Executive Summary

1. **Problem Statement.**
    a. How does the United States best employ and sustain a 2032 sea and air forward defense in the first island chain in a wartime scenario against the PRC?
        i. What is the best way to get logistics across the Philippine Sea to support forward mobile anti-ship missile (ASM) sites?
            1. Convoy operations or single logistic ship transits?
            2. Can we use large unmanned systems or submersibles?
            3. How can we best employ decoys?
        ii. What are the best shore-based ASMs to use?
            1. What are their minimum requirements?
            2. Are they survivable?
        iii. Can Guided High Velocity Projectile (HVP) systems help?
            1. How effective is it to combine ASM and Air Defense capabilities into one mobile system?
        iv. What is Red's response to the logistics, ASM, and HVP concepts outlined above?
            1. What are Red's objectives?
            2. What does Red target and attack?
            3. What does Red perceives as the highest risk to their forces?

2. **Scenario.** In an extended war at sea with the PRC, the U.S. and its allies establish C4ISR, ASM, and Air Defense sites along the first island chain in order to place at risk the PRC's surface combatants and aircraft attempting to leave the East and South China Seas. China threatens U.S. Sea Lines of Communications (SLOCs) across the Philippine Sea with submarines, ASMs, and bombers.
    a. **Geographic region:** Philippine Sea and first island chain
    b. **Time:** 2032
    c. **Road to war:**
        i. 2029:
            1. PRC seized Taiwan, Natuna Besar, and Palawan. Appeals for intervention were made to the United Nations and directly to the United States
            2. PLAN, maritime militia, and PRC law enforcement began inspecting all merchant traffic in the South and East China Seas which brought protests from Japan, South Korea, Australia, Singapore, Vietnam, and the United States which began inspecting all PRC flag ships world-wide
        ii. 2030:
            1. US DDG torpedoed by a suspected PRC submarine in the Philippine Sea
            2. US and allies declared war against the PRC
            3. PRC and North Korea responded in kind
            4. Allied submarines interdicted PRC merchant vessels inside the first island chain
            5. PLAN submarines, ballistic missiles, long-range bombers, and cruise missiles threaten allied sea control east into the Philippine Sea

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iii. 2031:
1. PRC sinks an American cruiser east of the first island chain with a submarine-launched anti-ship ballistic missile (ASBM)
2. Communication, navigation, and timing capability is degraded by 60% throughout the AO

3. **Player Role List**.

a. Blue Forces

1. Commander, O-6 (Ret) U.S. Navy, Surface Warfare Officer
2. Fires, O-5 U.S. Marine Corps Artillery Officer, MCWL FOPS.
3. METOC, O-4 U.S. Navy NPS METOC Student.
4. Supply, O-4 U.S. Navy Supply Officer, NPS Operations Research Student.
5. Communications, O-3 U.S. Marine Corps Comm-O, NPS ITM Student.

b. Red Forces

1. Commander, O-6 USMC Intelligence Officer, currently Military Advisor to Director Office of Net Assessment, former FAO.
2. Plans, former AV-8B pilot, MCWL Strategic Plans.
3. METOC, O-4 U.S. Navy NPS METOC Student.
4. Subsurface, O-2 U.S. Navy Submarine Officer.
5. LITMUS Operator, O-1 U.S. Navy Officer, NPS NSA Student.

a. **Player Role Objective(s)**.
i. Blue Team Commander: provide oversight and strategic guidance to members of Blue team
ii. 4-person Blue group: combine warfare area expertise to maximize Blue team's efforts to accomplish objective via LITMUS/Unity
iii. Red Team Commander: provide oversight and strategic guidance to members of Red team
iv. 4-person Red group: combine warfare area expertise to maximize Red team's efforts to accomplish objective via LITMUS/Unity

b. **Available Resources**. Players had geographic map along with respective Order of Battle (OOB) to place agents before each turn started. Blue team's surface OOB was divided into convoy, mini-convoy/swarm, and non-convoy unit distribution to meet game's objectives. Both team's geographic maps contained boxes for unit placement. All wargame decisions were executed via LITMUS/Unity, which was running via one laptop per each team.

c. **Relationships.** All Blue team players reported to Blue Team Commander. All Red team players reported to Red Team Commander.

4. **Wargame Description:**

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a. **Wargame Design**:
    i. Type: hybrid (system via LITMUS/Unity, seminar conducted after each game)
    ii. Information format: hybrid (closed during LITMUS/Unity operation, open during seminar)

b. **Wargame Execution**: Players were divided into two teams: Red and Blue. The red team played the role of the adversary, and had a constant force structure throughout all turns. The blue team had varying shore-based ASMs, GBAD, sensor, and hypervelocity projectile (HVP) technologies by turn. The blue team's objective was to get logistics ships into Manila and Sasebo ports while the red team was supposed to prevent that. The Data Collection and Management Plan (DCMP) focused on data collection throughout each turn to include player surveys and open seminar discussion in-between turns. We executed the wargame in a span of approximately eight hours, with one hour and a half dedicated for lunch and approximately ten minutes before each game dedicated to breaks. Wargame executed in five different scenarios, with 30-40 minutes of gameplay/seminar each. For each wargame turn conducted via LITMUS/Unity (software engine) in real time, we operated in a client-server model of gameplay.

5. **Methods, Models, and Tools (MMTs)**.
    a. **Adjudication**: We conducted adjudication via the LITMUS server with pre-programmed stochastic lethality and sensor probabilities, to include closed unit/agent placement from Red and Blue teams at the beginning of each game. Due to gameplay adjudication via LITMUS software (i.e. stochastic decisions based on unit engagement), very little adjudication was conducted by white cell. During issues with LITMUS and/or Unity software engine, adjudication conducted via seminar through discussion between Red and Blue players. Red and Blue teams were notified of any losses that occurred during the game. Intelligence injects were made at the beginning of each game, to include weather injects by METOC officers done in order to impact player decision-making.

    b. **Player Feedback/updates**: Although Unity displayed enemy and friendly losses to Red and Blue players, results were still compiled by the white cell and reviewed in post-game seminar between each turn.

6. **Key Constraints, Limitations, and Assumptions.**
    a. **Constraints**:
        i. MMT: LITMUS as the wargaming engine
        ii. Timeline: during the week of 3 – 7 June of 2019
        iii. Blue team operational concepts (convoy, mini-convoy/CLF-swarm, unescorted/single-ship)
        iv. Geographic and force structure scenario based on NPS Joint Campaign Analysis *GW2030* scenario
        v. Sponsor's questions and objectives as outlined in Problem Statement section
    b. **Limitations**.

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i. LITMUS run-time and interpretation limiting the number of decision points and rounds of game play
ii. Applicability of outcomes based on fixed scenario and immature technology, to include TTPs

c. **Assumptions**.

i. Command, control, computers, communication, precision navigation and timing (C4PNT) degradation inject
ii. Uncontested shore-based ASM sites inserts
iii. Red and Blue players having limited units to choose from (OOB)

7. **Findings.**

a. Blue favored implementing unmanned logistics surface vehicles (ULSVs) as decoys, while remaining units operated in a convoy and radiated to maximize offensive and defensive tactics. Communication degradation did not impact Blue's implementation of ULSVs as decoys as data flow/control of ULSVs was still maintained with the use of directional antennas and TALONS. HVPs were found to be maneuverable and easy to hide if containerized on barges. In terms of weather, Blue favored using bad weather as opportunity to reposition shore-based ASMs. WWII Atlantic-style logistics and escorted convoy tactics invited quicker detection and concentrated target by adversary, but theoretically not feasible for more than two terminal delivery points (game design). Forward shore-based ASM employment was perceived as high-risk, but with high reward in USN survivability. Expeditionary advanced base operations (EABO) concept was found to be central to U.S. success in South/East China Sea littoral fight, largely because the PRC is not manned, equipped, or trained to defeat the land-based Blue mobile launcher and air defense threats. As far as crossing the Philippine Sea, escort convoys were thought to be best, using 2 convoys to hug land for protection with USVs out in front radiating in an attempt to draw fire, rendering EMCON policy necessary to attack with CSGs. After getting across the Philippine Sea with warship escorts to mitigate Red's submarines and manned aircraft (which campaign analysis has showed many times will detect any of the surface logistics options considered), Blue saw deceptive sequential and distributed terminal logistics delivery as optimal method.
b. Red distributed its forces evenly to defend against Blue's approaches, keeping its surface ships outside perceived effective range of Blue sensors and shore-based ASMs. Blue's advanced base concept made Red Force more conservative with surface assets and routing of aircraft, favoring utilization of ASBM sites and bombers against Blue forces. Considering that Blue had the option to use mini-CLF/swarm logistics concepts, Red favored using more unmanned assets (if available) to counter Blue's mini-CLF if detected early enough. Red chose to target DDGs vice LUSVs first, leading with ASBMs, then aviation and torpedoes from submarines, keeping their own surface ships well outside of Blue ASM range. Red found that targeting ports was the best course of action if Blue targets could not be found. A key insight for future study is to consider more use of submersible and aviation logistics transport.
c. LITMUS showed that it can be useful in closed wargame play given its stochastic built-in functionality, but its outcomes are limited by classification level and software design.

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LITMUS is designed to analyze maritime tactics, but operational and strategic use for campaign-level insights are major hurdles for the system. There is currently limited bandwidth for multiple laptop operators, a steep learning curve, and limited ability to log performance metric outputs for wargaming, which all led to two of the five gameplay iterations to be conducted entirely in seminar for this particular wargame. Since LITMUS is DoD-owned and managed, it can be tailored to meet user requirements at different classification levels.

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