Interoperability for Joint All-Domain Operations: Lessons from Operation Desert Storm for the Korean Peninsula

A Monograph

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14. ABSTRACT

Operation Desert Storm in 1991, where Air-Land Battle doctrine was put into practice, demonstrated a high level of multinational interoperability with thirty-nine countries participating. Multi-Domain Operations (MDO), the US Army's future war concept, seeks to deter and defeat future adversaries such as Russia, China, Iran, and North Korea by optimizing combat power in multiple domains. Joint All-Domain Operation (JADO) is a joint warfighting concept being developed at the joint level integrating all services' concepts to include MDO. The monograph examines the reasons why the coalition forces in 1991 were able to achieve a high-level of interoperability and the implications for JADO if it was to apply on the Korean peninsula. The ROK and US forces maintain combined readiness and requirement for interoperability to counter North Korean conventional and asymmetric threats in Korea. Also, considering the UN Security Resolution 84, which became the basis for armed intervention with sixteen force providing countries during Korean War, is still in effect with continuing armistice status from Korean War. Thus, the next possible North Korean attack will most likely be responded to with multinational efforts, again. The monograph concludes that the high level of interoperability during Operation Desert Storm was due mainly to proper application and development of doctrine, materiel, and leadership of major participating nations' militaries with systems thinking. And, these three aspects along with systems thinking, will stay crucial for the conduct of JADO on the Korean peninsula as well, but on a different scale due to the complex nature of integrating operations in all domains.

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Abstract

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Operation Desert Storm in 1991, where Air-Land Battle doctrine was put into practice, demonstrated a high level of multinational interoperability with thirty-nine countries participating. Multi-Domain Operations (MDO), the US Army's future war concept, seeks to deter and defeat future adversaries such as Russia, China, Iran, and North Korea by optimizing combat power in multiple domains. Joint All-Domain Operation (JADO) is a joint warfighting concept being developed at the joint level integrating all services' concepts to include MDO.

The monograph examines the reasons why the coalition forces in 1991 were able to achieve a high-level of interoperability and the implications for JADO if it was to apply on the Korean peninsula. The ROK and US forces maintain combined readiness and requirement for interoperability to counter North Korean conventional and asymmetric threats in Korea. Also, considering the UN Security Resolution 84, which became the basis for armed intervention with sixteen force providing countries during Korean War, is still in effect with continuing armistice status from Korean War. Thus, the next possible North Korean attack will most likely be responded to with multinational efforts, again.

The monograph concludes that the high level of interoperability during Operation Desert Storm was due mainly to proper application and development of doctrine, materiel, and leadership of major participating nations' militaries with systems thinking. And, these three aspects along with systems thinking, will stay crucial for the conduct of JADO on the Korean peninsula as well, but on a different scale due to the complex nature of integrating operations in all domains.

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Abbreviations

ANGLICO	Air Naval Gunfire Liaison Company
C4I	Command, Control, Communications, Computers, & Intelligence
CBO	Congressional Budget Office
CFC	Combined Forces Command
DPRK	Democratic People's Republic of Korea
EAB	Echelons Above Brigade
EMS	Electro-Magnetic Spectrum
EMP	Electromagnetic Pulse
GCC	Ground Component Command
GDP	Gross Domestic Product
GOC	Ground Operations Command
ICBM	Inter-Continental Ballistic Missile
JADC2	Joint All Domain Command and Control
JLO	Joint Liaison Organization
JCS	Joint Chiefs of Staff
LSCO	Large-Scale Combat Operation
MDO	Multi-Domain Operations
MDTF	Multi-Domain Task Force
MND	Ministry of National Defense
NATO	North Atlantic Treaty Organization
OPCON	Operational Control
ROK	Republic of Korea
TRADOC	Training & Doctrine Command
UNSCR	UN Security Council Resolution
WMD	Weapons of Mass Destruction

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Introduction

> Schwarzkopf considered the Coalition's center of gravity to be the Coalition itself. If the frail bonds of the Arab-Islamic commitment to the US-led Coalition could be broken, perhaps by drawing Israel into the war, the Coalition would quite likely be fragmented and torn apart.
>
> —Robert H. Scales, *Certain Victory: The US Army in the Gulf War*

Background

The 2017 US National Security Strategy discusses increasing threats and capabilities of near-peer adversaries, mainly from China and Russia, and not insignificantly from North Korea and Iran. According to the document, those near-peer adversaries attempt to create stand-off throughout all domains of warfare to achieve their political advantage, as seen in Russia's annexation of Crimea in 2014. Also, the near-peers continue building capabilities such as hypersonic missiles, fighter jets, and other advanced weapon systems that can be utilized against United States (US) forces and its allies during a possible future conflict. Accordingly, each of the US military service departments has invested much effort in developing future operating concepts and doctrines to fulfill the defense strategy against the adversaries. US Army's Multi-Domain Operations concept in 2018 and Air Forces' Joint All-Domain Command and Control doctrine in 2020 are prime examples of those efforts. To integrate the efforts of different services, the US Joint Chiefs of Staff embarked on writing the Joint Warfighting Concept on conducting Joint All-Domain Operations in 2020. This monograph will attempt to inform the future conduct of the Joint All-Domain Operations in terms of operational interoperability among multinational partners. The monograph will closely examine the historical case of Operation Desert Storm in 1991 and draw implications for the conduct of Joint All-Domain Operations. During Operation Desert Storm, the Air-Land Battle concept was successfully applied against the Iraqi military, the fourth largest military in the world. The operation also showed a high level of interoperability among multinational partners. This monograph will also draw more specific implications for the

Joint All-Domain Operations on the Korean peninsula, where the US and allied forces can face two of the four near-peer adversaries: primarily North Korea, and potentially China.

This monograph is significant in the field of military studies in three ways. First, examining Operation Desert Storm in terms of operational interoperability provides some vital insights into the future interoperability implications of Joint All-Domain Operations, an important, but not heavily researched, subject. The successful interoperability of the past operation with the focus of synchronizing air and land domains can undoubtedly provide some lessons to a possible future operation; integrating multiple domains with added complexity when dealing with multiple domains is considered. Second, the implications drawn from this monograph can inform the development of future warfare concepts and capabilities of both the US and its allied nations, such as the Republic of Korea and NATO countries. Successful and legitimate military operations are rarely conducted unilaterally. If fighting with the allied nation(s) is a general assumption for the US military operations against near-peers, coordination among the allies on future war concepts and subsequent capabilities development becomes crucial. Finally, this monograph will enable readers to understand how effective interoperability contributes to exercising operational art. Although the focus of this monograph is the operational interoperability among multinational partners, interoperability's effectiveness can only be assessed within the context of the application of operational art.

Research Questions / Hypothesis

This monograph seeks to provide answers to the primary research question: what are the implications of multinational operations in Operation Desert Storm in 1991 for the future interoperability of Joint All-Domain Operations on the Korean peninsula? In so doing, the monograph will also attempt to answer three secondary research questions. The first secondary research question is: how did the coalition forces achieve effective multinational interoperability during Operation Desert Storm with the simultaneous synchronization in the land and air

domains? The second secondary research question is: What are the implications of that interoperability for Joint All-Domain Operations, given the increasing complexities of integrating operations in all domains? The third secondary research question is: What are doctrine, capability, and leader development implications of interoperability for possible Joint All-Domain Operations on the Korean peninsula in the future? Based on initial historiography and doctrinal readings, this monograph proposes the hypothesis that effective interoperability during Operation Desert Storm was possible due mainly to proper application and development of doctrine, capabilities, and leadership of major participating nations' militaries. And, these three aspects will stay crucial for the conduct of Joint All-Domain Operations on the Korean peninsula as well, but on different scales due to the complex nature of integrating operations in all domains.

Methodology

This monograph will use the lenses of history (a case study on Operation Desert Storm), doctrine (primarily Allied Joint Doctrine 01), and theory (Peter M. Senge's *The Fifth Discipline* and other theories) to answer the proposed primary and secondary research questions. With access to the Combined Arms Research Library (CARL) and various electronic academic sources, the research will concentrate on multiple analysis in the form of books or articles on Operation Desert Storm, Department of Defense background information, and written documents including interviews conducted with various military leaders involved in the operation. To inform my research, the historiography of the Gulf War and a case study on Operation Desert Storm will provide a basis for the beginning. The lens of doctrine will be particularly important, as Allied Joint Publication 01 lays out the interoperability principles during multinational operations and enables the research to analyze the operation. Meanwhile, Peter M. Senge's *The Fifth Discipline* will provide the lens of theory in analyzing interoperability during Operation Desert Storm, as his theory emphasizes on how to achieve an organization's goal by enabling systems thinking among various participants and teams. Finally, through the interoperability analysis of Operation Desert

Storm, this monograph will draw implications for the Joint All-Domain Operations in the future, primarily when the multinational forces conduct operations on the Korean peninsula (See Figure 1).

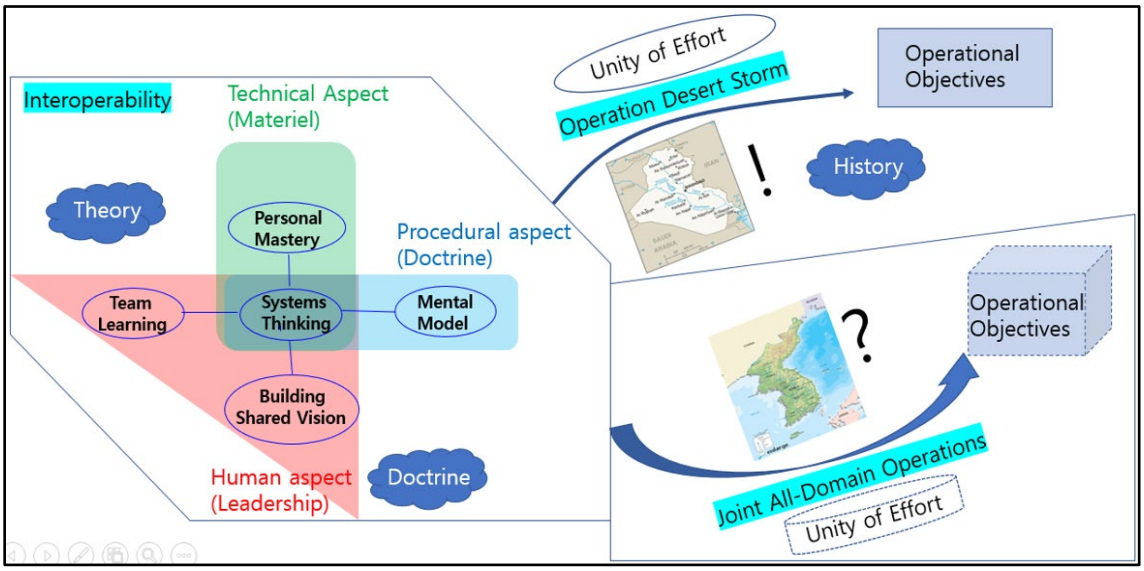

Figure 1. Research Methodology (Basic)
Source: Peter M. Senge, *The Fifth Discipline: The Art & Practice of the Learning Organization* (New York: Doubleday, 2006), 6.

Literature Review

Numerous resources exist regarding the conduct of Operation Desert Storm since the operation was seen as an enormous success for the US and its coalition partners. Resources for Multi-Domain Operations and interoperability between ROK and US forces exist to a lesser degree as the former deals with the fairly recent Army Operating Concept (AOC) and the majority of the latter's literature is published in the Korean language. Few publications have been written for Joint All-Domain operations, for this concept is in development as a joint warfighting concept as of 2020, with the exception of the Joint All-Domain Command and Control (JADC2), which became US Air Force doctrine in August 2020. This chapter of the monograph will explore major lessons and trends from the existing literature and find gaps in answering the primary research question: what are the implications of multinational operations in Operation Desert Storm in 1991 for the future interoperability of Joint All-Domain Operations on the Korean peninsula?

Operation Desert Storm

Certain Victory – United States Army in the Gulf War, a publication of the Desert Storm Study Project led by Brigadier General Robert H. Scales, attempts to discover "ground truths" of the Gulf War by using declassified intelligence, after-action reports, orders, personal stories, and combat narratives.[1] Much of the book's contents focus on how the US Army transformed following the Vietnam War through modernization efforts on training, materiel such as the Big Five weapon systems (the UH-60 Blackhawk, the M1 Abrams tank, the AH-64 Apache, the Patriot, and the M2/3 Bradley), combat training centers, education of officers and Non-Commissioned Officers (NCOs) and the impacts that transformation had on the conduct of the

[1] Robert H. Scales, *Certain Victory: The US Army in the Gulf War* (Washington, DC: Office of the Chief of Staff US Army, 1993), vii.

war.[2] The modernization efforts and developments were put into practice with maximum efficiency during Operation Desert Storm under the leadership of General Norman Schwarzkopf; as the book called "Schwarzkopf's Symphony" to describe the commander's effort to set conditions for the ground offensive to achieve the military objective of driving Iraqi forces out of Kuwait.[3] Although the book mentions coalition efforts of British, French, Saudi, and other forces and overall efforts to mitigate interoperability issues such as setting up Coalition Coordination and Communications Integration Center (C3IC), coalition logistics, liaison organizations, the main focus of the book is on US Army's performance.[4]

Rober M. Citino, a renowned military historian, in his book *Blitzkrieg to Desert Storm – The Evolution of Operational Warfare*, similarly attributes the successful transformation of the US military to the new doctrine, higher personnel standards, new equipment such as the Big Five, and training.[5] On top of the positive impacts that the transformation of the military had on the result of Operation Desert Storm, the author further discusses how Saddam Hussein made a strategic mistake by picking the worst timing for the invasion of Kuwait and an operational mistake by allowing the US and coalition forces to build up the reinforcements before Desert Storm.[6] Citino gave the most credit of the success of Operation Desert Storm to the shrewd application of the new doctrine Air-Land Battle, which emphasized "to defeat the enemy by conducting simultaneous offensive operations over the full breadth and depth of the battlefield."[7] For the first time in the US military history, "the army had conceived, planned, and executed an

[2] Ibid., 19.

[3] Ibid., 145.

[4] Ibid., 122.

[5] Robert Citino, *Blitzkrieg To Desert Storm – The Evolution of Operational Warfare* (Lawrence, KS: University Press of Kansas, 2004), 267.

[6] Ibid., 278.

[7] Ibid., 289.

entire campaign on the operational level."[8] In sum, the US Army and its coalition partners prevailed in Operation Desert Storm because the US Army transformed before the war; Iraq made strategic and operational mistakes; and the US and coalition forces applied Air-Land Battle effectively throughout the operation.

Paul W. Westermeyer's *The Battle of al-Khafji* takes a closer look at how US Marines and Saudi forces cooperated to repel the Iraqi spoiling attack at the Saudi town of al-Khafji during the initial air operation focused phase of Operation Desert Storm. The background of the Marines and Saudis fighting together goes back to General Schwarzkopf's initial guidance for Marines to remove the Iraqis from Kuwait fighting alongside Arab members of the coalition.[9] Various measures were taken to ensure the interoperability between the Marines and Saudis such as dispatching Air Naval Gunfire Liaison Company (ANGLICO) to Saudi forces and the 1st Marine Division commander ordering his Assistant Division Commander to take primary responsibility for liaison duties with Saudis.[10] At times, each side was frustrated by different priorities and ways of thinking, as seen in the middle of the battle where Saudi commanders were unsatisfied by the lack of US air support to what they thought should be the priority of air support.[11] Eventually, Saudis pushed to retake al-Khafji with heavy fire support from ANGLICO and recovered the mutual confidence.

Multi-Domain Operations

According to TRADOC Pamphlet 525-3-1, *The US Army in Multi-Domain Operations 2028*, the MDO concept, the US Army operating concept was created to describe how the Army can contribute to the Joint Forces in achieving the strategic objectives laid out in the 2017

[8] Ibid., 290.

[9] Paul W. Westermeyer, *The Battle of al-Khafji* (Washington, DC: US Marine Corps History Division, 2008), 1.

[10] Ibid., 8.

[11] Ibid., 23.

National Security Strategy and 2018 National Defense Strategy.[12] MDO recognizes four trends in the operational environment: first, adversaries are investing "to contest the US in all domains;" second, realizing the US has the advantage in the close fight, adversaries have "adopted strategies that employ multiple layers and types of stand-off"; third, knowing the vulnerabilities of the high threshold for conflict, adversaries have "leveraged innovative use of the competition space to achieve objectives;" and finally, these trends have "diluted US operational deterrence."[13]

The TRADOC pamphlet describes the MDO concept's central idea: "Army forces, as an element of the Joint Force, conduct Multi-Domain Operations to prevail in competition; when necessary, Army forces penetrate and dis-integrate enemy anti-access and area denial systems and exploit the resultant freedom of maneuver to achieve strategic objectives (win) and force a return to competition on favorable terms"[14] (See figure 2).

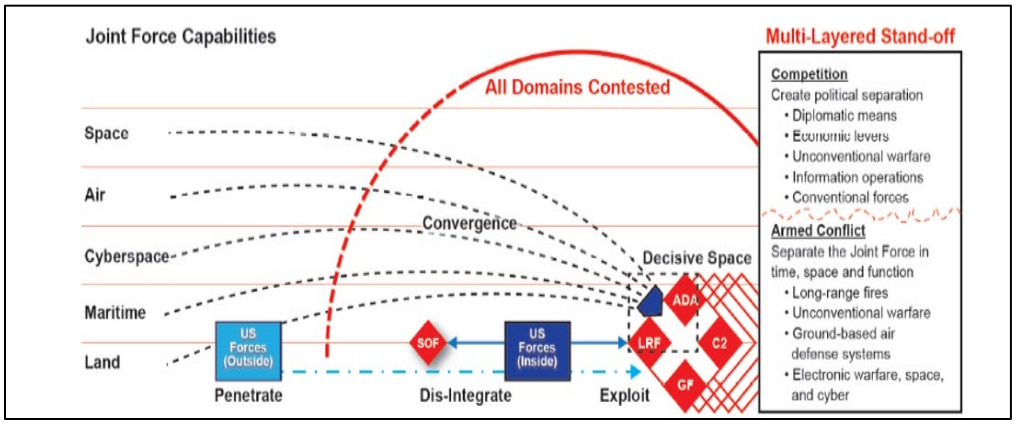

Figure 2. MDO Solutions
Source: US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-3-1, *The US Army in Multi-Domain Operations 2028* (Fort Eustis, VA: TRADOC, 6 Dec 2018), 26.

[12] US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-3-1, *The US Army in Multi-Domain Operations 2028* (Fort Eustis, VA: TRADOC, 6 Dec 2018), 3.

[13] Eric J. Wesley and Robert H. Simpson, "Expanding the Battlefield – An Important Fundamental of Multi-Domain Operations," *Land Warfare Paper* 131 (April 2020): 2.

[14] TRADOC Pamphlet 525-3-1, iii.

As seen in the central idea, the MDO concept provides two main options to the political leaders: first, “expanding the competition space,” which would force the adversaries to recalculate their intentions; and second, “enabling a rapid response” that can deny an adversary’s *fait accompli* attack, and achieve a position of advantage to return to competition.[15] The MDO concept attempts to accomplish given tasks with three tenets of calibrated force structure, multi-domain formations, and convergence.[16] Calibrated force structure has to do with the position and maneuverability of the forces over a strategic distance; multi-domain formation is about capabilities necessary to operate across multiple domains; convergence is about integrating capabilities in all domains.[17] Although the MDO concept assumes operating with multinational partners and requires interoperability especially for units in forward presence, the overall description of how those interoperability needs to be achieved lacks details and is primarily focused on technical aspects such as Army networks.[18]

TP 525-3-8, *US Army Concept: Multi-Domain Combined Arms Operations at Echelons Above Brigade 2025-2045*, is nested and congruent with the Multi-Domain Operations concept.[19] The document describes how future Army forces, especially Echelons Above Brigade (EAB), operate throughout the competition continuum, structure for effective future operations, and identify capabilities and capacities at each echelon necessary to meet the requirements for land forces in a future conflict.[20] TP 525-3-8 proposes that EAB formations need to possess capabilities to "gain and maintain contact; persistently compete; posture; converge multi-domain-effects; exploit the initiative; and consolidate gains" to provide essential linkages to the joint

[15] Wesley and Simpson, 3.

[16] TRADOC Pamphlet 525-3-1, vii.

[17] Ibid.

[18] Ibid., B-1.

[19] US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-3-8, *US Army Concept: Multi-Domain Combined Arms Operations at Echelons Above Brigade 2025-2045* (Fort Eustis, VA: TRADOC, 6 Dec 2018), 5.

[20] Ibid.

forces.[21] The document also states that EAB formations must include uniquely tailored theater armies, threat-focused field armies, versatile corps, and tactically-focused divisions.[22] The EAB concept discusses in a little more detail than the MDO concept about how each echelon can achieve interoperability. For example, a theater army can set the theater by establishing and maintaining critical lines of communication and relationship with partner nation's forces; also, a field army can increase its interoperability by conducting combined exercises with partner nations.[23] These discussions of interoperability in the EAB concept, however, still lack a holistic and systemic approach to maximize the interoperability of multinational joint forces, which is likely to be the form that the US forces would be fighting with.

Joint All-Domain Operation

According to US Air Force General John Hyten, the Vice-Chairman of the Joint Chiefs of Staff, Joint All-Domain Operations (JADO) combine air, land, sea, space, cyber, electromagnetic spectrum, and "everything that we need to operate in the future."[24] He argues that no one has yet to find out how to effectively integrate all domains; however, once the US does find a way to integrate them, they will have "a significant advantage over everybody in the world for a long time."[25] General Hyten goes on to explain that the services and joint staff are in the process of creating a joint warfighting concept that describes the capabilities and attributes necessary to operate in this future all-domain world.[26]

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[21] Ibid., iv.

[22] Ibid.

[23] Ibid., 39.

[24] Colin Clark, "Gen. Hyten On The New American Way of War: All-Domain Operations," *Breaking Defense*, accessed 10 October 2020, https://breakingdefense.com/2020/02/gen-hyten-on-the-new-american-way-of-war-all-domain-operations.

[25] Ibid.

[26] Ibid.

On 1 June 2020, the US Air Force published a doctrine, the first one regarding the JADO, Annex 3-1 *Department of the Air Force Role in Joint All-Domain Operations.* The doctrine recognizes the increasingly interconnected, interdependent nature of future joint operations and seeks "convergence across domains that present adversary dilemmas at an operational tempo complicating or negating adversary responses and enabling the joint force to operate inside the adversary's decision-making cycle."[27] In addition to the Army's effort of creating the MDO concept, which is the Army's contribution to the JADO, the Air Force also took the first step by writing a doctrine on the JADO. Completion of the Joint Warfighting Concept will certainly prompt further discussions and publications.

Interoperability between the ROK and US forces in Korea

In describing the ROK military's modernization process, Michael Raska, in his article "RMA diffusion Paths and Patterns in South Korea's Military Modernization," argues that the ROK military pursued modernization to "acquire advanced military capabilities to counter the widening spectrum of threats, mitigate technological and interoperability gaps with US forces, and eventually attain a self-reliant defense posture."[28] Interoperability with the US forces in Korea was an important concern for the ROK's recent defense reforms. According to Raska, the ROK-US Combined Forces Command (CFC) contributed to increasing the interoperability between the two militaries, especially on operational concepts.[29] Publications within the CFC such as "the Deep Operations Primer-Korea, Air-Ground Operations-Korea, Joint / Combined

[27] US Department of the Air Force, Air Force Doctrine Annex 3-1, *Department of the Air Force Role in Joint All-Domain Operations (JADO)* (Montgomery, AL: Curtis E. LeMay Center for Doctrine Development and Education, 2020), 2.

[28] Michael Raska, "RMA Diffusion Paths and Patterns in South Korea's Military Modernization," *The Korean Journal of Defense Analysis*, Vol. 23, No. 3 (September 2011): 369.

[29] Ibid.

Fires Korea" contributed to closing the gap on operational concepts of the two.[30] Regular combined exercises between the ROK and the US reinforces the application of the concepts.

Despite continuous improvements in interoperability, according to the retired ROK Lieutenant General In-Bum Chun, there are also deficiencies. He argues that language and cultural differences between the ROK and the US continue to be barriers to effective interoperability.[31] Also, Command, Control, Communications, Computers, & Intelligence (C4I) systems between the two militaries, with exception of higher operational level commands, are separated by independent systems.[32] Furthermore, recent debates on MDO or JADO concepts within the US military, which assumes allied participation and operations in allied territories, are not much discussed in the ROK military.

What was learned / What is missing?

Much of the literature on Operation Desert Storm heavily focuses on how the US military was able to transform itself after the Vietnam War and successfully conducted the operation as a result of the transformation. The topics of such discussions include the US Army's effective modernization preceding the operation, the doctrinal evolution of Air-Land Battle and its fruition during the operation, and the application of operational art during Operation Desert Storm. What is missing is a holistic analysis of multi-national interoperability during the operation. Even the publications that do discuss interoperability touch primarily on the technical aspect of interoperability such as communication systems and logistics, rather than looking at the interoperability from a systems perspective. The literature on MDO and JADO are not prolific, as the topics are relatively recent and still in their formative stages. Thus, the emphasis of the

[30] Ibid.

[31] In-Bum Chun, "Korean defense reform: History and challenges," *The Brookings Institution*, accessed 11 October 2020, https://www.brookings.edu/research/korean-defense-reform-history-and-challenges/.

[32] Ibid.

literature has been mainly on clarifying and elaborating different aspects of the concepts. Thus, not much attention has been paid to how applicable these concepts will be to different allied partners or what implications these concepts will have in a specific region within the regional strategic or operational context. The current US and ROK interoperability, according to existing literature, does not seem to have too much problem for now due to relatively aligned doctrine, equipment, and combined Command and Control (C2) structure. Nevertheless, the literature lacks on forecasting the future interoperability and implications when new concepts such as MDO and JDO are applied as doctrines to US forces in Korea.

Doctrine and Theory on Interoperability

Colin Gray, in his book, *Airpower for Strategic Effects*, argues that a theory not only explains how "the parts relate to one another," but also "connect the field of study to other human endeavors," and "anticipate how changes in the future will affect the field of study."[33] Geoffrey Till, in *Sea Power – A Guide for the Twenty-First Century*, also makes an analogy to describe the theory as "the art of cookery" and doctrine as "today's menu."[34] Overall, the relevance of doctrine and theory in this monograph is that they provide a lens and a framework to analyze a historical case of Operation Desert Storm in terms of holistic interoperability and to draw implications for future operations with the JADO concept.

Allied Joint Publication 01

Allied Joint Publication 01, the North Atlantic Treaty Organization (NATO) doctrine published in 2017, begins with emphasizing the importance of interoperability in multinational operation. According to the doctrine, the effectiveness of multinational forces in peace, crisis, and conflict to achieve a military end-state, depends on interoperability, which is defined as "the ability of the forces provided to operate together coherently, effectively and efficiently."[35] The doctrine goes on to elaborate on the three dimensions of interoperability for multinational forces: "technical (for example, hardware, systems); procedural (for example, doctrines, procedures); and human (for example, language, terminology and training)." Interoperability in this sense is not solely focused on effective communication between multinational partners; nor is it on the ability to support each member logistically; nor on possessing aligned doctrines as often described in

[33] Colin S. Gray, *Airpower for Strategic Effects* (Montgomery, AL: Air University Press, 2012), 268.

[34] Geoffrey Till, *Sea Power – A Guide for the Twenty-First Century* (London: Routledge, 2013), 51.

[35] North Atlantic Treaty Organization (NATO), *Allied Joint Doctrine 01* (Brussels: NATO Standardization Office, 2017), 1-2.

much of the existing literature. Rather, one should approach interoperability as a system, mainly consisted of technical, procedural, and human dimensions. Multinational forces with effective interoperability, therefore, must be compatible in all three dimensions to achieve the military end-state.

Joint Publication 3-16: Multinational Operations

JP 3-16, *Multinational Operations*, further offers insights on how to achieve effective interoperability among multinational partners. The doctrine states that nations must consider eight tenets of "respect, rapport, knowledge of partners, patience, mission focus, team-building, trust, and confidence" to achieve effective multinational interoperability.[36] Although these tenets do not guarantee the success of a mission, since there are more requirements than interoperability to fulfill the mission, disregarding the tenets can certainly fail a mission.[37] Although this doctrine mainly guides the US commanders and staff, these tenets can be applied to most multinational forces in general.

First, respect during multinational operation refers to acts of considering each partner nation's honor and prestige.[38] The doctrine elaborates by giving examples: "all partners must be included in the planning process, and their opinions must be sought in mission assignment, organizational structure, and the operation assessment process."[39] Respect provides a basis that can build rapport and mutual confidence. Secondly, rapport needs to be established between multinational partners for multinational operations. A good rapport will "improve teamwork among their staffs and subordinate commanders and overall unity of effort."[40] Multinational partners can establish rapport through personal and direct relationships, which include knowing at

[36] US Department of Defense, Joint Staff, Joint Publication (JP) 3-16, *Multinational Operations* (Washington, DC: Government Publishing Office, 2019), I-2.

[37] Ibid.

[38] Ibid., I-3.

[39] Ibid.

[40] Ibid., I-4.

least a few phrases and greetings in the respective nation's language, eye contact, and good listening skills.[41] Third, the knowledge of partners can act as a force multiplier to multinational operations. Good knowledge of partners includes "developing and demonstrating communication skills, regional knowledge, local customs, values, and cultural awareness."[42] Fourth, patience is also an important factor in multinational operations because “effective partnerships take time and attention to develop.”[43] Relationships between multinational partners can deteriorate quickly without patience. Fifth, mission focus is a significant aspect of multinational operations in that failure to accomplish given tasks will yield “catastrophic results to personnel and mission.”[44] Sixth, team-building is also crucial during multinational operations. Multinational forces can achieve team-building through “training, exercises, and assigning missions that fit organizational capabilities.”[45] Lastly, leaders of multinational forces must build trust and confidence with each other. The doctrine further elaborates that “the ability to inspire trust and confidence across national lines is a personal leadership quality to be cultivated.”[46]

Theory Applicable to Interoperability (Senge’s *The Fifth Discipline*)

Peter M. Senge, in his book *The Fifth Discipline: The Art & Practice of the Learning Organization* forecasts that in the future the world will become more complex, dynamic, and interconnected; thus, it is not effective for an organization to have members follow orders from a single grand-strategist anymore.[47] Rather, the organization that truly excels in the future will be the one that enables each member’s commitment and capacity “to learn at all levels in an

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[41] Ibid.

[42] Ibid.

[43] Ibid.

[44] Ibid.

[45] Ibid., I-3.

[46] Ibid., I-5.

[47] Peter M. Senge, *The Fifth Discipline: The Art & Practice of the Learning Organization* (New York: Currency Doubleday, 2006), 4.

organization."[48] Senge further discusses five disciplines of personal mastery, mental models, building shared vision, team learning, and systems thinking, all of which, through interaction between the components, enables an organization to become a learning organization that achieves its objectives in a complex, dynamic, and interconnected world.[49]

The discipline of personal mastery seeks to increase proficiency in competence and skills and to possess a personal vision to improve oneself continuously.[50] The importance of the personal mastery discipline lies in the fact that "an organization's commitment to and learning capacity can be no greater than that of its members."[51] The central principle of the discipline is the creative tension between personal vision and current reality. Setting a proper vision for oneself and genuinely realizing the current reality will create a creative tension, which will push the reality to the vision.[52]

The discipline of mental models discusses the deep-rooted assumptions and biases that individuals do not often recognize, but which often impact one's perceptions of the world and subsequent behavior.[53] The essence of the discipline is reflective practice, or "the ability to reflect on one's thinking while acting."[54] This reflective practice will allow an individual to examine the difference between what one says is important and how one acts, any jump from observation to generalization, implicit assumptions, and the effectiveness of one's collaborative learning skills.[55] The importance of the discipline lies in the fact that mental models of decision-makers often limit or enable a variety of actions that organizations can take.

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[48] Ibid.

[49] Ibid., 6.

[50] Senge, 131.

[51] Ibid., 7.

[52] Ibid., 140-141.

[53] Senge, 8.

[54] Ibid., 176.

[55] Ibid.

The discipline of building shared vision emphasizes the skill of having a shared picture of a future that "foster genuine commitment and enrollment rather than compliance."[56] A shared vision, as opposed to a mere vision statement or a vision solely laid out by a leader, is translated from the members' personal visions. Thus, a shared vision motivates the members to commit themselves to achieve the vision of the organization.[57] Members feel more responsible for achieving the organization's vision because they contributed to building the vision.

The discipline of team learning also can have an impact on one's quest for mastering operational art. The discipline of team learning pursues a process that produces extraordinary results as a team and significant individual growth.[58] The premise of the discipline is that if individual efforts are harmonized within team efforts, there will not be much energy wasted. Then, the commonality of direction, which is a product of harmony, would make the team efforts greater than a simple sum of the individual efforts.[59] The individual efforts are harmonized with team efforts mainly through shared vision, dialogue, and discussion. Shared vision guides individual efforts in a specific direction; dialogues let members gain insights that cannot be attained individually; discussions allow them to make sound decisions.[60]

Systems thinking is a conceptual framework "for seeing interrelationships rather than things, for seeing patterns of change rather than static."[61] The discipline of systems thinking integrates all other disciplines in a way that the whole can exceed the sum of individual effects, thereby making an organization a truly learning-organization that achieves its desired goals.[62] Due to the nature of complex human systems, understanding the cause and effect relationship of

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[56] Senge, 9.

[57] Ibid., 9.

[58] Senge, 9.

[59] Ibid., 217.

[60] Ibid., 10.

[61] Ibid., 68.

[62] Ibid., 12.

many problems that one faces, in reality, is dependent on seeing the whole picture of how each factor relates to the other.[63]

Assessment

Overall, synthesizing the main concepts of doctrines such as Allied Joint Publication 01 and Joint Publication 3-16, and theory of *The Fifth Discipline* will provide a framework through which one can assess and draw implications of a historical case concerning multinational interoperability during a multinational operation. Although its theory is oriented toward the business world, *The Fifth Discipline* can also apply to military operations since the future operating environment is becoming more complex, dynamic, and interconnected as the military technology and characteristics of warfare continue to evolve. With the application of the theory to multinational operations, a multinational force would refer to Senge's concept of an organization, and each nation-state's force would refer to individual members of an organization in the theory. Thus, 'personal' in this framework would mean something specific to the respective nation-state's forces and 'team' or 'organization' would mean multinational forces as a whole.

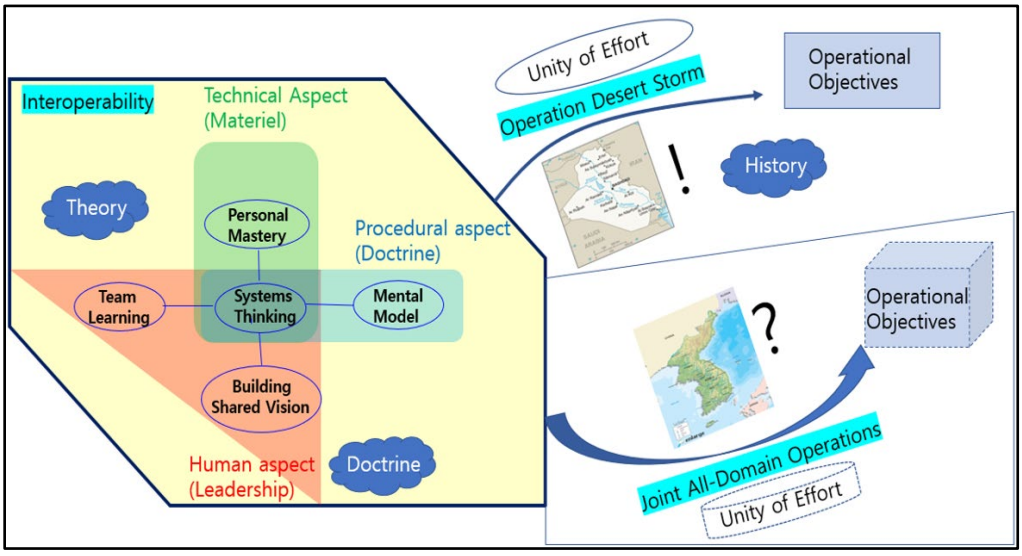

Figure 3. Research Methodology (Doctrine & Theory)
Source: Peter M. Senge, *The Fifth Discipline: The Art & Practice of the Learning Organization* (New York: Doubleday, 2006), 6.

[63] Ibid., 63.

Allied Joint Publication 01's concept of interoperability, which consists of technical, procedural, and human aspects, can relate to *The Fifth Discipline* concept in assessing interoperability of an operation (See Figure 3). The technical aspect, such as military materiel, relates to Senge's concept of personal mastery since the physical aspect of a military organization is crucial in assessing its capacity. Thus, each participating national forces' level of military materiel with consideration of systems thinking would impact the technical aspect of the multinational forces' overall interoperability. Procedural aspect, such as compatible doctrines, relates to Senge's concept of the mental model since each nation's doctrine provides guidance or model to which each force commits itself regarding how to conduct operations. Thus, the compatibility of doctrines among the multinational forces would significantly impact the procedural aspect of the interoperability. The human aspect, such as leadership, relates to Senge's concept of team learning and building shared vision since these two disciplines specifically require leadership through human interaction with members. This is where the eight tenets of multinational operations mentioned in JP 3-16 apply. All of the eight tenets in JP 3-16 emphasize the human aspect of the multinational operation, without which the operation may fall into mission failure. The leadership of each multinational partner and that of the multinational force commander in applying the tenets can significantly impact the human aspect of the interoperability. At the heart of all these dynamics is systems thinking, which emphasizes "seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots."[64]

[64] Ibid., 68.

Historical Case Study: Interoperability during Operation Desert Storm

Carl von Clausewitz, in his renowned book *On War*, cautions against improper use of historical examples to draw implications for future warfare and makes two main propositions.[65] First, he argues that "a single thoroughly detailed event is more instructive than ten that are only touched upon."[66] Using many lightly-touched historical examples, instead of proving concrete trends, may lead readers to false conclusions. Secondly, Clausewitz insisted that historical examples "should be drawn from modern military history, insofar as it is properly known and evaluated."[67] This is because conditions of modern war examples, as opposed to ancient war examples, are much closer to the present or future wars that need lessons as practical as possible. These two propositions of using a single in-depth and modern historical example support the reason for selecting Operation Desert Storm as a historical case study to draw implications for Joint All-Domain Operations in this monograph. This chapter will answer the first secondary research question of the monograph: how did the coalition forces achieve effective multinational interoperability during Operation Desert Storm with the simultaneous synchronization on land and air domains?

What Happened

On 2 August 1990, Iraqi president Saddam Hussein's nearly 100,000 troops and 2,000 tanks invaded Kuwait whose Army of 16,000 collapsed within hours. One of Saddam's major motivations for the invasion was to overcome Iraq's financial crisis, which reached a breaking point in early 1990, by annexing Kuwait, which possessed significant oil reserves. As a result, the Kuwaiti royal family escaped to Saudi Arabia and Kuwait came under Saddam's control.[68] The

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[65] Carl von Clausewitz, edited and translated by Michael Howard and Peter Paret, *On War* (Princeton, NJ: Princeton University Press, 1976), 170.

[66] Ibid., 173.

[67] Ibid.

[68] Alastair Finlan, *Essential Histories: The Gulf War 1991* (Oxford: Osprey Publishing, 2003), 12.

United Nations (UN) immediately condemned the Iraqi invasion and urged the withdrawal of Iraqi forces by issuing the UN Security Council Resolution (UNSCR) 660 on the same day.[69] To prevent possible Iraqi invasion of Saudi oil fields, the US began deploying troops to Saudi Arabia after discussing the matter with Saudi King Fahd, thereby officially launching Operation Desert Shield in defense of Saudi Arabia.[70] UNSCR 678 further required Iraq to withdraw its forces from Kuwait by 15 January 1991 and enabled military actions by multinational coalition forces if Iraq did not comply.[71] International attempts to solve the problem diplomatically failed and Iraq did not withdraw its forces from Kuwait. Consequently, Operation Desert Storm began on 17 January 1991 with the extensive coalition air campaign.[72]

The coalition forces that participated in the operation led by the US consisted of thirty-four countries, including the United Kingdom (UK), France, Saudi Arabia, are considered the largest coalition since World War II.[73] The coalition forces conducted Operation Desert Storm in four main phases: first, a strategic air campaign against Iraq's Air Force and air defense network including its missile capability; second, a strategic air campaign against key installations including command and control facilities; third, a tactical and operational air campaign against the Iraqi armed forces to include Saddam Hussein's elite Republican Guard forces; and finally a ground assault once airpower had prepared the battleground.[74] Throughout the first three phases of air campaigns, the coalition air forces successfully destroyed much of Iraqi air defense, air force, airfields, command and control facilities, critical infrastructures, and ground forces with

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[69] Ibid.

[70] Ibid., 29.

[71] Ibid., 12.

[72] Ibid.

[73] CNN In-Depth Specials, "The Unfinished War: A Decade Since Desert Storm," *CNN*, accessed 11 November 2020, https://web.archive.org/web/20080317110507/http://www.cnn.com/SPECIALS/2001/gulf.war/facts/gulfwar/.

[74] Stuart Griffin, *Joint Operations: A Short History* (London: Training Specialist Services, HQ, 2005), 181.

little coalition losses. The coalition air campaigns were so successful that by the end of Phase three (23 February 1991) just before the ground offensive began, the coalition air forces practically neutralized the Iraqi air force, air defense systems, command and control facilities, and land forces including the destruction of 1,685 tanks (60 percent of Iraq's strength), 925 armored carriers, and 1,485 artillery pieces.[75]

Although some ground battles and skirmishes occurred before February, such as the battle of Khafji on 29 January, the main coalition ground offensive phase began on 24 February 1991.[76] At Khafji, Iraqi forces attacked a Saudi border city of Khafji, in which Saudis immediately repelled the Iraqis with extensive support from the coalition Air Force, naval fire, and US Marines. The basic concept of the ground offensive phase was fairly simple: while two corps (XVIII and VII Corps) conduct deep maneuver through western Iraq to destroy Iraqi Republican Guard forces, Arab coalition forces (Joint Forces North and East) and the 1st US Marine Expeditionary Forces would thrust along the Kuwaiti Gulf coastline to liberate Kuwait.[77] The British 1st Armored Division participated in the operation under US VII Corps, and the French 6th Light Armored Division was part of the US XVIII Corps. Saudis took charge of the separate Arab coalition forces (Joint Forces Command) which consisted of troops from Egypt, Syria, Kuwait, Niger, Pakistan, UAE, Oman, Senegal, Morocco, Bangladesh, and Bahrain.[78] The ground coalition forces, in coordination with various joint efforts such as close air support, air interdiction, naval air support, naval gun support, deception operations of amphibious attack from the Persian Gulf, space global positioning system, and satellite imageries, successfully conducted the final phase of the war in one hundred hours, during which occupying Iraqi forces withdrew from Kuwait. The number of casualties after the operation reveals a stark difference between the

[75] Christopher Chant, *Air War in the Gulf 1991* (Oxford: Osprey Publishing, 2001), 79.

[76] Finlan, 57.

[77] Ibid., 50.

[78] Ibid., 51.

coalition forces and Iraqis. While coalition forces suffered 246 Killed-in-Action (KIA), the Iraqis, even by conservative measure, suffered more than 20,000 KIA.[79] Operation Desert Storm was a successful US-led multinational operation that directly contributed to the strategic aim of forcing the Iraqi troops out of Kuwait and recovering Kuwaiti sovereignty with seamless synchronization primarily between air and land domains.

Assessment

Despite the differences in language, values, religion, equipment, doctrine, and many other various aspects, the coalition forces during Operation Desert Storm were able to achieve a significant level of interoperability. How was this high level of multinational interoperability possible when the coalition forces were improvised in a short period after Saddam invaded Kuwait in 1990? In other words, how did the coalition forces become an effective system synchronizing effects throughout the air and land domains, to successfully achieve their military objective of extracting the Iraqi military out of Kuwait? To answer this question, one must closely assess technical, procedural, and human aspects of interoperability among the coalition forces and how those aspects relate to the concept of five disciplines in Senge's systems thinking-frame, as discussed in the literature review chapter. As far as the coalition forces are concerned, this monograph will mainly evaluate the four major contributing coalition forces: US, UK, France, and Saudi forces.

Technical Aspect and Personal Mastery

First, the technical capability of each coalition member, which can compare to the personal mastery concept within an organization, was sufficient and compatible with other coalition members during Operation Desert Storm, thereby achieving the coalition's overall interoperability. The technical aspect of interoperability refers to the compatibility between multinational forces especially regarding materiel such as weapon systems, C2 systems, vehicles,

[79] Ibid., 85.

fighter jets, space satellites, and many other types of hard power that specific national forces possessed.[80] Thus, the higher the physical capability of each multinational force and the compatibility of those capabilities with each other, the higher efficiency of overall interoperability will be. This technical aspect of interoperability is comparable to the personal mastery concept, meaning the personal capacity to achieve personal vision within an organization because personal mastery of each member of an organization is a cornerstone of the organization to become a learning organization adapting to environmental changes to achieve organizational goal.[81] Each member of the coalition had their own goals and brought physical capabilities and hard powers to fulfill those goals during the operation. These physical capabilities of each force became the basic ingredients of achieving overall coalition interoperability.

The physical capabilities of the coalition forces during Operation Desert Storm cannot be separated from military modernization efforts done before the operation. Each of the major coalition forces went through military modernization to achieve national goals and was ready to demonstrate those physical capabilities in the air-land battle. The primary vehicle driving the modernization during the 1980s, especially for the NATO countries such as the US, UK, and France was the necessity to counter challenges from the Warsaw Pact countries within a broader context of the Cold War. A study by Congressional Budget Office (CBO) in 1982 titled "Army Ground Combat Modernization for the 1980s: Potential Costs and Effects for NATO," emphasized that NATO must maintain less than 1.5 to 1 (the Pact to NATO) force ratio throughout the European theater for a proper military balance that can deter or defend from possible offensives from the Warsaw Pact countries.[82] According to the study, the continuous build-up of the Warsaw Pact forces would break the ratio up to 1.7 to 1 if NATO forces did not

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[80] Allied Joint Publication 01, 1-2.

[81] Senge, 10.

[82] Congressional Budget Office, *Army Ground Combat Modernization for the 1980s: Potential Costs and Effects for NATO* (Washington, DC: Congress of the US Congressional Budget Office, November 1982), xiv.

modernize by 1987.[83] The study showed that the modernization efforts of NATO countries if implemented as planned, would increase the NATO capability by 23 percent and would thus be able to maintain the 1.5 to 1 ratio.[84]

Part of this modernization effort was the US Army's Big Five weapon systems: The M-1 Abrams main battle tank, the M-2 Bradley infantry fighting vehicle, the AH-64A Apache attack helicopter, the UH-60A Black Hawk utility helicopter, and the Patriot air defense missile.[85] Initially, the development process of the weapon systems would be under scrutiny by multiple US media and there were issues with the weapon systems being over-budget and not meeting the standards; however, the controversy would end as a result of success in Operation Desert Storm.[86] Although not to the same extent, British and French forces modernized their militaries as well. In 1977, realizing their vulnerability to growing Warsaw Pact military power, NATO member countries agreed to "seek 3 percent annual real growth in defense outlays over the five years 1978-1983."[87] Both Great Britain and France strived to meet the goal; both countries' defense spending as a percent of GNP in 1981 was 5.4 percent and 4.1 percent respectively, nearing US defense spending of 6.1 percent and exceeding the NATO average of 3.6 percent.[88] Overall, the coalition forces of the US, UK, and France significantly modernized their forces during the 1980s as part of their plans to counter Warsaw Pact countries. These collective efforts on military modernization would later become an important ingredient for the success of Operation Desert Storm.

[83] Ibid.,

[84] Ibid.

[85] Citino, 267.

[86] Ibid.

[87] Congressional Budget Office, 9.

[88] Ibid., 18.

Saudi Arabia heavily invested in its military modernization during the 1980s as well: however, unlike the NATO coalition forces, its motivation was focused on deterring threats from Iran and Iraq.[89] Saudi Arabia spent around 16 percent to 23 percent of the GNP on defense spending during the 1980s.[90] Much of the defense spending during this time went into purchasing foreign weapons. One example of its extensive weapons purchase is the *Al Yamamah* program where the UK's record arms sales with Saudi Arabia occurred in exchange for Saudi crude oils.[91] Although the program was later criticized for its alleged corruption during the deal, the program equipped Saudi Arabia with modern weapon systems such as Tornado fighter jets, Sea Eagle anti-ship missiles, Sandown minehunter ships, and Alarm missiles before the Gulf war.[92] Saudi Arabia attempted to diversify the sources of weapons purchase to avoid relying on the US due to the US's ties with Israel; consequently, the diversification of weapons resulted in maintenance and compatibility even within the military.[93]

Despite the different backgrounds, the intense modernizations of the coalition forces coincided before the Gulf War and certainly became crucial elements of the technical interoperability of the coalition. In this sense, as Citino mentions in his book, Saddam “could not have picked a worse time for his invasion of Kuwait.”[94] The personal mastery concept is based on the premise that "an organization's commitment to and learning capacity can be no greater than that of its members."[95] The basis for an effective learning organization is first having proficiency

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[89] Anthony H. Cordesman and Nawaf Obaid, “Saudi Military Forces and Development: Challenges & Reforms,” *Center for Strategic and International Studies*, accessed 15 September 2020, https://csis-website-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/media/csis/pubs/saudimilforces.pdf, 9.

[90] Ibid., 10.

[91] Ibid., 34.

[92] World Peace Foundation, “The Al Yamamah Arms Deals,” *The Fletcher School*, Tufts University, accessed 22 November 2020, https://sites.tufts.edu/corruptarmsdeals/the-al-yamamah-arms-deals/.

[93] Anthony H. Cordesman and Nawaf Obaid, 12.

[94] Citino, 275.

[95] Senge, 7.

at the individual member level with each member's vision. Likewise, each member of the coalition forces reached a high capacity of conducting the air-land battle at the turn of the decade thanks to previous modernizations that they went through for different reasons.

Throughout Operation Desert Storm, the coalition forces fully utilized state-of-the-art military technology in multiple domains. In the air, approximately 2,000 combat aircraft, operated by coalition aircrews and support personnel, ranging from F-117A stealth fighter jet to more conventional F-15s and British Tornado, bombers such as B-52s, electronic warfare assets such as EF-111A Ravens, Airborne Warning and Control System (AWACS), and aerial tankers allowed the coalition forces to conduct all levels of air operations.[96] On land, the Big Five weapon systems, Multiple-Launch Rocket Systems (MLRS), self-propelled artilleries, Army and Marine helicopters, dominated the Iraqi ground forces.[97] At sea, Aegis class cruisers, Tomahawk land-attack missiles (TLAMs), frigates, mine-clearing ships, carrier battle groups, naval aircraft, and amphibious assault ships provided seaborne punch against Iraqi forces, transportation of bulk of coalition ground troops, and isolation of the theater.[98] In space, the Global Positioning System (GPS) and satellite imageries enabled the coalition forces to coordinate movements and gain substantial information on the Iraqi forces' locations.[99] There certainly were capability gaps between coalition members, but not to the extent that the gaps could not be overcome. The coalition forces exchanged various liaison units and utilized the Combined Operations Center (C3IC) for further coordination and complementing capabilities mutually.[100] The coalition forces were technically interoperable throughout Operation Desert Storm.

[96] Finlan, 20.

[97] Ibid., 22.

[98] Ibid., 23.

[99] Griffin, 173.

[100] Ibid., 174.

Procedural Aspect and Mental Models

Secondly, the coalition forces were also interoperable procedurally by being able to apply the Air-Land Battle doctrine. This procedural aspect of interoperability closely relates to the concept of the mental model in Senge's *Fifth Discipline*. The procedural aspect in this sense refers to the compatibility of military forces in terms of standardization or doctrine. Mental models are "deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action."[101] Thus, it is essential for an organization not only to have a common mental model but also to be able to shift mental models to the one that best profits the organization according to the changes of the environment. Being deeply entrenched in a mental model without proper regard for the changing environment surely is the antithesis to the features of a learning organization. The coalition forces before and during Operation Desert Storm were keen to change their mental model to the doctrine of Air-Land Battle and thus maximized the procedural aspect of interoperability.

The development process of the 1986 US doctrine of Air-Land Battle provides much insight in breaking from past mental models and adapting to a new one considering changes of dynamics in a new operational environment. In his book, *In Pursuit of Military Excellence*, Shimon Naveh assesses that the first step of the major change in American military theory from that of the Vietnam War era began with the introduction of Active Defense doctrine in 1976 by then TRADOC commander General W.E. Dupuy.[102] Active Defense doctrine, which sought to defend from numerically superior Warsaw Pact countries' offensive in Europe by winning the first battle, was greatly influenced by the 1973 Israeli conduct of armored warfare against Syrian and Egyptian offensives.[103] Naveh argued the doctrine possessed a false assumption that "the employment of a tactical defense allowed the American army to overcome the strategic problem

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[101] Senge, 8.

[102] Shimon Naveh, *In Pursuit of Military Excellence* (London: Frank Cass Publishers, 1997), 254.

[103] Ibid.

of numerical inferiority."[104] Surprisingly, subsequent criticisms of the doctrine created a cognitive crisis within the military and ignited professional debates that eventually led to the crystallization of the Air-Land Battle doctrine.[105]

Further contributing to refining the concept of Air-Land Battle were John Boyd's concept of relational maneuver and William Lind's concept of operational art. Both scholars viewed the Active Defense doctrine as unsuitable to face the strategic reality of the US military in Europe and took the discussion to a higher level.[106] Boyd argued the US forces can capitalize on relational maneuver by disrupting the synergy of elements of the enemy system; simultaneously engaging the enemy system's operational components throughout depth; and accelerating momentum by exceeding the enemy's reaction.[107] These thoughts from Boyd would later almost literally turn into four tenets of Air-Land Battle: initiative, agility, depth, and synchronization.[108] Lind emphasized the importance of applying operational art as opposed to merely maneuvering in the tactical battles. American armies, he argued, traditionally attempted to achieve strategic aims by accumulating tactical victories: however, such a method will likely wear out the friendly forces because there will no longer be units left to fight.[109] Combining those ideas and military professionals' ideas forged by various debates from the US and NATO, General Don Starry led efforts to publish the Air-Land Battle doctrine in FM 100-5 in 1982 and the refined version in 1986.[110] The Air-Land Battle doctrine, "defeating the enemy by conducting simultaneous

[104] Ibid., 255.

[105] Ibid., 256.

[106] Ibid., 258.

[107] Ibid.

[108] Ibid.

[109] Ibid.

[110] Ibid., 291.

offensive operations over the full breadth and depth of the battlefield," was refined and published in 1986 after going through the painful shifting of mental models for the US Army.[111]

The coalition forces had to adjust their mental model for the successful operation as well. With the British side joining the discussion of the Air-Land Battle from the formative stage and the close working relations with the US on regular basis, the UK had less trouble than other coalition forces in applying the doctrine during Operation Desert Storm. The UK still had to switch its mental model from the joint yet Navy-centric expeditionary warfare of the Falkland Islands War of 1982 to large scale air-ground focused warfare in the desert.[112]

French forces, on the other hand, had not worked with the US forces since the mid-1960s when France left the military portion of NATO.[113] And the experience of colonial wars that French forces conducted in the 1950s and 1960s were vastly different from what they would face in the Persian Gulf.[114] Nevertheless, the French force's transition to applying Air-Land Battle was smooth because they had been studying the doctrine after its publication, and what French forces had been training on back in France was not too different from that of the US forces.[115]

Saudi forces had to make a major adjustment before Operation Desert Storm since their fighting concept called for a static position defense and they did not have experience in operating formations larger than a battalion.[116] CENTCOM's forming of the Joint Liaison Organization (JLO), ANGLICO, training with US forces during Operation Desert Shield, the successful conduct of the battle of Al-Khafji supported by the US forces closed the existing gaps and brought confidence between US and Saudi forces. The coalition forces throughout the preparation

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[111] Citino, 288.

[112] Griffin, 163.

[113] James J. Cooke, *100 Miles from Baghdad – With the French in Desert Storm* (West Port, CT: Prager, 1993), 44.

[114] Ibid., 205.

[115] Ibid.

[116] Scales, 94.

and conduct of Operation Desert Storm were agile enough to shift their previous mental models to a new one thus achieving the procedural aspect of interoperability.

Human Aspect and Systems Thinking

Lastly, the human aspect of interoperability among the coalition forces was at a high level. This human aspect of interoperability closely relates to the concepts of team learning, building shared vision, and systems thinking in Senge's *Fifth Discipline*. The human aspect in this sense refers to types of activities that only humans can do such as the exercise of leadership. Building shared vision involves "the skills of unearthing shared pictures of the future that foster genuine commitment and enrollment rather than compliance."[117] Team learning essentially is becoming more than a sum of the elements and a better member by dialogue, thinking together, and learn new things.[118] Systems thinking, or the fifth discipline is "the discipline that integrates the disciplines, fusing them into a coherent body of theory and practice."[119] To maximize the human aspect of interoperability, or to enable effective team learning, building shared vision, and systems thinking, the most important component of combat power is leadership. Good leadership at all levels will collectively enable an organization to build a shared vision, facilitate team learning, and empower members of the organization to do systems thinking.

The coalition forces from various countries had a similar goal of repelling Iraqi aggression on Kuwait; however, the willingness of committing forces, and how to conduct operations were different for each country. For example, French forces deployed to defend Saudi Arabia from possible Iraqi invasion, but they were initially reluctant to participate in offensive operations due to economic relations with Iraq.[120] The British forces were at first planning on

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[117] Senge, 9.

[118] Ibid., 10.

[119] Ibid., 12.

[120] Norman Schwarzkopf, written with Peter Petre, *It Doesn't Take A Hero* (New York: Bantam Books, 1993), 468.

dispatching a maneuver brigade but later changed to sending a full armored division thus wanting to join the main effort of the VII Corps rather than the Marines.[121] Saudis originally did not want to go on an offensive due to Iraq's heavily mined defense lines.[122] Thus, the commander of CENTCOM needed to build a shared vision among the coalition forces to achieve the political goal of ejecting Iraqi forces out of Kuwait. General Schwarzkopf alleviated the coalition forces' concerns by finding convergence between the mission and each nation's interests. General Schwarzkopf placed the French division under the US XVIII Airborne Corps and gave a screening mission that would not require a head-on fight with Iraqi Armored forces, but at the same time would be a great achievement by conducting deep maneuver into the enemy territory.[123] He also placed the British 1st Armored Division under US VII Corps, the main effort, so that British forces could meet the public demand and play a prominent role in the operation.[124] General Schwarzkopf also persuaded the Saudi King to participate in the offensive by separating the Joint Forces Command under Saudis and placing Arab forces under the command. Also, he provided Saudis with experts and equipment such as armored excavators, mine plows that can breach Iraqi defense lines.[125] By adjusting resources and utilizing the convergence between mission-critical tasks and different national caveats, General Schwarzkopf's leadership enabled the coalition forces to build a shared vision.

Each of the commanders of the coalition forces interacted with each other so that the coalition forces could achieve team-learning and become a learning organization as a whole. As soon as he found out that the 1st Marine Division was going to work with the Saudis to liberate Kuwait, the division commander of the 1st Marine Division immediately ordered his Assistant

[121] Griffin, 172.

[122] Schwarzkopf, 462.

[123] Ibid, 468.

[124] Griffin, 172.

[125] Schwarzkopf, 462.

Division Commander to take primary responsibility for liaison duties.[126] This action by the commander impacted significantly because liaison organization with Saudis facilitated the air and naval support without which the mission of liberating Kuwait, not to mention the Battle of al-Khafji, could have been jeopardized.[127] General Schwarzkopf hosted a commanders conference in November to explain his concept of operations and listened to commanders' concerns.[128] Each commander learned about higher intent and concept and shared each unit's concerns. The conference benefited not only the subordinate commander but also General Schwarzkopf himself as well.

There are also various instances where leaders of the Coalition forces were applying systems thinking approach to achieve desired effects and facilitate all five discipline concepts to maximize overall interoperability. Air Force Colonel John A. Warden III, the Air Staff's Deputy Director of Plans for warfighting concepts, at the request of General Schwarzkopf to the Air Staff had to come up with a plan to conduct air campaigns that can shape the conditions for the ground offensive.[129] The air staff planning team led by Warden came up with a plan that completely paralyzed Iraqi leadership by targeting not only its command and control systems, but also radio and television sites, electricity, and oil sites, in a manner that "reduce Saddam's ability to project power."[130]

Throughout the preparation and the conduct of Operation Desert Storm, the human aspect of interoperability, especially leadership, remained crucial in achieving overall interoperability. The human aspect of interoperability combined and synchronized the efforts of different aspects as systems thinking does for the other disciplines. The human aspect enables a joint combined

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[126] Westermeyer, 8.

[127] Ibid., 32.

[128] Schwarzkopf, 462.

[129] Williamson Murray, *Air War in the Persian Gulf* (Baltimore, MD: The Nautical & Aviation Publishing Company of America, 1994), 18.

[130] Ibid., 20.

force to become more than a pure sum of its member forces' capabilities. Also, the human aspect of interoperability is what makes learning at the organizational level and personal level possible. Although they do not match perfectly, all three aspects of interoperability have a certain degree of conceptual connection to Senge's five discipline concept. And Operation Desert Storm was an ideal case study where those aspects and disciplines align. This is because multinational interoperability must be considered as a dynamic system; not merely as compatibility in communications equipment.

Analysis

The systemic approach to multinational interoperability during Operation Desert Storm provides various lessons for different occasions. The lessons are especially relevant to the future application of the Joint All-Domain Operation as the US military look into incorporating cyber, space, Electro-Magnetic Spectrum (EMS) domains with the traditional domains of land, air, and sea to counter growing near-peer threats. More specifically, the interoperability lessons in the Persian Gulf in 1991 provide important insights for future Combined Forces Command in Korea to prepare Joint-All Domain Operations to counter evolving North Korean threats in all domains. The interoperability becomes a more complex issue if an armed conflict breaks out on the Korean peninsula again because then more countries would send national troops to Korea as the UN Resolution 84 of 1950 to defend South Korea from North Korean invasion still stands. This chapter will attempt to answer the second secondary research questions: What are the implications of the interoperability for the possible Joint All-Domain Operations on the Korean peninsula in the future?

Similarities and Differences in Operational Concepts and Environment

JADO vs. Air-Land Battle

When drawing implications for JADO interoperability on the Korean peninsula from Operation Desert Storm, one needs to take the significant difference between operational concepts and the environment of the Persian Gulf in 1991 and the current and near-future Korean peninsula. At first glance, the definition of JADO discussed in the literature review does not seem to differ too much from what the Air-Land Battle doctrine applied during Operation Desert Storm. Nevertheless, two ideas stand out in the JADO concept for the joint forces and the MDO concept: competition and convergence. In competition, the JADO attempts to “incorporate all-domain approaches into flexible deterrent options; expose and counter malign influence; and

maintain freedom of access and maneuver in the global commons."[131] This concept is different from the Air-Land Battle doctrine in that it pursues military role even before the armed conflict to counter the adversary's evolving new concept of warfare using advanced technology below the threshold of the armed-conflict and to create multiple dilemmas for the adversaries to prevent them from ever beginning the armed conflict.

The tenet of convergence seeks to combine kinetic and non-kinetic forces and capabilities across domains that "present adversary dilemmas at an operational tempo complicating or negating adversary responses and enabling the joint force to operate inside the adversary's decision-making cycle."[132] This idea is closely related to the concept of synchronization from the Air-Land Battle. However, convergence is taking the concept further by actively integrating effects of all domains in a higher tempo using compatible command and control platforms that are interconnected, whereas synchronization in Air-Land Battle doctrine had to do more deconfliction from different platforms to synchronize effects on the adversary.

North Korean Military vs. Iraqi Military

There certainly are similarities between the current North Korean military and the Iraqi military in 1991. Despite differences in force ratio for each armed service, the sheer size of the militaries is fairly comparable for both militaries. Just as the Iraqi military was ranked the fourth largest military in the world in 1991, North Korea's military strength in terms of the size of its conventional forces stands at the fourth largest in the world, with more than 1.1 million active personnel, which is about 5 percent of the entire population as of 2019.[133] The military, under the command of the General Staff Department, possesses "more than 1,300 aircraft, nearly 300 helicopters, 430 combatant vessels, 250 amphibious vessels, 70 submarines, 4,300 tanks, 2,500

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[131] Ibid., 4.

[132] Ibid., 2.

[133] Eleanor Albert, "What Are North Korea's Military Capabilities?" *Council on Foreign Relations*, accessed 2 December 2020, https://www.cfr.org/backgrounder/north-koreas-military-capabilities.

armored vehicles, 5,500 multiple-rocket launchers, and over 1,000 missiles of varying ranges."[134] Although one might argue that the majority of North Korean military equipment is outdated and the Democratic People's Republic of Korea (DPRK) will not be able to sustain them in a war for an extended period, the mass concentration of conventional forces near the border between the South and the North poses a significant threat for both South Korea and the US troops stationed in the South.

Nevertheless, the North Korean military in 2020 or the near-future is not the same as the Iraqi military in 1991 when it comes to asymmetric military capabilities and possession of a reliable and powerful ally. According to an analysis written by the Council on Foreign Relations (CFR), the publisher of *Foreign Affairs* magazine, North Korea's nuclear stockpile is estimated to be between 30 and 60 bombs; the regime seems to have succeeded in testing the Inter-Continental Ballistic Missiles (ICBMs), capable of reaching the continental US (See figure 2).[135] The regime has tested nuclear bombs six times in total. On the sixth test, the report analyzed that they achieved about a yield equivalent of 35 kilotons of TNT; for comparison, the US nuclear bomb dropped on Hiroshima in 1945 yielded about 16 kilotons.[136] North Korea also has one of the most effective hacking capabilities in the world. North Korea executed multiple cyberattacks on institutions such as South Korean banks (2011), military headquarters (2016), financial institutions (2016), and even foreign entities, like Sony (2014) and the Bangladeshi Central Bank account at the Federal Reserve in New York (2016).[137]

Also, unlike Iraq in 1991, which did not have any country to fight against the coalition forces on their side, North Korea is supported by a powerful and reliable ally: China. Just as it did

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[134] Eleanor Albert, "What Are North Korea's Military Capabilities?" *Council on Foreign Relations*, accessed 3 December 2020, https://www.cfr.org/backgrounder/north-koreas-military-capabilities.

[135] Ibid.

[136] Ibid.

[137] Ibid.

during Korean War, China is ready to support North Korea militarily and economically, since China considers North Korea to be an important buffer for its security. In his address of 70th Anniversary of China's entry into the Korean War in 2020, Chinese President Xi Jinping described the US military intervention on the Korean internal matter, referring to North Korean invasion of South Korea during the Korean War, as an existential threat to China.[138] The president went on to extol China's victory in the Korean War, known in China as "the War to Resist American Aggression and Aid Korea," and emphasized that China is ready to "use war to prevent war" if necessary.[139] Such statements demonstrate a direct linkage of North Korea's survival to China's security and continued commitment for support for North Korea.

ROK-US Combined Forces Command vs. Coalition Forces in 1991

Combined Forces Command (CFC) has been a single war-time headquarter of ROK and US combined forces for the Korea Theater of Operation (KTO) since 1978 to deter and win against North Korea's armed aggression. CFC is an integrated command organization with a US four-star general as the commander and a ROK four-star general as the deputy commander; chiefs of each staff organizations and members are also combined between ROK and US forces. As of 2020, negotiations for Operational Control (OPCON) transfer, in which ROK four-star general would become the commander of the CFC thereby transferring OPCON from the US to ROK, is underway between the two countries: however, the transfer of OPCON will most likely not change the integrated nature of the CFC. As the UN Security Council Resolution (UNSCR) 84 still stands, the sixteen force providing countries are technically still committed to maintaining

[138] Shannon Tiezzi, "In Korean War Commemoration, Xi Warns That China Will Use War to Prevent War," *The Diplomat*, accessed 30 October 2020, https://thediplomat.com/2020/10/in-korean-war-commemoration-xi-warns-that-china-will-use-war-to-prevent-war.

[139] Ibid.

the peace on the peninsula but do not have regular unit-level interactions with the CFC in reality other than limited staff assignments at the UN command in Korea.[140]

This type of integrated command structure of ROK-US CFC is different from the coalition command structure in 1991 in that the coalition forces in 1991 had a parallel command structure between US-led coalition forces and Saudi-led Arab coalition forces. The parallel command structure during Operation Desert Storm was in large part a result of political consideration for General Schwarzkopf to maintain the commitment of Saudi Arabia and other Arab coalition partners.[141] Although the coalition forces in 1991 were formed on an ad-hoc basis to repel Iraqis from Kuwait, the coalition forces had considerable time and space to prepare for Operation Desert Storm throughout Operation Desert Shield, during which Saddam Hussein did not launch any significant attack against the coalition forces in Saudi Arabian soil. In the case of Korea, any possible future attack by North Korea will not guarantee time and space to prepare for the CFC or UN force providing countries to prepare and coordinate like in 1991. Also, the geography of the Korean peninsula does not provide safe space for large-scale augmentation or land maneuver like it did in Saudi Arabia. Although other factors distinguish the Korean peninsula from the Persian Gulf in 1991, taking these major similarities and differences into account is crucial in making the implications relevant.

Implications for JADO interoperability on the Korean peninsula

There are several implications for the CFC and other UN command force-providing countries to achieve successful interoperability in operations to counter a possible future North Korean aggression. The ROK and US forces are the most important actors for the implications discussed in this monograph because they comprise the CFC and other UN forces providing

[140] Euan Graham, "Back in focus: The United Nations Command in South Korea," *The Interpreter*, accessed 16 November 2020, https://www.lowyinstitute.org/the-interpreter/back-focus-united-nations-command-south-korea.

[141] Schwarzkopf, 449.

countries may or may not join them in case of possible North Korean aggression depending on each country's calculations at the moment. Nevertheless, it is still important to include those force-providing countries in this discussion as the UNSCR 84 is still standing and those force-providing countries are technically committed to maintaining peace of the peninsula. These implications are by no means to suggest how the concept should be written or how the allied forces should conduct all-domain operations. Rather, the implications are meant to suggest what to prepare now for a future combined joint all-domain fight with a high-level of interoperability.

First of all, the ROK, US, and UN force-providing countries need to build military capabilities that are compatible and able to counter North Korean threats in all domains. Just as personal mastery of each member is the basic requirement for Senge's effective learning organization, each of the CFC and UN member countries' military capabilities is the basic ingredient for effective interoperability. For example, the coalition forces during Operation Desert Storm could not have achieved a high level of interoperability if the US, British, French, or Saudi forces did not possess armored units that are capable of swift, deep maneuver and counter the Iraqi Republican Guard armored units. Not possessing a proper level of fighter jets for coalition forces could have jeopardized Air-Land Battle's concept of synchronization or attacking through the depth of Iraqi formations. These compatible capabilities in 1991 were the result of the coalition forces' modernization efforts largely coincided and driven by the need to counter conventional war threats from countries such as the Soviet Union. Today, there is no central driving force or common threat to necessitate such changes for the military capabilities of the US, ROK, and other UN forces. Early, conscious coordination of compatible capabilities among the countries is crucial to deter and prepare for a potential North Korean attack, whose capability is evolving in all-domains.

Of particular concern for the military capabilities to improve the JADO interoperability is the compatibility of Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network system. For the multinational forces to effectively

converge effects across all-domains to negate adversary responses and operate inside the adversary's decision-making cycle as the JADO pursues, the C4ISR network of each national force must be compatible. This is because the number of nodes and systems of the multinational forces throughout all domains is so vast that without a compatible network, there is no practical way to converge those effects at the right time and space to defeat the North Korean system. In the age of Air-Land Battle, the network was important as well. However, the liaison teams could make up for some deficiencies because there were mainly two domains and the concept was to synchronize and deconflict rather than converge different effects in all-domains. With the increased number of domains and advancement of technology, the importance of compatible network grew larger. At the same time, the risk is the increased reliance on the C4ISR networks. North Korean military possesses the ability to disrupt various military networks using jamming, cyber and physical attacks. It is, therefore, crucial to develop compatible military capabilities, especially the C4ISR network systems that are compatible among ROK, US, and UN force-providing countries and robust enough to protect themselves from North Korean jamming, cyber, and physical attacks.

Secondly, the ROK, the US, and the UN force-providing countries need to develop a compatible operating concept to deter and defeat North Korea's possible armed aggression. As Senge discussed in *The Fifth Discipline*, having a mental model that guides the actions of each member towards a common goal is a crucial aspect of an effective learning organization. In 1991, the Air-Land Battle doctrine was the mental model for the coalition forces to conduct operations. Since the doctrine was to counter threats from Warsaw Pact countries, the doctrine was discussed written in coordination with the NATO forces before the Gulf war. Although French forces were not directly involved in writing the doctrine, they paid attention to how other nations were developing doctrine and updated theirs accordingly. Saudis were also not much familiar with the concept, but with help from liaison teams and preparation during Operation Desert Shield, and culminating at the battle of Al-Khafji, Saudis also had chances to familiarize themselves to finally

apply the doctrine in Operation Desert Storm. Nevertheless, the ROK, US, and UN force-providing countries do not have any common concept or doctrine to conduct the operations in all-domains yet. The JADO and MDO concepts in the US are largely driven by Air Force and Army respectively, and there is no concept that all services in the US DOD agree upon as of 2020. Nevertheless, now is the right time to initiate the conversation between the allies to develop their concepts and doctrines in a mutually compatible way. The earlier the process initiates, the better for the future interoperability in a possible conflict.

Particular attention needs to be paid to how to realize the concepts of competition and convergence within the context of multinational operations. Competition pursues all-domain approaches to "achieve flexible deterrent options", to "counter malign influence", and to "maintain freedom of access and maneuver in the global commons," but not seeking to escalate to armed conflict.[142] There needs to be discussions and coordination between the allied forces to frame the scope and limits of activities during competition and how best to achieve those effects in all-domains. Those activities can include combined and multinational all-domain exercises demonstrating solidarities among the allied nations to deter North Korean armed attack, combined information, and cyber operations to counter North Korea's malign influence, and counter-jamming activities to prevent the North Korean military from jamming the communication satellites. The concept of convergence seeks to synchronize effects across all-domains in time, space, and purpose to "operate inside the adversary's decision-making cycle."[143] The allied forces need to share a general understanding of what convergence means to them and what assets they are willing to include to achieve that convergence. For example, there can be certain assets that one country cannot share due to national caveats or interests. Not making clear

[142] US Air Force, Annex 3-1, 4.

[143] Ibid., 2.

on those limits and scopes can create friction between national forces when maximum convergence is required.

Last, but not least, the ROK, the US, and the UN force-providing countries need to develop leaders at all levels who can think systemically and apply multinational operations tenets. Leadership is the most significant factor in the human aspect of interoperability. Leadership relates to Senge's concepts of building shared vision, team learning, and systems thinking in that effective leadership can create products that are more than the simple sum of factors belonging to an organization. The coalition forces during Operation Desert Storm in 1991 did possess more and better military assets compared to what Iraqis possessed: however, the very much lopsided result of operation could not have happened if coalition leaders were not able to properly utilize the doctrine and military capabilities that they had. There is enough evidence that General Schwarzkopf understood and applied the eight tenets of multinational operations: respect, rapport, knowledge of partners, patience, mission focus, trust and confidence, and team building.[144] Leaders like General Schwarzkopf strived to apply systems thinking along with the multinational operation tenets during Operation Desert Storm, which in turn increased efficiency of interoperability.

With the increased number of domains and given complexities of the region, the application of Joint All-Domain Operations on the Korean peninsula requires leaders who have an even higher level of systems thinking and can apply the multinational operation tenets. The military leaders operating on the peninsula must understand the complex environment of a divided Korean peninsula surrounded by the worlds' major powers. The leaders must understand how any type of military operation impacts the dynamics of the region; understand different forces committed to the peninsula; build a shared vision; build an effective team; and be able to achieve desired effects using assets in all-domains in coordination with other national forces or

[144] Joint Publication (JP) 3-16, I-4.

inter-agencies. It is therefore important to incorporate a curriculum to educate leaders to do systems thinking and multinational operation tenets. Also, the allied forces should exchange staff positions, military students and conduct combined all-domain exercises to increase knowledge, rapport, confidence, and trust. Since there will most likely not be time to reinforce, move, prepare as the coalition forces did during Operation Desert Shield, it is important to build rapport with each other during peacetime.

Conclusion

Findings

To answer the primary research question of “What are the implications of multinational operations in Operation Desert Storm in 1991 for the future interoperability of Joint All-Domain Operations on the Korean peninsula?” this monograph closely assessed how the coalition forces in 1991 achieved the high degree of interoperability, and what implications could be drawn from them. After examining the question through the lens of theory, history, and doctrine, the initial hypothesis of the monograph seems to be true. The effective interoperability during Operation Desert Storm was possible due mainly to proper application and development of doctrine, materiel, and leadership of major participating nation's militaries. And these three aspects will stay crucial for the conduct of the JADO on the Korean peninsula but on a larger scale due to the increased number of domains and complex operational environment. Some can say that organization or training were more significant factors in achieving interoperability. However, it was coalition forces leadership to include General Schwarzkopf that enabled the command structure and achieve the level of training. This research found that interoperability is not merely the compatibility of communication systems. Interoperability must be approached from a systems perspective that enables a learning organization. Member countries should consider all three technical, procedural, and human aspects to achieve a high level of interoperability.

Recommendations

First, ROK, the US, and other willing UN force providing countries should start investing in C4ISR systems that are compatible with each other. Second, the allied forces should develop capabilities in all-domains that can be protected by physical, cyber, and EMS attacks from North Korea. Third, the allied forces should start discussing Joint All-Domain Operations concepts that are feasible, suitable, acceptable to each nation but at the same time compatible with each other.

Fourth, the allied forces should include activities such as combined all-domain exercises, counter cyber/information operations, and counter jamming operations in competition concept to deter and counter North Korean threats below the threshold of armed conflict. Fifth, the allied forces should reach an agreement on the definition of convergence and decide the scope and scale of participation when converging their assets to create unified effects. Sixth, the allied forces professional military education should include a curriculum to develop a leader who can do systems thinking and apply eight multinational operations tenets. Lastly, the allied forces should expand staff exchanges, military student exchanges, and conduct combined exercises to have a better knowledge of each other and build rapport.

Further Study

Operation Desert Storm, while it provides great insights for interoperability and many other aspects of modern war, cannot be the only case study that one needs to examine to find lessons for effective interoperability in a complex environment of future war. Expanding studies to other historic cases such as the Burma Campaign and Battle of Bulge during World War II, Operation Iraqi Freedom (OIF), where allied nations faced different challenges of interoperability in different contexts would be beneficial to analyze how those past experiences can inform future multinational interoperability.

Furthermore, while this monograph mainly discussed multinational interoperability at the operational and tactical level, one can also focus on a strategic level and examine how politics and national interests of each nation affect interoperability at the operational level. Then theories or lenses to examine the problems can diversify further. Theories such as operational design, systems thinking, international relations, and game theories can be beneficial in examining the strategic level impact on the operational level interoperability between multinational partners in the future.

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