Several defense analysts have expressed concern that U.S. modernization initiatives such as Force XXI will outpace similar efforts by partner countries quickly enough to make effective coalition operations much more difficult.\(^1\) This chapter seeks to contribute to the debate by examining the Force XXI process and the modernization efforts of some of the most competent partners—the NATO allies. We then examine the potential incompatibility problems of fielding Army XXI units alongside the forces of less modern allies.

Analyzing the compatibility issues likely to arise in Army XXI coalition operations is an uncertain endeavor. This reflects the fact that Force XXI concepts are currently undergoing a series of experiments—some of which have highlighted operational problems of digitization\(^2\)—and may be altered before the first digitized division is fielded by the end of the year 2000. Informed speculation is possible, however, especially by taking into account Army XXI’s main features and the likely capabilities of allies. Although it is important to


\(^2\)According to a 1997 briefing of the Institute for Defense Analyses (IDA), during an early Force XXI large-scale field trial the new C4I system did not produce the expected increases in lethality, survivability, or operational tempo. The average message completion rate was lower than a baseline set by nondigitized troops before the experiment. Overall, the IDA brief concludes that “there was no compelling evidence of increased lethality and survivability, reduced fratricide or increased OPTEMPO relative to the nondigitized baseline brigades.” The Logistics Command and Control system also performed below expectations, while the tactical operations centers crucial for C2 functions are not mobile and efficient enough. For instance, see “Questions Raised on AWE Successes,” *Defense Week*, October 27, 1997.
recognize that the United States should be prepared to work alongside non-NATO partners, the focus on NATO armies provides a best-case scenario for future MFC.

FUTURE ARMY PLANS AND FORCE XXI

Army XXI is the first stage of the U.S. Army’s effort to achieve “full-spectrum dominance” in prompt and sustained joint operations. The Army’s broader modernization strategy, which includes both Army XXI and the AAN, is based on Army Vision 2010 (the Army’s support for Joint Vision 2010). Army Vision 2010 defines the operational patterns that, combined with high-quality soldiers and technological advances, are expected to provide essential land-power capabilities to future joint operations. Army XXI is the first step in this process. It absorbs the major equipment such as the Apache Longbow AH64D, M1A1 Abrams, and M2A1 Bradley and seeks to optimize their utility through “digitization,” the application of information technologies to acquire, exchange, and employ timely data throughout the operational area.

A key feature of Army XXI is the Army Battle Command System (ABCS), the network of C4I systems that links the Army XXI force. ABCS is a “system of systems” that will provide command and control from the individual soldier up to the theater ground force component commander and beyond. The ABCS will use broadcast battlefield information, including real-time data on friendly and enemy locations as well as information from other sources, to create a graphical depiction of the operation. Army XXI units will no longer rely on the traditional frameworks of battlefield geometry—phase lines, objectives, and battle positions. Instead they will operate on the basis of shared, real-time information about the arrangement of forces on the battlefield.

The tactical interface of ABCS is the Force XXI Battle Command Brigade and Below (FBCB2). FBCB2 gives each soldier the ability to know his or her location, the location of his or her friends, and the location of his or her enemies. Through the graphic interface known as appliqué, FBCB2 provides battlefield information to soldiers by integrating data from GPS and weapons sensors aboard tanks, scout vehicles, and other platforms and from external updates via its digital radio link to an Internet-like data-sharing network. FBCB2 will be
found on every platform from the Land Warrior individual soldier system to the Abrams tank.\textsuperscript{3}

Digitization is therefore expected to release soldiers from the constraints of traditional military organization, offering instead shared situational awareness and information dominance (superior ability to access and manipulate information). More specifically, Force XXI is intended to achieve operational benefits by

- enabling faster and more precise force-tailoring to avoid intermediate staging and assembly requirements, reduce U.S. forces’ vulnerability, and reduce time to combat;
- allowing standoff, nonlinear, dispersed operations through the development of deep precision fire systems such as the Multiple-Launch Rocket System (MLRS) and the Army Tactical Missile System (ATACMS);
- creating superior situational awareness—perhaps the cornerstone of Army XXI—through digitization (of the sort tested at the National Training Center) and the global positioning system (GPS);
- reducing the footprint of U.S. units on the battlefield by operating in a dispersed fashion (as opposed to massing forces) and by relying on defensive electronic warfare systems;
- allowing leaner logistics through Total Asset Visibility (TAV); and
- facilitating split-based operations through advanced telecommunications technologies, thus cutting the costs of deploying support functions such as intelligence nodes, medical specialists, and transportation planners, who can be “beamed in” via telecommunications rather than physically deployed.

Despite its impressive use of new technology, Force XXI is concerned with incremental, evolutionary improvements to the existing Army. Force XXI is rooted in the 1990s Army of Excellence, itself a product

\textsuperscript{3}ABCS has three major components: Force XXI Battle Command Brigade and Below (FBCB2), the Army Tactical Command and Control System (ATCCS), and the Global Command and Control System—Army (GCCS-A). See \textit{Army Weapon Systems Handbook}, 1999, pp. 2–3.
of AirLand Battle doctrine. Clear precursors of Force XXI developments were present in Operation Desert Storm, from superior situational awareness to high-speed operations, massing of effects, and precision deep fires.

In contrast, the AAN offers the potential for a “revolution in military affairs.” The AAN process envisions largely self-deployable air-mechanized raiding units offering strategic reach. The AAN process is expected to innovate both doctrine and force design, not to mention employ revolutionary technology in the areas of vehicle propulsion, logistics, signature control for both ground and aerial vehicles (tilt rotor aircraft and helicopters), and tube weapons. Only a small portion of the Army will be reconfigured for the AAN, acting as a spearhead to shock, stun, and disorient heavier enemy forces until the relatively slower-deploying Army XXI divisions arrive to roll them back and secure victory. The AAN is expected to be in place sometime between 2020 and 2025.

While AAN operations are likely to create radically new MFC requirements, the scope of this analysis is more near term. The following discussion focuses exclusively on the MFC issues likely to arise in Army XXI coalition operations in the next ten to fifteen years.

**Force XXI Doctrine and Multinational Operations**

Force XXI doctrinal publications highlight the requirement to be compatible with friendly forces in coalition operations. Army doctrine places considerable emphasis on the need to ensure compatibility in the areas of C4I and combat service support (CSS). TRADOC Pamphlet 525-5, *Force XXI Operations*, states as a goal that Force XXI operations are to be conducted under conditions where U.S. forces—

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5The 4th Infantry Division at Fort Hood, Texas is slated to become the first digitized division by the year 2000. In the FY02 to FY03 timeframe, the 1st Cavalry Division at Fort Hood will become the second digitized unit. The rest of the fully digitized corps, including Army Reserve and National Guard elements, is scheduled to be completed by FY04.
supported by coalition partners—enjoy an information advantage. To fulfill such a vision, TRADOC Pamphlet 525-66, Operational Capability Requirements, states that Army battle management systems must be interoperable with those of coalition partners. The pamphlet further claims that Army units will “require total, uninterrupted, interoperable communications between government and nongovernment agencies, and joint and combined forces throughout the battlespace from the National Command Authority to operator level.” Moreover, Army XXI units will be expected to “access, leverage and interoperate with multinational organizations and capabilities, as well as to assist in the tracking of friendly forces.”

Aside from the lofty goals for multinational force compatibility, Force XXI doctrine is silent on the issue of what specific problems are likely to arise, and what mitigation measures should be considered. In order to anticipate these, a better understanding of allied modernization efforts is necessary.

WIDENING THE GAP: IMPLICATIONS FOR NATO OPERATIONS

Since the end of the Cold War, most West European militaries have sought to become more modern and acquire new capabilities. They have begun to shift their defense priorities from territorial defense to power projection, developing smaller, more mobile, and more lethal armed forces. This is reflected, as in the United States, by new weapons purchases and an emphasis on digitization.

An assessment of multinational force compatibility must take these advances into account. They may offset the technology gap exacerbated by Force XXI; on the other hand, if the kinds of modernization

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6 Intel XXI—A Concept for Force XXI Intelligence Operations, TRADOC Pamphlet 525-75, November 1, 1996.
and the concomitant development of doctrine and operational procedures do not coincide with—or actually diverge from—U.S. efforts, compatibility problems may be worsened.

Weapon Systems

A brief examination of current and future weapon system acquisitions by European allies can provide some insight into possible incompatibilities with Army XXI. Drawing upon current and projected capabilities, and taking into account budgetary trends and political constraints, Table 3.1 highlights key allied ground force capabilities that might be relevant to coalitions with NATO allies in the near future. This list is not exhaustive. It does not, for example, set out the all-important weapons with which platforms will have to be equipped. Nor does it go into numbers or address operational quality or professional standards. Its accuracy, furthermore, will depend upon individual countries’ own plans over the next few years. Nevertheless, the table offers insights into the relative capabilities of European counterparts.

As the table illustrates, some European allies have in their arsenals key equipment for the conduct of Army XXI operations, such as MLRS and Apache.\(^8\) In other cases, European armies will be able to field counterparts to U.S. systems, as in the case of the Abrams Main Battle Tank, the Paladin,\(^9\) Bradleys, and the Comanche. A number of NATO allies field Patriot systems, some have limited missile defense capabilities, and others will be working with the United States to develop the Medium Extended Air Defense System (MEADS).

A number of European countries have also registered some progress in making these weapon systems more rapidly deployable than in the past. While most NATO allies are only at the beginning of this process, several countries have programs in place to acquire medium- to long-range airlift capability, in the form of C-17s, C-130Js, Antonov An-70s, or the planned Future Large Aircraft. This increased lift

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\(^9\)The Paladin may eventually be overtaken by the Crusader; however, the future of that system is in doubt.
<table>
<thead>
<tr>
<th>System</th>
<th>Foreign Military Sales</th>
<th>Foreign Counterparts</th>
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<tbody>
<tr>
<td>Comanche</td>
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<td>France/Germany (Tiger)</td>
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<td>Apache Longbow</td>
<td>Netherlands U.K.</td>
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<td>Abrams</td>
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<td>France (LeClerc)</td>
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<td></td>
<td></td>
<td>U.K. (Challenger 2)</td>
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<tr>
<td>Bradley Fire Support Team Vehicle</td>
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<td>France (AMX-10, AMX VTT/LT)</td>
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<td>U.K. (MCV Warrior MAOV, FV-432AV)</td>
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<tr>
<td>Bradley M2 Infantry/M3 Cavalry Fighting Vehicle</td>
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<td>France (AMX-10P, AMX VCI)</td>
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<td></td>
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<td>Germany (Marder 1)</td>
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<td></td>
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<td>U.K. (MCV-80 Warrior, FV-432)</td>
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<tr>
<td>Paladin</td>
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<td>France (155 GCT)</td>
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<td>Germany (PzH 2000)</td>
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<td>U.K. (AS90)</td>
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<td>Multiple Launch Rocket System (MLRS)</td>
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<td>Denmark</td>
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<td>Turkey</td>
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<td></td>
<td>U.K.</td>
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<tr>
<td>ATACMS</td>
<td>Turkey (Blocks I/IA)</td>
<td>France (Hades), Blocks I/IA</td>
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<td>Patriota</td>
<td>Germany</td>
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<td>Netherlands</td>
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<td>Joint STARS</td>
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<td>U.K. (Astor)</td>
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<td>MEADSb</td>
<td>Italy/Germany</td>
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**Table 3.1**

**Selected U.S./NATO Allied Army Weapon Systems**


**NOTE:** For a list of programs that deal with interoperability issues, see page 41, footnote 9.

*a* Germany and the Netherlands are currently participating in Patriot acquisition programs.

*b* MEADS is a trinational program between the United States, Germany, and Italy.
capability is extremely important in enhancing compatibility with the United States, since it will allow better synchronization of operations and a more rapid response.

The very existence of the same or comparable European weapon systems, however, does not ensure compatibility with the United States. Such systems may not be connected to command and control systems similar to the ones fielded by Army XXI units, and the doctrine guiding their operations may not be as focused as U.S. doctrine is on maneuver. At the same time, however, similarities between European and U.S. units in terms of the hardware deployed for battle are important. They imply, at the very least, greater potential for technological and doctrinal compatibility. Operations with other coalition partners who do not have similar systems (particularly standoff capabilities) are likely to be more complicated.

**Digitization**

Where a critical gap is emerging between the United States and allied armies is in the digitization process. As mentioned above, digitization underpins Army XXI. Although most NATO allies have sought to enhance their C4I capabilities in recent years, their digitization efforts continue to fall far short of the U.S. Army’s. Of the NATO allies, Britain, France, and Germany have embarked on the most comprehensive ground force digitization programs thus far.

The 1996 British digitization strategy calls for the “provision of modern digital command and control functionality to the army’s formation headquarters [from division headquarters to theater commander],” the creation of an automated battle management

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10For example, the French and German armies have shelved plans to equip the new-generation Tiger attack helicopter with highly advanced information systems. See “Western Europe Delays Military Digitization,” Defense News, October 28, 1997.

11This formation-level capability (FBMS) is to be based on the existing CIS (IARRCIS) deployed with Allied Command Europe’s Rapid Reaction Corps in Germany, and elements of the U.K. Land Command. The revamped Enhanced IARRCIS (also referred to as ATacCS/Army Tactical Computing System) is to enter service next year, providing a client-server architecture and including office automation, messaging facilities, and a geographic information system. See Rupert Pengelley, “International Digitizers Wrestle with Reality,” International Defense Review, September 1997, pp. 38–46.
system that extends down to the weapon platform and dismounted soldier level, and, eventually, the introduction of Britain’s first fully integrated digitized platforms. Other equipment expected to enter service in the short term should also boost British C4I capabilities, including the airborne ground surveillance radar (ASTOR), a battlefield unmanned target acquisition vehicle (PHOENIX), an artillery locating radar (COBRA), and the new generation of battlefield reconnaissance vehicles (TRACER).  

France and Germany have also laid out digitization maps. Budgetary restrictions are likely to slow the implementation of such plans, however. The French army did unveil its new formation-level command information system SICF (Système d’Information du Commandement des Forces) in Bosnia. French land forces are also beginning to develop concepts for digitization at lower levels of command, as in the case of their dismounted-soldier information system demonstrator. French army plans include a three-level battle management system that will be tested by the end of 2000. Following the operational trials, the French will conduct field experimentation of a digital brigade by the end of 2002.

The German army, for its part, is developing its battalion-and-below battle management system (BMS). The system is expected to rely on commercial off-the-shelf (COTS) products and commercial software. Germany will also acquire a command and weapon control system (Fuehrung und Waffen-Einsatz-System, or FuWES). Germany has yet to make provision for appropriate communications systems at platform and soldier levels, however—only about 1,000 VHF vehicular radios have so far been ordered, and all are destined for command posts.

Europeans lag further behind in the deployment of smart weapons and automated logistics systems. NATO allies are unlikely to deploy in the foreseeable future long-range and precise fires, such as

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13 The French army has yet to decide on a platform-level vehicular system to complement the SICF. See Pengelley, op. cit.
15 Pengelley, op. cit.
ATACMS (Block II)-like weapons equipped with Brilliant Anti-Tank (BAT) submunitions. The concept of total asset visibility (TAV) and streamlined logistics systems has also received limited attention by European army planners.

**Potential Problems**

Despite these efforts at digitization, even the most advanced NATO allies have not been able to keep up with the multiple U.S. Army digitization plans. The systems outlined above are not as pervasive, fast, or interconnected as those expected to be fielded by Army XXI units. This is potentially problematic for multinational force compatibility.

The most obvious compatibility problems involve fully digitized units attempting to operate alongside less sophisticated counterparts. The potential effects include compromising and depleting U.S. capabilities (in terms of both combat and combat support), increasing the probability of fratricide, creating unacceptable vulnerabilities among allies or coalition partners, and exacerbating political fault lines in the coalition. Partners with lower operating tempos (OPTEMPOs), lethality, and survivability are more likely to become enemy targets than their Army XXI counterparts. If the United States does not assist with force protection, the viability of the coalition will be threatened politically and operationally. If it does assist with force protection, its own efforts will be slowed and its resources taxed. Similarly, partners with less efficient logistics systems may become targets (if they build up “iron mountains”), requiring U.S. force protection; they may require direct U.S. logistical support; and they may slow the operation.

Incompatible allied units would also be an unexploitable resource for U.S. situational awareness because they would not be able to efficiently report enemy locations and transfer this data into the U.S. tactical Internet. Moreover, partners lacking the level of situational awareness available to U.S. units are likely to be less efficient and effective and even potentially dangerous to the U.S. units if they are not capable of tracking U.S. ground force movements. Such deficits may also lead to U.S. attempts to micromanage coalition partners, with the associated political stresses this may cause.
Fire support coordination and operations in a weapons of mass destruction (WMD) environment will be particularly challenging tasks. Fire support coordination needs to be responsive and backed by highly mobile units with long ranges. The precision of Army XXI fire support will allow such units to assist friendly forces engaged in close combat without a great risk of friendly fire casualties. Standoff fire support from nondigitized units may not be as helpful, since they could not rely on precision weapons and on a real-time picture of battlefield developments. Moreover, Army XXI fire support units may be unable to lay down broad fields of fire if friendly nondigitized forces cannot maneuver quickly enough.16

The threat of WMD further exacerbates incompatibilities between Army XXI and nondigitized partner forces. Army XXI units may be able to better withstand WMD attacks by dispersing, moving rapidly, and by detecting the presence of airborne toxins early on. These options may only be partly available to slower, nondigitized units operating in physically concentrated formations. Such units will either have to dig in to prevent heavy losses or continue moving and suffer significant casualties. In the first case, the coalition operation would suffer because entire contingents would be immobilized; in the second, partner casualties could become a significant burden on the coalition.17

Problems may also arise in coalitions where all members have reached a comparable level of C4I modernization. Even if coalition partners field digitized forces, they may rely on different hardware and/or software, making them technically incompatible with U.S. systems. The likelihood of this problem arising is enhanced by the rate of technological progress, which has already begun to nullify the concept of fielding standardized equipment across the whole of the U.S. Army, much less among allies or coalition partners. Another issue complicating compatibility between digitized national contingents is network protection. Since digitized units will depend heavily upon information, protecting that information will be paramount, with obvious implications for sharing data among digitized coalition units, especially if some field networks are deemed less secure than

16Gompert, Kugler, and Libicki, op. cit., p. 35.
17Ibid., pp. 35–36.
others. Finally, unless C4I modernization is accompanied by an extension of digitization to individual weapon systems, munitions, and combat service support activities, multinational force compatibility is likely to suffer.

The potential for compatibility problems resulting from digitization is thus great. Indeed, the U.S. Army would face similar challenges if it chose to deploy a hybrid force of Army XXI and nondigitized units in the near future. Ensuring compatibility at the joint level is another challenge. From the standpoint of multinational force compatibility, ongoing U.S. Army efforts to ensure internal and joint compatibility in light of digitization efforts can only be beneficial. Particular care will have to be exercised in ensuring that such procedures could be used with coalition units as well.

**SUMMARY**

As in the case studies, the importance of the potential problems described above will vary with each situation. The nature of the coalition will have an impact, since establishing operational compatibility will be more difficult in ad hoc coalitions than in alliances. The nature of the conflict and type of mission can also influence MFC, since the difference in performance between Army XXI and other coalition units is probably greatest in a high-intensity, fast-paced major theater war. The level of coalition compatibility will also be determined by the amount of time to prepare, test, and field different systems before deployment.

Indeed, situational factors will determine how much digital interconnection and data sharing is really needed. It seems quite likely that the cost of incompatibilities is much higher if allied commanders cannot speak to one another and get their objectives and rules of engagement straight, than if lower-level officers, much less soldiers, cannot communicate across national boundaries. This is especially the case for lower-intensity operations that will rely on geographic separation to some extent. In high-intensity warfare the requirements are likely to be greater because of the need for layered leak-proof defenses and because, in nonlinear combat, friendly forces might become entangled geographically.
The lessons from the recent Kosovo crisis may prompt European militaries to invest more resources in intelligence-gathering equipment and combat management systems, including digital C4I, space-based assets, and unmanned aerial vehicles (UAVs). Yet the discrepancy in modernization priorities and budgets between the United States and even its closest allies will increase the likelihood of incompatibilities in any effort. The technology gap that characterized past operations will continue to grow. Overall, it is clear that Force XXI developments will generally exacerbate current coalition problems—technically, operationally, and politically—and will prove more challenging than in the past.

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