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ABSTRACT

In this essay, the author argues for the proliferation of Unmanned Combat Aerial Vehicles (UCAV) in projecting air power in 2035, and highlights the concerns involved. The author first describes the likely security landscape in the years ahead. Next, he goes on to highlight the trends of UCAVs and the reasons why they will become even more relevant in the future. The author also examines the controversies involved in conducting UCAV operations, which may impede the adoption of UCAV systems. Finally, the author analyses the implications of such trends on Singapore, in particular.

Keywords: *Application; Prominent; Implications; Reliability; Effectiveness*

INTRODUCTION

Attaining control of the air domain has always been crucial towards realising strategic and military objectives. Since the days when air power was posited in the 1920s by the prominent thinkers of Guilio Douhet, Hugh Trenchard and William Mitchell, air power has been essential for governments and their military forces as a means of 'influencing the behaviour of people or the course of events.'[1] Through 'control of the air, global mobility, persistent surveillance and reliable precision attack, unrestricted by geography', air power has maintained its relevance. With rapid developments in technologies, the past decade also saw a significant breakthrough in the application of unmanned aerial vehicles (UAV) to project air power in military operations. This is especially evident in those conducted by the United States (US) military, where even unmanned combat aerial vehicles (UCAV) has begun to play a more prominent role. In the 2003 Iraq War, the US military was only capable of deploying a small number of UAV systems. Since then, it has operationalised more than 10,000 UAVs, with a growing proportion of them being UCAVs.[2] Beyond the US, such UCAV systems have extended to more than 20 other countries, including the UK, China and Israel.[3] As we forge into the future, specifically year 2035, this trend of employing UCAVs for air power is expected to persist, driven by the associated benefits of not risking pilots' lives while having the potential to realise greater combat capabilities.[4] The proliferation of UCAVs leads to the question of whether it can indeed meet future air power needs, as well as the concerns it brings when employing such systems.

APPROACH

This essay argues for the proliferation of UCAVs in projecting air power in 2035, and highlights the concerns involved. The paper will first describe the likely security landscape in the years ahead. Next, it will highlight the trends of UCAVs and the reasons why they will become even more relevant in the future. The essay will also look into the controversies involved in conducting UCAV operations, which may impede the adoption of UCAV systems. Finally, the essay will examine the implications of such trends on Singapore in particular.

UCAV IN MODERN WARFARE

UAVs are distinguished by the absence of a human physically on-board, and are usually remotely controlled. They can have a wide range of independence or autonomy, ranging from direct human operation to being controlled autonomously by on-board computers.[5] These UAVs can also be capable of sensing, thinking and acting.[6] To do so, they are made up of three main components—sensors that obtain

IAI Heron 1 UAV in flight.

information and detect changes from the operating environment, processors that decide how they will respond, and effectors that exert actions.[7] UCAVs are essentially UAVs equipped with offensive combat capabilities. Today, UAVs and UCAVs are generally used for 'dull, dirty, dangerous and demanding' combat scenarios, that could incur high casualty rates or have inherent risks that are unlikely to be mitigated tactically.[8]

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Applications and Trends

The employment of UAVs in military operations is not new. Examples of early applications include the British Sopwith AT 'Aerial Torpedo' in World War I (WWI), a radio-controlled aircraft that aimed to crash into German planes, as well as the OQ-2 Radioplane in World War II (WWII), a target drone for training anti-aircraft gunners.[9] Thereafter, the changing texture of warfare and the price placed on war casualties since WWII have also favoured the deployment of UAVs in modern wars.[10] During Winston Churchill's inaugural ministerial speech, he declared 'victory at all cost' for WWII.[11] In contrast, General Rupert Smith, a British commander during the Gulf War stated that countries have 'placed higher premium on preserving own forces rather than achieving the military aim.'[12] It is thus apparent the general populace's tolerance for military risk has dramatically shifted after the Cold War, and they are unwilling to send troops deep beyond the enemies' lines for fear of casualties. These fuelled the narrative for the significant venture into unmanned systems.

The spread of UAVs in military operations has since been extensive and the rate of pervasiveness is also remarkable. In the modern battlefield, they are widely present, not just for intelligence gathering, reconnaissance and target acquisition, but also to provide offensive striking capabilities.[13] For example, the US military utilises UCAVs such as the MQ-1 Predator, MQ-1C Sky Warrior and MQ-9 Reaper in its operations, and has increased its use of drone strikes in recent years against targets in foreign countries.[14] Researchers envisage the proliferation of such UCAVs to persist with the evolving security landscape, indicating that UCAVs will have a major role to play in the future of air power.[15]

EVOLVING SECURITY LANDSCAPE

As we project towards year 2035, the security landscape is expected to evolve significantly. First, future conflicts are likely to be hybrid in nature. This means they will involve the combination of both conventional and unconventional tools of warfare. In addition, there will be greater security threats from violent non-state actors, which includes transnational terrorist groups such as Al Qaeda and ISIS. These changes in the security landscape will have significant impact on the means of applying air power. Primarily, the distinction of legitimate targets will become increasingly difficult in the operating environments. This is especially so when the adversaries deploy irregular forces, such as civilian-dressed individuals to damage infrastructure, or harm the population directly through the use of terrorist methods. Unlike uniformed troops, such irregular forces can camouflage themselves within the populace, making it challenging to differentiate between military and civilians targets.[16] This will make it riskier for the deployment of ground troops as well as manned aircraft over the area of operations. The identification and striking of targets also needs to be more accurate, as well as more precise, in order to minimise collateral damages.

A Ryan Firebee, one of a series of target drones/ unpiloted aerial vehicles that first flew in 1951.

Second, as highlighted earlier, the general populace is increasingly against the loss of lives in military operations. A case in point is the CBS News poll after the US military's conduct of the Iraq War in 2003. It revealed that about 75% of the Americans felt that the war 'was not worth the costs', especially the loss of lives.[17] This shows that, despite the number of US soldiers who died in combat reducing significantly from about 400,000 in WWII to about 4,000 in the Iraq war, a life lost is still one too many.[18] With the increasing pervasiveness and speed of social media and communications, any perceived unnecessary loss of military lives can easily and very quickly trigger public discontent. As such, the means of applying air power when unmanned options are becoming more feasible, as well as the risking of pilots' lives in combat, will come under greater public scrutiny.

Third, most countries are expected to face greater budgetary constraints in funding their military requirements. From now till year 2035, global growth is expected to be slower, largely due to deteriorating demographics in most countries. Rising anti-globalisation political pressures, following the events of 'Brexit' and 'Trump', could further impact the growth outlook negatively due to more restricted trade flows and mobility.[19] Apart from the slow-growing economy, the rise of populism in politics would drive nations to focus their resources in addressing the welfare needs of their people. Concurrently, the costs of manned air platforms are on the rise. For instance, the cost of the next-generation manned fighter aircraft, the Lockheed Martin F-35, has escalated to US$ 91 million each.[20] Such high costs of manned air platforms would drive nations to look for cheaper yet effective means of projecting air power.

WHY UCAV WILL BECOME MORE RELEVANT

Increased Capabilities To Meet Operational Demands

Today, operational UCAVs such as the MQ-1 Predator and MQ-9 Reaper already possess the capabilities of being controlled remotely to strike targets. They are widely utilised in high risk operations, as well as those that require longer endurance for persistent air Intelligence, Surveillance and Reconnaissance (ISR), such as the US military's operations in the Middle East in their war against terrorism.[21] Moving forward, the combat capabilities of UCAVs are expected to advance drastically. These include improved automation and artificial intelligence

for more accurate processing and exploitations, and more precise targeting to reduce collateral damages. In addition to greater capabilities, the reliability and survivability of UCAVs are expected to improve substantially to ensure mission effectiveness. The reliability of UCAVs has been a concern, given the higher loss rates due to technical issues compared to manned platforms. For instance, the Predators has a loss rate of 34 per 100,000 hours compared to 3.35 for F-16, mostly due to propulsion and flight control issues. Studies have also shown that their reliability has suffered because of over-emphasis on affordability.[22] This realisation has since driven efforts to improve the reliability of UCAV propulsion and flight control technologies.[23] In addition, to enhance survivability, stealth technology is also increasingly applied to UCAV. An example is the Northrop Grumman X-47B, a stealth UCAV fighter. While it is yet to be operational, such stealth capabilities are likely to be attained within the 2035 timeline.

There are also developments on the greater autonomy of UCAVs as well as swarm technology. Greater autonomy will shorten the decision cycle in a fast changing operational environment, both in the control of the UCAVs and the identification of targets.[24] On swarm technology, there are already demonstrations on how unmanned aircraft can be self-reconfiguring, such that when some are taken out, the rest autonomously change their behaviours to complete the mission. While any aircraft, manned or unmanned, can be brought down by a single missile, a swarm can take multiple hits and keep going. Being able to absorb this type of damage makes the drone swarm hard to stop, especially when defences are geared towards shooting down single planes.[25] Such swarm technology are expected to be fielded within the next 20 years.[26]

Eliminate The Loss Of Lives

'When a robot dies, you don't have to write a letter to its mother.'

– Unidentified US Navy Petty Chief Officer[27]

As the term 'unmanned' suggests, the employment of UCAVs negate the need to deploy pilots and risk lives. Therefore, it is not difficult to see the appeal of such systems for many countries. This is especially so when targets, especially of those in deep-strike missions, are usually better defended. In the future, given the availability of high-technology weapon systems and network technology in the open market, it is likely that the integrated air defences of adversaries will also become very capable.[28] As such, it will be more difficult for any platforms to fly through without the high risk of being shot down. Moreover, the safety of UCAV operators can also be assured, as the base operating the UCAVs can be as far as being thousands of miles away. This range has been demonstrated during the drone missions in Afghanistan, with the controls from Creech Air Force Base in Nevada, USA.[29]

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Lower Costs

Finally, the costs of UCAVs are lower compared to manned platforms. For example, the MQ-1 Predator and the MQ-9 Reaper, employed in military operations in countries such as Afghanistan and Pakistan, cost US$ 4 million and US$ 6.5 million respectively.[30] This is just a fraction of the US$ 91 million cost of an F-35.[31] While the costs of UCAVs are expected to increase in the future along with their improved capabilities, the amount is expected to remain below that of a next-generation manned aircraft.[32]

The cost involved in training a UCAV pilot is also significantly lower. It costs only US$ 65,000 to train a drone pilot, compared to US$ 557,000 for a manned aircraft pilot.[33] In fact, the USAF has already trained more UAV pilots than manned aircraft pilots since 2014.

CONTROVERSIES IN OPERATING UCAV SYSTEMS

While UCAVs are expected to play a more significant role in the future of air power due to the evolving security landscape and the advantages that they can provide, UCAVs' utilisation has led to some key controversies, which could impede the acceptance and employment of these systems.

MQ-1L Predator UAV armed with AGM-114 Hellfire missiles.

Moral and Ethical Concerns

First, the proliferation of UCAVs has raised moral and ethical concerns. Primarily, it remains highly debatable if the judgement of life and death can be left to a machine. For entirely autonomous UCAVs, they could act based on their designs, without a frame to understand or make moral and ethical decisions. There are also strong doubts that such UCAVs would be able to mimic human judgement in the prospective future, especially in the areas of empathy as well as common sense, that could lead to the undesired effect of killing the innocents.[34]

Even if the autonomous UCAVs are eventually able to distinguish military targets from civilians, it is also doubtful if they can apply the proportionate amount of force to minimise destructions and casualties. For example, it was recorded that the US drone programme that targeted Pakistan, Somalia and Yemen caused between 384 and 907 civilian deaths in those countries.[35] These events led to questions about the effectiveness of utilising UCAVs and on how such wars will be waged in the future.[36]

In addition, there is a lack of legal and ethical framework today for this new realm of technology.[37] While some argued that future UCAV systems will continue to have the 'man-in-the-loop' to address these concerns, the 'control' could eventually be lost, as the combat potential of fully autonomous ones will continue to drive such developments.[38] For semi-autonomous UCAVs that are remotely controlled, the lack of ground presence also limits the capability of acquiring critical intelligence for accurate targeting, or to adequately appreciate the ground situation.

Psychological Effects

Apart from the moral and ethical concerns, the application of UCAVs also bring about the related psychological effects of such operations. There are assertions that the usage of UCAVs to kill, as compared to a traditional manned conflict, is regarded as inhumane and disrespectful.[39] As a result of avoiding the direct human to human clashes, it is also seen as making negotiations to end conflicts more challenging. Using the example of the US's drone killings in Pakistan again, the Pakistan population's reaction to drones were extremely negative and hostile, given their cultural emphasis of honourable warfare.[40] Coupled with the large numbers of civilian deaths caused, the drone campaign was regarded as politically counterproductive

and also resulted in great resentment from the Pakistani population. In addition, the resultant psychological effect of US drone strikes has facilitated the recruitment by terrorists and encouraged additional violent retaliations.[41]

Apart from the psychological effects on the adversaries, studies have also shown that the unmanned combat operations are also taking steep psychological toll on the UCAV pilots.[42] This resulted from the UCAV pilots having to watch their targets closely over prolonged durations and conduct post-strike assessments. At the same time, there are also concerns that with the lower operators' risks and the lower psychological barrier of combat by operating from afar, UCAV operators may be more disconnected from the decisions to kill and are therefore more likely to take lives.

As the term 'unmanned' suggests, the employment of UCAVs negate the need to deploy pilots and risk lives.

Ease Of Starting Wars

The elimination of the risks involved in sending pilots into dangerous territories also raised concerns that the proliferation of UCAVs could make wars more likely in the future. By removing human risk, it could result in the feeling of detachment from war. This can be especially applicable for civilians from countries that are capable of conducting expeditionary wars, as these wars do not affect their daily lives.[43] With no life loss and grieving families, the public may have lesser interest or even turn oblivious to wars that happen abroad.[44] The resultant more war-tolerant public will alleviate pressures on decision makers, making it easier for them to 'take an unwilling nation into war.'[45]

Similar views have also been articulated in the UK Ministry of Defence's policy strategy, which stated that the 'greater use of unmanned technology' could gain better public support for war.[46] Stanley McChrystal, a former commander of US and North Atlantic Treaty Organisation (NATO) forces in Afghanistan, also opined that UCAVs are 'more palatable to military decision-makers and lower the threshold for lethal force.'[47] In addition, the lower dollar cost of UCAVs may further compel decision makers to lower their threshold for war and 'might just encourage pre-emptive strikes.'[48] Indeed, when it comes to UCAV operations, there are concerns that nations may overlook the inherently destructive nature of warfare and make wars more likely.

IMPLICATIONS TO THE RSAF

Appeal Of Unmanned Technology

For Singapore, the benefits of UCAVs make it is a very attractive military option. This is especially so as the country is experiencing declining birth-rate, which has a direct impact on the number of soldiers that the Singapore Armed Forces (SAF) can employ.[49] In fact, Singapore, who has one of the world's lowest Total Fertility Rate (TFR), expects the declining birth rate to persist for the next 15 years and the number of conscripts to fall by about one-third in 2030.[50] This will severely understaff its conscript military and deplete the SAF's combat powers, if the military doctrine, organisation and technology are to remain status quo. Therefore, the impending manpower deficiency has compelled the SAF to leverage on unmanned technologies as a force multiplier. This endeavour is not new as the RSAF has been operating UAVs for several years. The latest UAV to be declared combat ready is the Heron 1, which provides the RSAF with advanced intelligence and surveillance capabilities.[51]

Although the Republic of Singapore Air Force (RSAF) does not possess UCAVs currently, it is conceivable that the RSAF may adopt them in the future, given the proliferation of these systems and the capabilities they bring. In doing so, however, the RSAF needs to be mindful of the controversies and concerns involved in UCAV operations highlighted earlier, and take active steps in addressing these watch areas up front. This is especially critical in Singapore's context, where the country is probably more obligated than other countries to obey international laws and conventions in order to remain relevant, due to its high dependence on international goodwill in the form of trade and investment. If left unaddressed, the propensity for unethical and unlawful conduct in war is high and Singapore cannot afford such mistakes.

Ensuring Man-In-The-Loop

Firstly, to address the moral and ethical concerns where UCAVs may be utilised to autonomously strike targets, the RSAF should ensure that there is always a man-in-the-loop in its future systems and processes. Largely, it would involve having a human commander to deliberate the course of action at critical decision points during UCAV missions. For instance, after an UCAV identifies a potential target based on its data analysis, the decision to fire must still reside with the commander. In fact, the next bound of developments for UCAVs will involve Manned-Unmanned Teaming (MUM-T), where the strengths of both manned and unmanned systems will be combined to improve situational awareness. This will allow the manned aircraft to control the UCAVs through datalinks, and take advantage of the UCAVs ISR and missile payloads to enhance decision making and mission effectiveness.[52]

Establishing Clear Rules of Engagement

Next, to address the concerns on the psychological effects and the lowered threshold for war with unmanned systems, the RSAF needs to establish clear Rules of Engagement (ROE) for UCAV operations. Today, the speed of technological development has already outstripped the evolution of laws which govern armed conflict. As a result, there is no mention of unmanned systems in the United Nations Charter.[53] On this, international consensus on drone warfare needs to be and is being sought in recent UN discussions, and the related laws would be developed over the next few years.[54] As per the existing approach by Singapore to abide international laws, the new laws should be adopted when founded. Internally, the RSAF also needs to establish the ROEs that it will follow when employing UCAVs. These include having clear doctrines to articulate the processes and responsibilities involved, to ensure that the usage of UCAVs will be sanctioned with proper authority, as well as to enhance training to exercise the new ROEs in a more dynamic operational environment that will require faster decision cycles.

CONCLUSION

The proliferation of UCAV systems to project air power is foreseeable given the evolving security landscape and the operational benefits that UCAVs offer, although the controversies involved may impede the adoption of such systems. Specific to Singapore's context, the demographic situation and resource constraints would also make UCAVs an appealing capability for the RSAF in the future. However, it would be prudent for the RSAF to consider holistically both the potential advantages and watch areas of such technologies, and address them at the onset. Only by doing so, can the benefits that UCAVs have to offer in projecting air power, be fully optimised.

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