

# CIVIL MILITARY RELATIONS IN AVIATION

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## INTRODUCTION

Singapore has made significant progress in both civil and military aviation. Today, aviation in Singapore is in a position of strength. On the military aviation front, the RSAF has undergone formidable transformation over the past few decades, to become one of the most advanced and respected air forces in the region. On the civil aviation front, Singapore is now a thriving aviation hub—home to the world’s seventh busiest airport and burgeoning aerospace engineering industry. Civil aviation is now integral to Singapore’s economy, contributing more than 3% to our GDP.<sup>1</sup> The global air connectivity has also enhanced Singapore’s position as a global city, tourism hub and international business centre. The successes in both the military and civil aviation have not been an easy feat; they have been built upon decades of hard work and ingenuity of our aviation pioneers, that have allowed a strong, synergistic civil-military relation to thrive in the Singapore aviation.

## SINGAPORE AVIATION - POWERING TO SUCCESS

Over the past four decades, the world witnessed the birth and transformative growth of Singapore aviation—a feat that is no less miraculous than the Singapore Story itself. Indeed, the growth of aviation has always been an integral part of Singapore’s growth as a nation, with the RSAF securing the sky over Singapore, while the civil aviation connects Singapore with the rest of the world and powers Singapore’s growth.

### *The RSAF: Transformation into 3<sup>rd</sup> Generation Air Force*

The RSAF started with a humble beginning as Singapore Air Defence Command (SADC) in 1968, inheriting British legacy air defence systems and infrastructure. The SADC subsequently expanded its basic air defence capabilities rapidly, seeding the formation of the RSAF in 1975. In the 1970s and 1980s, the RSAF expanded its fleet significantly to attain air superiority capabilities. In the late 1980s and 1990s, the RSAF embarked on its efforts to build a first-class organisation, focusing on enhancing the quality and professionalism of its people. At the same time, the RSAF continued to build a robust safety system and culture, to enhance mission success.

Since the early 2000s, the RSAF has successfully transformed into a 3<sup>rd</sup> Generation Air Force that is integrated and ready to deal with a full spectrum of operations. It stands ready to defend Singapore and its skies, 24/7 and all year round. It has operationalised a suite of sophisticated and advanced platforms, including the F15SG fighter aircraft, G550 Airborne Early Warning aircraft, AH-64 Apache helicopters and the Heron 1 Unmanned

Aerial Vehicles (UAVs). Indeed, the RSAF has one of the ‘best trained, led and equipped’ air forces in the region.<sup>2</sup>

### *Singapore Civil Aviation - Building World-Class Aviation Hub*

Similarly, the civil aviation in Singapore has witnessed a miraculous, rapid build-up from scratch to become a civil aviation hub in the region today. It had a much earlier beginning than military aviation. 1911 witnessed the birth of civil aviation in Singapore, when a British demonstration flight took place at the Singapore Race Course. In 1930, Seletar Airport was opened to commercial flights. Local air service, known as Weane’s Air Service (WAS), started operating a twin-engine biplane with an eight-passenger capacity to link Singapore to towns in the Malay Peninsula.<sup>3</sup>

However, it was not until a few decades later that Singapore began to witness significant growth in civil aviation traffic. As the commercial flight industry grew exponentially over the years, Kallang Airport and Paya Lebar Airport were built, in 1937 and in 1951, respectively, to accommodate the growing air traffic. After the separation from Malaysia Federation, Singapore built its own flag carrier, the Singapore Airlines (SIA), which aimed to become an international carrier. In subsequent years, the SIA aggressively built up its carrier capacity and became the first country in South East Asia to operate the Jumbo Jet. By 1975, annual passenger movements grew to 4 million. The existing Paya Lebar Airport was expanded, while the decision to build a new airport known as Changi Airport, was made. Today, SIA has flourished and continues to chart new grounds in innovation and service excellence. Changi Airport has become a world-class airport, known for its operational efficiency, service excellence and enhanced infrastructure, that supports 70 million passengers and 3 million tonnes of cargos annually.<sup>4</sup>

At the same time, the aviation industry had grown in vibrancy and diversity—able to house more than 100 international aviation Maintenance, Repair and Overhaul (MRO) companies, including SIA Engineering Company and ST Aerospace, two of the world’s largest MRO companies. Being one of the leading aviation hubs in the region today, Singapore captures a quarter of the Asian MRO market, providing comprehensive nose-to-tail engineering and maintenance services.<sup>5</sup> Today, Singapore is further seeing a rapid growth in the aerospace industry, particularly with the setting up of the Seletar Aerospace Park.<sup>6</sup> The Seletar Aerospace Park, a military airbase in the past, now houses more than 30 aerospace companies, such as ST Aerospace, Jet Aviation and Fokker Services Asia. This leading-edge aerospace facility is designed to meet the region’s burgeoning aerospace demands. Aircraft manufacturers have projected that a third of the worldwide aircraft delivery will go to the Asia Pacific region over the next two decades.

Recent years have also witnessed the diversification of local aerospace industry from MRO to aerospace design and manufacturing. Increasingly, leading companies have started to set up their engine manufacturing facilities in Singapore, leveraging on Singapore’s strength in precision engineering and electronics. For instance, Rolls Royce launched

their Seletar Campus in 2012, which is not only a facility for engine assembly and Research and Development (R&D), but also a manufacturing facility for their titanium engine fan blade. Similarly, Pratt & Whitney stood up their first turbo hybrid fan blade and turbine disk manufacturing arm outside of their US headquarters in Seletar.

The transformational journey to success of both the military and civil aviation was no less than a feat, considering the limited resources available in Singapore. To fully appreciate the extent of the enormous tasks and challenges involved, one has to understand the typical constraints in modern day military-civil aviation relationships.

## **EXAMINING CIVIL-MILITARY RELATIONS IN AVIATION**

Military and civil aviation, whilst operating in the same Air Traffic Management (ATM) environment, are fundamentally different from one another—both in their nature and functions. While military aviation is essential for national security and defence and is therefore a legitimate and indispensable activity, civil air transport is not only necessary for global interaction between nations but it also makes a significant contribution to the global economy.<sup>7</sup>

The global airline industry consists of over 2,000 airlines operating more than 23,000 aircraft, providing service to over 3,700 airports. The growth of world air travel has averaged approximately 5% per year over the past 30 years and is expected to continue at this pace for the foreseeable future.<sup>8</sup> Similarly, military aviation has also continued to grow not only through the sheer increase in the overall number and types of aircraft, but also evolved in its responsibilities to incorporate Humanitarian Aid and Disaster Relief (HADR) as well as a multitude of non-conventional missions under the ambit of Operations Other Than War (OOTW).

The continued development of both users of this common resource called Airspace has invariably led to changes in the relationship between military aviators and civil aviation authorities. In the past, civil-military relations revolved mostly around the military operating within its vast and exclusive training airspace and commercial air traffic being vectored around by a joint team of civilian and military controllers who take orders from their respective bosses. Most Air Forces were also independent entities and self-sufficient in almost all of their daily operations including logistical and engineering support. In recent years, economic and demographic evolution has brought about growth in leisure air travel, increase in professional mobility as well as explosion in the air freight sector. The symbiotic relationship is coming under strain whereby competition for resources has taken priority in the push for economic progression. This tension is particularly pronounced for a small country like Singapore. These key resources include airspace, land for airfield infrastructure and skilled manpower.

### *Civil-Military Airspace Management*

Airspace management has come to the forefront of several countries' civil aviation authorities as they try to contain the burgeoning number of commercial traffic and its impact on their bottom line. Countries like China, Jordan, UAE including the European

Union and the US have sought for a relook into the management of the military airspace to allow for greater flexibility in airspace use in order not to stifle the pace of growth of their respective aviation industries. The concept of a European-style centralised air traffic control system has also gradually gained popularity in order to avoid constraining growth in the aviation sector.<sup>9</sup>

### *Aviation Airfield Infrastructure*

The structure of most military air bases allows it to be self-sufficient in its operations and when necessary, provide critical support for the local community in times of emergency and disaster relief. With the pace of commercial aviation growth out-stripping the aviation infrastructure development, military airfields have become increasingly attractive as an economical alternative to the building of more airports which, amongst other issues, might have significant environmental impact on the local population. In Australia for example, in remote localities, the Royal Australian Air Force (RAAF) has traditionally opened its airfields to airlines, charter operators and general aviation. These airfields are a critical part of the transport infrastructure of regional and remote Australia, often providing the only means of reliable year round transport to other centres and cities.<sup>10</sup> The RAAF has and will continue to study the impact on its military operations with regard to their 'joint user airfields' against the backdrop of increased civil air traffic levels and rising costs at commercial airfields. Another country that has embarked on maximising existing aviation infrastructure is Japan. The proposal of civil-military dual usage of Yokota Air Base is an effort to combat capacity constraints, uneven distribution of airports to the eastern part of the Tokyo Metropolitan area, and insufficient measures for various air travel needs.<sup>11</sup> In Singapore, we are also working towards the co-usage of Changi Runway 3 for civil and military aviation.<sup>12</sup>

### *Human Resource and Skilled Labour*

Labour forces and skills matter very much to the high-technology and high-skilled business of the aerospace industry. Therefore, it is essential to the competitiveness of the aerospace industry that it can pull from a wide reservoir of skilled and qualified labour supply. In the current context, worries about skill shortages are widespread across the aerospace industries. In some parts of the world, the number of engineering graduates per year is not enough to fill the growing demands of the aerospace industry.<sup>13</sup> Overlay this situation with military aviation and you can be sure that the push to recruit skilled labour into the civil aviation sector will invariably lead to a manpower retention challenge in the military aviation sector. This challenge is likely to be more acute for countries that face declining birth rates and ageing population.

## **CIVIL-MILITARY RELATIONS IN SINGAPORE**

Singapore, being a small nation-state, invariably faces these key challenges in resource constraints as both its civil and military aviation power to success. Nonetheless, the ingenuity and meticulous long-term planning have allowed a synergistic civil-military relation to thrive in Singapore, creating a unique environment that enables both sectors to share and optimise the limited resources.

## *Airports and Air Bases*

Due to the scarcity of land in Singapore, it has always been a challenge to serve the interests of both the commercial and military aviation sectors. Unlike countries with an abundance of land, and consequently airspace, such as the United States (US) and the United Kingdom (UK) where commercial airports and military air bases are distinctly separated, Singapore does not have the luxury to do so. Resources have to be shared between these two sectors. Since the 1930s, these two sectors have overcome the constraints of resources and developed a synergistic relationship that allows the advancement of both sectors.

In the 1930s, Singapore, then under the British rule, operated from four flying Royal Air Force (RAF) stations, namely, RAF Kallang, RAF Seletar, RAF Sembawang and RAF Tengah. RAF Seletar (also known as Seletar Airport) was Singapore's first international airport. It served as stopovers for the Dutch Airline Koninklijke Luchtvaart Maatschappij (KLM) flight between Amsterdam and Jakarta and the British flagship airline Imperial Airways flight between London and Darwin. The booming commercial aviation industry created the demand for a larger airport. In 1937, the RAF Kallang (also known as Kallang Airport) replaced RAF Seletar as Singapore's international airport for land planes and seaplanes.

During World War II (WWII), all four RAF stations were used by the RAF for military aviation operations. RAF Kallang became the principal fighter airfield and housed the British Brewster Buffalo fighters and Hawker Hurricanes, while RAF Seletar housed the British PBY Catalina seaplanes and Vickers Vildebeest torpedo bombers. Despite efforts to protect Singapore, all four RAF stations ultimately fell into the hands of the Japanese.

During the Japanese Occupation, the Imperial Japanese forces built two unpaved landing strips, which intersected in an approximately North-South and East-West orientation, to support their military aviation operations. After the surrender of the Japanese, the RAF took over the facility, improved it and renamed it as RAF Changi.

After WWII, the commercial aviation industry started to develop exponentially. The increasing number and size of commercial aircraft resulted in the need for longer runways and more advanced aviation support equipment and technologies. RAF Kallang was operating at its maximum potential. In 1955, Paya Lebar Airport was opened and RAF Kallang was closed down.

When the British withdrew their forces in 1971, the RAF stations were handed over to the SADC. Singapore needed to expand its air defence capabilities rapidly. The SADC acquired the Cessna 172G Hawker Hunter, Singapore's first air defence fighter, Aerospatiale Alouette III, BAC Strikemaster and Shorts Skyvan. To increase strategic depth, these flying assets were spread out among the air bases. Paya Lebar Airport, which was originally a pure commercial airport, was converted for military use. In 1981, Singapore's

International Airport moved to Changi Airport and Paya Lebar Airport was renamed as Paya Lebar Air Base (PLAB).

On 29<sup>th</sup> November, 2004, Changi Air Base (East) was officially opened by then-Minister for Defence, Rear-Admiral (NS) Teo Chee Hean. The opening of Changi Air Base (East) marked a significant milestone in the development of the RSAF. Then-Minister for Defence, Rear-Admiral (NS) Teo Chee Hean, mentioned in his inauguration of Changi Air Base (East) Speech:

*"Changi Air Base (East) enhances the RSAF's operational capability and readiness, for it provides greater operational flexibility and more deployment options for the RSAF's fighter assets Changi Air Base (East) enhances the RSAF's ability to launch and recover its air assets under adverse conditions, as well as to mitigate our airspace constraints."*<sup>14</sup>

*Then-Minister for Defence, Rear-Admiral (NS) Teo Chee Hean*

Meanwhile, from the early days when Changi International Airport first received a commercial plane on 12<sup>th</sup> May, 1981,<sup>15</sup> it has now grown into a renowned aviation hub with over 6,500 flights weekly, flown by 100 airlines to over 300 cities.<sup>16</sup> This number is likely to keep growing with International Civil Aviation Organisation (ICAO) already forecasting world civil aviation to average growth of around 6% up to 2016.<sup>17</sup> This is a strong testament to the efforts undertaken by both the civil and military authorities in the management of airspace, as operations of both Changi Air Base (East) and Changi International Airport continued unhindered. This provides a strong foundation to manage the future expansion of both Changi Air Base (East)<sup>18</sup> and Changi International Airport,<sup>19</sup> which is likely to translate to greater demands for airspace usage.



*Then-Minister for Defence, RADM (NS) Teo Chee Hean viewing the RSAF's F16D Blk 52+ aircraft, operated by the 145 Squadron, housed at Changi Air Base (East).*

## *Airspace*

Airspace is the medium in which aviation activities (and non-aviation activities such as fireworks) shares. While intuitively easy to understand in basic concept, airspace is wrought with numerous rules, regulations, regimes and safety considerations which make

it a highly complex subject. It is in this context that we examine the differences between the usage of airspace by civil and military aviation.

In the early years of aviation (before WWI), “people with foresight had realised that the advent of the airplane added a new dimension to transport which could no longer be contained within strictly national confines.”<sup>20</sup> Though the two World Wars had demonstrated the deadly use of military aviation, its utilisation also significantly advanced the technical and operational possibilities of air transport in a world which had finally found peace again. Large numbers of people and goods were transported over long distances for the first time and ground facilities were correspondingly developed. The post-war civil aviation problems were studied by the US and the conclusion was that it had to be tackled on an international scale, else it would not be possible to use it as one of the principal elements in the economic development of the world. It was in this context that the ICAO eventually emerged and formalised the aviation rules in the manner of Convention of International Civil Aviation.

The most significant point to note for the civilian way of demarcating airspace is that it is territorial-boundaries-blind. The amount of airspace delegated by ICAO to a State for the purpose of Air Traffic Control (ATC) is not synonymous with boundaries or size of countries. Rather it is a combination of safety, track record, compliance to rules, equipment and infrastructure which determines the allocated area as a Flight Information Region (FIR). A FIR is a designated airspace where Air Traffic Services (ATS) are provided by a designated agency. In summary, a single FIR can straddle between two or more countries territorial airspace, as well as international airspace, while under the purview of a single ATC agency. This is an efficient mean of managing airspace for civilian air traffic to optimise the provision of ATS, as well as to enhance safety and reliability by giving the responsibilities to the best qualified agency.

Airspace is thus broadly classified as Controlled and Uncontrolled Airspace. Within Controlled Airspace, it generally indicates that ATC rules and procedures are applicable to all aircraft contained therein. This is further distilled into multiple types of ATS airspace like Airways (akin to sky highways for aircraft), Terminal Area, Control Zone (CTR), and Aerodrome Traffic Zone (ATZ). Other special uses of airspace also consist of Danger, Restricted and Prohibited airspace which the general aviator has to avoid or keep clear at all times. To further define the obligations and rules that are binding to the users and ATC service providers for the aforementioned airspaces, airspace can also be divided into different classes.

This results in an extremely complex and intimidating web of rules, regulations and imaginary boundaries interlaced on the unseen entity that we call airspace. The purpose is to put some semblance of order and control into an otherwise dynamic and chaotic air traffic environment. Uncontrolled airspace is less regulated and activities within are more associated on a seen-and-be-seen nature. However, the fact that it is classified as Uncontrolled airspace means that airspace is still been carved up in some ways. On top

of which, uncontrolled airspace can encompass territorial airspace, which means that while ATC rules are minimal, state laws are still applicable. Therefore, territorial airspace brings with it a set of rules that is associated with *Sovereignty and Legislations* and what a State can choose to do within this space and what its aircraft have to do out of it. Further segregation of civilian and military airspace is thus seen from the angle of *Control* and *Non-interference*. To differentiate clearly between civilian and military airspace is to allocate clearly segmented areas, so that both civilian (like recreational flying, cargo, commercial transport) and military activities (like military manoeuvres, air to air firing, parajump activities, sensitive areas) will not interfere with each other. But this does not preclude military aircraft from entering civilian airspace, unless it overlaps with foreign territorial airspace, then special permission is required from the foreign state.

### *Understanding Military/Security Airspace*

The airspace classified for military usage can potentially be dangerous for civil aviation and can have a security-laden nature. Military activities range from live firings (from air-to-air, air-to-ground and surface-to-air) to other activities that are considered dangerous for civil aviation. Fighter jets training which can utilise several thousands of feet of vertical airspace within a short lateral distance is definitely incompatible in operating within the same space associated with a passenger jet that is flying straight and level for passengers comfort and technical requirements. Hence, the need to have exclusive use of military training airspace arises. From the security enforcement point of view, there are also special airspaces that can be designated for the purpose of traditional national security and these airspaces can overlap with civilian airspace. For example, such control of airspace can be through the designation and enforcement of an Air Defence Identification Zone (ADIZ).<sup>21</sup> The ADIZ necessitates the identification of one's identity and purpose while flying through the designated airspace. While simple in concept, it can be difficult to implement and enforce. Declaring an ADIZ requires the co-operation of all aircraft flying through for it to work, without which, the country needs to have the means to enforce the ADIZ on errant or non-compliant aircraft. Moreover, the legitimacy of the ADIZ will be called into question if it is not confined solely within territorial boundaries or over disputed territories. To declare an ADIZ over another country's territorial airspace can also be interpreted as a hostile act, not to mention the means in which to enforce it using State assets. Even if it is declared over international airspace, its legitimacy can be challenged by an adjacent country who may similarly declare an overlapping ADIZ of their own. The US declared ADIZ and TFR (Temporary Flight Restrictions) over its territory after the 11<sup>th</sup> September episode for reasons of national security. They amended one of the ADIZ (Washington ADIZ) subsequently to SFRA (Special Flight Rules Area), which still reflected more onerous rules and responsibility on the pilots and the threat of criminal prosecution if breached.<sup>22</sup> While this was not met with protest by foreign countries since it was over US Airspace, it did elicit unhappiness and lobbying against it by the general aviation community within the US. Recently in November 2013, China established the East China Sea ADIZ which met with protests and regrets from neighbouring countries.<sup>23</sup>



The significance of which was that it covers disputed areas and overlaps with an existing ADIZ declared by Japan.<sup>24</sup> The onus is thus on civil aviation to ensure due care when navigating through such airspaces and hope that the situation does not arise when different militaries give conflicting instructions.

For the case of Singapore, given the geographical constraints, efforts must continuously be made by both the civil and military authorities to ensure that both civil aviation and military activities are managed safely and effectively for their respective purposes.

### *Manpower*

Another resource constraint faced by Singapore is human resource. As of June 2013, Singapore's total population was 5.4 million, of which 3.31 million or 61.3% was the citizen population.<sup>25</sup> The Total Fertility Rate (TFR) was 1.29, significantly below the 2.1 required for population replacement. With increasing life expectancy and declining fertility rates, the population will continue to age and the citizen old-age support ratio will decrease.<sup>26</sup>

The SAF is one of the largest organisations in Singapore. It has a strength of 300,000 personnel, made up of Regulars, NSFs and NSmen, of which NSmen form the backbone of Singapore's military defence system. Unlike other organisations, the SAF cannot rely on the foreign worker population to augment its workforce. With a declining population, it will only get increasingly challenging to compete with the other industries for manpower.

Against the backdrop of decreasing manpower pool, the SAF has introduced several innovative measures to ensure that the SAF's mission and operational capabilities are not compromised and at the same time, the civil sectors' manpower requirements are not ignored.

In both the civil and military sectors, pilots are a precious commodity. It takes a significant amount of time and money to train a pilot. To apply to become a pilot, one would have to undergo multiple rigorous medical examinations and aptitude tests.<sup>27</sup> After which, the trainee would have to undergo a few years of training before graduating as a pilot. The RSAF, which prides itself as a 'First Class Air Force, World Class People', and Singapore Airlines, which is one of the world's leading airlines, both require top-notch pilots. The RSAF and SIA have an existing arrangement to optimise the scarce national pilot resource. This arrangement allows the RSAF to meet its operational requirements and provide SIA with trained pilot resources through second career opportunities for RSAF at certain stages of their careers. After serving the country for a number of years, military pilots are allowed to cross over to the civil sector through various transition schemes as such the RSAF-SIA Pilot Schemes (Junior and Senior) and RSAF-Silkair Pilot Scheme. These schemes allow pilots to have a meaningful career in the RSAF, whilst ensuring that their transition to a second career in the civil aviation sector is taken care of. On the whole, this arrangement allows both the military and civil sectors' needs to be satisfied.

The success of the RSAF-SIA Pilot Schemes and the RSAF-Silkair Pilot Scheme has translated to the Air Traffic Control community. In Jan 2009, the Civil Aviation Authority of Singapore (CAAS) signed a Memorandum of Understanding (MoU) with the RSAF to formalise a career transition scheme for retiring RSAF Air Traffic Controllers.<sup>28</sup> Similar to the above mentioned schemes, this partnership allows the civil sector to tap on the highly experienced pool of military Air Traffic Controllers who are intimately familiar with Singapore's airspace, to augment its own recruitment and training efforts.

More recently, in April 2010, the SAF introduced the Military Domain Expert Scheme (MDES) to complement the existing Officer and Warrant Officer Corps. The purpose of the MDES is to attract, develop and retain talented military personnel with deep specialisation in specific military domains. Instead of the traditional retirement age of 50 for the SAF Officer Corps, Military Experts (MEs) have a full career up to 60 years old. The MDES also facilitates mid-career professionals with the relevant expertise to join the SAF. Coupled with the longer career, the MDES allows military personnel to develop deeper core expertise, harness the potential of highly sophisticated aircraft and weapon systems and meet the rising aspirations of a more educated youth.

## **FUTURE CHALLENGES**

### *Charting New Paths for Unmanned Aviation*

The world is witnessing significant growth in the advancement and commercialisation of unmanned technologies. While the current status remains that UAVs are largely operated by the military and segregated from the civil airspace, increasingly, commercial players are employing UAVs for various purposes. In countries such as the US, UAVs are deployed by the homeland security forces for surveillance operations and border patrols.<sup>29</sup> The environmental agencies have also commenced employing UAVs to survey forests and wildlife. Other uses of UAVs include firefighting, disaster relief, and search and rescue.<sup>30</sup> With the proliferation of UAVs for civilian uses, there has been increasing calls to integrate the UAVs into the civilian airspace. Significant progress has been made in this respect in countries such as the US, UK and Israel. Already, in the United States, UAVs are allowed to operate in certain civilian airspace, albeit under 'carefully monitored exemptions' to the Federal Aviation Administration (FAA) rules. Routine UAV flights over densely populated areas are still prohibited.<sup>31</sup> Significantly, the FAA plans to integrate UAVs into the civilian airspace by 2015,<sup>32</sup> and has chartered a 'UAS Aviation Rulemaking Committee' in 2011 to develop policy recommendations to integrate routine UAV flights into the national airspace, as well as the Unmanned Aircraft System Integration office in 2012 as a one-stop agency for civil and public use of UAVs in the national airspace.<sup>33</sup>

The predominant concern is the safety and reliability of UAVs flying in the civilian airspace, including the inability of the UAVs to perform 'sense-and-avoid' functions of a manned aircraft. Already, such collision warning and avoidance systems for UAVs are emerging in the market, even though there remain challenges in system integration and miniaturisation of these components into smaller UAVs.<sup>34</sup> Another ambitious

international project is under way to develop the Mid-Air Collision Avoidance System, in order to facilitate UAV integration into the civilian airspace. This project is fronted by five European countries and a consortium of 13 European companies.<sup>35</sup> There are also, however, significant legal challenges in integrating UAVs into the civil airspace, in ways that are consistent with the privacy and civil liberty considerations.<sup>36</sup> More significantly, in the context of Singapore, there will be national security implications, including maintaining air domain and air defence awareness in an increasingly congested and complex airspace.<sup>37</sup> This is particularly pertinent in today's context whereby the transnational terrorist threats are still real.

Taken together, these challenges imply that the civil aviation agencies and the RSAF will need to work closely together in the near future, to integrate the UAV into the local airspace. These include: (a) reviewing the regulatory policies in order to ensure that the UAVs meet the applicable airworthiness certification and performance baseline, and (b) reviewing existing air traffic control policies and procedures to ensure interoperability between the manned and unmanned aircraft.

## **CONCLUSION**

The RSAF and the civil aviation industries have played a crucial role in Singapore's growth as a nation, through building a harmonious and symbiotic relationship over the past few decades.

However, many challenges lie ahead for Singapore. The declining pool of manpower will affect all industries in Singapore. The sustained growth of civil aviation and the planned expansion of both Changi International Airport and Changi Air Base (East), as well as the proliferation of UAVs will require continued judicious management of airspace. To maintain its position as a leading premier civil aviation hub and a 'First Class Air Force', both civil and military aviation sectors must work in synergy to develop innovative ways to overcome these challenges and limitations.

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