Chapter Four

MITIGATING THE EFFECTS OF TECHNOLOGICAL DISPARITIES

To address the incompatibility problems that arose in past coalition operations, U.S. military planners had to devise a variety of mitigation measures. Some were long-term, continuous efforts; others were applied just before or during deployment. This section analyzes the mitigation measures from past operations, considers their relevance in the Army XXI era, and offers a framework to assist U.S. planners in mitigating coalition incompatibility.

LESSONS LEARNED FROM PAST OPERATIONS

The case studies summarized in Chapter Two provided a number of useful lessons for mitigating the technical, operational, and political effects of technological disparities. Table 4.1 lists the various mitigation measures adopted during the three operations. Broad categories of problems arising from technology gaps are presented in the first column. These are separated into (1) C4I, (2) logistics and deployability, and (3) doctrine, procedures, and employment. The second column addresses whether the mitigation measures undertaken were technological, operational, or organizational in nature. The third, fourth, and fifth columns list the mitigation measures employed in each operation.

1The technological disparities can actually cause problems between national governments participating in the coalition. For instance, political problems may arise when a country wishes its contingent to be assigned a prestigious mission despite its lack of technological sophistication.
Table 4.1
Incompatibility Mitigation Measures, by Problem and Operation

<table>
<thead>
<tr>
<th>Problems</th>
<th>Iraq</th>
<th>Haiti</th>
<th>Bosnia</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4I</td>
<td>• C4I liaison</td>
<td>• C4I liaison</td>
<td>• Commercial SATCOM</td>
</tr>
<tr>
<td></td>
<td>• Equipment</td>
<td>• Equipment</td>
<td>• Exercises</td>
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<tr>
<td></td>
<td>• Training</td>
<td>• Training</td>
<td></td>
</tr>
<tr>
<td>Organizational</td>
<td>• Geographic separation</td>
<td>• Geographic separation</td>
<td>• Geographic separation</td>
</tr>
<tr>
<td></td>
<td>• C3IC</td>
<td>• Preplanning</td>
<td>• Preplanning</td>
</tr>
<tr>
<td>Technological</td>
<td>• Loaned equipment</td>
<td>• Loaned equipment</td>
<td>• Loaned equipment</td>
</tr>
<tr>
<td></td>
<td>• Common equipment</td>
<td>• Some COTS</td>
<td>• Common equipment</td>
</tr>
<tr>
<td></td>
<td>(for some allies)</td>
<td></td>
<td>(for some allies)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Joint development</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• COTS</td>
</tr>
<tr>
<td>Problems</td>
<td>Iraq</td>
<td>Haiti</td>
<td>Bosnia</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>Logistics and Deployability</strong></td>
<td>Operational</td>
<td>Operational</td>
<td>Operational</td>
</tr>
<tr>
<td></td>
<td>Forecasting coalition needs</td>
<td>Forecasting coalition needs</td>
<td>Forecasting coalition needs</td>
</tr>
<tr>
<td></td>
<td>Phased deployment</td>
<td></td>
<td>Phased deployment</td>
</tr>
<tr>
<td></td>
<td>Geographic separation</td>
<td>Geographic separation</td>
<td>Geographic separation</td>
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<tr>
<td></td>
<td>Stovepiping</td>
<td></td>
<td>Stovepiping</td>
</tr>
<tr>
<td><strong>Organizational</strong></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Geographic separation</td>
<td>Geographic separation</td>
<td>Geographic separation</td>
</tr>
<tr>
<td></td>
<td>Stovepiping</td>
<td></td>
<td>Stovepiping</td>
</tr>
<tr>
<td><strong>Technological</strong></td>
<td>Loaned equipment</td>
<td>Loaned equipment</td>
<td>Common (some loaned) equipment</td>
</tr>
<tr>
<td></td>
<td>Common equipment (for some allies)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Doctrine, Procedures, and Employment</strong></td>
<td>Operational</td>
<td>Operational</td>
<td>Operational</td>
</tr>
<tr>
<td></td>
<td>Predeployment exercises and predeployment exercises with allies</td>
<td>Predeployment exercises</td>
<td>Predeployment exercises</td>
</tr>
<tr>
<td></td>
<td>Liaison</td>
<td>Liaison</td>
<td>Liaison</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geographic separation</td>
<td>Geographic separation</td>
<td>Geographic separation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Common doctrine and procedures</td>
</tr>
<tr>
<td><strong>Technological</strong></td>
<td>Loaned equipment</td>
<td>Loaned equipment</td>
<td>Common (some loaned) equipment</td>
</tr>
<tr>
<td></td>
<td>Common equipment (for some allies)</td>
<td></td>
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</tbody>
</table>
As Table 4.1 illustrates, some mitigation measures were robust across operations, while the employment of others depended on the circumstances of each deployment. For instance, equipment was loaned in all three operations, but only IFOR benefited from common doctrine and procedures.

Some measures were not only adopted across operations, but were also helpful in solving incompatibility problems of different types in each deployment. For instance, geographic separation and loaned equipment were useful in minimizing the effects of technological incompatibility in the areas of C4I, logistics/deployability, and operational concepts. Both measures dampened the harmful effects of incompatibility, either by minimizing contact among contingents or by preventing the use of incompatible equipment. A related enabling factor was the role played by the United States in organizing and conducting each operation. Many mitigation measures were feasible only because of the strong U.S. presence. Across the case studies, virtually all the equipment loans, liaison, and C4I support originated from American forces.

**Fixes and Workarounds**

A closer look at Table 4.1 suggests a useful distinction. Problems arising from technological incompatibilities may be addressed in two broad ways: either through “fixes” or through “workarounds.” “Fixing” a problem involves reducing incompatibility at its roots through sharing technology or developing long-term combined policies and planning to bridge technology gaps with nontechnological means. For example, multilateral technology research and development is a fix, as is the development of combined doctrine. “Workarounds,” by comparison, seek to reduce the effects of incompatibilities rather than reducing the incompatibilities themselves. Geographic separation of incompatible contingents is a workaround widely used in past operations.

Among the mitigation measures that would qualify as fixes are the following:

- **Technological cooperation:** a long-term solution involving cooperative ventures, joint development, standard-setting, and shared research. For alliances, this also involves devising com-
mon communications and information systems. By definition, it cannot be undertaken in the face of a crisis.

- **Common equipment**: the joint procurement of the same assets and systems in order to align operational and technological capabilities, as well as to simplify logistics and other support functions. Common equipment can be encouraged through foreign military sales (FMS).

- **Regular training and exercises**: a sustained effort, allowing armed forces to maintain compatibility over an extended period. Such training and exercises can also allow coalition partners to develop capabilities they otherwise would not have had. Programs such as the International Military Education and Training (IMET) program and NATO’s Partnership for Peace (PfP) initiative represent examples of this fix.

- **Cooperative doctrine and planning**: coordinated development of operating procedures to ensure consideration of, and compensation for, various partners’ capabilities, objectives, and standards. Such efforts also ensure mutual understanding of terminology.

Various workarounds include the following:

- **Geographic separation**: placing national contingents, usually at the division level or above, in sectors, allowing them to operate relatively independently, and thereby avoiding problems of language, operational, and technological compatibility. Integration at the division level or above would make less relevant those compatibility problems that can arise from different support structures and combat equipment.

- **Predeployment planning**: identifying incompatibilities and working with partners to develop an operational concept that minimizes them. Preplanning also involves forecasting coalition needs before deployment and attempting to meet those requirements.

- **Loaned equipment**: a much shorter-term alternative to common equipment, in which the countries with the more sophisticated equipment provide their systems (sometimes with related training) to partners for the duration of an operation.
• **Reliance on commercial, off-the-shelf equipment**: a coalition-wide decision, in the absence of enemy countermeasures, to operate with commercial equipment (such as satellites and radio transmitters) to which all partners have equal access.

• **Phased deployment**: deploying the most capable forces first, then following up with the other contingents once the situation is stabilized.

• **Predeployment training, liaison teams**: more capable partners provide training, equipment and operators, or advice to less capable partners to enhance the latter’s ability to conduct more sophisticated operations (thereby preventing an entire coalition from being drawn down to the lowest common denominator).

Workarounds tend to be much cheaper than fixes, can be undertaken much more quickly, and can temporarily address significant problems with relatively little short-term effort. On the other hand, workarounds may create other rifts within the coalition. Geographic separation, for example, can increase the vulnerability of weaker contingents and may be politically unpalatable (if a government is unsatisfied with the placement of its contingent or refuses foreign training). Moreover, workarounds are not usually robust. Loaned equipment must be returned. Phased deployments do not redress the gaps in contingents’ capabilities, they simply sidestep the problems such gaps might cause. And, finally, many workarounds may require some lead time, a luxury that will not always be available.

Fixes, in contrast to workarounds, represent real change; they address the roots of compatibility problems. Their effects, therefore, are often long-lasting. But such benefits come at a price. Fixing compatibility problems entails serious political and economic commitments, often over time, as well as a level of trust between nations that may not exist. At times, it simply may not be possible to “fix” some compatibility problems, either because less capable partner countries do not have the capacity, budget, or organization to adopt more advanced technologies or because political and strategic imperatives preclude such cooperation. At other times, when cooperation with a given coalition partner appears to be a singular event, it may not be worthwhile to allocate significant resources to fixes.
Case-by-Case Characteristics

The case studies also demonstrated that the severity of problems created by technological disparities varied with circumstances. Though it is important to recognize the costs and benefits of workarounds and fixes from the “push” side (their inherent qualities), it is equally important to consider their utility and relative value from the “pull” side (based on the specific problems that arise in a given coalition operation). The case studies indicate that the three variables most likely to determine which mitigation measures are appropriate for a given operation include (1) the degree of integration among the forces (whether the coalition is alliance-based or ad hoc),2 (2) whether the operation in question is high intensity or low intensity,3 and (3) how much lead time is available before the operation. These variations must be taken into account if mitigation measures are to be calibrated to potential problems. To be sure, these three variables cannot cover the entire spectrum of possibilities. However, they are important contextual factors and can lead to useful generalizations.

Table 4.2 compares the various push and pull factors across two illustrative cases: a long-developing/low-intensity operation undertaken by an ad hoc coalition (assuming a severe capability gap between U.S. and other contingents) and a short-notice/high-intensity alliance operation. The bold text indicates fixes, while the rest of the mitigation measures are workarounds.

The table includes two very different cases for illustrative purposes, and it allows some useful comparisons. For example, it is evident that U.S. provision of C4I capabilities, lift, and logistics remains a useful option in both cases. Yet this is an expensive, and potentially compromising, workaround. A fix useful across both kinds of operations and all three problem areas is the sale of U.S. equipment to

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2 Even in ad hoc operations, some coalition partners may achieve a higher level of integration with U.S. forces than others do. For instance, in Desert Storm British and French units were able to benefit from their familiarity with alliance standards and procedures even though the operation was of an ad hoc nature.

3 The intensity of conflict will change according to the type of mission. All other things being equal, an operation other than war (OOTW) with a peacemaking mission (disarming warring factions, capturing war criminals) has a higher intensity than an OOTW whose mission is to patrol and stabilize a given geographic area.
Table 4.2
Push and Pull Factors in Deriving Mitigation Measures

<table>
<thead>
<tr>
<th>Problems</th>
<th>Ad Hoc, Low Intensity, Long Lead Time</th>
<th>Alliance, High Intensity, Short Lead Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4I</td>
<td>Provide C4I, liaisons; IMET, predeployment MTTs; develop intel-sharing protocols</td>
<td>Provide C4I, liaison; develop combined exercise training and intel-sharing protocols</td>
</tr>
<tr>
<td>Operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational</td>
<td>Establish lead-nation C2 structure, geographic separation; set up C3IC</td>
<td>Integrate C2 structure, forces; or establish geographic separation</td>
</tr>
<tr>
<td>Technological</td>
<td>Loan/share/sell equipment; rely on lowest common denominator, COTS, SATCOM</td>
<td>Loan/share/sell equipment; rely on lowest common denominator, jointly develop equipment; rely on COTS, SATCOM where not compromised</td>
</tr>
<tr>
<td>Logistics and Deployability</td>
<td>Phase deployment; provide logistics and lift; lease lift, local transportation</td>
<td>Implement combined total asset visibility (TAV); provide logistics and lift; preposition materiel; lease local transportation</td>
</tr>
<tr>
<td>Operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational</td>
<td>Establish geographic separation; stovepiping</td>
<td>Develop combined, complementary lift and logistics planning and structure; or stovepipe</td>
</tr>
<tr>
<td>Technological</td>
<td>Loan/share/sell equipment</td>
<td>Share, co-develop TAV capabilities; coordinate procurement to ensure compatibility</td>
</tr>
</tbody>
</table>
Table 4.2—continued

<table>
<thead>
<tr>
<th>Problems</th>
<th>Ad Hoc, Low Intensity, Long Lead Time</th>
<th>Alliance, High Intensity, Short Lead Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Doctrine, Procedures, and Employment</strong></td>
<td>Provide liaisons; IMET; predeployment MTTs, standardized and predeployment exercises; invite LNOs to TRADOC, War College, other Army centers; provide missing capabilities (e.g., force protection); establish a quick reaction force</td>
<td>Develop combined doctrine, training, exercises, exchanges, etc.; provide missing capabilities (e.g., force protection); and compensate in combined planning</td>
</tr>
<tr>
<td><strong>Organizational</strong></td>
<td>Establish lead-nation C2 structure, geographic separation</td>
<td>Integrate command structure, forces; partly rely on geographic separation</td>
</tr>
<tr>
<td><strong>Technological</strong></td>
<td>Loan/share/sell equipment; rely on COTS</td>
<td>Loan/share/sell equipment; co-develop equipment and materiel; establish compatibility protocols</td>
</tr>
</tbody>
</table>
alies and potential coalition partners. But this may be ruled out as an option by a series of factors, including U.S. national security concerns and potential partners’ budgetary constraints. Geographic separation appears to be a fairly robust workaround across all the potential problem areas within both kinds of operations, although it is less desirable than integration since it is less efficient and reinforces fault lines between coalition partners. It would also prove unsuitable in fast-paced, high-intensity conflicts that demand rapid movements across different zones of the battlefield.

There are, of course, intervening combinations of the three variables. In addition to the two cited in the table, it is also possible to have (1) ad hoc low-intensity operations with short lead times, (2) ad hoc high-intensity operations with long lead times, (3) ad hoc high-intensity operations with short lead times, (4) alliance low-intensity operations with long lead times, (5) alliance low-intensity operations with short lead times, and (6) alliance high-intensity operations with long lead times.

The eight possible variations of operations can be reduced into three types for analytical purposes. The degree of integration in a coalition appears to be a key influence on which mitigation efforts will be most feasible and appropriate. This in turn reflects the fact that integration is likely to happen with competent and fairly modern militaries, such as NATO armies. Whether an operation has long or short warning appears to be the second-most influential factor. Although the intensity of an operation will determine how important it is to respond to problems arising from technological disparities, it does not seem to be a critical factor in shaping the appropriate response.

Examining the compressed framework (see Appendix B) facilitates a systematic analysis of the complex interactions between types of

- problems arising from technology gaps;
- coalition operations; and
- mitigation measures.

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4If the United States wanted to establish integrated operations with countries outside established alliances (such as Saudi Arabia), it would have to face a very difficult set of compatibility challenges.
Arguably, the most challenging problems will arise in short-term high-intensity operations, in which forces are closely integrated. The high level of integration may be desired either because the operation is being undertaken by an alliance such as NATO, or because geographic separation is deemed to be ineffective. These problems can best be addressed with fixes, which by their nature are easiest to implement within alliances. In this case the framework would prescribe a set of NATO-style initiatives on joint doctrinal development, technology sharing, and other forms of cooperation. Failures to coordinate and cooperate in preparation for such conflicts (whether as a result of parochial industrial interests or national security concerns) will be costly, since workarounds are unlikely to suffice. In contrast, even though some fixes, such as international military education and training (IMET) and foreign military sales (FMS), will help prepare the United States and potential partners to operate in ad hoc coalitions, workarounds will probably remain necessary. Though not ideal, workarounds have proved sufficient in past low-intensity operations, especially when there was time before deployment to conduct combined exercises and training, develop operational protocols, and define an acceptable C2 structure.

More generally, the framework helps to set priorities by suggesting which mitigation measures apply to more than one type of problem and/or to more than one type of operation, and by identifying which are most crucial (those that enable a strong multinational response to high-intensity short-warning operations). It indicates the value of engagement and long-term preparation for coalition operations. It also makes clear which workarounds are likely to be necessary, suggesting that ready-to-apply protocols and procedures can yield great benefits immediately before and during deployment. Although the framework could be pulled off the shelf to help guide operational planners when a contingency is imminent, it is better applied as a longer-term planning tool for guiding engagement efforts (fixes, in effect) and preparing U.S. military leaders in the likely event workarounds are necessary in future multilateral operations.

5IMET is funded at extremely low levels, limiting the amount of military-to-military interaction possible. Moreover, foreign military sales are declining substantially and are influenced by political and domestic economic decisions that limit their utility as coalition-strengthening mechanisms.
APPLICATION OF MITIGATION MEASURES IN THE FORCE XXI ERA

As discussed in Chapter Three, the types of coalition problems likely to arise from technological incompatibilities in the Army XXI era will differ more in degree than in type from those encountered in the past. Although many of the mitigation measures that worked in the past will remain relevant for at least the next 15 years, the widening technological gap will require a different balance of such measures.

What will be different? Within the NATO alliance, most key weapons capabilities will be roughly compatible. That will not be the case with most countries’ armies, however. In ad hoc coalitions involving less sophisticated national contingents, the United States will need to find ways to mitigate the substantial gaps in mobility, standoff and precision strike capabilities, and force protection.

Digitization will cause more serious compatibility problems in both alliance and ad hoc coalition operations, affecting every aspect of a deployment. The disparity in capabilities will be great enough so that equipment sharing or loans will not be viable options unless there is ample time before an operation to train foreign forces on sophisticated technologies. Selling equipment may also prove problematic in several cases, either because of U.S. national security concerns or because of prohibitive costs. Geographic separation, a steadfast workaround from past operations, may no longer be possible on the nonlinear and fast-changing battlefields of digitized warfare. Longer-term fixes such as the development of combined technologies may become more difficult than in the past, given the sheer complexity (and cost) of new systems. With the rapid advancement of technology, maintaining compatibility across hardware and software will be a persistent challenge.

Some mitigation measure variants could include

- loaned C4I equipment and “digitization” liaisons;
- tagging nondigitized units;
- mission separation;
- allowing interface with less sophisticated C4I systems;
Mitigating the Effects of Technological Disparities

- technological cooperation;
- common equipment;
- regular training with Army XXI units; and
- gaming and simulation to identify and respond to potential problems.

The first four are workarounds; the latter four are fixes. As discussed below, even workarounds may require long-term planning in the Army XXI era.

**Loaned C4I Equipment and “Digitization Liaisons”**

Although Force XXI experimentation has not specifically addressed the compatibility problems of coalition warfare, it has considered workarounds to improve the battlefield coordination of units with varying levels of digitization. For instance, during the recent Division XXI Advanced Warfighting Experiment (AWE) at the National Training Center, liaison teams proved essential for sharing command and control information when more digitized information transfers were impossible. Liaison teams also served as bridges between adjacent nondigitized units. Other possible solutions include providing C2 systems to selected units joining the digitized force.6

Using “digitization liaisons” and loaning C4I equipment are workarounds similar to those employed to mitigate past incompatibility problems. In principle, therefore, they should be applicable not only to nondigitized U.S. forces, but also to nondigitized coalition partner forces. These workarounds require far more technology—which will have to be provided by the United States—than in previous cases.7 Furthermore, in the case of equipment loans, coalition partners may be able to operate complex U.S. battle man-

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6Specifically, the Army could provide appliqué/Force XXI Battle Command—Brigade and Below (FBCB2) systems to selected units.

7It has been estimated that in a digitized unit the liaison officer would require a vehicle with 2x FM radios, tactical satellite communications (TACSAT), mobile subscriber equipment (MSE), enhanced position location and reporting system (EPLRS), and the Force XXI Battle Command—Brigade and Below (FBCB2) command and control system in order to be effective.
agement systems only after extensive training. This implies that, where feasible, the level of preplanning necessary for using liaisons and loaning equipment to allies should be greater than in the past.

**Tagging and C4I “Backdoors”**

Not all workarounds have to entail complex solutions, however. Two relatively simple mitigation measures would consist of retaining a lowest common denominator capability to ensure that nondigitized or digitized formations running on earlier technology can communicate with the most sophisticated digitized units (such an effort might be termed the use of “analog backdoors”). This solution has already been recognized by U.S. military planners and is likely to be implemented in the future. The second relatively simple solution would consist of electronically tagging nondigitized coalition units in order to monitor their movement on the battlespace. One could augment this approach by adding sensors to allied equipment. The sensors’ data output would be processed by U.S. C4I systems. Such a workaround would allow U.S. troops to have a more complete picture, although it would not increase the situational awareness of coalition partners.

**Mission Separation**

As stated before, a strategy of parceling zones to U.S. and partner forces based on their different capabilities can be problematic in Army XXI operations. Unlike traditional battlefields, terms such as center and flanks may become blurred in fast-paced Army XXI deployments. As the battle becomes deeper, separate operations from different starting points will merge and share the same geographic space.8

In the Army XXI era, assuming nonlinear, standoff operations, geographic separation may be less appropriate than mission separation. The U.S. Army, for example, will be ideally suited to deep, offensive battlefield operations. Other coalition members with slower forces and less technologically advanced communications systems might

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8Gompert, Kugler, and Libicki, op. cit., p. 37.
more appropriately take on offensive urban area missions or assume defensive or stability and support responsibilities. Although mission separation will be vulnerable to the same kinds of political sensitivities as geographic separation, it will allow each coalition member to contribute at its own level and would be a realistic response to capabilities gaps. This approach would also enable the more capable partners, such as NATO allies, to be involved in more challenging missions, perhaps alongside U.S. forces. Mission separation and geographic separation may become identical tasks in operations where the battlefield is static, such as in a peacekeeping and stabilization mission.

**Technological Cooperation**

The United States has already devised programs to foster technological cooperation, especially with NATO allies. Efforts in the field of C4I harmonization, as laid out in the Army’s International Digitization Strategy, should be expanded and refined to cover key coalition C4I capabilities. Another example of high-leverage technological cooperation is the recently signed agreement on coalition artillery support. The United States, Great Britain, France, and Germany

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9 These include the C4I agencies of NATO’s Military Committee, the C4I-related groups under NATO’s Conference of National Armaments Directors, the Army Tactical Command and Control Information Systems (ATCCIS) under SHAPE, the Quadrilateral Armies Communications Information Systems Interoperability Group (QACISfG), Artillery Systems Cooperation Activities (ASCA), the Low-Level Air Picture Interface (LLAPI), the ABCA working group on C4I, the C4I Defense Data Exchange Program (DDEP), the Multinational Interoperability Program (MIP), and regular C4I staff talks. The Theater Commanders-in-Chief (CINCs) also regularly plan C4I exercises and engagement efforts with theater allies. See *Tactical Coalition Interoperability*, ADO Briefing, March 16, 1999. Available on the Internet at http://www.ado.army.mil/Br&doc/TIC/TCI/index.htm.

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have agreed to develop interfaces to each other’s artillery support C2 systems, with Italy soon to follow.\textsuperscript{11}

Perhaps the most comprehensive technological cooperation effort that Army planners should consider is NATO’s Defense Capabilities Initiative (DCI), unveiled at the NATO Washington Summit in April 1999.\textsuperscript{12} DCI seeks to improve technological and industrial collaboration within NATO by focusing on key systems and capabilities, such as precision-guided munitions, C4I interoperability, transport assets, airborne ground surveillance systems, and integrated logistics. Within the context of DCI, NATO will establish a multinational logistics agency and devise a new alliance-wide C4I network by 2002.\textsuperscript{13} DCI’s focus on logistics is warranted, since compatible C4I alone cannot ensure that coalition forces will be as maneuverable and sustainable as their Army XXI counterparts.

Common Equipment

Technological cooperation can also lead to common C4I solutions and weapon systems. Other programs such as foreign military sales can provide key allies with equipment that will make their participation in an Army XXI coalition more compatible (e.g., deep fires).\textsuperscript{14}


\textsuperscript{14}The Assistant Secretary of the Army (Acquisition, Logistics, and Technology) as well as the International Programs division of the Army Materiel Command (AMC) are currently coordinating the development and acquisition of common equipment. Relevant activities include technology exchange and co-development of equipment, systems, and components. The aim is to introduce shared or at least compatible standards in a number of areas, including information exchanges, integrated force management, and employment of precision forces.
Long-Term Training and Planning

Army XXI makes the requirement of training and planning more important than ever, since several Force XXI concepts are still being developed and their impact on coalition operations has yet to be explored. The United States could take advantage of its current cooperation structures, such as IMET and NATO, to encourage training between Army XXI units and counterparts from other countries. The U.S. Army should continue to plan for coalition command post exercises and advanced warfighting experiments (probably at a smaller scale for cost considerations) with key allies, in order to identify problem areas and solutions. Force XXI–specific long-term planning and training should also be useful in reconciling Army XXI doctrine with the operational concepts of partner forces.

Gaming and Simulation

Gaming and simulation should be particularly useful in identifying the requirements for workarounds and fixes, as well as the optimal balance between these two mitigation approaches. These techniques have been embraced at the joint level; for instance, Joint Vision 2010 argues that

> simulations must be interconnected globally—creating a near-real-time interactive simulation superhighway between our forces in every theater. Each CINC must be able to tap into this global network and connect forces worldwide that would be available for theater operations.

Moreover, the U.S. Atlantic Command intends, ultimately, to establish a system enabling anyone with C4ISR equipment to be able to “plug and play in Distributed Joint Training activities.”\(^\text{15}\) Such modeling and simulation can help planners anticipate and adjust for incompatibility-related problems in coalitions as well. NATO is the primary candidate for hosting coalition warfare simulations, given the relatively high technological sophistication of its members. At

the same time, the United States needs to involve less sophisticated friendly armies in its gaming activities, since not all U.S. Army operations will be undertaken exclusively with NATO allies.

DTLOMS IMPLICATIONS

Doctrine

Coalition requirements and Force XXI have thus far been dealt with separately in doctrine. Although some of the Force XXI documents refer to the need to ensure interoperability, they do not explicitly guide such efforts. Likewise, doctrine addressing the MFC requirements—such as Field Manual 100-8, *The Army in Multinational Operations*—focuses on issues likely to be relevant immediately before and during a multinational operation. Future doctrine should address these gaps by highlighting the potential operational problems of Army XXI coalition operations. Such doctrinal discussions should also incorporate those measures that can be undertaken to mitigate incompatibility problems, both long before and immediately prior to deployment.

Training

As mentioned above, continued and, in some cases, increased combined training and IMET activities will improve military-to-military familiarity, allowing planners to identify and prepare for or eliminate capability gaps. Such efforts should also include standardized joint and combined simulations and modeling.

Leader Development

Army leaders should be trained and educated to balance the benefits of Force XXI developments against the requirements of coalition operations across the spectrum of conflict. Army leaders will need to understand under what circumstances technology gaps will lead to serious technical, operational, and strategic problems. The use of the framework outlined above should help leaders conceptualize and respond effectively to the tension between Force XXI priorities and coalition demands.
Organization

At the broadest level, existing alliances and organized engagement activities (such as NATO’s Partnership for Peace) will remain important means for ensuring compatibility even in the face of technological disparities. Within the U.S. military, the Joint Training Analysis and Simulation Center (JTASC) should be enhanced or augmented to allow more focused attention to the requirements of multinational force operations. Similarly, the U.S. Army’s Simulations Integration Division (SID), advanced warfighting experiments, and Battle Command Training Teams (BCTTs) should test and train for Army XXI participation in coalition operations. The U.S. Army should continue to plan for a series of multinational exercises involving Army XXI technology, including a remote command post exercise in 2000, a centralized command post exercise in 2001–2002, and a multinational AWE in 2004.16

Materiel

Coalition requirements should help guide how and how much materiel is procured. Quantities considered adequate in a lean, unilateral Army XXI operation, for example, are unlikely to be sufficient in a multinational context. Some slack may have to be built into plans for multinational operations in order to support liaisons and/or shared equipment. Additionally, backdoor technologies to facilitate C4I and logistics coordination among technologically incompatible coalition partners should be available to provide a lowest common denominator capability.

FINAL OBSERVATIONS: TOWARD A BROADER MFC STRATEGY

The framework developed in light of the case study findings will continue to be useful in the Army XXI era, as will the more general lessons concerning the desirability of fixes and workarounds, the requirements for engagement, and the need to anticipate future coalition requirements. The U.S. Army could pay a high price for

underestimating and failing to prepare for the coalition compatibility problems caused or exacerbated by Force XXI developments. For a future operating environment in which

- the United States cannot afford to operate consistently alone;
- there is a need to hedge against short-warning conflicts, and to promote early intervention;
- variations in capability can create vulnerabilities within a coalition; and
- differences in objectives or rules of engagement can cause the disintegration of coalition efforts or a strategic loss

it will be increasingly important to conduct long-term multilateral planning, research and development, and procurement so as to best ensure future coalitions’ compatibility and/or complementarity. This suggests a requirement for continued, if not increased, military-to-military engagement in conjunction with the U.S. Army’s technological and doctrinal evolution.

Indeed, in many respects, the U.S. Army is in a historically strong position from which to influence both its own future and that of the broader international security environment. As its modernization efforts set the standards to which other advanced armies will aspire, its engagement efforts can help ensure cooperative and constructive relations with foreign militaries—relations that will help ensure not only technological but also operational and political compatibility over time. With the potential for short-warning contingencies and the need for a rapid response, the types of long-term engagement activities that have underpinned NATO, inspired the American, British, Canadian, and Australian Armies’ Standardization Program (ABCA), and spread U.S. doctrine, equipment, and training worldwide (through IMET, FMS, and other security assistance efforts) will be increasingly important. There may simply be no time to organize last-minute training or protocol development in future coalition operations.

One of the key conclusions from this study is that the optimal combination of mitigation measures depends on the context of each operation. Army planners should develop a comprehensive MFC enhancement strategy that takes into account the compatibility
needs of the different operational categories identified in the framework. For instance, standard workaround packages (consisting of liaisons and loaned equipment) should be devised for ad hoc, low-intensity operations. Tailored MFC plans, with varying emphasis on workarounds and fixes, should be formulated for those countries most likely to contribute to critical, high-intensity conflicts. Elaborating on the specifics of these MFC enhancement packages is beyond the scope of this report, and will be addressed in future research. What is important, however, is that Army planners adopt a systematic approach to MFC enhancement that relies on a mix of ad hoc and long-term activities.

This challenge calls for a broader U.S. Army vision. Rather than treating modernization and coalition-building as separate efforts, the Army can combine them as part of a larger strategy. Bridging the dual pressures for technological development and engagement can be done within the context of long-term Army institutional and operational interests. Such an approach can also help the Army balance its responsibilities and resources in an environment characterized by a broader array of missions and increasingly constrained resources.