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To credibly retain airborne forcible entry as an employment option in non-permissive environments, the US military must apply the valuable lessons learned in Operations HUSKY and OVERLORD concerning planning for and commanding airborne forces, setting conditions for a joint forcible entry operation (JFEO), and overcoming friction. Although current service and joint doctrine reflect elements of these historical lessons, the joint force must strive to find innovative solutions to overcome the challenge of mitigating the vulnerability to modern A2AD systems by prioritizing realistic, combined training and further developing joint Army and Air Force airborne doctrine.

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Joint Forcible Entry in a Non-Permissive Environment:
Applying Operations HUSKY and OVERLORD to Airborne Operations in 2035

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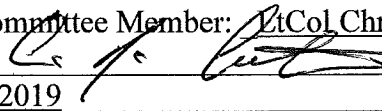
Approved: 
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Executive Summary

Title: Joint Forcible Entry in a Non-Permissive Environment: Applying Operations HUSKY and OVERLORD to Airborne Operations in 2035

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Thesis: To credibly retain airborne forcible entry as an employment option in non-permissive environments, the US military must apply the valuable lessons learned in Operations HUSKY and OVERLORD concerning planning for and commanding airborne forces, setting conditions for a joint forcible entry operation (JFEO), and overcoming friction. Although current service and joint doctrine reflect elements of these historical lessons, the joint force must strive to find innovative solutions to overcome the challenge of mitigating the vulnerability to modern A2AD systems by prioritizing realistic, combined training and further developing joint Army and Air Force airborne doctrine.

Discussion: Throughout history, the ability for a military to gain access to, seize, and control hostile territory forms the foundation of successful operations to enforce national policy and deter an attack on the homeland. The rise of peer adversaries with advanced anti-access and area denial (A2AD) capabilities threaten operational access for the United States and produce possible situations requiring JFEO in a non-permissive environment resulting in the overall threat to airborne forces rivaled only by that of operations in World War II. Considering Operations HUSKY and OVERLORD, the Allied airborne forces progressed significantly in planning for and commanding airborne forces, excelled at setting conditions for airborne operations, and consistently struggled to overcome friction. Through an analysis of these two operations, nine distinct lessons or requirements for airborne operations become apparent. Regarding planning for and commanding airborne forces, successful operations require unity of command, extensive coordination, proper objective area location, and mitigation of inherent risk. Surprise and air superiority constitute the two critical elements of setting the conditions for successful entry operations. To overcome friction, planners and commanders must consider the effect of the enemy and environmental conditions, prepare airborne forces with combined and realistic training, and utilize available technology.

Conclusion: After applying the lessons from Operations HUSKY and OVERLORD as incorporated in current doctrine to the JFEO 2035 scenario, the most significant deficiency for the joint force is setting the conditions for the entry operation due to the capabilities of modern A2AD systems coupled with the vulnerabilities of the airborne force. The United States must synchronize efforts across all instruments of national power to oppose these A2AD strategies. This focus does not discount the lethality of A2AD weapons systems. Rather, airborne planners must consider all aspects of an adversary's A2AD strategy to exploit vulnerabilities and develop operational plans in accordance with current military strategy and national policy. Presently, the United States must persistently conduct shaping operations to set the conditions of surprise and local superiority for possible JFEO. The likely temporary nature of this superiority requires the US military to maintain constant readiness by prioritizing realistic, combined training and developing *joint* Army and Air Force airborne doctrine focusing on the *joint* problem of airborne forcible entry operations, rather than air or ground force-specific issues.

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THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Preface

My interest in airborne forcible entry began as a C-17 pilot participating in airborne exercises and further developed at the United States Air Force Weapons School. As a requirement of that course, I authored a joint paper with a C-130 student on the tactical evolution of joint forcible entry focusing on C-17 and C-130 integration and the simultaneous use of multiple drop zones to support envelopment of an objective. Aware of the problems encountered in past airborne operations, such as URGENT FURY and JUST CAUSE, and the issues that occur in airborne exercises, I chose to expand my forcible entry perspective to the operational level. As the 2018 NSS and NDS describe, the US military must address the challenge of competition between major powers, especially concerning access. Therefore, I decided to examine airborne forcible entry operations in a non-permissive environment. World War II presented the last examples of US airborne forces operating in high threat locations. Specifically, Operations HUSKY and OVERLORD employed large airborne components and provide lessons that are evident in today's doctrine. To apply these lessons from World War II to future operations, I researched future war trends and current anti-access and area denial (A2AD) weapons to provide a fictional scenario that illustrates the challenges of airborne operations against a peer adversary. Operations HUSKY and OVERLORD provide valuable guidance that correlates to future airborne employment in a non-permissive environment.

I would like to thank Dr. Paul Gelpi for his time and guidance in completing this paper. His initial inspiration and continual assistance enabled the project's overall concept, extending lessons from past operations to a realistic future scenario.

I would also like to thank my wife, Leslieanne, and my three children for allowing me the time to complete this thesis through their constant support and understanding.

Introduction

Throughout history from the Peloponnesian War to World War II and today, the ability for a military to gain access to, seize, and control hostile territory forms the foundation of successful operations to enforce national policy and deter an attack on the homeland. Current US joint doctrine echoes this sentiment: "[t]o be credible both as a deterrent and as a viable military option for policy enforcement, the Armed Forces of the United States must be capable of deploying and fighting to gain access to geographical areas controlled by forces hostile to US interests."[1] The United States retains four primary capabilities for forcible entry: amphibious assault, airborne assault, air assault, and ground assault. Each of these capabilities possess inherent strengths and limitations. Access and speed are two attributes that define air operations, which allow airborne and air assault forces to respond on short-notice and mass quickly from a distance to achieve operational and tactical surprise.[2] Aircraft may reach any location on Earth while bypassing terrain and hostile threats that would prevent entry by amphibious and ground forces. Additionally, the range of fixed-wing airlift assets, such as the C-130 or C-17, enable airborne forces to launch from considerable distances from their targets. However, airborne forces also have inherent limitations of small payload, vulnerability to modern air defense systems, limited combat strength of their ground forces, and complexity of joint airborne operations.

These limitations produced difficulties in past airborne joint forcible entry operations (JFEO) in semi-permissive environments, such as Operations URGENT FURY and JUST CAUSE. The rise of peer adversaries with advanced anti-access and area denial (A2AD) capabilities produce possible situations requiring JFEO in a non-permissive environment resulting in the overall threat to airborne forces rivaled only by that of operations in World War

II. To credibly retain airborne forcible entry as an employment option in non-permissive environments, the US military must apply the valuable lessons learned in Operations HUSKY and OVERLORD concerning planning for and commanding airborne forces, setting conditions for a JFEO, and overcoming friction. Although current service and joint doctrine reflect elements of these historical lessons, the joint force must strive to find innovative solutions to overcome the challenge of mitigating the vulnerability to modern A2AD systems by prioritizing realistic, combined training and further developing joint Army and Air Force airborne doctrine. The following fictional scenario for a JFEO in 2035 emphasizes the challenges for airborne employment in a non-permissive environment and illuminates the necessity to examine the airborne components of Operations HUSKY and OVERLORD. By applying the historical lessons to the challenges of a future JFEO, the joint force may derive solutions and identify deficiencies for airborne operations in a non-permissive environment.

JFEO 2035: Responding to a Direct Challenge from a Peer Adversary

This description of events represents a potential operating environment for a future airborne operation in a non-permissive environment against a peer adversary. The purpose of the scenario is not to determine the probability or the exact cause of a major conflict but to highlight obstacles and challenges that the US military must address to maintain the forcible entry capability of airborne assault. Within the scenario and subsequent analysis, three significant assumptions apply. First, the weapons available to nations in 2035 will be similar to those today with increased emphasis on space and cyber capabilities. Second, even though A2AD systems will become more integrated with advanced early warning capabilities and long-range missiles, the entry force will be able to identify and exploit weaknesses in the individual systems. Third, the United States and the adversary nation will ensure the conflict does not escalate to nuclear

war. Appendix A contains a detailed explanation of the assumptions and specific examples of individual components of A2AD systems.

After a drop in oil prices in 2030, a worldwide economic recession ensued. The reduced US military budget combined with continuing global operations and a greying population resulted in difficult funding decisions, reminiscent of the budget situation in the early 2010s. This significantly impacted readiness for a peer-to-peer conflict. Around the world, authoritarian regimes, especially those with a middle-class accustomed to continuous economic growth for the past thirty years, began to experience internal dissension. Additionally, the increasing unemployment of these predominantly male societies coupled with recent military expansion, which consumed an expanding portion of the national budget, evolved into a climate ripe for government-inspired, nationalist movements and external expansion to distract from the current domestic conditions.

In 2032, under the guise of historic territorial rights and self-defense, a peer competitor of the United States began occupying adjacent, disputed territories. The adversary nation expanded military presence to defend its recent investments in oil and natural gas infrastructure in the region. Also, the area contained increased fishing opportunities and vital sea-lanes for its maritime industry. Late in 2032, the nation began militarily enforcing the exclusive economic zone (EEZ) and air defense identification zone (ADIZ) around its newly acquired territory. In response, the United States and several partner nations intensified sea and air freedom of navigation operations in the region leading to several tense standoffs between military forces. In the enforcement of the EEZ, the authoritarian nation sank several fishing vessels from nations with claims of land rights in the region. This violence did not escalate due to the military power imbalance between these nations.

With persisting domestic unrest continuing into 2034, the authoritarian government proceeded to remove its rivals' military bases in the region forcefully. Again, the regime used self-defense as justification. The international community responded with condemnation and sanctions, which further exacerbated the economic struggle of the authoritarian regime desperate to maintain its grasp on power. With permanent foreign presence removed from the region, the adversary nation consolidated and reinforced its new borders and intensified EEZ and ADIZ enforcement efforts, eventually restricting shipping through the area. The closure of this vital international shipping route decreased oil transportation to the United States and several of its allies. As 2035 approached, the US military increased freedom of navigation operations and commenced a military build-up in the region with the expectation that this would result in a peaceful reopening of the shipping lanes.

In January 2035, the authoritarian regime faced a deteriorating domestic situation and was on the verge of losing power. As one last effort to solidify the nationalist agenda, the authoritarian nation conducted a "preemptive, defensive strike" against the United States by sinking a US Navy destroyer on a freedom of navigation mission. The regime based this calculated decision on striking before the United States completed the military build-up with the belief that the American government and people would cower at such a significant loss of life and not risk losing more Americans over a foreign dispute. With the peer adversary's military expansion over the past forty years, the regime relied on their complex A2AD system to increase the risk to attacking forces above the American tolerance for loss of life. The unacceptable violence forced the United States to retaliate. Inaction would undoubtedly lead to a loss of US credibility and a complete restructuring of the international order. Consequently, the President of the United States ordered the Department of Defense to begin planning offensive operations,

including an airborne JFEO to eliminate ground-based anti-ship cruise missiles (ASCM) and secure an airfield for the positioning of force protection assets, such as Patriot and Terminal High-Altitude Area Defense (THAAD) missile systems.

Considering this scenario and the predictions of the future A2AD threat environment, several challenges to airborne operations emerge. Integrated air defense systems present a significant threat that could prevent the airlift formation from reaching the objective area. Additionally, the increased range and precision of ballistic missile systems create an extreme risk for airborne forces on the ground. The ability of adversaries to interrupt communications necessary for command and control and navigation presents a vulnerability due to the current reliance on technology. Airborne operations in World War II experienced many similar challenges regarding surface-to-air threats, risks to airborne troops on the ground, command and control issues, and navigation problems.

Historical Examples of JFEO in a Non-Permissive Environment

During World War II, the United States conducted multiple forcible entry operations to secure lodgments and enable follow-on operations in Africa, Europe, and the Pacific. By 1943, the Allies secured a foothold in North Africa. During Operation TORCH and subsequent operations on the continent, the Allies conducted four airborne assault missions. These missions proved that troop carrier aircraft could accurately drop forces during daylight missions and the airborne force could successfully attack lightly defended objectives. However, these missions also demonstrated two weaknesses of airborne forces. Without vehicles, airborne forces lacked mobility once on the ground. Additionally, they lacked firepower, which made them vulnerable to enemy mechanized units or large concentrations of forces.[3] The size and configuration of troop carrier aircraft prevented dropping equipment, such as vehicles or artillery. Before 1945,

only a single, disassembled 75-mm pack howitzer would fit in a C-47 or Waco glider.[4] With limited experience and doctrine, Allied airborne forces in North Africa awaited their next mission, the invasion of Sicily.

Operation HUSKY

Planning, Shaping, and Airborne Operations

At the Casablanca Conference in January 1943, President Roosevelt and Prime Minister Churchill agreed on Sicily as the next Allied objective. Allied Force Headquarters began planning on 3 February 1943, but initial plans showed little resemblance to the actual operation in July.[5] During this time, operations in Tunisia continued, which prevented the most experienced air planners from participating in initial planning, which occurred between many dislocated headquarters.[6] The reluctance of senior commanders in Tunisia to delegate planning authority exacerbated the problem resulting in many changes in the months prior to execution. The plan involved airborne forces securing inland objectives to support the massive amphibious assaults with a fleet of over 3,000 ships.[7]

Environmental considerations were the primary factor in determining the date of the operation. To mitigate the vulnerability of airborne forces during transport and assembly after the drop, these forces needed to arrive at night with enough light from the moon to identify the drop zones. The amphibious assault force, however, required the cover of darkness for the operation. The airborne troops needed four hours to develop their attack prior to the amphibious forces landing. The quarter moon setting shortly after midnight on the night of 9-10 July 1943 supported these requirements.[8]

The American 51st and 52nd Troop Carrier Wings supplied most of the airlift capability to transport the American 82nd Airborne Division and the British 1st Airborne Division. Since

the 51st Wing had operational experience with the 1st Airborne Division and the 52nd Wing previously transported the 82nd Airborne Division, planners paired these airlift and airborne units together early in planning to allow for combined training. Additionally, the British 38th Wing provided aircraft and crews for the missions of the 1st Airborne Division.[9] While the airborne force trained for the invasion, the Allies began shaping operations and adjusted the invasion plan.

Shaping operations focused on destroying Axis air capability and masking the location of the next Allied offensive. Allied aircraft bombed airfields, communication, and radar sites on Sicily, the Italian mainland, and other locations throughout the Mediterranean with the goal of forcing enemy air forces to withdraw outside of an effective range of Sicily. By focusing on the enemy air forces, the Allies achieved air superiority and prevented most air attacks, which were the primary long-range weapon of the era similar to ballistic missiles in the twenty-first century. Before the invasion, intelligence estimated that the enemy possessed 1,600 aircraft within range of Sicily compared to over 4,000 Allied aircraft.[10]

In addition to kinetic actions, the Allies conducted a deception campaign. Operation MINCEMEAT provided cover for the invasion by convincing Germany and Italy that the next Allied operation would occur in Greece.[11] Additional actions supported the airborne missions. Air and naval forces conducted diversionary bombing across the island immediately prior to the assault. While intelligence assessed the bombing as successful, the resulting smoke and fires obscured the drop zones and complicated troop carrier navigation.[12] Additionally, Allied aircraft dropped over 600 dummy paratroopers to draw enemy forces away from the actual drop zones. To prevent early detection of the assault force, modified B-17s jammed enemy radar stations.

Overall, these actions allowed the airborne mission to achieve the surprise essential to operations behind enemy lines.[13]

The airborne missions during Operation HUSKY supported the main effort of the amphibious assault forces. The Allies selected each objective to decrease the enemy resistance during the amphibious landing and accelerate the advance of the main force across the island. The plan required the airborne force to seize an airfield, capture river crossings, and isolate the landing beaches from enemy reinforcements. Once the amphibious assault occurred, the larger and more equipped force from the amphibious assault would relieve the airborne units.[14] On the night of 9 July 1943, "these airborne operations at night, involving the simultaneous use of over 350 aircraft (plus gliders) and 5,000 troops, were the first large scale efforts of this type in the history of war to be made by any nation."[15]

The first of these missions on the night of 9-10 July, "Husky #1," consisted of one parachute combat team from the 82nd Airborne Division and 220 aircraft from the 52nd Troop Carrier Wing. Arriving by parachute, their objective was to secure the road approaches to Gela and block enemy reinforcements.[16] The airborne force succeeded in their objective of blocking reinforcements despite most troops landing miles away from their drop zones. Some troops landed as far as 50 miles away.[17] With only 8 of 220 aircraft lost, enemy anti-aircraft fire was light, but environmental factors coupled with training deficiencies caused the wide dispersion of troops. The low illumination provided by the moon, low-altitude flight, smoke from the diversionary bombing, and a 35-knot wind at altitude challenged the navigational ability of the 52nd Wing's pilots and nearly led to mission failure.[18]

On the same night, the 51st Wing's mission, "Ladbroke," experienced similar challenges. "Ladbroke" differed from "Husky #1" in that it employed gliders to insert a brigade group from

the British 1st Airborne Division to secure the Ponte Grande bridge and the western outskirts of Syracuse. The 51st Wing flew 109 C-47s supported by the British contribution of 28 Albemarles and 7 Halifaxes. These aircraft towed 136 Waco and 8 Horsa gliders.[19] To avoid high concentrations of anti-aircraft artillery, the plan required releasing the gliders over the water. Identification of the glider release point over water at night proved difficult especially with the low illumination and smoke from the diversionary bombing. Additionally, the planned release altitude was too low to compensate for the 35-knot headwind. Even though some pilots climbed an additional 300 feet before release, at least 69 gliders landed in the sea, and only 58 gliders landed in Sicily.[20] Despite over 600 casualties and fewer than 5% of troops reaching their objective, the airborne forces displayed incredible fighting ability. The troops initially secured the bridge before enemy counterattacks forced their retreat, but within hours, the amphibious force arrived and recaptured the bridge.[21]

On the night of 10-11 July, the 52nd Wing and the 82nd Airborne Division embarked on a reinforcement mission, "Husky #2," dropping over 2,300 troops to assemble with the forces dropped on 9 July and seize the Ponte Olivo airfield near Gela.[22] Flown on a clear night with a bright moon, the mission went well until the aircraft approached Sicily. The formation overflew a naval convoy that was under attack from enemy bombers. Due to misidentification, the naval convoy opened fire on the troop carrier aircraft. As the aircraft approached the drop zone, friendly ground forces also misidentified the formation and opened fire. The troop carrier aircraft maneuvered to avoid the combination of friendly and enemy fire causing most aircraft to miss their drop zones. The friendly fire incident resulted in widely dispersed paratroopers, a loss of 23 of 170 aircraft and 410 personnel, and damage to 50% of the aircraft that were not shot down.[23]

During the "Fustian" mission three nights later, on 13-14 July, the British 1st Airborne Division conducted a combined parachute and glider assault with 1,947 troops to capture the Primasole bridge south of Catania. The participating aircraft consisted of 105 C-47s and 11 Albemarles with 8 Waco and 11 Horsa gliders.[24] The Allied forces failed to correct the conditions leading to the horrific friendly fire incident during "Husky #2," and the "Fustian" mission suffered a similar fate. The troop carriers lost ten aircraft with 40% of the returning aircraft damaged.[25] Additionally, the anti-aircraft fire affected the drop accuracy: 39 aircraft dropped within a mile of the assigned drop zone, 22 within 5 miles, 34 within 10 miles, 4 dropped on Mt. Etna over 20 miles away, and 27 aircraft returned with troops on board. Despite the losses and widely dispersed paratroopers, the force achieved its objective of securing the bridge.[26]

Overall, the airborne operations contributed to the success of the initial invasion by causing confusion among the enemy, diverting enemy resources away from the landing beaches, and neutralizing pillboxes and gun positions.[27] Additionally, Operation HUSKY proved that even if widely dispersed, small groups of airborne troops can create difficulties for the enemy. Many of these groups attacked targets of opportunity and severed communication cables.[28] Due to the inadvertent wide dispersion of paratroopers, enemy forces estimated that the Allies dropped 10,000 to 20,000 troops on the first night of the operation when the actual number was 5,000.[29] General George Patton credited the airborne operations for saving his force at least forty-eight hours in the initial advance. Likewise, General Bernard Montgomery praised the airborne operations in the British sector, stating that the actions of the 1st British Airborne Division significantly contributed to the early occupation of Syracuse and Augusta.[30] However, some senior leaders, such as Secretary of War Henry Stimson and General Dwight Eisenhower,

lost faith in airborne operations due to the friendly fire incidents and high casualty rate, estimated at 20 to 25%, compared to the marginal success of the missions.[31] Ultimately, Operation HUSKY would not be the end of US airborne operations, but the Allies recognized the need to correct the significant deficiencies that could result in disaster in the next airborne assault.

Lessons Learned from Operation HUSKY

On 23 July 1943, only two weeks after the first airborne assault in Operation HUSKY, General Eisenhower appointed a board of officers to review airborne operations with a focus on "discovering the factors which lessened the effectiveness of operations and toward finding the remedy." General Eisenhower's board identified 14 significant recommendations with the ultimate solution resting on training all air, ground, and naval forces participating in future operations with an airborne component. As a result, Allied Force Headquarters released Training Memorandum 43 on 2 August 1943.[32] Many of the board's recommendations included tactical and operational details derived from technological constraints and doctrine of the era. Several recommendations fit into three broad categories that apply as much to airborne forcible entry today as they did to subsequent operations in World War II: planning for and commanding airborne forces, setting the conditions necessary for successful entry operations, and overcoming friction during execution. In Operation HUSKY, the Allies failed in the first and last categories but were successful in setting the conditions prior to the invasion.

Regarding planning for and commanding airborne forces, Operations HUSKY defined appropriate missions. Training Memorandum 43 stated,

> [t]he use of airborne troops should be confined to missions suited to their role, and the force commander's decision to use them must be made only after he is positive that the mission cannot be accomplished by other means more economical or equally suited to the

mission…airborne operations are both hazardous and difficult of coordination, and can be justified only by a situation which clearly shows the use of such troops to be imperative.[33]

In a memo to General Eisenhower, Lieutenant General Carl Spaatz offered further restrictions on the mission of airborne forces by stating that drop zones located near organized enemy positions incur significant risk for the operation.[34] These statements reveal the inherent joint nature of airborne operations and the weakness of lightly armed airborne troops operating behind enemy lines.

These considerations emphasize the need to plan for and coordinate airborne operations. Planners must account for the additional airborne limitation of the slow, defenseless aircraft used to transport troops to the drop zone. The C-47s employed in Operation HUSKY lacked armor plating and self-sealing fuel tanks.[35] Due to these vulnerabilities, airborne operations are susceptible to anti-aircraft fire as the fratricide incidents near Sicily demonstrated. To prevent further incidents, the board emphasized complete and constant coordination between all services and elements involved as "paramount to the success of airborne operations."

Coordination failures contributed to both the fratricide incidents and the navigation errors. Since the "Husky #2" and "Fustian" missions were "on-call" as dictated by the ground situation, numerous Allied ships were unaware of the formations due to inadequate communication between services. Without prior knowledge of these missions, the naval vessels assumed they were under air attack and opened fire. To address the convoluted notification process, the board established airdrop request procedures originating with the Army commander and Army Group Headquarters with the final decision to launch the aircraft made by the Air Commander-in-Chief. Furthermore, coordination problems between the air and naval elements complicated troop carrier navigation due to the Navy's insistence that the aircraft avoid all ships

by flying a lengthened overwater route with several turns at low altitude and insufficient illumination. The board concluded that

> [a]irborne operations are air operations until the drop or release is made. Questions of fighter protection, routing, height, time of dispatch…are air matters upon which the Air Commander-in-Chief must have final say. The air and naval situation at the time must accordingly be taken into consideration.[36]

To simplify communication, the Air Commander-in-Chief should have direct control of the Troop Carrier Command. By establishing the requirement for an Air Commander-in-Chief, similar to today's Joint Force Air Component Commander (JFACC), the board aimed to achieve unity of command and effort.

Within the air component of Operation HUSKY, multiple commands prevented the efficiency of pre-invasion bombing and close air support during the invasion, but the Allies succeeded in establishing the conditions necessary for the airborne missions. The ability to mass forces quickly on objectives behind enemy lines is a strength of airborne operations. The element of surprise mitigates the vulnerabilities of the troop carrier aircraft and the airborne troops. General Spaatz declared that "[a]irborne operations can be carried out without excessive losses only when a high degree of surprise is obtained."[37] Through an operational deception campaign masking Sicily as the next objective and tactical deception during the invasion, the Allies achieved surprise. Overlapping with the lessons learned regarding planning and coordination, the Troop Carrier Command realized that airlift planners must request and coordinate this deception support as early as possible in planning.[38] The Command determined that planners must ensure the supporting forces understand the vulnerabilities of the airborne force to threats such as fighter aircraft and long-range weapons. Before the invasion of Sicily,

the Allied air forces succeeded in neutralizing or reducing many of these threats and achieving local air superiority. Without this pre-invasion effort, enemy fighters decimating the troop carrier formation or enemy bombers annihilating the airborne troops on the ground were likely possibilities. Instead of losses attributed to the enemy, the Allies succumbed to friction in execution reducing the effectiveness of the operation.

Carl Von Clausewitz stated that "[f]riction is the only concept that more or less corresponds to the factors that distinguish real war from war on paper."[39] On paper, the plan for Operation HUSKY's airborne assault expected ideal conditions.[40] The fratricide incidents proved this incorrect as uncertainty and confusion overwhelmed the gunners on the Allied ships resulting in the loss of several troop carrier aircraft. From these events, the Allies recognized the need for improved situational awareness and methods to identify friendly aircraft through visual and electronic means.[41] Additionally, operations before HUSKY proved that airborne pilots could accurately navigate and drop their troops near the objective, but the environmental conditions during the first night of the Sicily invasion introduced additional friction. Low visibility due to minimal light from a quarter moon and smoke from diversionary bombing prevented the pilots from visually navigating to the drop zones. High winds caused many gliders to miss their objectives or to land in the sea. Additionally, even light anti-aircraft fire caused pilots to maneuver and further exacerbate the navigation challenge. Operation HUSKY proved that friction and uncertainty would be present in an airborne operation, especially in a non-permissive environment. To overcome friction and ensure effective airborne operations, the review board provided specific training recommendations focused on the troop carrier crews.

The board identified several factors in the inadequate preparation of the crews as highlighted by the inaccurate airdrops. Before Operation HUSKY, the crews received limited

specialized training for the operation, and the overall training standard was insufficient.[42] Due to the continuing transport missions in Tunisia, troop carrier squadrons went up to 11 months without flying an airborne mission.[43] While pre-invasion training involved formation flying and overwater low-level navigation to unmarked DZ at night, the performance between units varied, and the training did not attempt to replicate combat conditions by introducing sources of friction. Further hindering preparation, the troop carrier squadrons did not receive complete intelligence information due to the common belief that troop carrier units should not require that level of intelligence to perform their mission.[44]

The Allies sacrificed many lives and significant time and resources to set the conditions necessary for the airborne operation. To prevent wasting the temporary, local air superiority achieved in the months before the invasion, the Allies needed trained aircrews capable of performing airborne missions. The board listed several requirements for airborne training. The first and most important condition was the necessity for the training to be realistic and approximate the actual or worst conditions expected for the operation. Additionally, the guidance dictated combined training between the aircrews and airborne troops. The training must encompass all details and contingency plans with a final rehearsal as close as possible to the execution of the operation. The board directed that the training standard for the troop carrier aircrews is the same as that of other combat aircrews.[45] Furthermore, the Troop Carrier Command should provide advanced training for "pathfinder" aircraft that would precede the large formation and accurately drop teams to mark the drop zones.[46]

This order to conduct realistic, combined training in addition to the recommendations regarding the inherent risk of airborne operations, the extensive coordination required, appropriate objective area location, the unity of command for air assets, and the necessity for

surprise and local air superiority allowed the Allies to develop large-scale airborne capabilities. The commanders, aircrew, and airborne troops understood the significance of these lessons paid for by the lives of those in their units. These insights concerning planning for and commanding airborne forces, setting the conditions necessary for successful entry operations, and overcoming friction during execution would prove invaluable in subsequent airborne assaults in World War II, such as those in Operation OVERLORD, and remain important. Most of all, the lessons from Operation HUSKY highlight the enduring significance of realistic, combined training and common doctrine between the air and ground components of the airborne force.

Operation OVERLORD[47]

Planning, Shaping, and Airborne Operations

Prior to invading Sicily, the Allies began planning for the invasion of Northwest Europe. In May 1943, the Allied leaders selected 1 May 1944 as the target date for Operation OVERLORD. This date later moved to 1 June 1944. Early in planning for the invasion, General Eisenhower approved the use of airborne forces to augment the amphibious landing after weighing the risk. He considered the landing at Utah beach as necessary for the success of the overall operation and the airborne missions as vital to the successful landing on Utah beach. Thus, the entire operation depended on the largest airborne assault ever attempted. Operation HUSKY provided many valuable lessons, but planners considered the initial reports from Sicily incomplete and contradictory. Despite this disagreement, the planning for Operation OVERLORD addressed the Sicily invasion's two major issues of fratricide and inaccurate airdrops. Increased coordination between the air and naval components resulted in more direct routing for the troop carrier aircraft, and a prohibition on naval gunners firing at any aircraft

during the airborne mission prevented a major fratricide incident. To address the navigation challenge, leadership placed greater emphasis on training the troop carrier and airborne units.[48]

Navigating and flying formation at night proved problematic over Sicily, but due to the extent of German capabilities in Europe, both the troop carriers and airborne troops agreed that Operation OVERLORD's airborne assault required the cover of darkness. The Allies expected increased training to improve the troop carrier's performance.[49] The airborne force requested that the assault take place with a full moon to allow sufficient lighting for the pilots to find the drop zones and to assist the assembly of the airborne troops on the ground. Additionally, the mission required surface winds less than 20 mph.[50] To further improve the odds of accurate airdrops, the Allies turned to technology.

This technology included beacons on the drop zones, radar ground mapping, and radio navigation. The troop carriers dropped pathfinder teams prior to the main formations to mark the drop zones electronically and visually. The electronic beacons, the Rebecca-Eureka system, guided aircraft to the drop zone, and the United States equipped all C-47s participating in the assault with these systems. Due to technological limitations, the plan permitted only flight leaders, one of every nine aircraft, and straggling aircraft to use Rebecca-Eureka, and the system exhibited errors of up to two miles. To arrive at the correct drop zones, the pathfinder aircraft used radar ground mapping and radio navigation. Only 50 aircraft received the SCR-717 radar to navigate via returns from the ground. The system accurately depicted coastlines, but it was of little value in navigating to the inland drop zones. Approximately 150 aircraft received the British Gee radio navigation system, which allowed navigation through triangulation from stations in Britain. This system required extensive training and only provided an accuracy of one mile near the drop zones. In theory, these three systems would allow the troop carriers to

navigate to a position in which they could acquire and use the visual markings on the drop zones for final course adjustments before the airdrops and prevent the wide dispersion of troops that occurred in Sicily.[51]

While Operation HUSKY included a large-scale airborne assault, Operation OVERLORD incorporated a larger airborne force of three divisions: the veteran US 82nd Airborne Division and untested 101st Airborne Division along with the British 6th Airborne Division. The Allied Expeditionary Air Force (AEAF), commanded by Air Marshal Trafford Leigh-Mallory, consolidated most aircraft participating in the invasion under its command and consisted of the British Second Tactical Air Force and the American Ninth Air Force. Consistent with the lessons learned in Operation HUSKY, the AEAF controlled the troop carrier units, hosted all planning at its headquarters, and retained final authority for all air operations. The British provided the 38th Wing, trained in glider operations, and the 46th Wing, trained in paratroop operations. The US IX Troop Carrier Command included the 50th, 52nd, and 53rd Troop Carrier Wings. During planning, the US and British troop carrier components established the joint troop carrier operations room and command post.[52]

In coordination with the Ninth Air Force, the AEAF introduced strict standards for troop carrier training, which began on 15 March 1944. These standards required troop carrier aircrew to fly night formation missions to within a mile of their objective and one minute of schedule. Aircrew proficiency increased throughout training with some exercises resulting in excellent performances. However, these instances only produced false confidence within the IX Troop Carrier Command. During multiple exercises in poor weather, up to 75% of the aircraft aborted while the remaining aircraft dropped their troops inaccurately. To assist the troop carrier aircraft in navigating to their drop zones, the Command Pathfinder School trained select crews with an

extensive 60-day course emphasizing navigation via Gee and radar ground mapping. Troop carrier training culminated in a final rehearsal, Exercise EAGLE, on 11-12 May. The rehearsal demonstrated improvement from the preparation for Operation HUSKY, but equipment preparation for the operation and the desire to limit risk to the troops prevented all personnel from participating. The pathfinders performed well in the exercise with only one of six aircraft becoming lost in the haze. Additionally, the command certified all groups except for three as prepared for Operation OVERLORD. The three remaining groups trained until 26 May showing improvement throughout this period, and the command certified all groups as ready for the operation.[53]

Before and during the troop carrier training, the Allies conducted operations to set the conditions for OVERLORD. Bombing missions attacked industrial sites in Germany and the transportation network in France during Operation POINTBLANK to achieve air superiority and inhibit the capability of the Germans to move reinforcements to Normandy.[54] This air campaign reduced the effectiveness of German fighters through pilot attrition.[55] Additionally, Allied intelligence assessed the German radar network in the vicinity of Normandy as reduced to 18% operational.[56] To prevent alerting the Germans to Normandy as the location of the invasion, the Allied bombers attacked numerous targets elsewhere in Northwestern Europe. This measure contributed to the extensive Allied deception plan, Operation FORTITUDE.[57]

As in Operation HUSKY, British and American aircraft provided additional deception in the days and hours prior to the assault. Bombers continued preliminary shaping operations until dusk on 5 June, the night of the airborne assault. Learning from HUSKY, the Allies ceased bombing at this time to reduce the effects of the resulting fire and smoke on troop carrier navigation. Just before and during the airborne assault, aircraft dropped dummy paratroopers

with rifle fire simulators far to the north and in locations closer to the actual objectives to confuse German forces. Although bombing degraded enemy radar sites, Allied aircraft employed *Window*, or chaff, to present the illusion of a large formation proceeding to the north of the actual objective while jamming other radars and fighter control stations, effectively diverting the German night fighter aircraft away from the troop carrier routes. The forecast of poor weather aided the Allied deception plan as the Germans did not expect an invasion at that time.[58] Through deception and shaping operations, the Allies achieved air superiority demonstrated by their 14,000 sorties to the enemy's 100 sorties over Normandy on D-Day.[59] While the Allies succeeded in stalling German reinforcement capability, the airborne force expected significant resistance during the airdrops and while securing their objectives.

The Allies conducted many airborne assault and resupply missions during Operation OVERLORD. This summary focuses on the three simultaneous, initial assault missions occurring on the night of 5 June involving the 82nd Airborne Division, the 101st Airborne Division, and the British 6th Airborne Division. For the missions of the 82nd and 101st, over 13,000 troops on 820 C-47s comprised the US assault force with the objectives of seizing the village and crossroads of Sainte-Mere-Eglise, securing the causeways from Utah beach, attacking Utah beach defenses, and blocking counterattacks on the amphibious force. Although the statistics vary, 35-40% of troops landed within a mile of their drop zone, more than 50% landed within 2 miles, and approximately 80% landed within 5 miles.

While the drop accuracy improved from Operation HUSKY, the wide dispersion of troops affected the mission of the airborne force. Like Sicily, environmental factors complicated troop carrier navigation. The troop carriers improved their ability to fly night low-level routes, but in hindsight, the poor exercise performance when encountering weather proved an ominous

foreshadowing of the operation. Approaching the Normandy coast, the American formations unexpectedly penetrated a cloud layer which extended from the coast to 12 miles inland and from 1,100 to 2,000 feet with a planned aircraft altitude of 1,500 feet.[60] Upon losing visual contact, most formations separated and dropped their troops inaccurately. Unfortunately, due to the requirement for radio silence, leading formations were unable to warn trailing aircraft. Enemy anti-aircraft fire downed 41 aircraft, damaged 450 more, and forced the further separation of formations. Despite the order prohibiting maneuvering before dropping troops, many pilots instinctively reacted to protect their aircraft.[61] Recognizing the potential for navigation issues, the plan incorporated the use of pathfinder aircraft and aids to navigation to mitigate the effects of environmental factors and enemy action.

The troop carrier formations received limited assistance from the pathfinder teams. Only 38 of 120 pathfinder personnel landed on their drop zones, but most of these teams were within sufficient range of their objectives to accomplish their mission of marking the drop zones. However, with less than one hour until the arrival of the main airborne force, the proximity of enemy forces prevented all but two teams from visually marking the zones.[62] The airdrop accuracy on the two marked drop zones was significantly better than the accuracy on the unmarked zones.[63] Most pathfinder teams installed the electronic beacons on the drop zones or near the zones. Due to the limited number of aircraft authorized to use the guidance and the one- to two-mile error inherent in the system, the beacons were of minimal assistance. Furthermore, only 40% of the aircraft had navigators on board.[64] Due to the enemy's effect on the pathfinder teams, inadequate technology, and limited availability of navigators, most aircraft dropped inaccurately after deviating off course for weather and anti-aircraft fire.

To seize the bridges over the Orne River and Caen Canal and block enemy counter attacks on the amphibious force, 237 aircraft dropped the British 6th Airborne Division concurrent with the US airborne operation.[65] The accuracy of these airdrops far surpassed that of the 82nd and 101st Airborne Divisions. The British formation did not experience unexpected clouds, and the location of the drop zones only 2 to 5 miles inland simplified navigation. This minimal distance over land reduced the exposure time of aircraft to anti-aircraft fire and diminished the effects of evasive maneuvering, but enemy fire claimed seven aircraft. All British aircraft possessed the Gee system, and 90% of the crews used it effectively.[66] The British airborne troops seized the critical river crossings and joined the advancing amphibious force.[67]

Overall, the airborne force accomplished most of its objectives despite the wide dispersion of US troops as a result of unexpected weather and heavy anti-aircraft fire. Numerous aircrews braved the enemy fire on multiple passes over the drop zones to ensure they delivered their troops. The airborne force lost 2.5% of the aircraft with another 24% damaged.[68] Once on the ground, the wide dispersion, terrain, and other factors extended the assembly time of the airborne troops. The airborne troop's maps did not accurately depict the flooded land, and the hedgerows and other obstacles impeded movement. Although the planners considered the moonlight in the timing of the operation, darkness slowed assembly, and the shortage of radios, many of which were lost in the drops, compounded this problem. Three German divisions, outnumbering the airborne troops three to one, stalled the assembly and advance of airborne troops. Similar to Operation HUSKY, the Germans assumed many more troops were present than the Allies dropped due to the airborne forces attacking targets and severing communications over an extensive area.[69] While the wide dispersion of troops slightly benefited airborne objectives, the airborne force narrowly accomplished their mission as a result of "the presence of

barely enough men in the right place at the right time."[70] Ultimately, the force captured Sainte-Mere-Eglise, reduced the opposition to the landing on Utah beach, and sped the Allied advance.[71]

Lessons Learned from Operation OVERLORD

Airborne operations improved from Operation HUSKY to Operation OVERLORD. Due to coordination with the Navy and increased emphasis on the importance of the airborne assault, the Allies prevented the disastrous fratricide events that traumatized the airborne component of HUSKY. The priority placed on troop carrier training resulted in more proficient aircrews, but unexpected weather negated this improvement. Concerning planning for and commanding airborne forces, setting the conditions necessary for successful entry operations, and overcoming friction during execution, the Allies demonstrated vast improvement in the first two but once again failed in overcoming friction.

The Allies effectively planned for and commanded airborne forces in Operation OVERLORD demonstrated by unity of command, mitigating the inherent risk of airborne operations, and determining appropriate objectives. Although disputes between the AEAF and the commands of the Combined Bomber Offensive occurred during shaping operations, the consolidation of most air assets under the AEAF enabled the success of the operation through a single advocate for the air plan. Furthermore, the joint troop carrier operations room and command post assisted training standardization and evaluation, planning deconfliction, and unity of effort among the airborne force. To decrease the vulnerability of their aircraft, the IX Troop Carrier Command acquired armor plating for the troop carrier aircrews. Due to resource constraints, the aircraft remained without self-sealing fuel tanks, but this did not have a serious impact on the operation.[72]

In Operation OVERLORD, the airborne planners and leadership accounted for the limitations of the aircraft and airborne troops through surprise and selecting objectives which would allow for timely reinforcement from the amphibious force. Following the operation, Major General Maxwell Taylor, commander of the 101st Airborne Division, extracted several conclusions about airborne operations. He stated that planning should allow at least twenty-four hours for the assembly on the ground before the airborne troops function as a unit. Before assembly, the primary effects of the troops will be from "the aggressive action of small groups." He reinforced the point that better-equipped forces must reinforce airborne troops quickly. Furthermore, he emphasized the necessity of surprise and added: "[i]t may be more economical of lives to land directly on the enemy than to come down at a distance and close with him."[73] This statement contradicted the opinion of Lt Gen Spaatz from Operation HUSKY. While the flooded terrain segmented by hedgerows impeded mobility and contributed to Maj Gen Taylor's conclusion, subsequent operations in World War II proved it to be a valid tactic.

Like Operation HUSKY, the Allies set the conditions for forcible entry through an air campaign and deception operations. Although anti-aircraft fire affected troop carrier aircraft and the airborne troops experienced intense resistance on the ground, the level of air superiority of 14,000 Allied sorties to 100 enemy sorties was remarkable. Additionally, the combined effects of Operation FORTITUDE and the tactical deception from dummy paratroopers, radar and communications jamming, and chaff enhanced surprise and reduced the risk to the airborne force. Operation OVERLORD confirmed the necessity of air superiority and surprise to minimize operational risk during airborne forcible entry.

The mission, like Operation HUSKY, succumbed to friction in execution nearly leading to failure. The troop carrier units trained crews to perform airborne operations at night, but they

ignored the poor performance in exercises due to weather. With the troop carrier aircraft in close formation, one cannot condemn the pilots for separating the formation since a mid-air collision before the airdrop would result in the loss of the aircraft, crew, and troops on board. If one pathfinder aircraft or the lead serial of the large formation made a radio call reporting the presence of clouds, the remainder of the force could adjust their altitude and prevent the separation of the formations and the navigation issues that ensued, but this was not possible as the formation operated under strict radio silence. Since the airborne force likely lost the element of surprise when the pathfinder aircraft flew over the drop zones and definitely by the time the first elements of the main force arrived, a short weather report would have encouraged mission success rather than hindered it.

To overcome factors such as the weather, the plan included new tactics and technology to assist navigation to the drop zones. The use of pathfinder aircraft allowed the troop carrier units to focus intensive training on a select number of crews to assist airdrop accuracy. Due to friction in the form of enemy action, the pathfinder concept provided limited benefits to the operation. Technological limitations of the navigation aids installed on the drop zones by the pathfinder crews further decreased the value of the pathfinder missions. This example proved that the unforeseen conditions in combat could spoil the tactics proven in previous operations.

Additionally, the best technology of the era possessed limitations, either in capability or limited availability due to resource constraints, that inhibited its effective use in operations. The new technology also required additional training. The Command Pathfinder School provided this training to select crews, but other crews in aircraft equipped with Gee or the SCR-717 navigational systems did not receive adequate training to benefit from the technology. The Allies increased emphasis on troop carrier training for the primary plan in ideal conditions.

However, the command did not satisfactorily address planning, procedures, and training for contingencies, such as weather. With clouds and low visibility negatively affecting performance in multiple exercises, this oversight was the most significant deficiency in aircrew preparation. Exercise EAGLE and previous exercises demonstrated the difficulty of adequately representing combat conditions, but the training program revealed enormous progress in airborne training in the eleven months between Operations HUSKY and OVERLORD.

The Allies refined large-scale airborne assault capabilities using the lessons learned in Sicily to contribute to a successful invasion of Northwestern Europe. The airborne force mitigated the inherent risk of airborne operations through acquiring aircraft armor, prevented fratricide through increased coordination, refined objective area selection for airborne troops, established air unity of command, achieved air superiority and surprise, and improved troop carrier training. The airborne operation in Normandy highlighted the shortcomings of current technology and contingency planning and training. Due to the changing operational situation to a more permissive environment, Operation OVERLORD was the last large-scale airborne operation occurring at night for the remainder of the war. The Allied airborne force continued to build on the experience in Sicily and Normandy to conduct subsequent operations in World War II, and these lessons form the foundation of airborne assault doctrine today.

World War II, Current Doctrine, and JFEO 2035

Due to the increased precision, lethality, range, and integration of threat systems in the more than seven decades since World War II, Operations HUSKY and OVERLORD do not directly validate current doctrine. These case studies, however, illuminate the dangers and complexity of forcible entry operations in non-permissive environments. Just as airborne forces in World War II emphasized training and doctrine development between HUSKY and

OVERLORD, current airborne forces must prioritize realistic, combined training and joint Army and Air Force doctrine. Additionally, airborne soldiers and airmen, especially planners, must internalize the nine distinct considerations for airborne operations that emerged from the analysis of Operations HUSKY and OVERLORD. Regarding planning for and commanding airborne forces, successful operations require unity of command, extensive coordination, proper objective area location, and mitigation of inherent risk. Surprise and air superiority constitute the two critical elements of setting the conditions for successful entry operations. To overcome friction, planners and commanders must consider the effect of the enemy and environmental conditions, prepare airborne forces with combined and realistic training, and utilize available technology. Appendix B provides specific examples of these nine World War II lessons in current airborne doctrine.

Linking current doctrine to future operations and challenges, the *Joint Operational Access Concept* (JOAC) and *Joint Concept for Entry Operations* (JCEO) suggest the understanding of the A2AD problem within the Department of Defense (DOD). The JOAC is the DOD's vision for addressing future A2AD systems while the JCEO emphasizes freedom of maneuver through "integration of force capabilities across domains."[74] The JOAC lists three emerging trends that challenge the United States' ability to gain and maintain access:

1. The dramatic improvement and proliferation of weapons and other technologies capable of denying access to or freedom of action within an operational area.
2. The changing US overseas defense posture.
3. The emergence of space and cyberspace as increasingly important and contested domains.[75]

Operational access requires defeating, at least locally, an adversary's A2AD system and transporting combat power, such as airborne forces, to the area of operations.[76] The joint force must set conditions and conduct entry operations with integrated efforts by exploiting A2AD vulnerabilities and gaining local superiority at specific locations.[77]

The JFEO 2035 scenario and Appendix A list several specific threat systems and ranges that the joint force will possibly face in a future conflict. These threats fit into several general categories of A2AD capabilities. Anti-access capabilities include ballistic and cruise missiles (with over 1000 NM range), long-range reconnaissance and surveillance systems, anti-satellite weapons, cyber attacks, and special operations forces. Area denial capabilities include air defense systems, anti-ship missiles and submarines, precision-guided rockets, electronic attack, mines, small boats, land maneuver forces, special operations forces, and unmanned systems.[78] While these systems are the typical focus of military operations, A2AD strategies are far more comprehensive and use all instruments of national power to deny access and freedom of maneuver. A2AD strategies incorporate long-term shaping operations focusing on information operations, cost-imposition policies through large-scale attacks or attrition, attacks on C3 systems (command, control, and communications), and contesting air and maritime superiority and land freedom of maneuver.[79] Ultimately, A2AD systems will threaten the joint force at greater distances which will require the airborne force to build upon the lessons learned in World War II and reflected in current doctrine.

Selecting appropriate objectives for the entry force must balance the risk posed by A2AD threats with the operational value of the objective. The JOAC advises commanders to avoid "attacking into the teeth of an enemy's A2AD defenses where possible."[80] Planners must identify and exploit gaps and vulnerabilities within individual A2AD weapons and the system as

a whole to allow entry forces to establish a lodgment. The JFEO 2035 scenario suggested the possible airborne objectives of seizing an airfield for the buildup of combat power, especially theater air and ballistic missile defense capability, while neutralizing a land-based ASCM site. Similar to Operations HUSKY and OVERLORD, the joint concepts emphasize attacks on multiple entry points with forces originating from various locations to complicate the adversary's decision-making and targeting ability. With the increased capability of adversary threats, the force must be able to mass quickly at critical locations. Airborne operations enable this capability but possess the same limitations highlighted in World War II.

The susceptibility of aircraft to surface fire and the vulnerability of airborne troops to attack from long-range systems will intensify with the improvement of surface-to-air missiles (SAM) and surface-to-surface fires, including ballistic missiles. To defeat one area denial capability, such as land-based ASCM, the entry force will likely expose itself to other threats, such as SAM and ballistic missiles.[81] The Allied airborne experience in Operations HUSKY and OVERLORD demonstrated that shaping operations could significantly reduce the loss of aircraft. The airborne troops on the ground, however, suffered high casualty rates. Future airborne JFEO in a non-permissive environment presents a similar situation. The speed and flexibility of aircraft combined with shaping operations and force packaging may mitigate the risk to the airborne force en route. Airborne troops on the ground, however, provide an adversary with a fixed target for long-range systems such as ballistic missiles. Airborne forces should deploy with air defense capabilities, but these are limited to organic, short-range systems. Planning must stress the importance of air and ballistic missile defense and the rapid buildup of high- to medium-altitude air defense systems.[82] As additional mitigation of these vulnerabilities, the joint

force must capitalize on the speed and flexibility of airpower to adjust objectives en route and disperse forces as the threat situation dictates.

Rapidly adapting to protect the force requires decentralized execution based on the commander's intent.[83] Learning from the World War II operations in Sicily and Normandy regarding the unity of command, today's Joint Force Commander (JFC) establishes the purpose of the operation and integrates the actions of the force. Exploiting weaknesses in A2AD systems necessitates unity of effort resulting from coordination among all components of the joint force. Coordination will prove equally as crucial as demonstrated in the historical examples and will be more complicated with the addition of the space and cyber domains.

Persistent coordination underpins shaping operations to gain and maintain operational access. Just as in World War II, setting the conditions for future airborne operations will prioritize surprise and air superiority. Due to the threat of long-range precision weapons, masking the objective area will aid force survivability. The JOAC describes the three methods of deception, stealth, and ambiguity to achieve surprise. First, deception exploits the enemy's current perception by suggesting that the entry force will select one course of action while pursuing another. Second, stealth denies information about the operation to the enemy so that the adversary is unaware of the plan. Third, ambiguity allows the enemy to believe that multiple courses of action are possible.[84] Allied actions to achieve surprise in World War II, such as Operation FORTITUDE, provide a guide for future operations in that they employed all three of these methods coordinated at the national level. Technology, such as long-range surveillance and reconnaissance, and cyber operations present new challenges to military deception (MILDEC) and operations security (OPSEC). These advances also present new opportunities to achieve surprise and complicate the enemy's decision-making process. In addition to strategic

and operational shaping, forcible entry operations require continual tactical shaping, such as tactical deception to mask the objective and supporting fires from aircraft, that must be present before, during, and after the airborne insertion. The joint force must balance the need for surprise against compromising that surprise through neutralization of specific A2AD capabilities.[85]

Just as in Operations HUSKY and OVERLORD, control of the air, and now space, is a principle for forcible entry operational success. First, air and space superiority ensure the neutralization of enemy air-to-air and surface-to-air capabilities to permit the airlift aircraft to arrive over the objective. Second, the joint force must protect the airborne troops on the ground from air-to-surface and surface-to-surface fires. Historically, forces attack the edges of the enemy's defense and sequentially push the enemy away from the objective area. The Allies used this approach when attacking airfields in preparation for Operation HUSKY. The cost imposition through attrition strategy of many nations employing A2AD systems could preclude this type of attack. Alternatively, the JOAC suggests attacking an adversary's defenses in depth to destroy the integrity of the system. Even with this approach, superiority in the air, space, or any other domain will likely be local and brief.[86]

This rapid change in the operational environment combined with uncertainty and ambiguity will induce friction in entry operations.[87] Forcible entry operations are inherently complex. As history demonstrates, a complex plan exacerbates the effects of friction. Planners must balance the complexity required by entry operations with the simplicity required to alleviate the inevitable friction in execution.[88] Overcoming friction in future entry operations requires thorough planning and preparation, especially to compensate for adversary space, cyber,

and electronic attacks. Joint force planners should assume these attacks will result in a degraded communications environment.[89]

Additionally, this degraded environment could affect airlift aircraft navigation requiring planners to devise contingency procedures for navigation.[90] While GPS and onboard technology solved many of the navigation issues experienced over Sicily and Normandy, current procedures depend on this technology. To prevent the airlift navigation issues of World War II, aircrew training must prepare crews to employ alternative procedures. Training for the airborne force must focus on the utilization of mission-type orders to support decentralized execution in a communications-denied environment.[91] As learned after Operation HUSKY, joint force must train to specific, common doctrine, and this training must incorporate realistic scenarios, environmental conditions, and threat systems to challenge both the airlift and airborne troop components. These exercises should test current command and control systems to aid the development of future robust, secure systems that enable integrated effects across domains to support operational access and freedom of maneuver for the United States.[92]

Conclusion

The rise of peer adversaries and numerous nations with A2AD capabilities present significant operational access and freedom of maneuver challenges for the United States. These conditions have the potential to present US airborne forces with a non-permissive environment comparable only to operations in World War II. Considering Operations HUSKY and OVERLORD, the Allied airborne forces progressed significantly in planning for and commanding airborne forces, excelled at setting conditions for airborne operations, and consistently struggled to overcome friction. Specifically, these operations highlight nine critical considerations applicable to future airborne operational planning: unity of command,

coordination between elements of the joint force, the inherent risk and vulnerability of airborne forces, appropriate airborne objectives, surprise, air superiority, effects of the enemy and environmental conditions, the importance of combined and realistic training, and reducing the impact of friction through technology.

After applying these lessons from the airborne missions of Operations HUSKY and OVERLORD as incorporated in current doctrine to the example scenario of a JFEO in 2035, the most significant deficiency for the joint force is setting the conditions for the entry operation due to the capabilities of modern A2AD systems coupled with the vulnerabilities of the airborne force. The range, complexity, integration, and survivability of A2AD systems increase the risk of future airborne operations. The cost, in terms of lives and resources, of forcible entry operations against a peer adversary might reach the level of those experienced in World War II, which will require a dramatic shift in the American public's tolerance for such losses. To minimize the damage inflicted by an adversary A2AD system, the United States must develop a comprehensive, national counter-strategy. Weapons systems that endanger military assets are the common emphasis when discussing methods to gain operational access. Colonel Vincent Alcazar describes this as a "focus on systems versus systems rather than strategies for success" often ignoring the comprehensive nature of A2AD strategies, which employ diplomatic, information, military, and economic actions.[93] The United States must synchronize efforts across all instruments of national power to oppose these A2AD strategies.[94] Specifically, the United States must persistently conduct whole-of-government strategic shaping operations to set the conditions of surprise and local superiority for possible JFEO.

This focus on the comprehensive nature of A2AD strategies and a whole-of-government counter-strategy does not discount the lethality of A2AD weapons systems. Rather, airborne

planners must consider all aspects of an adversary's A2AD strategy to exploit vulnerabilities and develop operational plans in accordance with current military strategy and national policy. Additionally, the likely temporary nature of this superiority requires the US military to maintain constant readiness by conducting realistic forcible entry training against modern, integrated threat systems to ensure operational success. This training must test and develop the full capabilities of both the air and ground components of the airborne force from initial planning through the completion of ground objectives. The time required to set the conditions, deliver the force, and accomplish objectives is extensive and will require persistent tactical shaping before, during, and after the airborne operation. Usually lasting only a few hours, current exercises do not emphasize this massive requirement of assets to support forcible entry operations. Future training events must strive to incorporate this requirement to ensure the conditions are as realistic as possible. While achieving realism in training is difficult due to risk, asset and personnel availability, and the ability to replicate combat conditions, airborne forces must attempt to conduct realistic training by prioritizing this training when considering asset, personnel, and fiscal decisions. As the operations in World War II illustrated, the joint force cannot wish away conditions likely to occur in combat operations, such as complications from enemy threats or environmental factors. Specifically, training must address command and control challenges, operations in a communications and GPS-denied environment, and vulnerability of the airborne force to threats such as ballistic missiles.

To meet the challenge of employing airborne forces in a non-permissive environment, the joint force must deliberately develop planners with an understanding of airborne operations, especially the nine considerations derived from the World War II operations, and with an appreciation for the *joint* problem of forcible entry, rather than a focus on air or ground force-

specific issues. Additionally, the airborne force must reinvigorate the intellectual debate on the employment of airborne forces in contested locations to develop a *joint* Army and Air Force doctrine for airborne employment that addresses the considerations, risks, and tactics of the air component, ground component, and the *joint* force. While current doctrine reflects the nine historical considerations, joint doctrine does not specifically address common operational and tactical concerns. Service doctrine and publications offer specific guidance, but this guidance is often contradictory as it favors the techniques supported by that service while ignoring the concerns of the other component. As Operations HUSKY and OVERLORD demonstrated, airborne forces must develop and continually improve *joint* Army and Air Force doctrine and conduct realistic, combined training to mitigate the inevitable friction in combat and the inherent vulnerabilities of the airborne force. A well-trained, rapidly deployable airborne force operating under common doctrine and capable of gaining access to non-permissive environments presents a credible deterrent to US adversaries and a practical option to enforce national policy.

Appendix A: JFEO 2035 Assumptions and A2AD Components

To frame a JFEO scenario that could occur in 2035, the following three assumptions apply. First, weapons and war in 2035 will be similar to today with advances in networked forces through space and cyber applications. Precision strike and counter-precision strike capabilities will continue to proliferate, and there will likely be increased use of autonomous machines, especially for transportation.[95] Quantum computing and artificial intelligence will not have an appreciable military effect by 2035. The integration of low-cost sensors will advance C4ISR capabilities and enable more robust A2AD systems.[96]

Second, even the most advanced and integrated A2AD systems consist of multiple components, each with weaknesses that an assaulting force may exploit. A common perception is A2AD systems form an impenetrable bubble around specific geographic areas. Anti-access weapons focus on long-range capabilities to prevent an adversary force from entering an area. Area denial weapons are shorter-range capabilities that limit freedom of movement within an area. The difference between anti-access and area denial capabilities is relative, and many weapons systems provide both capabilities.[97] Attacking the weaknesses of each of these weapons systems will be necessary in a JFEO. A2AD systems directly oppose forcible entry operations and will be one of the primary challenges of a future JFEO.

Third, the conflict will not escalate to nuclear war due to recognition by the United States and its adversary of the mutual consequences resulting from the nuclear capabilities of each nation. For example, Russia, China, and North Korea fielded 16 and began development of 18 nuclear delivery systems since 2010. In contrast, the United States began the development of a single nuclear delivery system, the F-35. Additionally, the United States retired most of its theater or tactical nuclear weapons after the Cold War. To address these concerns, the 2018

Nuclear Posture Review discusses the United States' development of the B61-12 gravity bomb, the modification of a small number of existing sea-launched ballistic missiles with low-yield warheads, and a long-term plan to procure a nuclear-armed, sea-launched cruise missile. The overall US nuclear strategy is to convince adversaries that there is "nothing to gain and everything to lose from the use of nuclear weapons" and to prevent adversaries from incorrectly assuming that limited use of theater nuclear capabilities is acceptable. Additionally, the B-21 Raider long-range, strategic bomber and the Columbia-class submarine, both capable of delivering nuclear weapons and designed for operations against sophisticated A2AD systems, will be operational before 2035.[98] As a result of the continuing development of nuclear capabilities, the United States and its potential adversaries will not escalate the conflict to nuclear war. Adversary capabilities still pose a significant access problem for American forces, and the United States must leverage its new weapons systems to disable these defense systems.

Current A2AD systems pose a considerable challenge to forcible entry operations. While the existing characteristics of these systems will remain in 2035, they will likely be more integrated with greater redundancy, survivability, and lethality in detection, counter-sea, counter-air, and counter-ground capabilities. Current over-the-horizon radars employed by US adversaries can detect aircraft and ships at a range of over 1,300 nautical miles (NM) with the radar sites located hundreds of miles inside adversary borders. Further assisting early recognition of entry forces, satellites provide target identification and geolocation through electro-optical imagery, electronic emissions analysis, and synthetic aperture radar.[99] The trend of the United States' peer competitors expanding naval forces, to include aircraft carriers, advanced submarines, amphibious forces, and integrated electronic and information systems will likely continue.[100] Similarly, other nations continue to challenge the air dominance of the United

States with emerging weapons systems, such as the J-20, J-31, and FC-31 fifth-generation fighter aircraft.[101]

Evolving missile systems to attack sea, air, and land targets are the preeminent weapons of A2AD systems. .Advanced surface-to-air missile systems, such as the S-200 and S-400 (NATO designations SA-5 and SA-21) with 160 and 215 NM ranges, respectively, threaten US aircraft. Currently, the S-500 is in development. Analysts expect this mobile air defense system, with a range of 320 NM, to be capable of destroying fifth-generation aircraft, ballistic missiles, cruise missiles, and satellites in low-earth orbit. [102] US naval forces will likely face an even greater threat with the increased range and lethality of anti-ship cruise missiles (ASCM). Current ASCM includes the YJ-12 (270 NM range) and the hypersonic CM-401 (150 NM range). Land-based vehicles or ships, such as the new Type 055 destroyers, can launch these missiles.[103] Adversaries of the United States are progressing in ballistic missile capability. The DF-21D, commonly known as the "carrier killer," is a mobile, medium-range ballistic missile (MRBM) designed to attack large ships at a range of over 800 NM.[104] Ballistic missiles endanger ground forces from an even greater distance. The DF-26 is a road-mobile, intermediate-range ballistic missile (IRBM) with a range of over 2,100 NM.[105]

Emerging weapons, especially missiles launched from aircraft, ships, submarines, and mobile ground systems, will restrict the access and freedom of movement of entry forces. For airborne forces, these systems deny airspace and could increase the distance from which airlift aircraft launch to reach their objective, resulting in extremely long sorties with paratroopers on board. Conducting a forcible entry against sophisticated A2AD systems will require a nation to accept the possibility of significant losses against initial entry forces and will likely limit these operations to only those of extreme necessity, such as the JFEO 2035 scenario.

Appendix B: Operations HUSKY and OVERLORD in Current Airborne Assault Doctrine

Joint doctrine provides principles of operation to guide the employment of joint forces in achieving national objectives. Historical analysis combined with modern lessons form the foundation of these fundamental principles.[106] The following joint doctrine, joint concepts, and service doctrine publications provide principles for airborne forces: Joint Publication (JP) 3-18, *Joint Forcible Entry Operations*; JP 3-17, *Air Mobility Operations*; *Joint Operational Access Concept (JOAC)*; *Joint Concept for Entry Operations*, (JCEO); Air Force Doctrine Annex 3-17, *Air Mobility Operations*; Army Field Manual (FM) 3-99, *Airborne and Air Assault Operations*. The airborne lessons from Operations HUSKY and OVERLORD permeate current airborne assault doctrine in these publications.

Planning for and Commanding Airborne Forces

Unity of Command

JP 3-18 states that unity of effort among the joint force is "perhaps the single, largest factor that will impact operational success." Additionally, the publication stresses the importance of unity of command to ensure unity of effort and overcome the inherent complexity and vulnerability of airborne operations.[107] Centralized control (and decentralized execution) allows commanders to exploit the speed, range, and versatility of airpower.[108] An airborne task force commander will normally serve as the single authority to direct the efforts of the airborne force, airlift force, and follow-on forces. Doctrine allows for flexibility in organizational structures depending on the situation but emphasizes the importance of clearly establishing the command relationships between the airborne task force commander, the airlift force commander, the joint force air component commander (JFACC), and other commanders involved in the forcible entry operation.[109] The joint force commander (JFC) retains authority and decides to

employ airdrop operations based on coordination with the ground and air component commanders.[110]

Coordination

JFEO is "inherently risky and always joint" with the increased possibility of fratricide. To reduce risk and friendly fire incidents, all components of the joint force must coordinate continuously from the initial planning stages through execution. Similar to Operations HUSKY and OVERLORD, this coordination entails directing joint and multinational forces, aligning deception and shaping operations, and establishing geographic boundaries between components, such as fire support coordination measures (FSCM) or the division of airspace.[111] Air mobility operations often require air corridors to ensure the safety of aircraft. The corridors require constant coordination among all joint force components.[112] Additionally, technology places an increased emphasis on coordination and deconfliction of communications and other operations in the electromagnetic spectrum.[113]

Inherent Risk

Employing airdrop operations, including airborne JFEO, must "justify the risk to, and expenditure of, scarce and costly airdrop resources." Furthermore, airdrop operations are less precise (compared to airland operations) and risk unplanned dispersion. Airdrop also increases complexity, and large-formations of aircraft increase operational level risk. Enemy surface-to-air and air-to-air capabilities pose a significant threat to airlift aircraft due to slow speed, low maneuverability, large radar signature, and limited defensive systems. Airlift aircraft can operate in high threat environments if protected by other assets, but the joint force must accept increased "operational risk, higher loss rates, and reduced efficiency."[114] Electronic attack presents a threat to aircraft and airborne ground forces. Ground force vulnerabilities early in the forcible

entry operation include enemy attack by artillery, armored units if located in open terrain, airstrikes, and surface-to-surface missiles.[115] Despite the ability to airdrop vehicles and artillery, airborne forces employ with limited firepower, mobility, and air defense capabilities, thus requiring immediate and persistent joint fire support.[116]

Objective Area Location

The mission of the airborne force is "to close with the enemy by means of fire and movement to destroy or capture him, or to repel his assault by fire, close combat, and counterattack. These missions usually require the seizure and defense of objectives and surrounding terrain."[117] Following the lessons from Sicily and Normandy, the early stages of the assault rely on the coordination of small units to secure initial objectives while the force retains the element of surprise.[118] Regarding the location of the drop zones relative to the objectives, planners should prioritize drop zones outside the range of enemy fire with terrain that provides protection from armored forces. Planners should consider the presence of covered routes of approach to the objective. Additionally, the drop zone should allow for easy identification to assist aircraft navigation.[119] Planners should begin with the location of the objectives and the ground tactical plan and work through a reverse planning sequence.[120] Current doctrine stresses that the slow assembly of the airborne troops on the ground increases the risk of mission failure.[121]

Setting the Conditions for Successful Entry Operations

Surprise

JP 3-18 lists surprise as a principle for forcible entry operational success as it serves to reduce operational risk. However, the publication states that surprise is not a necessary condition if the force has complete superiority.[122] Surprise "allows the joint force to seize and retain the

initiative while minimizing vulnerabilities."[123] Airlift planners exploit the advantages of aircraft speed and the immense number of possible drop zones to achieve surprise and "control the timing and tempo of operations."[124] Airborne troops rely on surprise to complete objectives through the rapid, coordinated actions of small units.[125] Synchronized information operations, including operations security (OPSEC) and military deception (MILDEC), are vital to achieving operational and tactical surprise, and planners must incorporate these capabilities in the initial stages of planning.[126]

Air Superiority

Doctrine accentuates the importance of setting conditions in the air and on the ground for JFEO through four of the principles for forcible entry operational success: control of the air, control of space, isolating the lodgment, and neutralizing the enemy forces within the lodgment. Each of these principles focuses on protecting the force and reducing operational risk associated with entry operations, especially airborne assault. Air control requires eliminating the enemy's air and missile capabilities and air defenses to "achieve local air superiority and protection over the planned lodgment." Regarding the threat to the airborne troops after landing, the joint force must neutralize enemy forces within the lodgment to "facilitate the establishment of airheads or beachheads" to provide immediate protection. The joint force must isolate the lodgment by attacking any enemy threats with the ability to affect the lodgment.[127]

Overcoming Friction

Effects of the Enemy and Environmental Conditions

Managing the impact of environmental factors, such as weather and illumination, is a principle for forcible entry operational success.[128] While marginal weather may contribute to surprise, it also has the potential to reduce the effectiveness of airdrop operations and increase

the frequency of accidents.[129] FM 3-99 advises commanders to consider the weather when selecting a drop zone due to weather's impact on aircrew visual acquisition of the drop zone and the possibility of high winds hindering operations. Additionally, when the joint force selects the timing of the operation, the planners must consider the degree of air superiority, the need for surprise, and the experience of airlift and airborne personnel. Night operations offer increased surprise and survivability but often complicate air and land navigation and result in a slow assembly on the ground.[130] Many adversaries possess the capability to affect the use of the electromagnetic spectrum. Despite technology solving many of the navigation issues experienced in World War II, JFEO will likely occur in a degraded communications and navigation environment. The force must prepare to operate without capabilities such as satellite communications or GPS navigation by incorporating this realism in training.[131] To overcome navigation issues, the force will employ lead elements to guide aircraft to the appropriate drop zone by possibly using special navigational aids or homing devices.[132]

Combined, Realistic Training

Forcible entry requires "leader initiative at every level to deal with friction, chance, and opportunity." Due to its unique nature and complexity, JFEO also requires "well-trained and well-prepared joint forces."[133] Airdrop operations add greater complexity which increases operational level risk and necessitates training.[134] A thorough joint training program focusing on realistic scenarios will prepare the joint force for JFEO.[135] Regular training develops habitual relationships which function to reduce friction between organizations, such as airlift and airborne units.[136] For specific forcible entry operations, rehearsals assist the preparation of the force and reduce "operational frictions inherent to entry operations."[137] The JFC must balance the need for rehearsals with the time available and the need to protect information.[138]

Technology

As doctrine focuses on validated principles and lessons learned applied to current capabilities, doctrine includes little discussion of technology, other than protecting vital assets and training to operate without them. The *Joint Operational Access Concept (JOAC)* and the *Joint Concept for Entry Operations* (JCEO) guide the future use and development of technology in JFEO since "Joint Concepts address emerging operational challenges, propose solutions and identify required capabilities through collaboration, engagement and rigor, in order to enhance the operational effectiveness of the Joint Force."[139]

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