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

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*Prepared for the
United States Air Force*

Project AIR FORCE

The research reported here was sponsored by the United States Air Force under Contract F49642-96-C-0001. Further information may be obtained from the Strategic Planning Division, Directorate of Plans, Hq USAF.

Library of Congress Cataloging-in-Publication Data

Interoperability of U.S. and NATO allied air forces : supporting data and case studies /
Eric Larson ... [et al.].
p. cm.
Includes bibliographical references.
"MR-1603."
ISBN 0-8330-3287-9 (pbk.)
1. United States Air Force. 2. Air forces—Europe. 3. Combined operations (Military science) 4. North Atlantic Treaty Organization—Armed Forces. I. Larson, Eric, 1957–
UG633 .I585 2003
358.4'146—dc21

2002152425

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Published 2003 by the RAND Corporation
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516
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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.

¹The 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

²Exceptions 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

³Operation 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.