THE LIBERTY INCIDENT: A MISGUIDED MISSILE IN THE PROPAGANDA WAR AGAINST ISRAEL

A. Jay Cristol, Captain, USNR JAGC (Ret)

On June 8, 1967, the USS *Liberty*, a U.S. Navy intelligence gatherer, sailed into the middle of combat on the fourth day of the Six Day War. Through blunders in the U.S. military communications system, the *Liberty* had failed to receive any of five U.S. naval messages ordering her to stand off and remain over the horizon and well clear of the combat zone.
The ship was erroneously designated hostile by the Navy, and the Navy's error was compounded when it concluded it could not overtake it. The ship was steering 283° about 12 miles offshore and appeared heading for Port Said. The Navy asked for air and the Israel Air Force attacked. Within twelve minutes, an Air Force pilot determined it was not an Arab ship and the air attack was terminated. Shortly thereafter, Navy motor torpedo boats arrived on the scene. While attempting to identify the ship, the Navy MTB's were fired upon by the *Liberty*. The Navy then considered her as hostile and attacked with gunfire and torpedoes. There is a longstanding debate in the Navy of Israel on whether the torpedo attack was appropriate. Thirty- four Americans died and 171 were wounded in what has been determined by over ten official U.S. investigations and four official Israeli investigations to have been a tragic case of mistaken identity.
Why is this tragedy of interest today? Persons and organizations with agenda aimed at destroying the excellent relationship between the

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United States and Israel continue to create and disseminate myths and conspiracy stories about the tragedy to further their anti-Israel agenda. There are more conspiracy stories about the Liberty incident than about the assassination of President John F. Kennedy.

Most recent, and with much fanfare and media coverage, is the claim made at a June 10, 2005 press conference in Washington, D.C. that Israel committed war crimes while attacking the *Liberty*. The charges are factually false and the legal basis of the claim is without merit. Nevertheless, it was filed with the Secretary of the U.S. Army. No doubt, the claim will soon be rejected when the false charges are examined. Unfortunately, the false charges continue to receive press coverage which is the primary intent of the anti-Israel entities supporting the claim.

A well-organized campaign, funded and supported by anti-Israel and anti-Semitic persons and organizations with their own political agenda and a receptive audience of conspiracy buffs, continues to use the *Liberty* incident as a lightning rod for anti-Israel and anti-Semitic propaganda. This propaganda includes a number of myths:

MYTH: The attack on the USS *Liberty* was a deliberate, malicious act by Israel against a ship known to be U.S.

FACT: The attack was a tragic case of mistaken identity caused by blunders of both Israel and the United States.

MYTH: There has never been a U.S. investigation of the incident.

FACT: There have been more than ten U.S. investigations, including congressional investigations. They all concluded that the attack was a case of mistaken identity, or, that there was no evidence that it was not a case of mistaken identity.

MYTH: There are audio tapes of radio intercepts collected by the National Security Agency which prove the attack was with knowledge the target was a U.S. ship.

FACT: The NSA released its audio tapes of radio intercepts which prove the opposite, that the target had been erroneously identified as hostile and was not identified as U.S. until 44 minutes after the attack was concluded.

MYTH: The attack on the USS *Liberty* was "unprovoked."

FACT: This myth completely ignores that the United States had publicly announced to the world at the United Nations Security Council only two days before June 8, 1967 that it had no warships within hundreds of miles of the combat zone. The chain of reactions was started by an Israeli army report of explosions at El Arish. Since Israel controlled the air and the ground, they made the assumption that they were being shelled from the sea and a warship was in eye view. In view of the U.S. public announcement, it seems more logical for the Israelis to have assumed that a haze grey warship sailing in a position from which the day before an Egyptian warship had reportedly shelled from the sea, within eye view of the ongoing combat was an enemy vessel rather than a U.S. ship.

MYTH: "Israel fighters and torpedo boats assaulted the ship for more than an hour."

FACT: The air attack lasted about 12 minutes and was terminated as soon as the Israel Air Force determined the ship was not an Arab ship. While the Air Force was initiating rescue operations, the torpedo boats approached, stopped, and began signaling to the *Liberty*. The response of the *Liberty* was to begin shooting at the torpedo boats which then began the torpedo attack. It lasted less than 15 minutes during which time the Navy torpedo boats believed they were facing an enemy who initiated the shooting.

MYTH: "Israeli reconnaissance planes had positively identified the ship."

FACT: A routine Israel Navy reconnaissance flight at dawn on June 8 sighted *Liberty* at about 6:00 A.M. steaming southeasterly and south more than 70 miles further west of El Arish. Positive identification was made and the information passed to Naval Intelligence Headquarters and the *Liberty* was marked on the battle control board at Naval Headquarters. Five hours later, the *Liberty* mark was considered old information and removed from the battle control board. At 11:00 A.M., shifts changed and the information about the *Liberty* was not known to the officer who assumed command. At about 1:00 P.M., when the presence of a ship, steaming west 14 miles off the coast of the Sinai and reported to be shelling Israel Army positions from the sea, became a tactical issue, the Navy Officer in command did not know about the dawn sighting of *Liberty* sailing in the opposite

direction many miles to the west.

MYTH: "Throughout the attack, the *Liberty* was flying a large American flag."

FACT: Immediately prior to the air attack, the *Liberty* had a 5 by 8-foot American flag hoisted but because of the light wind conditions it probably was not extended. This is the Finding of Fact number 2 of the U.S. Navy Court of Inquiry of June 18, 1967. As a matter of fact, a reference to the formula for visual acuity reveals that a flag that size, if fully extended in good light would not be identifiable beyond 1323 feet and the attacking aircraft never came that close. It is also the undisputed testimony of the Commanding Officer of the *Liberty* that the 5 by 8-foot flag was shot away on the first strafing run. A second, larger, 7 by 13 foot flag was hoisted after the air attack and prior to the torpedo attack but it was engulfed in smoke and thus was not an identification factor during the attacks. The first actual sighting of an American flag on the *Liberty* was made by an Israeli helicopter pilot about 45 minutes after both air and sea attacks were over.

MYTH: "Nowicki (a National Security Agency Hebrew linguist aboard an EC-121 near the scene) heard both the pilots and the torpedo boat crew members referring to the American flag during the attack." "Nowicki also heard the pilots talk about the American flag."

FACT: No reference to an American flag was made on any radio intercept until 1512, about 45 minutes after the attack was over. Transcripts of the Israel Air Force tapes confirm this. On July 2, 2003, the United States National Security Agency released their tapes of radio intercepts. The translations may be seen on the National Security Agency website (nsa.gov). The tapes confirm that the Liberty was not identified as U.S. until 1512, about 45 minutes after the termination of the attack.

MYTH: [The *Liberty*] "had its name painted in English in ten-foot letters across the stern."

FACT: The name *Liberty* on the curved stern of the ship was not larger than 18 inches and because of the curvature of the stern, was extremely difficult to read under any circumstances. The ships identifier, "GTR-5" was painted on both sides of the ship near the bow and near the stern but only the number

"5" was ten feet tall. The "GTR" was substantially smaller. It was the sighting of these markings by the second wave of aircraft that identified the ship as not an Arab ship and resulted in immediate termination of the air attack twelve minutes after it began.

MYTH: [The *Liberty*] never fired a shot."

FACT: This statement is false. The evidence has been undisputed for more than three decades that when the torpedo boats approached, stopped, and began signaling, the *Liberty* began shooting at them. Captain McGonagle, the commanding officer, testified to this under oath at the U.S. Navy Court of Inquiry and reconfirmed it in a videotaped press conference on board *Liberty* when the ship returned to the United States. He may be observed on videotape telling of the *Liberty* firing at the torpedo boats in the Thames TV documentary, Attack on the *Liberty*, aired on British television on January 27, 1987.

The deliberate conspiracy theories charged against both the U.S. government and Israel must first be examined in the big picture of the world situation in June 1967. Israel was facing threat of annihilation by Egypt, Syria, Jordan, Iraq, Saudi Arabia and other Arab countries. No country in the world stood with Israel except Israel's only friend, the United States. Under these circumstances would it have made any sense for Israel to deliberately attack the ship of its only friend? If Israel did not want the *Liberty* to intercept its radio communications, would it not have made more sense to not transmit by radio than to attack the ship of its only friend?
The U.S. Navy Court of Inquiry's record of investigation is 727 pages in length. Contrary to the claim, "No official investigation has ever permitted the testimony of the surviving crew members," the report includes 155 pages of sworn testimony from the crew members with the most knowledge of the event. It was taken by the U.S. Navy Court of Inquiry less than a week after the event. The entire Court of Inquiry Record may be viewed at www.libertyincident.com.

Fifty-two findings of fact were made by the Navy Court of Inquiry.
Two of the most important findings are:

- Available evidence combines to indicate the attack on *Liberty* was in fact a case of mistaken identity.

- There are no available indications that the attack was intended against a U.S. ship.

The Court of Inquiry record was presented to Admiral John S. McCain Jr. (the father of U.S. Senator John McCain) in his capacity as commander in chief, U.S. Naval Forces Europe. He endorsed the record with an overall conclusion that the attack was, in fact, a mistake.

The report then went up the chain of command, was endorsed to be legal and complete by the Navy judge advocate general, and found its way to the desk of the chief of naval operations. It was endorsed for the CNO with the comment, "retain the report for historical purposes."

The CIA investigated and its official position was stated in a Feb. 27, 1978 letter to an inquiring U.S. senator, "It remains our best judgment that the Israeli attack on the USS *Liberty* was not made in malice toward the United States and was a mistake."

President Johnson tasked Clark Clifford, chair of the Foreign Intelligence Advisory Board, to investigate and Clifford advised the president in his report: "The weight of the evidence is that the Israeli attacking forces originally believed their target was Egyptian."

Finally, the National Security Agency, in response to my Freedom of Information Act lawsuit, released on July 2, 2003, a conclusion it had kept classified since 1981, to wit: "While these reports revealed some confusion on the part of the pilots concerning the nationality of the ship, they tended to rule out any thesis that the Israeli Navy and Air Force deliberately attacked a ship they knew to be American." (This material may be viewed on the NSA website, nsa.gov, or www.libertyincident.com). Because so much time has passed, many younger persons have never heard of the *Liberty* incident. It is therefore important to be aware of the myths and, when confronted by them, to be able to respond with precise positive reference to the facts. All of the foregoing myths are fully discredited and refuted. The purveyors of anti-Israel poison follow the Goebbles doctrine, if you tell a lie enough times, people will believe it. For the sake of the US-Israel relationship, it is important to face the lies and expose them at every opportunity.
To view detailed documentary evidence, see www.libertyincident.com.

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The "Liberty" Incident

An Israeli View

Oded Marom

On June 8, 1967, the fourth day of the Six Day War, in the early hours of the afternoon, near the coast of El Arish, naval forces and aircraft of the Israeli Air Force attacked an American spy ship gathering intelligence by radio and radar. The ship (CTR-5 Liberty) that was sailing close to the battle areas in Sinai was attacked for about an hour, first by our aircraft and then by naval torpedo boats. When the attack was over there were 34 dead and 17 wounded on the deck.

In the wake of this serious incident, details and particulars were examined by various investigation committees in Israel and the US, as well as by independent researchers. The official findings of both Americans and Israelis maintain that it was not a deliberate attack with malicious intent, but the sorry outcome of a series of mistakes.

In 1976 journalist Anthony Pearson indicated in an article published in Penthouse magazine that Israel had a clear interest to disable the American vessel, which had intercepted Israeli intelligence signals, for this might have foiled Israeli strategic planning. Similar conclusions appeared in books written in 1979 and 1984 by James and Hirsch (one of them a member of the crew and a survivor) and judge Jay Kristol, who had devoted some 13 years to looking into the incident and wrote a doctoral thesis on it. Kristol interviewed more than 200 men, Israelis and Americans and his book, The Liberty Incident was published in 2002. All foreign publications, even when they come up with some new details actually endorse assertions by both Israeli and American investigations committees that the Liberty incident

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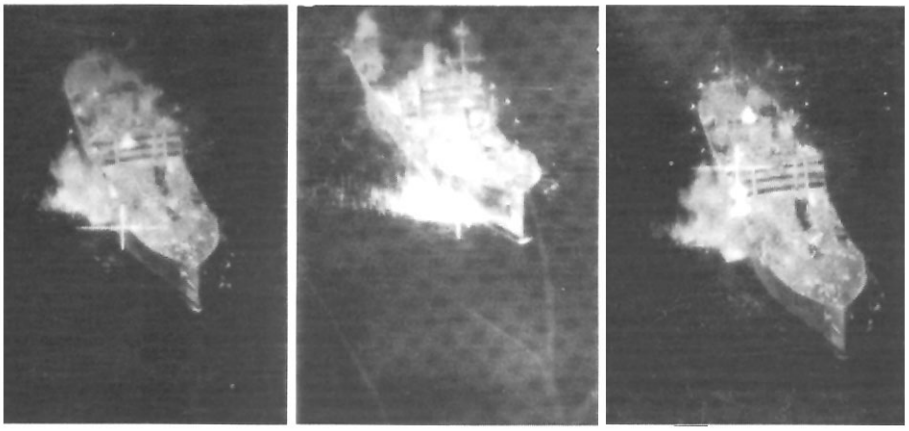

The “Liberty” attack through the sight of the Mirage aircraft.

was [the result of] an unfortunate blunder.
Yet the Liberty incident is still creating controversy even now, more than 40 years on. Debate is raging on in various internet sites, especially in www.halycom.com/jim/ussliberty/liberty.htm. Participants point out that Israeli forces displayed negligence, lack of professionalism and lack of coordination.
It is quite possible that the enormous gap between the dazzling victory won in Sinai and the Golan Heights and this embarrassing incident gave rise to some conspiracy theories about Israel.
The then military advocate general, Col. Meir Shamgar appointed Lieutenant Colonel Yeshayahu Yerushalmi as the examining judge, and accepted his verdict that the actions of the military personnel involved were in keeping with the norms of reasonable officers during a war, when their mission is to safeguard Israel's security, identify every enemy showing harmful intent - attack and destroy it. Lt. Col.Yerushalmi found no deviation from this norm justifying prosecution.

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Unmanned Aerial Vehicles/Unmanned Combat Aerial Vehicles Likely Missions and Challenges for the Policy Relevant Future

Manjeet Singh Pardesi

> Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.
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> —Giulio Douhet

The absorption of modern information and communications technologies (ICT) has transformed the US military. Unmanned aerial vehicles (UAV) and unmanned combat aerial vehicles (UCAV) are playing a crucial role in this transformation, as they provide the military with a new platform that exploits the advances in ICTs. At the same time, they are integral to the concept of network-centric warfare. Although interest in UAVs is as old as the history of manned aviation, UAVs started making news due to their military effectiveness in recent conflicts such as Afghanistan (2001) and Iraq (2003). The Afghanistan campaign highlighted the growing role of UAVs, because it was in Afghanistan that the UAVs actually started attacking targets in addition to performing their primary mission of intelligence gathering and guiding weapons to their target. [1]
This article seeks to answer whether UAVs represent a truly disruptive technology. What will be the impact of UAVs on manned aircraft and how does the increased use of unmanned platforms alter the strategic landscape? To this end, this article will examine various air operations—intelligence, surveillance, and reconnaissance (ISR); suppression of enemy air defenses (SEAD); and counterair—to establish the disruptive impact of UAVs, if any. This research will also briefly discuss how miniature/micro aerial vehicles (MAV), which are a subset of UAVs, are likely to be deployed on the battlefield.

UAVs, UCAVs, and MAVs

The US Department of Defense (DOD) defines a UAV as, "A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semiballistic

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vehicles, cruise missiles, and artillery projectiles are not considered unmanned aerial vehicles." [2] While the idea of removing the pilot from the cockpit may be conceptually simple, the UAV presents an operational challenge, as it is a system designed to fly in a hostile environment. Conventional wisdom states that removing the pilot from the aircraft would mean that the extensive and expensive life-support equipment is not needed, thereby making the UAV more cost-effective.

Even though the UAV concept seems somewhat revolutionary in nature, it is not new. The first heavier-than-air, sustained, powered flight was achieved by a pilotless aircraft, when Dr. Samuel Pierpoint Langley launched his steam-powered aircraft over the Potomac River on 6 May 1896, for a flight lasting over one minute. [3] After the Wright brothers' first piloted, powered flight on 17 December 1903, unmanned aviation took a backseat to manned aviation. While continuously maintaining a general interest in unmanned technologies, the United States devoted most of its time and resources to developing manned aircraft in the twentieth century. This was primarily a result of the fact that unmanned platforms represented an immature and relatively expensive technology.

Although the United States used UAVs for operational reconnaissance missions in Vietnam, it was Israel's successful use of UAVs during operations in Lebanon in 1982 that ignited American interest in this system.[4] The US Navy acquired the Pioneer UAV from Israel, and used it to provide tactical-level intelligence during Operation Desert Storm in 1991.[5] During Operation Enduring Freedom in Afghanistan, the Predator UAV started performing "armed reconnaissance" missions as mentioned earlier, and the Global Hawk UAV made its debut in the skies over Afghanistan in 2001 even though it was an experimental system then.[6] The Predators continued their combat role by attacking high-value targets in Iraq in 2003. Surveillance UAVs also helped US special forces in preventing Iraqis from launching any hidden Scud missiles.[7]

The United States is also heavily investing in a new class of unmanned platforms—MAVs. They are a subset of UAVs that are roughly two orders of magnitude smaller than manned systems (some as small as six inches). These compact, lightweight air vehicles carrying miniature sensors are playing a key role in the war against terrorism.[8] While MAVs are more vulnerable to attack and loss due to their low altitude, this is offset by the fact that they are extremely stealthy and very cheap. Their compact size and low weight will allow them to be carried by individual soldiers. The US Air Force is deploying MAVs for force protection in the shape of Lockheed Martin's SentryEye.[9]

Roles and Missions

While there is a good deal of confidence in the underpinning technology of unmanned platforms, there is a great deal less certainty surrounding their roles and missions. UAVs/UCAVs are likely to play a key role in mission areas commonly categorized as "the dull, the dirty, and the dangerous."[10] This section discusses some of the more important air missions (ISR, strike/SEAD, and counterair) to determine if UAVs/UCAVs can replace manned platforms in some or all of these roles. This will also include a short analysis of the role of MAVs on the battlefield. It must be pointed out that the move towards unmanned platforms is not necessarily due to the inadequacy of manned aircraft. Rapid technological advancement over the past decade has led to a "technological push" in this direction. Moreover, since

the end of the Cold War, the United States has been attempting to replace manpower with technology, mostly because it retains strategic interests in every corner of the globe but is increasingly hesitant to commit its military personnel for many of these missions. The move towards the unmanned platform is a result of all these developments.

Intelligence, Surveillance, and Reconnaissance

UAVs have been traditionally used as ISR assets, and their ability to do so is being boosted by advances in sensor and modern ICTs. For the United States, ISR collection is a critical factor in achieving the Joint Vision 2020 operational concept of "precision engagement."[11]

During the Vietnam War, the photos provided by the Ryan 147 Lightning Bug—a reconnaissance UAV—revealed precise locations of surface-to-air missile (SAM) sites, enemy airfields, ship activity in Haiphong Harbor, and battle damage assessment (BDA), intelligence that otherwise would have been obtained only if manned aircraft were sent in harm's way.[12] In Operation Desert Storm, the Pioneer UAV contributed to the tactical successes of the US Navy and Army by playing an important role in target designation, damage assessment, and reconnaissance.[13]

In Afghanistan, Global Hawk was used for reconnaissance prior to the strikes and for poststrike BDA.[14] The Predator was used in Afghanistan to feed imagery to AC-130 special operations gunships and special operations teams on the ground.[15] Global Hawk accounted for only 5 percent of intelligence sorties during Operation Iraqi Freedom but produced 50 percent of the information on time-sensitive targets.[16] UAVs retreated to their traditional role of reconnaissance in Iraq in spite of some successes in combat roles in Afghanistan. In Afghanistan, a dozen UAVs launched 115 Hellfire missiles and laser-designated 525 targets. In Iraq where more than 56 larger UAVs and more than 60 smaller portable ones were used, UAVs launched only 62 Hellfires and laser-designated only 146 targets. The main reasons for this disparity were Iraqi winds and sandstorms—these aircraft are much lighter than their manned counterparts—and the increased need for intelligence in the Iraqi campaign.[17]

UAVs face two competing systems for performing ISR missions, manned platforms, and satellites. While providing a significant improvement in information collection capability over these competing systems, UAVs also pose some serious limitations. Large and manned aircraft, capable of carrying Airborne Warning and Control Systems (AWACS) and Joint Surveillance Target Attack Radar Systems (JSTARS), have limited maneuverability and self-defense. Unlike the loss of UAVs, loss of these expensive manned systems is likely to cause severe domestic political repercussions for the United States. However, given the current state of technology, UAVs cannot completely replace AWACS- and JSTARS-manned aircraft in ISR missions. The military is seeking sensors with high-definition television standards, foliage-penetration radar with hyperspectral imagery, synthetic-aperture radar, and moving-target indication mode to track targets in all types of terrain throughout the spectrum of military operations.[18] Advanced sensor technology is still under development, and it is not sufficiently developed to perform the complex battle management and command and control functions handled by AWACS and JSTARS personnel. Due to their inability to absorb data and reason (at least for the foreseeable future), UAVs cannot process and relay the same amount of data as a pilot in the cockpit (who can do so by learning, experiencing, and by intuition) and cannot

maintain a 360-degree situational awareness (SA).
Manned missions provide high-resolution data and are extremely flexible at adapting to multiple-mission scenarios; however, their main limitation is their loiter time. UAVs on the other hand are capable of long loiter times; are smaller and hence stealthier than manned platforms; are much less costly to procure, operate, and support; and avoid putting pilots at risk. However, fast jet-based tactical reconnaissance remains a much sought after, but scarce capability for UAVs.[19]
The use of Global Hawk, Predator, and JSTARS systems (i.e., both manned and unmanned platforms) was the key factor behind the shattering of the Republican Guard and the success of the SCUD-suppression campaign in western Iraq during Operation Iraqi Freedom.[20] It is possible that in the future UAVs will be faster and more maneuverable; however, there are trade-offs as higher speed creates penalties for loiter time, one of the biggest assets of unmanned platforms.

Operation Desert Storm highlighted the pivotal role that satellites will have in future conflicts. However, UAVs have a major advantage over satellites in addition to being cheaper, as it is easier to alter their flight paths and coverage. Moreover, they provide a comparatively cost-effective method of collecting ISR. UAVs also have an additional advantage of being able to fly closer to the target.[21] However, the major drawback with UAVs as mentioned above is their lack of SA. This shortcoming can be overcome by integrating UAVs with reconnaissance satellites, but this creates an additional problem. High data rates (bandwidths) are essential for real-time interactive command and control systems like flight controls, video reception, and transmissions. UAVs are major consumers of bandwidth.[22] Since 11 September 2001, the US bandwidth requirement has increased eightfold due to the war in Afghanistan and the pursuit of terrorists in the region.[23] Stationing the mission control on a standoff aircraft (within line of sight) would decrease the dependency on satellites generated by stationing the mission control on the ground thousands of miles away. Autonomous UAVs will also require less bandwidth as more data will be processed on board.[24]
Moreover, since UAVs fly in close proximity to the target, they would need to have a high signal-to-noise ratio (especially if they are flying far from their control station), thus increasing their possibility of detection.

MAVs have tremendous potential for ISR operations. In the battlefield, they are likely to be operated by individual soldiers for local reconnaissance. MAVs integrated with a high-flying UAV will circumvent the need to develop foliage-penetration sensors. They will also play an important role in urban operations where stealthy airborne assets closer to the ground may be required. At sea, MAVs can also be deployed from ships to gather intelligence to prevent acts of maritime terrorism. They may also be fielded in a hostile environment to detect people equipped with shoulder-fired missiles to attack aircraft. MAVs shall play an important role in real-time detection and analysis of a biological or a chemical agent in an infected environment. They are also likely to play an important role in humanitarian missions (e.g., searching for survivors amidst rubble from earthquakes).

The way forward is to integrate manned, unmanned, and satellite-based sensors to create a common operational picture of the battlefield. Development

of ICTs and software algorithms to integrate the data provided by the three platforms will be crucial to ISR operations in the future. The information collection system of the future is likely to be based on space-based assets providing wide-area surveillance at a low level of resolution, but looking for cues that require detailed monitoring. Manned and unmanned vehicles will perform this detailed monitoring.

Armed Reconnaissance and Suppression of Enemy Air Defenses

US military strategy postembassy bombings in Africa focused on targeting Osama bin Laden and his training camps with Tomahawk Land Attack Missiles (TLAM). This strategy did keep US troops out of harm, but it suffered from many operational limitations. The most important of these was the long delay between acquiring reliable intelligence on the precise location of time-sensitive targets (from the skies over Afghanistan) and the execution of an actual cruise missile attack (from ships in the Arabian Sea). The United States was looking for an "armed reconnaissance" platform to strike time-sensitive targets. Technological momentum led the US Air Force to fit two 45-kilogram (kg), laser-guided Hellfire-C missiles to the Predator UAV.[25] On 15 November 2001, two Hellfire missiles launched from a Predator killed Muhammad Atef, al-Qaeda's chief of military operations.[26] This was the first use of the Predator as a weapons platform. On 3 November 2002, almost a year later, a CIA-operated armed Predator flying over Yemen, with Yemen's approval, killed a top al-Qaeda operative, Ali Qaed Sinan al-Harthi, and his five companions traveling in the same car.[27] By performing successful "strike" missions, these incidents demonstrated the usefulness of armed UAVs in the global war against terrorism. These strike missions opened up a debate on a possible new role for the armed UAVs—SEAD.

The US DOD defines SEAD as an "activity which neutralizes, destroys, or temporarily degrades surface-based enemy air defenses by destructive and/or disruptive means."[28] The Predator UAV was credited with two strikes in Operation Iraqi Freedom in March 2003—one strike was against an antiaircraft vehicle while the other was against a television satellite dish in Baghdad.[29] The United States is currently developing a new version of the armed Predator UAV, called Predator B, which will have the capability to carry eight Hellfire missiles instead of two.[30] The United States is also developing newer platforms—UCAVs—with a primary offensive mission of strike and SEAD. To determine the efficacy of the unmanned platform in a SEAD role, the United States will need to consider two rival challenges: the adoption of new countertactics by its opponents and the development of new antiair systems.

Today, the United States relies exclusively on the F-16 and the Navy's EA-6B for defense-suppression missions. The loss of a modern, expensive platform like the F-16 (and its pilot) will be a major political embarrassment for the United States, in addition to being an economic loss. SEAD is an important mission as it helps in attaining "air superiority." The air forces can attack the heart of the enemy (i.e., perform the "interdiction" mission) only after gaining command of the air. However, during Operation Desert Storm, the super-stealthy F-117 allowed the United States to hit the enemy's key nodes within the opening minutes of the conflict.[31] In order to avoid a similar fate during the air war over Serbia, the Serbs chose not to deploy a determined air defense system. This enabled them to launch 700 missiles in the course of the 78-day conflict and cause enormous frustration to the United States Airmen.[32] It was recently reported that the United States was using its drones to

scan Iran for nuclear weapons. It is likely that the Iranian authorities did not activate their air defense systems out of the fear of revealing their positions.[33]

In addition to such tactics, the United States is also likely to face "antiaccess-threat systems" like cruise missiles, theater ballistic missiles, and advanced air defense systems. The range of modern SAMs (estimated to be between 50 and 250 miles) is forcing the United States to develop strategies and systems to reduce the risk to its airmen.[34]

Missiles launched from a distance from mobile SAM sites are difficult to detect, and the high speed of newer missiles makes them more maneuverable. This means that the friendly aircraft/UAVs will have a very narrow "escape zone" to avoid the SAMs. Unmanned jet engine g-forces (g) limitations (±12 g) do not significantly exceed those of the human pilot (between –3 g and -+9 g) and hence do not substantially increase defensive capability against missiles.[35] The cost arithmetic further complicates the analysis and is not useful in determining the efficacy of UCAVs over current standoff systems like cruise missiles. JDAMs employed by UCAVs may be cheap compared to the Tomahawk, but the UCAV, which is an expensive recoverable platform, is likely to suffer considerable attrition due to its proximity to the target.[36]
Unmanned systems are "attritionable," but not expendable (i.e., it is fine to lose them only when the alternative to their loss is manned aircraft). Moreover, on an average, unmanned platforms are lost at a much higher rate than manned aircraft.[37]
It makes sense to use low-cost UAVs and/or decoys to locate the positions of enemy SAM sites, which may then be attacked as a part of a "reactive" SEAD strategy.[38]
This, together with UCAVs equipped with passive sensors (an extremely stealthy platform), represents an effective counter to mobile defenses. There are however, several constraints here that must be kept in mind: (1) the primitive nature of current target-recognition programs means that a human operator must be kept in the loop to authorize the "kill," thereby, increasing the bandwidth requirements, and (2) integration with other ISR platforms is necessary to locate time-sensitive targets.[39] These constraints put serious limitations on the use of unmanned combat platforms in reactive SEAD missions.

UCAVs are more likely to play an important role in "preemptive" SEAD missions (where the exact locations of enemy SAM sites are known) as opposed to reactive SEAD missions. UCAVs, integrated with manned and unmanned assets like AWACS, F-16s, F-117s, Global Hawk, and communications satellites, will play a role in future SEAD missions (reducing some risk to manned assets in this high-threat environment); however, they will be only one of many platforms used for this mission. UAVs/UCAVs are nevertheless very suitable for strike missions, especially against a very heavily defended target due to their high level of stealth.

UAVs/UCAVs will also play an important role in electronic-attack missions. However, they will only play a limited role at best, as the future use of electromagnetic pulse (EMP) weapons and directed energy (DE) weapons will increase the risk of self-jamming for the unmanned platform itself.
Swarms of MAVs equipped with sensors and miniaturized warheads are theoretically capable of attacking high-value targets such as radars and launchers of SAM sites,

that is, they are likely to play an important role in SEAD missions in the future.[40] Global Positioning System (GPS) allows precise autonomous navigation and position reporting for MAVs, which are critical to the military application of these technologies. Some of the limitations of this technology are its small-range and high-damage potential (especially due to the prevailing weather). Microelectromechanical systems (MEMS), micromanufacturing, and nanotechnology could provide an exponential leap in microminiaturization for weapons, sensors and platforms.[41]

However, for operational success, MAVs would have to be integrated with other UAVs or manned aircraft to address the complete operational scenario.

Counterair

In March 2003, Predator launched a Stinger air-to-air missile at an Iraqi MiG before the Iraqi aircraft shot it down.[42] This has led to the speculation that armed UAVs/UCAVs will play a role in counterair operations (and by extension as air superiority fighters in the future). The US DOD defines counterair as "a mission that integrates offensive and defensive operations to attain and maintain a desired degree of air superiority. Counterair missions are designed to destroy or negate enemy aircraft and missiles, both before and after launch.[43]

The USAF F-15C, USN F-14A/D, and USN and USMC F/A-18 aircraft were the platforms instrumental in the command of the skies over Iraq during Operation Desert Storm.[44] The same air assets were available during Operation Allied Force for the function of counterair. Lockheed Martin's F-22 Raptor is likely to play the key role in America's air superiority efforts in the years ahead.[45] Stealth, maneuverability, and cost are the most important design prerequisites for air superiority fighters of the future.[46] Whether or not a UCAV will replace the F-22 fighter (a manned platform) is a crucial question as American air superiority in a future conflict depends on the answer to this question. This is also a timely question since the decisions taken today will guide the research, development, production, and training of the new system (manned or unmanned replacement of the F-22 fighter) over the next two decades. Aerial combat is the most challenging mission for manned aircraft to perform, and it is believed that missiles do not always kill the adversary (especially one equipped with significant counterair assets and capabilities like the MiG-29 Fulcrum and the Su-27 Flanker[47]), so close engagements are necessary. Combat survivability remains the most significant limitation to UAV employment.[48] As previously mentioned, limitations imposed by line-of-sight data-transfer requirements will enhance the role of satellite communications. However, the current American and allied satellite communications infrastructure is incapable of supporting any sizable number of UAVs or UCAVs. Global Hawk consumed five times the total bandwidth used by the entire US military in the Gulf.[49] Autonomous systems will reduce bandwidth requirements. However, it is unlikely that the UCAV will replace the manned aircraft in all operations as some politically sensitive targets will still need a human operator to make the "kill decision." Moreover, systems based on artificial intelligence (AI) are unlikely to replace the human completely, even though significant developments are likely to occur over the next two decades.

Stealth requirements dictate that the UCAV weapons be small and precise.

The weaponization of the unmanned platform for air superiority missions is not likely to happen over the next two decades.[50] In the near future, the UCAV is not likely to have its own air-to-air weapons, that is, no air-to-air weapons are being designed or produced at the moment with the UCAV as the launch platform. For the foreseeable future, the UCAV is going to carry air-to-air weapons like the Sidewinder missile and advanced medium-range air-to-air missile (AMRAAM) that already exist.[51] UAVs/UCAVs will be used predominantly to provide active sensors against highly lethal antiaircraft weapons in support of inhabited vehicles.[52] UCAVs are unlikely to replace the manned aircraft for air combat missions in the policy-relevant future. The future will see a mix of manned and unmanned platforms together with space weapons in counterair operations.

Conclusions

On the one hand, UAVs enhance the ability for the United States to intervene militarily anywhere in the world whenever its interests are threatened (whether through ISR missions or in a combat capacity through surgical strikes, preemptive SEAD missions, etc.) without putting its forces in harm's way. On the other hand, this possibility will drive certain nations to acquire armed UAVs and/or weapons of mass destruction (WMD) to oppose a US-led intervention.[53] It must be emphasized that the greatest risk is posed by terrorists' use of armed UAVs. UAVs will also enable regional powers to bolster their power-projection capabilities. India has raised its profile in the Indian Ocean Region by operationalizing its first full-fledged UAV base in Kochi where its Southern Naval Command is based.[54]

The UAV is an innovative weapon system that avoids placing a pilot in harm's way, but it is not a truly disruptive technology as there will always be missions that will require the manned aircraft. Likewise, the unmanned platform has less flexibility, greater vulnerability, and cannot analyze its environment. Moreover, many advanced unmanned platforms are as expensive as manned aircraft, and their high cost makes them attritionable, not expendable. Their software complexity, automation, and communications architecture make them operationally unreliable for many missions. Thus far, communications technology has limited the effectiveness of the unmanned platform, especially its armed version.

UAVs also face considerable challenge from competing systems like satellites and TLAMs. Satellites not only provide better situational awareness, but also avoid international norms for violating national/sovereign airspace and are thus far invulnerable to shootdown. TLAMs have proven superior in weapon-delivery roles. However, many dull, dirty, and dangerous missions will see an increased role for the unmanned platform.

UAVs are going to perform the critical ISR mission in future military operations where they are likely to fly tactical missions together with their manned counterparts upon obtaining cues from satellites. MAVs with their potential to substantially transform urban operations and special operations missions will see their role enhanced in future conflicts. UCAVs and armed UAVs shall also perform strike and preemptive SEAD missions in the future, but are not likely to perform reactive SEAD missions due to the proliferation of sophisticated air defense systems worldwide. They are also likely to play an important, but limited, role in

electronic-attack missions. The proliferation of sophisticated counterair assets makes UAVs unsuitable for counterair missions, and communications and automation technology limitations, together with political ones (the authorization to fire), reduce their usefulness for combat missions. It is unlikely that the unmanned platform will make significant inroads into the force-application role in the policy-relevant future.[55]

However, their potential for homeland security and commercial applications will give unmanned platforms prominence in the years ahead. The defense-industrial sector is likely to see an influx of new players from the commercial sector, as advances in unmanned technologies are likely to have important commercial applications. However, unmanned platforms can never replace the manned aircraft, as the unmanned platform is just a machine that takes cues from the environment and follows a predefined set of instructions to react (i.e., it cannot analyze its environment). Even AI systems can at best only improve existing technology; they can never supplant the human under the uncertainties and rapid changes of war.

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[1] Keith Somerville, US Drone Takes Combat Role, BBC News Online, 5 November 2002, http://news.bbc.co.uk/1/hi/world/2404425.stm.

[2] Joint Publication (JP) 1-02, DOD Dictionary of Military and Associated Terms, 30 November 2004, http://www.dtic.mil/doctrine/jel/DODdict/data/u/05601.html. Unless stated otherwise, this article uses the phrase "unmanned platform" to refer to UAVs and/or UCAVs.

[3] Maj Thomas G. O'Reilly, "Uninhabited Air Vehicle: Critical Leverage System for our Nation's Defense in 2025" (master's thesis, Air Command and Staff College, Air University, Maxwell AFB, AL, 1999), 9–10.

[4] Elizabeth Bone and Christopher Bolkcom, Unmanned Aerial Vehicles: Background and Issues for Congress, 25 April 2003, 2, www.fas.org/irp/crs/RL31872.pdf.

[5] Ibid.

[6] John McWethy, "Robo-Planes: Unmanned Aircraft Redefines How Military Wages War," http://abcnews.go.com/sections/wnt/DailyNews/roboplane020501.html.

[7] Andrew Krepinevich, Operation Iraqi Freedom: A First Blush Assessment (Washington, DC: Center for Strategic and Budgetary Assessments, 16 September 2003), http://www.csbaonline.org/4Publications/Archive/R.20030916.Operation_Iraqi_Fr/R.20030916.Operation_Iraqi_Fr.htm.

[8] Michael A Dornheim and Michael A Taverna, "War on Terrorism Boosts Deployment of Mini-UAVs," Aviation Week & Space Technology 157, no. 2 (8 July 2002): 48; and Mark Hewish, "Small, but Well Equipped," Jane's International Defense Review 35 (October 2002): 53–62.

[9] Hewish, "Small, but Well Equipped," 53–62.

[10] Office of the Secretary of Defense, Unmanned Aerial Vehicles Roadmap 2002–2027, December 2002, iv, http://www.acq.osd.mil/usd/uav_roadmap.pdf. Dull missions include missions requiring coverage time beyond the capability of manned sorties. Dirty missions include reconnoitering areas contaminated with radiological, chemical, or biological agents. Dangerous missions include high-risk missions like SEAD with less need for supporting

aircraft.

[11] Chairman of the Joint Chiefs of Staff, Joint Vision 2020 (Washington, D.C.: Government Printing Office, June 2000), 12, http://www.dtic.mil/jointvision/jv2020.doc.

[12] Lt Col Richard M Clark, "Uninhabited Combat Aerial Vehicles: Airpower by the People, For the People, But Not with the People" (CADRE Paper No. 8, College of Aerospace Doctrine, Research and Education, Air University, Maxwell AFB, AL, 2000), 15–16.

[13] Ibid., 34–35.

[14] John Persinos, "Unmanned Aerial Vehicles: On the Rise," Aviation Today, 1 February 2002, http://www.aviationtoday.com/cgi/rw/show_mag.cgi?pub=rw&mon=0202&file=0202rorep.htm.

[15] Bone and Bolkcom, Unmanned Aerial Vehicles, 14.

[16] Thomas Donnelly and Michael Vickers, Iraq: Lessons Learned, American Enterprise Institute, 8 December 2003, http://www.aei.org/events/filter.,eventID.337/summary.asp.

[17] Gail Kaufman, "UAVs Shifted Role in Iraq Operations—Shot Fewer Missiles than in Afghanistan," Defense News, 8 December 2003, http://www.defensenews.com/sgmlparse2.php?F=archive2/20031208/atpc8593809.sgml.

[18] Mark Hewish, "Unmanned, Unblinking, Undeterred," Jane's International Defense Review 35, (September 2002): 47–55.

[19] A Predator is a slow platform that takes 30 minutes to travel 50 nautical miles.

[20] Donnelly and Vickers, Iraq: Lessons Learned.

[21] UAVs within 10 kilometers (km) of an object can resolve to 10 centimeters and those within one kilometer to just one centimeter. See Michael O'Hanlon, Technological Change and the Future of Warfare (Washington, DC: Brookings Institution Press, 2000), 34.

[22] Currently satellites offer low data-transfer rates. For a brief technical description of bandwidth requirements, see Maj William K Lewis, "UCAV—The Next Generation Air Superiority Fighter?" (master's thesis, School of Advanced Air Power Studies, Air University, Maxwell AFB, AL, 2002), 44–46.

[23] Bone and Bolkcom, Unmanned Aerial Vehicles, 17–18.

[24] Ibid. The Global Hawk is an autonomously, rather than a remotely, piloted vehicle. In spite of this, it still requires multiple-satellite and line-of-sight links for control, in-flight mission reroutings, and the relay-of-sensor data.

[25] Dennis M Gormley, "New Developments in Unmanned Air Vehicles and Land-Attack Cruise Missiles," in SIPRI Yearbook 2003—Armaments, Disarmament and International Security (Oxford: Oxford University Press, 2003), 416–17.

[26] Ibid., 417.

[27] Ibid.

[28] JP 1-02, DOD Dictionary of Military Terms, http://www.dtic.mil/doctrine/jel/doddict/data/s/05165.html.

[29] Bone and Bolkcom, Unmanned Aerial Vehicles, 14.

[30] Ibid., 14.

[31] The F-117, which flew only 2 percent of the total attack sorties, struck nearly 40 percent of the strategic targets. See Thomas A Keaney and Eliot A Cohen, Revolution in Warfare? Air Power in the Persian Gulf (Annapolis: Naval Institute Press, 1995), 189–93.

[32] See Gen John Jumper, "Global Strike Task Force: A Transforming Concept, Forged by Experience," Aerospace Power Journal 15, no. 1 (Spring 2001): 27.

[33] Nazila Fathi, "Iran Says Pilotless US Planes Are Spying on Nuclear Sites," The New York Times, 17 February 2005, A-16.

[34] Countering "antiaccess" threats implies a capability to operate from well outside an enemy's defenses. See John A Tirpak, "The Double Digit SAMs," Air Force Magazine 84, no. 6 (June 2001): http://www.afa.org/magazine/june2001/.

[35] Airframes and mechanical components can be designed to operate out to the ±20G envelope. See Lt David Bookstaber, USAF, "Unmanned Aerial Combat Vehicles—What men do in aircraft and why machines can do it better," Air & Space Power Chronicles, June 2000, www.airpower.maxwell.af.mil/airchronicles/cc/ucav.pdf. However, designing jet engines that could withstand ±20G would require billions of dollars in development or would produce limited thrust-to-weight ratios (speed). Moreover, sensor-technology limitations are unlikely to allow the vehicle to maneuver in the proper direction at the proper time. See Thomas P Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation" (PhD diss., Johns Hopkins University, 2000), 574.

[36] Joint Direct Attack Munitions (JDAM) employed by UCAVs have a unit cost of $21,000 compared to $600,000 for a Tomahawk cruise missile. See Col Robert E Chapman II, "Unmanned Combat Aerial Vehicles: Dawn of a New Age?" Aerospace Power Journal 16, no. 2 (Summer 2002): 60–73. However, UCAVs will need to fly closer to the target and are not inexpensive. The Joint Strike Fighter (JSF) will have a flyaway cost of $35 million, and it is estimated that the Defense Advanced Research Projects Agency (DARPA)/Boeing X-45 UCAV will cost about $25 million. See Bill Sweetman, "UCAVs Grow Fat on Requirements," Jane's International Defense Review 36 (1 May 2003): 44–47.

[37] The crash rate of a Predator is an order of magnitude higher than the F-16. Moreover, a large number of crashes are due to human operator error. See Sweetman, UCAVs Grow Fat on Requirements, 44–47.

[38] There are two categories of SEAD missions—reactive and preemptive. For a detailed analysis of the usefulness of UCAVs for SEAD missions, see Lt Col Robert E Suminsby Jr., "Fear No Evil: Unmanned Combat Air Vehicles for Suppression of Enemy Air Defenses" (master's thesis, Air War College, Air University, Maxwell AFB, AL, 2000).

[39] It is unlikely that political and military authorities would leave the "kill" decision to automated systems for such a move would empower a machine to autonomously make the decision to kill a human. Moreover, there would be significant political backlash if autonomous machines hit innocent civilians by mistake, for example, during an operation in an urban area.

The time for imagery transmission will depend on the bandwidth. Moreover, the time for human decision making is a major unknown. These delays can prove fatal under the high threat SEAD environment. Also, the size of a deployed UCAV fleet is a major concern as it increases bandwidth requirements. Integration with satellites for data transmission will be essential for UCAV command and control.

[40] Hewish, "Small, but Well Equipped," 53–62.

[41] For the potential military applications of MAVs, see Timothy Coffey and John A Montgomery, "The Emergence of Mini UAVs for Military Applications," Defense Horizons, December 2002.

[42] David A Fulgham, "Predator's Progress," Aviation Week and Space Technology 158, no. 9 (3 March 2003): 48. Also see David A Fulgham, "Stinger Eyed for UAV Role," Aviation Week and Space Technology 156, no. 9 (4 March 2002): 44.

[43] JP 1-02, DOD Dictionary of Military Terms, http://www.dtic.mil/doctrine/jel/doddict/data/c/01329.html

[44] Thomas A Keaney and Eliot A Cohen, Gulf War Air Power Survey Summary Report (Washington DC: Government Printing Office, 1993), 56.

[45] See F-22 Raptor, http://www.fas.org/man/dod-101/sys/ac/f-22.htm.

[46] Stealth enhances survivability before engagement, and maneuverability enhances survival while engaged.

[47] The proliferation of advanced S-300 and S-400 integrated air defense systems is also a serious concern for the Americans.

[48] The low altitude of tactical UAVs makes them susceptible to small arms fire. Strategic UAVs fly higher but at speeds observable by radar. Moreover, they may be within the range of modern SAMs. See Maj Ronald L Banks, "The Integration of Unmanned Aerial Vehicles into the Function of Counterair" (master's thesis, Air Command and Staff College, Air University, Maxwell AFB, AL, 2000), 18.

[49] See Lt Col Kurt A Klausner, "Command and Control of the Air and Space Forces Requires Significant Attention to Bandwidth," Air & Space Power Journal 16, no. 4 (Winter 2002).

[50] Lewis, 50.

[51] Ibid., 52.

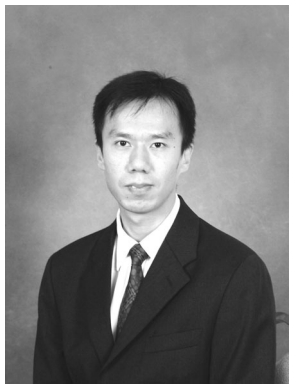
[52] Manned platforms will mostly rely on passive sensors.

[53] At least 40 countries have produced more than 600 different types of UAVs, many with ranges in excess of 300 km. See Gormley, 410.

[54] Josy Joseph, Navy to Use UAVs to Spy on Sea-Lanes, 29 December 2003, http://www.rediff.com/news/2003/jan/31uav.htm.

[55] However, advances in nanotechnology have the potential to boost the role of the unmanned platform (MAVs) in a combat mission.

AN ASSESSMENT ON THE SUITABILITY OF THE REPUBLIC OF SINGAPORE AIR FORCE TO COUNTER TERRORISM



Dr. Alvin Chew

INTRODUCTION

This paper touches on the effectiveness in utilising advanced and sophisticated inventories of the air force to counter the relatively low cost but devastating threats executed by the terrorists. It begins with a brief historical description on the economic rise of Singapore based on its strategic location in the South East Asian region and its geo-political vulnerability which leads to the essential development of the guardians for its airspace. Subsequently, the paper cites terrorism as a global threat, and argues if the nation's air force current inventories are suitable to be used against the types of threats posed by the terrorists in the region. The paper eventually concludes that the air force needs to enhance its participation in the areas of search and rescue operations and reconnaissance, while at the same time, maintaining its primary role in defending the nation from state aggressors.

1. SINGAPORE STRATEGIC LOCATION: AN ADVANTAGE OR A THREAT?

Singapore lies on the southern tip of the Malaysian Peninsula, which saw it prosper from a tiny settlement to a bustling city of modern architecture. When Sir Stamford Raffles founded the island in 1819, it was envisioned that Singapore would serve as a trade link between India and China.[1] The setting up of a port in the region act as a centre for entrepot trade in the South East Asian region, and Singapore continued to prosper, establishing itself as a British Crown Colony in the Straits Settlement. Today, ensuing decades of development after World War II has led this country to become one of the prime cities in South East Asia for foreign investments, enjoying strong economic growth coupled with stable governance. The government of Singapore has consistently emerged among the top ranking nations for transparency, demonstrating its austere political control to curb corruptions.[2] Furthermore, a major factor attributing to its success story is its relatively minute size in terms of its land area and its population, which possibly

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set a more desirable framework for the systematic governance of the nation. Having a strong government acts as a magnet for global companies to invest in Singapore, and in return, the government translates a part of its economic asset into tangible infrastructure. The various regions of the island are well connected via an excellent network of modern transport systems. In the southern-central region of the island, a business hub for the financial centres gave birth to a cluster of skyscrapers. It can be deemed that such architecture is often associated with prestige, with global Multi-National Companies (MNCs) setting up their regional headquarters in the central business district area of Singapore, following the trends of major cosmopolitan financial hubs in most developed countries.

With the economy of Singapore opening up to the global markets, it is poised to become more sensitive to world events. As it enjoys increasing attention as a robust economy through the media, inadvertently, that could spell for greater disaster if it rises to be out-of-sync with its regional counterparts. Singapore's relative success in a short frame of time has created an economic imbalance within the region taking into consideration its limited resources. Concerted efforts have been dedicated towards the forging of a single identity for its multi-racial citizens in order to prevent the dis-alignment from its neighbouring countries due to its ethnic composition. The birth of its national anthem, sung in the Malay language, could postulate Singapore's eagerness to retain strong ties with its Malay-speaking neighbours.

The success of a nation is always complemented with threats. Territorial sovereignty, domestic political order and sustained high economic growth constitute the three core values of Singapore's security.[3]

Emphasis on strong diplomatic ties alone within the region cannot guarantee the safety of the nation, with its vulnerability to an attack being accentuated by its social as well as economic distinction from the countries in the region. Even though an attack could be unlikely, it remains a question as to how much military support it can garner from its neighbours when faced with a light-intensity conflict. Hence, its attractiveness as an easy target to conquer led to the imperative for the formation of armed forces to defend the nation and protect its assets from likely aggressors. The end of World War II saw the exploitation of airspace as a crucial dimension in delivering military campaigns.[4]

Singapore, an island with only ground connections to Malaysia via its causeway links, recognises the high possibility of an air threat from its potential adversaries and therefore, is committed to defend this medium by developing a formidable team to protect its airspace.

2. COUNTER TERRORISM?

Despite being a young nation that lacks frontline experiences in a real war scenario, the Republic of Singapore Air Force (RSAF) hones its skills by conducting regular exercises with foreign air forces as well as joint exercises with its navy and army, achieving high accolades as one of the most superior squads within the region. The RSAF reputation as one of Asia's most modern air force[5] , consistently harnessing leading edge technology to military advantages, has successfully embedded a deterrence factor to its potential state aggressors, convincing them to think twice before launching an attack. With continual investment in state-of-the-art equipment for the air force, the nation is appropriately adapting itself to

the changing theatre of warfare in the future, whereby it is perceived that components such as integrated warfare as well as precision strike could dominate.
However, there stems more possible type of threaty that is against the rules of engagement in conventional warfare, mainly to commit acts of terror on innocent victims so as to underline their supremacy in overcoming technological advancement via unconventional means of operation. As their modus operandi remains highly irregular, scenario playing is not deemed as viable for military exercises and therefore, terrorism will surface as an area of challenge for the military forces.
Terrorism poses as an increasing threat to the national security of Singapore and various ministries have been summoned to safeguard the country from the damage it could inflict upon the nation. Owing to the present characteristics of terrorism, concerted efforts are drawn mainly from the military, homeland as well as foreign affairs group. The homeland ministry settles on issues concerning the internal security of the country, and scours for information and possible means that could deter or prevent terrorist activities, while the foreign affairs ministry has been brought in to deal with trans-national terrorism. The military remains operational ready in the background should there be a need to provide additional fire power.
However, a number of constraints and scenarios lead to the argument that the RSAF does not have an active role to play in counter-terrorism warfare for Singapore. By counter-terrorism definition, it means the offensive approach in defeating terrorist activities.[6]
Singapore has constantly invested in its aerospace defence system and saw it capable of assuming tasks in varied missions such as logistic supports, in addition to its conventional strike and defence role. Much as one would like to exploit its advance weaponry systems, it ultimately boils down to how effective it would be in fighting against the low-tech terrorists. According to militarist theorist Martin van Crevald:
"*In a world where almost all wars are fought not between states, but within them, many if not most of airpower's elements have become obsolete and useless*."[7]

The prime address would be the type of threat that Singapore is fighting against. Unlike large nations, Singapore, being a small state that lacks strategic depth, needs to safeguard its assets and cannot afford an attack to take place on its island. Terrorist organisations utilise asymmetric techniques to counter balance the prowess of a nation's military forces. Hence, unconventional methods of attack are being devised to launch surprises against the terrorists targets. In order to execute with an element of surprise, the most likely scenario will be to create the damage from within the country. An explosion in the heart of the city will puncture the homeland security confidence, with the accompanying effects of collapsing buildings and assets. In such a case, the perpetrators would have filtered into the country, and thereby the matter would be more appropriately taken care by the internal security.
With the tight air defence system, it remains difficult for terrorist organisations to direct precision guided missiles or artillery shells from precincts outside Singapore. If the hypothesis that the terrorists would not conform to aerial attacks is valid, it does not leave much to ask how effective can our air force be when used in a realm other than its primary operational domain.
Another assessment for the terrorists to strike Singapore on its own home ground

as opposed to outside the country is to maximise the potential effect of creating more secondary damages by the local military forces, fighting back in retaliation to the acts committed by the extremists. If an attack is carried out in Singapore, with its modern infrastructure, would it really be justifiable in helping the nation to carry out an aerial military campaign on its own soil just to force out the attackers? Even if a military campaign is justifiable, the use of ground troops and special troops, as opposed to the air force, would be more effective to combat the terrorists hiding in the country. The attacking squad of the RSAF would seem more feasible if used to strike terrorist targets outside Singapore, but certainly, more amicable resolutions is hoped to have arrived rather than resorting to military violence in order to settle the issue.

The next aspect which renders the air force obsolete is the terrain and size of Singapore. Unlike tensions in other states, whereby military supports could arrive shortly with the help of supersonic fighters, the immediate response to an attack in Singapore does not require an aircraft to be at the frontline, and being a small country, troops can be efficiently deployed to strategic locations within the island in a short frame of time. Military support could arrive in the form of ground or special forces, and the patrol coast guards can be activated to ward off additional infiltrators as well as containing the criminals within the island.

3. THE POSSIBLE ROLES FOR THE RSAF IN COUNTER-TERRORISM

Regardless of the nature of its missions, air power offers qualities such as dominant manoeuvre and precision engagement in both conventional and unconventional military operations.[8]

However, in the context of Singapore, its physical constraints as well as the likelihood of the terrorist threats do not suffice the RSAF to carry out attacks against the terrorists. In reducing collateral damage, the methodology of employing laser guided bombs to strike bunkers in Iraq[9] cannot be materialised in a congested city like Singapore. Nevertheless, an area whereby the air force can contribute is to support in its search and rescue operations.

Search and rescue missions could take on various forms, and particularly in urban areas, casualties of an attack could evacuate from the blast site and transported to hospitals via the air route. This scenario plays favourably in the hands of the air rescue craft as usually in a state of high intensity, several road closures could be imposed island-wide and traffic on the grounds would be chaotic. Highways, bridges and roads might be damaged in the process of the attack, and clearance would have to be made to allow special forces to deal with the terrorists.

Information gathering may be performed by air-crew and collated at the headquarters and be disseminated out to the relevant forces involved in the mission. In a dense city like Singapore, tracking of the attackers could be executed more effectively with an aerial search. The air force would need to work closely with the other rescue teams to provide information on the whereabouts of the terrorists, so that troops concentration can be deployed efficiently on the ground. This requires inter-service transfer of reliable information. Apart from restricting the information to the rescue team, the media can also be onboard the aircraft to provide broadcasts of situational updates to the general public, not ruling out the possibility that one of the terrorists' objectives is to attract the attention of the media and subsequently

engage in political negotiations.

While the air force does not explicitly provide firing power in this case, aircraft can be used to support and transport troops to their designated sites should there be a need to send reinforcement of arms. Troops can repel from the helicopters and gain direct access to any level of the skyscraper to capture the terrorists hiding in the building. Small arms can be fired off the crew onboard the aircraft, which will consequently incur a lesser extent of damage compared to a warhead launched by a strike aircraft.

With the urban landscape of Singapore, the helicopters would be more suited for the mission over the strike fighters because of their adaptability to land and take-off on ground conditions that do not conform to a normal runway. In addition, the helicopter is able to travel at a slower speed to provide an extensive search for the victims and attackers. It could also hover over a location as mobility in the air is significantly faster than ground movements. For the rescue mission, the helicopter is able to accommodate casualties and medical teams onboard, for emergency purposes prior to arriving at the hospital for proper treatment.

In a similar way whereby the air force plays its part as one of the tri-services within the armed forces, joint operations are effectively carried out if there is a network of information that is being shared among the different services in the military. In this case of the RSAF blending into the role of search and rescue mission within the team, the general network for communication purposes needs to be established among the various members in the respond team. Current architecture only frames the network connections between different services in the military,[10] and if taking terrorism into account, it is imperative to develop efforts into extending their current network to incorporate the homeland security and other relevant teams as well.

In view of optimising resources such as manpower or equipment, the RSAF needs to invest in technological systems that enable them to carry out their roles efficiently. The air force should look into light and portable systems that defray the constraint of logistic demands. To alleviate manpower restraint, the system should be able to perform multi-role functions to cater to the ever-changing characteristics of the threat. Both these two concepts of portable systems and multi-role functions lead to force miniaturisation, which will ideally fit into the greater framework of countering terrorism with other units.

In the technology arena, R&D efforts should be emphasised on sensor technology as well as secured communication systems to boost its intelligence and information transfer capability. Information gathering is an integral part in preventing terrorist threats. Global Positioning System (GPS) monitoring will not work to track down terrorists because in order to use GPS for tracking, the user needs to allow the satellites to track him.[11]

Thus the GPS is unrealistic operating under this constraint. Therefore, the reliable way is to conduct aerial scans with advanced sensors.

The use of unmanned aerial vehicles (UAVs) can be employed to carry out the scans or search for information so as to lessen the risk of engaging air crew to be onboard during flight sorties. The ramification of a 'remote-control' feature enables the aircraft to sustain longer flight time in the air, and thus a relatively low-cost platform to operate.[12]

Future development of the UAVs include a larger payload, as well as more complex sensors that can provide better image resolution at a greater stand-off.[13] Nevertheless, information gathered would be useless unless it can be processed and transmitted efficiently to the relevant units in the mission.

In view of reducing collateral damage, it is worth looking into Non-Lethal Weapons (NLW) as a tool to deal with terrorism. Bearing in mind that it is the terrorist acts that lead to condemnation, to what extent does it justify us to play the role of God in killing the terrorists? The use of massive fire power might result in more resentment, thus generating political oxygen that the terrorist organisation and its affiliation can exploit to sustain their movements and cause for greater disastrous acts.[14]

Therefore, development in laser-guided directed-energy beams and weapons that serve to temporarily incapacitate human targets rather than kill, should be explored for mounting on aerial launched platforms.

CONCLUSION

The threat of terrorism is prevalent across nations in this world, and in South East Asia, the economic and social well-being of Singapore in the region makes it susceptible to an attack from the JI terrorist group. Its excellent infrastructure and modern architecture of skyscrapers and lush landscaping pose as an ideal target for terrorists to strike. In addition, the characteristics of the city being densely populated with civilians and international tourists will heighten the effect of an attack.

Singapore's continual investment in the defence build-up has reaped an air force that commands superior air combat capabilities to protect its skies against possible state aggressors. However, it is limited in its capacity to play a defensive role in countering terrorism, given the likely scenarios and types of threat that JI could employ to effectively inflict a wound on its society. The primary concern is the use of matching equipment or suitable inventories to counter the possible types of attack employed by the terrorists. The advanced technological weaponry and information systems of the air force will deem to be incompatible in dealing with low-tech executions by the terrorists. Terrorist groups are better known to be covert in their operations and refrain from employing state-of-the-art devices for communication. In addition, the topographical nature of Singapore does not make it feasible for an aircraft to retaliate.

Nevertheless, the RSAF can assist in supporting operations related to search and rescue, whereby prudent R&D investments in this aspect would see it contributes more efficiently as part of a larger joint operation to help counter terrorism. Some of the developments would be to align its future inventories to be an integral part of a larger network of operations, thus looking into inventories capable to deliver in aspects of versatility, compactness and mobility. Substantial efforts should also continue in the field of sensors for intelligence and information gathering, as well as better and reliable communications systems for information transfer across the various platforms of operations. Development in the area of remote operations, such as UAVs or automated robots, reduces the risk of human lives by operating

in a secured environment away from the actual battle scene. In addition, the use of Non-Lethal Weapons mounted on aircraft can be explored to cripple the human targets, thus obliterating unnecessary scenarios to stimulate further hatred in the terrorist organisation.

Terrorism is a world wide phenomenon and evidently, it cannot be simply placated with the intervention of military forces. The acts of terrorism can be subdued with the exercise of military might, but the germination of abhorrence in the terrorist mindset against his antagonist certainly cannot be appeased with modern weaponry. However, that does not leave one to do away with technological advancement, as it can act as a mechanism to deter possible attacks, maintaining technological superiority against the terrorist groups.[15]

The development of the air force will continue to serve its functionary role in defending its skies, responding comprehensively to the ever-changing faces of threats posed by its enemies.

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