2006-09

Organizing the fight technological determinants of coalition command and control and combat operations

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THESIS

ORGANIZING THE FIGHT: TECHNOLOGICAL DETERMINANTS OF COALITION COMMAND AND CONTROL AND COMBAT OPERATIONS

by

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September 2006

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REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. AGENCY USE ONLY ***(Leave blank)***	**2. REPORT DATE** September 2006	**3. REPORT TYPE AND DATES COVERED** Master's Thesis

4. TITLE AND SUBTITLE: Organizing the Fight: Technological Determinants of Command and Control and Combat Operations

5. FUNDING NUMBERS

6. AUTHOR(S) Major Jack L Sine II

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Postgraduate School
Monterey, CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE
A

13. ABSTRACT (maximum 200 words)

Despite the political impetus for greater multilateralism in international military operations, recent coalitions including U.S. forces reflect a trend toward increasing U.S. dominance and decreasing allied participation. As the United States continues to invest in its military with research, development and acquisition budgets at least double that of any other nation, it fields technologies so advanced with respect to its allies as to leave them incompatible for combined operations. Recent coalition operations suggest that there is a close relationship between technological asymmetries created by partner contributions and the structures formed as the coalition assembles. Using Desert Storm and Operation Allied Force as case studies, this thesis identifies a systemic relationship between technological advantage and coalition dominance. As a coalition seeks to reduce aggregate risk, it relies on technologies that offer the greatest effectiveness. This reliance causes the coalition to divert combat burden to the technologically dominant partner which, in turn, imposes its operational culture. This thesis concludes that the technological transformation currently underway in the U.S. Department of Defense conflicts with U.S. political initiatives to promote greater multilateralism in combat operations by forcing allies to rely on U.S. technologies thereby creating more unilateral operations.

14. SUBJECT TERMS
Coalitions, coalition structures, coalition warfighting, multilateral organization, military technology, technology asymmetry, air power, Desert Storm, Operation Allied Force, multilateral operations, operational culture, risk, interoperability, unilateral operations

15. NUMBER OF PAGES
111

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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ORGANIZING THE FIGHT: TECHNOLOGICAL DETERMINANTS OF COALITION COMMAND AND CONTROL AND COMBAT OPERATIONS

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**MASTER OF ARTS IN NATIONAL SECURITY AFFAIRS
(DEFENSE DECISION MAKING AND PLANNING)**

from the

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF TABLES

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LIST OF ABBREVIATIONS AND ACRONYMS

AAA	Anti-Aircraft Artillery
ALARM	Air Launched Anti-Radiation Missile
ALO	Air Liaison Officer
ATO	Air Tasking Order
AWACS	Airborne Warning and Control System
BVR	Beyond Visual Range
DoD	Department of Defense
CALCM	Conventional Air Launched Cruise Missile
CAS	Close Air Support
CENTCOM	Central Command
COG	Center of Gravity
CJFACC	Combined Joint Forces Air Component Commander
EW	Electronic Warfare
FAC	Forward Air Controller
GPS	Global Positioning System
HARM	High-speed Anti-Radiation Missile
IADS	Integrated Air Defense
IFF	Interrogation Friend or Foe
ISR	Intelligence, Surveillance, Reconnaissance
JDAM	Joint Direct Attack Munition
JFACC	Joint Force Air Component Commander
JSOW	Joint Standoff Weapon
JSTARS	Joint Surveillance Targeting Attack Radar System
LGB	Laser Guided Bomb
MANPADS	Man Portable Air Defense Systems
MLRS	Multiple Launch Rocket System
NATO	North American Treaty Organization
OAF	Operation Allied Force
PACCOM	Pacific Command
PGM	Precision Guided Munition
R&D	Research and Development
RMA	Revolution in Military Affairs
ROE	Rules of Engagement
SAM	Surface to Air Missile
SATCOM	Satellite Communications
SEAD	Suppression of Enemy Air Defenses
TACP	Tactical Air Control Party
TGP	Targeting Pod
TLAM	Tomohawk Land Attack Misisle
UAV	Unmanned Aerial Vehicle

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ACKNOWLEDGMENTS

I would like to thank my thesis advisors, Professors Jim Wirtz and Tom Johnson, for their support, guidance, and patience.

A wise friend of mine told me early in my career that without family you have no country for which to fight. I finally understand what she meant. I would like to express my deep gratitude to my father, Richard Sine, for giving me the tools and to my loving wife, Amy, and my beautiful daughters, Anna and Bristol, who are my motivation and reward. Thank you.

This effort is dedicated to the loving memory of my mother, Beverly Sine.

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I. INTRODUCTION

Two themes run through American strategic thought today that offer different perspectives for the future of U.S. military capability. One school of thought considers technology to be the key to American military dominance.[1] Another believes closer working relationships with allies and multilateral coalitions to be the best way to generate enduring American influence.[2] Advocates of these two approaches suggest that they are not mutually exclusive strategies to guarantee future U.S. military primacy. Upon closer examination, however, these two potential strategies tend to be exclusive and non-complimentary.

The coalition school advocates claim that multi-lateral operations provide international credibility, increase deterrence, and create synergy through combined participation. A multilateral approach is believed to contribute to an international regime of cooperation that promotes peaceful solutions and dissuades deviance from international norms.[3] The technology school advocates significant investments in

1 Two strains of this debate exist today. One doctrinal discussion debates the existence of a revolution in military affairs related to the technological developments in information technologies and precision weapons: for a representative sample of the literature see Michael O'Hanlon, 2000, *Technological Change and the Future of Warfare*, Washington D.C.: Brookings Institute Press; Bill Owens and Ed Offley, 2000, *Lifting the Fog of War*, New York: Farrar, Straus and Giroux; Michèle A. Flournoy, Julianne Smith, Guy Ben-Ari, Kathleen McInnis, David Scruggs, 2005, *European Defense Integration: Bridging the Gap between Strategy and Capabilities*, Washington D.C.: Center for Strategic and International Studies; Barry R. Schneider and Lawrence E. Grinter, eds., 1995, *Battlefield of the Future: 21st Century Warfare Issues*, Maxwell Air Force Base, AL: Air University Press; and Joseph S. Nye, Jr. and Roger K. Smith, eds., 1992, *After the Storm: Lessons from the Gulf War*, New York: Madison Books. The other strain may found in the DoD's force transformation initiatives: see *Quadrennial Defense Review Report*, Department of Defense, February 6, 2006; *Joint Vision 2020*, Washington D.C.: U.S. Government Printing Office, June 2000, http://www.dtic.mil/jointvision/jvpub2.htm (Accessed 15 Aug 2006); and *The U.S. Air Force Transformation Flight Plan*, Washington, DC: HQ USAF, Future Concepts and Transformation Division, November 2003, http://www.af.mil/library/posture/AF_TRANS_FLIGHT_PLAN-2003.pdf (Accessed 15 Aug 1006).

2 For a sample of the discussion of the benefits of multilateral operations, see Robert H. Scales, Jr., 2000, *Future War Anthology: Revised Edition*, Carlisle Barracks, PA: United States Army War College and Robert W. Ricassi, 1993, "Principles for Coalition Warfare," *Joint Forces Quarterly* (Summer 1993): 58-71. For discussion of coalition operations as it relates to doctrinal and training issues see Myron Hura, Gary McLeod, Eric Larson, James Schneider, Daniel Gonzales, Dan Norton, Jody Jacobs, Kevin O'Connell, William Little, Richard Mesic, Lewis Jamison, 2000, *Interoperability: A Continuing Challenge in Coalition Air Operations*, Santa Monica, CA: RAND.

3 For coverage of the neo-liberal institutionalism, see Robert Keohane, "After Hegemony:Cooperation and Discord in the World Political Economy," in Robert Keohane, 1984, *After Hegemony: Cooperation and Discord in the World Political Economy*, Princeton, NJ: Princeton University Press; and Stephen Krasner, "Structural Causes and Regime Consequences: Regimes as Intervening Variables," in Stephen Krasner, ed., 1983, *International Regimes*, Ithaca, NY: Cornell University Press.

technologies that act as force multipliers. Technologists suggest that the world is undergoing a revolution in military affairs (RMA), and that certain technologies multiply the force potential of a military by improving efficiency and speed while reducing logistical requirements.[4]

Unfortunately, the literature debating these schools does not venture outside their respective paradigms to consider their impact on other areas of strategy, military operations and overall foreign and defense policy. The coalition school remains focused on diplomatic and policy relationships while the technology school remains focused on operational considerations. In reality, there is a close relationship between technology and the formation of coalitions and their military operations. Technological capabilities effect the contributions to and cooperation within military coalitions.

A. TECHNOLOGY AND COALITIONS

Current trends in defense spending, force structures, and military organization suggest that the United States will remain technologically far ahead of its allies for the foreseeable future. Some estimates predict that even if European allies increase spending to levels recommended by the North Atlantic Treaty Organization (NATO), decades will be required for them to catch up to U.S. capabilities.[5] Outside of NATO, only a handful of countries possess the potential to "buy up" to U.S. military capability within the next decade or two, and not all of those are U.S. allies.[6]

The overwhelming U.S. advantage in defense expenditures translates to more-modern equipment and more of it. With U.S. acquisition budgets twice the size of its

4 Literature covering the pros and cons of the technological force multipliers, technological force transformation, and the RMA is deep; for a representative sample see: O'Hanlon; Nye; Owens; Carl H. Builder, 1994, *The Icarus Syndrome: The Role of Airpower Theory in the Evolution and Fate of the U.S. Air Force*, New Brunswick: Transaction Publishers; Richard H. Schultz Jr. and Robert L. Pfaltzgraff, Jr. (eds.), 1992, *The Future of Air Power in the Aftermath of the Gulf War*, Maxwell Air Force Base, AL: Air University Press; and John E. Peters, Stuart Johnson, Nora Bensahel, Timothy Liston, Traci Williams, 2001, *European Contributions to Operation Allied Force: Implications for Transatlantic Cooperation*, Santa Monica, CA: RAND.

5 William Drozdiak, 1999, "War Showed U.S.-Allied Inequality," *Washington Post* (June 28): A1.

6 United States leads total world defense spending. China is second at 1/6th U.S. spending and France and Japan follow with less than 1/10th of U.S. defense spending (2005 estimates). *The World Factbook*, United States Central Intelligence Agency Website, http://www.cia.gov/cia/publications/factbook/rankorder/ 2067rank.html (Accessed 17 May 2006).

European allies, and triple in research and development, U.S. forces can expect to fight along side materially and technologically inferior coalition partners.[7] What does this mean for the future of coalition war fighting? How should the United States expect less capable forces to integrate into its war-fighting machine? How should allies expect U.S. forces to assist their military forces?

This thesis investigates the question: How do technological disparities affect coalition structures? Coalition partners tend to favor technologies that increase the likelihood of success and lower the costs of participation. Following these technologies through resulting coalition structures, systemic trends in coalition burden sharing, technological reliance, and operational culture emerge.

Focusing on operations Desert Storm and Allied Force (OAF), this thesis identifies systemic trends in coalition structures attributable to technology asymmetries among the coalition partners. The analysis that follows indicates that technological disparities among forces participating in a coalition lead to unilateral structures within the operation. While it may experience wide participation among contributors, the coalition will exhibit the operational culture of the technologically advantaged partner including leadership responsibilities, combat burden, and command and control.

B. UNILATERAL COALITIONS

In both Desert Storm and OAF, the United States provided new technology in great quantities. This may lead one to consider U.S. dominance in both cases over-determined: the United States provided the most forces, enjoyed the status as the sole remaining superpower, and wielded a GDP and related defense budget that could absorb the costs of a major conflict. [8] Some studies suggest that this is typically the case: the most capable or dominant member is destined to provide a disproportionate contribution

7 David C. Gompert, Richard L. Kugler and Martin D. Libicki, 1999, *Mind the Gap: Promoting a Transatlantic Revolution in Military Affairs*, Washington D.C.: National Defense University Press, 39.

8 Some contributing causal factors include: overwhelming military strength in both numbers and technology; four decades of NATO leadership defaulted leadership to the United States in any NATO dominated operation; status as a world leader demanded a leadership role in order to preserve its superpower status. See Andrew Bennett, Joseph Lepgold and Danny Unger, 1994, "Burden-Sharing in the Persian Gulf War," *International Organization*, 48 (1) (Winter): 39-75; Peters, et al. *European contributions*, 53-55 and Anthony H. Cordesman and Abraham R. Wagner, 1996, *The Lessons of Modern War, Volume IV: The Gulf War*, Boulder, CO: WestviewPress, 72-74.

to a coalition.[9] Others disagree, arguing that Desert Storm did not follow this model. They suggest that conditions leading to the formation of the coalition and the nature of the operation produced an equitable distribution of contributions, despite the wide array of participants and large degree of technological disparity.[10]

Assessments that state the general equity of burden sharing in recent coalitions tend to consider contributions from a strictly economic perspective where basing and financial contributions are equal to personnel and equipment commitments. Despite the financial equity among contributors in Desert Storm, however, the operation demonstrated distinctly American characteristics. Videos of U.S. laser-guided bombs flying through windows filled news broadcasts and half a million U.S. troops represented the main thrust of the ground effort. In OAF, U.S. generals occupied key leadership positions while U.S. planes provided the bulk of the combat power. In both cases, more U.S. troops and equipment were subject to enemy fire than the rest of their coalitions combined.[11]

Some argue that the mere size of the U.S. military necessarily places the United States in a leadership position. John Peters argues that European forces combined rival the U.S. military in size but remain irrelevant without the ability to project their military beyond their border. European militaries continue to maintain large, non-deployable forces tailored to border defense and lack the lift capabilities to project power outside of their region.[12] The cost of maintaining this cold-war-oriented force combined with large social welfare commitments prevents European militaries from ever reaching military parity with the United States in terms of force projection.[13]

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9 Andrew Bennet, Joseph Lepgold and Danny Unger reference three hypotheses that submit that either the dominant or most capable state in alliance contributes disproportionately to an alliance. They allude to Mancur Olson's expectation hypothesis, Robert Keohane's hegemonic state hypothesis, and Stephen Walt's balance-of-threat hypothesis: see footnotes 4, 5, 7, and 10 in Bennett, et al., "Burden Sharing in the Persian Gulf War," 41-43.

10 Ibid., 39-75.

11 Chapter II provides a plethora of statistics demonstrating that the U.S. provided over half of the forces in both conflicts.

12 Jeffery P. Bialos and Stuart L. Koehl, 2005, *The NATO Response Force: Facilitating Coalition Warfare through Technology Transfer and Information Sharing*, Washington D.C.: Center for Technology and National Security Policy, National Defense University.

13 Gompert, et al., *Mind the Gap* and Richard Sokolsky, Stuart Johnson, F. Stephen Larrabee (eds.), 2000, *Improving Allied Military Contributions*, Santa Monica, CA: RAND.

European allies continue to demonstrate either their inability or unwillingness to fund technology upgrades for their militaries. Studies of the growing capabilities gap between the United States and its allies suggest that allied failure to fund research and development and acquire new equipment will leave the allies forever in the United States' shadow. [14] These studies point to many of the symptoms and causes of the growing technology disparity between the United States and its allies, but none of the studies spend time on the systemic ramifications. Recommendations in this literature tend to remain tactical and technical and feature one common theme: allies must spend more money to "catch up" to U.S. technology. The literature overlooks more systemic trends caused by technological asymmetry; therefore, it does not consider a more realistic future where the United States continues to overwhelm its allies with its technological superiority.

The OAF case demonstrates that despite its leadership *role*, the United States did not enjoy the freedom of being *the* leader among coalition partners. U.S. generals serving in OAF filled command positions.[15] Nevertheless, even from the position of Supreme Allied Commander Europe, General Wesley Clark complained that coalition political influences constrained the military's ability to execute their plan for the campaign.[16] The key to these complaints was that it was *U.S. commanders* complaining they could not execute *their* plan. The U.S. military so dominated the coalition that its way of war became the coalition's way of war. This thesis argues that the coalition allowed the United States to imprint its warfighting paradigm on the operations in deference to the technologies the Americans contributed.

14 A partial list of these studies includes: Bennett, et al., "Burden Sharing in the Persian Gulf War;" Benjamin S. Lambeth, 2001, *NATO's Air War for Kosovo: Strategic and Operational Assessment*, Santa Monica, CA: RAND; DoD's *Kosovo/Operation Allied Force After-Action Report: Report to Congress*, Washington D.C.: United States Department of Defense, 2000; Peters, et. al., *European Contributions to Operation Allied Force*; and Anthony H. Cordesman, 2001, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, Westport, CT: Praeger Publishers, 2001.

15 General Wesley Clark as Supreme Allied Commander Europe (SACEUR), Admiral James Ellis as Commander in Chief Southern Forces (CINCSOUTH), and Lieutenant General Michael Short as Combined and Joint Forces Air Component Commander (JFACC).

16 For commentary by senior U.S. leaders during and following OAF see: John A. Tirpuk, 1999, "The NATO Way of War," *Air Force Magazine*, 82 (12) (December), http://www.afa.org/magazine/dec1999/1299watch_print.html (Accessed 10 May 06); Richard Parker, 1999, "NATO strategy doubted, Air chief queries chance of success," *The Denver Post* (May 23), 2nd ed., A-1; and Eric Q. Winograd, 1999, "Clark Says Air Campaign Wasn't Slowed by Coalition Requirements," *Inside the Army* (August 9), 2.

C. METHODOLOGY

This paper uses two cases, Operation Desert Storm and Operation Allied Force, to examine the effects of technological asymmetry on coalition structures. The first case, Desert Storm, presents a coalition consisting of a wide array of members, many of which had not worked together previously. Despite its unique nature, Desert Storm provides an example of a tightly formed coalition with clear objectives and strategic agreement. This case offers an example of technology asymmetries, related obstacles, and solutions in an environment of relative harmony among coalition members.

From a technology perspective, Desert Storm provides examples of both relative parity and significant disparity in specific mission areas. For example, low-technology weapons were common among coalition partners—the allies used relatively small quantities of high-technology weapons.[17] Therefore, weapons capability provides an example of relative parity. Significant disparity existed, however, between U.S. weapons platforms and those employed by the rest of the coalition.

OAF provides an example of a mature coalition consisting of members of a long-standing alliance, NATO, in which the partners spent decades organizing, planning and training together. In this case, coalition members disagreed on policy and strategic goals causing significant challenges for organizational structures, war planners, and targeteers. In this less harmonious atmosphere, the partners reached consensus less easily. Cooperation challenges emerging from coalition disagreements provide cases of obstacles mitigated or exacerbated by technology.

The coalition in OAF used many more high-technology weapons and systems than the coalition in Desert Storm. The sensitive nature of the engagement both internationally and domestically created a system of restrictions that relied on these high technology systems for mission execution. For example, systems such as targeting pods, ground mapping radars and night vision goggles allowed U.S. forces to locate and identify enemy forces in adverse conditions while allied forces without them could not.

17 Only eight percent of the weapons used in Desert Storm were considered precision-guided. *MILITARY OPERATIONS: Recent Campaigns Benefited from Improved Communications and Technology, but Barriers to Continued Progress Remain*, Washington D.C.: United States General Accounting Office (June 2004), GAO-04-547, 9.

Additionally, the exclusive use of airpower in this conflict allows a narrow focus on particular technological asymmetries that had grown within the NATO alliance.

The use of only two cases and the difficulty establishing consistent metrics to quantify technology asymmetry and the resulting coalition structures requires the use of a process trace to discern systemic trends.[18] As Steven Metz argues, technological asymmetries exist in many forms and in various uses.[19] Correspondingly, the coalition structures formed or altered by interoperability deficiencies exist in many forms and uses. By tracing the asymmetry from the external, antecedent conditions through the resulting structural elements, this analysis filters many of the over-determining factors attributed to the United States' dominant role.

This analysis begins by identifying the conditions present during the formation of the coalition. These conditions include political and strategic factors that established the coalitions' objectives, tolerance for risk, and forces contributed. The availability of technologies to abate risk and enhance success led to dependence within the coalition. In the cases considered in this analysis, U.S.-exclusive technologies offered many advantages that allied capabilities could not match. These technology disparities led to a reliance on U.S.-exclusive technologies.

The process continues from reliance to burden sharing. Reliance on U.S.-technologies led to operational burdens accumulating with U.S. forces. In both Desert Storm and OAF, the United States subjected the greater percentage of forces to combat, assumed leadership responsibilities and executed war planning tasks. The technological advantage enjoyed by the Unites States resulted in acceptance of the majority of the burden.

As coalition leadership filled with U.S. commanders and the bulk of the combat burden fell to U.S. forces, the coalition took on a U.S. personality. Command structures,

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18 Stephen Van Evra's process trace methodology allows for comparative analysis in a small-n study. For a description of the process trace, see Stephen Van Evra, 1997, *Guide to Methods for Students of Political Science*, Ithaca, N.Y,: Cornell University Press, 64-67.

19 Steven Metz, "The Effect of Technological Asymmetry on Coalition Operations," in Thomas J. Marshall, Phillip Kaiser and Jon Kessmeire (eds.), 1996, *Problems and Solutions in Future Coalition Operations*, Carlisle, PA: Strategic Studies Institute, 51.

war plans, and combat execution aligned with American doctrine. The more the United States dominated the coalition with its technological advantages the more the coalition looked like a U.S. operation.

Through this process, time emerged as an intervening variable affecting the degree of influence technological asymmetry had on the coalition structure. In Desert Storm, nearly six months of lead-time prior to the start of combat operations allowed the coalition to mitigate technological disparities thereby increasing the breadth of participation. In OAF, a relatively small amount of time between the decision to commit forces and the start of combat operations forced the coalition to create interoperability work-arounds that isolated, if not excluded, allies from operations within the coalition.

1. Limitations

Assessing the effects of technological asymmetry on the United States' leadership role is a difficult exercise. Drawing a relationship between asymmetry and U.S. leadership independent of force quantities must actually assume equal contributions among the coalition partners. Separating technological advantage and simple force size advantage presents a challenge in determining the causal influence on coalition structures. Both relate proportionally to defense spending and related acquisition, research and development budgets. This creates a temptation to dismiss offhandedly the United States' leadership role in both campaigns as attributable to the size of the military it is able to buy with its superpower economy.

A review of defense spending trends relating to technological capabilities does not suggest a direct relationship between defense spending and technological capability. First, spending on acquisition and research and development (R&D) as a percentage of total defense spending varies widely among U.S. allies.[20] Second, despite significant differences in absolute defense spending, countries such as France, Germany, Great Britain, and the Netherlands contributed some capabilities that narrowed technological

20 Only Turkey and Great Britain have comparable percentages at around 30%. Others are approximately 20% or less. For a list of allies considered, their absolute defense spending and as a percentage of GDP, and the percentage of defense spent on acquisition and R&D. *2004 Statistical Compendium on Allied Contributions to the Common Defense*, Washington D.C.: Department of Defense, http://www.defenselink.mil/pubs/allied_contrib2004/allied2004.pdf (Accessed 22 March 2006), D-9.

disparities in certain areas.[21] In fact, Anthony Cordesman argues that Great Britain was one of the few allied partners who possessed a high degree of interoperability with the United States despite an acquisition and R&D budget roughly 1/10th the size of the United States.[22] Certainly, in each of these cases, contributing coalition partners could not combine the advanced technology with large force quantities, as could the United States. In certain capability areas, however, the partners did possess some level of comparable technological capability despite their R&D spending.

Additionally, sheer numbers of troops do not necessarily determine coalition leadership. Commanding U.S. generals in OAF complained that political influence from coalition partners restrained strategic and operational planning and execution.[23] In Desert Storm, Saudi Arabia insisted on a parallel command structure giving their commanding general an equivalent status to the U.S. commanding general, Gen. Norman Schwarzkopf. While HRH General Khaled bin Sultan, Joint Forces Commander, confesses that ultimate command decision rested with the United States, Saudi Arabia continued to exercise its equal status as host nation and commander of Arab forces.[24] In both cases, members of the coalition denied absolute leadership to the United States through continuous political pressure.

2. Definitions

Coalition warfare requires some degree of integration among members of the combined force. The U.S. Department of Defense (DoD) uses the term "interoperability" to refer to this integration. In Joint Publication 1-02, DoD defines interoperability as,

21 France, Great Britain, and the Netherlands contributed precision-guided strike capabilities in OAF. Great Britain contributed electronic warfare capability to both Desert Storm and OAF. Germany contributed electronic warfare capability to OAF. See Cordesman and Wagner, 156-210, for a brief summary of coalition force contributions to Desert Storm. For a brief summary of allied aircraft contributions to OAF see Sokolsky, et al., Table 4.2, 74 and Cordesman and Wagner, 36-40 and 47-48.

22 Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 165.

23 Lt. Gen. Short was a vocal critic of the political pressure applied by coalition partners on military operations, Drozdiak, "War Showed U.S.-Allied Inequality," A-1 and Cordesman and Wagner, 66-72.

24 Khaled bin Sultan, 1995, *Desert Warrior: A Personal View of the Gulf War by the Joint Forces Commander*, London: HarperCollinsPublishers, 197.

> The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together.[25]

Myron Hura expands on this definition by suggesting that the degree of similarity in capabilities “[reflect] their fungibility in supporting coalition military goals.”[26] He refers to interoperability as an “enabler” facilitating closer cooperation and broader coalition participation.[27]

Measuring technical asymmetry within a coalition is problematic. The term “technological asymmetry” suggests an advantage/disadvantage relationship among coalition partners along a linear scale of technological progress. But technological asymmetry is not a matter of levels of technological capabilities, rather, it is a qualitative relationship existing in one of three forms: the degree of reliance the participant places on the technology; the form of the technology (e.g., formats and standards); and the uses for which the participant employs the technology.[28] This analysis will use “technology asymmetry” and “technology disparity” interchangeably referring to differing types, forms, and uses of technology and implying an interoperability deficiency.

When addressing a technological asymmetry, coalition partners may take one of three courses of action. They may ignore or isolate the asymmetry without correcting the interoperability deficiency. An example of this would the exclusion of a capability from an operation because of an inability to integrate technologies or operating capabilities with coalition partners. The coalition may “fix” the disparity by resolving it at its roots. This may involve a technology, policy or strategy such as transferring technology to allies. Lastly, a coalition may merely mitigate the effects of the disparity by developing a “work-around.” Work-arounds involve short-term solutions such as software patches or geographical separation of forces.[29]

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25 *Joint Publication 1-02*, *Department of Defense Dictionary of Military and Associated Terms*, 12 April 2001 (As Amended Through 31 August 2005). Washington D.C.: Department of Defense.

26 Hura, et al., 8.

27 Ibid., 8.

28 Metz, 53.

29 Michele Zanini and Jennifer Morrison Taw, 1999, *The Army and Multinational Force Compatibility*, Arlington, VA: Arroyo Center, RAND, 30.

D. CASE STUDIES

In Operation Desert Storm, political conditions leading to the formation of the coalition pre-determined a leadership role for the United States. From the outset, the United States committed itself to Saudi Arabia's defense.[30] This unilateral commitment, in both rhetoric and substance, established a foundation on which a coalition could form. While motivations and types of contributions varied by country, the totality of the contributions and the series of almost unanimous United Nations (UN) resolutions indicated the international community's disapproval of Iraq's invasion of Kuwait.[31] This political agreement led, in turn, to clear, coherent strategic objectives agreed to by the coalition as a whole: destroy Iraq's military capability to wage war, gain and maintain air supremacy, cut Iraqi supply lines, destroy Iraq's nuclear, biological, and chemical (NBC) capability, destroy Republican Guard forces, and liberate Kuwait City with Arab forces.[32]

While financial contributions deferred up to 90% of U.S. war costs, the United States contributed the majority of the military capability to the effort.[33] The United States provided twice as many troops, planes, ships, and tanks as the rest of the allies combined, and yet, did not own sole command of the coalition.[34] Saudi Arabian sensitivities and the political expediency of organizing other regional partners under Saudi Arabian command led to a parallel command structure with U.S. Central Command

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30 Prior to any international commitments, the United States committed over 200,000 troops to Saudi Arabia's defense for Operation Desert Shield. Following the decision to eject Iraq from Kuwait, the United State doubled this commitment, again prior to additional commitments from other nations. *Conduct of the Persian Gulf War: Final Report to Congress,* Washington D.C.: United States Department of Defense, April 1992, 58-64.

31 Bennet, et al., argue that in the aggregate, the contributions of the coalition members are not explained by Walt's bandwagoning or balancing behavior as outlined in his alliance formation theory. See Stephen M. Walt, 1985, "Alliance Formation and the Balance of World Power," *International Security* 9 (4) (Spring): 3-43; and Andrew Bennett, Joseph Lepgold and Danny Unger, 1997, *Friends in Need: Burden-Sharing in the Persian Gulf War*, New York: St. Martin's Press. For a list of the applicable UN resolutions, see *Conduct of the Persian Gulf War: Final Report to Congress*, 368.

32 *Conduct of the Persian Gulf War*, 580.

33 The United States received $53 billion dollars, cash or in-kind payment, in reimbursements against the estimated $61 billion it spent on the war. *Conduct of the Persian Gulf War*, 225.

34 *Gulf War Air Power Survey, Volume V*, Washington D.C.: Office of the Secretary of the Air Force (1993), 42-47 and 50; and Cordesman and Wagner, 94.

(CENTCOM) commanding one part of the force and Saudi Arabia's Joint Force Command leading the other.[35]

Politically, the United States assumed a leadership role from the outset. Militarily, the massive capabilities of its forces in theater left no doubt as to the United States' role as coalition leader. To understand the influence of technology on the coalition, these aspects of the campaign must be set aside. This study examines this case from a perspective tightly focused on technology. Most important for this analysis is an assessment of the political coherence of the coalition and the strategic agreement among its members.

The technologies that grabbed the spotlight in Desert Storm continue to fuel the ongoing debate about a late 20th century RMA. In the force application areas, these technologies include airborne radar surveillance systems, Airborne Warning and Control System (AWACS) and Joint Surveillance Target Attack Radar System (JSTARS); stealth aircraft and Tomahawk cruise missiles; night vision and thermal imaging devices; the M1A1 tank; and precision-guided munitions. While not all of these were new to the battlefield, their use in quantity and in coordinated operations established a new precedent in war fighting technology.

Another aspect of the Desert Storm coalition makes it an appropriate case for this analysis. The coalition had over five months to deploy, organize, train, and prepare for offensive operations. Over this time, the coalition worked to resolve a large number of technological asymmetry issues. Using the process trace, this analysis considers time an intervening variable that provided a mitigation function for asymmetries by allowing the opportunity to identify problems and implement fixes or work-arounds.

Using an alliance as the basis for a coalition introduces an obligation for participating countries that reduces their subordinate posture. In OAF, rhetoric supporting intervention in Serbia as a NATO mission phrased human rights issues in terms of threats to stability in Europe. OAF represented the first overt, multi-national violation of international law in the interest of human rights. It relied heavily on multi-

35 For a breakdown of forces under each command see *Conduct of the Persian Gulf War*, 574-578 and for a diagram of the high-level command relationships See Cordesman and Wagner, 230.

national participation to preserve the credibility and integrity of a campaign that clearly violated the borders of a sovereign nation.[36]

Unlike Desert Storm, arguments for intervention were less convincing, leaving allied countries with more tenuous domestic support for military action. Without massive support for action, member nations argued more complicated positions manifested in the ambiguous political objectives set for intervention: ensure stability in Eastern Europe, thwart ethnic cleansing, and ensure NATO credibility.[37]

Politically ambiguous goals led to ambiguous strategic objectives, which in turn, led to operational and tactical restraints. Like its political objectives, the coalition's strategic objectives reflected its lack of resolution:

> - Demonstrate the seriousness of NATO's opposition to Belgrade's aggression in the Balkans.
>
> - Deter Milosevic from continuing and escalating his attacks on helpless civilians and create conditions to reverse his ethnic cleansing.
>
> - Damage Serbia's capacity to wage war against Kosovo in the future or spread the war to neighbors by diminishing or degrading its ability to conduct military operations.[38]

Ambiguous political and strategic objectives created space for participants to leverage domestic political concerns into a low-risk operational philosophy.[39] Since NATO credibility was a political objective, maintaining coalition unity became a strategic imperative. As General Clark explained following the war, the coalition placed higher priority on maintaining the alliance than in striking any individual target..[40]

This low-risk dynamic put direct pressure on coalition operations that only U.S. technology could alleviate. In the area of force application, three politically motivated,

36 Michael Glennon, 1999, "The New Interventionism: The Search for Just International Law," *Foreign Affairs* 78 (3) (May/June): 2-7

37 William S. Cohen and Henry H. Shelton, "Message from Secretary of Defense William S. Cohen and Chairman of the Joint Chiefs of Staff Henry H. Shelton," preface to *Kosovo/Operation Allied Force After-Action Report: Report to Congress*, 1.

38 *Kosovo/Operation Allied Force After-Action Report*, 7.

39 Paul E. Gallis (coordinator), 1999, *Kosovo: Lessons Learned from Operation Allied Force*, Washington D.C.: Congressional Research Service, Report #RL30374, 2-5.

40 Winograd, 2.

low-risk constraints set up technology reliance within the coalition. First, member nations' low tolerance for risk was manifest in two obvious constraints: the unwillingness to commit ground troops to the campaign and the requirement for aircraft to stay above 15,000 feet during combat operations. Second, tenuous world support meant a low tolerance for collateral damage. Third, weather and terrain exacerbated the first two constraints by complicating identification and weapons employment. All three of these constraints created operational problems that U.S. technology solved.[41]

One other aspect of this low-risk dynamic is the question of whether OAF would have occurred at all had the technology used by the United States not been available. Following Kosovo, arguments that high-technology weapons systems and associated "bloodless wars" lowered public tolerance for collateral damage. If this is indeed the case, then the converse is necessarily true: high-technology weapons systems allow leaders to rally support for military action by emphasizing the capability to achieve national goals without unacceptable collateral damage. This argument applies to OAF: the NATO allies could survive domestic political pressure only through the promise of low-risk operations by using high-technology airpower.

OAF introduced another round of improvements in military technology. This campaign saw the first use of the B-2 stealth bomber with its weather penetrating ground mapping radar; the GPS-guided Joint Direct Attack Munition (JDAM) able to guide independently to its target; and the Predator Unmanned Aerial Vehicle (UAV) providing long-term, low-risk, and real-time reconnaissance. In addition, other technologies introduced in Desert Storm matured and were in abundant supply including fighter-capable versions of night vision goggles, JSTARS, and laser-designating targeting pods capable of guiding laser-guided munitions.

In the development of the OAF coalition, time played a much different role than in Desert Storm. On one hand, all combat participants belonged to NATO countries and therefore had trained and exercised together for over 40 years. On the other hand, the actual individual units who deployed into theater had not necessarily trained with the

41 For a discussion of the politically imposed constraints and the resulting operational and tactical impacts see Lambeth, 101-177; and Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 92-95;

other nations. There was little time between the start of deployment and the initiation of operations offering little time for the in-theater forces to establish working relationships with the other nations' units. In fact, not all participating forces had arrived in theater before the start of operations.[42]

Therefore, time prior to the campaign was not sufficient to provide the mitigation function as it did in Desert Storm. Instead, time provided a forcing function. Interoperability problems led to decisions about whether or not to use capability rather than how to optimize interoperability. Had time been available, commanders would have had the luxury to delay "use or lose" decisions while work-arounds or fixes could be formed.

E. ROADMAP

Three trends emerge indicating that technological supremacy predisposes coalitional structures to follow the advantaged nation's warfighting model. First, coalition leadership responsibilities shift disproportionately to the technologically advantaged force. Second, as the technologically advantaged force assumes greater leadership responsibility, the coalition assumes the advantaged force's operational culture at the expense of alternative methods, strategies, or avenues of attack used by other supporting nations. Third, time constraints create incentives for resolving technology disparities within the coalition that exacerbate the first two trends. While the assumptions leading to these hypotheses are somewhat artificial in that they isolate political and economic factors contributing to the U.S. leadership role, systemic trends in coalition burden sharing, technological reliance, and operational culture indicate that U.S. technological supremacy was sufficient to determine that these coalitions adopt the U.S. model of war fighting.

Chapter II supports the first proposition by arguing that technological advantage within a technologically asymmetric coalition necessarily accrues a disproportionate share of leadership responsibilities and combat burden to the advantaged force. In both Desert Storm and OAF, a low tolerance for risk was manifested in a framework of

42 Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 31-35 and *Kosovo After-Action Report*, 1-3.

constraints aimed at minimizing collateral damage and limiting friendly exposure. U.S. technology allowed the coalitions to reduce risk without having to modify their objectives. Reliance on this technology shifted the operational and tactical burden in many areas to the United States, including force protection, night and all-weather operations, precision-guided munitions, high-speed maneuver, and intelligence, surveillance and reconnaissance.

Disproportionate burden-sharing and associated leadership responsibility creates a war-fighting paradigm built around the technologically advantaged force. Chapter III analyzes airpower employment, command and control structures, and information access in both operations uncovering a U.S. war-fighting paradigm imposed by its technological advantage. The systems the United States contributed to each coalition relegated the technologically deficient allies to the margins as the coalition relied on U.S. technologies and their associated tactics. Alternative tactics and systems incompatible with U.S. systems were either isolated or excluded from operations.

Interestingly, time emerges as an intervening variable that provided both mitigating and forcing functions with regard to technology asymmetry and interoperability issues. Chapter IV explores the mitigating effects on interoperability provided by the five months of preparation afforded to the Desert Storm coalition. In contrast, the OAF coalition suffered from very little preparation time resulting in even greater deference to U.S. technology. In both cases, at the start of tactical operations, the lack of additional time to troubleshoot interoperability issues forced commanders to make use or lose decisions regarding assets and technologies incompatible with the coalition as a whole.

This study concludes by distilling the systemic trends derived from three propositions discussed above. Technological asymmetries resulting from reliance on U.S. technology advantage created structural elements in both coalitions that shifted burden and risk to the United States. Coalition reliance on U.S. technology contributed to the United States acceptance of these responsibilities and the leadership roles they demanded.

II. RISK, TECHNOLOGY ADVANTAGE AND DIVISIONS OF LABOR: COALITION LEADERSHIP ROLES

During any combat operation, political leaders, commanders and soldiers seek strategies and methods that decrease the likelihood of failure. U.S. Department of Defense defines risk as, “probability and severity of loss linked to hazards.”[43] Risk defines relationship between the known prior to a conflict and the uncertainty of the future. Risk is a variable controlled by commanders that modulates planning and preparation. Tolerance for greater risk allows pursuit of more difficult objectives with fewer resources. Less risk demands more resources to ensure the objective is met.

During Desert Storm and OAF, the coalitions defined risk in primarily in terms of men and material, collateral damage, and political capital. Risk was a pre-war planning variable that determined the numbers of troops sent to theater, the assets committed to meet objectives, and time dedicated to preparation. Advanced military technologies offered these coalitions a means to decrease risk without a proportional increase in men and material. These were U.S. technologies Secretary of Defense William Perry described as “revolutionary military systems” developed in the 1970s and deployed in the 1980s as “force multipliers to counter the perceived three to one disadvantage to the Soviets.”[44]

These revolutionary systems dazzled the coalition: stealth aircraft, satellite imagery, precise navigation systems, night vision goggles and defense suppression capabilities. They all offered the coalition the means to reduce risk to levels defendable to the voters back home and the world community in general. The desire to reduce risk, however, created a reliance on these technologies, which were provided almost exclusively by the United States. While reducing the myriad forms of risk is always a challenge for commanders, the implications of risk reduction was manifest in the division of labor among coalition members. This chapter answers the question: what effect does technological asymmetry have on coalition burden sharing and leadership roles?

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43 *JP 1-02*, 462.

44 William J. Perry, 1992. "Desert Storm and Deterrence in the Future," in Joseph S. Nye, Jr. and Roger K. Smith (eds.), *After the Storm: Lessons from the Gulf War*, New York: Madison Books: 241-264.

This chapter analyzes the relationship between coalition reliance on U.S. technologies to reduce operational risk and the diversion of combat burden and leadership responsibilities to U.S. forces. The first section uncovers three conditions present in both conflicts that contributed to coalition reliance on U.S. technologies to reduce the aggregate risk to the coalition: the desire to reduce international and domestic political risk through expansive multilateral operations; robust enemy military capability; and hypersensitivity to friendly losses and collateral damage. All three of these conditions produced operational constraints aimed at reducing risk. These risk-reducing constraints, however, added pressure to operations in the form of increased risks of friendly-fire incidents, increased combat risks to allied forces, and more-stringent requirements for weapons employment. U.S. technology offered commanders the means to meet operational objectives within these risk-reduction constraints.

The second section considers technologies not necessarily employed to reduce risk but that provided such an asymmetric advantage it produced a similar reliance on them. Whether for risk reduction or asymmetric advantage, the coalitions developed such a dependence on these U.S.-exclusive technologies that they assigned a disproportionate share of combat burden and leadership responsibility to the United States. The last section collates the data from the first two sections to discern a systemic relationship between technological advantage within a coalition and burden sharing and leadership responsibility.

The reliance on U.S. technologies to reduce aggregate risk and produce force advantage for the coalition contributed to the United States' leadership role. This is not to say that U.S. technologies alone forced the allies to cede all leadership responsibilities to the Unites States. Certainly, the sheer capacity of American forces contributed immensely to its role as a coalition leader. The point is that over-riding risk reduction constraints created such a dependence on U.S.-exclusive technologies that the United States would have been assigned a similar leadership role even if the size of its contribution equaled that of the allies. U.S. technological advantage was a sufficient condition to determine a U.S. leadership role within the coalition.

A. THREE CONDITIONS FORCING TECHNOLOGY RELIANCE

Three conditions emerge as contributing factors leading the allies to rely on U.S. technologies. The first condition is the desire to reduce international and domestic political risk by assembling a multinational force to meet the political objectives of the coalition. The diverse capabilities and experiences of the forces assembled instantly created interoperability and cooperation issues that increased the risk of friendly fire incidents. The second condition involved enemy threats to the coalition. The robust air defense systems employed by Iraq and Serbia presented coalition forces with formidable operational and tactical challenges increasing the risk to friendly forces and operational objectives. The third condition also derived from political concerns for risk to lives. Sensitivity to the risks of collateral damage and the loss of friendly troops introduced constraints on operations that forced a reliance of technology to meet strategic and operational objectives. Each of these conditions contributed to risk-conscious dependence on U.S.-provided technologies that produced two results: increased burden and risk to U.S. forces and greater leadership responsibility for the United States.

These conditions would not necessarily have led to failure had the technologies not been available. Each did present a significant challenge, however, that would have increased the duration of the conflict, increased losses, or both. The availability of a capability to mitigate the negative ramifications of these conditions led to a reliance on technologies not possessed by all members, thus creating a technology disparity within the coalition.

1. Coalitions and Deconfliction

In Desert Storm and OAF, the diverse membership of the coalition increased potential for friendly fire incidents. Multinational forces, working together for the first time in many cases, experienced the friction of coalition operations from the outset. Differences in tactics, doctrine, training, and equipment require a period of transition to allow interoperability issues to be worked out. Desert Storm and OAF were no exception and the different technologies embodied in these coalitions highlight the difficulties of forming effective coalition operations.

U.S. technologies, however, presented a particularly challenging scenario for interoperability and combined operations. In particular, technologies emphasizing speed and maneuver through long-range surveillance and identification and beyond-visual-range (BVR) weapon employment increased potential for friendly fire incidents. The complex procedures associated with BVR operations pile additional risk on these training-intensive operations.

In Desert Storm, longer firing ranges for ground based artillery and armor combined with an increased battle pace placed identification of targets and situational awareness at a premium.[45] While a combination of technologies available to U.S. and British forces allowed identification beyond normal visual ranges, in adverse weather, and at night, the potential for friendly forces to stray into areas of responsibility assigned to other coalition units was high, increasing the risk of friendly fire incidents.[46]

Communications equipment combined with navigation accuracy provided by the U.S. Global Positioning System (GPS) allowed ground units and command and control centers constantly to remain aware of friendly positions. Not all members of the coalition, however, had access to this equipment: a disparity existed in both the types of identification and communications equipment and their uses.[47]

To minimize fratricide incidents, the coalition implemented a series of risk-mitigating measures. First, Desert Storm war plans used geographical separation to isolate disparate forces allowing U.S. and some European forces to capitalize on common training and execute AirLand Battle doctrine without the friction of including forces unfamiliar with the doctrine.[48] The challenges of multi-national and multi-lingual forces navigating in a featureless desert, however, required additional effort. The United States provided 115 super-high frequency satellite terminals and 33 multi-channel satellite

45 *Conduct of the Persian Gulf War*, 675.

46 MLRS could travel at speeds up to 40 mph and weapons ranges of approx 20 nm; M1A1 could cruise at 30 mph and fire a variety of weapons with reported engagement ranges out to 2 nm. See *Conduct of the Persian Gulf War*, 832-834 and Cordesman and Wagner, 694-697.

47 GPS provided positional accuracy on the order of 16-25 meters, *Conduct of the Persian Gulf War*, 677-678 and 875; Cordesman and Wagner, 265-266.

48 Cordesman and Wagner, 561.

terminals to non-U.S. coalition members in an effort to improve command and control (C2) and, therefore, separation and awareness among the dissimilar coalition forces.[49]

To improve navigation issues in the interest of keeping units within their areas of responsibility, the United States acquired and shipped as many GPS receivers as possible into theater. Running at full production capacity over the six months leading up to the start of the war, the United States sent more than 5,000 military and commercial receivers into theater. In addition, Saudi and European partners acquired more than 2,500 receivers. Due to the number of coalition partners using GPS, the United States chose to disable GPS encrypting that would have otherwise denied the enemy from deriving the same GPS navigation benefits.[50]

An analogous airborne situation existed in both Desert Storm and OAF. Large numbers of aircraft transiting a relatively small volume of airspace presented challenges for fratricide and collision avoidance. Tracking systems and air-to-air missiles provided some fighters the capability to locate, track, and shoot airborne targets well beyond visual identification ranges.[51] Electronic Identification Friend or Foe (IFF) systems installed on almost all aircraft mitigated this problem but not all partners possessed compatible IFF systems.

In the Desert Storm case, some coalition members had been suppliers of Iraqi military equipment in years past meaning some Iraqi equipment was similar to, if not identical to, coalition equipment.[52] Technologically, disparate types of equipment in the form of weapons and identification systems presented a challenge for air operations.[53]

The primary solution to this technological disparity involved a work-around to compensate for the disparate IFF capabilities.[54] The Joint Forces Air Component

49 Cordesman and Wagner, 561.

50 *Conduct of the Persian Gulf War*, 875-877.

51 For a brief description of aerial detection, identification, intercept and engagement tactics see *Gulf War Air Power Survey, Volume IV*, 141-142.

52 *Conduct of the Persian Gulf War*, 594.

53 Inadequate IFF for ground and air forces was identified as a shortcoming, Ibid., 606.

54 Zanini, et al., define a work-around as a solution to an incompatibility that reduces the effects of the incompatibility but does not necessarily solve it. This is compared to a fix which eliminates an incompatibility by solving it at its roots. Zanini, et al, 30.

Commander (JFACC)[55] implemented rules of engagement establishing strict criteria for air-to-air engagement. Only aircraft with the capability to interrogate autonomously all types of IFF could formally designate an aircraft as an enemy without visual confirmation. This work-around increased the risk to fighters by either forcing them either to wait for other aircraft, such as the AWACS C2 and surveillance platform, or approach to within visual identification range.[56]

Only the U.S. F-15C, F-14 and AWACS aircraft had the capability to identify enemy aircraft beyond visual range.[57] As indicated by coalition aerial kills in Desert Storm, the U.S. F-15C enjoyed considerable technological advantage in theater. While flying only 33% of counter-air missions, the U.S. F-15C earned 34 of 41 aerial kills (83%).[58] One of two conclusions derives from these statistics: either the U.S. F-15C was the superior air-to-air fighter in theater, or the coalition leadership considered it to be superior despite its actual capabilities. The former draws a direct connection between its superior capabilities and its superior kill ratio. The latter case implies war planners considered it the superior asset and therefore placed it in scenarios most likely to engage with enemy fighters. In either case, the technology advantage enjoyed by the U.S. F-15C, whether real or perceived, led to the United States accepting primary responsibility for counter-air defense.

Ironically, the political successes that brought together forces from so many states created a technological disparity within the coalition that increased risk to its forces. Had the coalition divided labor among participants equally, the potential for friendly fire incidents and the risk to forces less capable than United States may have been greater. To mitigate this risk, the coalition implemented a number of work-arounds in the form of rules of engagement (ROE), technology patches, communication equipment, and system degradations. While the technology, such as long-range air-to-air weapons, provided by

55 CJFACC in OAF.

56 From this author's experience, this was 6000-12000' depending on the size of the target aircraft and the geometry of the intercept. These ranges are well within the lethal ranges of enemy fighters in both campaigns.

57 See *Gulf War Air Power Survey, Volume V*, 653-654 for the list of Desert Storm aerial kills. For a description of the F-15C, F-14, and AWACS, see *Gulf War Air Power Survey, Volume IV*, 106-108, *Conduct of the Persian Gulf War*, 772-774, 780-782, and 778-780.

58 Derived from Tables 64 and 96, *Gulf War Air Power Survey, Volume V*, pages 232-233 and 335.

the Unites States may have contributed to an increase in risk, the United States provided the work-arounds in each case to reduce risk to acceptable levels. The work-arounds, however, created a reliance on U.S. capabilities that increased combat burden and leadership responsibilities for American forces.

2. Integrated Air Defense

Enemy air-defense systems created the second condition emphasizing technological disparities that created a reliance on U.S. systems. The French-built, Iraqi KARI integrated air defense system (IADS) harmonized Iraqi surface and air counter-air forces through a centralized command and control system. Both air and ground shooters included capable Soviet built systems including the Mig-25 and Mig-29 fighters; SA-2, SA-3, and SA-6 medium and long range surface-to-air missile systems (SAM); short-range, man-portable air defense systems (MANPADS); guided and unguided anti-air artillery (AAA) batteries; and the French Mirage F-1 fighter and ROLAND SAM systems. The KARI system also incorporated redundant command and control capability; underground, fiber-optic communications; and robust early warning capability including radar systems and observations posts.[59] Iraq's KARI system presented a formidable challenge for coalition air operations.

Serbia's air defense also presented a challenge for coalition air operations, although for slightly different reasons. While not nearly as robust as the KARI system in 1990, Serbia's air defense system benefited from the lessons of Desert Storm and the subsequent 1998 operation, Desert Fox. Serbian tactics sought to attrit enemy air forces by conservatively employing surface-to-air shooters and placing priority on their survival. Serbia's SA-2, SA-3 and SA-6 SAM systems operated more autonomously than Iraq's and used shoot-and-run tactics to deny coalition forces the opportunity to locate and engage them. In addition to the SAMs, Serbian AAA and MANPADS presented a significant threat for low flying aircraft as well. Despite employment of Soviet Mig-29s, Serbia's airborne air defense was nominal at best.[60]

59 For a complete description of Iraq's air defense systems, associated weapons systems, command and control, and tactics, see *Gulf War Air Power Survey, Volume IV*, 1-38.

60 For a description of Serbia's air defense capability, see Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 192-207.

In both coalitions, only the United States possessed the capabilities to face these threats. Eliminating the Iraqi and Serbian air threat involved not only beating the threat the aircraft presented, but also doing so within the fratricide-prevention constraints established by the coalition JFACC. In Desert Storm, air-to-air kill statistics prove the U.S. fighters' dominance in this role: of the 41 total kills, the United States claimed all but two. The non-U.S. kills, both by the same pilot on the same sortie, required American AWACS for intercept geometry, identification, and authorization to shoot.[61] In Kosovo, U.S. fighters shot down five Serb fighters while a Dutch fighter had the only other kill.[62] Within the constraints imposed to prevent fratricide, the capability to identify and target aircraft at long range belonged exclusively to United States counter-air assets.

Using Steve Metz's taxonomy, the technology disparity in both coalitions involved both reliance on and uses of technology. Superior U.S. capability caused a disproportionate shift in responsibility for the air superiority phase of the battle to U.S. air power. In Desert Storm, only U.S. AWACS handled surveillance and early warning in the theater of operations while Saudi and NATO AWACS conducted strictly defensive surveillance missions.[63] U.S. aircraft flew 85% of all strike/attack/counter air sorties with 75% of the combat aircraft in theater.[64] As the air-to-air kill statistics indicate, however, sortie rates do not accurately reflect the assumption of risk or preponderance of capability. While coalition aircraft flew many of the counter air sorties, these sorties were more often defensive combat air patrols flown outside of Kuwait and Iraq or were strike sorties targeting air defense forces on the ground.[65]

It was the SAM threat that most plagued coalition air forces in both conflicts. Two elements of mission structure resulted from the threat presented by enemy IADS:

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61 *Conduct of the Persian Gulf War*, 594-595.

62 *Kosovo/Operation Allied Force After-Action Report*, 69.

63 *Gulf War Air Power Survey, Volume IV*, 97-98.

64 Cordesman and Wagner, 377 and *Gulf War Air Power Survey, Volume V*, 232-233.

65 Gulf War Air Power Survey statistics make it difficult to discern specifically which sorties were OCA sweep missions tasked to engage Iraqi fighters in Iraq. OCA sorties combine SEAD, air-to-surface attacks on air defense sights, and fighter sweep in the Gulf War Air Power Survey numbers.

the use of stealth aircraft and cruise missiles for deep and high risk strikes and the heavy reliance on electronic warfare (EW) and suppression of enemy air defense (SEAD) for force protection.[66]

Stealth aircraft offered coalition planners the option of assigning manned aircraft to strike heavily defended targets without having to eliminate or suppress enemy air defenses before hand. Both the F-117 and B-2 aircraft provided war planners with the ability to strike heavily defended targets using precision-guided munitions without having to assign escorts for counter air and counter air defense roles.[67]

Cruise missiles including the Tomahawk Land Attack Missile (TLAM), Conventional Air Launched Cruise Missile (CALCM), and Standoff Land Attack Missile (SLAM) offered similarly difficult-to-detect weapons systems that fly autonomously for hundreds of miles to strike targets deep in enemy territory.[68] The Joint Standoff Weapon (JSOW), while still in limited quantities, added an additional standoff, GPS-guided weapon to the U.S.'s OAF arsenal.[69] Coalition planners in both conflicts opted to use these systems to strike targets in heavily defended areas such as Baghdad in Iraq and Belgrade in Serbia.[70]

Stealth aircraft and cruise missiles, however, were in short supply for both campaigns. Coalition planners still required non-stealth combat aircraft to fly through SAM threats to accomplish their objectives. To protect more-vulnerable combat aircraft, planners "packaged" aircraft into mission groups combining various aircraft with various

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66 Electronic warfare involves jamming or spoofing enemy radar systems to disguise friendly assets. SEAD involves the use of detection and location equipment to fire weapons, usually radar homing missile, to damage or destroy enemy radars. SEAD missions have the secondary effect of persuading radar operators to shut down their radars for fear of attracting a homing missile, hence the term suppression.

67 The F-117 stealth fighter and B-2 stealth bomber use radar-evading technologies to electronically hide from enemy detection. Flown almost strictly at night to avoid visual detection, these aircraft can cross enemy air defense undetected. *Conduct of the Persian Gulf War*, 789-791, *Gulf War Air Power Survey, Volume IV*, 39-41; *Kosovo/Operation Allied Force After Action Report*, 91; Lambeth, 92.

68 TLAM used scene matching guidance for Desert Storm and GPS in variant used in OAF. CALCM and SLAM used GPS for guidance. For a description of TLAM, CALCM, and SLAM missile systems, see *Kosovo/Operation Allied Force After Action Report,* 91 and *Conduct of the Persian Gulf War*, 852-853, 858-859 and 862-864.

69 *Kosovo/Operation Allied Force After Action Report*, 92.

70 For the discussion of the preference for and use of cruise missiles and standoff munitions in both conflicts, see *Kosovo/Operation Allied Force After Action Report,* 91; *Conduct of the Persian Gulf War*, 231, 862-864; and Lambeth, 92.

capabilities in order to optimize survivability. Air combat fighters, EW and SEAD aircraft escorted more-vulnerable strike aircraft in order to defend them from the air defense threat.[71]

The SEAD and EW technologies available to each of the partners presented a significant disparity. The British Air Launched Anti-Radiation Missile (ALARM) used by the British RAF was in many senses more capable than the U.S. High-Speed Anti-Radiation Missiles (HARM) missiles used by the U.S., German and Italian SEAD aircraft. In Desert Storm, however, only the United States had airborne detection and location capabilities.[72] In OAF, German and Italian Tornados had both detection and location capabilities, but U.S. F-16CJ and RC-135's combined with datalink capabilities and a more advanced version of the HARM established a significant SEAD asymmetry independent of the numbers deployed into theater.[73]

The asymmetry in counter-air defense technologies ultimately led to a disproportionate shift in combat burden to U.S. forces. In Desert Storm, U.S. aircraft accounted for all but 80 EW sorties (2,842) and all of the 4,326 SEAD sorties.[74] The United States expended 1,964 HARMs compared to the British RAF expending 112 of its ALARMs.[75] In OAF, U.S. forces accounted for 60% of the aircraft in theater but flew 88% of the SEAD sorties and nearly all of the EW sorties.[76] The credible threat presented by the Serbian IADS and the vulnerability of the coalition aircraft forced upwards of 30% of the aircraft in each package to be dedicated to EW and SEAD.[77]

71 *Gulf War Air Power Survey, Volume IV*, 152.

72 In Desert Storm, the British RAF retrofitted a handful of its GR-1 Tornados in theater with the capability to launch ALARM missiles. However, this weapons system's inability to autonomously detect and locate enemy radars is likely the reason the RAF was credited only with OCA sorties and no SEAD sorties during the war. *Gulf War Air Power Survey, Volume IV*, 181-192; Cordesman and Wagner, 412.

73 For descriptions of the F-4G, EA-6B, EF-111, F-4G, HARM, and ALARM see *Gulf War Air Power Survey, Volume IV*, 92-96, 105. For a description of the F-16CJ and its SEAD capability as well as the limitations of U.S. and allied SEAD capability, see Lambeth, 102-116.

74 *Gulf War Air Power Survey, Volume V*, 232-233. For a list of EW and SEAD weapons systems used in Desert Storm, see Cordesman and Wagner, 411.

75 *Gulf War Air Power Survey, Volume V*, 229.

76 Peters, et al., *European Contributions to Operation Allied Force*, 20.

77 Ibid., 32.

The presence of U.S. technologies combining sensor, platform and weapon capabilities into an integrated force protection force allowed the coalition in both conflicts to exploit the air with relatively low resistance. In the absence of these technologies, the struggle for air supremacy would have taken much longer and cost many more lives. The availability of these capabilities, however, created a reliance on them, leading the United States to assume a disproportionate share of the counter-air defense burden and the risk inherent in establishing a permissive air environment for coalition operations.

3. Risk Tolerance Forcing Technology Reliance

Operation Allied Force provides an excellent example of the dynamic between risk and technology. All 19 NATO nations contributed to OAF with 14 actually providing forces for the operation.[78] Despite continuous rhetoric claiming that a ground presence remained a viable option, interviews and data since indicate that NATO never seriously considered committing ground troops during the conflict phase of the operation.[79] Concern for maintaining the integrity of the coalition, specifically fear of dwindling domestic support in many participating countries, drove coalition leadership to establish ROE that limited the exposure of allied forces to threats and minimized the risk of collateral damage.[80]

In one interpretation, the coalition's decision not to commit to a ground option reflects its low tolerance for risk to friendly forces. The U.S. DoD observed in *Kosovo/Operation Allied Force After-Action Report: Report to Congress* that,

78 *Kosovo/Operation Allied Force After-Action Report*, 78.

79 See *Kosovo/Operation Allied Force After Action Report*, 7-8; Cordesman, 17-36; Lambeth, 5-15; and Peters, et al., 9-52 for highlights of events leading up to OAF including causes for committing to an air war-only operation.

80 Gen Wesley Clark, commander of NATO forces, stated “"In addition, I would tell you that the cohesion of the alliance was more important than any single target we struck…” Quoted by Erin Q. Winograd, 1999, “Clark Says Air Campaign Wasn't Slowed by Coalition Requirements,” *Inside the Army* (August 9), 2.

> In the period leading up to the initiation of the air campaign, there was not a consensus in the United States or the alliance to aggressively pursue planning for a ground force option in other than a permissive environment.[81]

As a coalition, using ground troops to stop Serbia's ethnic cleansing presented too much risk to personnel to allow many alliance nations to participate.

As an alternative, air power offered the strategic promise of precise and effective operations as seen in Desert Storm less than a decade earlier. U.S. air power advocates claimed that an air-only campaign allowed the coalition to apply coercive force without excessive risk or investment. The choice at the political level appeared to be between a broader coalition using low-risk airpower and a smaller coalition willing to commit ground forces if necessary. The coalition opted for the former. The air-only option offered the potential to meet objectives while keeping risk at acceptable levels.

In choosing this option, political leaders placed coalition unity among the strategic objectives. The *Kosovo/Operation Allied Force After-Action Report* states,

> Once NATO commenced offensive operations, it became essential for NATO to maintain political consensus and cohesion in order to prevail. Maintaining alliance unity then became an overarching strategic objective in the offensive phase of the crisis.[82]

Air power offered a technological alternative to accomplishing strategic objectives using "boots on the ground." This option immediately established a technological asymmetry within the coalition: only the United States had the capabilities and forces to accomplish these objectives through airpower alone.[83]

In addition to using air power exclusively, the coalition implemented risk-mitigating measures designed to protect coalition personnel. For example, the Coalition

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81 *Kosovo/Operation Allied Force After Action Report*, 8.

82 *Kosovo/Operation Allied Force After Action Report*, 7.

83 NATO Secretary General, Lord Robertson, text of speech, "Rebalancing NATO for a Strong Future," *NATO Defense Week Conference*, Brussels, Belgium, 31 January, 2000, http://www.nato.int/docu/speech/2000/s000131a.htm, (Accessed, 12 May 2006).

JFACC (CJFACC) established a minimum altitude of 15,000 feet for all combat operations. By staying above this altitude, coalition aircraft reduced their vulnerability to small arms and MANPADS.[84]

The medium-altitude constraint, however, placed a strain on strike aircraft attempting to identify Serbian forces from almost three miles above. Typically, the presence of a tactical air controller on the ground able to assist airborne assets to locate, identify, and engage enemy ground forces mitigates this scenario.[85] This was the case in Desert Storm where U.S. commanders assigned U.S. Forward Air Controllers (FAC), Air Liaison Officers (ALO), Tactical Air Control Parties (TACP), special forces, and Air Naval Gunfire Liaisons to non-U.S. ground units to facilitate ground-air coordination.[86] OAF's air-only war eliminated this option.[87]

Operations from this altitude also limited the accuracy of standard, unguided weapons decreasing effectiveness and increasing the risk of collateral damage. The fallout from the damage to the Chinese embassy in Belgrade provides one example of the negative effects of collateral damage the coalition sought to avoid.[88] Moreover, Serbia proved to be adept at exploiting the media by using scenes of collateral damage, some of it staged, as propaganda.[89] Resulting ROE established strict guidelines for weapons employment and forced planners to increase their reliance on precision guided munitions (PGM).

84 After the start of air operations, exceptions to the altitude restrictions were made for certain missions. Lambeth, 49.

85 For a brief description of the CAS concept using ground FACs, see Patrick Sheets, "Air War over Serbia," in Wentz, Larry (ed.), 2002, *Lessons from Kosovo: The KFOR Experience*, Washington D.C.: Department of Defense Command and Control Research Program, 111.

86 *Conduct of the Persian Gulf War*, 582; Cordesman and Wagner, 517 and 561, and bin Sultan, 234-235.

87 *Kosovo/Operation Allied Force After-Action Report*, 66.

88 See Richard Parker, 1999, "NATO Strategy Doubted; Air Queries Chance of Success," *The Denver Post* (May 23, Sunday 2nd Ed.): A-1.

89 Lambeth, 139 and *Kosovo/Operation Allied Force After-Action Report*, 6 and Fintan O'Toole, 1999, "NATO's actions, not just its cause, must be moral," *The Irish Times* (April 24), 11.

Poor weather conditions in OAF further exacerbated weapons' accuracy and collateral damage concerns.[90] Non-U.S. combat aircraft did not have the technology to locate or identify targets on the ground through clouds. Collateral damage concerns prevented employment through clouds without the means to find and locate targets. Furthermore, many of the targets were not static. Serbian ground forces demonstrated a willingness and expertise at hiding from coalition aircraft, using decoys to divert coalition weapons, and using civilians as shields.[91]

Only the United States possessed the capability to "see" through the weather. JSTARS provided ground surveillance functions using ground-mapping radars to find Serb forces and track moving targets.[92] Unmanned reconnaissance aircraft, such as the U.S. Predator, permitted surveillance missions to fly below the 15,000 foot minimum altitude restriction for location and identification purposes. As an unmanned vehicle, the Predator allowed lower altitude flights without increasing the risk to coalition personnel.[93]

The B-2 stealth bombers also used internal ground-mapping radars to precisely locate its targets. The B-2 also employed GPS-guided JDAM, which was capable of autonomously guiding to its target using internal GPS receivers. Other PGMs required operators to guide the weapon to the target using a laser designator or locking the weapon on the target with imaging technology.[94]

As alluded to by NATO Secretary General Lord Robertson in a speech following OAF, only the United States possessed the inventories and capability to employ this technology:

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90 DoD's report to congress stated that operations experienced "a at least 50 percent cloud cover more than 70 percent of the time." *Kosovo/Operation Allied Force After-Action Report*, 86.

91 Lambeth, 123-126 and 141.

92 Lambeth, 121-123.

93 *Kosovo/Operation Allied Force After-Action Report*, 57.

94 John A. Tirkpak, 1999, "With Stealth in the Balkans," *Air Force Magazine*, 82 (10) (October), http://www.afa.org/magazine/oct1999/1099stealth.asp (Accessed 10 May 06).

> From precision-guided weapons and all-weather aircraft to ground troops that can get to the crisis quickly and then stay there with adequate logistical support, the European Allies did not have enough of the right stuff.[95]

Without the capability to operate within the constraints established by the coalition leadership, the rest of the coalition effectively shifted the burden of strike disproportionately to the United States. A glance at the numbers and types of aircraft contributed by all NATO participants offers the first indications of the technology disparity among the allies. By the end of the air operation, of the 1,022 total aircraft committed, the United States provided 720, or 70%.[96] Of 38,004 total coalition sorties, U.S. aircraft flew 30,018, or 78%.[97]

Weapons expenditures provide another example of burden shifting disproportionately to the U.S. technological advantage. Of the 28,018 weapons expended, the United States expended 83%.[98] Approximately 8,500, or 30%, of these munitions were precision-guided,[99] of which, the United States employed 6,728 or approximately 80%.[100] In some estimates, PGMs accounted for 74% of targets destroyed.[101] Of course, NATO allies did contribute in a myriad of other ways, such as basing and logistics. However, from a technology perspective, the policies intended to reduce risk to coalition aircrew built a requirement for technology that only the United States could provide in substance.

The B-2, JDAM, JSTARS, and Predator represented U.S. technologies capable of mitigating issues created by ROE and procedure intended to reduce the risk to coalition personnel a civilians. Without them, the coalition would have had to choose between not committing to the operation at all and accepting higher levels of risk to coalition

95 See text of Lord Robertson's speech, "Rebalancing NATO for a Strong Future," *NATO Defense Week Conference*, Brussels, Belgium, 31 January, 2000, http://www.nato.int/docu/speech/2000/s000131a.htm, (Accessed, 12 May 2006).

96 Cordesman details the aircraft contributions by country. Cordesman, 36-60.

97 Lambeth, 61-63.

98 Ibid., 66.

99 Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 44.

100 Lambeth, 88.

101 John A. Tirpak, 2000, "The State of Precision Engagement," *Air Force Magazine* 83 (3) (March). http://www.afa.org/magazine/March2000/0300precision.asp (Accessed 10 May 06).

personnel. Instead, the availability of U.S. technologies allowed the coalition to execute operations within the established risk parameters. In doing so, however, the burden for these operations shifted disproportionately to the United States. Paraphrasing Maj Gen Short, William Drozdiak claimed,

> Short said that since allied strategy demanded highly accurate bombing at night, he could not afford to take the risk of sending the warplanes of many European nations on missions that were deemed too risky -- out of concern for the pilots and for civilian casualties that might result from errant bombing.[102]

Even in the case of long-range surveillance like JSTARS and unmanned vehicles like Predator, while the risk to personnel was not present, U.S. forces assumed the risk to U.S. equipment and the cost to operate them.

The coalition in Desert Storm assembled with more agreement and coherence than did the coalition in OAF. In Desert Storm, overwhelming support from the world community and resultant agreement on political and strategic objectives established coalition cohesiveness that allowed a higher tolerance for risk. Furthermore, significant U.S. commitment up front established a more mission-oriented coalition less conscious of international and domestic political risks.

This does not mean that this coalition accepted all risks equally. Like OAF, risk reduction measures implemented by coalition commanders also resulted in reliance on technology measures. For example, the coalition limited aerial attacks of Baghdad, the most heavily defended air sector in Iraq, to two weapons systems, the F-117 and the TLAM, and only the latter during daytime operations.[103] Therefore, the United States assumed all risk for personnel attacking targets all responsibility for collateral damage for targets in Baghdad.

The U.S. AirLand Battle doctrine involved close coordination between air power and ground maneuver units. Emphasizing speed and agility, U.S. maneuver units relied heavily on training, doctrine, standardization and communications to allow air operations close to friendly forces without increasing the risk of fratricide. By taking coalition lead

102 William Drozdiak, 1999, "Allies Need Upgrade, General Says; Air War Leader Cites U.S. Dominance in NATO Campaign," *The Washington Post* (June 20), A.20.

103 *Conduct of the Persian Gulf War*, 862-864.

in planning and execution, the U.S. AirLand Battle became the template for execution.[104] While five months of preparation afforded coalition forces to exercise coalition partners and train up TACP of their own, the United States ultimately provided liaison teams to each coalition partner down to the battalion level and provided almost all of the Close Air Support (CAS) missions.[105]

CAS involves complex communications, doctrine, and standardization procedures to ensure aircraft flying at hundreds of miles per hour and thousands of feet above the ground do not employ weapons on friendly troops. Anthony Cordesman argues that the assumption of the CAS mission by U.S. air power was no accident,

> This emphasis on U.S. air power reflected the superior precision-strike and close air support mission orientation of U.S. aircraft, but it was also a matter of [Command, Control, Computers, Communication, Intelligence and Battle Management] capability. The U.S. found it far easier to control its own aircraft in what became a far more complex air combat environment the moment that strike/attack aircraft had to engage in combined operations and also found it easier to use this control to reduce the risk of fratricide.[106]

The number of nations participating with such diverse levels and type of training presented a challenge to the high-speed maneuver war that the United States planned to execute. Only the United States had the combination of all the assets required to execute such a complex mission. Once again, superior U.S. technology in weapons, aircraft, and command and control allowed the United States to solve the tactical problem presented by the diverse membership of the coalition.

B. UNFORCED ADVANTAGES

Coalition reliance on U.S. technologies derived in part from measures taken to reduce risk. Theoretically, the absence of these constraints would have allowed coalition partners a greater role in operations. Certain technological advantages possessed by the United States unassociated with political conditions, however, also led to reliance on

104 For a description of AirLand Battle doctrine as it applied in Desert Storm, see *Conduct of the Persian Gulf War*, 291-295.

105 Bin Sultan, 234. The Gulf War Air Power Survey attributes U.S. Air Assets with all of the CAS and FAC sorties during the campaign. *Gulf War Air Power Survey, Volume V*, 232-233.

106 Cordesman and Wagner, 528.

high-technology weapons possessed by only one or a few coalition members. The technological asymmetries in these cases reinforced the technological advantage provided by the United States, further contributing to its leadership role.

Ground combat in Desert Storm proved the value of beyond-visual-range and night-imaging devices. Combined with long-range weapons systems such as the Multiple-Launch Rocket System (MLRS) and the long detection and employment ranges of the M1A1 Abrams tank, thermal imaging systems allowed the detection, identification and engagement of targets outside the lethal ranges of Iraqi forces. Once again, few had these capabilities for the war. Not even all U.S. forces employed these advanced technologies.[107]

Coalition planners accounted for the disparity in capabilities by organizing the coalition forces by matching nations and capabilities to objectives. Planners used the high-speed, high-technology forces for the flanking maneuvers to the west. U.S. and other multi-national units with less capability engaged in breeching operations into Kuwait. The more advanced forces capable of executing high-speed, integrated operations allowed the western flank to cover much greater distances in a short time in order to cut off Iraqi forces fleeing north from Kuwait.[108]

Even light and capable units suffered from technological deficiencies that limited their contributions. The French 6th Light Armored Brigade supported the western effort attached to the U.S. Army XVIII Corps but they lacked the night imaging capability and long-range artillery to be effective against the more robust Iraqi forces.[109] Therefore, the planners assigned the French forces to a security function protecting the left flank of the

107 Press, Daryl G., "Lessons from Ground Combat in the Gulf: The Impact of Training and Technology," *International Security* 22 (2) (Autumn), 139-143.

108 For a complete description of ground operations see Conduct of the Persian Gulf War, 275-345, and Cordesman and Wagner, 584-658.

109 Cordesman and Wagner, 168-171, 591-592.

Army's XVIII corps as it sped to cut off the Iraqi forces fleeing north.[110] The United States even had to augment the French force with 4500 troops from the U.S. 82nd Airborne Division.[111]

The British 1st Armored Division represented the least disparate force within the coalition. Outfitted with thermal imaging capability and GPS navigation, it was able to move as rapidly, day and night, as its VII Corp counterparts.[112] Technological compatibility with U.S. forces enabled the 1st Armored Division to maneuver with the U.S. 1st Infantry Division (Mechanized) including moving through its positions at night.[113] British forces still required augmentation from a U.S. National Guard MLRS unit for long-range artillery support.[114]

The differences in responsibilities and assignments during the ground operations represented the technological disparity within the coalition. The U.S. Army possessed quicker forces with longer-range capability and the ability to operate day and night. These capabilities relegated these forces to western operations requiring high-speed to cover the longer distances required in the western flanking maneuver. Less quick coalition partners, including the 1st Marine Expeditionary Force with older armor and artillery, were assigned the breeching operations and shorter distances into Kuwait.

Another example of U.S. technological advantage involves its exclusive contribution of heavy bombers. For example, B-52 bombers in Desert Storm represented only three percent of the combat aircraft in theater yet delivered approximately 30% of the bomb tonnage.[115] This aircraft and the devastation they delivered produced, by itself, the surrender of Iraqi ground forces.[116] The long range and heavy payloads provided the coalition with overwhelming firepower delivered nearly unencumbered from high above the threat.

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110 *Conduct of the Persian Gulf War*, 294.

111 John E. Peters and Howard Deshong, 1995, *Out of Area or Out of Reach? European Military Support for Operations in Southwest Asia,* Santa Monica, CA: RAND, 15.

112 Cordesman and Wagner, 143 and 598-600.

113 Cordesman and Wagner, 143 and 598-600.

114 Peters and Deshong, 37.

115 Gulf War Air Power Survey, Volume IV, 52.

116 *Conduct of the Persian Gulf War*, 198.

The B-2 represents a U.S. technological advantage in many areas of force application. From a force projection perspective, the B-2 demonstrated the ability to take-off in Kansas, strike targets in Serbia, and land back in Kansas on a single sortie. This bomber proved an authentic, global power projection capability.[117] During OAF, it carried up to sixteen, 2,000 pound, GPS-guided JDAM allowing it to hit sixteen different targets within meters on a single pass.[118]

The heavy bomber represents a capability pursued by few countries worldwide. No U.S. allies possess this combination of range and payload. Capable of delivering long-range cruise missiles and precision-guided munitions, these aircraft provide war planners force-multiplying effects at all levels of war. Within both Desert Storm and OAF, these aircraft shifted burden and risk to the United States creating a reliance on their ability to deliver concentrated mass thereby accelerating the progress of operations.

C. SYSTEMIC TRENDS

Conditions external and internal to the coalition created operational pressures U.S. technologies could relieve. These technologies created an asymmetry within the coalition, forcing specific structural mechanisms to develop. Table 1 lays out the conditions that led to reliance on technologies provided almost exclusively by the United States, which in turn created technological asymmetries. These asymmetries produced structural elements within the coalition that shifted burden and risk to U.S. forces requiring the United States to accept responsibility for these mission areas.

The large and multi-national nature of these coalitions created the first condition: large forces working within defined spaces using weapons systems with the potential to kill beyond ranges that forces are able to identify. The use of various types of weapons systems and platforms adds to uncertainty for a shooter less familiar with the vehicles and aircraft of another nation. This scenario leads to a high potential for friendly fire.

In response, the United States provided technologies to mitigate the risk. For ground forces, a combination of GPS receivers, satellite communication (SATCOM)

117 Lambeth, 89-94.

118 *Kosovo/Operation Allied Force After-Action Report*, 91-92.

radios, and geographic separation reduced friendly-fire potential. Effective adherence to geographic responsibilities, however, required U.S. assets and the disabling of GPS encryption. For air forces, strict rules of engagement restricted the employment of weapons beyond visual range. Only U.S. forces possessed the capability to identify the enemy beyond visual range leading to a reliance on U.S. command and control assets for long range engagements. In both cases, coalition leadership accepted an increased risk from enemy forces in order to reduce the risk of friendly fire incidents.

Table 1. Technological Asymmetry Causal Relationship Trace

Condition	Issue	Asymmetry	Structural Result
Large, Disparate Force (Ground)	Friendly fire	GPS, SATCOM, Long-Range ID systems	Geographic separation, U.S. technology for coordination
Large Disparate Force (Air)	Friendly fire	Command and Control (AWACS, SATCOM)	U.S. AWACS assumes airborne C2
	Friendly fire	Beyond Visual Range ID capability	Coalition implements strict ROE for BVR engagement
Enemy Integrated Air Defense	Attacks on heavily defended targets	Stealth, Cruise missiles	United States assumes burden and risk for heavily defended targets
	Vulnerable allied strike aircraft	EW and SEAD capabilities	Force packaging requiring U.S. EW and SEAD assets tied to every mission
	Strict air engagement ROE	BVR ID capability	U.S. F-15C and AWACS primarily responsible for counter air mission
Low Risk Tolerance: Friendly Forces	Effectiveness above 15,000’	Precision-guided munitions, sensors	U.S. burden for weapons and missions
	Friendly Fire-CAS	CAS capability—a/c, communications, sensors, weapons	U.S. burden and risk: air assets, liaison teams, equipment
	Risk to ground troops (OAF)	Air power	Preservation of coalition becomes a strategic objective
Low Risk Tolerance: Collateral Damage	Weather and night: location and identification	JSTARS, predator, night vision devices	U.S. burden
	Collateral Damage	Precision-guided munitions	U.S. burden
Technological Advantage	Rapid Maneuver AirLand Battle	Long range artillery, high-speed armor	Mission responsibility assigned by capability
	Air Power Mass	Heavy Bombers	Burden and risk assumed by U.S. forces

The second condition, robust enemy air-defense networks, originated external to the coalition. In both conflicts, the United States provided technologies to mitigate the risk to coalition aircraft: stealth aircraft, cruise missiles, suppression aircraft, and BVR counter-air capability. Each of these allowed the coalition as a whole to enjoy air supremacy in relatively short order while U.S. assets assumed the bulk of the risk to men and materiel. War planners organized coalition missions with U.S. assets executing the riskiest missions and packaged other coalition aircraft with protective U.S. assets on the less risky missions.

In both coalitions, requirements to reduce risk, both to friendly forces and civilians, created operational and tactical challenges that U.S. technology could overcome. In OAF, rules of engagement requiring coalition aircrew to remain at medium altitudes forced a reliance on U.S. sensors that could locate and identify targets on the ground and weapons that could guide to their targets autonomously. In Desert Storm, the high-speed and integrated operations of the AirLand battle required that U.S. assets take lead for close air support on the ground and fly nearly all CAS sorties through the operation. In both conflicts, collateral damage concerns forced a reliance on weapons capable of consistently guiding to within meters of their targets.

In addition to constraint-driven technology reliance, certain technologies created reliance simply due to their superior capabilities. On the ground, high-speed armor, night-vision capability, and long-range artillery led war planners to assign responsibilities based on capability. More capable, quicker forces handled the more complex operations while less capable forces received less complex assignments.

In the air, the same held true. The availability of U.S. high-technology sensors, heavy bombers, and precision guided munitions shifted operational and tactical burdens to the United States. Shifts in burden include shifts in risk as well, both in the form of risk to friendly forces and risk of collateral damage responsibility. In both OAF and Desert Storm, the United States accepted a disproportional amount of risk compared to other coalition partners in the interest of reducing the aggregate risk for the coalition as a whole. By accepting this risk, the United States implicitly accepted responsibility for those mission areas whether they are high-speed ground maneuvers or aerial attacks on high-risk targets.

Burden shifting is the most obvious of the ramifications of U.S. technological advantage. As with the heavy bombers, dynamic of assigning the tough jobs to the most capable and the less tough jobs to the less capable inevitably leads to the technologically superior U.S. force assuming lead. John Tirpak quotes Maj Gen Short complaining about this phenomena following OAF,

> “I don't think there's any question that we've got an A team and a B team now," Short said. Those nations that failed to invest in precision guidance or nighttime capabilities or beyond-visual-range systems were "relegated to doing nothing but flying combat air patrol in the daytime; that's all they were capable of doing.”[119]

The A-team, B-team dynamic is not just an issue of assigning the tough missions to the best forces; this dynamic possesses political ramifications as well. In OAF, this approach was manifest in the decision to rely strictly on air power rather than risk ground troops. The coalition immediately looked to the United States to lead the operation arguably because it had the technological capability to meet coalition objectives from the air.

HRH General Kahled bin Sultan acknowledges the relationship between the overwhelming advantage U.S. forces provided to the coalition and the leadership role this advantage demanded. In summarizing the nature of Desert Storm, he alludes to U.S. technological advantage, “The Gulf War was something quite different. On the coalition side, the principal actor was a superpower, and the advanced weapons deployed—satellites, Stealth aircraft, submarine-launched Cruise missiles—were systems only a superpower can command.”[120] While he spent much effort preserving the leadership role of his own country, he admits that his position as Joint Forces Commander ultimately subordinated to U.S. leadership,

119 Maj Gen Michael Short as quoted by John A. Tirpak in “Short's View of the Air Campaign: What counted most for NATO's success in the Balkans was the reduction of strategic targets, not "tank plinking" in Kosovo,” i82 (9) (September, 1999) http://www.afa.org/magazine/sept1999/0999watch_print.html (Accessed 10 May 2006).

120 Bin Sultan, 461.

> I should perhaps add a word of explanation here about the notion of a "parallel command." It did not, and could not, mean that my command and Schwarzkopf's were equivalent: there was no equivalence in the men, resources and equipment available to each of us. In view of its overwhelming military contribution to the Coalition, there was little doubt that the United States had to make the ultimate command decisions.[121]

U.S. forces included such overwhelming advantage compared to the rest of the nations in the coalition that they had to accept increased risk and responsibility through the conflict and with them, a leadership role.

D. CONCLUSION

The relationship between technology advantage and leadership within a coalition requires a very narrow focus to uncover causal factors. The state of a military's technological capability links very closely to its budget, which in turn associates to its force size. This budgetary relationship makes a causal connection between technology and leadership difficult to discern. By filtering force size in comparing military contributions to a coalition, technological asymmetry emerges as a contributing factor in allocating leadership responsibilities.

This relationship suggests unintended consequences of the U.S. transformation effort today. As the United States continues to pursue leading edge technologies, allied nations willing to participate in military coalitions become less capable of fighting along side U.S. forces. Extending the logic slightly, as the United States continues on its current technologically oriented transformation trajectory, it will find multi-lateral coalitions becoming more unilateral in execution. Greater technological advantage will actually force the United States to accept a greater share of the risk at all levels.

121 Bin Sultan, 193.

III. OPERATIONAL CULTURE: TECHNOLOGY ASYMMETRY AND UNILATERALISM

As a coalition assembles, it develops characteristics based its membership, its objectives, the adversary, and the political and strategic environment. These characteristics define a culture attributable to the coalition as whole that determines its operational nature. This analysis presented in this chapter will describe a coalition's characteristics that define its operational structures as its operational culture. Operational culture refers to the goals, language, organization, rules, values, and limits of the coalition as they apply to the conduct of military operations.

The national forces and capabilities contributed to a coalition help shape its operational culture. As described in Chapter II, a technology asymmetry among coalition members will increase combat burden and leadership responsibilities for the technologically advantaged partner. Disproportionate burdens and leadership responsibilities create space for the technologically advantaged partner to import its operational culture into the coalition. Mission structures, organization, command relationships, doctrine, and standard operating procedures follow the technologically superior capabilities.

This chapter describes the effects of technology asymmetry on the operational culture of a coalition. Focusing on three aspects of the Desert Storm and OAF, this chapter demonstrates how U.S. technological advantage facilitated the adoption of U.S. operational culture. Airpower employment, command and control structures, and information access created a reliance on U.S. technologies that injected U.S. operational culture into the coalition. This American warfighting paradigm was manifested in strategic plans, organizational structures, and communications architectures. The paradigm both reflected and perpetuated U.S. operational culture by reinforcing American warfighting concepts and limiting allied participation at the operational level of the conflict.

The first section of this chapter focuses on air power employment in Desert Storm and OAF. It describes the process links between technological supremacy, operational culture, and the exclusion of allies from operational and command relationships. The Desert Storm coalition centralized coalition air power under a single U.S. commander, the Joint Force Air Component Commander. General Khaled bin Sultan, among others, point to the technologies provided by the United States as causal in its coalition leadership.[122] The technological superiority of these assets facilitated the implementation of the U.S. air strategy named "Instant Thunder," a phased campaign seeking strategic paralysis through simultaneous and parallel attacks on key Iraqi systems.[123]

The overwhelming success of this plan was not reflected in OAF, although USAF generals attempted to implement a similar coalition air campaign. In OAF, however, the U.S. war plan encountered political resistance from various coalition partners who wished to fine tune air operations to meet political sensitivities about collateral damage. Unable to target freely in accordance with the American operational concept, the strategic air plan stumbled under the coalition's incremental political objectives.[124]

The second section examines coalition operational culture by exploring command relationships and control structures. Command relationships enforce U.S. leadership and war fighting style. In OAF, for example, the United States established separate chains of command and air tasking orders (ATOs) to accommodate stealth and cruise missile technology security concerns. In Desert Storm, air power unity of command under the JFACC also did not match the parallel command system established for the rest of the coalition. The ATO concept also enforced an American operational environment by centralizing control of all air assets and short-circuiting the chain of command from the JFACC directly to the sortie generator. Command relationships and control mechanisms created and promoted the U.S. warfighting paradigm that existed in both operations.

The final section addresses the unique characteristics of information technologies. Information operations pose challenges for security and vulnerability that are not present

122 Bin Sultan, 338, 461; and Cordesman and Wagner, 942.

123 Edward Mann argues that Instant Thunder is the result of USAF doctrinal evolution beginning with Guilio Douhet's command of the air, strategic applications of World War II's combined bomber campaign, and lessons learned from Vietnam's Rolling Thunder operations. See Edward C. Mann III, 1995, *Thunder and Lightning: Desert Storm and the Airpower Debates*, Maxwell Air Force Base, AL: Air University Press.

124 Tirpak, "Short's View of the Air Campaign: What counted most for NATO's success in the Balkans was the reduction of strategic targets, not "tank plinking" in Kosovo."

with traditional weapons systems. Sometimes, merely exposing a piece of intelligence can reveal the intelligence sources and methods thereby providing unintended insights into U.S. information resources. These types of concerns drive extensive security protocols to protect finished intelligence and data fusion resources. Security measures, however, often double as exclusionary measures. Particularly in OAF, the heavy reliance on intelligence, surveillance, and reconnaissance (ISR) and the computer and communications systems led to reliance on U.S.-only technologies. Hence, only the Unites States contributed to the operational culture driving the employment of these assets.

As the U.S. military continues to experience an information-driven revolution in military affairs, it creates two problems for itself.[125] First, coalitions of allies unable to field interoperable systems contribute little to the operational nature of the coalition. Essentially, the coalition becomes a unilateral enterprise with a few partners adding resources only at the margins. Second, rather than capitalize on a breadth of capabilities and perspectives, a coalition will assume the operational culture associated with the leading technologies, thereby creating more space for asymmetric threats to find weaknesses in the coalition's strategy.

A. AIRPOWER AND OPERATIONAL CULTURE

Desert Storm seemed to validate 60 years worth of airpower advocacy in 38 days. Air power not only proved its efficacy in major combat, it proved decisive. General Khaled bin Sultan declares, "It was evident that, more than ever before in modern military history, control of the air was crucial: it was virtually impossible to fight without it."[126] The United States provided 86% of the combat sorties in Desert Storm and 78% in

125 This study assumes the existence of technology-driven RMA, although many scholars still debate whether or not this is the case. The literature on the information-age RMA is extensive; a representative sample includes, but is not limited to:, Stephen Biddle 1996, "Victory Misunderstood: What the Gulf War Tells Us about the Future of Conflict." *International Security*, 21 (2) (Autumn): 139-179: Thomas-Durell Young, 2003, "The Revolution in Military Affairs and Coalition Operations: Problem Areas in Solutions." *Defense & Security Analysis* 19 (June): 111-130; Zanini and Taw, *The Army and Multinational Force Compatibility*; Richard H. Schultz Jr. and Robert L. Pfaltzgraff, Jr. (eds.), 1992, *The Future of Air Power in the Aftermath of the Gulf War*, Maxwell Air Force Base, AL: Air University Press; Owens and Offley, *Lifting the Fog of War*; and O'Hanlon, *Technological Change and the Future of Warfare.*

126 Bin Sultan, 345.

OAF.[127] There is little argument that strictly in terms of assets and capabilities, the air war in both conflicts was an American show. Sortie rates and targets destroyed, however, do not tell the complete story. Desert Storm demonstrated a palpable shift in the use of air power in major conflict: airpower had finally become efficient and effective.

Desert Storm also seemed to resolve a debate within the U.S. Air Force over the proper use of air power. The U.S. air plan dubbed “Instant Thunder,” created by Colonel John Warden’s Checkmate planning staff, became the Desert Storm campaign forming the first three phases of General Norman Schwartzkopf’s four-phase plan for Desert Storm.[128] This plan employed airpower as a strategic weapon able to strike simultaneously at all the Iraqi centers of gravity (COGs). Equally as telling as the plan itself, the planning process occurred in a U.S.-only environment, behind locked doors, where allies could not access or participate in planning the air war.

OAF demonstrated the limits of Instant Thunder. Still riding on the successes of airpower in Desert Storm, the USAF attempted to implement a similar strategy in the air-only war of OAF. Political constraints placed on targeting and employment during the conflict, however, limited the effectiveness of this plan. Even after the war, OAF air commanders lamented the interference of politicians in their air plan rather than recognize the limits of U.S. operational culture.[129]

1. Instant Thunder

Close examination of the Instant Thunder air plan and its planning process highlight the U.S. nature of Instant Thunder. As a strategic concept, the idea of hitting

127 Cordesman and Wagner, 377; Lambeth, 61-63.

128 Col Warden led the Air Staff’s Directorate of Warfighting Concepts, also known as Checkmate, see Mann, 1. According to Mann, the concept of phased execution also developed during the planning of Desert Storm, see Mann, 61-66.

129 William Drozdiak paraphrases Maj Gen Short, OAF CJFACC, “As an airman, Short said he would have "gone downtown on the first night" and taken the war to Yugoslavia's civilian population by knocking out bridges, power plants and telephone networks. But France and other European governments vetoed many civilian targets and imposed a limited, phased approach that the military commanders say delayed victory.” William Drozdiak, “War Showed U.S.-Allied Inequality,” *Washington Post*, June 28, 1999: A-01.

centers of gravity was not new.[130] What was new, however, was the idea of hitting the centers of gravity simultaneously. The very name, Instant Thunder, reflected an opposite approach to Vietnam's incremental application of airpower in Vietnam's Rolling Thunder air operation.[131] The conceptual basis of Instant Thunder involved striking multiple, key nodes of a system identified as vital to the Iraqi war effort while doing the same to other vital systems (parallel attack) at the same time (simultaneity) which would produce a cascading failure of the enemy's military system (strategic paralysis). The planners of Instant Thunder believed that by striking many key strategic targets at the same time, at the outset of fighting, would cause the enemy's war machine to collapse in a matter of days.[132]

A review of Iraq's air and ground orders of battle and key elements of its infrastructure reveal that the overall goal of Instant Thunder this was not a simple task.[133] Striking just one target requires identification and location of a target, assessment of the munitions required to destroy it, enough aircraft carrying enough munitions to ensure its destruction, and support aircraft to protect the attacking aircraft during the attack. Multiplied by the number of targets Instant Thunder planned to strike at one time, the objective behind the operation appears impossible to achieve using pre-Desert Storm technologies.

In order to contemplate an operation like Instant Thunder, planners would have to capitalize on "force-multipliers" that were created by new technologies.[134] Stealth fighters and cruise missiles permitted strikes against heavily defended targets with no

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130 The Combined Bombing Offensive in World War II sent U.S. heavy bombers after key aircraft industry targets in an effort to establish air superiority. See Tami Davis Biddle, "British and American Approaches to Strategic Bombing: Their Origins and Implementation in the World War II Combined Bomber Offensive," in John Gooch, ed., 1995, *Airpower: Theory and Practice*, London: Frank Cass, 1995, 112-114.

131 Mann, 2.

132 Mann states that the Black Hole planners anticipated six to nine days initially. Mann, 74.

133 See Mann, 91, for CENTCOM's list of Iraqi centers of gravity, Mann, 37-39, for key target sets, Cordesman and Wagner, The Lessons of Modern War, 123-136, for Iraqi orders of battle.

134 Referring to technologies fielded in the 1980's, Secretary Perry argues, "At that time NATO estimated that if it had to face a surprise armored assault from the Warsaw Pact, it could be outnumbered three to one in personnel and armored equipment and so NATO and, in particular, the United States, sought to use technology as an equalizer, or "force multiplier." William Perry, "Desert Storm and Deterrence in the Future," in Nye and Smith, 241-264.

additional protection. Precision-guided munitions reduced the number of weapons from 88 per target in Vietnam to one per target in Desert Storm.[135] Satellite reconnaissance required no aircraft sorties to precisely locate and identify key, fixed targets deep in Iraqi territory. These force-multiplying technologies, all exclusive to the United States in Desert Storm, made the Instant Thunder air war plan possible.

The results of the operation illustrate the impact of these new force multipliers. Thirty-eight days of air operations created an environment in which enemy ground troops surrendered to heavy bombers flying overhead and allied ground operations required only four days to defeat the fourth largest army in the world.[136] At the strategic level, Instant Thunder reflected the ability of the coalition to employ airpower for strategic and tactical objectives simultaneously. At the operational level, the implementation of the air plan reflected an American warfighting paradigm made possible by the resources provided and flown by the United States. The efficiency of precision-guided weapons and the surprise provided by stealth fighters and cruise missiles provided the means for parallel attack and simultaneity. U.S. fighters and electronic warfare aircraft protected the mass of airpower from Iraq's robust air defense.[137]

2. The Black Hole

Although not as obvious as the U.S. armada of more than 1,300 combat aircraft picking apart Iraq's military capacity, the air planning process provide another example American exclusivity in the air portion of the Desert Storm Campaign. Lt General Charles Horner, Desert Storm's JFACC, established an air-planning cell in Riyadh known as the Black Hole both because of its heavily guarded location in a basement office and the fact that personnel seemed to enter the planning cell, never to be seen

135 Based on a .9 probability of kill per target. In WWII, one target required 1500 sorties and 9000 bombs, in Vietnam 88 sorties and 176 bombs, and Desert Storm using precision-guided munitions 1 sortie could actually kill two targets assuming two bombs per aircraft. *The U.S. Air Force Transformation Flight Plan*, 61.

136 *Gulf War Air Power Survey, Volume IV*, 266; Cordesman and Wagner, 113.

137 See discussion of counter-IADS resources and packaging in Chapter II.

again.[138] Here transplants from Colonel Warden's Checkmate planning staff set up shop to plan and eventually run the air war that won Desert Storm.[139]

Even as commander of Joint Forces Command, a theoretical equal to U.S. Commander in Chief, CENTCOM, General bin Sultan describes the U.S. air-planning cell from the perspective of spectator rather than participant. He matter-of-factly lists the reasons for the secrecy of the U.S. planning efforts: the United States insisted on extreme secrecy since "this was to be an overwhelmingly American effort" and expressed a desire to protect certain technologies. He lists these technologies as:

> the latest products of its military R&D, such as the F-117 Stealth fighter, invisible to radar; precision-guided munitions (PGMs), such as Tomahawk Cruise missiles as well as numerous types of laser-guided and TV-guided bombs and missiles; night-vision devices, principally infrared detectors; and a wide range of electronic systems for communications, surveillance and combat, which would jam Saddam's radars, disrupt his communications, and generally suppress his defenses. [140]

There was no doubt in the Joint Forces Commander's mind who really led the coalition and why.

Through policies of protecting sensitive technologies and the operational plans capitalizing on them, U.S. planners excluded other allies from planning roles. Desert Storm war plans were in fact U.S. war plans applied by U.S. commanders relying primarily on U.S. technologies. The Desert Storm coalition implemented a *phased execution* initiated with an overwhelming aerial *parallel attack* using the concept of *simultaneity* to achieve *strategic paralysis*. U.S. doctrinal terms used to describe a U.S. operational plan relying on U.S. technology.

3. Operation Allied Force

The air war in Kosovo provided air power enthusiasts with yet another success with which to proclaim the decisiveness of airpower. Using air power alone, the coalition

138 Bin Sultan, 337 and Mann, 46.

139 Colonel Warden was director of the Air Staff's future war plans director from which the initial version of the Instant Thunder plan originated. Mann, 1.

140 Bin Sultan, 338

of NATO forces met its strategic goals in Kosovo.[141] Like Desert Storm, however, the NATO coalition mostly employed American forces with a little European assistance. Lt. Gen. Michael Short, the CJFACC, stated after the war that the United States conducted four fifths of the air strikes I Allied Force.[142]

Once again, coalition air power revolved around the mass and efficiency provided by U.S. technologies. The operational culture evident at the start of the air war reflected a distinctly American warfighting paradigm. Two aspects of this U.S. operational culture highlight its American origins. First, medium-altitude operations, employed successfully for the first time in Desert Storm, reduced risk to coalition aircraft by eliminating the threat of small arms and MANPADS. Second, targeting plans focusing on Serbia's strategic centers of gravity embodied a simultaneous, parallel attack war plan

As Lt. Gen Short claimed, the 15,000-foot minimum altitude provided "our best opportunity to survive [in conjunction with night attack and precision guided weapons], and I continue to believe that."[143] Two underlying aspects of this rule of engagement, however, relate to U.S. technologies. First, medium-altitude operations capitalized on PGMs: only PGMs provided the control over collateral damage that the political leadership demanded. Additionally, aircrews often employ PGMs more effectively from medium altitude.[144] Weather further exacerbated the medium-altitude employment challenges but only the United States possessed the satellite-guided Joint Direct Attack Munition that was able to self-guide through cloud cover.[145] Second, while medium-altitude operations do protect aircraft from small arms fire and MANPADS, these

141 *Kosovo/Operation Allied Force After-Action Report*, xvii.

142 See Chapter II for details on sortie rates and munitions expended in OAF. Drozdiak cites Lt. Gen Short as saying the Unites States was responsible for four fifths of the bombing and missile strikes in the 11 week air campaign. William Drozdiak, "Allies Need Upgrade, General Says; Air War Leader Cites U.S. Dominance in NATO Campaign," *The Washington Post*, June 20, 1999: A-20.

143 Quoted in Tirpak, "Short's View of the Air Campaign…"

144 For two reasons: safety and effectiveness. LGB's require significant "head's down" time meaning the pilot is not looking at the ground but inside his cockpit. Also, medium altitude employment allows more time for the pilot to acquire and guide the weapon after release, over 30 seconds from above 20,000' compared to 6-9 seconds from low altitude. The author has experience flying F-16s with the U.S. Air Force.

145 While British, French, and Dutch forces possessed some laser-guide weapons capabilities, the U.S. provided 80% of the LGBs dropped in the conflict. Lambeth, 88. DoD's report to congress stated that operations experienced "a at least 50 percent cloud cover more than 70 percent of the time." *Kosovo/Operation Allied Force After-Action Report*, 86.

altitudes increase the threat from SAMs. U.S. suppression of enemy air defenses and electronic warfare assets, however, reduced this threat to a nominal risk.[146] While this altitude restriction intended to protect coalition aircrew, it appeared to be a viable tactic at the outset because of U.S. technology.

Entering the war, Lt Gen Short's planners anticipated another demonstration of the decisiveness of American-style airpower. They planned to all but ignore the Serbian ground force in Kosovo and concentrate instead on Serbian infrastructure targets in an effort to crush Serbia's will to continue fighting.[147] The B-2 stealth bomber, F-117 stealth fighter and Tomahawk cruise missiles offered the coalition the opportunity to hit targets in Belgrade with relatively little risk. According to John Tirpak:

> Had he been free to structure the air effort as he wanted, Short would have arranged for the leaders in Belgrade to wake up "after the first night ... to a city that was smoking. No power to the refrigerator and ... no way to get to work." He believes that in very short order, Milosevic's staunchest supporters would have been demanding that he justify the benefits of ethnic cleansing, given the cost.[148]

The mass of U.S. heavy bombers, the surprise of U.S. stealth technology, and the efficiency of precision-guided weapons offered the coalition the potential to repeat the successes of Desert Storm.

The political realities of the OAF coalition constrained the air war. Instead of giving commanders freedom to conduct the war as they saw fit, officials in Europe and Washington did not give commanders free reign to execute their war plan. Soon into the war, a tedious targeting process that required approval from all 19 members of the coalition starved the American air machine of targets.[149] Concerns about collateral damage in Serbia and Kosovo and high-level interest in targeting Serbian ground forces in Kosovo did not align with U.S. operational culture or plans. Lt. Gen. Short observed,

> It was not just apparent at the three-star level that we weren't following the classic air campaign that we'd all learned at Maxwell. It was just as apparent [at the captain and major level] that we were not using airpower

146 See IADS discussion in Chapter II.

147 Lambeth, xix

148 Tirpak, "Short's View of the Air Campaign…"

149 Lambeth, 185.

> the way we would have wished to use it…airpower [was] not being used as well as it could be and the way you have been taught to use it.[150]

So while airpower ultimately achieved success in OAF, constraints external to the operational process demonstrated the limits, rather than the decisiveness, of U.S. airpower and its associate operational culture.

Whether considered successes or failures, both Desert Storm and OAF bore the trappings of U.S. technological prowess. As the technologically advantaged partner, the United States imported its operational culture into the coalition in tandem with its airpower contributions. Both conflicts employed a warfighting scheme built around its force-multipliers: stealth aircraft, cruise missiles, satellite reconnaissance, and PGMs. In Desert Storm, parallel attack did in fact achieve strategic paralysis. Unfortunately, without the political will and strategic targets to attack in parallel, airpower in OAF regressed to incremental application of airpower reminiscent of Vietnam's Rolling Thunder.

B. COMMAND, CONTROL AND ACCESS

Command and control relationships and mechanisms serve two functions in understanding the operational culture of a coalition. First, command and control functions tend to reflect the political influence in the formation of coalition. In a relatively symmetrical coalition, command relationships tend to be nation centric. For example, in Desert Storm political considerations led to a dual-command structure with U.S. and Saudi Arabian generals leading each of the two primary organizations. Within them, the coalition organized other nations according to political sensitivities and capabilities: British and French forces fell under the U.S. commander while Arab forces fell under the Saudi Commander. Furthermore, these units tended to "plug into" the command chain with direction going directly from the corp-level commander to the national commander.

In both of these operations, however, command relationships deviated from the norm due to the technology asymmetry of U.S. forces. In Desert Storm, the overwhelming advantage offered by U.S. air power led to a separate chain of command

150 Quoted by John Tirpak, "Short's View of the Air Campaign…"

for airpower that unified all assets under an American commander. In OAF, the coalition deviated from typical NATO command relationships and the American principle of unity of command in order to preserve the operation security of its stealth and cruise missile assets. In the Desert Storm case, the technological supremacy of U.S. airpower justified the coalition's adoption of American unity of command doctrine. In the OAF case, the United States used the same airpower superiority to justify a deviation from this doctrine.

Command and control functions also transmit the warfighting paradigm of the lead nation. In Desert Storm, the United States introduced the ATO as a single source document for all air-related tasks and control orders. Published daily, the ATO published all mission tasks, airspace coordination measures, ROE, identification codes and even radio frequencies. The ATO forced all air assets in theater to conform to distinctly American forms of employment.[151] The dual-ATO system implemented in OAF highlighted the friction caused by technology asymmetry within a coalition.

Information access proved to be another area of friction in both coalitions. Information architectures reflected the dominant role played by U.S. assets and technologies. U.S. desire to protect sensitive technologies, intelligence-gathering technologies in particular, created a bureaucratic firewall that prevented the broad sharing of information around the coalition. Simply put, U.S. forces would not allow allied forces access to many classified computer and communication systems. As a result, coalition personnel developed cumbersome work-arounds to move releasable information from sensitive U.S. systems into allied-accessible formats. In many cases, the U.S. forces did not allow allies access to certain information, which allowed U.S. forces to dominate most operational functions.

The fragile advantages offered by force-multiplying technologies drives a desire within a military to protect its technological advantage, even from its allies. Security protocols designed to protect these technologies also serve to exclude the technology disadvantaged. Exclusion reinforces the leadership role of the technologically advantaged force and stymies broader participation in operational planning and

151 This did not include Navy fleet defense or Army and Marine helicopter missions. Hallion, 155.

execution. In both operations, much of the intelligence and communication functions existed on U.S.-only systems leaving only the United States to create and implement coalition operations.

1. Technology and Command

Command relationships in Desert Storm and OAF were derived from very different sources. The former developed out of political sensitivities and recognition of the overwhelming contribution of the United States. The coalition established a dual, parallel structure to accommodate the political sensitivities of the host country and facilitate the operations of the greater force contributor.[152] OAF command relationships derived from established NATO relationships with American generals occupying the key leadership positions. Despite well-established NATO relationships, two separate planning and approval processes developed to accommodate technologies that U.S. officials believed were sensitive.

The command structure in Desert Storm was not unexpected or unique. As would be expected in a diverse, multilateral coalition, command relationships ran along national lines with international crossovers happening only at the highest levels. Political realities provided the basis for the general command scheme: two parallel commands, one led by the United States because of its dominant contribution to the coalition and the other led by Saudi Arabia to mitigate potential Arab sensitivities. National forces "plugged in" to the force commanders (CENTCOM and Joint Forces Command) at their highest command level and operational direction flowed top down through this chain of command with one exception, the air war.[153]

The DoD organized U.S. forces in accordance with the Goldwater-Nichols Department of Defense Reorganization Act of 1986.[154] Accordingly, all U.S. forces in theater reported to a single, unified commander, the Commander in Chief, Central Command (CINCCENT). In accordance with joint doctrine, forces were organized into

152 Bin Sultan, 193.

153 For diagrams and explanations of Desert Storm organizational structures, see Joel H. Nadel, 1993, "Command and Control," in Bruce W. Watson, Bruce George, Peter Tsouras, B.L. Cyr, 1993, *Military Lessons of the Gulf War*, London: Greenhill Books.

154 Hallion, 259-260.

functional components: land, maritime, air, and special operations with a commander for each reporting directly to CINCCENT. While this command organization applied to U.S. forces, those forces falling under Joint Forces Command remained outside the U.S. chain of command and those forces that remained in CINCCENT's organization did not necessarily fall under the respective component command.[155]

The JFACC commands all U.S. air assets in theater.[156] The JFACC then conducts centralized allocating, planning and tasking functions thereby ensuring the efficient use of airpower for the overall campaign. This meant that a single commander, for the first time in U.S. history, controlled all air power in theater directly. If an aircraft was not on the JFACC's ATO it did not fly.[157] The U.S. unified command concept entailed complete centralized control for the entire air effort.

American air power in Desert Storm provided the coalition with air superiority. Recognition of the asymmetry in air capability within the coalition led all of the coalition participants to cede their air assets to the control of the JFACC. In Desert Storm, the JFACC allocated all coalition air power, matched targets to aircraft, formed mission packages, tasked refueling and surveillance, and directed every air mission.[158]

Operation Allied Force also established a parallel command but, in this case, U.S. officers headed both chains of command. The United States chose to place stealth aircraft, cruise missiles and their related assets under U.S. European Command (EUCOM) rather than chop them to NATO's air component and Lt. Gen. Short. EUCOM maintained allocation, planning and targeting responsibilities for these assets separate from the NATO chain of command (see Figure 1). Despite the fact that

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155 For example, all Arab forces reported to Joint Forces Commander. The UK's 1st Armored Division reported to U.S. VII Corp commander; the French 6th Light Armor Division Daguet reported to U.S. XVIII Airborne Corps Commander. Noel in Watson, 136-142.

156 This was an indirect result of the Goldwater-Nichols Act in that the law did not specify this organization structure. However, joint doctrine rewritten after the passage of the law did organize all functional components under single component commander. This arrangement, particularly for airpower, was new and still controversial within the U.S. military since none of the other services wanted to surrender control of their assets to the JFACC. Mann, 55.

157 Again, this did not include Naval fleet defense or Marine and Army helicopters. Hallion, 155

158 The exceptions to this were tactical assets tied specifically to a ground commander or Naval commander such as air assault or Marine-specific close air support.

American generals led the NATO coalition as well, U.S. stealth and cruise missile assets plan and flew in U.S.-only operational structures, denying access or even awareness to NATO allies.[159]

This is not to say that the CJFACC was not privy to these missions. After the war, Lt. Gen. Short confessed that maintaining separate ATO systems, mission planning cells, and execution processes complicated the war effort.[160] The DoD's report to Congress echoed Lt. Gen. Shorts concerns about leaving allied forces out of portions of the air campaign, "NATO's command structure worked well, but parallel U.S. and NATO command-and-control structures complicated operational planning and unity of command."[161] Separate planning and execution elements in the same air war within such limited airspace created a series of issues from political friction to increased risk of fratricide.

Concern about the operational security of stealth and cruise missiles presented the United States with a choice: do not include these assets in the operation or create a separate operational structure to accommodate them. In choosing the later, the United States demonstrated commitment to its own strategic and operational paradigm at the expense of self-proclaimed, key tenets of military operations: centralized control and unity of command.[162] The coalition's tacit acceptance of this separate, U.S.-only operational structure reflects its complete dependence on U.S. assets.[163] Coalition dependence on American technology and leadership opened space for the United States

159 Lambeth, 188. For a graphic view of the OAF chain of command, see *Kosovo/Operation Allied Force After-Action Report*, Figure 3, 20; and Lambeth, Table 7.1, 189.

160 Lt. Gen Short indicated that had he had the chance to do it again, he would have had one system for ATO, mission planning, and execution. Tirpak paraphrasing Lt Gen Short in Tirpak, "Short's View of the Air Campaign..."

161 *Kosovo/Operation Allied Force After-Action Report*, 20.

162 Patrick Sheetz, "Air War over Serbia," in Larry Wentz, ed., 2002, *Lessons from Kosovo: The KFOR Experience*, Washington D.C.: Department of Defense Command and Control Research Program, 106.

163 Michael Evans relays an interview with Lt Gen Short in which he claimed that Europe required U.S. participation to be successful in OAF. He quotes Short as saying "We will take the alliance to war and we will win this thing for you, but the price to be paid is we call the tune." Michael Evans, 2000, "General wanted US to call the shots in Kosovo," *The Times* (UK), (January 27) http://www.the-times.co.uk/news/pages/tim/2000/01/27/timfgneur01010.html?1984 (Accessed May 7, 2006).

to imprint its operational culture on the coalition. The resulting command structures served to transmit the American way of fighting wars throughout the operation.

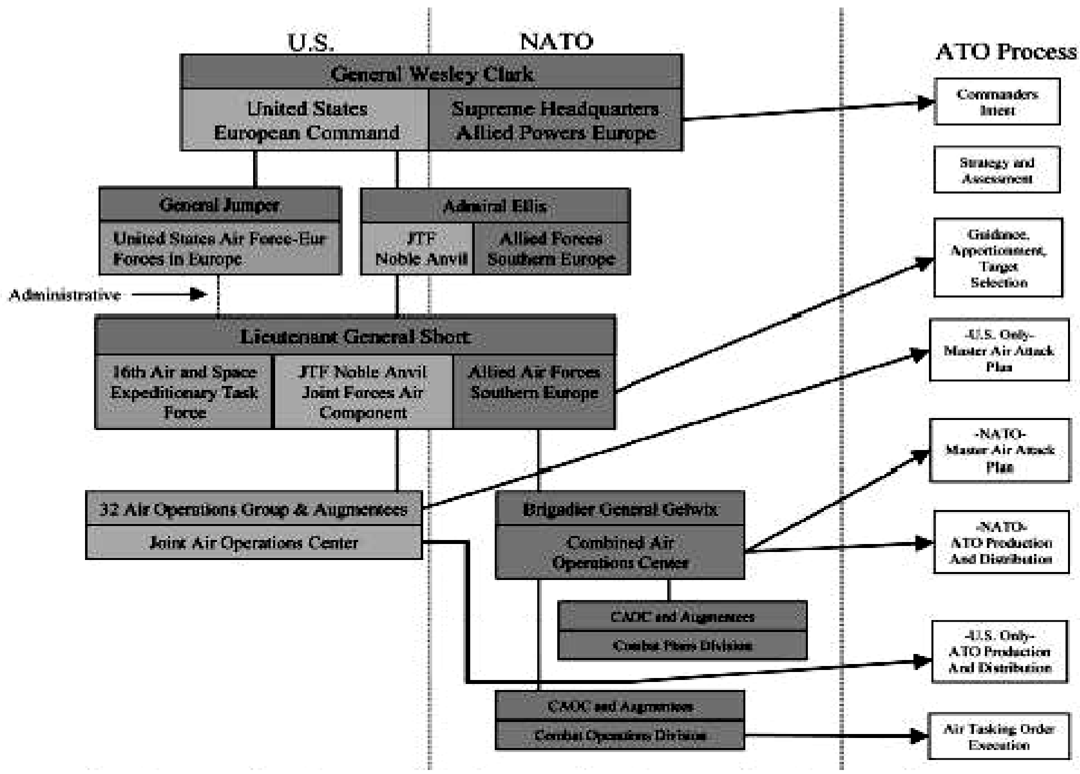

Figure 1. Operation Allied Force Organizational Strucutre
Source: Sheetz, Patrick, "Air War over Serbia," in Larry Wentz, ed., 2002, *Lessons from Kosovo: The KFOR Experience,* Washington D.C.: Department of Defense Command and Control Research Program, 104.

2. The Air Tasking Order

The ATO provides a key indication of the implementation of U.S. operational culture. Used for the first time in Desert Storm, the ATO reflected the centralized command of the JFACC. Through the ATO, the JFACC matched targets to specific sorties bypassing many layers in the chain of command. The ATO was a uniquely American function derived from a uniquely American organizational structure. The fact that the coalition willingly accepted the unified air commander concept in Desert Storm and the ATO as the single-source tasking document for air power reveals the extent to which U.S. operational culture shaped coalition operations.

The dual-ATO structure in OAF provides even greater evidence of the relationship between technology advantage and operational culture. In the interest of preserving the operational security of its stealth and cruise missile assets, the United States felt obligated to establish a separate planning and execution function outside of the NATO coalition. Violating its own doctrine touting the value of unified command, these assets remained outside of the coalition chain of command (see figure 1). This meant that U.S. desires to preserve the technological advantage provided by stealth and cruise missiles compromised the centralizing functions the ATO.[164]

The United States in OAF established an air war in accordance with its doctrine using its unified command structure and mechanisms for centralized control. It then created a new U.S. warfighting structure in the interest of preserving the technology asymmetry of stealth and cruise missiles. The operational culture of the coalition and the exceptions to this operational culture were both distinctly American in origin.

Command relationships and their control mechanisms provide evidence of the direct relationship between technological asymmetry and operational culture. The Desert Storm command relationships demonstrate this influence most clearly. The ground and air wars possessed very different forms and degrees of technological asymmetry. The ground war did see some U.S. advantages in the form of faster combat vehicles, long-range weapons, and detection technologies but much of this difference was on the margins. Using Steven Metz's taxonomy, these differences represented less asymmetry as merely improvements in capability. Air power, on the other hand, reflected a tremendous asymmetry between the United States and its allies. Stealth, satellite reconnaissance, electronic warfare, heavy bombers, and precision weapons produced significant asymmetries within all three of Metz's asymmetry categories.

The U.S. technological advantage in air power enticed the allies to cede their air power to U.S. control and accept its operational method. The U.S. JFACC relied on his plan and implemented it through U.S. mechanism, the ATO. Through these structures, the air war displayed a distinctly American form: parallel attack executed simultaneously in pursuit of strategic paralysis.

164 Peters, et. al., 39-41.

C. INFORMATION ACCESS

The implications of the RMA, continue to be contested in the literature.[165] One implication not thoroughly explored by scholars, however, is the risk that new information technologies might lead to the exclusion of allies from command and combat function for technical security reasons.

Information is intangible, fleeting, and perishable. The means for gathering information are vulnerable to low cost countermeasures and once information gets into enemy hands or the public sphere, it cannot be recovered. Information technologies, therefore, require high degrees of protection to ensure the security of the means of collection and content. Simply revealing a piece of intelligence can reveal the manner in which it was collected and then risk the viability of that method in the future. The implications of sharing these technologies and the information they produce include many ramifications that extend well beyond the immediacy of the operation at hand.

In Desert Storm and OAF, the United States provided the bulk of the information technologies in the form of ISR and communications systems. The fragile nature of these technologies led to strict access protocols that often allowed access to only one member of the coalition, the United States.[166] Patrick Duecy noted in his assessment of NATO Headquarters during OAF that intra-coalition secrecy had a negative impact on operations:

> Perversely, the most significant impediment to effective crisis information reporting and dissemination operations during Kosovo was posed by the nation contributing the most intelligence to the Alliance, the United States. U.S. intelligence producers persisted in using U.S.-only intelligence information systems to disseminate intelligence released to NATO.[167]

Information collection, processing and dissemination remained stuck behind U.S. security restrictions. Even when U.S. officials determined the information itself may be released to allied forces, the exclusive nature of the intelligence systems required slow,

165 Owens, for example, argues that the information RMA offers the means for the United States military to remain the dominant world force well into the future. Owens, *op cit*. For a relevant debate about information technologies and RMA, see Barry R. Schneider and Lawrence E. Grinter, eds., 1995, *Battlefield of the Future: 21st Century Warfare Issues,* Maxwell Air Force Base, AL: Air University Press.

166 Patrick Duecy, "The forgotten Echelon: NATO Headquarters Intelligence During the Kosovo Crisis," in Wentz, 150.

167 Ibid, 149.

cumbersome transcription processes to pull the information off of these systems, often by hand, and retransmit it via systems accessible by the allies.[168]

The use of U.S.-exclusive information systems reflected and transmitted U.S. operational culture. In his account of OAF targeting cell procedures, Deputy Judge Advocate General Tony Montgomery's description of the target approval process provides another indication of the U.S.-nature of the operational process. He described a complex collaborative process of target identification and approval run using off-the-shelf Microsoft software but located on secure, U.S.-systems.[169]

Most indicative of the U.S. operational culture are Montgomery's complaints about the cumbersome nature of the serial target processing early in the operation. He describes several initiatives, including the online collaborative process, aimed at expediting the target approval process to ensure sufficient targets were available for the intended pace of operations.[170] The motivation to shrink the targeting process from a one-week cycle to one day reflects U.S. operational culture for speed and simultaneity.[171] The online-collaboration taking place on a U.S.-only classified system perpetuated U.S. operational culture by excluding allies from participation in the process.

Information technologies introduce even greater interoperability concerns than traditional weapons systems. Access, data formats, speed and capability all present frictions that could inhibit if not totally prevent cooperation among allies. Without broad participation, the lead participant develops the form of the operation. In Desert Storm, the United States mitigated interoperability problems by assuming responsibility for command, control and ISR functions.[172] In OAF, targeting process and information

168 Patrick Duecy, "The forgotten Echelon: NATO Headquarters Intelligence During the Kosovo Crisis," in Wentz, 150.

169 Tony Montgomery, 2002, "Legal Perspective form the EUCOM Targeting Cell," in Andru E. Wall, ed., 2002, *International Law Studies: Legal and Ethical Lessons of NATO's Kosovo Campaign*, New Port, R.I.: Naval War College, 189-197.

170 Ibid, 193.

171 Montgomery states that the collaborative target and classification initiatives shortened what would have been a one week cycle from introduction of a target to final approval to one day. Ibid.

172 Zanini, et al, state that the "United States provided most coalition C4I. Intelligence collection relied extensively on U.S. satellite systems, while approximately nine-tenths of all airborne coverage originated from U.S. communications and dissemination capabilities." Zanini, 54.

sharing systems created access barriers that excluded allies from participation. In both cases, the United States created an operational environment to suit its doctrine and strategy.

D. CONCLUSION

Technological asymmetry opens space for the advantaged partner to imprint its operational culture onto a coalition. This occurs through both passive and active interaction between technologies and coalition structures. Technological advantage passively transmits its operational culture through the deference of other coalition partners to the advantaged partner. Additionally, coalition reliance on risk mitigation technologies and dependence on force multiplying assets leads members to relinquish leadership responsibilities to the advantaged partner. Desert Storm provides the textbook case: the coalition allies willingly ceded all their air assets to the command and control of the U.S. JFACC in recognition of its superior air capabilities.

Technology advantage actively impresses its associated operational culture through exclusion functions. Reliance on stealth and cruise missile assets in OAF led to coalition acceptance of dual planning and execution functions, one of which remained exclusive to U.S. visibility. Similarly, American information systems built with strict security and access protocols denied allies access to precious intelligence and coordination functions. Once again, reliance on the United States for these functions allowed American doctrine to define the operational environment of the coalition. The allies essentially were left out of loop.

The net effect of passive and active favoritism toward the technologically advantaged partner is the adoption of this partner's operational culture at the expense of other inputs. From another perspective the more reliant a coalition becomes on a nation-exclusive technology, the less influence it has on the related applications and the more unilateral the operational culture becomes. In Desert Storm, the overwhelming technological advantage of American air power from aircraft to weapons to intelligence translated into a distinctly American air war. The JFACC's air machine absorbed the air assets of other nations into the Instant Thunder paradigm.

Taking a holistic look at the interdependence among U.S. technology, leadership, and operational culture, a pattern of reinforcing relationships appears that culminates in an apparent unilateral nature of coalition operations. U.S. military technologies continue to progress in the direction of greater speed, greater interdependence, and broader situation awareness. Only the United States today possesses the resources to acquire this level of development. Doctrine associated with this technological push builds on the Instant Thunder premise of overwhelming mass applied instantaneously across parallel strategic systems. Only the United States possesses the overwhelming mass, multiplied by its technologies, to implement this strategy viably. The resulting operational culture requires command structures and mechanisms tailored to these high-speed but centralized strategic concepts. Only the United States has built and trained to these command structures and only the Unites States has the experience to employ them effectively.

IV. THE MITIGATING EFFECTS OF TIME

Integrating military forces into a coherent coalition is a process of combining many discrete systems to develop a single, coherent system of systems. Each participating force provides a discrete military capability that must interface with the military systems of other participants. In general, as the density of relationships within a system increases, altering the system becomes more complex.[173] Applied to a system of military systems, more participants in a coalition increase its complexity. Controlling complexity is a function of time: time to assess ramifications of change, time to scope integration tasks, and time to develop and implement interoperability fixes and work-arounds.

In a war, time is a limited commodity. Eventually, time runs out and a coalition must begin combat operations accepting interoperability within its military system as it stands. Given a deadline with coalition objectives at risk, commanders must weigh the potential instability created by attempting to merge various military systems versus the benefits of employing a coherent system of systems.[174] If the risks of instability are too great, commanders are obligated to discontinue attempts to merge participating forces opting instead to maintain a coalition of independent systems.

A coalition of independent military systems, however, still presents commanders with a "use or lose" choice: use participating military systems as independent but isolated entities or pick the most effective of the systems and discontinue use of the others. Factors such as efficiency, effectiveness, cost, political gain and operational risk contribute to this assessment. Time either provides opportunity to troubleshoot interoperability or forces a decision as time for action nears.

In terms of technological asymmetries within a coalition, lack of time exacerbates the tendency of a coalition to coalesce around the technology-advantaged partner's operational culture. Any amount of time less than that required to implement an

[173] James Wirtz argues that dense systems can "defeat purposeful behavior" and "make a system resistant to change," James J. Wirtz and Jeffery A. Larsen, eds., 2001, *Rocket's Red Glare: Missile Defenses and the Future of World Politics*, Boulder, CO: Westview Press, 7.

[174] Wirtz argues further that interconnections within a system may cause resistance to change which can "lead to instability or cascading effects when change does occur," Wirtz, 7.

interoperability fix results in even greater reliance on the technologically advantaged partner to either provide a work-around or assume an increased burden. Lack of sufficient time to implement a fix diverts burden to the technological leader by either allowing just enough time to insert its technological capabilities as interoperability work-arounds or forcing the coalition into relying on the technology leader's capabilities at the expense of greater participation.

Time acts as an intervening variable on the effects of technological asymmetries on coalition structures. As more time is available, interoperability issues are more likely to be solved allowing greater allied participation. As time available decreases, fixes become less possible forcing coalitions to implement work-arounds to mitigate interoperability problems. An absence of time to prepare forces a coalition to depend heavily on the advantaged partner to assume greater combat burden and leadership responsibilities.

This chapter examines the intervening effect of time on technology asymmetries by examining two aspects of Desert Storm and Allied Force. The first section compares operational structures in Desert Storm, with over five months of preparation time, to OAF, with close to no preparation time. In Desert Storm, preparation time allowed for extensive training regimens, including full-scale rehearsals allowing coalition forces to become accustomed to the U.S. battle pace and extensive use of airpower. OAF, on the other hand, did not reach its peak operational strength until 34 days into the 72-day war forcing a heavy reliance on U.S. airpower and its operational system.[175]

The second section focuses on communications structures. While time allowed the Desert Storm coalition to create work-arounds for many communications interoperability deficiencies, these work-arounds often entailed dependence on American technologies. In OAF, a lack of time did not allow the coalition the opportunity to integrate the various national systems, including those of NATO members, into the more robust U.S. systems. This exacerbated exclusion issues for the allies and increased American dominance within the coalition.

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[175] Cordesman, 31.

The last section briefly looks at a twist in the technology asymmetry-time relationship. Desert Storm introduced American high-speed maneuver doctrine, the AirLand Battle. The United States attempted to implement this doctrine into OAF with even greater improvements in the areas of intelligence, communications and collaboration. Computer-based planning and approval processes provided by the United States presented such a dense operational system that they effectively prevent allied systems from integrating into it. This did not prevent the allies, however, from wielding political influence on coalition operations. Political influence in the form of a tedious and slow target approval process slowed the U.S. high-speed operational culture by starving it for targets to attack. The operational culture of the coalition remained disconnected from its political leadership as the military continued to implement a war plan incompatible with the incremental application of force prescribed by the allied partners.

Without time to create fixes to asymmetries, a coalition will increase its reliance on technologies provided by the technologically-advantage partner. Without time to implement work-arounds, the coalition will rely completely on the technologically advantaged partner or suffer without some capabilities altogether.

A. PREPARATION AND TRAINING

The nature of military technologies today does not allow for rapid development of high-technology fixes for technology deficiencies. Long gone are the days when a military could identify the need for a new airplane and have a full production line running in a matter of months.[176] To develop interoperability, countries establish military relationships to develop fixes through long-term programs such as training exercises, personnel exchanges, and technology transfers. Militaries do not always have the luxury of choosing coalition partners, however, and often find themselves having to fight alongside other militaries with whom they are unfamiliar. Without years available to address technological asymmetries among national militaries, the likelihood of implementing fixes for interoperability deficiencies is small.

[176] "North American P-51 Mustang," *The Aviation History Online Museum*, http://www.aviation-history.com/north-american/p51.html, (Accessed 27 Aug 06).

As a military alliance, NATO provides its members a forum for establishing interoperability. NATO members participating in Desert Storm enjoyed over four decades of doctrine sharing, cooperative training, and common hardware development. Similarly, decades of close ties with the Saudi Arabian government led to U.S. Foreign Military Sales programs that provided a degree of U.S. compatibility with Saudi military infrastructure. According to the *Conduct of the Persian Gulf War: Final Report to Congress*, these programs paid large dividends:

> Since the 1950s, US foreign policy has included a long-term commitment to security assistance, which helped develop strong relationships with NATO and Coalition partners. Security assistance and defense sales provide compatibility of equipment; the training that comes with US hardware often leads recipients to adopt US doctrine and tactics, resulting in operational compatibility as well. The US Foreign Military Sales (FMS) system provided Saudi military infrastructure, US-origin equipment and training for most of the partners, and the foundation of peacetime cooperation and interoperability on which the Coalition was built.[177]

Even interoperability successes identified in the report to Congress, however, relied heavily on U.S. technology. Additionally, FMS and security assistance led to the adoption of U.S. doctrines and tactics.

Despite the efforts of decades past, NATO forces participating in Desert Storm did not enjoy complete interoperability and Saudi Arabian forces still lacked key equipment required for proper communications with U.S. forces, let alone other NATO members.[178] The addition of over a dozen more militaries who had never worked together increased interoperability complexity considerably.[179] The U.S. Air Force provided the coalition with a well-equipped air armada trained in close-support operations and combined operations. This force possessed communications, weapons systems, surveillance and reconnaissance, and battle management capabilities able to

[177] *Conduct of the Persian Gulf War*, 487.

[178] British and French forces both required communications equipment from the United States to establish long-range communications links and coordinate beyond their own forces, Peters and Deshong, 36. Saudi Arabia relied on U.S. National Security Agency to provide secure telephone capability, Cordesman and Wagner, 691.

[179] Ibid., 208-209.

work closely with fast-moving ground forces.[180] Not only were other air forces not as capable or proficient, but many of the ground forces had never even worked with close air support.[181]

Since time did not permit other militaries to reach similar levels of air capability, coalition planners designed and executed many exercises immediately preceding Desert Storm to provide the other militaries to close air support (CAS).[182] The coalition conducted seven separate air exercises and held five different weekly exercises all designed to familiarize participating air forces with control systems, identify and correct coordination and safety procedures, and rehearse combat operations. Coalition air assets participated in 123 exercise events covering air interdiction, defensive counter air, close air support and special operations.[183]

The complexity of close air support operations also led U.S. commanders to deploy to liaison teams to Joint Forces Command East and West (JFC-E and JFC-W) to manage coordination with American CAS assets. The United States attached tactical control parties to allied forces at the battalion level and above to facilitate cooperation and assist with CAS procedures. The Saudi Arabian military used the training and exercise opportunities to form six of its own tactical control teams prior to combat operations.[184]

In addition, the United States deployed ground liaison teams and Special Forces units to train coalition soldiers in a wide range of tactical applications. U.S. communications gear, NBC defensive equipment, and CAS all created technological asymmetries that may have prevented the coalitions from accessing these capabilities at all. Training in the days that lead up to the war mitigated this interoperability deficiency. As *Conduct of the Persian Gulf War* explains,

[180] Cordesman and Wagner, 528.

[181] General Khaled bin Sultan explains, “The problem was that my Saudi forces, and most of the other forces under my command, had not had any experience of close air support." Bin Sultan, 198.

[182] The Gulf War Air Power Survey states one of the objectives of in-theater training to be, “Demonstrate to allied land forces that fighters could be brought over their positions safely.” *Gulf War Air Power Survey, Volume V,* 165.

[183] Ibid., 167-204.

[184] *Conduct of the Persian Gulf War*, 582; Cordesman and Wagner, 517 and 561; and bin Sultan, 234-235.

> Since the Coalition troops would have to rely on a largely American air force, communications and CAS received especially heavy emphasis, but the Green Berets also stressed weapons training and instruction in basic small unit tactics, chemical countermeasures, and land navigation.[185]

Training not only provided non-U.S. forces the opportunity to employ these capabilities, it transferred American doctrine and tactics to these militaries. Five and a half months of training oriented toward mitigating interoperability deficiencies equated to five and a half months of coalition forces learning the U.S. way of warfighting.

In sum, the five and half months leading up to Desert Storm afforded coalition forces time to mitigate compatibility issues through a program of technology transfer, training, and personnel exchange. Each of these programs increased the burden on the United States, which had to provide the training and liaison personnel and equipment. The work-arounds implemented by U.S. forces also created a one-way conduit for the transmission of tactics, doctrine, and standard operating procedures to coalition partners.

B. COMMUNICATIONS

Communications structures in Desert Storm and OAF offer comparative cases highlighting the effect of time on technological asymmetries. Incompatibilities in communications capabilities stand out among other forms of asymmetry. Without the means to share information, coordinate, or collaborate, a coalition partner risks exclusion from operations. In cases where time was available to develop work-arounds, exclusion was limited or prevented. However, without time to develop work-arounds, commanders had to choose between excluding allies and losing capability.

1. Desert Storm: Time for Work-arounds

The diverse membership of the Desert Storm coalition created a myriad of communications problems. Even members of NATO, whose close military relationships theoretically ensured allied compatibility, suffered from communications deficiencies.

[185] *Conduct of the Persian Gulf War*, 588.

Allied capability gaps forced the United States to provide satellite communications gear to coalition members and assist with equipment modifications to establish communications interoperability.[186]

Saudi Arabian forces also required a significant quantity of U.S. communication equipment to improve the robustness of their command and control apparatus. Secure communications, specifically, required an infusion of U.S. technologies to allow the Joint Forces Command (JFC) to maintain a high level of operation security.[187] For example, the Saudi Arabian military did not have the means to communicate securely with CENTCOM and other NATO forces. The U.S. National Security Agency modified a number of commercial variants of the U.S. STU-III secure telephone systems to give the Saudis this capability. This was a work-around, however, rather than fix in that this modified STU-III was not compatible with either U.S. or NATO systems thus requiring that these forces maintain multiple secure phone systems during the conflict.[188]

The sheer volume of communications suggests the gravity of the scenario and the intervening effect of time to mitigate problems. Just after U.S. forces arrived in Saudi Arabia, telephone call completion rates back to the United States hovered between 20 and 30 percent. It took a team of Bell Laboratories and AT&T specialists three months to identify the problem and apply a work-around.[189] As Lt. Gen. James Cassity, Director of Command, Control and Computers for the Joint Chiefs of Staff, bragged, “The [United States’] services put more electronic communications connectivity into the Gulf in 90 days than we put into Europe in 40 years."[190] U.S. forces inserted U.S. technology to improve the inadequate communications infrastructure in theater. Without months available prior to combat, much of the communications capacity that enabled the high-speed operations of the AirLand Battle would not have been available.

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[186] Zanini and Morrison Taw, 53 and 55*; Conduct of the Persian Gulf War*, 582.

[187] Zanini, 53.

[188] *Gulf War Air Power Survey, Summary*, 215.

[189] Sterling D. Sessions and Carl R. Jones, 1993, *Interoperability: A Desert Storm Case Study*. McNair Paper Eighteen. Washington D.C.: National Defense University, 5.

[190] Sessions, 1.

2. Allied Force: Use or Exclude?

OAF offers examples of technological asymmetries causing commanders to either exclude allies to preserve capability or discard capability to include allies. Without the time to implement work-arounds, interoperability in these cases was not possible. Commanders had to decide whether to rely exclusively on one partner for a capability or go without the capability altogether.

Despite forty years of close working relationships, NATO aircraft did not possess interoperable, secure communication equipment. Many air forces arrived in theater with their own type of secure radio; some arrived with no secure communications capability at all. Unlike Desert Storm, there was no time to establish common protocols or transfer hardware to establish secure communications capability among all the participants. This forced coalition commanders to choose between relying solely on coalition aircraft with compatible hardware and using only non-secure communications to ensure proper control and coordination. The commanders chose the later and thereby compromised operations security for greater coalition participation.[191]

In another example from OAF, systems used to transmit and process sensitive intelligence information prevented access by allied partners. As reported in the *Kosovo/Operation Allied Force After Action Report*, the coalition never established a single, integrated network to share sensitive information.[192] At best, information passed from U.S. systems to allies using liaison personnel who would pull information off a classified system, transcribe it into a form releasable to allies, and hand it to an allied representative. More typically, allies did not receive information at all. Since the United States provided the bulk of the intelligence, surveillance, and reconnaissance (ISR) infrastructure, the preponderance of intelligence data existed within the U.S. intelligence system "stovepipe."[193] The reports adds, "In addition to dissemination problems on the

[191] John Peters claims, "After the war, several U.S. and NATO commanders acknowledged that the Yugoslav forces often had advance knowledge of NATO targets, and indicated that the lack of secure communications played an important role in this security breach," John E. Peters, et al., *European Contributions to Operation Allied Force*, 57. See also *Kosovo/Operation Allied Force After-Action Report*:, 74.

[192] *Kosovo/Operation Allied Force After-Action Report*, 49.

[193] "Stovepipe" refers to systems or forces not integrated horizontally within a greater organization.

data networks discussed above, U.S. sensitivity to releasing certain types of information greatly inhibited combined planning and operations in some areas."[194]

Between Desert Storm and OAF, time both provided and denied opportunity to mitigate interoperability issues. At one extreme, four decades allowed NATO forces to develop some common doctrine and develop some technical interoperability. At the other, time forced commanders to choose between including and excluding allied participation.

In Desert Storm, a small amount of time allowed coalition forces to adopt U.S. hardware for communication interoperability. Time to train and exercise allowed allies in Desert Storm to learn and incorporate U.S. tactics. The absence of time to address asymmetries forced "use or exclude" decisions that ultimately decreased the degree of allied participation.

C. TIME, POLITICS AND OPERATIONAL CULTURE

Time intervenes in the relationship between operational and political levels of a coalition as well. When sufficient time does not exist for coalition militaries to address cooperation and compatibility issues, the coalition gives deference to the more technologically advanced force. The operational culture of the coalition reflects that of the more capable partner. This relationship does not extend, however, to the political level of the coalition. When time limitations force deference to a technologically advanced force, time is similarly unavailable for the coalition's operational structures to digest political agreements and varied national policies. Coalitions relying heavily on one military risk a mismatch between political and diplomatic considerations and operational culture.

In OAF, U.S. operational culture derived from the high-speed maneuver doctrine that proved successful in Desert Storm. The Instant Thunder air plan created a ripple effect on U.S. joint doctrine. Buzz words such as effects-based targeting, parallel attack, simultaneity, and strategic attack concentrated strategy on speed. Through rapid, parallel strikes at key nodes within the enemy's military system, the attacker would not allow the enemy time to recover, reorient, or rebuild. This strategy advocated decreasing the time

[194] *Kosovo/Operation Allied Force After-Action Report*, 49-50.

friendly forces require to see, assess, and act while increasing the time the enemy requires to do the same. Success is achieved though agility and speed.[195]

The lack of time to plan and prepare for OAF left the coalition heavily reliant on U.S. assets and operational culture. American strategic thought following Desert Storm resulted in a force and doctrine formed around the strategic philosophy evolved from Instant Thunder. Resultant operational structures and resources supported this strategy: air tasking orders; precision-guided weapons; command and control functions using computer-collaboration and video teleconferencing; high-technology ISR assets; and night operations technologies to name just a few.[196]

The U.S. commanders in charge of the OAF coalition envisioned a plan resembling Instant Thunder. Through an overwhelming application of airpower, the coalition would force Serbia to capitulate in just a matter of days.[197] The plan, however, stumbled on reality as the war extended longer than the anticipated few days. Adding targets to attack lists involved a tedious process involving unanimous approvals from all participating members. Not only did the approval process slow the pace of operations, but every member nation exhibited its own interpretations of appropriate targeting in pursuit of coalition objectives.[198]

In the rush to establish coalition operational structures, the members of the coalition did not have the opportunity to establish consensus on strategy or operational mechanisms before the start of operations. U.S. commanders bristled as the member nations expressed their standpoints through the target approval process.[199] When target approval process limited the military's ability to execute its style of war, operational effectiveness suffered. It took the coalition in Desert Storm 38 days of air attacks and 4

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[195] An indication of this strategic mindset from this quote regarding the combined air operations center concept found in the Kosovo After-Action, "This faster deployment will help shrink the strategic decision loop while the greater cohesion and training of an expeditionary CAOC will enable it to tighten the operational decision loop," Kosovo/Operation Allied Force After-Action Report, 46.

[196] *Kosovo/Operation Allied Force After-Action Report*, 25 and 28.

[197] Lambeth, xix.

[198] For example, Netherlands vetoed the Serbian presidential palace as a target because a Rembrandt painting hung on the first floor of the building. For ramifications of varied national concerns and the approval process, see Peters, et al., *European Contributions to Operation Allied Force*, 26-29.

[199] John Tirpak, "Short's View of the Air Campaign…"

days on the ground to defeat the forth-largest army in the world. It took the coalition in Allied Force 72 days to meet its limited objectives. Without the time for coalition members to express their national concerns and deliberate on a unified approach to operations, the coalition endures operation friction as issues are worked out in the midst of combat.

The operational culture in OAF did not align with the political objectives. Since the coalition still required target approvals and guidance from a unanimous committee of 19 members, the coalition military adopted an operational culture ill-suited to its own political leadership.[200] The political level of the coalition in OAF was multi-lateral; the operational level was not. In OAF, the exclusionary effects resulting from dependence on U.S. technologies and operational culture limited the communications channels from national leaders to coalition military leaders. U.S. operational dominance meant the coalition could not easily adapt to the varied national concerns of its members.

Comparing the OAF disconnect between the political leadership and operational culture to that of Desert Storm, the mitigating effects of time stand out. Over the months leading up to the war in Iraq, commanders worked through a myriad of organizational and operational issues that fine-tuned the operational structures. Operational issues such as placing French Troops with American forces in the west and the shifting British forces to attack with the Army's VII Corp addressed technological issues while simultaneously appeasing national leadership.[201] Even seemingly small issues, such as the Saudi Arabian commander assuming the title of "Joint Forces Commander," served to mollify political tension.[202]

Time available in Desert Storm to fine tune operational structures allowed some discourse between the national leadership of participants and the coalition military

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[200] Peters, et al., *European Contributions to Operation Allied For*ce, 72.

[201] The decision to move the French was based on their light armor, limited night capabilities, and limited air support. This placement also allowed French forces to cooperate with U.S. troops while still remaining independence of command, Cordesman and Wagner, 170. The shift of British troops from U.S. Marine's 1st Marine Expeditionary Force to VII Corps was in response to British concerns that their 1st Armor Division was not suited for the frontal assault planned for 1 MEF, Cordesman and Wagner, 160. Both of these cases exemplify changes in operational structure possible only because of time available to negotiate for and implement the change.

[202] Bin Sultan, 29-33.

command. National concerns had time to be expressed and absorbed into the coalition. A lack of time to build and tune coalition structures in OAF forced its operational culture to reflect that of the United States without fine-tuning to address multi-national concerns. As a result, the coalition experienced friction between the incremental and political target approval process and the U.S.-imposed operational culture.

D. CONCLUSION

Technology asymmetry contributes to, and is often causal to, operational structures built within a coalition. The military with a technological advantage will assume a greater burden, risk, and responsibility for the coalition as a whole. As coalition members cede more responsibility, the coalition more closely reflects the operational culture of the advantaged partner.

Time intervenes in this relationship inversely. With time in abundance, allies use a variety of programs to establish relationships between their militaries. Through long-term exposure to one another, militaries troubleshoot compatibility issues until fixes establish interoperability. Interoperability is not, however, absolute. The Desert Storm and OAF cases indicate that interoperability exists per capability. Two forces may possess interoperable non-secure communications, for example, but incompatible secure communications. Therefore, any coalition presents potential interoperability issues as it approaches combat operations.

Since a coalition is temporary by definition, time to implement fixes is most likely not available. Coalition partners must then use time available to implement work-arounds for compatibility issues. More participants add greater complexity to the interoperability puzzle. Desert Storm offered examples of the many strategies to mitigate interoperability deficiencies including training, technology transfers, and personnel exchanges. Each of these strategies, however, added additional burden and contributed to even greater reliance on the technology-advantaged partner, the United States.

This influence of time on technology asymmetry-generated interoperability problems is most acute when time does not exist to implement work-arounds. Without the time to troubleshoot operational structures and rehearse military relationships, the coalition cedes operational responsibilities to the partner offering the technologies that reduce risk to friendly troops and innocents and offer the greatest potential for success. In OAF, the United States assumed the bulk of the operational responsibilities causing the coalition as a whole to adopt its warfighting paradigm emphasizing speed and overwhelming force.

Time intervenes further in the effects of technological asymmetry by allowing interaction between a coalition's operational level and its political level. With time available, coalitions implement work-around strategies, which allow allies greater participation. Greater allied participation at the operational level provides a conduit for discourse between participating nations and the coalition's military leadership. With time in short supply, coalition participants cede responsibility to the dominant partner at the expense of their own participation. As a result, communications between the political and operational levels of a coalition are more limited. National leaders wield less influence on operations as military readiness outpaces political deliberations. OAF demonstrated one possible repercussion: coalition military leadership misinterprets political objectives creating tension between operational culture and political leadership.

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V. CONCLUSION AND RECOMMENDATIONS

A. TECHNOLOGY AND COALITION STRUCTURES

U.S. technological dominance in Desert Storm and Operation Allied Force contributed to the U.S. role as primary force provider and coalition leader. Participating members of both coalitions ceded influence in return for the advantages provided by U.S. technologies: reduction in friendly losses, decreased risk of collateral damage, increased intelligence and greater effectiveness. Chapters II and III trace the process in Desert Storm and OAF that contributed to the United States taking responsibility for most operations. Technological advantages offered by U.S. capabilities reduced the aggregate risk of friendly losses and collateral damage while improving the effectiveness and efficiency of operations. Coalition preference for these advantages contributed to increased operational primacy for the United States, which allowed it to impose its operational culture on the coalition as a whole.

This process suggests a systemic relationship between technological asymmetry and coalition structure. Figure 2 illustrates this process relationship. Technological asymmetries emerge as coalitions assemble. Preferences for lower risk and greater effectiveness lead a coalition to rely on the most capable technologies. As the coalition develops dependence on these technologies, the dominant participant assumes greater combat burdens and leadership responsibilities, which inadvertently or intentionally imposes its operational culture on the coalition.

Time intervenes in this process inversely. When minimum time is available for a coalition to organize and prepare for combat, the process represented in Figure 2 is most severe. Without time to address interoperability discrepancies, exclusion functions inherent in sensitive, proprietary technologies decrease multilateral participation as the coalition faces the “use or exclude” decisions described in Chapter 4.

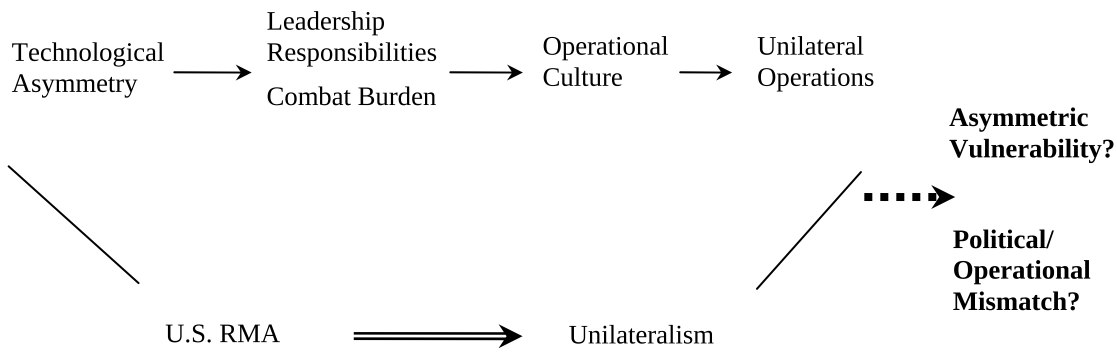

Figure 2. Technology Asymmetry and Coalition Structures Process Trace

When sufficient time exists for a coalition to troubleshoot interoperability issues, work-arounds implemented to mitigate compatibility problems allow wider participation by its members. Work-arounds, however, tend to rely on technologies provided by the advantaged partner. Interoperability patches achieved through work-arounds still add operational and command and control burdens to the advantaged partner, which create additional ways of increasing the influence of its operational style.

In the absence of technology parity, a coalition tends to resemble the operational culture of the technologically advantaged partner. The more stark the asymmetries and the less time available to address them, the more operations reflect the advantaged partner's war fighting paradigm. Thus, the greater the technological lead of one partner, the more coalition operations appear unilateral in form and execution, regardless of rhetoric about the desirability of multilateral participation in all facets of coalition operations. Figure 2 represents this general relationship as applied to the United States: current U.S. initiatives contributing to its technology-driven RMA contributes to it assuming nearly unilateral responsibility for the combat operations undertaken by the coalitions it joins.

As a coalition assembles, the time spent preparing for combat operations also provides an opportunity for the coalition to tailor operations to fit political objectives. As argued in Chapter IV, more time allows wider coalition participation in planning as a coalition implements work-arounds to technological asymmetries. Wider participation provides more channels of communication for allies to engage in discourse between the political level and operational level of a coalition. OAF demonstrated that the converse to this relationship also is true: without time to prepare, military readiness outpaces political deliberations and, therefore, the military is unable to accommodate political concerns into operational planning.

B. IMPLICATIONS FOR COALITION OPERATIONS

1. Political-Operational Mismatch

The process illustrated in Figure 2 suggests two scenarios. OAF demonstrated the first scenario: operational dominance by one partner leads to disconnects between political objectives and operational culture. Military force cannot be a cure all for every international problem, especially the high-speed, high-tech force that the United States currently possesses. As the United States continues to struggle with an appropriate military posture for the future, the prospect of scenarios requiring political solutions or force configurations incompatible with U.S. instruments of power grows.[203]

The operational culture imported by the United States in OAF did not align with the conservative, incremental approach desired by the nations participating. The disconnect between political leadership and operational culture suggests that relationships flowing from technological asymmetry remain at the operational level of war and do not bleed into a coalition's political process.

Multilateral coalitions may thus actually impede rather than improve U.S. operations. Military forces train, equip, and organize based on the policies and strategies of its national leadership. In the United States, the President transmits his grand strategy through the *National Security Strategy* document, which the DoD translates into training, funding, and organizing initiatives to meet his strategy. A coalition dominated by a military tailored to one nation's grand strategy risks friction when many nations with differing grand strategies provide political guidance for the conduct of military operations.

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203 Thomas Johnson and James Russell argue that the United States continues to struggle as its traditional instruments of national power appear to be ill-suited for the current world situation. See Thomas H. Johnson and James E. Russell, 2005, "A Hard Day's Night? The United States and the Global War on Terrorism," *Comparative Strategy*, 24, 128.

Desert Storm demonstrated that friction between national leaders and military officers can be mitigated by using time available to integrate coalition forces. The integration process opens channels of communication both among member nations and between political and military leaders. Time for planning generates wider participation, allowing operational culture to more closely align with political intent.

2. Disruptive Technologies: Asymmetrical Threat

The second scenario highlights how coalitions can end up on the losing end of a disruptive technology scenario.[204] U.S. technologies continue to grow rapidly through a "sustaining innovation" process where current technologies evolve through incremental improvements and new technologies enter service only by ensuring complete compatibility with the current systems.[205] Allies unable or unwilling to keep pace with U.S. progress will be unable to interface with U.S. capabilities.

The process described in Chapter III suggests that growing technological dominance by one partner attenuates other partner's influence on operational structures. As a result, potentially innovative approaches or unique technologies risk exclusion if they cannot integrate with the dominant partner's technologies. Relying on a single operational paradigm risks blindness to potential asymmetric threats or, even worse, risks dismissal of capabilities potentially beneficial to the coalition.[206]

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[204] Joseph Bower describes the disruptive technologies as innovations unsuccessful in traditional markets but cause new markets to form as new applications develop around the innovation. He uses the example of the personal computers that mainframe giant, IBM, did not consider useful or competitive but Apple and Radio Shack used to create a new home-computer market. See Joseph L. Bower and Clayton M. Christensen, 1995, "Disruptive Technologies: Catching the Wave," *Harvard Business Review*, 73 (1) (January-February):43-53.

[205] Terry Pierce states that sustaining innovations "result in improved performance along a trajectory that traditionally has been valued." See Terry C. Pierce, 2004, *Warfighting and Disruptive Technologies: Disguising Innovation*, New York: Frank Cass.

[206] Johnson and Russell argue that an international system increasingly driven by "sub-system dynamics" increases the threat from non-state actors presenting an asymmetric threat to U.S. instruments of power oriented toward traditional, state-owned threats. Johnson and Russell, 128.

3. Opposing Strategies

From the technological perspective, the United States currently pursues two potentially contradictory strategies for future military operations. On one hand, growing uncertainty about the future of the international system raises doubt about the configuration of U.S. instruments of power.[207] Multilateralism and coalition operations offer American administrations political flexibility and international credibility that are the fundamental building blocs of any successful military endeavor as an alternative to unilateral military operations.

On the other hand, the DoD continues to chase its elusive "Transformation," but seems focused on the force multiplying promise in high-intensity combat created by the continuous introduction of leading-edge technology to military systems. The goal is to capture the benefits promised by the information revolution: a highly integrated, high-speed, long range, agile military force.

With defense budgets approaching that of the rest of the world combined, however, the United States simply outpaces its allies in the procurement and integration of high-technology into its military systems and operations. Not only does this guarantee that future coalitions will experience technological asymmetry, but the problems associated with asymmetry will intensify. The U.S. technology-driven transformation continues to advance in the direction of more dense and complex systems that make allied participation in U.S. coalitions increasingly more difficult.

The mismatch between political leadership and operational culture described in Chapter IV typifies the conflict between these two strategies. In OAF, political constraints forcing incremental applications of power and slower, more deliberate targeting did not exploit the high-speed tactics of parallel attack. Operational culture seeking strategic paralysis was unable to adjust for a different political environment. The issues generated by pursuing the technology school and multilateral school strategies will only intensify as the United States continues to pursue technology-oriented military solutions on one hand and greater international cooperation on the other.

[207] Johnson and Russell argue that an international system increasingly driven by "sub-system dynamics" increases the threat from non-state actors presenting an asymmetric threat to U.S. instruments of power oriented toward traditional, state-owned threats. Johnson and Russell, 128.

C. RECOMMENDATIONS

1. Embrace Unilateralism

If the price of pursuing force-multiplying, risk-reducing technologies is greater unilateralism, then maybe U.S. diplomacy should begin to mirror this reality. The costs of implementing combined training programs, technology transfers, and exchange programs are great and the evidence suggests that long-term programs designed to develop fixes to interoperability programs are only marginally successful. Even a coalition consisting of allied forces with a long history of close cooperation will suffer interoperability deficiencies related to technological asymmetry.

Pursuing unilateral military solutions provides a single, coherent command structure with an operational culture tailored specifically to its political leadership. A direct, unambiguous chain of command will provide for greater accountability and increased strategic flexibility. As a corollary, if U.S. leadership still desires multilateral participation, then it should enter a coalition making no bones about its role as leader of the coalition.

This type of strategy, however, could entail significant political costs. Unilateral military operations alienate allies and diminish domestic and international public opinion. Without the assistance of allies, the United States would also lose invaluable support in the form of diplomatic reinforcement, logistics, and basing infrastructure. What the United States may gain in streamlined, operational efficiency may also be lost in political isolation.

2. Change Investment Priorities

If the future of U.S. foreign policy involves increasing multilateral participation, then investment priorities should focus on initiatives that enhance cooperation with allies. With acquisition and R&D investment more than twice that of our allies, the DoD can accept more risk in high-technology R&D to resource alternative programs. If the administration wishes to pursue multilateral solutions, it should accept greater risk in military technologies by slowing development and fielding timelines while using the resulting dividends to invest in greater diplomatic efforts such as personnel exchanges, language and regional studies, and aid-related initiatives.

NATO initiatives aimed at transferring technology and increasing interoperability indicate that complete technological interoperability may be unachievable. If this is the case, then the U.S. DoD must invest more resources in non-technology means to establishing and maintaining interoperability with its allies.

Diverting resources away from technology and defense acquisition include many potentially negative ramifications. Historically, force-multiplying technologies have provided the United States with superior military advantage without having to maintain an enormous force structure. Defense acquisitions tie directly into the well-connected defense industry, which means significant congressional resistance to any decrease in acquisition funding. The task of shifting resources away from defense acquisition and toward less tangible initiatives such as personnel exchanges, language proficiency, and aid programs may involve nearly impossible domestic obstacles to overcome.

3. Change U.S. Operational Culture.

Currently U.S. operational culture pays little respect to true coalition operations. Currently, CENTCOM planners plan contingencies with areas for potential allies to "plug into" U.S. operations. Pacific Command spends tremendous resources on training and technology transfer programs to ensure regional allies are familiar with the American way of war fighting. Both strategies assume future coalitions to adopt U.S. operational characteristics; neither strategy earnestly incorporates potential allied contributors as peer members of an operation.[208]

If the United States wishes to pursue both the technology school and multilateralism school simultaneously, it must merge these schools into a coherent strategy capitalizing on the potential synergies of a holistic strategy. U.S. planners must war game operational organizations and contingency plans for numerous political

[208] For a description of the strategies each combatant command uses in considering allies in contingency planning, see Robyn Read, 2003, *Coalition Warfare: Coordination and Planning Options.* Maxwell AFB, AL: Airpower Research Institute, Research Paper 2003-02.

scenarios and various national participants. U.S. military leaders must be willing to sacrifice efficiency in return for the political benefits of multilateralism.

A holistic approach to coalition operations, however, involves much more than bureaucratic adjustments and policy changes. Fundamental operational philosophies must change as well. For example, jealous protection of information technologies and intelligence means must end in favor of open architectures and information access; strict ROE favoring low risk operations may require loosening to allow wider international participation, and military leaders may have to cede some control over operations to allied participants. U.S. military professionals have to be capable of entering a coalition without considering it “my fight” in which other contributors may be permitted to participate *if* they can keep up.

From a military perspective, the costs involved in the holistic approach are large. It involves sacrificing the very things the American public has expected from its military: high-speed, highly efficient operations; near-bloodless combat; and short campaigns. Future coalition operations may have to become more “messy” in order to ensure greater participation and wider distribution of the combat burden.

D. CONCLUSION

Technology asymmetry contributes directly to operational structures within a coalition that effect its multilateral character. Greater asymmetry and limited time leads to operational dominance by the technologically advantaged partner. In the United States, the drive toward high technology, force-multiplying military solutions runs counter to the political desire to pursue greater multilateral cooperation. While both the technology school and multilateralism school offer benefits for U.S. international power, proponents of both schools fail to consider the other in their recommendations for the future. Inevitably, these two schools converge when the international community dictates a coalition in response to crisis.

U.S. foreign policy requires a more holistic approach to future coalition operations. The implications of the DoD’s technology-driven transformation reverberate well beyond the U.S. military. If the Unites States’ current defense transformation continues on its current vector, it risks unilateralism by default as U.S. allies become increasingly unable to integrate with U.S. military technology.

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