

Naval Postgraduate School  
**Naval Warfare Studies Institute (NWSI)**  
**Wargaming Center**

**Quarterly Report - Fall 2020 (1Q FY21)**

Jeff Appleget, Operations Research, and Rob Burks, Defense Analysis, Directors

**Naval Warfare Studies Institute:** We are proud and excited to direct the NWSI Wargaming Center. To learn more about the NWSI, please see the attached NWSI Slicksheet.

**How-to Book on the Craft of Wargaming Hits the Streets** *By Javier Chagoya*

Naval Postgraduate School (NPS) scholars in the field of wargaming have authored a seminal work that lays out a detailed planning guide for defense planners and analysts in a new book, "The Craft of Wargaming."

The book is co-authored by NPS Senior Lecturer retired Army Col. Jeff Appleget, NPS Associate Professor retired Army Col. Robert Burks, and internationally-recognized Operations Research Analyst Fred Cameron. These three authorities bring more than 100 years of wargaming knowledge to an ever-expanding cadre of wargaming professionals.

The book is designed to support defense planners and analysts on their journey from wargaming apprentice to journeyman, with topics of particular interest to commercial wargamers. With its focus on design and development, the book serves a primer for initiates to senior commanders seeking to advance their knowledge and understanding of the wargaming field.

For the full article, see: <https://www.navy.mil/Press-Office/News-Stories/display-news/Article/2360929/naval-postgraduate-school-publishes-how-to-book-on-wargaming/>

Click to hear the authors discuss the motivation behind the book in a podcast with the Naval Institute Press: <https://www.usni.org/the-proceedings-podcast/episode-193-craft-of-wargaming>

The following CIMSEC article discusses the role wargaming should have in DoD education:

**REVAMPING WARGAMING EDUCATION FOR THE U.S. DEPARTMENT OF DEFENSE** Jeff Appleget and Rob Burks (NWSI Wargaming Center directors), and Jeff Kline (newly appointed director of NWSI)

<http://cimsec.org/revamping-wargaming-education-for-the-u-s-department-of-defense/46037>

**1. Resident NPS Wargaming Courses:**

**OA4604 Wargaming Applications:**

This course teaches students how to initiate, design, develop, conduct, and analyze a wargame. Students are organized into teams who work for real world sponsors who need wargaming support. Sponsors come from DoD, defense allies and partners, and industry. The sponsor and student team must first agree on the problem definition. Then the student teams design and develop the wargame to respond to the objective and issues that they and the sponsor have agreed upon. For the first six weeks, the students learn about wargaming through on-line lectures and practical exercises as they are also building the foundation of their sponsored wargame. After the Wargaming Apprentice Certification Exam on week 6, the student teams work full time completing the design of the wargame. The wargame is then played for the sponsor and the findings are documented and provided to the sponsor.

This quarter we had 14 Students (13 Operations Research and one Defense Analysis): They were predominantly US students: 10 USN, one USMC, one USAF, one USA, one German Army.

Two of the three sponsored wargames for this course were conducted virtually during Wargaming Week (7-11 December). The ADF ASW wargame was classified and conducted in classified spaces. Executive summaries of the wargames are noted at Appendix 2.

Short descriptions of the wargames follow:

- Sponsor: Australian Defence Force Joint Experimentation Directorate.  
Wargame: **Assess concepts for the optimal employment of AUS, US and JPN ASW forces in the Full Spectrum ASW mission (previously TASW)**
- Sponsor: Naval Information Warfighting Development Center.  
Wargame: **Assess the ability of U.S. Navy CSGs to use cloud cover to prevent detection from adversary Electro-Optical/Infrared (EO/IR) capabilities.**
- Sponsor: OPNAV N4.  
Wargame: **Examine Command & Control (C2) with a combined USN/USMC staff in support of Distributed Maritime Operations (DMO) and Expeditionary Advanced Base Operations (EABO) within a Logistics Task Force Commander organization in a contested environment against a peer adversary.**

#### **DA4500 Special Topics in Strategic Analysis: Modeling for Special Operations in an Era of Great Power Competition.**

This course serves as a continuation of the OA4604 Wargaming Applications course to allow students to further develop and extend a wargame designed to gain insights into how NATO SOF can better support the internal security of a NATO nation facing a hybrid threat. This quarter, students worked with Estonian SOF element to refine and update their wargame looking at how Allied SOF elements can be used to support deterrence and assurance across the European theater against Russian hybrid warfare and Influence Operations, using analytical wargaming models. Recently developed wargame includes looking at how NATO SOF can foster Estonia's resilience to malign influence from Russia.

#### **2. Mobile Education Team (MET) Course:**

The purpose of the NPS Basic Analytic Wargaming MET course is to provide the sponsoring organization an opportunity to educate a cadre of their personnel on wargaming by having student teams build wargames for execution. The workshop is a mixture of practical exercises and lectures focused on teams designing, developing, conducting, and analyzing a wargame, activity-based learning or 'learn-by-doing.' The sponsoring organization provides the wargaming topic for the practical exercises, which culminate with the students demonstrating a wargame they designed to address the sponsor's topic on Friday. At the end of the course, the students have enough education and experience to be considered 'wargaming apprentices.' These students have the opportunity to receive Continuing Education Units if they pass a 'Wargaming Apprentice Certification Exam' that resides on their organization's Sakai wargaming course site, a web-based repository of wargaming materials created by the NPS MET for the sponsoring organization's use.

**METs conducted this fall:** NPS NWSI deployed a Wargaming MET to the NATO Joint Warfare Centre in Stavanger, Norway to conduct both a Basic and an Advanced Analytic Wargaming Course in October, 2020. NATO JWC used these courses to design and develop both an educational and an analytic wargame in conjunction with the NATO CIMIC Centre of Excellence. See the NATO JWC link about the course here:

<https://jwc.nato.int/articles/strategic-and-operational-level-decision-making-tested-during-two-analytic-wargaming-courses-joint-warfare-centre>

### **3. NPS Wargaming Outreach and Collaboration:**

- 23 November 2020: Jeff Appelet engaged with CAPT Mike O’Hara from the Naval War College to make him aware of NPS wargaming program and to better coordinate wargaming within USN via the Analytic Master Plan (AMP).
- 25 November 2020: Robert Burks engaged with Deputy Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict Daniel Pick to make him aware of the NWSI Warfare Continuum effort.
- 30 November 2020: Robert Burks engaged LTC Tsuneyoshi, Commander 2<sup>nd</sup> Battalion, 1<sup>st</sup> Special Forces Group (Airborne) on NPS support to 1<sup>st</sup> Special Forces Group on wargaming and Course of Action development in support of FORAGER 21.
- 9 Dec 2020: Jeff Appelet participated in a round table discussion with the Assistant Commandant of the Marine Corps and five other USMC GOs.

### **4. Conferences and Workshops:**

- 7-9 December: Jeff Appelet and Rob Burks presented at the virtual Connections Oz. Jeff presented “Wargaming at the Naval Postgraduate School” and Rob presented “The Craft of Wargaming: Building Future Wargamers.”

### **5. NPS Wargaming Thesis Work:**

MAJ Richard Hill and MAJ Derek Hirtz: Insurgent/Counter-Insurgent Wargame. The U.S. military is currently in an era of change highlighted by a shift in focus from small scale and limited wars involving counter-terror (CT) and counterinsurgency (COIN) to preparations for large scale combat operations with a near peer threat. This has placed emphasis on conventional focus in training, education, and planning to stand ready for a potential conflict as the US continues to maintain its unilateral grip as the world’s lone superpower, and Russia and China try to expand their spheres of influence in the Great Power Competition (GPC). But, similar to the Cold War, it is unlikely this showdown will occur. Conversely, it is far more probable conflict will be highlighted by competition through state-sponsored insurgencies, proxy wars, and a struggle over influence. Special Operations Forces (SOF) therefore must balance their understanding and preparedness of conventional warfare while standing ready to execute unconventionally. This wargame is designed to train entry level Special Forces (SF) candidates the interaction between the insurgent and counter-insurgent, utilizing COIN and Unconventional Warfare (UW) doctrine as a basis while also employing the concepts of insurgent, resistance, and COIN theorists. The goal of the wargame is to aid SF candidates as they prepare to serve in their operational Groups, providing a venue to test strategies and understandings of COIN and UW principles, and ensure an enhanced education in doctrine and theory.

### **6. Upcoming NPS Wargaming Center Events and Engagements (Winter):**

**USN Planning Wargaming Instruction:** The NPS Mobile Education Team will develop and teach a 12-hour block of planning wargaming instruction for the US Naval Surface and Mine Warfighting Development Center Warfare Tactics Instructors. This block introduces the students to the Naval planning process (NWP 5-01) and focuses on wargaming courses of action. This block of instruction will be delivered in January at SMWDC in San Diego.

**MET:** NPS NWSI will deploy a Wargaming MET to Canberra, Australia to conduct a two-week basic course and a week-long advanced course in February and March.

**Wargaming Week (15-18 March 2021):** The 1<sup>st</sup> Special Forces Group (Airborne) is sponsoring three wargames designed to propose the requisite capabilities, force posture, and organizational Mission Command structure that Joint SOF should employ during the phase of persistent competition to be successful against a peer adversary (China) in armed conflict in INDOPACOM in partnership with the Army's Multi-Domain Task Force.

**Projected MET Courses (travel conditions permitting):**

Summer 2021

- U.S. Army Futures Center, Picatinny Arsenal, NJ – one-week basic course
- Defense Threat Reduction Agency, Ft. Belvoir, VA – one-week basic course
- Hybrid Center of Excellence, Helsinki, FI – one-week basic course & one-week advanced course
- U.S. Army Europe, Wiesbaden, GE – one-week basic course
- USMC CD&I Operations Analysis Directorate - one-week basic course

## Appendix 1: About the Naval Postgraduate School NWSI Wargaming Center

The Wargaming Activity Hub was envisioned by NPS Graduate School of Operational and Information Sciences (GSOIS) Dean Gordon McCormick to bring higher visibility and synergy to the myriad wargaming activities that NPS is involved with across campus and worldwide. Dr. Jeff Appleget (OR) and Dr. Rob Burks (DA) direct the activities of the hub. Ms. Jane Barreto assists the directors in the overall administration of the hub to include managing wargaming research and professional development sponsors, activities, and funding, and assists NPS wargaming students with coordinating wargame facilities for sponsored games, and creating wargaming maps, charts, and other graphical materials. The WAH joined the NPS Naval Warfare Studies Institute in 2020 as the organization's Wargaming Center.

**Mission:** Conduct high quality research, analysis, gaming, and education to support the Naval Postgraduate School's mission, prepare future leaders, and help shape and form key decisions on the future of the Department of Defense (DoD).

**Purpose:** Support and contribute to the Naval Postgraduate School's educational and research mission and provide a gaming and simulation environment to assist DoD leaders in their mission to:

- develop new strategies and concepts across all levels of warfare to counter emerging adversary capabilities and
- complement ongoing field experimentation activities for the rapid testing and fielding of new technologies.

### Aligning the Wargaming Activity Hub with U.S. Naval priorities:

- **STRENGTHEN NAVAL POWER AT AND FROM SEA:** We wargame current and emerging concepts, both doctrinal and technical, against contemporary and future adversaries. Graduates are better able to anticipate who we will fight and how after designing and analyzing wargames that address real-world DoD sponsors' biggest challenges in the NPS classroom.
- **STRENGTHEN OUR NAVY TEAM FOR THE FUTURE:** NPS students are typically LTs and LCDRs. The Wargaming Applications course, along with the Joint Campaign Analysis course, exposes these young students to operational and strategic challenges, raising their level of thinking to that of more senior leaders, preparing them for the challenges our Nation will face in the future.
- **EXPAND AND STRENGTHEN OUR NETWORK OF PARTNERS:**
  - Our resident Wargaming Applications course typically has U.S. Navy, Army, and Marines and international students from several nations. The student wargaming teams are, by design, a mix of these students (unless the game is classified, which restricts the student teams to U. S. only). Our Wargaming scenarios are often crafted to include the involvement of the nations represented by our international students and we do have international organizations sponsor wargames in the course.
  - Our Basic Analytic Wargaming Mobile Education Team (MET) course originated from a request by the Centre for Operational Research (COR) in Canada, and the inaugural course was delivered at Canadian Forces Base, Trenton, Ontario in 2011. Since then we have provided the course for STRATCOM, CENTCOM, MCCDC, ADF & DST-Group (Australia) and the Indonesian Navy and created a Wargaming R&D workshop for Lockheed Martin delivered via a CRADA.

## Appendix 2: Unclassified Executive Summaries from Fall Wargames

### ADF 2029 WARGAME FOR THE AUSTRALIAN DEFENSE FORCE

#### 1. Problem Statement.

a) **Wargame Objective.** Analyze concepts of operation that provide successful employment of Australia, United States, and Japan undersea warfare (USW) forces in the Full Spectrum USW (FSUSW) mission the South China Sea and Southwest Pacific Ocean.

#### b) Key Issues.

i. What delineation of geographic area into Areas of Responsibility (AOR) is needed to execute FSUSW?

ii. What are the gaps in coverage of U.S./Japan/Australia USW to cover delineated AORs?

iii. What apportionment of allied USW assets across the SW Pacific and within the SCS is needed to execute selected aspects of FSUSW?

iv. What are the force integration requirements for execution of FSUSW?

v. What are the required command and control (C2) arrangements for employment of a trilateral TASW fleet?

2. **Scenario.** The year is 2029 and most of the world dismisses China's claim to the Spratly Islands, the strategic archipelagic sea lanes in the South China Sea (SCS). With the navies of the United States, Japan and Australia working together to deescalate the situation, China has made it apparent that they will do whatever is necessary to assert their traditional claims if conflict arises. To this end, allied intelligence-gathering organizations have amassed intelligence regarding PLA (Navy) submarine movements from the East and South Sea Fleets (ESF/SSF). Further, resident AOR surveillance has monitored PLAN training exercises that simulate submarine-launched ballistic missile strikes against potential land targets as well as free commerce disruption and interdiction. From this information, intelligence agencies determined that a primary effort of the PLAN submarine force will be to disrupt Sea Lines of Communication (SLOC) and strike attacks on Australian land-based strategic targets and high-density cities. Indeed, it is determined that PLAN submarines are intent on testing allied vulnerability in the SCS and Southwest Pacific.

a) **Geographic Region. Southwest Pacific and South China Sea**

b) **Time.** The game is set in 2029 with force structures projected for that time frame.

c) **Road to War.** In 2020, Japan and Australia signed a historic defense pact specifically focusing on joint efforts to deter China from its aggressive strategic maneuvering in the region. The pact upset Chinese sensitivities with leadership viewing the pact as an alliance against China at the encouragement of the United States.

Since that the signing of the pact, China continued to proclaim wide swaths of control over the South China Sea putting the three allies on the defensive. Further, PLAN maritime forces persistently tested the allied USW capability to defend the Australian maritime approaches. Japan's investment in protected passage through SCS SLOCs to maintain a consistent flow of oil resources has only increased its resolve to support the alliance. Japan has even offered to supply naval assets for freedom of navigation operations (FONOPS) to bolster strategic trade routes. The US also views SLOC maintenance as a strategic necessity not just to ensure its allies are resourced, but to maintain regional stability and ensure a growing China does not supplant the US as the arbiter of the seas.

With these concerns in mind, the three allies have agreed to mutual support activities across the undersea warfare spectrum. Their avowed aim is to detect and deter PLAN submarines prior to the outbreak of conflict, identify AOR delineation in the theater, and structure a communications and control plan that will best support unity of effort.

**3. Player Role List.** The wargame utilizes two teams. The first consists of allied forces in the form of the United States, Australia, and Japan and is made up of three players with each player representing the assigned country's force maritime component commander (FMCC). The second team represents the PLAN FMCC and requires at least one player though two were used in the game. Each team is accompanied by a white cell member to ensure proper game play, answer questions, and collect information for each player's move.

**a) Player Role Objective(s).** Allied forces must detect and deter PLAN submarines from reaching the Australian vital area. This will be accomplished through apportionment of forces throughout the AOR in a deconflicted manner. PLAN submarines must achieve mission goals without being detected by Allied forces.

**b) Available Resources.** Both Allied and PLAN forces represent projected force structures to be in place by 2029. Weather forecasts are provided in each round which will alert players to the presence of inclement weather which could affect submarine detection. In addition, players are provided 'mission' cards that represent available resources outside of the maritime domain. These cards may be used to employ assets not represented as pieces on the board(s).

**c) Relationships.** Allied forces work in concert to prevent PLAN submarines from reaching the Australian vital area. However, while allied forces are unified in the overall USW effort, allies work in a deconflicted nature with limited communications and situational awareness between allied entities. PLAN forces, regardless of the number of players, act as a unified command. Allied and PLAN teams interact indirectly as allied players attempt to detect PLAN submarines as those submarines work to reach their mission objective.

**d) Player Experience and Expertise.** The wargame team employed eight players. Of those players six players were assigned to the allied team and two assigned to the PLAN team. The six allied players were broken into two groups with one group playing in each of two sessions. The PLAN players played in both sessions.

Allied team members originated from the U.S. military with the rank of LCDR or LT.

**Allied Team 1:**

i. Rank: LT	Service: U.S. Navy	Community: Surface Warfare	Experience: ASW Officer in SEVENTH Fleet
ii. Rank: LT	Service: U.S. Navy	Community: Surface Warfare	Experience: ASW Evaluator in SEVENTH Fleet
iii. Rank: LT	Service: U.S. Navy	Community: Sub-surface	Experience: Multiple deployments with at least one to SEVENTH FLEET

**Allied Team 2:**

i. Rank: LCDR	Service: U.S. Navy	Community: Intelligence	Experience: Multiple operational postings with next posting in with the SEVENTH FLEET carrier strike group.
ii. Rank: LT	Service: U.S. Navy	Community: Sub-surface	Experience: Submarine officer with operational deployment experience.
iii. Rank: LT	Service: U.S. Navy	Community: Surface Warfare	Experience: ASW Evaluator and SUWC in SEVENTH FLEET. Additionally, worked alongside Japanese forces in multiple ASW exercises.

**PLAN Team:**

i. Rank: LT	Service: U.S. Navy	Community: Surface Warfare	Experience: Destroyer Squadron staff with ASW experience in SEVENTH FLEET.
ii. Rank: Capt	Service: USMC	Community: Engineer	Experience: N/A.

#### 4. Wargame Description.

**a) Wargame Design.** ADF Wargame 2029 is an analytical, hybrid wargame with multiple open and closed aspects. The game uses three boards: PLAN board, Allied board, and White Cell board. Each board consists of a map of the AOR with hex overlay representing the movement space. Each hex represents approximately 90 nautical miles of geographic space. Players maneuver in order to achieve mission objectives (PLAN) or detect and deter submarines (Allied). The Allied team consists of three separate countries, working in a deconflicted nature towards the same goal of finding PLAN submarines. However, allied countries act individually, and while each ally's surface force locations are known by their partner commanders, their allied partners cannot see their subsurface picture until communicated by that country. Points are awarded to PLAN for mission objectives completed. Allies receive points based on preventing PLAN forces from reaching those mission objectives. Points are assigned per round representing a deployment cycle for PLAN submarines.

**b) Wargame Execution.** This game consists of rounds that correspond to seasons (~90 days). Each round consists of four turns (each ~3 weeks). Ninety days is the duration a PLAN submarine can depart its homeport and attempt to execute its mission objective. Upon hitting the 90-day threshold, the submarine must return to port for refit for a minimum of 60 days (3 turns).

Prior to game start, the Allied forces participate in an initial planning phase. This phase only occurs at the beginning of the game and allows the allied forces to simultaneously place their forces within the AOR (gameboard) to help establish their overall strategy. There is no initial planning phase for the PLAN. Their positions are pre-determined by the White Cell, however they may still establish a strategy as they see fit to accomplish their mission objective.

At the conclusion of the initial planning phase the game begins. Each turn is conducted in the same order. Turns consists of four main components: Weather, Movement, Search and Communication Phase. Movement and Search are all aspects of the Action Phase of the game. The Action Phase is conducted in full by each side, with PLAN conducting the action phase first for each turn. Weather, components of the Action Phase and Communication Phase are listed below in the order they are played as well as their accompanying details.

**Weather:** The encompassed area of this game experiences extreme weather (typhoons) throughout each year and can affect operations and forcefully shape the battlefield. Weather is an aspect of each turn, with each round representing one of four seasons. White Cell incorporates METOC expertise to determine the probability of typhoons during each season. The probability of typhoon occurrence is conducted by the White Cell at the beginning of each turn by means of a dice roll. If the typhoon occurs, subsequent rolls are conducted to determine its location and direction. This typhoon will remain in effect for two turns. Surface vessels must avoid the spaces the typhoon occupies for the next two turns while Submarines may travel freely.

**Action Phase:** The action phase is comprised of Movement and Search. Within the action phase, non-maritime cards can be played at any point, as they may have application during movement or search. Each player has access to one card per turn, there are a total of four cards. These cards represent and simulate the use of multi-domain assets to deter or diminish the opposing force. At the end of a round (four turns), the mission cards replenish and may be used for the next round. Cards may not be "banked" for subsequent rounds. The Action Phase is conducted by the PLAN first. Allied forces conduct the action phase individually with no other allied representatives present.

**Movement:** Allied and PLAN have the same movement allowance. The allowance is dependent on the unit's geographical location: greater allowance in open ocean, restricted allowance in high density traffic areas. Both sides use movement to achieve their mission objectives and shape the AOR. During the movement phase it is assumed that all units are always passively searching. During player movements passive detection of PLAN or Allied units can be

achieved. This detection is determined by a White-Cell dice roll. Probability of success is determined by the moving unit's capability and geographical location. In the case that a PLAN submarine passes an Allied unit within passive sonar range, the White Cell rolls a die to determine if the PLAN submarine is detected and vice versa.

Search: Searching is conducted immediately after movement and is used to locate adversary units. Units have the option to passively or actively search, both of which have their benefits and disadvantages. Detection of an adversary unit is determined by a dice roll. Probability of success is determined by the searching unit's capability and geographical location.

**Communication Phase:** At the conclusion of all Allied forces conducting their movement and search phases they will have the opportunity to discuss their findings during the Communication Phase. During this time limited phase, Allied forces can discuss their findings from their last turn and determine the best method to achieve their mission objective the next turn. This phase is important because Allied forces move individually and are not immediately alerted to the findings of partner forces. There is no communication phase required for the PLAN. The culmination of the Communication Phase marks the beginning of the next turn.

All adjudication of detection occurs with a dice roll for each unit searching for a submarine.

## 5. Methods, Models and Tools (MMTs)

- a. **Game Tracking.** The game requires three boards with two boards being the 'play' boards, one for the PLAN team and one for the Allied team. The White Cell possesses a separate board hidden from the players that tracks all associated pieces and placements.
- b. **Adjudication.** Game adjudication occurs using dice rolls in almost all circumstances. Submarine detection is accomplished by dice roll. Two different modes of sonar, active and passive, are available to each player with active mode having a higher probability of success than passive. Each piece is considered to always be in passive search so a PLAN piece cannot bypass an Allied piece if it comes within the search radius of the Allied asset. If a submarine is detected, only the allied country that detected the submarine will be alerted to its presence until the 'Communications Phase' of the turn. Typhoons are placed in geographic areas depending on probabilities provided by the METOC representative. Once placed, typhoons prevent surface piece movement into the hex space covered by the storm. Submarines may move freely.
- c. **Player Feedback/updates.** Throughout the game players receive feedback during the action phase. All searches are conducted by the player so they receive immediate feedback regarding a successful or unsuccessful search and information regarding a detection is then provided by the white cell. This information is then retained by each player to be discussed during their communication phase. Along with adjudication and player discussion visual feedback is provided by the White Cell as the game progresses. The board is constantly updated by the white cell giving each player the visual of the AOR in "real-time". This "real-time" picture includes the player's surface and sub-surface units as well as known allied MPRA deployment and enemy surface contacts. As a player's units move across the board, sub-surface and surface detections can occur which the player will be immediately informed of by the white cell (upon adjudication, if required). The white cell updates the information as quickly and efficiently as possible to allow each player to make their optimal strategic decision each turn.
- d. **Data Flow and Collection Plan.** Each player annotates why they made the move they did and what overall objective they intended to meet. Each time a card is played this will be noted and a reason given for the play. Each player ensures the White Cell proctor assigned to their side, notes the movements, searches, and card plays. The White Cell maintains the master board with all pieces. The White Cell 'commander' annotates in a log these movements with amplifying information. The White Cell proctor assigned to the Allied team monitors the communication aspect to note the topic of discussion and keep time. At the end of the game, all players are interviewed to clarify intentions during the game. At the end of the two-day gaming period, the study team provides the wargame sponsor with a quick-look report.

**6. Key Constraints, Limitations, and Assumptions.** Listed below are the constraints, limitations and assumptions of the ADF 2029 Wargame.

**a. Constraints.**

- i. Wargame to be conducted, analyzed, and conducted with results delivered to sponsor by 17 December 2020.
- ii. Wargame must incorporate both South China Sea and Southwest Pacific geography
- iii. Wargame must be conducted at SECRET level

**b. Limitations.**

- i. No classified information about Chinese submarine capabilities is available to study team to inform the team about PLAN movement and searching
- ii. The team does not have access to a Chinese, Japanese, or Australian subject matter expert, which limits the fidelity of these players' actions and motivations
- iii. The scenario does not extend beyond the South China Sea and Southwest Pacific
- iv. The game board only captures two dimensions; sea depth considerations for submarine movement and evasion are not included in the game

**c. Assumptions.**

**Limitation Accommodation**

- i. PLAN vessels have identical move and search capabilities as Allied assets
- ii. American players will comprise foreign roles (i.e., China, Japan, and Australia), but their motivations will be informed by background information and an in-brief
- iii. PLAN submarines avoid transit through archipelagic waters southwest of the South China Sea
- iv. Varying sea depths do not affect submarine movement

**Assumptions from Sponsor**

- i. High density shipping waters reduce mobility and detectability
- ii. Bad weather reduces detectability
- iii. Allied active sonar alerts PLAN submarines within search radius
- iv. Area of focus is bounded such that Indian/Thai naval intervention will not occur

**Assumptions from Wargame Team**

- i. No land-based missile or cruise missile preemptive strike
- ii. All forces have a finite number of units (no replenishment)
- iii. The Allied team is an enduring force that does not need to return to base
- iv. Surface Action Groups (SAG) maintain a constant formation that clusters individual assets, and therefore is represented as one unit on the playing board
- v. Allied passive search is always on, with option to go active
- vi. Allied players have real time knowledge of each other's surface locations, but not submarines
- vii. In port submarine locations are known

**Findings.** Classified

**Study Team Members.** CDR David Barnhill, Maj Lewis Flinn, LT James Wiltshire, ENS Logan Hughes and ENS Jasmine Ye

**Sponsor POC:** GPCAPT Philip Arms, Australian Defense Force

## CLOUDS AS CONCEALMENT (CLOAK) 2032

SPONSOR: NIWDC-W

### **1. Problem Statement.**

**a. Wargame Objective:** Analyze the effectiveness of using clouds to prevent detection of Carrier Strike Groups (CSGs) by adversary EO/IR threats.

**b. Key issues that the wargame examined:**

- i. How well does using cloud concealment hide CSG operations from EO/IR threats?
- ii. What effect do cyclic flight operations have on the ability to use cloud concealment to hide CSGs?
- iii. How does maximizing the amount of time the CSG is under cloud concealment impact transit time?
- iv. What impact do MODLOC, aggregated, and dispersed operations have on the ability to use cloud concealment?
- v. In which Western Pacific regions are cloud concealment techniques most/least effective?
- vi. How does the ability to use cloud concealment change temporally?
- vii. How does proximity to land affect the ability to use cloud concealment?
- viii. What impact does an adversary's use of EO/IR sensors on diverse air and space platforms (satellite, manned, unmanned, AI enhanced) have on the effectiveness of using cloud concealment?
- ix. What impacts do adversarial space denial operations have on the ability to use cloud concealment?

**2. Scenario.** CLOAK 2032 is set in the western Pacific Ocean with focus on operations in the Philippine Sea between the first and second island chains. The geopolitical scenario is based on increased tensions in the South China Sea leading to declaration of war in 2030. The game is played in 2032, two years into the war, at which point the U.S. has not achieved air superiority in the region and the Opposing Force (OPFOR) have sub-surface access to the area between the first and second island chains. Additionally, the OPFOR have achieved dominance in space, resulting in reduced allied capabilities, especially regarding communications and the ability to generate and transmit accurate weather reports.

The red and blue teams were given intelligence that informed them of the current status of the conflict which included an allied plan to liberate Palawan island from OPFOR control. After breaking out into respective red and blue teams, the blue team (U.S. forces) was given orders to maneuver two CSGs, the REAGAN out of Japan and the GEORGE WASHINGTON out of Guam, while attempting to maximize cloud cover. The red team was given intelligence which guided them to the general area of the CSG (within 2-3 hexes) and informed them of the general destination of each (i.e. northeast coast of the Philippines).

At the outset of each game, the teams were asked to plan their strategies without taking clouds into consideration and again while taking clouds into consideration. The blue team annotated both routes on their gameboards (for post-game analysis). The game was played twice, once in April and again in June. During wargame construction, these months were assessed to be the cloudiest and least cloudy periods of the year (based on weather data provided by the Meteorology and Oceanography (METOC) Department faculty and students at Naval Postgraduate School). By design, the blue team was given the same start and end points for their transit routes to provide comparison across seasons. Based on the scope of the game, red surface combatants, typhoons, ground observers, and commercial shipping, as well as surface-to-surface or air-to-surface threats, were not taken into consideration.

**3. Player Role List.** To play the game, a red team, blue team, and white cell are required. If weather products are available ahead of time, the game could theoretically be played by two persons (one on each team) and no white cell. To achieve more accurate results, the teams were comprised of subject matter experts in varying fields that relate to the concept of moving a CSG across the Philippine Sea or acting as OPFOR military members tasking air and space assets for intelligence gathering purposes.

The blue team was led by a senior leader (O-6) with experience in the AOR and application of weather data to maneuver operations. The blue team also consisted of an assistant team lead (O-4) with no specific experience. Also included in the blue team complement was a foreign affairs officer, an intelligence analyst, and an additional weather specialist with relevant experience in the area of operations.

The red team was led by another senior leader (O-6) with intelligence experience in the AOR. The red team assistant director was a mid-level officer (O-4) with intelligence and foreign area studies experience specific to Pacific region. Additionally, a METOC officer, a senior enlisted foreign area officer, and an operations research student were part of the red team.

Each team also included three embedded wargame design team members, they were not considered players and did not provide insight or opinions regarding team “moves” to their assigned teams during the game. A METOC officer was provided to each team as a consultant. They provided weather forecasts and updates as appropriate and helped interpret weather products. A data collector was assigned to each team to record each move and information about decisions made and discussions held. Lastly, a core wargame design team member was embedded in each team to administer the game and ensure the players had access to information and resources required. The white cell included a METOC specialist that provided weather analysis for adjudication for both the red and blue team as they maneuvered. The game director coordinated play, assisted in data collection, and provided intelligence injects as required to ensure the team was able to gather required data to analyze the key issues above. The assistant game director conducted adjudication, assisted in data collection, and provided status updates regarding technical issues that occurred throughout the game.

**a. Player Role Objective(s).**

- i. Blue team lead: The goal was to bring in appropriate experience and leadership to provide insight into how a CSG Commander might employ techniques to use cloud cover.
- ii. Blue team assistant lead: The goal was to bring mid-level officer perspective, outside perspectives, and additional operational relevance. They were also tasked with controlling the board and stepping in as the leader in the absence of the team lead.
- iii. Blue team regional/intel/METOC specialists: The goal for these players was to bring expertise and relevance in their respective professions to further enable knowledgeable decision making.
- iv. Red team leader: Much like the blue team leader the goal was to provide leadership, knowledge, experience and guidance from a senior leader with extensive background with systems real-world red forces might use.
- v. Red team assistant leader: The goal for this player was to supplement the experience and knowledge provided by the red team leader and to act as the leader in their absence.
- vi. Red team regional/METOC/OR: The goal for these players was to bring expertise and relevance in their respective professions to further enable knowledgeable decision making.

**b. Available Resources.**

- i. All players: Read-ahead materials were provided to all players with the overarching scenario, descriptions of capabilities, and rules. Therefore, both teams were aware of the other’s capabilities and a general understanding of how the capabilities would be employed. The players were given access to necessary weather products as well as weather consultants to effectively use the weather products.
- ii. Blue team: The blue team was given a preliminary intelligence inject before starting each game giving them the start point, end point, and objectives. Additionally, they were provided the game board with corresponding pieces and activity cards. The assistant team leader was given the task to manage the gameboard for the team, however, because of connectivity issues these tasks were delegated at times. The blue team was given intel injects throughout the game regarding enemy submarine and aircraft threats to drive additional decision making. Of note, the original plan included a third game intended to exercise a scenario that modelled denial of timely weather reporting to the blue team. In that scenario they were to receive a forecast once every fourth turn opposed to receiving updates every turn as in previous games.

iii. Red team: The red team was given preliminary intelligence injects before the start of each game that gave them the general area (within ~2-3 hexes) of the CSG positions. They were also given additional injects throughout the game to drive decision making and discussions to generate data for analysis. The assistant team leader was given the task to manage the gameboard for the team, however, because of connectivity issues these tasks were delegated at times.

**c. Relationships.** No organizational structure or command relationships of player roles were identified. Both teams used conversations as a group to derive team decisions. Although both teams had players that led most of the discussions, neither specifically acknowledged a hierarchy nor did they establish command relationships.

**d. Player Experience and Expertise.** The experience brought by the two naval captains was a vital part of this game. The team leader for the red team was unable to play during the second and third days. There was a notable difference observed by the wargaming team about the quality of decisions being made by the red team when the O-6 was absent. This was assessed to be caused by lack of player experience regarding remote sensors and space operations. Although generalized intelligence officers added some insight, without specific experience with optical sensors or imagery analysis their technical expertise was not especially helpful to either team. Regional and operations research experts were not especially helpful during play, but along with the other players, they offered very insightful feedback regarding game design, assumptions, and considerations. The METOC players were critical, especially on the blue team. Without their ability to quickly interpret weather products and apply the information garnered the blue team would have struggled to make educated decisions within the time constraints of the game.

#### **4. Wargame Description.**

**a. Wargame Design.** The game was designed with a mixed system format. To make the game more realistic, it was necessary to restrict information flow between the red and blue teams while also restricting information available to each regarding the other's status. Therefore, the only information that was shared between both teams was the overarching geopolitical situation, rules, and weather products. The common board, game pieces, activity cards, and rules that comprised the game system were used to constrain options available and drive decision toward what was needed for analysis.

**b. Wargame Execution.** The game was executed over the course of three days. The first day was an overview, review of mechanics and rules, a planning session, and then a brief set of practice turns. It was also an opportunity for the players to get to know each other prior to officially starting play. Days two and three were dedicated to game play. Each game began with an intelligence inject and weather update, followed by a planning period. The blue team sketched their planned route for each CSG on the gameboard and the facilitator captured the routes with a screenshot. During this time the red team was planning their overall strategy for how they would posture their sensors. After the planning session was complete, the game began. Teams made their moves simultaneously under a five-minute time constraint. When the moves were complete, the embedded team facilitators would move the pieces on a master white board (not visible to the red/blue players) that was used for tracking and adjudication. The white cell would then adjudicate and determine whether the CSG was effectively covered by clouds and whether they were detected or categorized. The only feedback offered by the white cell was whether the red team detected or categorized a ship and in which hex. Play continued until the CSGs reached their planned destinations. Injects were inserted by the white cell as necessary to drive deliberate decision making by either team. The teams did not know detailed results of the games until the end of game two. Game three was intended to use new start/end points for the CSGs and was planned to explore potential consequences of blue team operations without complete access to space based communication and observation assets. Had the third game been played, the blue team would have only received weather forecasts once every four turns opposed to each turn, while the red team would have had full access to weather reporting. Unfortunately, because of delays driven by connectivity issues, the teams only completed the planning phase of game three.

#### **5. Methods, Models, and Tools (MMTs).**

**a. Adjudication.** Adjudication was performed by the White Cell that consisted of a METOC representative and two project team members. Using Microsoft Excel and Google Earth as tools, the White Cell made adjudications based on the current state of the game, current cloud coverage, and sensor detection probabilities. More specifically, if blue assets passed through or were in the same hexagon as red sensors at the end of the turn, the state of the game allowed for detection/classification adjudication. If this case did not occur, adjudication was not necessary, although weather data was still recorded for analysis. If the state of the game allowed for detection/classification adjudication, a METOC representative would pull the current cloud cover, represented in “oktas”, from the red/blue overlapping location in Google Earth. Once the cloud cover was pulled, this was converted to a probability of concealment (e.g., 8/8 oktas was total cloud coverage and blue was guaranteed concealment, 1/8 oktas was minimal cloud cover and had a probability of concealment of 0.125). Once the concealment probability was determined from the current weather, the probability was imported into Microsoft Excel where it was determined if concealment occurred given the probability of concealment. If the CSG was concealed, no further adjudication was necessary; however, if the CSG was not concealed, Excel was again used to determine if detection occurred given the probability of detection of the overhead sensor(s) and whether it was day or night.

**b. Player Feedback/updates.** After adjudication, the red team was always given feedback while the blue team was never given feedback. If no detection occurred, the red team was notified prior to their next turn. If a detection occurred, they were given either a detection-only update or a detection and classification update. If the detection occurred using a satellite, they were given both detection and classification information. If the detection occurred using an aircraft during the day the red team was provided detection and classification information; however, if the detection occurred at night, they were given the detection-only feedback due to sensor capabilities. Additional feedback included the start and time of each turn, time remaining for turns, occasional injects (either as additional information they didn't need but would have gathered from being in theater or as additional useful information from human intelligence sources), and notifications when end-game conditions were met.

## **6. Key Constraints, Limitations, and Assumptions.**

### **a. Constraints:**

- i. Wargame must be conducted, analyzed, documented during NPS fall quarter and results provided to sponsor by 19 DEC 2020.
- ii. Wargame must be developed and executed virtually at an UNCLASS level (COVID mitigations).

### **b. Limitations.**

- i. Wargame planning team has limited opportunities to meet face-to-face.
- ii. Wargame cannot be conducted face-to-face.
- iii. Wargame planning team is limited to using open-source information to generate the scenario and to inform Blue/Red team technologies and TTPs.
- iv. Wargame can only analyze 2 transit scenarios and is limited to 45nm hex framework due to play time constraints, board complexity, geographic area considerations, real world CSG transit speeds, and team complements (i.e. C3F and FDNF).

### **c. Assumptions.**

- i. The limited opportunities to meet face-to-face are sufficient to plan the wargame.
- ii. A virtual wargame is sufficient to answer all sponsor essential questions.
- iii. Using commercial technologies and an open-source scenario is sufficient for conducting the wargame and answering all sponsor essential questions.
- iv. Using two transit scenarios is sufficient to answer all sponsor essential questions.
- v. All CSGs travel at a speed of 15 knots in transit.
- vi. CSGs are not threatened by detection from ASW forces, SuW forces, or sight from land.
- vii. Rough seas and typhoons do not limit CSG operations.
- viii. If cloud cover in a region is less than 50% (measured in oktas), a CSG is not concealed by cloud cover.

- ix. If cloud cover in a region is 50% or more, the percentage of cloud cover correlates to the probability of concealment of a CSG.
- x. Red Team satellites can detect and categorize a CSG in clear skies with probability 99% during the day.
  - a. At night, Red satellites can only detect, not categorize ships.
- xi. Red Team aircraft can detect and categorize a CSG in clear skies with probabilities ranging from 55-90%, dependent on altitude and aircraft type.
  - a. At night, probability of detection decreases by 10%.

**7. Findings.** The nine key sponsor issues along with corresponding findings follow:

**a. How well does using cloud concealment hide CSG operations from EO/MWIR threats?**

- i. CSGs were able to effectively utilize heavy cloud cover (7/8 okta or greater) when it was available. In the April scenario, the Reagan CSG was in heavy cloud coverage for about 45% of the time. The George Washington CSG was in heavy cloud coverage for about 89% of the scenario. In the June scenario, these proportions of time spent in heavy cloud coverage were 83% and 84%, respectively.
- ii. In the June scenario, there were multiple instances in which the George Washington CSG was concealed by cloud cover while in the field of regard of Red sensors. After Red categorized the George Washington (GW) CSG as it approached its destination approximately 45nm off the eastern coast of the Philippines, it was immediately lost as it entered an area of heavy cloud cover. Red left several reconnaissance assets static over the coastline to attempt to reacquire as they assumed the GW CSG had made a turn northward up the coast. In fact, the GW CSG reached their destination on the next turn and remained in position for the final four turns of the game (play continued as the Reagan CSG was still in transit). It was not until the final turn when the cloud cover broke that Red was able to categorize the GW CSG while static at its destination. In summary, there was a 24-hour period during which Red maintained persistent sensor coverage of the GW CSG at its destination but were unable to detect or categorize the CSG due to cloud cover.
- iii. The use of cloud cover can also provide indirect concealment by encouraging the allocation of reconnaissance assets to areas with lower levels of cloud cover. Toward the end of the April scenario, Red allocated search assets north of cloud cover to maximize their effective search area. This prevented Red from locating the George Washington CSG, which was transiting through the southern cloud cover.

**b. What effect do cyclic flight operations have on the ability to use cloud concealment to hide CSGs?**

- i. Cyclic flight operations did not appear to have an adverse impact on the utilization of cloud cover during the wargame. The CSGs planned cyclic flight operations to take place while under cloud cover, which helped mitigate the risks of extending the amount of time spent in transit. However, in practice, other factors that were not considered during this game, like rough sea states associated with adverse weather typically accompanied by cloud cover, could preclude cyclic flight operations and deserve further analysis.
- ii. The execution of cyclic flight operations also made it more difficult for Red to determine how far CSGs had travelled since their last known position. The execution of flight operations and other activities meant that CSGs were not necessarily traveling at maximum speed. Unknown travel speeds, along with CSG routing intended to complicate tracking, made it more difficult for Red to determine if CSGs had passed through search perimeters or simply not arrived yet.

**c. How does maximizing the amount of time the CSG is under cloud concealment impact transit time?**

- i. In the April scenario, the routes planned for CSGs with cloud concealment considerations took 42% and 48% more time than minimum distance routes for the Reagan and George Washington CSGs, respectively (this excludes time spent executing flight operations and MODLOCs). A similar analysis of the June scenario shows that routes planned for CSGs with cloud concealment considerations took 54% and 48% more time than minimum distance routes. We can observe that the Reagan CSG was able to significantly increase its cloud cover with a proportionally smaller increase in transit time between the April and June scenarios.
- ii. When routes were executed, they often ended up shorter than planned. The route executed by the Reagan CSG in April was 25% longer than the minimum distance route. The route executed by the George Washington CSG was 26%

longer than the minimum distance route. In June, the route executed by the Reagan CSG was 58% longer than the minimum distance route, a slight increase from what was seen with the planned route. The George Washington CSG executed a route that was 26% longer than the shortest possible route.

iii. If mission objectives are time sensitive, the ability to use cloud concealment may be hindered.

**d. What impact do MODLOC, aggregated, and dispersed operations have on the ability to use cloud concealment?**

i. MODLOC did not have a negative impact on the ability of CSGs to use cloud concealment during the wargame. As with cyclic flight operations, MODLOC can be planned to take place while underneath cloud cover. If cloud cover is moving along the CSGs transit route, the reduced movement during MODLOC can help the CSG remain under cloud cover. MODLOC also complicated the efforts of Red when tracking CSGs due to the same transit time considerations imposed by cyclic flight operations. As similarly mentioned regarding cyclic flight ops, adverse weather associated with cloud cover may confound these findings and deserve further analysis.

ii. We did not observe a significant reduction in cloud concealment during dispersed operations. Both CSGs in both scenarios were able to execute dispersed operations while in a large enough region of heavy cloud cover to provide concealment for all ships.

e. In which Western Pacific regions are cloud concealment techniques most/least effective?

i. In both scenarios there was heavy cloud cover east of the Philippines and south of Japan. There was less cloud cover east of Taiwan.

f. How does the ability to use cloud concealment change temporally?

i. There was little impact on the George Washington CSG's use of cloud coverage in April versus June. Its average cloud coverage decreased from 88% in April to 84% in June. However, the REGAN CSG was able to improve its cloud utilization from 47% in April to 83% in June. This result reinforces the importance of weather conditions during the execution of a transit. If cloud cover exists, we see that CSGs are capable of effectively utilizing coverage along their transits.

ii. If Red failed to detect CSGs after receiving intelligence about their approximate locations, they became less and less certain about where the CSGs were located. This emphasized the importance of cloud cover for CSG concealment following these intelligence reports. If Red failed to locate CSGs after a couple of days, they were forced to set up search perimeters where they guessed the CSGs were going.

iii. Space assets were limited to detection during the night. We would assume that this would hinder Red's ability to categorize CSGs during the night. However, there were no instances of Red detecting but not categorizing either, preventing closer analysis of this impact.

**g. How does proximity to land affect the ability to use cloud concealment?**

i. The CSGs did not take proximity to land into account when planning routes, only cloud forecasts. The data gathered from the two scenarios is insufficient to make a comparative analysis of cloud coverage based on proximity to land.

**h. What impact does an adversary's use of EO/MWIR sensors on diverse air and space platforms (satellite, manned, unmanned, AI enhanced) have on the effectiveness of using cloud concealment?**

i. In the April scenario, Red planned to allocate satellite assets near Guam and low-altitude aircraft near Japan, which had heavier cloud cover. After Red failed to locate either CSG early on, all assets were shifted north to prioritize the search for the Reagan CSG. Red tended to avoid searching cloudy regions, and instead worked to maximize the total area it could search.

ii. In the June scenario, Red focused its efforts on locating the Reagan CSG with all assets. There was heavy high-altitude cloud cover for most of this scenario, and while Red did use mid-altitude searches on occasion, they failed to locate either CSG. The reduced search area resulting from lower-altitude flight may indicate that low altitude searches are more effective following an initial detection or categorization of a CSG.

**i. What impacts do adversarial space denial operations have on the ability to use cloud concealment?**

i. Based on the degree to which the CSGs were able to maneuver to remain under cloud cover in the scenarios with full forecast availability, it is likely that using climatology data and intermittent forecasts would have degraded the

ability of the CSGs to use cloud cover. There was insufficient time to examine this scenario, preventing a quantitative analysis of this impact.

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**DECISION-MAKING AND OPERATIONAL PRIORITIES WITHIN  
A LOGISTICS TASK FORCE COMMANDER ORGANIZATION (OPNAV N4)**

**1. Problem Statement.**

**a. Objective:** Examine an effective C2 structure that enables CTF LOG to deliver fuel and ammunition to a USN/USMC task force operating in the South China Sea, in a DDIL environment.

**b. Key Issues:**

- i. What makes an effective C2 structure for logistics decision-making?
- ii. How are competing demands handled?
- iii. How much of each supply will be required?
- iv. Where are the priorities for supplies to be shipped?

**2. Scenario.**

**a. Geographic Region:** The geographic region extends from Taiwan in the north to Australia in the south (1,900 nm) and from Singapore in the west to the island of Palau in the east (2,100 nm), which is an area of about 4,000,000 square nm. The South China Sea in the north of the region is the main area of battle, focus of this wargame are the sea areas adjacent, through which the military assets in this area (CSG, ARG, EAB) get delivered.

The area in the vicinity is considered the DDIL-area, where it is assumed, that no communication is possible, and GPS-spoofing is being conducted.

This area is bounded in the south-west by the Java Sea until Jakarta, in the south-east by the Sulu Sea and in the east by the Philippines.



**b. Time:** This wargame takes place in the year 2032. Each turn is assumed to be a 24-hour period.

**c. Road to War:**

**2015:**

- China populated several islands terra-formed with military installations.

### **2029:**

- Tensions build in the South China Sea, U.S. has built stronger ties with ally nations in the region: Japan, Australia, and Singapore.
- Chinese deep-sea exploration ship exploded north of Natuna Besar.
- China claims Vietnam, Indonesia, or Philippines responsible. All traffic through the South China Sea is subject to inspection and control by Chinese forces.

### **2030:**

- China occupies islands Natuna Besar, Indonesia, and Palawan, Philippines.
- Quickly evolved to maritime war of attrition.

### **2032:**

- All sides have lost 10-15% of their submarines, ships, aircraft, and crew.
- Weapon inventories are down to 50% for allies and 70% for PLANMC.

**3. Player Role List.** The team consists of three player roles: the CTF LOG Commander (CDR), the Afloat Naval Base (AFLB) Logistic Operations Officer (LogO), and the Advanced Naval Base (ANB) Logistic Operations Officer (LogO). Each of these roles can be filled by one or two players. Two players would work cooperatively and make decisions as a team. Thus, there is no command structure for two players who fill the same role; they are equals. For this wargame, each role was filled by a single player.

#### **a. Player Role Objective(s):**

- CTF LOG Commander: The primary objective of the player filling the Commander role is to relay information and assign goals and responsibilities to the subordinate officers: the AFLB and ANB LogO's. The secondary objective of the Commander is to manage and utilize logistics aircraft to collect reconnaissance and deliver supplies.
- AFLB Logistic Operations Officer: The primary objective of the player filling the AFLB LogO role is to manage two logistics ships: a replenishment oiler (T-AO) and strategic sealift ship (T-AK). These ships are used to supply afloat and ashore bases with fuel and ammunition.
- ANB Logistic Operations Officer: The primary objective of the player filling the ANB LogO role is to manage two logistics ships: a replenishment oiler (T-AO) and strategic sealift ship (T-AK). These ships are used to supply afloat and ashore bases with fuel and ammunition.

#### **b. Available Resources:**

- CTF LOG CDR:** The Commander role serves as the point of contact for subordinate officers – the AFLB and ANB LogO's – when communication is available. Additionally, the Commander is responsible for employing logistics aircraft. These aircraft can be employed for additional logistics support and/or intelligence collection. There are three classes of aircraft: The C-130, the C-40, and the CMV-22. These aircraft can carry 25, 40, and 10 short tons (STONS) of ammunition, respectively. Up to all three types of aircraft can be used in a single turn. The CMV-22 can deliver supplies to any location supplied by the CTF LOG. The C-130 and C-40 can only deliver supplies to certain locations due to the amount of fuel used in flight. The C-130 and C-40 have no hex limitation in distance they can travel. The CMV-22 may only travel a maximum of 16 hexes on the gameboard. An aircraft must return to its home station within the same turn that it is used. In addition to supply capabilities, the CMV-22 may also be used for intelligence purposes. The CMV-22 may land at any of the locations being supplied by the CTF LOG and collect information on its current inventory of fuel and ammunition.
- AFLB Logistic Operations Officer:** The AFLB LogO role utilizes two logistics ships, the T-AO and T-AK, to supply afloat and ashore bases with fuel and ammunition. The T-AO can carry 154 barrels (bbls) of fuel, while the T-AK can carry 36 bbls of fuel and 4,872 STONS of ammunition. The AFLB LogO role has one of each class of logistics ship at their disposal. In each turn, the AFLB LogO decides what actions these logistics assets can take. These actions include moving around the map, supplying bases, refueling or resupplying themselves, and/or communicating with the Commander.
- ANB Logistic Operations Officer:** The ANB LogO role utilizes two logistics ships, the T-AO and T-AK, to supply afloat and ashore bases with fuel and ammunition. The T-AO can carry 154 barrels (bbls) of fuel, while the T-AK can carry

36 bbls of fuel and 4,872 STONS of ammunition. The ANB LogO role has one of each class of logistics ship at their disposal. In each turn, the ANB LogO, like the AFLB LogO role, decides what actions these logistics assets can take. These actions include moving around the map, supplying bases, refueling or resupplying themselves, and/or communicating with the Commander.

**c. Relationships:** Both the AFLB and ANB LogO's report directly to the CTF LOG Commander. As the superior officer in the CTF LOG command structure, the Commander develops strategy, coordinates actions, and provides directives and information to subordinate officers. Due to the communications limitations put in place, the AFLB and ANB LogO's are responsible for initiating communications with the Commander during the wargame. The AFLB and ANB LogO's cannot communicate directly. They must relay information to the Commander, who decides which information to pass to other subordinates. The AFLB and ANB LogO's are solely responsible for deciding the actions for their ships and do not have to verify these actions with the Commander.

**d. Player Experience and Expertise:** All the players have operational experience working in logistics management. The Commander is a Lieutenant Commander (LCDR) in the United States Navy and the AFLB and ANB LogO's are United States Marine Corps Captains with prior experience in aviation logistics. Additionally, the Captains completed a thesis that analyzed command structures for military logistics. They leverage these experiences in the wargame via decisions to coordinate logistics assets and communicate with other players. Of note, the player in the role of the AFLB LogO joined the wargame the day of gameplay. Consequently, he had a limited amount of time to become familiar with the wargame and its rules.

#### **4. Wargame Description.**

**a. Wargame Design:** The OPNAV N4 Wargame is designed for a single team of three or more players. This team represents a United States Navy and United States Marine Corps Combined Logistics Task Force (CTF LOG). The CTF LOG is responsible for transporting fuel and ammunition to U.S. land bases and afloat assets in the South China Sea. Players assume different roles in the Task Force and work together to supply these land bases and afloat assets with fuel and ammunition. Players exercise push logistics to supply U.S. forces in the Area of Operation (AO) that is assumed to be a DDIL environment. Because we are modeling a DDIL environment, the information format is primarily closed; however, brief communication is allowed throughout the game as the scenario dictates. Player engagement is a hybrid method, with players interacting directly with the board, and not with other players (except during communication). Additionally, the Wargaming Team controls the dynamics of the scenario "behind the scenes".

**b. Wargame Execution:** At the start of the game, the CTF LOG CDR player determines the location of the AFLB, receives intelligence on the current state of resupply locations from the White Cell, and meets with the ANB and AFLB players separately to communicate a logistics strategy. Each subsequent turn, which represents 24-hours, consists of the following sequence of events:

1. All players receive weather information from the White Cell which dictates how many actions each logistics ship is permitted to take during that turn.
2. White Cell provides both AFLB and ANB Logistics Officer with the following information:
  - i. Whether communication with the CTF LOG CDR can occur; and
  - ii. Whether either (or both) of their logistics ships have had fallen victim to a GPS Spoofing attack.
3. Players simultaneously take actions, which may consist of the following:
  - i. Movement of ships (AFLB/ANB Players)
  - ii. Resupply bases (AFLB/ANB); and
  - iii. Employ air support, if available (CTF LOG CDR)

Once all players have completed their actions, the White Cell advances the game to the next turn in which new weather conditions and supply consumption rate multipliers are determined (explained in more detail in the following 'Adjudication' section). The game is played for approximately 20 rounds, or 2.5 hours. If supplies at any of the locations go negative, the game will continue, but the players will need to resupply this location back to a positive amount. The number of times that supplies at any of the bases go negative serves as an indicator of the CTF LOG's performance.

## **5. Methods, Models, and Tools (MMTs).**

**a. Adjudication:** During gameplay, the wargaming team utilized a macro-enabled spreadsheet tool to manage the game mechanism.

i. Weather/action tracker: Weather was tracked on a discrete scale between bad, normal, and good. Each of these conditions corresponded to 4, 5, or 6 actions for player ship assets.

ii. Consumption rate tracker: Consumption rate multipliers ranges between 1 and 2, in steps of 0.2. Consumption rate multipliers at each location were the product of the multiplier and the base rate. Between turns, the consumption rate multiplier could decrease or increase by 0.2. Players were provided a qualitative measure for consumption rates of either, low, medium, or high rather than numerical values.

iii. Supplies tracker: Each turn, the current stock of fuel and ammo was tracked. Supplies decremented each turn based on the consumption rate. Supplies increased when a player chose to resupply a location.

iv. Red force spoofing: This was modeled as a 1/6 chance of occurring for every ship in the DDIL area. Spoofed ships would be moved to an adjacent cell based on a random draw.

**b. Player Feedback/Updates:** When players chose to resupply in a turn, they were provided current information on the location. They were given current fuel and ammo inventories and the current qualitative consumption rate (low, medium, or high).

## **6. Key Constraints, Limitations, and Assumptions.**

### **a. Constraints:**

1. The wargame is developed over a 7-week period.
2. The final wargame is conducted virtually utilizing Microsoft Teams.
3. The materials used to develop the wargame and the final analysis is unclassified.

### **b. Limitations.**

1. The study team can only address one scenario and C2 structure due to the limited players.
2. Homeland-theater and Inter-theater logistics are not modeled.
3. The study team can only study a force structure composed of currently known assets/capabilities for the USN, USMC, ally nations, and adversary nations.
4. Insufficient means exist to collect real data or model fuel and ammunition consumption rates.

### **c. Assumptions.**

1. The single scenario studied is sufficient to examine a C2 logistics structure in a contested, DDIL environment.
2. Homeland-theater and Inter-theater logistics operate without disruptions.
3. A force composed of current assets/capabilities is sufficient to examine a C2 structure in a contested environment for a future conflict.
4. Available data on consumption rates can be increased (25-30%) to represent operations in a contested environment.
5. Communications in the Area of Operation (AOR) are disrupted and intermittently available.
6. Blue forces will primarily take an offensive posture.
7. Findings.

#### **a. BLUF:**

Several occurrences (see Findings, Section b, for examples) led to delays in resupplying, doubling of resupply efforts, adapting to changes in supply needs, and not maintaining an updated common operating picture of the battlefield. These incidents were driven primarily by two factors: planning and communication. The number one factor as to why the above events occurred was the lack of planning and coordination. The second factor is minimal communication during the conflict.

#### **b. Examples with Explanations:**

- AFLB LogO resupplied Palawan once with fuel and twice with ammo, which was part of their joint area of responsibility. However, the LogO elected to remain in the vicinity to continue to provide support. The AFLB LogO adjusted their initial resupply plan and determined it would be best to remain near Palawan due to the high rate of fuel and ammo consumption from a prolonged high intensity conflict.
- Palawan EAB, ARG, CSG 2, and CSG 3 all maintained a positive fuel and ammo rates during the 10-day conflict. However, both Natuna Besar and CSG 1 ammo supplies were fully consumed by day six and seven, respectively. This depletion in supplies is due to not receiving the requisite amount of ammo needed for their individual conflicts. This lack of resupply stems from the proximity of those two locations when compared to the joint area objectives and the lack of coordination between subordinate commands. Although the theater logistic commander devoted their air assets to Natuna Besar, the amount of ammo the aircrafts hauled could not sustain that conflict (Figures 3-8).
- Of the resupply objectives, Palawan EAB, CSG 2, and ARG had a joint responsibility between the ALFB LogO and ANB LogO. This joint sharing of an AO lead to both subordinate commands overlapping their resupply efforts. This occurrence was due to lack of clear guidance on responsibilities and a resupply plan involving two organizations.
- With respect to average percentage of fuel capacity during the conflict (Table 1), the ARG average status was green (85% - 100%), CSG 1 was amber (70%-85%), Palawan and CSG 3 were red (50%-70%), and Natuna Besar and CSG 2 were black (> 50%). The main contributing factors to these levels are: 1) The capacity at the beginning of this 10-day conflict, 2) The intensity of the combat in those areas, and 3) The decision to refuel in the early days versus mid conflict. Simply, those who were resupplied within the first three days, ended mostly in the black and red, and was resupplied only once, while the other locations more than once.
- ANB LogO directed their vessels to sail along the coast line while en route to CSG 3. The goal of this maneuver was to maintain visual of the shoreline in the event that the vessels are spoofed. The belief was that the shoreline could serve as a reference point if spoofed.
- For at least half the battle, the commander was not tracking the supply levels of the six objectives. This lack of visibility of the battlefield was due to minimal communication between the theater logistic commander and the subordinate AFLB LogO and ANB LogO. In order to minimize the sacrificing of time, the LogOs would delay communication and carry out their initial guidance.

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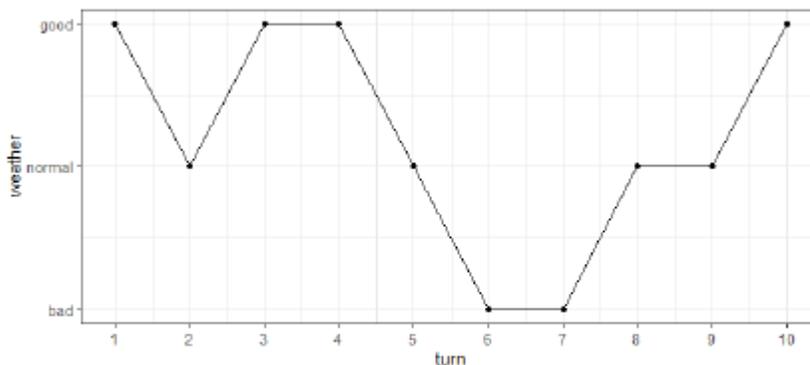
### Figures and Tables

	<i>Palawan</i>	<i>Natuna Besar</i>	<i>ARG</i>	<i>CSG 1</i>	<i>CSG 2</i>	<i>CSG 3</i>
<b>Start</b>	86%	50%	100%	88%	50%	33%
<b>End</b>	29%	29%	75%	51%	15%	93%
<b>Average</b>	62%	49%	89%	72%	33%	59%

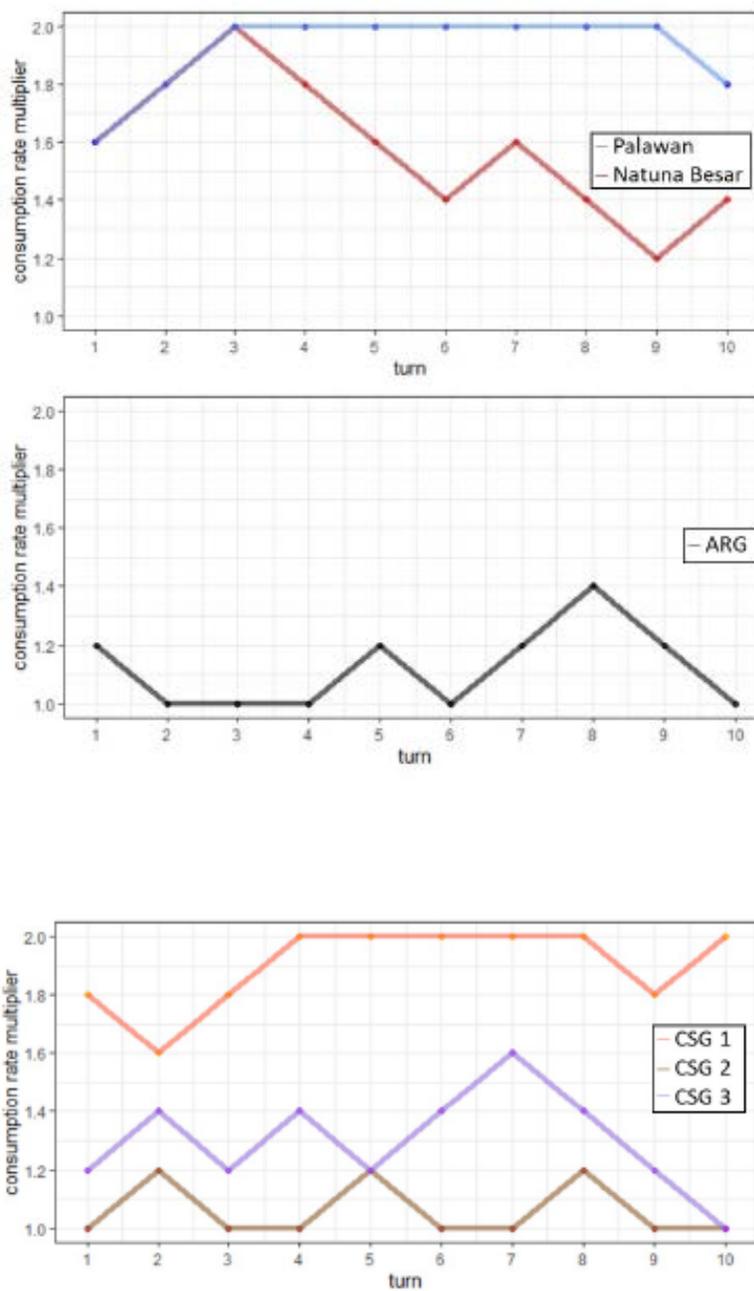
Table 1. Percentage of Fuel Capacity.

	<i>Palawan</i>	<i>Natuna Besar</i>	<i>ARG</i>	<i>CSG 1</i>	<i>CSG 2</i>	<i>CSG 3</i>
<b>Start</b>	83%	50%	100%	84%	50%	33%
<b>End</b>	86%	91%	84%	<0%	83%	26%
<b>Average</b>	69%	16%	91%	19%	76%	48%

Table 2. Percentage of Ammo Capacity.

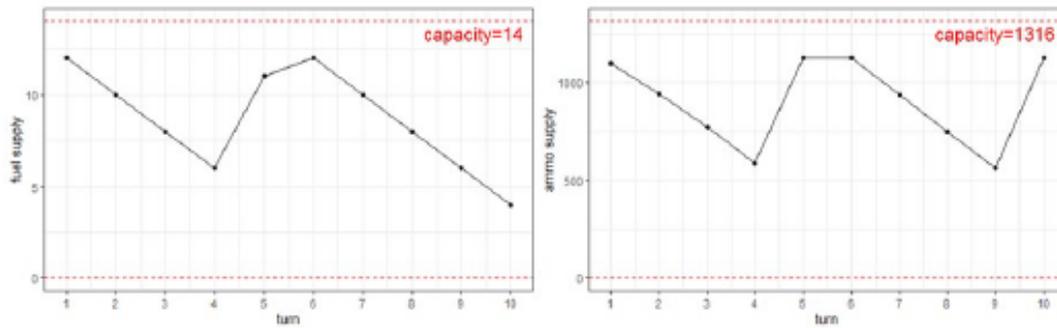


**Figure 1. Weather conditions.** This figure shows the weather conditions for each day (turn) represented in the wargame. Weather was classified as the following – bad, normal, and good. Each of these classes corresponded to 4, 5, or 6 actions for player ships, respectively.



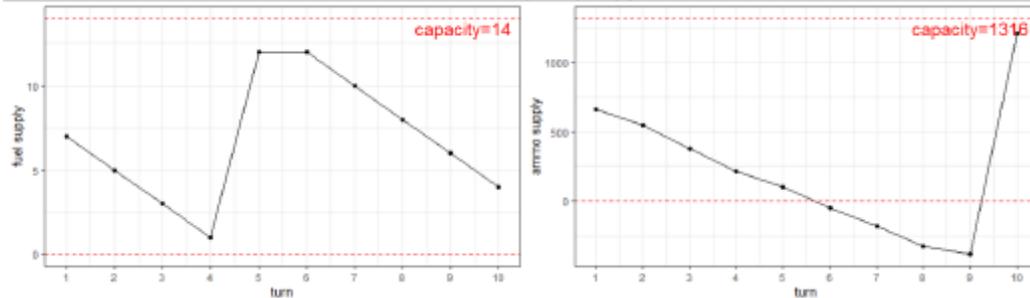
**Figure 2. Consumption rate multipliers.** The consumption rate multipliers represent the relative intensity of activity at a resupply location. The multipliers range from 1 (low to intensity), to 2 (high intensity). The absolute consumption rates are a product of the base consumption rate and the multiplier for each location.

### Palawan (EAB) Supplies



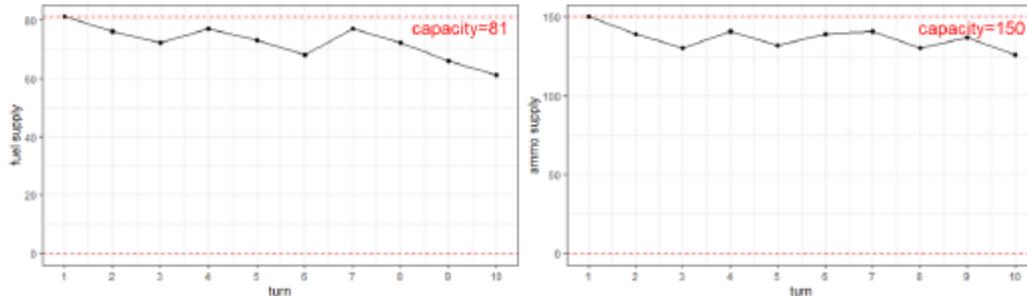
**Figure 3. Fuel and ammo supply at Palawan EAB.** This figure shows the fuel and ammo stocks at Palawan every day (turn). Consumption rates at the Palawan EAB ranged from 1 bbl/day to 2 bbl/day for fuel and 94 STONS/day to 188 STONS/day. The red dotted line at the bottom shows when supplies reached zero. The red dotted line at the top represents the supply capacity at the location.

### Natuna Besar (EAB) Supplies



**Figure 4. Fuel and ammo supply at Natuna Besar EAB.** This figure shows the fuel and ammo stocks at Natuna Besar every day (turn). Consumption rates at the Natuna Besar EAB ranged from 1 bbl/day to 2 bbl/day for fuel and 94 STONS/day to 188 STONS/day. The red dotted line at the bottom shows when supplies reached zero. The red dotted line at the top represents the supply capacity at the location.

### ARG Supplies



**Figure 5. Fuel and ammo supply at ARG.** This figure shows the fuel and ammo stocks at the ARG every day (turn). Consumption rates at the ARG ranged from 4 bbl/day to 8 bbl/day for fuel and 9 STONS/day to 18 STONS/day. The red dotted line at the bottom shows when supplies reached zero. The red dotted line at the top represents the supply capacity at the location.

CSG 1 Supplies

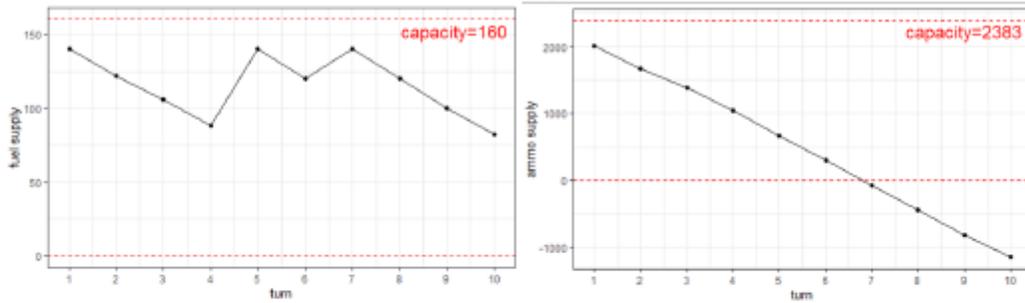


Figure 6. Fuel and ammo supply at CSG 1. This figure shows the fuel and ammo stocks at CSG 1 every day (turn). Consumption rates at CSG 1 ranged from 10 bbl/day to 20 bbl/day for fuel and 186 STONS/day to 372 STONS/day. The red dotted line at the bottom shows when supplies reached zero. The red dotted line at the top represents the supply capacity at the location.

CSG 2 Supplies

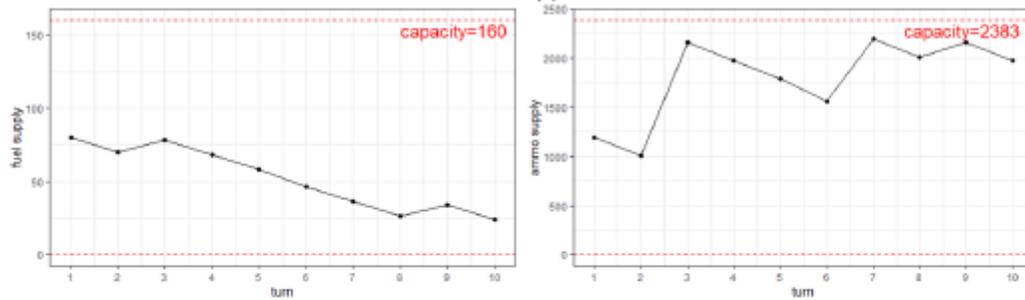


Figure 7. Fuel and ammo supply at CSG 2. This figure shows the fuel and ammo stocks at CSG 2 every day (turn). Consumption rates at CSG 2 ranged from 10 bbl/day to 20 bbl/day for fuel and 186 STONS/day to 372 STONS/day. The red dotted line at the bottom shows when supplies reached zero. The red dotted line at the top represents the supply capacity at the location.

CSG 3 Supplies

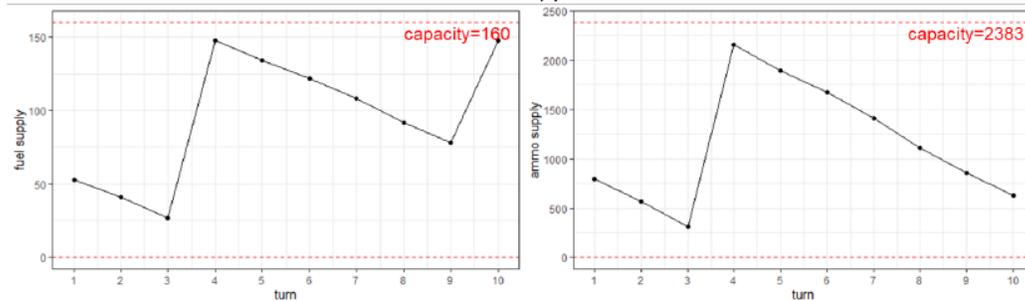
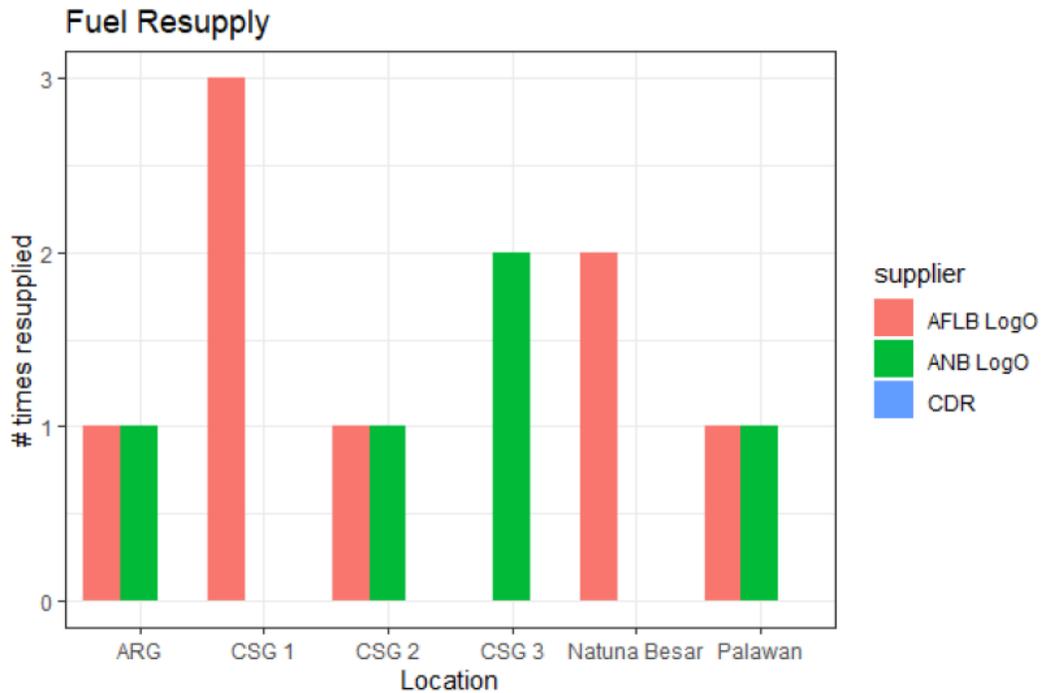
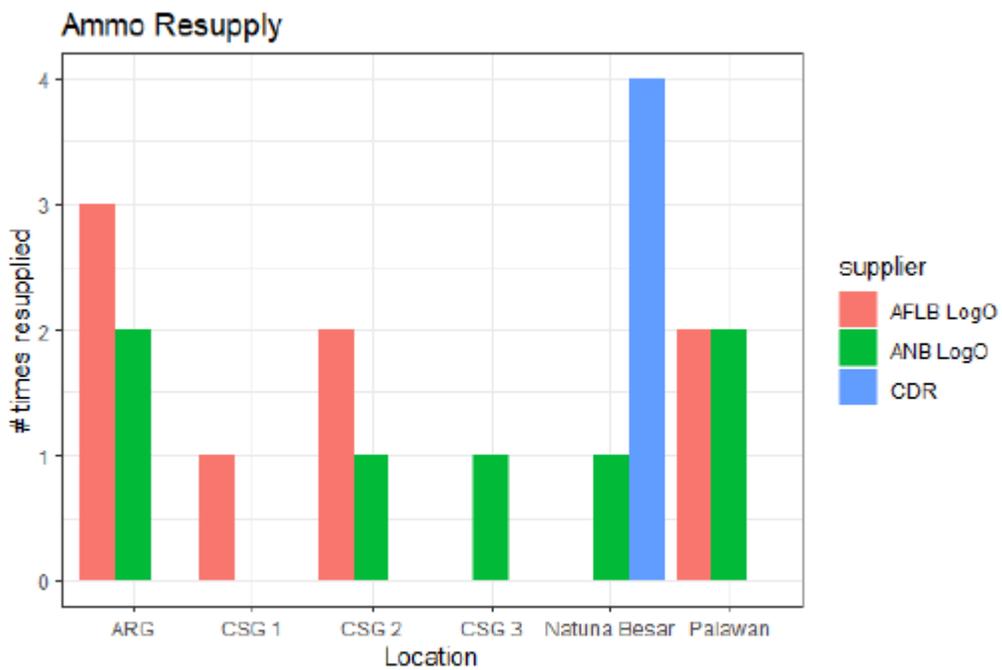


Figure 8. Fuel and ammo supply at CSG 3. This figure shows the fuel and ammo stocks at CSG 2 every day (turn). Consumption rates at CSG 2 ranged from 10 bbl/day to 20 bbl/day for fuel and 186 STONS/day to 372 STONS/day. The red dotted line at the bottom shows when supplies reached zero. The red dotted line at the top represents the supply capacity at the location.



**Figure 9. Suppliers for Fuel.** This figure shows the number of times each that the CDR and AFLB/ANB LogOs resupplied fuel at a particular location.



**Figure 10. Suppliers for Ammo.** This figure shows the number of times each that the CDR and AFLB/ANB LogOs resupplied ammunition at a particular location.

### **Appendix 3: Catalog of OA4604 Wargaming Applications Sponsored Wargames (2010-Current)**

**Background:** The first half of the Wargaming Applications course teaches the fundamentals of wargaming using a mix of lectures and practical exercises. The course concludes with the completion of the “Wargaming Apprentice Certification Exam.” The second half of the course focuses on applying wargaming fundamentals to design, develop, conduct and analyze a wargame to answer a DoD sponsor's actual requirement.

Unclassified Executive Summaries are available for all wargames conducted during FY15 and later. Contact Jeff Appleget ([jaappleg@nps.edu](mailto:jaappleg@nps.edu)).

#### **FY10**

- Sponsor: **SOCPAC & JSOTF through NPS. Wargame: Capabilities analysis of Maritime Support Vessel alternatives in OEF-Philippines.**
- Sponsor: **TRADOC Analysis Center. Wargame: US Army Civil Affairs force structure analysis in OEF-Afghanistan.**
- Sponsor: **EWTGLANT. Wargame: Develop a game to Assess Student Understanding of Amphibious Operations.**

#### **FY11**

- Sponsor: **EWTGLANT. Wargame: Assessment of Amphibious Operations.**
- Sponsor: **Navy Warfare Development Command. Wargame: Develop the framework for a computer game to enhance US Naval officers' understanding about the operational level of war**
- Sponsor: **CTF-73 (OPLAN Logistics wargaming). Wargame: Assess the capability of CTF-73 logistics assets to support 7<sup>th</sup> Fleet operations**

#### **FY12**

- Sponsor: **MCCDC OAD. Wargame: Examine US military response options to a mass atrocity in Darfur**
- Sponsor: **MCCDC OAD. Wargame: Examine US military response options to a mass atrocity in Abyei (Sudan/S. Sudan)**
- Sponsor: **Lockheed Martin. Wargame: Examine US military ability to execute missions when GPS is jammed**

#### **FY13**

- Sponsor: **Naval Postgraduate School Littoral Operations Center. Wargame: Examine the application of innovative joint and combined naval formations conducting combat operations in the littoral environment**
- Sponsor: **PACOM. Wargame: Examine US military ability to execute missions when GPS is jammed. Classified results.**
- Sponsor: **Navy Warfare Development Command. Wargame: Examine capability of future US Navy distributed force structures (flotilla and air wing) in a South China Sea Anti-Access/Area Denial (A2/AD) scenario.**

#### **FY14**

- Sponsor: **DoD Modeling & Simulation Coordination Office. Wargame: Examine the migration of Taiwan Armed Forces training from current status to a Live-Virtual-Constructive paradigm.**
- Sponsor: **USARPAC. Wargame: Contingency Planning in the PACOM AOR [Classified results]**
- Sponsor: **Navy Recruiting Command. Wargame: Analysis of the Make Goal table top wargame**

## **FY15**

- Sponsor: **Undersea Integration Program Office, PEO C4I. Wargame: Undersea Constellation**
- Sponsor: **USARPAC. Wargame: Contingency Planning in the PACOM AOR [Classified results]**
- Sponsor: **JWAC. Wargame: Examine the global implications of an energy-independent United States in 2035**
- Sponsor: **Royal Canadian Navy. Wargame: Examine non-lethal weapons for boarding parties**
- Sponsor: **Norwegian Armed Forces. Wargame: Examining Hybrid Threat**

## **FY16**

- Sponsor: **Navy N-96. Wargame: Red Team the Navy's new Distributed Lethality Concept in a South China Sea scenario.**
- Sponsor: **USSOCOM J-3 (International). Wargame: Russian Hybrid Threat in the Arctic**
- Sponsor: **USSOCOM J-35. Wargame: Interdicting the flow of Foreign Fighters to the Islamic State**
- Sponsor: **USCENTCOM J-8. Wargame: Explore the impacts of potential interactions between Shia Militia Groups (SMGs) and U.S forces to evaluate deterrent and de-escalation options [Classified results]**
- Sponsor: **Navy N-96. Wargame: Distributed Lethality Wargaming (Eastern Mediterranean)**
- Sponsor: **9<sup>th</sup> Mission Support Command. Wargame: Military Support of Disaster Relief (Pacific)**

## **FY17**

- Sponsor: **SOCCENT. Wargame: Trans-Regional Threats: Countering The Spread of ISIS.**
- Sponsor: **U.S. Navy. Wargame: War in the Pacific: Strength Through Allies.**
- Sponsor: **SOCOM J-3I. Wargame: Preventing Crisis: International SOF Operations in the Gray Zone.**
- Sponsor: **U.S. Navy COMSURFOR. Wargame: Distributed Lethality Wargaming (SCS)**  
Sponsor: **U.S. Navy N-98. Wargame: Examining the deterrence potential of Carrier Strike Groups.**
- Sponsor: **USMC CD&I. Wargame: Examining the operational impact of Extreme Cold Weather (ECW) storage alternatives.**
- Sponsor: **Operational Energy Academic Group. Wargame: Assessing the impact of Operational Energy availability to a ground combat force fighting a hybrid threat in a European scenario.**
- Sponsor: **Australian Defence Force Joint Experimentation. Wargame: Assessing the future Australian Army battlefield requirements for manned and unmanned aviation.**

## **FY18 (7)**

- Sponsor: **U.S. Naval Special Warfare Command. Wargame: Examining Future SEAL operational capabilities**
- Sponsor: **U.S. Fleet Forces Command. Wargame: Examining the Distributed Lethality concept in a SCS scenario**
- Sponsor: **MARFORPAC-ADF. Wargame: Assessing USMC-ADF interoperability**
- Sponsor: **USFF. Wargame: Distributed Maritime Ops-EABO synergy**
- Sponsor: **USARPAC. Wargame: MDTF Ops**
- Sponsor: **USASOC. Wargame: Special Ops support of near-peer conflict**
- Sponsor: **NAVY. Wargame: Evaluating LITMUS as a wargaming adjudication tool**

## FY19 (11)

- Sponsor: **NATO Special Operations Forces HQ (two wargames)**. Wargame: **Assess how NATO SOF can conduct operations in an occupied or denied environment against a peer or near-peer adversary after Article V has been declared**
- Sponsor: **NATO Special Operations Forces HQ**. Wargame: **Assess how NATO SOF can conduct operations in an occupied or denied environment against a peer or near-peer adversary pre-Article V declaration**
- Sponsor: **MARFORPAC**. Wargame: **Determine the Marine Corps' ability to affect change and support Phase 0 (competition phase) activities in 2025.**
- Sponsor: **MCWL**. Wargame: **Assess Naval expeditionary forces to perform sea control and sea denial missions by securing (seizing or occupying) and establishing land bases.**
- Sponsor: **USMC**. Wargame: **Assess shore-based ASMs capability to execute sea control and sea denial missions.**
- Sponsor: **Australian Defence Force**. Wargame: **USMC MEB /Australian Amphibious Force interoperability.**
- Sponsor: **USN**. Wargame: **Assess CONEMPS for Small Combatant Flotillas teamed with Shore-based ASMs.**
- Sponsor: **USARPAC**. Wargame: **Assess Multi-Domain Task Force Joint Operational Maneuver capabilities.**
- Sponsor: **MARSOF**. Wargame: **Maximize indirect operational approaches to secure advantages in phase zero or the "Contact Layer" while setting conditions to deter or dominate in the "Blunt layer."**
- Sponsor: **MARSOF**. Wargame: **Determine the mechanisms and processes will allow MARSOC to better serve as a bridge for capabilities integration with SOF and deployed MAGTFs in a conventional maritime conflict scenario.**

## FY20 (14)

- Sponsor: **NATO Special Operations Forces HQ (two wargames)**. Wargame: **How could/should NATO support deterrence and assurance to its allies under pressure short of an Article V declaration?**
- Sponsor: **MARSOC (five wargames total)**:
  - **MARSOC 1: Determine the actions and partnerships MARSOC can enhance and develop to counter Chinese influence via the BRI, while maintaining emphasis on CVEO, within Phase Zero or the "Contact Layer" in INDOPACOM, Pakistan, and Afghanistan.**
  - **MARSOC 2: Analyze how MARSOC can work with and through Joint, Interagency, and Coalition partners in the Philippines during Phase Zero in the Philippines area of operations (Philippines mainland, surrounding territorial waters, and territorial claims to South China Sea to include Spratly Islands) in order to secure advantage in the "Contact Layer" while setting conditions to dominate in the "Blunt Layer."**
  - **MARSOC 4: What direct and indirect options can MARSOC and other SOF provide to an escalation scenario in the Mekong River Watershed IOT apply pressure and impose costs to deescalate or seize advantage?**
  - **MARSOC 5 (two wargames): What SOF options can be taken in the Contact-Blunt Layers to apply pressure and deescalate in a contested environment in neighboring SCS nations of Taiwan, Philippines, and Vietnam. While providing analysis of the types of operations and activities that can be executed, allowing MARSOC to develop training scenarios and force capabilities.**
- Sponsor: **OPNAV N4**. Wargame: **Explore extended range (>10 day) planning and decision-making regarding positioning and operations of naval and joint/combined logistic assets in the Western Pacific.**
- Sponsor: **Taiwan**. Wargame: **Explore the possible strategies the Taiwan Navy can use to maintain open sea lines of communication entering Taiwan while deterring or preventing Chinese invasion of the west side of Taiwan.**
- Sponsor: **ADF**. Wargame: **How should MRF-D be configured to be able to conduct contingency operations in 2022?**
- Sponsor: **MCLOG**. Wargame: **Create a wargame to provide the requisite critical thinking skills necessary for logistics personnel to conceptually execute expeditionary logistics?**
- Sponsor: **SURFDEVRON ONE**: Wargame. **Create a wargame to demonstrate the capabilities and tactics needed to employ M/LUSV in a joint service/joint nation conflict.**

- Sponsor: **MCWL. Wargame: Wargame Responsiveness Capacity and Time Comparison for Centralized vs Decentralized Fires Clearance Processes.**
- Sponsor: **MARSOC. Wargame: Prepare the environment for potential major combat operations in a South China Sea conflict scenario.**

### **FY21 (3 to date)**

- Sponsor: **Australian Defence Force Joint Experimentation Directorate. Wargame: Assess concepts for the optimal employment of AUS, US and JPN ASW forces in the Full Spectrum ASW mission (previously TASW)**
- Sponsor: **Naval Information Warfighting Development Center. Wargame: Assess the ability of U.S. Navy CSGs to use cloud cover to prevent detection from adversary Electro-Optical/Infrared (EO/IR) capabilities.**
- Sponsor: **OPNAV N4. Wargame: Examine Command & Control (C2) with a combined USN/USMC staff in support of Distributed Maritime Operations (DMO) and Expeditionary Advanced Base Operations (EABO) within a Logistics Task Force Commander organization in a contested environment against a peer adversary.**

**Capstone Sponsors (39 total):** 16 Navy, 7 Joint, 6 Int'l, 4 Army, 5 Marine Corps, 1 Industry

**Wargames (81 total):** 29 Navy, 18 Marine Corps, 9 Joint, 14 Int'l, 9 Army, 2 Industry