
**NEW TRENDS THAT MAY AFFECT FUTURE
INTEROPERABILITY**

In this chapter, we examine new technology, security, and military trends—as reflected in top-level DoD guidance and visions of future military operations—to identify interoperability challenges that U.S. and NATO allies’ air forces will need to address over the next decade. We consider the following factors: the changing international security environment, the budgetary and programmatic environment, and the potentially widening gap between U.S. and NATO allies’ military capabilities.

THE INTERNATIONAL SECURITY ENVIRONMENT

Future interoperability needs must be understood in the context of recent changes in the international security environment that affect coalition operations. Of particular interest are changes in NATO’s security environment that have led to new missions for NATO, and the United States’ increasing reliance on European coalitions and organizations.

Arguably, the international security environment is more stressing now than it was during the Cold War. This situation results from potentially fast-changing circumstances, the wider range of possible contingencies to which forces must respond, and the interface between forces of different nations at different levels. Thus, interoperability becomes increasingly important because of the new missions likely to develop in this environment, the increasing U.S. reliance on European “coalitions of the willing,” and a political environment that

is less tolerant of mistakes leading to “unnecessary” casualties or collateral damage.

U.S. national security strategy increasingly emphasizes the role of Europe in coalition operations and reliance on European allies to achieve global security objectives. NATO’s security environment has also changed: NATO continues to reengineer itself to undertake a range of new missions, and its focus is shifting from a strategic concept based on the threat of Soviet aggression to one that will improve NATO’s ability to manage internal instabilities on the periphery and in out-of-area operations.

Changes in NATO’s Security Environment

Traditionally, threat-based analyses (What are the threats? How can they best be countered?) have provided the overall context and justification for establishing military needs and for developing new concepts and systems to address the identified needs. Since the end of the Cold War, however, the international security environment—and U.S. military operations—have been dominated by less predictable events such as civil wars and regional crises. There is little reason to believe that this situation will change in the immediate future.

SWA, at least until Saddam passes, will likely continue to be a focus of U.S. and, to a lesser extent, European concern.¹ In the longer term, there is the possibility of a revanchist Russia or an emergent China as a “regional,” “niche,” or even “peer” competitor (although the level of European interest in China is less obvious than that in Russia).

Recurring crises below the MTW level² suggest that proliferation of ballistic missiles and weapons of mass destruction (WMD) may be an area of increasing concern, leading to the deployment of air defense

¹Although not as obviously an area of interest to Europe, North Korea may also be a future locale for combined U.S.-European action. Accordingly, interoperability issues can be expected to center on South Korea and, to a lesser extent, Japan.

²Examples include the crisis with Iraq over United Nations Special Commission (UNSCOM) inspections, the October 1994 crisis with North Korea over nuclear weapons, the September 1998 launch of a North Korean theater ballistic missile (TBM) over Japan, and the deployment of Patriot missiles to Israel in late 1998.

and C3ISR capabilities. And, as demonstrated by the U.S. strike on Libya in 1986 and the strike on Bin Laden's facilities, counterterrorist strikes aimed at preventing further acts of terrorism are also likely to continue to be part of U.S. future operations.

U.S. and multinational involvement in Somalia and Bosnia, as well as events in Kosovo and elsewhere, suggest that in some cases internal conflicts can create requirements for the use of force. Peace operations in Bosnia, Kosovo, and other places can be expected to continue to create demands on the United States and its European allies.³

There is little reason to believe that the prevalence of often complex and sometimes risky humanitarian disasters in Africa will end any time soon. These situations will likely continue to require attention and some level of interoperability, even when U.S. combat forces are not participating.⁴ We also note that some allies are more worried about U.S. unilateralism than about some of the threats discussed above.

In such operations, the United States and NATO allies may also encounter new, more challenging threats such as advanced mobile surfaces-to-air missiles (SAMs), tactical cruise and ballistic missiles (perhaps low-observable variants or those carrying WMD), and more mobile force elements (mobile C2 nodes and dismounted forces). Along with changes in the nature of warfare (e.g., nonlinear as opposed to linear battlefields), and with increased employment of more advanced capabilities such as information warfare, these developments may present new interoperability problems.

³The Petersburg Declaration of 1992 foresees that European states in the Western European Union (WEU) could undertake a range of military actions, including humanitarian and rescue operations, peacekeeping, and the use of combat forces in crisis management, including peacemaking. The European Union's Treaty of Amsterdam also envisions a military role for WEU states.

⁴This is true even if interoperability considerations center on issues such as compatibility in handling outsize cargo. In addition to frequent participation in such operations by the United States and its NATO allies, increasing attention is being paid to promoting the development of African nations' own capabilities to carry more of the burden of many of these operations. This suggests another area of potential interoperability opportunities or challenges.

By all accounts, the post–Cold War world has left NATO and its member nations with a less compelling set of security problems than those posed by the Soviet Union and the Warsaw Pact. National survival is no longer at stake as it was in the Cold War. Accordingly, NATO and its member nations have had to adapt their capabilities and organizations to address a different set of challenges, including conflicts such as Bosnia, and to tailor their planning to address those challenges. NATO has also tried to tie itself more closely to other political and security institutions that are relevant to European security, has widened the circle of nations that participate, and has thereby added additional degrees of freedom to interoperability requirements.⁵ For example, the Partnership for Peace (PfP) includes the 19 NATO nations as well as 24 others.⁶

In the face of less compelling threats, the importance of minimizing casualties—including those of friends and even possibly adversaries—has arguably increased in the post–Cold War world. This is because NATO politicians who ultimately decided if military intervention is warranted put a high value on minimizing casualties in efforts to mitigate public opposition. Thus, any given intervention will likely be judged by the electorate and is likely to be undertaken only if casualties are expected to be commensurate with the importance of the interests and values that are engaged.⁷

In a similar vein, by reducing fratricide within NATO, the NATO nations can reduce potential frictions with each other's publics. The implications for interoperability are numerous and include comparable (i.e., easily substituted) all-weather precision-strike capabilities across NATO allies' air forces, improved secure communications and combat identification, and other information-intensive capabilities. These factors suggest that research to identify interoperability

⁵Among these institutions are the WEU, which, until the Anglo-French agreement of December 1998, was slated to form the core of the prospective European Security and Defence Identity (ESDI); the Euro-Atlantic Partnership Council (EAPC); and the PfP—all of which include non-NATO members.

⁶Non-NATO members of the PfP are Austria, Finland, Sweden, Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, Albania, Armenia, Azerbaijan, Belarus, the Former Yugoslav Republic of Macedonia (FYROM), Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Slovenia, Turkmenistan, Ukraine, Uzbekistan, and Malta.

⁷This is also true, generally to a lesser degree, in the case of noncombatant casualties. See Mueller (1994) and Larson (1996).

needs and longer-term solutions should focus on the capabilities and levels of interoperability that will be needed to perform future high-interest missions at acceptable performance levels.

New Missions for NATO

Since the collapse of the Soviet Union and the demise of the Warsaw Pact, challenges to security in Europe have derived more from instability arising within countries than from external threats. This poses a requirement for fighting highly limited wars that are infused with political constraints.

The emergence of these missions as a key focus for planning and action by NATO and its member nations has challenged the adequacy of extant doctrine, organizations, training, exercises, and systems in ways that were never envisioned in planning to deter and, if need be, repel a Warsaw Pact attack. The constraints imposed on these new missions—on rules of engagement, civilian and military casualties (including fratricide), and the like—pose unique challenges for interoperability in coalition and Alliance operations. Recognizing these new challenges, NATO is reengineering itself to undertake a range of out-of-NATO-area power projection missions.⁸

THE BUDGETARY AND PROGRAMMATIC ENVIRONMENT

An equally challenging budgetary and programmatic environment is emerging in which interoperability enhancements are seen as a means of achieving efficiency and ensuring that critical gaps between the United States and its NATO allies can be minimized.

Tighter Defense Budgets

As a result of the diminished threat environment, U.S. and NATO allies' defense budgets have declined. This decline has been disproportionately severe in the investment account, with a few large programs consuming most of that budget. As a consequence, whatever efforts are made to achieve interoperability will need to fit well

⁸The C2 case study presented in Chapter Five discusses NATO reengineering efforts.

within constrained resources. Further, in pursuing interoperability, each nation may be asked to trade off national military capability for interoperability with other NATO members. The extent to which nations are willing to sacrifice military capability to achieve interoperability is a critical consideration.

The Political and Economic Aspects of Defense Consolidation

Interoperability initiatives offer a number of approaches for promoting the further rationalization of alliance-wide defense industries—for example, through collaborative efforts (e.g., EF-2000, European Joint Strike Fighter) or through single-source efforts (e.g., U.S. manufacture and sale of F-16s). Because these efforts frequently result in smaller pies being divided up among a smaller number of commercial players, pressures for rationalization and consolidation are in tension with continued national desires to preserve the perceived economic benefits of national defense industries (e.g., revenues and employment). Political-economic interests in many quarters (including the United States) are likely to press for equity over economic efficiency and may impede otherwise promising interoperability initiatives.

This dynamic budgetary and programmatic environment makes the question of performance and interoperability gaps a complex one. Further complicating the picture, gaps between the capabilities of the United States and its key allies could emerge or widen as a result of the United States' JV 2010 capabilities and the sorts of top-level future operational concepts and emerging systems described later in this report.

Concurrent Development and Introduction of New NATO Capabilities

A related concern can be found in the research, development, and acquisition activities of the United States' NATO allies. These development programs may be proceeding with inadequate consideration of the interoperability requirements for operating in a coalition with the United States, potentially producing a widening gap in per-

formance and interoperability.⁹ The NATO allies have a number of air and C3ISR systems that are well along in research, development, or acquisition—e.g., EF-2000 (Typhoon), Rafale, and the Airborne Stand-Off Radar (ASTOR).¹⁰ Although planned to be NATO-interoperable, these systems will need to be integrated with U.S. capabilities at some investment cost to achieve maximum benefit. Furthermore, a strong argument can be made that interoperability should be addressed early in the design, development, and acquisition process so that least-cost, longer-term solutions can be found for integrating capabilities into effective and efficient combined operations. The alternative—attempting to integrate deployed systems—means that integration is likely to amount to little more than improvised workarounds that are less effective than systematic integration of elements in a larger system.

In summary, in the near term, U.S.-NATO interoperability may be limited by the United States' and NATO allies' piecemeal introduction of new systems, standards, doctrine, and organizations. The dynamic acquisition environment will pose challenges to the integration and interoperability of these new capabilities with operational concepts, doctrine, and organizations.

A POTENTIALLY WIDENING GAP IN U.S.-NATO CAPABILITIES

With JV 2010, the U.S. military has embarked on an ambitious path that may mean that the gap between U.S. capabilities and those of its adversaries will widen further as the United States capitalizes on

⁹Development and procurement of common systems by the NATO nations can certainly foster interoperability. The NATO AWACS program and the MIDS terminal discussed in Chapter Seven and Nine, respectively, are examples. Today this is more problematic given the political and economic stakes, including the desire to nurture emerging high-technology industries and to ensure sizable work shares. In addition, international programs have generally exhibited greater cost growth and schedule slippage than national development efforts. For a more complete discussion of this last point, see Lorell and Lowell (1995).

¹⁰The International Institute for Strategic Studies' *Military Balance* provides a comprehensive listing of NATO members' current aircraft, C3ISR, and other acquisition programs.

technological prowess in information superiority, stealth, standoff, precision, joint interoperability, and other capabilities.¹¹

The gap between the capabilities of the United States and its key allies may also be widening to the extent that the NATO allies may not be able to perform military missions at U.S. performance levels.¹² Without a compelling threat, if NATO and its member nations' capabilities and operational concepts become outdated or incompatible with those of the United States, NATO allies' participation in coalition operations may become increasingly marginal and could ultimately erode the Alliance. If a compelling threat should emerge, the result would be a weakened NATO capability to respond. In short, the stakes of lack of interoperability are high.

If there are near-term challenges to the interoperability of U.S. and NATO allies' air forces, the far-term challenges may be even more sobering. At its most fundamental level, JV 2010 represents an objective design point for future U.S. military forces, doctrine, organization, training, and equipment. Thus, unless NATO—selectively or as a whole—moves toward a parallel or complementary design point, interoperability may become an increasingly difficult problem.¹³

Because NATO allies may ultimately need to interoperate with U.S. JV 2010 forces, it is essential, as a first step, to describe JV 2010 in tangible terms to reveal potential future interoperability needs. We describe JV 2010 below in terms of top-level operational concepts, along with the emerging systems, standards, doctrine, organization,

¹¹The United States has a margin in many capabilities, including stealth, standoff and cruise missiles, and information.

¹²Indeed, the U.S. focus on the effectiveness and efficiency of military operations may not be shared by its NATO allies, some of whom may place a higher premium on consensus and equity.

¹³An issue for further study centers on the best U.S. strategies for achieving interoperability with NATO allies. An alternative to NATO-wide interoperability efforts would be to pursue bilateral or multilateral interoperability initiatives with selected or key allies. For example, one strategy would be to invest heavily in improving interoperability with the largest allies, including the United Kingdom, Germany, France, or Italy, which have relatively robust air capabilities. Another strategy would be to focus on smaller allies such as Denmark and Norway, which are more inclined to buy U.S. equipment and will need to integrate with a larger ally such as the United States to have access to the full suite of air and C3ISR capabilities.

and training and exercise options that may provide the enabling capabilities for performing these missions.

Top-level DoD guidance such as JV 2010 and Air Force *Global Engagement* postulate new military operational concepts: precision engagement, dominant maneuver, focused logistics, and full-dimensional protection.¹⁴ These concepts are enabled by improved C2 and intelligence assured by information superiority, which is in turn made possible by the dramatic advances in information technologies (e.g., navigation, guidance, computers, and communications) and new ways of doing business that rely on off-the-shelf technologies and commercial standards and solutions.

The major improvements in C3ISR capabilities envisioned in JV 2010 may enable new operational concepts and activities. Improvements in information and systems integration technologies will also affect future military operations by providing decisionmakers with accurate and timely information. Information technology will improve the ability to see, prioritize, assign, and assess information. The fusion of all-source intelligence with the fluid integration of sensors, platforms, command organizations, and logistic support centers will allow a greater number of operational tasks to be accomplished faster.

Advances in computer processing, precise global positioning, sensor technologies, and telecommunications will allow for the accurate determination of locations of friendly and enemy forces as well as the ability to collect, process, and distribute relevant data to thousands of locations. Forces harnessing the capabilities potentially available from this “system of systems” will gain dominant battlespace awareness—an interactive “picture” that will yield much more accurate assessments of friendly and enemy operations. Although this interactive picture will not eliminate the fog of war, dominant battlespace awareness will improve situational awareness, decrease response time, and make the battlespace considerably more transparent to those who achieve it.¹⁵

¹⁴See Appendix B for definitions of these new operational concepts. See also Chairman of the Joint Chiefs of Staff (1996).

¹⁵*Ibid.*

We next describe three overarching concepts that characterize the contribution of C3ISR assets to future force-level and unit-level air operations: precision strike, network-centric collaborative operations, and dynamic assessment, planning, and execution (DAPE).

Precision Strike

Precision strike operations are the precise application of weapons against critical points of individual targets or nodes of target sets to achieve damage with increased efficiency and minimal collateral damage. The development and fielding of a large number and variety of all-weather PGWs, and the increasing availability of precise information provided by ISR assets are the key enablers for such operations. U.S. investment in such capabilities proved their value in recent coalition operations. NATO allies have recognized the value of such systems but have yet to make comparable investments.

Network-Centric Collaborative Force-Level and Unit-Level Operations

A network-centric collaborative environment for future force-level and unit-level assessment, planning, and execution will ensure unity of effort (attainment of commanders' objectives) while providing all relevant parties easy access to the right data, at the right time, in proper format, at the right locations, and at the right security level. In this concept, access to information would be provided on a global grid consisting of terrestrial, airborne, and space connectivity assets. Information for the grid would be provided by a wide range of sensors balanced with data analysis resources. Unity of effort and maintenance of control are to be achieved through new network protocols (policy, semantics, and procedures) that tie together sensor collection, data analysis resources, and decisionmakers (e.g., planners, controllers, and shooters).

Five key prerequisites for such a distributed collaborative environment are (1) sensors capable of collecting (night and day and in poor and good weather) accurate and sufficient data on a wide range of stationary and mobile targets across the battlefield, (2) sufficient analytical resources to exploit collected data in a timely fashion, (3) enhanced decision aids, (4) robust multilevel security communica-

tions, and (5) trained personnel who can operate confidently in such an environment. To accomplish this, major impediments to information sharing and the current predilection for collocated operations (with face-to-face contact) as opposed to distributed operations will have to be overcome.

Dynamic Assessment, Planning, and Execution

Implicit in JV 2010 is the DAPE concept. The traditional 72-hour ATO process will have to be modified to allow for the retasking of substantial numbers of air missions to address time-critical targets. A necessary enabler for DAPE is timely and accurate situation awareness of adversary forces, U.S. and coalition partner forces, and neutrals. A common operational picture (COP), a common tactical picture (CTP), and a single integrated air picture (SIAP) will provide operators with data needed for situational awareness. However, full use of these data requires evolution in doctrine and tactics, new weapon systems, C2 decision aids, and operators trained to perform in such an environment. There must also be recognition that traditional, deliberate ATO planning will still take place. Such capabilities are currently under development.

These top-level concepts of JV 2010 are likely to reveal—or produce—additional interoperability gaps between U.S. and NATO allies' air forces and, if left unattended, will lead to even wider gaps in capabilities.

Defence Capabilities Initiative

Recognizing that these and other shortfalls exist among its members, NATO endorsed the Defence Capabilities Initiative in April 1999 to meet the challenges of the present and foreseeable security environment¹⁶ The most important areas identified for improvement were the deployability and mobility of Alliance forces, their sustainability and logistics, their survivability and effective engagement capability, and the necessary C2 and information

¹⁶See Solana (1999).

systems.¹⁷ Note that these improvements are needed not only for future NATO air operations but also for other future coalition air operations in which NATO members are likely to participate.

Both the former and the current NATO Secretary General have indicated that addressing these shortfalls will require increased defense expenditures by the NATO allies:

It's a matter of political will and harmonizing Europe's military industries, but most of all it's a matter of money. It's hard to say just how much will be enough. Defense budgets will have to rise, but we could accomplish a lot just through better coordination of the way we spend our money.¹⁸

That [getting relevant capabilities for the future] means we've got to reorder spending priorities and, in a lot of countries, spend more on defense if we're going to have the investment in security for the future that the continent needs.¹⁹

With current budgetary constraints and weak public support in some countries for defense expenditures, it is not clear that the NATO allies will make the necessary investments by increasing the defense budget or by shifting resources from personnel and operations and maintenance to investment to acquire the needed capabilities.²⁰ According to Secretary of Defense William Cohen: The challenge Europe faces today is to turn words into action.²¹

¹⁷See NATO (1999b).

¹⁸Javier Solana as quoted in Drozdiak (1999).

¹⁹George Robertson as quoted in Dahlburg (1999).

²⁰According to the U.S. General Accounting Office, NATO countries have made some progress since 1991 to increase the mobility and deployability of their forces to conduct out-of-area offensive campaigns, but "the alliance still faces challenges to continue to improve mobility and deployability capabilities" (GAO, 1999, p. 6). During the Cold War, this capability was not needed, as the countries were planning to fight in place with logistical support provided by fixed facilities.

²¹See Cohen (1999).

CASE STUDIES

In the next six chapters, we examine key ongoing U.S. and allied programs that have major implications for future interoperability, from the strategic down to the technological level, and suggest actions the U.S. Air Force can take to address interoperability challenges that the U.S. and NATO allies' air forces will face over the next decade. Mindful of the current budgetary environment on both sides of the Atlantic, we emphasize lower-cost short- and medium-term solution directions (e.g., actions regarding organizations, doctrine, standard setting, and systems based on available information technology rather than new, major weapon programs)²² that will encourage the United States' NATO allies to "turn words into action."

²²This does not imply that efforts such as NATO's Alliance Ground Surveillance capability and the Joint Strike Fighter should be abandoned but rather that a common platform approach should not be the dominant factor in addressing interoperability challenges.