BLAZING SKIES

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MASTER OF MILITARY ART AND SCIENCE
Wargame Design

by

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This wargame thesis seeks to answer the question: "Can Air and Missile Defense (AMD) concepts be effectively modeled to educate junior Air Defense Artillery (ADA) officers and senior non-air defense officers on the basic employment of AMD and its cost trade-offs in a competitive wargame?" Many wargames focus heavily on air to air combat or air support of ground units, but few focus on air and missile defense beyond the most abstract level. Joint and Army design and mission planning concepts informed game structure and goals while AMD doctrine provided guidelines for tactical decisions. Research into a variety of different games provided mechanics and elements that enabled these concepts to be woven together to support 14A individual critical tasks using the Time-Space-Assets-Resolution (TSAR) model. Research using open source intelligence, such as *Jane's Defense*, informed threat data and modeling. This wargame enhances understanding though a God's eye view of the air environment to demonstrate AMD concepts at the tactical, operational, and strategic levels.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

BLAZING SKIES, by David Andrew Jackson, 192 pages.

This wargame thesis seeks to answer the question: “Can Air and Missile Defense (AMD) concepts be effectively modeled to educate junior Air Defense Artillery (ADA) officers and senior non-air defense officers on the basic employment of AMD and its cost trade-offs in a competitive wargame?” Many wargames focus heavily on air to air combat or air support of ground units, but few focus on air and missile defense beyond the most abstract level. Joint and Army design and mission planning concepts informed game structure and goals while AMD doctrine provided guidelines for tactical decisions. Research into a variety of different games provided mechanics and elements that enabled these concepts to be woven together to support 14A individual critical tasks using the Time-Space-Assets-Resolution (TSAR) model. Research using open source intelligence, such as *Jane’s Defense*, informed threat data and modeling. This wargame enhances understanding though a God’s eye view of the air environment to demonstrate AMD concepts at the tactical, operational, and strategic levels.

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I offer a final thanks to you all, knowing that such words are insignificant to your contributions. Knowing this, I offer the following work.

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ACRONYMS

ABT	Air Breathing Threat
AD	Air Defense
ADA	Air Defense Artillery
AI	Air Interdiction
AIAMD	Army Integrated Air and Missile Defense
AMD	Air and Missile Defense
AO	Area of Operations
AOI	Area of Interest
APOD	Air Port of Debarkation
ARM	Anti-Radiation Missile
ASCM	Anti-Ship Cruise Missile
ATO	Air Tasking Order
BCT	Brigade Combat Team
BM	Ballistic Missile
CAS	Close Air Support
CAL	Critical Asset List
CEP	Circular Error Probable
CFIT	Controlled Flight Into Terrain
CDR	Commander
CM	Cruise Missile
CRBM	Close Range Ballistic Missile
C-RAM	Counter Rocket, Artillery and Mortar
DAADC	Deputy Area Air Defense Commander

DAL	Defended Asset List
DCA	Defensive Counter Air
DSA	Divisional Support Area
EW	Electronic Warfare
FRRP	Forward Rearming and Refueling Point
FW	Fixed Wing
GBAD	Ground-Based Air Defense
GMD	Ground-based Midcourse Defense
HIMAD	High and Medium Altitude Air Defense
HQ	Headquarters
IADS	Integrated Air Defense System
IAMD	Integrated Air and Missile Defense
ICBM	Intercontinental Ballistic Missile
ICTL	Individual Critical Task List
IFPC	Integrated Fire Protection Capability
IMD	Integrated Missile Defense
IRBM	Intermediate Range Ballistic Missile
JFACC	Joint Forces Air Component Commander
JTF	Joint Task Force
LACM	Land Attack Cruise Missile
MAAP	Master Air Attack Plan
MD	Missile Defense
MDO	Multi-Domain Operations
MP	Movement Point
MRBM	Medium Range Ballistic Missile

MSE	Missile Segment Enhanced
OCA	Offensive Counter Air
OR	Operational Readiness
PAC	Patriot Advanced Capability
PTL	Primary Target Line
RCS	Radar Cross Section
RW	Rotary Wing
SAM	Surface to Air Missile
SHORAD	Short-range Air Defense
SLBM	Submarine Launched Ballistic Missile
SPOD	Sea Port of Debarkation
SRBM	Short Range Ballistic Missile
TBM	Theater Ballistic Missile
THAAD	Theater High Altitude Area Defense
UAS	Unmanned Aerial System
VP	Victory Point
WEG	Worldwide Equipment Guide

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CHAPTER 1

INTRODUCTION

The history of US Air Defense emerged alongside the use of the airplane as a military capability in World War I. In its infancy during World War I, the first air defense tactics and doctrine were created and employed leading to the emplacement guidelines and principles still in use today.[1] As airpower continued to demonstrate its effectiveness after World War I, air defense rose in prominence as well, along with the development of improved weapons. These include: sensors, such as Radar in the 1930s; shooters, such as guided missiles in the early 1950s, and integrated command and control alongside both.[2] The end of the Cold War and a shift in the US military to focus on counter terrorism eroded US air defense capability against near peer threats. However, Air and Missile Defense (AMD) has now been identified as one of six army modernization priorities required to retake these advantages against emerging threats.[3]

An important concept to understand throughout this work is the difference between air defense (AD), missile defense (MD), air and missile defense (AMD), and

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[1] John A. Hamilton, *Blazing Skies: Air Defense Artillery on Fort Bliss, Texas, 1940-2009* (Washington, DC: Government Printing Directorate, 2009), accessed 10 November 2018, https://books.google.com/books?id=4Pz7CijIZnAC&pg=PA280&lpg=PA280&dq=general+wainwright+first+to+fire+speech&source=bl&ots=BxvVMMUoRf&sig=FpqhfoD1mv-T3zF2S1bSA3m-XYs&hl=en&sa=X&ved=2ahUKEwj85f2kuJ7ZAhWnhOAKHbHHCQYQ6AEwCHoECAwQAQ#v=onepage&q=V2&f=false, 26-28.

[2] Ibid., 125.

[3] Mark Milley and Ryan D. McCarthy, "Modernization Priorities for the United States Army," Government Executive, 3 October 2017, accessed 10 November 2018, https://admin.govexec.com/media/untitled.pdf.

integrated air, missile or air and missile defense (IAD, IMD and IAMD respectively). AD concerns only the defense from air threats to include fixed wing (FW), rotary wing – helicopters (RW), and unmanned aerial systems (UAS). MD deals solely with defense against missile threats of which there are two primary types: Ballistic Missiles (BM) and Cruise Missiles (CM). Ballistic Missiles are missiles that follow a ballistic trajectory determined by their velocity at burnout, the point in time when thrust is no longer applied. Cruise missiles are unmanned craft typically designed to fly at low altitudes and high speeds. When a system conducts air and missile defense simultaneously, it is conducting AMD. Finally, while many systems provide this defense without outside support, the systems are greatly enhanced by integration with each other. This concept is called Integration and leads to IAD, IMD or IAMD based on the threats the system of systems is defending against.

As the joint force continues to shift its focus back towards large-scale combat operations against near-peer competitors, the need for commanders and staff to understand the role AMD plays on the battlefield will only continue to grow. *Blazing Skies* is a competitive wargame designed to teach AMD concepts to junior air defense officers and to experienced military personnel without a significant background in air defense. It answers the question: "Can AMD concepts be effectively modeled to educate junior Air Defense Artillery (ADA) officers and senior non-air defense officers on the basic employment of AMD and its cost trade-offs in a competitive wargame?" This game provides an opportunity for players to experience some of the dilemmas facing IAMD on the modern battlefield as they attempt to find balance between AMD assets to best prioritize defense of critical assets.

To successfully reach these goals, the following sub questions should be considered, based on Peter Perla's elements of wargaming[4]:

1. What are the key air and missile defense concepts that should be included?

2. What are the roles and key decision points for the players?

3. How will these concepts be related to the player in a realistic setting?

4. What resources should the players have in order to achieve the objective?

5. How will AD concepts and threat aviation be translated into usable game mechanics that will inform real-world understanding?

Several assumptions must be made to effectively design an Air and Missile Defense focused wargame. The first assumption is that the resulting game will effectively contribute to the learning of the target audience. The second is that using publicly releasable data to model systems will allow system modeling similar enough to real world values to enable learning objectives.

This game will be available for public release, limiting system and threat data. Capabilities and limitations for all assets, threat aviation and air defense platforms, will utilize open source documents, primarily the *Worldwide Equipment Guide* (WEG)[5] and *Jane's Defense* publications on land-based air defense, sensors, aircraft, unmanned aerial systems (UAS), strategic weapons, and air launched weapons.[6] These are well respected,

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[4] Peter Perla, *Peter Perla's The Art of Wargaming: A Guide for Professionals and Hobbyists* (Annapolis, MD: United States Naval Institute, 2011.), 158-160.

[5] US Training and Doctrine Command (TRADOC) G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS: TRADOC G-2ACE-Threats Integration, December 2016).

[6] Christopher F. Foss, and James C. O'Halloran, *Jane's Land Warfare Platforms: Artillery and Air Defense 2017-2018,* 35th ed. (Coulsdon, UK: IHS Markit. 2017); Martin

publicly accessible sources. All formulas utilized to develop system models will be included for use in creating or modifying threats and AMD systems.

Air and Missile Defense covers a range of threats from mud to space.[7] Due to this vast expanse of threats from small mortars to Intercontinental Ballistic Missiles (ICBM), Blazing Skies limits itself to US Army systems currently fielded to defend BCT and larger maneuver forces and selected geo-political assets. The US Navy Aegis system is included to provide a measure of joint integration and set conditions for future work. The Ground Based Midcourse Defense (GMD) system is unique to the National Guard and is built to defend the homeland against limited ICBM attack.[8] The Indirect Fire Protection Capability (IFPC) is a system of record designed to defeat rockets, artillery and mortars fielded as an interim solution to rocket and mortar attacks on forward operating bases in Counter Insurgency Operations. IFPC Phase II will feature a new interceptor but it is unclear what new capabilities will become programs of record and therefore it is not included in *Blazing Skies*.[9] Due to the unique aspects and limited availability of counter

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Streetly, ed. *Jane's Radar and Electronic Warfare Systems 2011-2012*, 23rd ed. (Coulsdon, UK: IHS Global Limited, August 2011); Jamie Hunter, *Jane's All the World's Aircraft: In Service 2017-2018* (Coulsdon, UK: IHS Markit, 2017); Martin Streetly, ed. *Jane's All the World's Aircraft: Unmanned 2016-2017,* 42nd ed. (Coulsdon, UK: IHS Market, May 14, 2015); James C. O'Halloran, *IHS Jane's Weapons: Strategic 2015-2016* (Coulsdon, UK: IHS Janes, 2015); Rahul Udoshi, *Jane's Weapons: Air-Launched 2017-2018* (Coulsdon, UK: IHS Markit, 2017).

[7] Fires Center of Excellence, *Fires Bulletin*, "Mud to Space" January-February 2015, accessed 26 January 2019, http://sill-www.army.mil/firesbulletin/archives/2015/jan-feb/index.html#.

[8] CSIS Missile Defense Project, "Ground-based Midcourse Defense (GMD) System," accessed 9 January 2019, https://missilethreat.csis.org/system/gmd/.

[9] Missile Defense Advocacy Alliance, "Counter-Rocket, Artillery, Mortar (C-RAM)," November 2018, accessed 9 January 2019,

rocket, artillery, and mortar (C-RAM) assets, *Blazing Skies* focuses on the five other threats— Fixed wing (FW), rotary wing (RW), cruise missile (CM), unmanned systems (UAS), and Ballistic Missiles (BM). While space and cyber operations play important roles in the current operational environment, to maintain the game's focus on Air Defense, cyber and space operations will be greatly abstracted and it is assumed that both the Red and Blue forces are equally adept at cyber and space offensive and defensive actions.[10]

http://missiledefenseadvocacy.org/missile-defense-systems-2/missile-defense-systems/u-s-deployed-intercept-systems/counter-rocket-artillery-mortar-c-ram/.

[10] Chairman, Joint Chiefs of Staff (CJCS), Joint Publication (JP) 3-0, *Joint Operations,* Change 1 (Washington, DC: Government Printing Directorate, 22 October 2018), III-21 - III-22.

CHAPTER 2

LITERATURE REVIEW

The Literature Review for *Blazing Skies* can be divided into three categories: government documents used to provide background information and real-world data, public documents such as *Jane's* to provide publicly releasable data, and past games. The government documents provided historical and background material as well as the real-world capabilities of the game assets. Tabletop and board games were used to inspire mechanical and structural development of *Blazing Skies* while providing insight into what different elements may work together.

Joint and Army doctrine greatly influence *Blazing Skies'* development. The United States military's primary doctrine for AMD is JP 3-01 *Countering Air and Missile Defense*. This publication outlines many of the key air defense concepts including Offensive and Defensive Counterair, integration via command and control, planning considerations and enabling capabilities. JP 3-30 *Command and Control of Joint Air Operations* defines the Air Tasking Order cycle. ATP 3-01.16 *Air and Missile Defense Intelligence Preparation of the Battlefield* outline the threats and their defining characteristics. These form the basis for key concepts within *Blazing Skies*.[11]

To support its duties as the proponent for the ADA branch, the US ADA Schoolhouse has created an individual critical task list (ICTL) for *Blazing Skies*' target audience—14A, Air Defense Officers. These critical tasks outline what is expected of ADA lieutenants, (level 1), and captains, (level 2). This critical task list informs the

[11] CJCS, JP 3-0, v - vii.

critical decisions for players by outlining training objectives and levels of knowledge for the target audience.[12]

While detailed representation of real-world capabilities is not critical to the learning objectives, accurate modeling increases player understanding and buy-in. Critical to creating both ground-based air defense systems and real-world threats were publicly releasable system data. *Jane's Defense* provides a library of publications to create database of AMD systems and, air and missile threats. Jane's is well respected as a source of data on military equipment from around the world and provides a single point of reference on US systems. Similarly, the *Worldwide Equipment Guide,* published by US Training and Doctrine Command (TRADOC), provides a detailed library on threat systems. This data was key in creating threat representative models using a resource familiar to the target audience at the publicly releasable level.

During the development process, many games helped to shape the formation of concepts and methods of implementation within *Blazing Skies.* Most of these games heavily abstract AMD while focusing on ground operations with the support of airpower, such as Bruce Maxwell's *Air and Armor*. Maxwell's game distinguishes between SHORAD and HIMAD systems. SHORAD systems are abstracted as a permanent part of headquarters units which models massing of ground-based fires and limited maneuverability on the battlefield. Additionally, aircraft are immune from SHORAD fires except at the point of attack due to game mechanics, preventing the use of defense in depth, early engagement, and weighted coverage. HIMAD systems are greatly abstracted

[12] US Army Air Defense Schoolhouse (USADASCH), *Individual Critical Task List (ICTL) 14A Air Defense Artillery Officer* (Fort Sill, OK: USADASCH, June 2015).

as a simple modifier affecting the entire board. This concept allows for little consideration for air defense planning. [13]

Lee Brimmicombe-Wood's *Downtown* instead focuses on the air war. Its ruleset allows for a realistic ground-based air defense system including line of sight based on aircraft altitude, modifiers for aircraft maneuverability and the need to integrate differing ground defense systems with defending aircraft to create a strong structure for further development. The historical focus of the game means the US Air Force's and Navy's vastly superior air power over the North Vietnamese allows only harassing ground-based fires instead of creating an IAD system. Finally, because *Downtown* models the historical air war over Hanoi, it does not include the full range of modern air threats such as attack helicopters, unmanned aerial systems, cruise missiles and ballistic missiles.[14] However, *Downtown*'s basic mechanics, especially aircraft movement, provide a sound foundation for development of a modern AMD game.

The ability to model player decisions across multiple timescales is critical to AMD planning when considering force composition, deployment and employment of weapon systems. James Dunnigan's classic *Jutland* utilized two time and area scales to represent operational and tactical maneuver in the North Sea in World War 1. *Jutland* uses synchronization of these scales to swiftly progress while no tactical operations are

[13] *Air and Armor*, by Bruce S. Maxwell (West End Games, 1986).

[14] *Downtown,* by Lee Brimmicombe-Wood (GMT Games, 2004).

ongoing.[15] Telescoping time scales allows *Blazing Skies* to demonstrate the vast differences between planning timelines and the speed of air and ground movement.

[15] *Jutland*, by James Dunnigan (Avalon Hill Game Co., 1967).

CHAPTER 3

FACTORS TO BE MODELED IN THE SIMULATION

Blazing Skies is a board game modeling Air and Missile Defense concepts to provide understanding to junior ADA officers and senior non-air defenders. Overall, the most important player decisions focus on prioritization of critical assets to support the Joint Force Commander's (JTF) mission in pursue of national interests in a complex, near-peer environment. The 14A Air Defense Officer ICTL provides a foundation for Air Defense (AD) player decisions emphasizing the employment of US Army AMD systems to develop defense designs to prioritize the defense of critical assets. JP 3-01, *Counterair,* and JP 3-30, *Command and Control of Joint Air Operations* define important decisions for Red Air players in managing airpower to create a viable offensive capability. The priority for Red Air's actions are to support the AD player's understanding instead of detailed modeling of real-world processes and threats. The individual systems will be modeled from unclassed sources primarily *Jane's Defense* and *Worldwide Equipment Guide* sources. This paper will utilize the Time – Space – Assets – Resolution format to organize concepts, Chapter 3, and mechanics, Chapter 4.

Player Roles

Endstate

Conflict resolution and termination of military operations should be based on military end state in support of national strategic objectives. The JTF Commander's guidance and objectives outline how military operations are nested in national objectives and achieve termination. The achievement national strategic goals and desired JTF

Commander objectives are measures of effectiveness (MOE) for Joint operations. These objectives should include host nation government stability, and availability of US and coalition combat power for follow-on missions.[16]

As an instrument of national power, the military works alongside diplomatic, informational, and economic instruments during conflict to ensure the endstate matches national goals.[17] As the other instruments are also working, it is not necessary for either combatant to complete its military objectives before both sides can come to a compromise solution. It is important for AMD planners to understand how they contribute to the perception of the military situation, and the resulting affects on diplomatic, informational and economic solutions to national goals.

As an alternative to seizing critical terrain and destruction of a nation's military, Giulio Douhet proposed that air power could be used to achieve victory by targeting centers of industry and civilian morale.[18] This paper will not attempt to debate the validity of that theory; but, it will account for its effect on Red targeting and Blue defended assets by allowing Red targeting of key industry and civilian targets as a pathway to victory.

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[16] CJCS, JP 3-0, I-7 - I-8.

[17] Ibid., I-1.

[18] David MacIsaac, "21. Voices from the Central Blue: The Air Power Theorists," in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986), 630.

Military Objective

JP 3-0 identifies six cyclic phases of military operations: Shape, Deter, Seize Initiative, Dominate, Stabilize, and Enable Civil Authority. Deter and Seize utilizes defensive operations to delay the enemy until combat power can be built and conditions are set to seize the initiative. Once this occurs, forces transition to the Dominate phase as ground force conduct primarily offensive operations to achieve a military endstate before transitioning to stability. Within stability, ground forces work to restore a safe and secure environment and prepare to return the area to civil control.[19] *Blazing Skies* focuses on the transition from Seize Initiative to Dominate as this exposes the players to the greatest mix of dilemmas as these operations require mobile forces to support changing critical assets.[20]

To conduct offensive, defensive and stability operations, Joint Task Force Commanders assign tasks to subordinate units. The units' current and future missions, and facilities required to support them, identify an asset's criticality to the JTF Commander's plan leading to the prioritized critical asset list (CAL). The CAL allows AMD commanders to prioritize defensive capabilities and make recommendations to the JTF Commander, resulting in the defended asset list (DAL).[21]

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[19] CJCS, JP 3-0, V-7 - V-17.

[20] Headquarters, Department of the Army (HQDA), Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Directorate, October 2017), 6-26.

[21] Chairman, Joint Chiefs of Staff (CJCS), Joint Publication (JP) 3-01, *Countering Air and Missile Threats* (Washington, DC: Government Printing Directorate, 21 April 2017), xvi.

Asset prioritization is a critical skill for any AMD planner based on its criticality (the importance of each asset across each phase of operation), its vulnerability (a measure of is hardness, dispersion, ability to repair and availability of alternatives), and the likelihood of enemy attack. These assets include maneuver forces and geo-political assets such as host nation infrastructure or government facilities. Often, the cost of entry into theater is the defense of host nation assets not critical to the military operation. Designation of critical assets is a responsibility of the JTF commander, while AMD planners conduct the detailed analysis required to recommend assets for protection.

AMD planners must conduct detailed analysis of each asset's criticality, its vulnerability and likelihood of attack in order to prioritize limited AMD assets. The status of these critical assets provides a measure of performance (MOP) for AMD plans based on level of protection provided and effectiveness of each protective measure.[22] From a learning perspective, scoring provides feedback to the player to help analyze their actions in terms of intended outcomes, while leveraging an individual's competitive nature to provide focus and to direct attention to areas of weakness and seek improvement.

Ground Based Air Defense Player – Blue

As the focus of the wargame, there are two critical roles for the Blue player – the Ground based Air Defense Commander (GBAD) and the Maneuver Forces Commander. As the GBAD Commander, the blue player must be able to control AMD Task Force elements with the authority to plan, prepare and execute AMD operations in defense of assigned assets. This span of control allows integration of AMD operation representing

[22] CJCS, JP 3-01, III-15 - III-19.

real-world AMD Commanders[23] and the Deputy Area Air Defense Commander (DAADC).[24] Detailed modeling of operator actions, Blue aircraft, and non-ground-based systems is less critical as the Blue player is forces on the role of the AMD and maneuver commanders and planners. To keep focus on the tactical employment of AMD systems and asset prioritization, sustainment of friendly units can be very abstract. By being both the AD and maneuver commander, the player should gain understanding of command relationships per 14A ICTL. [25]

The GBAD Commander is the supporting commander to the ground force maneuver commander. The maneuver forces commander is responsible for the overall ground fight and will maneuver forces to best advantage against the ground threat to achieve operational objectives.[26] An AMD commander will advise conduct of ground forces in response to the air situation but ultimately supports the ground effort. By playing the role of the ground force commander, the player gains better understanding of the ground force perspective and goals, allowing the AMD commander to better support operations.

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[23] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 3-01.7, *Air Defense Artillery Brigade Techniques* (Washington, DC: Government Printing Directorate, March 2016), 3-1.

[24] CJCS, JP 3-01. II-12.

[25] USADADSCH, *ICTL*, 2.

[26] HQDA, ATP 3-01.7, 3-4.

Air Threat Player – Red

The Red player, as the Opposing Force, is responsible for creating a dynamic, complex threat environment to challenge Blue GBAD Assets. [27] These threats identified in JP 3-01 are Air Breathing Threats (ABTs)—FW, RW, CM, UAS; and Missiles—generally BM; and Rockets, Artillery and Mortar. Due to the unique aspects and limited availability of counter rocket, artillery, and mortar (C-RAM) assets, *Blazing Skies* focuses on the five other threats, which are generally controlled by the Red Joint Force Air Component Commander (JFACC).[28] Some assets, such as Army Aviation, do not traditionally fall under JFACC's control or may have multiple commanders. A single Red Commander allows for greater integration of the threat's capabilities and reduces the player requirement. As with the Blue player, the Red player, as the JFACC, will not be involved with most pilot decisions. Instead, Red player decisions will focus on supporting learning objectives and the integration and maneuver of Red aviation assets.

Time

Time Scales

AMD planning occurs across multiple time horizons and it is important to understand how actions taken well in advance of an operation will have significant impact on its outcome. The first timeframe is the long-term strategic decisions such as force composition and deployment of forces into theater. These actions take weeks,

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[27] Headquarters, Department of the Army (HQDA), Army Regulation (AR) 350-2*, Operational Environment and Opposing Force Program* (Washington, DC: Government Printing Directorate, 19 May 2015), 6.

[28] CJCS, JP 3-01*,* II-8 - II-10.

months, or years to complete. The second timeframe consists of actions that require days to a week, including maintenance and repair of equipment, execution of the joint targeting process including sortie generation, and unit planning and preparation for operations. The final timeframe is tactical actions taking place within minutes including aircraft maneuvering and engagement decisions. The large difference in time span for these critical actions require a method to allow the players to understand the different scales without unnecessarily slowing the game.

Turn Sequence

Wargaming is an important part of the military decisionmaking process. A method of conducting the wargame is the action-reaction-counteraction format with the side with initiative taking the action and driving the scenario. Reactions are actions taken by the side without initiative in response to the initial action. Counteractions end the sequence with the initiative player conducting actions in response to the reaction. This cycle continues until the critical event has been completed. Understanding the conduct of the wargame and its ability to shape understanding of future operations is critical to COA analysis and provides a doctrinal basis for structuring a game. [29] Blazing Skies uses the action-reaction-counteraction sequence as its basis of play as it is familiar to the target audience and allows an organized system for players to interrupt each other's actions.

When considering AMD COAs, it is important to account for the sequence of key actions by both the attacker and the defender. The attacker should be able to develop its

[29] Headquarters, Department of the Army (HQDA), Field Manual (FM) 5-0, *The Operations Process*, Change 1 (Washington, DC: Government Printing Directorate, 18 March 2011), B-31.

forces over months and years, dedicate its assets daily, and fight and maneuver their forces over a period of minutes. The defender's reactions should occur within similar timeframes including daily management and employment of sensors and shooters, and activating, deactivating, repositioning and operating radars and launchers to allow engagements within moments. Counteractions to these reactions should be continuing movement, conducting attack, or reacting to being engaged. These actions require a flexible timescale expanding to months and years for strategic decisions, shrinking to days and hours for operational ones and collapsing to seconds for tactical operations.

Space

Area of Operations, Area of Interest

The first step of AMD Intelligence Preparation of the Battlefield (IPB) is identifying that AMD Area of Operations (AO) and Area of Interest (AOI). AMD AO differs from traditional AOs by including three additional areas: enemy air and missile threats operational areas, friendly forces locations, and sensor and shooter coverage.[30] Additionally, the differences in range between THAAD, Patriot and Stinger missiles and FW threats compared to RW and smaller UASs is difficult to visualize. One must consider an area large enough to show the limitations of theater weapon systems like the Patriot with fine enough detail to represent SHORAD elements like Stinger and Avenger.

[30] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 3-01.16, *Air and Missile Defense Intelligence Preparation of the Battlefield* (Washington, DC: Government Publishing Directorate, March 2016), 2-1.

Terrain

AMD principles and guidelines are used in all operational environments and are dependent on local conditions in how they are utilized. A map providing wide diversity of terrain features will therefore aid the players more than a map replicating a real world operational area with less diversity. High flying aircraft are often unimpeded by terrain effects apart from navigational markers. However, aircraft and missiles routinely fly low in order to utilize terrain to mask their movements and must be aware of obstacles that could result in a crash. Modeling terrain effects to influence Red to develop realistic threat profiles is important to understanding how terrain affects operations for both Red threats and Blue assets contributing to improved IPB though detailed terrain analysis.

Line of Sight

Controlling line of sight (LOS) between air threats and AMD systems is the basis of masking. Utilizing terrain features to delay detection by flying behind intervening terrain such as wooded areas, hills and mountains allows aircraft to approach closer to a target with less risk. Understanding how to determine LOS based on aircraft altitude allows AMD planners to identify likely Air Avenues of Approach (AAA) critical in developing defense designs.

Movement

BMs, ABTs, and ground-based forces move on very different paths at vastly different speeds. TBMs fly ballistic trajectories that allow for very high speeds along a set path consisting of large vertical and horizontal components. In missile defense, the relatively fixed flightpath of a ballistic trajectory means the actual flight path matters less

than the time remaining along that flightpath.[31] Aircraft and CMs fly at relatively similar speeds and their location in three-dimensional space is critical to understanding their threat profile. Ground-based systems move far slower than either TBMs or ABTs and continually interact with terrain. Differing timescales help to illustrate why GBAD systems cannot react to air and missile threats and must therefore be prepositioned using detailed planning beforehand.

Additionally, some ground units require time to prepare for movement or to emplace upon arrival. This is important when considering continuous rates of march for front line troops compared to supporting AMD systems that lag despite faster average movement speeds.

Assets

Force Selection

AMD planners must understand how resource limitations drive the triple problems of asset protection—balancing between area, amount, and time—and force availability—the balance of cost, capability, and capacity between systems. BG Clement Coward, Commander 32nd AAMDC at a strategic and international studies event said, "The requirements exceed the capacity we have today. When it comes to combatant commander needs for missile defense, we find out we simply do not have enough."[32]

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[31] Missile Defense Agency, "A System of Elements," accessed 30 January 2019, https://www.mda.mil/system/elements.html.

[32] Kris Osborn, "The New Missile Gap is Here (as in the US Military Needs More Missile Defenses)," *The National Interest,* December 4, 2018, accessed 11 January 2019, https://nationalinterest.org/blog/buzz/new-missile-gap-here-us-military-needs-more-missile-defenses-37867.

The US Army Air Defense Force currently consists of four Area Air and Missile Defense Commands (AAMDCs), eight Air Defense Brigades and twenty-six Battalions.[33] These units are equipped with the Avenger, Stinger, Sentinel, Patriot, Theater High Altitude Air Defense (THAAD), Indirect Fire Protection Capability (IFPC) and Ground Based Midcourse Defense (GMD) systems.[34] Understanding the capabilities and limitations of threats and AMD systems allows players to learn emplacement of AD assets, the necessity of interoperability, and system tactical operations in supporting both the maneuver force and protecting geo-political assets.[35] Finally, understanding the trade-off between additional AMD capacity or maneuver forces is also important for force flow and composition.

The range of threats presented to AMD systems on the modern battlefield are varied but fall into five general categories: ABTs including FW, RW, UAS and CMs and tactical ballistic missiles (TBMs). Each threat has unique characteristics due to their design, preferred targets, and desired effects.[36] Enemy Courses of Action (COAs) will integrate these capabilities to achieve results not possible with individual systems in order to overwhelm integrated air and defense systems (IADS).[37] Therefore, AMD planners

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[33] Air Defense Artillery Commandant Office, "Air Defense Artillery Unit Websites, Facebook pages & other links," accessed 9 January 2019, http://sill-www.army.mil/ada-online/_docs/org-links.pdf.

[34] Foss, *Jane's Land Warfare Platforms,* 825.

[35] USADASCH, *ICTL*.

[36] HQDA, ATP 3-01.16, 1-1.

[37] Ibid., 5-1.

must be prepared to counter complex, integrated air and missile threats to defend critical assets.

Airspace Control

Air control is important to modern combat operations and is normally a requirement for successful ground operations. It prevents the effective employment of enemy air and missile systems and their ability to influence other domains. For this reason, air control is often the first objective of the JFACC. The degree of air control is not fixed, but varies in degree, time, and location. Time and location mean that the degree of control can vary across the battlefield and during different times of day such as during air raids and strikes. Degree is measured on a spectrum from no control, neutrality—neither side can gain control,[38] local air superiority—the ability to permit operations at a given space and time without prohibitive interference, and air supremacy—when the other side is incapable of effective interference.[39] As air control changes over time and both air superiority and air supremacy imply some remaining interference, understanding air control is important in balancing operational risk.

Emergent trends for future conflict identify the proliferation of technology and capabilities as critical enablers that allow adversaries to contest US dominance in five domains: air, land, maritime, space and cyberspace.[40] The US Army's strategy to counter these growing threats is Multi-Domain Operations (MDO) based on an understanding

[38] CJCS, JP 3-01, I-4.

[39] Ibid., GL-8.

[40] HQDA, FM 3-0, 1-5 - 1-6.

that peer adversaries have the capability to separate joint forces strategically, operationally and tactically though the use of long-range fires integrated with ISR assets, unconventional warfare, cyber, and IADS, while moving quickly in order to achieve objectives before joint forces can respond.[41] Within MDO, commanders calibrate force postures to defeat hybrid threats, employ resilient formations that can operate semi-independently with the ability to affect all domains and converge capabilities to create windows of advantage to enable maneuver.[42] The enemy will also attempt to similarly converge capabilities to create windows of vulnerability for friendly forces. Understanding how air control contributes and is created from windows of opportunity helps players understand operational tempo, balance movement against asset coverage, and manage risk to assets.

Air Tasking Order and Force Allocation

The Joint Air Tasking Order (ATO) cycle is critical to efficient use of modern air power by ensuring the Joint Task Force Commander's (JTF CDR) guidance is translated into individual missions utilizing the most capable and efficient platform. Understanding the ATO cycle allows better input into AMD orders and enemy COA development.

The ATO cycle begins with JTF CDR guidance which is used by the Joint Task Force Air Component Commander (JFACC) to develop air apportionment. Air Apportionment identifies priority or percentage of effort for an objective or mission type

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[41] Headquarters, Department of the Army (HQDA), *Draft: Multi-Domain Battle: Evolution of Combined Arms for the 21st Century 2025-2040*, Version 1.0 (Washington, DC: Government Printing Directorate, October 2017), i.

[42] Ibid., 1-2.

including counterair, strategic attack (strike), Air Interdiction (AI), Intelligence, Surveillance, and Reconnaissance (ISR) and Close Air Support (CAS).[43] Counterair consists of Offensive Counter Air (OCA) and Defensive Counter Air (DCA). OCA includes attack operations against enemy AMD systems; Suppression of Enemy Air Defense (SEAD) missions to neutralize, destroy or temporarily degrade AMD systems; Fighter Escort missions to protect other aircraft; and Fighter Sweeps to seek out and destroy enemy aircraft. DCA tasks include active AMD and passive defense measures taken to protect the force using deception, cover, and concealment.[44] Strategic attack or strikes are "attacks to damage or destroy an objective or capability."[45] AI and CAS are missions against enemy maneuver assets and supporting facilities differing based on coordination requirements with friendly ground forces. AI does not require close coordination while CAS does require close coordination.[46]

The Joint Targeting process nominates targets for attack based on JFACC priorities using the Joint Integrated Prioritized Targeting List (JIPTL). JIPTL targets are weaponeered in the third stage of the process by aligning available munitions with desired effect and delivery system. The master air attack plan (MAAP) team combines these weaponeered targets into individual strike packages and sorties to develop ATO.

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[43] CJCS, JP 3-01, II-9.

[44] Ibid., I-5 - I-7.

[45] Chairman, Joint Chiefs of Staff (CJCS), Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Washington, DC: Government Printing Directorate, 15 February 2016), 227.

[46] Ibid., 7, 34.

The MAAP results in air allocation - the total number of sorties by each weapon system available against each objective.

In step four, the ATO is produced, disseminated and air control measures are developed. This order is then executed by the JFACC who retains the ability to redirect assets based on changes to the situation through dynamic targeting.

Finally, the ATO cycles assesses the performance of all assigned missions using mission reports and ISR to compare against JTF guidance. This allows for continuous refinement of the air campaign plan.[47] Ground based fires to include CM and TBMs can be incorporated into the ATO process or retained by ground commanders for tactical support.

By understanding the ATO process, especially the processes for Air Allocation and Air Apportionment, players gain a better understanding of the inflexibility of aircraft to dynamically change missions due to ordnance restrictions. Understanding this restriction and the ATO process helps players visualize how factors affect both sides' ability to conduct air operations and contributes to threat analysis and asset protection.

Resolution

Asset Characteristics

The US Army currently fields Avenger, Stinger, Patriot and THAAD to defend maneuver forces and geo-political assets from air and missile attack. Each system has its own capabilities and mission sets which players must understand to be effective planners.

[47] Chairman, Joint Chiefs of Staff (CJCS), Joint Publication (JP) 3-30, *Command and Control of Joint Air Operations* (Washington, DC: Government Printing Directorate, 10 February 2014), III-18 - III-26.

The Avenger weapon system is a self-propelled, mobile surface to air missile system equipped with eight short range infra-red (IR) seeking Stinger missiles, an M3P .50 caliber machine gun, a forward-looking infrared camera and a daytime optical camera mounted on a HMMVV chassis. The system can traverse 360 degrees in azimuth and -10 to 70 degrees in elevation. The Avenger has a shoot on the move capability up to a maximum speed of approximately 35 kilometer (km) per hour. Most US Army Avengers have been upgraded with a Slew to Cue system that allows them to be directed, or slewed, based on external sensor data. The Stinger missile has a man portable configuration as well. Both versions have an effective range between 2 and 8 km in range and 200 meters to 3800 meters in altitude traveling at approximately Mach 2.2 and are capable of defeating targets maneuvering in excess of 8 gravities (gs).[48]

The Patriot missile system is a towed SAM system consisting of a Patriot radar, a manned engagement control station, an electrical powerplant, communication systems, and missile launchers capable of defeating manned and unmanned fixed wing, rotary wing, cruise missiles and ballistic missiles.[49] All equipment except the launching station are co-located. The AN/MPQ-65 Patriot Radar is a phased array radar with a range between 3 and 170 km with a field of view of 90 degrees for search and 120 degrees for track.[50] The Patriot missile launching stations can carry 4 Patriot Advanced Capability

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[48] Foss, *Jane's Land Warfare Platforms,* 587-590.

[49] North Atlantic Treaty Organization (NATO), "Patriot Fact Sheet," accessed 9 January 2019, https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2012_12/20121204_121204-factsheet-patriot-en.pdf.

[50] Foss, *Jane's Land Warfare Platforms,* 817-825.

(PAC) 2 interceptors, 16 PAC-3 interceptors, 12 Missile Segment Enhanced (MSE) interceptors or a mix of 6 MSE and 8 PAC-3 interceptors. These launchers have a remote capability up to 30 kilometers from the controlling battery.[51] The Patriot PAC-2 interceptor has a maximum speed of 1750 meters per second (m/s) with up to 30 gs of maneuverability with a maximum time of flight of 170 seconds. The interceptor is designed to engage targets between ranges of 3 and 160 kms and altitudes from 60 m to 24 kms. The PAC-2 missile is guided though all phases of flight by the Patriot Radar using track via missile (TVM) guidance.[52] The PAC-3 interceptor utilizes hit to kill technology instead of a warhead. This makes the missile much smaller than the PAC-2 interceptor raising launcher capacity to 16. The MSE interceptor is an improvement over the PAC-3, featuring a higher intercept altitude and more advanced capabilities.[53] Against BM threats, the Patriot system can defend an area out to 15 to 20 kilometers around the system.[54]

The THAAD system defends large areas from BMs. The radar has a range greater than 1000 km and the interceptor has a range of 200 km and a maximum altitude of 150 km. Nine THAAD launcher carrying 8 interceptors can be assigned to a single battery.

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[51] Foss, *Jane's Land Warfare Platforms,* 825-829.

[52] Ibid., 824.

[53] Ibid., 825-829.

[54] NATO, "Patriot Fact Sheet."

The system has a shoot, look, shoot capability against most threats with a probability of kill (Pk) of 0.9.[55]

In addition to US Army systems, sister services, allies, and partners all field a myriad of ground and air-based air and missile defense systems. Understanding sensor and shooter capabilities outside of US Army systems is important in building an IAMD system.[56] The Aegis combat system onboard Navy cruisers and destroyers is a common partner for Army AMD and is an important platform within US, Australian, Japanese, Norwegian, Republic of Korea, and Spanish fleets.[57] Aegis BMD is designed to defeat SRBM, MRBM and IRBM threats exo-atmosphere utilizing the Standard Missile (SM) 3 and SRBMs with the SM-2 Block IV and SM-6 interceptors.[58] 360-degree search, track and missile guidance is provided by the onboard SPY-1 S-band radar.[59]

Likewise, enemy threat systems are diverse and include capabilities unique to their threat type. By understanding the similarities and differences between these threats, players can better consider their possible targets and develop defense designs.

TBMs are missiles that follow a ballistic trajectory after launch. There are six categories based on maximum range: Close Range (CRBM) with ranges less than 300

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[55] Foss, *Jane's Land Warfare Platforms,* 829-831.

[56] USADASCH, *ICTL*, 3.

[57] Lockheed Martin, "Aegis Trifold," accessed 9 January 2019, https://www.lockheedmartin.com/content/dam/lockheed-martin/rms/documents/aegis/Aegis-trifold.pdf.

[58] Missile Defense Agency, "Aegis Ballistic Missile Defense Fact Sheet," 28 July 2016, accessed 9 January 2019, https://www.mda.mil/global/documents/pdf/aegis.pdf.

[59] Streetly, *Jane's Radar and Electronic Warfare Systems*, 159-162.

km, Short Range (SRBM) with ranges between 300 and 1000 km, Medium Range (MRBM) with ranges between 1000 and 3000 km, Intermediate Range (IRBM) with ranges between 3000 and 5500 km, Inter-Continental (ICBM) with ranges greater than 5500 km, and Submarine-launched (SLBMs) which are those missiles fired from submarines. To maintain focus on threats faced by US Army systems, threats should be limited to CRBM, SRBM and a limited number of MRBMs. This will provide opportunities for active and passive defense measures. TBM threat characteristics should include range, warhead size, accuracy, and inventory; the launcher's mobility and reload capability; and the threat's ability to command and control launchers, in order to allow players to conduct IPB.[60]

The remaining threats, FW, RW, UAS and CMs, are all ABTs and create effects on the ground though direct attack and supporting actions including ISR and EW.[61] Aircraft should be capable of executing all missions outlined in the air control section to include OCA, DCA, strike, CAS, and AI. Additionally, ABTs should be modeled for direct attack and at range with various stand-off munitions.

Analysis of FW and RW threats should include minimum, maximum, attack and cruising speeds and altitudes, range of aircraft and associated weapons, launch and recovery restrictions, weapon capacity, and ability to operate at day, night, or in adverse weather as well as threat order of battle.[62] CM are similar to FW and RW threats but

[60] HQDA, ATP 3-01.16, 4-1 - 4-8.

[61] Ibid., 4-9.

[62] Ibid., 4-11.

commonly fly at high speeds and very low altitude utilizing terrain to mask their approach while displaying a low radar cross section (RCS). These aspects make detection of the target challenging. In addition to the considerations for FW and RW threats, CM definitions should include navigation capabilities and the targets it is designed to attack to differentiate land attack cruise missiles (LACM), Anti-ship cruise missiles (ASCM), and Coastal defense cruise missiles (CDCM), and their launch platforms—land (LLCM), air- (ALCM) or ship-launched (SLCM). As with TBM launchers, the system's ability to emplace and fire must be considered especially as launcher inventories for CMs are often larger than TBM.[63]

The final category of threat is the Unmanned Aircraft System (UAS), which have evolved rapidly over the past few decades and continue to gain in popularity due to their low cost, and ease of use. Traditionally, UAS are slower, smaller, and cheaper than manned aircraft filling a similar mission. Their similarity to manned systems allows for the same considerations as FW threats while accounting for their size, cost, versatility, and expendability.[64] By understanding the capabilities and limitations of US Army AMD systems, partner systems, and threats, players are able to fuse this knowledge to develop a balanced AMD plan.

Attack Sequence

Attack resolution needs to help players understand target prioritization, asset vulnerability including hardening and dispersion, and accept the inevitability of

[63] HQDA, ATP 3-01.16, 4-11 - 4-15.

[64] Ibid., 4-15 - 4-16.

successful penetrations. Therefore, resolution of air and missile attacks should be based on the vulnerability of the target to air attack, the size and accuracy of the attacking payload and some level of friction.[65] Understanding the enemy's likely targets and destructive capability informs the level of threat to each assets and allows players to manage risk between multiple defended assets.

Intercept Sequence

Players must make risk decisions based on asset criticality, level of protection provided and duration of defense due to limited resources. Additionally, players need to conceptualize mission kill—preventing the target from conducting its assigned tasks—and warhead kill—outright destruction of the target—and mission requirements.[66] Therefore, interceptor Pk should be a function of the interceptor's and target's capabilities with a non-zero chance of interceptor failure and possibilities for mission and warhead kill.

Controlled Flight into Terrain

A danger to air and missile systems operating at lower altitudes is controlled flight into terrain (CFIT). CFIT occurs when a pilot or navigation system with full control of an airframe losses situational awareness and unintentionally directs itself into the ground. Contributing factors include distraction, a lack of knowledge of the local terrain,

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[65] Carl von Clausewitz, *On War,* edited by Michael Howard and Peter Paret, (Princeton, NJ: Princeton University Press, 1976), 119.

[66] Bernard Rostker, "TAB A-Acronyms, Abbreviations, and Glossary," *Information Paper – Iraq's Scud Ballistic Missiles,* 25 July 2000, accessed 19 January 2019, https://gulflink.health.mil/scud_info/scud_info_taba.htm.

and reduced visibility.[67] Military pilots are often well trained but the additional stressors of combat flight, including the need to coordinated operations and distraction from SAM launch, can greatly increase the risk. CFIT introduces risk to help players understand the tradeoff between low flight profiles to avoid GBAD systems and increase risk of catastrophic failure. This leads to complex threat profiles as the Red player maneuvers on to attack defended assets.

Operational Readiness

Equipment operational readiness is an important planning consideration for AMD forces that are often thinly stretched to maximize asset coverage. Planners must balance risk of equipment outage due to standard or unexpected maintenance against the opportunity to expand asset coverage. Unit Status Reporting utilizes Readiness and Serviceability level or R-level to measure equipment readiness. The highest level of readiness, level 1, for equipment other than aircraft was greater than 90 percent. This standard was used to aid in the identification of common equipment issues and represented a minimal threshold acceptable for equipment readiness.[68] The inclusion of Operational Readiness (OR) encourages players to consider redundancy in defense of critical assets in exchange for extending coverage to additional assets.

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[67] Federal Aviation Association (FAA), *Advisory Circular 61-134, General Aviation Controlled Flight Into Terrain Awareness* (Washington, DC: US Department of Transpiration, 1 April 2003), 7-8.

[68] Headquarters, Department of the Army (HQDA), Army Regulation (AR) 220-1*, Army Unit Status Reporting and Force Registration-Consolidated Policies* (Washington, DC: Government Printing Directorate, 15 April 2010), 50-51.

CHAPTER 4

DESIGN

Blazing Skies focuses on US Army ground base air defense planning to inform its target audience of air defense officers and supported commanders the importance of asset prioritization in planning AMD operations to support military objectives and national interests. To maintain focus, tactical ground maneuver, air to air combat, and supporting capabilities of Joint and Multi-national partners are greatly abstracted. A d100 percentile system is used as percentages are commonly used to expresses AMD capabilities.

Player Roles

Endstate

In order to drive asset prioritization dilemmas, *Blazing Skies* reaches endstate though three means: mutual consent, Red sudden death conditions, and the capture of JTF CDR objectives by Blue maneuver forces. The mutual consent ending reflects the actions of the other levers of power acting based on their perception of the current state of the conflict. This provides an ending based on factors external to the game. Once both players agree to end, Blue immediately scores and both players compare total victory points (VP).

Blazing Skies reflects Douhet's theory by allowing Red to destroy civilian targets. Civilian targets are easily damaged and have few hit points but are numerous. By destroying all civilian infrastructure, the Red player has inflected sufficient damage to force instant capitulation. At the end of the game, the status of civilian infrastructure determines the scoring system used (See Table 1).

Table 1. Effects of damage to Civilian Assets	
Percentage of Civilian Targets at 0 HP or Below	Effect
100%	Immediate Red Victory
75-99%	Red Victory at End game
50-74%	Draw
< 50%	Compare Victory Points

Source: Created by author.

The final endstate condition is the capture of JTF CDR objectives by Blue maneuver forces. End of game scoring is used instead of outright victory as Red may inflict enough damage to military or civilian targets over the course of the game to turn Blue success into a pyrrhic victory.

This scoring systems helps players understand the balance of Criticality, Vulnerability, and Threat (CVT) utilized in analysis to determine which critical assets on the critical asset list (CAL) become defended assets on the defended asset list (DAL). Criticality is supplied by the JTF CDR guidance. Vulnerability is based on the number of each asset on the game map, the repair ability of the sea port and the susceptibility value of each asset. Threat is influenced by Red's Victory Point (VP) modifiers and the Red force composition.[69]

Overall, this leads to the most important learning point in *Blazing Skies*—asset prioritization. The Blue player will never have enough capability to cover all assets as they face an equally large Red force. Secondly, AMD's defensive nature and its ability to

[69] CJCS, JP 3-01, III-16.

provide time, not invulnerability, to the JTF CDR is represented by having Blue start the game at maximum points and declines from there.

At the end of every 'Day', before the Blue player uses Sea Ports to repair damage, Red scores VP for each assessed damage token on Blue critical assets including maneuver units, airbases, sea ports, capital, and civilian targets. Unassessed damage still effects the capability of each critical asset, but points are only scored for assessed damage to reinforce the importance of the assessment phase of the ATO cycle. The VP modifiers for each asset are tied to the relative importance of each asset to operations while providing incentive to Red for deep attack (See Table 2). Target location, VP value and special rules help players understand asset criticality and likelihood of enemy attack. At the end of the game, if the Blue player achieved the JTF Commander's Guidance but failed to do so in time, the Red player gains additional VPs to represent the difficulties created by a lengthy campaign even if successful.

Table 2. Asset VP Modifiers

Asset	VP Bonus	HP	Total possible VP
Corp HQ	3	6	18
Division HQ, DSA	2	6	12
BCT	1	-	Unlimited
Airbase, Sea port	3	10	30
Capital	6	10	60
Civilian	1	5	5

Source: Created by author.

Blue scoring only occurs at the end of the game to provide incentive to quickly seize military objectives and prioritize protection of maneuver forces. Blue scores 1 VP per HP remaining on each critical asset and maneuver unit, multiplied by the asset's criticality multiplier in the JTF CDR guidance. The criticality multipliers are based on a 1 to 10 scale with must scenarios having 1 10-point multiplier, 2 to 4 8-point multipliers and 1 to 2 4- or 6-point multipliers.

The Scoring system design drives the Blue player to achieve JTF CDR objectives quickly while protecting only critical assets. The Red player achieves victory though an air campaign balancing target priority between delaying Blue maneuver forces and assessing damage on high value critical assets.

Military Objective

The JTF Commander guidance card defines the scenario by providing the mission, objectives to be occupied by Blue maneuver forces, critical asset VP modifiers and scenario special rules. The format of the JTF Commander card is based on the operations order formation as simple reinforcement. By these conditions, the JTF Commander's guidance can shape a variety of scenarios including abstract reimaginations of historical campaigns such as the lightning thrust of Thunder Run, the methodical push against the German counteroffensive in 1944, or a Joint Force entry scenario. The mission section is used to provide a time limit to the game, forcing the Blue player to balance speed with security. The use of the 5 Ws mission format helps players understand how AMD planners translate directed missions into defended assets. This

supports 14A ICTL items to develop AMD input for plans and orders.[70] The objectives section clearly states the individual hexes or series of hexes that must be occupied reflecting the execution paragraph of the standard OPORD. The lack of specific unit assignments allows Blue player flexibility and mission command. The special instructions section allows shaping of the scenario by modifying starting conditions such as unit location, status of assets and areas under Red control. Finally, the CAL section identifies individual assets, their location, and the VP modifier. Generally, these assets provide powerful bonuses to the Blue player but are not directly related to the maneuver forces that will end the game. This helps players see the relationship between the JTF mission, its main effort, and key enablers such as sustainment, command and control, or geo-political assets.

The Red player also receives JTF Commander's Guidance to increase understanding of the JFACC's role in supporting ground forces. The Red JTF Commander's Guidance is built in the same format as the Blue player's guidance. The guidance provides Blue's most likely course of action as well as target priorities. Additionally, in play testing, most players had difficulty visualizing the slow advance of Blue forces without Red ground forces being represented on the map; therefore, the Red JTF Commander's Guidance includes the starting locations for Red ground forces. These markers are for visualization only and have no ingame effects. This guidance is not incentivized with VP bonuses and is intended only to aid in understanding.

[70] USADASCH. *ICTL*, 1.

Ground Based Air Defense Player – Blue

The Blue player has sole control of all GBAD and maneuver forces within the game. This provides the player with the span of control to make all critical decisions for AMD forces supporting the JTF. By combining the GBAD and maneuver commanders, players can better visualize the concert between forces including the harmonies and discord based on competing goals. This allows the players to understand the risks as ground forces move beyond AMD coverage contrasted with the time required for AMD systems to move forward.

Air Threat Player – Red

The Red player controls all Air and Missile threats providing the span of control required to present a complex, realistic threat, and multiple dilemmas to the Blue GBAD player. [71] Combining all air and missile threats into a single player also maintains the generic flavor of Red Air instead of modeling a real-world force. The Red player gains insights into AMD operations by attempting to deconstruct the AMD plan. This allows players to gain understanding of AMD planning from different perspectives.

This unification of roles for Blue and Red reduces the required number of players to 2. Additional players can be involved by dividing roles along units, sector, or mission lines.

[71] HQDA, FM 3-0, 1-19.

Time

Time Scales

Blazing Skies meets the requirement for multiple time horizons by telescoping time from a strategic 'Game' phase, to short-term 'days' phases, and tactical 'windows of vulnerability' phases. *Blazing Skies* borrows this from the classic board game *Jutland*.[72] Telescoping the timeline allows time to pass quickly once decisions have been made and then slow again once a new decision is required. The Game phase has no explicit time interval, the Day phase uses one-hour time intervals and the Window of Opportunity phase uses 30-second intervals.

Turn Sequence

Strategic decisions occur in the Game phase including force selection, deployment, and military endstate. As time and space are more abstracted in the Game phase, long-term strategic decisions can be made without requiring detailed time in the game itself. In this phase, the players determine the scenarios by selecting or randomly determining a JTF Commander's guidance card, select forces up to an agreed points value using either pre-build or a la carte forces and deploy them in accordance with the JTF Commander's Guidance and initial intelligence information. These actions are no longer available after the Game phase to reinforce the requirement for detailed prior planning and the inability to react quickly by fielding additional systems or deploying forces once the fighting begins.

[72] *Jutland*, by James Dunnigan (Avalon Hill Game Co., 1967).

The Day phase contains short-term planning decisions over the span of a day. At the start of each day phase, the Blue player conducts AMD operational readiness checks and selects the time of the Blue airstrike, while Red conducts force allocation, and identifies the number and timing of windows of vulnerability. At the conclusion of each day, both players adjust the current Air Superiority track marker, record Red Air's VPs, determine if an endstate condition is met, and then Blue removes damage tokens from friendly assets in accordance with the Seaport special rules. The Day phase consists of 24 Hours in a day/night cycle to provide greater fidelity on the sequence of events and synchronize the Day with individual windows of vulnerability. One-hour time intervals were selected as they are large enough to model the movement of large ground formations. At the start of each Hour, the Red Player declares the start of a Window of Opportunity if scheduled for this hour, followed by Blue's declaration of an air strike if scheduled and moves maneuver and GBAD assets utilizing administrative movement points (MP). Players can use the Hour/Day tracker to maintain the current game time by recording key events such as lost and recovery of assets, Red Windows of Vulnerability start times and Blue airstrikes.

The Window of Opportunity phase reduces the time interval to 30 seconds to allow for tactical maneuvering of individual aircraft and missiles, and GBAD engagements. Windows of Opportunity utilizes the action-reaction-counteraction cycle. As the attacker, Red has the initiative and takes actions. Blue reacts to Reds actions, then Red counteracts to Blue. This borrows from FM 6-0 wargaming and the *Micro Armor*

sequence of play. [73] Windows of Opportunity begin with setting initial conditions as Blue sets each radar to active or inactive and faces sensors and shooters along primary target lines (PTLs). [74] Red acts by selecting an asset and performing movement. At any point in the aircraft's or missile's movement, Blue may conduct a reaction by activating radars, slewing sensors or shooters, or engaging targets within range and LOS. Blue may only slew a radar once per round of activations but may fire any number of interceptors. Blue interceptors that have not reached their maximum range or conducted an intercept remain in play and activate immediately following the completion of the target's activation in subsequent phases.

Following any Blue reactions, Red may conduct counteractions including react to SAM launch, continuing movement, or conducting attack or reconnaissance. This sequence allows the Blue player to react to multiple targets, provides SHORAD assets an opportunity to engage within the defended hex and allows Red aircraft and missiles to turn away from interceptors.

Once all counteractions are complete, play reverts to Red actions until the piece has completed its actions for the activation. Play then moves to the next Red selected piece. Once Red has activated each active asset, he or she may activate uncommitted

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[73] Headquarters, Department of the Army (HQDA), Field Manual (FM) 6-0, *Commander and Staff Organization and Operations,* Change 2 (Washington, DC: Government Printing Directorate, 22 April 2016) 9-26; *Micro Armor Tanks,* GHQ, accessed 30 January 2019, http://www.ghqmodels.com/pdf/BeerandPretzelsGame-ModernMicroArmour.pdf.

[74] Headquarters, Department of the Army (HQDA), Army Techniques Publication (ATP) 3-01.64, *Avenger Battalion and Battery Techniques* (Washington, DC: Government Printing Directorate, 10 March 2016), 2-29.

assets. After Red has activated all desired assets, play advances thirty seconds and activations begin again. The Window of Opportunity ends when no more significant actions will occur either though the removal of all Red units from the board or mutual agreement between the players.

Space

Area of Operations, Area of Interest

Blazing Skies defines the operational environment of the game as a 300 by 300 km square map with 5 km hexes creating a 60 hex x 60 hex game board. This size allows for the tactical maneuver of high-speed aircraft and is large enough that theater SAM systems cannot range the entire map. This challenges Blue to identify the AMD AO and AOI based on the location and missions of enemy and friendly assets. The 5 km hex cell size was selected as it was large enough to represent the 5 to 8 km range of the Avenger weapon system and small enough that the Patriot missile's 170 km range would not provide complete coverage of the board. Additionally, it allows easy conversion from real-world data by dividing by 5. Utilizing 1/2-inch hexes the game board covers approximately 30 inches allowing it to fit on most tables.

Blazing Skies used *Hexographer*[75] software to develop its map based on a real-world location. *Hexographer* features an ability to underlay a screenshot of real-world geography to help build realistic maps. *Google Earth*[76] was used to capture a 300 by 300 km area defined by Tuscaloosa, Alabama along the western edge; Huntsville, Alabama

[75] *Hexographer*, Windows, Inkwell Ideas Inc., 2016.

[76] *Google Earth Pro*, Windows, Google LLC, 2018.

along the north, Atlanta, Georgia to the east and Montgomery, AL in the south. This area was selected due to the diverse terrain present. To the northeast along the Alabama-Georgia border, the Appalachian foothills, running generally NE-SW, provide numerous ridge lines and masked terrain. In the southern part of the map, the flatter plains shift the terrain in favor of the defender due to the limited masking features. The terrain has a gradient from north to south that can be used to show the effects of small elevation changes on sensor LOS. The map area was modified south of Montgomery to create a coastline and opportunity to differentiate between LACM and ASCMs, include sea ports as critical assets and enablers, and provide a lodgment for Joint Force Entry scenarios. As is traditional, the names of these areas were then changed based on historical references and humorous insights.

Movement

Telescoping time accounts for the speed divergence between ground-based forces and airborne platforms allowing the two to use similar MP values executed in different time scales. As TBMs flight ballistic trajectories, they required a separate system resulting in three types of movement: TBM, ABT MPs and ground based administrative MPs.

Blazing Skies accounts for TBM's unique flight profile by moving to a separate TBM Flight Track. This tracker ignores vertical and horizontal movement and focuses on time. CRBM, SRBM and MRBM tracks are different lengths replicating different times of flight based on range. Each of the three tracks is twice as long as the previous track. While the maximum range of an SRBM (1000 km) is greater than twice that of a CRBM (300 km), the slight shortening of the SRBM track relative to the CRBM track represents

the higher speed of the longer-range missile and better reflects the flight times of a ballistic trajectory.[77]

Aircraft and missiles all fly at relatively the same speeds and are modeled in the same timeframe. *Blazing Skies* borrows heavily from *Downtown's* movement actions to develop a system based on a maximum speed modified by the energy costs of maneuvers. [78] (See Table 3). This movement scheme provides relative simplicity and freedom of movement allowing Red to focus on tactical instead of operator actions. Aircraft and missiles enter play at the same hex and altitude as their airbase or launcher, generally 'deck' altitude.

[77] Stephen R. Schmitt, "Ballistic Trajectory (2-D) Calculator," 2004, accessed 12 January 2019, http://www.convertalot.com/ballistic_trajectory_calculator.html.

[78] *Downtown,* by Lee Brimmicombe-Wood.

Table 3. Aerial Movement Cost		
Action	Additional movement Cost	Reasoning
Move 1 Hex	0	Baseline value
Increase Altitude	1	Represents the effect of gravity and the longer distance required
Decrease Altitude	0	Represents the effect of gravity offsetting the longer distance
Turn <= 60 degrees	0	Represents the minimal energy loss for minor vector changes.
Turn > 60 degrees <= 120 degrees	1	Represents moderate energy loss of a moderate vector change.
Turn > 120 degrees	2	Represents significant energy loss of major vector change.
First movement at 'Deck' altitude	1	Represents the aircraft's needs to avoid ground features and the increased drag at lower levels.
'Assess Damage' action	1	Represents the aircraft's need to slow or maneuver to observe the ground below without specialized equipment.

Source: Created by author using rules from *Downtown,* by Lee Brimmicombe-Wood (GMT Games, 2004).

Administrative movement occurs in the 'Day' phase to account for the slower movement of ground-based combat forces relative to aircraft. Each asset has fixed MP that are spent to enter hexes. The cost of entering a hex is based on the predominate terrain in the area. Ground-based launchers, GBAD assets and maneuver HQs and DSAs have march order and emplacement times representing the time needed to prepare equipment for travel before and after movement. These delays require the player to proactively plan to account for lag in movement. BCTs do not have march order times allowing them to easily outrun AMD coverage despite their lower speed.

Blazing Skies accounts for altitude limitations for various aircraft by using a system of altitude bands borrowed from *Downtown.*[79] These bands are based restrictions for significant systems within the game (See Table 4).

Table 4. Altitude Bands		
Altitude Band	Approximate height	Justification
Ground	0m to 3m. 3m used for height of AD sensors	Ground Based sensor
Deck	200 m to 2500 m	Altitude for CM threats
Low	2500 m to 5000 m	Maximum altitude of Stinger missile
Medium	5000 m to 8000 m	General maximum altitude for RW
High	8000 m to 15000 m	General maximum altitude for non-fighter FW
Very High	15000+ m	High altitude FW aircraft

Source: Created by author using rules from *Downtown,* by Lee Brimmicombe-Wood (GMT Games, 2004), 5-6.

Terrain

Terrain affects the movement of ground-based systems, Line of Sight (LOS) of sensors, and low flying aircraft freedom of movement. Ground-based systems must travers the ground and can be slowed by it. To represent this, hexes of normal terrain such, as flat plains, require one MP to enter. More complex terrain is more difficult to traverse and requires additional points to enter while major roads can greatly decrease the difficulty of movement (See Table 5). As the area represented in Blazing Skies is generally developed, only major roadways are depicted and it is assumed that movement

[79] *Downtown,* by Lee Brimmicombe-Wood, 3.

within hexes not containing a road occur over lesser roads or minor cross country movements.

Table 5. Admin Ground Movement Cost	
Terrain Type	Ground MP cost
Sea	Impassible
Lowlands, Midlands	1
Midland Forest, Midland Hills, Populated Area (Light or Heavy)	2
Midland Forested Hills, Mountains, Populated Area (Heavy Hills)	2
Rivers	+2 to cross hex boundary
Major Road	1/3 BCTs are considered in contact and do not gain increased movement from roads.

Source: Created by author.

Terrain also affects line of sight for aircraft and ground-based systems. Within *Blazing Skies*, the effects of variations in terrain elevation, forest, hills, and mountains are accounted for by additions and subtractions to the radar LOS calculations based on altitude band. These modifications represent the interference from intervening terrain features that may not completely block LOS. Larger features such as hills and mountains create masked terrain and avenues of approach by completely blocking LOS at certain altitudes. This system creates a relatively simple model that forces the players to account for the terrain effects (See Table 6). This replicates the real-world tradeoff between Patriot's high cost and long range that is restricted by LOS at lower altitudes and Stinger's low cost but short range and low engagement altitude.

Table 6. Terrain Effects on Line of Sight		
Terrain Type	Radar LOS change	Special Effects
Increase in Terrain elevation (-1, 0, 1, 2)	-1	N/A
Decrease in Terrain Elevation (2, 1, 0, -1)	+1	N/A
Midland (Elevation 1) Forest	+1 at Deck band	N/A
Midland Hills, Midland Forested Hills	+1 at Low Band	Block LOS to all hexes behind at Deck band
Mountain (Elevation 2)	+1 at Medium Band	Impassible to Aircraft at Deck band. Block LOS to all hexes behind at Deck and Low band
Populated Area, Light Populated Area, Heavy	No change	
Populated Area, Heavy, Hills	+1 Low	Block LOS to all hexes behind at Deck band

Source: Created by author.

Line of Sight

Altitude bands allow for a pre-computed LOS model based on the minimum altitude of each band allowing players to consult a chart to determine maximum LOS comparted to sensor range. Ground-based sensors use a common 3 m height to account for the size of the platforms based on quick study of pictures of the THAAD, Patriot and Sentinel radars. Atmospheric refraction, the bending of light in the atmosphere, of microwave emitters requires a 4/3 multiplier to account for the refraction extending the radar horizon beyond the visible horizon (See Figure 1).

$$LOS = \left(\sqrt{(Hradar + Rearth) * Refraction} + \sqrt{(Htarget + Rearth) * \text{Refraction}}\right)$$

Where Hradar = Height of Radar, Rearth = Radius of the earth, R = refraction due to atmospheric effects on EM or ~4/3.

Figure 1. Radar Line of Sight Equation

Source: RF Café, "Electronic Warfare and Radar Systems Engineering Handbook – Radar Horizon / Line of Sight," accessed 12 January 2019, http://www.rfcafe.com/references/electrical/ew-radar-handbook/radar-horizon-line-of-sight.htm.

An online horizon calculator was utilized to reduce mathematical errors on behalf of the author before converting to hexes (Tables 7 and 8).[80]

Table 7. True Line of Sight in 5km Hexes

Altitude Band	Sensor Height	Target Height					
		Ground	Deck	Low	Medium	High	Very High
Ground	3m	1	11	37	52	65	89
Deck	200 m	10	20	46	61	74	98
Low	2500 m	36	46	71	86	100	123
Medium	5000 m	51	61	86	101	114	138
High	8000 m	34	74	100	114	128	151
Very High	15000 m	87	97	123	138	151	175

Source: Created by author.

[80] Gary Richardson and Peter Wittenberg, "Horizon Calculator – Radar / Visual," accessed 12 January 2019, http://members.home.nl/7seas/radcalc.htm.

Table 8. Radar Line of Sight in 5km Hexes with 4/3 Earth refraction							
Altitude Band	Sensor Height	Target Height					
		Ground	Deck	Low	Medium	High	Very High
Ground	3m	1	13	43	60	75	102
Deck	200 m	12	23	53	70	85	113
Low	2500 m	42	53	82	100	115	142
Medium	5000 m	58	70	100	117	132	159
High	8000 m	74	85	115	132	148	175
Very High	15000 m	101	113	142	159	175	202

Source: Created by author.

Assets

Blazing Skies includes multiple GBAD, Critical Assets and Red threats to allow for a variety of scenarios (See Appendix C). Player assets in *Blazing Skies* are represented by quarter-inch colored cubes marked with either unit symbology or a small picture of the asset with facing noted by the top of the unit symbology or 'pointing' feature of the marker (See Table 9). Cubes are moved about the game map to visually depict the location of each asset. ABTs and interceptors are marked with a token stating their current altitude band. FW, RW, UAS and CMs use the same hostile red diamond symbology to reflect the real-world limitations of radar contacts. This requires the player to monitor movement patterns to determine target type, predict future risk to defended assets and make engagement decisions based on asset prioritization.

Table 9. Asset Markers			
Asset	Color	Marking	Facing
GBAD radar	Dark Green	Mil Standard Emitter and number	Corner 'pointed' at by Emitter symbol
GBAD non-radar	Light Green	Mil Standard ADA symbology and number	Perpendicular to top center of symbology
Corps	White	Mil Standard Combined Arms Corps	Not applicable
Division HQ	1st Division -Brown 2nd Division - Blue 3rd Division -Purple	Mil Standard Combined Arms Division	Not applicable
DSA		Mil Standard Division with 'DSA'	Not applicable
BCT		Mil Standard Combined Arms Brigade	Not applicable
Interceptor	Yellow	Image of Patriot missile	Corner 'pointed' to by missile nose
ABT: FW, RW, CM, UAS	Red	Hostile Red Diamond on white background	Perpendicular to top center of symbology
TBM	Red	Grey Cone on red background	Point of Cone
Red Ground Forces - Brigade	Orange	Mil Standard Hostile Combined Arms Brigade	Not applicable
Red Ground Forces - Battalion	Orange	Mil Standard Hostile Combined Arms Battalion	Not applicable
FRRP	Black	White oval on red background with 'FRRP'	Not applicable
Ground Launch Point	Black	Yellow 32-point star on red background with 'Ground Launch'	Not applicable

Source: Created by author.

Force Selection

Blazing Skies provides two methods for force composition: Pre-built task forces and a la carte. Both methods use a maximum point value agreed upon by the players and

suggested by the scenario to determine the maximum number of assets. This helps control the scale and time required for the game. Both systems allow the player to develop skills related to providing recommendations for force composition and emplacement of air defense assets.[81]

Pre-built force packages help players begin a game quickly and reduce the risk of poor player decisions due to unfamiliarity leading to an inability to meaningfully participate. As force deployment decisions occur at echelons above junior air defenders, pre-built force packages can also constrain players to certain formations they may employ instead of those they may unrealistically desire. The Blue pre-built task forces are based on current force structures. Pre-built Red Air assets focus less on threat doctrinal structure and instead provide either pure or mixed threats within a set points structure.

The a la carte options allows for additional flexibility and experimentation with unique force structures. *Blazing Skies* assigns points based roughly on the asset's contribution to the mission instead of the economic cost or transportation cost. For example, the cost of additional maneuver forces is based on the added ability of the Blue player to achieve JTF Guidance objectives which is much smaller than the cost to field or deploy three BCTs compared to additional AMD assets. This is intended to keep focus on AMD while providing awareness of the tradeoff between AMD and additional maneuver forces.

[81] USADASCH, *ICTL*, 2.

Airspace Control

Blazing Skies uses Windows of Vulnerability to represent the enemy converging capabilities in order to gain temporary dominance in the air domain and act with relative impunity from Blue aircraft. The Air Superiority Track represents the overall balance of power within the air domain. In addition to replicating concepts of temporary dominance, the lack of Blue air within Windows of Vulnerability greatly simplifies the *Blazing Skies* ruleset and maintains a GBAD focus by removing the need for Blue Air, air command and control, and air to air engagement rules.

Blazing Skies replicates the shifting degree of air control using the Air Superiority tracker. As Air Superiority tips towards Blue, more aircraft can be diverted from air superiority missions to attacking ground forces and infrastructure, increasing the damage inflicted on Red's air and missile force as well increasing the speed of Blue BCTs. As Red gains advantage, more Blue aircraft are required to conduct counterair operations leading to fewer Blue aircraft for strikes. Mechanically, this reduces the damage inflicted by Blue airstrikes and increases the number of Windows of Opportunity available to the Red Player.

The state of the Air Superiority Track is determined by scenario rules and the current remaining HP of airbases under each players' control. Normally, the Air Superiority track starts at even and shifts as players target each other's airbases with air or ground forces. At the end of the 'Day' phase, both players total the number of HP remaining on each airbase they control. The players then compare these numbers with the delta determining the position of the Air Superiority Track for the next day rounding

down. These numbers are not based on any tangible values and were selected to create a general slope of increasing Red or Blue dominance (See Figures 2 and 3).

$$Air\ Superioirty\ Value = Blue\ Airbase\ HP - Red\ Airbase\ HP$$

Figure 2. Air Superiority Value Calculation

Source: Created by author.

Air Supremacy	Air Superiority		Air Neutrality					Air Superiority		Air Supremacy
Red 10	Red 8	Red 6	Red 4	Red 2	Even START	Blue 2	Blue 4	Blue 6	Blue 8	Blue 10
No Blue Airstrikes +2 Red Window of Opportunity	Blue Airstrike: 1 damage	Blue Airstrike: 1d3 damage +1 Red Window of Opportunity	Blue Airstrike: 1d3 damage	Blue Airstrike: 1d5 damage	Blue Airstrikes: 1d5 damage	Blue Airstrikes: 1d5 damage	Blue Airstrikes: 1d6 damage	Blue Airstrike: 1d6 damage +1 Blue asset MP	Blue Airstrike: 6 damage	Blue Airstrike: 1d3+6 damage +2 Blue asset MP

Figure 3. Airspace Superiority Track

Source: Created by author.

The Blue air strike represents the totality of net benefit of that Day's operations and its effectiveness is based on the current Air Superiority Track. Red may allocate aircraft to active DCA missions to reduce the Blue Strike damage by 1 for every 5 points of air to air strength. The Blue player may allocate damage equal to the die result indicated on the current airspace superiority track value. The Blue player can target Red controlled critical assets on the map, such as airbases, or any number of cells of the air allocation table: OCA, Strike, CAS, SEAD, DCA, Passive Defense, Ready to Fire, Reloading or Hide Site. The Red player will allocate this damage to individual assets within that cell. This represents the Blue JFACC guidance regarding targeting priorities

and the difficulty in destroying individual pieces of equipment. The Passive Defense and Hide Site cells can only be targeted if no other targets exist in the other cells and halves all damage taken to represent the additional protection of hardened and concealed positions. This provides the Red player with an ability to protect high value assets for later use.

Windows of Vulnerability represent the Red Air's ability to converge capabilities and create opportunities for attack by pushing Blue aircraft out of the area prior attack. The Red Player can always launch one Window of Vulnerability per day no matter the position of the Airspace Superiority tracker. This abstracts the use of unmodeled cross domain capabilities while allowing the Red player at least the possibility of improving the situation. Additional Windows of Vulnerability can be gained by shifting the Air Superiority Track to Red 6 or Red 10 or by allocating additional 5 points of air to air strength to the OCA cell in exchange for an additional window (See Figure 4).

$$\begin{aligned} &Red\ Windows\ of\ Oppertunity \\ &\quad = 1 + \frac{AtA\ points\ allocated\ to\ OCA}{5\ points\ per\ Oppertunity} \\ &\quad + Air\ Superiorty\ Bonus\ (+1\ at\ Red\ 6, +2\ at\ Red\ 10) \end{aligned}$$

Figure 4. Red Windows of Opportunity Calculation

Source: Created by author.

Air Tasking Order and Force Allocation

Blazing Skies replicates key parts of the ATO process though Red Air Apportionment based on the air apportionment system in the unpublished game *Kursk Air*

War by Dr. James Sterrett.[82] Air apportionment occurs at the beginning of each 'Day' and uses the Red Air Apportionment mat and Red ATO to plan the Day's operations. The Red Air Apportionment mat (See Appendix C) first replicates the air apportionment decisions of a JFACC by forcing the Red player to prioritize strategic strike missions against OCA missions such as Fighter sweeps and escort, close air support, air interdiction, and SEAD; or DCA tasks such as active defense and passive defense. The mat also controls the operation of ground-based launchers. In *Blazing Skies*, AI and CAS missions are combined to target Blue maneuver forces, strike is used for missions against Blue fixed assets and SEAD targets GBAD assets. Next, the Air Apportionment mat replicates allocation as the Red player assigns OCA and DCA missions to individual aircraft. Once complete, the Red ATO compiles this information for easy reference. ABTs utilize their Air to Ground value for AI, CAS, and strike missions and their SEAD values for SEAD missions. ABTs striking target types not aligned with their allocation reduce their strength by half, and may not conduct SEAD attacks at all as they are not loaded with ordnance weaponeered for that target. While this does not replicate the full 72-hour ATO process, it does enforce the concept of forward planning and the limited flexibility of aircraft payloads while providing flexibility to the Red player to replicate dynamic targeting.

The Ground Based Launchers track replicates ground-based launchers as they fire their missiles and conduct reload. The Ready to Fire block represents a loaded and prepared launcher. Empty launchers are placed in the Reload or Hide Site boxes by the

[82] *Kursk Air War*, by Dr. James Sterrett, unpublished.

Red player. The Reload box replicates launchers conducting reload operations at the launch site instead of moving to protected sites trading security for speed. A launcher remains in the Reload box for a time equal to its Reload time value before moving back to the Ready to Fire box. Launchers in Hide Sites require twice as long to reload but take half damage and must be targeted last. Upon return to the Ready to Fire box, all launchers may fire after pausing for a time equal to their emplace time.

The assessment phase of the ATO is modeled though the requirement for Red to assess damage before scoring VPs. Any aircraft may assess damage by expending an additional MP over the target hex no earlier than two activation rounds (1 minute) after the attack. This delay allows smoke and debris to clear over the target. The Recon special rule allows the aircraft to bypass the MP cost and conduct assessments from a distance in hexes equal to its recon value, accounting for the special equipment onboard. This concept is borrowed from *Downtown.*[83]

Resolution

Asset Characteristics

Real-world assets were modeled using multiple characteristics. Most characteristics are common across multiple asset types but others require unique rules to represent unique capabilities.

[83] *Downtown*, by Lee Brimmicombe-Wood.

Common Characteristics

Common characteristics include tier value, movement points and movement preparation, range, allowable altitude bands, weapon inventory, emplace and reload times, common special rules, and points cost.

Tier

The WEG uses tier value to represent the technological sophistication of threats.[84] Tier affects Red survivability, and air to air strength. *Blazing Skies* projects this for Blue interceptor lethality based on relative capability to each other as Pk values are not available (See Table 10). Tier provides a catch-all value to account for numerous improvements that may not be directly modeled by other characteristics.

Table 10. Tier Benefits

Red Air			Patriot Interceptors	
Tier	Survivability (Lower is Better)	Air to Air strength	Missile	Lethality
4	-10	+2	MSE	+20
3	-5	+1	PAC 3	+10
2	0	0	PAC 2/Stinger	0
1	+5	-1	M3P .50 Gun	-5

Source: Created by author.

[84] TRADOC G-2, *Worldwide Equipment Guide: Volume 2,* 4.

Movement Points

Movement points represent the assets ability to move about the battlefield. Due to the wide range of speeds between TBMs, Aircraft and ground systems, *Blazing Skies* borrows *Jutland's*[85] telescoping timeline concept to divide movement into three areas: TBM movement, aircraft movement points and administrative movement points for ground-based assets.

TBM movement is conducted on the TBM Flight Track. TBMs move one box per activation starting in the box equivalent to their maximum assessed range: CRBMs less than 300 kms, SRBMs from 300 to 1000 km, and MRBMs between 1000 to 3000 km. Intermediate or Interconnectional BMs are outside the scope of this game.

Aircraft and missiles all fly at relatively the same speeds that allow them to be modeled in the 30 second Window of Vulnerability timeframe. MPs are calculated by the maximum speed presented in *Jane's* or the WEG divided by the hex size of 5 km (See Figure 5). Maximum speed was used over cruising speed, where available, as it provides a measure of total energy for combat maneuvers.

$$MP = \frac{Vmax\ in\ m/s}{5\ km\ hex\ size} * 30 \frac{second}{activation}$$

Figure 5. Movement Points conversion

Source: Created by author.

[85] *Jutland*, by James Dunnigan (Avalon Hill Game Co., 1967).

Ground-based units move in the one-hour Day timeframe where a movement value of 4 represents sustained cross-country mobility of 20 km/hr. Individual vehicles may move at greater speeds, but the lower number represents the delays created by the requirement to keep large units together. Most ground based systems, including Red ground-based launchers, have march order and emplacement times that adds a time delay before and after movement to account for the need to pack-up, load and prepare equipment for travel. This forces players to consider the effects of march order and emplacement on rate of march and ability of AMD assets to provide coverage to maneuver forces.

BCTs within *Blazing Skies* are assumed to mark the forward line of own troops and are in continual contact. Low MPs for BCTs, at 1 MP per 2 hours or approximately 2.5 kms per hour, represent fighting along the front instead of march movement like other ground-based assets. This value was informed by CACDA Jiffy III War Game data.[86] BCTs are further slowed by lack of enablers, requiring an extra two hours when outside range of influence for Division HQs or DSAs or also if the Corps HQ is damaged. BCTs entering a hex requiring more than 1 MP receive a terrain token to represent the combat advantages of the defenders. BCTs also receive damage markers like other assets but have no maximum HPs. BCTs must expend 1 MP to remove each point of damage or terrain marker and must remove all markers before further movement. This represents the slower advance created by a lack of enablers and supplies, difficult terrain, and Red Air

[86] US Army Combined Arms Center, *CACDA Jiffy III War Game Volume II Methodology Technical Report 6-80* (Fort Leavenworth, KS: US Army Combined Arms Studies and Analysis Activity), accessed 30 January 2019, https://apps.dtic.mil/dtic/tr/fulltext/u2/a091290.pdf, 68.

support to ground forces. This creates dilemmas for the Blue player as they must balance speed of maneuver forces with protection of critical assets, replicating the real-world dilemmas discussed in Chapters 1 and 3.

Range

Within the 300 km by 300 km game map of *Blazing Skies*, range will not be a major factor for most FW aircraft but will have a greater effect on shorter range RW, CM, UAS and CRBM threats. Range values utilized the combat radius values within *Jane's* and WEG and were converted into total hexes of movement (See Figure 6). For TBMs, the maximum range of the missile was used. Modeling maximum range creates limits on avenues of approach and basing. A drawback of this approach is the bookkeeping required that often has little effect on the situation. Players are encouraged to ignore range in cases where the distance traveled is clearly insignificant to the ABTs range.

$$Range = \frac{combat\ range\ at\ maxium\ load\ in\ km}{5\ km\ hex\ size}$$

Figure 6. Range Conversion

Source: Created by author.

Altitude Bands

Blazing Skies utilized data from Jane's Defense and the WEGs for the maximum altitude of FW, RW, CM and UAS threats with combat load. Aircraft can operate in all

altitude bands containing or below this altitude. All aircraft can operate at deck and low altitudes, though they may suffer terrain effects.

Weapon Inventory

Missiles per launcher is a common value for all ground-based launchers and aircraft capable of launching cruise missiles. This characteristic is directly from the WEG or Jane's.[87] Tracking missile inventory and reload times forces players to balance current engagement against expected future threats and is a critical learning objective. An ABT's ordnance is not tracked and is assumed to be utilized in a single attack on a target.

Emplacement and Reload

Most GBAD systems and Red ground-based launchers have emplacement and reload times to model these delays and create an operational tempo. All ABTs have a 3 hour reload time to represent rearming, refueling and crew rotations.

Reload and emplacement times are in real time values allowing players to track their progress in either the Day or Window timescale by multiplication.

Point Cost

The assets' point costs are based on game effect instead of real-world cost or deployment requirements. Red point cost is based on the tier level, attack strengths, MPs, available altitudes, survivability, and special rules (See Figure 7). Blue point costs are based on effectiveness versus Red point costs.

[87] Foss, *Jane's Land Warfare Platforms*.

$$Point\ Cost = Tier * (Air\ to\ Air + Air\ to\ Ground + SEAD\ strengths) + Movement\ Points + \frac{-1 * survivability}{5} - 2\ per\ missing\ altitude\ band + 2\ per\ beneficial\ special\ rule$$

Figure 7. Points Cost

Source: Created by author.

Ground Based Air Defense

Characteristics unique to Blue GBAD assets include administrative movement points, radar range and line of sight, radar field of view, missile loadout, viable targets, TBM defensive radius, interceptor lethality, susceptibility, and special notes for select assets.

Radar Range, Field of View and Early Warning

GBAD radar range and field of view use *Jane's* listing for each radar's maximum effective range converted into game hexes. This number was compared to the maximum radar horizon to determine maximum range for each altitude band. Radar horizon only affects the Patriot radar at deck altitude, reducing its maximum range to 13 hexes.[88] For TBM detection, maximum radar range was considered against the minimum and maximum ranges for each TBM type to approximate detection times. The THAAD radar is only for BM defense only and does not require range and LOS calculations for ABT threats.

[88] Streetly, *Jane's Radar and Electronic Warfare System,* 52-53.

Field of view was calculated in a similar manner; the Sentinel radar has a 360-degree field of view and required no further restrictions.[89] The Patriot radar has a 90-degree field of view for search and 120-degrees for track. For simplicity, the 120-degree field of view was used for radar LOS engagement restrictions.[90]

Joint and coalition sensors are represented by TBM launch declarations and Blue player awareness of all aircraft in flight. TBM launch detection, but not targeted location, represents early warning from Space Base Infrared Surveillance (SBIRS).[91] TBM targeted locations are declared when the TBM enters detection range of an active Aegis, THAAD or Patriot radar on the TBM Flight track. Blue's situational awareness abstractly models contributing ground and airborne sensors without requiring the management of individual systems. *Blazing Skies* accepts risk with understanding joint sensors and their employment on the battlefield in order to focus on Army systems, increase player visualization of the airspace and maintain simplicity. This is offset by Red's knowledge of AMD locations. By assuming other sensors exits for Red and Blue, the game is further simplified by removing the requirement for hidden placement and movement for undetected tracks.

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[89] Foss, *Jane's Land Warfare Platforms*., 52-53.

[90] Ibid., 822-823.

[91] Lockheed Martin, "Space Based Infrared Surveillance SBIRS," accessed 28 January 2019, https://www.lockheedmartin.com/en-us/products/sbirs.html.

Missile Guidance

Missile Guidance is taken from source documents and create restrictions on interceptor launch and intercept. IR guided missiles such as Stinger do not require a supporting radar to continue flight. PAC-2 interceptors use Track Via Missile (TVM) guidance and require continuous illumination of the target by the Patriot radar.[92] In game terms, Radar LOS is checked at launch and before the PAC-2 interceptor movement. PAC-3 and MSE interceptors have an active seeker activated once the missile nears its target. To represent this, radar LOS is checked only after movement is complete for PAC-3 and MSE interceptors, allowing for the missile to continue intercept for a short time after the target leaves radar FOV.[93]

Missile Inventory

Missile inventory and loadout are taken from *Jane's* or WEG and require no calculations into *Blazing Skies*. The Blue player SAMSTAT was used to aid in tracking current missile inventory. The Red player uses the ATO to aid in tracking remaining inventory loaded on launchers.

The Stinger MANPAD holds Stinger interceptors. The Avenger loadout is 1 M3P .50 gun and 8 Stinger missiles.[94] Patriot launchers can carry 4 PAC-2, 16 PAC-3, 12 MSE or a mixture of 8 PAC-3 and 6 MSE interceptors. [95] THAAD launchers carry 8

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[92] Foss, *Jane's Land Warfare Platforms,* 824.

[93] Ibid., 825-829.

[94] Ibid., 587-590.

[95] Ibid., 817-829.

Talon interceptors. *Jane's* does not list the maximum number of THAAD or Patriot launchers per battery but other sources identify them as 16 for Patriot[96] and nine[97] for THAAD.

The Aegis BMD is modeled as multi-mission platform with limited interceptors by restricting total ship inventory to 10 instead of the 96 cells on the smaller Arleigh Burke class destroyers.[98] The ship's SPY-1 radar is abstracted as equivalent to the THAAD radar due to the abstractions in the TBM Flight Track, and in order to drive learning objectives on the importance of integrating early warning sensors.

Target Restrictions

Each air defense system has target limitations base on system specifications converted into game mechanics. The Stinger interceptor can engage FW, RW, UAS and CM targets operating below 5000 m, which is the Low and Deck altitude bands and does not have a BM engagement capability.[99] The Patriot system can engage all ABTs and SRBM and CRBM threats.[100] Patriots are restricted to engaging TBMs landing within 15 kms (3 hexes) of the launcher. [101] THAAD can defend against SRBMs and MRBMs only.

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[96] Global Security, "Patriot TMD – Units," accessed 28 January 2019, https://www.globalsecurity.org/space/systems/patriot-unit.htm.

[97] Army Technology, "THAAD Theatre High Altitude Area Defense – Missile System," accessed 12 January 2019, https://www.army-technology.com/projects/thaad/.

[98] US Navy, "U.S. Navy Destroyer (Ship Class – DDG)," accessed 12 January 2019, https://www.public.navy.mil/surfor/pages/Destroyer.aspx.

[99] Foss, *Jane's Land Warfare Platforms,* 587-590.

[100] Ibid., 822-823.

[101]NATO, "Patriot Fact Sheet."

THAAD's TBM defended area is unrestricted due to its endo- and exo-atmospheric engagement capability and a lack of available information. [102] The general transition line between endo- and exo-atmospheric is approximately 100 km altitude, well above maximum altitudes of the PAC-2 interceptor at 24 km, the PAC-3 at 20 km, and the MSE at 36 km. This allows for a two-tier BM defense system between THAAD and Patriot and a two-tier ABT defense system between Patriot and Stinger. [103]

Interceptor Lethality

Interceptor lethality is difficult to assess due to a lack of information. Comparing the data from *Jane's* against Red AMD systems in the WEGs, the SA-10b provides a reasonable substitute for the Patriot system to base the probability of kill of the PAC-2 missile as approximately .8 or 80% versus FW and RW.[104] The smaller missile on the SA-20a has similar size and speeds to the PAC-3. The SA-20 small missile has approximately .9 Pk versus FW and RW and .7 versus other targets.[105]

To allow room for understanding of mission kill versus aircraft or warhead kill, and of trade-offs between interceptor types, *Blazing Skies* utilizes 0.7 as a standard value for the in game Pk tables. Interceptor tiers provide lethality bonuses of +20 for MSE, +10

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[102] Foss, *Jane's Land Warfare Platforms,* 829-831.

[103] Global Security, "Endo-Atmospheric," accessed 12 January 2019, https://www.globalsecurity.org/space/systems/endo.htm; Foss, *Jane's Land Warfare Platforms,* 824-831.

[104] TRADOC G-2, *Worldwide Equipment Guide: Volume 2,* 402-403.

[105] Ibid., 409-410.

for PAC-3 and THAAD, +0 for PAC-2 and Stinger and -5 for the M3P gun, to represent the capabilities of interceptors.

GBAD Special Rules

Finally, several special rules were used to capture points unique to each weapon system. As it is the heart of the Patriot system, if there is not an operational Patriot battalion to provide control, the Red player may place three additional target markers representing additional confusion for the Patriot crews without the battalion's support.[106] As Patriot radars can turn 360-degrees to shift their FOV, in the game, Patriot Batteries can slew or turn their facing as a reaction to Red movement. [107] Slewing requires the radar to take no further actions or support any interceptors for 1 activation cycle. Finally, the Avenger's fire on the move or short halt ability allows the Avenger to shift 1 hex per Window of Opportunity.[108] This accounts for the abstracted location of the Avenger within the hex, the 8 km maximum range of the missile and the systems' general mobility.

Due to lack of fidelity of sources, GBAD systems are assumed to be able to engage an unlimited number of targets per activation and support any number of missiles in flight. While this is unrealistic, the assumption emphasizes interceptor management by allowing for quick depletion of inventory.

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[106] Foss, *Jane's Land Warfare Platforms,* 824.

[107] Ibid., 825.

[108] Ibid., 587-590.

Blue Critical Assets

Blue critical assets' unique characteristics are hit points, susceptibility, and victory point modifiers. A myriad of special rules captures key capabilities and effects.

Hit Points

Each asset has a set HP value representing the capability to continue operation in some capacity after sustaining damage while setting a maximum VP limit for Red Air as the further attacks against the target become unproductive. Assets can receive damage markers in excess of their HP. The excess must be removed normally by Blue, but Red may only score VP equal the asset's maximum HP. These HP values are arbitrary and represent 'usefulness' generally tied to asset size or capacity.

Susceptibility

Susceptibility represents the value of passive defense and is a measure of cover, concealment, and dispersion of the asset reducing its vulnerability to attack. The sea port's ability to repair assets and aircraft, and provide missile resupply replicates recoverability and replicability.[109] Mechanically, the susceptibility value is inverse from doctrinal tradition as higher is better. In *Blazing Skies*, the susceptibility value is subtracted from the attack's strength to represent this mitigation (See Attack Sequence).

Red VP modifier

Each Blue Critical Asset has a Red VP modifier intended to reward Red for risking strikes against more valuable rear assets. This represents the added value of

[109] CJCS, JP 3-01, III-17.

attacking SPODs, APODs and critical command and control networks over front line units while forcing Red into important decisions based on slowing the Blue advance or scoring VP.

Blue Critical Asset Special Rules

Finally, Blue critical asset special rules reflect their contributions to military operations. HPs are used as a measure of remaining capacity. The competition between asset abilities, protection of the maneuver force and JTF Commander guidance creates multiple dilemmas as the Blue player attempts to prioritize assets.

BCTs provide the means for Blue to end the game by seizing objectives listed on the JTF guidance card. BCTs require Corps, DSA, and Division HQ support to move at their full MP value. In *Blazing Skies*, the loss of enablers delays a BCT by 2 hours. The Corps HQs provides support across the map until reduced to 0 HP, when it stops functioning until repaired. Division HQ and DSAs provide a radius of support in hexes, when emplaced, equal to twice their HP value, or their current HP when moving. This results in BCT movement values of 1 hex per 2 hours, 1 hex per 4 hours, 1 hex per 6 hours or 1 hex per 8 hours depending on status of supporting elements.

Airbases and Sea Ports are critical to both players. For each HP remaining, airbases provide air power points and launch locations for Red aircraft. Sea Ports are critical to sustainment. At the end of each 'Day' turn, the Sea Port generates sustainment points to represent arrival of supplies and replacement equipment. Sustainment points allow the Red player to repair damage or crippled aircraft, both players to remove one point of damage from any asset or aircraft, and the Blue player conduct missile resupply.

These capabilities reinforce the importance of air and sea ports of debarkation as critical infrastructure in conducting and sustaining joint operations.

Civilian critical assets include a national capital and numerous civilian targets. They provide no direct benefit to the Blue player but allow the Red player the ability to force an endstate by reducing all civilian targets below 0 HP. The capital asset is worth 6 VP for each point of damage inflicted by the Red player representing the need to maintain host nation leadership's goodwill to continue operations.

Red Air

Red Air additional characteristics include aircraft type, role, survivability, air to air, air to ground and SEAD capability, and special rules. Red TBMs have other characteristics including type, range, accuracy, and payload. These characteristics are based on Intelligence Preparation of the Battlefield considerations from ATP 3-01.16.[110]

Type

Threats are typed to distinguish FW, RW, UAS, CM, and TBMs threats from each other. All threats within a type share special rules to replicate their unique nature. FW threats are the baseline threat within the *Blazing Skies* design and require no additional rules. They follow normal movement rules and only enter play from fixed airbases with more than 0 HP. Generally, FW threats have higher values across all characteristics representing their larger carrying capacity, range, and flexibility. RW, CM, UAS and TBM threats each have unique special rules.

[110] HQDA, ATP 3-01.16, 4-10.

RW Special Rules

All RW aircraft have the Forward Basing special rule to represent their operating from forward bases instead of being restricted to airfields like FW aircraft. This allows the Red Air player to purchase Forward Arming and Refueling Points (FARPs). FARPs act as airbases for RW and other assets with the Forward Basing rule allowing them to enter and leave play from the designated FARP hex in addition to Airbases. FARPs have a minimal cost and are removed from play if occupied by a Blue maneuver asset. As RW often operate at very low altitude, they receive a +1 bonus to CFIT check, rendering them immune to CFIT under normal conditions.

UAS Special Rules

UAS represent a diverse and growing threat area and each system requires multiple individual special rules to distinguish them from each other and other threat types.[111] Some UASs support ground forces and have the field launched special rule allowing them to enter play from any Red controlled hex. UAS assets designed to provide observation for ground-based fires or support attacks by other aircraft have the Spotter rule. Spotter allows a UAS to attack Blue targets within 6 hexes, 30 kms, of a Red controlled hex, causing a small amount of damage to represent increased effectiveness of Red artillery. Additionally, Spotter allows Red aircraft to re-roll the damage die for other aircraft representing the system's ability to aid targeting. Most UAS do not have chaff or flares or the awareness to react to GBAD interceptors. This results in reduced survivability despite their small size, and the inability to conduct evade or abort

[111] HQDA, ATP 3-01.16, 4-15 - 4-16.

counteractions, but they do not take additional CFIT penalties for distraction caused by interceptor launch. Finally, some UAS follow preprogrammed flight paths to execute their missions. The Preprogrammed rule requires the Red player to record up to 5 hexes as waypoints before flight. The UAS is required to fly a direct path between these points during its movement.

CM Special Rules

CM threats represent fast, low flying unmanned aircraft and do not pay an additional MP for the first hex at the deck altitude band. CMs are broken into two Roles: Land attack cruise missiles (LACM) and Anti-ship Cruise Missiles (ASCMs). LACMs are designed to attack land targets over complex terrain and therefore do not suffer from CFIT. ASCMs are designed to attack ships in open water and use less sophisticated guidance systems.[112] Therefore, ASCMs take CFIT tests normally. As unmanned systems do not have the awareness to react to GBAD interceptors, they may not perform evade or abort actions and do not suffer CFIT penalties for inceptor launch.

CMs are either ground or air launched. Ground launched CMs use the ground-based launcher track for force allocation. Ground based CMs enter play from any Red controlled hex at deck altitude denoted by the placement of a Red launch marker. The CM launcher is removed from play if Blue maneuver forces occupy the hex before the end of the Day. This launch point may be moved for each launch unless it is a fixed launcher. Fixed launcher markers never leave play and the launcher may only be placed in Ready or Reload cells on the ground-based launcher track. Air launched CMs are

[112] HQDA, ATP 3-01.16, 4-13.

launched from aircraft such as the TU-95 Bear replacing the aircraft's opportunity to attack. Air launched CMs enter play from the same hex and altitude as the launching aircraft.

TBM Special Rules

TBMs have the most unique special rules due to their threat profile. Like ground launched CMs, they used fixed and mobile ground launchers and follow the same rules. The launch point is utilized to determine if the TBM is within the FOV of a Patriot Radar for LOS. All TBMs move one box on the TBM flight track instead of moving on the game map. A TBM's role is defined as CRBM, SRBM or MRBM based on maximum range and identifies which track on the TBM flight track to use.

TBM targeting restrictions are based on accuracy measured in Circular Error Probable.[113] Each critical asset is identified as a fixed, area or point target based on its size, mobility, and dispersion. TBMs with large CEPs do not possess the accuracy to effectively target point or area targets. TBMs with CEPs in excess of 1000 m are so inaccurate that they are required to roll multiple dice for damage and apply the lowest result, representing the difficulty of hitting a target directly. Some modern TBMs are integrated with near real-time firing data. To represent these benefits, the Integrated special rule allows these TBMs to roll twice on the damage table and apply the higher result (See Table 11).

[113] HQDA, ATP 3-01.16, 4-3.

Table 11. TBM CEP effects on Valid Targets and Damage Modifiers		
CEP	Available Targets	Damage modifiers
Integrated Targeting Systems	Per CEP	Reroll damage if desired
0-300 m	Point, Area and Fixed	
301-1000 m	Area and Fixed	
1001-1499 m	Fixed	
1500 m – 1999 m	Fixed	Inaccurate – Roll twice and apply lowest
2000m +	Fixed	Highly Inaccurate – Roll three times and apply lowest

Source: Created by author.

TBM payload size determines attack strength at the rate of one point of strength per 100th kg of payload regardless of type or targeting restrictions (See Figure 8). Payload strength is used for Air to Ground strength. TBMs with the ARM warhead special rule use payload strength for SEAD strength as well.[114]

$$TBM\ Payload\ Strength = \frac{kg\ of\ payload}{1000\ kg}$$

Figure 8. TBM Payload Strength

Source: Created by author.

[114] HQDA, ATP 3-01.16, 4-1 - 4-8.

Role

Aircraft Role represents the mission set the aircraft was designed to execute. Role increases Air to Ground attack strength for multi-role aircraft by 1, ground attack FW and RW aircraft by 2 and bombers by 4.

Survivability

Survivability represents an aircraft's resistance to attack through evasion and hardening and is based on the aircraft's tier, availability of chaff and flares, maneuverability, and other special equipment such as additional armor or jammers. The survivability value is subtracted from the Pk roll during interception increasing the aircraft's probability of surviving the attack (See Table 12). These values range from -20 for advanced fighters and CMs to +25 for large bomber and transport aircraft.

Table 12. Survivability Factors

Factor	Survivability
Tier 1	-10
Tier 2	-5
Tier 3	0
Tier 4	+5
Armored (such as armored crew compartments)	-5
Heavily Armored (such as the Su-25 or A-10)	-10
Large Target	+20
Jammer	-5
Maneuverability > 7 gs	-5
Maneuverability < 2 gs	+5

Source: Created by author.

Attack Characteristics

The Air to Air, Air to Ground and SEAD characteristics model an amalgamation of possible armaments available for different mission sets based on aircraft capacity and tier level. This eases mission planning, reduces complexity, and focuses on targeting and aircraft apportionment instead of weaponeering.

Air to Air

The Air to Air strength represents the aircraft's capability to conduct offensive counterair missions such as fighter escort and fighter sweeps.[115] FW Air to Air Strength was calculated by adding the number of Air to Air missiles carried by the aircraft plus three minus the tier level. This provides a bonus for tier 1 and tier 2 aircraft and a penalty for tier 4. RW and UAS threats halved the number of missiles carried before adding tier modifiers. RW attack helicopters received an additional point as they more commonly carry air to air missiles than other RW aircraft. CMs and TBMs do not have an Air to Air attack capability (See Figures 9 and 10).

$$FW\ AtA = \#\ AtA\ Missiles + 3 - Tier$$

Figure 9. FW Air to Air Strength

Source: Created by author.

[115] CJCS, JP 3-01, I-5.

$$RW\ and\ UAS\ AtA = \frac{\#\ AtA\ missiles}{2} + 3 - Tier + 1\ for\ RW\ Attack\ Helicopter$$

Figure 10. RW and UAS Air to Air Strength

Source: Created by author.

Air to Ground

The Air to Ground characteristic represents the aircraft's effectiveness at attacking ground targets. Advances in guided missiles and rockets have increased an aircraft's standoff distance at the cost of explosive weight. As with *Air and Armor, Blazing Skies* uses two profiles for the Air to Ground attack value: a range 0 attack repressing a direct attack from overhead to maximize destructive payload and a ranged attack that trades explosive power for standoff range. [116] Air to Ground Range zero attack strength is equal to 1 point of strength per 1000 kgs of combat payload plus bonus for aircraft role: 1 for multi-role, 2 for ground attack and 4 bomber aircraft (See Figure 11). The standoff attack strength is simply half of the range zero value to account for the design features inherent to dedicated platforms (See Figure 12). This value was chosen to emphasize the tradeoff between destructive power and security instead of a real-world value. The inclusion of standoff range forces the Blue player to utilize the emplacement guidelines of early engagement and defense in depth as the Avenger and Stinger weapon systems' short range prevents them from engaging if collocated with the target.

[116] *Air and Armor*, by Bruce S. Maxwell (West End Games, 1986).

Additionally, halving the strength value at range helps illustrate the deterrent effect of SHORAD weapon systems.[117]

$$AtG\ Range\ 0 = \frac{Combat\ Payload}{1000\ kg} + 1\ for\ Multirole + 2\ for\ Ground\ attack + 4\ for\ Bomber$$

Figure 11. Air to Ground Range 0 Attack Strength

Source: Created by author.

$$AtG\ Range\ Strength = \frac{AtG\ Range\ 0\ Strength}{2}$$
$$AtG\ Range = Maxium\ Range\ of\ Sample\ Armament\ from\ WEG$$

Figure 12. Air to Ground Ranged Strength

Source: Created by author.

SEAD

Aircraft and Missile threats received a SEAD value only if source documents indicated the ability of the system to carry Anti-Radiation Missiles (ARMs) or was itself equipped with an ARM seeker. The SEAD strength and range was determined by selecting an ARM listed and using that missile's maximum range (See Figure 14). Attack strength is the number of the selected missile the aircraft can carry (See Figure 13). For UAS, and CM threats with ARM seekers performing a SEAD mission, 1 was added to

[117] CJCS, JP 3-01, V-8.

the Air to Ground strength to represent the higher accuracy of the warhead and, along with the SEAD damage table, the mission to suppress rather than destroy the target. (See Figure 12 above).[118]

$$SEAD\ strength = \#\ of\ ARMs\ carried$$

Figure 13. SEAD Strength Calculation

Source: Created by author.

$$SEAD\ range = Range\ of\ selected\ ARM\ in\ hexes$$

Figure 14. SEAD Range Calculation

Source: Created by author.

Common Special Rules

Blazing Skies utilizes several special rules to reflect different threat types. This includes the Launcher special rules for CMs and TBMs discussed above, but also terrain avoidance, reconnaissance, electronic and signals intelligence, low radar cross section, electronic warfare, and day, night, and weather restrictions.

Some aircraft are designed to penetrate AMD systems at low altitude utilizing terrain following radars. Aircraft equipped with terrain following radars receive a one-point bonus to the CFIT rolls. This allows them to avoid CFIT rolls unless engaged by interceptors.

[118] CJCS, JP 3-01, IV-12; HQDA, ATP 3-01.64, 2-15.

The Recon special rule accounts for special equipment onboard aircraft to allow for easier target assessment by removing the requirement for the aircraft to slow to assess damage. A Recon value above 0 also allows the aircraft to assess damage from a range in hexes equal to its value.

Electronic and Signals intelligence is often used to identify emitters such as radars on the battlefield[119]. To represent ELINT/SIGINT, aircraft with this capability allow the Red player to identify the specific type of radar represented by Blue's emitter markers. This information can aid in attack planning by identifying gaps in radar coverage.

Low Radar Cross Section (RCS) accounts for stealth aircraft and threats that are difficult to detect due to their size and profile reducing detection range and reaction time for AMD systems.[120] Low RCS adds additional hexes to the measured range when determining LOS for radars. This may extend the distance between the radar and the target beyond the maximum range of the radar allowing the aircraft to get closer before being engaged.

Electronic Warfare (EW) platforms provide a variety of capabilities to support and defeat AMD systems. Within *Blazing Skies*, EW systems disrupt or degrade AMD systems' ability to acquire targets.[121] While RCS effectively adds range to a single target, EW platforms instead influence a radius of hexes equal to its EW value. Within these hexes, radars count each hex as 1 extra. Normally, EW increases the hex cost from one to

[119] CJCS, JP 3-01, IV-11.

[120] HQDA, ATP 3-01.16, 4-15.

[121] CJCS, JP 3-01, V-16.

two. This allows the EW platform to protect itself and aircraft within or behind the affected hexes. Thus, a radar tracing LOS though 3 jammed hexes would count as 6 hexes for range, allowing the threat aircraft and protected aircraft to close with the radar before risking engagement.

Some older platforms do always not have the capability to operate in adverse conditions despite pilot training. *Blazing Skies* currently assumes all air crews are trained to maximize the use of their aircraft and only applies Day only or Fair Weather only restrictions when the aircraft itself is not equipped to operate at other times. These restrictions help to illustrate the value of all-weather aircraft and aids players in understanding how platform limitations affect IPB.

Activating and Slewing Radars

Activating and slewing radars are conducted either at the start of a Window of Vulnerability or in reaction to Red actions. An inactive radar cannot support missile engagements and is represented by a red inactive radar marker. To activate, the Blue player declares the activation and replaces the red inactive marker with a blue active marker. A radar may not take further reactions until the end of the activation round. The option to activate and inactivate radars allows the player to conceal the operational status of his or her force as inactive and NMC radars appear the same.

Slewing allows the radar to rotate within its hex to a new facing, changing the FOV. To slew, the Blue player declares the radar is slewing as a reaction to Red. A radar that slews immediately cease radiate. The Blue player may declare the radar is radiating at the new facing following the rules above. The option to slew radars allows the Blue player to adapt to Red's actions by reconfiguring sensors and drives understanding of the

difference between mobility provided by 360-degree FOV, slewing, and the movement of the sensor.

Intercept Sequence

The Interceptor Sequence begins with the Blue decision to launch interceptors in reaction to Red expending a movement point. The Blue player may only launch on the active Red target and only if the target is within the maximum range of the interceptor measured from the launcher's location. If required by the interceptor's guidance, a supporting radar must also have LOS to the target. Assuming all conditions are met, the Blue player declares the number of interceptors launched. Interceptors are placed on the map on the launcher's hex at deck altitude and immediately move their maximum MPs towards the target and conduct an intercept if they enter the same hex and altitude band as their target. Interceptors still in play activate immediately following the completion of their target's movement. Interceptors are immediately removed once they have expended MPs equal to their range. TVM guided interceptors, such as PAC-2, check for radar LOS to the target at the beginning of movement. Active missiles, such as PAC-3 and MSE, check for radar LOS to the target after movement is complete. If the interceptor enters the same hex and altitude band as the target, an intercept immediately occurs. Blazing Skies illustrates the difference between maximum range and effective range by having the interceptor move immediately upon launch and then after the target aircraft in subsequent activations. This gives the targeted aircraft the opportunity to turn away and attempt to defeat the interceptor kinematically.

For TBM engagements, the Blue player determines if any GBAD system provides TBM coverage to the target hex and if the supporting radar has LOS. If so, the Blue

player may declare the launch of any number of interceptors at the target. Interceptors immediately move onto the left most box of the target TBM's track. Interceptors activate after their target TBM completes its move and must move forward 1 box per activation. Patriot interceptors may not enter any box beyond the first. Talon interceptors may not enter any box beyond the one labeled THAAD. If an interceptor enters a box with the target TBM, an intercept immediately occurs.

If an interceptor occurs against a FW or RW asset, the Red player may declare evade or abort counteractions representing last moment reactions to the missile. UAS, CM and TBM are unmanned and often do not have systems to detect and react to incoming interceptors and so do not have this option. Aircraft conducting evade gain -5 to their survivability rating, but may not attack this activation. Aircraft choosing to abort receive a -10 to their survivability rating but may not attack for the rest of the Window of Opportunity except for aircraft allocated to SEAD missions. Either reaction allows the Blue player to choose to move the evading target 1 hex and increase or decrease its altitude 1 band representing the loss of situational awareness as the pilot reacts to the missile. This movement may trigger other missile launches and CFIT tests. This concept is modified from the SAM reaction rules found in *Downtown*.[122] This provides a tradeoff between risk to the aircraft and mission accomplishment, as well as producing the distinction between destroying the target and preventing the attack by forcing the aircraft to abort its missions resulting in a mission kill.

[122] *Downtown*, by Lee Brimmicombe-Wood.

Once an intercept has occurred and the Red counteractions have been completed, the Blue player rolls a 1d100 for the interceptor adding the interceptor's lethality bonus and subtracting the target's survivability and missile reaction modifiers (See Figure 15 and Table 13). The modified results table increases game speed by removing the need for players to add and subtract relevant modifiers (See Appendix C).

$$Pk\ value = 1d100 + interceptor\ lethality - target\ survivability - 5\ if\ performed\ evade - 10\ if\ performed\ abort$$

Figure 15. Pk Value Calculation

Source: Created by author.

Table 13. Pk Table

Pk value	Effect
01-30	Miss. No effect
31-50	Aircraft Shaken. Red aircraft cannot conduct an attack until its next activation.
	CM and TBM Mission Kill – Randomly determine a hex adjacent to the target hex by rolling a d6. CM or TBM impacts this hex and damages fixed or area targets. PAC-3, MSE, Talon treat this result as Warhead Kill instead.
51-70	Aircraft Damaged. Half total MP for rest of Window of Vulnerability. Red aircraft cannot conduct an attack unit its next activation. Red aircraft must be placed in Passive Defense next Allocation Phase.
	CM and TBM Warhead Kill – Remove from play immediately
71-90	Aircraft crippled. Half total MP for rest of Window of Vulnerability Red aircraft immediately performs Abort counteraction. Red aircraft cannot conduct attack for rest of Window of Vulnerability Red aircraft must be placed in Passive Defense until end of Day. Red UAS treat this effect as Destroyed.
	CM and TBM Warhead kill – Remove from play immediately
91-100	Destroyed. Immediately Remove from Play.

Source: Created by author.

The Pk Table further develops the concept of mission kill vs warhead kill. A mission kill occurs when the target can no longer conduct its mission, or, for TBMs and CMs, when it is diverted from its intended point of impact.[123] A warhead kill follows the more common understanding of kill, destroying the target. The interceptor result table is focused on creating discussion on mission versus warhead kill, and level of protection verses duration of defense due to limited interceptor inventory, instead of replicating accurate Pk values versus each threat. This is accomplished by providing a range of outcomes that is somewhat realistic while providing understanding of mission kill and warhead kill results.

Attack Sequence

The Red player may conduct an attack as a counteraction following Blue's reactions. The attack is resolved against a target hex either occupied by the aircraft for range 0 attacks, or in a 30-degree arc ahead of the aircraft for standoff attacks. Red declares the target and compares the target against the apportionment box the aircraft was placed in. If the target matches, attacks occur at full strength. If not, halve the strength for the attack. Aircraft use their Air to Ground value for all attacks against fixed and maneuver targets. The damage inflicted is equal to the attack strength minus the target's susceptibility plus 1d5 (See Figure 16). Players place an unassessed damage token on the target for each point of damage. These become assessed after the Red player conducts reconnaissance of the target and are replaced with assessed damage tokens.

[123] Rostker, "TAB A."

$$Damage = Attack\ Strength - Susceptibility + 1d5$$

Figure 16. Damage calculation

Source: Created by author.

SEAD attacks occur when the Red player declares an attack on a GBAD asset and follows all the rules for normal attacks until damage resolution. To determine damage, the Red player rolls a d100 and adds the SEAD value of the aircraft, halving the SEAD value if the aircraft was assigned to strike or CAS missions, then consulting the table below and applying the SEAD value for any subsequent re-rolls (See Figure 17). An aircraft or missile must have a SEAD value to conduct a SEAD attack. As SEAD is intended to suppress air defense by destruction, neutralization, or temporary disruption, most SEAD attacks only result in loss of a GBAD system for a limited time instead of loss of the asset. The Operational Readiness table is to represent more severe results as repair parts must be supplied outside the unit. If the Blue player declares the radar will cease radiating before the SEAD roll, the SEAD value of the aircraft is halved for the attack but the radar is immediately made inactive, and its interceptors may be lost due to lack of radar guidance in the interceptor's next activation. The halving of SEAD value accounts for the ARM losing target lock before impact but continuing towards the target's last known location. This dilemma helps to drive player discussion on the value of turning off the radar when under ARM attack.

$$SEAD\ effect = 1d100 + attack\ value - 5\ if\ radar\ ceases\ radiating$$

Figure 17. SEAD Effect Value

Source: Created by author.

Table 14. SEAD Effect	
1d100 + attack value result	Effect
01-40	No damage
41-70	Light Damage. Blue GBAD must take no actions for the next 1d5 turns within the Window of Vulnerability. Radars immediately cease radiating
71-80	Moderate Damage. Blue GBAD must take no actions for next 1d10 turns within the Window of Vulnerability. Radars immediately cease radiating
81-90	Sever Damage. Blue GBAD must take no other actions this Window of Vulnerability. Radars immediately cease radiating. Roll on the Operational Readiness – Degrade table.
91-100	Catastrophic Damage. Blue GBAD must take no further activations this Window. Radars immediately cease radiating. Roll on the Operational Readiness – NMC table.

Source: Created by author.

Operational Readiness

Blazing Skies requires players to plan for unexpected equipment outages though Operational Readiness (OR) rules. OR is a metric that accounts for the availability of units to conduct combat operations including personnel and equipment readiness.

GBAD individual systems represent complex systems with multiple single points of failure allowing for a reasonable possibility of loss of capability. Blue Maneuver assets

are immune to OR tests as they are larger organizations of like equipment that will not degrade at the same time. Blue's knowledge of the OR result and subsequent delay, replicates estimated time to return to operations (ETRO) forecast by sustainment personnel. The Red player does not observe the roll as this information would not be available to his real-world counterpart.

The Operational Readiness Table utilizes a 95% OR rate instead of the 90% minimal requirement outlined in AR 220-1 as use of the lower OR rate would overly focus the game on chance and maintenance, and the primary purpose of *Blazing Skies* is asset protection not reacting to maintenance issues. The extra 5% accounts for the actions of commanders and system maintainers to quickly correct faults utilizing on-hand repair parts, internal personnel rotations, and ingenuity. The variable system recovery times in the Operational Readiness – Degrade table account for actions requiring repairs with parts on hand or delays due to the lack of personnel on hand. This accounts for 90% of all OR faults. This number was selected due to its relationship with the 90% threshold within AR 220-1 and to reduce the severity of the OR rate on the Blue player's plan. The last 10% of the OR Table is the Operational Readiness – NMC column. The NMC column represents major system errors that require extensive time to repair or the replacement of equipment from outside of theater.

OR tests are taken for each GBAD asset at the start of each Day while Red conducts air apportionment. The GBAD player rolls a 1d100 for each asset and applies the result on the Operational Readiness—Normal Operations. As systems may experience unexpected faults at any time, Blue randomly determines the system down time by rolling

a 1d00 and dividing by 4 to find the start of the downtime for the system. If the 1d100 result is 96-100, apply the next highest result instead (See Table 15).

Table 15. Operational Readiness					
Normal Operations		Degrade		NMC	
Roll	Effect	Roll	Effect	Roll	Effect
01-95	No Effect	01-50	System must take 'recover' action for next 1 hour	01-50	System must take 'recover' action for next 1d6 hours
96-100	Roll on Operational Degrade Table	51-90	System must take 'recover' action for next 1d3 hours	51-70	System must take 'recover' action for next 1d12 hours
		91-100	Roll on NMC Table	71-90	System must take 'recover' action for next 1d3 days
	If Asset becomes Degraded/NMC due to daily OR roll, randomly determine time effect begins by rolling D100/4. If 96-100, apply the next highest result.			91-100	Remove System from play. Launchers maybe reassigned following normal movement rules. Any missiles are lost.

Source: Created by author.

Controlled Flight into Terrain

CFIT occurs when a pilot or navigation system unintentionally directs their aircraft into the ground. *Blazing Skies* uses the CFIT rule to represent the possibility of a crash. CFIT occurs over rough terrain – midland forest, midland hiss, midland forested hills, populated areas – in the deck altitude band and in Mountains at the Low altitude

band. The owning player of an aircraft or missile entering a hex meeting these conditions rolls a 1d10. On a result of 1, the aircraft or missile has conducted a CFIT and is removed from play. LACMs, and RW or FW aircraft with terrain following radar, add one to the CFIT result, rendering them immune from the effect unless suffering additional penalties. FW and RW aircraft receive a -1 to the CFIT roll for every GBAD engagement targeting them this turn and -1 for each interceptor in pursuit, representing the additional distractions of reacting to interceptor launch.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

AMD is a complex topic touching multiple points at the tactical, operational, and strategic levels. Chapter 2 discussed some of the information available at the Joint and Army level for AMD, publicly releasable data for air and missile threats and ground-based air defense systems, and a range of tactical and operational wargames featuring either air combat or aircraft in support of ground operations. Despite this, modeling of AMD capabilities in these games are often greatly abstracted. Chapter 3 detailed considerations for employment of AMD in a complex multi-domain environment across the strategic, operational, and tactical levels of war. Chapter 4 explained the modeling of these considerations into a competitive wargame to illustrate AMD interactions across the land, air, and space domains. Chapter 5 considers lessons learned and makes recommendations for future work.

Lessons Learned

Perhaps the most insightful lesson from designing of *Blazing Skies* is the difficulty of simplicity. Simple, something that can be easily taken up and played, is greatly desired in a game as it allows the player to stop focusing on running the game and instead think about the problem presented by the game. Simplicity is reached though limited, simple, and concise rules. Greater accuracy of real-world systems and inclusion of additional concepts quickly increases complexity. Complexity is not desired, but a certain amount is required to achieve one's learning objectives. Complexity also grows

from inconsistent rules. This is a second type of complexity that quickly saps away a player's ability to focus on the game's outcomes by forcing them to concentrate on the rules. Therefore, there is a hierarchy of rules design: simple, needed complexity, and needlessly complex.

Wargames are not developed overnight and are never truly finished. Successful games, those that illuminate their core learning objectives, require dedication for SMEs and laymen in design, playtesting, and its continued growth to support the game's intended audience. As a game can always be improved, the author must convey a sense of rules as intended- interpreting the written rules to achieve learning objectives- over rules as written-blindly following the letter of the rules. By preferring rules as intended, players more regularly enter discussions of what is happening, what should happen and what are the probable outcomes. These questions improve the game though the modification of rules in future games and further player knowledge as they research possible outcomes. Discussions of the game, its rules, and the realities they represent help players to tackle unexpected real-world problems that may not have arisen though more traditional forms of learning.

Finally, the role of wargaming in planning cannot be undervalued. Just as Admiral Chester Nimitz reflected that wargaming in the interwar era meant that nothing the Japanese did in World War II was a surprise except the kamikaze, wargaming at all levels can help planners prepare for future conflict.[124] As FM 5-0 emphasizes, wargaming is an

[124] Perla, *Wargaming*, 79.

important piece to analyzing courses of action to select the best option.[125] While FM 5-0 proscribes a process for wargaming there are a myriad of ways to model an operational environment to conduct strenuous analysis of a plan. Overall, the method of wargaming is not the focus, only the rigors of challenging a plan until the best possible course emerges is important.

Recommendations

Blazing Skies marks the first iteration of an AMD based game begun and has numerous possible improvements to better model assets, increase development of critical skills, and increase player understanding. The most obvious improvement would be to increase the classification of the game to allow more accurate system representations. This upgrade can provide valuable skills to junior air defenders as it would require finding, analyzing, and implementing important data.

Next, expansion of *Blazing Skies* to include more joint and coalition capabilities would help players visualize the wider AMD operational environment. These capabilities should include air, electronic warfare, cyber, and space-based capabilities. This could be implemented though situational game rules as either mission specific rules or as a purchasable capability as part of force selection. Overall, this would add depth and a greater sense of the interrelation between active and passive defense, and lethal and non-lethal fires.

This expansion could include Blue aircraft and Red maneuver and air defense assets. This would require modification to victory conditions and the development of air

[125] HQDA, FM 3-0, B-20 - B-33.

to air and ground to ground combat rules but the resulting game would provide a sound representation of an air campaign in support of ground operations. *Blazing Skies* chose to forgo these systems in order to focus on US Army AMD planning.

Finally, the JTF Guidance cards can be expanded to create additional scenarios. These scenarios could continue to focus on large scale combat operations or transition to more counter insurgency or shaping missions. *Blazing Skies'* design allows for the use of any 5 km scale hex map allowing it to represent past or current operations to support these scenarios.

APPENDIX A

ASSET CHARACTERISTICS REFERENCE DATA

Table 16. Fixed Wing Aircraft Reference Data

Aircraft	Tier	Role	MP (Max speed)	Range (Max Load, km)	Max Altitude (m)	Survivability	Armament						Point Cost	Notes (Extra capabilities)
							Air to Air	Air to Ground		SEAD				
							Str	Str	Range	Str	Range			
Su-35	1	Fighter /Interceptor	5	758	All	-20	12	7 4	0 4	6	10		52	
			Atl: 2125 km/h sea: 1350 km/h	3790	clean: 18000 climb: 305 m/s	Jammer: IR/Radar Radar Warning Receiver (RWR) Missile Warning Receiver (MWR) Chaff/Flare +9 Gs	AA-10: 10 AA-11: 6 AA-12: 6	6000 kg AS-10: 8 AS-14: 6 AS-18: 2 Gun pod: 3 420 mm Rocket: 4 80 mm Rocket: 80 122mm Rocket: 20 KAB-500kr bomb: 6 KAB-1500 bomb: 2		AS-10: 8 AS-14: 6 AS-17: 6 AS-18: 2				All-weather Gen 4 ++ Laser Designator IR Sensor Look-down/shoot-down radar: 240 km/185 km Laser Designator Similar Aircraft: Su-27, Su-30, Su-32
Mig-27	2	Multi-Role/ Ground attack	3	300	All	-15	3	6 3	0 4	4	4		28	
			Mach 1.7 Sea: Mach 1.2	1500	clean: 18600 climb: 240 m/s	Armored Cockpit RWR Jammer: IR/Radar Decoy Flare/Chaff +7 Gs	AA-7: 2 AA-8: 2	3000-4000 kg AS-7: 2 AS-10/14: 4 Rocket pods (S5, S8, S24): 4		AS-10: 4 AS-12: 4				Radar Doppler nav Laser rangefinder/designator TV sighting system Upgrade to MiG-23
Mig-21 F FISHBED	4	Fighter /Interceptor	4	200	All	5	3	1	0	0	0		5	{Day Only}
			High: 2175 km/h Low: 1300 km/h	High: 1000 low: 560	18000 climb 225 m/s	RWR Chaff/flare +8.5 Gs	AA-2C/D: 2-4 Gun Pods: 2 Rockets: 4	1200 kg 30mm cannon Bombs						Limited Weather Day only Similar aircraft: J-7 Fighter, MiG-21 M Multirole Fighter

Su-25TM	2	Ground Attack	2	100	D, L, M, H	-15	3	9 6	0 2	8	10	34	
			alt: 880 km/h sea: 950 km/h	Max load: 500	Climb: 72 m/s	Titanium cockpit Titanium inter-engine plate Strengthened flight control linkages Exhaust cooling Jammer: IR RWR Flares +6.5 Gs	AA-11: 2 AA-12: 2	6400 kg 30 mm gun: 2 AT-16 ATGM (4/pod): 8 23/30 mm gun pod: UB-20 80/122/240/340 mm rockets, laser guided: 8 AS-10/11/14/17: 8 KAB-500KL or R laser or TV guided bombs	S24 rocket (7KM) S-25 rocket 10KM	AS-11: 8 AS-17: 8			Laser designator Upgrades: Su-39
Su-17	4	Ground Attack	4	300	D, L, M, H	-5	1	6 3	0 2	0	0	8	
			Atl: Mach 2.1 sea: Mach 1.1	Max load: 1500	clean: M2: 1800 M4: 15200 Climb: 230	RWR Chaff/Flare Armored Cockpit +7 Gs	AA-2: 2 AA-8: 2 AA-11: 2	4000-4250 kg 30 mm gun: 2 315mm S-25: 1 80mm S-8 rocket pods (20): 57mm S-5 rocket pods (32) AS-7: 1 23mm gun pod 100, 250, 500 kg unguided/ guided bomb:					recon variants exist

MiG-29 FULCRUM	2	Multi-role	4	300	All	-15	7	5 2	0 2	2	10	29	
			Atl: 2400 km/h sea: 1500 km/h	max: 1500 km low: 710 km	clean: 18000 external stores: 17500 Climb: 330 m/s	RWR Radar Jammer Chaff/Flare +9 Gs	AA-8: 6 AA-10: 4 AA-11: 4 AA-12: 4	3000-4000 kg 30mm cannon: 1 AS-14: 2 Bombs 240kg: 8 500 kg: 4 ZB-500 (Napalm): 4 KMGU-2 (Sub munition): 4 Rockets 130 and 240 mm: 4 B-8M1 (80mm) pod: 4		AS-17: 2			All weather/day/night Upgrades: MiG-29SMT is ASM capability
F-4 Phantom	3	Multi-role	4	278	All	-5	6	6 3	0 4	4	10	20	{Recon: 5}
			alt: 2130 km/h		1389	ECM/ESM RWR MWR towed decoy Chaff/ Flare +9/-3 Gs	BVRAAM: 6 ASRAAM: 6	6500 kg Shadow: 2 AMRAAM: 4 ASRAAM: 2 Alarm: 2	6500 kg	SEAD package Alarm: 6			Recon Variant day /night /all weather

SU-24 MK	3	Multi-Role	4	188	All	-5	2	5	0	4	10	23	{Terrain Following} {Recon 5} {EW 2 - all hexes out to range 2 count as 2 hexes for radar range.}
								3	4				
			alt: 2320 km/h sea: 1530 km/h	max load: 940	clean: 17500 Climb: 150 m/s	Jammer: IR, Radar Chaff/Flare +6.5 Gs	AA-8: 2 AA-11: 2	23mm 6x cannon 100kg FAB-100 bomb: 38 TV/laser-guided bomb: 4 AS-7/-13 S-25 laser designated rockets Gun pod: 3		AS-17			EW -2nd Gen jammer, 100 kw Terrain following Radar with Autopilot Laser/TV targeting All weather/day/night Recon Variant
TU-95MS6 Bear-H	3	Bomber	1	1300	D, L, M, H	25	0	14	0			90	{Terrain Following} {Can Launch 2 AS-4 or 10 AS-15 ALCM}
			alt: 830 km/h sea: 550 km/h	10500 max load: 6500	10500	ECM pods IR warning Receiver ECM Jamming RWR Chaff/Flare Large Target +2 Gs		normal: 9000 max: 20000 MSL: 1-3 AS-4 ALCM: 2 AS-15 ALCM: 10					Short range navigation navigation/bombing radar Weather Radar Terrain following radar Long range strategic bomber. Recon variants
IL-18	3	Heavy Transport	1	800	L, M, H	30	0	0	0	0	0	30	{No Chaff/Flare} {Transport} {Recon: 20}
			675 km/h	Max load: 4000	10000 climb: INA	Large Target		122 Troops					Large target aircraft ELINT variants Recon - side looking radar SIGINT variants Transport: 122 troops

Source: Created by author using TRADOC G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS: TRADOC G-2 ACE- Threats Integration, December 2016), 8, 22-27, 33-35, 40-47, 56-62.

Table 17. Rotary Wing Reference Data

Aircraft	Tier	Role	MP (Max speed)	Range (Max Load, km)	Max Altitude (m)	Survivability	Armament						Point Cost	Notes (Extra capabilities)
							Air to Air	Air to Ground		SEAD				
							Str	Str	Range	Str	Range			
Mi-28 HAVOC	1	Attack Helicopter	2	95	D, L, M	-15	2	5	0	0	0		14	
								4	2					
			300	475	6000	Titanium cockpit IR suppressor RWR Chaff Decoy +3.7/-.3 Gs	SA-24: 2	3640 kg AS-12: 2 23mm gun pod: 2 2-4 of the following: AT-6c/9 pods (4 each), 250/500 kg bomb, S-8 80mm rocket (20), S-13 122-mm rocket pod (5), KMGU Mine pod						FLIR, Targeting radar, Laser designator
Mi-35M2 HIND	2	Attack Helicopter	2	90	D, L, M	-10	3	4	0	0	0		11	{Transport: 8}
								3	2					
			335	450	5700 climb: 15 m/s	Armored cockpit, titanium rotor head IR suppressor Jammer: IR RWR Chaff/Flare		2x 23mm gun 12.7mm gun AT-6c/9 x 16 Rocket Pod: 2						Transport: 8

Mi-24 HIND-F	3	Attack Helicopter	2	90	D, L	-5	3	4 3	0 2			8	{Transport: 8}
			335	450	4500	armored cockpit, titanium rotor head IR suppressor Jammer: IR RWR Chaff/Flare	AA-8: 4 SA-24: 4	2x 23 mm 12.7mm gun AT-2/-6/-9 ATGM rack: 2 2-4 x S-8 80mm rocket pod (20), 500kg bomb, KMGU mine pod, Gun pod, S-5 57mm rocket (32), S-13 122mm rocket (5), S-24 240mm rocket, 250kg bomb					Transport: 8
Mi-2 HOPLITE	4	Multi-role Helicopter	1	34	D, L	0	0	2 0	0 0	0	0	3	{Day Only} {Recon 2}
			220	170	4000			20mm cannon: 2 7.62mm gun: 2					Transport: Day only Recon
Mi-17-V7	1	Medium Helicopter	2	135	D, L, M	-10	2	4 2	0 2	0	0	12	{Transport: 36}
			300	675	6000	armor plating IR Jammer, Chaff/Flare exhaust diffuser	AAMs: 6	6000kg 6 x rockets, ATGMs, bombs, mines, AAMs, ASMs. 7.62mm gun: 2 AT-6c/AT-9 4x ATGM (4), 80mm rocket (20), 250 kg bomb 500 kg bomb: 2 VSM-1 (4): 1 23mm gun pod: 2					Transport: 36

Mi-8 HIP-E	3	Medium Helicopter	2	138	D, L	0	2	3 2	0 2	0	0	12	{Transport:} {EW 1}
			250	690	4500	Armor IR Jammer Chaff/Flare	AAMs: 6	AT-2: 4 Rocket pods: 2					Transport, EW
Mi-26	2	Transport Helicopter	2	160	D, L	0	0	0 0	0 2	0	0	10	{Transport: 80}
			295	800	4500	IR suppressor IR Jammer Decoy Flare							Transport 80 troops
Ka-52/HOKUM	1	Attack Helicopter	2	100	D, L, M	-15	2	5 3	0 2	0	0	11	
			310	500	5500		SA-24:2	30mm cannon, 80mm rocket (20): 2 AT-16: 12					

Source: Created by author using data from TRADOC G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS, December 2016), 8, 12-19, 22-23, 30-38.

Table 18. Unmanned Aerial Systems Reference Data

Aircraft	Tier	Role	MP (Max speed)	Range (Max Load, km)	Max Altitude (m)	Survivability	Armament						Point Cost	Notes (Extra capabilities)
							Air to Air	Air to Ground		SEAD				
							Str	Str	Range	Str	Range			
Hermes 900	1	High Alt, Long Range	1	936	L, M, H, VH	-5	0	1	0	0	0		20	{Recon 3} {ELINT} {Low RCS 1} {Spotter} {Airfield Launched}
								1	2					
			222	4680	30000	light composite low RCS		Nimrod: 2 (10 km range)						Preprogrammed and inflight control. Non-LOS data link. Recon ELINT Low RCS
Hermes 450	2	Med Alt, Long Range	1	80	D, L, M, H	0	0	1	0	0	0		4	{Recon 2} {Low RCS 1} {Spotter}
								1	2					
			175	400	7000	light composite low RCS		Nimrod: 2 (10 km range)						Preprogrammed and inflight control. Recon 10 km
Mohadjer 4B	1	Tactical	1	30	D, L	-5	0	0	0	0	0		6	{Field Launched- launch in any friendly hex} {Recon 1} {Spotter}
								0	0					
			200	150	5400	Small								truck/trailer launched
Shmel-I	3	Tactical	1	20	D, L	5	5	0	0	0	0		4	{Recon 0} {Field Launched}
								0	0					
			180	100	2500	Small								Rocket Catapult launched

Spylite	1	Vehicle/ Man-Portable	.5	10	D, L, M, H	10	0	0	0	0	0	0	3	{Low RCS 2} {Recon 0} {Spotter} {Preprogrammed}
			100	50	11000	Lightweight, composite Low RCS								4 kg catapult launched Day/Night Optical camera. Laster Pointer Low RCS
Harpy	2	ARM / Attack UAS	2	200	D, L	0	0	1 0	0 0	0	2	0	2	{Ground Launched – 18 Harpy/ Launcher. Emplacement: 5 mins. Reload: 40 mins. 15 points} {One Use Only} {Preprogrammed}
			260	1000	2438			32 kg HE Warhead			Passive Seeker 2-18 GHz			18/launcher Truck Launched 1 use only

Source: Created by author using data from TRADOC G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS. December 2016), 8, 19-22.

Table 19. Cruise Missile Reference Data

Aircraft	Tier	Role	MP (Max speed)	Range (km)	Max Altitude (m)	Survivability	Payload	Missiles / Pod	Emplacement Time (Mins)	Reload Time (Mins)	Point Cost	Notes (Extra capabilities)
Delilah	1	LACM	5	50	D, L, M	-20	2	2	30	40	24	{Ground Launched}
	1		.3 to .7 Mach	250	8600	Small	<200 kg HE-Frag	2	5	20		Air and Ground launched
			@ 8.5 km alt: .7 Mach @Sea level: .3 Mach	250	9144		30 kg HE 1 m CEP					GPS, INS (EO/IIR) guidance. Capable of targeting Time-sensitive moving targets.
R-500 Club Caliber SS-N-27 / -30	1	LACM	2	100	D	5	3	4	15	40	40	{Ground Launched} {Launched from Iskandar Launcher.}
	1 (SS-26)		250 km/h	500	Min <100 m	Low altitude, small	<30m CEP	4				Low altitude Multi waypoint Inflight Reprograming
		ASCM or LACM	2.2 Mack	20-220			450 kg					Air launched from Mig-29, -35, Su-30MK2, -33, -35, -27KUB, TU-142, Tu-22M.
BrahMos	1	ASCM	6	60	D, L, M, H	-20	3	2	15	40	26	{Ground Lunched} {ASCM}
	1		2.8-3.0 Mach	300	14000	Small	300 kg HE <20 m CEP	3	5			
	1998	ASM/ SSM	2.8 Mach	300	15000	Stealthy Low terminal approach	<5 m CEP	3	4			Based on Bastion CDSM Salvo Launch
AS-4	4	ASCM	9	80	L, M, H	0	9	-	-	-	-	{Air Launched}
	1960	ASCM	4.5 Mach	400	1000-22000		930 kg					
		ASCM	4.6 Mach	200			930 kg HE					
AS-15 Kh-555	3	LACM	1	700	D, L, M, H	0	4	-	-	-	-	{Air Launched}
	1984		.75 Mach	3500	200-12000	Low RCS	400 kg HE 25 m CEP					Air Launched
	1981	LACM	.8 Mach	2500	Cruise 40 – 110 m		400 kg 25 m CEP					Air launched from TU-95 Bear H6 (12 internal + 4 external)

Source: Created by author using data from TRADOC G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS. December 2016), 8, 245, 247; Rahul Udoshi, *Jane's Weapons: Air-Launched 2017-2018* (Coulsdon, UK: IHS Markit, 2017), 142-144, 291-293, 332-334, 343-345, 349-351; James C. O'Halloran, *IHS Jane's Weapons: Strategic 2015-2016* (Coulsdon, UK: IHS Janes, 2015), 174-176, 178-179, 184-186.

Table 20. Ballistic Missile Reference Data

Aircraft	Tier	Role (Range km)	Range (km)	Target Type (m, CEP)	Survivability	Payload (kg)	Missiles / Launcher	Emplacement Time (Mins)	Reload Time (Mins)	Point Cost	Notes (Extra capabilities)
Shahab-3B	2	MRBM	400	Fixed, Area	-10	5	1	60	60	15	{Ground Launched} {Fixed Launcher}
	2	2000	2000	190		500 kg HE, Submunition	1	60			
	2003	2000	2000			800 kg HE, Chemical, Submunition	1				
No Dong-1	3	MRBM	260	Fixed	0	7	1	60	60	12	{Ground Launched} {Fixed Launcher} {Highly Inaccurate-Roll 3 times for damage and apply lowest result}
	3	1300	1300	4000		770 kg HE	1				
	1990	1300	1300	2000		1200 kg	1				Design similar to Shahab 3
SS-26 Iskander-M	1	SRBM	80	Fixed, Area, Point	-20	7	2	15	40	40	{Ground Launched} {Arm Warhead-May target GBAD assets at S: 7} {Multi-mission – may launch SS-26 TBM or R-500 CM} {Integrated-May benefit from Spotter Aircraft}
	1	400	400	10	Non-ballistic Assent Decoys possible	700 kg HE, Chem, Blas-Frag, ARM, Nuclear	2	15 (Emplace, Launch and Displace)			1 min separation between missile launch. IR homing warhead. Integrated into fire control net allows for UAV spotting.
	2003	500	500	.03		480-700 kg Various Types	2 SS-26 or 4-6 R-500	4-15 mins			
CSS-6 DF-15	3	SRBM	120	Fixed, Area	0	6	1	60	60	8	{Ground Launched} {Inaccurate-Roll 2 times for damage and apply lowest}
	3	600	600	600		600 kg HE, Nuclear, Submission	1				
		600 (DF-15) 900 km (DF-15A)	600 (DF-15) 900 km (DF-15A)	600 (DF-15) 45 (DF-15A)			1				

CSS-7 DF-11	3	SRBM	60	Fixed, Area	0	8	1	60	60	10	{Ground Launched}
	3	300	300	300		800 kg HE, Nuclear	1				
	1984 (DF-11) 1998 (DF-11A)	280 (DF-11) 350 (DF-11A)	280 (DF-11) 350 (DF-11A)	600 (DF-11) 200 (DF-11A)		800 (DF-11) 500 (DF-11A) HE, WMD, EMP, Submunition					Solid fuel variant of SCUD B
SCUD-B	4	SRBM	60	Fixed	5	10	1	60	60	10	{Ground Launched} {Fixed Launcher} {Inaccurate}
	4	300	300	1000		1000 HE, Chem, Nuclear	1				
	1950	300	300	3500 (R-11) 300 (R-17)		690 (R-11) 987 (R-17)	1				Baseline for most TBMs, based on V-2.
SCUD-C	4	SRBM	100	Fixed, Area	5	7	1	60	60	10	{Ground Launched} {Fixed Launcher} {Inaccurate}
	4	500	500	800		700 kg HE, Chemical	1				
	1988	50-500	50-500	1000		770 kg HE, Chemical	1				
SS-21 M3	2	CRBM	24	Fixed, Area, Point	-10	5	1	15	40	16	{Ground Launched} {Integrated}
	2	120	120	15	Non-ballistic ascent	482 kg HE, Chemical, Nuclear, ARM	1	16	40		Integrated into Fires Net.
	1993	120	120	95		482	1	16	20		
CSS-8	3	CRBM	30	Fixed, Area	0	2	1	15	40	7	{Ground Launched} {Fixed Launcher}
	3	150	150	150		190 kg HE, Chemical	1				

Source: Created by author using data from TRADOC G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS. December 2016), 8, 246-254; James C. O'Halloran, *IHS Jane's Weapons: Strategic 2015-2016* (Coulsdon, UK: IHS Janes, 2015), 9-10, 12-14, 46-48, 51-53, 56-58, 79-81, 82-91.

Table 21. Ground-Based Air Defense Reference Data

System	Admin MP	March Order (mins)	Emplacement (mins)	Radar Range	Radar FOV (Degrees)	Missile / Launcher	Point Cost	Notes
Patriot BN HQ	7	120	120	-	-	-	20	Lack of BN HQ adds 3 false targets if Patriot BTY present.
								Correlates and validates tracks. SOP: Fire 2 MSLs / target
Patriot BTY	7	120	120	Deck: 13 Low-High: 34 TBM: 3 Boxes	120	-	40	{Slew – change PTL. May take no other actions this turn}
				170 km	Search: 90 Track: 120			
		Static/towed system	Static/towed system					Capable of Engaging TBMs and ABTs
		Good mobility	Good mobility	150+ km				Ability to engage multiple targets simultaneously, 6 major components: power plant, radar set, engagement control station, launcher stations, antenna mass group, interceptors 15-20 km TBM defense
Patriot Launcher	7	120	120	-	-	PAC-2: 4 PAC-3: 16 MSE: 12 PAC-3/MSE: 8/6	PAC-2: 20 PAC-3: 40 MSE/Mix: 50	
						PAC-2: 4 PAC-3: 16 MSE: 12 PAC-3/MSE: 8/6		
Patriot Remote Launch Site	7	120	120	-	-	-	10	{Remote Launch. Assigned launchers may use any Patriot BTY within 6 hexes for guidance}
								10-30 KM Remote Launch capability
Sentinel Radar	7	5	15	8	360	-	10	{Slew to Cue - +5 to Avenger Lethality if target within range and FOV of Sentinel}
	5	5	15	CM: 30 km Fighter: 40 km Bomber: 75 km	360	-		

Avenger	7	0	0	-	-	Stinger: 8 M3P .50 Gun	10		{Short Halt- may shift 1 hex immediately before or after firing, once per Window}
	Shoot on the move: 35 km/hr. Max: 105 km/hr.	Shoot on the Move	Shoot on the Move			Stinger: 8 M3P .50 Gun			FW, RW and UAS targets
Stinger	3	0	0	-	-	Stinger:1	2		
	Man-portable	MANPAD	MANPAD			1 Stinger			<10 second reload
THAAD BTY	7	720 (12 hrs.)	720 (12 hrs.)	TBM: 10 Boxes	-	-	100		
				1000 km					X-Band. Designed for Ballistic missile detection and tracking
				1000 km					TBM targets
THAAD Launcher	7	60	60	-	-	Talon: 8	50		
						Talon: 8			Quick reload capability
Aegis Support				10 Boxes					
				360					S-Band. Search, Track and Missile Direction functions.

Source: Created by author using data from TRADOC G-2, *Worldwide Equipment Guide: Volume 2: Air and Air Defense Systems* (Ft. Leavenworth, KS. December 2016), 360-361; Christopher F. Foss and James C. O'Halloran, *Jane's Land Warfare Platforms: Artillery and Air Defense 2017-2018,* 35th ed. (Coulsdon, UK: IHS Markit, 2017), 587-590, 817-831; Martin Streetly ed., *Jane's Radar and Electronic Warfare Systems 2011-2012,* 23rd ed. (Coulsdon, UK: IHS Global Limited, August 2011), 45-46, 52-53, 90-92, 159-162; NATO, "Patriot Fact Sheet," accessed 9 January 2019, https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2012_12/20121204_121204-factsheet-patriot-en.pdf; Lockheed Martin*, PAC-3 Missile: How the System Works,* accessed 17 February 2019, https://www.youtube.com/watch?v=xU9C2iLm764.

Table 22. Ground-Based Interceptor Reference Data

Interceptor	Targets	MP	Range (km)	Altitude Bands (max altitude, m)	TBM Defense	Lethality (Pk Modifier)	Point Cost	Notes
Stinger	FW, RW, UAS	4	1	D, L	-	0	1	{IR Guidance – Requires no radar LOS}
	FW, RW, UAS	2.2 Mach	4.8 km	3800 m				IR Guided
M3P .50 Gun	FW, UAS	-	0	D	-	-5	0	{Direct Fire – Requires not radar LOS}
								.50 Cal gun with high rate of fire
PAC-2	All	10 1 TBM box	32	All	4 hexes around Launcher. 1 TBM Box	0	2	{TVM Guidance – Radar LOS required at start of movement}
	FW, RW, UAS, CM, TBM	5.0 Mach	160 km	24000 m				4 MSL/ Launcher TVM Guidance – uses Radar guidance for intercept Remote Launch out to 30 kms from controlling radar.
PAC-3	All	10 1 TBM box	32	All	4 hexes around Launcher. 1 TBM Box	10	3	{Active Seeker – Radar LOS required at end of movement}
	ABTs and TBMs with ranges <1000 kms	1700 m/s	160 km	20000 m				Hit to Kill interceptor, Lethality Enhancer for ABT and CM, Ka-band Active Seeker, 10-30 KM remote launch capability.
MSE	All	10 1 TBM box	7	All	4 hexes around Launcher. 1 TBM Box	20	4	{Active Seeker- Radar LOS required at end of movement}
	ABTs and TBMs with ranges <1000 kms	1700 m/s	35 km	36000 m				Upgraded version of PAC-3 with extended range, 12 Missiles/ Launcher Or mix of 6 MSE and 8 PAC-3
Talon	TBM	1 TBM box	Unlimited	TBM	Map 3 TBM Boxes	10	8	{Active Seeker- Radar LOS required at end of movement}
	TBM	2800 m/s		150 km	Endo- and Exo-Atmospheric	.9 vs 2 possible targets		8 interceptors / launcher, Can engage multiple targets,

Source: Created by author using data from Christopher F. Foss and James C. O'Halloran, *Jane's Land Warfare Platforms: Artillery and Air Defense 2017-2018*, 35th ed. (Coulsdon, UK: IHS Markit, 2017), 587-590, 736, 824, 829-831.

APPENDIX B

PARTS LISTING

The following is a listing of all parts required to play the game.

Both Players will use the items below:

- Maps
  - [24.0] Game Map
  - [24.1] TBM Flight Tracker
  - [25.0] Air Superiority Track
  - Trackers
  - [29.1] Critical Asset Damage Tracker – in clear document protector
- Tables
  - [27.0] Pk Table
  - [28.0] SEAD Table
  - [29.0] Damage Table
  - [31.0] Terrain Legend
  - [32.0] Air Movement
  - [33.0] Critical Assets
- Equipment
  - 1 x purple cube to mark current Air Superiority Track value
  - 1x black dry erase marker

Blue Player will use the items below

- Tables
  - [30.0] Operational Readiness Table
  - [34.1] GBAD Table
  - [34.2] GBAD Interceptors Table
  - [34.3] Blue Pre-built Forces
- Documents
  - [37.0] JTF Commander's Guidance – Scenario Dependent
    - [37.1.1] Thunder Run – Blue JTF Commander's Guidance
    - [37.2.1] International Boarder – Blue JTF Commander's Guidance
    - [37.3.1] Joint Force Entry – Blue JTF Commander's Guidance
- Trackers
  - [38.0] Blue SAMSTAT – in clear document protector
- Equipment
  - 10 x dark green cubes representing Radiating GBAD assets
  - 10 x light green cubes representing Non-Radiating GBAD assets

- 5 x yellow cubes representing GBAD interceptors
- 1 x white cube representing Corps HQ
- 5 x purple cubes representing 1st Division HQ, DSA and 3 BCTs
- 5 x blue cubes representing 1st Division HQ, DSA and 3 BCTs
- 5 x brown cubes representing 1st Division HQ, DSA and 3 BCTs
- 1 x blue dry erase marker

Red Player

- Maps
  - [26.0] Air Apportionment Mat
- Tables
  - [35.1] FW
  - [35.2] RW
  - [35.3] UAS
  - [35.4] CM Launcher
  - [35.5] TBM Launcher
  - [35.6] Red Pre-built Forces
- Documents
  - [37.0] JTF Commander's Guidance – Scenario Dependent
    - [37.1.2] Thunder Run – Red JTF Commander's Guidance
    - [37.2.2] International Boarder – Red JTF Commander's Guidance
    - [37.3.2] Joint Force Entry – Red JTF Commander's Guidance
- Trackers
  - [39.0] Red ATO – in clear document protector
- Equipment
  - 10 x red cubes representing ABT threats
  - 10 x red cubes representing TBM threats
  - 5 x black cubes representing FARPs
  - 5 x black cubes representing Launch Points
  - 3 x orange cubes representing Red ground force brigades
  - 3 x orange cubes representing Red ground force battalions
  - 1 x red dry erase marker

APPENDIX C

RULES[126]

1.0 Introduction - *Blazing Skies* is a board game modeling Air and Missile Defense concepts to provide understanding to junior ADA officers and senior non-air defenders. Overall, the most important player decisions focus on prioritization of critical assets to support the Joint Force Commander's (JTF) mission in pursuit of national interests in a complex, near-peer environment. To do this, US and coalition forces seek to capture key objectives with minimal losses utilizing maneuver and ground based air and missile defense forces. The opposing air component commander seeks to slow the advance and inflict untenable losses on US and coalition forces, and selected geo-political assets utilizing a range of threats including fixed wing, rotary wing, cruise missiles, unmanned aerial systems and ballistic missiles.

1.1 Two players are required. The target audience is air defenders and those familiar with military operations; therefore, a familiarity of Army Air and Missile Defense and common Air and Missile threats generally aids in gameplay.

1.1.1 One player is the Blue player and takes control of ground-based maneuver forces and supporting air defense. They are referred to as Blue or the Blue Player. Blue achieves victory by integrating GBAD systems into the maneuver plan enabling quick capture of objectives while preserving critical assets.

1.1.2 One player is the Red player and takes control of air and missile threats. They are referred to as Red or the Red Player. Red achieves victory by balancing efforts between delaying the Blue maneuver force, damaging high value assets, and preserving combat power.

1.2 Rules

1.2.1 Rules are numbered to provide ease of reference and cross-reference with other rules [denoted with square brackets]. When necessary, designer intent is *italicized*. Designer notes are primarily found in Chapter 4.

1.2.2 New players are encouraged to use a lower points value and to utilize a prebuilt force for their first games. The JTF Commander's Guidance to seize Resurgence is the most straight forward scenario and the best for beginners.

[126] Rules format and sequencing based on *Downtown*, by Lee Brimmicombe-Woods.

1.2.3 The Most Important Rule. While the author made every attempt to cover all conditions found within a game, this ruleset is not comprehensive.[127]

1.2.3.1 If a situation arises that is not covered within the rules presented here or the effect of the rule is unclear, players should discuss with each other the most probable outcomes of the particular event and likelihood of each occurring then roll a die to determine the event's outcome.

1.2.3.2 If the players cannot come to an agreement, both players should roll a 1d100. The player that rolls highest determines the outcome of the event and play continues normally.

1.3 Glossary of Game Terms

1.3.1 ABT. Air Breathing Threat. This includes fixed wing, rotary wing, unmanned aerial systems and cruise missiles.

1.3.2 Action. Asset actions that begin a chain of action-reaction-counteraction. Actions are events that expend movement points including movement, increase or decreases in altitude bands, turning, assessing damage, and launch. Action is also used to denote execution of an ability.

1.3.3 Activation. Activation is the selection of an asset to conduct an action, reaction, or counteraction. During a Window of Opportunity, a turn is complete when all air assets have been activated. Outside a Window of Opportunity, an Hour (turn) is complete when all maneuver and GBAD assets have been activated.

1.3.4 Active Seeker. An active interceptor guided by an onboard seeker.

1.3.5 Admin Move. Admin move is movement points for maneuver and GBAD assets activated outside of a Window of Vulnerability.

1.3.6 Air Apportionment. Process of allocating ABT and Ground-based Launchers to specific missions using the Air Apportionment mat. ABT specific missions include OCA, DCA, SEAD, CAS/AI, Strike, and passive defense. Ground-based Launcher specific missions include ready, reload, and hide. Red player allocation of individual aircraft to specific missions uses the Air Apportionment mat.

1.3.7 Air Superiority Tracker. A measure of the current balance of the air war used to determine damage dealt by Blue strike, and

[127] *Warhammer 40k,* 7th ed., by Games Workshop (Games Workshop Ltd., 2014), 10.

contributes to Blue maneuver admin move values and the number of Red Windows of Vulnerability.

1.3.8 Air Superiority Value. The current value of the Air Superiority Tracker.

1.3.9 Allocation Cell. A single generic cell of the Red Air Apportionment mat. Each Allocation Cell is associated with a specific mission.

1.3.10 Altitude Band. Generalization of aircraft altitude. The bands are Deck, Low, Medium, High, and Very High.

1.3.11 ASCM. Anti-Ship Cruise Missile.

1.3.12 Blue Strike. The totality of Blue air commander's OCA campaign represented by a die roll modified by the Air Superiority Value.

1.3.13 CAL. Critical Asset List. Critical Assets listed on the JTF Commander's Guidance are worth additional VPs to the Blue player at the end of the game.

1.3.14 CFIT. Controlled Flight Into Terrain. Unintentional intersection of a controlled aircraft and terra firma.

1.3.15 Close Air Support (CAS) / Air Interdiction (AI). ABTs conduct CAS/AI missions against Maneuver and GBAD assets.

1.3.16 CM. Cruise Missile.

1.3.17 Counteraction. Action taken by the Red player in response to a Blue Reaction. These actions include react to GBAD, conduct ground attack, or continue movement.

1.3.18 Critical Asset. Critical Assets include maneuver units, GBAD, Airbase, Sea Port, Capital, and Civilian Assets. Critical Assets are worth VPs.

1.3.19 Damage. Measure of destruction or degradation of a Critical Asset. Assessed Damage has been assessed by the Red player and is added to Red VPs at the end of the day. Unassessed Damage has not been assessed by the Red player and is not yet worth Red VPs.

1.3.20 Day. Measure of time consisting of 24 game hours. Air allocation, Operational Readiness, Window of Vulnerability determination, Blue Strike, air superiority adjustment, scoring, victory determination and Sea Port removal of damage tokens occur once per Day.

1.3.21 DCA. Defensive Counterair.

1.3.22 ELINT/SIGINT. Electronic Intelligence / Signals intelligence.

1.3.23 ETRO. Estimated Time to Return to Operation.

1.3.24 FARP. Forward Arming and Refueling Point. Serves as a launch point for RW.

1.3.25 Fixed Asset/Target. Geopolitical or military Assets depicted on the game mat including Airbase, Sea Port, Capital, and Civilian assets.

1.3.26 FOV. Field of View. Radar Guided missiles require supporting Radar with FOV and LOS to fire. Aircraft are assumed to have a 60-degree FOV for ranged attacks, GBAD asset FOV is recorded on Blue GBAD Asset sheet.

1.3.27 FW. Fixed Wing aircraft.

1.3.28 GBAD. Ground based Air Defense Assets. All air and missile defense assets including all assets whose name contains Stinger, Avenger, Patriot, THAAD, Aegis or Missile Storage Area.

1.3.29 Hour. Time period containing Windows of Vulnerability and Admin move. 24 Hours make 1 Day.

1.3.30 IR Guided. Infrared Guided missile.

1.3.31 JTF Commander's Guidance. Card used to determine scenario mission, victory conditions, special rules, and Blue CAL assets.

1.3.32 LACM. Land Attack Cruise Missile.

1.3.33 Launcher. Vehicle or fixed site used to launch aircraft or missiles. Aircraft and Missiles enter play from a valid launch location in the launcher's hex and altitude band.

1.3.34 Lethality. Measure of interceptor's ability to defeat a target. Increases the likelihood of mission or warhead kill.

1.3.35 LOS. Line of Sight.

1.3.36 Maneuver unit. Ground based combat unit under control of the Blue player. Maneuver units include Corps HQ, Div HQ, DSAs and BCTs. These units move about the game mat utilizing Admin moves and have the Area or Point target types.

1.3.37 Mission Kill. Defeat of an ABT or TBM that results in the assets randomly impacting an adjacent hex instead of outright removal.

1.3.38 MO&E. March Order and Emplacement.

1.3.39 MP. Movement Points. MP are used by ABT and TBM activated within a Window of Vulnerability.

1.3.40 MSL. Missile.

1.3.41 NMC. Non-Mission Capable.

1.3.42 OCA. Offensive Counterair. Air Allocation that allows additional Windows of Opportunity.

1.3.43 OR. Operational Readiness. OR-Normal represents day to day operations. OR-Degraded and OR-NMC represent system down time due to maintenance or damage.

1.3.44 Pk. Probability of Kill. Measure of the likelihood to damage or destroy a target based on Lethality of interceptor and Survivability of target.

1.3.45 PTL. Primary Target Line. Centerline of assets' facing.

1.3.46 Reaction. Actions taken by the Blue player in response to a Red Action. Reactions include activate, deactivate, or slew radar,

launch interceptor, or no action. Blue interceptor reactions include move, increase, or decrease altitude, or turn.

1.3.47 RW. Rotary Wing. Commonly called a Helicopter.

1.3.48 SEAD. Suppression of Enemy Air Defense. Aircraft and Missiles conduct SEAD missions against GBAD assets.

1.3.49 Strike. Aircraft and Missile conduct strike missions against fixed critical assets.

1.3.50 Strike Package. Group of ABTs and TBMs utilized within a single Window of Vulnerability.

1.3.51 Susceptibility. Measure of fixed or maneuver asset's ability to prevent or mitigate damage. Reduces damage from air and missile attack.

1.3.52 Survivability. Measure of aircraft or missiles ability to prevent or mitigate damage. Decreases likelihood of mission or warhead kill.

1.3.53 Target Type. Category of ground target based on size and maneuverability.

1.3.53.1 Fixed asset—assets denoted on game map

1.3.53.2 Area asset – Corps HQ, Div HQ, and DSAs

1.3.53.3 Point asset—BCTs and GBAD.

1.3.54 TBM. Tactical Ballistic Missile. Missile. TBMs utilize the TBM Flight Tracker.

1.3.55 Theater Ballistic Missile Flight Track. Track used for the movement of TBMs relative to time to impact.

1.3.56 TVM Guided. Track Via Missile guided missile.

1.3.57 Turn. A turn occurs once all Red air and missile assets have been activated and Blue reactions are complete in a Window of Opportunity.

1.3.58 UAS. Unmanned Aerial System.

1.3.59 Victory Condition. Set of conditions that determine the outcome of the game. Conditions include Blue occupation of all JTF Commander Guidance objectives, Red destruction of all civilian critical assets, or player determination.

1.3.60 Warhead Kill. *Blazing Skies* uses this term to refer to outright destruction of ABTs and TBMs.

1.3.61 Window of Vulnerability. Red may launch assets and conduct air attack during Windows of Vulnerability.

1.4 Scale.

1.4.1 Time. Window of Vulnerability Turns are 30 seconds in length. Hours are 60 minutes or 120 Turns in length. Days are 24 hours in length. Games are several Days in length.

1.4.2 Space. Hexes are 5 km across. MPs are an ABT's maximum speed over a 30 second time interval. TBM MPs are a measure of typical TBM time of flight divided into 30 second time intervals. Admin

points are based on approximately 35 km/hr. rate. BCTs admin move is 2.5 km/hr. representing speed in contact with the enemy. There are five altitude bands representing ABT and interceptor height above ground: Deck (200 m to 2500 m), Low (2500 m to 5000 m), Medium (5000 m to 8000 m), High (8000 m to 15000 m) and Very High (above 15000 m).[128]

1.4.3 Assets. Players control the following assets.
1.4.3.1 Blue. GBAD, Maneuver Units, Fixed Critical Assets.
1.4.3.2 Red. FW, RW, UAS, CM and TBMs, Fixed Critical Assets.

1.4.4 Resolution. Player decisions and game mechanic include strategic, operational, and tactical actions. They do not include system specific actions.

2.0 Game Equipment

2.1 Dice. *Blazing Skies* uses 1d100, 1d10, 1d5, 1d6 and 1d3. The number preceding the d represents the number of die to roll and the numbering following the d represents the maximum result of the die. These results can be created from 2 10-sided die and 1 6-sided die. 1d100 is a combination of 2 10-sided die, one marked with single digits and one marked with 10s. When rolled, the 10s die creates the 10s value and the single digits creates the single value. The result of 000 is 100, 909 is 99 and 001 is 1. To determine 1d5, roll a single 10-sided die and divide the result by 2, rounding up. To determine 1d6, roll a single 6-sided die. To determine 1d3, roll a single 6-sided die and divide the result by 2, rounding up. *Blazing Skies* die roll are designed so the high value benefits the player rolling the die with the exception is the Operational Readiness table.

2.1.1 Die roll modifiers. Some rules apply bonuses marked with a + and penalties marked with a -. These modifiers are added to the final result of the die.

2.1.2 Die Re-rolls. If a rule requires a die to be re-rolled or rolled multiple times, all die used to generate the result (both die of a 1d100) must be rerolled.

2.2 Map[129]

2.2.1 Hex Grid. The map contains hex grids to determine movement and position of each asset. Individual hexes are marked with a unique XX.XX number where the first two digits represent the column and the second two digits represent the row of the cell on the map. To measure distance, count the number of hexes entered along the straightest line possible between the origin and the target hex.

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[128] *Downtown,* by Lee Brimmicombe-Wood, 1.4.

[129] Ibid., 2.2.

2.2.2 Terrain Features. Terrain has effects on ground-based movement, aircraft at the Deck and Low altitude bands and LOS. Tile markings denote the terrain effects of that entire hex.

2.3 Playing Pieces

2.3.1 Blue Units

2.3.1.1 GBAD Radiating asset. Represents a GBAD system that emits radiation. All Radiating Assets are Sensors. Radiating Elements are represented by dark green cubes with a blue milstandard signal symbol on white background and a numeral. The zigzag bolt of the symbol denotes the PTL of the sensor. Assets currently radiating are represented by a green boarder. Assets not currently radiating are represented by a red boarder. Assets in March Order are represented by a milstandard signal symbol with a Blue border.

2.3.1.2 GBAD Non-Radiating asset. Represents a GBAD system that does not emit radiation. Non-radiating assets include Launchers (Avenger and Remote Launchers), and Missile Storage Areas. Non-Radiating Elements are represented by a light green cube with a blue milstandard air defense symbol on white background and a numeral. The top edge of the symbol represents the PTL of the asset. Assets in March Order are represented by a White milstandard air defense symbol with a Blue background.

2.3.1.3 GBAD Interceptors. Represents an inflight interceptor. Interceptors are represented by a yellow cube with a picture of a patriot missile. The nose cone of the Patriot missile denotes the current heading of the missile.

2.3.1.4 Maneuver Units.

2.3.1.4.1 Corps. Represented by a white cube with a light blue milstandard CORPS (XXX) combined arms team marking on white background. When in march order, the colors are reversed to white markings on blue background.

2.3.1.4.2 Division Assets. There are three divisions and each division is represented by a different color cube. 1st Division is represented by a purple cube. 2nd Division is represented by a blue cube. 3rd division is represented by a brown cube. When Emplaced, all markings are Color on White. When March ordered, all markings are White on Color.

2.3.1.4.2.1 Division HQ. Marks include a purple, blue, or brown Division (XX) combined arms team.

2.3.1.4.2.2 DSA. Marks include a purple, blue, or brown Division (XX) and 'DSA' within the unit icon box.

2.3.1.4.2.3 BCT. Marks include a purple, blue, or brown Brigade (X) combined arms team.

2.3.2 Red Units

2.3.2.1 ABTs. Represented by a red cube. Each face contains a red milstandard hostile diamond symbology on white background and a numeral. The top edge of the symbol denotes the ABT's heading. Each facing has a small letter in the bottom right of the symbol denoting the aircraft's current altitude band. D for Deck, L for Low, M for Medium, H for High, V for Very High.

2.3.2.2 TBMs. Represented by a red cube. The top face contains a grey cone on a red background with a numeral.

2.3.2.3 Ground Forces. Represented by an orange cubes with a red milstandard Hostile combat arms teams at battalion (II), brigade (X) or division (XX) strength. Most JTF Commander Guidance Scenarios include Red ground forces. These build situational understanding by helping to visualize the overall conflict. The ground force markers have no in game effects.

2.3.2.4 FARP. Represented by black cube. A face contains a white oval on red background with 'FRRP' in back text.

2.3.2.5 Ground Launch Point. Represented by a black cube. A face contains a 32-pointed yellow star on red background with 'Launch Point' in black text.

2.3.3 Fixed Assets. Fixed Assets are denoted on the Game Map and do not have individual pieces.

2.3.3.1 Airbase. Black symbol of a jet aircraft.

2.3.3.2 Capital. Symbol of a domed building colored red.

2.3.3.3 Civilian Infrastructure. Symbolized by either a black factory, cathedral, pair of small houses or oil well. The particular symbol has no effect on game play.

2.3.3.4 Sea port. Symbolized by a black anchor.

2.4 Game Charts and Tables. Various Tables and charts are utilized to resolve game mechanics. These charts and tables are a considered a rules source.

2.4.1 Game Map [24.0]

2.4.1.1 TBM Flight Track [24.1]

2.4.2 Air Superiority Track [25.0]

2.4.3 Air Apportionment Mat [26.0]
2.4.4 Pk Table [27.0]
2.4.5 SEAD Table [28.0]
2.4.6 Damage Table [29.0]
2.4.6.1 Critical Asset Damage Tracker [29.1]
2.4.7 Operational Readiness Chart [30.0]
2.4.8 Terrain Legend [31.0]
2.4.9 Air Movement [32.0]
2.4.10 Critical Assets [33.0]
2.4.11 Blue Assets. Reference on Blue asset abilities containing specific information on all GBAD assets and Interceptors [34.0]
2.4.11.1 GBAD [34.1]
2.4.11.2 GBAD Interceptors [34.2]
2.4.11.3 Blue Pre-built Forces [34.3]
2.4.12 Red Assets. Reference on Red asset abilities containing specific information on all ABTs and TBMs assets. [35.0]
2.4.12.1 FW [35.1]
2.4.12.2 RW [35.2]
2.4.12.3 UAS [35.3]
2.4.12.4 CM Launcher [35.4]
2.4.12.5 TBM Launcher [35.5]
2.4.12.6 Red Pre-built Forces [35.6]

2.5 JTF Commander's Guidance. The JTF Commander's Guidance provides information on the specific scenario for both the Red and Blue Player. Scenarios can be selected by training goals, agreement of the players, or determined randomly. [37.0]

2.6 Force Selection. Force selection is conducted in one of two ways: Scenario driven or Point based.

2.6.1 Scenario Driven. These forces are selected to represent a real-world scenario and may or may not be balanced against each other. *This is intended to allow for additional discussion or aid mission planning.*

2.6.2 Points. A point system is in place to allow players to select a force based on relative points values using either a la carte or pre-built selections to build a force. Point values for each asset are found on their respective data cards. There are two options for the points threshold.

2.6.2.1 Current environment. The current environment attempts to create a GBAD to Red Air ratio approximately equivalent to the current day. This puts greater emphasis on interceptor conservation and prioritization of assets. In this mode, both players select forces to an agreed upon force limit.

2.6.2.2 Equal Opportunity. This mode attempts to create a fairer scenario with both sides having an equal opportunity for victory. In this mode, the Blue player receives 1.5x more points than the Red player.

2.6.3 Maneuver forces. The Blue place receives 1 Corps HQ, and 3 Divisions consisting of 1 Division HQ and 1 DSA and 2 BCTs. The Blue player has the option of exchanging 1/3 of their current points (rounded up) for an additional BCT per Division.

2.7 Planning Tools

2.7.1 SAMSTAT. The Blue SAMSTAT worksheet allows the Blue player to track important game information for quick reference. Multiple SAMSTAT sheets maybe required for larger games. The SAMSTAT should be laminated for ease of use. If additional information is needed, utilize the margins of the paper. [38.0]

2.7.1.1 Air Superiority Level. Record the current Air Superiority level in the blank beside it. [13.0]

2.7.1.2 DTG.

2.7.1.2.1 Current. Record the current game time

2.7.1.2.2 Blue Strike Time. Record the time of the daily Blue Strike. [16.0]

2.7.1.3 Unit. Record the Unit Type and Icon for each GBAD asset purchased. The Unit Type is the name of the unit on the GBAD Asset chart. The Icon is the numerical of the cube used to represent the unit on the game mat. [34.2]

2.7.1.4 Radiate. Record current radiate status. All non-radiating units are N. [5.3.1]

2.7.1.5 Missiles. Record the type of missile carried by the asset in the blank. The open circles represent available inventory. Fill in circles for unavailable interceptors.

2.7.1.6 Current Location. Record the current hex the asset is located in.

2.7.1.7 PTL. Record the current facing of the asset in either compass direction, degree heading or hex number of target hex. [18.2]

2.7.1.8 Status. Current status of the asset. FMC assets are free to take any valid action. NMC assets may not take actions and instead must ‘hold’ or ‘wait’. [17.1]

2.7.1.9 ETRO. If NMC, record when the asset is available once more by recording a specific hour or number of turns within a Window of Opportunity. [17.1]

2.7.1.10 Proposed Location. Location a march ordered asset is moving to. [7.2.3.1]

2.7.1.11 Defended Assets. Record the hex number of assets currently defended by the GBAD asset.

2.7.2 ATO. The Red ATO worksheet allows the Red player to track important game information for quick reference. Multiple ATO sheets maybe required for larger games. The ATO should be laminated for ease of use. If additional information is needed, utilize the margins of the paper. [39.0]

2.7.2.1 Unit. Record the Unit Type and Icon for each Red ABT or TBM asset purchased. The Unit Type is the name of the unit on the Red Asset charts. The Icon is the numerical of the cube used to represent the unit on the game mat. [33.0]

2.7.2.2 Status. For Ground Based Launchers only. Ready status is a launcher currently capable of firing missiles. Reload status is a launcher currently reloading missiles. Hide status is a launcher currently in Hide Site for reload or protection. [4.1.7]

2.7.2.3 Status. For ABTs without the Ground launched rule. Record the current status of the aircraft. [8.4]

2.7.2.4 ETRO. Record the time the launcher will be or was reloaded [4.1.7], or the time the aircraft will be available for operations [20.2]

2.7.2.5 MSL/Attacks. Record the number of attacks remaining for the asset. Normally, this is one.

2.7.2.6 Mission. Fill in the circle corresponding to the mission the ABT was assigned on the Air Apportionment map. [4.0]

2.7.2.7 Air Superiority. Record the current Air Superiority level in the blank beside it. [13.0]

2.7.2.8 Windows. Record the time for each Window of Opportunity. [4.2]

2.7.2.9 Score. Record the number of VP scored at the end of each day. [22.1]

2.7.3 Air Apportionment Mat. The Air Apportionment mat is utilized for planning and identifying Air Apportionment decisions and is divided into the ABT section and the Ground Based Launcher section. [4.0]

3.0 Game Sequence of Play

3.1 Pre-game

3.1.1 Select Point Threshold [2.6.2]

3.1.2 Select JTF Commander's Guidance Card [2.5]

3.1.3 Red. purchase ABT and TBM Assets [2.6.2]

3.1.4 Blue purchase Air Defense Assets [2.6.2]

3.1.5 Declare Order of Battle – Both sides provide # and type of assets purchased [15.0]

3.1.6 Blue place Maneuver assets at initial location [6.4]
3.1.7 Red make Day 1 Force Apportionment [4.0]
3.1.8 Blue place Air Defense assets at initial location [6.2]
3.1.9 Set Initial Air Superiority Value, as indicated on JTF CDR Guidance card [13.0]

3.2 Day

3.2.1 Red make Initial Air Apportionment. Skip on Day 1. [4.0]
3.2.2 Blue conduct daily maintenance. Roll once on the Operational Readiness-Normal Operations table for each line of the SAMSTAT. [17.1.1]
3.2.3 Red declare number of Windows of Vulnerability and record times on ATO. [4.2]
3.2.4 Blue determine Blue Strike time and record on SAMSTAT. [16.0]
3.2.5 Begin Hours. Begin at 0000 and continue until 2300.
3.2.5.1 Red Window of Opportunity. [5.0]
3.2.5.2 Blue Admin Moves. [7.2]
3.2.5.3 Advance to next Hour.
3.2.6 Red declare end of Windows of Vulnerability. Blue finishes day's moves.
3.2.7 Adjust Air Superiority Tracker. [13.0]
3.2.8 Red record Points for Assessed Damage. [22.1]
3.2.9 Determine if any Victory Conditions are currently met [21.0]
3.2.9.1 Mutual Consent [21.1]
3.2.9.2 Red player destroys all civilian critical assets [21.2]
3.2.9.3 Blue player achieves JTF Guidance [21.3]
3.2.10 Sea Port sustainment [20]
3.2.10.1 Repair [20.1]
3.2.10.2 Missile Resupply [20.2]

3.3 Window of Opportunity

3.3.1 Blue set Initial Conditions. Blue declares active Radars and changes to PTLs. [5.3.1]
3.3.1.1 Red declare aircraft in strike package. [5.1]
3.3.2 Action-Reaction-Counteraction cycle. Begin at Hour:00:00 after the hour and continue Turns until the End of the Window. Each Turn increases the current time by 00:00:30.
3.3.2.1 Red Action. [5.2]
3.3.2.1.1 Launch [12.0]
3.3.2.1.2 Move [7.1]
3.3.2.1.3 Delay, prior to launch only.
3.3.2.2 Blue Reaction. Conduct an action below in response to expenditure of any Red asset MP. [5.3]
3.3.2.2.1 Activate/Deactivate Radar. [5.3.1.1]
3.3.2.2.2 Slew Radar. [5.3.1.2]

3.3.2.2.3 Launch Interceptor [5.3.2]
3.3.2.2.4 Interceptor inflight. [5.3.2.4.1]
3.3.2.2.5 No Action.
3.3.2.3 Red Counteraction. Conduct an action below in response to any Blue reaction. [5.4]
3.3.2.3.1 React to GBAD launch [5.4.1]
3.3.2.3.2 Attack [Strike and CAS/AI 9.0] [SEAD 10.0]
3.3.2.3.3 Continue Movement [5.4.2]
3.3.2.3.4 No Action
3.3.3 Ending the Window [5.5]
3.4 End of Game
3.4.1 Determine Final Score [22.0]
3.4.1.1 Red Scoring [22.1]
3.4.1.2 Blue Scoring [22.2]
3.4.2 Determine Victor [21.0]
3.4.3 Discuss key game events and shake hands.

4.0 Air Apportionment. In the Air Apportionment step [3.2.1], the Red player secretly places each unit icon representing an ABT without the ground launch rule into a mission box and records the assigned mission on the ATO [2.7.2]. ABTs assigned to a mission box does full damage to targets corresponding to that mission type. ABTs attacking targets that do not correspond to the mission's target type, deal half damage. ABTs may not change missions until the next Air Apportionment phase. Damaged or Crippled ABTs must be placed in Passive Defense. Ground Based Launchers are allocated to the Ground Based Launcher box based on their current reload status.

4.1 Missions
4.1.1 OCA. The Red player receives an additional Window of Opportunity for every 5 points of AtA strength within this box. [4.2]
4.1.2 SEAD. Mission target type is GBAD assets. Only ABTs with a SEAD value may be placed in this box.
4.1.3 CAS/AI. Mission target type is Maneuver.
4.1.4 Strike. Mission target type is Fixed.
4.1.5 DCA. -1 to Blue Strike damage for every 5 points of AtA strength within this box. [16.0]
4.1.6 Passive Defense. Half all damage done to ABTs in this box. ABTs in this box cannot be targeted unless all other assets have been destroyed.
4.1.7 Ground Based Launchers
4.1.7.1 Ready. Launchers in this box may launch missiles in any Window of Opportunity. After firing, immediately move the launcher to the Reload or Hide Site box.
4.1.7.2 Reload. Launchers in this box may not participate in a Window of Opportunity. At the beginning of each hour,

before declaring strike packages, any Launcher that has spent time equal to the asset's reload time may be moved to the Ready to Fire box.

4.1.7.3 Hide. Half all damage done to Launchers in this box. Launchers in this box cannot be targeted unless all other assets have been destroyed. At the beginning of each hour, before declaring strike packages, any Launcher that has spent time equal to **twice** the asset's reload time may be moved to the Ready to Fire box.

4.2 Determining number of Windows of Vulnerability. The Red Player receives 1 Window of Opportunity each day. The Red player receives 1 additional Window of Opportunity for every 5 AtA strength points placed in the OCA mission box in the Air Apportionment stage. The Red Player also receives 1 additional Window of Opportunity if the Air Superiority Track value is Red 6 or higher and 2 additional if the air superiority value is Red 10. These effects are cumulative.

5.0 Windows of Vulnerability.

5.1 Strike Package. The Red Player identifies all asset icons that will participate in the Window of Opportunity. ABTs can participate in one Window of Opportunity every three hours. TBMs can participate in any number of Windows of Opportunity if it is reloaded by the start of the Window of Opportunity.

5.2 Action

5.2.1 Select Asset. Select one asset to conduct actions. Each asset must expend at least 1 MP and may not be selected again until the next Turn.

5.2.1.1 Delay. ABTs and Ground Based Launchers may take a delay action for 1 MP if they have not yet been launched.

5.3 Reaction. Any number of Blue GBAD assets may conduct the following actions.

5.3.1 Conduct Radar Action.

5.3.1.1 Radiate/Cease Radiate. Radars may Radiate or Cease Radiate as a Reaction. A radar may only Radiate or Cease Radiate once per turn. Radars who are currently in Cease Radiate have no LOS. Any interceptors currently supported by a radar are immediately removed from play if the radar Cease Radiate.

5.3.1.2 Slew. Radars may slew as a reaction. The radar immediately Ceases Radiate. The controlling player may then rotate the radar within its hex to a new facing. A radar may only Radiate or Cease Radiate once per turn.

5.3.2 Launch Interceptor.

5.3.2.1 Select Launchers and number of interceptors. The controlling player selects any number of launchers and interceptors to launch. The controlling player must declare all interceptor launches before moving or intercepting with any interceptors. When an interceptor is launched, subtract the appropriate interceptor type from the firing launcher's missile inventory.

5.3.2.1.1 Supporting Radar. The supporting radar is the radar of the Battery that is controlling the Launcher that fired the interceptor. All interceptors except Stinger require the supporting radar to have LOS at launch.

5.3.2.2 LOS Test. Test for LOS for both the launcher and any supporting radars. If LOS does not exist for the Launcher or the Radar, if required, the interceptor is not launched. [18.0]

5.3.2.3 Place Interceptor. The interceptor enters play in the Launcher's hex in the Deck Altitude band.

5.3.2.4 Movement. Immediately moves up to its maximum movement distance following all rules for ABT and Interceptor movement [7.1].

5.3.2.4.1 Continued Flight. Interceptors that have not reached their max range at the end of their movement phase remain in play and activate immediately after the targeted aircraft completes its activation in subsequent phases. Interceptors whose target is destroyed may not be retargeted and are removed from play.

5.3.2.4.1.1 Test for Range. Count the total number of expended MPs the interceptor has made. If these exceeds the range of the interceptor, it is immediately removed from play.

5.3.2.4.1.2 Test for Radar LOS.

5.3.2.4.1.2.1 IR Guided. Interceptors with this rule do not require a supporting radar with LOS.

5.3.2.4.1.2.2 TVM Guided. Interceptors with this rule must have a supporting radar with LOS to target. TVM Guided interceptors check LOS <u>before</u> beginning movement.

If the Radar does not have LOS, the missile is removed immediately.

5.3.2.4.1.2.3 Active Seeker. Interceptors with this rule must have a supporting radar with LOS to target. Active Seeker interceptors check LOS after completing movement. If the Radar does not have LOS, the missile is removed immediately.

5.4 Counteraction. The Red player may take the following actions in response to a Blue reaction.

5.4.1 React to GBAD. FW and RW aircraft may conduct a React to GBAD launch counter action when intercepted by an interceptor. The player must declare the reaction before the roll for intercept occurs. [8.1]

5.4.1.1 Evade. The aircraft gains -5 to the Pk Roll but the Blue player may immediately move the Aircraft up to 1 hex in any direction and reduce or increase its altitude by one band. The Aircraft cannot conduct an Attack until its next activation.[130]

5.4.1.2 Abort. The aircraft gains -10 to the Pk Roll but the Blue player may immediately move the Aircraft up to 1 hex in any direction and reduce or increase its altitude by one band. The Aircraft cannot conduct an Attack this Window of Opportunity.[131]

5.4.2 Continue Movement. The aircraft may continue to conduct actions by expending MPs [7.1]

5.5 Ending the Window of Vulnerability. The Window of Vulnerability ends when any of the following conditions are met: All Red ABTs and TBMs have been removed from the game map and TBM track and the Red player does not wish or cannot launch any additional assets, or the players agree that no further actions of interest will occur. Once the Window of Vulnerability is complete, return to the Day phase in the Hour where the Window of Opportunity occurred to allow Blue to conduct Admin movement.

6.0 Types. Assets are broken down into numerous categories based on their function within the game. This section outlines unique aspects of each category.

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[130] *Downtown,* by Lee Brimmicombe-Wood, 15.43.

[131] Ibid., 8.4.

6.1 Friendly Controlled. JTF Guidance will provide initial control for each hex. Terrain and Fixed Assets become friendly controlled if a BCT is currently occupying the hex, or if a BCT has entered the hex previously. Hexes between two BCTs from the same Division who are within 5 hexes of each other also become friendly controlled.

6.2 Blue GBAD Assets. GBAD Assets may only be placed or enter hexes that are friendly controlled.

- 6.2.1 Patriot Remote Launch Site. Must be placed within 6 hexes of a controlling Patriot Radar.
- 6.2.2 Patriot Launcher. Must be placed within a hex containing a Patriot BTY or a Patriot Remote Launch Site.
- 6.2.3 THAAD Launcher. Must be placed within a hex containing a THAAD BTY.

6.3 Blue Interceptors. Blue Interceptors must be placed on a valid launcher. A launcher may not have more than one type of interceptor. Any number and type of interceptors can be stored within a Missile Storage Area.

- 6.3.1 Reload. A Launcher may reload by conducting an Emplacement while already emplaced. Additional interceptors must be present within a Missile Storage area within 3 hexes of the reloading launcher.
- 6.3.2 Interceptors.
  - 6.3.2.1 Stinger. A Stinger team has 1 Stinger Missile. An Avenger can have up to 8 Stinger missiles.
  - 6.3.2.2 M3P .50 Gun. The M3P may conduct an unlimited number of engagements over the course of a game.
  - 6.3.2.3 PAC-2. A Patriot Launcher may have up to 4 PAC-2 interceptors.
  - 6.3.2.4 PAC-3. A Patriot Launcher may have up to 16 PAC-3 interceptors. Additional interceptors must be purchased in multiples of four. Reloads must be conducted in multiples of four.
  - 6.3.2.5 MSE. A Patriot Launcher may have up to 12 MSE interceptors. Additional interceptors must be purchased in multiples of two. Reloads must be conducted in multiples of two.
  - 6.3.2.6 MSE/Mix. A Patriot Launcher may have a mixture of up to 8 PAC-3 interceptors and 6 MSE interceptors. This is an exception to the mixture rule. Additional interceptors and Reloads follow the rules for the respective interceptors.
  - 6.3.2.7 Talon. A THAAD Launcher may have up to 8 TALON interceptors.

6.4 Blue Maneuver units. The movement rate of BCTs is determined by the presence of supporting units. Division HQ and DSA can only provide support

to BCTs within the same division. Other than BCTs, maneuver assets may only be placed or enter hexes that are friendly controlled.

6.4.1 BCT. BCTs move 1 hex every 2 hours if all supporting units are available. Decrease this by an additional 2 hours per missing supporting unit. i.e. All supporting = 1 per 2 hours, 2 of 3 supporting = 1 per 4 hours, 1 of 3 supporting = 1 per 6 hours. BCTs may enter any hex if it has at least 1 MP but immediately takes unassessed damage markers equal to the remaining MP cost. A BCT may not move if it has damage markers but may expend a MP to remove a damage marker. BCTs are the only maneuver unit that can capture objectives.

6.4.2 Corps. Provides map wide support if its HP is greater than or equal to 50%.

6.4.3 Division HQ. Provides a radius of support equal to 10 x current HP. This value is halved when the Division is March Ordered.

6.4.4 DSA. Provides a radius of support equal to 2 x current HP. This value is halved when the DSA is March Ordered.

6.5 Red FW Assets. FW have the airfield launched rule. [12.0]

6.6 Red RW Assets. RW have the airfield and FRRP launch special rules. [12.0] RW receive a +1 to CFIT rolls. [7.1.4.2]

6.7 Red UAS Assets. UAS treat all results of 'Aircraft crippled' as destroyed. UAS do not take additional penalties for CFIT rolls for interceptor engagement. [7.1.4.2]

6.8 Red Cruise Missile Launcher. Most CMs have the ground launched special rule. Some CMs have the Air Launched special rule. CM do not take additional penalties for CFIT rolls for interceptor engagement.

6.9 Red TBM Launcher [12.0]

6.9.1 Target determination. The Red player determines the TBM's target before launch and records the target hex. The target type (Fixed, Area or Point) must match those found in the TBM's target type on the RED TBM Launcher data sheet.

6.9.2 TBM Flight track initial placement. TBMs are placed on the TBM flight track in the red box corresponding to the TBM's role. The Red player then informs the Blue player of TBM launch but not the target location.

6.9.3 Point of Origin. Place a Ground Launch token on the launch hex for the TBM. If the TBM launch exceeds the range of the Game mat, place the token in any red controlled hex along the edge of the map.

6.9.4 TBM Movement. [7.1.5]

6.9.5 Target declaration. When a TBM enters a hex marked with the name of a radar that is radiating and has the TBM's Point of Origin

in FOV (disregard range), the Red player must declare the TBM's target hex to the Blue player.

6.9.6 TBM Defense. The Blue player may declare reactions normally. A GBAD interceptor may target any TBM impacting (targeting) a hex when a radius of the interceptor's launch hex equal to the interceptor's TBM Defense value.

6.9.7 Attack. Once the TBM exits the TBM Flight track, to conducts an attack at a strength equal to its payload value following the rules for Ground attack – Strike and CAS/AI and Ground Attack – SEAD ignoring range and LOS. [Strike and CAS/AI 9.0] [SEAD 10.0]

6.10 Critical Assets

6.10.1 Airbase.

6.10.2 Sea Port.

6.10.3 Capital.

6.10.4 Civilian.

7.0 Movement[132]

7.1 ABT and Interceptor Movement

7.1.1 Marker Placement. All markers must be placed at the center of a hex facing any hexside.

7.1.1.1 Marker Facing. Markers may only face hexsides.

7.1.1.2 Altitude. ABTs may only enter altitude bands listed in its Altitude Bands cell of its profile. ABTs without the D altitude band enter play after launch in the L altitude band. Air launched missiles may only be launched when the parent aircraft is within a value altitude band.

7.1.1.2.1 Deck. ABTs must expend 1 extra MP when entering their first Deck hex of their activation. This is ignored for launch. Midland Forest, Midland Hills, Midland Forested Hills, and Populated Areas produce CFIT effects on this band.

7.1.1.2.2 Low. Mountains produce CFIT effects on this band.

7.1.1.2.3 Medium

7.1.1.2.4 High. Aircraft conducting range 0 attacks half their attack value if attacking at this altitude.

[132] *Downtown,* by Lee Brimmicombe-Wood, 6.0.

7.1.1.2.5 Very High. Add 1 to range for ABTs at this altitude. This will make range 0 attacks impossible.[133]

7.1.2 Movement Points. ABTs and Interceptors receive MPs equal to their MP value every turn of a Window of Opportunity. These are expended to conduct movement, attack, and assess damage.

7.1.3 Range. An ABT may expend a number of MPs equal to its range within a Window of Opportunity. Upon exceeding this number, the ABT is removed from play.

7.1.4 Movement

7.1.4.1 Movement Actions. All Movement actions expend 1 MP. Expenditure of a MP allows Blue to conduct a reaction.

7.1.4.1.1 Launch or Recover. [12.0]

7.1.4.1.2 Move. Move forward into an adjacent hex as the same altitude band. ABTs must pay an additional 1 MP upon entering the Deck altitude band for the first time each activation.

7.1.4.1.3 Turn. Assets may rotate up to 60 degrees for free, up to 120 degrees for 1 MPs, and up to 180 degrees for 2 MP.

7.1.4.1.4 Increase Altitude. Increase altitude band by 1.

7.1.4.1.5 Decrease Altitude. Decrease altitude band by 1.

7.1.4.1.6 Assess Damage. Expend 1 MP to assess damage within the aircraft's current square. ABTs with the Recon rule do not pay the MP cost.

7.1.4.1.7 Attack. Conduct an attack. The Blue Reaction occurs before the attack is resolved. [Strike and CAS/AI 9.0] [SEAD 10.0]

7.1.4.1.7.1 Launch Missile. ABTs with special rules allowing them to launch missiles may expend 1 MP to launch 1 missile.

7.1.4.2 CFIT. When an ABT or interceptor enters a hex or altitude band meeting CFIT conditions listed in the Terrain Legend [pointer-terrain effects], immediately roll a 1d10. On a modified result of a 1, the asset is lost. RW, CMs with the LACM role, and FW with Terrain Following, receive a +1 to the die roll. An FW or RW aircraft receives a -1 for each interceptor launched at it this turn and for each interceptor currently inflight targeting the aircraft.

[133] *Downtown,* by Lee Brimmicombe-Wood, 15.52.

7.1.5 TBM Movement. TBMs must advance 1 box on the TBM Track per activation. TBMs moving off far side of the TBM track from their starting location immediately attack their target. Blue may not launch interceptors in reaction to a TBM moving off the track. [14.2]

7.2 Admin Movement

7.2.1 Marker Placement. All markers must be placed at the center of a hex facing any hexside.

7.2.2 Movement Points. GBAD and Maneuver units receive Admin MPs equal to their Admin MP value every Hour. These are expended to move into hexes and conduct march order or emplacement.

7.2.3 Movement

7.2.3.1 Movement Actions

7.2.3.1.1 March Order. A unit may March Order by expending a number of MPs equal to its March Order Value. Once a unit has begun march order, flip the unit to its march order facing. A unit that has begun March Order may not take part in any Window of Opportunity until it has completed Emplacement.

7.2.3.1.2 Emplace. A unit may Emplace by expending a number of MPs equal to its Emplacement value. Once a unit has completed emplacement, flip the unit to its emplaced facing, either radiating or not radiating.

7.2.4 Move. A unit may enter a hex by expending MPs equal to the hexes' MP Cost. Except for BCTs, a unit may not enter a hex unless it pays the full MP cost. Hexes containing major roads cost 1/3 MPs regardless of the parent hexes' normal MP cost.

7.3 Stacking. Stacking assets is permitted in all cases.

8.0 Intercept. An intercept occurs immediately when an interceptor and its target occupy the same hex and altitude band.

8.1 Declare Counteraction. The Red Player may declare a React to GBAD counteraction. [5.4.1]

8.2 Determine Pk Modifiers. Locate the interceptor type row on the PK Table. Locate the column equal to the target's survivability value. Cross reference these values to determine the Pk Table for the intercept. [27.0]

8.3 Roll 1d100. Utilize the Pk values within the Pk Table subtracting Evade or Abort bonuses.

8.4 Result. A roll of 001 always misses. A roll of 100 is always ABT: Destroyed or TBM: Warhead Kill. Remove the Interceptor from play immediately after determining the result.

8.4.1 Miss. 001 or result on PK Table. No Effect.

8.4.2 Shaken. ABT cannot conduct an Attack until its next activation.

8.4.3 Damaged. ABTs cannot conduct an Attack until its next activation. The ABT may only expend half (rounding down) its MPs for the rest of the Window of Opportunity. Damaged ABTs must be placed into Passive Defense until they are repaired.

8.4.4 Crippled. ABTs cannot conduct an Attack this Window of Opportunity. The ABT may only expend half its MPs (rounding down) each activation for the rest of the Window of Opportunity. ABT must immediately attempt to land along the most expedient route. Crippled ABTs must be placed into Passive Defense until they are repaired.

8.4.5 Destroyed. The target is immediately removed from play.

8.4.6 Mission Kill. CM and TBMs only. CM or TBM conducts an attack on a randomly determined adjacent hex. Damage may only be applied to area and fixed targets. If multiple targets are in the hex, the Blue player selects the target. Hit to Kill (PAC-3, MSE, THAAD) interceptors count as Warhead kills.

8.4.7 Warhead Kill. The target is immediately removed from play.

9.0 Ground Attack – Strike or CAS/AI

9.1 Select Attack Profile. Red player selects any attack profile listed in the AtG column of the FW, RW, UAS, or CM data sheet [35.0]. The Strength (S:) value is utilized to determine Attack Strength.

9.2 Select Target. Select a fixed or maneuver asset.

9.3 Compare Target type to ABT mission. Half damage if target type does not match mission type. [4.1]

9.4 Check Range.

9.4.1 Range 0. ABTs are at Range 0 if they occupy the target's hex.

9.4.2 Standoff. ABTs may conduct attacks in any targets within the max Range (R:)

9.4.2.1 Check Line of Sight to target. ABTs have a 60-degree FOV. [18.0]

9.5 Determine target Susceptibility. Reference Critical Assets data sheet Susceptibility column for the target asset. [33.0]

9.6 Determine Damage. The attack deals unassessed damage equal to the Attack's Strength value – Target's Susceptibility + 1d5. [29.0]

10.0 SEAD Attack. Aircraft conduct SEAD attack against GBAD targets. If an ABT with a SEAD value conducts a SEAD attack when apportioned to a different mission, halve the SEAD value for the attack.

10.1 Select Attack Profile. ABTs conducting SEAD utilize their SEAD attack profile. ABTs without a SEAD value may not conduct SEAD.

10.1.1 Determine Range. Determine the range to target by counting the intervening hexes. If the range is greater than the SEAD attack R: value, the attack automatically fails.

10.1.2 Determine LOS. [18.0]

10.2 Declare Radar reaction. The Blue player may declare a radar reaction. Non-radiating GBAD assets automatically conduct No Reaction.

10.2.1 No Reaction. No modifiers.

10.2.2 Cease Radiate. Apply -5 to SEAD attack roll. Radar immediately ceases radiate destroying any supported interceptors in flight. [5.3.1]

10.3 Locate SEAD Strength column on SEAD Attack Chart. [28.0]

10.4 Roll 1d100. Apply result from SEAD Attack Chart. Radiating GBAD assess immediately Cease Radiate for any result other than a 'Miss'.

11.0 Assessing Damage. FW, RW and, UAS aircraft with the Spotter rule, can conduct the Assess action for 1 MP. Assess assesses all unassessed damage in the occupied hex. Annotate this on the Critical Asset damage tracker. [29.1]

12.0 Launch and Recovery

12.1 Launch. Aircraft may launch from any valid launch site that they have the launch rule for (i.e. FW may only launch from airbases with at least 1 HP remaining). Place launching aircraft in the launch hex at the Deck altitude band.

12.2 Recovery. Aircraft may recover (land) at any valid launch site by ending their movement in the same hex at Deck altitude band.

12.3 Airfield. Any airbase may launch or recover a number of aircraft per Window of Opportunity equal to its current hit points. Airfields change ownership if occupied by a friendly maneuver unit and all aircraft recovered at that site in the last Window of Opportunity are removed from play.

12.3.1 Off map airfield. The Mariot AB (59.04) is located off map. It follows all rules for airbases except that aircraft can be placed at any valid altitude and must subtract 30 from its range for a total of 60 if launching and recovering.

12.4 FRRP. A FRRP must be purchased at the beginning of the game. Place a FRRP marker in any friendly controlled hex. It may not be moved. It can launch and recover any number of aircraft in a Window of Opportunity. A FRRP and all aircraft recovered at that site in the last Window of Opportunity are removed from play if the hex is occupied by an enemy maneuver unit.

12.5 Ground launched. Ground launch sites are placed when the player chooses to launch an aircraft with this rule. Ground launch site markers may be placed in any friendly controlled hex and any number of ground launch site markers may be placed in a single hex. Any number of aircraft may launch or recover from a valid ground launch site. Ground launch sites and all aircraft recovered at that site in the last Window of Opportunity are removed from play if occupied by a friendly maneuver unit. Launchers with the Ground Launched rule use the Ground Based Launchers apportionment boxes instead of the ABT apportionment boxes.

12.5.1 Fixed Launcher. Fixed launchers follow all the rules for ground launchers except they may not be moved between launches and therefore always launch from the same hex. Fixed Launchers may not be placed in the Ground Based Launcher Hide Site apportionment box.

12.6 Field Launched. Field launch sites are placed when the player chooses to launch an aircraft with this rule. Field launch site markers may be placed in any friendly controlled hex and any number of ground launch site markers may be placed in a single hex. Any number of aircraft may launch or recover from a valid ground launch site. Ground launch sites and all aircraft recovered at that site in the last Window of Opportunity are removed from play if occupied by a friendly maneuver unit.

12.7 Air Launched. Air Launch allows the placement of the ABT within a hex occupied by a valid launching aircraft. The ABT is placed in the same altitude band as the launching aircraft and must immediately expend all movement points.

13.0 Air Superiority Track. [25.0]

13.1 Air Superiority Points. At the end of each Day in the Adjust Air Superiority Tracker step [3.2.7], airfields generate Air Superiority points equal to their current hit points.

13.2 Air Superiority Adjustment. In the Adjust Air Superiority Tracker step [3.2.7], players total their current number of Air Superiority Points and compare them. For each 2 points a player exceeds the other player's value, the higher player may shift the Air Superiority Track marker one box.

13.3 Bonuses. The extra rules contained within the current Air Superiority Value box are in effect. Bonuses for Windows of Opportunity and Admin MPs (including BCTs) are cumulative.

14.0 TBM Flight Tracker. TBMs and Interceptors targeting TBMs are not placed on the Game mat and instead utilize the TBM Flight Tracker. [24.1]

14.1 Placement. TBMs are placed on the right-hand side of the track in the red square corresponding to their TBM Role. Interceptors enter the track from the left-hand side of the track.

14.2 Movement. All TBMs and Interceptors must move 1 box per activation.

14.2.1 Range. Interceptors are immediately removed from player when exiting the farthest right box labeled with the controlling system. (i.e. Patriot interceptors are removed when exiting box 1 and Talon interceptors when exiting box 4 for MRBMs.)

14.3 Intercept. Intercept occurs when the target and the interceptor enter the same box. [8.0]

15.0 Declare Order of Battle.

15.1 Red. Provide the Blue player the number of Aircraft and Launchers by Role.

15.2 Blue. Provide the Red player the number of Assets by Name.

16.0 Blue Strike

16.1 Timing. The Blue player determines the Hour of the Blue Strike at the beginning of the Day. It occurs after Red conducts any Window of Opportunity for that Hour.

16.2 Strength. The strength of the Blue Strike is equal to the value listed in the current Air Superiority Track value box [13.0]. For every 5 points of AtA strength the Red player has allocated to DCA, reduces the Blue Strike damage by 1.

16.3 Targeting. Damage is distributed by the Blue player across any combination of Red controlled Airbases, Sea Ports, or Air Apportionment boxes: OCA, DCA, Strike, AI/CAS, SEAD, or Ground Launchers. If DCA is selected, damage is done first to the Active Defense box then the Passive Defense Box. If Ground Launchers are selected, damage is done first to Ready launchers then Reloading and then Hide Sites.

16.4 Damage. For each point of damage, the Red player must remove one asset within the target apportionment box from the game. Assets within passive defense or hide sites require 2 damage to remove. Excess damage cannot be reassigned and is lost.

17.0 Damage and Repair.

17.1 Operational Readiness. [30.0]

17.1.1 Daily OR. Roll a 1d100 ever every asset and apply the result of the OR-Normal Operations table. If an Asset rolls a 96 or higher (fails), determine the effect on the OR-Degrade table first then determine the time.

17.1.1.1 Determine start time. Roll 1d100 again and divide the value by 4. This results in a value of 1-25. On a 1-24, the start time is the hour equal to the result with 24 counted as 00:00:00. On a result of 25 (96 or higher again), repeat Daily OR for that asset using the OR-Degrade table.

17.1.2 SEAD. Roll 1d100 + SEAD attack value on the OR-Degrade or OR-NMC table per SEAD attack result. Start time is immediate.

17.1.3 Assets that fail OR rolls immediately cease radiate and may only conduct ‘recover’ actions until it reaches ETRO. OR results are not cumulative, use the value with the longest ETRO. Recover actions are a ‘do nothing’ action.

17.2 Aircraft damage. ABTs can be repaired using the Resupply option of the Sea Port. Ground-based launchers are destroyed upon taking damage. Damaged and Crippled ABTs must be placed in the Passive Defense box of Air Apportionment until repaired. Damaged Ground-based Launchers are removed from play.

18.0 Line of Sight. LOS occurs when an asset has Range and FOV on a target hex and altitude band.

18.1 Range. Range is determined by the range of the radar as listed in the GBAD data sheet. ABTs LOS range is determined by their altitude. Deck = 13 hexes. Low = 41 hexes. Med = 58 hexes. High = 74 hexes. Very High = 101.

18.1.1 Terrain. Hexes normally count as 1 when determining range. Forests, Forested Hills, and Hilly populated areas count as 2 against targets in the Deck and Low altitude bands.

18.2 FOV. FOV for GBAD is 360 unless noted on the GBAD data sheet. ABTs FOV is 60 degrees (30 degrees to each side of their current heading).

18.3 Block LOS. Hills and Forested Hills block LOS between assets at the Deck level. Mountains block LOS between assets at the Low and Deck level.

19.0 Terrain Effects. [31.0]

19.1 Air Movement

19.1.1 CFIT. CFIT can occur in in Midland Forests, Midland Hills, Midland Forested Hills, and all populated areas in the Deck altitude band.

19.1.2 Impassible. Mountains are impassible to ABTs in the Deck altitude band.

19.2 Ground Movement

19.2.1 Impassible. Sea hexes are impassible to all ground units.

19.2.2 Hexes cost MP equal to the MP cost (ground) to enter.

19.2.3 All ground units except BCTs may utilize Major Roads for movement. Major Roads cost 1/3 MP to enter regardless of parent hex as long as the hex is friendly controlled.

20.0 Sea Port. At the end of each Day in the Sea Port step [3.2.10], Sea Ports provide sustainment points equal to their current hit point value. Sustainment points allow the controlling player to conduct Repair or Resupply actions.

20.1 Repair. The controlling player may remove 1 damage marker (assessed or unassessed), repair a damage aircraft to operation, or a crippled aircraft to damaged for 1 sustainment point. The same asset can be repaired multiple times.

20.2 Resupply. The controlling player may receive one of the following interceptor packages in exchange for 2 sustainment points: 8x Stinger, 6x PAC-2, 4x PAC-3, 2x MSE or 1x Talon.

21.0 Victory Conditions

21.1 Consent. If both players decide the game should end, the game ends and the player with the highest score is the victory.

21.2 Civilian Critical Assets. If all Civilian assets are at or below 0 HP, the game ends immediately as a Red victory. If at the end of the game 75-99% of civilian assets are at or below 0 HP, Red is the victor. If 50-74% of civilian assets are at or below 0 HP, the game is a draw. If less than 50% of civilian assets are at or below 0 HP, the player with the highest score is the victor.

21.3 JTF Mission. The game ends immediately if the Blue player meets all the required JTF Commander's objectives listed on the JTF Commander's Guidance. The player with the highest score is the victor.

22.0 Scoring

22.1 Red. Red scores points at the end of each day [3.2.8], before Sea Port repairs, for each point of damaged assessed up to the maximum hit points of the target that day multiplied by the target's VP modifier. No points are scored for damage in excess of the target's current hit points. If the Blue player does not achieve the JTF Commander's objectives by the NLT date of the mission, the Red player receives 100 bonus points.

22.2 Blue. The Blue player scores points at the end of the game only [3.4.1]. For assets listed on the JTF Commander's Guidance CAL, the Blue player receives 1 point per remaining HP multiplied by the CAL criticality value. The Blue player receives 1 point for each HP remaining on all other friendly controlled assets.

23.0 Universal Special Rules[134]

23.1 ARM Warhead. TBMs with this ability can target GBAD assets using their payload value as their SEAD strength value.

23.2 Command and Control. If the Blue player has any active Patriot Batteries, the Red player may place up to 3 false targets unless the Blue player controls an active (no operational degrades from daily maintenance and no SEAD results other than miss) GBAD asset with this ability. False targets are represented exactly as ABTs, have no movement, or launch restrictions and may not conduct attacks.

23.3 Day Only. Aircraft with this restriction can only be added to strike packages between 0600 and 1700.

23.4 Early Warning. Any number of Avengers engaging targets in LOS of an active Sentinel radar gain +5 Lethality.

23.5 ELINT/SIGINT. When an aircraft with this capability is airborne, the blue player must identify all assets currently capable of radiating and declare all radiating assets by type (the name characteristics of the asset).

23.6 EW. Aircraft with this capability project an EW bubble into its hex and all hexes within X determined by its EW value (i.e. EW 2 covers the aircraft's hex, all 6 adjacent hexes and all 12 hexes beyond that). Radars count all hexes affected by EW as 2 hexes instead of the normal 1 hex.

23.7 Fixed Launcher. Launchers with this capability may be purchased as Fixed Launchers. Fixed launchers reduce the point cost of the launcher by 4 but may not be placed in the Ground Based Launcher Hide Site apportionment box and must always launch from the same hex.

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[134] *Warhammer 40k,* by Games Workshop, 156.

23.8 Highly Inaccurate. TBMs with this restriction must roll three times on the damage table and apply the lowest result.

23.9 Inaccurate. TBMs with this restriction must roll twice on the damage table and apply the lower result.

23.10 Integrated. CM and TBM with this capability may utilize the reroll provide by Spotter aircraft.

23.11 LACM. CMs with the LACM role are immune from CFIT.

23.12 Low RCS. Radars attempting to draw LOS to an aircraft with this capability must add the Low RCS value to the range when determining LOS. (i.e. a radar attempting to draw LOS to a Low RCS 2 aircraft 7 hexes away would count the distance as 9 hexes.)

23.13 Preprogrammed. Aircraft with this restriction must follow a preprogrammed route after launch. Prior to launch, the controlling player records up to 5 hexes as waypoints. The aircraft must fly directly from waypoint to waypoint in sequence. It may conduct other actions such as attack or assess at any point along this route. Preprogrammed aircraft automatically return to their launch point upon reaching waypoint 5.

23.14 Recon. Aircraft with this capability are not required to expend a MP to conduct the Assess action (and therefore will not trigger a Blue reaction for the act). The value following Recon denotes the range the aircraft can conduct recon (i.e. Recon 5 can target all hexes out 5 hexes from its current hex for recon).

23.15 Radar. GBAD assets with this capability count as Radiating assets utilizing the range and FOV found in their profiles.

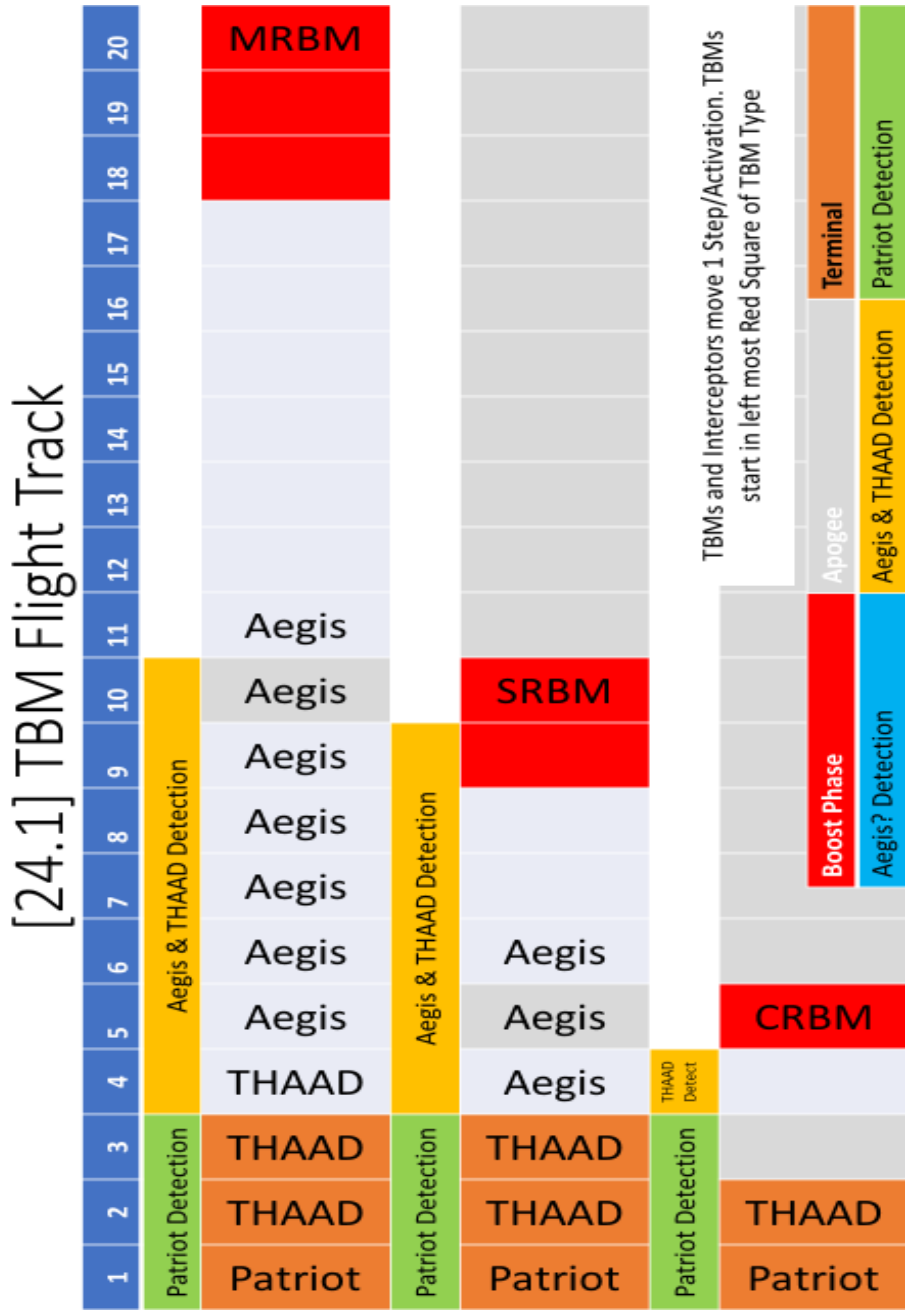
23.16 Short Halt. May shift 1 hex immediately before or after launching an interceptor. This may not occur more than once per Window of Vulnerability.

23.17 Spotter. Aircraft with this capability may target ground maneuver units that are within 6 hexes of a friendly controlled square for artillery barrage. An artillery barrage does 1d3 points of damage to the target. This ability can be used once per Window of Opportunity. Friendly FW, RW and UAS aircraft attacking targets within the Spotter radius may reroll damage results.

23.18 Terrain Following. Aircraft with this capability gain +1 to CFIT rolls.

24.0 Game Map – See Appendix E

24.1 TBM Flight Track



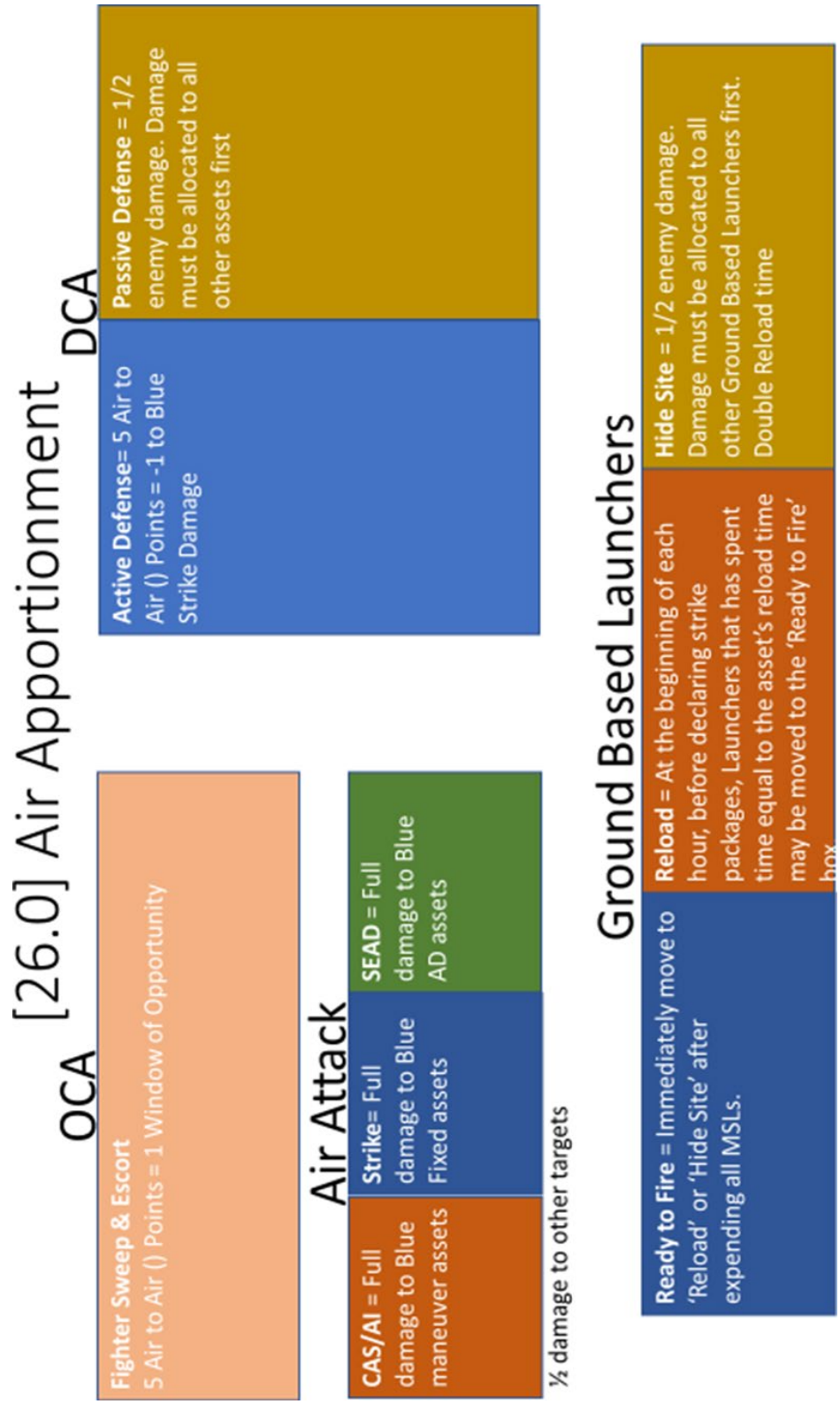
[25.0] Air Superiority Track

Air Supremacy	Air Superiority		Air Neutrality					Air Superiority		Air Supremacy
Red 10	Red 8	Red 6	Red 4	Red 2	Even START	Blue 2	Blue 4	Blue 6	Blue 8	Blue 10
No Blue Airstrikes +2 Red Window of Opportunity	Blue Airstrike: 1 damage	Blue Airstrike: 1d3 damage +1 Red Window of Opportunity	Blue Airstrike: 1d3 damage	Blue Airstrike: 1d5 damage	Blue Airstrikes: 1d5 damage	Blue Airstrikes: 1d5 damage	Blue Airstrikes: 1d6 damage	Blue Airstrike: 1d6 damage +1 Blue asset MP	Blue Airstrike: 6 damage	Blue Airstrike: 1d3+6 damage +2 Blue asset MP

In the Air Superiority Step (Day step 8) adjust the Air Superiority tracker:
In the Adjust Air Superiority Tracker step, compare number of Air Superiority Points. For each 2 points a player exceeds the other player's value, that player may shift the Air Superiority Track marker one box.

Bonuses are cumulative and take effect the next 'Day'.

26.0 Air Apportionment Mat



27.0 Pk Table

27.0 Pk Table

		Effect (d100 result is =<)		Target Survivability								
Type	**Roll Bonus**	**ABT**	**TBM**	**-20**	**-15**	**-10**	**-5**	**0**	**5**	**10**	**15**	**20**
MSE	**20**	**Miss**	**Miss**	1	1	1	1	1	1	1	1	1
		Shaken	**Warhead Kill**	30	25	20	15	10	5	2	2	2
		Damaged	**Warhead Kill**	50	45	40	35	30	25	20	15	10
		Crippled	**Warhead Kill**	70	65	60	55	50	45	40	35	30
		Destroyed	**Warhead Kill**	90	85	80	75	70	65	60	55	50
PAC 3	**10**	**Miss**	**Miss**	11	6	1	1	1	1	1	1	1
		Shaken	**Mission Kill**	40	35	30	25	20	15	10	5	2
		Damaged	**Warhead Kill**	60	55	50	45	40	35	30	25	20
		Crippled	**Warhead Kill**	80	75	70	65	60	55	50	45	40
		Destroyed	**Warhead Kill**	100	95	90	85	80	75	70	65	60
PAC 2	**0**	**Miss**	**Miss**	21	16	11	6	1	1	1	1	1
		Shaken	**Warhead Kill**	50	45	40	35	30	25	20	15	10
		Damaged	**Warhead Kill**	70	65	60	55	50	45	40	35	30
		Crippled	**Warhead Kill**	90	85	80	75	70	65	60	55	50
		Destroyed	**Warhead Kill**	100	100	100	95	90	85	80	75	70
Stinger	**0**	**Miss**	**Miss**	21	16	11	6	1	1	1	1	1
		Shaken	**Mission Kill**	50	45	40	35	30	25	20	15	10
		Damaged	**Warhead Kill**	70	65	60	55	50	45	40	35	30
		Crippled	**Warhead Kill**	90	85	80	75	70	65	60	55	50
		Destroyed	**Warhead Kill**	100	100	100	95	90	85	80	75	70
MP3 Gun	**-5**	**Miss**	**Miss**	26	21	16	11	6	1	1	1	1
		Shaken	**Warhead Kill**	55	50	45	40	35	30	25	20	15
		Damaged	**Warhead Kill**	75	70	65	60	55	50	45	40	35
		Crippled	**Warhead Kill**	95	90	85	80	75	70	65	60	55
		Destroyed	**Warhead Kill**	100	100	100	100	95	90	85	80	75

28.0 SEAD Table

28.0 SEAD Table										
			Attack Strength							
Attack Type	**Target**	**Effect (d100 result is =<)**	**0**	**2**	**4**	**5**	**6**	**7**	**8**
SEAD	**Any GBAD**	**No Effect**	1	1	1	1	1	1	1
		Light Damage. Blue GBAD must 'recover' for 1d5 Turns	41	39	37	36	35	34	33
		Moderate Damage. Blue GBAD must 'recover' for 1d10 Turns	71	69	67	66	65	64	63
		Server Damage. Roll on Operational Readiness-Degrade. Apply Immediately.	81	79	77	76	75	74	73
		Catastrophic Damage. Roll on Operational Readiness-NMC. Apply Immediately	91	89	87	86	85	84	83

29.0 Damage Table

29.0 Damage Table

Asset Type	Target Susceptibility	Effect (d10/2)	Attack Strength										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**20**
Capital Civilian	**1**	**1**	1	2	3	4	5	6	7	8	9	10	20
		2	2	3	4	5	6	7	8	9	10	11	21
		3	3	4	5	6	7	8	9	10	11	12	22
		4	4	5	6	7	8	9	10	11	12	13	23
		5	5	6	7	8	9	10	11	12	13	14	24
DSA Airbase Sea Port	**2**	**1**	0	1	2	3	4	5	6	7	8	9	19
		2	1	2	3	4	5	6	7	8	9	10	20
		3	2	3	4	5	6	7	8	9	10	11	21
		4	3	4	5	6	7	8	9	10	11	12	22
		5	4	5	6	7	8	9	10	11	12	13	23
Corps HQ Div HQ	**3**	**1**	0	0	1	2	3	4	5	6	7	8	18
		2	0	1	2	3	4	5	6	7	8	9	19
		3	1	2	3	4	5	6	7	8	9	10	20
		4	2	3	4	5	6	7	8	9	10	11	21
		5	3	4	5	6	7	8	9	10	11	12	22
	4	**1**	0	0	0	1	2	3	4	5	6	7	17
		2	0	0	1	2	3	4	5	6	7	8	18
		3	0	1	2	3	4	5	6	7	8	9	19
		4	1	2	3	4	5	6	7	8	9	10	20
		5	2	3	4	5	6	7	8	9	10	11	21
BCT	**5**	**1**	0	0	0	0	1	2	3	4	5	6	16
		2	0	0	0	1	2	3	4	5	6	7	17
		3	0	0	1	2	3	4	5	6	7	8	18
		4	0	1	2	3	4	5	6	7	8	9	19
		5	1	2	3	4	5	6	7	8	9	10	20

29.1 Critical Asset Damage Tracker

[29.1] Critical Asset Damage Tracker									
Maneuver Forces, Max HP: 6									
Critical Asset	Damage		Critical Asset	Damage		Critical Asset	Damage		
Corps HQ	Assessed OOOOOO Unassessed _____								
1 Div HQ (Purple)	Assessed OOOOOO Unassessed _____		2 Div HQ (Blue)	Assessed OOOOOO Unassessed _____		3 Div HQ (Brown)	Assessed OOOOOO Unassessed _____		
1 Div DSA (Purple)	Assessed OOOOOO Unassessed _____		2 Div DSA (Blue)	Assessed OOOOOO Unassessed _____		3 Div DSA (Brown)	Assessed OOOOOO Unassessed _____		
BCT, Max HP: N/A									
1-1 BCT (Purple)	Assessed _____ Unassessed _____		1-2 BCT (Blue)	Assessed _____ Unassessed _____		1-3 BCT (Brown)	Assessed _____ Unassessed _____		
2-1 BCT (Purple)	Assessed _____ Unassessed _____		2-2 BCT (Blue)	Assessed _____ Unassessed _____		2-3 BCT (Brown)	Assessed _____ Unassessed _____		
3-1 BCT (Purple)	Assessed _____ Unassessed _____		3-2 BCT (Blue)	Assessed _____ Unassessed _____		3-3 BCT (Brown)	Assessed _____ Unassessed _____		

[29.1] Critical Asset Damage Tracker								
Air Base, Max HP: 10								
Critical Asset	Damage		Critical Asset	Damage		Critical Asset	Damage
 Madison 17.03 Blue/Red	Assessed OOOOO OOOOO Unassessed _____		 Ironvale 14.27 Blue/Red	Assessed OOOOO OOOOO Unassessed _____		 Bernard 20.54 Blue/Red	Assessed OOOOO OOOOO Unassessed _____
 Mariot 59.04 Blue/Red	Assessed OOOOO OOOOO Unassessed _____		 Resurgent 58.27 Blue/Red	Assessed OOOOO OOOOO Unassessed _____		 Founding 48.52 Blue/Red	Assessed OOOOO OOOOO Unassessed _____
Sea Port, Max HP: 10							
 Bernard 24.55 Blue/Red	Assessed OOOOO OOOOO Unassessed _____		 Lee 39.49 Blue/Red	Assessed OOOOO OOOOO Unassessed _____		 Founding 45.52 Blue/Red	Assessed OOOOO OOOOO Unassessed _____
Capital, Max HP: 10							
 Bernard 24.55 Blue/Red	Assessed OOOOO OOOOO Unassessed _____					 Resurgent 56.23 Blue/Red	Assessed OOOOO OOOOO Unassessed _____

[29.1] Critical Asset Damage Tracker								
Civilian, Max HP: 5								
Critical Asset	Damage		Critical Asset	Damage		Critical Asset	Damage	
 Madison 15.01 Blue/Red	Assessed OOOOO Unassessed _____		 Unnamed 09.05 Blue/Red	Assessed OOOOO Unassessed _____		 Unnamed 12.14 Blue/Red	Assessed OOOOO Unassessed _____	
 Unnamed 26.18 Blue/Red	Assessed OOOOO Unassessed _____		 Unnamed 12.22 Blue/Red	Assessed OOOOO Unassessed _____		 Ironvale 11.29 Blue/Red	Assessed OOOOO Unassessed _____	
 Ironvale 10.31 Blue/Red	Assessed OOOOO Unassessed _____		 Ironvale 12.31 Blue/Red	Assessed OOOOO Unassessed _____		 Seban 00.34 Blue/Red	Assessed OOOOO Unassessed _____	
 Seban 01.36 Blue/Red	Assessed OOOOO Unassessed _____		 Lee 37.48 Blue/Red	Assessed OOOOO Unassessed _____		 Bernard 22.53 Blue/Red	Assessed OOOOO Unassessed _____	

[29.1] Critical Asset Damage Tracker								
Civilian, Max HP: 5								
Critical Asset	Damage		Critical Asset	Damage		Critical Asset	Damage	
 Carter 55.10 Blue/Red	Assessed OOOOO Unassessed _____		 Roma 44.12 Blue/Red	Assessed OOOOO Unassessed _____		 Resurgent 58.21 Blue/Red	Assessed OOOOO Unassessed _____	
 Resurgent 50.23 Blue/Red	Assessed OOOOO Unassessed _____		 Unnamed 43.23 Blue/Red	Assessed OOOOO Unassessed _____		 Resurgent 56.24 Blue/Red	Assessed OOOOO Unassessed _____	
 Resurgent 58.24 Blue/Red	Assessed OOOOO Unassessed _____		 Unnamed 44.27 Blue/Red	Assessed OOOOO Unassessed _____		 Resurgent 52.28 Blue/Red	Assessed OOOOO Unassessed _____	
 Unnamed 50.32 Blue/Red	Assessed OOOOO Unassessed _____		 Resurgent 58.32 Blue/Red	Assessed OOOOO Unassessed _____		 Unnamed 48.36 Blue/Red	Assessed OOOOO Unassessed _____	
 Unnamed 46.39 Blue/Red	Assessed OOOOO Unassessed _____		 Founding 46.51 Blue/Red	Assessed OOOOO Unassessed _____				

30.0 Operational Readiness

30.0 Operational Readiness Table					
Normal Operations		Degrade		NMC	
Roll	Effect	Roll	Effect	Roll	Effect
01-95	No Effect	01-50	System must take 'recover' action for next 1 hour	01-50	System must take 'recover' action for next 1d6 hours
96-100	Roll on Operational Degrade Table	51-90	System must take 'recover' action for next 1d3 hours	51-70	System must take 'recover' action for next 1d12 hours
		91-100	Roll on NMC Table	71-90	System must take 'recover' action for next 1d3 days
If Asset becomes Degraded/NMC due to daily OR roll, randomly determine time effect begins by rolling D100/4.				91-100	Remove System from play. Any assigned missiles, MSAs or Launchers maybe reassigned following normal movement rules.

31.0 Terrain Legend

31.0 Terrain Legend

Icon	Name	Elevation	MP Cost (Ground)	Radar Range Cost	CFIT	Special Effects
	Sea	-1	Impassible	1	None	
	Lowlands	0	1	1	None	
	Midlands	1	1	1	None	
	Midland Forest	1	2	2	Deck	
	Midland Hills	1	2	2 (Low) 1 (Med+)	Deck	Block LOS to Deck altitude band beyond this hex.
	Midland Forested Hills	1	3	2 (Low) 1 (Med+)	Deck	Block LOS to Deck altitude band beyond this hex.
	Mountain(s)	2	3	2 (Med) 1 (High+)	Low	Impassible to Aircraft at Deck Block LOS to Low and Deck altitude band beyond this hex.
	Populated Area, Light	Majority adjacent	2	1	Deck	
	Populated Area, Heavy	Majority adjacent	2	1	Deck	
	Populated Area, Heavy, Hills	Majority adjacent	3	2 (Low) 1 (Med+)	Deck	Block LOS to Deck altitude band beyond this hex.
	River	Same as Hex	+2	+0	-	
	Major Road	Same as Hex	1/3	+0	-	Useable in Friendly controlled territory
	International Boarder	Same as Hex	-	-	-	Unless otherwise noted, players control territory on their side of the boarder.

32.0 Air Movement

32.0 Air Movement				
Altitude Band	MP Cost (Air)	Radar Range Cost	CFIT	Special Effects
Deck	1 (+1 for first hex in activation)	-	Forests, Hills, Populated areas	Intervening Midland Forest, Midland Hills, Midland Forested Hills, or Mountains block LOS.
Low	1	-	Mountains Only	Intervening Mountains block LOS
Medium	1	-	-	
High	1	-	-	Half Range:0 Air to Ground Damage
Very High	1	1	-	Add 1 to all Range measurements. Range:0 attacks not possible.

33.0 Critical Assets

33.0 Critical Assets								
Icon	Name	Type	MP	MO &E	Susceptibility	HP	Red VP Mod.	Special Rules
XXX	Corps HQ	Area – Maneuver	4	4	3	6	x3	Provides Support if >50% HP and Emplaced
XX	Division HQ	Area – Maneuver	4	2	3	6	x2	Support Radius = 10 x remaining HP 1/2 support radius when March Ordered
XX DSA	DSA	Area – Maneuver	4	8	2	6	x2	Support Radius = 2 x remaining HP 1/2 support radius when March Ordered
X	BCT	Point – Maneuver	1/2 (1 MP every 2 hrs.)	-	5	-	x1	MP reduced per missing Support. 3/3 support: 1/2 MP 2/3 support: 1/4 MP 1/3 support: 1/6 MP
	Airbase	Fixed – Military	-	-	2	10	x3	Generates 1 Air Power Point for each HP remaining.
	Sea Port	Fixed – Military	-	-	2	10	x3	Generates 1 Sustainment Point for each HP remaining.
	Capital	Fixed – Geopolitical	-	-	1	10	x6	Red Civilian Critical Assets Victory Condition
	Civilian	Fixed – Geopolitical	-	-	1	5	x1	Red Civilian Critical Assets Victory Condition
	GBAD	Point-GBAD	See 34.1	See 34.1	-	SEAD	x0	

34.0 GBAD Assets

34.1 GBAD Assets

34.1 GBAD Assets					
System Name	Admin MP	March Order	Emplace	Notes	Points
Patriot BN HQ	7	7	7	Command and Control	20
Patriot BTY	7	7	7	Radar – Supports Patriot Interceptors Range: Deck: 13 hexes, Low-Very High: 34 hexes, TBM: 3 boxes Field of View (degrees): 120.	40
Patriot Launcher	7	7	7	MSL Load outs (Interceptors may not be mixed): PAC 2: 4, PAC 3: 16 (sets of 4), MSE: 12 (Sets of 2), or Mix PAC 3/MSE: 8/6 Must be in a hex containing a Patriot BTY or Patriot Remote Launch Site	PAC2: 20 PAC3: 40 MSE/Mix: 50
Patriot Remote Launch Site	7	7	7		10
Sentinel Radar	7	1	3	Radar Range: Deck-Very High: 8 hexes Field of View (degrees) 360 +5 to Avenger Lethality if target in FOV of Sentinel	10
Avenger	7	0	0	MSL Load out: 8 Stinger. 1 M3P gun Short Halt	10
Stinger Team	3	0	0	MSL Load out: 1 Stinger	2
THAAD BTY	7	24	24	TBM Only: 10 boxes	100
THAAD Launcher	7	7	7	MSL Load out: 8 Talon Must be in a hex containing a THAAD BTY	50
Missile Storage Area	3	6	6	May store any number and mixture of interceptors	5

34.2 GBAD Interceptors

34.2 GBAD Interceptors								
Interceptor	Targets	MP	Range	Altitude Bands	TBM Defense Radius	Lethality	Notes	Points (Missiles per 2 Sustainment Points)
Stinger	FW, RW, UAS	4	1	D, L	-	0	IR Guided	1 (8)
M3P .50 Gun	RW, UAS	-	0	D	-	-5		0
PAC-2	All	10	32	All	3	0	TVM Guided	2 (6)
PAC-3	All	10	32	All	3	10	Active Seeker	4 (4)
MSE	All	10	32	All	3	10	Active Seeker	5 (2)
Talon	TBM	-	TBM	All	Map	10	Active Seeker	10 (1)

34.3 Blue Pre-Built Forces

34.3 Blue Pre-Built Forces				
Force	Composition	Number	Cost/Unit	Total Cost
Avenger BN	Avenger BTY, NG	3	160	500
	Sentinel Section	1	20	
Avenger BTY	Avenger PLT	2	70	160
	Sentinel Radar	2	10	
Avenger PLT	Avenger	6	10	70
	Sentinel Radar	1	10	
Sentinel Section	Sentinel Radar	2	10	20
Patriot Composite BN	Patriot BTY – Firing Unit	4	200	980
	Avenger BTY	1	160	
	Patriot BN HQ	1	20	
Patriot BN, Pure	Patriot BTY – Firing Unit	4	200	820
	Patriot BN HQ	1	20	
Patriot BTY-Firing Unit	Patriot BTY	1	40	200
	Patriot Launcher, PAC-3	2	40	
	Patriot Launcher, PAC-2	4	20	
Patriot BTY-MEP	Patriot BTY	1	40	120
	Patriot Launcher, PAC-3	2	40	

35.0 Red Assets

35.1 FW

35.1 FW

Aircraft	Role	Tier	MP	Range	Altitude Bands	Surviv ability	Air to Air	Air to Ground	SEAD	Notes	Points
SU-35	Fighter	1	5	750	All	-20	12	S:7 R:0 S:4 R:4	S:6 R:10		52
MIG-21F	Fighter	4	3	200	All	5	3	S:1 R:0	-	Day Only	5
MIG-27	Ground Attack	2	3	300	All	-15	3	S:6 R:0 S:3 R:4	S:4 R:4		28
SU-25TM	Ground Attack	2	2	100	D, L, M, H	-15	3	S:9 R:0 S:6 R:2	S:8 R:10		34
SU-17	Ground Attack	4	4	300	D, L, M, H	-5	1	S:6 R:0 S:3 R:2			8
MIG-29	Multi-Role	2	4	300	All	-15	7	S:5 R:0 S:2 R:2	S:2 R:10		29
F-4	Multi-Role	3	3	280	All	-5	6	S:6 R:0	S:4 R:10	Recon 5	20
SU-24 MK	Multi-Role	3	4	188	All	-5	2	S:5 R:0	S:4 R:0	Terrain Following Recon 5 EW 2	23
TU-95	Strategic Bomber	3	1	1300	D, L, M, H	25	0	S:20 R:0		May launch up to 2x AS-4 or 10x AS-15. If so, TU-95 may not conduct an attack. Terrain Following	90
IL-18	Heavy Transport	3	1	800	L, M, H	30				Recon 5 ELINT/SIGNIT Transport: 122	30

35.2 RW											
Aircraft	Role	Tier	MP	Range	Altitude Bands	Survivability	Air to Air	Air to Ground	SEAD	Notes	Points
Mi-28 HAVOC	RW Attack	1	2	95	D, L, M	-15	2	S:5 R:0 S:4 R:2			14
Ka-52 HOKUM	RW Attack	1	2	100	D, L, M	-10	2	S:5 R:0 S:4 R:2			11
Mi-35M2 HIND	RW Attack	2	2	90	D, L, M	-10	3	S:4 R:0 S:3 R:2		Transport: 8	11
Mi-24 HIND-F	RW Attack	3	2	90	D, L	-5	3	S:4 R:0 S:3 R:2		Transport: 8	8
Mi-17-V7	RW Multi-Role	1	2	135	D, L, M	-10	2	S:4 R:0 S:2 R:2		Transport: 36	12
Mi-8 HIP-E	RW Multi-Role	3	2	138	D, L	-5	2	S:3 R:0 S:2 R:2		Transport: 12 EW 1	12
Mi-2 HOPLITE	RW Multi-Role	4	1	34	D, L	0	0	S:2 R:0		Day Only Recon 2	3
Mi-26	RW Transport	2	2	160	D, L	0	0	0		Transport: 80	10

35.3 UAS											
Aircraft	Role	Tier	MP	Range	Altitude Bands	Survivability	Air to Air	Air to Ground	SEAD	Notes	Points
Hermes 900	UAS Long Range	1	1	936	L, M, H, VH	-5	0	S:1 R:0		Recon 3 ELINT LOW RCS Spotter 3 Airfield Launched	20
Hermes 450	UAS Long Range	2	1	80	D, L, M, H	0	0	S:1 R:0		Recon 2 Airfield Launched	4
Mohadjer 4B	UAS Tactical	1	1	30	D, L	-5	0	S:0 R: 0		Field Launched Recon 1 Spotter 1	6
Shmel-I	UAS Tactical	2	1	20	D, L	5	0	S:0 R:0		Recon 0 Field Launched	4
Spylite	UAS Man-Portable	1	1/2	10	D, L, M, H	10	0	S:0 R:0		Low RCS 2 Recon 0 Spotter Preprogramed	3
Harpy	UAS ARM Attack	2	2	200	D, L	0	0	S:1 R:0	S:2 R:0	Ground Launched Preprogrammed One Use Only Launcher: Inventory: 16 Harpy Launch/activation: 1 Emplacement: 1 MP. Reload: 40 mins. Cost: 10 Points	2

35.4 CM

35.4 CM Launcher											
Aircraft	Role	Tier	MP	Range	Altitude Bands	Surviv ability	Payload	Ready time	MSLs / ea.	Reload time	Notes	Points
Delilah	LACM	1	5	50	D, L, M	-20	S: 2	30 mins	2	40 mins	Ground Launched	24
R-500	LACM	1	2	20	D	-5	S:3	15 mins	2	40 mins	Ground Launched Multi-Mission – May launch SS-26 Iskander-M or R-500	40
BrahMos	ASCM	1	6	60	D, L, M, H	-20	S: 3	15 mins	2	40 mins	Ground Launched	26
AS-4	ASCM	4	9	80	L, M, H	0	S: 9	-	10	-	Air Launched	See TU-95
AS-15	LACM	3	1	700	D, L, M, H	0	S: 4	-	4	-	Air Launched	See TU-95

35.5 TBM

35.5 TBM Launcher										
Aircraft	Role	Tier	Range	Target Type	Surviv ability	Payload	Ready Time	MSLs / ea.	Reload time	Notes	Points
Shahab-3B	MRBM	2	400	Fixed, Area	-10	S: 5	1 hr.	1	1 hr.	Ground Launched Fixed Launcher	15
No Dong-1	MRBM	3	260	Fixed	0	S: 7	1 hr.	1	1 hr.	Ground Launched Fixed Launcher Highly Inaccurate	12
SS-26 Iskander-M	SRBM	1	80	Fixed, Area, Point	-20	S: 7	15 mins	2	40 mins	Ground Launched Arm Warhead Integrated 1 MSL launch/ activation. Multi-Mission – May launch SS-26 Iskander-M or R-500	40
CSS-6	SRBM	3	120	Fixed, Area	0	S: 6	1 hr.	1	1 hr.	Ground Launched Inaccurate	8
CSS-7	SRBM	3	60	Fixed, Area	0	S: 8	1 hr.	1	1 hr.	Ground Launched	10
SCUD-B	SRBM	4	60	Fixed	5	S: 10	1 hr.	1	1 hr.	Ground Launched Fixed Launcher Inaccurate	10
SCUD-C	SRBM	4	100	Fixed, Area	5	S: 7	1 hr.	1	1 hr.	Ground Launched Fixed Launcher Inaccurate	10
SS-21 M3	CRBM	2	24	Fixed, Area, Point	-10	S: 5	15 mins	1	40 mins	Ground Launched Integrated	16
CSS-8	CRBM	3	30	Fixed, Area	0	S: 2	15 mins	1	40 mins	Ground Launched	7

35.6 Red Pre-Built Forces

35.5 TBM Launcher										
Aircraft	Role	Tier	Range	Target Type	Surviv ability	Payload	Ready Time	MSLs / ea.	Reload time	Notes	Points
Shahab-3B	MRBM	2	400	Fixed, Area	-10	S: 5	1 hr.	1	1 hr.	Ground Launched Fixed Launcher	15
No Dong-1	MRBM	3	260	Fixed	0	S: 7	1 hr.	1	1 hr.	Ground Launched Fixed Launcher Highly Inaccurate	12
SS-26 Iskander-M	SRBM	1	80	Fixed, Area, Point	-20	S: 7	15 mins	2	40 mins	Ground Launched Arm Warhead Integrated 1 MSL launch/ activation. Multi-Mission – May launch SS-26 Iskander-M or R-500	40
CSS-6	SRBM	3	120	Fixed, Area	0	S: 6	1 hr.	1	1 hr.	Ground Launched Inaccurate	8
CSS-7	SRBM	3	60	Fixed, Area	0	S: 8	1 hr.	1	1 hr.	Ground Launched	10
SCUD-B	SRBM	4	60	Fixed	5	S: 10	1 hr.	1	1 hr.	Ground Launched Fixed Launcher Inaccurate	10
SCUD-C	SRBM	4	100	Fixed, Area	5	S: 7	1 hr.	1	1 hr.	Ground Launched Fixed Launcher Inaccurate	10
SS-21 M3	CRBM	2	24	Fixed, Area, Point	-10	S: 5	15 mins	1	40 mins	Ground Launched Integrated	16
CSS-8	CRBM	3	30	Fixed, Area	0	S: 2	15 mins	1	40 mins	Ground Launched	7

[37.1.1] Thunder Run – Blue JTF Commander's Guidance

1) Situation: Red Leader has continued to defy the international community. To restore international order and once more allow free elections in Redland, Red Leader must be removed.
   a) Enemy Forces
      i) Ground: A Division sized element of Redland ground forces have established a defense of Resurgent. Three BNs have formed disruption zones vic 43.23, 47.33 and 51.36. Three BDE sized elements have formed a main defensive line vic 48.24, 52.80 and 58.33.
      ii) Air: Redland Air forces have dispersed to airbases vic 59.04, 58.27 and 48.52. Redland Missile forces have dispersed from garrison to bases of operations throughout Redland.
      iii) MLCOA: Redland ground forces will concede most of Redland and conduct an area defense of the approaches into Resurgent. Red Air and Missile forces will seek to support ground forces by delaying Blue maneuver forces through direct and indirect attack.
2) Mission: JTF Skies seizes Resurgent Capital and key infrastructure NLT D+5 IOT remove Red Leader and restore international order.
3) Execution
   a) CDR Intent
      i) Purpose: Rapid seizure of key locations in the Redland capital will remove Red Leader's center of gravity and allow swift restoration of international order and allow Redland to hold democratic elections.
      ii) Key Task: Seizure of Red Leader Critical Vulnerabilities.
      iii) Endstate: Blue forces hold key objectives within Resurgent and prepared to conduct stability operations, damage to civilian infrastructure is minimized, and Redland air forces are unable to effect JTF operations.
   b) Tasks
      i) JFLCC (ME) – Victory Conditions
         (1) Seize Resurgent Capital at 56.23
         (2) Seize Resurgent AB at 58.27
         (3) Seize Key Industrial complex at 58.32
   c) Coordinating Instructions
      i) No friendly forces East of International Boundary before D+0

CAL	Hex	Criticality
Ironvale AB (JTF HQ)	14.27	10
Madison AB	16.03	8
Bernard AB	22.54	8
Bernard Port	24.55	6
Lee Port	39.49	6

[37.1.2] Thunder Run – Red JTF Commander's Guidance

1) Situation: The international community continues to threaten our sovereignty by threating Red Leader. Coalition forces lead by Blueland have begun to buildup combat power along the international boarder threating our capital of Resurgent. Blueland has a weak coalition and operations beyond D+5 may become problematic.
   a) Enemy Forces
      i) Ground: Blueland has deployed a Corps and three divisions along the international boundary and are preparing for offensive operations into Redland.
      ii) Air: Blueland Air forces have deployed to airbases vic 17.03, 14.27 and 20.54.
      iii) MLCOA: Blueland ground forces will move quickly to occupy Resurgent utilizing the flatlands to the west and southwest of the city. Blue air will focus on defense of maneuver forces to enable rapid movement.
2) Mission: Delay Blueland forces from occupying Resurgent until D+6 IOT allow international pressure to force their withdrawal.
3) Execution:
   a) CDR Intent
      i) Purpose: Delaying Blue occupation of the city will degrade international support and allow end of hostilities on favorable terms enabling Red Leader to continue his rule.
      ii) Key Task:
         (1) Delay Blueland forces via degradation of BCTs and supporting maneuver forces
         (2) Disrupt sustainment capability by targeting Sea Ports vic Bernard and Lee
         (3) Gain and maintain air superiority
      iii) Endstate: Red forces hold Resurgent and are prepared for further defense. Blue forces culminate before entering the capital and Red Leader remains in power.
   b) Tasks
      i) JFLCC (ME)
         (1) Defend Resurgent
         (2) Deploy 3 BDE sized elements to defend the approaches vic 48.24, 52.80, and 58.33
         (3) Deploy 3 BN sized elements to form a disruption zone vic 43.23,47.33 and 51.36.
      ii) JFACC (SE)
         (1) Delay Blueland ground forces
         (2) Disrupt key sustainment capability
         (3) Gain and maintain air superiority
   c) Coordinating Instructions
      i) All Victory conditions are authorized.

[37.2.1] International Boarder – Blue JTF Commander's Guidance

1) Situation: Redland has invaded the eastern portions (west of 21.XX) of its neighbor of Yellowland in order to seize key industry and natural resources claiming protection of ethnic Redlandians in the region. Yellowland has called on the international community to restore the boarder.
   a) Enemy Forces
      i) Ground: A Div. sized element of Redland ground forces have established a defensive belt in occupied territory between Ironvale and the International Boarder (I.B.). Three BNs have formed disruption zones vic 26.05, 25.27 and 31.47. Three BDE sized elements have formed a main defensive line vic 33.06, 35.26 and 37.48.
      ii) Air: Redland Air forces have dispersed to airbases vic 59.04, 58.27 and 48.52. Redland Missile forces have dispersed from garrison to bases of operations throughout Redland and occupied territories.
      iii) MLCOA: Redland ground forces will utilize the restricted terrain in the north of our AO to allow concentration of forces in the south. Red Air and Missile forces will seek deter further international involvement by targeting coalition ground forces and select geo-political assets.
   b) Civilian: Yellowland resolve is wavering in light of the invasions, protection of remaining civilian infrastructure is critical.
2) Mission: JTF Skies seize key terrain along the I.B. NLT D+5 IOT restore regional stability.
3) Execution
   a) CDR Intent
      i) Purpose: Seizure of key locations along the I.B. boarder will force the withdrawal of Redland forces, show our resolve, and restore Yellowland sovereignty.
      ii) Key Task: Seizure of Key terrain along the Yellowland boarder
      iii) Endstate: Blue forces hold key objectives within Yellowland and prepared to continue the attack, damage to civilian infrastructure is minimized, and Redland forces have withdrawn from Yellowland.
   b) Tasks
      i) JFLCC (ME) – Victory Conditions
         (1) Secure the International Boarder with at least two BCTs occupying I. B. hexes between
            (a) 39.00 to 39.14
            (b) 39.24 to 41.33
            (c) 42.40 to 45.50
   c) Coordinating Instructions
      i) No friendly forces East of 22.XX before D+0
      ii) Blue ground forces are not authorized to cross the I.B.

CAL	Hex	Criticality
Ironvale AB (JTF HQ)	14.27	10
Madison AB	16.03	8
Bernard AB	22.54	8
Corps HQ	TBP	8
Bernard Capital	22.52	4

[37.2.2] International Boarder – Red JTF Commander's Guidance

1) Situation: Redland forces have liberated oppressed ethnic Redlandians regions of Yellowland after years of repression. The international community has deployed to Yellowland and called our withdrawal.
   a) Enemy Forces
      i) Ground: Blueland has deployed a Corps and three divisions behind the 20.xx demarcation line and are preparing for offensive operations into Redland.
      ii) Air: Blueland Air forces have deployed to airbases vic 17.03, 14.27 and 20.54.
      iii) MLCOA: Blueland will attack along a board front driving towards the old international boarder (I.B.) in the North (Vic. 39.10), Central (vic. 40.30) and South (vic 43.45) in an attempt to return ethnic Redlandian populations to Yellowland, attack into Redland and overthrow Red Leader.
   b) Civilian: Yellowland resolve is wavering, destruction of remaining civilian infrastructure could force them to rescind control of former West Redland.
2) Mission: Retain control of West Redland between 20.xx and the I.B.
   a) CDR Intent
      i) Purpose: Retaining control of West Redland will reinforce our claim on our former territory and ensure the unity of ethnic Redlandians.
      ii) Key Task:
         (1) Gain and Maintain air superiority
         (2) Delay Blueland forces via degradation of BCTs, supporting maneuver forces and sustainment capabilities.
         (3) Degrade Yellowland resolve though the destruction of remaining infrastructure.
      ii) Endstate: Redland forces hold West Redland and are prepared to repel future attacks, Blue forces are denied access to the I.B. region, and Yellowland has conceded control of the area.
   b) Tasks
      i) JFLCC (SE)
         (1) Defend West Redland between 20.XX and the I.B.
         (2) Deploy 3 BDE sized elements to defend Redland along the I.B.
         (3) Deploy 3 BN sized elements to form a disruption zone between 20.XX and 32. XX.
      ii) JFACC (ME)
         (1) Gain and Maintain air superiority
         (2) Delay Blueland forces via degradation of BCTs, supporting maneuver forces and sustainment capabilities.
         (3) Degrade Yellowland resolve though the destruction of remaining infrastructure.
   c) Coordinating Instructions
      i) All Victory conditions are authorized.

[37.3.1] Joint Force Entry – Blue JTF Commander's Guidance

4) Situation: Redland has invaded and seized control of its neighbor of Yellowland in order to gain regional hegemony by claiming Redlandian nationalization. Yellowland has called on the international community for support. Blueland forces have recently conducted Joint Force Entry by seizing the Yellowland capital of Bernard and are preparing to expansion of the lodgment.
   a) Enemy Forces
      i) Ground: A Div. sized element of Redland ground forces have established a defensive belt in occupied territory. 2 BDEs have formed a defense along the southern approaches to Ironvale and Seban vic 14.33 and 03.36 and 1 BDE has formed a hasty defense of the port towns of Lee and Founding vic 37.48. Three BNs have formed disruption zones vic 15.40, 12.42 and 30.41.
      ii) Air: Redland Air forces have dispersed to airbases vic 59.04, 58.27, 48.52, 17.03 (1 HP), and 14.27 (1 HP). Redland Missile forces have dispersed from garrison to bases of operations throughout Redland and occupied territories.
      iii) MLCOA: Redland ground forces will conduct area defense along lines of communication to Ironvale and Lee. Red Air and Missile forces will seek disrupt expansion by targeting the beachhead.
   b) Civilian: The occupation of Yellowland has led to civilian uprisings. It is unlikely that further targeting of civilian infrastructure will be effective (Civilian Critical Assets Red Victory Condition does not apply).
5) Mission: NLT D+10, JTF Skies seize sea ports vic Lee and Foundings and the city of Ironvale IOT expand lodgment and set conditions for Yellowland liberation.
6) Execution
   a) CDR Intent
      i) Purpose: Seizure of Lee, Foundings and Ironvale will enable flow of follow-on forces and provide a staging area for future operations.
      ii) Key Task: Expansion of Lodgment by seizing APODs and SPODs.
      iii) Endstate: Blue forces hold key objectives within Yellowland and prepared to continue the attack, civilian control is reestablished, and Redland forces are unable to counterattack.
   b) Tasks
      i) JFLCC (ME) – Victory Conditions
         (a) Seize Foundings 46.51
         (b) Seize Lee Port 39.49
         (c) Seize Ironvale 12.29
   c) Coordinating Instructions
      i) No friendly forces further than 4 hexes of Bernard AB (22.54) or Sea Port (24.55) before D+0.
      ii) Blueland Amphibious Task Force and Carrier Strike Group is on station maintaining Air Neutrality. (Air Superiority Track fixed a 0 until D+10).
      iii) Blue may exchange 2 Air power points for 1 sustainment point.

CAL	Hex	Criticality
JTF HQ	20.54	10
Bernard Port	24.55	10
Bernard AB	22.54	8
Corps HQ (JFLCC)	TBP	8
Division HQs and DSAs	TBP	4

[37.3.2] Joint Force Entry – Red JTF Commander's Guidance

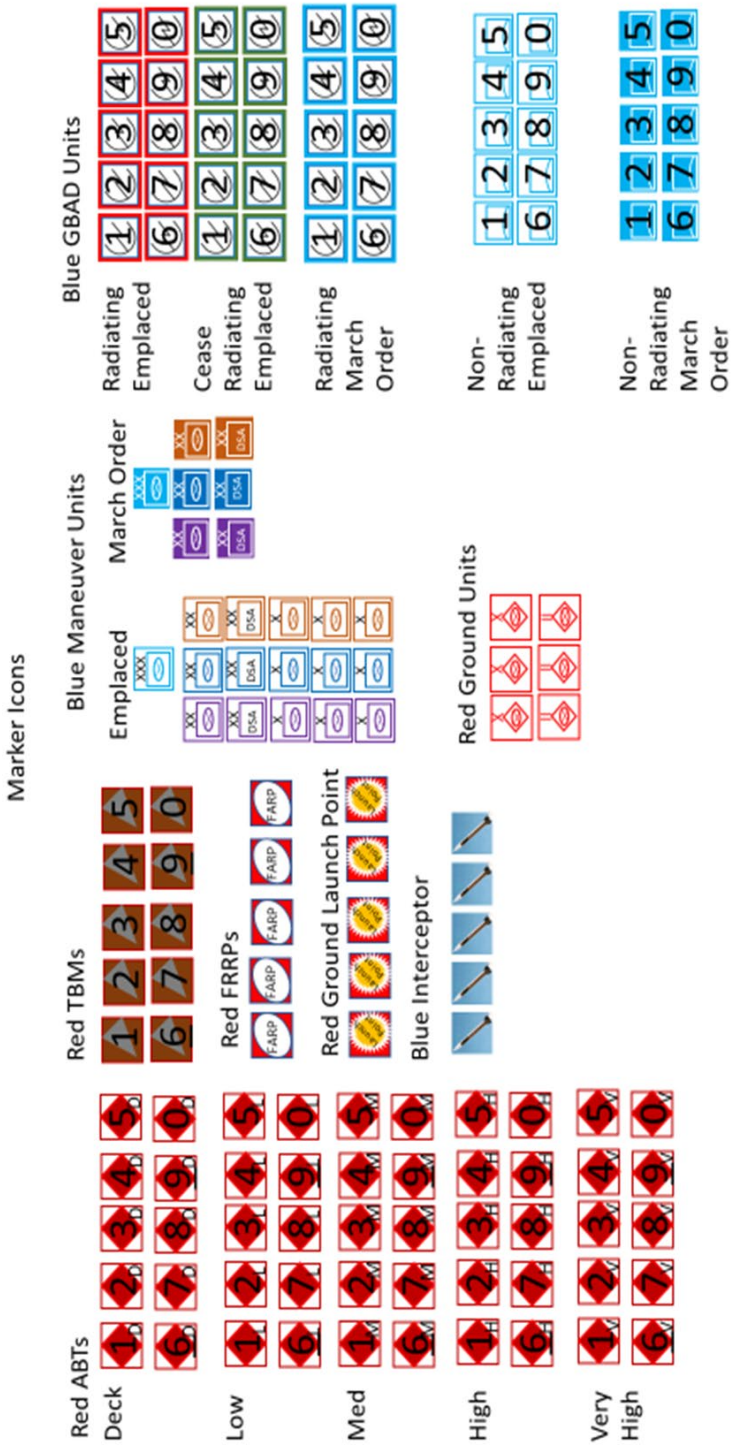
3) Situation: Redland forces have liberated oppressed ethnic Redlandians within Yellowland and is once again the regional hegemony. The international community has seized the former Yellowland Capital and calling for our withdrawal from Yellowland.
   a) Enemy Forces
      i) Ground: Blueland has conducted Joint Force Entry vic Bernard (22.54) and deployed a Corps and three divisions. They are preparing for offensive operations into Redland.
      ii) Air: Blueland Air forces have deployed to airbases 22.54 and have an Amphibious Task Force and Carrier Strike Group offshore maintaining air neutrality. (Air Superiority Tracker fixed at 0 until D+10).
      iii) MLCOA: Blueland will attack along lines of communication towards APODs and SPODs vic Lee, Foundings and Ironvale.
   b) Civilian: Remaining Yellowlandians have begun to resist our presence. It is unlikely that further targeting of civilian infrastructure will be effective (Civilian Critical Assets Red Victory Condition does not apply).
4) Mission: Destroy JTF Skies beachhead vic Bernard IOT secure Redland territory.
   a) CDR Intent
      i) Purpose: Destruction of JTF Skies and their beachhead will prevent further incursions and force the international community to respect Redland regional dominance.
      iii) Key Task:
         (1) Gain and Maintain air superiority.
         (2) Neutralize Airbases and Sea Ports supporting JTF Skies.
         (3) Neutralize JTF Skies ground forces.
      ii) Endstate: Redland forces hold Lee, Foundings and Ironvale and are prepared to counterattack into Bernard, Blue forces are denied access to Bernard LOCs, and Yellowland has conceded control of the region.
   b) Tasks
      i) JFLCC (SE)
         (1) Defend approaches to Ironvale, Lee and Foundings. 2 BDEs have formed a defense along the southern approaches to Ironvale and Seban vic 14.33 and 03.36 and 1 BDE has formed a hasty defense of the port towns of Lee and Founding vic 37.48. Three BNs have formed disruption zones vic 15.40, 12.42 and 30.41.
         (2) Deploy 2 BDE sized elements to defend Ironvale and Seban vic 14.33 and 03.36.
         (3) Deploy 1 BDE sized element to defend Lee and Foundings vic 37.48.
         (4) Deploy 3 BN sized elements to form a disruption zone vic 15.40, 12.42 and 30.41.
      ii) JFACC (ME)
         (1) Gain and Maintain air superiority
         (2) Delay Blueland forces via degradation of BCTs, supporting maneuver forces and sustainment capabilities.
         (3) Degrade Yellowland resolve though the destruction of remaining infrastructure.
   c) Coordinating Instructions
      i) Civilian Critical Assets Victory Condition is not authorized

		[38.0] Blue SAMSTAT							DTG	
Air Superioirty Level	___								______	Current
									______	Blue Strike Time
Unit		Radiate	Missiles	Current Location	PTL	Status	ETRO	Proposed Location	PTL	Defended Assets
Type	Icon									
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				
		Y / N	0000 0000 __________ 0000 0000			FMC NMC				

[39.0] Red ATO								Air Superioirty	
Unit		Status	Status	ETRO	MSL/ Attacks	Mission			_____
Type	Icon							Windows	
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	1	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	2	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	3	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	4	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	5	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	Score Day	Points
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	1	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	2	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	3	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	4	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	5	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	6	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	7	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	8	_____
		Ready Reload Hide	Damaged Crippled			O OCA O DCA	O CAS O AI O SEAD	Total	

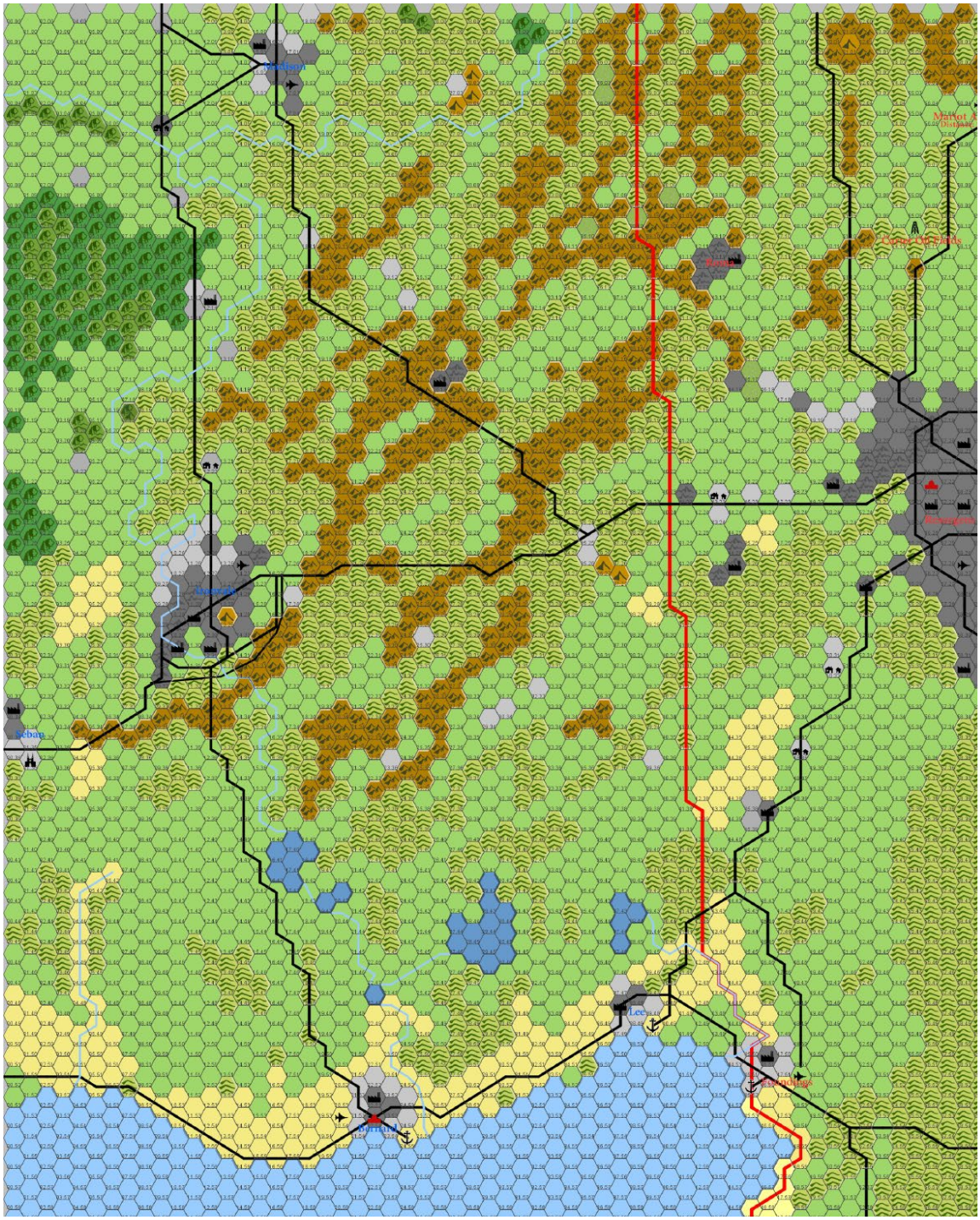
APPENDIX D

ACCESSORIES



APPENDIX E

MAP



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