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Interoperability of U.S. and NATO Allied Air Forces: Supporting Data and Case Studies

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Preface

To help the U.S. Air Force identify potential interoperability problems that might arise in NATO alliance operations or U.S.–allied coalition operations with NATO allies over the next decade, and to suggest nonmateriel and technology-based solution directions to mitigate any identified potential shortfalls, this report provides background information used in a larger Project AIR FORCE study entitled Interoperability: A Continuing Challenge in Coalition Air Operations. The focus of that study was on command, control, communications, intelligence, surveillance, and reconnaissance (C3ISR) systems and on out-of-NATO-area operations.

The present report provides additional supporting analytic material for the larger study's final report:

> Myron Hura et al., *Interoperability: A Continuing Challenge in Coalition Air Operations,* Santa Monica, Calif.: RAND, MR-1235-AF, 2000.

This material includes a data-based historical overview of the U.S. experience in coalition operations up to 1999; a selection of case studies used to identify common interoperability challenges encountered in coalition operations; and relevant lessons to be drawn for improving the interoperability of U.S. and NATO air and C3ISR capabilities. The research was completed in early 1999, and although some discussion of Operation ALLIED FORCE in Kosovo was added, no further efforts were made to update the material with detailed information on more recent operations. The report is being published in the belief that the information it contains may be of lasting value to scholars, researchers, and policymakers.[1]

The research was co-sponsored by the Air Force Director of Intelligence, Surveillance, and Reconnaissance (USAF/XOI), the Air Force Director of Command and Control (USAF/XOC), and the commander of the Aerospace Command, Control, Intelligence, Surveillance, and Reconnaissance Center (AC2ISR/CC). The research was performed within the Aerospace Force Development program of Project AIR FORCE (PAF), and it builds upon two

[1]Some of the data reported here differ from the earlier results reported in Hura et al. (2000) as a result of some changes to our classification scheme that were suggested by one of our reviewers.

recent PAF study projects: Investment Guidelines for Information Operations—Focus on ISR, and Developing Future Integrated C2 and ISR Capabilities.

This report should be of interest to policymakers, planners, and program managers involved in interoperability issues and programs of U.S. and NATO allies' air forces. It also should be of interest to planners and operational commanders involved in the employment of coalition C3ISR and combat capabilities.

Project AIR FORCE

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Summary

The United States conducts air operations with other willing NATO allies, including non-NATO members. To help the U.S. Air Force identify potential interoperability problems that may arise in such coalition air operations over the next decades and to suggest solution directions to mitigate those problems, this report applies a broad definition of *interoperability* used by the Department of Defense (DoD) to explore interoperability issues at each level of military operations—strategic, operational, tactical, and technological.[1] A survey of aggregate data and a series of detailed case-study analyses regarding recent U.S. coalition operations with NATO allies were undertaken to better understand interoperability through five key questions:

1. For What Missions Is Interoperability Required?

Judged on the basis of 14 recent United Nations (U.N.) operations and 26 non–U.N. operations in which the United States operated in a coalition with NATO allies, it is clear that the United States operates in coalitions across the entire spectrum of operations, from humanitarian relief and peacekeeping operations in a permissive environment to major theater war. Such breadth dictates that interoperability issues also be considered across this spectrum (see pp. 4–6 and 49–55).

2. With Which NATO Allies Is Interoperability Required?

Participation in U.S. coalition operations has varied greatly from situation to situation, and over time (see pp. 6–11 and 56–85). The most frequent NATO coalition partners in the 40 operations examined were the United Kingdom (29 of 40 operations), France (28), Turkey (23), Germany (22), and Italy and the Netherlands (21 each); other NATO allies participated in fewer actions with the United States.

[1]The definition of *interoperability* used by DoD and NATO is: "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." DoD, Joint Chiefs of Staff, *DoD Dictionary of Military and Associated Terms,* Washington, D.C.: Joint Publication 1-02, March 23, 1994, as amended through February 10, 1999.

The implication is that interoperability planning needs to be adaptive enough to accommodate the possibility of coalitions of different sizes, and composed of different coalition partners. "Plug and play" is a concept well known at the technological level, but it also is required at the national level: for example, to provide for the possibility of different combinations of coalition partners; and to manage the comings and goings of coalition members as the mission focus changes and/or missions are added, completed, or abandoned, while minimizing disruptions to the overall coalition effort. This requirement suggests a broad range of interoperability solution options, including organizations, doctrine, procedures, and systems that can improve the ability to accommodate the dynamic character of coalitions, including transitions.

3. For What Capabilities and Services Is Interoperability Required?

On the basis of the operations examined, allied contributions vary greatly across operations (see pp. 11–18 and 86–98). For example, the United States has contributed a majority of coalition aircraft in Southwest Asia operations, and during the recent air war over Serbia, but typically closer to four in ten aircraft to coalition operations in Bosnia. The United States also generally tends to contribute the broadest range of aircraft, although several nations—the United Kingdom, France, and Italy—also seem to have breadth in their air capabilities. These observations suggest that important roles can be played and are being played by the United States' coalition partners, and U.S. interoperability planning can take advantage of these capabilities. Nevertheless, because coalition partners vary across operations, the United States often may need to provide the richest mix of forces, so as to provide the "glue" for the operation.

The aggregate analyses also suggest that although the United States' NATO allies are, relatively speaking, adequately endowed in combat aircraft, recurring problems continue to be observed in integrating these aircraft at the operational and tactical levels. Although notable exceptions exist, allies are generally not adequately endowed in the sorts of support capabilities that are needed to conduct high-intensity operations (see pp. 86–98).[2] These capabilities include refueling, mobility, intelligence, surveillance and reconnaissance, electronic warfare, and other specialized types of systems. For example, further analysis of potential performance gaps in areas such as precision strike capabilities and

[2]Exceptions include France and the United Kingdom (e.g., for their Airborne Warning and Control System [AWACS] and other capabilities) and Germany (e.g., for its electronic combat capabilities in the Tornado Electronic Combat and Reconnaissance [ECR] systems).

sortie generation appears warranted, and to the extent that gaps are substantiated, interoperability planning needs to address their root causes.

Analysis of mission capabilities raises important questions regarding how coalition operations would continue in the event that U.S. low-density, high-demand (LD/HD) aircraft (e.g., U-2 or Rivet Joint) were reassigned by the President and the Secretary of Defense to meet a higher-priority contingency in another theater; it could very well be that shortfalls in alliance support aircraft would leave them incapable of holding whatever gains had been made until U.S. capabilities returned.

Finally, our analysis of basing in three combat operations in the last decade (DESERT STORM, DELIBERATE FORCE, and ALLIED FORCE [see pp. 99–105]) revealed the importance of allied air bases in Italy to the U.S. coalition operations in the Balkans, and those in Saudi Arabia to air operations in the Gulf War. It also raised important questions about what sorts of operations could have been conducted without the base access and support provided. Appropriate future hedging actions might then include efforts to improve the capacity and capabilities of airfields of other nations in these regions.

4. What Key Challenges Were Observed?

To complement the aggregate analyses just described, a number of recent U.S. coalition operations—U.S. operations in Southwest Asia, Bosnia, Somalia, and Rwanda—were examined through detailed case studies (see pp. 22–43). These case studies revealed a number of additional important lessons regarding challenges to coalitions and interoperability:

- Interoperability clearly can be seen to have strategic, operational, tactical, and technological dimensions, and interoperability problems have been encountered at all levels in recent U.S. coalition operations.
- The impacts of interoperability problems are not isolated within the level in which they were observed. Strategic-level interoperability problems, for example, tend to reverberate throughout the operational and tactical levels. For example, divergences can develop over the political objectives of a military operation, as in different preferences over whether to pursue total destruction of an adversary or some agreed-upon level of damage to his forces. In a similar vein, the absence of secure communications or the existence of combat identification problems may greatly increase the risk of aircraft attrition and reverberate up from the technological or tactical levels to the strategic level.

5. What Key Workarounds Were Observed?

The case studies also revealed a number of additional important lessons regarding workarounds to coalitions and interoperability (see pp. 22–43):

- Interoperability *workarounds*—used here to connote short-term and usually incomplete solutions to the interoperability problems that were encountered—and longer-term interoperability solutions need to address the fundamental sources of the problem. For example, no amount of operational, tactical, or technological workarounds can repair an interoperability problem whose origins are fundamentally at the strategic level. A good example is Somalia, in which a lack of unity of purpose compromised unity of effort and command and led to a chain of command that proved incapable of preventing or mitigating the consequences of a downed helicopter. By the same token, with consensus at the higher (e.g., strategic and operational) levels, lower-level interoperability problems are less likely.
- Uncertainty about what missions will be needed, which countries will participate, the conditions under which allies will join or leave the coalition, and what forces they will contribute creates the need for flexible organizational structures, doctrines, procedures, and "open architecture" systems. These elements should be lubricated by the ready availability of liaison officers to overcome cultural and linguistic barriers and facilitate information flow. However, in the short run the tools most likely to be effective in managing these frictions are organizational and doctrinal elements that enhance flexibility and adaptiveness, and routine exercise and training in a coalition setting.

The case-study analyses, presented in Chapter 3 and Appendix C, also identified key interoperability challenges and workarounds at the strategic, operational, tactical, and technological levels (see pp. 22–43 and 86–98). These include the following:

- At the *strategic* level, key interoperability challenges included coalition-building (DESERT STORM), access restrictions (DESERT THUNDER/FOX and DELIBERATE FORCE), command and control and decisionmaking (DENY FLIGHT, Implementation Force/Stabilization Force [IFOR/SFOR]), changing political objectives (RESTORE/CONTINUE HOPE), and evolving force structure requirements.
- At the *operational* level, force planning and command and control were among the predominant challenges encountered in the cases examined,

followed by information dissemination and security issues. The case studies also show that nations are likely to continue to maintain direct national control of their national and theater ISR (intelligence, surveillance, and reconnaissance) assets, rather than contributing them to a larger, shared pool under coalition control.

- At the *tactical* level, the key interoperability challenges encountered in the case studies were quite diverse. In four cases—DESERT STORM, RESTORE/CONTINUE HOPE, DELIBERATE FORCE, and ALLIED FORCE—the particulars differed, but the key tactical challenge essentially was the difficulty in conducting tactical operations with coalition forces of varying performance capabilities. In DESERT STORM, for example, problems with coalition tactical communications and combat identification led to division of the battle space to separate (and deconflict) air and ground coalition forces; the United States carried the greatest burden for some missions (e.g., precision strike). By contrast, in RESTORE/CONTINUE HOPE, a principal tactical issue was a shortfall in coalition C3 (command, control, and communications) capabilities; the workaround was provision of communications assets by the United States and extensive use of liaison officers.
- At the *technological* level, the lack of similar automated tools and compatible and sufficient communication systems, for example, made it difficult to build and disseminate the air tasking order (ATO) or its equivalent and to establish and maintain secure communications among coalition aircraft. This was the key challenge in operations such as DESERT STORM, DENY FLIGHT, RESTORE/CONTINUE HOPE, ALLIED FORCE, and IFOR/SFOR. A variety of workarounds were observed, including physical dissemination in DESERT STORM and RESTORE/CONTINUE HOPE, and improved tools in DENY FLIGHT. Workarounds to address the lack of adequate and secure communication systems included use of unsecure communications and, when possible, use of codes, taking the associated risk of information compromise. Meanwhile, in IFOR/SFOR, the principal technological interoperability challenge was managing what amounted to information overload; few tools were available for managing the problem. The problem of coalition-wide secure communications is a recurring challenge in coalition operations.

The case studies also revealed other, broader lessons for interoperability planning.

For example, a key strategic lesson from the case studies is that even when coalition partners agree on an overall objective and military mission, they can

have distinctly different preferences, which can complicate coalition politics. In the worst case, agreement may be somewhat nominal—a papering-over rather than resolution of differences—while coalition partners may continue to disagree on the specific courses of action to be pursued. In cases in which political motives are misaligned, no amount of technological or other interoperability will mitigate the problem.

A related lesson is that commanders and political leaders may face significant challenges in balancing each nation's political needs against the military requirements of the operation, particularly when political guidance changes in the course of an operation. Furthermore, these tensions can complicate both command and control (the vertical dimension) and coordination (the horizontal dimension).

Finally, differences in the perceived stakes can lead to differences in the willingness to accept risks; in cases where the stakes for a nation are very low, the willingness to accept risks will be commensurately low, and this can greatly complicate unity of purpose and effort.[3] At some level, policy leadership may be a function of the willingness to accept risks—the more risk that a nation is willing to accept, the stronger its negotiating position will be in the coalition. In cases where the stakes and acceptable risks vary across coalition partners, the United States may face great difficulties in forging a common purpose, effort, and harmonized chain of command.

These analyses suggest that it is necessary to view NATO interoperability in a way that explicitly acknowledges that interoperability issues and problems can arise at each level of a military operation, and that the interdependencies among the levels require that interoperability initiatives simultaneously consider the feasibility and potential impacts at each level.

The historical perspective and lessons learned presented in this report provided the initial starting point for the final report, which accordingly takes up where this report concludes. The final report describes new trends that may affect future U.S.–NATO air and C3ISR (command, control, communications, intelligence, surveillance, and reconnaissance) interoperability; offers short- and

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[3]Operation ALLIED FORCE provides a recent example: "Nevertheless, SACEUR [Supreme Allied Commander, Europe] acknowledges that the execution of Operation 'Allied Force' was significantly affected by the need to maintain cohesion among the 19 NATO allies. Each had their own constituencies to answer to, and varying degrees of how much risk they were willing to take. This forced NATO military planners to introduce some strict rules of engagement—primarily an order to limit damage to civilian infrastructure and prohibiting pilots from flying below 15,000 ft. Clark indicates this was contradictory to the usual execution of military operations." Interview with GEN Wesley Clark, *Jane's Defence Weekly*, Vol. 32, No. 1, July 7, 1999, posted at *Jane's* website: http://www2.janes.com/docs/definterview/dw990707_i.shtml.

medium-term solution directions for five C3ISR thrust areas (command and control, space, air and ground surveillance and control, secure digital communications, and fighters and weapons); and analyzes several types of military benefits that might be expected from interoperability enhancements of various kinds.

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The authors would like to thank RAND colleagues Robert Hunter, John E. Peters, and Judy Larson for their comments on earlier drafts, and Tim Bonds and Michael Kennedy, Program Director and Associate Program Director, respectively, of the Aerospace Force Development program in Project AIR FORCE, for their invaluable assistance and support.

Acronyms

AB	air base
ABCCC	Airborne Battlefield Command and Control Center
ACA	Airspace Control Agency
AEW	Airborne Early Warning *or* air expeditionary wing
AFSOUTH	Air Forces Southern Europe
AI	air interdiction
AMC	Air Mobility Command
AOC	Air Operations Center
AOR	area of responsibility
ARRC	Allied Command Europe Rapid Reaction Corps
ASIC	All-Source Information Center
ATO	air tasking order
AWACS	Airborne Warning and Control System
C2	command and control
C3	command, control, and communications
C3IC	Coalition Coordination, Communication, and Integration Center
C3ISR	command, control, communications, intelligence, surveillance and reconnaissance
C3/SU	command, control, communications, and surveillance
CAOC	Combined Air Operations Center
CAP	combat air patrol
CAS	close air support
CDS	Container Delivery System
CENTCOM	Central Command
CJFTO	Commander, Joint Force/Theater of Operations
CJTF	combined joint task force
CMOC	Civil-Military Operation Center
CTAPS	Contingency Theater Air Planning System
DoD	Department of Defense

ECR	Electronic Combat and Reconnaissance
ELINT	electronics intelligence
EUCOM	United States European Command
EW	Electronic Warfare
FGA	fighter/ground attack
FRY	Federal Republic of Yugoslavia
GCC	Gulf Cooperation Council
GUN	gunship
HAST	Humanitarian Assistance Survey Team
HELO	helicopter
HMMWV	high-mobility multipurpose wheeled vehicle
HNS	host nation support
HUMRO	Humanitarian Relief Operations
IFOR	Implementation Force
IISS	International Institute for Strategic Studies
ISARC	Intelligence, Surveillance, and Reconnaissance Cell
ISR	intelligence, surveillance, and reconnaissance
JAC (Molesworth)	Joint Assessment Center
JBS	Joint Broadcast Service
JDISS	joint deployable intelligence support system
JFACC	Joint Forces Air Component Commander
JTF	joint task force
JTF-GA	Joint Task Force GUARDIAN ASSISTANCE
KVCC	Kosovo Verification Mission
LAN	local area network
LD/HD	low density, high demand
LNO	liaison officer
MCM	mine countermeasures
MND	multinational division
MNF	multinational force
MoD	Ministry of Defence (United Kingdom)
MPA	maritime patrol aircraft
MTW	major theater war
NAC	North Atlantic Council

NAEWF	NATO Airborne Early Warning Force
NATO	North Atlantic Treaty Organization
NEO	Noncombatant Evacuation Operation
NFZ	no-fly zone
NIC	national intelligence cell
non-MTW	non–major theater war
OAF	Operation ALLIED FORCE
OCA	Offensive Counterair
ODS	Operation DESERT STORM
OGA	Operation GUARDIAN ASSISTANCE
OSCE	Organization for Security and Cooperation in Europe
RAF	Royal Air Force
RECCE	reconnaissance
SACEUR	Supreme Allied Commander, Europe
SAR	search and rescue
SETAF	Southern European Task Force
SFOR	Stabilization Force
SOF	Special Operations Forces
SOFA	status of forces agreement
STANAVFORMED	Standing Naval Force, Mediterranean
SUPP	support
TACP	Tactical Air Control Party
TALCE	Tactical Airlift Liaison and Control Element
TANK	tanker
TRAN	transport
TRIADS	Tri-wall Aerial Delivery System
TRRIP	Theater Rapid Response Intelligence Package
UAE	United Arab Emirates
UAV	unmanned aerial vehicle
UNITAF	Unified Task Force
UNPROFOR	United Nations Protection Force
UNSCR	United Nations Security Council Resolution
USA	U.S. Army
USAF	U.S. Air Force

USAFE	U.S. Air Force Europe
USASETAF	U.S. Army Southern European Task Force
USCENTAF	U.S. Central Command Air Forces
USMC	U.S. Marine Corps
USN	U.S. Navy
WAN	wide area network
WEU	Western European Union

1. Introduction

Objective

The United States participates in coalition air operations with other willing NATO allies, including non-NATO members. The objective of the research reported here was twofold: (1) to help the U.S. Air Force identify potential interoperability problems that may arise in such operations over the next decade;[1] and (2) to suggest solution directions to mitigate those problems. Specifically, this report applies a broad definition of *interoperability* used by the Department of Defense to explore interoperability issues in military operations from a strategic, operational, tactical, and technological perspective, and provides additional aggregate data and detailed case-study information that were used in the larger project's final report:[2]

> Myron Hura et al., *Interoperability: A Continuing Challenge in Coalition Air Operations*, Santa Monica, Calif.: RAND, MR-1235-AF, 2000.

A Framework for Revealing Interoperability Issues

We established a simple framework for screening a number of recent cases of U.S. coalition operations that would provide insights into the sorts of C3ISR (command, control, communications, intelligence, surveillance, and reconnaissance) interoperability challenges and workarounds that have been observed in actual practice and potential domains for more-durable solutions to these challenges. The framework sought to answer five key questions about interoperability.

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[1] Although the authors recognize that interoperability problems remain in joint-service operations and are worthy of research, they are beyond the scope of the effort documented here.

[2] The definition of *interoperability* used by DoD and NATO is: "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." DoD, Joint Chiefs of Staff, *DoD Dictionary of Military and Associated Terms*, Washington, D.C.: Joint Publication 1-02, March 23, 1994, as amended through February 10, 1999. A more detailed discussion of interoperability definitions and the different perspectives considered—strategic, operational, tactical, and technological—can be found in Chapter Two of the final report (Hura et al., 2000).

The answers to the first three questions are addressed through a survey of aggregate data for a large number of recent coalition operations in Southwest Asia (SWA), the Balkans, and Africa:[3]

1. *Interoperability for what?* To understand the breadth of aims that have been pursued in U.S. coalitions, we chose a mix of operations that illustrate the range of missions in which the United States and its NATO allies have participated in the post–Cold War world. These missions included a range of noncombat operations, such as humanitarian relief—in both permissive and somewhat nonpermissive environments—monitoring and observing using C3ISR assets, support to naval embargoes, and enforcement of no-fly zones. At the high end, we also included crisis responses, including strike operations, and one major theater war (MTW) (Operation DESERT STORM).
2. *Interoperability with whom?* Believing that such an analysis would lead to a better understanding of likely future participation in coalitions by the United States' NATO allies, we examined the records of participation by NATO members and others in operations (including U.N. operations) in which the United States also participated.
3. *Interoperability with what?* In a similar vein, we wanted to understand the nature of the forces contributed by various coalition partners in recent coalition operations in order to understand the sorts of capabilities that might be contributed in future operations. Because interoperability requirements may differ by mission type or may be more important for some missions than others, we sought to understand the air power roles played by the NATO allies.

The final two questions identify a richer array of lessons learned through detailed case-study analyses:[4]

4. *What interoperability issues, problems, or challenges occurred at the strategic, operational, tactical, and technological levels?* As suggested by the varying definitions of *interoperability* presented in the final report (Hura et al., 2000), we sought to ensure that we could identify critical interoperability problems or challenges at each level of warfare.
5. *What workarounds—technological, doctrinal, organizational, or otherwise—were used to resolve interoperability challenges?* Because there may be many workarounds to interoperability problems, we sought to identify how these problems were resolved.

[3]A listing of the 40 operations examined, and the detailed data and accompanying analyses, is presented in Appendices A through C.

[4]Detailed information for the case studies is found in Appendix C.

This report is organized to address these five questions, as follows:

- Chapter 2 reports the results of a survey of relevant data that aims to answer the first three questions, focusing on (a) the objectives of recent U.S. coalitions, (b) which NATO partners have participated in coalitions, (c) what air capabilities they contributed, and (d) what missions they flew.
- Chapter 3 addresses the two remaining questions and reports the results of in-depth analysis of interoperability issues, challenges, and workarounds in a number of post–Cold War coalition operations in which the United States participated with NATO partners.[5]
- Chapter 4 provides conclusions.
- The four appendices provide supporting documentation and analysis, more-detailed data, and case studies.

In the next chapter, we begin our review of interoperability lessons from the United States' recent coalition experience with NATO allies.

[5]Throughout this report, we use the term *workaround* or *short-term solution* to connote the partial or incomplete solutions that were developed to deal with interoperability problems that were encountered, and to contrast them with *long-term solutions*—more durable and more fundamental solutions that might be provided, for example, through new systems.

2. An Overview of Recent U.S. Coalition Experience

As described in the preceding chapter, we collected data from a large number of recent U.S. coalition operations that related to the first three key questions: the range of campaign objectives of recent U.S. coalitions; which of the NATO allies participated in these coalitions and the capabilities they contributed; and what missions they flew.[1] We now report the results of this survey of relevant data.

For What Missions Is Interoperability Required?

The first question is the range of objectives in recent U.S. coalition operations.

A Broad Range of Missions

The United States has acted in coalitions across the entire spectrum of operations (see Table 2.1, which lists operations by mission focus, in rough order of lethality as categorized by the research team), including humanitarian and peacekeeping operations, monitoring operations, maritime intercept operations, enforcement of no-fly zones in Iraq and Bosnia, peace enforcement operations in Bosnia, strike operations in Iraq, and a major theater war in Southwest Asia (SWA).[2]

The table shows the range of missions that the United States has undertaken in concert with one or more of its NATO allies. It suggests that actual combat operations (e.g., strike operations and major theater war) are in the minority, accounting for only four of the 26 non–U.N. operations examined. By contrast, noncombat operations ranging from humanitarian relief to airlift operations have been more frequent, as have "gray area" operations such as enforcement of no-fly zones, peace enforcement, and crisis response.

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[1]For the survey, we relied upon unclassified, openly available sources, including publications, fact sheets, information posted at relevant websites, and press accounts. The detailed data and interpretations of these data are presented in Appendices A through C.

[2]See Tables A.1 and A.2 for the operations considered.

Table 2.1

Forty U.S. Multilateral Operations, by Mission Focus

Mission Focus	Non–U.N.	U.N.
Humanitarian	4	1
Peacekeeping	3	11
Monitoring/observing	2	2
Maritime intercept operations	3	
Airlift	2	
No-fly zones	4	
Other peace enforcement	1	
Crisis responses	3	
Strike operations/coercive campaigns	3	
Major theater war	1	
Totals	26	14

NOTES: *U.N.* signifies United Nations operations in which the United States participated with other NATO allies; *non–U.N.* signifies U.S. non–U.N. coalitions that included NATO allies.

The obvious implications are that (a) some level of coalition interoperability may be needed across the entire spectrum of operations, but (b) we would expect that interoperability requirements could easily vary from mission to mission. For example, we might conjecture that the least difficult operations, such as humanitarian or peacekeeping operations in a permissive environment, probably have rather low interoperability needs, because the consequences of interoperability shortfalls are rather small. On the other hand, high-intensity combat operations probably have quite high interoperability requirements, because they are time- and resource-stressed operations, and because the stakes—and the consequences of failure—are typically much higher. In a similar vein, interoperability requirements might be moderately high for no-fly zones and other peace enforcement operations in a nonpermissive environment, because—as was described earlier—the tolerance for risks and costs is much lower in these operations than in major theater wars where the stakes are higher.

Several Large and Very Complex Operations

While the United States has engaged in a wide range of operations in the post–Cold War world, the recent U.S. coalition experience has been dominated by one MTW in Southwest Asia—a coalition operation in which several NATO allies (and others) participated—and large, complex, and multifaceted peace

operations in Southwest Asia and the Balkans (see Table 2.2), the last of which has included combat operations undertaken by NATO.[3]

Not only large and complex, these operations have tended to be of very long duration; the U.S. presence in Southwest Asia has lasted nearly eight years and that in the Balkans nearly seven. Furthermore, these operations have been quite dynamic in nature. In addition to the routine rotations that have been required, they periodically have been punctuated by changes of mission, the entry or exit of coalition partners, and occasional crisis responses and/or strike operations.

Planning and executing this mix of sequential, parallel, and crisis response activities have posed great challenges to commanders. Indeed, it is possible that the interoperability challenges posed by these complex, multifaceted operations may even begin to approximate the difficulties inherent in coordinating major theater wars such as Operation DESERT STORM but without the time constraints.

With Which NATO Allies Is Interoperability Required?

The next questions are, Who has recently participated in U.S. coalitions, and Who is likely to be a future U.S. coalition partner?

Table 2.3 indicates how many times NATO partners participated in 26 recent non–U.N. U.S. multilateral operations, and in 14 U.N. operations in which the United States also participated.

As shown in the table, the most frequent NATO coalition partners were the United Kingdom (29 of 40 operations), France (28), Turkey (23), Germany (22), and Italy and the Netherlands (21 each). The most frequent U.S. partners in the 26 non–U.N. multilateral operations were the United Kingdom (22 operations), France (18), Turkey (16), Germany (15), and Italy (14). Canada (11), France and Norway (10 each), Denmark (9), and Belgium and the Netherlands (8 each) were the most frequent U.S. partners in the 14 U.N. operations in which the United States also participated.

[3]Somalia was another large and complex operation, although of much shorter duration than U.S. operations in Southwest Asia and the Balkans. U.S. operations in Somalia included famine relief (PROVIDE RELIEF, RESTORE HOPE, CONTINUE HOPE), airlift movement of peacekeepers (IMPRESSIVE LIFT), nation-building, strikes and raids (CONTINUE HOPE), and withdrawal of U.N. forces (CTF UNITED SHIELD).

Table 2.2

Twenty-Six Recent U.S. Non–U.N. Multilateral Operations

Operation Name	Location	Mission	Date
PROVIDE PROMISE	Fmr. Yugo.	HR	7/92–3/96
MARITIME MONITOR	Adriatic	MIO	6/16/92–11/22/92
SKY MONITOR	Bosnia	MON	10/16/92–4/12/93
DENY FLIGHT	Bosnia	NFZ	4/12/93–12/20/95
SHARP GUARD	Adriatic	MIO	6/15/93–10/02/96
QUICK LIFT	Croatia	LIFT	7/95
DELIBERATE FORCE	Bosnia	STR	8/29/95–9/21/95
DECISIVE ENDEAVOR (IFOR)	Bosnia	PE	12/20/95–12/20/96
DECISIVE ENHANCEMENT	Adriatic	MIO	12/95–6/19/96
DECISIVE EDGE	Bosnia	NFZ	12/95–12/96
DETERMINED GUARD	Adriatic	PKO	12/96–present
DELIBERATE GUARD (SFOR)	Bosnia	PKO	12/20/96–6/20/98
DELIBERATE FORGE (SFOR II)	Bosnia	PKO	6/20/98–present
DETERMINED FORCE	Kosovo	CR	planned 9/98
EAGLE EYE	Kosovo	MON	10/16/98–present
ALLIED FORCE	Kosovo	STR	3/25/99–6/20/99
DESERT STORM	SWA	MTW	1/17/91–2/28/91
PROVIDE COMFORT	Kurdistan	HR	4/5/91–12/31/96
SOUTHERN WATCH	Iraq	NFZ	8/92–present
VIGILANT WARRIOR	Kuwait	CR	10/94–11/94
NORTHERN WATCH	Iraq	NFZ	12/31/96–present
DESERT THUNDER	Iraq	CR	9/3/96–9/4/96
DESERT FOX	Iraq	STR	12/16/98–12/19/98
QUICK LIFT	Zaire	LIFT	9/4/91–10/91
RESTORE/CONTINUE HOPE	Somalia	HR	12/11/92–5/4/93
GUARDIAN ASSISTANCE	Zaire/Rwanda	HR	11/14/96–12/27/96

NOTES: HR = humanitarian relief; MIO = maritime intercept operations; MON = monitoring/observing; LIFT = airlift; PKO = peacekeeping; PE = peace enforcement; NFZ = no-fly zone; CR = crisis response; STR = strike; MTW = major theater war. Operation PROVIDE COMFORT is sometimes broken into two components: PROVIDE COMFORT (4/6/91–7/24/91) and PROVIDE COMFORT II (7/24/91–12/31/96).

Also of interest is the size of the coalitions in which the United States has acted with its NATO allies; this information can provide a sense of the complexity that can arise from interoperating with a large number of other countries with diverse military capabilities. Although coalition size has varied across operations, on average, the United States acted in a coalition of five NATO nations in the non–U.N. operations, and in a coalition of 29 countries in the U.N. operations, seven

Table 2.3

NATO Participation in U.S. Multilateral and U.N. Operations

Country	U.N.	Non–U.N.	Total
U.S.	14	26	40
Belgium[a]	8	9	17
Canada	11	8	19
Czech Republic[b]	1	0	1
Denmark[c]	9	5	14
France[a]	10	18	28
Germany[a]	7	15	22
Greece[a]	5	11	16
Hungary[b]	2	1	3
Iceland[b]	1	0	1
Italy[a]	7	14	21
Luxembourg[a]	0	1	1
Netherlands[a]	8	13	21
Norway[d]	10	8	18
Poland[b]	3	0	3
Portugal[a]	6	8	14
Spain[a]	4	11	15
Turkey[d]	7	16	23
United Kingdom[a]	7	22	29

NOTES: *U.N.* signifies U.N. operations in which the United States participated with other NATO allies; *non-U.N.* is U.S. non–U.N. coalitions that included NATO allies.

[a]Also members of Western European Union (WEU).

[b]Joined NATO in 1999.

[c]WEU observer.

[d]Associate member of WEU.

or eight of which countries were NATO allies.[4] Put another way, the non–U.N. operations tend to be undertaken by much smaller coalitions than the U.N. ones.

There are several implications. First, U.S. coalition partners clearly vary from operation to operation, and few coalition operations are likely to involve all the NATO allies.[5] The consequence is that organizations, doctrine, procedures, and systems will need to be able to "plug and play" with all possible permutations of players. It also suggests that, because the capabilities of these NATO allies also

[4]See Appendix A, Tables A.4 and A.5, for data on coalition size for the 26 non–U.N. and 14 U.N. operations in Tables A.1 and A.2.

[5]We note that IFOR, SFOR, and the related activities involved all of NATO's members, but these were the first NATO operations ever undertaken.

vary, the United States often may need to provide the richest mix of forces, so as to provide the "glue" for the operation.

Summary Observations

Factors Conditioning Participation. The United States routinely acts in "coalitions of the willing" with countries that have, like the United States, determined that important interests or values are at stake. In fact, the most important factor regulating participation in coalitions appears to be the degree to which shared interests and values are engaged in a specific situation.[6] Membership in a coalition also may be regulated by largely political factors other than the simple willingness of the central government leadership to participate.

One set of factors includes the domestic constitutional, legal, or political constraints faced by decisionmakers in NATO countries.[7] For example, until recently, German military forces were generally restricted from participating in a combat role in out-of-area operations; currently, German combat-capable forces can participate but only with the consent of the German Bundestag;[8] in the case of Belgium, political declarations have imposed political constraints on the conditions under which Belgium would participate in peace or other military operations.[9]

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[6]While more durable factors, including cultural and historical ties, also are likely to condition participation, we believe that the specific merits of each case are likely to weigh more heavily.

[7]In a similar way, although its constitutionality has never been confirmed and in practice it has not been used, the War Powers Resolution could, in theory, restrict a U.S. president's ability to use the U.S. armed forces.

[8]According to the German Bundeswehr:

> Until 1990, German armed forces were not deployed abroad for purposes other than humanitarian aid, beginning in 1960 with the relief operation in response to the earthquake in Agadir (Morocco). Well over a hundred operations have since established a long tradition of providing assistance worldwide.
>
> Decisions on the employment of the Bundeswehr in armed operations cannot be taken without the approval of the Bundestag. This principle was reaffirmed by the Federal Constitutional Court in connection with the ruling 12 July 1994 on the commitment of Bundeswehr forces to operations abroad.
>
> Source: German Bundeswehr website at http://www.bundeswehr.de.

[9]For example, in 1994 after the Rwanda crisis, Belgian Prime Minister Dehaene presented a note to the Belgian Parliament outlining the role of the Parliament and general policy of the government toward military operations as follows:

> The decision to participate in a peace-keeping operation will stem from systematic information to Parliament. It is the question of fundamental principle that guarantees the social base of the governmental decision. [from the Introduction]
>
> Belgium shall/should not send [any more] combat troops to the terrain of countries with which we have had colonial ties. This does not exclude all other forms of participation [in] an operation in such a country. An eventual Belgian participation can be envisaged in a support

In other cases, other political forces may restrict participation. For example, in the case of Joint Task Force GUARDIAN ASSISTANCE (JTF-GA), the Government of Rwanda refused to allow the French to lead the multinational force (MNF).

Finally, the situation may change in important ways that affect the shape of the coalition that actually is needed. In the case of JTF-GA, when Rwandan refugees in Zaire and Tanzania returned to Rwanda by foot, the situation essentially resolved itself, thus foreclosing the need for the large MNF of 24 nations—including France—initially conceived. In the end, the result of these developments was a much smaller coalition than originally envisioned.

In sum, shared interests and values are not the only determinants of coalition participation.[10] But the result is that coalitions may range from the large (e.g., JOINT ENDEAVOR, in which 33 nations participated) to the small (Operation DESERT FOX, in which the United States operated in a coalition of two with the United Kingdom).

Tight and Loose Coalitions. Similarly, a coalition may be either tight—for example, a single combined joint task force (CJTF) or U.N. headquarters—or loose—involving separate national headquarters that may need to be integrated at some level. An example of a loose coalition was JTF-GA, in which the U.S. JTF headquarters was independent of the Canadian-led MNF headquarters but interacted with it regularly and provided information support and other assistance. Interoperability planning and preparations need to contend with the eventuality of the entire range of coalition arrangements, from tight, integrated ones, to dispersed or loose ones, and command structures need to be adapted to the exigencies of each coalition type.[11]

Changing Membership. Coalitions are often dynamically resized according to the immediate task at hand and the changing willingness of potential coalition partners to participate in new missions or to accept new risks. For example, the United States participated in a coalition with 11 NATO allies in Operation DENY FLIGHT in Bosnia, but only eight of these countries provided aircraft to conduct

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> role—in areas of logistics or communications—in favor of the peace operations . . . peace and stability in Africa is in first place the responsibility of Africans. [Article I, paragraph 5]

Source: http://premier.fgov.be/fr/001/001024.htm.

[10]For example, a decision to participate also might result from other inducements—e.g., the promise of concessions or side payments, or the threat of aid withheld or a tougher position that will be taken in bilateral negotiations on another issue.

[11]In fact, the current draft of Joint Chiefs of Staff, *Joint Doctrine for Multinational Operations*, Washington, D.C.: Joint Publication 3-16, April 5, 2000, in particular pp. II-8 through II-11, discusses in some detail various alliance command structures.

crisis response and strike operations in Operation DELIBERATE FORCE. Of the latter, only the United States, the United Kingdom, France, and Germany augmented their forces by providing additional aircraft that were not already assigned to NATO Balkan operations. Similarly, while France participated in Operation PROVIDE COMFORT in northern Iraq, it did not participate in the follow-on operation, NORTHERN WATCH; and while France contributes to SOUTHERN WATCH, it did not participate in DESERT FOX.

The key implication is that, to enhance interoperability, organizations, doctrine, procedures, and system architectures all must be able to accommodate the comings and goings of potential coalition members as the mission focus changes and missions are added, completed, or abandoned. Put another way, "plug and play" at the national level is required, in addition to that at the operational, tactical, and technological levels.

For What Capabilities and Services Is Interoperability Required?

Our analysis of recent operations shows that allied contributions appear to vary greatly across operations. In Southwest Asia, the United States historically has contributed a majority of the aircraft, while in many Balkan operations NATO allies have contributed a majority. The United States not only is often the single largest contributor to coalition operations but also tends to provide the broadest range of aircraft. Nevertheless, several nations—such as the United Kingdom, France, and Italy—also have some breadth in their air capabilities.

Patterns in the Size of the Contributions

Table 2.4 presents the minimum and maximum number of aircraft contributed by the United States and its NATO allies to some recent operations.

The greatest number of aircraft contributed to any operation was the 2,088 aircraft the United States contributed to Operation DESERT STORM. France and the United Kingdom (U.K.) were the next-largest contributors, with 84 aircraft for France in Operation ALLIED FORCE and 65 to 90 for the United Kingdom in DESERT STORM (exact number classified).

Table 2.4

Minimum and Maximum Number of Aircraft Contributed to Various Operations, by Country

Country	Minimum Number of Aircraft (Operation Name)	Maximum Number of Aircraft (Operation Name)
U.S.	24 (SFOR)	2,088 (DESERT STORM)
Belgium	2 (DETERMINED FALCON)	14 (ALLIED FORCE)
Canada	18 (ALLIED FORCE)	24 (DESERT STORM)
Denmark	2 (DETERMINED FALCON)	8 (ALLIED FORCE)
France	6 (DETERMINED FALCON)	84 (ALLIED FORCE)
Germany	8 (DETERMINED FALCON)	33 (ALLIED FORCE)
Greece	1 (SFOR, SFOR II)	2 (IFOR, DETERMINED FALCON)
Iceland	—	—
Italy	6 (DETERMINED FALCON)	58 (ALLIED FORCE)
Luxembourg	—	—
Netherlands	5 (DETERMINED FALCON)	22 (ALLIED FORCE)
Norway	1 (SFOR)	6 (ALLIED FORCE)
Portugal	2 (DETERMINED FALCON)	2 (DETERMINED FALCON)
Spain	7 (IFOR, ALLIED FORCE)	11[a]
Turkey	4 (DETERMINED FALCON)	21 (ALLIED FORCE)
U.K.	5 (DETERMINED FALCON)	65–90 (DESERT STORM)

NOTE: See Appendices A and B for data used in constructing this table and classification of Operation DETERMINED FALCON (Table A.3).

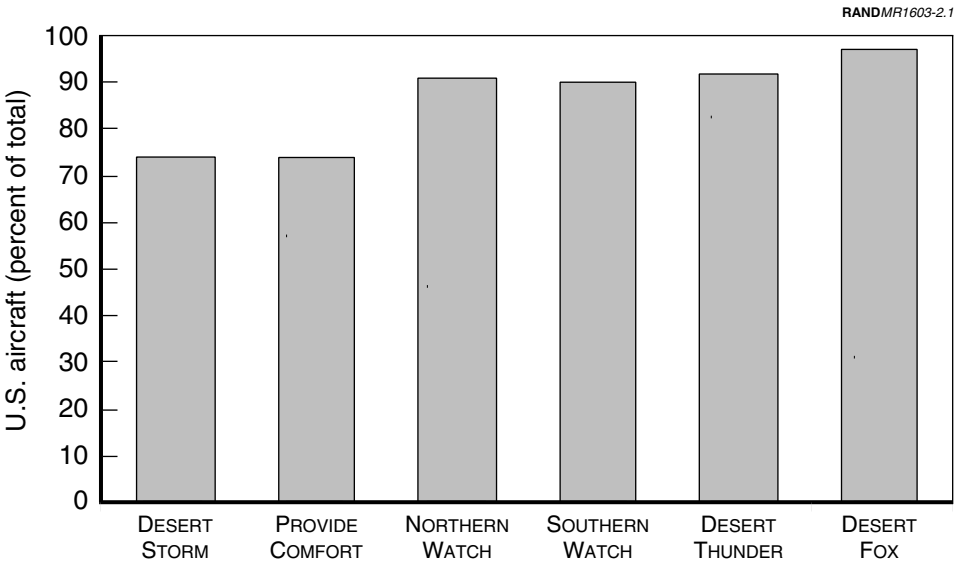
[a]Spain contributed 11 aircraft to Operations DENY FLIGHT, DELIBERATE FORCE, SFOR, and SFOR II.

Figures 2.1 and 2.2 show the relative contribution of the United States and its NATO allies to operations in SWA and the Balkans. We believe that these data are representative of other cases for which we have no data.

These data show that, while the United States generally has provided a large share of the aircraft flown, the relative importance of U.S. and allied contributions has varied across regions and operations.

Figure 2.1 shows the following:

- In the Gulf War, the United States' coalition partners provided about one-quarter of the total coalition aircraft.
- In post–Operation DESERT STORM SWA, the United States provided two-thirds or more of the aircraft in PROVIDE COMFORT (estimated at between 67 and 80 percent), NORTHERN WATCH (91 percent), SOUTHERN



NOTE: The figure for PROVIDE COMFORT represents an average of upper- and lower-bound estimates.

Figure 2.1—U.S. Contributions to Various SWA Operations

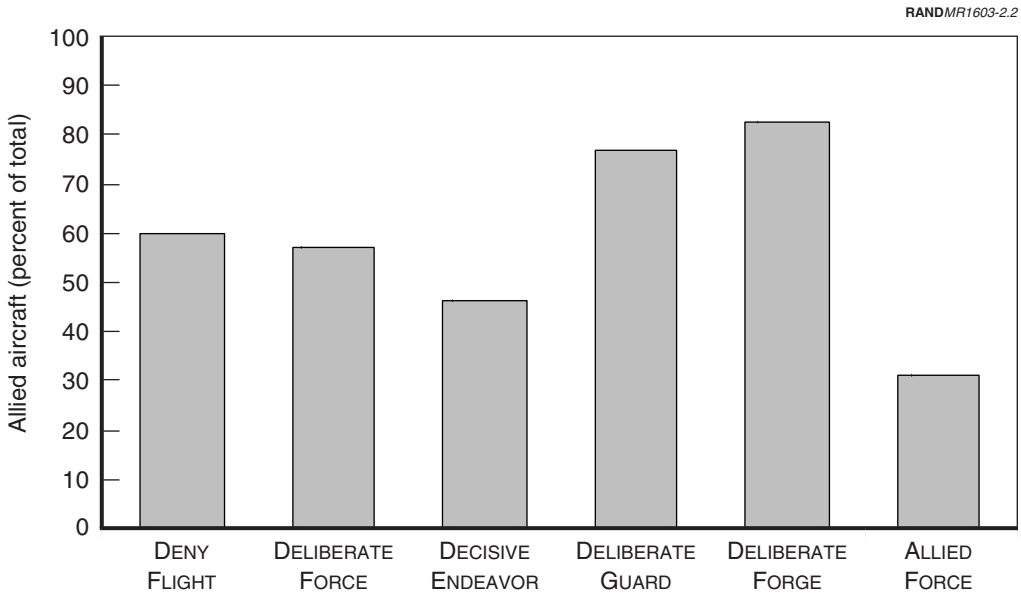
WATCH (90 percent), DESERT THUNDER planning (92 percent), and DESERT FOX (97 percent); and it appears to have been the sole provider of air power in VIGILANT WARRIOR.[12]

By contrast, Balkan operations (see Figure 2.2 and Table 2.5) have been somewhat different: the United States generally provided smaller contributions of aircraft than did its NATO partners:[13]

- Figure 2.2 and Table 2.5 show that in all but two cases (Operations DECISIVE ENDEAVOR and ALLIED FORCE), the United States' NATO allies contributed more than half of all NATO aircraft. The non–U.S. percentage has ranged from as low as 31 percent (in Operation ALLIED FORCE) to as high as 83 percent (in DELIBERATE FORGE).

[12]VIGILANT WARRIOR was centered on Army assets (Army War Reserves) and a plus-up of U.S. Central Command Air Forces (USCENTAF) air assets to more than 170 aircraft and 6,500 USCENTAF personnel.

[13]The inference is that the Balkans region is viewed by Europeans as more directly engaging their interests and values than the security of Southwest Asia.



NOTE: In this figure, NATO partner contributions do not include those of the United States. DECISIVE ENDEAVOR refers to the air component of JOINT ENDEAVOR (IFOR); DELIBERATE GUARD refers to the air component of JOINT GUARD (SFOR); and DELIBERATE FORGE refers to the air component of JOINT FORGE (SFOR II).

Figure 2.2—NATO Partner Aircraft Contributions to Various Balkan Operations

Other observations on Balkan operations include the following:

- Table 2.5 also shows that the contributions of the NATO allies can vary greatly. For example, the United Kingdom provided between 4 and 12 percent of the aircraft to the listed operations; the French, between 8 and 18 percent; and the Germans, between 3 and 12 percent.
- The United States was the single largest provider of aircraft in Bosnia-related operations such as DENY FLIGHT, DISCIPLINED GUARD, DELIBERATE FORCE, DECISIVE ENDEAVOR (IFOR), and DELIBERATE GUARD (SFOR).[14] Aircraft contributions were more even among the NATO allies for Operations PROVIDE PROMISE (the humanitarian airlift operations to Sarajevo), SKY MONITOR, SHARP GUARD, and the various follow-on maritime components associated with IFOR, SFOR, and SFOR II.
- In Kosovo operations, NATO allies contributed about one-third of the aircraft to Operation ALLIED FORCE; Operation EAGLE EYE and the

[14]See the tables in Appendices A and B for detailed data on each operation mentioned.

Table 2.5

Percentage of Aircraft Provided in Various Balkan Operations, by Country

Country	Operation Name					
	DENY FLIGHT	DELIBERATE FORCE	DECISIVE ENDEAVOR (IFOR)	DELIBERATE GUARD (SFOR)	DELIBERATE FORGE (SFOR II)	ALLIED FORCE
U.S.	41.8%	43.2%	54.4%	23.0%	17.3%	69.1%
Non–U.S.	58.1	56.8	45.7	77.0	82.7	30.6
Belgium			1.3	2.0	2.2	1.3
Canada						1.7
Denmark						0.8
France	13.8	17.0	8.8	18.2	17.3	7.9
Germany	5.9	4.8	7.9	10.8	11.5	3.1
Greece			0.9	0.7	0.7	
Iceland						
Italy	8.4	8.2	7.0	10.1	10.8	5.5
Luxembourg						
Netherlands	6.3	6.1	4.8	6.8	8.6	2.1
Norway	0.8		1.3	0.7		0.6
Portugal						0.3
Spain	4.6	3.7	3.1	7.4	7.9	0.7
Turkey	3.3	6.1	3.5	5.4	12.9	2.0
U.K.	11.7	9.5	5.3	12.2	7.9	3.7
NAEWF	3.3	1.4	1.8	2.7	2.9	0.9

NOTES: Percentages may not total to 100 due to rounding. Hungary contributed four aircraft to Operation ALLIED FORCE (0.4 percent). NAEWF = NATO Airborne Early Warning Force.

Kosovo Verification Mission (KVCC) support operation relied upon a more balanced mix of U.S. and other reconnaissance assets; and planning for Operation DETERMINED GUARANTOR evidently envisioned no U.S. air power assets.

- In Somalia, the United States was the largest contributor of airlift to Operations PROVIDE RELIEF, RESTORE HOPE, and CONTINUE HOPE, and was the sole provider of airlift in IMPRESSIVE LIFT and, possibly, in UNITED SHIELD.[15] The United States also was the single largest contributor of ground troops to RESTORE HOPE.
- In JTF-GA in Rwanda, Canada, which was leading the MNF and providing humanitarian relief to the refugees, probably contributed a greater number of aircraft than the United States in terms of airlifters, but the United States

[15]No data on NATO ally contributions were available for UNITED SHIELD.

provided three of the four reconnaissance aircraft that supported the operation.[16]

- The United States' contributions of ground forces to Operation DESERT STORM, IFOR, SFOR, and SFOR II, and RESTORE HOPE also were the lion's share made by NATO countries, but only in DESERT STORM and RESTORE HOPE did they represent the majority of the total ground forces provided.[17]

Patterns in the Breadth of the Contributions

When we examine the *breadth* of the contributions of air capabilities in terms of the range of aircraft types that each nation contributed, it seems clear that the United States historically has been able to provide a more robust mix of aircraft to operations than most of its NATO allies, but several allies (the United Kingdom, France, Italy) on occasion also have contributed a diverse mix of aircraft:

- **Southwest Asia.** In Operation DESERT STORM, the United States provided the largest percentage of all aircraft except pure fighter/air superiority aircraft. In some areas, such as C3 (command, control, and communications) and surveillance aircraft, the United States provided as much as 94 percent of the aircraft. In NORTHERN WATCH, while the United States, the United Kingdom, and Turkey all provided fighter/ground attack aircraft, the United States provided aircraft for five other missions (airborne early warning, electronic warfare, search and rescue, tanker, and helicopters), while the United Kingdom provided aircraft for only one other mission (refueling).[18] The same was the case for SOUTHERN WATCH, VIGILANT WARRIOR, and DESERT THUNDER but apparently not DESERT FOX.[19] In short, in Southwest Asia, the United States has tended to provide the greatest range of air capabilities.

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[16]No data on the number of Canadian aircraft contributed were available.

[17]The United States contributed approximately 28,000 of the 35,000 troops that participated in the Unified Task Force (UNITAF). IISS, *The Military Balance 1993–1994,* London: IISS, October 1993, pp. 257–258.

[18]For our purposes, FGA (fighter/ground attack) aircraft include fighters in air superiority and air-to-ground roles, bombers and other air-to-ground aircraft excluding helicopters, and multirole aircraft that can fly in these roles. The open sources we relied upon for this survey did not always provide specific, detailed information on how aircraft were configured or in what roles (air superiority, ground attack, reconnaissance) they flew. Accordingly, the data presented in this section and in Appendix B may somewhat overestimate contributions of FGA aircraft and underestimate the extent to which these aircraft actually might have flown in other roles (e.g., reconnaissance).

[19]In DESERT FOX, it appears that the United Kingdom contributed fighter/ground attack aircraft but no tankers.

- **The Balkans.** In Bosnia, the United States and several of its NATO allies provided airlifters for PROVIDE PROMISE or airborne early warning aircraft to SKY MONITOR. The United States provided the broadest range of air capabilities to DELIBERATE FORCE, DECISIVE ENDEAVOR (IFOR), DELIBERATE GUARD (SFOR), and DELIBERATE FORGE (SFOR II). However, France provided the broadest mix of air forces to DENY FLIGHT, followed by the United States, the United Kingdom, and Italy.[20] A number of nations, including the United States, provided ground and naval forces or maritime patrol aircraft.
- **Somalia.** In Somalia, the United States appears to have provided the broadest set of capabilities, with contributions ranging from USAF airlifters to U.S. Army and Marine helicopters (especially gunships) in the air, a Marine amphibious ready group off the coast, and Army troops, HMMWVs, armored personnel carriers, and tanks on the ground.[21]

Several other observations also are relevant:

- The type of aircraft most often contributed by the United States and its NATO allies is fighter/ground attack aircraft, although some of these aircraft may have flown in a reconnaissance rather than combat role.[22]
- Fighter/ground attack aircraft have been contributed in variously sized detachments or squadrons, ranging from a few aircraft to squadrons of a dozen or more.

A number of specialized capabilities also have recently been employed in multinational coalitions:

- NATO multinational, French, and British aircraft from the NATO Airborne Early Warning Force (NAEWF) have been employed extensively in the Bosnia conflict.
- The NATO allies also have routinely contributed reconnaissance assets to coalition operations in Southwest Asia, the Balkans, and Africa, and it appears that many countries often contribute aircraft in the reconnaissance role. For example, in DENY FLIGHT, four countries (France, Italy, the Netherlands, and the United Kingdom) contributed one or more

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[20]France provided aircraft for six roles, whereas U.S., Italian, and British aircraft flew in five.

[21]Precise unclassified data on aircraft contributions were not available.

[22]Given that multirole fighter/ground attack aircraft were not always identified as to role, it may be that we actually are underestimating the number of multirole aircraft flying reconnaissance missions.

reconnaissance aircraft; in DECISIVE ENDEAVOR (IFOR), six countries (the United States, France, Germany, Italy, the Netherlands, and the United Kingdom) provided reconnaissance aircraft; in DELIBERATE GUARD (SFOR), five countries (France, Germany, Italy, the Netherlands, and the United Kingdom) provided reconnaissance aircraft; and in DELIBERATE FORGE (SFOR II), the United States, France, and the United Kingdom provided reconnaissance aircraft. In JTF-GA, the United States and the United Kingdom contributed reconnaissance aircraft, while the Canadians appeared to contribute none. In DELIBERATE FORCE, by contrast, the United States, France, the Netherlands, and the United Kingdom provided reconnaissance capabilities.[23]

The foregoing suggests that even when nations agree that their interests or values are engaged, agree on the desirability of specific political objectives and military missions, and elect to participate, they do vary widely on what sorts of forces they contribute to the coalition.[24] These variations are also affected by the availability of mission-specific aircraft.

While the NATO allies have been fairly reliable contributors of fighter/ground attack aircraft, uncertainties remain as to what other aircraft types will be contributed in a specific contingency. Such uncertainties necessitate that interoperability planning consider the possibility of needing to integrate not only forces from a diverse set of contributing nations but also diverse mixes of forces. This possibility heightens the desirability of organizations, doctrines, procedures, and systems that will assist commanders in adaptively integrating diverse force elements into the combined effort, as well as demonstrations, training, and exercises to establish interoperability.

For What Types of Missions Is Interoperability Required?

Analyzing what missions were flown by the United States and its NATO allies provides a better appreciation of the relative contributions made to different operations and the degree of specialization. Because the data are much more sparse, these analyses yield fewer observations.[25]

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[23]Netherlands F-16s and U.K. GR Mk 1As flew in the tactical reconnaissance role. Reconnaissance aircraft contributions may be somewhat underestimated both because some multirole fighter/ground attack aircraft can be employed in the reconnaissance role, and because the number of reconnaissance aircraft can change over time.

[24]As just described, however, the default contribution may be to simply offer fighter/ground attack aircraft.

[25]See Appendix C for the detailed data summarized here.

When the United States contributes the largest number of aircraft to an operation, not surprisingly, it also tends to fly the largest share of sorties as well. For example:

- In Operation DESERT STORM, the United States flew approximately 101,000 of the total 118,700 coalition sorties flown (over 85 percent), and it flew two-thirds or more of the sorties in each mission category. Thus, while the United States provided approximately 75 percent of the aircraft, it flew approximately 85 percent of the sorties.
- In Operation SOUTHERN WATCH, the USAF reportedly has flown 70 percent of the total coalition sorties.
- In Bosnia, in Operation PROVIDE PROMISE, the United States flew slightly less than half of the sorties, while during DELIBERATE FORCE, the United States flew nearly two-thirds of the 3,535 sorties.
- In Operation ALLIED FORCE, the United States flew about two-thirds of the 38,000 sorties, and a little over half (53 percent) of the combat sorties over the campaign, although it flew most strike sorties in the first month of the campaign, and 71 percent of the support sorties over the course of the campaign.

Looking across these operations, then, because the percentage of sorties has often exceeded the percentage of aircraft provided, it can be concluded that U.S. air power frequently operates at a higher operational tempo than that of the United States' coalition partners; however, because the data are quite sparse, this is an area that bears more detailed examination than is possible in the present report.

The foregoing also suggests possible gaps between the United States and its NATO coalition partners in terms of critical capabilities, although data limitations in each case mitigate against reaching strong conclusions:

- As mentioned earlier, in a few cases the proportion of sorties flown by U.S. aircraft substantially exceeded the proportion of aircraft contributed by the United States. Additional analyses need to examine whether there are consistent gaps in sortie-generation and, if so, precisely what the reasons are.
- The United States' extensive precision strike capabilities confer leadership in strike operations and may have effectively ruled out participation by others in strike operations that required high levels of precision.[26]

[26]Allied precision strike capabilities are slowly improving.

- The data presented in Appendix B also suggest that the United States often is the sole contributor of electronic warfare (i.e., jamming and electronic intelligence [ELINT]) aircraft. In fact, we believe that these data may underestimate the contributions of the allies to these missions: the United Kingdom has provided the electronic Nimrod (reconnaissance and ELINT) for years to various operations, and the French, Germans, and Italians have several electronic/ELINT aircraft that they use in the Balkans.[27]

Even the less challenging and dangerous operations (e.g., humanitarian relief operations) can require specialized or advanced capabilities:

- The humanitarian relief effort in PROVIDE PROMISE relied not just on airlift but also airdrop operations.
- JTF-GA made rather extensive use of the P-3 aircraft's sophisticated reconnaissance assets.

Finally, this analysis of mission capabilities raises important questions regarding how coalition operations would continue in the event that U.S. low-density, high-demand (LD/HD) aircraft (e.g., U-2 or Rivet Joint) were tasked by the President and the Secretary of Defense to meet a higher-priority contingency in another theater; it could very well be that alliance shortfalls in support aircraft would leave them in a precarious position until U.S. capabilities returned.

Conclusions

This chapter has summarized the results of aggregate-level analysis of recent U.S. multinational coalitions with NATO partners:

- The United States has recently operated in coalitions across the entire spectrum of operations, from humanitarian relief and peacekeeping operations in a permissive environment to major theater war. This situation dictates that interoperability issues be considered across this spectrum.
- Participation by NATO allies in U.S. coalition operations has varied greatly from situation to situation, and over time. Accordingly, interoperability planning needs to be adaptive enough to accommodate the possibility of coalitions of different sizes and composition, as well as the comings and goings of coalition members, while minimizing disruptions.

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[27] We suspect that the undercounting of reconnaissance and EW (electronic warfare) aircraft may be due to the fact that aircraft counted as fighter/ground attack aircraft actually were configured for these roles.

- On the basis of the operations examined, the United States appears to have contributed a majority of coalition aircraft in Southwest Asia operations but typically closer to four in ten aircraft to coalition operations in Bosnia; Operation ALLIED FORCE is a recent exception, in which the United States contributed the largest share of aircraft to an operation in the Balkans.
- The United States also generally tends to contribute the broadest range of aircraft, although several nations—the United Kingdom, France, and Italy—also appear to have breadth in their air capabilities. These observations suggest that significant tactical roles can be played and are being played by the United States' coalition partners, and U.S. interoperability planning can take advantage of these capabilities.
- There may be some reasons for concern, however, in terms of the performance levels of coalition aircraft, and more detailed analysis should explore these issues. For example, although the data on the matter are quite sparse and the reasons unclear, there are indications that the United States is capable of higher sortie rates than its allies. Similarly, although the allies' precision capabilities are increasing, the United States' greater precision capabilities have often led it to dominate in the most demanding strike operations, ruling out or making unnecessary more meaningful contributions by NATO allies to these most stressing missions. Further analysis of these issues is required, and to the extent that performance gaps are substantiated, interoperability planning needs to address them.

3. Lessons Learned in Some Recent Coalition Operations

The preceding chapter provided a survey of aggregate-level data on the recent U.S. experience in coalition operations. This chapter reviews the lessons learned from a number of detailed case-study analyses of recent U.S. coalition operations, including Operation DESERT STORM (ODS),[1] post-ODS operations in Southwest Asia,[2] Bosnia,[3] Somalia,[4] and Rwanda,[5] to better address the two remaining key questions:[6]

- What issues, problems, and challenges were encountered at the strategic, operational, tactical, and technological levels?
- What workarounds were observed for these interoperability challenges, including adaptations to organizations, doctrine, procedures, use of systems, training, and exercises?

To address these questions, we selected a set of case studies meant to provide a rich picture of the range of U.S. coalition operations, as well as the interoperability challenges and workarounds in these operations. These cases included

- operations from three regions in which the United States and its NATO allies have traditionally cooperated—Southwest Asia, the Balkans, and Africa
- recent NATO operations in the Balkans, which have involved all of NATO's members, as well as other coalition operations that involved the United States and one or more of its NATO allies
- a range of operations, from humanitarian or peacekeeping operations in a permissive environment to strike operations and major theater war

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[1]It does not assess very deeply the developmental and programmatic aspects of interoperability, i.e., the benefits and costs of specific systems and programs that have the potential to enhance future interoperability. For interoperability lessons in Operation DESERT STORM, this study relied primarily on Winnefeld et al. (1994) and Peters and Deshong (1995).

[2]Our focus was on Operations DESERT THUNDER and DESERT FOX.

[3]The focus was on Operation DELIBERATE FORCE, as well as air component operations for IFOR, SFOR, and SFOR II.

[4]We focused on Operations RESTORE HOPE (UNITAF) and CONTINUE HOPE.

[5]We focused on Joint Task Force GUARDIAN ASSISTANCE (JTF-GA).

[6]More detailed information on each operation can be found in Appendix C.

- operations that involved the United States either in a leadership role or in a supporting role.

The case studies were, in Southwest Asia, Operation DESERT STORM and Operation DESERT THUNDER/DESERT FOX; in the Balkans, U.S. air operations in Bosnia, including DENY FLIGHT, DELIBERATE FORCE, and IFOR/SFOR; and in Africa, U.S. operations in Somalia, including RESTORE HOPE (UNITAF)/CONTINUE HOPE, and in Rwanda, Joint Task Force GUARDIAN ASSISTANCE (JTF-GA).

Overview

Table 3.1 summarizes the results of case-study analyses that identified key challenges—strategic, operational, tactical, and technological—and workarounds in a number of recent U.S. coalition operations.

The case studies can be summarized by describing the lessons learned at each level of interoperability.

Strategic Level

Key Challenges and Workarounds

As shown in the table, at the *strategic* level the principal interoperability challenges were coalition-building (DESERT STORM), access restrictions (DESERT THUNDER/FOX and DELIBERATE FORCE), command and control and decisionmaking (DENY FLIGHT, IFOR/SFOR), changing political objectives (RESTORE/CONTINUE HOPE), and the evolving force structure requirements.

Challenges at the strategic level include the processes of defining and standing up the operation. Achieving a "coalition of the willing," whether from an alliance such as NATO, participation of a subset of NATO countries, or a coalition of NATO and non-NATO countries, requires addressing leadership structure; unity of purpose, effort, and command; political versus military control and requirements; and integration of varying levels of force capabilities. Command structure may be based upon the preponderance of forces made available for an operation or may be determined within international-level forums. Differences in political agenda, politically acceptable rules of engagement, or the willingness to place troops/systems under command of another country may require some form of parallel command structure. Force structure and size may be envisioned to be far more robust than are actually required or desired by host nations.

Table 3.1

Key Challenges and Workarounds Identified in Case Studies

	Strategic		Operational		Tactical		Technological	
Operations	Challenge	Workaround	Challenge	Workaround	Challenge	Workaround	Challenge	Workaround
				Southwest Asia				
DESERT STORM	Coalition-building	Parallel chains of command	Force-level planning/ execution; C2	JFACC, CJTF command structure	Force integration, performance	Battlefield/ time-space apportionment	ATO construction, dissemination; secure communi-cations	Physical dissemination; loan, sell communi-cations equipment
DESERT THUNDER/ DESERT FOX	Access restrictions	Carrier battle group, Kuwait, UAE, Bahrain operations						
				Balkans				
DENY FLIGHT	U.N. & NATO decision-making	Dual-key command & approval	Centralized control for air operations	Build CAOC	CAS/BAI coordination	LNOs & TACPs	Lack of ATO tools	CTAPS & planning tools
DELIBERATE FORCE	National consider-ations—F-117s denied access to Italy	None	NATO crisis action planning, air campaign planning	Used U.S. planning staff (16AF)	Heavy precision-strike requirement	Used primarily U.S. aircraft	Allied C4ISR inter-operability	Information-sharing
IFOR/SFOR	Overall C2 organiza-tional structure	None	Information releasability	New releasability directives			Bandwidth/ information overload	JBS/ ignore information

Table 3.1—Continued

	Strategic		Operational		Tactical		Technological	
Operations	Challenge	Workaround	Challenge	Workaround	Challenge	Workaround	Challenge	Workaround
				Africa				
RESTORE/ CONTINUE HOPE	Change of mission & U.N. mandates	Independent U.S. command structure for anti-Aidid operations	Control of air operations	ACA: USMC/AMC/ USN humanitarian relief sectors for deconfliction	Communi-cations interoperability	U.S. assets & liaison teams	ATO/flight schedule distribution, secure communicationss	Various dissemination means, secure radios
JTF– GUARDIAN ASSISTANCE	Force structure/ size	SETAF JTF SOP/ HAST	Information processing/ sharing	ASIC	Refugee tracking	PR-9/ P-3 days, AC-130, nights	Austere local communications infrastructure, bandwidth limitations	None

NOTES: BAI=battlefield air interdiction; C4ISR=command, control, communications, computers, intelligence, surveillance, and reconnaissance; SOP=standard operating procedures.

While there were no workarounds for these challenges in two cases (DELIBERATE FORCE and IFOR/SFOR), an essentially organizational workaround—rationalized parallel chains of command—were the workaround in three cases (DESERT STORM, DENY FLIGHT, and RESTORE/CONTINUE HOPE). The only workaround to the access problems encountered in Operation DESERT THUNDER/FOX was to operate from aircraft carriers and locations other than Saudi Arabia. And the force structure/sizing problem in JTF-GA was resolved through an organizational workaround—the creation of a Humanitarian Assistance Survey Team (HAST), which assisted in tailoring the follow-on forces that were required for the operation.

Unity of Purpose, Effort, and Command

Unity of Purpose. A key lesson from the case studies is that, even when they agree on an overall objective and military mission, coalition partners can have distinctly different preferences, which can complicate coalition politics. In the worst case, agreement may be somewhat nominal—a papering-over rather than resolution of differences—while coalition partners may continue to disagree on the specific courses of action to be pursued. In such cases, where political motives are misaligned, no amount of technological or other interoperability will mitigate the problem.

Unity of Effort. Unity of effort also is a key requirement for benefiting from interoperability. Multinational operations are always subject to what each providing nation allows its forces to do.

Unity of Command. Unity of command is obviously desirable, even if achieved through dual-hatting of commanders. In Operation DESERT STORM, there were two chains of command,[7] but these were coordinated through a Coalition Coordination, Communication, and Integration Center (C3IC).[8]

By contrast, dual chains of command to multiple political organizations have generally proved anathema to good unity of command. In the United Nations Protection Force (UNPROFOR) air operations in Bosnia, for example, dual-key approval was a lengthy and cumbersome process that essentially enabled the United Nations to limit or vitiate NATO decisions regarding the use of air power

[7]The United States headed one chain of command, which included U.S. and non-Arab allied forces. Saudi Arabia headed the second chain of command, which included Arab forces.

[8]The C3IC facilitated coalition-wide planning, training, firing exercises, logistics, radio frequency management, intelligence gathering and sharing, boundary changes, and fire support. Zanini and Taw (1998), p. 6.

to protect U.N.–designated safe areas.[9] A request by ground troops typically went through Lt. Gen. Sir Michael Rose, the ground commander for U.N. forces in Bosnia, to Gen. Jean Cot, the French officer in Zagreb (who commanded all U.N. troops in the former Yugoslavia), to Yasushik Akashi, the U.N. special envoy with the authority to command a strike.[10] In other words, U.N. procedures required that NATO strikes against ground positions attain approval from Rose's Bosnian military command in Sarajevo; the request would then be relayed to the UNPROFOR commander in the Balkans before reaching special envoy Akashi. In the case of NATO close air support (CAS) to help defend UNPROFOR ground troops, a dual-key approach was also found wanting, because it generally resulted in aircraft arriving on scene and having to loiter while authority was sought from U.N. civilian authorities to provide support. As a result, the United Nations eventually agreed to delegate to UNPROFOR commanders decisions regarding close air support for their ground forces. By the time of IFOR, NATO thus insisted that there be no parallel chain of command, involving the United Nations or any other institution, and SACEUR was given full authority for the operation.

As a result of this experience with dual chains of command, NATO now opposes the principle of operating in such a framework. For example, in the threatened air operations in Kosovo and Serbia in early 1999, a single key (NATO secretary-general) approved air strikes,[11] and in contemplating an employment of ground troops in Kosovo, NATO also insisted on a single chain, rejecting a parallel, Organization for Security and Cooperation in Europe (OSCE) decisionmaking role. In Operation ALLIED FORCE, Secretary-General Javier Solana was given the authority to commence air operations.[12]

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[9]This process prevented, for example, the use of NATO air power to respond to Serb attacks on the safe areas of Gorazde (1994) and Srebrenica (1995). NATO air power was used in essentially three ways. First, NATO prevented the use of Bosnian airspace by fixed-wing aircraft under its full authority (Operation DENY FLIGHT). Second, U.N. ground commanders could call in NATO planes for close air support to protect U.N. troops (not, however, to conduct offensive operations or to protect Bosnians, since UNPROFOR had no authority to do so). Eventually, authority for air support to ground forces was delegated from the United Nations' civilian officials to its ground commanders, while the NATO "key" was kept permanently turned. Third was the broader use of air power to protect U.N.–designated safe areas; such use was under a two-key system, and NATO requests for broader use of air power were usually denied or limited by the United Nations.

[10]General Jean Cot served in this position between June 1993 and March 1994. Follow-on commanders include Gen. Bertrand de Sauville de Lapresle and Gen. Bertrand Janvier.

[11]Norman Kempster, "NATO Chief Empowered to Order Airstrikes in Yugoslavia," *Los Angeles Times*, January 31, 1999.

[12]Although dual chains of command did not operate during ALLIED FORCE, coalition partners retained the right to decide how their airspace would be used, what sorts of missions could be flown from their bases, and what sorts of targets their own forces would service.

Flexible Command Structures

Flexibility in command structure, even in the presence of organizations such as a Combined Air Operations Center (CAOC), is vital. In Operation DESERT STORM, the political need for a dual U.S./Saudi command structure required the establishment of a C3IC. This organization assumed responsibility for coordination between the Saudi Commander, Joint Force/Theater of Operations (CJFTO) and the U.S. Combatant Commander, U.S. Central Command. C3IC "served as the coordination point for training and firing ranges, logistics, frequency management, and planning activities, as well as the mechanism for the sharing of intelligence and strategic and tactical reconnaissance."[13]

Finally, the specific contributions of the United States' coalition partners can be the result of detailed, even protracted, negotiation. To be sure, specific coalition contributions ultimately reflect both what is needed by the coalition and what is offered by each coalition partner, and some of these contributions may, from the vantage point of military contribution, be somewhat superfluous, even if they are not, from a political vantage point. In such cases, capabilities were typically relegated to a supporting or rear-area role.[14]

Leadership Enabled by Risk Acceptance

A related lesson is that, at some level, policy leadership is a function of willingness to accept risk—the more risk that the United States is willing to accept, the stronger its negotiating position will be in the coalition. In Operation DESERT STORM, the United States not only provided the vast majority of military capabilities but also accepted the largest share of risk—the *sine qua non* for effective leadership of the coalition. Conversely, during the UNPROFOR operation, the United States—which had not put troops on the ground—preferred to use air power in Bosnia, while nations with forces on the ground were averse to air strikes that might increase the risk of retaliation against their forces. With the promise to use U.S. troops to help extract UNPROFOR forces in hostile conditions, if need be, and by declaring its willingness to put peacekeepers in Bosnia if a peace agreement was reached, the United States was better able to argue for the coercive actions engendered in Operation DELIBERATE FORCE. And in IFOR, the United States was prepared to share risk and put the largest single share of troops in Bosnia, an act that helped to

[13]Winnefeld et al. (1994), p. 96.

[14]For example, in Operation DESERT STORM, French Mirage F-1s did not fly offensive missions, because it was impossible to distinguish them from the Iraqi F-1s, which had been sold to Baghdad by France. Peters and Deshong (1995).

confer a degree of leadership, in addition to the natural advantages of the overall U.S. role in NATO, and in contrast to UNPROFOR.[15]

Of course, in cases where the stakes for the United States are very low, the willingness to accept risk will be commensurately low; in such cases, the United States may face great difficulties in forging a common purpose, effort, and harmonized chain of command.[16]

Tensions Between Political and Military Requirements

Another related lesson is that commanders and political leaders may face significant challenges in balancing each nation's political needs against the military requirements of the operation, particularly when political guidance changes in the course of an operation. This balancing issue has implications both for command and control (the vertical dimension) and for coordination (the horizontal dimension):

- In the vertical dimension, even when there is a single chain of command, national forces still need to report back to their capitals, which also can lead to friction.[17]
- The horizontal dimension also is essential to coalition operations, and organizations, doctrine, procedures, and systems also need to support this dimension. The reason is that the horizontal, cross-cutting interactions between members of a coalition help to build trust; as system architectures become less centralized, information is exchanged, and as interoperable systems are integrated into platforms, multinational strike packaging and other, tactical-level integration can occur.

Complexities of Political Control

A number of lessons arise regarding issues of political control of coalition operations, including those regarding multinational political control, status of

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[15]Nevertheless, a recent study of multiforce compatibility suggested that the U.S. requirements for force protection and support, which prompted the U.S. Army, Europe (USAREUR) to deploy a forward headquarters to Hungary, could have led to problems had there been open conflict. Zanini and Taw (1998), p. 18.

[16]In IFOR/SFOR, it can be argued that the United States shared the risks but insisted that they be kept extremely low.

[17]For example, U.S. political guidance changed in Somalia to direct military activities against the warlord Aidid, while the Italians continued to act on political guidance that they were participating in a humanitarian operation only.

forces agreements, political oversight in the area of responsibility (AOR), and nationally controlled assets.

Multinational Political Control. The question of multinational political control of operations has been resolved in various ways in different operations, although one must remain mindful of differences in the political contexts and sources of decisions. In the Gulf War, for example, the European security architecture for out-of-area operations was inchoate and still evolving, making collective action more difficult.[18] In Bosnia, on the other hand, political control initially was exercised through a dual-key chain of command that went to the United Nations and NATO. In the preparations for air strikes against Serbian forces in Kosovo and Serbia in early 1999, a single chain of command was created. In JTF-GA in Rwanda, by contrast, a committee of more than 20 potential contributors was envisioned originally but was discarded when the operation ultimately involved only three contributors.

The Political and Legal Status of Military Forces. The political status of military forces also is of critical importance. For example, status of forces agreements (SOFAs) are required for CJTF operations and make possible the use of host nation support (HNS), as well as ensuring the security of coalition forces. In Rwanda, however, difficulties in securing a SOFA resulted in the redeployment of the JTF-GA headquarters from Rwanda to Entebbe, Uganda.

Political Oversight in the AOR. Peacekeeping and other operations can be complicated by the desire of political authorities in host nations of the AOR to maintain some level of veto power over issues ranging from force levels and military activities to use of commercial communications frequencies. For example, in Somalia during JTF PROVIDE RELIEF, the Kenyan government insisted on limits to the level of U.S. staff deployed, as well as the releasability of JTF work products to the Kenyan government. These circumstances contributed to a degraded force-protection capability. Additionally, in the force buildup prior to DELIBERATE FORCE, the Italian government refused to allow F-117s to be based in Italy for attacks into Bosnia. U.S. planners had to contend with the lack of this capability to support a NATO operation.

Nationally Controlled Assets. Some assets, such as C3ISR, tend to remain under the control of the contributing nation and are not typically provided directly to NATO. This situation frequently leads to the need for organizations and systems to fuse and disseminate the contributions of each of the dispersed national intelligence cells.

[18]Peters and Deshong (1995), p. xi.

Other Strategic-Level Issues

Among the other issues at the strategic level are the integration of non-NATO forces, strategic and operational planning, the role of standing organizations, challenges encountered in an initial assessment phase, emergent doctrine, and classification and information-sharing.

Integration of Non-NATO Forces. Although this study focuses on NATO forces, non-NATO forces also frequently need to be integrated into a coalition and made at least minimally interoperable. If the addition of partners without minimal support assets is made for political reasons, those partners must be properly supported, using assets such as airlift and at least minimal C3ISR connectivity. In Somalia, representatives from many participating nations did not have adequate levels of support or access to the infrastructure required in order to be substantively helpful. As a result, the presence of some participants actually reduced military effectiveness and efficiency.

Strategic and Operational Planning. Finally, at the interstices between the strategic and operational levels, initial crisis response planning, particularly at the United Nations, may call for a far greater military footprint than is required in the final assessment. To avoid sending more personnel and equipment than are needed—or personnel and equipment that are unsuited to a particular mission—the advance assessment team concept is a critical factor in tailoring the force structure. The Humanitarian Assistance Survey Team (HAST) performed this function in Rwanda/Zaire, as well as operating as a forward-deployed JTF HQ, which allowed both assessment and initial operations to be conducted with the same limited number of personnel. HAST coordinated with AOR governments, relief agencies, and other participating organizations and agreed upon the scope of the mission and the structure of the forces required.

Standing Up. In a number of cases, the period of standing up presented the most difficulties because of the various issues to be resolved. It is during this period that issues such as the following come into play:

- Various national contributions need to be integrated into the coalition and begin to train, exercise, or operate together.
- The implications of differences in national Rules of Engagement (ROEs) need to be resolved.
- Organizational structures, doctrine, and procedures need to be established.

- The C3ISR operational architecture for air, land, and maritime forces needs to be established.[19]
- Combat identification and deconfliction issues need to be worked out.
- Information-sharing and security issues need to be resolved.

It seems clear, however, that the interoperability problems encountered in standing up a coalition with NATO allies are minimized because the supporting organizations of the NATO alliance itself—from the North Atlantic Council (NAC) through the integrated command structure and down to the working groups that develop standards and harmonize systems development—provide the opportunity for interactions and development of common long-term solutions, including organizations, doctrine, systems, and procedures. Equally important, the integrated command structure makes possible preparations in advance of actual operations—including design of organizations and chains of command, configuration of systems, and training and exercises—that can greatly reduce the frictions encountered in standing up a new operation.

Standing Organizations. During the standing-up process, perhaps the key lesson learned was that the interoperability difficulties encountered can be greatly reduced through the prior establishment, training, and exercise of the CJTF or its equivalent:

- The NATO alliance itself, including the NAC, standing committees, and commands, is perhaps the preeminent example of the benefits of standing organizations.
- Although they have limitations—such as having a much more limited focus, usually receiving their planning from external organizations (e.g., in SHARP GUARD, from a Combined Task Force [CTF]), and being incapable of planning and executing air operations—standing organizations, such as the Standing Naval Force, Mediterranean (STANAVFORMED), often can deploy and begin execution more quickly than task-organized organizations created on an *ad hoc* basis. They also demonstrate how multiple components can be fielded effectively, as surface forces and maritime patrol aircraft are organically linked in these operations.[20]
- In JTF-GA, the Southern European Task Force (SETAF) organized the JTF-GA headquarters and exercised the specific missions that it would execute in

[19]According to Wentz (1997, especially pp. 273–378), establishing C4ISR for the IFOR was quite challenging.

[20]For example, British naval forces integrated well with U.S. maritime forces. Peters and Deshong (1995), p. 42.

Rwanda for a month before deploying, thereby smoothing the process of standing up when the JTF headquarters finally deployed.

Initial Assessment Phase for Refining CJTF Requirements. The assessment process that determines the size and shape of follow-on forces is also a critical issue. In JTF-GA in Rwanda, for example, the biggest challenge was making decisions on force structure for the mission, even as the situation was still evolving. This issue was handled by HAST, which proved pivotal in reducing the overall footprint, tailoring forces to meet specific needs, and ultimately reducing the cost of the operation.

Furthermore, transitions from one operation to another tend to benefit from the prior arrangements that have been worked out to resolve interoperability issues.[21]

Emergent Doctrine. Emergent joint doctrine is addressing a number of key organizational and other issues that should facilitate the standing up of future multinational coalition organizations. This emergent doctrine provides guidance for a rich menu of organizational templates that can be applied in various circumstances, thereby reducing the improvisation that would otherwise be required.[22]

Classification and Information-Sharing. One of the key lessons learned from the case studies is the frequency with which classification and information-sharing problems arise in U.S. coalition operations. As suggested earlier, participating nations tend to rely upon their own national assets for intelligence collection and strive to protect the security of both intelligence and the sources and methods that were used to acquire intelligence. Because all coalition operations require some level of trust and information-sharing, classification and information-sharing issues appeared to arise in virtually all U.S. coalition operations. The implications include the following:

- Clear guidelines on information-sharing need to be established at the onset of the operation.

[21]For example, the transition from PROVIDE COMFORT to NORTHERN WATCH and, in Bosnia, the transitions between UNPROFOR, IFOR, SFOR, and SFOR II.

[22]See Joint Chiefs of Staff (2000), pp. II-8–II-12.

- Liaison officers can be used to share mission-critical information in a less formal setting.
- Consideration should be given to a workaround developed in IFOR, whereby NATO reportedly devised a new classification called "IFOR-releasable" to maximize the intelligence flow to non-NATO countries and simplify what otherwise would have been an *ad hoc* and piecemeal process.[23]

Of course, because coalition partners may vary across operations, whatever longer-term solutions are developed will need to be flexible and easily adapted to the political and other constraints in each situation.

Operational Level

Key Challenges and Workarounds

As shown in Table 3.1, at the *operational* level planning and control were the predominant challenges encountered in the cases examined, followed by information dissemination and security issues.

In two operations—DESERT STORM and DELIBERATE FORCE—force-level planning was the critical operational challenge; in both cases, the workarounds were organizational ones. In two other operations—DENY FLIGHT and RESTORE/CONTINUE HOPE—control of air operations was the key challenge; again, the workaround was organizational. Finally, in two other operations (IFOR/SFOR and JTF GUARDIAN ASSISTANCE), the releasability and dissemination of information were the key challenges. In one case, the workaround was doctrinal—promulgating a directive that created a new category of information that was IFOR-releasable—and in the other case, the workaround was organizational—the creation of the All-Source Information Center (ASIC).

Other interoperability issues that arose at the operational level were capability shortfalls and performance deficiencies, changing missions and forces, weaknesses in NATO operational planning for air, challenges posed by dispersed organizations, information overload, and exercises and training.

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[23]Zanini and Taw (1998), p. 19.

Capability Shortfalls and Performance Deficiencies

In a number of areas, the United States' European partners currently exhibit capability shortfalls or performance deficiencies:

- Neither the Allied Command Europe Rapid Reaction Corps (ARRC) nor the Eurocorps is as capable as an equivalent U.S. corps, and neither can project significant military power into Southwest Asia, much less sustain a long-term presence there.[24]
- Since the Gulf War, although some of the United States' European partners have sustained a presence in Bosnia and Southwest Asia, their capabilities—relative to those of the United States—are weak in terms of long-range transportation, rotation base, and logistics infrastructure for sustaining a protracted mission in a distant, austere, and harsh theater, particularly against a resolute opponent threatening open warfare.[25]
- Weaknesses in C3 led to the suggestion that the European nations create a strategic C3 brigade or battalion that would enable European forces to maintain contact with their national leadership, direct subordinates, and integrate into the communications networks of the ARRC, the Eurocorps, or other *ad hoc* formations.[26]
- As mentioned earlier, limited precision-strike capabilities in European air forces may have militated against fuller participation in some of the most important precision-strike missions in past operations.

Changing Missions and Forces

Coalition operations also appear frequently to change their mission focus or add other, new missions. Particularly during crisis responses, but also during buildup and build-down of a coalition force, there can be an ongoing, dynamic resizing of the force based on changes in participation. Such resizing demands an increasing degree of sophistication and interoperability between and among forces, especially as operations tend to overlap and require deconfliction across functional areas.[27]

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[24]Peters and Deshong (1995), p. xii.

[25]Peters and Deshong (1995), p. xi. However, the United Kingdom has earmarked one brigade for MTW and one brigade for Operations Other Than War (OTW); France has 15,000 troops for an MTW and 3,000 for OOTW; and Germany has one two-brigade division. Among these, the United Kingdom arguably has the highest level of capabilities in these areas.

[26]Peters and Deshong (1995).

[27]The three best examples are post-ODS Southwest Asia, the Balkans, and Somalia.

Issues in NATO Operational Planning for Air

In Bosnia, some NATO nations' air power doctrine focuses heavily on tactical operations with little emphasis on planning an air campaign and turning commanders' guidance into an air tasking order or message for a large number of sorties. In large part, this focus seems to be because air power is generally treated by some allies as a necessary organic capability for effective ground operations, where air power plays an important role in close air support and battlefield air interdiction. While not necessarily incompatible with the U.S. view of air power, this view of the world does, however, pose challenges to operational-level planning for air, since it divides the battle space into national or multinational enclaves that then need to be integrated into a theater-wide, operational-level picture.[28]

These nations also are reluctant to give up operational and tactical control of their aircraft to a combined commander to use in satisfying the combined commander's requirements. This fact makes NATO CJTF and Joint Forces Air Component Commander (JFACC) doctrine the subject of further debate and coordination.

Challenges Posed by Dispersed Organizations

The prevalence of dispersed organizations—headquarters, intelligence cells, and other organizations—creates additional challenges for operational control and needs to be considered in planning organizational and system architectures. The potential problems for the future interoperability of dispersed organizations and activities include the following:

- The integration of dispersed intelligence activities to produce a common intelligence picture. In IFOR in Bosnia, ground commanders requested air support through 20 Tactical Air Control Parties (TACPs), which remained under national control, and IFOR's ARRC had ten national intelligence cells (NICs) supporting it.
- Challenges in disseminating information to noncollocated entities. In Southwest Asia and Bosnia, liaison officers were used extensively as a means for sharing relevant information, and in Rwanda, JTF-GA used its ASIC to support the noncollocated, Canadian-led multinational force (MNF). JTF-GA

[28]The potential operational challenges include deconflicting air-ground operations in adjacent sectors and assuring a degree of interpermeability of these sectors to allow for U.S. theater-wide applications of air power.

also used MNF personnel and equipment to operate both its CAOC and its ASIC, which jointly provided information services.[29]

The implication is that organizations and operational and system architectures will need to be able to support a range of dispersed activities, including planning, execution, and information dissemination, while still providing overarching deconfliction and integration functions.

Information Overload

The proliferation of data collection and storage assets and the increased bandwidth of computers and communications systems are creating a world in which the information that is available to commanders and operators has in some cases outstripped their ability to put it to effective use. While new tools for managing this information are under development or already deployed, such "information overload" is likely to be a perennial problem for future operations, and for the interoperability of future forces, insofar as the ability to use various types of information and the availability of tools to manage that information may not be evenly distributed among the United States and its coalition partners.

To illustrate, "information overload" was a problem in Bosnia (IFOR/SFOR), from the operational level down to the division level, as a result of the vast amount of information available and the limited tools for managing that information. No real solutions to the "information overload" problem were found.[30]

Also important is that many Military Operations Other Than War (MOOTW) will take place in areas in which the location communications infrastructure will not support modern command, control, communications, computing, and intelligence (C4I) systems, or the volume of required communications in and out of the JTF/MNF headquarters (HQ). Nevertheless, deploying units must be equipped with the systems required for modern HQ operations, including classified and unclassified local area networks (LANs), message-handling systems, communications (telephones, radios, cellular phones, INMARSAT, etc.), computers, planning/managing tools (Contingency Theater Air Planning System [CTAPS], Theater Rapid Response Intelligence Package [TRRIP], Joint

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[29] For example, with respect to planning and execution, the use of dual U.S. and NATO air tasking orders (ATOs) in operations such as ALLIED FORCE posed substantial coordination challenges.

[30] Unpublished case study of U.S. coalition operations in Bosnia by Lt Col Jim Keffer, RAND Air Force Fellow, FY 1999.

Deployable Intelligence Support System [JDISS], etc.), and security systems to protect nonreleasable information. In Rwanda, many such items were available but were somehow limited because of bandwidth, numbers, or incompatibility with "reach-back" units such as Joint Analysis Center (JAC) Molesworth.[31]

Exercises and Training

Planning and training for operations (e.g., GUARDIAN ASSISTANCE) are major challenges, highlighting the need to develop standardized forces and systems for crisis response. United States European Command (EUCOM) has designated the U.S. Army Southern European Task Force (USASETAF) to plan, equip, and deploy a small footprint JTF HQ for either Noncombatant Evacuation Operations (NEO) or Humanitarian Relief Operations. SETAF maintains the basic personnel and equipment to stand up a JTF HQ, and it trains for these missions during regular joint training exercises in Europe. SETAF uses specified unit "plugs" to make up the required forces for a specific operation. These "plugs" fulfill subspecialties within the HQ staff and provide required equipment and personnel for specific missions (e.g., intelligence, surveillance, and reconnaissance [ISR], airlift, etc.).[32]

Tactical Level

Key Challenges and Workarounds

As shown in Table 3.1, at the *tactical* level the key interoperability challenges encountered in the case studies were quite diverse.

In three cases—DESERT STORM, DELIBERATE FORCE, and RESTORE/CONTINUE HOPE—the particulars differed, but the key tactical challenge essentially was force integration in light of the varying performance capabilities of coalition forces. In DESERT STORM, the short-term solution was a twofold one involving dividing the battle space to separate coalition forces to minimize problems, and then pairing the coalition forces with U.S. forces that would compensate for specific performance gaps.

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[31]Unpublished case study of JTF GUARDIAN ASSISTANCE by CDR Bill Little, RAND Navy Fellow, FY 1999.

[32]"Africa Aid Mission Scaling Down," *Air Force News*, December 18, 1998. JTF-GA benefited greatly from work that previously had been done by the Southern European Task Force (SETAF) to design a standard JTF organization that could easily be stood up, married to supporting EUCOM assets, and deployed to the theater of interest. SETAF will utilize EUCOM Directive (ED) 55-11 to identify personnel fills for the JTF based on operation requirements: Noncombatant Evacuation Operations (NEO) with Forcible Entry or Humanitarian Relief Operations (HUMRO).

In a similar vein, the desire to avoid noncombatant casualties and collateral damage led to a heavy precision-strike requirement in DELIBERATE FORCE. Because the United States' coalition partners had limited precision capabilities, however, this requirement essentially limited a number of coalition partners from a more substantial contribution to precision-strike missions, and the only short-term solution was to rely primarily on U.S. aircraft for strike operations. In RESTORE/CONTINUE HOPE, the principal tactical issue was a shortfall in coalition communications capabilities; the workaround was provision of communications assets by the United States and extensive use of liaison officers.

In Operation DENY FLIGHT, the main issue was the coordination of air and ground operations; the workaround was improved modes of interaction, involving tactical air control parties (TACPs) and, as in RESTORE/CONTINUE HOPE, liaison officers (LNOs). And in JTF GUARDIAN ASSISTANCE, the key tactical interoperability and capability challenge was day/night refugee tracking, which was addressed through a mix of U.S. and coalition capabilities.

Technological Level

Key Challenges and Workarounds

Table 3.1 shows that at the *technological* level building and disseminating the air tasking order (ATO) or its equivalent were key challenges in three operations—DESERT STORM, DENY FLIGHT, and RESTORE/CONTINUE HOPE. A variety of workarounds were observed, including physical dissemination in DESERT STORM and RESTORE/CONTINUE HOPE and improved tools in DENY FLIGHT.

C3ISR Capabilities

U.S. coalitions across the entire spectrum have seen C3ISR capabilities contributed by the United States and, to a somewhat lesser extent, by its coalition partners. Nevertheless, these capabilities also can pose important interoperability challenges:[33]

- In Operation DESERT STORM, the lack of deployable wide area networks (WANs) significantly hampered the dissemination of the ATO to all involved organizations. As a result, ATO coordination was sometimes reduced to the

[33]However, airborne early warning and maritime patrol aircraft appear to integrate fairly well, in large part, we suspect, because of common capabilities and the existence of standing organizations such as the NAEWF and STANAVFORMED.

lowest common denominator of transmission capability: the manual dissemination of the ATO.[34]

- Even in small-scale operations, adequate deployable communications assets are essential to provide coordination between organizations and a minimal level of situational awareness. In Somalia, for example, secure point-to-point links for long-haul message and voice traffic proved essential due to the lack of local commercial communications infrastructure. Short-haul point-to-point tactical communications such as secure radios and facsimile capabilities were even more vital, enabling local coordination efforts and preventing fratricide.
- In Bosnia, interoperability problems were encountered with secure radios, arising from the absence of the necessary cryptography equipment among non–U.S. pilots, which had an adverse impact on tactical operations.
- Many non–U.S. NATO aircraft currently lack the capability to receive incoming radio information while airborne and act on that information; nevertheless, they can take instructions via radio.

Finally, the case studies show that nations are likely to continue to maintain direct national control of C3ISR assets rather than contributing them to a larger, shared pool under coalition control. This was the case in Bosnia, for example, where national assets such as the German Atlantic surveillance platform, the United Kingdom Nimrod and Canberra aircraft, and the U.S. U-2R and RC-135s were held under national control. The case studies also suggest the possibility in the future of a hub-and-spoke architecture, in which a coalition intelligence center is at the hub[35] and independent national intelligence collection and dissemination centers share subsets of their national intelligence product with the coalition intelligence center.

Because information and communications technologies are increasingly enabling effective distributed operations, it seems likely that future operations may increasingly be characterized by distributed collection systems, dissemination systems, and organizations on common networks. A possible implication for interoperability planning, then, is that the architectures that are developed to manage intelligence collection and dissemination may need to integrate separate, national nodes, whether they are sending or receiving this information.

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[34]Winnefeld et al. (1994), p. 111.

[35]Such as the Intelligence, Surveillance, and Reconnaissance Cell (ISARC) in ALLIED FORCE.

Conclusions

This section has provided an overview of lessons learned in recent U.S. coalition operations with NATO allies. The principal findings are as follows:

- First, viewed from the perspective of a number of recent operations, interoperability clearly can be seen to have strategic, operational, tactical, and technological dimensions, and interoperability problems have been encountered at all levels in recent U.S. coalition operations.
- The impacts of these interoperability problems, furthermore, are not isolated within the level in which they were observed. Strategic-level interoperability problems, for example, tend to reverberate throughout the operational and tactical levels. In a similar vein, the absence of secure communications or the existence of combat identification problems can greatly increase the risk of fratricide and reverberate up from the technological or tactical levels to the strategic level.
- Interoperability workarounds and solutions need to address the fundamental sources of the problem. For example, no amount of operational, tactical, or technological workarounds can repair an interoperability problem whose origins are fundamentally at the strategic level. A good example is Somalia, in which a lack of unity of purpose compromised unity of effort and command, and led to a chain of command that proved incapable of preventing or mitigating the consequences of a downed helicopter.

A number of overarching principles can help to facilitate future coalition operations:

- Many strategic or political challenges confronting a coalition operation will continue to complicate future operations; however, organizational and doctrinal elements that enhance flexibility and adaptiveness, experience in real-world coalition operations, routine exercise and training in a coalition setting, and an ample supply of liaison officers to lubricate information flow can in the short run help in managing these frictions.
- Operational-level dependence upon the United States and limited capabilities—for example, for precision-strike operations, operational planning for air operations, and combat assessment—also pose potentially longer-term interoperability challenges, since they may require new capabilities. Many NATO allies are improving these capabilities, however, suggesting that these operational inflexibilities will prove less problematic in the future.

- There are a number of emerging longer-term solutions to reducing the challenges inherent in standing up new operations. While the doctrinal underpinnings and notional structure for CJTFs are still maturing, the possibilities for standing up CJTFs and for exercising CJTFs before they are deployed also are quite promising, as are various other organizational innovations, such as for information dissemination.

Uncertainty about what missions will be needed, which countries will participate, and what forces they will contribute creates the need for flexible organizational structures, doctrines, procedures, and systems with "open architectures," lubricated by the ready availability of liaison officers. As described in the foregoing, a number of nonmateriel solutions have provided the basis for workarounds to many—but not all—of the interoperability challenges encountered in these case studies. They suggest that in addition to longer-term materiel solutions, any program to foster interoperability also should include the many relatively inexpensive actions that can be taken in the short term. Prominent among these are

- new or modified organizations and doctrine that can provide flexible structures and procedures for improvising solutions to interoperability problems encountered
- personnel staffing solutions, such as the ready availability of liaison officers (LNOs) who can troubleshoot problems
- training, exercises, and interoperability demonstrations to reveal potential future interoperability problems before they are encountered in operational situations where they may pose threats to the overall mission
- identifying message characteristics, interfaces, or other potential impediments to the effective flow of information to create standards for collaboration.

In addition, there also may be short-term materiel or systems solutions, including "mods and pods,"[36] that can be added to existing platforms over a shorter time horizon than that associated with the development of new platforms. In such cases, substantial interoperability improvements may be possible without incurring the far more substantial costs associated with buying new platforms.

[36] "Mods and pods" generally refers to the upgrades and subsystems used to improve the performance and capabilities of existing weapon platforms. An example might be providing older systems with night-fighting or stand-off precision-strike capabilities.

The focus of this report thus far has been on broad patterns in the aggregate data on U.S. participation in coalitions with NATO allies (Chapter 2) and interoperability challenges and "workarounds" to these challenges—improvised actions that have been taken to mitigate or ameliorate interoperability problems encountered at the strategic, operational, tactical, and technological levels (this chapter). In the next chapter, we provide our conclusions.

Afterword on Operation ALLIED FORCE (OAF)

Although OAF was not the subject of one of our detailed case studies, a number of interoperability problems were observed in the operation that are worth noting.

At the strategic level, political restrictions manifested themselves in a number of ways: in terms of the deliberative consensual process for authorizing targets, in terms of stringent rules of engagement, and in other ways.[37] For example, the testimony of General Clark, Admiral Ellis, and Lieutenant General Short suggested that strategic-level political restrictions placed great constraints on the earliest phases of the air campaign:

> As the campaign progressed, early difficulties in selecting targets and generating strong pressure on the Yugoslav government were overcome. As commanders, of course, we would have wanted to conduct a more rapid, overwhelming campaign with more strike power. Our desire to do so, however, had to be balanced with the need to maintain Alliance cohesion and unity. The loss of unity would have ended the campaign. Sustaining unity in the face of efforts to destabilize the countries around Yugoslavia, a sustained propaganda campaign, ethnic cleansing, and the efforts of certain nations to halt our actions sent a powerful message to the international community in general, and to Slobodan Milosevic in particular. This message was that NATO stood together, we could win, and we would win.[38]

A broad range of operational, tactical, and technological capability gaps also were revealed in OAF:

> Operation ALLIED FORCE illuminated the capability gaps between the U.S. military and our NATO Allies. For example, not all NATO nations

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[37]Cordesman (1999, p. 10) reports that "France and several other NATO countries put political limits on the number and nature of sorties flown early in the war, and . . . political constraints on targeting played a major role in limiting the impact of air strikes in creating the kind of 'shock' and 'compellance' that might have led to an earlier resolution of the war."

[38]Combined Prepared Statement of GEN Wesley Clark, USA, ADM James Ellis, Jr., USN, and Lieutenant General Michael Short, USAF of the United States European Command Before the Senate Armed Services Committee, October 21, 1999.

> possess adequate precision munitions, secure communications, and mobility assets in terms of airlift and tankers. These gaps impeded interoperability among allied forces during the campaign.[39]

These themes were developed further in the DoD's Kosovo after-action report:

> Notwithstanding the allied contributions, and overall success of the campaign, Operation Allied Force highlighted a number of disparities between U.S. capabilities and those of our allies, including precision strike, mobility, and command, control, and communications capabilities. The gaps in capability were real, and they had the effect of impeding our ability to operate at optimal effectiveness with our NATO allies. For example, because few NATO allies could employ precision munitions in sufficient numbers (or at all), the United States conducted the preponderance of the strike sorties during the early stages of the conflict. Problems regarding communication interoperability persisted throughout the campaign. Insufficient air mobility assets among our allies slowed deployment of Kosovo ground forces—beyond those already in the theater—once Milosevic agreed to NATO's terms to end the conflict. Disparities in capabilities will seriously affect NATO's ability to operate as an effective alliance over the long term.[40]

General Jumper, then Commander, U.S. Air Force Europe (USAFE), indicated shortfalls in these areas, as well as in several others:

> NATO Interoperability. Allied unity was our greatest weapon—we simply could not have conducted this operation without the framework of NATO. Our allies and other non-NATO partners provided us critical access to airspace, airfields, and transportation infrastructure. NATO interoperability allowed us to successfully integrate widely varying assets and capabilities into a deadly combat force.
>
> Interoperability was an overwhelming success throughout the conflict, but it was not problem-free. With the great flight distances from many bases to Yugoslav airspace, air refueling was a critically needed capability. By the end of the conflict, we had assembled a force of nearly 200 NATO tanker aircraft to provide the lifeblood of the air campaign. However, pilots from several allies lacked adequate training for in-flight refueling, which diminished their participation. In another shortfall, our secure communications capabilities were insufficient and many of our transmissions were made "in the clear." As a result, sensitive information sometimes fell into enemy hands. Some aircraft also lacked jam-resistant radios and were unable to communicate with other airborne elements in the face of Serbian electronic warfare measures. In addition, several allied aircraft types were not equipped with the necessary Identification Friend or Foe (IFF) equipment that would have distinguished them from enemy

[39]Combined Prepared Statement (1999).

[40]DoD, *Kosovo/Operation Allied Force After-Action Report,* Washington, D.C., January 31, 2000, p. 25.

> aircraft. This hampered the ability of battle managers to maintain an accurate, complete picture of air operations.[41]

Anthony Cordesman further notes:

> In many cases, this level of U.S. commitment was a product of the fact that allied aircraft would have had serious problems in participating in U.S. air groups involving a mix of different aircraft with dedicated missions for communications and training reasons, because the allied aircraft had limited strike-attack capabilities, or because of limitations in allied training and precision guided munitions stocks.[42]

These lessons generally are consistent with lessons learned in the other cases we examined.

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[41]Statement of Gen John P. Jumper before the House Armed Services Committee, October 26, 1999.

[42]Cordesman (1999), p. 34.

4. Conclusions

This report has provided an historical review of the United States' recent experience in coalition operations with its NATO allies, and the lessons most relevant to improving the interoperability of the air and C3ISR capabilities of the United States and its NATO allies.

Throughout, the report has portrayed interoperability in terms of a hierarchy of levels—strategic, operational, tactical, and technological—that need to be considered in developing strategies for improving the interoperability of U.S. and NATO ally air and C3ISR capabilities.

In Chapter 2, we described—in such terms as numbers participating, frequency of participation, and contributions made—the shape of U.S. coalition operations in the recent past. To accomplish this, we reviewed aggregate-level data describing broad patterns in the United States' historical experience. This analysis showed how the aims of these coalition operations, and the scale of the U.S. contributions relative to those of its NATO allies, have varied greatly across operations. It also showed that the United States' NATO allies were typically able to provide fighter/ground attack aircraft but generally lacked precision-strike capabilities and rarely were able to contribute other combat support capabilities in sizable number.

In Chapter 3, we described in some detail how at each level of the hierarchy (strategic, operational, tactical, and technological) interoperability challenges frequently were encountered and how at each level "workarounds" often were found to mitigate the consequences of these challenges. These practical "workaround" solutions point to a number of arenas in which interoperability improvement efforts might be focused—new or modified organizations; personnel staffing (e.g., liaison officers); doctrine; training, exercises, and interoperability demonstrations; standards; and systems—which are examined in greater detail in the project's final report.[1]

Our analysis suggests that compatibility—in doctrine and tactics, national systems, and standards—will only result from national political commitments by NATO partners to achieve interoperability at the operational level, and over the

[1]Hura et al. (2000).

longer term, through coordinated development of operational concepts, research, development, and acquisition. The key dimensions for future interoperability will require sustained commitment to multipronged efforts in the following domains:

- developing the doctrinal underpinnings of out-of-area operations, posture, standup of commands, and other elements
- assuring both continued sustainment and an ability to redeploy elsewhere once forces and commands are deployed
- providing force-level planning and execution capabilities that enable integration of air forces at different levels and, equally important, with ground and maritime forces
- fostering unit-level and mission-level interoperability of multinational forces
- improving systems and communications interoperability
- underlying all of these, integrating information to support coalition aims.

Equally important is gaining agreement on performance goals, the thresholds that will serve as the short-, mid-, or long-term criteria for judging whether NATO has in fact achieved an "acceptable" or "minimal" level of interoperability in a specific area.

This agenda presents a daunting challenge to commanders, policymakers, the U.S. joint community, and individual services that will provide the enabling doctrine, organization, training, and equipment that will make interoperability a possibility in a future U.S. Joint Vision 2020 world and to the NATO allies.

The project's final report takes up the interoperability question where this report leaves off. It describes key trends that may affect the future interoperability of U.S. and NATO air and C3ISR capabilities and identifies several areas in which the gap between U.S. and NATO ally capabilities is widening. The report addresses the question of costs and benefits through case-study analyses that identify relatively low-cost, high-payoff actions that the Air Force can take to improve, in the short-, mid-, and long-term, U.S.-NATO interoperability in the areas of command and control, space, air and ground surveillance and control, secure data links (such as the multifunctional information distribution system [MIDS]), and fighters and weapons. It provides analyses of peacekeeping, force protection, and interdiction operations in a major theater war that illustrate the potential utility of enhanced interoperability. The final report concludes with a range of suggested actions that the Air Force can take to improve the interoperability of U.S. and NATO ally air and C3ISR capabilities.

Appendix

A. Operations, by Mission Focus

This appendix provides additional background information on the operations considered, including information used in constructing Table 2.1, which describes U.S. multilateral operations by mission focus, and Table 2.3, which describes NATO participation in U.S. multilateral and U.N. operations.

U.S. Non–U.N. Multilateral Operations

We identified 26 recent U.S. non–U.N. operations in which the United States' NATO allies also participated. Table A.1 identifies these operations, their mission focus, and dates.

U.N. Multilateral Operations in Which the United States Participated

We also examined the participation of the United States' NATO allies in 14 U.N. operations worldwide, including operations in Europe, the Middle East, Eurasia, and Africa (see Table A.2).

Other Operations with U.S. Participation

Table A.3 lists other operations with U.S. participation. They range from exercise operations (DETERMINED FALCON) to operations in support of larger operations (IMPRESSIVE LIFT).

Size of Recent Coalitions

Tables A.4 and A.5 provide information on the size of recent U.S. coalitions in terms of the number of NATO and non-NATO coalition members in each of the operations identified in Tables A.1 and A.2.

Table A.1

Twenty-Six Recent U.S. Non–U.N. Multilateral Operations

Operation Name	Location	Mission	Date
PROVIDE PROMISE	Fmr. Yugo.	HR	7/92–3/96
MARITIME MONITOR	Adriatic	MIO	6/16/92–11/22/92
SKY MONITOR	Bosnia	MON	10/16/92–4/12/93
DENY FLIGHT	Bosnia	NFZ	4/12/93–12/20/95
SHARP GUARD	Adriatic	MIO	6/15/93–10/2/96
QUICK LIFT	Croatia	LIFT	7/95
DELIBERATE FORCE	Bosnia	STR	8/29/95–9/21/95
DECISIVE ENDEAVOR (IFOR)	Bosnia	PE	12/20/95–12/20/96
DECISIVE ENHANCEMENT	Adriatic	MIO	12/95–6/19/96
DECISIVE EDGE	Bosnia	NFZ	12/95–12/96
DETERMINED GUARD	Adriatic	PKO	12/96–present
DELIBERATE GUARD (SFOR)	Bosnia	PKO	12/20/96–6/20/98
DELIBERATE FORGE (SFOR II)	Bosnia	PKO	6/20/98–present
DETERMINED FORCE	Kosovo	CR	planned 9/98
EAGLE EYE	Kosovo	MON	10/16/98–present
ALLIED FORCE	Kosovo	STR	3/25/99–6/20/99
DESERT STORM	SWA	MTW	1/17/91–2/28/91
PROVIDE COMFORT	Kurdistan	HR	4/5/91–12/31/96
SOUTHERN WATCH	Iraq	NFZ	8/92–present
VIGILANT WARRIOR	Kuwait	CR	10/94–11/94
NORTHERN WATCH	Iraq	NFZ	12/31/96–present
DESERT THUNDER	Iraq	CR	9/3/96–9/4/96
DESERT FOX	Iraq	STR	12/16/98–12/19/98
QUICK LIFT	Zaire	LIFT	9/4/91–10/91
RESTORE/CONTINUE HOPE	Somalia	HR	12/11/92–5/4/93
GUARDIAN ASSISTANCE	Zaire/Rwanda	HR	11/14/96–12/27/96

NOTES: HR = humanitarian relief; MIO = maritime intercept operation; MON = monitoring/observing; LIFT = airlift; PKO = peacekeeping; PE = peace enforcement; NFZ = no-fly zone; CR = crisis response; STR = strike; MTW = major theater war.

Table A.2

Fourteen Recent U.N. Operations with U.S. and Allied Participation

Operation Name	Location	Mission	Date
	Balkans		
UNPROFOR	Former Yugo.	PKO	2/92–3/95
UNCRO	Croatia	PKO	3/95–1/96
UNPREDEP	Macedonia	PKO	3/95–present
UNMIBH	Bosnia	PKO	12/95–present
UNTAES	Croatia	PKO	1/96–1/98
UNPSG	Croatia	PKO	1/98–present
	Other		
UNTSO	Jerusalem	MON	6/48–present
UNIKOM	Iraq/Kuwait	MON	4/91–present
UNAMIC	Cambodia	PKO	11/91–3/92
UNTAC	Cambodia	PKO	3/92–9/93
UNOMIG	Georgia	PKO	8/93–present
MINURSO	Sahara	PKO	4/91–present
ONUMOZ	Mozambique	PKO	12/92–12/94
UNOSOM II	Somalia	HR	3/93–3/95

NOTES: UNPROFOR = United Nations Protection Force; UNCRO = United Nations Confidence Restoration Operation; UNPREDEP = United Nations Preventive Deployment Force; UNMIBH = United Nations Mission in Bosnia and Herzegovina; UNTAES = United Nations Transitional Authority in Eastern Slovenia; UNPSG = United Nations Police Support Group; UNTSO = United Nations Truce Supervision Organization; UNIKOM = United Nations Iraq-Kuwait Observer Mission; UNAMIC = United Nations Advance Mission in Cambodia; UNTAC = United Nations Transitional Authority in Cambodia; UNOMIG = United Nations Observer Mission in Georgia; MINURSO = United Nations Mission for the Referendum in Western Sahara; ONUMOZ = United Nations Operation in Mozambique; UNOSOM II = United Nations Operation in Somalia II;
PKO = peacekeeping; MON = monitoring/observing; HR = humanitarian relief.

Table A.3

Ten Other Coalition Operations with U.S. Participation

Operation Name	Location	Mission	Date
PROVIDE RELIEF	Somalia	HR	8/21/92–2/28/93
IMPRESSIVE LIFT	Somalia	LIFT	9/13/92–9/29/92
MARITIME GUARD	Adriatic	MIO	11/22/92–6/15/93
DISCIPLINED GUARD	Bosnia	NFZ	1993
SUPPORT HOPE	Rwanda	HR	7/14/94–9/30/94
UNITED SHIELD	Somalia	LIFT	1/7/95–3/23/95
DETERMINED EFFORT	Bosnia	PE	Planned 7/95
DETERMINED FALCON	Kosovo	SHOW	6/98
DETERMINED FORGE	Adriatic	MIO	6/20/98–present
DETERMINED GUARANTOR	Kosovo	EXT	planned 11/98

NOTES: MIO = maritime intercept operation; PE = peace enforcement; SHOW = show of force; EXT = extraction; NFZ = no-fly zone; HR = Humanitarian relief; LIFT = airlift.

Table A.4

Number of Coalition Members in Recent Non–U.N. Operations

Operation Name	NATO	Others	Total
PROVIDE PROMISE	4	NA	NA
MARITIME MONITOR	5	0	5
SKY MONITOR	11	0	11
DENY FLIGHT	8	NA	NA
SHARP GUARD	10	0	10
QUICK LIFT	3	0	3
DELIBERATE FORCE	8	0	8
DECISIVE ENDEAVOR (IFOR)	15	18	33
DECISIVE ENHANCEMENT	10	NA	NA
DECISIVE EDGE	8	NA	NA
DETERMINED GUARD	4	NA	NA
DELIBERATE GUARD (SFOR)	11	20	31
DELIBERATE FORGE (SFOR II)	11	20	31
DETERMINED FORCE	12	0	12
EAGLE EYE	5	0	5
ALLIED FORCE	19	0	19
DESERT STORM	14	16	30
PROVIDE COMFORT	4	0	4
SOUTHERN WATCH	3	0	3
VIGILANT WARRIOR	3	2	5
NORTHERN WATCH	3	0	3
DESERT THUNDER	2	0	2
DESERT FOX	2	0	2
QUICK LIFT	3	0	3
RESTORE/CONTINUE HOPE	10	NA	NA
GUARDIAN ASSISTANCE	2	NA	NA

NOTE: NA = Complete numbers not available.

Table A.5

Number of Coalition Members in Recent U.N. Operations

Operation	NATO	Others	Total
	Balkans		
UNPROFOR	11	26	37
UNCRO	12	26	38
UNPREDEP	7	20	27
UNMIBH	14	29	43
UNTAES	5	25	30
UNPSG	3	17	20
	Other		
UNTSO	8	12	20
UNIKOM	9	24	33
UNAMIC	7	16	23
UNTAC	9	38	47
UNOMIG	7	15	22
MINURSO	7	21	28
ONUMOZ	6	28	34
UNOSOM II	9	15	24

NOTES: UNPROFOR = United Nations Protection Force; UNCRO = United Nations Confidence Restoration Operation; UNPREDEP = United Nations Preventive Deployment Force; UNMIBH = United Nations Mission in Bosnia and Herzegovina; UNTAES = United Nations Transitional Authority in Eastern Slovenia; UNPSG = United Nations Police Support Group; UNTSO = United Nations Truce Supervision Organization; UNIKOM = United Nations Iraq-Kuwait Observer Mission; UNAMIC = United Nations Advance Mission in Cambodia; UNTAC = United Nations Transitional Authority in Cambodia; UNOMIG = United Nations Observer Mission in Georgia; MINURSO = United Nations Mission for the Referendum in Western Sahara; ONUMOZ = United Nations Operation in Mozambique; UNOSOM II = United Nations Operation in Somalia II.

Royal Air Force (RAF) Deployment to Operations

Tables A.6 and A.7 summarize British operational deployments to various operations. These missions were in support of other ongoing operations. Table A.6 is a current snapshot of RAF deployments to various operations worldwide, in early 1999. Of these operations,

- DELIBERATE FORGE (SFOR II) is in support of the Kosovo resolutions.
- RADOME is the U.K. contribution to the NATO Air Verification Plan for Kosovo.
- PALATINE is Bosnia-based support for SFOR in Bosnia.

- WARDEN is monitoring the no-fly zone and Kurdish regions of Northern Iraq.
- JURAL is monitoring the no-fly zone of Southern Iraq.
- BOLTON is in support of Kuwait.

Table A.7 provides a snapshot of RAF deployments in early 2000.

Table A.6

RAF Operational Deployments, Early 1999

Operation Name	Location	Focus	Aircraft
DELIBERATE FORGE (SFOR II)	Italy	Kosovo	4 Harrier GR-7s
RADOME	Italy	Kosovo	1 Canberra PR-9
SFOR	Italy	Bosnia (SFOR)	E-3 AEWs
PALATINE	Bosnia	Bosnia (SFOR)	3 Chinook HC-2 helos
WARDEN	Incirlik	N. Iraq	Jaguar GR-1s, 1 VC-10 tanker
JURAL	Bahrain	S. Iraq	6 Tornado GR-1s, 1 VC-10K tanker
BOLTON	Kuwait, Bahrain	Kuwait	12 Tornado GR-1s, 2 VC-10K tankers

SOURCE: Royal Air Force, at http://www.raf.mod.uk, April 1999.
NOTE: All of these operations were conducted in conjunction with the United States.

Table A.7

RAF Operational Deployments, Early 2000

Operation	Location	Focus	Aircraft
AGRICOLA[a]	Macedonia/ Kosovo	Kosovo	8 Chinooks, 6 Puma paratroopers
BOLTON[a]	Kuwait, Bahrain	Gulf	Tornado GR-1, 6 Tornado F3s, VC-10 tankers
WARDEN[a]	Incirlik	N. Iraq	4 Jaguar GR-3s, 1 VC-10 tanker
ENGADINE[a]	Gioia del Colle, Italy	Balkans	Harrier GR-7 Tristar
BARWOOD	Mozambique	Mozambique	Puma HC-1

SOURCE: Royal Air Force, at http://www.raf.mod.uk, as of March 24, 2000.
[a]Operations conducted in conjunction with the United States.

B. NATO Contributions to Recent U.S. Coalition Operations

Overview

Table B.1 presents the number of aircraft contributed by the United States and its NATO allies to a number of recent coalition operations.[1]

Southwest Asia

Operation Desert Storm

Air Power Contributions. To begin with the most recent major theater war, consider the respective air power contributions of the United States and its coalition partners to Operation DESERT STORM (see Table B.2).[2]

As shown in the table, at the end of the Gulf War U.S. allies had provided a little over one-quarter of the aircraft, with the largest contribution being in fighter/ground attack aircraft (33.4 percent). The remaining 74.1 percent of the aircraft—and the largest contributions across all categories of aircraft—were contributed by the United States.

Table B.3 breaks out the ground and naval contributions of the United States' NATO partners in the Gulf War. The data in the table suggest that air interoperability requirements in the Gulf also demanded deconfliction and other activities with non-air forces, particularly in the cases of missile batteries and naval warships.

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[1]The precise number of coalition aircraft contributed to ODS remain sclassified. Sources used for ODS include Department of Defense (1992), Keaney and Cohen, *Gulf War Air Power Survey (GWAPS)* (1993), and Winnefeld et al. (1994).

[2]For our purposes, FGA (fighter/ground attack) aircraft include fighters in air superiority and air-to-ground roles, bombers and other air-to-ground aircraft excluding helicopters, and multirole aircraft that can fly in these roles. The open sources we relied upon for this survey did not always provide specific, detailed information on how aircraft were configured or in what roles (air superiority, ground attack, reconnaissance) they flew. Accordingly, the data presented in this appendix may somewhat overestimate contributions of FGA aircraft and underestimate the extent to which these aircraft actually might have flown in other roles (e.g., reconnaissance).

Table B.1

Number of Aircraft Contributed to Recent Coalition Operations, by Country and Operation

Country	ODS	DENY FLIGHT	DELIB-ERATE FORCE	IFOR	SFOR	SFOR II	DETER-MINED FALCON	ALLIED FORCE
U.S.	2,088	100	127	124	34	24	27	731
Belgium				3	3	3	2	14
Canada	24							18
Denmark							2	8
France	(a)	34	50	20	27	24	6	84
Germany	21	14	14	18	16	16	8	33
Greece				2	1	1	2	
Iceland								
Italy	8+	20	24	16	15	15	6	58
Luxembourg								
Netherlands	1 sqn[b]	15	18	11	10	12	5	22
Norway		2		3	1		2	6
Portugal							2	
Spain		11	11	7	11	11	9	7
Turkey		8	18	8	8	18	4	21
U.K.	(a) +3wngs	28	28	12	18	11	5	39

NOTE: The aircraft listed for Canada, Germany, and the Netherlands under ODS were stationed in Turkey. The aircraft number for France under Operation DENY FLIGHT represents its contribution during 1995 (as such, a one-aircraft difference in comparison to the figure in Table B.10). Hungary provided four aircraft to OAF.

[a]Although the comprehensive inventory of air contributions is classified, the United Kingdom provided the second-largest contingent of aircraft to ODS and the French provided the third-largest air contingent.

[b]sqn = squadron.

Table B.2

Aircraft in DESERT STORM on February 24, 1991

Type	FGA	SOF	RECCE	EW	C3/SU	TRAN	TANK	Total
U.S.	1,215	25	69	144	134	156	345	2,088
Allies	608	0	20	0	8	61	34	731
Total	1,823	25	89	144	142	217	379	2,819
%Ally	33.4	0.0	22.5	0.0	5.6	28.1	9.0	25.9

SOURCE: Adapted from Winnefeld, Niblack, and Johnson (1994), Table A.2, p. 290.
NOTE: C3/SU = command, control, and communications, and surveillance.

Table B.3

Illustrative Allied Ground and Naval Contingents in DESERT STORM

Country	Ground	Naval
Belgium		2 minesweepers
Canada	1,700 troops	2 destroyers
Denmark		1 corvette
Greece		1 frigate
Netherlands		2 frigates
Norway		1 cutter
		1 supply ship
Portugal		1 supply ship
Spain		2 corvettes
		1 destroyer
Turkey		2 frigates
U.K.	24 missiles	
	4 armored vehicles	
	18 Scorpion tanks	
	117 Challenger tanks	
	75 Infantry Fighting Vehicles (IFVs)	
	18 recon vehicles	
	155 SP artillery	

SOURCE: Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey, Volume V*: *A Statistical Compendium and Chronology,* Washington, D.C., 1993.

Post-ODS Southwest Asia

Although the data are somewhat sketchy, it appears that contributions to the following post-ODS operations were as next described.

Operation PROVIDE COMFORT. Operations PROVIDE COMFORT I (April 6, 1991, to July 24, 1991) and PROVIDE COMFORT II (July 24, 1991, to December 31, 1996) combined post-ODS Kurdish relief operations with a security effort in Turkey/northern Iraq and were replaced by Operation NORTHERN WATCH on January 1, 1997. These operations involved a mix of airlifters (for humanitarian relief), fixed-wing combat aircraft (for no-fly-zone enforcement), and other aircraft. According to the International Institute for Strategic Studies (IISS), in the first two years of PROVIDE COMFORT, the U.S. contribution was 57 aircraft; by

1996, the U.S. contribution was down to 39 aircraft.[3] Typical contributions from France in the three years were six to nine aircraft.[4] The United Kingdom typically contributed eight to ten aircraft at this time.[5] Additionally, the United States flew OLIVE COMFORT U-2 reconnaissance operations out of Akrotiri against northern Iraq.

Based upon these numbers, the U.S. contribution to PROVIDE COMFORT, therefore, seems to have ranged between 67 percent (39 out of 58 aircraft) and 75 percent (57 out of 76 aircraft).

Operation NORTHERN WATCH. Operation NORTHERN WATCH (ONW) (January 1, 1997, to present) was the follow-on to PROVIDE COMFORT II, with the mission of enforcing the no-fly zone (NFZ) over northern Iraq. The French ended their participation in the operation when PROVIDE COMFORT was terminated, leaving the United States contributing perhaps one wing of aircraft, including F-16s, F-15Cs, KC-135s, E-3B/Cs, C-12s, HC-130s, and HH-60s, and the United Kingdom contributing six Tornado GR-1/1As and one VC-10 tanker.[6] If we make the simplifying assumption that the wing of U.S. aircraft assigned to NORTHERN WATCH comprises about 72 aircraft, that would suggest that the United States is contributing about 91 percent (72 out of 79 aircraft) to NORTHERN WATCH.

Illustrative contributions to Operation NORTHERN WATCH are described in Table B.4.[7]

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[3]IISS lists the following types of aircraft as being involved in PROVIDE COMFORT: F-15Es, F-15s, F-111Fs, EF-111s, and F-4Gs Haulman (1998b) gives a more complete listing: A-10, C-5, C-12, C-21, C-130, C-141, E-3, EC-130, EF-111, F-4, F-15, F-16, F-111, HC-130, KC-10, KC-135, MH-53, RC-135, and RF-4. IISS, *The Military Balance*, various years; Daniel L. Haulman, "Operation Provide Comfort," in Warnock, ed. (1998b), pp. 173–183.

[4]In 1993–1994, this included four Mirage F1-CR reconnaissance aircraft, four Jaguars, and a C-135 tanker; in 1995, the French contributed five Jaguars and one KC-135. IISS, *The Military Balance*, various years.

[5]In 1993–1994, this included eight GR-1 Tornadoes and two VC-10 tankers, and in 1995, six Tornadoes and two VC-10s. IISS, *The Military Balance*, various years.

[6]According to IISS, USAF aircraft are on detachment only, and the total numbers vary accordingly.

[7]Precise numbers of aircraft were not available and, in any case, tend to vary over time. Another snapshot from Incirlik AB on January 12, 1998, describes the following forces as participating in ONW: United States—E-3A, F-15C, F-15E, F-16CJ, KC-135, HC-130, HH-60, EA-6B, and C-12; United Kingdom—Jaguar and VC-10 tanker; Turkey—KC-135 Stratotanker, F-16C, and F-4E (www.incirlik.af.mil/onw/fact_sheet.htm.). The U.K. contributions of Jaguars and a VC-10 are consistent with contributions to U.K. Operation WARDEN. See "Current RAF Operational Deployments," at http://www.raf.mod.uk.

Table B.4

Aircraft Contributions to Operation NORTHERN WATCH

Mission	United States	United Kingdom	Turkey
FGA	F-16C/CJ, F-15C, F-15E	Jaguar GR-1s	F-4E, F-16C
AEW	E-3		
EW	EA-6B		
SAR	HC/MC-130		
Tanker	KC-135	VC-10	
Helicopter	UH-60A, HH-60		

SOURCE: Operation NORTHERN WATCH Combined Task Force Public Affairs, "Operation NORTHERN WATCH," fact sheet, current as of November 25, 1998; http://www.incirlik.af.milonw/fact_sheet.htm.

Operation SOUTHERN WATCH. Of the total 286 aircraft in use in Operation SOUTHERN WATCH in February 1999, the United States was contributing 257 aircraft, of which 155 were land based, while the United Kingdom provided 20 and France, nine.[8]

These numbers suggest that the United States is contributing about 90 percent of the aircraft used in SOUTHERN WATCH, and they are somewhat higher than what appear to be the typical U.K. and French contributions: United Kingdom (six Tornado GR-1As) and France (six Mirage 2000Cs and three C-135FR tankers).[9] Importantly, on occasion the United Kingdom has operated as mission commander, with operational control of U.S. and French forces. SOUTHERN WATCH is part of the Peninsular Shield Force of approximately 7,000 personnel, which includes one infantry brigade element from Gulf Cooperation Council (GCC) states, and 1,400 U.S. Army personnel, including one Patriot unit, a signals unit, plus others on short-term duty.[10] Table B.5 describes representative USAF forces assigned to Southwest Asia, and Table B.6 describes recent rotations of USAF expeditionary forces to JTF-SWA.[11]

[8]U.S. numbers vary because of rotational detachments, but include F-15, F-16, F-117, C-130, KC-135, U-2, and E-3 aircraft. IISS, *The Military Balance, 1998/99.* Furthermore, the number of aircraft appears to reflect increased levels for crisis response operations, not the routine aircraft levels.

[9]According to the Ministry of Defence, the United Kingdom currently has six Tornado GR-1s and a VC-10K tanker in support of Operation JURAL, the name given to U.K. participation in Operation SOUTHERN WATCH. See http://www.raf.mod.uk.

[10]IISS, *The Military Balance, 1998/99*.

[11]We note that U.S. naval aviation also plays a role in Southwest Asia.

Table B.5

U.S.–Assigned Air Forces to Southwest Asia

Element	Description	Number
AOC	Air Operations Center (C2)	
F-15C	FGA	18
F-16CJ	FGA	8
F-16CG	FGA	10
A-10A	Attack	13
E-3B	C2	3
RC-135	RECCE	2
U-2S	RECCE	2
HC-130	TANK	2
HH-60A	HELO	2
HH-60G	HELO	3
KC-10	TANK	4
KC-135	TANK	8
C-21	TRAN	1

SOURCE: CENTCOM Office of Public Affairs, http://www.htfswa.centcom.smil.mil/directorates/pa/centaf-facts.html.

NOTE: Provider reported in parentheses ().

Finally, a number of crisis responses or strike operations have taken place since Operation DESERT STORM, including VIGILANT WARRIOR, DESERT THUNDER, and DESERT FOX.

Operation VIGILANT WARRIOR. In Operation VIGILANT WARRIOR in October 1994, the United States deployed over 28,000 personnel and over 200 additional aircraft,[12] with an estimated total of 275 fixed-wing aircraft. Initial allied contributions to the force were the French destroyer *Georges Leygues* and the British frigate HMS *Cornwall* and destroyer HMS *Cardiff*. It is not clear what, if any, coalition aircraft participated.

Operation DESERT THUNDER. As of May 1998, open source reporting described planning for Operation DESERT THUNDER as involving between 320 and 405 U.S. aircraft. In addition to the U.S. aircraft, the plan envisioned the contribution of eight Tornadoes, presumably from the United Kingdom.[13] By October 15, 1998, it appears that there were 80 land-based and 85 carrier-based aircraft, for a total of 165 aircraft available for DESERT THUNDER

[12]USCENTCOM, Chapter 7, "1994 Operations."

[13]See http://www.fas.org/man/dod-101/ops/desert_thunder_orbat_980501.htm.

Table B.6

Air Expeditionary Force Deployments to Operation SOUTHERN WATCH

Unit	Dates	B-1B	B-52	F-15C	F-15E	F-16	F-117	KC-10	KC-135
366th AEW	9/97–10/97	2		6	6	10			2
347th AEW	11/97–3/98	2		12		18			4
2nd AEW	11/97–6/98		14					4	
8th EFS	11/97–3/98						12		
305th AEG	2/98–6/98							5	
366th AEW	3/98–6/98	3	14	12	12	12		7	4
9th EFS	3/98–6/98						12		

SOURCE: http://www.jtfswa.centcom.smil.mil/directorates/pa/centaf-facts.html.

NOTES: Numbers vary on a daily basis. F-16s include F-16, F-16CJ, and F-16CG. AEW = air expeditionary wing; EFS = expeditionary fighter squadron; AEG = air expeditionary group.

operations. U.K. aircraft included 12 GR-1s and two VC-10s,[14] which suggests that the United States planned to contribute approximately 92 percent of the aircraft to the operation.

Although specific numbers are unavailable for the United States, Table B.7 breaks out aircraft contributions by broad mission.

Operation DESERT FOX. By December 23, 1998, when the evolutionary DESERT THUNDER planning culminated in Operation DESERT FOX, an estimated 330 combat aircraft and 81 support aircraft were involved. While the United States provided the bulk of the air forces, the U.K. contribution reportedly included both the 12 GR-1s in Operation BOLTON, and one or more VC-10 tankers, which were used to refuel both U.S. and British aircraft; again, more precise U.S. numbers for aircraft by mission are unavailable. These numbers suggest, however, that the United States may have provided as many as 397 aircraft (330 combat aircraft plus 81 support aircraft, less the British contribution of 14 aircraft), or nearly 97 percent of the aircraft. Table B.8 categorizes the U.S. and British contributions by mission (detailed numbers by mission are unavailable).[15]

Table B.7

Contributions to Operation DESERT THUNDER

Country	FGA	AEW	EW	RECCE	TRAN	TANK	HELO
U.S.	X	X	X	X	X	X	X
U.K.	12					2	

NOTE: The United Kingdom reportedly also was to provide VC-10s for aerial refueling.

Table B.8

Contributions to Operation DESERT FOX

Country	FGA	AEW	EW	RECCE	TRANS	HELO
U.S.	X	X	X	X	X	X
U.K.	X					

[14]These aircraft are part of United Kingdom Operation BOLTON, which has been in Kuwait since March 1998.

[15]Cordesman (1999, p. 19) indicates a total of 213-plus aircraft were used in DESERT FOX, with the United States supplying 201 or more of them. He also indicates that the United States used 425-plus cruise missiles.

The Balkans

Bosnia

In Bosnia, a succession of humanitarian, peacekeeping, peace enforcement, air, and maritime operations was undertaken. Table B.9 summarizes the contributions of the United States and its coalition partners to recent coalition operations in Bosnia.

The table suggests that most of the NATO allies, including the United States, participated in the land and air components of the various operations in Bosnia, but only selected countries participated in the maritime components.

UNPROFOR. In the United Nations Preventive Force (UNPROFOR) (March 1992 to December 15, 1995), the U.N. operation in Croatia and Bosnia-Herzegovina, NATO nations contributed primarily battalion-level ground forces, as follows: Belgium, infantry battalion; Canada, infantry and engineer battalion; Denmark, infantry battalion; France, infantry and logistics battalion; Luxembourg, infantry platoon; the Netherlands, signals; Norway, movement control; and Portugal, observers.[16] On June 29, 1992, UNPROFOR was enhanced with additional troops to ensure the security and functioning of Sarajevo airport and the delivery of humanitarian assistance. At that time, a Canadian battalion deployed to Sarajevo and was relieved by a small headquarters and three battalions of infantry (including one battalion from France).[17] UNPROFOR's strength in 1995 was approximately 19,000 troops.[18]

Operation PROVIDE PROMISE. In Operation PROVIDE PROMISE (July 3, 1992, to January 9, 1996), U.S., Canadian, French, German, and British airlifters provided humanitarian relief to the beleaguered city of Sarajevo.[19] Although 15 to 20 countries are said to have contributed aircraft,[20] according to the Air Force, contributions to PROVIDE PROMISE included more than 100 U.S. C-130s,

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[16]See also the contributions to PROVIDE PROMISE, DENY FLIGHT, and SHARP GUARD.

[17]Egypt and Ukraine also contributed a battalion each. IISS, *The Military Balance, 1994/95*, p. 257.

[18]IISS, *The Military Balance, 1995/96*, p. 304.

[19]Haulman (1998c, pp. 270–273) reports that the United States was one of "at least 15 countries"; IISS reports that a total of 20 countries provided aircraft for the operation.

[20]IISS, *The Military Balance, 1994/95*, p. 275.

Table B.9

Participation in Land, Air, and Maritime Components of Selected Bosnia Operations

	Land				Air				Maritime			
Country	U.N.	IFOR	SFOR	SFOR II	U.N.[a]	IFOR	SFOR	SFOR II	U.N.[b]	IFOR	SFOR	SFOR II
U.S.	X	X	X	X	xX	X	X	X	Xx	X	X	X
Belgium	X	X	X	X		X	X	X				
Canada	X	X	X	X				X	X			
Denmark	X	X	X	X					X			
France	X	X	X	X	xX	X	X	X	Xx	X		
Germany		X	X	X		X	X	X	Xx	X		
Greece		X	X	X	x	X		X		X	X	X
Iceland												
Italy		X	X	X		X	X	X	Xx	X	X	X
Luxembourg		X	X	X								
Netherlands	X	X	X	X	X	X	X	X	Xx	X		
Norway	X	X	X	X		X						
Poland	X	X	X	X					x			
Spain	X	X	X	X	X	X	X	X	Xx	X		
Turkey	X	X	X	X	X	X	X	X	X	X	X	X
U.K.	X	X	X	X	X	X	X	X	Xx	X		

SOURCES: United Nations; NATO.

NOTES: U.N. is UNPROFOR. Classified data on numbers are available but were not used so that the present report would remain unclassified.

[a]Air operations in parallel with UNPROFOR were PROVIDE PROMISE (participation indicated by "x") and DENY FLIGHT (participation indicated by "X").

[b]Maritime operation in parallel with UNPROFOR was SHARP GUARD. Naval forces indicated by "X"; maritime patrol aircraft indicated by "x".

C-141s, C-5s, and C-9s, as well as an unknown number of German C-160s, and Canadian, U.K., and French C-130s.[21]

Operation SKY MONITOR. Operation SKY MONITOR (October 16, 1992, to April 12, 1993) was the NATO response to U.N. Security Council Resolution 781 establishing a ban on military flights in the airspace of Bosnia-Herzegovina, in support of the United Nations Protection Force (UNPROFOR). In Operation SKY MONITOR, NATO Airborne Early Warning Force (NAEWF) aircraft monitored airspace in the former Yugoslavia but did not have the authority to engage or otherwise enforce airspace restrictions on Serb air forces. NAEWF E-3A aircraft were flown by multinational crews provided by 11 NATO nations: Belgium, Canada, Denmark, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Turkey, and the United States,[22] and NAEWF E-3D from the United Kingdom's No. 8 Squadron also participated. SKY MONITOR ended on April 12, 1993, when Operation DENY FLIGHT began.

Operation DENY FLIGHT. On March 31, 1993, the U.N. Security Council passed United Nations Security Council Resolution (UNSCR) 816, which extended the ban on air operations to cover all flights not authorized by UNPROFOR, and authorized member states to take all necessary measures, in the event of further violations, to ensure compliance with the ban. Operation DENY FLIGHT was the name given to enforcement of the no-fly zone in Bosnia from April 12, 1993, to December 20, 1995. NATO allies from 12 NATO countries—Belgium, Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Turkey, the United Kingdom, and the United States—contributed almost 4,500 personnel. According to Air Forces Southern Europe's (AFSOUTH's) final fact sheet for DENY FLIGHT, the United States' NATO partners contributed 58 percent of the aircraft for the operation (see Table B.10).

Operation DETERMINED EFFORT. Operation DETERMINED EFFORT (July 1995) was a plan for a NATO operation for withdrawing U.N. forces should such a contingency have arisen; the plan was never executed. The underlying planning served as the stepping-stone for Operation JOINT ENDEAVOR. Twenty-two active army units were identified for the operation, and 49 Army National Guard and Army Reserve units were notified to begin training for possible deployment to the European theater.

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[21] U.S. numbers are from Haulman (1998c, pp. 270–273). Vick et al. (1997, p. 149) report that C-17s also were used.

[22] AFSOUTH fact sheet.

Table B.10

U.S. and NATO Aircraft in Operation DENY FLIGHT

Country	FGA	CAS	GUN	AEW	EW	RECCE	TRAN	TANK	SUPP	Total	Percent
U.S.	18	44	2		21			15		100	41.8
France	16	9		1		5	1	1		33	13.8
Germany	14									14	5.9
Italy	6	6				2		1	5	20	8.4
Neth.	9					3	2		1	15	6.3
Norway							2			2	0.84
Spain	8							2	1	11	4.6
Turkey	8									8	3.3
U.K.	6	16		2		2		2		28	11.7
NAEWF				8						8	3.3
Total	85	75	2	11	21	12	5	21	7	239	

SOURCE: http://www.afsouth.nato.int/factsheets/denyflightfactsheet.htm.
NOTE: This is a representative snapshot.

Operation DELIBERATE FORCE. In Operation DELIBERATE FORCE (see Table B.11), the strike operations that pushed the Serbs toward negotiations and the Dayton Accords, the NATO allies contributed 167 aircraft (56.8 percent), while the United States contributed nearly 130 fixed-wing aircraft (43.2 percent).[23]

IFOR, SFOR, and SFOR II. Following the execution of DELIBERATE FORCE and the signing of the Dayton Accords in the fall of 1995, NATO undertook a series of peacekeeping operations: the Implementation Force (IFOR) and the follow-on Stabilization Force (SFOR and SFOR II). These were large and complex operations that involved land, air, and maritime components.

IFOR Land Component. Approximately 60,000 troops were deployed to IFOR, 50,000 of which were from NATO countries (see Table B.12).

These contributions included those from the United States (one armored division plus support troops), the United Kingdom (one corps headquarters [multinational]; a division headquarters with two reconnaissance squadrons, one engineer and one aviation regiment; one armored brigade; one engineer regiment plus logistics and support troops), and France (two mechanized infantry brigades); these countries made the largest contributions. Other NATO nations contributed as follows: Belgium, logistics and engineering troops; Canada, one brigade headquarters, one infantry company group; Denmark, one infantry battalion group; Germany, one medical brigade, one transport, one engineering, and one logistics battalion; Greece, Italy, one mechanized infantry brigade group; Luxembourg, the Netherlands, one mechanized infantry battalion group; Norway, one logistics battalion and a field hospital; Portugal, one airborne battalion; Spain, one infantry battalion group; and Turkey, one infantry battalion group.[24] The operation was controlled by a main IFOR headquarters in Sarajevo, with a collocated ARRC HQ, and three multinational divisions (MNDs), with divisional headquarters headed by the United States, the United Kingdom, and France.[25]

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[23]Additional non-NATO forces supporting the operation also are listed; the numbers of these aircraft are not known.

[24]The reader will note that many of the smaller contributors brought task force–type units without extensive logistics capabilities. Iceland, which has no armed forces, contributed medical personnel. Eighteen non-NATO nations also contributed to IFOR.

[25]The U.S.–led MND in IFOR included brigades from Turkey and Russia, and a third brigade made up of troops from Finland, Sweden, Norway, and Poland (the NORDPOL brigade). Zanini and Taw (1998), p. 16.

Table B.11

U.S. and NATO Aircraft in Operation DELIBERATE FORCE

Country	FGA	GUN	AEW	EW	RECCE	SAR	TRAN	TANK	HELO	Total	Percent
U.S.	60	4		23	12	4		17	7	127	43.2
France	35		1		5			1	8	50	17.0
Germany	6			8						14	4.8
Italy	14		4				5	1		24	8.2
Netherlands	18									18	6.1
Spain	8						1	2		11	3.7
Turkey	18									18	6.1
U.K.	24		2				2			28	9.5
NATO			4							4	1.4
Total	183	4	11	31	17	4	8	21	15	294	

SOURCE: www.afsouth.nato.int/factsheets/deliberateforcefactsheet.htm.
NOTE: U.S. HELOs are MH-53Js, used in a SAR role.

Table B.12

Estimated Troop Contributions to IFOR, SFOR, and SFOR II

Country	IFOR	SFOR	SFOR II
U.S.	18,400	8,427	7,400
Belgium	420	123	550
Canada	1,024	982	960
Denmark	807	658	600
France	10,500	3,594	3,300
Germany	4,000	2,516	2,600
Greece	1,000	217	250
Iceland	—	—	—
Italy	2,200	1,812	
Luxembourg	NA	22	25
Netherlands	2,000	988	1,220
Norway	750	579	700
Portugal	900	319	350
Spain	1,400	1,554	1,600
Turkey	1,300	1,488	1,300
U.K.	10,500	3,610	

SOURCE: IISS, *The Military Balance,* various years.
NOTE: NA = information not available.

SFOR Land Component. As a result of IFOR's success, SFOR (December 20, 1996, to June 1998) was of a smaller size—approximately 30,000 troops. NATO SFOR contributors included the United States, the United Kingdom, and France, who continued to make the largest national contributions—the United States, one infantry brigade plus support troops; the United Kingdom, one augmented brigade headquarters (multinational); and France, two mechanized infantry brigades. Other NATO contributors included Belgium, Canada (infantry company group, armed reconnaissance, and engineering squadron), Denmark (one infantry battalion group), Germany, Greece, Italy (one mechanized infantry brigade group), Luxembourg, the Netherlands (one mechanized infantry battalion group), Norway (logistics battalion), Portugal (infantry battalion), Spain (infantry battalion group and 12 observers), and Turkey (infantry battalion group).[26] SFOR was organized under a main SFOR headquarters in Sarajevo, with three divisional headquarters as follows: U.S. Divisional Headquarters, Multinational Division (North), including the Nordic Brigade HQ and the Russian Brigade HQ; French Divisional Headquarters, Multinational Division (Southeast), including the Spanish Brigade HQ, the French/German Brigade HQ, and the Italian Brigade HQ; and United

[26]In addition, 20 non-NATO nations contributed to SFOR. IISS, *The Military Balance, 1997/98*.

Kingdom Divisional Headquarters, Multinational Division (Southwest), which included the Turkish Brigade HQ.

SFOR II Land Component. Contributions to SFOR II came from the United States (one infantry brigade, plus support troops), the United Kingdom (one augmented brigade headquarters [multinational]), and France (two mechanized infantry brigades). Other NATO contributors included Belgium, Canada (one infantry battalion, one armed reconnaissance, one engineer squadron), Denmark (one infantry battalion group), Germany, Greece, Italy (one mechanized infantry brigade group), Luxembourg, the Netherlands (one mechanized infantry battalion group), Norway (one infantry battalion), Portugal (one infantry battalion), Spain (one infantry battalion group, 12 observers), and Turkey (one infantry battalion group).[27] The organization established during SFOR was retained, with Multinational Division Headquarters at MND (N), MND (SE), and MND (SW).

Because of the higher risk of a deteriorating security situation and the attendant risk of combat, the total national contributions to operations in Bosnia-Herzegovina peaked during IFOR, at a total of about 60,000 troops; that total shrank to about 30,000 in SFOR and was at about 33,000 with SFOR II, with 27,055 NATO forces—over 80 percent of the total—contributing to the latter operation.[28]

Only the United States, the United Kingdom, France, and Italy contributed brigade-level forces, while the others tended to contribute task force–type units at the battalion level, which generally lacked organic logistics and other support capabilities. Nevertheless, these forces were integrated into higher-level headquarters that improved somewhat command and control of the operation.[29]

IFOR, SFOR, and SFOR II Air Components. An air component operated in parallel with the land components of IFOR and SFOR. Over time, and as the situation in Bosnia stabilized, the number of NATO aircraft devoted to IFOR and the first and second phases of SFOR declined, from over 228 in 1995–1996 to 139 in 1998. Over the same period, the percentage of aircraft provided by the United States' NATO allies increased from about 46 percent in 1995–1996 to about 83 percent in 1998 (see Tables B.13 and B.14).

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[27]IISS, *The Military Balance, 1998/99*.

[28]IISS, *The Military Balance, 1998/99*, p. 291.

[29]For example, the various battalion-size Nordic forces were integrated into a Nordic brigade, which is presumed to have had some organic support capabilities; similarly, the various brigades were integrated into three multinational divisional (MND) headquarters, all under the control of the main SFOR headquarters in Sarajevo.

Maritime Operations in the Adriatic. In addition to and parallel with the operations just described, a number of air-supported maritime operations have taken place in the Adriatic.

- **Operation MARITIME MONITOR.** In MARITIME MONITOR (July 16, 1992, to November 22, 1992), Allied Command Europe, in coordination with the Western European Union (WEU), began enforcing the U.N. embargo against the former Yugoslavia in the Adriatic Sea, in support of UNSCRs 713 and 757. NATO units were ordered to conduct "surveillance, identification, and reporting of maritime traffic in areas to be defined in international waters of the Adriatic Sea." The NATO naval force (Standing Naval Force, Mediterranean, or STANAVFORMED) was supported by maritime patrol aircraft (some of which were operating on behalf of the WEU in the parallel, linked operation called SHARP VIGILANCE).[30] The United States and its NATO allies contributed maritime patrol airborne early warning aircraft, as follows: the United States, P-3C; the United Kingdom, Nimrod and E-3D NATO AEW Force AWACS; Portugal, P-3P; Greece, Albatross maritime patrol aircraft; and France, E-3F NATO AWACS.
- **Operation MARITIME GUARD.** MARITIME GUARD (November 22, 1992, to June 15, 1993) was the NATO STANAVFORMED operation conducted in parallel with WEU Operation SHARP FENCE. MARITIME GUARD was a naval embargo operation enforcing UNSCRs 713, 757, and 787. The United States, France, the United Kingdom, Portugal, and Greece all contributed maritime patrol aircraft.[31] All ships bound to or coming from the territorial waters of Yugoslavia (Serbia and Montenegro) were halted to inspect and verify their cargoes and destinations, as well as all ships proceeding to all other parts of the former Yugoslavia. According to AFSOUTH, MARITIME GUARD involved a number of complex interactions between the NATO

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[30]STANAVFORMED forces patrolled an area of international waters off the Montenegro coast in MARITIME MONITOR, while WEU forces patrolled the Otranto Straits in international waters within SHARP VIGILANCE. AFSOUTH, "NATO Operation MARITIME MONITOR," AFSOUTH fact sheet, undated.

[31]AFSOUTH fact sheet.

Table B.13

U.S. and NATO Aircraft in Operation DECISIVE ENDEAVOR (IFOR)

Country	FGA	GUN	AEW	EW	RECCE	C2	SAR	TRAN	TANK	SUPP	HELO	Total	Percent
U.S.	68	8		19	5	4	2		8	4	6	124	54.4
Belgium	3											3	1.3
France	9		1		5			1	1		3	20	8.8
Germany					6			12				18	7.9
Greece								2				2	0.9
Italy	4				4			5	3			16	7.0
Netherlands	4				3			3	1			11	4.8
Norway								3				3	1.3
Spain	6							1				7	3.1
Turkey	8											8	3.5
U.K.	6		2		2			1	1			12	5.3
NATO			4									4	1.8
Total	108	8	7	19	25	4	2	28	14	4	9	228	

SOURCE: AFSOUTH, "Peace Implementation Force—IFOR," fact sheet, available at http://www.afsouth.nato.int/factsheets/iforfactsheet.htm.
NOTE: U.S. HELOs are MH-53Js used in a SAR role.

Table B.14

U.S. and NATO Aircraft in DELIBERATE GUARD (SFOR) and DELIBERATE FORGE (SFOR II)

	DELIBERATE GUARD		DELIBERATE FORGE	
Country	Number	Percent	Number	Percent
U.S.	34	23.0	24	17.3
Belgium	3	2.0	3	2.2
France	27	18.2	24	17.3
Germany	16	10.8	16	11.5
Greece	1	0.7	1	0.7
Italy	15	10.1	15	10.8
Netherlands	10	6.8	12	8.6
Norway	1	0.7	0	0.0
Spain	11	7.4	11	7.9
Turkey	8	5.4	18	12.9
U.K.	18	12.2	11	7.9
NATO	4	2.7	4	2.9
Non–U.S. NATO	114	77.0	115	82.7
Total	148	100.0	139	100.0

SOURCE: IISS, *The Military Balance*, various years.

forces and other forces.[32] A total of 12,367 merchant vessels were contacted by NATO and WEU forces before the operation ended, and of these, 1,032 were inspected and nine were found to be in violation of the U.N. embargoes.

- **Operation SHARP GUARD.** SHARP GUARD (June 15, 1993, until suspended on June 19, 1996, and terminated on October 1, 1996) was a

[32]According to AFSOUTH's fact sheet on MARITIME MONITOR:

> In addition to the NATO ships, airborne radar and maritime patrol aircraft participated in the operation. NATO airborne radar aircraft provided an air/sea picture to all the NATO and WEU units operating in the Adriatic Sea and in the Otranto Channel. French aircraft operating under the auspices of the WEU also contributed to this effort. This picture was further integrated with the surveillance continuously provided by NATO and WEU maritime patrol aircraft (MPA), which helps in locating and identifying the ships for inspection. British, U.S., and Portuguese MPA aircraft operated under NATO control. Additionally, Greek MPA aircraft flew patrols south of the Otranto Channel in support of NATO and WEU forces. Furthermore, the NATO and French airborne radar aircraft, concurrent with the assistance to MARITIME GUARD forces, continued their monitoring operations in support of U.N. Security Council Resolution 781, which established a ban on military flights in the air space of Bosnia-Herzegovina. This aspect of the combined operation was called Operation SKY MONITOR, which since 12 April 1993 developed into a combined resolution 816.

NATO-led, U.N. Chapter VII peace-enforcement operation, with WEU participation, to enforce U.N. sanctions in the Adriatic Sea.[33] SHARP GUARD essentially became the maritime component of IFOR. As shown in Table B.15, the principal contributors to the operation were the United Kingdom and the United States; the United States contributed two or more ships and deployed four of nine P-3Cs to Sigonella, which were assigned to NATO CTF 440, while the number of ships contributed over the course of the operation changed somewhat from year to year.[34] A total of 74,192 merchant vessels were challenged; 5,951 were boarded and inspected at sea, and 1,480 were diverted and inspected in port.

Table B.15

Number of Ships Contributed to Operation SHARP GUARD, 1993–1996

	1993		1994		1995		1996	
Country	Ships	MPA	Ships	MPA	Ships	MPA	Ships[a]	MPA
U.S.	2	4	2	X	4	X	1	NA
Canada		NA	1		1			NA
Denmark		NA	1					NA
France	2	NA	2	X	1	X		NA
Germany		NA	2	X	2	X	1	NA
Greece		NA			1		1	NA
Italy		NA	2	X	2	X	1	NA
Netherlands		NA	2	X	2	X	1	NA
Portugal		NA		X		X		NA
Spain		NA	2	X	2	X	1	NA
Turkey		NA	1		1		1	NA
U.K.	6 to 8	NA	3	X	2	X	1	NA
Total	10 to 12	NA	18		18		8	NA

SOURCE: IISS, *The Military Balance*, various years.

NOTES: MPA = maritime patrol aircraft; NA = information not available; X = a contribution was made, but number is unknown.

[a]Reported as numbers if SHARP GUARD reimplemented.

[33]SHARP GUARD was authorized in a joint North Atlantic Council–Council of the Western European Union session on June 8, 1993. Operational control of the combined NATO/WEU Task Force (CTF) for embargo operations was delegated through SACEUR to Commander Allied Naval Forces Southern Europe (COMNAVSOUTH). See NATO, June 8, 1993.

[34]The following snapshot captures the typical contributions made by the United States and its coalition partners: the United States, one frigate, P-3C; France, two frigates, Atlantique; Germany, one frigate, Atlantique; Greece, one destroyer; Italy, two frigates, Atlantique; the Netherlands, one frigate, P-3C; Portugal, P-3P; Spain, two frigates, P-3B; Turkey, destroyer; the United Kingdom, one destroyer, Nimrod; and eight E-3A NATO early warning force (NAEWF) aircraft flown by multinational crews from 11 NATO nations.

- **Operation DECISIVE ENHANCEMENT.** DECISIVE ENHANCEMENT was the mine countermeasures (MCM) operation in the Adriatic that took place simultaneously with IFOR and SHARP GUARD; the operation concluded when IFOR ended. Up to ten ships from five NATO nations involved in IFOR (not further specified) were involved in the operation,[35] and it seems likely that maritime patrol aircraft also were employed.[36]
- **Operation DETERMINED GUARD.** DETERMINED GUARD was the name given to the initial maritime component for Operation JOINT GUARD (SFOR). The ships and aircraft selected for this operation were formed into Task Force 436 (TF 436), which typically comprised three frigates and seven minehunters/sweepers from Greece, Italy, and Turkey. In addition, other maritime forces in the Mediterranean could be made available upon request, including U.S. Navy Sixth Fleet amphibious air assets.[37]
- **Operation DETERMINED FORGE.** DETERMINED FORGE is the name given to the maritime component of Operation JOINT FORGE (SFOR II).[38]

Kosovo

The case of Kosovo presents yet another example of complex peace operations, involving monitoring and observing (EAGLE EYE and JTF-KVCC), capabilities to extract Organization for Security and Cooperation in Europe (OSCE) peace monitors should the situation deteriorate (DETERMINED GUARANTOR), a show of force (DETERMINED FALCON), and capabilities to force Serb compliance with UNSCR 1199 and earlier agreements to deescalate the situation in Kosovo (DETERMINED FORCE).

Kosovo also is an example where three international organizations—NATO, the United Nations, and the OSCE—are deeply involved, and where, because of the obvious risks to unarmed observers, a high degree of political-military coordination has been necessary.

A number of NATO coalition operations are of interest in Kosovo, where Serbia has sought to crush the Kosovar effort to establish some degree of autonomy.

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[35]North Atlantic Treaty Organization, "At the End of IFOR's Mission: An Account of Success," NATO Public Information Adviser, International Military Staff, press backgrounder, December 20, 1996, available at http://www.nato.int.

[36]*1997 Department of the Navy Posture Statement.*

[37]The source is www.vm.ee/nato/ifor/general/sf-mar.htm.

[38]AFSOUTH, SFOR Maritime Component Fact Sheet.

Operation DETERMINED FALCON. Operation DETERMINED FALCON was a show of force in Kosovo in June 1998 involving approximately 80 combat, airborne early warning, electronic warfare, reconnaissance, and other support aircraft from 13 countries (see Table B.16), in which NATO aircraft patrolled the Yugoslavian frontiers with Albania and Macedonia.[39]

Operation EAGLE EYE. The mission of Operation EAGLE EYE (October 1998 to the present) is verification, assessment, and reporting for the OSCE verification mission. Several NATO nations have offered aircraft or unmanned aerial vehicles (UAVs), and air assets are currently being provided by France, Germany, Italy, the United Kingdom, and the United States. Unarmed aircraft

Table B.16

Aircraft Contributed to Operation DETERMINED FALCON

Country	FGA	AEW	EW	RECCE	TRAN	TANK	SUPP	Total	Percent
U.S.	16	1	2			8		27	32.9
Belgium	2							2	2.4
Denmark	2							2	2.4
France	4					2		6	7.3
Germany	8							8	9.8
Greece	2							2	2.4
Italy	6							6	7.3
Netherlands	4					1		5	6.1
Norway	2							2	2.4
Portugal	2							2	2.4
Spain	8					1		9	11.0
Turkey	4							4	4.9
U.K.	4				1			5	6.1
NATO		2						2	2.4
Total	64	3	2	0	1	12	0	82	100.0

SOURCE: AFSOUTH fact sheet, undated.

[39]Force contributors included Belgium (two F-16s); Canada, Denmark (two F-16s); France (four Jaguars and two C-135s); Germany (eight Tornadoes); Greece (two F-16s); Italy (two Tornadoes, two AMXs, and two F-3s); the Netherlands (four F-16s and one KDC-10); Norway (two F-16s); Portugal (two F-16s); Spain (eight EF-18s and one KC-130); Turkey (four F-16s); the United Kingdom (four Jaguars and one L-1011); the United States (12 F-16s, eight KC-135s, one EP-3, four AV-8Bs, and two EA-6Bs); and two E-3A NATO Airborne Early Warning Force aircraft. AFSOUTH fact sheet, undated.

conducting or supporting the missions include U-2s, Canberras, RC-135s, C-160s, P-3s, Breguet Atlantiques, and UAVs, including the Predator.[40]

Kosovo Verification Mission. The Kosovo Verification Mission (KVCC) is a multinational NATO headquarters that is part of NATO Operation EAGLE EYE and that contributes to assess Federal Republic of Yugoslavia (FRY) compliance with UNSCR 1199. The KVCC serves as the primary liaison between the OSCE ground verification mission and NATO air verification, and coordinates NATO unarmed air verification flights and NATO requests for use of airspace in the former Yugoslavia Republic of Macedonia. It also coordinates with the Extraction Force headquarters and will constitute a vital information link for the effectiveness of the Extraction Force mission.[41]

Operation DETERMINED GUARANTOR. Operation DETERMINED GUARANTOR is the name for the Extraction Force, a NATO contingency force that will intervene in an emergency to extract OSCE and other designated personnel from the FRY on request by the OSCE verification mission in the event the FRY is unable or unwilling to fulfill its obligations. The Extraction Force largely consists of ground forces and helicopters.[42]

Operation DETERMINED FORCE. Operation DETERMINED FORCE was the name given the threatened NATO air strikes should Belgrade balk on compliance with UNSCR 1199; the operation never was actually executed. Contributions include a variety of land- and carrier-based combat and support aircraft from 13 NATO nations, as well as NATO Airborne Early Warning (NAEW) aircraft (see Table B.17).

Operation ALLIED FORCE. Operation ALLIED FORCE (OAF) was the 78-day NATO air campaign that ran from March 24 to June 9, 1999, that ejected Serb forces from Kosovo.

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[40]Source is http://www.afsouth.nato.int/operations/deteagle/eagle.htm#forces.

[41]Source is http://www.afsouth.nato.int/kvcc/kvcc.htm.

[42]The contributorss are as follows: France (battalion, 12 helicopters, engineer company [temporary]); Germany (infantry company); Netherlands (three CH-47D Chinook helicopters, engineer company, ambulances); Italy (infantry company, six helicopters); United Kingdom (infantry company, engineer company [temporary]); Extraction Force Headquarters (about 300, from ten NATO nations). Source is http://www.afsouth.nato.int/operations/detguarantor/Guarantor.htm#forces.

Table B.17

Aircraft Contributed to Operation DETERMINED FORCE, as of January 25, 1999

Country	FGA	GUN	AEW	EW	RECCE	SAR	TRAN	TANK	HELO
U.S.	X	X		X	X	X		X	X
Belgium	X								
Canada	X								
Denmark	X						X		
France	X		X				X	X	
Germany	X								
Italy	X						X		
Netherlands	X						X	X	
Norway	X						X		
Spain	X						X	X	
Turkey	X								
U.K.	X		X				X	X	
NAEWF			X						

SOURCE: AFSOUTH fact sheet, undated.

While all 19 NATO nations participated in Operation ALLIED FORCE,[43] only 13 supplied air capabilities (see Table B.18).[44] As shown in the table, the United States' NATO allies contributed about 31 percent of all the aircraft to Operation ALLIED FORCE, while the United States provided the lion's share (nearly 70 percent).[45] Among the United States' allies, France again contributed the greatest number of aircraft (84), followed by Italy (58), the United Kingdom (39), Germany (33), and the Netherlands (22).[46]

The allies' principal contribution to OAF was in combat aircraft: nearly 70 percent of the allied contribution consisted of fighter/attack aircraft (see Table B.19), although in somewhat smaller numbers than those contributed by the

[43]DoD, "Operation Allied Force," last updated on June 21, 1999, at http://www.defenselink.mil/specials/kosovo.

[44]The number of aircraft that participated in Operation ALLIED FORCE changed over time. Accordingly, the numbers reported in the tables are not always identical. Nevertheless, the relative numbers contributed generally are consistent, at least to the first order. For other estimates, see AFSOUTH fact sheet, "Operation Allied Force," http://www.afsouth.nato.int/operations/detforce/force.htm; and Federation of American Scientists, http://www.fas.org/man/dod-101/ops/kosovo_orbat.htm.

[45]According to DoD: "While the United States provided the preponderance of the military forces employed during the campaign, our NATO allies were crucial partners and contributors throughout the operation. Our European allies' aircraft that were committed to the operation were roughly as large a part of their total inventory of aircraft as was the case for the United States, and they flew a very substantial number of strike missions, facing the same dangers as U.S. aircrews." DoD, *Kosovo/Operation Allied Force After-Action Report,* Washington, D.C., January 31, 2000, Executive Summary, p. 2.

[46]Other sources generally report comparable numbers, although the Federation of American Scientists reports that Hungary provided a total of 51 aircraft. See Federation of American Scientists at http://www.fas.org/man/dod-101/ops/kosovo_orbat.htm.

Table B.18

Number of Aircraft in Operation ALLIED FORCE, by Country

Country	Aircraft	Percent
Belgium	14	1.3
Canada	18	1.7
Denmark	8	0.8
France	84	7.9
Germany	33	3.1
Hungary	4	0.4
Italy	58	5.5
NATO	10	0.9
Netherlands	22	2.1
Norway	6	0.6
Portugal	3	0.3
Spain	7	0.7
Turkey	21	2.0
U.K.	39	3.7
U.S. allies	327	30.9
U.S.	731	69.1
Total	1,058	100.0

SOURCE: DoD, *Kosovo/Operation Allied Force After-Action Report*, Washington, D.C, January 31, 2000, p. 78.

United States. All told, according to DoD, the United States' allies contributed about two-thirds as many fighter/ground attack aircraft as the United States, about one-fifth as many support aircraft, a comparable number of reconnaissance aircraft, and a small proportion of helicopters).

Table B.19

U.S. and Allied Air Contributions to Operation ALLIED FORCE, May–June 1999

	May 26, 1999		June 21, 1999
Type	U.S.	U.S. Allies	U.S. Allies
Fighter/bomber	309	221	192
Support	261	51	63
Reconnaissance	44	40	19
Helicopters	103	12	3
Total	717	324	277

SOURCES: DoD, May 26, 1999, briefing; DoD, "Operation ALLIED FORCE," last updated June 21, 1999, available at http://www.defenselink.mil/specials/kosovo.

Table B.20 breaks out aircraft types contributed to OAF without respect to country of origin. Of interest from the standpoint of interoperability considerations is that the most common aircraft flown in Operation ALLIED FORCE was the F-16: A total of 193 allied F-16s flew, predominantly from the United States (126), but also from Belgium, the Netherlands, Turkey, Poland, Denmark, and Norway.[47]

Table B.21 describes the French contribution to OAF; as shown in the table, land-based air accounted for three-quarters of the French contribution, with the remainder being attached to the French air and sea group. Although France's greatest contributions were in combat aircraft, France also provided transport, combat search and rescue (CSAR), and airborne warning capabilities.

Table B.20

Number of Fixed-Wing Aircraft, by Type, in Operation ALLIED FORCE

Aircraft Type	Number
Bombers	23
B-52H	12
B-1B	5
B-2A	6
F-117	24
F-15C	24
F-15E	84
A-10	36–45
F-16	193
FA-18	54
F-14	28
Mirage 2000	23
Harrier	24
Tornado	48
EA-6B	29
Jaguar/MirageF1/F104	32
Tankers	189
RECCE/EW/AWACS	79
Transport	46

SOURCE: Authors' estimates based on various sources.

[47]From an interoperability perspective, the ubiquity of the F-16 suggests that alliance-wide improvements to this platform could come at a lower per-unit cost than similar improvements to less common aircraft.

Table B.21

French Contributions to Operation ALLIED FORCE

Aircraft Type	Number
French land-based air	66 (total)
Mirage F1CT	10
Mirage 2000C	8
Mirage 2000D	15
Mirage IV P	3
Mirage FCR	6
Jaguar	12
Transall C160 Gabriel	1
SA 330 PUMA (CSAR)	3
C-135 FR (supply)	6
E-3F-SDCA	2
French air and sea group	22 (total)
Super-Etendard	16
Standard IV P	4
Super Frelon CSAR	2

SOURCE: French Ministry of Defense, "Participation de la France à l'operation 'Allied forces' mise en oeuvre par l'Alliance atlantique," June 10, 1999, posted at http://www.defense.gouv.fr/ema/operations/ex-yougolavie/kosovo/forcesalliees.htm.

NOTE: This table represents a slight discrepancy (of four aircraft) with DoD's OAF *After-Action Report* numbers, which had 84 French aircraft participating (Table B.18).

Table B.22 describes the United Kingdom's contribution to ALLIED FORCE. As shown, about three-fourths of the U.K. contribution was in fixed-wing aircraft, with the rest consisting of helicopters. Like France, the United Kingdom emphasized combat aircraft but also provided aerial warning, cargo, and other support aircraft.

Africa

We examined a number of coalition operations set in Africa between 1992 and 1996 in which the United States participated.

Somalia

According to a recent study of USAF operations in Somalia, over the course of the three humanitarian relief operations in Somalia—PROVIDE RELIEF,

Table B.22

United Kingdom Contributions to Operation ALLIED FORCE

Aircraft Type	Number
Fixed-wing	48
Harrier GR7	16
Sea Harrier FA2	7
Tornado GR1	12
E-3D	3
Nimrod	1
TRISTAR	4
VC-10	5
Helicopters	18
Chinook	8
Puma	6
Lynx	4
Total	66

SOURCE: United Kingdom Ministry of Defence (MoD), "Operation ALLIED FORCE: NATO Air Campaign in FRY," available at the MoD website, http://www.mod.uk/news/kosovo/account/stats.htm.

RESTORE HOPE, and CONTINUE HOPE—the following types of USAF aircraft participated: C-5, C-141, C-130, KC-10, KC-135, and AC-130.[48] The U.S. coalition operations in Somalia between 1992 and 1995 included the following.

Operation PROVIDE RELIEF. PROVIDE RELIEF (August 21, 1992, to February 28, 1993) was the name given to the U.S. humanitarian airlift operations in August 1992 in support of the multinational United Nations relief effort in Somalia. USAF C-130s and C-141s participated,[49] with ten USAF C-130s and 400 people deployed to Mombasa, Kenya, during the operation.[50]

Operation IMPRESSIVE LIFT. When humanitarian relief operations in Somalia encountered resistance from the clans, USAF airlifters moved U.N. troops from Pakistan to Somalia in Operation IMPRESSIVE LIFT (September 13–29, 1992).

[48]Daniel L. Haulman, "Crisis in Somalia," in Warnock, ed., *Short of War: Major USAF Contingency Operations*, manuscript, 1998a, pp. 202–211 (published as *Short of War: Major USAF Contingency Operations, 1947–1997,* Washington, D.C.: Air Force History and Museums Program in Association with Air University Press, 2000).

[49]Haulman (1998a).

[50]Haulman (1999).

Operation RESTORE HOPE/JTF SOMALIA. Somalian clans and gangs continued to target the U.N. relief operations after the arrival of the Pakistani peacekeepers. Operation RESTORE HOPE (also known as the Unified Task Force, or UNITAF) was the operation that sought to ensure the security of humanitarian relief operations in Somalia, and involved the introduction of a large multinational coalition. The USAF contributed C-5s, C-141s, C-130s, KC-135s, and KC-10s. In addition to the contributed air capabilities, the United States also contributed approximately 28,000 of the 35,000 multinational troops, including elements of the 1st Marine Division and 10th Mountain Division, and other elements such as special forces, aviation, military police, engineers, and public affairs. Other NATO nations contributing an infantry battalion plus support to the United Nations Operation in Somalia (UNOSOM) included Belgium (940 personnel, one airborne battalion), Canada, France (1,083 personnel, including one motorized infantry battalion, one engineer and one logistics company, and 12 helicopters), and Italy (2,500 personnel, including one airborne brigade, G-222 airlifters, and three helicopters).

Operation CONTINUE HOPE. CONTINUE HOPE was the continuation of humanitarian relief operations in Somalia when RESTORE HOPE concluded in early May 1993; it also included so-called nation-building activities in Somalia that effectively split the coalition and led to an escalation in the situation. When the situation deteriorated in the summer of 1993, USAF AC-130s were deployed from Europe and Florida to Mombasa, Kenya, and C-5s were used to transport tanks and Bradley fighting vehicles to Mogadishu; KC-10s provided aerial refueling.[51]

Operation UNITED SHIELD. UNITED SHIELD (January 7, 1995, to March 23, 1995) was the operation in support of the withdrawal of U.N. forces from Somalia. An unknown number of USAF airlifters and tankers participated.[52]

Rwanda

Operation SUPPORT HOPE. According to the Department of Defense's *Report to Congress on U.S. Military Activities in Rwanda, 1994–August 1997*, as of August 19, 1997, approximately 2,100 U.S. military personnel participated in Operation SUPPORT HOPE from July 14 to September 30, 1994. JTF SUPPORT HOPE was primarily a logistics operation that provided humanitarian aid to refugees in Rwanda and Zaire. JTF headquarters was in Entebbe, Uganda, with logistics

[51]Haulman (1998a); Vick et al. (1997), p. 152.

[52]Vick et al. (1997), p. 157.

bases in Goma and Bukavu, Zaire; Nairobi and Mombasa, Kenya; and Kigali, Rwanda. At the height of the operation, approximately 200 JTF personnel were in Kigali, including a Civil-Military Operation Center (CMOC), a large U.S. Air Force Tactical Airlift Liaison and Control Element (TALCE), a military police detachment, and other staff and logistics personnel. In Operation SUPPORT HOPE, the United States provided an unknown number of C-5, C-135, and C-141 airlifters and capabilities to support the humanitarian relief mission,[53] and over 700 sorties were flown by USAF C-141s, C-135s, and C-5s, moving 11,000 passengers and 23,000 tons of cargo.

JTF GUARDIAN ASSISTANCE. Joint Task Force GUARDIAN ASSISTANCE (JTF-GA) (November to December 1996) was the U.S. contribution to the Canadian-led multinational force (MNF), and provided the initial assessment of humanitarian and military requirements, as well as ongoing assessments of refugee flows thereafter. To accomplish this mission, JTF-GA established a JTF HQ forward in Kigali, Rwanda, utilizing personnel from its Humanitarian Assistance Survey Team (HAST), conducted an assessment of the refugee situation, which recommended a drastic reduction in the size and composition of required forces, and began coordinating reconnaissance and airlift operations. Once the MNF was stood up in Entebbe, JTF-GA was organized to provide information support and force protection. JTF-GA's activities prepared the way for the Canadian-led MNF by providing assessments of the humanitarian needs and, once the MNF stood up, assessments in support of humanitarian relief operations.

The United States contributed an AC-130U flying in the reconnaissance role and two Naval Forces, Europe (NAVEUR) electro-optical P-3 maritime patrol aircraft, and relied upon two USAF C-130s for logistics support. The United Kingdom contributed a Canberra PR-9 reconnaissance aircraft to the operation, and because the Canadian-led MNF's principal focus was humanitarian relief, Canada provided C-130s. These aircraft collected ISR data, which were processed by the JTF's All-Source Information Center (ASIC) and disseminated to the MNF, the Government of Rwanda, humanitarian relief agencies, and the press.

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[53]Vick et al. (1997), p. 155.

C. Analysis of Missions Flown

This appendix presents data on the number of missions or sorties flown by the United States and its coalition partners, which turn out to be far more difficult to acquire than data on contributed capabilities.

Southwest Asia

Operation DESERT STORM

Given that the United States provided the bulk of the air forces in Operation DESERT STORM, it should be of little surprise that the United States flew the preponderance of missions (see Table C.1). Overall, the United States' coalition partners in the Gulf flew only 14.6 percent of the total missions, although the percentage flown ranged from as low as 0.0 percent (for CAS missions) to as high as 32.7 percent (for CAP missions).[1]

The data in the table make clear that in the case of Operation DESERT STORM, the United States flew the lion's share of missions, across all mission categories.

Table C.2 breaks out the sorties by mission for the United States and each of the NATO and GCC allies who participated in the coalition.

It is clear from the table that of the NATO allies, the United Kingdom was a particularly important contributor to coalition combat, reconnaissance, lift, and tanker operations. By comparison, France, Canada, and Italy flew only a small share of the total coalition sorties.

Post-ODS Southwest Asia

Data on post-ODS operations in Southwest Asia from unclassified sources available to us were very sketchy.

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[1]The order of countries by the total number of sorties each flew is as follows: Saudi Arabia (6,852), United Kingdom (5,417), France (2,258), Canada (1,302), Kuwait (780), Bahrain (293), Italy (237), the UAE (109), and Qatar (43). Keaney and Cohen (1993).

Table C.1

U.S. and Allies Gulf War Mission Totals

Mission Type	U.S.	Allies	Total	Percent Allies
AI	33,648	4,629	38,277	12.1
CAS	6,128	0	6,128	0.0
CAP	8,803	4,272	13,075	32.7
OCA	9,115	1,555	10,670	14.6
RECCE	2,894	342	3,236	10.6
Refueling	14,323	1,572	15,895	9.9
Support	1,022	49	1,071	4.6
Training	526	160	686	23.3
Surface CAP	198	40	238	16.8
EW	2,838	80	2,918	2.7
SOF	946	2	948	0.2
C3	1,904	85	1,989	4.3
Airlift	17,657	4,407	22,064	20.0
Other	1,368	98	1,466	6.7
Total	101,370	17,291	118,661	14.6

SOURCE: Keaney and Cohen (1993).
NOTE: Allies column is totals for all coalition members.

Operation SOUTHERN WATCH. Joint Task Force–Southwest Asia (JTF-SWA)—the organization responsible for the conduct of Operation SOUTHERN WATCH—consists of U.S., British, and French air forces. As of December 1997, since the beginning of Operation SOUTHERN WATCH, the USAF had flown over 70 percent of the estimated coalition total of 188,500 sorties.[2]

Operation PROVIDE COMFORT. Operation PROVIDE COMFORT I (April 5, 1991, to July 24, 1991) was the Kurdish relief operation and no-fly-zone enforcement in northern Iraq. A total of 500 of the PROVIDE COMFORT I fixed-wing sorties were flown by the United States, out of a coalition total of 700

[2]According to JTF-SWA Public Affairs, in calendar year 1997, of a total of 36,310 OSW sorties, the United States had contributed 33,559 (92 percent), and the USAF had contributed 26,631 (73 percent). See JTF-SWA Public Affairs, "JTF-SWA CENTAF Facts," fact sheet at http://www.jtfswa.centcom.smil.mil/directorates/pa/centaf-facts.html. See also the Secretary of the Air Force's Report, in William S. Cohen, *Annual Report to the President and Congress,* Washington, D.C., 1998, which reports the USAF had flown over 110,400 sorties, 70 percent of the coalition total. Allen (1998, p. 184) reports that by February 1997, Operation SOUTHERN WATCH aircrews had flown more than 133,000 operational sorties, with over 86,000 being over southern Iraq. William J. Allen, "Operation SOUTHERN WATCH," in A. Timothy Warnock, ed., *Short of War: Major USAF Contingency Operations*, manuscript, 1998, pp. 183–189.

Table C.2

U.S. and Coalition Sorties Flown in Operation DESERT STORM

Country	AI	CAS	CAP	SCAP	OCA	C3	RECCE	EW	SOF	LIFT	TANK	SUPP	TRAIN	Other	Total
United States	33,648	6,128	8,803	198	9,115	1,904	2,894	2,856	946	17,657	14,323	1,022	526	1,368	101,388
USAF	24,292	2,120	4,558	0	6,422	604	1,311	1,578	134	16,628	11,024	203	174	358	69,406
USN	5,060	21	4,245	198	1,936	1,143	1,431	265	3	0	2,782	41	262	916	18,303
USMC	4,264	3,956	0	0	757	157	3	343	1	9	461	714	14	4	10,683
USSOCCENT	32	31	0	0	0	0	2	84	808	19	56	64	76	90	1,262
USA	0	0	0	0	0	0	147	586	0	201	0	0	0	0	934
CRAF	0	0	0	0	0	0	0	0	0	800	0	0	0	0	800
NATO allies	1,970	0	1,729	40	1,264	0	218	80	1	2,529	1,087	40	158	98	9,214
Canada	48	0	693	0	144	0	0	0	0	277	64	0	64	12	1,302
France	531	0	340	0	230	0	62	0	1	855	223	0	4	12	2,258
Italy	135	0	0	0	0	0	0	0	0	13	89	0	0	0	237
U.K.	1,256	0	696	40	890	0	156	80	0	1,384	711	40	90	74	5,417
GCC allies	2,659	0	2,543	0	291	8	124	0	1	1,878	485	9	2	0	8,000
Saudi Arabia	1,656	0	2,391	0	277	8	118	0	0	1,829	485	9	2	0	6,775
Kuwait	780	0	0	0	0	0	0	0	0	0	0	0	0	0	780
Bahrain	122	0	152	0	14	0	0	0	1	4	0	0	0	0	293
UAE	58	0	0	0	0	0	6	0	0	45	0	0	0	0	109
Qatar	43	0	0	0	0	0	0	0	0	0	0	0	0	0	43
Total	38,277	6,128	13,075	238	10,670	1,912	3,236	2,936	948	22,064	15,895	1,071	686	1,466	118,602

SOURCE: Keaney and Cohen (1993).

NOTE: LIFT = airlift; SCAP = surface CAP; CRAF = Civil Reserve Air Fleet; USSOCCENT = U.S. Special Operations Command Central.

sorties; thus, 71 percent of the sorties were flown by the United States, while the remaining 29 percent were flown by the United States' coalition partners.[3]

PROVIDE COMFORT II (July 24, 1991, to December 31, 1996) was the continued coalition effort for Kurdish relief and security in northern Iraq. The United States flew over 62,000 fixed- and rotary-wing sorties;[4] the coalition total number of sorties is not known.[5]

Operation NORTHERN WATCH. Operation NORTHERN WATCH succeeded PROVIDE COMFORT on January 1, 1997. Although the breakout of sorties by coalition members is not known, as of December 31, 1997, the USAF had flown over 3,325 fixed-wing sorties in support of Operations PROVIDE COMFORT and NORTHERN WATCH, 72 percent of the coalition total.[6]

The Balkans

Bosnia

Operation PROVIDE PROMISE. Sources differ on the number of sorties flown in Operation PROVIDE PROMISE. For example, according to one Air Force source,[7] the operation involved a total of 12,895 sorties and delivered 160,536 metric tons of food, medicine, and relief supplies. According to this source, the United States flew 3,951 C-130, 236 C-141, and ten C-17 air-land sorties, as well as 2,222 C-130 airdrop sorties, which suggests that the United States flew somewhat less than half of the total sorties flown. Another source provides a roughly comparable total in terms of the total number of air-land tons lifted but breaks out coalition sorties and deliveries somewhat differently (see Table C.3).

The table suggests that the United States delivered slightly less than half of the total air-land tons and was responsible for about 39 percent of the air-land tons, 77.5 percent of the airdrop sorties, 91 percent of the CDS bundles, and 22 percent of the TRIADS bundles.

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[3]Harrington, USAFE/HO, "Recent USAFE Contingencies," January 19, 1999.

[4]As of 1997, AMC reported a total of 2,914 airlift missions, 7,553 tanker refueling missions, and a total of 37,499 passengers and 136,593 short tons moved over the course of the operation.

[5]Harrington (1999).

[6]Cohen (1998).

[7]Louis Arana-Barradas, "A 'Promise of Peace': Sarajevo Humanitarian Airlift Ends, New Hope Begins," *Airman,* March 1996, available at http://www.af.mil/news/airman/0396/promise.htm.

Table C.3

Sorties Flown in Operation PROVIDE PROMISE

	Air-Land		Airdrop	Number of Bundles	
Country	Sorties	Tons	Sorties	CDS	TRIADS
U.S.	4,197	62,802	2,220	28,748	1,185
Canada	NA	NA	0	0	0
Germany	NA	NA	380	1,527	2,819
France	NA	NA	263	1,319	1,313
Total	NA	160,634	2,863	31,594	5,317

SOURCE: Harrington, USAFE/HO, "Recent USAFE Contingencies," January 19, 1999.
NOTE: CDS = container delivery system; TRIADS = tri-wall aerial delivery system; NA = information not available.

Operation DENY FLIGHT. In Operation DENY FLIGHT, enforcement of the no-fly zone in Bosnia-Herzegovina, a total of 100,420 sorties were flown, as broken out in Table C.4; no information was available to us on sorties flown by nation.[8]

The table shows that combat air patrol and strike sorties comprised about 50 percent of the total sorties flown.

Operation DELIBERATE FORCE. Table C.5 breaks out the total sorties flown in Operation DELIBERATE FORCE by country and shows again the predominance of the United States: Although the United States contributed only about 42 percent of the aircraft, it flew nearly two-thirds of the missions, while the NATO allies flew the remaining one-third.[9]

Table C.6 presents data on sorties flown by mission. The table shows that CAS/BAI sorties comprised nearly 40 percent of the sorties flown, followed by SEAD (22.3 percent), support (21.3 percent), reconnaissance (9 percent), and CAP (8.4 percent).[10]

[8]Source is http://www.afsouth.nato.int/factsheets/denyflightfactsheet.htm.

[9]The 3,515 sorties flown in DELIBERATE FORCE included 2,470 penetrating sorties (CAS, BAI, SEAD, RECCE, SAR/CSAR) and 1,045 support sorties (NAEW, ABCCC, ELINT/ESM, AAR).

[10]Owen et al. (1998), pp. 8-7, 8-12, breaks out the support sorties as follows: AAR (383); RECCE (312); ELINT (169); AEW (166); ABCCC (32); CSAR (19); and other (ten).

Table C.4

Operation DENY FLIGHT Sorties, by Mission

Mission	Sorties	Percentage of Total
Combat air patrol (NFZ)	23,021	23
Strike (including CAS)	27,077	27
Support (SEAD, NAEWF, RECCE, tanker)	29,158	29
Training	21,164	21
Total	100,420	100

SOURCE: AFSOUTH, "Operation Deny Flight," fact sheet, undated, at http://www.afsouth.nato.int/operations/denyflight/DenyFlightFactSheet.htm.

NOTE: SEAD = suppression of enemy air defense.

Table C.5

DELIBERATE FORCE Sorties, 8/29/95–9/14/95, by Country

Country	Sorties	Percentage of Total
United States	2,318	65.9
France	284	8.1
Germany	59	1.7
Italy	35	1.0
Netherlands	198	5.6
Spain	12	0.3
Turkey	78	2.2
United Kingdom	326	9.3
NATO (NAEWF)	96	2.7
Other NATO	109	3.1
Total	3,515	100.0

SOURCE: AFSOUTH, "Operation Deliberate Force," Allied Forces Southern Europe Fact Sheet, available at http://www.afsouth.nato.int/FACTSHEETS/DeliberateForceFactSheet.htm.

Table C.7 breaks out the use of precision and nonprecision munitions, and high-altitude radiation missiles (HARMs), by country, and shows that the United States was the principal user of precision munitions and fired nearly all of the HARMs; by comparison, only a few of the United States' NATO allies (France, Spain, and the United Kingdom) used precision munitions, and only Spain fired HARMs.

Table C.6

Operation DELIBERATE FORCE Sorties, by Mission

Mission	Number of Sorties	Percentage of Total
CAP	294	8.4
SEAD	785	22.3
CAS/BAI	1,372	39.0
RECCE	316	9.0
SUPP	748	21.3
Total	3,515	100.0

SOURCE: AFSOUTH, "Operation Deliberate Force," Allied Forces Southern Europe Fact Sheet, available at http://www.afsouth.nato.int/FACTSHEETS/DeliberateForceFactSheet.htm.

Table C.7

Munitions Used in Operation DELIBERATE FORCE, by Country

Country	Precision	Nonprecision	HARMs
France	14	73	
Germany			
Italy		50	
Netherlands		136	
Spain	24		2
Turkey			
U.K.	48	47	
U.S.	622	12	54
Total	708	318	56

SOURCE: Owen (1998).

Table C.8 breaks out munitions by munition type.

IFOR, SFOR, and SFOR II

Operations DECISIVE ENDEAVOR (IFOR), DELIBERATE GUARD (SFOR), and DELIBERATE FORGE (SFOR II). Although we found no information on the number of sorties flown by each of the 14 participating NATO countries, Table C.9 does provide information on the total number of CAP/CAS sorties and all other sorties flown.

Operation DECISIVE ENDEAVOR (IFOR). As of December 2, 1996, NATO forces had flown 2,511 combat air patrol (CAP) fighter sorties, 14,098 close air support (CAS) and strike sorties, and 29,842 sorties by SEAD, NAEW, tanker, reconnaissance, and other aircraft.[11]

Table C.8

Munitions Used in Operation DELIBERATE FORCE, by Type

Type of Munition	Number
Total precision munitions	708
Laser-guided bombs	653
GBU-10	303
GBU-12	125
GBU-16	215
GBU-24	6
GBU AS30L	4
Electro-optical	42
SLAM	10
GBU-15	9
Maverick	23
Tomahawks	13
Nonprecision munitions	318
MK 82	175
MK 83	99
MK 84	42
CBU-87	2

SOURCE: Federation of American Scientists, http://www.fas.org/man/dod-101/ops/deliberate_force.htm.

Table C.9

Sorties Flown in Operations DECISIVE ENDEAVOR (IFOR), DELIBERATE GUARD (SFOR), and DELIBERATE FORGE (SFOR II), by Mission

	12/20/95–12/20/96	12/21/96–6/20/98	6/21/98–2/2/99	Total
	Operation			
	DECISIVE ENDEAVOR	DELIBERATE GUARD	DELIBERATE FORGE	
CAP/CAS	17,290	14,549	6,061	37,900
Other aircraft	32,937	33,593	12,542	79,072
Total	50,227	48,142	18,603	116,972

SOURCE: http://www.afsouth.nato.int/FACTSHEETS/SFORAirComponent.htm.

[11]AFSOUTH, "Peace Implementation Force—IFOR," fact sheet, at http://www.afsouth.nato.int/FACTSHEETS/IFORFactSheet.htm.

Operation DELIBERATE GUARD (SFOR). Although no data are readily available on the number of sorties flown by the United States' coalition partners, according to one source, between December 20, 1996, and December 31, 1997, the USAF flew over 3,000 missions in support of Operation JOINT GUARD, or 25 percent of the coalition total.[12]

Operation DELIBERATE FORGE (SFOR II). We did not find any additional information beyond that reported earlier.

Maritime Operations in the Adriatic. Of the maritime operations in the Adriatic, information on the number of sorties flown is available only for two—MARITIME MONITOR and SHARP GUARD:

- **Operation MARITIME MONITOR.** U.S., U.K., and Portuguese maritime patrol aircraft (MPA) flew more than 200 sorties within NATO control, and from July 16, 1992, a Greek Albatross MPA also flew in support of NATO forces. Additionally, NAEWF aircraft provided all the involved international units with operational connectivity, including an air radar picture that was integrated with the surveillance conducted by the various MPA, helicopters, and ships on patrol. All together, AWACS aircraft flew more than 360 sorties. Of the total 63 coalition MPA sorties flown, four United States P-3Cs flew 57 sorties, and a Portuguese P-3P flew six.[13]
- **Operation SHARP GUARD.** A total of 7,151 MPA sorties were flown during the operation, and NATO and French airborne early warning aircraft sorties totaled 6,174.[14]

Kosovo

With the exception of Operation ALLIED FORCE, no data were found on missions flown for the various operations in Kosovo. Nevertheless, with few exceptions, open-source data on missions flown in Operation ALLIED FORCE appear generally to be available only at a fairly aggregate level. We now present these data.

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[12]Cohen (1998).

[13]AFSOUTH, "NATO Operation Maritime Monitor," fact sheet, undated, at http://www.afsouth.nato.int/factsheets/maritimemonitor.htm.

[14]Sources are http://www.fas.org/man/dod-101/ops/docs/SharpGuardFactSheet.htm; www.ndu.edu/ndu/inss/sa95/ sach03f3.html.

According to General Clarke's February 17, 2000, testimony before the House Armed Services Committee,[15] the United States and its NATO allies flew 38,000 sorties in OAF, of which 14,000 were strike sorties by F-16s and F-117s.[16] Of these 38,000 total sorties, the 305 participating NATO non–U.S. aircraft flew more than 15,000.[17] A total of 1,751 airlift missions moved 78,000 tons of supplies and 42,380 passengers, while 500 airlift sorties delivered 4.5 million tons of food, 1,962 tons of shelter, and 57 tons of medical supplies. The United States reportedly launched over 90 percent of the cruise missiles, and most of the actual strike sorties during the first month of the campaign.[18]

The United States carried the greatest burden of the effort in OAF:

> [I]t is clear that the U.S. flew over 60 percent of all the sorties in the air and missile campaign, flew 53 percent of the strike-attack sorties, dropped over 80 percent of the strike-attack munitions, flew 71 percent of the overall support sorties, carried out over 90 percent of the advanced intelligence and reconnaissance missions, flew over 90 percent of the electronic warfare missions using dedicated aircraft, fired over 80 percent of the precision guided air weapons, and launched over 95 percent of the cruise missiles.[19]

With a more substantial capability in combat aircraft than in specialized aircraft, the United States' NATO allies were able to generate proportionally more combat sorties than support sorties. Secretary Cohen has testified that while the United States' NATO allies were able to provide 47 percent of the strike sorties, they could provide only 29 percent of the support sorties.[20]

The British Contribution. As described earlier, the United Kingdom was one of the larger contributors to Operation ALLIED FORCE. In terms of the employment of these forces, the United Kingdom's Ministry of Defence (MoD) suggests that the U.K.'s principal contribution was in generating strike sorties

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[15]Statement of GEN Wesley K. Clark, USA, Commander in Chief, U.S. European Command, Before the House Armed Services Committee, February 17, 2000.

[16]It also is known that the B-2 flew a total of 49 sorties. Statement of GEN John P. Jumper Before the House Armed Services Committee, October 26, 1999.

[17]The DoD *Kosovo/Operation Allied Force After-Action Report* reports a total of 327 manned aircraft provided by the United States' NATO allies, which flew over 15,000 sorties (about 39 percent of the total). See DoD (2000).

[18]Cordesman (1999). He further reports: "A number of European air forces lacked interoperable communications, secure communications to handle targeting information, and the sensors and avionics to deliver precision guided munitions in poor weather. The U.S. eventually flew half of the combat sorties, well over half of the strike sorties, and two-thirds of the support sorties during the 78 days of active fighting." Cordesman (1999), p. 8.

[19]Cordesman (1999), p. 34.

[20]As Secretary Cohen put it, "We also need to assess NATO's aircraft requirements. While our allies were able to deploy 47 percent of the strike sorties for the mission, they provided only about 29 percent of the overall support sorties. All allies were able to get air contributions to the crisis quickly; however, the KFOR deployment was slower than desired." William S. Cohen, Prepared Statement to the Senate Armed Services Committee Hearing on Operations in Kosovo, July 20, 1999.

(see Table C.10). In total, the United Kingdom flew over 1,000 strike sorties, nearly 10 percent of those flown by the coalition, which represented nearly two out of three of the 1,600 sorties flown by British air forces.

The U.K. Ministry of Defence has also described the munitions used in its strike operations (see Table C.11).

Taken together, this suggests that the United Kingdom flew about 4 percent of the total sorties and nearly 10 percent of the strike sorties flown by NATO but that it dropped only 4 percent of the munitions, more in line with its proportion of total sorties than its proportion of the strike sorties.

Table C.10

U.K. Contributions to Operation ALLIED FORCE

Type of Sortie	Number of Sorties Flown (NATO Total)
Strike	1,008 (10,484)
Combat air patrol (CAP)	102
Airborne early warning (AEW)	184
Air-to-air refueling	324
Total	1,618 (38,004)

SOURCE: United Kingdom Ministry of Defence, "Operation ALLIED FORCE: NATO Air Campaign in FRY," available at MoD website, http://www.mod.uk/news/kosovo/account/stats.htm.

Table C.11

U.K. Aircraft Munitions Released in Operation ALLIED FORCE

Type of Munition	Number (NATO Total)
1,000-lb bomb	230
PAVEWAY II	226
PAVEWAY Iii	16
RBL 755	532
ALARM	6
Total	1,010 (23,614)

SOURCE: United Kingdom Ministry of Defence, "Operation ALLIED FORCE: NATO Air Campaign in FRY," available at MoD website, http://www.mod.uk/news/kosovo/account/stats.htm.

The German Contribution. Germany reportedly flew 394 Tornado SEAD sorties over the course of OAF, fired 244 HARMs, and flew 46 reconnaissance missions.[21]

The Dutch Contribution. According to the Royal Netherlands Embassy in Washington, D.C., Dutch air forces flew more than 1,900 sorties, accounting for over 5 percent of all sorties flown in OAF and one out of every four sorties flown by non–U.S. forces.[22]

Africa

Only the Somalia case study provided useful data on sorties flown; JTF-GA evidently was too small a case.[23]

Somalia

We first turn to the allocation of missions flown in various U.S. coalition operations in Somalia.

Operation PROVIDE RELIEF. According to Air Mobility Command (AMC), a total of 3,094 USAF airlift missions were flown in PROVIDE RELIEF, and a total of 31,175 metric tons of relief supplies were delivered.[24]

Operation IMPRESSIVE LIFT. According to AMC, in IMPRESSIVE LIFT, USAF airlifters flew 94 missions to move the 974 Pakistani peacekeepers and 1,168 short tons of equipment to Somalia.[25]

Operation RESTORE HOPE. According to AMC, USAF airlifters flew 2,295 missions, and USAF tankers flew 1,692 missions in support of 99,156 passengers and 70,502 short tons moved.[26]

Operation CONTINUE HOPE. The escalation in Somalia in August 1993 that led to the provision of additional U.S. forces resulted in five C-5 sorties and one

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[21]Cordesman (1999), p. 34.

[22]Royal Netherlands Embassy, Washington, D.C., "Dutch Forces Play Central Role in and around Kosovo," June 28, 1999, at http://www.netherlands-embassy.org/c_kosovoprs.html.

[23]We do know, however, that in the latter case, while the Canadians focused on humanitarian relief operations in support of the refugee movements, the U.S. role was primarily to provide surveillance and reconnaissance and, if necessary, to conduct search and rescue (SAR) operations. USAFE deployed two C-130s on November 21, 1996, to provide support to JTF-GA; one returned on December 12, and the other, four days later.

[24]Air Mobility Command, "A Chronology of Mobility Operations Since January 1990," 1997.

[25]Air Mobility Command (1997).

[26]Air Mobility Command (1997).

KC-10 sortie being flown;[27] it is unclear how many sorties were flown in support of the humanitarian mission, or by helicopters.

Operation UNITED SHIELD. According to AMC, USAF airlifters flew a total of 59 missions, carrying 1,436 passengers and 1,447 short tons of cargo.[28]

Rwanda

Operation SUPPORT HOPE. A total of nearly 1,400 missions were flown by USAF C-141s, C-135s, and C-5s, moving 11,000 passengers and 23,000 tons of cargo. Of these, 380 strategic and 996 tactical missions were flown, and an estimated 15,331 tons of supplies were delivered to the area of operations.[29]

JTF GUARDIAN ASSISTANCE. Specific sortie numbers are unknown for JTF-GA; however, the Navy P-3s flew primarily during the day and were capable of flying approximately 15 missions per month each. The AC-130U flew mostly at night and also had a sortie rate of every other day. No additional information is available on the sorties flown by U.S., British, or Canadian aircraft.

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[27]Vick et al. (1997), p. 152.

[28]Air Mobility Command (1997).

[29]Schroeder (1994).

D. Base Access

In addition to the sorts of military capabilities that coalitions can provide, as described in preceding appendices, from an interoperability perspective another important contribution that coalition partners can make to coalition operations is providing overflight and basing rights. This appendix focuses on some patterns in the provision of base access by looking at three past U.S. coalition operations: Operation DESERT SHIELD/STORM, Operation DELIBERATE FORCE, and Operation ALLIED FORCE.[1]

Basing in Operation DESERT SHIELD/STORM

Table D.1 describes bases used by USAF units in deployments for Operation DESERT SHIELD/STORM. As suggested by the table, the USAF relied extensively not just on those in-theater bases that enabled land-based air operations to be effectively conducted (e.g., Saudi Arabia and the other GCC states, as well as Turkey and Diego Garcia), but also on a network of en route

Table D.1

Bases Used by USAF Units in ODS Deployments

In-Theater	En Route and Extra-Regional
Saudi Arabia	Egypt (Cairo West)
Bahrain	France (Mont de Marsan)
Oman	Greece
Qatar	Italy
United Arab Emirates	Spain (e.g., Moron AB)
Turkey	U.K.
Diego Garcia (U.K.)	

SOURCE: "USAF Unit Deployment," Table 17 in Keaney and Cohen (1993), pp. 58–64.

[1] As demonstrated in Operation ELDORADO CANYON, in which USAF F-111Gs were refused permission to fly through French airspace, the importance of overflight rights cannot be overemphasized. Nevertheless, because of the difficulties in compiling an accurate record of overflight permissions in past U.S. coalition operations, in part due to the expressed desire of many nations to keep such support from public view, we focus in this appendix on the provision of base access. The final report (Hura et al., 2000) examines this issue in more detail and provides an analysis of the benefits conferred by overflight rights and access to en route bases in a notional Southwest Asia contingency. See Hura et al. (2000).

and extra-regional bases that enabled the construction of an air bridge, notably including Moron Air Base (AB) in Spain and Cairo West in Egypt, and provided basing for KC-135s out of Mont de Marsan, France.

Basing in Operation DELIBERATE FORCE

As indicated in Table D.2, in Operation DELIBERATE FORCE, Italy provided the lion's share of the basing, accommodating 258 out of 294 aircraft.

Table D.3 breaks aircraft out by country and base location. As shown in the table, Italy provided basing for French, German, Italian, NATO, Dutch, Spanish, Turkish, British, and U.S. aircraft; France based only French aircraft; and Germany provided basing for some Italian E-3As.

Table D.2

Basing of Aircraft Assigned to NATO for Operation DELIBERATE FORCE

Basing Country	Number of Aircraft	Aircraft by Country
Italy	258	FR (42), GE (14), IT (20), NAEWF (4), NETH (18), SP (11), TU (18), UK (22), US (109)
France	2	FR (2)
Germany	4	IT (4)
Mediterranean	30	USS *T. Roosevelt, Foch* (FR), HMS *Invincible* (UK)

SOURCE: AFSOUTH fact sheet, "Operation DELIBERATE FORCE."

Table D.4 identifies the location of non-NATO air forces that were not assigned to DELIBERATE FORCE as such.

Table D.3

Basing of Aircraft Assigned to NATO for Operation DELIBERATE FORCE

Country	Number	Aircraft Type	Base Location
France	3	Mirage F-1CT	Italy
	5	Mirage F1-CR	
	8	Jaguar	
	9	Mirage 2000C	
	5	Mirage 2000D	
	4	Mirage 2000K	
	8	Puma	
Germany	8	Tornado ECR	
	6	Tornado	
Italy	8	Tornado	
	6	AMX	
	1	Boeing 707 Tanker	
	1	C-130	
	4	G-222	
NATO	4	E-3A	
Netherlands	18	F-16A	
Spain	8	EF-18A	
	2	KC-130	
	1	CASA 212	
Turkey	18	F-16C	
U.K.	12	GR-7	
	6	FMK-3	
	2	L-1011	
	2	E-3D	
U.S.	12	O/A-10A	
	8	F-15E	
	12	F/A-18D	
	12	F-16C	
	10	EA-6B	
	10	F-16C (HTS)	
	3	EC-130H	
	4	EC-130E	
	4	AC-130H	
	12	KC-135	
	5	KC-10	
	7	MH-53J	
	4	MC/HC-130P	
	6	EF-111A	

Table D.3—Continued

Country	Number	Aircraft Type	Base Location
France	1	E-3F	France
	1	C-135FR	
Italy	4	E-3A	Germany
France	6	Super Etendard	Mediterranean
U.K.	6	FA-2	
U.S.	18	F-18C	

Table D.4

Basing of Non-NATO Forces in Operation DELIBERATE FORCE

Country	Aircraft Type	Base Location
France	Mirage IV	Mont de Marsan, France
U.S.	U-2R	RAF Fairford, U.K.
	F-14	USS *T. Roosevelt*/Med
	P-3C	NAS Sigonella, Italy
	RC-135	RAF Mildenhall, U.K.
	E-2	USS *T. Roosevelt*/Med
	S-3	USS *T. Roosevelt*/Med
	HH-60	USS *T. Roosevelt*/Med
	F-16C	Aviano, Italy
	F-15E	Lakenheath, U.K.
	AV-8B	USS *Kearsarge*/*Wasp*/Med
U.K.	GR-1b	Gioia del Colle, Italy
	Canberra	Marham, U.K.
	Nimrod	Waddington, U.K.
Germany	BR-1150	Nordholz, GE

SOURCE: AFSOUTH fact sheet, "Operation Deliberate Force."

Basing in Operation ALLIED FORCE

The DoD Kosovo after-action report has indicated the importance of the basing support provided by the United States' coalition partners and neighboring countries:

> European airbases were essential for the effective prosecution of the air operation. European facilities providing communications, intelligence, and logistics support similarly were necessary for the campaign's prosecution. Europeans provided the majority of the humanitarian relief supplies, particularly in adjacent countries such as Albania and the Former Yugoslav

Republic of Macedonia, which was critical in limiting the human cost to the many Kosovo refugees.[2]

According to *Jane's Defence Weekly*, 59 air bases in 12 countries supported NATO air strikes and provided support to ground operations (see Table D.5).[3] Of

Table D.5

NATO Nations Providing Airfields Used in Operation ALLIED FORCE

Italy (17)	U.K. (5)
Aviano AB	RAF Fairford
Bari Airport	RAF Brize-Norton
NAS Sigonella	RAF Mildenhall
Dal Molin AB, Vicenza	RAF Marham
Cervia	RAF St. Morgan[a]
Gioia Del Colle AB	France (4)
Brindisi AB	Istres AB
Falconara Airport, Ancona	Mont de Marsan
Trapani AB	Avord AB
Amendola AB	Solenzara AB, Corsica
Grazzanaise AB	Turkey (4)
Gosseto AB	Balikesir AB
Istrana AB	Corlu[b]
Piacenza AB	Bandyrma[b]
Pratica di Mare AB	Incirlik[a]
Brescia-Ghedi AB	Spain (2)
Naples-Caodinichino	Moron AB
Germany (6)	Rota
Spangdahlem AB	Greece (1)
Geilenkirken AB	NAS Souda Bay, Crete
Rhein-Main AB	United States (1)
Ramstein AB	Whiteman AFB, MO
Eindhoven[a]	
Landsberg[a]	

SOURCES: *Jane's Defence Weekly*, "Operations Allied Force/Allied Harbour/Joint Forge—Order of Battle/Basing 1 June 1999," on Jane's website, http://www.janes.com/defence/features/kosovo/airassets.html, February 24, 2000; Federation of American Scientists, Operation Allied Force Kosovo Order of Battle, http://www.fas.org/man/dod-101/ops/kosovo_orbat.htm, February 24, 2000.

[a]According to Federation of American Scientists.

[b]According to *Jane's Defence Weekly*.

[2]DoD, *Kosovo/Operation Allied Force After-Action Report*, Washington, D.C., January 31, 2000, Executive Summary, p. 2.

[3]*Jane's Defence Weekly*, "Operations Allied Force/Allied Harbour/Joint Forge—Order of Battle/Basing 1 June 1999," on Jane's website at http://www.janes.com/defence/features/kosovo/airassets.html on February 24, 2000.

significant interest is the sizable contribution that Italy made in providing basing for coalition aircraft; according to *Jane's*, Italy provided the most substantial number of bases (17) supporting the operation of any country. Indeed, it is difficult to imagine that OAF could have been undertaken without this critical Italian contribution. Following Italy were Germany (six bases), the United Kingdom (five bases), and France and Turkey (four bases each).

Also of interest is that, despite Greece's general unhappiness with the NATO operation against Serbia, it allowed U.S. KC-135s to fly out of the naval air station at Souda Bay in Crete.

As shown in Table D.6, in addition to the bases provided by the United States' NATO allies, other Balkan nations also provided base access and support.

As shown in Table D.7, Italy provided basing for the largest number of NATO fixed- and rotary-wing aircraft (506) in ALLIED FORCE, followed by Germany (120), Bosnia-Herzegovina (117), the United Kingdom (88), and Albania (87). An estimated 105 aircraft were afloat.

Table D.6

Other Nations Providing Airfields Used in Operation ALLIED FORCE

SFOR/Bosnia-Herzegovina (10)	SFOR/Croatia (1)
Tuzla AB	Ploce, Croatia
Comanche Base, Tuzla	
"Blue Factory," Tuzla	Macedonia (3)
Metal Factory, Banja Luka	Petrovec Airport
Divulje Barracks, Split	Tetevo
Ljubija	Kumanovo
Sisava	
Rajlovac	Albania (1)
Ortijes	Rina Airport, Tirana
Sarajevo Airport	

SOURCES: *Jane's Defence Weekly*, "Operations Allied Force/Allied Harbour/ Joint Forge—Order of Battle/Basing 1 June 1999," on *Jane's* website, http://www.janes.com/defence/features/kosovo/airassets.html February 24, 2000; Federation of American Scientists, Operation Allied Force Kosovo Order of Battle, http://www.fas.org/man/dod-101/ops/kosovo_orbat.htm, February 24, 2000.

Table D.7

Basing of Fixed- and Rotary-Wing Aircraft in Operation ALLIED FORCE, by Country Total and by Percentage of Overall Total

Base Location	Total	Percent	FW	Percent	FGA	Percent
U.S.	6	0.5	6	0.6	6	0.9
U.K.	88	7.0	88	9.1	17	2.7
Germany	120	9.6	120	12.4	36	5.7
France	47	3.8	47	4.8	16	2.5
Hungary	37	3.0	37	3.8	27	4.3
Spain	37	3.0	37	3.8	0	0.0
Greece	10	0.8	10	1.0	0	0.0
Turkey	58	4.6	58	6.0	54	8.5
Italy	506	40.4	489	50.4	413	65.2
Bosnia (SFOR)	117	9.3	1	0.1	0	0.0
Albania	87	6.9	0	0.0	0	0.0
Macedonia	34	2.7	0	0.0	0	0.0
Afloat	105	8.4	77	7.9	64	10.1

NOTES: FW = fixed-wing; FGA = fighter/ground attack.

As one reads from left to right, the importance of Italy to the operation can be seen to increase: Italy provided basing for 40 percent of the NATO aircraft, 50 percent of the fixed-wing aircraft, and nearly two-thirds of the fighter and ground attack aircraft. As in Operation DELIBERATE FORCE, it is rather difficult to imagine how NATO could have undertaken Operation ALLIED FORCE without this crucial Italian support.

This brief analysis of basing in three recent coalition operations has revealed, *inter alia*, the crucial role played by Saudi base access in the Gulf War air operations and by Italy in supporting Balkan operations. It is difficult to imagine these operations being conducted without the basing rights provided by these two nations. It also raises the larger question of what sorts of actions should be taken (e.g., development of other bases in the region) to hedge against the possibility that these bases might not be available in some comparable future conflict.

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