Canadian
Forces
College

Collège
des
Forces
Canadiennes

TRAIN AS YOU FIGHT: HOW SYNTHETIC TRAINING WILL SHAPE RCN COMBAT READINESS

LCdr Bill Sanson

JCSP 44	PCEMI 44
Master of Defence Studies	**Maîtrise en études de la défense**
Disclaimer	**Avertissement**
Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.	Les opinons exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.
© Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence, 2018.	© Sa Majesté la Reine du Chef du Canada, représentée par le ministre de la Défense nationale, 2018.

TRAIN AS YOU FIGHT: HOW SYNTHETIC TRAINING WILL SHAPE RCN COMBAT READINESS

LCdr Bill Sanson

TABLE OF CONTENTS

ABSTRACT

Today's world is one of rapidly advancing technology. These new technologies bring many benefits to the world. From enhanced medical treatment to more affordable renewable energy are just two examples of where new technologies benefit humankind. The military has benefited from these technologies as well. Advancements in military technology have spurred dramatic improvements in military hardware and capability for those countries that can afford to purchase them. While military technology has evolved Canada's defense budget has struggled to increase to a point where these benefits can be garnered. The defence budget in Canada has not increased to a point where these benefits could be utilized by the Canadian Armed Forces. Almost on the contrary the Canadian Armed Forces (CAF) has been plagued with procurement issues which have forced the military to use out of date equipment in many cases and to conduct operations under challenging circumstances.

The RCN has struggled to procure new ships to replace decommissioned ships as well as its aging Halifax Class frigates. Of the budget that the Navy receives each year, a large percentage of it goes to this procurement process as the navy continues to plan for the future. Another large portion of these funds goes to conducting actual operations and ensuring that the ship's themselves are physically capable of fulfilling the operation requirements that will be demanded of them. With most of the money going to these areas other areas within the navy such as training, do not get the funding that they require. This funding shortfall means that new ways need to be looked at so that the requirements of the Navy are met with the resources that are given and in the most cost-effective way possible.

Within the RCN training establishment, there have been major changes to allow for better and more timely training. To assist in the betterment of training the increased use of synthetic training must be used. Regular training in synthetic environments for combat operators will increase not only their own capability but that of entire the entire fleet. Although this capability will initially cost the RCN, the benefits will far outweigh the cost. Sailors will be able to train more regularly in simulators at home and abroad. By training in multi-ship scenarios with partner nations from around the world, and with the army and air force, the RCN will be able conduct joint operations, integrate with allied forces and remain at higher states of overall readiness.

These advanced simulators will provide a cost-effective training capability that is able to deliver state of the art, realistic training that will be interconnected not only within the joint community in Canada but with allies around the world. This is an important capability that can bring many benefits to the RCN and to the CAF writ large. In this time of fiscal restraint, the CAF needs to seek out ways to stay current and able to conduct the missions that Government of Canada directs it to undertake. This means being prepared as possible to do just that. Synthetic training environments allows the RCN to do just that. No longer will operations teams only be able to train together once or twice a year in simulators ashore they will now be able to fight highly complex, realistic battles on their ships in their own operations rooms.

INTRODUCTION

A professional standing army has been a necessary ingredient for successful states for thousands of years. Since the first professional armies of Sumer and Akkad were formed in 3500 B.C, countries have had militaries made up of professional full-time soldiers that were paid to defend the states interests at home and abroad.[1] These forces are as expensive now as they were then and require a significant amount of funding to be sustained at proper levels. As expensive as a military is to maintain it is a "necessary evil" for a modern state as protection of its people is one of its most integral responsibilities. For many states then and now, this is not an easy endeavour. Maintaining a force that can defend a country's borders while projecting national power abroad, at times through offensive action, while not bankrupting or severely impacting a country's other fiscal responsibilities is not an easy task. Expensive equipment must be sourced through lengthy procurement processes, purchased, and more importantly skilled people need to be employed by the government as professional warriors. Even though militaries are expensive, governments have always looked for ways to support them as economically as possible

Along with ability of a state to defend itself, the ability of states and other actors to cause harm to others has developed over time as well. In the world today, both state and non-state actors that are a threat to Canada and its allies. The threat of a major peer to peer conflict is again on the rise. Russia has once again revitalized its military to a level not seen since the Cold War. Metz and Richard discuss this resurgence and renewed threat in, *A Short History of War,* "In October 2008, Moscow started its most radical and comprehensive military reform since Soviet times."[2] There are also many other non- state actors such as Daesh that pose a security risk to

---

[1]   Karen S.Metz, Richard A Gabriel, *A Short History of War* (U.S. Army War College, 1990), https://books.google.ch/books/about/A_Short_History_of_Africa.html?id=4_7sORxHiPQC&redir_esc=y.
[2]   Margarete Klein, "Russia ' S Military : On the Rise ?," *Transatlantic Academy*, no. 2 (2015),pg 2.

Canada and its interests. This threat requires a completely different approach to warfare if they are to be defeated. The world in which the Canadian Armed Forces (CAF) operates is described the Government of Canada's new defense policy as, "Canadians live in a world characterized by volatility and unpredictability."[3] Those types of conflicts today are fought on much smaller scales by small teams using unconventional weapons and methods. These challenges represent radically different types of warfare which Canada and its allies must be able to confront militarily.

These very different types of conflict requires countries such as Canada to be prepared to not only fight in peer to peer type scenario, but also have the capability to fight small unconventional conflicts and be prepared to conduct peace support and stability operations as well. Fighting a conventional war and combatting an insurgency are two types of conflict that demand different organizational structure, equipment, and require soldiers, sailors, and air personnel to train in a wide variety of methods. Some of these are traditionally taught such as conventional warfare and others are far more adaptive as when in conflict with non-state aggressors. How to train for these potential types of conflicts is a difficult problem for even the most well funded and equipped countries in the world such as the United States, let alone a less capable military power such as Canada. With limited personnel and a limited budget when compared to other countries in NATO, Canada does not have the capacity to be able to be prepared for a full spectrum of conflicts at once.[4] In this reality, the Canadian Armed Forces must find a way to be flexible enough to be able to contribute to coalition operations with the forces available. Knowing that there are limited forces at hand there are other issues to be

---

[3]   Minister of National Defence, "Canada First Defense Strategy", pg 6.
[4]   "Military Spending by NATO Members - Daily Chart," *The Economist*, 2017,
https://www.economist.com/blogs/graphicdetail/2017/02/daily-chart-11.

mindful of as well. Attrition of experienced personnel has been increasing and equipment has been aging with few replacements forecasted in the near future. The Canadian Forces and for the purposes of this paper more specifically the Royal Canadian Navy (RCN) must now come up with ways that maintain a combat ready force by working within the means that they have available.

Attempting to determine how to maintain a combat ready force under these conditions is a very daunting challenge for RCN leadership. As directed by Canada's defense policy, "Strong, Secure, Engaged," the military writ large must be able to, "act decisively with effective military capability."[5] However with both fleets having very demanding operating tempos that are expected to remain as such for the foreseeable future. it is difficult to find the appropriate amount of time to focus on any one type of warfare training. The ships conducting these operations are now in some cases over 25 years old, meaning that their sailing periods must be carefully monitored as to not overwork the aging platforms. The question of readiness is very complex. There are readiness cycles in place for each ship or force element that must be followed and are dependent on the requirements for engineering work periods. The readiness cycles focus on how from a personnel perspective a fleet is maintained while at the same time ensuring its operators are at a readiness level that will allow them to deploy into a theatre of intense operations at moments a notice. To be able to do this the RCN must look past the traditional methods of training such as bi annual task group exercises. It must begin to embrace fully technology that is available now and move with a purpose into the future. One such way this can be accomplished is through the use of synthetic training environments augmented with artificial intelligence (AI). Although not new to the RCN, technology in this field has far outpaced the RCN and the CAF as

---

[5]   Minister of National Defence, "Strong, Secure, Engaged," 2017, pg 16.

a whole, and the time is now for it to be fully embraced to ensure that the fleets of today and tomorrow are ready to face the challenges of an ever-volatile world.

The use of simulators is nothing new to the military. Various attempts were made to use the technology as early as World War I. Simulators at this time were developed to provide "ground" training for pilots and aircrews.[6] Later in World War II simulation began to be truly developed for use in the military. Russian flying ace, Juri Gilsher, designed a Gunnery Trainer that taught pilots how to aim their fixed gun, while the French created the Antoinette Trainer, which was simply a half barrel in which the pilot sat while others rocked the structure, giving the trainee the "feel of flight."[7] However, the innovator that can be attributed to contributing the most during this period is Edwin Albert Link. Edwin Link established the Link Aeronautical Corporation in 1929 and constructed over 10, 000 trainers to support the war effort and truly led the innovation in the field during the war.[8] Air Marshall Robert Leckie, wartime Chief of Staff of the Royal Canadian Air Force, once said that "the Luftwaffe met its Waterloo on all the training fields of the free world where there was a battery of Link Trainers."[9] He would continue this innovation well after the war as the industry slowly continued to develop.[10] Edwin Link demonstrated how positive an impact trainers could have and this would help shape the industry into the future.

Since World War Two there has been a slow but steady increase in the use of simulation within the Canadian Armed Forces. Canada's allies also experienced an increase as well but have

---

[6]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe'" (Winter Park, Florida, USA, 2017),pg 2.

[7]   *Ibid*, pg 3.

[8]   *Ibid*, pg 3.

[9]   Chris Lehman, "Early Flight Training in the United Kingdom - Military Training and Education," *Maritime Simulation and Training Magazine*, 2013, https://militarysimulation.training/air/early-flight-training-in-the-united-kingdom/.

[10]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe'" (Winter Park, Florida, USA, 2017),pg 2.

progressed at different rates than Canada. The United States in particular has been highly innovative in the field and, in the decades following the war, would be instrumental in the progression of the field. After the war militaries largely reverted to live training, funding was plentiful as were opportunities to train as countries readied for the new Soviet threat. However, as time passed, and the Soviet Union ceased to exist, funding for the military began to shrink and again there was more emphasis placed on simulator use by the military. This was because their benefits were realized to be more than just fiscal. Systems improved significantly with technology making them now comparable at least in some respect to the real thing. Henry Okranski describes the early days of simulation in his paper *Remembrance of a Simulationist,* "digital computers were just beginning to be embedded in simulators. They were the large mainframes with limited capability compared to today's computing systems."[11] With systems like this now available to be used it was only a matter of time that the use of simulators would become a permanent fixture in military training.

In recent decades, the field has seen accelerated growth largely because of the fiscal constraints seen in the United States and around the world. Major conflicts have drained much of the United States resources both financially and in military hardware and the once seemingly bottomless US military budget of the Cold War is now in an age where fiscal responsibility is a reality. Now even their mighty forces are looking for ways to save money and at the same time maintain operational effectiveness. Simulation has been the tool that they have turned to with its capability to augment actual real-life training. With the savings that they are experiencing there

---

[11]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe'" (Winter Park, Florida, USA, 2017), pg 8.

is no turning back from the field, one US report indicated that, "the operating cost of flight simulators is estimated to be between 5-20 percent of the cost of aircraft,"[12]

Although there is limited data in Canada regarding the condition of the ships within the two fleets in the RCN, an assumption will be made that a comparison can be drawn between the effects that the United States is witnessing to what is seen here in Canada. In fact, with the Halifax Class past its mid life, it could be assumed that the saving could be more significant here in Canada.[13] With this in mind Canada has to far more limited extent, looked to synthetic training to reduce wear and tear on its assets while ensuring they are ready to go to sea when required. The extent of which the RCN has done so will be the topic of the first chapter.

Ships that go to sea this day in age require highly skilled personnel to operate them which is especially important true in a modern warship. Synthetic trainers have been used to assist with this to ensure that personnel readiness is where it needs to be. Interestingly, a Canadian warship has not fired a shot in anger since the legendary "Train Busters Club" in Korea in the 1950s.[14] Since it has been so long that a Canadian warship has seen actual combat there is no one in the navy today that has seen conflict at sea. How then do you train personnel effectively for conflict? Simulators are used to provide a life like environment where ships can go to war without firing a single shot. This is a critical capability with incredible potential in the RCN that can be used to teach sailors today what war and other evolutions at sea really look.

---

[12]   Jennifer Mcardle, "Gaming to Victory: Synthetic Training for Future Combat," *War On The Rocks*, accessed February 18, 2018, https://warontherocks.com/2017/11/gaming-to-victory/.

[13]   Government of Canada, "Halifax-Class Modernization/ Frigate Life Extension (HCM/FELEX) - Canada.ca," 2016, https://www.canada.ca/en/department-national-defence/news/2016/11/halifax-class-modernization-frigate-life-extension-felex.html.

[14]   Michael, Whitby, "The Long Reach : The RCN and the Korean War" 1, no. 4 (2006): 1948–52.

LITERATURE REVIEW

The use of synthetic training environments has grown rapidly over the last number of decades, not only in the military but in other professions as well. Many of the fields that have developed uses for synthetic training can draw at least some similarities between their uses and needs in their respective field and those of the military. For instance, the airline industry where operating costs are high and seemingly always on the rise look to synthetic training vice training flights to maintain skills of their employees, to test new equipment or to test new procedures. Other fields such as medicine use simulators more for testing or training for dangerous procedures which doctors may perform. They are also utilized to train new doctors or maintain current doctors skills in a stress reduced environment as there is no actual patient that could suffer negative consequences of a potential mistake. Okraski discusses some of the industries that have also seen a growth in the use of synthetic training, "Synthetic training is everywhere to be seen: in defense, space, law enforcement, entertainment, medicine, transportation, education, and the list gets larger with each passing year: an expanding field of view of technology."[15] The use of this technology by other fields will only enhance what the military will be able to do with the field as the relationship between the military and its contractors continues to grow stronger. These examples of the many fields where synthetic training are in use today. With simulation use increasing in civilian applications so to has the literature and research to support it. Understanding that industry potentially has much to offer the military by means of technology in the field due to the use that it has seen in the private sector is important considering the new direction in the defense policy, "Strong, Secure, Engaged," that directs that the CAF liaise more

---

[15]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe'" (Winter Park, Florida, USA, 2017), pg 6.

closely with academics and industry to push capabilities which in this case would include synthetic training environments.[16]

Most militaries today are affected by budgetary restraints. They need to find ways to cut spending while at the same time remain operationally effective. One way that militaries are doing this si by increasing the use of synthetic training. This type of training does not require ships at sea. They can remain in port and receive the maintenance they need, personnel can go home at night and the navy does need to pay for fuel and other necessities that it normally would if ships were at sea, saving a huge expense. With the increase focus on this type of training there has been an increase in research that is used to support its application. The research that is conducted is used by numerous agencies to ensure that the training that is being provided is as effective as it can be considering that it is a simulated environment and not the real thing. In the United States where much of this research within the allied nations is conducted has most of there industry collocated in one city, Orlando Florida. Located here as well is the National Training and Simulation Association (NTSA). The association was formed in 1988 to improve the liaison between the simulation industry that is present in the city and the military. Their website describes their role as having, "a very important job to do in providing the very best of training equipment and simulation technologies for our forces in the field,"[17] This close relationship is beneficial to not only the US but to Canadian Forces as well as the products that are developed are in direct response to a need in the military.

The NTSA is important as it either produces or directs most of research from civilian companies that are involved in the industry. It sponsors, "the Interservice/ Industry Training,

---

[16]   Minister of National Defence, "Strong, Secure, Engaged." Pg 67.
[17]   "About IITSEC | IITSEC 2017," 2018, http://www.iitsec.org/about-iitsec

Simulation and Education Conference (I/ITSEC),"[18] which is held in Orlando Florida and "is the

world's largest modeling, simulation, and training conference."[19] Here is where the industry each

year gathers to review progress that is made within the field including new products and

capabilities as well as review the research that has been conducted throughout the year. The

research that is presented here although conducted by the industry towards the requirements that

the military and is an important event for companies to compare ideas and develop ways ahead

for the industry, "I/ITSEC is organized by the NTSA, which promotes international and

interdisciplinary cooperation within the fields of modeling and simulation (M&S), training,

education, analysis, and related disciplines at this annual meeting."[20] The research therefore is

largely focused on capabilities that have improved or where there is still a need to focus for

future improvement. Largely technical in nature the conference focuses on, "harnessing new

technologies to win in a complex world," emphasizes the need to embrace "non-traditional"

technologies for training military and civilian personnel on the complex tasks enabled by today's

technological advances that are not practical, or possible, in the real world.

 The second focus of research is conducted by the end users, the military. The military has

a vested interest in this technology as it's future capability and readiness has become reliant on

it. In Canada, there is little research that has come directly from the RCN or the CAF writ large.

There is however direction from the Navy that directs the growth of the field for training

purposes. This direction has been issued through the, "RCN Synthetic Collective Training

Strategy Policy and Guidance."[21] It states that, "the Sea Training Group (STG) will introduce

---

18 "About IITSEC | IITSEC 2017," 2018, http://www.iitsec.org/about-iitsec.
19 *Ibid*.
20 *Ibid.*
21 Commander Sea Training Group, "RCN Synthetic Collective Training Strategy Policy and Guidance"
Halifax Canada: Sea Training Group, n.d.

Fleet Synthetic Collective Training (FSCT), leveraging rapidly evolving network technologies that enable greater training effectiveness and expanded training capabilities in increasingly realistic distributed synthetic environments."[22] Even with this being stated, with the resources that the RCN has available and with a myriad of other commitments that draw on resources there has been little in the way of official research conducted. Although there is a lack of official research in the field it does not infer however that metrics are not tracked, or improvements made to the existing systems it merely indicates that most of the research that the RCN uses is from other resources.

Although NATO does influence the direction that the RCN takes with simulated training, most of the influence comes from the United States as Canada's closest ally. With the increase in capability of the simulators and with the maintenance issues that are being experienced in the fleet due to the pace of operations, the USN has directed research into just how much simulated training can be conducted to make up for the loss of sea and flight time before it is detrimental to the individual and/ or their unit. For instance, the use of simulators to keep pilots proficient in carrier deck landings is extremely valuable especially with today's trainers. However, at some point, pilots need to experience the real things by actually landing on a pitching carrier deck at sea. "Perhaps the most challenging task in the Navy requiring above-normal vision, hand/eye coordination and a good sense of situational awareness involves landing an aircraft on a moving carrier at sea." [23] The balance between simulated training and actual training is where the majority of the USN's research is directed and should be focused on as well in the RCN. Striking

---

[22]   Commander Sea Training Group, "RCN Synthetic Collective Training Strategy Policy and Guidance" Halifax Canada: Sea Training Group, *pg 19.*
[23]   Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe", pg 10.

the correct balance is critical to ensure that capability is maintained in the most effective and efficient way possible.

Another area which is important to recognize and which both the RCN and the USN focus research is directed at the systems themselves. Although industry focuses most of its effort on the technical aspects of the systems, the USN has spent resources on research that is focused on making the training systems more interconnected and have the ability to be connected and used simultaneously throughout the world. This area of concentration will be discussed later in this paper as this capability will allow not only individual and small teams to train but up to and including entire fleets. These units may be at the time separated by an ocean but will be able to train together before proceeding into a potential conflict region. For the RCN this area is of particular interest.

Reviewing the research in this field in particular shows how the capabilities in simulation have grown since its infancy after WWI. During the early day research focused purely on how to train massive amounts of pilots on the basics of flying using little more than a box and pneumatic parts from a organ factory.[24] Today research not only focuses on what the individual trainer can provide to one individual or small team but to entire units and even entire fleets. This expansion of capability that has not yet seen its full potential illustrates how the field has grown and will continue to grow as long as there is a military appetite to support it which seems likely considering the conflicts in the world today and with the fiscal restraints that most governments find themselves operating in.

The government research in the field is the last focus point for research. The research that is directed by governments tend to be focused on the cost and the effectiveness of the trainers.

---

[24] Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe", pg 3.

Can money be saved by having military members train in simulators vice going to sea and doing the real thing? To the United States governments credit, it does look to strike a balance between the comfort of a simulated environment and what has to be trained in a real environment. Armed with this knowledge the US government looks to keep military leadership focused on the importance of striking a key balance between the two. This research seems to keep the industry within the bounds of reasonableness as it searches for cost effective ways to deliver state of the art training that can replace many of tasks and still be delivered at a fraction of the cost.

All this research is relevant as it speaks to the way ahead for most militaries within the NATO alliance. With an increase focus on shrinking defense budgets there has been a corresponding increase in interest in synthetic training and in studies that support its use as a training tool in the military. Although these studies have been conducted primarily in the United States by either the military of by defence contractors regarding the increased use of simulators in the training environment. Several factors point to the increased use of simulators however the one of the key primary factors is fiscal responsibility which will be focused on throughout the paper. "The planned cuts are significant, and driven primarily by budgetary pressures rather than any exogenous change in the security environment."[25]

Scholars in the field of simulation have almost unanimously agreed that the use of synthetic training will only increase in the future, "service leaders are trying to accelerate the creation of a new synthetic training environment. The initiative, also known as the STE, is seen as the key to survival and victory on tomorrow's battlefields."[26] With operating cost of the

---

[25]   Dane Rowlands, "Budget Restraint and Military Expenditures in NATO Countries: A Review of the Literature," no. October (2015), pg 13.

[26]   Jon Harper, "Synthetic Training Technologies Gaining Foothold with Military," *National Defense*, 2017, http://www.nationaldefensemagazine.org/articles/2017/11/27/synthetic-training-technologies-gaining-foothold-with-military.

military mounting because of numerous factors such as rising fuel costs and the use of aging equipment, the increase use of synthetic training environments seems inevitable, especially considering how quickly trainer capabilities are improving. What makes this paper unique however is that there is no scholarly discussion on how a different approach to the use of trainers in the RCN can increase its capability throughout the service, from the individual operator, straight through to an entire task group operating at sea. Although trainers have been in use in the RCN training system for decades there is far more that can be done with the technology which will be able to further enhance capability.

State of the art synthetic training environments are essential to the future readiness of the RCN. They connect throughout the world and with their use within the Navy's training cycles will provide cost-effective capability that will deliver realistic training to the RCN. With its use, the RCN will be able to connect to other joint elements within Canada as well as with allies throughout the world providing a platform to train effectively and to higher standards by using highly realistic state of the art synthetic environments. This type of use when conducted in a structured manner on a more regular basis will increase allied nations inoperability and capability as they will be able to train in a controlled environment. This will mean significant changes for the RCN. Infrastructure upgrades will have to be the priority such as adding fibre optic cables to all the jetty's which will allow units to connect to the synthetic environment. Infrastructure upgrades such as these are critical so that full benefit of their capability can be achieved. Changes to how readiness is achieved must also be made. More training that is provided by shore-based experts at each level of readiness will provide operators with more opportunities to enhance their skills and combats teams the ability to maintain cohesiveness throughout a ship's full readiness cycle. By adding the additional training units will achieve a

higher readiness faster as they will receive better, more effective training which will make them able to deploy at much shorter notice if required. The ability to train as a task group while alongside and with partner nations will greatly enhance the RCN's operational capability and readiness status as they can train together as a task group before leaving harbour.

CHAPTER ONE

Present State

The use of synthetic training environments is not a new concept for the Royal Canadian Navy. There have been synthetic trainers on both the east and west coast for decades successfully used to conduct both navigation and operations training. In addition to the trainers in use by the naval operations trades, the engineering community has also used them effectively to train sailors to fight floods, fires and helicopter crashes as well as on how to repair complex combat systems. The combat type trainers illustrate just how embedded into the Royal Canadian Navy the use of trainers really is.

The use of trainers within the training community has deep seated roots. The trainers used by the operations community in the early days were at times as simple as Edwin's WWII box trainers.[27] They were nothing more than simple boxes painted to resemble pieces of equipment that would be found in an operations room. Equipment at times has lacked capability. However, its use as a training tool has always had a positive effect as it is able to teach sailors the proper way to conduct operations in high tempo and dangerous environments. It was recognized early on that it made sense to use trainers no matter how primitive they may have been as it allowed instructors the ability to teach fundamentals to students prior to them going to sea for the first time or assuming new responsibilities onboard. Trainers, simply put, allowed sailors to learn in a safe environment where there were no danger of damaging equipment or people getting hurt.

Much has changed since those early days and today trainers are in use within the Royal Canadian Navy and the Canadian Armed Forces at large. Trainers are state of the art facilities

---

[27]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe'", pg 7.

which are very capable for their intended use. They are used for a number of purposes which are important to the Navy. Sailors brand new to the fleet no matter what their trade in the operations community is, learn in these trainers the very basic skills that are required of their position. Examples of these types of operators could be the new Acting Sub-Lieutenant who is learning the basics of the Rules of the Road and how to navigate a ship or the Ordinary Seaman who is learning to tune a radar for the first time. They are also used to instruct sailors who are progressing in their careers and moving to new positions with the operations room or on the bridge. Finally, trainers are used to maintain skillsets, and prepare combat teams for upcoming missions and deployments. Based on all of these uses the combat trainers are heavily relied upon by the two fleets throughout the year and almost fully booked as they try and cope with the training requirements of the navy.[28]

The RCN would have a hard time without the use of trainers. Without trainers in place the onus to train even the simplest of tasks would fall to the fleet. Demand on the fleet and supporting elements would be completely unmanageable based on the operational requirements of units, especially the Halifax Class frigates. Even to be remotely feasible the most likely course of action to achieve training would be to once again go back to the training fleet model. A number of smaller less capable ships would have to be acquired for the sole purpose of training sailors much like what was in service during the Cold War era where funding and personnel shortages were less of a concern. In today's environment where procurement is already difficult it would be intangible.

---

[28]   "Canadian Forces Naval Operations School Homepage," 2018. http://halifax.mil.ca/CFNOS/.

Fortunately, the RCN utilises trainers today to facilitate these types of training. The RCN and CAF at large have used synthetic training environments in the past. Each of the various trainers that are in use within the RCN are specialized to conduct specific training that is required by the navy's operators to do business in today's demanding at sea environment. These trainers are a cornerstone of today's operations and are incredibly important to the way the navy prepares for and conducts operations. Navigations simulators are on both east the west and east coasts. These state of the art simulators that are able with high fidelity simulate what it is like on the bridge of a warship at sea. These simulators are used at all stages of a Naval Warfare Officer's career commencing from the initial phase training that occurs at Work Point in Esquimalt British Columbia. From there it is used during the Navigation Officer Course where it is used repetitiously as junior Lieutenant (Navy) officer apply their skill in an attempt to become qualified as a Fleet Navigation Officer. Trainers for this course are especially important as it allows for a safe, less stressful learning environment where students can be mentored throughout the runs by retired naval officers, something that would not be able to happen if these training evolutions were only conducted at sea due to the conditions and the limited time they would have available to train. The other clear benefit is that a warship with over 200 personnel and which costs tens of thousands a day to operate does not have to go to sea for weeks with the sole focus of training these officers. Other junior officers as well as Non-Commissioned Members train in a different type of simulator. The Synthetic Advanced Combat Operations Trainer (SEACOT) and Synthetic Environment Advanced Warfare Operational Leadership Facility (SEAWOLF) simulators are used extensively to train combat operators.

SEACOTT has three trainers that can be linked amongst themselves and the system is more focused on the individual operator skillsets instead of full combat team training. It has the

capability of simulating virtually any of the instruments in the operations room which allows for more specific operator training or for instructors to focus in on one area of warfare. For instance, sonar operators can use SEACOTT to hone passive detecting skills which they will use predominantly while hunting submarines or other underwater vehicles. They can do this while sitting in a classroom vice at sea. Instructors are able to input variables as required so that students are exposed to everything thing they need to see prior to joining a ship that may potentially at some point be hunting submarines. SEAWOLF on the other hand is less capable when training individual skill sets as it is more focused on team training. It consists of two full simulated operations room which each have a fully capable ship's bridge connected to it. These trainers are used to train sailors on how to operate as a combat team in the operations room under war-like conditions. Having the two interconnected trainers allows instructors to force students to interact with other units which adds another layer of complexity to their training and again makes training far more realistic.

This capability is now being further enhanced with the, Distributed Mission Operations Center (DMOC) which is now stood up and operational at Naval Fleet School Atlantic (NSF(A)), bringing together geographically dispersed resources into a single, cohesive synthetic environment. With DMOC these simulators will eventually be able to connect to other units in Canada and around the world. This capability will bring a whole new level of training to the Royal Canadian Navy and its sailors. Chief Petty Officer First Class Miller of the Naval Personnel and Training Group (NPTG) explains that, "There are a number of benefits that can accrue by adding FSCT into the way we currently train at the TG and unit level which fall into three categories: more efficient training, smarter training, and more effective training." These benefits are very important for units but even more important at the multi unit level. Having the

ability to train together in a simulated environment with multiple units is a huge benefit to the navy as it will allow for better cohesion amongst units as they can train more effectively and more regularly together. With DMOC, it is not only ships that will benefit from this interconnectedness. Other trainers such the Cyclone trainers and the CF-18 trainers can link in as well making this capability beneficial to the joint training and operations as well.

In 2012, the RCN established one command that is responsible for most of the training within the navy. The Chief of the Royal Canadian Navy at the time, Vice Admiral Maddison created the first rendition of this new organisation. "A new Commander Naval Training System (CNTS) is being established as we consolidate our five naval schools into a single Naval Training System. That authority will be assigned to the Director General Naval Personnel."[29] NTS has evolved into the (NPTG) that is led by a Captain (Navy) who is in turn responsible to the Commander Canadian Fleet Pacific (CCFP) who is responsible overall for training and readiness. With all the five schools now under NPTG there is far more synchronization of resources and a better focus of effort. In Darlene Blakely article CPO1 Miller explains that, "the integration of all of the navy's individual training assets under the same group will ensure consistent training delivery from coast to coast and move the marker on the 'One Navy' directive."[30] Naval Personnel Training Group is responsible for both individual and team training. This includes everything from the individual operator courses for junior members in the operations room through to operations room team training that is required for ship readiness. CPO1 Miller describes the work that is being conducted at NPTG, "great work is under way to ensure that the new trades being created will be set up for success and that the sailors of the

---

[29]   "Naval Transformation Announcement," *The Canadian Naval Review*, no. May (2012).

[30]   Darlene Blakeley, "Newly Created Senior Appointments to Assist with RCN Transformation," *The Maple Leaf* (Ottawa, Canada, December 2017), pg 10.

future are properly trained for the future fleet that is coming our way."[31] NPTG will be a critical organization moving forward for the RCN with regards to how the sailors of tomorrow are trained.

This new unit experienced many growing pains but now there are many benefits to be found from it. With only one unit responsible for training many of the redundant positions have been reallocated to where they could be more effectively employed. The amalgamation of the units has had two main effects. The first is that there are more actual training positions available to train sailors instead of only administration for them and secondly it is far more cost effective. Furthermore, assets and training facilities can be held under one roof and shared amongst the units. There is no longer a need to have multiple specialized classrooms as it now an all be shared by all the training establishments. These steps are all important as the navy moves into a more technologically advanced training era. Blakeley describes how the senior leadership at NPTG foresees the upcoming transformation, "he hopes to set a strong foundation for the new training system, including transforming outdated classroom facilities into modern, inviting institutes of learning, and turning chalkboards and drawings into technology-enabled learning that will better engage and motivate students."[32] This type of vision from NPTG is important for the navy as it will help facilitate how the RCN moves into the future with respects to training. By taking a positive leadership role by forcing the move from traditional teaching methods to more modern ones not only within the schools but throughout the fleet as well.

There is one other entity that is responsible for some aspects of team training as well. Sea Training Group (STG) commanded by Commander of Maritime Operations Group Five

---

[31]   Darlene Blakeley, "Newly Created Senior Appointments to Assist with RCN Transformation," *The Maple Leaf* (Ottawa, Canada, December 2017), pg 10.
[32]   *Ibid*, pg 10.

(CMOG5) is responsible to ensure the readiness of the units within the fleet and conducts the readiness training required for each force element at each readiness level and prior to deployment. Commander Sea Training Group describes the role of his unit, "Sea Training Group will provide afloat and alongside collective training, certification and maintenance of standards for ships and submarines through the continuum of readiness, assuring operationally capable sea power."[33] This unit is made up of three sub units which are very important in today's training and readiness environment and will be even more so in the future. The first unit is the Sea Training Group itself. This unit stays alongside and works directly for Commander Sea Training Group (CSTG). They are responsible for the administration for the group and for updating its policies and directives. The other two groups are Sea Training (Atlantic) and Sea Training (Pacific). These units are made up of senior members of their respective trades who are considered experts in their fields. These units conduct alongside and at sea training and readiness evaluations for all the coastal units. They work at times alongside the Fleet staffs to ensure that the force elements on both coasts are at required readiness levels. Much of what Sea Training does is in simulators. They test units prior to going to sea to ensure that the individual operators, sub-teams and the combat team as a whole are ready and prepared prior to going to sea and joining a very busy exercise schedule. The thorough training that units receive from these staffs allows for their deficiencies to be corrected and for units to receive additional training which allows them to be effective at sea.

The intent is for these two entities to work in harmony with each other to ensure that units and individuals receive the training that they require. Ideally, there would be ample staff and trainers would be available to conduct all of the Individual Training (IT) and Team Training

---

[33]   Commander Sea Training Group, "Sea Training (Atlantic) Webpage," *http://halifax.mil.ca/SEA_TRG/*, 2018.

(TT) requirements. There is always a very high demand on the usage of the trainers and on the minimal staff that operate them and therefore, issues regularly arise. Conflicts in who specifically does what specific training and who provides manning for training evolutions cause issues with training. Training at times may not be done to the standard that it could be. Therefore, now is the time to change the way that training is conducted by not only changing the way training is delivered but where it is delivered within training cycles as well. The RCN needs to look no further than to ally to the south for a way forward into the future.

Allied Nations Use of Synthetic Trainers

Canada is not the only country that heavily relies on synthetic training to train their armed forces. Many of Canada's partners in NATO as well as all the countries in the five eyes community use some form of synthetic training for many of the same reasons as Canada. It gives credibility to the capability, be a place to fund mutual support and could be a place where Canada can train with its allies without even leaving the country. No where is synthetic training used more and to greater effect than in the United States. This is because in its infancy it was recognized an essential tool to train and maintain skillsets. Although this is true now it was not always the case. Up until the 1970's, "simulator time" was considered an adjunct to flight training, Henri Okraski describes what it was like in the beginning of the modern age of simulation in his paper, "trainer utilization was not strictly enforced. The "age of enlightenment" came into being when the military services institutionalized the Instructional Systems Design (ISD) process in the design of training systems."[34] Today however due to a number of factors they are heavily used in the training systems.

---

[34]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe.", pg 8.

There are many benefits that can be derived from simulated training. These benefits are important to consider for the RCN as they will allow the Navy to enhance capability alongside in a cost-effective manner. A report prepared for the Training and Education Command (TECOM) in the United States indicates three main benefits of synthetic training which are time saving, cost saving, safety to both personnel and equipment.[35] The costliness of war and the current fiscal reality in their country is a reality that the US forces find themselves. Although the defense budget grew last year increasing from $639 billion dollars US to over $686 billion US in 2019, most of this was not earmarked for the various training establishments as the priority was put elsewhere.[36] The focus of the new United States defense budget is on recapitalization as well as to fund the conflicts that the United States are currently involved in. The Defense Secretary discussed how the United States needed to fund its military in order to keep pace with its competitors in the 2019 Defense Budget. "To address the scope and pace of our competitors' and adversaries' ambitions and capabilities, we must invest in modernization of key capabilities through sustained, predictable budgets."[37] With this heavy focus on buying new equipment and waging war, it clearly indicates that other areas of the defense department may not get the attention that they deserved. This situation is very similar in Canada and although the budget is always a question of priorities that reflect the government of the day, training always has to be heavily considered so that forces remain able to conduct operations as required.

A direct fallout of this is with their training budget. This new budget has less funds available for training that is not directly involved in current operations which is a case not only in the United States Navy but in all of the services. In a report written for the US Government

---

[35] Under Secretary, "Optimizing the Mix Between Virtual and Live Military Training, Task 4.2 –Final Project Report," no. September (2013), pg 6.
[36] "FY 2019 Defense Budget 2019," 2018, https://www.defense.gov/News/Special-Reports/0218_Budget/.
[37] *Ibid.*

called, *Going Virtual To Prepare for a New Era of Defense,* the constraints that are put on

training due to budgetary constraints is discussed. "Army flying hours are funded at only 87% of

requirements in the FY 2015 defense budget."[38] This is a trend that has continued to today as

discussed in the same report which indicates the difficulties that training establishments are

having in the current constructs. "Training regimens are still not up to par. Just 23 percent of

DoD employees surveyed by GBC believe that current training levels will meet the military's

readiness needs.[39] These sentiments have been backed up as well by a number of incidents that

have recently occurred. There have been two major collisions involving US warships over the

last year. Both USS FITZGERALD and USS JOHN S. MCCAIN were involved in collisions in

two separate incidents where a loss of life occurred and millions of dollars' worth of damage to

the vessels resulted. The initial reports into both incidents indicated that training levels were

dangerously low. "Both of these accidents were preventable, and the respective investigations

found multiple failures by watch standers that contributed to the incidents," said Chief of Naval

Operations (CNO) Adm. John Richardson. "We must do better."[40] The reality of the situation has

caused the forces in the United States to take drastic measures. At the time of the incidents all

operations in those regions were put on hold until a reassessment of safety. "This trend demands

more forceful action," Chief of Naval Operations Admiral John Richardson said in a video

released online. "I have directed an operational pause be taken in all of our fleets around the

world."[41] The direct result of a force having to take operational pauses could be an indication

---

[38]   GBC, "Going Virtual To Prepare for a New Era of Defense How Virtual Training Can Help the,"
Government Research Council, 2014, http://www.govexec.com/gbc/going_virtual_for_new_defense_era/.
[39]   *Ibid.*
[40]   "Navy Releases Collision Report for USS Fitzgerald and USS John S McCain Collisions," 2017,
http://www.navy.mil/submit/display.asp?story_id=103130.
[41]   "US Navy Pauses Global Ops After Crashes | The Daily Caller," *Daily Caller*, 2017,
http://dailycaller.com/2017/08/21/top-admiral-suspends-us-navy-fleet-operations-worldwide-following-devastating-crashes/.

that they are less capable of responding to major world crisis both to the government and to the population at large. If a navy is not capable of putting crews to sea that are able to conduct basic tasks such as navigating the ocean safely, the question could be asked of how they could possibly fight in a region of conflict. Modern militaries are expected to be able to conduct peacetime operations safely and although accidents will occur, if they do happen to often questions will be raised about how that force is conducting business. One of the major factors that led up to these two incidents was a lack of training by members of the bridge teams. Simulators could have been used to increase the amount of training that was given which would have increased their chances of safely navigating these busy waterways.

The question then becomes how do militaries find ways to deploy as safely as possible in today's complex environment? In the United States Navy, an intern solution was found however it does not satisfy the problem of lack of training opportunities and competency amongst its members. To deal with these shortfalls, the United States Navy has unofficially instituted a tiered readiness system. Units that are deployed or about to deploy are given priority. They receive more training, and, their equipment has a higher rate of serviceability. The effect of this funding shortfall has been a tiered readiness in the United States Navy. Many F/A-18 pilots simply do not get the flying hours they require due to equipment shortages. MacKenzie Eaglen describes the situation in his report titled, *Newsflash to the New Congress: Tiered Readiness Is Here Now,* "it is a situation described as one of "haves" and "have nots." Pilots in a conflict zone or high-tension area are getting the staff and parts needed to keep jets in the sky. But those not deploying anytime soon are forced to sit idle alongside their parked aircraft and wait.[42] The requirement to

---

[42]   Mackenzie Eaglen, "Newsflash to the New Congress: Tiered Readiness Is Here Now | RealClearDefense," *Real Clear Defense*, 2014,

slash funding for some units to support those deployed or deploying has been felt across all the services in the United States, in Canada and amongst all of the countries in the NATO alliance.

Simulation has played and will continue to play an increasingly important role. The United States has recognized the importance of simulated training and continues to use it to ensure that the United States military is able to conduct operations around the world. The use of simulators is increasingly easier to support as the costs of these systems for the most part are going down and their capability especially in their fidelity and ability to represent operating environments go up. With this capability and with budget restrictions that do not allow for real time training all the time, the decision to move to trainers is a wise one as long as there is recognition that there is absolutely no substitute for live training. It still needs to occur so that sailors can learn their trades under demanding circumstances. Therefore, their must be a balance between the two in order for sailors to be trained effectively as possible. This type of balance is what the Royal Canadian Navy must look to as well. This is especially important as the experience level between the two navies are very different. The United States Navy and their forces at large find themselves engaged around the world on a regular basis. Actually conducting operations is a form of training in itself and the best method to ensure that the training that they are receiving is actually effective and works in real life scenarios. In Canada the story is quite different as these opportunities have not existed for some time.

Synthetic Training Effectiveness

As Canada has been in no major conflicts at sea since the Korean War it could be argued that the training being conducted now is adequate for the purposes of the Navy. Ships are going to sea safely and seemingly there are no major issues to be had. With that fact alone, it could be

---

https://www.realcleardefense.com/articles/2014/11/06/newsflash_to_the_new_congress_tiered_readiness_is_here_now_107530.html.

argued that what the Royal Canadian Navy is doing is adequate to meet its needs. There have

been no combat operations to prove without a doubt the navy's combat effectiveness. The

reorganization of the training establishments should mean that there will be enough resources in

the future to ensure the future training needs of the navy are met. It is tempting to think that this

is enough and that the Royal Canadian Navy is adequately prepared for anything the future may

hold but notions like this may are misleading and if thought by everyone within the organization

could lead to a training stagnation that would prevent future progress which cannot be allowed to

happen if the navy intends to keep pace with its competitors.

Although Canadian warships have been going to sea safely it has not been without any

incidents. Of the incidents that occurred at least some could have been prevented with more

effective training, training that could have been provided in simulators. A good example of this

that has occurred in recent memory happened in 2010 off the coast of Virginia, in the VACAPES

Operations Areas.[43] In November 2010, Her Majesty's Canadian Ship FREDERICTON collided

with United States Naval Ship KANAWA while conducting alongside replenishment at sea. It

was later determined from a Defense Research DC study that the, "available data suggest that

hydrodynamic interaction forces at the onset of unexpected motion behaviour were likely less

than 10 percent of hydrodynamic interaction forces that would have been experienced when

closer to the alongside refuelling position."[44] This data from the report would indicate that the

collision was caused by human error vice from the effects of the environment. Conducting

Replenishment at Sea (RAS) approaches can easily be trained for in the simulators that are

available on both coasts currently, but they are rarely practised because of trainer availability and

[43] Virginia Capes Operation Areas
[44] Defence Research and Development Canada., "Analysis of Hydrodynamic Interaction Between HMCS FREDERICTON and USNS KANAWHA," no. September (2012),pg 3.

operational tempo. Although the accident is not a combat-related incident much like the collisions the United States Navy recently had, it shows that issues with the system that may need to be addressed.

With the benefits that can now be gained from simulation technology the time is now to embrace them. Henri Orkanski describes some of the industries that have already embraced its use, "simulation is everywhere to be seen: in defense, space, law enforcement, entertainment, medicine, transportation, education, and the list gets larger with each passing year: an expanding field of view of technology."[45] This technology needs to be invested in heavily by the Royal Canadian Navy and the rest of the Canadian Armed Forces so that the Canadian military can keep pace with the world around it. Many of Canada's allies are heavily invested in synthetic trainers and are able to train their own forces in a synthetic environment to a standard that is very high. Many of these countries can do this type of training within their own forces or even with their allies around the world. As Canada continues to deploy in a contribution type manner this type of interoperability is essential and being able to train with forces before a unit gets into theatre would greatly enhance interoperability.

There is also the problem of the pace at which warfare changes. As warfare changes and as Canada's adversaries become more weaponized it will be impossible for ships to train solely at sea to meet these challenges. Interconnected trainers will allow for repetitious training that will ensure teams are prepared to meet adversaries or any other threats prior to deploying on missions. This is a critical capability that will increase the RCNs overall readiness when deploying. Furthermore, although trainers are used for single ship deploying units prior to their departure there is no training that will allow for a task group to be trained together prior to it

---

[45]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe.", pg 8.

sailing. Having an ability to train everything from a single ship joining a NATO task group to a Canadian task group is a capability that must be capitalized on especially considering the minimal cost that it will take to bring these systems online. Instead of ships from various countries meeting somewhere in the ocean and taking weeks to establish communications and learn to work together, much of that will be done prior to sailing while the ship is in home port. With proper satellite support this could also be conducted while enroute to the task group rendez-vous point. The ability for units to proceed into theatre and almost instantaneously operate as a task group would be a huge advantage for military planners. Planners previously had to plan for a slow easement into operations to allow for the integration of the units.

Although ship's go through the whole readiness cycles and receive training both alongside and at sea, it is doubtful that they are fully prepared to depart immediately into a threat environment. Even the most competent operator needs time to refresh skills and to work with their teams again. In a situation where they would be facing a peer on peer type conflict this would be crucial based on the pace of modern day naval warfare. Pushing this type of training in a trainer should be preferable to at sea where pushing people hard in training can lead to exhaustion and dangerous situations that could potentially lead to loss of life or damage to expensive machinery. Furthermore, these ships would most likely have to integrate into some sort of allied task group which in itself takes precious time, something that may not be available depending on the nature of the conflict. The problem then is how do training establishments provide training to meet the challenges of today? The RCN already uses synthetic training environments to provide operators with the basic skills that they need. The use of these trainers has been proven to be effective but now with the advances in technology it is time to expand on that capability to get the full benefits of what synthetic training environments can achieve.

CHAPTER TWO

How to Advance Synthetic Training

If the Royal Canadian Navy wishes to be relevant and combat ready now and into the

future it must embrace change and be constantly willing to evolve. This concept is important to

embrace. It is extremely important especially in the age of rapidly evolving technological

advances that are changing the face of naval warfare. Super cavitating torpedoes, supersonic

missiles and asymmetric threats are some dangers that the Royal Canadian Navy has to be

prepared to encounter. Historically, the Royal Canadian Navy has proven itself to be a combat

effective force. However, after decades of operating in non-combat situations its ability to

conduct those types of combat operations is unknown as its sailors have not been tested. There is

no doubt that the navy of today can conduct non-combat operations such as Humanitarian

Assistance (HA). Cdr Gord Noseworthy led HMCS ST. JOHN'S during relief efforts in

hurricane ravaged Barbados in October 2017.[46] His successful mission illustrates the

effectiveness of the training they received. This level of effectiveness is however not as easy to

determine when it comes to its capability to conduct combat operations.

Understanding the Canadian political environment and knowing that Canada most likely

will have a contribution role within NATO and one that most likely to be patrol and presence

type operations in NATO's areas of operations. This understanding is important so that naval

planners can determine where to apply funding and other resources and for the purpose of this

paper where to spend education funds and for what should sailors be educated on. The United

States Secretary of Defence in 2016 stated: "today's national security environment is

---

[46]   "Halifax Warship Returns from Hurricane-Scarred Caribbean Islands | Globalnews.ca," *Global News*,
2017, https://globalnews.ca/news/3789006/hmcs-st-johns-returns-from-hurricane-relief/.

"dramatically different—and more diverse and complex in the scope of its challenges—than the one we've been engaged with for the last 25 years, and it requires new ways of thinking and new ways of acting" (2016, emphasis is ours)." The Royal Canadian Navy is at a disadvantage as it does not regularly learn from combat operations like the United States Navy and look to maintain its fighting capabilities through other means. This is simply because the RCN has not conducted these types of operations on a regular basis. Although the RCN has deployed in recent history to dangerous regions such as during the Libyan conflict it conducted more patrol type operations vice actual combat.[47] This means that although the RCN regularly trains to fight it does not get the opportunity to determine if what training it is providing is working.

One method where this can be achieved is by using private sector support within Canada. Strong, Secure, Engaged gives the military direction to do just that. The Canadian Armed Forces is to "leverage the expertise of Canada's defence and security academic community."[48] This is a cost-effective way to increase capability in a cost-effective manner and something that has been done in other countries such as the United States for years.

There have been numerous deficiencies noted within the Royal Canadian Navy and the Canadian Armed Forces overall with regard to how training is conducted. These training deficiencies must be addressed. For military forces to be successful they must be adaptable and capable of necessary change. Albert and Hayes define as, "the ability to alter force organization and work processes when necessary as the situation and/or environment changes."[49] Those militaries that are not able to evolve find themselves lacking in capability. Militaries must strive

---

[47] "The Royal Canadian Navy in NATO – NAOC," *NATO Association of Canada*, 2012, http://natoassociation.ca/the-royal-canadian-navy-in-nato/.
[48] Minister of National Defence, "Strong, Secure, Engaged, pg 69.
[49] David S Alberts and Richard E Hayes, About the CCRP, Information Age, vol. 10, 2003, doi:10.1038/nri2836, pg 52.

to continually adapt to the times so that they have the ability to defend their countries and do their governments bidding abroad.

This is especially true in this era of rapidly changing warfare. As warfare continues to evolve at a very high rate, the military must adapt to stay relevant. This is not easy considering the budget constraints that many militaries, including Canada's find themselves in. As countries such as China and Russia continue to rapidly develop more high tech and more lethal weaponry it is difficult for other countries to adapt their tactics to keep up with them. To do so requires potentially new tactics and potentially new defensive systems both of which take both time and money to develop. Therefore, any method that can give allied forces any advantage such as training in simulated environments must be embraced. This type of training his will allow for tactics to be developed and practiced in a safe environment to ensure that they are effective as possible and are the best tools available.

The increased use of simulators will also save taxpayers potentially millions of dollars each year due to the ability to train alongside vice always at sea, but also greatly increase the capabilities of naval forces. The potential to do this should not be ignored. Even though the initial cost of buying the necessary infrastructure may be large and there will be necessary changes to the long term positive effects will no doubt be even larger. Being able to conduct high intensity training in very life like conditions with the ability to go home at the end of the night would have very positive effects on the Navy. Synthetic training systems allow the Royal Canadian Navy to keep pace with the operational capabilities allies and foes alike. Although there will be an initial cost to buy the necessary infrastructure and changes to the readiness policies will be challenging but necessary, the benefits to the navy over the long term will far out weigh these short-term pains.

For these changes to take place they need to occur in three key areas, policy, infrastructure and personnel. It is important that the changes are incorporated correctly so that they will generate long lasting positive effects.

Infrastructure

A key requirement that is necessary for synthetic trainers to be effective is an up to date infrastructure. Since these trainers operate in real time in trainers that are located across the country and around the world the need for real time communications which is provided through fibre optic cabling is a must. "The Canadian Advanced Synthetic Environment (CASE) Project is leading the development of an interoperable CAF on-demand synthetic environment."[50] This project originally created by the Royal Canadian Airforce (RCAF) is, "focused around Force Generation, by connecting all capable warfare simulators in the CAF in a common distributed mission training (DMT) network."[51] Although focus in the RCN is more on developing its own capability at this time it is beneficial to realize that the other elements are beginning to focus more on their own synthetic capabilities as well. This is especially important when discussing upgrades in infrastructure. When discussing most types of upgrades in infrastructure the price tag associated with it is usually quite high as new equipment will have to be purchased. In this case there could be a reasonable expectation that the up-front costs that are necessary to upgrade the ability of units to training in a connected, synthetic environment would be high as well. However, surprisingly there is not as much required as may be expected. There are shore-based simulation facilities already in place in Halifax. Part of these facilities are collocated with the DMOC which is the key facilities that will allow trainers to interconnect with one another ashore, with ships in harbour and with other units across Canada and around the world.

---

50   Sea Training Group, "RCN Synthetic Collective Training Strategy Policy and Guidance."
51   *Ibid.*

As this capability continues to grow the emphasis needs to be put on how the ships themselves can be connected. Currently, there is no capability to connect ships in their home ports to a simulated network so that combat teams can connect and train with one another. If they were to attempt this in the current state, ships would have to use sensors and communications equipment aloft in their masts. This configuration would work to some degree although it would not be as effective as other communication methods that are available. Furthermore, when that equipment is in use the mast is out of bounds and therefore there is a very limited amount of work that can be conducted on the upper decks and especially the aloft areas, severely impacting maintenance periods. This impact would be impossible to deconflict with the planned maintenance periods and therefore is not sensible to use as a training method.

The issue to these problems lie in custom off the shelf (COTS) solutions. An example is fibre optic cabling. If fibre optics were to be installed at each of the alongside positions it would allow ships to plug into a highspeed network environment which would then nullify the need to transmit and maintenance work could carry on as usual. Clearly, the answer is not as simple as putting in fibre optic cables and pressing play. There are issues of data security, potential upgrades onboard the ships etc, all of which have to be carefully thought out. Saying that however it is being done already and to great effect.

The United States Navy has had this type of infrastructure already in place in their port facilities for some time. Having this capability in their port facilities has allowed them to carry out alongside training on a regular basis and as part of the work up programs. Ships in harbour will plug into the network while alongside and trainers are able to run task group combat serials without the ships companies leaving their ships. "This is the future of training for the Navy," said Terry Allard, head of ONR's Warfighter Performance Department. "With simulation, you can

explore endless possibilities without the expense and logistical challenges of putting hundreds of ships at sea and aircraft in the sky."[52] This significant capability allows United States Navy forces to be at a higher readiness level while alongside. When they do deploy they are able to deploy at a higher state of readiness than they would have been able to do in the past because of the training they can achieve before the even leave harbour.

Personnel

With changes being made to the way training is delivered the question then becomes who delivers that training. As it stands individual training is conducted by the fleets school. This is the individual operator training that gives sailors the basic skills they need to then operate in the larger combat teams within the operations room. Collective training, meaning training for ships combat teams as a whole is primarily the responsibility of the Sea Training Group. Although it makes sense for individual training to be conducted in the school environment collective training should be conducted by one entity. Sea Training is comprised of senior members who are among the best in their respective trades. Currently, they are the teams that go to sea with units and run training programs to ensure that ships are prepared to face the challenges of their upcoming operational schedules. Units would be far more effective if they would be able to conduct training on a regular basis alongside and prior to going to sea for exercises or deployments. Changes need to be made to crewing levels at Sea Training Group so that they can effectively carry out this training.

Sea Training is currently crewed to conduct training at sea only. If they are to conduct training alongside on a regular basis the unit will need to be expanded and a shore-based training team will need to be established. This team would be comprised of the same sort of experts as

---

[52] "FIST2FAC: The Future of Navy Combat Training?," *United States Navy*, 2016, http://www.navy.mil/submit/display.asp?story_id=94123.

those that go to sea however their mandate would be to conduct the shore-based training working with the team that goes to sea once the alongside training is complete. By having this training conducted by the same unit with the same command structure there would be far better training delivered. Training expertise would once again reside within the fleet as there would be dedicated personnel that sole job is to train and teach.

Sea Training is already posed to move in this direction. As Commander Sea Training Group states in the units annual report, "STG will take advantage of the forthcoming synthetic training capabilities provided by the DMOC and a software module called the Synthetic Environment Tactical Trainer (SETT) in the Mod-Halifax Class."[53] A shift in mentality from this senior unit certainly helps enable to process with the rest of the navy and the Royal Canadian Navy at large. Commander Sea Training also stated that, "the goal is a permanent, on-demand, distributed synthetic environment, that will enable the RCN to conduct cost-effective, distributed mission operations, through training events such as naval, joint, and coalition virtual/synthetic exercises and mission rehearsal."[54] The process to move in this direction seems to have already begun. "Steps are being taken to improve alongside synthetic training that will enable combat teams to attain or maintain their warfighting proficiencies. While staff structures, including those within STG, will have to evolve to support these changes."[55] Personnel position changes in the military is never an easy task. These changes will mean that ome unit will lose coveted positions which are very difficult to get back. These changes must be well thought out because of this however in this case, adding to the training capability of the Navy will lead to a more competent and stronger navy in the future which Commander Sea Training explains in the annual report, "as

---

[53]   Sea Training Group, "Sea Trainng Annual Report 2016 / 17 Sea Training Group," 2016, pg 2.
[54]   *Ibid*, pg 2.
[55]   *Ibid*, pg 6.

the result will be ships' teams that are far more prepared for the challenges of operations at sea."[56]

Policy

When it comes to changing policy in the Navy it is never an easy task. These changes are especially difficult when it comes to training and readiness as it speaks directly to its operational capability. To make these changes will require the cooperation of a number of key departments within the Navy. These changes will not only affect how training will occur but will affect readiness of force elements and their readiness cycles within the Royal Canadian Navy. The multiple agencies involved are highly interconnected as are the policies under their control. As they are deeply connected it would mean that any changes that are made with one organisation would have to be reflected in the policies of the other. These concurrent changes occur now, however the process can be labour intensive and time consuming.

The operational readiness of units within the RCN is one of the major planning considerations within the Navy. The department that has the most influence on readiness as it controls the various readiness levels is Naval Force Readiness (NFR). As stated on its homepage it, "is responsible to the Assistant Chief of Naval Staff (Afloat Training and Readiness) – Commander MARLANT – as the Operational and Readiness Authority for the RCN."[57] This unit is the one that determines what the various readiness levels look like for each class of ship and for each readiness level for the various units. "NFR provides pan-RCN direction and management of all operational readiness policy, coordinates operational readiness functions

---

[56]   Sea Training Group, "Sea Training Group Annual Report 2016 / 17 SEA TRAINING GROUP," 2016, pg 6.

[57]   "Naval Force Readiness Homepage," 2018. http://halifax.mil.ca/NFR/.

within the RCN and develops and manages the RCN's Managed Readiness Plan (MRP) and Operational Assignment Schedule (OAS)."[58] It is within NFR's mandate to make the necessary changes to ensure that units receive more training at each readiness level and by increase their readiness while doing so.

By adding mandated training at each readiness level will mean that units will be able to conduct more regular training with Sea Training Group personnel. More regular mandated training would ensure that operators remain proficient at their duties and units as a whole will increase in capability as they will receive more structured training from STG. Instead of units receiving very minimal training support alongside prior to either deploying or conducting readiness training, they will be able to have a more dedicated training regime which can be conducted in their own ship prior to going to sea. Having the ability to conduct this training will ensure that not only will units be better prepared when they go to sea, they will be after to start off operating at a much higher level which is not the case now. For instance, when units go to sea for a Task Group Exercise (TGEX) there is little to no combat training conducted prior to going to sea. Ships have very high amounts of maintenance and the focus is more on just getting to sea vice getting to sea operating at a high operational tempo. Now with this capability fleet staffs will be able to integrate early and direct task group training prior to any lines being slipped. This training capability has not been present in the past and is quite different than what is required for a single ship deployer as stated in the Task Group Force Integration Team Training (TGFITT) manual. "Whereas HR WUPS focuses on bringing individual ships to high readiness for combat operations, there is an overarching need for additional, task-group level training that focuses on

---

[58]   "Naval Force Readiness Homepage," 2018. http://halifax.mil.ca/NFR/.

command and control processes."[59] Training such as what can be done in these synthetic

environments will not only increase readiness but the ability to achieve a higher state of

readiness as well.

The ability to train in a multi unit synthetic environment could be especially beneficial

before a task group deploys on contingency operations. This is especially true due to the limited

time that is available to prepare as stated in the VCDS Defence Plan, "MARCOM maintains a

High Readiness Task Group (TG) to respond to emerging "Contingency" Operations at 10 days

notice for deployment (plus 5 days embarkation leave) to an area of mid-intensity conflict."[60]

These tasks group must meet certain readiness criteria which ensures their ability to operate

effectively as quickly as possible. "A Contingency TG needs to be High Readiness (HR) ships,

current in WUPS and Operations Team Training" [61] Prior to sailing as a task group for this sort

of mission there is a short amount of time to conduct team training and a TGFITT. The aim of

the TGFITT is to bring the Canadian Naval Contingency TG Command Staff and assigned ships

to the level of cohesion, functionality and readiness necessary to conduct operations up to and

including mid-intensity conflict, as required by the Government of Canada.[62] Combat team

training would normally have to be done ashore drawing key personnel away from their ships at

a key time. This caused personnel to work excessive hours or for training to be reduced or

scrapped all together. With the ability to connect with other units from their own ships, personnel

can now stay onboard conduct their training and be available for other issues that will arise.

Conducting training onboard ensures that training is achieved much like when conducted ashore,

---

59   "Naval Force Readiness," 2018. http://halifax.mil.ca/TGFITT//NFR/.
60   Defence Plan, http://vcds.mil.ca/DPOnline/Main_e.asp
61   *Ibid.*
62   *Ibid.*

however by doing it onboard the team can train in a familiar environment and the ship's staff can be onboard to ensure that the ship maintains its program.

Clearly, much work is needed to upgrade the navy's training capability. These changes cannot happen over night and will take careful consideration. There is much at stake as the future readiness of the Royal Canadian Navy depends on the decisions that are made. However, the navy and the Canadian Armed Forces as a whole are not alone when it comes to deciding on the future of training. The United States for instance has renewed their focus on the importance of training. They have been working towards more synthetic environments as they look at how they will train their personnel into a future that holds much uncertainty as stated in the GBC report called, *Going Virtual To Prepare for a New Era of Defense How Virtual Training Can Help* . "DoD's 2010 Strategic Plan for the Next Generation of Training states that effective training in the new era of defense must account for anything from full spectrum combat to being able to engage new and adaptive adversaries."[63] The Canadian Armed Forces must do the same by carefully considering the roles that they may be asked to undertake. With this renewed focus on the future and how the navy can best use its resources to train for it there seems to be hope that the future capabilities of the senior service will be bright.

---

[63]   GBC, "Going Virtual To Prepare for a New Era of Defense How Virtual Training Can Help."

CHAPTER THREE

Benefits of Training in Synthetic Environments

Most militaries would dream of large budgets much like during the Cold War at their

disposal. Canada has never spent very much on national defence. As Canada's defense budget

for 2017 was 0.99 percent of Canada's gross domestic product vice the two percent that is

expected by NATO.[64] In Canada there is very little threat and the budget for the military reflects

this as are the capabilities provided to them by the government. The negative effects of this

modest budget are described in, *Geopolitical Monitor,* "Canada is currently in the unfortunate

situation where its military is likely to soon lack the capabilities necessary to fulfill the

commitments outlined in the Canada First Defence Strategy – exactly the situation that Harper

decried prior to taking office."[65] Although that comment was made in 2014, there has been very

little in the ways of new military hardware while what Canada currently has continues to age. A

large portion of the funds allocated to the security of Canada are going into national security

agencies such as CSE and CSIS instead of the military. With a limited budget and with limited

physical capabilities, military leaders need to be smart on how they allocated the money and

resources they do have. With simulated training environments it is possible with relatively small

investments to achieve very tangible training objectives without even sending ships to sea. When

discussing the low cost of using simulators to actually going to sea, personnel from one of the

USN training establishments noted that trainers are very low cost as noted by the USN article,

FIST2FAC: The Future of Navy Combat Training? "By comparison, it costs about $250,000 just

to get an aircraft carrier out for live training and approximately $6 million to fuel a strike group

---

[64]   "FY 2019 Defense Budget 2019."

[65]   Geopoliticalmonitor Intelligence Corp., *Geopolitical Monitor.*, accessed April 18, 2018,
https://www.geopoliticalmonitor.com/canadian-military-still-suffering-a-capabilities-gap-4930/.

for a week. A live event lasting six to 10 hours may cost a million dollars."[66] These costs would

be very comparable in Canada. With the high cost of fuel alone be a deterring factor it only

seems logical that another way be found to train sailors.

Benefits can be achieved by using simulation within the Royal Canadian Navy training

construct. These changes to the training mindset within the RCN will have long term positive

effects. These positive effects will help ensure that the navy is able to sail and conduct any tasks

that are directed by the Government of Canada. Although the RCN has been able to effectively

conduct operations in recent years what the future holds remains to be seen. As warfare changes

and tasks become more complex it is critical that the RCN be able to use all means available to

train for these outcomes. This type of flexibility will be especially important when naval units

either integrate into task groups with other nations or when they are conducting joint operations

such as naval fires.To better understand these benefits, they have been broken down into three

key categories: capability, interoperability and fiscal. What potentially could be an important

enhancement in RCN capability.

Capability

The Canadian Armed Forces needs to embrace the technology of today and embrace

innovation. Nina Kollars describes this type of thinking in her article, *Genius and Mastery in*

Military Innovation, "That is, creative innovation requires getting "outside the box." And by

being outside the box, one's thinking is unbound by the structures that constrain creativity. Being

inside the box, conversely, is to be insular, or stuck in ones thinking."[67] This type of thinking is

difficult concept for military institutions to grasp at times. These institutions are built on

---

66   "FIST2FAC: The Future of Navy Combat Training?"
67   Nina Kollars, "Genius and Mastery in Military Innovation," *Survival* 59, no. 2 (March 4, 2017): 125–38, doi:10.1080/00396338.2017.1302193.

longstanding traditions and ideas that have worked in the past, the Royal Canadian Navy is certainly no different. An example of this was how the RCN originally tried to cope with the maintenance for the Victoria Class submarines. Gary Garnett describes the difficulty that the RCN had with the program in his article, *Victoria Class Submarines,* "maintaining and repairing these complex submarines was a struggle as our navy, its in-house maintenance capability and ad hoc contracted industry support essentially had to move from supporting a relatively simple post World War II submarine to a 1990s complex, modern high-tech submarine."[68] Although it took considerable time and effort to fix the submarine program the RCN was able to do so. By fully embracing new capabilities that are available now and looking to the future for possible new ones, will allow for RCN planners to effectively plan for the new capabilities that could be used and for business planners to determine how best to fund them.

Synthetic training has a very bright future when it comes to training the warriors of tomorrow. If it is carefully integrated into training plans and cycles what can be done with it to improve sailor's capacity is seemingly limitless, especially when it is integrated with live training events. However, although there are many possibilities the RCN must be cautious and ensure that there is in fact a balance between live and synthetic training and only use virtual environments when the time is right to do so and there is effectiveness in that type of training. Even though there are many great technologies out there synthetic training is not perfect by any means. Some of these challenges are described in the Squire and Jones article, *Creating Effective LVC Training with Augmented Reality*, "One of the biggest challenges of employing effective Live, Virtual, Constructive (LVC) training is providing the live participants with realistic visuals

---

[68]   Gary Garnett, "Victoria Class Submarines," *Canadian Naval Review* (Ottawa, Canada, September 2017).

of and interactions with virtual and constructive entities."[69] Understanding that synthetic training today has its limitations while knowing that in the future it will be better. That means that you must work with what you have now but plan for the future.

This is very much the same for capability. The RCN is well aware of what capabilities it does and does not have. However, as it looks to the future it must envision what it could potentially have. A good example of this is with the future Canadian Surface Combatant.[70] This vessel will be designed as the work horse for the Navy and will be able to fulfill many roles that potentially the Halifax Class ships could not, such as an air defense platform such as the retired Tribal Class destroyers. As the RCN currently plans to bring these vessels on line they must as well plan how best to train the sailors that will sail within them. Will the trainers ashore be the same, can they modified for different operations rooms, will there finally be shore fibre optic hookups so that these new ships may not need a shore-based trainer at all and they can do all of their training from ashore? These are all questions that should be asked along with what capabilities those ships will have. It is not good enough to determine what to do once the ships are built and about to go to sea.

The good thing is that the training establishment is not alone in trying to determine the best way forward. Training is more and more moving to training the leaders to be able to train their own combat teams which is an increase in capability in itself. This change of philosophy is discussed in Sea Training Groups *Annual Report,* "the philosophy of how we execute CT is also changing. Over the past year, during both shore-based and at-sea programmes, Sea Trainers have

---

[69]   Peter Squire, Nathan Jones, "Creating Effective LVC Training with Augmented Reality" (Orlando, Florida, 2017).
[70]   "Canadian Surface Combatant | Investing in Equipment | National Defence | Canadian Forces," *National Defence and the Canadian Armed Forces*, 2018, http://www.forces.gc.ca/en/business-equipment/canadian-surface-combatant.page.

focused on developing the ships' leaders."[71] This important concept will greatly improve

capability into the future. Ships will not need to rely on others to train their teams rather they will

be able to do so themselves. Combat teams will be able to train while alongside or doing routine

at sea patrols can be training to ensure that they remain at a high state of readiness. This is an

important capability now that will only gain in importance as new technologies such Artificial

Intelligence emerge that could be leveraged to provide more effective training. Edward Harvey

discusses some of the possibilities in his article, *Enhanced STEM Subject Outcomes from the Use*

of Intelligent Tutors, "newly emerging computer educational tools such as conversational avatars

extend the hope of effective and economical implementations. Many other techniques such as

serious games are also useful in addressing the issues laid out."[72] This type of skill sustainment is

incredibly important and will help ensure from an operator perspective that a high readiness is

constant throughout the fleet. In an US Under Secretary of Defence report called, *Optimizing*

The Mix Between Virtual and Live Military Training Task 4.2, "Skill sustainment refers to the

maintenance of task proficiency after a period of non-use. It is also called refresher training and

is closely related to the psychological concepts of skill retention and skill decay."[73] These skills

will allow for further training by individuals and by combat teams as whole or in part.

Having the ability to train in various simulated environments has various benefits that

effects both individuals and teams alike. Ships could train together in a networked wartime

simulation or single operators could practice their war cries and button pushing while sitting at

their displays on watch at sea on routine patrol. Operators will be able to constantly train in

---

[71]   Sea Training Sea Training Group Annual Report 2016 /17, Sea Training Group., pg 12"

[72]   Edward Harvey, "Enhanced STEM Subject Outcomes from the Use of Intelligent Tutors" (Virginia Beach, Virginia, 2017)., pg 12.

[73]   Under Secretary Defence, "Optimizing The Mix Between Virtual and Live Military Training Task 4.2 – Final Project Report," no. September (2013), pg 24.

effective training environments that will allow them to not only remain proficient but to master their trades. As outlined in, *Enhanced STEM Subject Outcomes from the Use of Intelligent Tutors,* "Professional educators use a score of 90% on knowledge exams as the threshold for demonstrating mastery."[74] Having the ability to have sailors at that level of competency would allow exercises to progress far beyond what they do today as there would no longer be a need to spend the first four to five days of an exercise going over the basics and shaking off the rust which is the case now in Task Group Exercises (TGEX).[75] For the first number of days during these exercises units go to sea and establish communication and complete very basic serials which can easily be completed alongside or at the very least only take one day at sea to do. With the ability to do this alongside and have sailors at a heightened level prior to sailing those exercise could progress into far more complex evolutions which would benefit the Navy immensely and increase its capability and readiness while doing so. With limited sea time this push for increased capability is a must.

Interoperability

The RCN for the next foreseeable future will most likely conduct contribution operations with allied forces throughout the world. The RCN regularly contributes to NATO standing forces and more and more it is seen with a forward presence in the far Pacific. Operating within these types of structures is very different than operating as a single ship or within a Canadian only task group. Even within NATO where interoperability is extremely important, it is often difficult to achieve for a number of reasons. Language, capability, equipment all contribute to how well or not well a task group can work together. Even taking a step back from that and looking at how

---

[74]   Edward Harvey, "Enhanced STEM Subject Outcomes from the Use of Intelligent Tutors" (Virginia Beach, Virginia, 2017), pg 2.

[75]   Andrew Tunstall, William Sanson, "Task Group Exercise 16-01 FLEX" (Halifax Canada: CCFL, 2016).

the RCN works with other elements within the CAF, can be seen as slow and difficult to achieve effectiveness. This is because for the most part these units only work together for a few days a year and when they do it is to a very subscribed program that does not allow for extra training or operations if it is deemed necessary.

Connected synthetic environments such as what the CASE project is working to achieve can correct that issue. Units will still have to physically get together as they do now, at sea and under difficult conditions to exercise. Many of these issues which negatively impact training or operations can now be worked out ahead of time making the time at sea more productive. Having the ability to work out issues prior to going to sea and potentially wasting valuable sea time is important as training time at sea is limited, as are the assets available to train with. These factors are being discussed in the US as well. There is an attempt to use synthetic training environments more to reduce costs and the need for live assets as described in the report by Castillo, Johnson, Baker and Cisneros, called, *Dynamic Occlusion Using Fixed Infrastructure for Augmented Reality* "Within training, the Department of Defense (DoD) has a strong interest in augmented reality (AR) for its ability to combine live and virtual assets to reduce cost, increase safety, and to mitigate unavailability of needed live assets."[76] There is another key benefit as well that reaches past training and into the operational world. If units are deploying on short notice operations they would now have the ability to connect with the other units that they would be working with as well as training establishments ashore. With the ability to do this these units will be able to forgo and required mission training ashore and conduct that training while transiting to their area of operations which will allow those units to proceed to sea as soon as possible and more importantly allow them to commence work almost immediately upon arrival.

[76]   Juan Castillo Scott Johnson, John Baker, Jaime Cisneros, "Dynamic Occlusion Using Fixed Infrastructure for Augmented Reality" (Orlando, Florida, 2017).

Simulated environments would help further promote joint operations as well. All too often the individual elements work alone and focus on their individual needs vice looking for opportunities to train together to enhance interoperability. One of the factors that contribute to the lack of joint training exercise is the difficulty and expense to work in these joint conditions. For instance, it is costly and time consuming for RCAF aircraft to be added to a naval exercise outside of what are assigned to the ships already. However, if there was the opportunity to do this sort of exercise in simulators in both the navy and air force there is far more likelihood that they would be carried out. Conducting more joint exercises even in a simulated environment would greatly enhance joint capabilities and help avoid costly skill fade when it comes to joint operations. Harvey describes the potential for skill fade in his paper Harvey, *Enhanced STEM Subject Outcomes from the Use of Intelligent Tutors*, "This training and learning process requires a strong foundation of understanding Joint or Service procedures. Depending on each war fighter's area of specialization, there might be a highly technical skill-set which can quickly decay if unused or un-refreshed on a regular basis."[77] Having core skills and basic understandings of how to operate in a joint environment if the RCN is to continue to advance its joint capabilities. The ability to use synthetic environments to train and to conduct joint mission rehearsals prior to arriving into theatre will greatly aid the Navy achieve its aims in joint operations.

The RCN could also take part in joint exercises abroad with countries such as the United States. Training in these types of situations would greatly enhance all of the CAF's capabilities draw on the operational experience that the operators from these countries have. An example would be Operation LUMBERJACK. Operations such as these are important as they are

---

[77] Edward Harvey, "Enhanced STEM Subject Outcomes from the Use of Intelligent Tutors." Pg 2.

designed specifically to enhance joint interoperability. From the Nellis Airforce Base webpage it

describes the exercise as, "theater interdiction, strike coordination and reconnaissance, and close

air support to break an adversary's will/capacity for resistance.[78] The ability to draw on this

knowledge would help deliver the capability that the Government of Canada expects from the

military at a very reasonable cost.

Fiscal

Among compelling reasons, the military is pursuing greater use of virtual training is

potential to be very cost-effective. In fact, reduced cost is the top benefit of integrating live and

virtual training according to US Department of Defense surveys. As outlined in *Gaming to*

Victory, "57 percent of respondents indicate as much, more than any other benefit. Moreover, 85

percent indicate integrating live and virtual training would reduce costs."[79] There are a number

of ways that these costs will be reduced as discussed in *Gaming to Victory,* "Increased use of

virtual training could cut costs by, among other things, lowering maintenance costs, avoiding

costly trainee errors, and shrinking logistics costs associated with coordinating multifaceted

exercises."[80] Having a technology such as this that can reduce costs yet increase capability is

something that must be embraced.

Technology has progressed in virtual and synthetic environments. It is now a very

capable platform or tool that can be embraced to deliver very effective, realistic training to

sailors, soldiers and air personnel. Although the military has had a major role to play in these

new capabilities, an equal if not larger role has been conducted by the private sector. Having the

military follow the lead of the private sector is a change from historical norms where the military

---

[78]   "Flying Operations," 2018, http://www.nellis.af.mil/Home/Flying-Operations/.
[79]   Jennifer Mcardle, "Gaming to Victory: Synthetic Training for Future Combat."
[80]   *Ibid.*

would either request industry to create or it would create the new technologies itself that it

requires where as in this day in age the military feeds off the technological advances that

industry produces. Continued budgetary pressures and rapid advancements in modeling and

simulation capabilities are fostering substantial growth in the use of simulation-based training

technologies in the Department of Defense. Additionally, low-cost, commercial-off-the shelf

(COTS) technologies are beginning to supplant custom simulation environments.[81] The ability to

use these cost-effective solutions will be a benefit for the Canadian Armed Forces. With the

ability to utilize off the shelf technology means that there is the potential for significant cost

savings for the military while being able to use state of the art equipment. These benefits are just

some of the benefits that will be experienced with the increase use of simulators within the

Canadian Armed Forces. The fiscal benefits do not stop there however. There will be other

positive effects as well which are especially pertinent to the navy. There will be far less wear on

machinery as ships do not need to go to sea to conduct the types of training that can be

accomplished in a simulator. The reduced wear on machinery was also a factored considered by

studies conducted in the USN as noted in, *Remembrances of a Simulationist: An Exciting Career

of 'Make Believe*, "It was obvious that there are certain tasks that could be better taught in the

simulator than in the expensive aircraft. Further, simulators are less expensive to operate with a

1/10 simulator to aircraft cost ratio."[82]

The reduced necessity to operate in harsh climates is an important factor considering the

operating environments that the Royal Canadian Navy finds itself in. In the North Atlantic for

instance it is not uncommon for ships exciting Halifax Harbour to experience eight-meter swells

---

[81]   Jocelyn Faubert, Jaclyn Hoke, Christopher Reuter, Thomas Romeas, Maxime Montariol, Thomas Schnell, "
         Perceptual-Cognitive & Physiological Assessment of Training Effectiveness" (Cedar Rapids, Iowa, 2017).
[82]   Henry Okraski, "Remembrances of a Simulationist: An Exciting Career of 'Make Believe, pg 9.'"

right away which is difficult not only on the crew but on the ship as well. To conduct training in this type of environment is extremely demanding not only on personnel but on equipment as well. Often serials are cancelled due to the sea state, but the unit will remain at sea only to experience more wear and tear. Clearly this is an important factor as the naval fleet ages with no replacement expected in the near future. Although a reduction in the necessity to go to sea is a benefit, careful consideration given to what training still must be conducted in the actual operating environment.

"All of the U.S. military services, as well as many other security agencies and coalition partners, have released detailed guidance on how to evolve their learning and development processes."[83] It is now time for the RCN to do the same after carefully considering where this capability can take the Navy's ability to train its sailors. The benefits that advanced simulation will bring in the Navy's ability to train new sailors while ensuring the operators of the entire fleet are at a readiness state where it is able to carry out the tasks that is asked of it. As discussed by Elaine Raybourn in her paper, *At the Tipping Point*, "The old ways of training and educating are no longer sufficient. We must become more effective, efficient, agile, and proactive in the development and real-time support of our personnel for the future challenges they will face."[84] If the CAF does this it will reap many of the benefits that have been discussed in this chapter. The amount of training and its quality will certainly increase along with the overall readiness of the fleet, something that has been lacking to date both in Canada and in the other allied countries that we work with. The need to change how we train must be considered as discussed in *Going Virtual To Prepare for a New Era of Defense How Virtual Training Can Help*, "Training

---

[83]   Elaine M. Raybourn, "At the Tipping Point: Learning Science and Technology as Key Strategic Enablers for the Future of Defense and Security" (Orlando, Florida, 2017).
[84]   *Ibid*, pg 3.

regimens are still not up to par. Just 23 percent of DoD employees surveyed by GBC believe that current training levels will meet the military's readiness needs."[85] Training however is only one of the areas that needs to be changed in order to meet the threats of tomorrow.

Senior leadership within the military must lead when it comes to the necessary changes that are required to the military training system. Defense Secretary James Mattis stated, "Ensuring our people, processes, technology, and organizations are ready for these challenges will require significant effort and organizational reforms."[86] Indeed, as U.S. Secretary of Defense Jim Mattis recently stated, "the DoD must "be prepared to deal with technological, operational, and tactical surprise, which requires changes to the way we train and educate our leaders and our forces, and how we organize for improved Departmental agility"[87] New training methods will help to achieve this effect here in Canada. Synthetic trainers will elevate the readiness in the RCN today and will lead to more capabilities tomorrow. Even though the RCN does not take part in combat operations often, with the ability to train in a realist synthetic environment with partners from Canada and around the world, when the RCN is called upon to undertake a mission in a conflict zone it will very able to do so.

---

[85]   GBC, "Going Virtual To Prepare for a New Era of Defense How Virtual Training Can Help"
[86]   "Defense Secretary James Mattis Envies Silicon Valley's AI Ascent | WIRED," *Wired*, 2017, https://www.wired.com/story/james-mattis-artificial-intelligence-diux/, pg 7.
[87]   *Ibid*, pg 7.

CONCLUSION

In today's technologically advanced world, navies are very expensive and cost tax payers considerable money. Warships today are highly complex and technologically advanced therefore they are very expensive to build and maintain. As technology advances the cost of advanced warships will only increase over the coming decades. Comparatively, as those costs increase the amount of money allocated by governments to defence budgets will most likely not increase along with them which has been the recent trend for many of the NATO countries. In countries like Canada where defence budgets are limited, where money is spent and where resources are allocated need to be carefully thought out. A large portion of those funds will most likely be focused on the recapitalization of equipment and of course to the conduct of operations. With most of the available money being spent elsewhere it will mean that money available to go on training exercises and conduct simple training serials could potentially be limited compared to what it was in the past. The ramifications of less training are not good. Forces have more difficulty maintaining a high level of readiness and sailors do not get the proper training that is needed to conduct their jobs properly. This lack of training time or time on the job can lead to dangerous situations as we have seen in the past with the recent collisions at sea. To prepare for situations and to maintain readiness in this type of climate alternative ways to train need to be found. This is even more important in times when there are less funds made available to the military. Therefore, military leaders need to find ways to maintain readiness and conduct operations in ways that have not been traditionally focused on. This is one of the many reasons that make synthetic trainers so attractive.

Although synthetic training environments have been in use for decades they have not been utilized to their full potential in military applications here in Canada. In other countries for

quite some time such as in the United States These systems have been employed far more effectively and are a large part of how they train their forces and are in use where it is deemed to be effective and safe to utilize them. As technology in the field increases in capability it is time now for the Royal Canadian Navy to grab hold of it and use it to its advantage or it may run the risk of falling behind the capabilities of other countries when it comes to conducting combat operations. By being able to connect units from their own operations rooms to one another to conduct training is a very large step in the right direction. Being able to connect to these units or other units from other countries anywhere in the world furthers this capability and will increase the readiness of not only the RCN but of other navies as well.

Training operators against modern real-time threats is difficult to achieve. Simulated environments will not only be a place when basic skills can be taught but will allow for complex training scenarios that will include entire fleets and their staffs. These environments are controllable and safe which are far better than the cumbersome training tools that are in use today. Whole fleets will be able to train together no matter where they are in the world against relevant threats that may be faced in their upcoming missions.

Another benefit of this approach is that it is in lock step with our most powerful ally, the United States where they are looking more and more to simulation to help ease their training issues. They understand the importance of future readiness if they wish to remain competitive and see synthetic training environments to prepare for what lies ahead. The US forces have realized to keep pace with the rapidly evolving world of warfare that has adversaries become more weaponized every year, it will be impossible to keep relevant and competitive with them by only doing intermittent training at sea. By using simulation and technology such as interconnected trainers, units and operators will be able to conduct repetitious training that will

ensure teams are prepared to meet adversaries or any other threats prior to deploying on missions.

This is a critical capability that will increase the RCN overall readiness when deploying. Although trainers are used today for single ship deployers there is no training that will allow for a task group to be trained together prior to it sailing. Having an ability to train everything from a single ship deployer to a Canadian Task Group is a capability that must be capitalized on. Although ship's go through their readiness cycles and receive training both alongside and at sea, it is difficult to maintain that level of readiness that is needed prior to proceeding into a threat environment. Even the most competent operators need time to refresh skills and to work with their teams again and the combat teams of the other units. Fleet staff as well needs time to integrate and ensure that the units under their command are operating at an acceptable level. In the US simulators have been used extensively to fight skill decay and to ensure that operators remain current with their jobs and the systems that they have put in place have proven to have made an impact. In a situation where they would be facing a peer on peer type conflict, this level of readiness that they would be able to achieve would be crucial and would mean that the RCN, the USN and other allies would be competitive against their adversaries. The ability to more quickly integrate into an allied task group or USN Strike Group is a critical consideration as well. RCN units as well as those that they will sail with would be able to prepare alongside in their respective ports, combat teams can be running through drill and refining procedures even before the set sail.

There is much work to do to upgrade the Navy's training capability. These changes will take time but considering their importance it is important to do it correctly but the work that is needed is not unmanageable as long the recognition is there that it must be done. It is now time

for the RCN to fully commit to the use of synthetic training environments considering where this capability can take the Navy's ability to train its sailors. The benefits that advanced simulation will bring in the Navy's ability to train new sailors and maintain fleet readiness are impossible to ignore. The old ways of training and educating are no longer sufficient, and it is time to embrace newer technologies and teaching methods much like many of Canada's allies do. The amount of training and its quality will increase alone with the readiness of the fleet. With streamlined training plans that do not interfere with other work that needs to be conducted onboard units will be able to continuously progress as they move through their readiness cycle. More training and more consistent training will have the added benefit as well that they will be able to build on the skills that they have just learned and continue to push their unit's capabilities. This was not the case before when units were only able to do this type of training a couple of times a year.

Ensuring our people, processes, technology, and organizations are ready for these challenges will require significant effort and organizational reforms throughout the various RCN departments. This change will be a move away from the norm and therefore may be difficult at first. However, new training methods will help to achieve this effect here in Canada. Synthetic trainers will elevate the readiness in the RCN and will lead to more capabilities tomorrow. Even though the RCN does not take part in combat operations often, with the ability to train in a realist synthetic environment with partners from Canada and around the world when the RCN is called upon to undertake a mission in a conflict zone it will very able to do so.

BIBLIOGRAPHY

"About IITSEC | IITSEC 2017," 2018. http://www.iitsec.org/about-iitsec.

Alberts, David S, and Richard E Hayes. *About the CCRP*. *Information Age*. Vol. 10, 2003. doi:10.1038/nri2836.

Blakeley, Darlene. "Newly Created Senior Appointments to Assist with RCN Transformation." *The Maple Leaf*. Ottawa, Canada, December 2017.

Canadian Forces Naval Operations School Homepage, 2018. http://halifax.mil.ca/CFNOS/.

"Canadian Surface Combatant | Investing in Equipment | National Defence | Canadian Forces." *National Defence and the Canadian Armed Forces*, 2018. http://www.forces.gc.ca/en/business-equipment/canadian-surface-combatant.page.

Commander Sea Training Group. "No Title." *http://halifax.mil.ca/SEA_TRG/*, 2018.

Defence Research Development Canada (Atlantic), Kevin Mctaggart, and Neil Pegg. "Analysis of Hydrodynamic Interaction Between HMCS FREDERICTON and USNS KANAWHA," no. September (2012).

Defense Under Secretary. "Optimizing The Mix Between Live and Virtual Military Training Task 4.2 –Final Project Report," no. September (2013).

"Defense Secretary James Mattis Envies Silicon Valley's AI Ascent | WIRED." *Wired*, 2017. https://www.wired.com/story/james-mattis-artificial-intelligence-diux/.

Eaglen, MacKenzie. "Newsflash to the New Congress: Tiered Readiness Is Here Now | RealClearDefense." *Real Clear Defense*, 2014. https://www.realcleardefense.com/articles/2014/11/06/newsflash_to_the_new_congress_tiered_readiness_is_here_now_107530.html.

"FIST2FAC: The Future of Navy Combat Training?" *United States Navy*, 2016. http://www.navy.mil/submit/display.asp?story_id=94123.

"Flying Operations," 2018. http://www.nellis.af.mil/Home/Flying-Operations/.

"FY 2019 Defense Budget 2019," 2018. https://www.defense.gov/News/Special-Reports/0218_Budget/.

Gabriel, Richard A., Karen S. Metz. *A Short History of War*. U.S. Army War College, 1990. https://books.google.ch/books/about/A_Short_History_of_Africa.html?id=4_7sORxHiPQC &redir_esc=y.

Garnett, Gary. "Victoria Class Submarines." *Canadian Naval Review*. Ottawa, Canada, September 2017.

GBC. "Going Virtual To Prepare for a New Era of Defense How Virtual Training Can Help the." *Government Research Council*, 2014. http://www.govexec.com/gbc/going_virtual_for_new_defense_era/.

Geopoliticalmonitor Intelligence Corp. *Geopolitical Monitor.* Accessed April 18, 2018. https://www.geopoliticalmonitor.com/canadian-military-still-suffering-a-capabilities-gap-4930/.

Government of Canada. "Halifax-Class Modernization/ Frigate Life Extension (HCM/FELEX) - Canada.ca," 2016. https://www.canada.ca/en/department-national-defence/news/2016/11/halifax-class-modernization-frigate-life-extension-felex.html.

Harper, Jon. "Synthetic Training Technologies Gaining Foothold with Military." *National Defense*, 2017. http://www.nationaldefensemagazine.org/articles/2017/11/27/synthetic-training-technologies-gaining-foothold-with-military.

Klein, Margarete. "Russia ' S Military : On the Rise ?" *Transatlantic Academy*, no. 2 (2015).

Kollars, Nina. "Genius and Mastery in Military Innovation." *Survival* 59, no. 2 (March 4, 2017): 125–38. doi:10.1080/00396338.2017.1302193.

Group, S E A Training. "Sea Training Group Annual Report 2016 / 17 Sea Training Group," 2016.

"Halifax Warship Returns from Hurricane-Scarred Caribbean Islands | Globalnews.ca." *Global News*, 2017. https://globalnews.ca/news/3789006/hmcs-st-johns-returns-from-hurricane-relief/.

Harvey, Edward. "Enhanced STEM Subject Outcomes from the Use of Intelligent Tutors." Virginia Beach, Virginia, 2017.

Hoke, Jacelyn,.Christopher Reuter, Thomas Romeas, Maxime Montariol, Thomas Schnell, Jocelyn Faubert. "Perceptual-Cognitive & Physiological Assessment of Training Effectiveness." Cedar Rapids, Iowa, 2017.

Johnson, Scott, Baker, John, Cisneros, Jamie and Castillo, Juan. "Dynamic Occlusion Using Fixed Infrastructure for Augmented Reality." Orlando, Florida, 2017.

Jones, Nathan, Squire, Peter. "Creating Effective LVC Training with Augmented Reality." Orlando, Florida, 2017.

Lehman, Chris. "Early Flight Training in the United Kingdom - Military Training and Education." *Maritime Simulation and Training Magazine*, 2013. https://militarysimulation.training/air/early-flight-training-in-the-united-kingdom/.

Minister of National Defence, "Strong, Secure, Engaged," 2017.

Mcardle, Jennifer. "Gaming to Victory: Synthetic Training for Future Combat." *War On The Rocks*. Accessed February 18, 2018. https://warontherocks.com/2017/11/gaming-to-victory/.

"Military Spending by NATO Members - Daily Chart." *The Economist*, 2017. https://www.economist.com/blogs/graphicdetail/2017/02/daily-chart-11.

"Naval Transformation Announcement." *The Canadian Naval Review*, no. May (2012).

"Navy Releases Collision Report for USS Fitzgerald and USS John S McCain Collisions," 2017. http://www.navy.mil/submit/display.asp?story_id=103130.

Naval Force Readiness Homepage, 2018. http://halifax.mil.ca/NFR/.

Okraski, Henry. "Remembrances of a Simulationist: An Exciting Career of 'Make Believe,'" 2017.

Raybourn, Elaine M. "At the Tipping Point: Learning Science and Technology as Key Strategic Enablers for the Future of Defense and Security." Orlando, Florida, 2017.

"RCN Synthetic Collective Training Strategy Policy and Guidance." Halifax Canada: Sea Training Group, n.d.

Rowlands, Dane. "Budget Restraint and Military Expenditures in NATO Countries: A Review of the Literature," no. October (2015).

"The Royal Canadian Navy in NATO – NAOC." *NATO Association of Canada*, 2012. http://natoassociation.ca/the-royal-canadian-navy-in-nato/.

Tunstall, Andrew, Sanson, William. "Task Group Exercise 16-01 FLEX." Halifax Canada: CCFL, 2016.

"US Navy Pauses Global Ops After Crashes | The Daily Caller." *Daily Caller*, 2017. http://dailycaller.com/2017/08/21/top-admiral-suspends-us-navy-fleet-operations-worldwide-following-devastating-crashes/.

Whitby, Michael. "The Long Reach : The RCN and the Korean War" 1, no. 4 (2006): 1948–52.