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This project examines the applicability of MUM-T technologies to the nature and conduct of future warfare. The South China Sea served as the general operating environment template. A case study of the Battle of the Atlantic explored issues related to U-Boats' disadvantages in several domains and the technology competition that occurred throughout the Battle. Historical lessons inform concept development on expanded ideas surrounding Expeditionary Advanced Base establishment, specifically, employing a small detachment forward to limit enemy freedom of action, shape the battlespace and create opportunities for maneuver. An operational decision game was

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MASTER OF MILITARY STUDIES

TITLE:

FIGHTING AGAINST THE TIDE

THE GERMANS' BATTLE OF THE ATLANTIC AND
AN OPERATING CONCEPT FOR DISTRIBUTED DENIAL DETACHMENTS

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
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Executive Summary

Title: Fighting Against the Tide: The German Battle of the Atlantic and A Concept for Distributed Denial Detachments

Author: Major John Campbell, USMC, AY2016-2017

Thesis: Manned and unmanned teaming in a localized battle network can limit enemy freedom action and gain maneuver space and initiative for larger forces.

Discussion: The purpose of this project was to examine the applicability of MUM-T technologies to the nature and conduct of future warfare. The South China Sea served as the general template for the future operating environment. A case study of the Battle of the Atlantic from the German perspective explored issues related to U-Boats' disadvantages in several domains and the technology competition that occurred throughout the Battle. Concept development expanded ideas surrounding Expeditionary Advanced Base establishment, specifically, employing a small detachment forward to limit enemy freedom of action, shape the battlespace and create opportunities for maneuver. An operational decision game was utilized to test and refine the initial concept.

Conclusion: The broad scope of the study reinforced the importance of mass and objective when committing disadvantaged forces and highlighted the importance of a battle network which provides capabilities in multiple domains. The small nature of the conceptual detachment makes understanding the strategic purposes of employing a detachment just as important as the detachment's functional ability to complete its mission. MUM-T provides enabling capabilities without which the conceptual detachment would not be effective.

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Introduction

For more than five years, the German *unterseeboot* fleet attacked Allied shipping around the British Isles and throughout the Atlantic. These undersea boats (U-boats) were vilified and feared by the Allies for their surprise attacks and threat to Britain's supply lines. In reality, the U-Boat fleet fought as an outnumbered and outmatched force throughout most of the war.

Admiral Karl Doenitz, the Commander U-Boats, recognized many of the difficulties the Germans would face and developed doctrine and tactics during the interwar period. Despite solid tactics derived from solid theoretical foundation and experimentation, the German submarine force was not able to overcome the disparity in combat power and technological advances demonstrated by the Allies. Germany continued to pit increasingly disadvantaged U-boats against a strengthening Allied network of surface ships, aviation support and intelligence capability for strategic purpose. The U-boat force reduced the flow of supplies to Europe, but did not stop an eventual Allied triumph. The fundamental disadvantages faced by the U-boats and the catastrophic losses they endure begs the question, was it worth it?

This question is open for eternal debate, but the historical study of how the Germans employed their forces and the circumstances which eventually led to Allied domination of the Atlantic are relevant to today's military. The subsurface domain is becoming increasingly relevant because of the growth of unmanned systems and the ubiquity of sensors which cover the land and air. The United States' power projection capabilities are being increasing questioned because of the proliferation of networked capabilities which limit freedom of action, networks similar to the one that decided the Battle of the Atlantic.

This paper provides a basic definition of what a battle network is and identifies potential unmanned adversary capabilities that may contribute to the subsurface domain of a maritime battle network. The historical case study of the Battle of the Atlantic spans operational and tactical aspects and attempts to glean lessons from German experiences. Finally, this paper applies some of those lessons to expand on aspects of current operating concepts and envision how unmanned systems can benefit future operations.

Battle Networks

The concept of a battle network is important for understanding the potential employment of autonomous systems. Battle networks are presented throughout this paper; in the historical case study, operational decision game design, and operating concept. Networks are not always explicitly introduced as such, but the reader should keep the larger picture in mind when considering individual capabilities. John Stillion and Bryan Clark define a battle network as, "a combination of target acquisition sensors, target localization sensors, command and control elements, weapons, weapons platforms, and the electronic communications linking them together."[1] The linkages between the individual elements provide awareness and agency across multiple domains and, in a well-developed network, provide redundant or reinforcing capabilities.

[1] Bryan Clark and John Stillion, *What it Takes to Win: Succeeding in 21st Century Battle Network Competition*, (Center for Strategic and Budgetary Assessment, 2015), 1.

Manned and Unmanned Teaming: A Review of Chinese Surface and Subsurface Capability

The Marine Corps Operating Concept highlights the importance of automation in the future and lists three ways of exploiting automation:

- Refine the concept of manned-unmanned teaming (MUM-T) to integrate robotic autonomous systems (RAS) with manned platforms and Marines.
- Develop CONOPs that support and embrace RAS as a critical enabler.
- Develop unmanned reconnaissance and surveillance systems to investigate littoral environments and complex terrain features.[2]

Other countries recognize the importance of automation as well. China has a broad ranging and well-supported unmanned vehicle program and interest maritime unmanned systems has increased significantly in the last several years.[3] Unmanned underwater systems (UUV) comprise a large portion of China's unmanned vehicle program and were a specific starting point for this research paper.

Prototype Chinese UUVs exhibit both commercial and military applicability. The tradeoff between endurance and payload and the difficulty of underwater communication makes offensive military UUVs a challenging prospect. Long-endurance UUVs, like the glider type, move very slowly through the water and carry a minimal cargo suite. Gliders are intended for employment in large numbers across a wide area for ocean research; they can surface to receive or transmit data as required.[4] Larger UUVs, such as China's Semi-Autonomous Robotic Vehicle and Autonomous Robotic Vehicle, can be launched from torpedo tubes or mated to other naval

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[2] Headquarters US Marine Corps, *Marine Corps Operating Concept*, (Washington, DC: Headquarters US Marine Corps, September 2016), 16.

[3] Michael S. Chase et al., *Emerging Trend's in China's Development of Unmanned Systems*, RAND RR990, (rand.org: 2015), 3, http://www.rand.org/content/dam/rand/pubs/research_reports/RR900/RR990/RAND_RR990.pdf

[4] "Gliders propel themselves by changing buoyancy and using wings to produce forward motion." Daniel L. Rudnick et al. "Underwater Gliders for Ocean Research," *Marine Technology Society Journal 38* (Spring 2004), 1, http://pordlabs.ucsd.edu/rdavis/publications/MTS_Glider.pdf.

vessels in order to increase on-station time.[5] Many of the UUVs in use or under development are designed for scientific research or natural resource exploration.

Current hydrographic and geologic survey UUVs are easily adapted to military use. The Chinese Shipbuilding Corporation's proposed "Underwater Great Wall" is reminiscent of the Integrated Undersea Surveillance System.[6] The "Great Wall" concept consists of a network of static seafloor sensors supported by UUVs with the primary purpose of deterring and locating enemy submarines.[7]

The utility of UUVs for anti-submarine warfare (ASW) is the subject of current debate. The debate is centered around whether advances in technology (e.g. computing power, small sensors, etc.) will be sufficient to overcome the difficulties of the underwater domain in a manner which dramatically alters the utility of submarines.[8] Regardless of the ultimate effect, the development of UUV ASW capabilities will make undersea actions more difficult to conduct clandestinely.

China's vast unmanned aerial vehicle program includes maritime variants and exceeds UUV research, but a RAND study analyzing unmanned vehicle development trends did not find corresponding emphasis on unmanned surface vehicles.[9] Less information is available, but a few

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[5] Jeffery Lin and P.W. Singer, "The Great Underwater Wall of Robots: Chinese Exhibit Shows off Sea Drones,"*Eastern Arsenal* (Popular Science blogs), June 2016, http://www.popsci.com/great-underwater-wall-robots-chinese-exhibit-shows-off-sea-drones.
[6] The IUSS is the system employed in the Greenland-Iceland-UK gap during the cold war, consisting of the sound surveillance system and other assets, to detect Soviet submarines. Jane's C4ISR & Mission Systems: Maritime, "SOSUS/IUSS," *janes-ihs-com*, last modified February 1, 2017, https://janes-ihs-com.lomc.idm.oclc.org/Janes/Display/1505241.
[7] Lin and Singer, "The Great Underwater Wall."
[8] Andrew Tate, "Future Risk? Assessing the Unmanned Threat to Submarines," *Jane's Navy International*, ihs.com, may 12, 2016, 2.
[9] Chase et al, "Emerging Trends,"

USVs are in development, including a 13-meter trimaran interceptor, which is being marketed for export.[10]

It is evident from the research, development, and fielding of various unmanned maritime systems that these systems will be critical components of a Chinese naval battle network. The following historical review of the Battle of the Atlantic provides insight into potential methods of employment and technological competition involving unmanned systems.

[10] Ridzwan Rahmat, "DSA 2016: China unveils 13 m high-speed USV concept and targets Southeast Asian navies," *Jane's Defence Weekly*, ihs.com, April 18, 2016, 1.

Historical Review of the Battle of the Atlantic

The Battle of the Atlantic is the World War II campaign fought over use of the sea lines of communication between the Americas and Europe. The British required vast amounts of men and material to sustain their population and war-effort. The Germans recognized this vulnerability and attempted to interdict and isolate the British Isles throughout the war. The battle developed into a competition between German submarines (U-boats) and Allied anti-submarine warfare (ASW) forces. Allied advantages and improvements in intelligence, technology, tactics, and forces available steadily reduced the area where German forces had significant freedom of action. The German U-Boat Command employed multiple methodologies (e.g. innovative tactics, improved technology, operational maneuver, broad intelligence support, etc.) but were not able to overcome the combined effectiveness of the Allies' area denial efforts.

In a denied environment, military force must be applied against the right objective with enough initial concentration (i.e. mass) to achieve decisive effects. Failure to meet strategic goals in the opening stages sets up a competition in which the established force has a significant advantage. The Battle of the Atlantic highlights this at the operational and tactical levels.

The Battle of the Atlantic has area denial context at both the operational and tactical levels. From an operational perspective, the U-Boat Command's challenge was to determine where to employ U-boats to locate enemy shipping. British, and later American, forces continually expanded ASW efforts to cover as much of the shipping routes and U-boat transit lanes as possible. The Allied convoy system attempted to deny U-boats the ability to close with and engage merchant shipping at the tactical level. German forces had some significant initial capabilities, but the environment consistently became less permissive for U-boat action over time because of the nature of the tactical competition.

Discussion of German strategy begins with a historical overview of the battle broken into commonly accepted phases. This discussion is followed by an assessment of the strategic impact of the two most successful phases of the battle. Analysis of German efforts to solve the two problems of how to find convoys and how to attack them leads to a discussion of the German U-boat battle network and the technical challenges associated with executing U-boat tactics.

Overview of Historical Phases

The Battle of the Atlantic took place over a five-year period. Historical assessments generally break the period into seven or eight phases.[11] The phases are grouped around a general trend of results during each time period. These results are correlated to changes in technology, tactics, operational deployments and, in later research, intelligence capabilities. A general overview of the phases helps highlight the overall cycles of move and counter-move between Allied forces and the German U-Boat Command. The first phase lasted from the beginning of the war in September 1939 until June of 1940. The small number of U-boats available for Atlantic duty conducted independent cruises with limited communication between boats and/or shore. U-Boat Command was directed to employ its entire force in support of the invasion of Norway between March and May. A high percentage of defective torpedoes frustrated the Germans. The Allied convoy system developed slowly and most attacks were on individual

[11] The original 8 phases utilized by Hessler were updated by Rohwer to reflect correlation with newly released information on Allied (primarily British) intelligence capabilities. The time period of the phases remains consistent, with the exception of Rohwer's second phase ending two months later.

ships. Allied ability to locate U-boats through signals intelligence (SIGINT) and other technical means remained extremely limited. [12]

The second phase lasted from July 1940 and May of 1941. The German conquest of France allowed for the basing of U-boats along the French coast, shortening transit times to patrol areas. U-Boat Command began to control operations directly from ashore and employ wolfpacks (i.e. groups of U-boats) against convoys. Allied convoy efforts continued to develop slowly and escort proficiency was low. U-boats reached their maximum effectiveness during this period.[13]

The third phase went from May to December of 1941. The balance of advantage shifted towards the Allies. A breakthrough in reading German codes allowed for the routing of convoys around U-boat patrol areas at the same time resources and assets were released from the threat of a German invasion of Britain. ASW support to convoys increased and U-boats were forced to transit to more distant patrol areas. U-Boat Command shifted primary operational areas several times during this phase in an attempt to reliably find Allied traffic. Admiral Doenitz deployed U-boats to the mid- and north- Atlantic, the Strait of Gibraltar and off the West African coast to find vulnerable targets.[14]

American entry into the war ushered in the fourth phase of the Battle of the Atlantic. U-Boat Command shifted its main effort to the American coast and Caribbean. Limited American

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[12] Signals intelligence in this case encompasses both obtaining information through codebreaking and direction finding (COMINT and ELINT).

[13] Effectiveness or productivity defined by Admiral Doenitz as tonnage sunk per U-boat per day at sea. The post-war CNO report simplifies the calculation to tonnage sunk per boat at sea per month. Karl Doenitz, *Memoirs Ten Years and Twenty Days*, Trans. R.H. Stevens. (Annapolis: Naval Institute Press, 1958); Charles Sternhell and Alan Thorndike, *Antisubmarine Warfare in World War II*, Operations Evaluation Group Report No. 51 (Washington, DC: Office of the CNO, 1946), 14, available at http://www.ibiblio.org/hyperwar/USN/rep/ASW-51/

[14] Jurgen Rohwer, afterword to Doenitz, *Memoirs*, 493.

coastal defense measures, no convoy system and unprepared merchant shipping allowed a relatively small number of U-boats to achieve significant successes. This phase came to an end as convoying was implemented along the American coast and U-Boat Command shifted primary operations back to the North Atlantic. Results achieved near American waters produced the highest rate of tonnage sunk per month (overall, not adjusted for U-boats in action) throughout the war.[15]

The decisive phase five, running from July 1942 through May 1943, saw increased numbers of U-boats and Allied ASW assets (escorts and aircraft) coming into the battle. Many pre-war development projects began to be fielded and effectively utilized, especially on the Allied side. The influence of technical innovations and tactics development continued to curtail U-boat freedom of action, even as more boats were available to operate together. Increasing numbers of escort ships and aircraft swung the tide from German success in March 1943 (110 ships sunk in the North Atlantic) to the greatest number of U-boats sunk at sea in May (41). Admiral Doenitz refers in his memoirs to this period as "The Collapse of the U-Boat War."[16] During an intermediate phase of two months, U-Boat Command attempted to find operational areas with weak ASW defenses.[17]

Phase seven, from September 1943 to May 1944, saw the Germans attempting to regain freedom of action though fielding of additional technology. Allied ASW proficiency and intelligence support rendered any German advances irrelevant. From this point onward, U-Boat Command sunk less ships than it lost U-Boats. The final phase commenced with the loss of German bases in France and continued until German forces surrendered in May 1945. Most

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[15] Ibid.
[16] Doenitz, 315.
[17] Gunter Hessler, *The U-Boat War in the Atlantic 1939*-1945, vol. I-III (London: Her Majesty's Stationery Office, 1989); Jurgen Rohwer, afterword to Doenitz, *Memoirs,* 494.

Allied capabilities were known, but the new U-boats designed to counter those capabilities were not available in any meaningful numbers.[18]

Strategy and Results

The man responsible for Germany's U-Boat strategy and employment throughout the War was Grand Admiral Karl Doenitz. A veteran of submarines in World War I, then-Captain Doenitz was assigned as commander of the Weddigen U-boat Flotilla in 1935. This flotilla constituted the rebirth of the German submarine arm. Doenitz foresaw the coming war with Britain and focused on planning an anti-commerce strategy after extrapolating U-boat results from World War I. He estimated a large fleet (approximately 300 U-boats) would be necessary at the outset of hostilities in order to sink British merchant shipping at a rate sufficient to bring a war to a successful close.[19] Lingering treaty restrictions and different priorities at German Naval Command precluded building up the U-boat fleet strength to anything close to Doenitz's proposals before the war began. Clay Blair makes the argument that a building program which supported Doenitz's 300 boat fleet would have offset any advantage by triggering British and US counter reactions.[20] Whether or not such a large pre-war fleet was realistic, it was not built. U-Boat Command entered World War II with 56 operational U-boats and declined to a nadir of 22 operational boats in February 1941, before wartime construction began to show results.[21]

German U-Boat Command remained committed to targeting Allied shipping throughout the war. While this focus remained constant, the strategic purpose shifted over the course of the conflict. Initially, U-Boat Command hoped to strangle Britain and force an early negotiated end

[18] Rohwer in *Memoirs*, 494.
[19] Clay Blair, *Hitler's U-Boat War: The Hunters 1939-194,* (New York: Modern Library, 1996), 39; Doenitz, *Memoirs*, 43.
[20] Blair, *The Hunters,* 100.
[21] Doenitz, *Memoirs,* 47.

to war in the west. Likelihood of this occurring faded with Britain's victory in the Battle of Britain and the US entry into the war. The anti-shipping focus continued, but the strategic purpose shifted to delaying the buildup for an Allied invasion of France. In the last year of the war, with Allied forces pushing on Germany from both sides, U-Boat Command continued to harass shipping to tie up Allied resources in convoy protection and ASW efforts.

The two most effective phases

U-Boat Command achieved significant success in two periods of the Battle of the Atlantic. U-boats operated with their highest level of productivity during the second phase, from July 1940 and May 1941. U-Boat Command had just enough boats available to begin utilizing wolfpack tactics and the British convoy system provided limited defensive capability. U-boats were able to gain contact and execute night attacks against convoys, exploiting their low silhouettes and maneuverability on the surface. Escorts struggled to find U-boats during attacks and deter follow-on actions; U-boats frequently evaded escorts by submerging and re-engaged the convoy after a short delay.

Another significant factor in German success during this phase was the experience level of the U-boat commanders and crews. Many of the boats had crews with pre-war training and gained experience against independent shipping during the first several months of the war. The loss of several highly successful boats in the spring of 1941 depleted the experience pool as the rate of U-boats being commissioned increased and Allied capability increased. The effectiveness of German training for new boats during the war could not maintain the pre-war level of proficiency.[22]

[22] David Westwood, "Training the U-Boat Crews: The Effect of the War," *Uboat.net*, accessed April 12, 2017, http://www.uboat.net/men/training/effect_of_war.htm.

The other successful phase, the fourth, coincided with the opening of the American side of the Atlantic for operations. After seeing successes decline in the summer of 1941 U-Boat Command repeatedly shifted operational areas attempting to find vulnerable areas. American entry into the war provided a prime opportunity for U-boats to attack with a local advantage. U-boats making the long transit to the American side of the ocean in early 1942 were rewarded with the opportunity to easily find and attack many individual ships. This period saw the highest rate of tonnage sunk, but productivity per U-boat was nowhere near the high of the early wolfpack days.

Strategic effects

German success during the second and fourth phases of the battle did not have significant strategic effect on the war. The highly productive U-boats of the early wolfpacks simply lacked the numbers to put a real dent in the British supply situation. The fact U-boats also attacked empty, westbound shipping also limited the effects. U-boats made less impact in the North Atlantic during major operations off the American coast. Despite an increased overall number of ships sunk during this phase, fully loaded ships continued to pull into British ports.

The Germans exploited each window of opportunity, but did not have the mass necessary to achieve a decisive effect in either case. U-Boat Command averaged less than 20 boats at sea until June of 1941.[23] Impact of the force at sea was affected by missions directed by German Naval Command or directly from Hitler. The forays to Norway, a standing requirement to maintain boats in the Mediterranean and unexpected missions like support to the crippled Bismarck continuously diluted U-Boat Command's ability to apply pressure against its preferred

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[23] "Combat Strength," *Uboat.net,* accessed January 21 2017, http://www.uboat.net/ops/combat_strength.html.

operational areas. Retrospectively, it seems highly unlikely Germany could have ever won a tonnage war because of American productive capacity.

A significantly larger U-boat force early in the war could have interdicted material reaching Britain enough to influence the Battle of Britain (July – October 1940) and chances for a negotiated settlement in the west, but this is improbable. Even when the Germans employed large numbers of submarines and had significant success, destruction of material, which would influence British resistance, constituted only a portion of the success. For example, in March 1943 the Germans sank 110 ships. Only 47 were loaded ships bound to Britain along the convoy "lifeline." The four most heavily hit convoys lost 39 ships out of 248; 209 loaded ships (85%) still made port.[24]

The Two Main Problems

Pre-war actions were driven by the identification of shipping as the primary U-boat mission. The Weddigen flotilla served as the development crucible for U-boat tactics and operational doctrine during the late interwar period. Submarines of the era operated primarily on the surface, utilizing their diesel engines as primary propulsion. Top speed was greatly reduced by submerging, with battery and air supply limiting underwater endurance. Sonar capabilities, as they exist now, were in primordial stages of development and were the subject of misinformation, speculation and overestimation.[25] The limitations imposed on a submarine's offensive capabilities by submerging precluded strategic success (i.e. winning a tonnage war) using submerged attacks as a primary method. Capt Doenitz started with the idea of the U-boat primarily as a torpedo carrier executing surface attacks and identified two main problems.

[24] Blair, *The Hunters*, 249-267, 768.
[25] Doenitz, *Memoirs,* 12.

The crux of both problems was how to locate and attack targets. U-boats possessed limited ability to conduct reconnaissance (with regard to finding ships on the open ocean). Therefore, U-boats should be employed in conjunction with support from different branches, primarily aircraft and intelligence. Second, British shipping could be expected to implement a convoy system shortly after hostilities commenced. Therefore, "a massed target [ships in convoy], then, should be engaged by massed U-boats."[26] These two problems framed the initial training and exercises for the Weddigen flotilla. They also continued to shape the operational and tactical employment of U-boats throughout the war. The changing employment of U-boats was hampered by failure of effective coordination between maritime and aviation elements; improved submarine tactics could not make up that deficit.

Pre-war exercises gave Donitz three groups of individual questions to further address the two main problems.[27] The first group, "exercise of control," focused on how much direction should come from higher headquarters and where that higher headquarters should be located (ashore or afloat). The second group involved aspects of communication. Technical details like wavelength and transmission capabilities and procedural details such as reporting windows related directly to how higher headquarters could exercise control. The third, and most novel group, was the tactical problems. Doenitz's small fleet continuously tested and refined his plan for employing U-boats in massed attacks. These three groups of questions are still relevant to tactical units and battle networks today. Tactical surprise is fleeting; the Germans had an edge at the beginning of the war, but time allowed the Allies to adapt their tactics and methods to counter that edge.

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[26] Doenitz, *Memoirs,* 14.
[27] Doenitz, *Memoirs,* 20.

Problem 1: Reconnaissance, or How to locate Convoys

To answer his first problem, Doenitz envisioned a battle network of intelligence, aircraft reconnaissance and submarine patrols to locate convoys. He incorporated intelligence into the battle network, but was not able to do the same with aircraft. The broad, intermittent nature of intelligence information missed a critical link to the local, visual area covered by U-boats. Aircraft provided this link for the Allies, but not for the Germans. Failure of the overall network to function in concert had deleterious effects on the U-boat campaign.

Pre-war doctrine development provided a foundation for U-boats to maximize their portion of the reconnaissance fight. *Rudeltaktik*, or “pack” (wolfpack) tactics, placed U-Boats in long patrol lines astride probable convoy routes. Small numbers of operational boats limited the employment of packs early in the war. Intelligence was garnered from Germany’s codebreaking unit, *B-Dienst*, and sources such as newspapers and informants in foreign ports. This intelligence produced estimates of convoy routes to position the U-boat patrol lines. Broad intelligence analysis was limited by lack of institutional support; U-Boat Command’s small staff did much of its own analysis.[28] However limited, information from *B-Dienst* played a large role in Donitz’s direction of the U-boat campaign. The problem may be reversed in today’s environment. The amount of information available taxes a commander’s ability to see the important pieces and identify critical points for action.

Luftwaffe support to the U-boat fight was limited. Aircraft enjoyed reasonable success against shipping in the second half of 1940, but this waned as Allied defenses improved. The eventual creation of *Fliegerfurher Atlantik* (Flight Command Atlantic) did little to affect the under-resourced naval aviation. The flight command worked with U-Boat Command, but even

[28] Jak Showell, *U-Boat Command and The Battle of the Atlantic,* (London: Conway Maritime Press, 1989), 110.

when sufficient aircraft were allotted to conduct reconnaissance patrols they added little value. Position reports from aircraft were often inaccurate and lack of persistent contact limited aircraft ability to accurately determine a convoy's course. Conversely, U-Boat navigation errors and weaker homing signals limited their ability to guide bombers to convoys.[29] Westward-shifting operations in the latter half of 1941 put U-Boats beyond the range of aircraft support.

The Germans made another concerted attempt to integrate air with submarine operations in late 1943. Airborne radar increased aircraft ability to locate ships, but since U-boat speed was impacted by increasing necessity to submerge in transit, the time-in-contact provided by limited numbers of aircraft was insufficient. U-Boat Command recognized that Allied air forces denied the surface domain to U-Boats on an operational level. U-Boat Command continued to advocate for additional air support with hope of challenging this dominance. According to Doenitz, "In the future, therefore, pack attacks by existing and projected types of U-boat could only be carried out with any prospect of success if continuous air reconnaissance were available to direct them to the objective."[30]

Fluctuating availability of intelligence and shifting the operational focus of scarce U-boats reduced the efficacy of these two portions of the U-boat battle network. The Germans also missed several opportunities to identify capability mismatches because of these fluctuations. Newer historical analyses credit Allied advantages in the electromagnetic and intelligence domain for much of their victory in the Battle of the Atlantic.[31] Adequate integration of aircraft would have provided a key clue to the Allies ability to route convoys around U-boat patrols

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[29] Showell, *U-Boat Command,* 51; E.R. Hooton. *The Luftwaffe: A Study in Air Power, 1933-1945*., (Classic Publications), London. 2010. 112 cited in https://en.wikipedia.org/wiki/Fliegerf%C3%BChrer_Atlantik#cite_note-Hooton_p112-37

[30] Karl Doenitz, "Survey of U-Boat Operations," *War Diary Flag Officer U-Boats* (February 29 1944), quoted in Hessler, *The U-Boat War*, Vol III, 41.

[31] Rohwer, afterword to Doenitz, *Memoirs*, 508.

based on intelligence intercepts and High Frequency Radio Direction Finding (HF/DF). Sufficient boats to sustain operations in the North Atlantic simultaneously with operations off the American coast might have provided additional indications of Allied codebreaking success.[32] The constantly shifting baseline of German operations masked changes in the Allied capabilities. Absence of evidence as an indicator makes causality especially difficult to determine. A reconnaissance unit that observes no enemy activity could have identified an enemy gap, or the enemy may have altered his scheme of maneuver because he knows the reconnaissance element is there.

Doenitz's attempt to exercise control of this network facilitated Allied advantages in codebreaking and radio direction finding. Early wolfpack employment demonstrated the difficulty of controlling a pack from a boat at sea. U-Boat Command's view of the operational picture ashore was better than could be achieved afloat. Direct control from U-Boat Command ashore became the standard operating procedure. Boats were repositioned based on updated intelligence, contact reports and intuition. A U-boat making contact with a convoy would report its position and attempt to track the convoy while U-Boat Command vectored other boats in the pack in. The Germans had few initial concerns about radio direction finding because they incorrectly deemed high frequency direction finding to provide broad and inaccurate location information. Late in the war submarines often maintained radio silence throughout a patrol decreasing both susceptibility to detection and information available to U-Boat Command.[33]

Communications from boats at sea revealed general U-boat locations and the amount of information passed in after action reports provided significant material for British decoders to

[32] Showell, *U-Boat Command*, 84.
[33] Hessler, *The U-Boat War*, vol III, 93.

work on.[34] The Germans later suspected some Allied direction finding capability and implemented additional communication policy restrictions, but accomplished little actual reduction in radio traffic.[35] U-Boat Command did not suspect or adjust for escorts' ability to utilize HF/DF equipment at the tactical level; this also spoiled many German attempts to locate and close with convoys.

Germans believed their Enigma-encoded message traffic was unbreakable. The system proved to be extremely difficult for the Allies to defeat, especially the later four rotor naval version. Difficulties aside, Allied codebreakers were able to decipher some naval message traffic initially in 1941. The introduction of the four-rotor naval Enigma in February 1942 put an end to regular decryption until it was successfully broken in December of that year.

Difficulty finding convoys led to concern. Doenitz remarked, "coincidence always seems to favor the enemy."[36] He became obsessive about possible compromises of information and severely limited to U-boat information, but Enigma was deemed secure by the Naval War Staff. The ability to determine U-boat deployments and disposition through decoded communications and radio direction finding thwarted numerous German submarine patrols. Admiral Doenitz's exercise of control weakened U-boat chances of finding Allied convoys rather than improving them.

U-Boat Command reliably positioned submarines to find shipping at a few intervals. These intervals corresponded with early Allied weaknesses in area denial and lapses in intelligence during the second, fourth and early fifth phases of the battle. Small numbers of available U-boats limited strategic impacts during the second and fourth phases. More U-boats

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[34] Sternhell and Thorndike, *Antisubmarine Warfare*, 13.
[35] Showell, *U-Boat Command*, 67.
[36] Karl Doenitz quoted in Showell, *U-Boat Command,* 86.

helped to find targets during the fifth phase, but strong convoy defenses exacted higher costs for attacks. Vulnerabilities inherent in the German exercise of control were exacerbated by failure to establish a responsive and effective aviation link between intelligence, operational intuition and the local reconnaissance abilities of the U-boats themselves. Lack of a cohesive multi-domain battle network stopped successful U-boat actions as Allied presence and control over convoy routes increased.

Problem 2: How to attack

Admiral Doenitz addressed his second problem, how to attack massed targets, primarily during the interwar period. Initially effective German tactics were degraded by improving Allied tactical responses and the cycle of technological development throughout the war heavily favored the Allies. Resulting tactical changes to improve U-boat survivability lessened effectiveness. Major German technical innovations came too late in the war to bring about a substantial shift in the balance.

The U-boat fleet entered World War II well-trained for the expected convoy battles. Tactical development initiated by the Weddigen flotilla produced commanders and crews well versed in the submarine procedures and different skills for attacks. Night surface attacks were preferred for speed and maneuverability; the submarine’s low profile was difficult to detect at night. Daytime attacks required U-boats to gain positions ahead of a convoy and wait submerged for targets to move into range. Periscope usage, consideration of wind and wave direction, and illumination all factored into U-boat attempts to attack.

The *Rudeltaktik* combined these procedures and skills with the actions of other boats to maximize effects against convoys. The initial U-boat in contact would signal the others in the patrol line and vector them towards the convoy to execute joint attacks. This early form of "swarm" tactic envisioned mitigating convoy defenses through simultaneous actions at multiple points. The wolfpacks attempted to maintain contact with a convoy over a period of several days in order to maximize the number of attack opportunities and vector additional U-boats in on the target.

The U-boat fleet's small size at the beginning of the war restricted employment of wolfpacks. Only two attempts, in October and November of 1939, were planned. In each case only three U-boats made it to the patrol areas for various reasons. The U-boats on station showed some success against weakly guarded convoys, but torpedo failures and the small number of boats limited the results. Pack operations were not attempted again until June 1940.

Resumption of wolfpack employment marked the beginning of the second phase of the Battle of the Atlantic. German submarine availability was still greatly limited, but establishment of bases on the French coast and the end of diversions to Norway allowed effort to be focused in the Atlantic. The high rate of success per boat validated Doenitz's confidence in his pre-war judgment, "The operations justify the principles on which U-boat tactics and training have been developed since 1935, *i.e.* that U-boats *in packs* should attack the convoys…The execution of such attacks is possible only if the commanders and crews have been thoroughly trained in these tactics."[37]

While Admiral Doenitz's confidence in his submarines' tactics was well placed, the high productivity and limited losses stemmed from weak Allied defenses more than a permanent advantage. Wolfpack tactics maximized U-boats strengths and limited disadvantages through joint action; little refinement was possible with the existing submarines. The performance gap

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[37] Karl Doenitz, *War Diary Flag Officer U-Boats* (October 20 1940), quoted in Hessler, *The U-Boat War*, vol I, 52

between attacker and defender could only narrow with U-boats already operating near their tactical and technological ceilings.

Pack success was tied to U-boat ability to leverage their speed and low profile for surface attacks. Increasing proficiency of Allied escorts and the extension of air coverage forced U-boats to submerge more frequently and limited the ability to inflict damage. Allied advantages in the technological competition reinforced improving escort proficiency and began to prevent U-boats from being able to attack in accordance with their tactics. A fundamental adjustment of tactics depended on a fundamentally different type of submarine, a submarine which was not available until the very end of the war. Hope for development and fielding of a game-changing technology inside the span of a conflict is foolhardy. The rapidity of modern conflict suggests the need for new technology to be farther along the development process before a conflict starts.

Technology Competition

The technological competition during the Battle of the Atlantic was primarily of a hide and seek nature. A U-boat's utilization of the undersea domain to hide or escape once detected on the surface provided a good deal of protection, but shifted the U-boats role from attacker to defender. British developments focused on increasing the ability to find surfaced U-boats and improved weaponry for targeting submerged ones. The Germans fielded new technical assets to increase survivability, but struggled to counter Allied technology in a manner which allowed U-boats to operate effectively. The competition cycle influenced both the ability to locate and attack shipping.

The first important technical issue however, was a one-sided affair. Torpedo malfunctions dogged U-Boat Command for the first two years of the war. A plethora of mechanisms in the torpedoes stymied otherwise successful attacks. Faulty firing mechanisms of both contact and magnetic type rendered hits on ships impotent as torpedoes failed to explode. An insidious leak in the depth keeping mechanism defied identification and contributed to numerous misses. U-Boat Command fought with the Torpedo Trials Department and ultimately the defects were attributed to extremely poor testing and evaluation prior to the war. Defective torpedoes substantially reduced the performance of the already small number of U-boats available.

As the Germans worked to ensure successful attacks resulted in sunken ships, the Allies worked on various methods to find U-boats and keep them away from valuable convoys. High-frequency radio direction finding has already been mentioned with regard to operational deployment of U-boats, but it was employed at the tactical level as well. U-boats utilized HF radio to communicate during pack attacks, not only with U-Boat Command, but with other boats in the pack. Rapid improvement of HF/DF technology enabled mass production and installation on escort ships by 1942. HF/DF provided transmission bearings beyond the range of radar detection and allowed escorts to maneuver towards U-boats before they came in range of a convoy.

The Germans did not recognize the Allied tactical ability to home in on their radio signals. The system of encoding messages in a shorthand system limited transmission time and belied detection. Communications technology research conducted to counter direction finding was not an emphasized priority for U-Boat Command until late in the war. *Kurier*, a burst-type HF transmission technology was tested in late 1944 but never fielded. Avoiding direction finding and message interception improved German ability to position submarines along convoy routes more consistently, but other Allied capabilities still limited freedom of action during attacks.

Improving radar technology exposed U-boats to unknown detection at several intervals during the battle. Similar to direction finding, radar did not provide an initial warning of vulnerability; higher rates of loss and sudden appearance of aircraft and escorts at U-boat positions provided clues to the two detection technologies. Germans were aware of radar development and eventually exploited a downed British aircraft to identify its capabilities. U-boats were fitted with crude radar warning receivers. Warning receivers allowed submarines to detect the presence of a radar system and submerge to avoid detection. This improved U-boat survivability, but forced them underwater where they could not easily locate, identify or close with enemy shipping.

Three cycles of Allied radar improvement each created a window of significant mismatch. Due to differences in wavelengths, German receivers could not detect new, and more accurate, radar sets; U-boats were once again exposed to sudden appearances and attacks by aircraft and escorts. The Tunis X-Band search receiver, fielded in 1944, detected the third iteration of British radar development and signaled the culmination of the radar-search receiver competition.[38] Bryan Clark and John Stillion suppose the Allies were "saved by the bell" (the end of the war) because of the end of competition cycles in the electromagnetic (radio & radar) domain and the introduction of the snorkel. Neither the electronic advances nor the snorkel, however, allowed U-boats to attack targets more effectively. U-boats were still forced to submerge to avoid detection and prosecution.

[38] Clark and Stillion, *What it Takes to Win,"* 19-21.

The snorkel, or *shnorchel,* allowed U-boats to run their diesel engines while submerged, but did not aid the submarines directly in the attack. The submarines generally used the snorkel for 3-4 hours a night to recharge batteries. This reduced, but did not eliminate, detection by radar. The reduction in overall speed and visual detection radius made it even harder to find targets while operating submerged for extended periods of time.

The three previous technological developments all focused on protection. Each countered an Allied capability and made U-boats more survivable. The defensive response of submerging also countered the premise on which U-boat tactics were based. U-boat training and strategic employment was based on a high-speed, torpedo-carrying platform operating primarily on the surface. None of these protective technologies facilitated changing that premise.

The Germans attempted to maintain and alter their tactical premise with other equipment. Additional anti-aircraft (AA) armament and acoustic (homing) torpedoes aimed at providing the U-boats the ability to remain on the offense in a contested domain. The development of a high underwater speed submarine looked to change the entire basis of how U-boats attacked.

AA armament gave U-boats an option besides diving to avoid aircraft contacts. This occurred frequently in the Bay of Biscay as boats were transiting to and from their operational areas. Several boats were converted into “flak boats” or “aircraft traps.”[39] This idea was abandoned due to poor results and improved AA armament on all U-boats.[40] Despite a few successful engagements of aircraft, fighting on the surface still exposed a U-boat’s position and the exchange rate in manpower and material between submarine and aircraft was highly unfavorable.

[39] Doenitz, *Memoirs,* 269.
[40] Hessler, *The U-Boat War,* vol III

The T5 acoustic torpedo (*Zaunkonig)* gave the U-boats a weapon to employ against escorts. In theory, the homing torpedo let U-boats engage escorts and avoid being driven out of contact with a convoy. The initial batch of these torpedoes was delivered in August 1943. The sound principle behind this weapon did not lead to particular success. Gunter Hessler describes the procedural factors which led to overconfidence in the new torpedo in his *U Boat War in the Atlantic*.[41] Initial direction called for U-boats to crash dive immediately upon firing; relying solely on hydrophones left serious room for error in battle damage assessment. Allies countered the T5 by developing an acoustic decoy called Foxer. The T5 provided the U-boats a defensive weapon which improved their odds against individual escorts, but the weight and depth of the Allied convoy defenses in the second half of the war were too substantial to reshape the contest.

The German's bid to alter the shape of the Battle of the Atlantic did not materialize in time. The first and only Type XXI U-boat to conduct an operational patrol put to sea in April 1945. The development of the Type XXI, with vast submerged range and a top underwater speed of 16 knots, can be traced to the interwar period. The resulting submarine did not employ the hydrogen-peroxide turbine engines its designer initially envisioned, but it was a boat made for living under the water. Submerged attacks were the primary tactic of Type XXI U-boats.

Type XXI deployment would not have altered the outcome of the Battle of the Atlantic. Allied ASW networks were too strong to allow a dramatic swing of results, even if the boats were deployed two years earlier. Underwater cruising or snorkeling speeds were not fast enough to maintain contact with a convoy. Operating at high underwater speed to evade escorts after an initial attack would drain the U-boat's batteries rapidly and reduce the chances of executing follow-on attacks. The ensuing contest would be more even, but shorter.

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[41] Hessler, *The U-Boat War,* vol III, 23-27.

The technological competition during the Battle of the Atlantic was clearly won by the Allies. To quote JFC Fuller, "every improvement in weapon power has aimed at a lessening the danger on one side by increasing it on the other. Therefore every improvement in weapons has eventually been met by a counter-improvement which has rendered the improvement obsolete."[42] A similar theme holds true for improvements in concealment and detection and this theme is just as applicable today as it was during World War II. The mental ability to determine critical aspects and industrial capacity and intellectual capital is just as important as the capacity and capital themselves.

Results of the technical competition

Clark and Stillion discuss the importance of metrics in their paper on battle networks.[43] They correctly identify the German metric of U-boat productivity as ineffective in a strategic sense; its relation to impacts on the Allied war effort is negligible. However, U-boat productivity is relevant to German efforts to overcome Allied area denial efforts. U-Boat Command defined the "effective quotient" as tonnage sunk per boat per day at sea.[44] Post-war U.S. Navy analysis estimates productivity using tonnage sunk per boat at sea per month.[45] These metrics combine the U-boat's ability to find a target with its ability to successfully attack a target(s) once found.

The downward cycle of U-boat productivity demonstrates the German difficulty in responding to Allied technical advances. U-boat losses did not initially increase because these

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[42] JFC Fuller, *Armament and History*: *A Study of the Influence of Armament on History from the Dawn of Classical Warfare to the Second World War*, (London: Eyre and Spottiswoode, 1946), 33.
[43] Clark and Stillion, *What it Takes to* Win, 12.
[44] Doenitz, *Memoirs,* 109.
[45] Sternhell and Thorndike, *Antisubmarine Warfare*, 6.

developments primarily increased survivability of the U-boats and limited the ability to locate and attack enemy targets. Allied forces mitigated German offensive capabilities by leveraging control over air and surface to deny U-boats their preferred operating domain. When Allied tactics and weapons caught up with their ability to prevent U-boat attacks U-boat losses began to rise sharply. The technological effort required to shift the contest to a different domain (a high underwater speed submarine) greatly outweighed the numerous incremental technological developments which denied the U-boats' preferred domain. The case study portends the eventual triumph of many smaller (relatively) inexpensive technologies over a singular all-encompassing one. This suggests diversification and simplicity of purpose for development of future unmanned systems.

Operation at sea increasingly exposed German submarines to detection and attack. This exposure drastically reduced their ability to locate and attack targets. U-boats sunk less than 20 ships per month in the last two years of the war despite twice as many boats at sea. By the end of the war the U-boat fleet posed a nuisance to Allied forces, but carried little influence on events.

Lessons Learned

Appropriate strategic focus is an imperative for success in war. This focus is even more important when operating in contested or denied modern environment. German experience demonstrates the pitfalls in diluting strategic efforts and the consequences of not having enough mass to achieve decisive effects early in a campaign. A numerically inferior force operating in a contested environment will only have a limited window before opposition tactics, assets and technology are adjusted to limit freedom of action. These fleeting windows must be exploited forcefully or extended in order to achieve the desired results. Full commitment of available forces is necessary if the desired results are essential to the campaign or strategic ends.

German national strategic decisions and resource allocations did not align with U-Boat Command's military strategy. Pre-war submarine construction and initial restrictions on submarine warfare limited the U-boat's initial punch. Even the first employment of wolfpacks, successful at the tactical level, did not damage Allied shipping enough to threaten Britain's participation in the war. Implementation of convoying reduced the efficiency of trans-Atlantic supply by up to 30%.[46] U-boats necessitated this measure and maintained pressure throughout the war. This was a reasonable strategic goal for the U-boat fleet; it did not require the same all-out effort and massive U-boat casualties to achieve. Strategic goals must be coordinated across the highest levels political and military command. Campaigns with decisive strategic objectives must be resourced and executed to allow favorable resolution; supporting campaigns can be resourced and planned in a different manner.

Extending the window of opportunity for decisive action in a potentially denied environment is another option. German attempts to create opportunity through technological development were not successful. The continual disadvantage of U-boats in the detection and protection cycle showcases the danger in relying on technology. Remaining hidden on the offense is extremely difficult, especially when the enemy has superior capability in multiple domains. Rapid technological advances are unlikely to reverse situations in contested environments; they serve to balance the competition or reduce a disadvantage. Technology with the potential to fundamentally change an operating environment from a denied one to a permissive or evenly contested one requires substantial mass to make it effective.

[46] Sternhell and Thorndike, *Antisubmarine Warfare,* 111.

Extension of opportunity can also be obtained through misdirection and military deception. The Battle of the Atlantic can be used to explain this in a hypothetical manner. The Germans recognized the fact they did not have enough U-boats to decisively interdict British shipping early in the war. If U-Boat Command avoiding employing U-boats against merchant shipping, focusing instead on minelaying, surface combatant support and military targets with individual submarines the Allies may have made different decisions regarding convoy implementation and resource allocation for ASW assets. U-boats would then be employed against merchant shipping once a steady or covert buildup had increased striking power to a level where decisive effects could be expected. This strategy prevents an enemy from gaining experience against specific tactics, but risks defeat if the enemy correctly anticipates and prepares for the future threat.

The Battle of the Atlantic is a complex piece of World War II. There are many additional relevant aspects of the battle which are not discussed in this paper, but influence the battle. The interrelated nature of the operational and tactical methods and assets employed in support of U-Boat Command's military strategy should be apparent. Platforms like submarines must be employed with enough force towards a realistic objective in order to overcome initial and rapidly improving defenses. An effective battle network is an integral part in ensuring contested areas remain contested. The Battle of the Atlantic serves as a stark warning to those who would rely on a singular technological advancement to reshape the battlefield.

Operational Decision Game

The author's idea for the operational decision game (ODG) was to replicate the challenges faced by the Germans in employing limited (in number and capability) platforms (i.e. U-boats) against a more numerous and multi-domain capable enemy. The goal was to elicit responses which considered both the tactical and operational employment of a MUM-T capability in a denied or overmatched environment. Additionally, highlighting the casualty implications of employment during the game was a significant aspect for follow-on concept development.

Translating lessons learned from the case study to an operational decision game proved challenging. Case study consideration of both tactical and operational level actions, and alternating defensive/area denial roles (i.e. Germans sought to deny/limit British shipping at an operation level, but took the offense during tactical engagements) was too complex for a single decision game. The naval nature of the case study did not lend itself directly to a Marine Corps MUM-T concept.

The construct used to create the decision game utilized work from the School Year 13/14 Advanced Studies Program (ASP). That year's program developed concepts to support Expeditionary Force 21's Expeditionary Advanced Base (EAB) concept.[47] One of the supporting concepts was Distributed Area Denial. The idea is defined as, "in the early stages of the crisis small MARDETS [Marine detachments] deploy with naval strike missiles and anti-air missiles creating a protective envelope threatening local enemy command of the seas (fleet in

[47] Headquarters US Marine Corps, *Expeditionary Force 21*, (Washington, DC: Headquarters US Marine Corps, March 2014), 15.

being) as Joint forces array in theater."[48] Distributed denial detachments would precede the seizure or establishment of an EAB.

Using the distributed denial detachment allowed the ODG to replicate the desired aspects of the historical case with Marine Corps relevance. Two notional distributed denial detachment constructs (Basic and Advanced) were developed, with the Advanced construct (ADD) containing MUM-T elements. The ODG contained ground-based systems which were removed from the refined concept.

The ODG scenario involved Chinese aggression in the South China Sea and put the respondent in the middle of a situation where several Basic detachments had been destroyed and remaining effectiveness was uncertain. This condition corresponded to the sporadic and limited information U-Boat Command received and the losses the U-boat fleet experienced.

The ODG provided the respondent with additional forces, including Basic and Advanced detachments, and gave them the expectation of being tasked with seizing an advanced base and reducing Chinese strongpoints in order to allow naval forces to maneuver and defeat the People's Liberation Army (Navy). The ODG left specific objectives and forces to be employed up to the respondent.

The majority of responses produced fairly standard concepts of operation dealing with continued aggregation of MEB forces and significantly higher involvement by theater Air Force assets to level the playing field before seizing a full-fledged advanced base. Respondent 3 purposefully did not deploy additional denial detachments; the other respondents employed the detachments in various ways. Respondent 3 cited concerns of detachment vulnerability and

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[48] Advanced Studies Program SY13/14, "ASP 13/14 Concept: How Does it Complement EF 21?" (unpublished, June 2014), PowerPoint Presentation. Presentation included as slides 2 & 3 in Operational Decision Game, Appendix A.

supportability in addition to concern over diverting combat power (men and machines) from the core units.[49]

There were several common trends regarding ADD employment. Timing and sequencing of ADD deployment with an air campaign and main effort attack (e.g. forcible entry operation) was the main comment. The majority of respondents recognized the importance of coordinating denial detachment employment with other efforts; to employ detachments as an independent effort would provide little value, and would create significantly higher risk. Supportability was another area addressed. Respondents posed questions regarding maintenance and resupply of people and equipment. Respondent 5 considered expendable unmanned systems; this eliminates maintenance concerns, but increases resupply requirements.[50]

Respondent 2 provided the most interesting employment plan. Respondent 2's concept of operation called for a significant feint to the south and main effort attack in the north. Respondent 2 employed the available ADDs throughout the SCS like reconnaissance elements to identify seams and gaps in Chinese deployment. Without explicitly stating it, Respondent 2 is prepared to sacrifice the small units to determine where an advantage might be gained.[51]

A few respondents asked about range capabilities for ADD systems and Chinese weapons. Range considerations were deliberately omitted from the ODG to keep it focused at the operational level, but range considerations are a crucial factor in further assessment of denial detachment viability. A denial detachment's integral systems (weapons and sensors) must provide a reasonable capability independent of a global network.

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[49] *Hyenataktik*, Respondent 3, Field Grade Officer, March 16, 2017

[50] Appendix B, Table of Respondent Solutions to Hyenataktik Decision Games.

[51] *Hyenataktik*, Respondent 2, Field Grade Officer, March 16, 2017

Overall feedback remained at the operational level as intended. The scope of the ODG was too broad to elicit ideas on specific technological requirements. Additional operational or tactical decision games should be developed to refine these requirements. Follow-on decision games should include more detailed enemy and friendly characteristics (e.g. system ranges, detailed table of organization & equipment, support requirements).

The ODG served to refine operating concept development and highlight additional areas for thought and refinement. The varied experiences and knowledge of the respondents (Infantry, Logistics, Marine Air, & Air Force) were evident in each response and provided well-rounded feedback. This feedback helped refine the operating concept for distributed denial detachments.

Military Concept for Distributed Denial Detachments

Area denial is defined as, "Those capabilities, usually of shorter range, designed *not* to keep the enemy out but to *limit* his freedom of action within the operational area [emphasis added]."[52] This definition is important to keep in mind; the distributed denial detachment does should not need the most advanced sensors and weapons systems to deny enemy freedom of action. The simplest effective system(s) should be employed. The distributed denial detachment concept focuses on area denial in the air and maritime surface domains.

This paper follows the terminology laid out in John Schmitt's *A Practical Guide for Developing and Writing Military Concepts*.[53] The military concept laid out in this paper spans several aspects of Schmitt's Hierarchy of Military Concepts; it attempts to link the higher-order operating concept to several enabling concepts, which can lead to technological requirements.[54] Approaching military technology in this way is important in order to ensure tactical concepts are fully supported and to avoid being on the reactive side of a technological competition.

Schmitt defines an operating and function concepts as "the articulation in broad terms of the application of military art and science with some defined set of parameters…A functional concept is a description of the performance of a military field of specialization (such as logistics, crisis-action planning, or targeting) within a broader operating context."[55] The operating concept

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[52] Joint Staff, *Joint Operational Access Concept*, (Washington, DC: Joint Staff, January 17, 2012), 40.
[53] John Schmitt, A Practical Guide for Developing and Writing Military Concepts, (working paper, Defense Adaptive Red Team, Hicks & Associates, December 2002). Also available online at: http://www.au.af.mil/au/awc/awcgate/dod/dart_guide.pdf.

[54] Ibid 5.
[55] Ibid 7, 9.

for distributed denial detachments supports portions of *Expeditionary Force 21 (EF21)* and the *Marine Corps Operating Concept (MOC)*.

The initial ASP work on distributed denial detachments implies two related, but distinct, purposes for employment. The primary mission, "threaten enemy movement and local command of the sea within their [enemy] A2AD envelope," supports the creation of temporary maneuver space and rapid aggregation of units for follow-on action.[56] The mission also allows for detachment employment to buy time for force buildup in theater and/or political resolution. The former purpose nests directly with *EF21* and the *MOC*. The latter does not; it may more effectively support strategic goals (i.e. a measured, incremental response), its utility for creating maneuver space is fleeting. The two purposes are not fully interchangeable; the operational concept of employment, necessary capabilities and risks differ for each.

For the purpose of creating maneuver space, denial detachment employment is a supporting effort in a closely sequenced and aggressive expeditionary/naval action. Creating maneuver space is an enabling action that reduces the threat to primary units (i.e. ships, aircraft and personnel) and neutralizes enemy response as a "fleet in being".[57] Detachments can be employed with specific objectives and in enough quantity to gain a local advantage. The window of vulnerability and sustainment requirements is lessened by the tempo generated through follow-on actions. The denial detachment employed to create maneuver space can support the rapid aggregation of forces (*EF21/MOC)*, but not the buildup of theater forces (e.g. Desert Shield).

[56] ASP 13/14, "How Does It Complement EF21?"
[57] The denial detachment itself does not itself compromise a fleet in being; it facilitates the fleet in being effect by creating areas were the opposing navy cannot take offensive action without being risk from smaller friendly naval forces (augmented by denial detachment support). Julian S. Corbett, *Some Principles of Maritime Strategy*, (1918; Project Gutenberg, 2005), Chapter 3, http://www.gutenberg.org/files/15076/15076-h/15076-h.htm.

For the purpose of creating political space, the tight coupling between detachment employment and follow-on actions is not present. Denial detachments contain enemy maneuver and tamp down aggression to support political resolution. The tempo necessary for maneuver warfare at the operational and tactical levels is sacrificed to political considerations and considered escalation. Employment for this purpose does support the buildup of theater forces in preparation for later action.

While the tactical risks to small, forward deployed units are significant in both cases, the operational and strategic risks differ. The risks in utilizing denial detachments to create maneuver space are narrower because of their use in a coordinated operation. Using denial detachments to create maneuver space diverts resources from the main effort and altering the scheme of maneuver once committed would impose a substantial penalty in time and effort. This differs from the case study where it was fairly easy for U-Boat Command to alter operational areas.

Detachments focused on creating political space will likely have to threaten a larger area, reducing the likelihood of mutual support and increasing sustainment challenges. In order to exert political-military pressure, these detachments cannot be completely passive; initial action will expose some of the detachment locations and capabilities. This affords the enemy the opportunity to alter operations and begin a technological competition. Neither the British nor the Americans adopted the convoy system until the Germans demonstrated the ability to significantly influence shipping in specific areas; the cost in "virtual attrition" was higher than the initial risk to actual shipping.[58]

[58] Clark and Stillion, *What it Takes to Win*, 3.

Susceptibility to detection and attack increases with time. U-boats became much more vulnerable as they continued to lose cycles in the technology competition. The Germans sustained U-boat operations in the face of almost 75% casualties in the submarine arm; it is unlikely the American public would accept similar losses in anything other than a world war.[59] Domestic response to losses of individual denial detachments could apply pressure in either direction, towards an unfavorable negotiated settlement or an unwanted increase in escalation.

The distributed denial operating concept envisions two main purposes for employment. These two purposes, creating maneuver space and creating political space, have separate operational concepts of employment and different associated risks. However, on a tactical level, distributed denial detachments look very similar.

Tactical Concept

The tactical concept of a distributed denial detachment integrates the key functional activities of command and control (C2), intelligence and fires. Other areas, such as force protection and logistics, are important supporting functions, but not integral to the concept itself. In this manner, the distributed denial detachment is a smaller, more focused cousin of an EAB or Enhanced Company Landing Team.[60]

A denial detachment operates in principle along the same lines as a wolfpack. A forward deployed element, with limited protection and self-defense capability, utilizes a network of sensors and weapons platforms (i.e. other U-boats) to disrupt enemy activity in a given area. The

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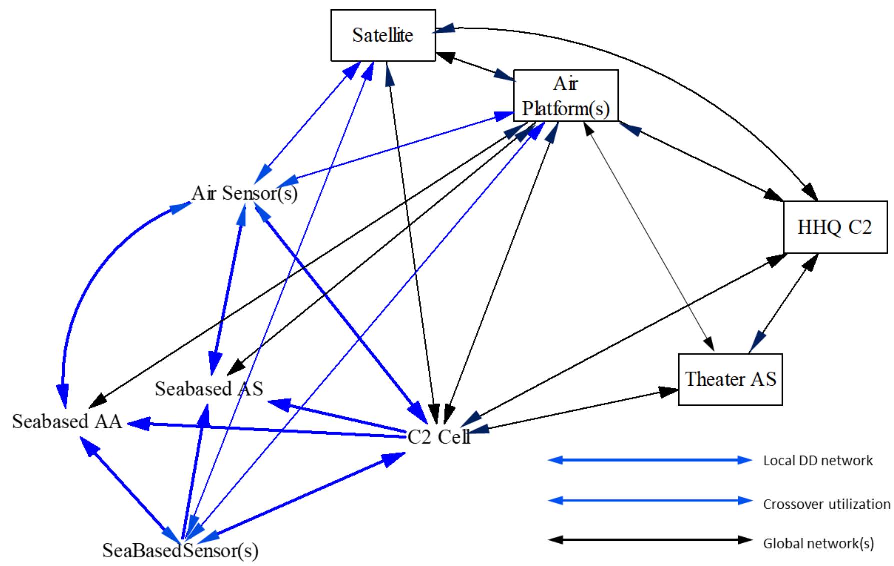
[59] Naval Historical Society of Australia, "British and German Submarine statistics of World War II," *navyhistory.org*, https://www.navyhistory.org.au/british-and-german-submarine-statistics-of-world-war-ii/.

[60] Commanders and Staff, SPMAGTF 3, "Company Landing Team: Employment from the seabase," *Marine Corps Gazette 99*, January 2015, 6-13..

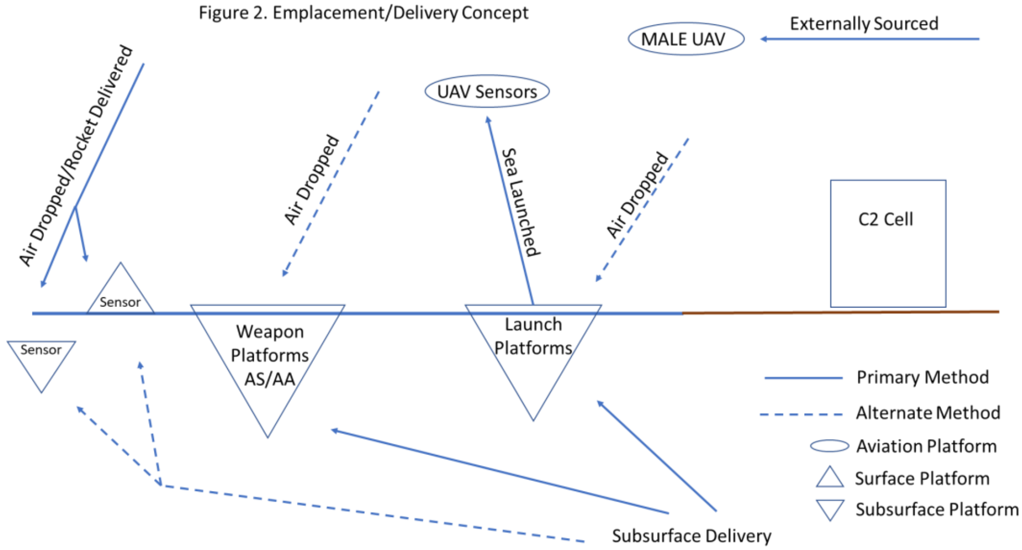
critical difference is a denial detachment's local multi-domain battle network and its connection to a larger network (i.e. JOA, theater and/or global) (See Figure 1). The detachment uses its organic platforms and access to larger networks to identify and target enemy units.

Figure 1. Denial Detachment basic network structure



The separation of sensor and shooter from the C2 platform, unlike a U-boat, provides flexibility and redundancy between platforms and allows the detachment to exploit unmanned systems. It also provides a measure of protection. Distributed deployability will also be critical for concept success. It is hard to envision a single package being inserted clandestinely into an area of operations and subsequently deploying a multitude of individual platforms capable of covering a large area. If the C2 element is deployed successfully, platforms can be deployed, and re-deployed, independently (See Figure 2). This makes unmanned systems a crucial enabling concept and differentiates the distributed denial detachment from a small EAB.

Figure 2. Emplacement/Delivery Concept



Reducing enemy ability to operate in a given area is essential to either purpose for a denial detachment. The C2 element must be robust enough to assess input from the sensory network and respond while having a small enough footprint to deploy clandestinely and remain relatively hidden. Maintaining a local network, independent from larger platforms and systems, improves effectiveness in a degraded signal environment. It also creates the ability for the detachment to operate under mission-type orders and reduce the burden on higher headquarters intelligence and targeting elements.

The composition of a detachment's sensors and weapons platforms is flexible. Primary necessity for organic weapons and sensors is in the air and maritime surface domains. Integrating ASW into a denial detachment may too difficult, but the subsurface domain provides an effective medium for platforms which support air and surface targeting.

The tactical concept for distributed denial detachment is simply a forward-deployed, clandestine area-denial network with the ability to operate independently of larger elements. Similar detachments can be utilized in support of either of the two purposes. In order to differentiate a distributed denial detachment from an EAB and maintain reasonable chances of clandestine employment, several enabling concepts are necessary.

Expeditionary Advanced Base concepts propose a small forward base, potentially seized by force, which builds up sea and air denial capability, forward logistics staging and sea-basing. capacity.[61] An EAB is not clandestine and relies upon anti-missile defense and hardening for protection. Numerous anti-missile platforms and decoys may be necessary at an EAB to win the salvo competition or balance the cost of a missile exchange.[62] This type of footprint is not tenable within the distributed denial detachment concept; it is too large. Similarly, ground based air defense and sea search radars are too large and require a large support footprint (i.e. power generation). Without eliminating significant ground support requirements, distributed denial detachments would face the same challenges U-boats faced in the last two years of the war, inability to operate without being discovered and lack of protection in multiple domains.

MUM-T Enabling Concepts

Autonomous technology and MUM-T provides potential solutions to some of these problems and can greatly increase striking power. MUM-T can conceivably reduce the human footprint to a small C2 cell that can hide effectively and remotely control a network of sea and air platforms. The C2 element serves a hub for aggregation of sea and air platforms in a given area. Three areas of autonomous system development are required to support the distributed

[61] *Marine Corps Operating Concept*; Marine Corps Concepts and Programs, *EABO Concept Toolkit*, https://marinecorpsconceptsandprograms.com/sites/default/files/files/EABO%20Concept%20Toolkit%20(Public).pdf.

[62] Mark Gunzinger and Bryan Clark, *Winning the Salvo Competition: Rebalancing America's Air and Missile Defenses*, (Center for Strategic and Budgetary Assessments, 2016), iii.

denial detachment concept; delivery/basing platforms, sensor capabilities and weapons firing platforms.

Potential avenues of basing and delivery are laid out in Figure 2. Chinese research in UUVs provides a glimpse at some of the potential in the subsurface domain. The US Navy has been conducting research along the same lines.[63] The US Navy recently accelerated development of its Large Displacement Unmanned Underwater Vehicle.[64] These types of unmanned systems provide potential platforms for both the sensors themselves and an underwater delivery system.

Sufficient quantities of unmanned delivery systems could have tremendous impact on the effectiveness and sustainability of a denial detachment. The Germans attempted to increase U-boats' effective days at sea with the *milch-cow* U-Boat.[65] The tactical result was effective; submarines received fresh food and fuel to continue patrols, but the operational effect was negligible across the scope of the Battle. Distributed denial detachment deployments in a smaller operational area will benefit from the concentration of effort. Unmanned delivery of sea-based sensors and weapons platforms give the denial detachment the ability to extend area denial capabilities in time or surge coverage to further limit enemy action in support of maneuver.

Endurance is a significant challenge for airborne platforms. Short duration systems must be launched from a larger sea or air-based system such as the Navy's "Sea Robin" or the Defense Advanced Research and Projects Agency's "Gremlins" Project.[66] Whether or not airborne

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[63] Mark Pomerleau, "DOD plans to invest $600M in unmanned underwater vehicles," *Defensesystems.com*, February 4, 2016, https://defensesystems.com/articles/2016/02/04/dod-navy-uuv-investments.aspx.
[64] Megan Eckstein, "Navy Accelerating Work on 'Snakehead' Large Displacement Unmanned Underwater Vehicle," *news.usni.org*, April 4, 2017, https://news.usni.org/2017/04/04/navy-splits-lduuv-into-rapid-acquisition-program-at-peo-lcs-rd-effort-at-onr.
[65] Doenitz, *Memoirs*, 219.
[66] Daniel Parry, "Navy Launches UAV from Submerged Submarine," news release, US Naval Research Laboratory, December 5, 2013, https://www.nrl.navy.mil/media/news-releases/2013/navy-launches-uav-from-submerged-

systems are recoverable and reusable by a denial detachment is an area for further cost/benefit study. Larger UAVs (Medium Altitude Long-Endurance) can be launched from supporting bases and "check-in" with a denial detachment for additional capability.

Connection to theater and global networks provide a substantial portion of denial detachment sensor capability, but the concept demands the ability to operate independently if necessary. Size, weight and power consumption requirements are driven by sensor capabilities, especially in the air. Simple sensors, which provide adequate detection and identification capability, are all that should be fielded to a denial detachment. Utilizing swarm technology to spread different sensor capabilities between common platforms is a potential alternative to single, multi-mode, complicated, and expensive sensor platforms.

Since the mission is area denial, sensor coverage in an area can also be intermittent, especially when operating in close sequence with other military actions. Operating airborne systems intermittently balances effectiveness with resource conservation. With surface and subsurface systems, intermittency has fewer impacts on effectiveness. The primary targets for surface and subsurface sensors, ships and submarines, move much more slowly relative to aircraft. Operating intermittently still provides a high likelihood of detecting a target within range and delayed reporting still provides the ability to cue other sensors to a general area. Unmanned maritime vehicles (surface and subsurface) are uniquely suited to this because of the minimal energy necessary to remain in position (i.e. floating/drifting).

Once targets are identified they can be actioned. Connection to theater firing platforms provides sustainable and effective fires, but the detachment still requires organic capability.

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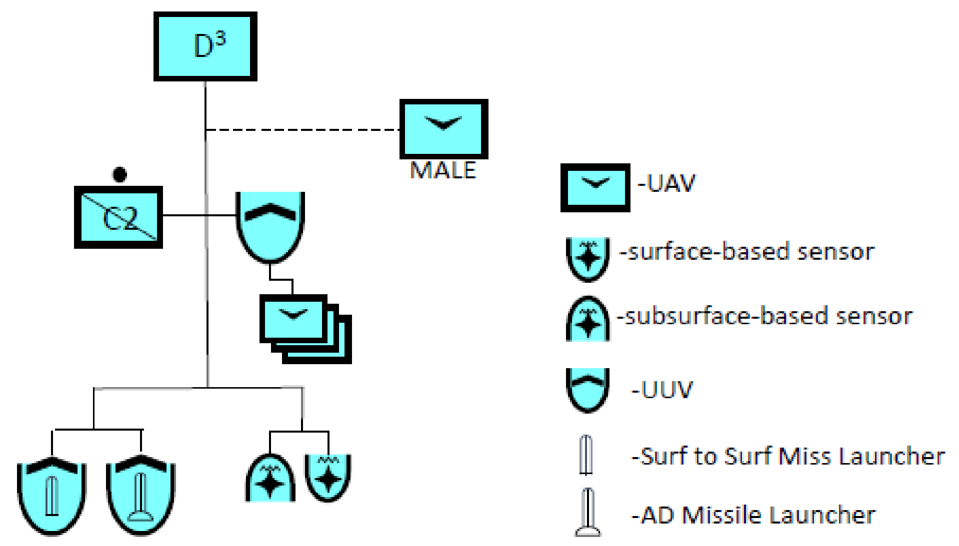
submarine; Defense Advanced Research Projects Agency, August 28, 2015, https://www.darpa.mil/news-events/2015-08-28.

Detachment fires will be short range with simple guidance systems; the concept is to deny enemy freedom of action, not achieve catastrophic kills on every available target. Maritime emplacement of firing platforms makes the most sense. Floating or moored missile containers delivered by a UUV (or air-dropped into the water) can be activated and fired as required. Multiple containers spread across an area provides significant coverage. The basic technology already exists in many submarine launched missiles; modifications to the launch canister and addition of a C2 link would be required.

Figure 3. Notional Distributed Denial Detachment



Without the threat of a degraded signals environment, all of the systems could be designed to be controlled from a secure rear area. Since the concept envisions a degraded theater environment and the ability operate independently, the C2 node must be positioned forward and is not autonomous. The delivery/basing, sensor capabilities and weapons firing platform all require utilization of unmanned and autonomous systems to make the distributed denial concept feasible (See Figure 3). Minimizing the C2 footprint is vital. This requires a common terminal for receiving and controlling all types of sensors and weapons deployed. It also limits the detachment's ability to engage multiple targets at once. Future advances in autonomous missile capability or Rules of Engagement that do not require a man in the loop could improve the engagement cycle, but sequentially engaging individual targets will still achieve area denial effects.

Risk

The distributed denial detachment concept is not without risks and challenges. As presented in the operating concept discussion, small forward-deployed detachments incur significant tactical risk. This concept sacrifices many aspects of protection, such as ground security, missile defense, and hardened structures, for concealment. The difference between the concept and the German experience with U-boats is that MUM-T separates the sensors and weapons from the personnel. The denial detachment is also designed to proactively engage some of the platforms searching for it, unlike a submarine.

The disregard for protection runs counter to the American desire to minimize casualties. Employing MUM-T reduces the number of personnel at risk, but the cost to undertake action to assist those personnel is proportionally higher. Deploying units with the expectation that they will not be medevac'd or rescued if attacked is a significant departure from recent American conflicts. Increasing protection and value of the detachment eliminates its ability to accomplish the desired tasks. Decision-makers must be aware of this condition; lacking the will to risk small units requires employing a fully protected EAB with the corresponding requirements to seize and sustain it.

Implementing a C2 structure that is compatible with developing technologies rather than proprietary is a difficult challenge in the American acquisition system. Building an integrated system from the ground up would take significantly longer and would be much more susceptible to obsolescence. Being able to rapidly field and integrate new technology into the existing C2 structure goes a long way towards winning a technological competition. The German experience on the losing side of technological competition serves as an example.

The concept also requires specialized training in multiple areas. Personnel in the C2 node are expected to have substantial fieldcraft skills, C2 systems expertise and an understanding of air and sea engagement procedures. Dedicating manpower and equipment for training will require reductions in other areas.

Applicability and Alternatives

This project's ODG design and concept development used the South China Sea as a template for an operational area. This is consistent with *EF21* and portions of the *MOC*. However, it limits the distributed denial concept as currently presented because of its dependence on islands and lack of ground security considerations. One of the ODG respondents participated in another ODG involving Iran and the Straits of Hormuz. He commented, "I wish we had it [denial detachment]… planning for a similar scenario involving area denial."[67] Additional study and analysis is required to determine if the current concept is feasible in different settings. It is likely significant aspects will have to be addressed.

The concept shares similarities with several naval concepts. Bryan Clark's "Potential Undersea Battle Network" is ASW focused, but envisions a SOSUS-like emplacement of sensors and a missile delivered torpedo. The "Distributed Lethality" concept put forth by the Navy envisions a more offensive surface fleet, shifting naval focus from power projection back

[67] Christopher A. Macak, email to author, May 5, 2017.

towards sea control. Distributed Lethality also calls for closer integration with the Marine Corps to "provide persistent presence that can influence and control events at sea and in the littorals, applying the right capability to the right target..."[68] These similarities and the skill set required for sea control suggest distributed denial detachments may be more effective as a Navy-Marine Corps unit or solely a Navy one.

Composition as a Navy unit would allow for deployment of the C2 element in a surface or subsurface vessel. Many of the protection issues are still present, but the flexibility of employing a denial detachment seems promising. Admiral Doenitz maintained control of the U-boat fleet ashore because the on-scene commander was too busy fighting his own boat and the span of time facilitated it.[69] The conceptual denial detachment operates in the reverse; the C2 element is not physically in action and timing is more critical.

The concept needs continual refinement, but it is applicable to future operational environments. The *EF21* and the *MOC* indicate continued dispersal and aggregation of forces to meet future challenges. The distributed denial detachment concept provides a way to regain some of the initiative and facilitate follow-on actions. The concept is aggressive; clear understanding of its capabilities and the purpose for employment must match expectations for results.

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[68] VAdm Thomas Rowden et al, "Distributed Lethality," *Proceedings*, January 2015. https://www.usni.org/magazines/proceedings/2015-01/distributed-lethality.
[69] Doenitz, *Memoirs*, 21-22.

Conclusion

The United States is likely to encounter situations where it initially at a disadvantage and must regain the initiative. Studying the German actions during the Battle of the Atlantic provides insight into a force trying to regain the initiative through operational and technological means. The ultimate failure of those efforts and the tremendous losses suffered by the German submarine arm should inform our thinking about the difficulty of trying to wrest the initiative from an established force.

The distributed denial detachment concept is an elaboration particulars of *EF21* and the *MOC*. MUM-T is a critical element in the concept. Without the system dispersion and reduced human footprint facilitated by unmanned systems, a denial detachment would be too unwieldy to be effective. It would suffer the same fate as the easily detected and targeted U-Boat in the last two years of World War II.

Allied success during the Battle highlights the importance of a multi-domain battle network. This is the fundamental premise behind the distributed denial detachment concept, but a network in and of itself is not sufficient for military success. As with all military forces, it must be employed within its capabilities. Current paradigms regarding high-technology and the non-disposable nature of equipment need to change in order for many concepts, including this one, to support strategic success. The Germans paid a heavy price for their effect on Allied shipping; we have the opportunity to remove much of the human cost from similar effects.

Hyenataktik

ASP Decision Game

Employed distributed denial detachments to allow follow-on operations

Maj John Campbell
ASP/CG-14

UNCLASSIFIED

Advanced Studies Program School Year 13/14. "ASP 13/14 Concept: How Does it Complement EF21?" unpublished, June 2014.

ASP SY13/14 Concept: Generating Access, Exploiting Gaps

- Engagement Pull
  - Use partnership capacity building activities as a means of generating access for future crises
  - Align training activities to threats including testing IAD systems, RSOI of aviation strike packages and cyber engagement pull (i.e., building up partner cyber defense capability as a form of cyber defense in depth)
- Active Intelligence
  - Push intelligence collection platforms and integration down to lower echelons to enable distributed MAGTFs to have independent targeting cycles
- Distributed Strike Area Denial Detachments
  - Deploy small MARDETs with anti-ship and anti-air systems linked to fleet targeting in order to threaten enemy movement and local command of the sea within their A2AD envelope (i.e., Marine Corps forces as Corbett's fleet in being)
- Destabilizing Maneuver In Depth
  - Deploy small teams deep into rear areas to mobilize local forces or at least create the illusion thereof
  - Make the enemy fear everywhere to destabilize C2 and cause them to disaggregate forces and functions
  - If enemy turns to pursue, larger force can exploit the resulting gap


Engaging partners, + SA & access


Advanced Tactical Sensors


Norwegian Kongsberg Missile
290 km range anti-ship missile

UNCLASSIFIED

Appendix A

UNCLASSIFIED

Advanced Studies Program School Year 13/14. "ASP 13/14 Concept: How Does it Complement EF21?" unpublished, June 2014.

ASP SY13/14 Concept: How Does it Complement EF21?

Expeditionary Force 21 in Action: Compositing Naval Forces ... Agility in Responding to Crisis and Assuring Littoral Access

a. **Engagement Pull**: advisors gain access through building partner capacity in nearby staging areas; includes increasing cyber defenses (cyber defense in depth)

b. Distributed area denial: in the early stages of the crisis small MARDETs deploy with naval strike missiles and anti-air missiles creating a protective envelope threatening local enemy command of the seas (fleet in being) as Joint forces array in theater

c. **Network mobility**: in addition to seizing an advanced base, forces establish a network of expeditionary airfields connected to surface platforms to form an inter-theater network to flow forces and generate strike options

d. **Destabilizing maneuver in depth**: small teams deploy deep to pull attention away from potential littoral penetration sites; link up with local forces or create the illusion thereof

UNCLASSIFIED

3

Road to Crisis 2024

- China has backed off fortification of contested South China Sea islands after US ratification of UN Convention on the Law of the Sea
- Increased piracy off the Horn of Africa
- Iran threatens to close the Strait of Hormuz and captures several US patrol craft
- Reduced number of operational US Navy capital ships requires 7th Fleet to reinforce 5th Fleet in the Indian Ocean
- Small surface action groups and a MEU remain in the Pacific

Somali Pirates

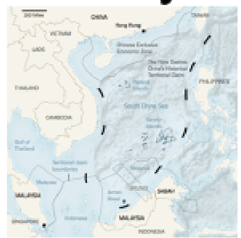
Iranian Navy Aggression

Mothball Fleet

4

China sees an opportunity

- China sees an opportunity with lack of US Naval presence
- China reasserts claims to the South China Sea (9-dash line)
- China reoccupies several contested islands and renews fortification. PLA(N) initiates significant naval maneuvers along the 9-dash boundary
- PLA(N) sinks 3 naval vessels conducting FON operations, including a US DDG
- PLA(N) maintains three Task Groups from its South Sea Fleet at sea with submarines and unmanned underwater vehicles (UUV) patrolling entrances to the South China Sea
- Philippine Navy sorties and then withdraws east of the Philippines after losses due to anti-ship missiles and surface action



9 Dash Line

Naval Action

5

Crisis Develops

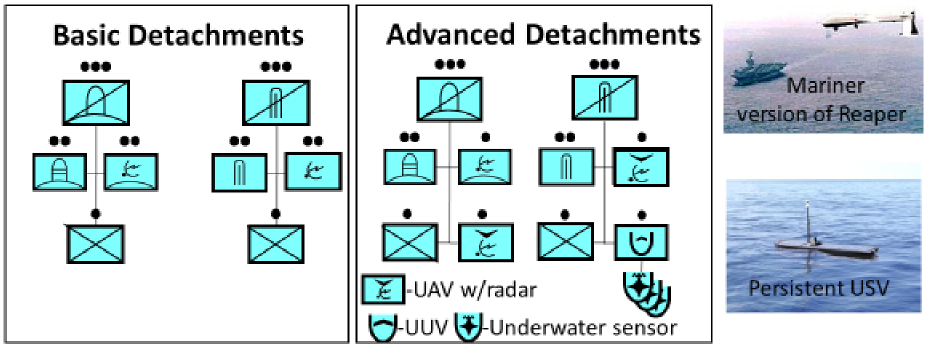
- UN Security Council at an impasse
- ASEAN condemns China, but takes no coordinated action
- Singapore, Malaysia and the Philippines grant access to US forces; Indonesia remains neutral
- US Naval assets begin transit back to Pacific
- 11th MEU deploys 9 basic distributed denial detachments in contested islands and Philippines

UN Security Council

Carrier Battle Group

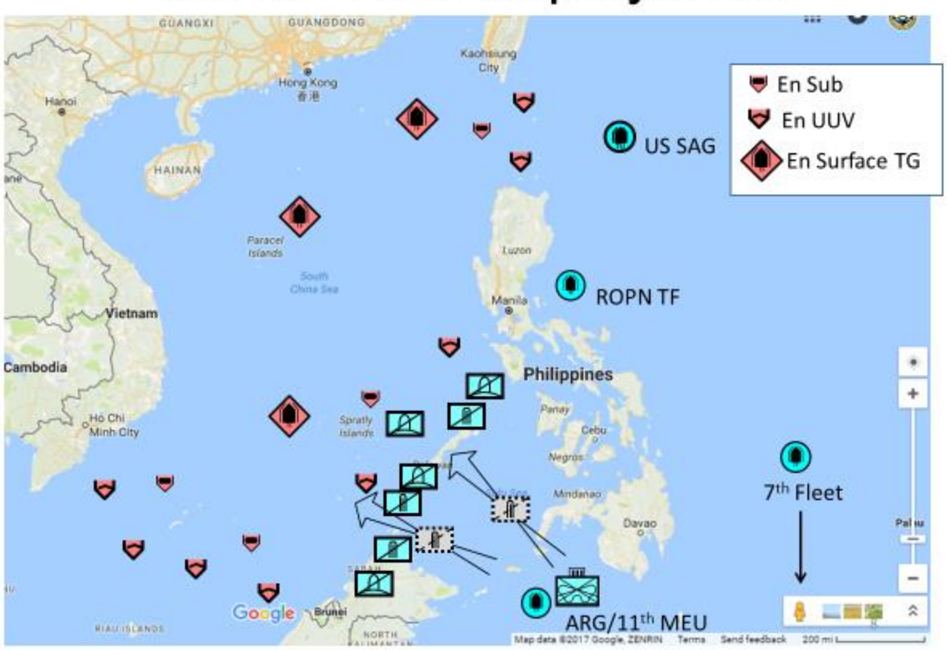
6

Distributed Denial Detachments



Detachments are either anti-air or anti-ship. Basic detachments are simple (current-type) ground based systems with a small security detachment. The advanced detachments are based around smaller (future) missile systems and include aerial, surface and subsurface reconnaissance capability. Aerial platforms are similar to platforms like the MQ-8C Fire Scout, RQ-21A Blackjack or Mariner Demonstrator (Maritime radar version of Reaper) with varied sensors (advanced EO, metamaterial radar, etc.) The subsurface unit has high-endurance UUVs with disposable sensors or multiple disposable UUVs/Unmanned Surface Vehicles (USV). 7

Initial Force deployment



Crisis Deepens

- Contested Airspace
  - Both sides have suffered losses in the air
  - China has refrained from targeting aircraft on the ground in Thailand, Malaysia, etc.
- Area Denial Detachments
  - 2 Destroyed during insert
  - Some initial success against A/C; unknown effects against shipping
  - 3 Destroyed after insert
  - The 4 remaining detachments have identified limited targets since insert
- Reinforcements
  - CSG
  - Aggregating MEB
  - Supporting theater aviation

J-15

KJ-2000

Glider-type long range UUV

9

Situation Update

Order of Battle

American

- MEB
  - 2x MEU/ARG
  - FIE- to Philippines (not immediately available)
- AEF (Thailand/Philippines/Guam)
  - 4x Sqd (2-F-22, 2-F-15)
  - 1x E-8C JSTARS
  - 2x EC-130 Compass Call
  - 1x RC-135 Rivet Joint
  - 10x MQ1-B Predator
- Tanker Squadron
- Surface Action Group
  - 2x DDG 1x CG
  - 1x LCS
- 2x Carrier Strike Group
  - 1x CVN 2x DDG
  - 1x CG 1x SSGN
  - 1x SSN

Chinese

- PLAN South Sea Fleet
  (divided into 3 Groups)
  - 1 A/C carrier
  - 21 Frigates
  - 9 Corvettes
  - 11 Destroyers
  - 30 patrol/missile craft
  - 16 Patrol submarines
  - 3 Attack submarines
- PLA
  - Detachments on several islands
- PLAAF (Southern Theatre Cmd)
  - 2d Fighter Div
    - J-8, J-10, J-11, Su-27
  - 9th Fighter Div
    - J-10, J-7
  - 8th Bomber Div
    - H-6
  - Elint Tu-154
  - C3I Boeing 737-3QB
  - AWACS KJ-2000

11

Decision Scenario

- You are the MEB CG. Your second MEU/ARG has aggregated at sea. The Fly-in Echelon is arriving, but MPF equipment shipping is being held outside of Chinese ASM range for the time being.
- You expect to be tasked with securing an advanced base and reducing Chinese island strongpoints within the South China Sea in order to allow naval forces to defeat the PLAN in the South China Sea.
- The arriving MEU contains 6 Advanced Denial Detachments in addition to normal MEU capabilities.

Fortified Island

Autonomous Underwater Vehicles

12

Solution Set

Fill in the problem framing, COA Graphic/narrative,and theory of victory slides based on your concept, as MEB CG, to employ MEB forces in support of future operations against the PLA(N)

13

Problem Framing

Problem Statement (incl. list of key facts and assumptions):
Tensions Between Current Conditions and Desired Conditions:
Elements that Must Change to Achieve the Desired Conditions:
Opportunities and Threats to Achieving the Desired Conditions:
Limitations:

14

JP 5-0, Figure III-6

COA Graphic and Narrative

MISSION:

INTENT
(purpose, method, desired condition)

CONCEPT
(incl. key tasks by phase)

15

Theory of Victory

Synopsis of your Central Idea	Necessary Capabilities
Application & Integration of Military Functions	**Spatial & Temporal Dimensions**

16

Appendix B

		Theory of Victory				Problem Framing				
	Respondent	Central Idea	Necessary Capabilities	Integration of Military Functions	Spatial & Temporal Dimensions	Problem Statement	Tensions BTWN Current and Desired	Elements that Must Change	Opportunities and Threats	Limitations
1	USAF Major C-17 Pilot	Use ADD in place as umbrella for MEU/7th Fleet Ops in Sulu Sea -Use US airpower to expand the umbrella into SCS - Use the MEU to seize an advanced base in the Spratlys	ASM/SAM in the ADD - THAAD in the Philippines to protect naval surface assets and land based aviation assets -B-2 to hit A2AD nodes/assets in Spratlys - F-16 Wild Weasels to suppress AD network		Stage 1-4 will take time to develop and degrade Chinese forces to an acceptable level -Stage 5 should be rapid	The PLAN A2AD network in the SCS prevents the employment of large US naval formations capable of engaging and defeating China's SCS fleet	DC: Chinese A2AD network degraded to the point where US 7th Fleet can operate in the SCS with an acceptable level of risk	MEB must seize key terrain to deploy ADD capable of providing protective umbrella to US surface assets	Spratly Islands offer an advanced base capability roughly bisecting the SCS and providing an opportunity to seize key terrain w/short LOC to the Philippines. ON the downside, the Spratlys house aircraft and SAM/ASM and there are nearby PLAN ships to interdict	Air cover. Seizing the Spratlys will surely result in a contested assault with little in the way of US assets capable of suppressing the air and sea defenses. In short...you could really use some more Air Force help.
2	USAF Major Acquisitions	Use mass and maneuver to move USMC & USN assets south of Palawan into SCS - launch 5th Gen aircraft sorties into Paul Islands. MEU move into position north of Palawan to seize N island on Spratley Chain	Intel-heavy ISR collection capability required: use organic assets to USAF, USN, USMC and new concept - anti-sub, anti-air & anti-ship capabilities - capability to secure advance base defend	Intel-utilize sensors on ADD systems, 5th gen a/c, ships and MQ-1 to determine enemy location and disposition maneuver- create and exploit gaps to move forces into contested SCS protection LO aircraft will mask signature while collecting data and protecting friendly forces from PLAAF	spatial-whats the range of the ADD and how does into get back to ship (I don't know A2AD range of Chinese capabilities tempo & synchronization will be critical in ensuring feint is believable and to draw Chinese forces south	USMC needs to secure an advanced base to reduce Chinese strength in the SCS IOT establish conditions for USN to defeat PLAN	Unknown enemy locations/strongpoints throughout SCS -Chinese air, sea and AA coverage makes entrance into contested SCS potentially too dangerous to secure an advance base at this time	must find and exploit a gap in Chinese air, surface, subsurface AA coverage	O- ADD and basic ADD allow recon of area to map battlespace and understand seams and gaps T- Chinese AD capability	Inability to bring tankers deep into SCS due to survivability- limits range and loiter of fighter a/c from launch location or outside contested bubble
3	USMC Major RW Pilot	Employ unmanned vehicles IOT augment larger force. By employing them with disaggregated small dets, the machines become useless once the people that operate them are forcibly overrun. Don't break up the MAGTF especially in the face of one of our largest, most sophisticated, trained and equipped adversaries.	The UAV and UUV capabilities as advertised are great but need to be tied in a supportable (physically and by tasking) fashion to the maneuver element.	Intel & surveillance lethal fires against sUl targets		PLAN has initiative bc SCS is willing to commit to lethal warfare, the US is responding in isolation with an ill-equipped Navy to regain initiative in a sea/air battle	China is reclaiming SCS and US is only nation willing to push back	US must commit a larger force. We cannot expect to hold island chains in the Pacific with small detachments spread out w/ 50-100 miles btw them. USNs and UAVs will be vital to aid humans fighting in war. If ADDs prove effective what would limit China from targeting them from the mainland with MRBMS.	O: Forward presence. Land based and distributed Fleet protection. Buffer btw Chinese Naval/air capabilities and the Fleet shipping. T: Dets are not supported nor mutually supporting. ADDs reduce manning on MEUs and MEBs; thus reducing manpower for forcible entry.	
4	USMC Major Logistician	Need to est adv bases at Fuirido to support spratly base seizure. Need to est adv base at Sandakan for follow on/RPT ops to Rial Island. JSF and Navy neutralize IAD/ASCM threat on spratly base. MEB FEO Spratly and seizes	ability to neutralize/des IAD/ASCM at near spratly base. GMAM/IAD at Adv Base for FP. Sea connectors to rapidly conduct FEO. Navy clear naval targets		China knows we can only advance from S or E so theyt will focus there. Time between MEF arrival at Fuirido and Sandakan may tip hand and allow time for PLAN to Reinforce. Once Spratly seized, sustain from south and east until SCS clear	China has denied access to SCS, MEB needs to establish an advanced base to reduce Chinese island strongpoints	Chinese UUVs and subs provide A2AD against MEU. MEB challenged to establish adv base in zone combo of spoe and apoe for FIE. Chinese ability to effect MEB ops on Palawan and Sandakan	Neutralize Chinese effects/ability to disrupt MEB est adv base at Fuirido IAD/ASCM on Spratly Island neutralized. PLAN TF neutralized. Chinese UUV disrupted. Chinese subs in zone destroyed	O- Eastern coasts of Palawan support at sea offload of MPF. Sandakan supports APOD/SPOD for FIE. Eastern approach sea lanes option for MPF and MEU. Provide MEB w/multiple options for adv base. Depending on MRBM capabilities from Chinese base, may be in range	must offload on eastern side of Palawan and Malaysia. Must offload across santa monica beach (NE Palawan). Fuirido relatively mature
5	USMC Major Infantry	Strike PLA(N) with a Poseidon spear...see next slide. Employ DDDs to impose a threat to HVTs that exceed China's risk threshold. Consider employment of DDDs at Philippine bases that may happen to be located generally ivo population centers... Ensure USN postured to exploit disruption of PLA(N) achieved by the MEB. Prioritize HPTs: C4 nodes, A/C Carrier, ASCM/ASBM sites, EAFs in SCS, submarines. Once DDDs inserted, pull F-35s and form "TF F-35" to coordinate aggregating ACE Strike actions for multi-domain approach.	DDDs with anti-air/sea capable munitions and firing platforms. Organic ISR or link to ISR capabilities to develop targeting solutions to exploit. Survivability after emitting/firing. Options: Maneuverability: ability to displace w/in sufficient time period – 15min? Overhead protection/armor – likely not sufficient in expeditionary environment Visual/EMS concealment – is this possible post launch? Is it possible to spoof a CBR? Deception: Firing multiple ASMs at once from multiple locations to disrupt PLA response long enough to displace. Ability to insert small detachments into PLA rear area to destabilize PLA maneuver in depth. Do we find a way to insert a team to find willing recruits or is this an important requirement for phase 0 before the crisis emerges? Perhaps it's a 'wag the dog' approach by producing deceptive propaganda that makes PLA think we are in his rear.	1.ISR required to drive targeting. 2.C4 required to tie ISR to firing platforms for overall targeting process. 3.Secure LOCs to either maintain supply of DDD munitions or expeditionary footprint sufficient for mission requirements.	1.USN must be aggregated and postured, ready to exploit the conditions set by the MEB IOT seize the initiative and generate tempo relative to the PLA's ability to respond. DDDs probably need to CSMO RFN once they emit/fire unless some other form of protection can be achieved. 3. Request MEB AO	Aggregating MPF enabled MEB must finish aggregating to form the MEB, buy time to deny PLA from exploiting current initiative in seized SCS, secure an advanced base to enable DDD's to reduce Chinese island strongpoints in SCS IOT allow USN to defeat PLA(N) in SCS.	Current: China reasserts claims to 9-dash line by reoccupying several contested islands. Renews fortifications. PLA(N) maneuvers in zone, sinks three USSs. Current Threat: three PLA(N) Task Groups in SCS with UUVs, the initiative and fortified positions. Desired: Disrupted PLA(N) C4 and defensive positions which allows gaps to emerge for exploitation.	Disrupt PLA(N)'s ability to C4 and deny maneuver into SCS.	Opportunities: USN forces enroute; Singapore, Malaysia and the Philippines available for maneuver space; Indonesia remains neutral; contested airspace but China has not targeted A/C in Thailand + Malaysia; four remaining distributed denial detachments. Six additional DDDs with arriving MEU. Threats: Contested airspace; contested maritime domain from sea and shore based threats; vulnerable/destroyed area denial detachments. Indecisive UNSC/ASEAN means lack of international resolve beyond US to address to confront crisis.	

Appendix B

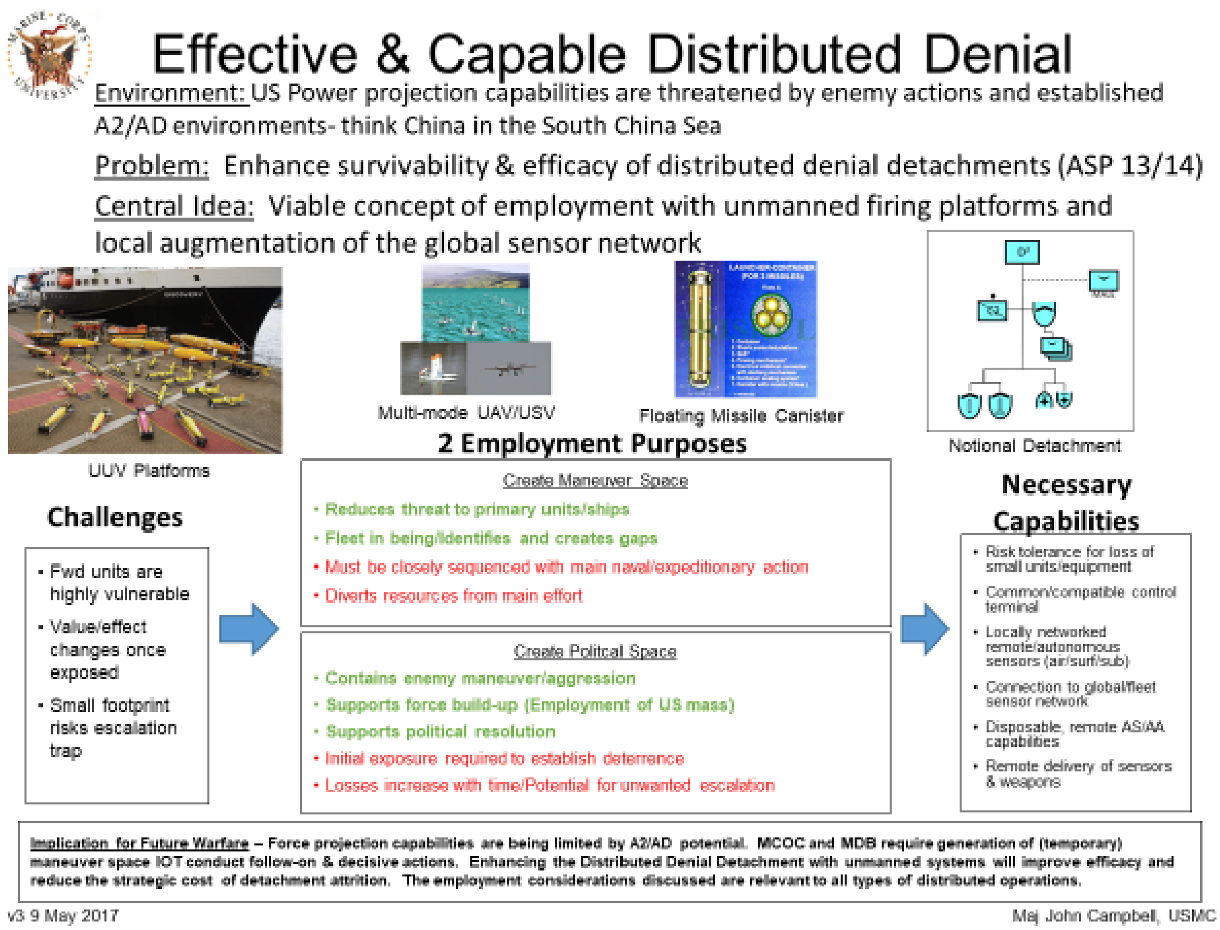
	Respondent	COA Graphic & Narrative: Mission	Intent	Concept	Additional Comments		
1	USAF Major C-17 Pilot	O/o secure the Spratly Islands as an advance base in order to threaten Chinese LOCs and provide a platform to deny Chinese surface and air assets use of the Southern and central areas of the SCS.	Purpose: Securing an advance base on the Spratlys deny PLAN the freedom of movement along their main LOC in the SCS Method: utilize the in place ADO to suppress PLAN forces in and around the Spratlys Desired Conditions: MEU takes key terrain in the SCS for future 7th Fleet Ops	1) Initial ADOs remain in place 2) 7th Fleet moves to Sulu Sea to allow for air operations 3) Land and carrier based air assets establish air superiority over the Palawan Islands 4) Once air superiority is achieved insert ADO to smaller islands in/around Spratlys 5) USe aviation and missile assets to degrade the Spratly defenses to a level that an amphibious assault can take the Chinese airfield			
2	USAF Major Acquisitions	seize advanced base and establish conditions for USN to fight PLAN in SCS	Purpose: draw Chinese forces south while seizing advanced base on the N end of Spratlys Method: coordinate with USN to mass forces and create a feint south using intel gathered by ADO ES: seize advanced base	deploy 6 ADO throughout SCS and use for SA and targeting employ destabilizing maneuver in depth concept by sending all available assets and flying 5th gen a/c N of Riao Islands to draw Chinese forces south -seize and secure north island in Spratley chain			
3	USMC Major RW Pilot	Distribute MEB to N and S sides of Palawan Island. 1 Meu in N and 1 in the S IOT secure Sulu Sea for the 7th Fleet movement	Secure advanced sea-basing and provide a location from which to launch attack on Spratlys. These two locations also allow sufficient manpower to dissuade assault by PLAN on troop locations. Western front of Palawan is relatively useless. Marines need to protect shipping lanes into SCS.		Do they have maintenance capability for these systems? Where/who is doing data analysis? Distributed is going to make logistics harder if not impossible. What is the medical capability at these distributed sites? Are the Marines operating covertly or with support of the local populace? What is the force protection concept for these isolated individuals? Why are we risking Marines if UN is at impasses and ASEAN doesn't care enough to do anything?	Thes 4 [remaining original detachments] are now responsible for 21km^2 How many systems do they have?	
4	USMC Major Logistician	O/O MEB seize Spratly Island base and occupy Adv bases at Fonido and Sandakan IOT reduce Chinese island strongpoints in SCS and allow naval forces to defeat PLAN in SCS	P: to establish multiple advanced bases for follow-on ops against PLAN M: Coord with coalition partners to establish advanced bases at Fonido and Sandakan to support securing spratly island base DS: Advance base occupied readt to receive FIE/MPF and follow-on forces, spratly island base seized	MEB establishes advanced bad (APOD/SPOD), builds combat power IOT seize spratly base PH 1: Est adv base Sandakan & Fonido RSOI FIE/MPF establish CRAAA/IAD for force protection destroy en IAD/ASCM on Spratly base UUVs recon sea lanes and spratly base PH2: Conduct FRO Spratly base PH3: Seize Spratly base PH4: Conduct deportation of IDP/EPW PH 5: Handover Spratlys to coalition forces			
5	USMC Major Infantry	In coordination with JFMCC, MEB secures advanced naval bases to disrupt PLA strongpoints in SCS IOT allow USN to gain area access to defeat the PLA(N) in the SCS.	P: to allow USN to gain access to defeat the PLA(N) in the SCS. M: Tell the USAF to man up and dominate the airspace. Maintain four DODs currently in zone and emplace six additional DODs with arrival of 2d ARG/MEU. Prioritize HPTs as C4 nodes, A/C Carrier, ASCM/ASBM sites, EAFs in SCS, and submarines. Synchronization between achieving these effects with the USN postured to exploit is important in order for the US to seize the initiative and exploit it. E: PLA(N) C4 and A2AD capabilities disrupted, USN postured to exploit temporal gap.	MEU/ARG 1: Maintain four Advanced DODs to neutralize HPTs in zone IOT disrupt PLA(N) strongpoints in SCS. MEU/ARG 2: Insert and maintain six advanced DODs to neutralize HPTs in zone IOT disrupt PLA(N) strongpoints in SCS. SCS and conduct OAS to neutralize HPTs IOT disrupt PLA(N) strongpoints in SCS. TF F-35 infiltrate SC and conduct OAS to neutralize HPTs IOT disrupt PLAN strongpoints in SCS.	•What about ultra high endurance UUV suicide drones. Once they detect/find an enemy vessel, they can automatically engage. Prevents risk of revealing location when emitting. Reduces F2-T2 the targeting solution process. Assumes less risk by DOD ashore. •Concept identifies a Marine version of Reaper – should that be read as STOVL capable? Expeditionary runway? Or is it a standard land based Reaper/Predator similar to how the MAGTF maintains C-130s in OS of the MEUs. They can't launch from ship, but they can be prepositioned to support as the ARG/MEU passes through AORs. Scott Cuomo is working on a MALE-T UAS (Medium Altitude Long Endurance Tactical UAS) concept towards this end.	•Will DODs bring multiple disposable UUVs forward or call back to the amphib to launch additional UUVs/USVs? For a high endurance and/or seaworthy UUV/USV, I'd imagine their size may be a limiting factor with how many can be brought forward. I'm thinking it's a call back to the ship to launch a new set of UUVs into the water to keep DODs expeditionary. •I wonder how the inter service tension will be resolved, assuming USN may want 'ownership' of the UUVs/USVs. For multiple disposable USVs/UUVs, I wonder what maintenance requirements would be required, manpower requirements, spare parts bin, and how that footprint affects existing ARG/MEU loadouts.	Engagement Pull and Destabilizing Maneuver in Depth. •I see these concepts linked together. Inserting a small det in the enemy's rear in an A2AD environment will be difficult. Building and shaping relationships before a crisis emerges is important. This applies to phase 0 ops domestically in China (non-USMC mission), and in partner nations. In this scenario, Vietnam does not afford US basing access. But Vietnam has ASMs and capabilities that can be integrated into a combined fight to address PLA aggression. As the MEB struggles to insert DODs to create a temporal gap for the USN to exploit, another operational approach could entail combining this effort with adjacent efforts, placing the PLA(N) in a horns of a dilemma as that their capacities cannot cope. As it applies to MUM-T....do we share DOD technologies, concepts, training and education, with selected partner nations?

Appendix B

	Respondent	Theory of Victory: Central Idea	Theory of Victory: Necessary Capabilities	Theory of Victory: Integration of Military Functions	Theory of Victory: Spatial & Temporal Dimensions	Problem Framing: Problem Statement	Problem Framing: Tensions BTWN Current and Desired	Problem Framing: Elements that Must Change	Problem Framing: Opportunities and Threats	Problem Framing: Limitations
6	USMC Major RW Pilot	Seizure of advanced naval base and consolidationg of area denail teams in defense of this base will legitimize Phillipine claims to the islands, delegitimize Chinese claims and create favorable conditions for negotiations	Portable anti-ship & anti-air missiles including long range ship and air detection, tracking, ID and targeting - air to surface anti-ship missile	Intel, C2 and firepower integration is critical for the ADD teams to ID target and engage PLAN vessels and to coordinate exploitation of the resultant gap -also critical for SAG and ROPN TF to attack South	Sequential, conditions-based operation to exploit temporary, local area denial to seize and defend an advanced base - coodination required over extremely large area	-PLA foces significantly outnumber US -PLAN currently occupies key terrain, controlling SCS - Large scale (total war) with China not politically desirable -other allies and partners remain uninvolved PS: Must reassert US policy of freedom of navigation w/in SCS without instigating war above the level palatable by US populace	PLAN controls access to SCS, preventing FON - PLAN has drvien away potential allies - ADD have failed to establish a foothold or create gaps	Gaps created in sea LOC, enabling access to SCS and Island strongpoints	O- ROPN TF has strong willingness to engage PLAN -FIE will have significant technological advantage over PLAAF	US surface movements will be observed
7	LtCol, Foreign Naval Officer	Navy prepares environment, assault & hold, dimish PLAN credibility, hasten enemy entropy, hold is joint N/MC function	Naval strike capability (CRUDES) -SSV (SSN & ASW Capable) -resupply & withdraw			Conflict with PLAN forces must be kept below "low" for 30 days to restore trade routes through SCS	escalation dynamic preventing return to normalcy	Force escalation, number of conflicts	O- Backchannel diplomacy de-escalation or decisive strike T-Chance conflicts/mishaps contributing to death toll	
8	USMC Major Aviation C2	-China has the initiative and the naval superiority at start point. JFEOs can acquire needed airfields at small Chinese held islands. Will force PLAN to commit resources to islands thus turning their South Sea Fleet, which USN CSG can exploit.	-Plan hinges significantly on ability of US air power to conduct OAS and Assault Support operations during JFEO. Also, the ability of manned and unmanned ISR in the air, sea and subsurface will assist in the screening operations and targeting of PLAN vessels to attrite their combat power prior to Phase 3, Stage B.	JFEO requires pre-mission ISR and coordinated air and surface fires ISO assault force introduction to the islands. This will most likely include EW strikes to prevent Chinese IADS operations. Lastly, I didn't mention cyber support b/c I do not know much about that... -Logistics will also be huge, as MPF is being held out of AOA currently due to ASM...will need to be introduced to sustain Phase 3, Stage A operations -Finally, want to utilize ROPN to operate in/around the Spratly Islands...this will free up USN for Stage B and also allow our partners to take a more active role in their regional defense	-Plan can be derailed if Stage A is significantly delayed -My thought process is that PLAN needs to have a divided problem (MEB to their East and USN CSG to their South). Otherwise they will retain a quantitative advantage.	US forces and our allies in the region have lost the initiative and must reassert military presence to defeat PLAN South Sea Fleet. -Facts: Malaysia, Singapore and Philippines support US basing; Indonesia remains neutral; UN at impasse (diplomatic efforts not helping at the moment); US area denial detachments have been moderately successful but have been met with resistance (5 of 9 destroyed) -Assumptions: reduced USN presence created opportunity for China to exploit in S China Sea; PLAN strength greater than current USN and allied strength; PLAAF strong enough to create contested airspace, but is not prohibitive for US air operations. AEF, MEB, and CSG aviation assets will facilitate local air superiority	S China Sea is unstable now, desire a return to pre-crisis environment where China reduces fortifications in contested S China Sea islands	PLAN active patrolling in S China Sea must stop - military -China must adhere to UNCLOS - diplomatic -China must stop fortifications along 9 dash line - military/diplomatic	Opportunity-Increased access for US basing, increase in FMS to allies/partners, operational testing and evaluation for newly formed area denial detachments, increase US attractiveness to ASEAN/limit China influence -Threats-S China Sea distraction exploited by other global threats (Iran, Russia, etc.), cannot extract PLAN = American credibility suffers, cost of operation on already limited naval assets if significant ship losses occurs	USN vessels are limited initially, must remove PLAN from S China Sea

Appendix B

Respondent		COA Graphic & Narrative: Mission	Intent	Concept	Additional Comments
6	USMC Major RW Pilot				
7	LtCol, Foreign Naval Officer	Seize Amphrite group through bombay reef (Paracels)	to establish stronghold throught amphib asault, hold for 45 days to threaten domestic perception of PLAN competence	1 Air & surface superiority 2 subsurface superiority 3 Amp. Assault 4 withdraw	
8	USMC Major Aviation C2	MEB conducts JFEO to seize advanced base and reduce Chinese island strongpoints to facilitate USN operations to defeat PLAN in S China Sea.	P: Regain initiative in S China Sea to allow decisive USN operations against PLAN M: Seize advance base, establish secure base of operations in/around advance base and Philippine AOR to facilitate FON, establish screen west and north of Spratly islands to allow USN operations to defeatPLAN in S China Sea Desired condition: PLAN unable to project power in contested S China Sea AO	Phase 0: Complete, failure of diplomatic/UN discussions Phase 1: Complete, introduce 9 x area denial detachments Phase 2: JFEO - Spratly islands AOR *ME: 11th MEU seizes Fiery Cross Reef and the accompanying airfield *SE: 2nd MEU w/MEB prepares for REIN of 11th MEU or subsequent JFEO IVO Spratly Islands *SE: AEF conducts OAS/AS ISO JFEO and pre-mission ISR Phase 3: -Stage A: *11th MEU w/organic area denial detachments conducts screening operations west and north of Spratly Islands *2nd MEU w/MEB utilized as reserve to REIN 11th or conduct second JFEO to Mischief Reef *Area denial detachments will conduct A2AD and ISR missions in corridor along Philippine - Spratly Island - N Indonesia axis *USN SAG continues operations N of Philippines *ROPN TF conducts presence operations in/around Palawan and Spratly islands *Transition to Stage B occurs once local	


Effective & Capable Distributed Denial
Environment: US Power projection capabilities are threatened by enemy actions and established A2/AD environments- think China in the South China Sea
Problem: Enhance survivability & efficacy of distributed denial detachments (ASP 13/14)
Central Idea: Viable concept of employment with unmanned firing platforms and local augmentation of the global sensor network
UUV Platforms
Multi-mode UAV/USV
Floating Missile Canister
Notional Detachment
Challenges
• Fwd units are highly vulnerable
• Value/effect changes once exposed
• Small footprint risks escalation trap
2 Employment Purposes
Create Maneuver Space
• Reduces threat to primary units/ships
• Fleet in being/identifies and creates gaps
• Must be closely sequenced with main naval/expeditionary action
• Diverts resources from main effort
Create Politcal Space
• Contains enemy maneuver/aggression
• Supports force build-up (Employment of US mass)
• Supports political resolution
• Initial exposure required to establish deterrence
• Losses increase with time/Potential for unwanted escalation
Necessary Capabilities
• Risk tolerance for loss of small units/equipment
• Common/compatible control terminal
• Locally networked remote/autonomous sensors (air/surf/sub)
• Connection to global/fleet sensor network
• Disposable, remote AS/AA capabilities
• Remote delivery of sensors & weapons
Implication for Future Warfare – Force projection capabilities are being limited by A2/AD potential. MCOC and MDB require generation of (temporary) maneuver space IOT conduct follow-on & decisive actions. Enhancing the Distributed Denial Detachment with unmanned systems will improve efficacy and reduce the strategic cost of detachment attrition. The employment considerations discussed are relevant to all types of distributed operations.
v3 9 May 2017
Maj John Campbell, USMC

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