 22, 2013, http://japandailypress.com/defense-ministry-to-spend-for-research-on-surveillance-aircraft-2234428/.

CHAPTER THREE

Case Study I: The U.S. Military's Commitment to UAS

"…military weapons are much more than the technological capability of the system. Its military potential is determined by the synergistic effect of its technology, organization, and doctrine."

—Lt Gen Brett M. Dula, USAF, 1997

The United States Army

The U.S. Army began combat operations in Afghanistan in October 2001 with 54 operational Hunter and Shadow unmanned aircraft. Today, the Army has 40,000 UAS of various sizes and capabilities with more forthcoming.[1] The Army has been incredibly successful in introducing UAS. In 1979, the Army started its first major UAS acquisition effort with the Aquila program. In 1985, the Department of Defense (DOD) procured the Pioneer, its first operational UAS, which flew over 300 combat missions during Operations Desert Shield and Storm in 1991 to hunt for Scud missiles and high-value targets for coalition commanders. In 2003, the Army deployed 13 aircraft for Operation Iraqi Freedom. Some 10 years later, roughly 1,200 unmanned medium and large aircraft are deployed in the field. Today, the U.S. Army has more UAS than the U.S. Navy and Air Force combined.[2]

Army UAS are categorized into five groups. Group one UAS are lightweight, man-portable, organic assets that provide timely and accurate situational awareness at the battalion-level and below. They typically operate within the operator's line-of-sight less than 1,200 feet above ground level. The RQ-11B Raven is an example. Group two UAS are typically medium-sized, catapult-launched mobile systems that support brigade-level (AGL) and lower ISR and target acquisition requirements. These systems operate less than 3,500 feet above ground level. Group three UAS operate at medium to long range endurance. They have a wider array of sensors as well as the capability of being weaponized with precision guided munitions, like the RQ-7B Shadow. Group four UAS are relatively large systems that must meet DOD airworthiness standards. Their payloads may include electro-optical/infrared sensors, radars, lasers, communication relays, SIGINT, automated identification systems, and weapons. The MQ-5B and MQ-1C are examples in this category. Group five UAS are the largest systems that perform specialized missions, including broad area surveillance and

penetrating attacks.[3] The Army is using a variety of UAS mainly as sensors for delivering information to any command post level.

U.S. Army-manned aviation is largely consolidated in the Combat Aviation Brigades. The exception is the Military Intelligence Aerial Exploitation Battalions organized to a Military Intelligence Brigade. In contrast, most Army UAS are decentralized to maneuver and support organizations across the Army's force structure, from platoon through corps levels. These organizational concepts include integrating UAS into manned aircraft organizations. For example, the Shadow UAS is integrated into redesigned attack and reconnaissance battalions.

The U.S. Army's UAS have diverse missions, including reconnaissance, surveillance, security, attack, command, control and communications (C3), combat support, and combat service support. However, the Army mainly expects that UAS will collect information and distribute it to command posts, manned platforms, and soldiers. For instance, an Apache pilot can use UAS sensors just as he uses those onboard his aircraft, except that the UAS can be up to 80 kilometers ahead of his aircraft. In this concept, UAS operators need not be traditionally qualified pilots.

The U.S. Army's Aviation Center of Excellence UAS Training Battalion (UASTB) at Fort Huachuca conducts all tactical UAS training, to include the Shadow, Hunter, and Extended-Range Multi-Purpose (ERMP) systems. The U.S. Army's Maneuver Center of Excellence at Fort Benning, Georgia, conducts all small UAS training, including the Raven. To keep pace with the prolific UAS growth, the U.S. Army will train more than 2,100 UAS operators, maintainers, and leaders in fiscal year 2012 (FY2012), which is an 800 percent increase compared to FY2003.[4] The UASTB's primary mission is to train UAS operators, mechanical and electrical repairers, warrant officers, and leaders in order to provide the ground force commanders with highly trained individuals. Additionally, the UASTB supports the joint community by training a large portion of U.S. Marine Corps and U.S. Navy UAS personnel. The UASTB executes 17 programs of instruction, which are broken into advanced individual training, officer education, and other common functional courses. Enlisted soldiers, sailors, and Marines attend a UAS Operator Common Core Course.

The United States Navy and Marine Corps

The U.S. Navy and Marine Corps have been operating UAS since the mid-1980s. AAI's RQ-2 Pioneer was first acquired and deployed on sea and land from 1986 until 2007 for reconnaissance and surveillance missions. It was developed jointly by the AAI Corporation and the Israel Aircraft Industry. However, a replacement program failed when Congress halted funding. The Navy turned over its RQ-2 fleet to the USMC, a total of 47 platforms, which initiated a Pioneer Improvement Program (PIP) in 2000, and as PIP funding began in 2003, the U.S. Air Force was already managing the HALE UAS program focused on the RQ-4 Global Hawk. As the Air Force planned to buy 51 RQ-4

through FY2011, the Navy funded two RQ-4 platforms in 2003 as part of an advance demonstration and evaluation (DEMVAL) effort associated with the Broad Area Maritime Surveillance (BAMS) program.

In this evaluation, there are interesting prospects for BAMS missions. The manpower related cost elements for P-3Cs – aircraft performing near equivalent mission sets – divided by the number of aircraft in the fleet results in a cost per aircraft multiplier. The BAMS manpower costs were determined to be 51 percent of P-3C costs. Of course, several assumptions based on factors such as BAMS manpower requirement will be filled by 100 percent military personnel and will vary between 136 and 199 personnel; taking the average of the values gives a notional manning of 168 personnel. The current average P-3C squadron manning is 330 personnel.[5] Thus, the ratio of 168 to 330 personnel provides a rough estimate for associated BAMS manpower costs.[6]

In 2007, Pioneer was retired by the Navy and was replaced by the Shadow UAS. The Navy procured vertical takeoff and landing tactical UAS, the RQ-8, for reconnaissance and targeting missions as well. However, the Navy has only one operational UAS squadron, the VC-6, thus far. The VC-6 is the Navy's only operational UAS controlled by personnel onboard Navy vessels. Tactical employment of this unique asset primarily supports both Battle Group deployments and Amphibious Warfare Operations.

The Navy's existing UAS programs are mostly limited to small, handheld tactical devices used for local intelligence, surveillance and reconnaissance. There are about 163 sailors holding the Navy's existing secondary (NECs) for UAS, which includes UAS pilots, technicians and payload operators. The primary UAS in service is the ScanEagle, a small aircraft with a 10-foot wingspan that sends live video feeds to ship commanders. The Navy has seven ScanEagles in service, which are prioritized for deploying ships. While traditional pilots will maintain their primary role, new technology is expected to push highly trained sailors into UAS roles including flight operators, real-time intelligence analysts, and targeting decision-makers. "UAS are going to provide an opportunity for sailors to get into a new realm of war fighting," says Rear Admiral Mark Guadagnini, the chief of naval air training. He also notes, "We have to decide what rating can be a part of this or do we need to generate a completely different, separate rating for unmanned aerial systems."[7] The Navy appears to be more willing to give key positions in the UAS community to enlisted personnel.

Meanwhile, the U.S. Navy wants a long endurance air surveillance vehicle capable of performing strike missions from a deployed carrier strike group. The Unmanned Combat Air Vehicle (UCAS) is one of two aircraft built by Northrop Grumman for the Navy to demonstrate the potential of using such drones from—and landing them on—aircraft carriers. Already, the X-47B has successfully launched from a carrier and successfully completed so-called "touch and goes," but the July 10, 2013

landing marked the first time the aircraft was captured on the flight deck.[8] The X-47B might be a game changer in the near future.

The United States Air Force

This relatively brief investigation into the evolutionary nature of the Air Force's UAS organization is meant to accomplish two specific objectives: to describe the multiple agencies and their importance to UAS development and to infer from the establishment of these agencies the attitudes and dispositions of senior-level Air Force decision makers towards UAS development.

The foundations were laid for remote-controlled vehicles and weapons just as WWI began. As individuals viewed war as less glorious and more deadly, unmanned weapons began to gain appeal. The "electric dog" and "land torpedo" are examples of early unmanned weapons. Currently, the operation of unmanned aircraft is virtually monopolized by the U.S. military, especially given the Air Force's strong foundation and advanced capabilities. Today, there are over 8,000 UAS and over 12,000 ground systems, with UAS now conducting over 500 strike missions per year (an increase of approximately 96 percent since 2009).

U.S. military spending on unmanned planes did not develop until 1979, when the Army's Aquila program came to fruition. The Aquila was a small propeller-powered drone that could circle over the front lines. Hints of reliable UAVs appeared during the Vietnam Conflict. Throughout Vietnam, the Air Force utilized unmanned systems at a rate never seen before. UAS flew thousands of sorties and provided valuable intelligence information to the warfighter. Throughout the 1960s and 1970s, Ryan Aeronautical Company manufactured dozens of models of UAS for the Air Force. The most notable set of these was the Ryan 147. The Air Force's operational name for these aircraft was the AQM-34, comprising almost 30 different models of which a majority flew actual combat sorties in Southeast Asia. By the time the last sortie was flown in 1975, Ryan 147 had flown over 3,400 sorties in the region.

On July 29, 1995, the Air Force established its first UAS squadron with the reactivation of the 11th Reconnaissance Squadron at Nellis Air Force Base. Its establishment coincided with the emergence of the MQ-1 Predator in the mid-1990s. Since then, numerous agencies have been created with myriad responsibilities pertaining to unmanned systems. As of May 2007, eight squadrons had been designated Air Force active-duty UAS squadrons. Pragmatism was the driving force behind the initial operating locations for both the Global Hawk and Predator. According to General Jumper, Beale AFB provided an ideal location for "good communication" between older and newer aircraft. The personnel for the older U-2 system could provide guidance to the operators of the Global Hawk. They could debate about who was better on the ground, while the Global Hawk operators learned how to best accomplish the ISR mission.[9]

The space also provided an important career path for future UAS operators. Thus, the Predator had finally earned "organizational wings" with an operations group. At the same time, the concept of holding a single squadron responsible for initial crew training and operational missions was, in the words of General Jumper, "totally out to lunch. The two missions just didn't go together."

Department of Defense Efforts

According to the Unmanned Systems Integrated Roadmap FY2011-2036, the DOD has been successful in rapidly developing and fielding unmanned systems. The DOD will continue to focus on responding rapidly to combatant commander requirements while ensuring systems are acquired within the framework of the DOD's new wide-ranging Efficiencies Initiatives.[10] The challenges facing all military services in the DOD fall into seven issue areas: Interoperability, Autonomy, Airspace Integration (AI), Communications, Training, Propulsion and Power, and Manned-Unmanned (MUM) Teaming.

DOD explained these issues in the Unmanned Systems Integrated Roadmap FY2011-2036. Interoperability is designed to achieve the full potential of unmanned systems. These systems must operate seamlessly across the air, ground, and maritime domains, as well as with manned systems. The next challenge is autonomous control. Today's iteration of unmanned systems involves a high degree of human interaction, but DOD continues to pursue technologies and policies that introduce a higher degree of autonomy to reduce the manpower burden and reliance on full-time, high-speed communications links. The Airspace Integration (AI) issue is one that the DOD must continue to work on with the Federal Aviation Administration (FAA) to ensure that UAS have routine access to the appropriate airspace needed within the National Airspace System (NAS) to meet training and operations requirements. The communications challenge pertains to unmanned systems relying on communications for C2 and dissemination of information. The DOD must continue to address frequency and bandwidth availability, link security, link ranges, and network infrastructure to ensure availability for operational/mission support of unmanned systems.

The issue of training requires an overall DOD strategy to ensure that continuing and joint training requirements are in place against which training capabilities can be assessed. Such a strategy will improve basing decisions, training standardization, and has the potential to promote common courses resulting in improved training effectiveness and efficiency. The challenge of propulsion and power amid the rapid development and deployment of UAS has resulted in a corresponding demand for more efficient and logistically supportable sources of energy. The final issue is Manned-Unmanned (MUM) Teaming. Today's force includes a diverse mix of manned and unmanned systems. To achieve the full potential of unmanned systems, the DOD must continue to implement technologies and evolve tactics, techniques and procedures (TTP) that improve the teaming of unmanned systems with the manned force.

The 2014 QDR addresses UAS-enabled ISR in the following manner: "Continuing a trend that began in the late 1990s, U.S. forces will increase the use and integration of unmanned aerial systems for ISR."[11] However, the Air Force will have to retire 80 more aircraft, including the Global Hawk Block 40 fleet, because of cost. The MOD should consider aligning their procurement plan with U.S. DOD planning because the JSDF's operations are based on U.S. strategy. The Unmanned Systems Integrated Roadmap offers an important clue for incorporating UAS into JASDF.

Summary and Lessons for the JASDF

In today's U.S. military, unmanned aerial systems are highly desired by each of the service branches. Each service has its own concept of UAS utility for its individual missions and culture. The UAS program was started by the U.S. Army Air Corps as a trial for strategic bombing with the QB-17 in WWII. The U.S. Air Force that evolved thereafter from the Army Air Corps began employing systems such as the AQM-34 Ryan for reconnaissance missions during the Vietnam War. However, UAS could not replace traditional manned reconnaissance aircraft due to technological limitations and cost concerns. Nowadays, the landscape of war has changed dramatically. The main source of conflict is frequently asymmetric and drawn out. As a result, UAS have proved that they are the most effective weapons to accomplish political and military objectives while keeping soldiers out of harm's way.

The U.S. Army pushed to utilize the UAS program in the GWOT, and the U.S. Army and Marine Corps are operating UAS in support of manned systems. They have many small and medium sized UAS, and each is apportioned between battalion and corps levels to provide the information required by each level of authority. These two branches also have a culture of recognizing UAS as trucks. Therefore, any soldier who takes special education for UAS operations becomes a UAS operator. This process is similar to the process to become a tank operator.

In contrast to the U.S. Army and Marine Corps, the U.S. Air Force has treated UAVs as airplanes. The Air Force restarted the UAS program following the DOD's development of the MQ-1. They have since developed operational concepts of UAS through their inherent knowledge of airpower, ultimately decreasing mishap rates and increasing operational times.[12] As part of the GWOT, the Air Force was confronted with a difficult task: Carry out attack missions against time-sensitive targets such as individual terrorists. To meet this objective, the Air Force developed armed UAS. The Air Force has independent UAS squadrons, and the UAS are controlled by qualified pilots. Nowadays, the Air Force faces strong limitations in assigning pilots as UAS operators because the demand for UAS operators has continued to grow, but the Air Force's pilot-based culture frowns upon assigning non-pilots as UAS operators.

The U.S. Navy is similar to the U.S. Army in concept, but they are pursuing autonomous operation by exploiting UCAV. The Navy took charge of the UCAV

program (known as the X-47) after the Air Force stopped employing the X-45. If they were to activate at the front line for a SEAD mission, the concept of UAS operations would have to be changed.

The DOD's efforts at UAS development also deserve examination because the Department created a roadmap that brought together precepts that the U.S. military has since used to develop UAS. With regards to the security environment in East Asia, the MOD needs to solve interoperability issues among ground, maritime, and air forces, including with the U.S. military. The MOD also needs to address airspace integration and communication issues, such as satellite bandwidth. The current security situation would not require the JSDF to use UAS for reconnaissance worldwide or to assault ground targets. Therefore, the JASDF should emulate the U.S. Army's model of using UAS for sensor operations. However, the JASDF should emulate the U.S. Air Force model in light of operating HALE and 24/7 operations. In regards to the AI issue, JASDF pilots should be UAS operators. Still, the most important consideration moving forward is to organize a combined ISR coordination center among allied military services like NATO. The JASDF needs to have joint development and evaluation teams in the Joint Staff Office, like the Joint Unmanned Aerial Systems Center of Excellence (JUAS COE), to study suitable MUM and UCAV operations in the near future.

TABLE 1. Classification of UAS in the U.S. Military

	Army	Navy (includes Marine Corps)	Air Force
Platform	MALE [MQ-1 (Warrior, Gray Eagle), MQ-5 Hunter] Small [RQ-7Shadow, RQ-11 Raven, gMAV]	HALE [RQ-4 ABAMS] MALE [MQ-8B Fire Scout] Smal l [RQ-7 Shadow, RQ-21, RQ-11, Wasp, T-Hawk] UCAV [X-47]	HALE [RQ-4A, RQ-4B Global Hawk] MALE [MQ-1B, MQ-9]
Purpose	• Corps Level (recon, surveillance, target acquisition, battle damage assessment) • Division Level (division fire support, battlefield surveillance) • Brigade Level (tactical level recon, surveillance, target acquisition, battle damage assessment) • Battalion Level (beyond visual line of sight recon, surveillance, target acquisition)	ISR, deep strike, and SEAD missions in the early stages of hostile operations	CAP, ISR, deep strike
Force structure	Apportion to each level of troops [Corps and Division Level- MALA; Others-Small]	Apportion to manned squadron	UAV squadron
Training and personnel	As sensor operator	Same as army, pursue autonomy	Pilot
Administration and C2	Army has ADCOM, MUM ops	Navy, independent ops	AF has independent ops

Notes

[1] United States Army, "Eyes of the Army: U.S. Army Roadmap for Unmanned Aircraft Systems 2010-2035," U.S. Army UAS Center of Excellence, http://fas.org/irp/program/collect/uas-army.pdf.

[2] Michael F. Spigelmire and Timothy Baxter, "Unmanned Aircraft Systems and the Next War," *Army Magazine* 63, no. 5 (May 2013): pp 55-58.

[3] "Eyes of the Army."

[4] Ibid., p 1.

[5] Keith Jacobs, "Manned and Unmanned Aerial Vehicles: Right Mix For Future U.S. Navy Aviation," *Naval Forces* 25, issue 5 (2004).

[6] Ibid., pp 38-48.

[7] Andrew Tilghman, "New rating considered for UAV operators," *Navy Times*, November 2, 2008.

[8] Brandon Vinson, "X-47B Makes First Arrested Landing at Sea," United States Navy, http://www.navy.mil/submit/display.asp?story_id=75298.

[9] "Beyond Butterflies."

[10] "Unmanned Systems Integrated Roadmap FY2011-2036."

[11] "Quadrennial Defense Review," United States Department of Defense, 2014, http://www.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf, p 38.

[12] "Beyond Butterflies."

CHAPTER FOUR

Case Study II: Lessons From Other Allied Air Forces

"The affinity of pilot for airplane has its parallel in the history in the cavalry soldier and his horse. The airman, like the cavalryman of the past was not known for his modesty, or his objectivity, when it came to the employment of his chosen steed."

—Perry McCoy Smith
The Air Force Plans for Peace, 1943-1945

The United Kingdom's Royal Air Force

The UK Royal Air Force (RAF) recognizes the necessity of UAS and operates them very effectively. According to UK Joint Doctrine, unmanned aircraft now hold a central role in modern warfare, and there is a real possibility that, after many false starts and unfulfilled promises, a technological tipping point is approaching that may well deliver a genuine revolution in military affairs.[1]

The RAF has two Remote Piloted Aircraft System (RPAS) Squadrons: 39 Squadron is currently based at Creech Air Force Base, and 13 Squadron is based at RAF Waddington, Lincolnshire. The UK has purchased a number of Reaper aircraft in support of UK ground forces in Afghanistan under the Reaper Urgent Operational Requirement (REAPER UOR). In January 2005, a new unit, No. 1115 Flight, was formed at Creech AFB in Nevada to operate the RAF's first UAS. Operating the MQ-1 Predator, the unit began training personnel in the operation of UAS prior to the standup of a new squadron. 39 Squadron was formed in March 2007. In 2012, it was announced that the RAF's XIII Squadron would operate five Reapers from RAF Waddington, in Lincolnshire, and that No. 39 Squadron personnel and their five Reapers would relocate from Creech to Waddington, with personnel beginning to return to the UK in 2013.[2]

The RAF's first UAS squadron structure imitated the USAF model. Therefore, it was no surprise that the RAF naturally assumed an aviator model. The aforementioned UAS were controlled by qualified pilots with conventional aircraft experience. However, although the RAF had been cultivating drone pilots from previously qualified pilots, they have started to train newly-qualified pilots exclusively for unmanned aircraft. Until now, all personnel operating RAF drones had been drafted from other sections of the RAF, where they piloted manned aircraft. All pilots had

undergone basic training for manned aircraft before specializing in drone flights, and RPAS pilots get a dedicated wings badge.

At the same time, the RAF and UK MOD have also taken the first step towards developing the next generation of Unmanned Combat Air Systems (UCAS).[3] Project Taranis, a joint MOD and BAE Systems (plus other key UK industrial partners) venture, was unveiled in 2010, and a demonstrator flew in 2011 in Woomera, Australia. The demonstration will be used to evaluate how RPAS/UCAS would contribute to the RAF's future mix of aircraft. The RAF's UAS structure could potentially shift to an autonomous model in the future. UK Joint Doctrine has stated, "…despite the growing ubiquity of unmanned aircraft, key questions remain over how to best procure, employ and support them."[4]

The French Air Force

The French Air Force (FAF) is a pioneer in the UAS field and has MALE UAVs. In 1995, the French Ministry of Defense decided to purchase four Hunter tactical UAS, which allowed the FAF to acquire first-hand experience in what was then a completely new field. In 1996, the "drones" program team was established. This particular unit was responsible for the tactical testing and evaluation of the Hunter UAVs at Mont-de-Marsan, the FAF's flight test center.[5] The unit became the "Adour" Experimental UAS Squadron in 2002 and was transferred to Cognac in 2009.

The Hunters were used operationally in Kosovo in 1999 and in 2003 to ensure aviation security for the G8 summit in Evian. They were withdrawn from service in September 2004. Because its endurance was limited to between 10 and 12 hours, the Hunter was replaced at the end of 2007 by the SIDM (Interim MALE UAS System), which offers a mission endurance of 24 hours. The Air Force currently operates three Harfang UAS stationed in Afghanistan since 2009 to support the International Security Assistance Force (ISAF). This new equipment complements the first three UAS and two ground stations already in the FAF's service.

Since its introduction, the Harfang UAS has been continuously upgraded. On March 4, 2010, it performed its first flight in the Afghan theater equipped with a Rover data link. This remote video terminal (RVT) system broadcasts video images from the UAS to troops in contact with the enemy in real-time. With this capability, French UAS will meet the strong demand for direct support of ground operations. The Harfang UAS require specially qualified ground personnel to fly. The flight operator, or pilot, sits at a screen that displays an image of the drone. During its long missions over the Afghan theater, the UAV monitors the territory it overflies, identifies potential targets, and collects tactical intelligence for the benefit of all ISAF troops.

The ground component of the UAS is composed of three stations: a ground station for mission planning, another station for flight operations that controls the UAS

during flight and receives real-time video via a satellite data link, and a station for interpretation and dissemination of intelligence data, which is placed under the responsibility of an intelligence officer. Thus, missions require at least three personnel on the ground. In fact, nine individuals alternate managing the mission, which can last as long as 20 hours or more. The team includes four flight operators who fly aircraft and operate the image sensors, two intelligence officers who prepare the mission and, during the flight, ensure their objectives are attained, two photo analysts who analyze collected data and prepare target files, and finally, an operator who collates all the intelligence available in the Afghan theater. In addition, 15 technicians of many trades (ground engineers, electronics and network specialists, etc.) also ensure the system is working properly. Before each flight, the aircraft engineers must establish the satellite data links, carry out pre-flight inspections as well as other procedures, and check all equipment. The UAS fly almost every day, and the operational pace has been sustained.

France has formally requested the purchase of 16 Reapers for $1.5 billion through the U.S. Defense Security Cooperation Agency (DSCA).[6] France's defense funding program, the "Project de Loi de Programmation Militaries 2014-2019" (LPM) of August, pared the French MALE requirement down to 12 systems with the purchase of an initial two aircraft for accelerated delivery in late 2013. The LPM expects that all 12 systems will be in operational service by 2019 and remain in service until between 2023 and 2025, after which France may seek to purchase a European designed system. To operate the first Reapers after delivery, three crews from UAS Squadron 1/33 "Belfort" from 709 Air Base Cognac-Châteaubernard are currently training on the systems at the U.S. Air Force's Holloman Air Base in New Mexico. According to the FAF, "other crews will make their first flight soon." UAS Squadron 1/33 "Belfort" currently operates the FAF's four EADS Harfang (modified IAI Heron) MALE UAVs.

The German Air Force

Germany's UAS is similar to the Euro Hawk. The Euro Hawk was slated to replace Germany's aging fleet of specially modified Atlantique ATL1 twin-turboprop SIGINT aircraft in active service from 1972 until 2010.[7] The German Air Force (GAF) operates three Israel Aerospace Industries Heron 1 MALE UAS for reconnaissance missions in Afghanistan. Its first large HALE UAS for signals intelligence missions, the Euro Hawk, is currently undergoing certification. The transatlantic Euro Hawk project aimed to produce an RQ-4B with additional capabilities in SIGINT collection to complement its native ground surveillance capabilities. The four to five UAS would provide information detection and collection from electronic intelligence (ELINT) radar emitters and communications emitters and would be connected to ground stations that can receive and analyze the data.

But the GAF's UAS program is now stuck. Armed UAS, such as the U.S.-built Reaper, are viewed negatively by some as killer robots. Others object to the U.S. practice of using them to kill suspected terrorists. Germany has requested the purchase of five

Reapers and four ground control stations as well as related support material and training. However, it has not completed this procurement and for the time being has decided to lease the IAI Heron, offered by IAI and Rheinmetall, for an initial stop-gap year before a long-term decision on a MALE system is made. The German Defense Ministry has also failed to make an effective case for why the German military needs these armed aircraft. In Afghanistan, military leaders reported the value of an enduring "armed over watch" to rapidly respond to changes on the ground. A procurement contract for a temporary bridging solution for a future MALE UAS will likely be presented at the beginning of the next legislative session. The military also wants to extend the current lease contract for the Heron, which runs until October 2014, to April 2015. In the interim, a joint company is testing how to arm the Heron 1.[8]

What about the Euro Hawk? Licensing of large UAS for civilian European airspace is needed because the risk of collisions with other aircraft cannot be eliminated unless the airspace is closed to civilian aircraft. This problem would be especially challenging if U.S. systems were used because the U.S. refuses to share certain technological details with customers, even allies. For UAS, this secrecy includes the flight control systems. Still, an MOU was signed in May 2006, followed by a firm system development contract on January 31, 2007. The Euro Hawk flew and was performing on a technical level, but regulatory barriers killed the program in May 2013. It is easy to imagine that the JASDF would be confronted with similar issues if it tried to acquire the MALE UAS. German UAS implementation efforts should be monitored as they could provide critical lessons for the JASDF.

The Royal Australian Air Force

The Royal Australian Air Force (RAAF) recognizes that UAS will play a pivotal role in delivering air power in support of national security interests. During the 1950s and 1960s, Australia led the way with cutting-edge research into UAS. Currently, universities such as the University of Sydney and RMIT run extensive UAV research programs.[9] With a fledgling UAS manufacturing industry and growing global interest in UAS, Australia may be positioned to once again lead the way.

The RAAF is operating one squadron of UAVs called No. 5 Flight. The squadron was created on January 18, 2010 at RAAF Base Amberley as part of No. 82 Wing.[10] This Flight is responsible for operating the RAAF's small fleet of IAI Heron unmanned aerial vehicles, which are based at Kandahar in Afghanistan, and training personnel from all branches of the Australian Defense Force to operate them. The RAAF acquired a third Heron during 2011, which No. 5 Flight uses to train UAS operators in Australia. Before this, Heron operators were trained in Canada.

To ensure the safe and effective operation of the aircraft at Base Amberley, the RAAF uses military pilots who have experience in complex and dynamic air domains to pilot the Heron. Pilots qualified on Army helicopters, F/A-18 Hornets, F-111s, AP-3C

Orion and C-130 Hercules have deployed and operated the Heron RPA since August 2009. The Heron pilot is supported by a Payload (Sensor) Operator who also acts as copilot for the Heron. In addition, up to seven operational staff process, analyze, and disseminate information from the Heron's sensors. The operational staff may include aircrew, intelligence staff, operations officers, engineering staff, administration officers, and logisticians.

Australia, like Japan, is surrounded by ocean. According to Air 7000 Phase 1B, Australia will utilize UAS for maritime patrol and other surveillance purposes, and Australia has implemented a requirement for obtaining up to seven HALE UAVs.[11] A further phase of AIR 7000 will oversee the introduction of eight Boeing P-8A Poseidon multi-mission maritime aircraft in a project that broadly parallels the U.S. Navy's broad area maritime surveillance (BAMS) program. In light of the Japanese Joint Operation, the JASDF should focus on Air 7000 phases 1B and 2B because the JMSDF has started to replace maritime patrol planes P-3C to P-1. The RAAF's use of UAS will not replace human capability but will rather extend and complement it. Despite the ethical and moral issues associated with the use of UAS, the RAAF recognizes it must be ready to exploit all the opportunities provided by UAS, including UCAV.

The Israeli Air Force

The Israeli Air Force (IAF) is one of the most advanced air forces in terms of UAV technology. In 1982, the Israelis carried out strikes on Syrian-occupied areas in the Bekaa Valley that decimated Syrian air defenses using UAVs to first gather the electronic frequencies of Syrian radars.[12] The first 12 of these UAS – the Firebee – arrived in Israel in July 1971. This model was based on a previous USAF design.

On August 1, 1971, the first UAS unit was established on Palmahim Airbase. Its main missions were to take photographs of areas defended by surface-to-air (SAM) missiles and act as aerial decoys.[13] In June 1971, another IAF delegation was sent to the U.S. to investigate UAS that would act as aerial decoys for enemy antiaircraft systems. Having emerged from this search, the Chukar's aim was to draw enemy antiaircraft fire, making it easier for combat planes to locate and destroy missile batteries. Later, its purpose was augmented: photography, deception (decoy), and testing.

The UAS squadron was tasked with maintaining the platforms and training UAS technicians as operators. During its restructuring, the squadron was reorganized into two independent bodies with separate operations, management, and maintenance. In 1979, the squadron was separated into three flights: UAS operations (regular and reservist), maintenance (regular and reservist), and the Chukar flight (reservist). As the UAV squadron's activities increased significantly, the need to split the flight became apparent. Limited resources and funding prevented the split from taking place in 1984 and 1985. After the eventual restructure, the squadron was composed of six flights (scout, UAV, operations, training, maintenance, and management).

Since the 1990s, there has been an effort to develop a heavyweight UAS approaching several tons. Most of the Israeli defense industry has been involved in the development process in cooperation with the UAS office at the military's R&D Directorate (MAFAT). An especially noteworthy aircraft, the "Eitan," belongs to the HALE family of UAS and is intended to replace manned flights in various reconnaissance missions. As a multipurpose aircraft, it will gather general intelligence, mark targets for attack, and photograph targets from a long distance.

On June 11, 2001, in light of the growing number of UAS and their increasingly varied roles, the order was given to establish a flight school for training UAS operators at Palmahim Airbase. Beyond its role training UAS operators, the school was also given the right to train its operators as officers, to train UAS instructors, and to maintain its own UAS and ground stations. On April 1, 2004 the school transferred from Ain Shemer to Palmahim and moved into a new facility in the north of the base.

With the transfer completed, the school ceased to train on the IAI Scout, and instead operated UAS that are currently in operational use. The other services provided by the school include basic and ongoing training for UAS operators, training for UAS instructors, and training center facilities. Thus, as evidenced by the Israel UAV squadron, the use of UAS requires rapid organizational expansion. JASDF must expect a similar path to effective UAS operations but must bear in mind the affordability of any plan for UAS management in the future.

Summary of Allied Air Forces' Experiences

All of the examined air forces treat the UAS medium systems like an airplane. Classifications of UAS are depicted in Table 2. The RAF and FAF fundamentally operate their UAS with combined operations with the U.S. military in mind. They are establishing their UAS squadrons at Creech AFB in Nevada and will transfer to homeland bases after acquiring operational know-how. Germany's effort to operate the Euro-Hawk provides a good lesson for the JASDF as it will need to prepare for similar problems, including AI, communication issues, and cost-effectiveness. The RAAF's concept of operating combined BAMS and P-8 for maritime surveillance should also be taken into account. Israel is different from other countries in UAS development. It is the most advanced military in utilizing UAS, evidenced by their original operational concepts and Israeli domestic technology. Therefore, Israel's systems are very reasonable and instructive for developing military forces in the UAS field.

For the JASDF, UAS operations should be designed for joint operations with the U.S. military, especially for ISR activities. However, the JASDF can emulate the positive aspects of each air force, such as the C2 system of the RAF, operational concepts of the RAAF, and force structure of the IAF. The JASDF's education and personnel systems could almost be identical. At the beginning of the UAS program, qualified pilots would become UAS pilots. After this initial phase, the JASDF would create special education

and training courses for UAS operators and would have new qualifications for UAS pilots.

TABLE 2. Classification of UAS in Allied Air Forces

	RAF	FAF	GAF	RAAF	IAF
Platform	MALE [MQ-9]	MALE [EADS Harfang]	HALE [RQ-4B] MALE [IAI Heron]	HALE [RQ-4 BAMS] MALE [IAI Heron]	MALE [Heron] Small [Hermes, SkyLiteB]
Purpose	CAP, ISR, deep strike	CAP, ISR	CAP, ISR, deep strike	BAMS, ISR	ISR
Force structure	Independent squadron	Independent squadron	Independent squadron	Independent squadron	Independent squadron
Training and personnel	Pilot	UAV operator	Pilot	UAV operator	Pilot and UAV operator
Administration and C2	Combined ops and NATO joint ops	NATO joint ops	NATO joint ops	Combined ops	Independent ops

Notes

[1] "The UK Approach to Unmanned Aircraft Systems."

[2] "RAF To Fly Armed Reapers," *Aviation Week & Space Technology* 167, no. 20 (November 19, 2007): p 19.

[3] Douglas Barrie, Robert Wall, and Michael A. Taverna, "U.K. Stealth Debut Reveals Visible Progress," *Aviation Week & Space Technology* 172, no. 27 (July 19, 2010): p 36.

[4] "The UK Approach to Unmanned Aircraft Systems."

[5] Michael A. Taverna and Robert Wall, "French Could Turn To U.S. For Male UAV," *Aviation Week & Space Technology* 172, no. 24 (June 28, 2010): p 44.

[6] "France Requests $1.5 Billion In MQ-9 Reapers," *Defense Daily*, July 1, 2013.

[7] Jürgen Pöppelmann, "AUVSI 2013 – EURO HAWK - Death of a Programme," *Military Technology* 37, no. 8 (August 12, 2013): pp 29-31.

[8] Albrecht Müller, "German Debate Swirls Around Use of Armed UAVs," *Defense News*, April 30, 2013, http://www.defensenews.com/article/20130430/DEFREG01/304290020/German-Debate-Swirls-Around-Use-Armed-UAVs.

[9] Geoff Brown, "Unmanned Air Systems and Australia's Air Power," speech given at Williams Foundation Seminar, Australia, July 3, 2013. http://airpower.airforce.gov.au/UploadedFiles/General/2013_WilliamsFoundationAddress.pdf.

[10] "No. 5 Flight RAAF," Wikipedia, http://en.wikipedia.org/wiki/No._5_Flight_RAAF.

[11] Nigel Pittaway, "Air 7000 - ISR for the 21st Century," *Asia-Pacific Defence Reporter* 36, issue 8 (October, 2010): pp 14-21.

[12] P. W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (New York: Penguin Books, 2009), p 56.

[13] Ralph Sanders, "An Israeli Military Innovation: UAVs," *Joint Force Quarterly* (Winter 2002-2003): pp 114-118.

CHAPTER FIVE

Review of the East Asia Security Environment

"A large part of that "something else" was the emergence of four "new" threats: (1) a rising China, (2) a miscreant regime in North Korea, (3) the possibility of abandonment by the United States, and (4) the relative decline of the Japanese economy. Japan responded to each – and to lesser ones, such as the nonproliferation regime – with strategic agility."

—Richard J. Samuels
Securing Japan: Tokyo's Grand Strategy and the Future of East Asia

Political Considerations and Future Assumptions

The process of building the JSDF was very unique. The Japanese Navy emulated the Royal Navy in force structure and operational concepts, and the Japanese Army emulated the German Army. The Japanese Imperial Military changed its own style out of necessity during the imperial era, and after the Empire was defeated in WWII, the Army and Navy were demobilized completely by General Headquarters (GHQ). GHQ reined in Japan on the assumption that an ideal international society would be better off without a militarily strong Japan. As a result, the allies made the Japanese constitution renounce war.

The JSDF was established in 1954 at the start of the Cold War era to prevent the Communist bloc from overtaking East Asian countries. At that time, Japan emulated the U.S. military in constructing the JSDF in the same way that Imperial Japan emulated the Royal Navy. As East Asia has grown tenser, the JSDF, which were designed mainly for policing operations, have developed into instruments of power that can execute combined operations. Indeed, Japan is transitioning from a reactive military posture to a more proactive footing.

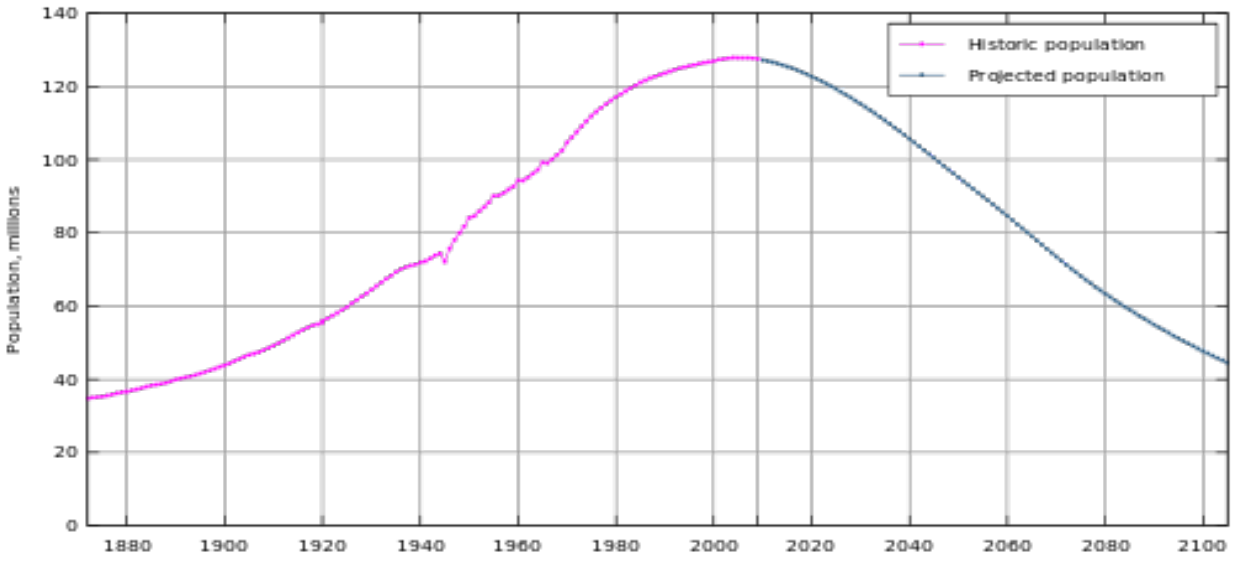
During the Cold War, Japan was endowed with a strategic deterrence – the U.S. Forces Japan (USFJ) – and was able to concentrate on economic growth. For the good of the economy, it was important to minimize political and military conflict. Therefore, Japan avoided clearly outlining its military strategy, and the country has not actively revised it. A desire for redemption after WWII caused Japan to foster an attitude that despises the military and regards military issues as taboo. However, the security environment around Japan has changed dramatically. The JSDF, which once prepared

for an invasion of the Soviet Union, is now confronted by growing maritime pressures and a modernized Chinese military, as well as missile threats from North Korea.

Due to this precarious situation, the Abe Administration has started to discuss the right of collective defense and rearmament, which was once forbidden in political conversations. In addition, the prospect of bilateral operations between the U.S. military and the JSDF will be revisited by the end of 2014. Although we can expect a stronger U.S.-Japan alliance, there are many domestic issues to be addressed. The Japanese Government needs to tackle medical care reforms for an aging society with fewer children, recovery from the 311 East Japan Earthquake, and the conclusion of the atomic disaster at Hukusima Daiichi. Even if tax revenue is increased, the future government cannot afford to allocate more funding to the MOD. Most of Japan's infrastructure, including roads and bridges, has not been upgraded in half a century and must be reconstructed or reinforced ahead of the 2020 Tokyo Olympics.

Most of the JSDF's equipment also needs modernization, but the JSDF cannot expect to improve their budgetary situation in the foreseeable future. Moreover, a modernization program would paralyze the JSDF with high value equipment like the F-35. Although the Japanese defense budget was increased in 2013, the military should prepare for a reduced budget in this decade. The cost of new conventional weapons is soaring, and the air power gap between advanced countries and developing nations will continue to grow. UAS would be an effective method for filling the air power gap in the future.

FIGURE 3. Population of Japan[1]



Japan must consider its human resources as well. Japan's population is decreasing; according to one study, the Japanese population will decrease by six million people in 2025, and people over 65 will comprise 25 percent of the population and

increase at a rate of 7 percent.[2] The JASDF currently employs 47,000 personnel. If the JASDF maintains this number of personnel, it would need to recruit as many as 7,800 individuals by 2025. This projection means that the JASDF would have to close three airbases. Therefore, it is important to consider what would be the best way to incorporate UAS into the JSDF based on the assumption that there will not be extra human resources or budget allocations available.

Current JSDF Force Structure

Before addressing the best possible force structure of UAS in the JASDF, it is necessary to outline the current JSDF force structure, which includes airpower capabilities. The JSDF consists of ground, maritime, and air forces. Each self-defense force and joint staff are expected to execute joint operations. The JGSDF has hundreds of helicopters, including AH-64 Apaches and some LR-2 fixed wing airplanes. It procured ScanEagle devices, and soldiers are now learning how to use them. The JMSDF maintains approximately 100 P-3C and carrier-based helicopters for a total 200 aircraft, preceding the replacement of the P-3C with the P-1. The JASDF has approximately 350 operational aircraft, including 300 fighter airplanes, 12 E-2Cs, four E-767s, and four KC-767s. Currently, the JASDF is tackling the fighter modernization program, which includes the procurement of F-35 and C-2 cargo aircraft. In 2005, the Joint Staff was established, and the Joint Task Force would be organized for appropriate missions if necessary. Since the JSDF shifted to a system of joint operations execution, frictions have emerged, such as communication frequency issues among both personnel and equipment. The largest issue is that military strategy can affect the force structure of each service. The services have not yet crafted new structures, but they undoubtedly will need to so.

The JASDF equipped link 16 to the F-15J 10 years ago. It apparently understands the tactics of air combat with the link at last through the multinational exercise "Red Flag" as well as bilateral training. After the introduction of the F-35, the tactics of the JASDF will change. According to a midterm report of new defense guidelines, the JGSDF needs a maritime amphibious function with 3,000 soldiers, the JMSDF needs additional submarines, and the JASDF needs more tankers to assure A2/AD capabilities and shift from north to southwest (Russia to China). The report also emphasized the need to improve the surveillance capability of the southwest region and that AEW and UAV are needed to secure the Japanese air domain.

Japan should avoid being involved in an arms race in East Asia. However, any programs that each SDF wants to develop are currently halted or delayed (especially the modernization and recapitalization of conventional equipment) because of a limited military budget. Therefore, the Joint Staff should take the lead in procuring UAS and oversee the creation of a UAS joint squadron. Unfortunately, Japan cannot immediately establish and activate UAS for ISR missions, which is particularly alarming given that the PLAAF already has the capability to operate 280 UAVs.[3] To prevent an imbalance of

power in the East China Sea, the JSDF should move forward with the robotics revolution to reinforce its airpower, especially because conventional weapons like the AWACS require at least 10 years to begin operations.

Japan's Current Perspective and Commitment to UAS

According to the midterm technological prospect from TRDI in 2009, technology is needed to create any type of UAV for the gathering of information with long endurance and mobile capability.[4] The report anticipated that Japanese industry would acquire the technology to make autonomous UAVs like the HALE in five years, UCAV in 10 years, and small UAVs smaller than five centimeters for counterterrorism in 15 years. The current challenge for the UAV program is the TAyouto COgata MUjinki (TACOM) multi-role, small UAV. TRDI started the TACOM program using the requirements set by the JASDF in 1995. Fuji Heavy Industries (FHI) designed the system and built six UAVs.

TACOM is a unique, indigenously developed unmanned system that is designed as a multi-purpose unmanned platform which can be tailored for a multitude of missions, including reconnaissance, electronic warfare/decoys, and air strikes. Unfortunately, the program is terribly behind schedule. Therefore, Japanese industry should focus on exploiting autonomous UAVs with its knowledge of AI and stealth technology. It is no exaggeration to say that Japan has the most advanced robotic technology in the world. This robotic technology should be used as a solution for military operations as well as the country's population trends.

On April 1, 2014, the government of Japan eased its self-imposed arms export ban for the first time in almost 50 years. This will allow Japan to jointly develop arms with allies and offers its defense industry access to new markets and technologies. UAVs are spreading rapidly throughout the world and their usefulness would have exponential impact in Asia because there are big gaps in air power between advanced countries and developing nations. Now is the time for Japanese domestic industries to concentrate on developing an indigenous UAV and an information distribution system.

FIGURE 4. TACOM System[5]

Challenges and Dilemmas in Implementing UAS into the JSDF

Japan's MOD plans to fund research on unmanned surveillance planes because the JASDF radar system cannot detect low level targets approaching specific areas and cannot prevent unlawful incursions into the air domain around the Senkaku islets. The MOD is looking into UAS like Northrop Grumman's Global Hawk so it can better defend remote islands. The MOD has stated, "In order to respond effectively to attacks on islands, it is indispensable to securely maintain superiority in the air as well as on the sea."[6] But the purchase of such aircraft may be set for the 2015 budget year, so the JASDF will ensure territorial integrity in the air by deploying a half squadron of E-2C to Okinawa.

While the JSDF begin to think about adapting to Chinese provocations, JASDF aircraft have already scrambled to intercept Chinese UAS headed toward Okinawa. On September 9, 2013, the JASDF observed a Chinese UAV flying over the East China Sea. China has been developing a drone capacity for over half a century. Japan knows that the PLAAF has over 280 combat drones and that it is already using drones to photograph the Senkaku Islands. However, this first contact with a Chinese UAV shocked the Japanese defense establishment. Ultimately, implementing UAVs into Japan's defenses might encourage the PLA to further operate UAVs in this theater, so the JASDF needs to take immediate action to exercise the sovereignty of its airspace.

According to an article in *Foreign Affairs*, China is unlikely to use its drones more provocatively for fear it could set a precedent for the use of drones in East Asian hotspots that the U.S. could eventually exploit.[7] Thus, it is very important that the Global Hawk stationed in Guam be transferred to the Misawa air base in Japan from May 2014. If the JSDF chooses to acquire its own UAVs, the operational concept of UAS must be aligned with the mission of U.S. forces. Additionally, Japan cannot ignore the fact that military activities in its air domain are increasing exponentially in the East China Sea. As a result, Japan needs to embark on efforts to prevent aerial accidents amidst the construction of the Chinese ADIZ. At the same time, Japan should not expect to reach a bilateral agreement with China and should instead pursue multilateral talks concerning UAV operations in East Asia. Incorporating UAV in the JSDF would be just such a trigger to establish a risk-averse mechanism for the East Asian sky.

Notes

[1] "Demographics of Japan," Wikipedia, http://en.wikipedia.org/wiki/Demographics_of_Japan.

[2] "Japanese Population projection," Japan Aging Research Center, February 3, 2006, http://jarc.net/aging/06feb/060203JARC_Population_En.pdf, p 4.

[3] Andrew Erickson and Austin Strange, "China Has Drones. Now What?" *Foreign Affairs*, May 23, 2013, http://www.foreignaffairs.com/articles/139405/andrew-erickson-and-austin-strange/china-has-drones-now-what.

[4] Hirofumi Doi, "TACOM – Air-Launched Multi-Role UAV," August 29-September 3, 2004, 24th International Congress of the Aeronautical Sciences, Yokohama, Japan, http://www.icas.org/ICAS_ARCHIVE/ICAS2004/PAPERS/075.PDF.

[5] Ibid., pp 2, 6.

[6] John Watanabe, "Japanese defence ministry calls for substantial budget increase," World Socialist Web Site, September 25, 2013, http://www.wsws.org/en/articles/2013/09/25/japa-s25.html.

[7] "China Has Drones. Now What?"

CHAPTER SIX
Recommendations

"Napoleon once said, 'There are but two powers in the world, the sword and the mind. In the long run, the sword is always beaten by the mind.'"

— P. W. Singer
Wired for War: The Robotics Revolution and Conflict in the 21st Century

JASDF UAS Doctrine

The JSDF have not recognized the need for an original doctrine for the national security of Japan because they believe that following and aligning with U.S. military doctrine is the only option. As the JSDF grew throughout the Cold War, they have been expected to accomplish high-end operations, but Japanese military leaders assumed that the JSDF were not able to wage war against a communist superpower without U.S. military support, transforming JSDF into a reactionary force. Although Japan has advanced robotic technology, Japanese society is not amenable to using new technology for military purposes. Therefore, it is important to explain the doctrine of UAS to Japanese society before implementing it into the JSDF.

To prevent an escalation in the East Asian security environment, the JASDF should not facilitate a dramatic change with UAS because the PRC already has a substantial UAS force readiness and the capability to invade Japanese territory. Japan also needs to monitor the Korean Peninsula's armistice. Thus, it is reasonable that the JASDF maintain conventional military power and pursue a modernization program. It is also important to adapt and conduct more PKO missile defense missions without taking on extra costs or manpower. Implementing UAS will be one of the prominent solutions. Therefore, the UAS that the JASDF procures should be used for ISR missions to reduce costs and human resources as well as provide disaster relief.

Next, the JASDF could use UAS to compensate for the delayed modernization of conventional weapons. For example, the JASDF needs to procure the next generation of fighter aircraft, except for the F-4 replacement program. However, the F-35 would not be best suited to replace the F-2 or F-15 PreMSIP (Multi-Stage Improvement Program), because of its high cost. In addition, the F-35 could be limited to use for defensive counter air (DCA) and alert missions. In terms of compensation of the F-35, the UCAV might be useful as a weapon carrier alternative to the F-35 or other fighter aircraft.

The final stage would be an autonomously-controlled UAS. Due to Japan's geographic characteristics, the JASDF will always be forced to operate their forces

within A2/AD territory. In regards to cyber defense, a remote-controlled system is not reliable enough, and there is concern about communications because the Japanese satellite system is vulnerable. JASDF employment of small, reliable and autonomous UAS is almost inevitable. Therefore, TRDI should create a plan that concentrates on exploiting domestic UCAV and pursues a cost-effective product. Moreover, the JASDF should consider establishing a doctrine for logistics missions in which UAS would be used for cargo and tanker purposes.

Leadership, Education and Personnel

Strong leadership with knowledge of UAS and a future vision of war is critical for implementing UAS. Cultural conflict between the new community of UAS and the conventional military community is all but assured in the distribution of personnel, promotion rates and awards. The JASDF leaders should recognize that implementing UAS will not only cause a sacrifice of Japan's modernization program, but it will also encounter resistance from the military's conventional weapons culture. Moreover, UAS could force JASDF leaders to realize that current C2 has been changed by real-time information supplied by UAS and through higher mission success rates and reliability. Thus, a high flow of real-time information results in an absence of command because any level commander is apt to issue orders while observing an accurate battlefield. Leaders need to learn how to maintain C2 with UAS so as not to demote the strategic leader to the tactical level. A former UAS squadron commander posits that a "new definition of airmanship" is needed.[1]

It is necessary to establish an original education system, including a pipeline of pilot cultivation. JASDF needs to assign qualified pilots to operate UAS rather than cultivate unskilled student operators. There are three reasons for this proposal. First, commissioned officers are more accountable than enlisted members in the case of UAS mishaps. Second, information captured by UAS contains highly confidential information. Therefore, a UAS operator must be of high integrity and responsibility to protect information security. The third consideration is career pathway. If the JASDF creates a joint UAS squadron, it could be a chance to establish a new career pathway for the Joint Staff. This joint UAS squadron must cultivate a joint mind and mutual understanding among each service. It is reasonable that a UAS operator might make a short rotation in post for two years or less in order to increase the potential for UAS operations.

Cultivating a Unique UAS Culture within JASDF

Some say that Japan has an environment in which people accept robotic systems in their society because they believe in an ancient religion that preaches that everything, not just animals, has its own life. Although Japanese robotic technology has been spreading among civil society, controversy would still erupt if this technology were used for military activities due to persistent anti-military sentiment. However, UAS and other unmanned systems have demonstrated that they are useful for humanitarian

disasters. It is important when implementing UAS to not only develop a mechanism whereby UAS can be used at the request of civil authorities for humanitarian purposes but also to cultivate a culture where UAS are regarded as essential for reducing the military budget.

The JASDF needs to cultivate a new UAS culture within its own ranks too. The operators who control manned systems like airplanes, maritime vessels, and tanks are apt to disregard UAS operators because they are not on the battlefield. However, while they are conducting UAS missions operators are, in effect, stationed at the front lines and are required to make critical decisions. The JASDF should create its own culture and organization for UAS operations in order to cultivate a manned-unmanned (MUM) mindset that promotes partnership. Incorporating UAS into the JASDF will require collaboration between each Ground, Maritime and Air Self-Defense force capability to create an effective joint operation mindset. I recommend that the Japanese military establish a joint operations research team for UAVs in the Joint Chiefs of Staff and cooperate with JUAS COE to learn from U.S. military expertise and enhance interoperability. The JSDF can refer to JCGUAV in order to achieve this purpose pragmatically as well.

On the other hand, the JASDF should look to expand UAS culture beyond its organization. China has unilaterally established an air defense identification zone, and to implement UAS into the JASDF, the service must take measures to avoid an accident with other Asian countries. A risk-aversion mechanism, such as a multilateral organization, could help prevent sensitive incidents and accidents and improve allied force interoperability. The JASDF must execute its ISR missions efficiently with allied countries as well. NATO has already established organizations to this effect, known as JCGISR and JCGUAV.

Notes

[1] "Beyond Butterflies."

CHAPTER SEVEN
Conclusion

The security environment in East Asia is uncertain and unstable. North Korea's nuclear program and continued missile development, coupled with its provocative rhetoric and behavior, poses a serious and imminent threat to Japan's security. China is rapidly expanding and intensifying its activities on the sea and in the air. On December 13, 2012, Chinese aircraft violated Japan's air domain around the Senkaku Islands and went undetected by radar. As a result, Japan's Ministry of Defense had to correct flaws to better protect airspace sovereignty. However, utilizing surveillance aircraft 24/7 has led to increased equipment maintenance and fatigue. Under these circumstances, the new National Defense Program Guidelines and midterm defense program were released at the end of last year, and the Ministry of Defense announced its decision to acquire three unmanned aerial vehicles to reinforce its ISR capability. But many questions have arisen about the incorporation of these new systems into the force structure: Why do we need unmanned systems? Who should operate them? How do the new systems fit into existing command and control architectures?

Unmanned aircraft are less susceptible to human performance or physiological limits, making them useful in executing 3D missions. For the JSDF, avoiding "danger" is less of a concern because Japan has renounced war and the Japanese military is restricted in its activities within safe territory. So the focus must be the "dirty and dull" UAV missions. I believe it is important to acquire UAVs to prevent an arms race and to replace the weaker aspects of human performance. Japan should not try to catch up to China in this potential arms race even though there is an imbalance of conventional weapons between China and Japan; the Japanese military must cope with the PLA's strategy of exhaustion. The JASDF will probably face pressure to reduce costs because it has to undertake modernization programs, including the acquisition of the F-35. At the same time, the JASDF is striving to maintain readiness for these alert missions by focusing human resources on the East China Sea. Even if the JASDF could increase its budget for personnel, more funding would not solve the problems of human error and aircraft fatigue. Since the Japanese military spends 42 percent of its total budget on personnel, reduction of personnel is essential to ISR enhancement with UAVs.

The Ministry of Defense has prepared a budget of $2 million for research of UAVs in FY 2014. The new midterm defense program says UAVs belong to a new joint force, but the JASDF needs to acquire its own UAVs because the joint force might not meet the JASDF mission requirements. It is inevitable that U.S. Air Force methods will influence UAV squadrons and that the JASDF will take the lead in organizing the joint

force. With this in mind, I suggest three concepts relating to "doctrine, leadership and culture."

First is doctrine or operational concept. The JASDF has failed to recognize that an original doctrine is needed for homeland security. Military leaders have assumed that the JASDF was not able to fight communist superpowers without U.S. military support, and accordingly the force has become reactionary. Nevertheless, the security environment has changed and we need to modernize our air power for the information age. It is important that the doctrine explain the need to adapt to increased missions without extra costs and overloads. When formulating UAV doctrine, the JASDF must include an operational concept for future missions and alternative plans for delayed modernization programs. An autonomous UAV, such as the UCAV, could compensate for conventional air power. This doctrine should insist that Japanese domestic industries concentrate on developing an indigenous UAV and an information distribution system. History proves that thinking about how a weapon will be used before deciding what to acquire is very important.

Next is leadership. In order to implement UAVs effectively, strong leadership with knowledge of UAS capabilities and a proper future vision of war is needed. We can expect some kind of conflict between the new UAS community and the old conventional weapons community in regards to personnel management, career paths, promotion rates, and awards. Moreover, UAVs enable JASDF leaders to realize C2 has changed. In addition, senior leaders need to learn how to maintain C2 over UAVs without demoting strategic leaders to tactical ones. We need a "new definition of airmanship."

Last is culture. The JASDF needs to cultivate a new culture of UAVs. All JASDF members should learn about UAVs and eliminate prejudices against them. Implementing UAVs into the JASDF should lead to enhanced synergy in each service and help create an effective joint operations mindset. I recommend the Japanese military create a joint operations research team for UAVs in the Joint Chiefs of Staff, cooperate with JUAS COE to learn from U.S. military expertise and enhance interoperability. The JASDF should also expand UAS culture outside its organization.

Finally, as technologies advance, UAS automation and hypersonic flight will reshape the battlefield of tomorrow. One of the most important elements to consider on this battlefield is the potential for UAS to rapidly compress the observe, orient, decide, and act (OODA) loop. Future UAS that can perceive situations and act independently with limited or little human input will greatly shorten decision times. This Perceive-Act line is critical to countering growing adversarial UAS threats that seek automation capabilities. As autonomy and automation merge, UAS will be able to swarm (one pilot directing the actions of many multi-mission aircraft), creating a focused, relentless, and scaled attack.

UAVs are spreading around the world in both advanced and developing nations. Their usefulness is exponential in Asia because there are big gaps in air power between advanced countries and developing nations. The Afghan war taught us that it is not possible for F-16s alone to achieve the mission in new types of war. The JASDF needs be aware that we are embarking on a journey into the information age. UAS would be a game-changer.

Policy can change quickly in response to crises, but it takes a long time to develop the actual capabilities, mutual trust, and joint vision and doctrine upon which effective action is built. Therefore, if we care about new technology, like UAS, that provides significant utility, we need to take immediate action. Incorporating UAVs into the JASDF will be the first challenge as we adapt to this future.

GLOSSARY

AAR	Air-to-Air Refueling
ACC	Area Control Center
ADCOM	Administration Commands
AEW	Airborne Early Warning
AFB	Air Force Base
AGL	Above Ground Level
AI	Artificial Intelligence/Airspace Integration
A2/AD	Anti-Access/Area-Denial
BAMS	Broad Area Maritime Surveillance
CCDR	Combatant Commander
CSAR	Combat Search and Rescue
CONUS	Continental United States
COP	Common Operational Picture
C2	Command and Control
C3	Command, Control, and Communication
DCA	Defensive Counter Air
DEMVAL	Demonstration and Validation
DOD	Department of Defense
DR	Disaster Relief
DSCA	Defense Security Cooperation Agency
ELINT	Electronic Intelligence
EO/IR	Electro-Optical/Infrared
ERMP	Extended-Range Multi-Purpose
FAA	Federal Aviation Administration
FAF	French Air Force
FIR	Flight Information Region
FMS	Foreign Military Sale
GAF	German Air Force
GHQ	General Headquarters
GPS	Global Positioning System
GWOT	Global War on Terrorism
HA	Humanitarian Assistance
HALE	High-Altitude Long-Endurance
ISAF	International Security Assistance Force
ISR	Intelligence, Surveillance and Reconnaissance
JASDF	Japan Air Self-Defense Force
JCGISR	Joint Capability Group for ISR
JCGUAV	Joint Capability Group on Unmanned Air Vehicle

JGSDF	Japan Ground Self-Defense Force
JMSDF	Japan Maritime Self-Defense Force
JUAS COE	Joint Unmanned Aerial Systems Center of Excellence
MALE	Medium-Altitude Long-Endurance
MOD	Ministry of Defense
MOOTW	Military Operations Other Than War
MSIP	Multi-Stage Improvement Program
MUM	Manned-Unmanned
NAS	National Airspace System
NATO	North Atlantic Treaty Organization
NDPG	National Defense Planning Guidance
NEC	Navy's Existing Secondary
OODA	Observe Orient Decision Action
PIP	Pioneer Improvement Program
PRC	People's Republic of China
QDR	Quadrennial Defense Review
RAAF	Royal Australian Air Force
RAF	Royal Air Force
RMA	Revolution in Military Affairs
RMIT	Royal Melbourne Institute of Technology
RPAS	Remotely Piloted Aircraft System
SAR	Search and Rescue
SEAD	Suppression of Enemy Air Defense
SIGINT	Signal Intelligence
TACOM	TAyouto COgata MUjinki (Multi-role small UAV)
TRDI	Technical Research and Development Institute
TTP	Tactics, Techniques, and Procedures
UASTB	Unmanned Aircraft System Training Battalion
UAV	Unmanned Aerial Vehicle
UCAS	Unmanned Combat Aerial System
UCAV	Unmanned Combat Aerial Vehicle
UOR	Urgent Operational Requirement
USAACE	United States Army Aviation Center of Excellence
USA	United States Army
USAF	United States Air Force
USFJ	United States Forces Japan
USMC	United States Marine Corps
USN	United States Navy

BIBLIOGRAPHY

Barrie, Douglas, Robert Wall, and Michael A. Taverna. "U.K. Stealth Debut Reveals Visible Progress." *Aviation Week & Space Technology* 172, no. 27 (July 19, 2010).

Boyle, Ashley. "The US and its UAVs: A Cost-Benefit Analysis," American Security Project, July 24, 2012, http://www.americansecurityproject.org/the-us-and-its-uavs-a-cost-benefit-analysis/.

Brown, Geoff. "Unmanned Air Systems and Australia's Air Power." Speech given at Williams Foundation Seminar, Australia, July 3, 2013. http://airpower.airforce.gov.au/UploadedFiles/General/2013_WilliamsFoundationAddress.pdf.

Cantwell, Houston R. "Beyond Butterflies: Predator and the Evolution of Unmanned Aerial Vehicle in Air Force Culture." Thesis, School of Advanced Air and Space Studies, Maxwell Air Force Base, 2007.

"Demographics of Japan." Wikipedia. http://en.wikipedia.org/wiki/Demographics_of_Japan.

Doi, Hirofumi. "TACOM – Air-Launched Multi-Role UAV." August 29-September 3, 2004, 24th International Congress of the Aeronautical Sciences, Yokohama, Japan. http://www.icas.org/ICAS_ARCHIVE/ICAS2004/PAPERS/075.PDF.

Erickson, Andrew and Austin Strange "China Has Drones. Now What?" *Foreign Affairs*, May 23, 2013. http://www.foreignaffairs.com/articles/139405/andrew-erickson-and-austin-strange/china-has-drones-now-what.

"France Requests $1.5 Billion In MQ-9 Reapers," *Defense Daily*, July 1, 2013.

Hill, Tom "Boot." Interview by the author.

Jacobs, Keith. "Manned and Unmanned Aerial Vehicles: Right Mix For Future U.S. Navy Aviation." *Naval Forces* 25, issue 5 (2004).

"Japanese Population projection." Japan Aging Research Center, February 3, 2006. http://jarc.net/aging/06feb/060203JARC_Population_En.pdf.

Keynes, John Maynard. "Some Economic Consequences of a Declining Population." *Eugenics Review* 29 (April 1937).

MacMillan, Margaret. "Preventing Another Great War: Lessons From 1914." Remarks made at the Brookings Institution, Washington, DC, November 7, 2013. From transcript http://www.brookings.edu/~/media/events/2013/11/7%20great%20war/20131107_macmillan_wwi_transcript.pdf, 40.

Müller, Albrecht. "German Debate Swirls Around Use of Armed UAVs." *Defense News*, April 30, 2013, http://www.defensenews.com/article/20130430/DEFREG01/304290020/German-Debate-Swirls-Around-Use-Armed-UAVs.

National Intelligence Council. *Global Trends 2030: Alternative Worlds*, December 2012. http://www.dni.gov/files/documents/GlobalTrends_2030.pdf.

"No. 5 Flight RAAF." Wikipedia. http://en.wikipedia.org/wiki/No._5_Flight_RAAF.

"Ordinance for Enforcement of the Civil Aeronautics Act." Ordinance of the Ministry of Transport No. 56, July 31, 1952. http://www.schedule-coordination.jp/archives/arc_aviation_law/2009/Ordinance%20of%20Enforcement%20of%20CAA%20in%20EN.pdf.

Pittaway, Nigel. "Air 7000 - ISR for the 21st Century." *Asia-Pacific Defence Reporter* 36, issue 8 (October, 2010).

Pöppelmann, Jürgen. "AUVSI 2013 – EURO HAWK - Death of a Programme." *Military Technology* 37, no. 8 (August 12, 2013).

"Quadrennial Defense Review." United States Department of Defense, 2014. http://www.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf.

"RAF To Fly Armed Reapers." *Aviation Week & Space Technology* 167, no. 20 (November 19, 2007).

Saeki, John and Adrian Leung. "Japan's Military Shopping List," Agence France-Presse, December 17, 2013. https://sg.news.yahoo.com/photos/japan-39-military-shopping-list-photo-084135690.html.

Samuels, Richard J. *Securing Japan: Tokyo's Grand Strategy and the Future of East Asia*. Ithaca, NY: Cornell University Press, 2007.

Sanders, Ralph. "An Israeli Military Innovation: UAVs." *Joint Force Quarterly* (Winter 2002-2003).

Schaub, Jr., Gary John, Kristian Søby Kristensen, and Flemming Pradhan-Blach. "Unmanned and Unarmed: On the Future of Unmanned Systems in the Danish Armed Forces." Copenhagen: Center for Military Studies, 2014. p 5.

Singer, P. W. *Wired for War: The Robotics Revolution and Conflict in the 21st Century*. New York: Penguin Books, 2009.

Smith, Perry McCoy. *The Air Force Plans for Peace*. Baltimore: The Johns Hopkins University Press, 1970.

Spigelmire, Michael F., and Timothy Baxter. "Unmanned Aircraft Systems and the Next War." *Army Magazine* 63, no. 5 (May 2013).

Taverna, Michael A., and Robert Wall. "French Could Turn To U.S. For Male UAV." *Aviation Week & Space Technology* 172, no. 24 (June 28, 2010).

Tilghman, Andrew. "New rating considered for UAV operators." *Navy Times* (November 2, 2008).

Torres, Ida. "Defense Ministry to Spend for Research on Surveillance Aircraft." *Japan Daily Press*, August 22, 2013. http://japandailypress.com/defense-ministry-to-spend-for-research-on-surveillance-aircraft-2234428/.

United Kingdom Ministry of Defence. "The UK Approach to Unmanned Aircraft Systems," Joint Doctrine Note 2/11, March 30, 2011. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33711/20110505JDN_211_UAS_v2U.pdf.

United States Air Force. "United States Air Force Unmanned Aircraft Systems Flight Plan," May 18, 2009. http://fas.org/irp/program/collect/uas_2009.pdf.

United States Army. "Eyes of the Army: U.S. Army Roadmap for Unmanned Aircraft Systems 2010-2035," U.S. Army UAS Center of Excellence. http://fas.org/irp/program/collect/uas-army.pdf.

United States Department of Defense. "Unmanned Systems Integrated Roadmap FY2011-2036," 11-S-3613. http://www.acq.osd.mil/sts/docs/Unmanned%20Systems%20Integrated%20Roadmap%20FY2011-2036.pdf.

United States Government Accountability Office. "Nonproliferation: Agencies Could Improve Information Sharing and End-Use Monitoring on Unmanned Aerial Vehicle Exports," GAO-12-536, July 2012. http://www.gao.gov/assets/600/593131.pdf.

United States Joint Chiefs of Staff. "Joint Airspace Control," Joint Publication 3-52, May 20, 2010.

U.S. Congress. House of Representatives. Military Procurement and Military Research & Development Subcommittees. *Unmanned Aerial Vehicle Programs*. 105th Cong., 1st sess., April 9, 1997.

Vinson, Brandon. "X-47B Makes First Arrested Landing at Sea," United States Navy. http://www.navy.mil/submit/display.asp?story_id=75298.

Watanabe, John. "Japanese defence ministry calls for substantial budget increase," World Socialist Web Site, September 25, 2013. http://www.wsws.org/en/articles/2013/09/25/japa-s25.html.

ABOUT THE AUTHOR

Colonel Ryoji Shirai was commissioned as a 2nd Lieutenant of Japan Air Self-Defense Force (JASDF) in 1994 upon graduation from the National Defense Academy. He most recently served as supervisor of the Defense Policies and Programs Division's Air Staff Office in the Japanese Ministry of Defense.

In 1997, Shirai took specialized undergraduate pilot training at Laughlin Air Force Base (AFB) in Texas, and an introduction to fighter fundamentals course at Randolph AFB in Texas. He was later assigned to the 305th Fighter Squadron, Hyakuri AFB and transferred to the Air Development and Test Wing. In 2005, he was assigned to the 204th Fighter Squadron with Hyakuri AFB. From 2006 to 2010, he served as a staff member in the Defense Policies and Programs Division's Air Staff Office, where he organized the 2006-2007 JASDF fiscal year annual budget plan, organizing programs focused on KC-767 tanker and C-2 cargo and jet training and personnel planning. In 2010, he became commander of the 204th Fighter Squadron.

Shirai holds a bachelor's in aerospace engineering from the National Defense Academy. He is a senior pilot with over 2,100 hours in the T-4, T-38 and F-15J, and he is qualified as a test pilot.