Cruise Missile Proliferation in the Iran-Israel Regional Security Conflict: The Overlooked Offense-Defense Arms Race

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Abstract

Cruise missiles have been proliferating since World War II, leading to their gradual sophistication throughout history which has expanded to include long range and precision strike capabilities. Alongside these capabilities, the cruise missile is able to carry weapons of mass destruction, making its proliferation an international security challenge. Yet, arms control regulations and nonproliferation regimes have allowed the weapon to multiply completely undisturbed as priority is placed on ballistic missile proliferation instead. The September 2019 cruise missile attacks on Saudi Arabia's oil facilities changed the perception of cruise missiles as it highlighted the threat these weapons pose in the hands of states like Iran. Furthermore, the attacks showed the world that these weapons had been introduced to nonstate actors, furthering the danger of its use within conflict ridden regions like the Middle East. Iran's investment in cruise missiles began prior to this attack and stems from its ongoing security conflict with Israel. Iran and Israel have fluctuated between amity and enmity ultimately resulting in a regional rivalry that has fueled the proliferation of cruise missiles throughout the region. While the Islamic state incorporated cruise missiles to its missile arsenal, Israel has invested in its cruise missile defense capabilities (Pasandideh, 2019). This dissertation will utilize the theory of regional security complexes (RSCT), to illustrate the impact unstable regional security conflicts have on the expansion of cruise missile usage, sophistication, and capabilities. The research will show that the Iran-Israel conflict has fueled cruise missile proliferation and incited an offense-defense arms race that has extended to include other actors in the region.

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Introduction

Israel has closely monitored Iran's cruise missile capabilities since the 2006 Lebanon War. They have attempted to prepare for direct cruise missile attacks by the Islamic state. Israeli Prime Minister Benjamin Netanyahu stated that the recent attack on Saudi Arabia was a warning to Israeli officials to prepare for future direct attack with the use of LACM and ASCMs (Times of Israel, 2019). Israel believes that Iran is seeking to develop and deploy these long-range precision weapons to strike the state from different points of the Middle East, becoming the single greatest threat to Israel's existence. Experts believe this to be a possibility because Iran is known to supply these strategic missiles to nonstate actors such as Lebanon's Hezbollah, and most recently, Yemen's Houthi rebels. Through the use of Hezbollah, in particular, Iran has engaged in a proxy war with Israel that continues to instigate low conflict escalations, raising fears that any escalation could start a major war. These weapons allow Iran and its proxy to strike all of Israel, including entire cities and infrastructures, with growing precision (Stratfor, 2018). In order to prepare for this, Israel has continued to invest extensive funds in developing capable missile defenses to counter these weapons, but have been unsuccessful in developing a system that can detect and intercept various attacks at once. The implications these weapons pose in the hands of Iran and these groups present a challenge to the region. A single incident that could spark a chain reaction of violent attacks and confrontations that could lead to a full-scale nuclear war.

Due to the complex security environment fostered between Iran and Israel, both state's perceive each other as threats. This has resulted in a competition to ascertain power in the region for the sake of national security, which has fueled the proliferation of cruise missiles and incited an offense-defense arms race. While Iran has adopted an offensive posture to combat the security threat Israel has on the Islamic regime via development of sophisticated cruise missiles (Cufi, 2020). Israel has sought to mainly adopt a defensive posture. They are relying on missile defenses and new technologies in development to deal with the precision cruise missile threat. However, Israel has not been able to successfully develop a missile defense system, therefore it has steered towards combating the proliferation of cruise missiles from Iran and Hezbollah with airstrikes and bombings in Syria. This regional complex environment has therefore both helped the evolution of cruise missiles and allowed the Iran-Israel conflict to thrive. This has showcased that the acquisition of a weapon cannot be considered without the geopolitics of the region (Mishra, 2011).

What is a cruise missile?

Historically, the cruise missile was not considered to be a threat until the 1990s, and faced various technological challenges since its inception that altered its use and development throughout the years. With shifting strategic environments throughout the decades and emerging technology, the weapon was modified into a sophisticated precision strike weapon, allowing it to proliferate within multiple powers and later within developing countries. A cruise missile can be defined as "an unmanned self-propelled guided vehicle that sustains flight through aerodynamic lift for most of its flight path and whose primary mission is to place an ordnance or special payload on a target" (Congressional Research Service, 2020). Cruise missiles are therefore able to fly a predetermined flight path to their target at low and high altitudes, while remaining within the Earth's atmosphere throughout its trajectory.

Cruise missiles are broadly categorized as land-attack cruise missiles (LACMs) or anti-ship cruise missiles (ASCMs) that can be launched from a variety of land, sea, or air launch platforms. Most of the cruise missile arsenals in the world have consisted of ASCMs, but LACMs gained popularity due to their long-range capabilities, which makes them ideal weapons to carry both conventional and nonconventional payloads (Gormley, 2008). Similar to a ballistic missile, a cruise missile has the capability to carry weapons of mass destruction that can launch nuclear, chemical, and biological agents to major land targets, including single buildings or entire cities (Kueter & Kleinberg, 2007). Cruise missiles can be launched simultaneously towards the same target from various launch platforms and directions, which can overwhelm defenses and make them difficult to detect (Brookes, 2020). Although the cruise missile is much smaller than the ballistic missile, its potential use as a weapon of mass destruction could have ramifications similar to those of the atomic bomb.

In order to fly a predetermined flight path undetected, cruise missiles fly through the air in powered flight for the duration of their trip through the use of a small jet engine (Mahnken, 2005). Due to its size, a jet engine is able to generate less heat during flight, making the weapon difficult to detect against heat seeking missiles and sensors (Kueter & Kleinberg, 2007). The engine's small size also allows the missile to fly at both subsonic and supersonic speeds while sustaining its range, altitude, and maneuverability (Missile Defense Advocacy Alliance, 2018). While less commonly

used scramjet engines can be used to help make the missile hypersonic, allowing them to fly to their targets with speeds five times the speed of sound (Raytheon Missiles & Defense, 2020).

Alongside the jet engine, guidance and navigation systems (such as radars, inertial navigation (INS), global positioning, terrain contour matching systems, or digital scene matching area correlation) have allowed cruise missiles to successfully reach the accuracy necessary to strike its targets (Peter Brookes, 2020). With the advent of dual use technologies, global positioning systems like GPS, Google Earth, and other commercially available technology has made it possible for these weapons to become even more precise, at a fraction of the cost (Kueter & Kleinberg, 2007). Different guidance and navigation methods allow cruise missiles to either maintain a predetermined high-altitude flight path or a low altitude flight path to make them less susceptible to missile defense systems. Depending on the role and mission of the weapon, some use both a low and high-altitude flight path to ensure the missile successfully strikes the final target with accuracy and avoid all defenses.

Purpose and Significance

This thesis aims to demonstrate that cruise missile proliferation has been historically undervalued, even though it poses a substantial security risk within unstable regional security environments such as the Middle East. Currently, cruise missiles continue to negatively impact regional conflicts. States in possession of these weapons are significantly more likely to initiate a militarized interstate dispute or crisis (Crawford, 2019). The purpose of this thesis is to explore the reasons behind cruise missile proliferation from a regional perspective. Much of the relevant literature on the proliferation of these weapons focuses on the technical aspects as well as specifications and performances of the weapons, but not on the geopolitical implications that drive weapon proliferation. This thesis looks at the regional rivalry between Iran and Israel including their insecurities and competition for power to ensure their survival and increase their hegemonic influence.

In order to evaluate the threat these weapons pose, the first chapter of this research focuses on the evolution of the weapon and its gradual sophistication. It is important to demonstrate the weapon's technical importance and how the rapid proliferation of technology allowed cruise missiles to be introduced throughout different parts of the world in various conflicts, specifically

within the Middle East. This chapter also focuses on key trends towards the use of strategic weapons, the technical revolution of the 1970s, the missile regulation, varying methods of acquisition, and more.

The second chapter dives into the intricate regional security dynamics in the Middle East specifically a case study of the Iran and Israel conflict and how the conflict has impacted cruise missile proliferation. The use of the regional security complex theory helps to better understand the connection between cruise missile proliferation and the Iran-Israeli conflict by studying the historical rivalry between both states. This rivalry has been shaped by patterns of amity and enmity that have altered threat perceptions throughout the region and led to a shift in strategies and tactics within national securities. With the security complex model, the regional security of the Middle East is shaped by security interdependencies within geographically coherent regions. Therefore, this chapter focuses on introducing the hostile relationship between Iran and Israel and how cruise missile proliferation has led the conflict into an offense defense arms race.

The final chapter focuses on detailing the shift in balance of power between Iran and Israel and the effect it is having on international security. With increasing sophisticated technology, a new cruise missile age has started to emerge, as evident with the development of new hypersonic cruise missiles. While land attack cruise missiles (LACMs) are capable of carrying weapons of mass destruction, these new and improved cruise missiles could further alter the offense-defense balance between Iran and Israel if either state is known to be in possession of them. The examination will conclude by discussing the future of cruise missile proliferation and defense capabilities. There is a growing offensive cruise missile arsenal around the world which could prove to be even more challenging as cruise missiles are used as weapons of mass destruction.

The Cruise Missile Literature

According to a preliminary survey of literature, the cruise missile proliferation debate has been heavily understated throughout history. Previously scholars such as Dennis M. Gormley, Scott McMahon, W. Seth Carus, Kenneth P. Werrell, and Richard K. Betts released scholarly work attempting to exemplify the threat these weapons brought in comparison to other weapon systems such as ballistic missiles. Throughout history, cruise missiles can be traced to the start of World War I, yet only a modest amount of scholarly work focuses on the weapon's development, proliferation, and threat. Cruise missiles are mainly analyzed in reference to its technology, which plays a large role in the evolution of the threat, but the literature is limited in discussing the repercussions that this weapon has within regional conflicts.

The first critical study of cruise missiles was Richard K, Betts (1981) titled 'Cruise Missiles: Technology, Strategy, Politics'. In it, he states that cruise missiles have evolved without a well-defined conception of why they are needed and without an assessment of their full implications. Dennis M. Gormley (1995) also specified in his work that understanding the difference between ballistic and cruise missiles would help explain why cruise missiles could become a severe threat. Confusion surrounding the capabilities and differences between anti-ship (ASCM) and land-attack (LACM) was also a problem. ASCMs posed a significant threat to naval fleets, but with evolving security environments and significant technological advances, the cruise missile threat intensified and transformed to include LACMs.

Since the 1990s, analysts have argued that LACMs in particular were likely to proliferate rapidly as Third World countries began to acquire cruise missiles (Carus, 1992). Analysts also warned that cruise missiles would go beyond conventional use as states acquired the weapons, posing a large threat to the international community (Arnett, 1991). At this time, the existing relevant scholarship on cruise missiles peaked as improved technology transformed the way these weapons operated, leading scholars to explore cruise missiles in an attempt to fill the literature gap in comparison to ballistic missile literature. K. Scott McMahon and Dennis M. Gormley (1995) both cautioned that analysts previously focused too much on the technology and not on the implications the weapon could have. Both concluded that acquisition of LACMs by the end of the decade would suggest that the cruise missile threat had emerged and reached the 'tipping point.'

Throughout the years, Gormley (2008) maintained his stance and described cruise missile proliferation to be an 'epidemic' and a 'contagion'.

While the world once again focused on weapons of mass destruction and ballistic missiles after the September 11 attacks and the start of the War on Terror, nonstate actors and regional powers considered to be "rogue states" began to gain and develop cruise missile capabilities. At this time, much of the research came from American scholars, making the literature biased in regards to who was considered to be a rogue state and a terrorist group. The focus was mostly placed on Iran, North Korea, and China, leading analysts to argue that there were no sophisticated missile defense systems capable of tracking and intercepting cruise missiles (Kueter & Kleinberg, 2007). The development of cruise missile defenses has been argued since the cruise missile surpassed the ballistic missile in accuracy yet was never prioritized due to the assumption that conventional weapons posed a relatively minor threat to international stability based on the bi-polar nature evident throughout the Cold War (Carus, 1992). Steven J. Zaloga (2000) corroborated this claiming that cruise missile defenses remained of marginal concern in comparison to the development of weapon systems for ballistic missile defense. Sitakanta Mishra (2011) further agreed with these assessments and argued that cruise missiles were the under-acknowledged weapon of the future.

Nevertheless, cruise missile proliferation is starting to gain attention from the international security community due to Iran's use of these weapons within the Iran-Israel conflict. While previous literature took a Cold War perspective, current literature is beginning to discuss the threat these weapons pose on international security from a regional perspective. Still, these occurrences are relatively recent and there is still no proper consensus on how to prevent cruise missile proliferation or defend against it, leaving states at risk of experiencing the lethal capabilities these weapons hold. As states attempt to develop their own security arrangements, the acquisition and proliferation of these weapons has finally reached the 'tipping point' Gormley once talked about. This research attempts to fill the gap evident within the literature in regards to cruise missile proliferation by analyzing the evolution of the threat and the consequences that have led to their proliferation within regional conflicts; as well as, to showcase how the proliferation of these weapons have incited a regional arms race that have implications at the global level. The hope is that this work can potentially contribute to important conversations about how the impact of cruise missile proliferation is being shaped by factors not primarily focused on technology.

Theoretical Conceptualization Framework

This dissertation uses the theory of regional security complexes (RSCT), within the context of the Iran-Israel conflict, to demonstrate the impact destabilizing geopolitics has on the rise of cruise missile proliferation. The research question of this dissertation is: what effect does the Iran-Israel regional security conflict have on cruise missile proliferation in the Middle East and how has it impacted the international security community?

The primary hypothesis is that the security environment taking place between Iran and Israel has fueled cruise missile proliferation and incited an offense-defense arms race that could extend beyond the Middle Eastern region. Furthermore, this hypothesis will support the belief that the rivalry between Iran and Israel can be modelled from the Middle Eastern regional security complex. A security complex can be defined as having "durable patterns of amity and enmity taking the form of sub-global, geographically coherent patterns of security interdependence" (Buzan & Wæver, 2003). Within this security construct, both states have engaged in patterns of amity and enmity and compete for power brought forth by the security interdependencies within the region. This unique security environment has allowed for the thriving of cruise missile proliferation.

While international and nonproliferation regimes continue to focus on ballistic missile proliferation, the proliferation of cruise missiles is likely to continue and expand to include weapons of mass destruction. Some argue that cruise missiles are not an integral part of an arms race in comparison to ballistic missiles and have less capability to transport weapons of mass destruction. In addition, literature supporting this argues that ballistic missiles play a larger role in destabilizing the international community. However, this dissertation will argue against this and for the increase in cruise missile proliferation due to regional instability which could have further ramification for international security.

The proliferation of a weapon should be considered as an integrated element of a broader revolution in science, technology, and human condition (Mishra, 2011). While missile proliferation occurs due to the transfer of weapons and technology, the motives that instigate a nation to acquire these types of weapons need to be considered. Ultimately the acquisition of missiles is to gain security against adversarial threats. In order to analyze the effect the Iran-Israel regional conflict is having on the acquisition of cruise missiles, the phenomenon needs to be

examined through the lens of the RSCT. States within regional security complexes seek to acquire weapons due to the national security deficits evident within a specific region (Buzan & Wæver, 2003).

The RSCT provides a theoretical framework that offers a regional perspective instead of the common international perception. In the 1990s, the international security architecture transitioned towards unipolarity and introduced regional security patterns that became prominent within states seeking to secure their own regions. The autonomy of regional security patterns proved to be very different from previous patterns of bipolar superpower control, which commonly defined the Cold War era. With the end of the bipolar rivalry between the Soviet Union and the US, the security environment shifted and states within their respective spheres of influence were forced to develop their own security arrangements, instigating regional competitions characterized by arms races and conflict formation.

The argument brought forth by Buzan and Wæver states that these new post-Cold War security patterns are evident within regional security complexes. It aids one in understanding how the new structure affected the security interactions and balance of power through specific regions. Security complexes suggest that geographical proximity impacts security interactions within a region and strongly influences military, political, societal, and environmental sectors (Misrha, 2011). Security interactions between regions can be explained via the securitization theory, which assumes that decision makers, or securitizing actors, start the process of securitization by declaring that the object of security is existentially threatened (Jarzabek, 2018). While globalization played an important role in enabling new security patterns and structures, regional security environments experienced heightened threats due to the close proximity of adversarial neighbors. This led states to participate in securitization processes in order to protect themselves against existential threats (Koch & Stivachtis, 2019). Overall, eight interdependent regional security complexes were identified, the most intricate being the Middle East.

Historically, the Middle East has been a conflict-ridden region, resulting in an increasing weapon acquisitions amongst states entangled in interstate conflicts. The Middle East is characterized as a regional security complex due to differing dynamics and conflict formation resulting in conditioned rivalries based on power distribution and patterns of amity and enmity. According to Buzan and Wæver (2003), the security threats perceived by each state depend on and affect the threats of others in a way that no single state's security issues and threats can be resolved

unless those of the other states are also resolved. Since the end of the Cold War, the Middle East has faced new security challenges such as terrorism, weapon proliferation, ethic and national extremism, religious fundamentalism, etc. With the rise of nonstate actors in the region, Buzan and Wæver (2003) modified their theory to include different actors, labeled as units. Differing from the traditional international relations explanation, units are not only considered to be states but also referenced as nonstate actors (Schmoll, 2015). These elaborate intricacies further shaped the security threats perceived by each state, raising fear and suspicion within the already complicated region.

With the evolving security environment, states began seeking their own security arrangements, leading to missile proliferation amongst certain adversaries. The diffusion of military technology cannot be considered in isolation from the geopolitics of a given region (Mishra, 2011). Within this RSCT security construct, cruise missile proliferation has been the product of the Iran-Israel rivalry. Their motivation to acquire weapons in order to protect themselves against existential threats is a defining reason for cruise missile proliferation. These threat perceptions are fueled by patterns of amity and enmity taking place within the rivalry. Through a wide-ranging spectrum, patterns of amity can either foster desecuritization that introduces friendships or foster securitization that introduces conflict formation based on threat perceptions and fear. In the case of Iran and Israel, the actions and interpretations of both state's threats have resulted in a leaning towards increased securitization between both states.

Due to the geographical proximity between both states, changes in threat perceptions have also fostered shifts in competition for balance of power (Ergag, 2017). Ultimately affecting the strategic preferences of both states and regional security arrangements via the acquisition of cruise missiles and missile defense systems. According to Ergag (2017), arms supplies have a considerable effect on the distribution of power in the region, affecting the overall character of the security complex. This has been most evident with Iran's supply of missiles to Hezbollah, which has helped tilt the balance of power towards Iran and its proxy. Through the proliferation of cruise missiles, both Iran and Hezbollah have pushed Israel to enhance their missile defense capabilities. Therefore, as one adversary acquires a certain weapon, the balance of power tilts, instigating the other adversary to enhance their weapon arsenal, leading to unending arms races (Mishra, 2011).

Methodology

The primary goal of this study is to deduce whether the security environment created between Iran and Israel has fueled cruise missile proliferation and incited an offense-defense arms race. The reason for the selection of the Iran-Israel conflict case study was due to evidence of cruise missile proliferation at alarming rates, which has increased tensions and escalated conflict between both countries and throughout the region. To answer the research question, this thesis evaluates cruise missile proliferation through a regional perspective, enabling the researcher to understand how these weapons have affected the rivalry between the states through the use of the regional security complex theory and how the proliferation stems from this conflict. Deductive theory testing was therefore chosen to help answer the research question. The reason for this approach was because it allows for causal relationships to be drawn, and those can be helpful in making sense of recent events. Furthermore, the deductive approach, to a certain extent, allows for the generalization of findings, and therefore implications for future as well as recommendations can be drawn more easily. For this reason, the case study selection was straightforward because the intent was to showcase that both states are fueling the cruise missile threat. During the research phase, it was also discovered that nonstate actors like Hezbollah are also fueling the threat through the use of extended proliferation.

Data Collection and Methods

After establishing the theoretical framework, secondary data was collected to contextualize the circumstances that have led to the Iran-Israel case that fueled cruise missile proliferation and incited an offense-defense arms race. Data selection and collection methods for this research are derived from the notion that cruise missile proliferation is an overlooked subject, especially in regards to regional conflicts like the Iran and Israel conflict. Due to the ambiguity of the information and the nature of the topic, secondary data was collected to synthesize existing knowledge on the topic through the use of university databases, internet search engines, professional journals, published books, newspapers, newspaper archives, contemporary reviews, and think tank documents. The data collected covers extended periods of time ranging from World

War II to present time, to showcase the evolution of cruise missile proliferation through history and through the Iran-Israel regional security conflict.

In order to analyze the data, a literature review and a case study were used. Both of these data collection methods were conducted to contextualize the research and to allow for in-depth understanding of the topic. The literature review was broken into two segments. One segment provided an overview of what experts have said throughout history in regards to the proliferation of cruise missiles to showcase that although the issue has been discussed, it has been paid minimal attention to. Through the use of the literature review, prior and current knowledge evident amongst scholars in cruise missile proliferation literature was used to write about the evolution of cruise missile threat. The review sampled work that discussed the evolution and covered various periods in history that have been fundamental in shaping the weapon's capabilities.

Through the use of a case study, the Iran-Israel regional security conflict is explored through the historical rivalry between Iran and Israel, which has been shaped by patterns of amity and enmity for over five decades. The reason this case study was chosen is due to the fact that both countries have displayed a high interest in cruise missile technology for offensive and defensive purposes, raising the proliferation of the weapon.

Limitations

This research was limited in scope due to its reliance on open source data in regards to Iran and Israel's offensive and defensive cruise missile capabilities, which can be unreliable and contradictory due to limited data and lack of open source access to intelligence data. The development of these advanced types of weapons is a matter of national security, making most of the sensitive details hidden from the public view. This can lead to speculative data and misinformation in regards to both states' capabilities as open-source estimates can confuse and exaggerate a state's capabilities as a way to further heighten the threat. Therefore, there is no reliable data related to cruise missile proliferation within Iran and Israel, except for factual evidence of cruise missile production, uses, and tests as well as missile defense production countermeasures. Data concerning the evolution of the weapon was also limited because it tended to be one sided and mostly written about by American scholars. There is currently no Israeli or

Iranian literature on cruise missiles, limiting the literature written about the use of these weapons within this conflict even more.

The research design and methodology focuses strictly on text-based research and did not require participants or informed consent. Research interviews were not covered due to language barriers regarding texts, limitations introduced by the coronavirus pandemic, as well as geographical location. Additionally, a lot of the literature is outdated and focuses on the early evolution of the cruise missile throughout the early 2000s. Until recently, no vital information was reproduced to discuss the threat these weapons produce. With Iran's escalated efforts to produce cruise missiles, the international community has started to take notice of these weapons through their increased proliferation within the conflict. Due to the limited information, the relationships between some of the pieces of information depended largely on the interpretation of the author as well as on what assumptions the media made. It was a priority for the author to stay as impartial as possible when doing the analysis even though the influence of the researcher's biases on the interpretation of the information cannot be ruled out. Due to the scope and limitations of the research, all ethical considerations focused on crediting authors and scholars for their work through citations and notations within the chapters. All information was collected in a legal manner through accessible documents and published work.

Chapter One:
The Evolution of the Cruise Missile Threat

The cruise missile was first introduced in the early 1900s, before the start of World War I. Unfortunately, inadequate technology at the time made the development of such a weapon a difficult task at the time, preventing the cruise missile from becoming an effective military weapon during the war (Werrell, 1985). Since its inception, experts faced problems in developing the weapon into an unmanned aircraft that could fly with proper guidance systems and engines. Launching failures also contributed to the weapon's technical limitations. With the start of World War II, a shift in the strategic landscape sought to prioritize the development of long-range weapon programs instead of cruise missile programs, limiting the development of the weapon even more so. Once Germany made significant progress in the development of its own long-range program, later referred to as a ballistic missile program, these programs quickly took precedence over all cruise missile developments.

As Germany worked on its long-range program, they quietly produced the first operational cruise missile for use during World War II. Through the "Vengeance Weapons" program, the V-1 cruise missile was utilized through an offensive weapon campaign launched against Britain after the invasion of German-occupied France. On June 13, 1944, V-1 cruise missile salvos were launched towards the city of London, forcing mass evacuations and causing thousands of civilian casualties and fatalities (Mishra, 2011). Hundreds of missiles were launched towards the city daily, forcing millions of civilians to abandon the city. It is estimated that Germany launched over 20,000 V-1 cruise missiles during this campaign, which resulted in over 18,000 casualties (Correll, 2020). Other cities throughout Europe, such as Antwerp and Brussels were also terrorized by the weapon and faced over 24,000 additional casualties (Werrell, 1985). Towards the end of the weapon campaign, the V-2 ballistic missile was introduced and quickly gained recognition around the world for its capability to reach unprecedented speeds of 5,310 km/h, whereas the cruise missile was only capable of reaching speeds of 640 km/h, further overshadowing the weapon (Ibid, 1985).

The V-1 Cruise Missile

A number of factors encouraged Germany to develop the V-1 cruise missile. First, the invasion of France in 1940 reduced the distance between England and Germany, providing Hitler with close range proximity to engage in attacks against the city of London through the use of the English Channel (Mishra, 2011). The close proximity ultimately ended the need for radio-controlled pilotless vehicles (UAVs), which provided various limitations during long distance flights due to radio interference and difficulties in directing the vehicles towards their destinations (Leu, 2015). Upon Britain's strategic bombing campaigns against Germany, Hitler officially demanded the development of a flying bomb as retaliation against Britain's attacks. As the war continued, Germany's ranks were severely depleted, making the idea of a pilotless bomber more attractive for use during the war since it refrained from risking the life of more men (Werrell, 1985).

The V-1 cruise missile resembled a small airplane and was originally nicknamed the flying buzz bomb due to the pulsating sound of its pulsejet engine. The weapon's pulsejet engine required airflow for ignition and was not able to operate at speeds of less than 240 km/h (Correll, 2020). Therefore, the weapon had to be placed on an inclined ramp and launched towards the targeted cities through the use of a firing tube. The weapon's takeoff was also assisted by a piston catapult, which allowed the pulsejet engine to reach its cruising speed and a range of 240 km/h (ibid, 2020). As the V-1 cruised through the atmosphere in a straight line, it reached altitudes of 600-900 m (Roblin, 2020). In order to help regulate the weapon's altitude, the Germans developed an autopilot that used gyroscopes to follow a predetermined course through the use of a magnetic compass and a timer to help it maintain course and determine the point of engine cut off for the weapon to dive to its target (Smithsonian National Air and Space Museum). Once the weapon dove towards the targeted city, a warhead was used to detonate upon impact in order to maximize casualties (Roblin, 2020).

The German V-1 cruise missile had many advantages that ultimately made it Germany's weapon of choice during the offensive weapon campaign against Great Britain. For starters, the V-1 did not require an extensive list of crucial materials, making it cheap and fast to develop in comparison to the V-2 ballistic missile, which cost ten to twenty times as much to manufacture (Roblin, 2020). In comparison to the V-2, the V-1 was also smaller in size, which enabled it to

weigh less, increased its speed and altitude, and allowed it to carry a reduced warhead to prevent crashes or explosions mid-flight (Werrell, 1985). Even though the pulsejet engine gave the weapon speed limitations, it provided the weapon with extraordinarily low altitude that allowed it to reach its range, speed, while carrying a 1,000 kg warhead (Robin Radar Systems, 2018). Concurrently, the use of the gyro autopilot guided system allowed the missile to have an undetectable flight trajectory, making the weapon difficult to intercept. Unlike most of the weapons at the time, the V-1 cruise missile was fully operational regardless of the type of weather condition, popularizing its use throughout the war, especially when attacking the city of London (Mishra, 2011). Overall, the V-1 cruise missile's greatest advantage was that it provided an element of surprise due to the random nature of the attacks, which incited fear and terror throughout European cities.

Unfortunately, the weapon also faced various technical limitations that prevented it from changing Germany's strategic situation during the war. The V-1 cruise missile faced various challenges that affected its overall accuracy and reliability, which prevented it from becoming a precision weapon (Roblin, 2020). For example, the autopilot guidance system was successful in determining course direction, but faced problems when regulating the weapon's overall altitude (Ibid, 2020). In regards to the weapon's engine, the pulsejet engine was the first propulsion system of its kind, but consisted of loud buzzing sound that helped make the weapon susceptible to detection. The engine also caused hundreds of crashes and explosions right after launch or mid-flight, with Germany attributing over 35% of failures to premature crashes induced by the pulsejet engine (Mishra, 2011). Problems with the engine also required the weapon to have a boosted launch that was only activated once the missile reached a specific operational speed. The boosted launch forced Germans to create ground launch sites and launch ramps to allow the weapon to launch successfully and penetrate targets more accurately. The use of these launch sites and ramps also made the missile's flight predictable and more susceptible to attacks.

Introduction of Cruise Missile Defenses

The security threat these weapons of terror produced on the British population, led British defenses to orchestrate attacks against the V-1 cruise missile. Through active defense strategies set to develop an elaborate multi-layered defense system, the British aimed at attacking launch sites and intercepting missiles using bombers, fighters, guns, and barrage balloons. However, the

cruise missile's warhead made the weapon difficult to attack mid-flight and many of the defenses were unsuccessful in intercepting a large quantity of them (Roblin, 2020). It is estimated that the Allied defense measures were able to detect and intercept over 1,800 cruise missiles during the war, but faced high costs and large casualties in doing so (Mahnken, 2005). Defenses soon shifted to attack major launch sites, but Germany quickly shifted its offensive strategy and developed concealed launch platforms alongside newly developed air launched variants of the weapon, making it even harder for defenses to accurately detect and intercept the weapons. It soon became evident that providing defenses against the V-1 cruise missile was not working, steering the active defenses towards the V-2 and its speed capabilities (Ibid, 2005). By the end of the war, Germany had manufactured a staggering 30,000 V-1s that had inflicted damage unlike any other weapon at the time (Roblin, 2020). The use of these missiles during the last couple of months of the war ultimately paved the way for a new era of missile technology and intense competition to develop more sophisticated versions.

The Cold War and the New Cruise Missile Age

Upon the culmination of World War II, the United States and the Soviet Union utilized German V-weapon technology to seek ways to develop strategic cruise missiles. With the help of German scientists and salvaged missile parts acquired during the war, both powers sought to develop their own variants of the V-1. Originally, both powers saw the potential the cruise missile could have and wanted it to carry large nuclear warheads and achieve intercontinental range in order to reach a strategic nuclear parity (Mishra, 2011). Prototypes of these cruise missiles quickly started manifesting themselves throughout missile inventories but proved to be ineffective and wildly inaccurate in comparison to ballistic missiles. Americans attempted to develop the JB -2, Navaho, Snark, Matador, and Regulus cruise missiles, but all failed to provide results early on and were rendered obsolete throughout the Cold War (Werrell, 1985). Soviet efforts also attempted to develop various types of cruise missiles with nuclear capabilities, such as the KS-1 Kometa, but also proved to be ineffective (Mishra, 2011). As both countries continued to exploit missile technology, ballistic missiles were considered to be more successful in carrying large nuclear warheads and became the strategic weapon of choice, while cruise missiles were designated as tactical weapons for use against land and ship battlefield targets throughout military missions.

In general, a strategic weapon is seen as a weapon designed for mass destruction that could be targeted at specific infrastructures or entire cities whereas a tactical weapon typically carries high explosive warheads used for battlefield targets that can change positions rapidly (Fought & Durant, 2018). There can be a considerable overlap between both terms and their classification, but at the time, it was relatively easy to distinguish between both due to their different capabilities and different mission types. Strategic weapons were considered to be large vehicles that could travel long ranges and carry large high-yield warheads while tactical weapons were much smaller and traveled over shorter ranges carrying low-yield warheads (Kartha, 1998). As the nuclear parity competition between both superpowers took place, considerations for tactical strategies were implemented alongside research and technology focused on improving the cruise missile's capabilities in regards to propulsion, guidance, navigation, and overall accuracy. This new way of thinking led experts to develop new generation cruise missiles that could be launched from various platforms and be used as both offensive and defense tactical weapons to help defend coastal areas and attack ships, platforms, aircrafts, and more (McMahon & Gormley, 1995). In the case of the cruise missile, its classification as a tactical weapon produced two types of missiles: the anti ship cruise missile (ASCM) and the land attack cruise missile (LACM).

ASCMs and LACMs

Third-generation cruise missiles were introduced at the start of the Cold War after previous cruise missiles failed to provide successful results in terms of accuracy and reliability. Prototypes of two types of cruise missiles, the anti ship cruise missile (ASCM) and the land attack cruise missile (LACM), began to emerge from within US and Soviet missile arsenals, but they too were faced with problems regarding navigation and propulsion, due to lack of technology (Werrell, 1985). While the US focused on developing land attack cruise missiles (LACMs), the Soviet Union emphasized the development of anti ship cruise missiles (ASCMs) and successfully developed the Styx ASCM. The Styx ASCM was a tactical weapon assigned to provide coastal defenses and naval dominance throughout the region (Fahrenkopf, 2018). The Styx became one of the most distinguished cruise missiles within missile arsenals and helped shape the cruise missile's reputation while the US continued to develop its land attack cruise missile capabilities.

Once launched, the Styx could fly towards its target following a predetermined flight path using inertial guidance and a radio altimeter before activating an active radar sensor for terminal guidance (Mahken, 2005). As increasingly more sophisticated guidance designs were generated, autopilots previously used were also replaced to include inertial guidance systems to help provide navigational control (McMahon & Gormley, 1995). Nevertheless, these third-generation cruise missiles continued to face guidance failures and were still considered to be unreliable, forcing the weapon to be used as a decoy or as a stand-off weapon instead of a strategic weapon (Mishra, 2011). As problems persisted with the weapon's capabilities, the US and Soviet Union granted their allies access to the previously acquired German cruise missile technology, enabling the development and use of these weapons within a variety of countries around the world. The proliferation of anti ship cruise missiles (ASCMs) in particular, was introduced into various conflicts that allowed it to gain attention for the first time as a strategic weapon.

First Strategic Use of the Cruise Missile

The first strategic use of a cruise missile took place outside of Soviet airspace during an Egyptian attack on the Israeli Eilat destroyer during the Six Day War in 1967 (Fahrenkopf, 2018). Enabled by the Soviet Union, Egypt acquired a large number of Styx ASCMs and strategically launched them against the Eilat, sinking the destroyer and causing hundreds of casualties. At first, radars were unable to detect the weapons due to their close proximity launch (Egypt Today, 2018). Despite Israeli attempts to shoot the missiles down upon detection, the Styx ASCMs were able to maneuver themselves to evade missile defenses and intercept their target. Overall, only four Styx ASCMs were needed to sink the Israeli destroyer, underlining the overall effectiveness cruise missiles could have as strategic weapons in warfare (Vermylen, 2020).

The sinking of the Eilat ultimately showed the world how effective the cruise missile could be in attacking superior targets, renewing the widespread interest of its use and its capabilities as a strategic weapon (Mishra, 2011). States were quick to realize that strategic weapons did not have to be exclusively connected to long vehicles with long ranges and large payloads like ballistic missiles, leading to the proliferation of this weapon throughout developing countries. Following the Egyptian attack, Israel developed its own ASCMs. The development of the Gabriel ASCM granted Israel dominance and prestige throughout the Middle East as it became the first developing

state to produce these weapons with its own resources and technology. Israeli sophistication ultimately helped create an anti ship cruise missile with sea skimming capabilities able to provide countermeasures in the event of additional adversarial attacks (Fahrenkopf, 2018). The Gabriel was first used in the 1973 Yom Kippur War against Syrian and Egyptian ships armed with Soviet Styx ASCMs (Ibid, 2018). Israeli forces armed missile boats with Gabriel ASCMs, which were quickly credited in evading, defeating and sinking the adversarial ships. Gabriel's capabilities ultimately rendered the Styx missile obsolete, paving the way for a new generation of cruise missiles and the acquisition of these weapons within conflict ridden regions.

While Israel continued producing its own ASCMs, it became the first Middle Eastern country to export cruise missiles. The exportation of these weapons provoked a chain reaction among adversaries, leading to the development of new cruise missile variants (Carus, 1992). Alongside the Gabriel and Styx ASCMs, new ASCMs included the Chinese Silkworm and Seersucker missiles (Kueter & Kleinberg, 2007). The gradual proliferation of this weapon started to change the nature of warfare within these conflict-ridden countries, inciting new concepts, practices, technologies, and tactics amongst countries.

The Technical Revolution and Changing Doctrines

During the 1970s and 80s, newly acquired stealth technology led to innovations in navigation, guidance, and propulsion that turned the cruise missile into a reliable and accurate precision strike long-range system. Technological advances enhanced computer capabilities and revolutionized all existing systems, leading to the creation of systems like the Terrain Contour Matching (TERCOM), the Global Positioning System (GPS), the Global Navigation Satellite System (GLONASS), Digital Scene Matching Area Correlator (DSMAC), and improvements in previous Inertial navigation systems (INS) (McMahon & Gormley, 1995). These new systems enabled the cruise missile to improve its guidance and fly at low altitudes completely undetectable to defenses. Systems like the GPS and GLONASS became easier to acquire due to their commercial availability, while TERCOM, DSMAC and other military programs could only be acquired through a technologically advanced state such as the US or the Soviet Union. Nevertheless, developing countries also benefited from the commercialization of technology such

as the GPS since it granted them access to equipment and technology necessary to produce accurate cruise missiles at a much lower cost.

Improvements made to the weapon's engines, fuel, material, and warhead design, also increased the cruise missile's military utility, which allowed the weapon to operate within a variety of missions, ranges, altitudes, and speeds (Werrell, 1985). The creation of new propulsion systems like the solid fueled turbojet engine replaced the pulsejet engine and made the weapon weigh less, travel faster and reach longer distances (Mishra, 2011). Changes made in warhead designs also helped the weapon weigh less, turning the cruise missile into a capable long-range delivery system and a bigger threat than in previous decades. Alongside the creation of a new engine and lighter warhead, a variety of land, air, and sea platforms were developed to allow the weapon to successfully reach all types of targets with improved accuracy, extended range, and maneuverability (Kueter & Kleinberg, 2007).

The technical innovations produced during this time ultimately created improved cruise missile variants like the anti ship American Harpoon and the French Exocet. Both cruise missiles had started to be developed after the sinking of the Israeli destroyer Eilat, as the use of these weapons had not been considered a threat until the attack. Due to the lack of technology in the 1960s, both weapons had faced various limitations and were unable to enter service until the late 1970s. The use of anti ship cruise missiles in the Falklands War in 1982 between Argentina and the British Royal Navy proved the use of these weapons alone could produce strategic results when air and ground launched Exocets were able to sink the destroyer HMS Sheffield alongside the Atlantic Conveyor transport ship (Mahnken, 2005). The sophistication of these new anti ship cruise missiles quickly led to their exportation for use in various conflicts that ranged across the Middle East, the Far East, and South America (McMahon & Gormley, 1995).

Alongside the anti ship cruise missile's technical developments, the land attack cruise missile (LACM) started to raise interest among various countries seeking to develop cheap long-range precision weapon programs. Up until the 1980s, much of the technology needed to produce precision land attack cruise missiles was only available to the United States (Mishra, 2011). As stealth missile technology became widely available, the demand for these missiles increased alongside the demand for capable delivery systems (Said, 2001). This allowed the land attack cruise missile to be reintroduced as a long-range weapon equipped with better guidance, navigation, and propulsion technologies. Once cruise missiles became reliable long-range

weapons, previous plans to develop them as capable delivery systems for WMD payloads became a reality with the development of the American Tomahawk LACM. It was at this time that missile proliferation began to pose a threat to international security, inciting nonproliferation regimes and arms control regulations to take place in order to prevent the spread of WMDs. Unfortunately, the norms established proved to be weak when it came to cruise missiles.

Missile Proliferation Regulations

With the advent of new technology and the proliferation of missile systems capable of delivering weapons of mass destruction, political pressure and security concerns introduced legal limitations to missile warfare. Despite the fact that cruise missiles became more sophisticated and started to proliferate alongside ballistic missiles, legal limitations were introduced specifically focusing on limiting the proliferation of ballistic missiles. Strategic offensive arms control agreements and treaties such as the Strategic Arms Limitation Talks (SALT I and II), Treaty on the Nonproliferation of Nuclear Weapons (NPT), Intermediate-Range Nuclear Forces Treaty (INF), Anti-Ballistic Missile Treaty (ABM), and Missile Technology Control Regime (MTCR) all aimed to prevent the spread of a strategic weapon threat. Strategic weapons were identified as long-range weapons used to carry large warheads whereas tactical weapons were identified as short-range weapons used for discrete objectives on the battlefield (Congressional Research Service, 2020). Although cruise missiles started to acquire longer ranges and produced strategic capabilities, they were ultimately excluded from SALT I and II discussions once the United States and the Soviet Union saw the importance of the weapon's tactical use in winning conventional war strategies (Gormley, 2010). Other countries also became reluctant to limit the use of cruise missiles within missile warfare and no treaty was ever created to specifically focus on cruise missile warfare in relation to international law.

As countries continued developing their missile programs, political pressure to prevent the export of critical technology needed for missile developments began to take precedence. The 1987 MTCR agreement was voluntarily founded amongst seven industrial states to help prevent the spread of weapons capable of delivering nuclear, chemical or biological weapons, as well as related technology (Gormley, 2010). This agreement sought to help prevent the spread of cruise missiles, but mostly focused on ballistic missiles. Two categories were established to address export control

policies. Category I focused on the actual weapon systems and production facilities while category II focused on specialized materials, technologies, propellants, and any sub-components for the creation of these weapons (Kearn, 2012). After much delegation, the regime enforced limitations on ballistic and cruise missile exports with ranges over 300km and payloads over 500kg (Horowitz, 2017). However, member states had more discretion regarding Category II items, which were considered to be less sensitive in comparison to the actual systems. Voluntary compliance between founding states and advanced missile producers ultimately helped restrict the development of ballistic missile arsenals but failed to prevent the exploitation of cruise missile weapons and its technologies.

During the MTCR's first years of operation, the regime's emphasis on ballistic missiles helped prevent the spread of ballistic programs in Argentina, Brazil, Egypt, Libya, Syria, South Korea, and more (Gormley, 2009). Meanwhile, cruise missile technology caused confusion regarding the systems that should be controlled and various loopholes in the regulations and lack of consensus amongst countries allowed for the creation of new variants. In the case of Britain and France, both powers used the loopholes to curve regulations and sell sophisticated cruise missile exports, stating that the sales were in compliance with the MTCR (Arms Control Today, 2019). Even though the weapon was calculated to have a range exceeding 300 km, the sale still took place. This lack of attention towards cruise missiles heightened their proliferation and capabilities even more so.

After the cruise missile sale violated MTCR regulations, members updated their guidelines to standardize how to calculate the range of missiles. But, members were still not compliant with the guidelines and control lists concerning cruise missiles. In 2002, the adoption of the Hague of Conduct (HCOC) sought to supplement the MTCR with various issues, including the spread of long-range cruise missiles. The HCOC once again failed to restrict the weapons, allowing further sales to occur within different regions (Gormley, 2010). While other non-proliferation initiatives like the Russian Global Control Systems (GCS) and the US Proliferation Security Initiative (PSI) were introduced, they too failed to address the evolving cruise missile threat as ballistic missiles and WMD proliferation continued to receive more attention between decision makers and analysts (Arms Control Today, 2019). As the proliferation continued, these countries sought to produce cruise missiles for use in different warfare scenarios, showing that they had moved away from the notion of deterrence and containment towards attacking their enemies first.

From Deterrence to Warfighting

With the technical revolution and the implementation of political regulations, a new strategic culture was also introduced that started to produce fundamental changes in strategies and doctrines of war in relation to missiles. Once there was a nuclear balance between the Soviet Union and the United States, the focus shifted towards long-range precision strike weapons for use in warfare (Said, 2001). Prior to the dissolution of the Soviet Union, ballistic missiles had presented the superpowers with a credible nuclear deterrent through threats of punishment and denial (Nichols, 2013). Deterrence by punishment would keep adversaries from attacking while deterrence by denial advocated that states should be able to credibly threaten to initiate nuclear war in order to provide a credible deterrence posture (Cone, 2019). With the introduction of new and more diversified threats after the collapse of the Soviet Union, it became apparent that countries sought to attain their own strategic missile capabilities for use in warfare, leading to a shift from classical missile deterrence doctrine towards warfighting and strengthening conventional capabilities (Gormley, 2008). With this shift, different roles and missions began to characterize offensive and defensive uses of conventional weapons.

During the post-Cold War, the high-risk security environment led countries to become more reliant on precision weapons to attain security and regional dominance through means of warfare (Issa, 2001). At the time, most of these countries did not have the capabilities to develop their own ballistic missiles or had just started seeking ways to produce these missile programs, leading to a shift in cruise missile possession. While the anti ship cruise missile had successfully been used in different conflicts, the nuclear deterrence posture of the time made countries use these weapons strictly for military purposes. As many started to rely on conventional military forces and technology to deter the enemy from engaging in further action, a new denial strategy also emerged which became largely dependent on precision conventional capabilities (Gormley, 2008). This denial strategy originally emerged in the 1970s and helped lead to the development of credible war fighting options to deprive adversaries from attacking. Within the new strategic culture, the notion that cruise missiles like the Tomahawk LACM could be credible war fighting options was passed along to other countries with the weapon's first use in the 1991 Gulf War.

The LACM Threat

The introduction of the Tomahawk LACM in warfare proved that stealth technology had successfully increased the weapon's precision, speed, maneuverability, altitude and ability to evade missile defense systems. The emergence of this land attack cruise missile threat ultimately pushed countries further away from previous missile deterrence doctrines towards developing these weapons for use in conflict. With the introduction of preemptive strike doctrines in the 2000s, states moved further away from the Cold War era notion that missiles would be used for deterrence purposes, towards attacking adversaries first in the face of an imminent attack (Steinberg, O'Hanlon & Rice, 2002).

The development of the Tomahawk LACM was ultimately pushed during the 1980-88 War of the Cities and became operational in 1983, once Iraq's ballistic missile capabilities and its use of sophisticated missile technology for strategic attacks against adversarial threats posed an international security threat. Although it was considered to be operational in the 1980s, the weapon was first used in the 1991 Gulf War by American forces against Iraqi targets, exemplifying the military utility and offensive capabilities of the cruise missile as a precision strike weapon. The Tomahawk could be launched from aircrafts, ships and submarines to strike strategic land targets in heavily defended regions while flying at subsonic speeds (Gormley, 2008). With the advent of new stealth technology, the Tomahawk used various systems to help it accurately strike its targets: TERCOM, GPS, and DSMAC. Alongside the use of these systems, the weapon's accuracy and effectiveness allowed the missile to strike from long distances at low altitudes in unpredictable and untraceable flight paths (Mahnken, 2005).

The Tomahawk's use during the Gulf War accurately attacked strategic targets within Iraqi cities and strategic Iraqi defense infrastructures such as command and control centers, electrical power facilities, weapon plants, and radar installations, among others. According to reports, 288 Tomahawks were successfully fired towards Iraqi targets after US missile defense systems failed to intercept Iraqi ballistic missiles (Issa, 2001). The use of these weapons ultimately showed the world the military effectiveness and offensive capabilities of the cruise missile. Unfortunately, its successful use in the Gulf War led Middle Eastern countries to seek ways to acquire these weapons, leading them to become prominent instruments of warfare in the region. Iraq's use of five primitive land attack cruise missiles in the 2003 Iraq War saw the first use of these missiles in the hands of

a developing country. The use of these missiles against US forces not only enabled Iraq with the capability to evade and counter American missile defenses but also provided them with the ability to convert anti ship cruise missiles into longer range land attack versions (Gormley, 2008). While the US was able to intercept all of Iraq's ballistic missile attacks, they were unable to detect or intercept any of the land attack cruise missiles, bolstering the cruise missile's value and turning it into the 'poor man's air force' (Mishra, 2011). As countries shifted towards developing their land attack cruise missile capabilities, it became evident that various methods of acquisition were capable in helping obtain these precision weapons.

Methods of Acquisition

It soon became evident that land attack cruise missiles surpassed other missiles in accuracy, costs, and missions both operationally and strategically. The increasingly sophisticated nature of the weapon raised demands in the development and usage of cruise missiles, specifically throughout the Middle East. Nearly every country wanted to gain access to the weapon and its technology, steering away from previous anti ship systems. With Iraq's anti ship conversion into a primitive land attack cruise missile, anti ship systems became pivotal in the development of these highly sophisticated weapons. Reports state that in 2005, nearly 70 countries were known to be in possession of sea and land launched anti ship cruise missiles, with 20 of these countries in possession of air launched versions as well (Mahnken, 2005). The countries known to be in possession of advanced anti ship cruise missiles include France, Germany, Israel, Italy, Norway, Sweden, and the United Kingdom. Meanwhile, countries such as Iran, North Korea, and China, are known to be in possession of older versions whose simplistic designs allows developing countries to convert them into functioning land attack cruise missiles (Ibid, 2005).

When the new weapon was manufactured, the systems could be developed to work in compliance with MTCR restrictions, which meant that they could be adapted and easily extended without raising red flags (Jackson, Frelinger & Lostumbo, 2008). In fact, due to MTCR restrictions on several materials, technologies, and other subcomponents, many missiles were illegally modified into sophisticated long-range versions (Strategic Survey Journal, 1996). Still, many first generation missiles are unable to be converted to land attack versions, making it difficult to input sophisticated systems due to the gradual sophistication the weapon has endured. Therefore, many

countries sought assistance from Russia and China, who produced and manufactured these older versions. Iran in particular, has relied on both Russian and Chinese support in order to upgrade over 300 anti ship missiles with proper turbojet engines and guidance systems (Ibid, 2008).

With the help of countries like Russia and China, another method of land attack system acquisition led to indigenous development (Gormley, 2009). Indigenous development started to take place via transferred specialized knowledge and skill sets between experienced engineers, which incited further cooperation to help reverse engineer these weapons. Only a few countries had the adequate technology to develop such sophisticated weaponry at the time, therefore commercial technologies were used and integrated into these weapons. Although this method took the longest and was limited by each state's capabilities, tacit knowledge made it easier to share research and produce the necessary components to create these weapons (Nuclear Threat Initiative, 2012). Countries also shared specific engineering skills to develop advanced technological components like turbojet engines and guidance and navigation systems. Indigenous development became difficult to track due in part to tight export controls that attempted to block the transfer of specialized knowledge and prevent the spread of technology like TERCOM and DSMAC systems (Gormley, 2009). These limitations have forced indigenous programs to develop under the radar and use materials not subjected to regulations, leading to the use of dual use systems like the GPS.

Countries have not only acquired these weapons from indigenous development but also through direct sales. Prior to the Gulf War, direct sales were the only way countries could acquire cruise missiles, unless they had the technology to develop their own variants (Hinz, 2019). As previously mentioned, in comparison to ballistic missiles, cruise missile sales faced unevenly executed controls and weak international norms that allowed the sales to go through. Once limitations were introduced due to export controls, most direct sales were legally made with the limitations enforced by the MTCR of 300 km ranges and 500 kg payloads, but were quickly altered to produce longer ranges and higher payloads (Gormley, 2010). Other countries resorted to just selling land attack cruise missiles illegally to bypass all types of restrictions. In 2001, direct sales of Russian land attack cruise missiles were made to Iran, China, and Pakistan through Ukrainian back channels (Hinz, 2019). Through these direct sales, countries were also capable of trading stealth technology, inciting the diffusion of more sophisticated cruise missiles.

As land attack cruise missiles proliferated through these various pathways of acquisition, the LACM threat made it enormously difficult for nonproliferation regimes to detect and monitor their

proliferation. It is unknown how many land attack cruise missiles are currently in the hands of every country seeking to acquire them, but what is known is that the cruise missile is spreading throughout various regions around the world, raising signs of missile contagion and instituting a threat much higher than that of ballistic missiles.

Implications to International Security

The diffusion of technology, the shift in role/mission, lack of regulation, shift in strategic cultures, varying methods of acquisition and lack of missile defenses have all been some of the main drivers behind the current cruise missile proliferation threat. Throughout history, the cruise missile has faced many advantages and disadvantages, but it has become evident that the gradual sophistication of these systems has fueled international instability as countries race to acquire these weapons or the technology to produce these systems. As a consequence, anti ship and land attack cruise missiles have proven to be more relevant in the current world and have gained greater utility than in the previous decades, now constituting them as a primary threat to induce arms races through regional conflicts within developing countries (Issa, 2001).

As these countries attempt to acquire both of these weapons, over 130 types of cruise missiles have been developed and distributed, driving many to produce, export, or import them at a faster pace (Mishra, 2011). Likewise, with the continued proliferation of these weapons, countries are also seeking ways to develop capable defenses as means to contend the increasing threat. While missile defenses have been successful in detecting and intercepting ballistic missiles, they are still unable to defend against cruise missiles. Notably, the 2003 Iraq war showcased this when even US defenses were unable to detect the five Iraqi LACMs (Mishra, 2011). The inability to defend against these missiles has therefore added to the weapon's perceived value, especially within countries seeking to use these weapons in conflict-ridden areas. Currently, countries are seeking to develop systems that could detect the weapon after launch, mid-flight, or during the terminal phase. Although some defenses proclaim to have anti-cruise missile capabilities, limitations regarding the type of terrain, weather, and noise, have all had an additional impact on radars used to detect them (Mayers, 2020; Mahken, 2005). Ideally, the best way to defend against cruise missiles would be to detect them as early as possible after their launch. Unfortunately, advanced cruise missiles continue to be undetectable due to their altitude, high speeds, and

unpredictable flight patterns, making the use of in-depth defenses a priority. Through the use of a layered defense, incoming cruise missiles could engage them, but such defenses are currently unavailable.

Alongside the cruise missile's proliferation, the idea that these weapons are suited to deliver weapons of mass destruction started to take precedence with the sophistication of the land attack cruise missile. Similar to a ballistic missile, a land attack cruise missile has the capability to carry nuclear, chemical, and biological agents to major land targets, including single buildings or entire cities (Kueter & Kleinberg, 2007). Following MTCR regulations, these weapons can effectively deliver nuclear warheads under 500kg, showing an alarming correlation between countries pursuing cruise missiles and those in possession of WMDs, especially within the Middle East (Bowen, 1997).

Chapter Two:
Cruise Missile Proliferation During the Iran-Israel Conflict

Since the cruise missile's inception, there have been more than 130 different types of cruise missiles distributed among 75 nations (Mishra, 2011). Of these 75 nations, 70 were known to be in possession of anti-ship cruise missiles (ASCMs) and 12 were known to be producing land-attack cruise missiles (LACMs) (Feickert, 2005). The current trend of cruise missile proliferation has shown a horizontal expansion of the global cruise missile inventory within developing countries, affirming that an increase in the number of cruise missiles is gradually occurring. The majority of countries seeking to possess these missiles happen to be in conflict ridden regions where security deficits are evident, such as the Middle East.

The proliferation of cruise missiles in the Middle East has increased since their use in major regional events like the Gulf War (1991) and the Iraq War (2003) (Gormley, 2010). Since then, the proliferated development of these weapons has mostly been evident within the Iran-Israel conflict. While Israel was once the sole possessor of cruise missiles in the Middle Eastern region back in the 1970s, Iran has focused on developing its own cruise missile arsenal, raising the proliferation of these precision guided weapons. As a result, the proliferation of these weapons has also extended to include nonstate actors such as Hezbollah, Iran's main proxy militia. Through this extended proliferation, Israel has sought to develop cruise missile defenses by instituting multi layered defenses in order to combat what they consider to be an existential threat.

As history has previously shown, cruise missiles are not a new threat in the missile proliferation world, but their acquisition has presented a challenge to the regional stability and overall security of the Middle East since it has granted countries and nonstate actors with the strategic capabilities to gain power and influence. By taking a regional security perspective, this chapter aims to explore the security environment between Iran and Israel to examine the cruise missile proliferation phenomenon taking place. In order to do so, one must first consider the complex nature of the region.

The Dynamic Nature of the Middle East

The Middle East has become the world's most polarized region, characterized by high dynamics of growing tensions and regional conflicts due to its lack of a security architecture. This combination, along with weak structures, territorial disputes, civil wars, nonstate actors, and multiple power transitions, currently make it the most volatile region in the world (Malley, 2019). The region is dominated by authoritarian regimes who seek hegemonic power and engage in interstate aggression towards one another. While none of the regional states have been successful in gaining such power, rivalries have manifested themselves among countries seeking to fill the power vacuum left by external powers. After World War II, France and Britain's withdrawal from the region produced a power vacuum, which left states struggling to transition from colonialism to neocolonialism. After the end of the Cold War, the US and the Soviet Union attempted to fill this power vacuum but were unsuccessful in doing so, leading to a regional power imbalance and to the introduction of a new power structure amongst the countries in the region. Since then, the regional balance of power throughout the region has been highly uncertain and has seen a further shift in the region's power dynamics followed by uprisings, local disputes, and arms sales and transfers (Cammack & Dune, 2020).

Alongside the lack of a security architecture, the region is also affected by religious ideologies that have led to fragmentation amongst states and allowed for the pursuit of differing national interests (Holmquist & Rydqvist, 2016). After World War II, the era of decolonization introduced the Arab-Israeli conflict and incited high intensity conflicts between Israel and Arab states seeking to eliminate the Jewish state. Throughout the years, the conflict subsidized into the Israeli-Palestinian conflict, which has introduced a growing number of nonstate actors that base their ideals on Islamic fundamentalism and extremism (Jarzabek, 2018). In the case of Iran and Israel, both countries are characterized as non-Arab nations, but Iran holds an anti-Israeli sentiment rooted by ideological and religious claims while Israel sees Iran as a strategic challenge and existential threat. This has been further exacerbated by Iran's proclaimed "axis of resistance" alliance with Hezbollah and Syria in opposition against the Jewish state.

Therefore, the dynamic that describes today's Middle Eastern region is one shaped by security dilemmas, which begets that as one state seeks to increase its security, another produces countermeasures, thus risking a chain reaction leading to conflict. To Israel, it is evident that Iran

is attempting to alter the balance of power through the use of failed states such as Lebanon, Yemen, and Syria. Given Iranian hostility towards the Jewish state, Israel has created a credible military posture, but from Iran's perspective, its actions are justified as a response to Israeli military threats. Within this strategic security environment, the regional competition has fueled a rivalry between both states characterized by patterns of amity and enmity.

The Iran-Israel Conflict: Patterns of Amity and Enmity

Iran and Israel were never destined to engage in conflict, given the fact that they have no territorial disputes and have different regional zones of interest: the Levant for Israel and the Persian Gulf for Iran ((Kaye, Nader & Roshan, 2011). Prior to the start of the Iran-Israel conflict, Iran and Israel cultivated a relationship based on geopolitical interests as both sought out strategic alliances with non-Arab states (Speier et al., 2017). Searching for legitimacy in the Muslim world, former Israeli Prime Minister David Ben-Gurion established the 'periphery doctrine' with the premise that Israel would develop close relations with the region's non-Arab states and ethnic minorities (Ibid, 2017). The Shah of Iran also began seeking relationships with non-Arab countries to counter hostile Arab neighbors and develop close ties with the West, putting its religious ideologies aside to institute a strategic alliance. As both states developed close ties, the Iranian government recognized the state of Israel two years after its establishment in 1950, although it never became official (Daou, 2018).

The strategic alliance fortified when both states viewed the shift in balance of power and regional alignments caused by Soviet influence as a common threat. By the 1960s, Israel and Iran also viewed Iraq as a major threat and simultaneously supported the Iraqi Kurds who fought against the Iraqi regime (Nada, 2020). Moreover, the Iranian-Israeli alliance brought extensive economic and energy cooperation to the region, feeding Iran's desire to establish itself as a dominant player in the international oil market. The oil production ultimately led to military advancements such as the 1977 joint Iranian-Israeli military effort to modify and develop advanced missile systems. At the time, Israel had started producing its missile capabilities, granting both states the ability to gain influence in the region. Project Flower provided Iran with the opportunity to turn into a formidable military power and also granted Israel the opportunity to access guaranteed oil supplies and advanced military research financing (Sciolino, 1986). The joint effort was led by Israeli research

developers and funded by Iran, who created various missile facilities to produce the joint operational missile systems. There were also indications that the Shah was looking into developing a nuclear program. Unfortunately, all joint missile production operations and future plans were halted when the Shah was exiled and replaced by Ayatollah Ruhollah Khomeini to establish the Islamic Republic of Iran. With the Shah's exile, both countries started to view one another as imminent threats, quickly changing the security environment within the Middle East and shifting towards increased instability and hostility.

From Amity to Enmity

Upon Ayatollah Ruhollah Khomeini's rise to power in 1979, the Iranian Revolution marked the onset of the rivalrous relationship between Iran and Israel. This revolution was intended to spread throughout the Islamic world due to the anti-imperialist world view of Khomeini's leadership (Maloney, 2019). Hardline clerics were brought to power with an anti-imperialist worldview that sought to spread the Islamic revolution rhetoric and empower all the Shiite groups throughout the Middle East (Ibid, 2019). This new theocratic regime embraced the Palestinian cause as its own, leading to enmity towards the Jewish state.

Still, the Islamic Republic continued engaging in mutual cooperation for strategic purposes as it sought to advance its weapon capabilities during the 1980-88 Iran-Iraq War once it became known that Iraq was developing a nuclear program. The Iraqi threat was an imminent threat to both countries and ultimately drove Israel to transfer an estimated $500 million worth in arms on the grounds that Iraq was developing into a military power capable of shifting the balance of power in the Middle East (Maher, 2020). While arms sales continued, Israel believed that the relationship between both countries could be improved. But, Iraq's use of ballistic missiles during the war ultimately led Iran to seek ballistic missiles capabilities with the help of China, Russia, and North Korea due to the devastating results these weapons had on Iranian cities (Olson, 2016). The use of these weapons during the war not only led Iran to focus on developing its own ballistic missile arsenal but also to seek out other advanced weapons such as the Chinese Silkworm anti ship cruise missile in order to deter adversaries. Soon, the state relied on Chinese expertise for weapon developments, steering clear of Israeli weapons to design its missile arsenal. Since then, Iran has been heavily reliant on missiles as part of its defense strategy.

The Nuclear Threat

Alongside the development of its missile arsenal, Iran also sought to increase its nuclear capabilities, further deteriorating the relationship between Iran and Israel. Prior to Khomeini's death, Iran had halted all nuclear production activities, which resulted in the near disintegration of the state's nuclear program. Upon Ayatollah Ali Khamenei's rise to power in 1989, Iran sought help from the Soviet Union, China, and Pakistan in order to purchase and gain extensive support in acquiring their own ballistic missiles (Gormley, 2010). Since the Iran-Iraq war had already led to the gradual proliferation of ballistic missiles in the region, the proliferation of nuclear weapons became a dangerous possibility. At the time, Israel had not perceived the Iranian threat as extensive in comparison to the Iraqi threat, but with the defeat of Iraq during the 1991 Gulf War and Iran's new nuclear developments, Israel's concerns that Iran's influence would increase throughout the region intensified the rivalry.

While Iraq's use of ballistic missiles led Iran to seek its own missile and nuclear capabilities, it also led Israel to develop a layered ballistic missile defense system to combat the ballistic missile threat. Israel was already considered to be in possession of a sizable number of nuclear weapons, but maintained a policy of nuclear ambiguity (Brom, 2016). Due to Israel's precarious geographic location, the concept of strategic stability has been deeply embedded in Israeli strategic thinking, making the possible proliferation of nuclear weapons in the Middle East a critical threat to the state's existence. In order to maintain a qualitative military edge over its adversaries, Israel focused on developing advanced offensive and defensive missile systems to deploy as it stated it would not be the first state in the region to employ the use of nuclear weapons.

With the introduction of the Iraq War into the region in 2003, a US led coalition invaded Iraq in order to disarm it of its weapons of mass destruction. The demise of Iraq's regime left a power vacuum that transformed the region's geopolitics and incited Iran to further develop its nuclear capabilities, serving to strengthen its position throughout the region. Upon Iranian President Mahmoud Ahmadinejad's election in 2005, his support for Iran's nuclear program led to the announcement that the country had successfully begun to pursue uranium enrichment and was a nuclear state. In the eyes of Israeli leaders, the prospect of a nuclear-armed Iran meant that Iran was a step closer to developing nuclear weapons capable of obliterating the state of Israel

(Kaye et al., 2011). According to the International Atomic Energy Agency (IAEA), Iran has attempted to explore a number of possibilities in regards to the development of missile warheads capable of delivering a nuclear payload (Iran Watch, 2020). Israel's concerns were further exacerbated with the demise of the Joint Comprehensive Plan of Action (JCPOA) in 2018, which sought to limit Iran's nuclear activities and allow international inspectors access to ita facilities in exchange for sanctions relief (Laub & Robinson, 2020). Since then, tensions have increased as Iran has gradually restarted its uranium enrichment.

With the continued development of Iran's nuclear program, Israel's concerns over Iran's ability to supply other parts of the region with the capabilities to attack Israel has also become a reality and posits a great threat to the region's security. Part of the reason why the deal crumbled was due to its failure in addressing Iran's proxy warfare in the region, which has heightened the prospects for conflict as Iran continues to step up its anti-Israel rhetoric and asserts its interests in areas that border Israel (Ibid, 2020).

Hezbollah as a Proxy

Alongside the nuclear threat, Iran has used nonstate actors as proxies to pressure Israel strategically and expand its influence and power projection throughout the region. Nonstate actors like Hezbollah have been a critical component of Iran's proxy warfare strategy to deter adversarial threats from attacking the Islamic Republic. As Iran attempted to develop its missile arsenal in the 1980s, it helped create the Lebanese Hezbollah militant organization. Upon Israel's invasion of Lebanon, also known as Operation Peace for Galilee, Israeli forces hoped to eliminate the Palestinian Liberation Organization (PLO) and help the Christian factions living in Lebanon (Simon, 2010). The PLO fought to create a liberated Palestine in Israel and was considered to be an ally of Khomeini when Iran embraced the Palestianian cause. Once the Israeli invasion was successful in pushing the PLO out of Lebanon, Iran created a resistance faction in hopes of spreading the regime's hostile religious ideology to destabilize Israel and gain influence throughout the Middle East (Khan & Zhaoying, 2020). Within days, Iran deployed its Iranian Revolutionary Guard Corps (IRGC) to train and equip the new Shiite militia. While Israel was successful in expelling the PLO from Lebanon, Hezbollah's emergence paved the way for Iran's use of proxies through asymmetric warfare.

The emergence of Hezbollah tilted the balance of power in the Middle East towards Iran and began to supplement Israel's enmity towards the state. In order to compensate for the strategic vulnerabilities that came with the Iran-Iraq War, Iran started to use Hezbollah to engage in conflicts after the PLO was forced out of Lebanon. Through the use of Hezbollah, Iran had the capability to engage in asymmetric warfare throughout Israel's northern border without physically placing any Iranian troops along the border. This granted them the ability to compensate for its conventional military deficiencies in comparison to Israel's technological capabilities.

Iran first used Hezbollah to launch a guerrilla war against Israeli forces, turning it into the single most effective adversary Israel has faced to this day (Khan & Zhaoying, 2020). Through the use of suicide bombings, Hezbollah successfully launched its first asymmetric attacks towards Israeli forces to force them to fully withdraw from Lebanon. Under growing attack, Israel withdrew to a 'securitized zone' controlled by the South Lebanon Army, an ally to Israel. The withdrawal ultimately encouraged Hezbollah to incite more attacks due to their success in moving Israeli targets out of specific areas within Lebanon. With the release of its 1985 manifesto, Hezbollah started to change its warfare tactics to include suicide bombings and rocket attacks, on the premise that Hezbollah's fight against the 'Zionist entity' would result in the state's obliteration (Nada, 2020).

In the first years of the organization's inception, the IRGC provided funding, arms, and training, providing Hezbollah with the ability to become a capable and formidable threat against Israel throughout the 1990s. Alongside its rise, the organization continued to engage in asymmetric warfare with Israeli forces and the South Lebanon Army. Following the collapse of the Soviet Union, a shift in strategy led to coordinated attacks against Israel in other parts of the world. The coordinated attacks on the Israeli Embassy and a Jewish center in the Argentinian capital of Buenos Aires in 1992 and 1994 were portrayed as the deadliest anti-Semitic attacks since World War II (Politi, 2019). In addition to these attacks, Hezbollah also increased its rocket attacks on Israeli forces along the border, ranging from 52 attacks in 1991 to 1100 attacks in 1998 (Khan & Zhaoying, 2020). It was at this time that Israel's security establishment started to consider Iran as a major security challenge.

With Hezbollah's increased acts of violence against the Jewish state, Israel sought to counter the attacks through persistent counterinsurgency operations such as Operation Accountability (1993) and Operation Grapes of Wrath (1996). Both of these operations aimed to

neutralize the attacks on Northern Israel but proved to be unsuccessful in minimizing the Hezbollah threat as it continued to face casualties (Gleis, 2006). By 2000, Israel made the strategic decision to withdraw from Lebanon. The withdrawal from Lebanon ultimately allowed Hezbollah to gain influence and power within Lebanon. With the help of Iran, the organization was able to secretly enhance its weapons arsenal to include more rockets and more advanced and capable weapons for use against Israel. This proved to be extremely destabilizing as it allowed Iran to spread its proxy network and increased the threat of attacks against the Jewish state. Alongside the changing strategic environment, Iran started to introduce its recently acquired conventional cruise missile capabilities to Hezbollah. Meanwhile, as Iran supplied Hezbollah with weapons, Israel's unsuccessful attempts to stop Hezbollah's rocket attacks led the state to begin developing a missile defense system capable of countering the organization's imminent rocket threat.

The 2006 Lebanon War

The war between Hezbollah and Israel was the first demonstration of Iran's shift in military doctrine towards the strategic use of precision guided weapons in the conflict. After Israel's withdrawal from Lebanon in 2000, Hezbollah continued initiating attacks against Israeli targets across their shared border. This pressure campaign against Israel ultimately led both states to engage in low conflict escalations up until 2006 when two Israeli soldiers were captured by the militia group as a plot to demand the release of Palestinian and Lebanese prisoners. Israel's response ultimately consisted of massive air and ground retaliations, which Hezbollah responded with by launching over 4,000 rockets and missiles across the border (Brookes, 2020). While the war provided Iran and Hezbollah with the opportunity to weaken Israel, Israel saw the war as an opportunity to neutralize Hezbollah and therefore weaken Iran's retaliation capabilities (Byman, 2018). Instead, the war led both parties to engage in a deadly 34-day war, which resulted in mass casualties on both sides and no results.

What stood out this time around was Hezbollah's surprise launch of a precision guided anti ship cruise missile towards Israeli targets. Throughout the war, Hezbollah's massive unguided rocket attacks had threatened Israel's security and endangered the state's very existence, but Israel had gotten used to these attacks. Therefore, Israel believed that by preemptively striking Hezbollah, it would deprive Iran of its ability to retaliate in the event of ever going to war (Byman,

2018). Instead, Israel's position was weakened when Hezbollah successfully identified, located and struck the Israeli warship INS Hanit with an anti ship cruise missile derived from Iran's increased missile arsenal (Brookes, 2020). While the anti ship cruise missile provided a precision strike that caused several Israeli casualties and crippled the Israeli ship, the attack symbolized Hezbollah's new cruise missile capabilities and showed the world that the organization had gained access to sophisticated missile technology.

Throughout the 34-day war, Israeli officials had heavily miscalculated how advanced Iran's missile arsenal was and relied more on its military for ground invasions into Lebanon giving Hezbollah certain fighting advantages it lacked from the air. While the organization's arms buildup was tracked, the extent of the defenses and armaments came as a surprise to everyone. Once it became evident that Israel did not have the capabilities to deter Hezbollah, Iran's proxy proved to be a key regional player in the Iran-Israel conflict. Since 2006, anti ship cruise missiles have become more readily available to the organization as Iran's sophistication increases, leading the weapon to become an exclusive attack platform designed for rapid penetration and delivery of high explosive warheads within asymmetric warfare (Cordesman, 2020). Although Hezbollah does not list its current missile arsenal, the group has continued to gain access to sophisticated missile technology through a precision guided project aimed at granting it access to more anti-ship cruise missiles, rockets and long-range precision weapons.

Hezbollah's Arms Buildup

In the aftermath of the war, Iran has slowly embarked on an ambitious force buildup program and has replenished and increased Hezbollah's arsenal from 13,000 missiles and rockets to over 150,000 per today's estimates (Cordesman, 2020). During the first years following the war, Iran focused on restocking Hezbollah's rocket arsenal and providing it with more short range anti ship cruise missiles in preparation for future conflict (Lappin, 2017). In the following years, Iran upped its antics to provide long-range missiles and guidance kits to develop the organization's precision firepower against Israel. Alongside their supply of these weapons, Iran has also been increasing the production of warhead explosives and is in the process of building factories in Lebanon and Syria. Hezbollah's weapons are often smuggled into Lebanon through an array of regional routes from Iran to its allies. With Iran's increased missile sophistication, the Islamic

regime is assumed to also be granting Hezbollah supplies of land-attack cruise missiles, indicating that the organization has the ability to direct more precise attacks towards the state of Israel and possibly launch weapons of mass destruction.

Iran's continued investment in these weapons has ultimately led Israel to enhance its own defenses to combat any threat coming its way. Israel's concerns about Hezbollah's ability to disrupt Israeli cities and infrastructure in the event of a future conflict has forced it to shift its passive stance towards a policy taking the initiative to deter future attacks with these weapons. According to the 2018 Israeli Defense Forces (IDF) strategy document, Israel has stated its willingness to strike the group in order to establish strategic stability and achieve a fast victory in the event of a war (Eilam, 2020). Although the IDF has vast amounts of more technologically advanced weapons than Iran, it has stated that Israel will continue containing Hezbollah in order to avoid another war. Israel's containment strategy consists of surveillance and reconnaissance operations to successfully allow it to disrupt weapons transfers and developments through retaliatory strikes.

The War Between Wars

After the Arab spring, a new strategic landscape emerged in the Middle East that postulated new threats that changed the balance of power towards Israel and intensified the regional conflict between both countries. As Iran continued to stretch its influence in the region through the use of Hezbollah as a proxy, Syria became involved in the conflict, leading both states to develop a strategic alliance focused on keeping Bashar al-Assad in power (Nada, 2020). Since then, Iran's alliance has allowed Hezbollah to acquire sophisticated weaponry through arms transfers taking place from Iran through Syria and into Lebanon. While Israel maintained a neutral position on the Syrian Civil War, the state became involved after reconnaissance missions discovered various missile bases and tunnel networks infiltrated throughout Syrian territory. Israel's opposition to Iranian presence in Syria has led the state to carry out air strike campaigns on Hezbollah and Iranian targets throughout Syria that have ultimately increased the possibility of a high intensity war. Known as the "War Between Wars", this policy attempts to target the buildup of all the weapons programs that threaten Israel national security (Lappin, 2017).

Israel's defense establishment has focused much of its attention on these counterattacks, stating that they have been successful in diminishing Iran and Hezbollah's capabilities. Between 2012-2018, the Israeli Air Force acknowledged that it carried out over 100 strikes on arms convoys making their way to Lebanon and over 200 strikes between 2017 and September 2018 (Ibid, 2020). The first known attack occurred in 2013 when Israel struck a Syrian convoy allegedly transporting Iranian long-range weapons. In 2015, the conflict further escalated when Israel also launched various cruise missile attacks once it was alleged that Iran was transporting Russian made anti-ship missiles to Lebanon, described to be more sophisticated and capable than the previously used anti ship missiles against the INS Hanit (Gordon, 2013). The increased attacks prompted Hezbollah and Syria to launch retaliatory attacks on Israeli forces towards Israeli-controlled territory to diminish Israeli forces, but the Israeli attacks continued and shifted to include warehouses, bases, reconnaissance sites, training facilities, and more. In 2018, Israel launched its deadliest strikes against Iranian infrastructure in Syria, reportedly killing dozens of Iranian personnel (Congressional Research Service, 2019). In order to evade further attacks on its arms network, Iran decided moved its missile production network to Lebanon, increasing the risk that Israel's retaliatory strikes could further intensify the conflict as Israel has made it clear that it will not tolerate the development of bases, factories, tunnels that risk the security of the Jewish state. Many experts believe Iran's strategic move hopes to deter Israel from attacking Hezbollah in Lebanon, but this move could help Hezbollah advance its guidance systems and increase its payloads, creating a serious problem for Israel.

In 2019, Israel continued its attacks through various operations as Iran continued to advance its efforts to bring advanced precision guided weapons to transfer to Hezbollah (Cohen & Huggard, 2019). Unfortunately, the attacks have not prevented Iran from enhancing its military capabilities and extending them to other nonstate actors. As the Iran-Israel conflict continues to escalate within Syria, Iran has recently spread its influence to Yemen, granting the Houthi rebels the capabilities to acquire sophisticated weapon arsenals for use against its adversaries. Due to Yemen's weak security architecture, Iran has focused on transforming the failed state into a powerful Shiite state. With Iran's sponsorship, the militia group has received training, aid, and arms, which includes the transfer of various precision guided weapons, including cruise missiles (Khan & Zhaoying, 2020). The transfer of cruise missiles in particular has allowed the Houthis to engage in asymmetric warfare in various occasions in 2019 and 2020. The 2019 airport attack in

Abha, Saudi Arabia was the first to occur against civilian targets, which resulted in a large number of casualties (Hinz, 2019). The Houthi rebels escalated Iran's asymmetric campaign once more with the 2019 land attack cruise missile attacks against Saudi Arabian oil processing facilities, proving that Iran has started to equip the Houthis with cruise missiles and other advanced military equipment as it seeks to extend its regional influence to include other states and nonstate actors (Hinz, 2019).

With the introduction of the Houthi rebels as Iran's proxy, Israel believes that Iran is preparing to escalate the conflict and is bracing itself for a war. Prime Minister Benjamin Netanyahu has stated that Israel would widen its operations to Yemen, in order to prevent Iran from entrenching itself in the region (Welle, 2020). As tensions continue to rise, it is evident that the rivalry between both states is reaching a tipping point that could once again see the initiation of war in the region, but this time with precision strike cruise missiles. The 2020 killing of Quds force leader Qassem Soleimani further solidified this notion, leading Iran to vow retaliation for the death of its leader, who was in charge of Hezbollah's precision guided project throughout the region. Although the US led the strike, it is believed that Israel cooperated in the demise of the leader.

Current Threat Perceptions

Iran and Israel's prolonged rivalry has incited both states to view each other as existential threats. Israel currently views Iran as its main rival and biggest threat, which stems from a range of geopolitical concerns and geostrategic interests in direct competition with Iran's. Iran's current regional environment continues to administer hostile stances against the Jewish state ((Kaye et al., 2011). While Iran's nuclear program has been extensively debated by Israeli experts and decision makers since the 1990s, the regime's increasing cruise missile arsenal has been taking center stage as it is being used for coercion and force projection against Israel (Brookes, 2020). With Iran's rising military capabilities and the increased use of asymmetric warfare, the regional balance of power in the Middle East has shifted, forcing Israeli experts to view Iran's aspirations as hegemonic in nature, focused on gaining strategic influence in the region and leadership over the Muslim world ((Kaye et al., 2011). Through Iran's use of Hezbollah, the regime has become a powerful military force in the Levant and Persian Gulf regions, forcing Israel towards a more

hawkish approach when dealing with the Iranian regime (Sachs, 2014). This approach has steered Israel away from its previous stance, which sought to limit the escalation of conflict. As Iran's conventional forces continue to expand and improve, Israel prepares for the possibility of war. Meanwhile, Iran's overall threat perception that it is surrounded by enemies who want to overthrow its regime, has fueled the need to acquire enough military capabilities to deter attacks from the Jewish state (Farhi 2017).

As the security environment continues to steer towards conflict, the regional disorder introduced by the Iran-Israel rivalry has become a breeding ground for the proliferation of cruise missiles, which has extended the conflict to include other states and nonstate actors. Currently, Iran and Israel are the only countries with cruise missile programs in the Middle Eastern region. As history shows, Iran's decision to acquire its cruise missile capabilities to counter Israel's military superiority stems from the fact that both states view each other as existential threats. While steering away from the use of ballistic missiles, the acquisition of these weapons has provided the Islamic regime with a credible deterrent against Israeli aggression, while also triggering Israel to adopt a security posture focused on deterring cruise missile threats from Iran and its proxies. Iran's current emphasis on the development of these weapons and Israel's emphasis to deter future attacks has therefore led the regional competition taking place between both states to foster an offense-defense arms race characterized by cruise missile proliferation.

Chapter Three:
The Iran-Israel Cruise Missile Arms Race

For decades, analysts have focused on Iran's ballistic missile program, due to its ability to grant Iran the capability to acquire weapons of mass destruction and the threat that this would pose for international security. Despite efforts made by regional and world powers to prevent the procurement of missile-related materials, equipment, and technology through heavily imposed restrictions, Iran continued to develop its missile program while becoming heavily reliant on cruise missiles. As the international security agenda continues to focus on ballistic missiles and the nuclear threat issue they provide, Iran's development of cruise missiles went completely unnoticed until recently. On the contrary, Israel has been monitoring Iran's development of cruise missiles and developing its own missile defense systems to combat the threat, exposing the Middle Eastern region to a new type of overlooked arms race.

Colin Gray (1971) proposed that the basic conditions of an arms race must include: (1) two or more parties that are conscious of their antagonism; (2) their armed forces must be structured with attention to the probable effectiveness of the forces in combat with, or as a deterrent to, the other arms race participants; (3) they must compete in terms of quantity and/or quality; (4) there must be rapid increases in quantity and/or improvements in quality. In the case of the Iran-Israel arms race, all conditions have been instituted. As previously discussed, the motivation behind the acquisition of these weapons is mainly linked to the security deficit that takes place within the Middle East. Due to this deficit, the proliferation of these weapons is thriving within the region, which leads both states to compete as both view each other as direct threats and rivals. Likewise, both have sought to showcase their acquired capabilities in order to deter potential adversarial attacks. In the case of Iran, several tests have been executed to show how sophisticated these weapons have become, while Israel also tests its missile defense systems and states that they are able to deter any cruise missile attack. Both have a clear perception that they cannot lag behind, or risk losing power. As cruise missile proliferation has taken place, both states have competed in upgrading their technology, with Iran possibly seeking to pursue cruise missiles that would be able to carry weapons of mass destruction. Israel on the other hand, is seeking to develop a multi layered defense system capable of countering all these threats while also instituting new defense strategies through its use of air power. Lastly, in the last decade there has been a gradual increase in both the

quantity and improvements of cruise missiles and missile defenses, showing that a rapid increase in capabilities is something that both states have in common. Therefore, it is evident that the security environment within the Middle Eastern regional security complex has led Iran and Israel to engage in an offense-defense arms race due to the proliferation of these weapons.

Iran's Cruise Missile Capabilities

Currently, Iran has the largest and most diverse missile arsenal in the Middle East as it seeks to develop conventional and nonconventional missile capabilities. As ballistic missiles progressively improved in accuracy, cruise missiles were purchased due to their accurate targeting capabilities alongside their ability to evade sophisticated missile defenses. Since then, the proliferation of these missiles has allowed the regime to embrace cruise missiles as part of its strategy to advance their hegemonic ambitions and compete with Israel (Brookes, 2020). The missiles are produced by Iran's Aerospace Industries Organization (AIO), an entity to Iran's Ministry of Defense and Armed Forces Logistics (MODAFL), which are both sanctioned for their ballistic missile production (Taleblu, 2019).

As the Iranian missile threat increases, it is presumed that so will its conventional missile attacks. The goal of Iran's missile program is to deter any adversarial efforts to attack or invade the state. With Iran's cruise missile capabilities, there has been an evident shift from deterrence to warfighting as these missiles have become an integral part of Iran's security strategy for use in asymmetric warfare. Due to limiting open-source information, specifics vary on the amount of cruise missiles currently in Iran's arsenal. Most of the information on Iranian cruise missiles can be found on official Iranian sources, making the misinformation of the cruise missiles and their capabilities a possibility. As Iran continues to embrace cruise missiles as part of its power competition with Israel, it is also unclear how many cruise missiles are considered to be operational.

As previously discussed, Iran first purchased cruise missiles in the 1980s, after failed attempts to use ballistic missiles against Iraq led to devastating results in the War of the Cities (Pasandideh, 2019). At the time, Iraq was seen as an existential threat to the regime, forcing them to engage in an extensive cooperation with China in order to export Silkworm anti-ship cruise missiles (ASCMs). Reports claim that Iran purchased over 100 Chinese ASCMs in 1995, which

were then developed into Iranian variants (Hanna, 2020). As China exported Silkworm ASCMs, it also assisted Iran in developing its indigenous production capabilities by providing the regime with guidance systems and other technologies (Iran Watch, 2020). Still, Iran only began successfully developing its indigenous cruise missile program in the early 2000s. In 2004, Iran developed its first cruise missiles capable of targeting ships, foreign oil tankers, and more (Ibid, 2020). The Raad ASCMs were reengineered versions of the Silkworm, but were speculated to also have been converted into a land attack version. Iran's arsenal at the time mainly consisted of these anti-ship missiles and its Chinese variants, which were quickly transferred to proxies as part of the regime's asymmetric security strategy against Israel. Originally, Iran sought to use these missiles to attack ships across the Persian Gulf (Gormley, 2009). Since 2006, it became evident that Iran started to provide Hezbollah with these cruise missiles for use against Israel. Considered to be one of the most significant attacks against Israeli defenses during the war, the anti ship attack on the Israeli INS Hanit marked the transition into the organization's precision attack capabilities.

Iran's current cruise missile capabilities can also be traced back to Soviet era cruise missiles. In 2001, Iran purchased 12 KH-55 cruise missiles through the Ukrainian black market (Taleblu, 2019). The Soviet KH-55 was an air launched cruise missile capable of delivering both conventional and unconventional warheads. The KH-55 cruise missile ultimately granted Iran the opportunity to develop its own land-attack cruise missile, the Meshkat (Pasandideh, 2019). The Meshkat was described as an air, ground, and ship cruise missile with conventional payload capabilities, although its range and speed were undetermined. Since then, Iran has unveiled various land attack cruise missile models: the Soumar, Hoveizeh, Mobin, Ya Ali, and Quds-1 (Iran Watch, 2020).

Iran first unveiled the Soumar, another variant of the KH-55, in 2015. The unveiling revealed that the cruise missile had a range of 2,500 km and was equipped with advanced propulsion and navigation systems, showing that Iran's cruise missile capabilities were extending (Taleblu, 2019). The range of this missile expanded the threat radius of all missiles at the time, threatening a large part of the region. Iran also unveiled the Hoveizeh cruise missile, considered to be a variant of the Soumar. Alongside the Soumar's range, the Hoveizeh was reported to be 1,350 km, granting Iran the capability to strike targets across the Middle East, South Asia, and Europe (Pasandideh, 2019). The difference in ranges has led experts to believe that the regime's capabilities to develop precision strike weapons continue to improve at an alarming rate, indicating

that the regime had no intention of giving up its long range missile program and would keep using them to build up its deterrence. The weapons are suspected to be equipped with inertial navigation systems, and navigation satellite systems, such as the GPS, but it is unclear if they are being equipped with more advanced guidance systems (Ibid, 2019). It is also unclear what payload weight and capacity capabilities these cruise missiles have, although it is believed that both can carry nuclear warheads similar to its Soviet predecessor. According to Iranian sources, the weapons can fly at low altitudes with extreme accuracy, which makes them lethal weapons in the eyes of its adversaries (Segall, 2019). During both exhibitions, the IRGC issued direct threats against Israel in regards to its new capabilities stating that Israel would be obliterated if it continued to incite conflict in the region (Ibid, 2019). According to Iran's threat perceptions, Israel is trying to breach the balance of power in the region through the use of its defense strategies.

In August 2019, Iran introduced a new cruise missile followed by another in August 2020. According to Iranian sources, the Mobin has a range of 450 km and can carry a warhead up to 120 kg (Peck, 2019). The new missile, referred to as the Martyr Abu Mahdi, is described to be a naval LACM with a range of 1,000 km (Newdick, 2020). Both the Mobin and the Martyr Abu Mahdi are said to be variants of the Hoveizeh and are described to be a more flexible option for Iran than long-range ballistic missiles due to the close proximity of its Gulf adversaries. Other shorter-range cruise missiles include the Ya Ali, with a reported range of 700 km and the Quds-1, with an estimated range of 700- 1,350 km (Brookes, 2020). Analysts also believe the Quds-1 is a variant or a hybrid of the Ya Ali.

While the recent priority has been to mass produce land attack cruise missiles, Iranian anti ship missiles are also being developed with the strategic capability to threaten important waterways in the Middle East such as the Persian Gulf, the Strait of Hormuz and the Gulf of Oman (Rezaei, 2019). The Nasr is a short range ASCM with a range of 30 km that can be deployed on ships and fighter aircraft whereas the Jask-2 ASCM has a range of 35 km and can be launched from submarines (Brookes, 2020). It is not confirmed but is believed that the Jask-2 is an upgraded version of the Nasr and both derive from Chinese cruise missiles. The Jask-2 was displayed in 2019, when it was launched from a submarine during a naval exercise. The use of this missile mimics Israel's submarine launched cruise missile capabilities, which are also considered to be a major threat for Iranian officials. Iran has also developed a medium ranged ASCM known as the Noor. The Noor has the capability to be launched from a ship or from the ground and is estimated

to have a range of 120 km (Brookes, 2020). Alongside these short and medium range ASCMs, the development of long range ASCMs known as the Ghader and Ghadir, provide coastal defenses and have a range of 200 and 300 km, respectively (Ibid, 2020). While these weapons do not provide long-range strike capabilities like LACMs, they may have greater implications for the regional balance in the Middle East as they can be modified to strike land targets and can also be modified into land attack versions.

While Iran has simultaneously unveiled ballistic missiles as well, the continued introduction of newer and more sophisticated cruise missiles into its missile arsenal is evidence that the country is engaging in a proliferated arms race with Israel. President Hassan Rouhani recently stated that "cruise missiles are of special importance to us, we must mobilize all of our powers to build cruise missiles" (Hakamian, 2020). Therefore, as Iran continues to view Israel as a security threat, it fears losing power to the Jewish state, leading the Islamic regime to develop upgraded variants at a rapid pace for mass production. In regards to Hezbollah, the Iranian led precision project has granted the organization the capability to acquire precision weapons equipped with guidance systems for more accurate attacks against Israel (Israeli Defense Forces, 2019). If Hezbollah acquirex the capability to execute these attacks, critical infrastructure within Israeli cities are at threat of being attacked, including but not limited to airports, factories, centers, military facilities, power plants, and more.

Through the use of anti ship cruise missiles, Hezbollah's missile program has increased throughout the following years to include Russian-made versions. Although the exact size of its arsenal is withheld, there is evidence that shows Hezbollah's increased cruise missile capabilities has expanded due to Iran's production capabilities to indigenously manufacture precision-guided weapons such as cruise missiles (Samaan, 2017). Hezbollah's possession of cruise missiles not only portrays a threat to supplementing the Iran-Israel conflict, but has also extended to include other parts of the region that include waterways such as the Persian Gulf, Strait of Hormuz, and Gulf of Oman (Brookes, 2020). Since the precision project started, hidden facilities have been established throughout Syria and Lebanon in regards to arms production and transfers. These missile production facilities are managed by the IRGC, and include tunnels, bases, centers, ports, warehouses, and more. Recent reports concur that Iran's cruise missile production research facilities have also extended to include Lebanon, Syria, and Iraq (McKay, 2020). With Iran's recent use of the Houthi rebels in Yemen, there is also a great possibility that Iran is seeking to develop

production facilities in the failed state to grant the group cruise missile capabilities. The attack on Saudi Arabia's oil facilities showed that the Houthis already had access to Iranian made cruise missiles when they launched the Iranian Quds-1 cruise missile, heightening the threat to Israel's security and stability.

Israel's Cruise Missile Defense Capabilities

Israel is considered to be the dominant state focused on the development of cruise missile defenses in the Middle Eastern region. Threatened by potential cruise missile attacks from various locations, the Jewish state has sought to strengthen its defense doctrine. The root cause of Israel's emphasis on developing missile defense systems stems from the effect of missile proliferation between states in the 1970s (Samaan, 2015). The 1967 Six Day War and the 1973 Arab-Israeli war marked the advent of Israel's military supremacy in the region, which led states like Iran to develop their missile arsenals. Since then, Israel has faced existential threats, forcing the state to seek multi layered missile defenses capable of deterring all adversarial attacks. With the end of the Cold War, a new security architecture was introduced which saw the missile proliferation landscape evolve and left the state defending itself through the use of an anti missile defense network that consists of active missile defenses seeking to provide protection for the entire population (Jewish Virtual Library). Currently, Israel's existing missile defense infrastructure is still not adequately designed to counter and protect against the cruise missile threat, forcing Israel to develop more sophisticated advanced systems capable of destroying incoming cruise missile threats from Iran and its axis of resistance. The Arrow, Iron Dome, David's Sling, and Barak-8ER are some of the regional defenses that Israel has modified to develop a multi layered defense system capable of deterring cruise missiles.

The Arrow system

Prior to the Gulf war, Israel's military superiority drove the state to rely on a traditional offensive doctrine that enabled the launch of preemptive campaigns against adversaries in order to deter the use of ballistic missiles (Kattan, 2018). Threatened by the Iraqi ballistic missile threat, Israel sought to develop a defense-based strategy with the help of the US. During the war, the U.S

deployed Patriot missile defense systems to help defend Israel against the Iraqi threat. Unsatisfied with the effectiveness of the Patriot systems, Israel sought to develop its own defense systems, leading to the development of the Arrow system.

Considered to be a highly sophisticated system, the Arrow system works as an interceptor with a fragmentation warhead aimed at destroying incoming ballistic missiles during the midcourse phase of their flight (Kattan, 2018). The Arrow system first focused on specifically deterring threats produced by incoming short range and medium range ballistic missiles. As the Iraqi threat declined and Iran was introduced to Iran's evolving missile proliferation network, Israel introduced new versions. The Arrow-2 version was first introduced in 2000 with a design that allowed it to intercept short-and medium range ballistic missiles through a two-stage interceptor (Missile Defense Project, 2018). Israel quickly began developing a follow-up system in 2008, known as the Arrow-3.

This system was designed to intercept medium and long-range ballistic missiles that could be used to carry weapons of mass destruction (Samaan, 2015). The Arrow-3 is the only system that can defend against threats outside the atmosphere, which allows it to operate at a greater range and provide Israel with the upper tier in its multi-layer defense architecture (Missile Defense Project, 2018). While the Arrow-3 provides the longest range, Israel sought to upgrade the Arrow-2, in order to introduce new components that would allow the system to intercept incoming missiles at lower altitudes, such as a cruise missile attack (Gross, 2020). Testing continues to take place, although it is not known how effective this new defense will be since the Arrow missile defense constitutes as the highest level of Israel's multi-layered defenses. Many have discussed the possibility that the Arrow could be used alongside the Iron Dome missile defense system to counter future cruise missile threats.

The Iron Dome

The Iron Dome is the lowest layer of Israel's technologically innovative multi-tiered missile defense systems. With the emergence of nonstate actors like Hezbollah, this new threat introduced a second phase to Israel's missile defenses. The evolving threat environment not only introduced Iran's rising missile arsenal but ultimately led to Hezbollah's acquisition of short-range weapons. In the 1990s, both Iran and Hezbollah became a significant military threat to Israel due

to the strategic campaign mounted by Iran and its proxy against the Jewish state (Samaan, 2015). The use of rockets at the time ultimately sought to deter Israel's military superiority since Israel had no low tier defenses and was unable to use its offensive capabilities to target all of the rockets launched. With the advent of these weapons in the hands of Israel's most threatening adversaries, Israel needed a new defense posture which triggered the development of the Iron Dome missile defense system.

The Iron Dome sought to intercept short range rockets through the use of its detection and tracking radar, a missile firing unit, and a battle management control (Jewish Virtual Library). The system was considered to be nonoperational at the time of the 2006 war, even though developments continued to take place. Hezbollah's performance in the 2006 Lebanon War showcased a new sophisticated arsenal which included the use of guided missiles with extended ranges capable of reaching cities deep within Israeli territory (Samaan, 2015). Hezbollah's particular use of anti-ship cruise missiles against the INS Hanit proved that the group had increased its missile capabilities, forcing the Israeli government to accelerate their efforts to develop a missile defense program capable of shooting down these new adversarial threats. As Israel continued developments on the Iron Dome, Israeli experts and decision makers gained support for the development of an indigenous multilayered shield to counter these attacks.

The system was officially declared operational in 2011, with the capability to identify and destroy projectiles through the use of Tamir missiles interceptors (Raytheon, 2020). According to Israeli reports, these interceptors have allowed the system to intercept over 1,500 targets and receive a 90% interception rate, making it a system of choice when it comes to shielding against rocket offensives launched by Hezbollah (Missile Defense Project, 2018). But, several experts have questioned the system's overall effectiveness as the information cannot be fully verified (Kattan, 2018). This means that while the Iron Dome is 90 percent effective, it is incapable of covering the entire country, which poses a larger threat with precision guided cruise missile attacks.

In response to the evolving cruise missile threat, the Iron Dome has faced several modifications throughout the years that have led to the development of variants, such as the Tamir Adir system. The Israeli Navy successfully tested the Tamir Adir Missile Interceptor System in 2016, which is set to provide the Israeli defenses with a sea-based version of the Iron Dome (Raytheon, 2020). Information is limited regarding the Tamir Adir but reports state that it is

capable of accurately shooting down short-range missiles from a moving platform, helping protect strategic assets at sea (AFP & Wootliff, 2016). The system ultimately grants the Iron Dome the opportunity to become operational aboard warships, providing Israel with another operational layer to its multi-tiered defenses. As this version continues to be tested, Israeli authorities have not offered specific details on the improvements that have been made even though it has been reported that it is capable of engaging cruise missile targets (Trevithick, 2020).

David's Sling

In order to augment Israel's multilayered shield, a third phase of missile defenses was introduced. David's Sling was developed as a multipurpose system designed to counter all types of weapons ranging from short and medium-range ballistic missiles, rockets, to cruise missiles that could be fired from 40km-300km (Samaan, 2015). The David's Sling system has formed a crucial element in Israel's multi-layered missile defense architecture due to its ability to provide mid-tier missile defenses during a missile's terminal phase (Missile Defense Project, 2018). Neither the Arrow nor the Iron Dome are capable of defending against these types of missile threats, granting this system the opportunity to defend against current and future missile threats introduced by Iran and Hezbollah.

The system uses Stunner interceptor missiles designed for land, sea, and air that are capable of conducting all-weather operations in order to target incoming missiles during their terminal phase (Jewish Virtual Library). The Stunner is a multi-purpose, two-stage interceptor that uses sophisticated sensors, control systems, and multi mission radars for targeting and guidance (Raytheon, 2020). These interceptors provide the system with maneuverability, allowing the missile to change paths and retarget itself in order to destroy threats with complete force of impact.

David's Sling was initiated before the 2006 war but faced challenges that did not allow it to become operational until 2017 (Ibid, 2020). The system was first used in 2018 when two Syrian missiles entered Israeli airspace. Although the system was able to successfully launch its interceptors, it was unsuccessful in preventing the missiles from hitting Israeli territory. The system continues to face adjustments but questions have also been raised about this system's overall capabilities and whether it could really defend against cruise missile attacks. In theory, the system is thought to be able to defend against this threat, but it has never been tested in combat

and therefore its defense is not certain. As Israel prepares for a direct cruise missile attack by Iran or its proxies, it continues to boost David's Sling with the hope that it can become operational alongside the variants of the Arrow and the Iron Dome in order to successfully develop a cruise missile multi-layered shield.

Barak-8ER

The most recent system that Israel has sought to develop is the Barak-8ER. With the emerging cruise missile threat, Israel has sought to improve its Barak-8 air defense missile system in order to minimize gaps in its multilayered defense shield brought on by these weapons. The Barak-8 system provides vertical launch capabilities that support 360-degree coverage, quick reactions, and high maneuverability to be able to protect against cruise missiles (Egozi, 2019). Currently, the Barak-8ER version is being developed with an extended range, granting a 150km range, unlike Barak-8 which only offers 70km ranges (Ibid, 2019). This system protects against a variety of aerial platforms and weapons and can operate in weather conditions and in scenarios with simultaneous threats (Missile Defense Advocacy Alliance, 2019). This feature makes this system capable of not only operating against Iranian cruise missile threats, but also incoming rocket threats and other weapons. This system recently became operational and not much is known, but there is a possibility that this upgraded system could be deployed within the Israeli Navy aboard missile ships capable of protecting against anti-ship cruise missiles in the Persian Gulf and other waterways.

Overall, Israel continues to seek upgrades to its missile defense systems in order to successfully identify and deter all incoming cruise missile threats. With the Iranian attacks on Saudi Arabia's oil facilities, In order to do so, the state will have to strengthen all of its systems to make them capable of intercepting these weapons, which use small radar signatures and fly at low altitudes with high maneuverability, making them more difficult to defend against than rockets or drones. Although Israel has an advantage when it comes to its small airspace, its vital infrastructure is still vulnerable to these attacks. Therefore, in order to help combat the cruise missile threat, Israel has also chosen to launch an offensive campaign against Iran and its proxies through the use of its cruise missile arsenal and air defenses.

Israel's Cruise Missile Capabilities

Prior to Israel developing its missile defense systems, it developed its own cruise missile capabilities. Israel's strategy to maintain a qualitative military edge over its adversarial neighbors has led it to develop the region's most advanced missile capabilities. Similar to its nuclear capabilities, there is no detailed information about its missile inventory although reports state that the state has expanded its cruise missile arsenal to include various types of anti ship and land attack cruise missiles, similar to its adversary.

Israel's arsenal consists mostly of the Itald, the Msov, the Delilah, and Popeye cruise missiles. Due to limited information, there is no open source material on the Itald and Msov cruise missiles. According to open source records, Israel began development of the Popeye cruise missile in 1989, and has since modified it to become a versatile platform for multiple countries (Nuclear Threat Initiative, 2012). Since then, the Popeye has been upgraded to the Popeye Turbo, a submarine launched missile capable of carrying a nuclear warhead with an estimated range of 1,500 km (Missile Defense Project, 2019). Submarine launched Popeye turbos were tested alongside Israel's Dolphin-class submarines in 2000. In 2002, an air launched version was also tested, with a reported range of 200-350 km (Pike, 2020).

The Delilah cruise missile is an air, ship, and ground launched land attack cruise missile that was originally developed into a UAV designed to act as a decoy. Upgraded versions have led to variants with ranges between 200-250 km (Missile Defense Project, 2020). The Delilah's first use was in 2006, after Israel launched the weapon to prevent the transfer of weapons from Syria to Hezbollah. It is assumed that the launch of this weapon occurred as a way to deter Hezbollah from launching any more cruise missile attacks towards Israel, as it did with the INS Hanit. Since then, the Delilah has been highly classified within Israeli sources, allowing it to become a sophisticated weapon that can linger around a target before attacking. The Delilah was used again once in 2018 against Syrian and Iranian targets attempting to transfer weapons to Hezbollah.

Israel's Offensive Capabilities as a Means for Defense

As Israel seeks to develop its defense architecture to combat Iran's increased cruise missile arsenal, the Israeli Defense Forces (IDF) have also engaged in an offensive campaign against the Hezbollah-Iranian weapons trafficking network to protect against the funneling of cruise missiles

and other precision strike weapons. Due to the threat that the transfer of cruise missiles pose to Israel's security, the Israeli forces continue to engage in its War Between Wars, previously discussed in the second chapter. Unfortunately, the use of this strategy has increased the risk of confrontation within the Iran-Israel conflict in the past couple of months and has incited Iran to continue developing and employing countermeasures through the use of its proxies as a response to Israel's military strides. For the most part, Israel's air defense campaign is helping escalate the cruise missile proliferation threat.

As of today, Israel continues to prepare for a direct cruise missile attack by Iran. In order to prevent attacks like the one on Saudi's oil facilities, Israel has sought to upgrade its ability to identify these threats by unveiling a new multi-year plan to expand Israel's missile defense capacities and make the state more capable of defending against the threats imposed by Iran and its axis of resistance. The plan, titled Momentum, seeks to invest in developing Israel's arsenal and air defenses for the purpose of winning a future war as quickly as possible (Oren, 2019). To maintain its technological edge, Israel is seeking to include air defenses such as the F-35 radar fighter jet to identify and intercept airborne threats flying at low altitudes and high speeds (Frantzman, 2020).

Israel's F-35s have been operational since 2017, granting the state the opportunity to spot low flying cruise missiles. With the use of these aircrafts, Israel could also expand its precision strike capabilities through the use of air launched cruise missiles capable of engaging targets within heavily contested environments (Plopsky, 2018). The use of Israel's Delilah cruise missile, would offer a long range of 250 km and would be able to engage fixed, relocatable and moving targets (Brun & Shapira, 2020). The integration of a cruise missile and a fighter jet would ultimately help the state contest the recent threats being enforced by Iran, Hezbollah, Syria, Yemen, and Iraq, all while bolstering its defenses.

Under the Momentum plan, the IDF would seek to also obtain other precision guided missiles from the US, who is working alongside Israel to develop a cruise missile shield that will enable defenses to successfully shoot down these weapons (Oren, 2019). In 2019, President Donald Trump announced that the US would boost its missile defense systems by investing in technology to protect against the growing threat of cruise missiles (Watkins, 2019). With US help, the IDF could develop new missile defense capabilities to create a new strategy that effectively destroys adversarial cruise missile threats from all these states and nonstate actors.

So far, Iran has not directly fired any cruise missiles against Israel, but reports do indicate that the state continues to traffic missiles to aid Hezbollah for such an attack to happen in the future. The regime's Defense Ministry has also stated that it is working to expand its range of cruise missiles and is working on developing a laser air defense system (Gross, 2019). As the deep-rooted rivalry between Iran and Israel continues to take place, plans for arms modernization, acquisition, and war preparations will not stop.

On the Brink of Escalation

As Israel continues to gain military and technological superiority to increase its cruise missile defense capabilities, Iran and its axis of resistance continue to follow an offensive military doctrine that seeks to offset Israeli superiority in hopes of damaging the state's national infrastructure and military capabilities which would allow it to gain regional hegemony (Brun & Shapira, 2020). This doctrine grants Iran and its proxies offensive capabilities that seem to be similar to Israel's campaign due to its attacks on infrastructure and the launch of guided weapons from Syria towards Israel (Ibid, 2020). Recently, Israel has engaged in airstrikes against Iran and its proxies that have affected Iranian civilian and military facilities as well as missile production and nuclear complexes (Shepp, 2020). Experts believe that Israel is engaging in these attacks in order to delay the outbreak of war, by selectively disrupting Iran and its allies' force buildups to grant Israeli defenses time to successfully improve its own forces (Lappin, 2017). The problem with this strategy is that these attacks are posing a severe threat to the whole region since an increase in tensions could easily lead to a large-scale conflict and possible full-scale war. With Israel's airstrikes on nuclear complexes, the state seeks to develop a credible Israeli capacity to strike Iranian nuclear targets, leading the state to prepare for war in the event of further escalation with the Iranian-led coalition.

Although Israeli reports indicate that Iran's buildup has slowed, various reports state that the transfer of weapons continue to take place. Israel now believes that Iran will use Yemen to strengthen the supply chain to Lebanon and deploy precision strike missiles that can hit any target in the Middle East within 5 to 10 m (Shepp, 2020). According to Prime Minister Nethanyahu, Iran could use a combination of anti-ship and land-attack cruise missiles alongside drones to deploy precision strikes on various infrastructure in Israel (Ibid, 2020). Ultimately, the current dynamic

between Iran and Israel has demonstrated that both are preparing to retaliate militarily against one another, and are seeking to provoke a response from one another to engage in such retaliation. If such retaliation were to happen, the risk of nuclear armed missiles and highlight accurate missiles with conventional warheads could raise the stakes of war much higher.

Cruise Missiles and Weapons of Mass Destruction

Iran has powerful military incentives to deploy nuclear weapons, and Iran's missile forces give it the potential to do so. Although Israel has remained ambiguous about its possession of nuclear weapons, it is estimated that the state has a fully developed nuclear program with all sorts of missile capabilities. Iran is currently not a nuclear state, but estimates believe that the Islamic regime will be in a couple of years (Cordesman, 2014). With the current instability taking place within the Iran-Israel conflict, such actions remain possible, which could have universal ramifications to international security.

The reality is that this scenario has recently become a possibility due to the offense-defense arms race taking place between Iran and Israel and it's fueling cruise missile proliferation. Cruise missiles have the ability to be armed with nonconventional warheads, that can include nuclear, biological or chemical weapons. Iran's recent long range cruise missile capabilities have therefore given them opportunity to produce weapons of mass destruction. With the abundant proliferation pathways these weapons offer, it is likely that they could be used as WMDs in the future within developing countries in the Middle East and other regions of the world. In comparison to ballistic missiles, these weapons can provide a cheaper alternative for developing countries since they tend to cost four to ten times less than ballistic missiles, making them easier to acquire and maintain (Scheffran, 2007). Developing countries tend to use this to their advantage and see these weapons as an inexpensive means for coercing neighbors, deterring outside intervention and aggression, and for direct attacks (Kiziah, 2000). This is also the case with non-state actors, who have less capabilities to pursue missile and nuclear programs but have started to seek out these weapons.

Cruise missiles carrying nuclear payloads can have an explosive force ten to hundreds of times more powerful than the atomic bomb dropping on Hiroshima (Congressional Research Service, 2020). Iran's acquisition of the Russian Kh-55 land attack cruise missile in 2001 ultimately provided the regime with the opportunity to develop a weapon with that type of force

when it gained access to land attack cruise missile technology capable of specifically carrying nuclear warheads. As of now, it is not known whether Iran's nuclear program has successfully developed nuclear warheads, but the regime's proliferated interest in cruise missiles indicates that the proliferation of land-attack cruise missiles capable of delivering mass-destruction payloads is a possibility. This notion does not go disregarded by Israel who considers Iran's nuclear program to be an existential threat.

While the focus is placed on the cruise missile and its nuclear capabilities, cruise missiles are much better suited to deliver chemical and biological payloads. Due to the cruise missile's steady horizontal flight, the payload can be subtly released, permitting the spraying of chemical or biological agents directly towards targeted areas (Mahnken, 2005). Chemical and biological weapons have been attractive for many developing countries because they are much easier to produce than nuclear weapons. Syria's use of chemical weapons in the Syrian Civil War proved the effect these lethal weapons of terror can have against civilian populations. While Iran is a declared chemical weapons state, not much is known about Israel's weapons of mass destruction capabilities. Iran has stated that it can launch chemical payloads consisting of nerve and blister agents that include sulfur mustard, cyanide, and more (Congressional Research Service, 2020). Still, making these weapons highly lethal is a major challenge, which is probably why they have not been pursued as often.

Biological weapons are also considered to be a major challenge and can be even more lethal than nuclear and chemical weapons if launched from cruise missiles. Now that the world has seen the devastating repercussions that a virus can have on a global scale, the use of biological attacks could now become a greater possibility within conflict ridden regions, especially through the use of land-attack cruise missiles, due to their long ranges and ability to fly at low altitudes completely undetected. The development of these weapons alone could trigger massive preventive strikes, which could see counterstrikes with other lethal weapons such as nuclear weapons (Cordesman, 2014).

Due to cruise missile proliferation happening in the Middle East, it is possible that other states will successfully acquire cruise missile programs and seek to develop weapons of mass destruction. When these states are able to do this, they will pose major threats to civilian life in cities as well as to key military, government, petroleum, power, and water infrastructure (Cordesman, 2014). Israel is already discussing different strategies to deal with this threat focused

on deterrence, preemptive strikes, preventive attacks, and more. The risk of Israel attacking Iran would ultimately lead to a serious escalation in the conflict that would trigger a nuclear arms race. Likewise, Israel's nuclear and cruise missile capabilities also provide as much of an existential threat to Iran due to its ability to destroy Iranian cities and population centers. The risk of using weapons of mass destruction is therefore much higher with the cruise missile proliferation threat, as these weapons can be easily acquired and could provoke other powers to seek these capabilities as well.

As previously mentioned, Iran does not seem to be arming its missiles with weapons of mass destruction and no source has claimed that Iran is seeking to deploy these weapons anytime soon. But the fact that Iran would be capable of having these weapons in its arsenal as tensions escalate with Israel, and that it could give them to its proxies and allies, would be detrimental to Israel's security as well as global security. Likewise, if Iran does launch an attack of this scale, it is highly likely that Israel would react immediately and launch a retaliatory second strike, possibly leading to the obliteration of both states. As both states continue to engage in a cruise missile arms race, there is also the risk that it could lead the states to seek out the latest generation of cruise missiles.

The Hypersonic Threat

Hypersonic ballistic missiles have been around for decades, however recent technological developments have focused on cruise missiles, which are already known to be causing regional instability in the Middle East. The development of hypersonic cruise missiles has created a revolution in strategic capabilities within world powers such as the US, Russia, and China, which has developed into its own arms race. A hypersonic cruise missile follows a high-altitude trajectory to be able to reach its target. This missile is boosted to high speeds by a rocket motor, followed by the ignition of the scramjet engine, which allows the weapon to follow a high-altitude cruise trajectory to help the missile achieve speeds faster than Mach 5 (Wilkening, 2019). Unlike ballistic hypersonic missiles, cruise missiles spend most of their flight path within the upper atmosphere between 20 and 60 km flying higher than traditional cruise missiles (Ibid, 2019). Hypersonic cruise missiles also have superior maneuverability capabilities, which allows them to fly undetected,

similar to regular cruise missiles. The threat these weapons possess could further exacerbate the offense-defense arms taking place within Iran and Israel.

Currently, Russia and China are both seeking to develop nuclear capable hypersonic cruise missiles. Since both states have been known to provide Iran with its current cruise missile capabilities, the threat that these advanced cruise missiles could also make their way into Iran's growing arsenal is likely. The Director of the Missile Defense Agency in the US, assessed this risk to be extremely high, further stating that the hypersonic threat needs to be addressed expediently (Keck, 2019). Once Russia and China perfect their hypersonic capabilities, its technology will begin spreading, as it often has throughout history. The proliferation of these weapons is no match for current missile defenses, which will further stimulate an offense-defense competition as Israel would seek to counter the threat by enhancing its missile defenses and offensive strike capabilities. RAND Corporation's study on the proliferation of hypersonic weapons showed that these weapons would lead nations to adopt risk strategies, such as counterforce strikes (Speier, Nacouzi & Moore, 2017). Simultaneously, Israel could also seek to acquire hypersonic cruise missiles from the US, who is attempting to develop them for conventional purposes.

Therefore, the development of hypersonic cruise missiles could create a less stable strategic environment with the Iran-Israel offense-defense arms race that could incite other arms races within the region and around the world. Conflict escalation would be more difficult to control, especially if these weapons are developed with nuclear capabilities as they have an unpredictable flight path which could generate uncertainty about the weapon's intended target (Congressional Research Service, 2020). Some analysts argue that unintended escalation could occur due to the warhead ambiguity this weapon provides, and a state's inability to distinguish between conventional and nuclear armed hypersonic cruise missiles. Iran recently announced that it was close to obtaining hypersonic weapons, and that the production of these weapons would soon provide a new generation of missiles (Keck, 2019). Iran has already stated its intention to build anti-ship cruise missiles capable of traveling at supersonic speeds and has already completed construction on a hypersonic wind tunnels, which are considered to be a step forward in its ability to develop, test, and protect its hypersonic missile R&D (Speier et al., 2017). Likewise, Israel has also developed hypersonic wind tunnel facilities, but there is little evidence that it is actively engaging in the development of hypersonic research. This proves that the offense-defense arms race between both states is fueling the acquisition of more sophisticated technology and weaponry.

Introducing hypersonic weapon systems to developing states will not only impact the arms race between Iran and Israel, but will alter the global strategic landscape.

Conclusion

Kenneth P. Werrell (1985), once considered the cruise missile to be the weapon of the future whereas Dennis M. Gormley (2008) once stated that cruise missile proliferation would soon reach a tipping point; both were correct. All signs seem to be pointing towards continued cruise missile proliferation as the weapon becomes more effective and gains more capabilities, such as being able to carry weapons of mass destruction and its ability to be developed into a hypersonic weapon. Throughout history, the cruise missile has faced various limitations in relation to technology and its strategic utility, limiting its effectiveness and allowing it to remain unconstrained throughout the past couple of decades. With the changing strategic security environment, this weapon started to face a gradual sophistication in regards to its range, propulsion, guidance, navigation, and precision capabilities, leading to its proliferated use throughout warfare in conflict ridden regions. Since then, developing countries have started to seek ways to gain cruise missile capabilities, posing a challenge to nonproliferation regimes and to international security. While the cruise missile literature has focused on discussing the proliferation of this weapon through a technical and strategic context, this dissertation also focused on taking a regional perspective to discuss how regional security environments impact cruise missile proliferation.

Since there are no legal obstacles and no capable missile defenses, this weapon is mostly being used by countries where a security deficit is prevalent. Although it is currently unknown exactly how many countries are in possession of these weapons, many developing countries have already demonstrated either limited or sophisticated capabilities to produce the critical technologies. Additionally, the weapon has made it into the hands of nonstate actors, extending the weapon's proliferation within the region even more.

The Iran-Israel case study was chosen to analyze the effect the security environment between Iran and Israel has had on fueling cruise missile proliferation in the region. The primary hypothesis was that the Iran-Israel conflict fueled cruise missile proliferation to the point that it has incited an offense-defense arms race. By using the regional security complex model, it was

concluded that the security interdependencies between both states have allowed them to engage in patterns of amity and enmity that have altered their threat perceptions and ignited more power competition, allowing for conflict formation and the proliferation of cruise missiles. Furthermore, extended proliferation has also been evident within this conflict due to the introduction of these weapons to nonstate actors within the region, which also partake in the Iran-Israel conflict. In turn, this extended proliferation has intensified the Iran-Israel rivalry, recently leading to a faster paced arms race. Under this notion, the proliferation of cruise missiles cannot be considered in isolation from the geopolitics of the region.

As Iran continues to accelerate the development of its cruise missile arsenal and helps its proxies and allies develop their own capabilities, Israel will continue to produce more advanced missile defenses. As the conflict introduces more actors and escalates, there is no say as to what consequence this arms race will have for the region when considering the weapon's mass destruction capabilities. Currently, it is neither in Israel or Iran's best interest to engage in a full-scale conflict since both view each other as existential threats, but the proliferation of these cruise missile for use as a strategic weapon of choice continues to provoke further intensification and confrontation, fueling the arms race even more. Without a doubt, the proliferation of cruise missiles within this conflict is expected to expand in the coming years as both countries continue to engage in a rivalry and develop strategic goals to enhance their security, prestige, and regional influence. Furthermore, the proliferation of cruise missiles is expected to expand and engage other states in similar destabilizing arms races, magnified further by ongoing WMD proliferation and new emerging technologies. In the future, the international community should focus on slowing the proliferation of cruise missiles by strengthening existing nonproliferation measures in regards to these weapons and implementing new proliferation regulations that focus on the spread of these missiles, and not just strictly on ballistic.

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