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From Sea Kings to VUAVs

By /par Maj J.D. Moulton

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Abstract

The marriage of the Sea King and the DDH revolutionized the capabilities of the Canadian Navy. Conceived in the 1950s in response to the continued advances in Soviet submarine technology and the requirement to be able to provide NATO with convoy protection on a limited budget. Canadian innovation and determination set a new standard for naval aviation that continues to pay dividends.

Today, the Canadian Navy faces similar challenges, as they are required to operate in continuingly difficult circumstances with ever decreasing resources. In order to ensure the safety of naval personnel and their scarce resources, the navy must endeavour to develop new approaches to operating in the ever-dangerous littoral environment. The development of VUAVs provides an opportunity for the navy to expand its fleet's capabilities and to sustain it into the future.

The paper identifies that today's situation and its challenges are no different than those faced in the 1950s and 60s. The ability to create new and revolutionary solutions is as essential today as it was during the Cold War. The employment of VUAVs within the navy provides as much promise as the operating of large helicopters off of small ships. As such, the navy should vigorously pursue the introduction of VUAVs into the fleet.

Introduction

Throughout its history, the Canadian navy has been challenged with finding a balance between the cost of a maritime force and the fiscal realities of Canadian defence spending. Peace time pressures have been particularly hard, with the inter war era as a prime example of the demands placed on the navy's scarce resources, "[t]he RCN, more than any other western navy, had had to make do with very few warships in peacetime….[i]n this light it is not at all surprising that the RCN should be so interested in methods, however radical, for increasing the effectiveness of each available escort."[1] In order to make her scarce resources go further, the Canadian navy has endeavored to create synergies from her modest fleet and the weapons systems it carries. The marriage of Sea King helicopters with Canadian DDHs (Destroyer Helicopter) represented an immense leap in capabilities for the Canadian Navy. It is a prime example of how ingenuity overcame the fiscal realities of the Canadian government[2]. Similarly, the emergence of ship-borne VUAVs (VTOL Uninhabited Aerial Vehicles) represents an equally important opportunity for the Canadian navy and is the next logical step in Canadian maritime air power. Given the historic example of the integration of the DDH and the large helicopter, this paper will argue that Canada should be vigorously pursuing ship-borne VUAVs to meet both current and future threats.

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[1] Michael Shawn Cafferky, "Uncharted Waters: The Development of the Helicopter Carrying Destroyer in the Post-War Royal Canadian Navy, 1943-1964," (doctorial thesis, Carlton University, 1996), 140.

[2] Memorandum, "Report on Piasecki HUP-2 Helicopter," A/CNTS (Air) to ACNS (Air) and CNTS, NSS 7820-102-3, NAC.

In arguing this thesis, the paper will first look at the history of the integration of the DDH and the large helicopter within the Canadian context, and in particular discuss the naval threats of the Cold War that drove Canada to maximize the effectiveness of her limited fleet. This will be followed by an extensive review of the challenges involved with the integration of the two weapons systems that ultimately found Canadian DDHs carrying Sea King helicopters. The paper will then turn to current naval threats and the challenges the Canadian navy now finds itself in and the need to once again maximize the utility of her limited fleet to meet the needs of the Canadian public and her political masters. The paper will then deal with the current state of ship-borne VUAVs and the challenges and rewards that can be found in their application to the Canadian navy of today. Finally the paper will compare the rewards of the integration of the Sea King with the DDH and the possible rewards that can be derived from Canada moving forward with the integration of VUAVs within her fleet.

The Challenges of the Early Cold War

With the onset of the Cold War, western nations had an opportunity to evaluate a number of lessons learned during the Second World War. The development of the aircraft carrier as the major capital ship for the American and Japanese navies, demonstrated just how far the delivery of weapons had evolved. No longer were naval engagements occurring within visual range of adversaries; rather they were taking place at the extended ranges of the carrier's air wing. The physical effect of concentrating naval air power became overwhelming to the enemy.[3]

[3] Wayne P. Jr. Hughes, *Fleet Tactics and Coastal Combat* (Annapolis: Naval Institute Press, 2000), 41.

With this evolution in naval combat, the requirement for opposing forces to locate the enemy with sufficient time to deliver an initial strike became a crucial element in the tactical process of engagement. "Scouts deliver[ed] tactical information about the enemy's position, movements, vulnerabilities, strengths, and, in the best of worlds, intentions."[4] This information, often called the Recognized Maritime Picture (RMP), allowed a commander the opportunity to attack first and with decisive results and would continue to drive navies to advance their scouting abilities.

As the Cold War deepened and the Soviets continued to field greater and more powerful fleets, it became incumbent on NATO to continue development of countermeasures to these threats. Within Canada, W.A.B. Douglas put it best: "Conflict … facilitates and, indeed, accelerates the process of innovation."[5] This fact was to be instrumental in Canada creating a most unique combination of weapons systems in order to achieve her national objectives within her financial means.

Having been chiefly involved with convoy duties during the Second World War, and with the continuing threat of a Soviet invasion of Western Europe, the role of convoy protection continued to be a major challenge. This challenge was to be met as "Canada's specialized maritime force contribution of an essential and first-rate ASW [Anti-

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[4] *Ibid*., 175.

[5] W.A.B. Douglas, "Conflict and Innovation in the Royal Canadian Navy, 1939-1945," in Naval Warfare in the Twentieth Century, Gerald Jordan, ed., (London: Croom Helm, 1977), 210-233.

Submarine Warfare] capability was a valued ingredient in the security mosaic of the Western worlds."[6]

The integration of a large helicopter and a small ship was a marriage of two evolving approaches, that of maritime aviation, which had come of age during the Second World War, and the viability of using the helicopter as a weapons system. "The [special] committee's[7] records show that the officers were particularly influenced by the seriousness with which both the USN and RN regarded the ASW potential of the helicopter."[8] With the advent of nuclear powered submarines it was apparent that the helicopter would have to play a vital role in dealing with the Soviet's nuclear submarines.[9]

In 1956, Commodore Tisdall of the Royal Canadian Navy, in discussions with Flag Officer Atlantic Coast, enthusiastically echoed his belief in the suitability of helicopters in the role of ASW. "[T]he inherent capabilities of the helicopter provide a most effective complement to those of the surface escort and the value of its presence in any anti-

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[6] Gordon Davis, *The Contribution of Aviation to Canadian Maritime Security and the Requirements for the Future*, Maritime Security Occasional Paper No. 6 (Halifax: Centre for Foreign Policy Studies, Dalhousie University, 1998), 35.

[7] A special committee under Commander S. Hook, RN, the Deputy Chief of Aviation (Tactics), on loan to the navy, was studying the value of ship-borne helicopters in ASW throughout 1953.

[8] Michael Shawn Cafferky, "Uncharted Waters…, 140.

[9] Captain Brayton Harris,USN (Retired), World Submarine History Timeline: 1580-2000, http://www.submarine-history.com/NOVAfour.htm; Internet; accessed, 14 March 2005. The US launched her first nuclear submarine in 1954 with the Soviets following suit in 1958.

submarine force was considered to be beyond question".[10] This support for ship-borne helicopters from the navy would prove invaluable to the struggling maritime aviation community.

"The advantage of the manned helicopter was that it carried [two] sensors – dunking sonars and passive sonobouys – and thus extended the search and striking range of a warship far beyond that of RAT, ASROC and DASH[11]."[12] These capabilities would prove essential in dealing with the added speed of the nuclear submarine threat. This threat was highlighted during USS Nautilus' "shakedown cruise, [where] she steamed 1,381 miles from New London to San Juan, Puerto Rico submerged."[13] In fact, "[s]he was so fast that, on her first exercise with an ASW force, she outran the homing torpedoes."[14]

As part of the defence against the nuclear submarine threat, the ability to maneuver the fleet to avoid direct contact with surface high value units was essential. "[S]uccessful

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[10] Appendix B, "Some Details of Discussions with HS-50 in Task Force 301 during the Period 1 March – 12 April 1956," NSS 1115-39 (Staff), 21 April 1956, Commodore E.P. Tisdall to Flag Officer Atlantic Coast, RG 24 83-84/167, vol. 11, file 1115-39 vol. 2, NAC.

[11] Definitions: RAT, Rocket Assisted Torpedo – delivers a torpedo to a range of approx. 2,000 – 4,500 yds; ASROC, Anti-Submarine Rocket - delivers a torpedo to a range of approx. 1.2 – 10 nm; DASH, Drone Assisted Torpedo – delivering torpedoes at the outer range of ship radars and ship sonars – 4500 yds.

[12] Michael Shawn Cafferky, "Uncharted Waters…, 276.

[13] Captain Brayton Harris,USN (Retired), World Submarine History Timeline: 1580-2000, http://www.submarine-history.com/NOVAfour.htm; Internet; accessed, 14 March 2005.

[14] *Ibid*.. The "Nautilus" operated at a surface speed of 18 knots and 23 knots submerged.

maneuver will rely on the ability to identify, locate, and track targets."[15] This ability to contain the submarine threat was vital to the convoy duties of the time and was enhanced by the tactical advantages that ASW helicopters added to that of the escort ships. " Not only did the helicopters have the capacity to improve the range at which weapons could be launched, but they also increased the likelihood of detecting submarines by extending the range of ship-borne radar and sonar equipment…. well beyond the escort screen."[16] These characteristics would be essential to the concept of layered defences, or defence in depth, necessary to protect high value units such as merchant ships and aircraft carriers.

"When considering the capability requirements of maritime aircraft, it is important to understand the synergistic nature of maritime force components."[17] As LCol (Retd) G. Davis goes on to articulate, the area of control more than doubles when an embarked helicopter augments an escort. This in combination with shore-based maritime patrol aircraft can be a formidable team in the surface and sub-surface realms.[18]

It is important to note, that the continuing evolution of weapons delivery during the Second World War and the ongoing increase in capabilities of the nuclear submarine during the early Cold War era represented only two of the factors that made early detection of enemy forces so critical in the naval environment. It was the pressure of

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[15] Barnett, Roger W. "Grasping 2010 with Naval Forces." *Joint Force Quarterly* (Autumn/Winter 1997-98): 26.

[16] Michael Shawn Cafferky, "Uncharted Waters…, 237.

[17] Gordon Davis, *The Contribution of Aviation …,* 36.

[18] *Ibid*., 36.

meeting these tactical challenges that drove the Canadian navy to consider the integration of the large helicopter and the DDH to expand the sphere of influence of its maritime forces. The development of a RMP continues to be a major challenge to today's navies as weapons and platforms continue to evolve.

The Development of the DDH and Ship-borne Helicopters

With the challenges of the Cold War in the early 1950s came opportunities. In this case, the opportunity to evaluate the viability of first, ship-borne aviation off of small decks and second, to determine the limits to which escort-borne helicopters could contribute to the ASW challenge that was emerging.

The first naval experience was to be as a result of the HMCS Labrador icebreaker project, which called for the operation of a helicopter onboard. "The aircraftpportelear in ope

In parallel to these flight opportunities, both the USN and the RN were busy with the development of the helicopter in general for ASW operations. The initial findings were considered to be outstanding. As Commodore C.L. Keighly-Peach described it, "there was no question in my mind that the helicopter is the thing in the anti-submarine war of the future. The sooner we get in on it the better, instead of relying entirely on either the UK or the U.S. for all the information we require. I think we could get it ourselves"[21].

In particular, USN and RN ASW trials indicated that the helicopter could fulfill a number of roles. These were articulated by Commander Hook in his report on RCN requirements identifying four areas of particular interest: "augmenting convoy screens when the number of surface escorts available was insufficient for the task; extending the detection range of convoy screens; forming small barrier screens, and; shortening the time needed for A/S [Anti-Submarine] forces to reach a datum point"[22].

Throughout the 1950s and early 60s there would continue to be challenges facing the ship-borne helicopter programme. The complexities of the environment and the demands made of the weapons system would continually push the technologies of the day to their limits. These were seen as part of the price of pursuing such a promising combination. "Commander Hook was quick to point out that, while there were still teething problems with the helicopter, particularly in its lack of performance, endurance, and all weather

[21] Transcript of address given by the ACNS (Air) to the ninth Meeting of Senior Officers, 17-21 March 1952, RG 24 83-84/167, vol. 144, file TS 1279-188, NAC.

[22] Memorandum, "First Progress Report of Committee On RCN Requirelments for A/S Helicopters," Appendix A, The Role of Helicopters in ASW, NSS 1115-39 (Staff), 5 May 1953, RG 24 83-84/167, vol. 11, file 1115-39 vol. 1, NAC. Commander S. Hook was the Deputy Chief of Aviation (Tactics) on loan to the Canadian Navy.

capability, it showed great promise especially in the hunter/killer role."[23] Despite these challenges, the programme continued as hurdles were continually met with new innovations. Those involved with the project were comfortable that all was well despite the demanding environment.[24]

One of the real challenges faced by Canadian developers was the demanding conditions that would be found in the North Atlantic where Canadians would be asked to ply their trade. One of the trials organized was specifically designed to assess the operational availability of the helicopter while at sea. "Despite the fact that a St. Laurent class destroyer had a higher rate of roll than a frigate, the comparative motion experiments, conducted during the second stage of the mid-ocean trials, showed that helicopter operations were possible."[25]

Throughout the development of the integrated weapons system, there was a continual need to reengineer the helicopter as the demanding environment and the tactical needs of the navy continued to ask the weapons system to do more.[26] This is evidenced by the ongoing changes in helicopters trialled and proposed prior to finally settling on the Sea

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[23] Michael Shawn Cafferky, "Uncharted Waters…, 139.

[24] Memorandum, "HUP-2 Helicopter," Deputy Chief of Naval Aviation to ACNS (Air), NSC 7820-102 (Staff) & NS 7800-408/1 (Staff), 19 February 1953, RG 24 83-84/167, vol. 3428, file C-7820-102-3, NAC.

[25] Michael Shawn Cafferky, "Uncharted Waters…, 217. For a detailed analysis of the deck motion trials see, "Comparative Ship Motion Trials: HMCS St. Laurent and HMCS Buckingham," PHx-104, December 1956, prepared by the Nval Research Establishment, Defence Research Board, DHist 93/110 Item 080.

[26] *Ibid*., 304.

King in the early 1960s. Throughout the programme six separate helicopters took part or were considered for the job.[27] Even the Sea King required modifications to meet the navy's final requirements.[28]

Any discussion of Canada's integration of the large helicopter with the small ship would be incomplete without discussing the importance that the development and implementation of the Beartrap system had as this revolutionized small ship navies. "Indeed, the Canadian Beartrap system transformed operations by frigate and destroyer sized vessels in the late twentieth century. Because these [vessels] are the work horses of ocean-going fleets [today], it would be fair to say that Canadian innovation has significantly changed naval warfare."[29] The challenge of landing and securing a 10-ton[30] helicopter on a deck that will move in ranges of motion from 9 degrees of pitch and 31 degrees of roll was considerable. Through intensive collaboration with industry, the programme was able to build, test and introduce the Helicopter Hauldown and Rapid Securing Device (HHRSD). This allowed ship's personnel to launch and recover the helicopter without endangering aircraft and crew in conditions up to sea state 9.[31]

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[27] *Ibid*., These included: S-55 (1960), Kaman HUK-1 (1960), Kaman HU2K-1, S-58, Hup-3 (Piasecki or Vertol), and the CHSS-2 (Sea King).

[28] *Ibid*., 317.

[29] *Ibid*., 343.

[30] *Ibid*., 375. All up weight for the CHSS-2 (Sea King) was listed as 19,100 lbs, eventually expanded to 20,500 lbs. Department of National Defence, C-12-124-A00/MB-002 *Ship-borne Helicopter Operating Procedures (SHOPS)* (Ottawa: DND Canada, 2003), 2-1-2.

[31] Sea State 9 on the Beaufort Scale is defined as: Severe Gale: Winds 41-47 kt. - High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.

The entire integration programme of the DDH and the ship-borne helicopter demonstrated the complexity of solutions required to meet the demands of a modern navy. Whether it was the long process of selecting the appropriate helicopter to meet the navy's needs or the creation of a whole new concept of handling helicopters at sea, it was only through a full understanding of the navy's requirements that lead to appropriate solutions. It is also obvious from this process, that the entire effort can be a long and arduous one. In hindsight, it is easy to say today that the challenges and risks taken on by the navy during the late 1950s and 60s have paid off handsomely. However, it must be noted that future requirements will again require the navy to find new ways to deal with the new threats and challenges that continue to evolve.

The Challenges of Today's and Tomorrow's Maritime Environment

Given today's security climate, post 9/11, and our National Defence policy, Canada has identified three major areas of concern: the defence of Canada, the defence of North America and contributing to international security. Given Canada's position in the world and her geography, it is inevitable that maritime forces will play a significant role in the exercise of her national agenda. The navy's participation in operations from peace support to armed conflict over the last decade clearly demonstrates this fact.[32]

The use of maritime forces to further Canada's national and international desires, demands that these forces are properly equipped to deal with all current and future

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[32] Recent operations include: OP TUCAN, OP APOLLO, OP MEGAPHONE, OP DELIVERENCE, OP FRICTION, OP SHARPGUARD, OP TEMPEST, OP FOREWARD ACTION, OP OCEAN VIGILANCE, OP AUGMENTATION.

challenges. The rate at which weapon and sensor ranges have increased over the last decade requires that Canada's equipment keeps pace with this evolution. As Wayne Hughes points out, "in modern naval combat, when weapon and sensor ranges so dominate ship and even aircraft maneuver, that is, the ability to shift position, maneuver should enter into the tactician's calculations as the vital feasibility check against his plans for positioning and timing."[33]

In particular, the advent of the missile age has radically changed the speed and lethality of naval engagements. Illustrating this trend, John C. Schulte conducted an analysis of warships that were engaged by various missile systems. This analysis identified a total of 155 confirmed missile attacks against warships. "Whether in terms of incidents, damage achieved, weapons fired at a target, or cost of ordnance expended, missiles and missile warfare [have come to] dominate modern warfare at sea."[34]

The use of missiles is not limited to warship against warship as the evidence presented by Navias and Hooton in their book, "Tanker Wars: The Assault on Merchant Shipping During the Iraq-Iran Conflict," shows. During this conflict, approximately 260 missile launches occurred against civilian registered tankers. These missile attacks accounted for 80% of all attacks against shipping during the conflict.[35] This in fact exceeds the number

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[33] Wayne P. Jr. Hughes, *Fleet Tactics…,* 178.

[34] John C. Schulte, "An Analysis of the Historical Effectiveness of Antiship Cruise Missiles in Littoral Warfare." Naval Postgraduate School master's thesis (Monterey, California, September 1994), 3-14.

[35] Martin S. Navias, and E. R. Hooton. Tanker Wars: The Assault on Merchant Shipping During the Iran-Iraq Conflict, 1980-1988 (New York: I. B. Taurus, 1996), 129.

of missile attacks against military vessels. This shift to missile warfare, that started with the Battle of Latikia[36], has increased the speed and range at which naval engagements occur. It has also significantly increased the number of platforms that can achieve this type of decisive effect, as Fast Patrol Boats (FPB) can now be equipped with these weapons. What was once a capability limited to major capital ships has proliferated to platforms from submarines to FPBs to aircraft of all sorts.

Given these facts, it is easy to see that the speed-distance relationships of past conflicts have changed to the point that new models are required to deal with the challenges the navy faces today. Wayne Hughes alludes to this when he states: "[t]he key to [the] fruitful study of tactics is an appreciation of how battles transpire in time and space. The activities – the dynamics – of combat are the wellspring of understanding. Dynamics suggest time-dependent models – descriptions of combat processes."[37] Supersonic missiles and Over The Horizon Targeting (OTHT) have forever changed the battle space.

It quickly becomes apparent that the value of scouting, communications, and command and control of forces and the countermeasures that can be applied against them cannot be underestimated.[38]

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[36] The Battle of Latakia: October 7, 1973, http://www.jewishvirtuallibrary.org/jsource/History/latakia.html, Internet; accessed 08 April 2005. This event was the first recorded missile engagement at sea during which the Israeli navy evaded Syrian SSMs while inflicting considerable damage to Syrian missile boat fleet.

[37] Wayne P. Jr. Hughes, *Fleet Tactics …*, 174.

[38] *Ibid*., 144.

> Effective fusion of reconnaissance, surveillance, and intelligence information is so important that it must receive the same emphasis as the delivery of firepower. Contrarily, obstructing the enemy's scouting by cover, deception, confusion, or distraction merits enormous attention, for successful scouting and screening are relative to each other and a matter of timeliness.[39]

This fusion of Intelligence, Surveillance and Reconnaissance (ISR) information is essential to the ongoing refinement of the RMP. As a result, there is an increased need for the physical assets that make this information available. Whether it is from satellites, airborne, surface or subsurface assets, the information they provide allows commanders to obtain what is now called: "dominant battlefield awareness"[40].

Probably the greatest challenge within the naval environment has been the shift away from the blue water challenges of the Cold War to the littoral theatre where "operational and tactical scouting takes place in the land, sea, and aerial domains."[41] This shift has reduced the time to react to engagements and has introduced a variety of new menaces. "Operations in the littorals will expose surface, subsurface and air units to a variety of weapons not normally encountered in an open ocean environment, such as land-based surface-to-surface and surface-to-air missile systems, and a wide range of underwater mines."[42] The challenge is to avoid the slugfest with the land-based installations. As Wayne Hughes commented, "a ship's a fool to fight a fort."[43]

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[39] *Ibid*., 44.

[40] *Ibid*., 9.

[41] *Ibid.*, 9.

[42] Department of National Defence, "Leadmark: The Navy's Strategy for 2020," http://www.navy.dnd.ca/leadmark/doc/index_e.asp; Internet; accessed 21 February 2005.

[43] Wayne P. Jr. Hughes, *Fleet Tactics ...,* 9. This saying was first attributed to Horatio Nelson.

For the small navies operating in the littorals, the goal will be to ensure that "the common denominators [of] stealth, swiftness, and surprise [are attained]. Any failure to achieve all three bodes ill for the attacking ships."[44] In dealing with the littoral threats, "organic air will allow naval forces to optimize (*sic*) the capabilities of weapons and sensor systems by its ability to extend substantially the ISR and control capabilities of its host unit or task group."[45] This can be accomplished in a rapid manner in almost all weather conditions for organic assets.

Given the broad spectrum of conflict within which the navy will have to conduct operations, ranging from humanitarian aid to general war, "C4ISR[46] [will be] a central element of naval activity. Across the full spectrum of operations – from peace to war - it is critical to determining the situation, influencing the actions of our forces, and imposing our will on the adversary."[47] Overall, maritime aviation must ensure that the naval commander has the RMP necessary to enable him to proactively execute his maritime mission. LCol (Retd) Davis puts it succinctly, "In addition to their surface and underwater surveillance role, maritime forces must also be able to identify, track and prosecute a subsurface intruder, and must be able to provide OTHT information to allow

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[44] *Ibid.,* 38.

[45] Department of National Defence, "Leadmark….

[46] C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance.

[47] Department of National Defence, "Leadmark….

a surface ship to intercept the contact or remain out of harm's way."[48] Although simple in thought, this ability requires dedicated assets that are either integral to the naval task force or are assigned to meet the navy's needs.

The continued increase in speed and range of attack in today's naval environment, combined with the increase of littoral operations demands that the navy of today be equipped with the assets necessary to provide the commander with the RMP in a timely fashion. It is only with this information that a commander can make the crucial decisions necessary to meet his mission, while safe-guarding the ships and sailors under his command. This will require the navy to continually invest in new concepts and ideas to meet this increasingly challenging task.

Ship-borne VUAVs

Prior to discussing the employment of ship-borne VUAVs, it is important to understand some of the developments and uses of these air vehicles. The first major use of TUAVs (Tactical Uninhabited Aerial Vehicle) was during the Vietnam conflict. In 1963, the US government developed the first operationally successfully TUAV, the Ryan 147 Lightning Bug[49]. This TUAV was used during the Vietnam conflict to conduct a variety of missions including day and night reconnaissance and SIGINT (Signals Intelligence) revealing precise locations of SAM sites, enemy airfields, ship activity and BDA (Battle

[48] Gordon Davis, *The Contribution of Aviation …,* 29.

[49] Lt Col Richard M Clark, "Uninhabited Combat Aerial Vehicles – Airpower by the People, For the People, But Not with the People" (CDRE Paper no. 8, College of Aerospace Doctrine Research and Education, Air University, Maxwell Air Force Base, Alabama, US, 2000), 15-16.

Damage Assessments).[50] The Lightning Bug flew a total of 3,435 operational missions between 1964 and 1975.[51]

These roles and others have evolved with the continued development of UAVs around the world. More recently, UAVs were used during Operation Allied Force performing "numerous functions that included target identification, probing of Serbian air defences, monitoring ethnic cleansing, bomb damage assessments, electronic intelligence operations, airborne communications relays and jamming of Serbian communications."[52]

Probably the final development of UAVs was as a launch platform. "The US was looking for an 'armed reconnaissance' platform to strike time sensitive targets. Technology momentum led the US Air Force to fit two 45-kg, laser guided Hellfire-C missiles, to the Predator UAV."[53] This combination was used on various occasion during attacks in Afghanistan and most notably in the attack upon al-Qaida operatives in Yemen on the 4th of November 2002.[54]

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[50] The Lightning Bug Reconnaissance Drones, http://www.vectorsite.net/twuav04.html.

[51] Lt Col Richard M Clark, "Uninhabited Combat Aerial Vehicles …, 15-16.

[52] Jim Garmone. (1999). Predator Demonstrates worth over Kosovo. Available: www.fas.org/irp/program/collect/docs/n19990921_991750.htm [08 March 2005].

[53] 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), 416-417.

[54] MQ-1B Armed Predator, http://www.globalsecurity.org/intell/systems/armed-predator.htm; Accessed 08 March 2005.

As is evidenced by the recent technological advances incorporated into UAVs, we have entered a new age of warfare. As described by Wayne Hughes in his book, Fleet Tactics and Coastal Combat, "we may be on the leading edge of a new age of tactics. Call it the 'age of robotics'. Unpeopled air, surface, and subsurface vehicles have a brilliant, if disconcerting, future in warfare."[55] What has really allowed this leap forward has been the continuing increase in the bandwidth, or the amount of information that can be passed, on the battlefield. This increase is best demonstrated by the fact that one Global Hawk today consumes five times the total bandwidth used by the entire US military during Gulf War I in 1991.[56]

Most recently, the US Navy, US Marine Corps (USMC) and the US Coast Guard (USCG) have been involved in the development of VUAVs (VTOL Uninhabited Air Vehicles) for deployment on US Navy and Coast Guard ships. In particular, the US Navy has focused on the use of the Northrop Grumman RQ-8A Fire Scout for use as a C4ISR platform from its surface fleet operating in littoral waters.[57] With a useful payload of approximately 93 kg, the Fire Scout can be equipped with a number of packages that would give it various abilities, such as detecting mines in shallow coastal waters and along beachfronts. The USCG and the USMC have shown interest in the development of the Bell Eagle Eye, a VUAV of the tilt rotor variation which provides a

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[55] Wayne P. Jr. Hughes, *Fleet Tactics ...,* 4.

[56] Lt Col Kurt A. Klausner, "Command and Control of the Air and Space Forces Requires Significant Attention to Bandwidth", Air & Space Power Journal, Winter 2002.

[57] Jane's Unmanned Aerial Vehicles and Targets 2002, Edited by Kenneth Munson, Issue 18. (Alexandria, Virginia, Jane's Information Group Inc, 2002), 269-270.

significant speed increase over the Fire Scout.[58] For both the USCG and the USMC, the Eagle Eye would provide surveillance and reconnaissance, while it would additionally provide the Marines with targeting and communications relay.

As identified in the Canadian Navy's future vision paper, Leadmark: The Navy's Strategy for 2020, the ability to survive in the littorals of the world, requires that the defensive envelope around the fleet will have to increase and the key to this is the increase in fleet ISR capabilities.

> [T]he projected capabilities of future weapon systems, the self-defence envelope must expand well beyond the 7-10 nm area around each surface platform that is the accepted norm today, if a unit is to have any chance of defending itself successfully. Key to providing a suitable self-defence capability will be an effective and early detection ability.[59]

As this sensor war[60] continues to escalate it will require new approaches to achieve the desired results at an acceptable risk, particularly within the littorals. "The increasing sophistication of signature reduction technology and the more difficult littoral-operating environment will increase the challenges of detecting and identifying Targets Of Interest (TOI)."[61] Within this littoral area the use of VUAVs from maritime platforms will extend the range at which their sensors will be able to detect, identify, track and target

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[58] Jane's Unmanned Aerial Vehicles and Targets 2002…, 269. Fire Scout has a max speed of 125 kts while the Eagle Eye has a max speed of 210 kts. Janes

[59] Department of National Defence, "Leadmark: ….

[60] Wayne P. Jr. Hughes, *Fleet Tactics…,* 118.

[61] Department of National Defence, "Leadmark: ….

contacts without exposing manned vehicles to unnecessary risk.[62] As Wayne Hughes puts it, "good sensors and scouting could overcome better firepower."[63] This will be essential in confronting the possible firepower that can be delivered from land-based platforms.

As identified by the navy in "Leadmark: The Navy's Strategy for 2020", C4ISR will be a major component of naval operations in the future. "[N]aval forces will require versatile and easily deployable surveillance and reconnaissance systems…. Canadian naval forces and national command authorities will require integral and independent ISR information to the greatest practicable extent."[64] As the speed of battle quickens, the requirement to keep pace is essential. "The time from location and identification of a target to weapon arrival will become more significant for success."[65] Whether it's employed during combat, national sovereignty operations or humanitarian assistance missions, the availability of organic ISR platforms will be critical to the navy in the development of its RMP.

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[62] It is calculated that the addition of two Fire Scout VUAVs added to a Canadian Frigate would provide an area coverage of approx 35,000 nm^2 during a single 6 hour mission. Revisit times and probabilities of detection required will influence the total area that can be cover in a tactical sense.

[63] Wayne P. Jr. Hughes, *Fleet Tactics…,* 132.

[64] Department of National Defence, "Leadmark….

[65] Barnett, Roger W. "Grasping 2010 with Naval Forces." *Joint Force Quarterly* (Autumn/Winter 1997-98), 25-31.

From Sea Kings to VUAVs

Canada's integration of the Sea King with the DDH in the 1950s and early 60s had enormous payoffs for the navy. "This breakthrough tremendously increased the effectiveness of moderate sized navies, not only in combating increasingly powerful submarines, its original purpose, but in the whole range of maritime activities from search and rescue to the prevention of smuggling, and, as was demonstrated in the war in the Persian Gulf, enforcement of economic sanctions."[66] The introduction of VUAVs within the Canadian Navy could likewise provide immense benefits to Canadian operations now and well into the future.

As has been explained by Wayne Hughes, in making ship acquisition decisions it is essential to "*maximize the net delivered combat power over the effective life of the task force.* This takes into account that the ship will be incapacitated in the midst of fulfilling its mission."[67] In calculating the 'net delivered combat power', it is essential to take into account the vulnerability of the asset based on its weapons systems, both offensive and defensive, as a single unit and within the fleet. Even from an American perspective and their current defence budgets, the value of their ships is never underestimated. "As we shape the fleet of the future, we had better get it right, because we do not have money to waste, and today's decisions will be tomorrow's Navy for a lot of tomorrows to come."[68]

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[66] Michael Shawn Cafferky, "Uncharted Waters…, 1.

[67] Wayne P. Jr. Hughes, *Fleet Tactics* …, 165.

[68] Byron, Captain John. "A New Navy for a New World." *U.S. Naval Institute Proceedings* (March 2003), 1.

Given that the Canadian fleet was designed from the outset to be complimented by embarked helicopters, it is essential to view this requirement as a vital and integral component of our maritime force's operational capability[69]. With a stated requirement of twenty-six operational helicopters and the projected availability of only nine to eleven H-92 'Cyclones' for deployment, a significant operational deficit will exist.[70] Therefore, it is obvious that the navy will be left without the required ISR platforms necessary to ensure the viability of our Canadian fleet.

As was the case in the Cold War, when Canada found itself with a requirement for which no suitable alternative was currently available, she proceeded to fill the gap.

> "[T]he most unusual step was the use of sonar fitted helicopters to close the gap between finding the submarine by long-range aircraft and the arrival of the surface attack unit. This of course, is not a new thought or procedure to either the RCN or RN but is felt that such great strides forward have been made in their operations that it is time to enter the development with more than observers interest…. The most significant advance in A/S detection operations since World War II is this development and that it holds the greatest possible promise for the future[emphasis in original].[71]

Canada again finds itself in this situation with the shortfall in available MH (Maritime Helicopter) assets. As identified within 'Strategy 2020", the navy has recognized this

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[69] Gordon Davis, *The Contribution of Aviation …*, 38.

[70] *Ibid*., 39.

[71] Commanding Officer, HMCS Iroquois. "Report of Hunter/Killer Exercise," to Commander, Canadian Destroyers, Far East, 25 September 1953, RG 24 83-84/ 167, vol. 1713, file 4903-4. vol. 4, Interim Box 24, NAC; Commander F.C. Frewer, Director of Tactics and Staff Duties, "Report of Hunter/Killer Exersice," to Director Tactics and Air Sea Warfare, 28 October 1953, RG 24 83-84/167, vol. 1713, file 4903-4, vol. 4, Interim Box 24, NAC.

shortfall of integral aerial assets to the task group or TSSU (Tactically Self Sufficient Unit) and suggests the possible use of "UAVs" to fill the gap in ISR capabilities.[72]

This will be essential if Canada is to fulfill her role as a Rank 3 Medium Global Force Projection Navy. To meet these requirements, our navy must be able to operate independently and in concert with our allies around the world in operations ranging from peace support to full-scale conflict. As times change, so must the navy in order to meet the ever-evolving international environment. As was the case during the revolutions in submarine and anti-submarine warfare in the 1950s and 60s, so it is today with the increasing sophistication and lethality of the weapons systems we face today.[73]

Although there will be challenges, fiscally, doctrinally and operationally, this is nothing new for the Canadian Navy. As was the case during the 1950s and 60s with the integration of Sea King and DDH, these are once again opportunities to be exploited and capitalized upon. The result of such challenges can place Canada at the leading edge of VAUVs as she was with the integration of the Sea King and the DDH.[74]

Conclusion

Canadian military history has always been about a balance between fiscal realities and the need to meet the nation's national security policy. The navy has faced its share of

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[72] Department of National Defence, "Leadmark: ….

[73] Michael Shawn Cafferky, "Uncharted Waters…, 18.

[74] *Ibid*., 238.

these challenges. However, regardless of the challenges, the navy has always developed unique solutions to Canadian problems. Faced with the reality of the Cold War during the 1950s and 60s and falling naval budgets, the navy was challenged to meet its responsibilities of convoy escort across the Atlantic. Through ingenuity and perseverance, the Canadian navy came up with the unique solution of marrying the capabilities of the DDH and the Sea King helicopter to create a world class ASW platform, capable of providing convoy escort with reduced numbers of ships at an overall cost savings to the country.

Faced with an international environment that has shifted significantly since the end of the Cold War, Canada and her navy are once again challenged to meet the emerging threats and needs of the country. The fiscal realities of the 1990s has stretched the capabilities of the navy while the government has continued to demand an operational tempo beyond the navy's resources. The resulting shortage in ISR platforms (maritime helicopters) necessary for the navy to operate in this increasingly hostile environment has created an opportunity to integrate VUAVs into the inventory.

As a result of this situation, Canada finds herself with the opportunity to once again move into the forefront of operational capabilities by integrating VUAVs into her naval operations. This integration, although challenging in many respects, provides a possible solution to the currently exposed fleet. When properly integrated, VUAVs will significantly increase the capabilities of the Canadian navy and provide a platform for continued growth. Given the past results of the Sea King acquisition and the

opportunities currently before us, it is essential that the Canadian navy vigorously pursue the acquisition of ship-borne VUAVs.

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