1st Marine Division Combat Camera (Brian L. Wickliffe)

Systems Integration and the New American Way of War

By PAUL BRACKEN

There is a new American way of war. As seen in Afghanistan and Iraq it involves winning with smaller, more agile forces, where jointness and networking combine to produce large-scale gains in warfighting. Using this experience to transform the defense and intelligence communities for networked operations is one of the biggest managerial challenges ever undertaken.

Many plans focus on building blocks like doctrine, organization, and technology. That is necessary, but it leaves out one critical element—how the blocks are put together. In a networked force it is more important than ever to ensure proper coordination and timely integration of assets. This is what gives the big payoffs.

Transformation involves various building blocks and different ways of combining them, here designated as systems integration. But organizational skills and capabilities for systems integration have not kept pace with the requirements of the new way of war. Current frameworks and tools reflect the industrial era when most of them were created. That world no longer exists; new approaches are needed.

Instead of focusing on systems integration, transformation is too often regarded as a choice

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between incremental and revolutionary approaches to change. Stated in these terms, the incremental approach often wins out because it appears to be less risky and radical.

But these choices—incremental versus revolutionary change—offer an inadequate concept of transformation. Overlooking the interdependence of the building blocks ignores one key aspect of networked operations. The sharply increased degree to which military tasks are carried out by different organizational units amplifies the importance of coordination. Without it, each unit will go it alone, thereby losing the tremendous benefit of networking. The incremental-revolutionary model all but guarantees a lopsided organization whose performance is limited by its least effective parts. Systems integration tools must be sharpened and a systems integration framework should replace the choice between incremental and revolutionary approaches to transformation.

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Alternative Paths

The incremental-revolutionary model misses a key feature of networked operations: change in one part of the organization affects other parts. This is true in combat operations, acquisition, and intelligence. An incremental or evolutionary approach tackles problems serially through small-scale improvements in existing processes and technologies. The focus is on local expertise, and the changes are small enough that outside organizational units are not usually involved.

By contrast, the revolutionary or radical approach involves strategic leaps to overhaul an organization across the board, which may mean changing doctrine, organization, and technology simultaneously. This approach requires extensive financial and intellectual capital: sizable budgets because projects are expensive and intellectual capital because risks are high. Consultants, technical experts, strategic planners, and others are necessary to advise leaders about the risks.

AT&T in the 1990s offers an example of revolutionary transformation. It undertook radical change in its core technology, moving to digital fiber optics from copper analog circuits. A new CEO revolutionized the personnel system, terminated 60,000 employees, and made it obvious that loyalty to workers was a thing of the past. The corporation entered a new business area, cable television, taking on massive debt in the process.

The result was indeed a revolutionary transformation of AT&T. But despite hiring the best and the brightest investment bankers, strategic planners, and technical experts, the transformation nearly destroyed the firm. In five years it became a pale image of its former self and was forced to auction off key divisions at fire sale prices to avoid bankruptcy.

Organizations can only manage so much change at a time. Most leaders understand this, and that is why, practically speaking, an incremental approach nearly always prevails.

Incremental change has been the historical approach to military transformation. For example, the tank was first introduced without changing the organization or tactics for land warfare. It took nearly two decades after developing the tank for organization and tactics to catch up. Even when they did change during World War II, the German army looked much as it did during World War I, with masses of infantry and horse-drawn supply trains supporting tanks. Similarly, the airplane transformed combat at sea only after years of incremental experimentation. In the United States and Japan fleet battle tactics did not develop until the 1930s.

There are two major problems with an incremental approach. First, military transformation now rests on smaller force structures than the case studies of the tank and airplane. This removes the cushion that reduces risk. The United States developed innovative technologies in virtually every war from the Civil War to Vietnam. But more than technological innovation, America used mass—measured in men and dollars—to batter an enemy into submission. If technology did not do the job, as in Vietnam, mass would, or so it was thought. Large force structures provided a huge redundancy against technological failure. That reduced risk and made the incremental approach safe. Because technological failure was offset by massive force structures, mission success did not depend on the complete success of innovation, whether tanks, laser guided munitions, or armed helicopters.

A second problem is that the Armed Forces are far more tightly coupled than ever before. A breakdown or performance lag in one part of the force could check the performance of the whole organization because of increased interdependency. Networking interconnects the forces and links them to supporting systems, such as logistics and intelligence. That increases performance and the chances of mission success, but it also introduces a risk that was not present in earlier episodes of innovation and transformation-network risk, the chance that some part of the organization will not keep up with the others.

Relatively simple incremental transformation strategies worked in the past because various elements of the military were not tightly coupled.

U.S. Navy (Andrew Meyers)

Monitoring exercise aboard *USS Coronado*.

Such approaches are not likely to be as effective again, which is important to understand. Historical studies of innovation offer insight into a world that no longer exists, an era of loosely coupled mass forces where change was slow. Bureaucratic resistance was a big obstacle in this world because change threatened established routines.

Although bureaucratic reluctance still exists, it is not the problem it was. The defense and intelligence communities recognize the need for change. They want to do their best, but they are not sure how. The issue is less one of bureaucratic resistance than of factoring a complex problem into digestible bites. These are tasks carried out by linked organizational units. All relevant parts must work together. For example, suppressing enemy air defenses may involve a combination of air, space, and special operations forces. Deciding who does what, when, and how is a factoring problem, meaning it requires breaking down a big problem into manageable parts. Coordination is needed to make the assignment, monitor execution, and synchronize the actions of many subunits. In such situations incremental approaches to transformation can be dangerous.

Transformation in Japan

One drawback with incremental approaches to transformation is that they nearly always focus attention on assets at hand rather than how they are put together with other building blocks. Because changes are small, they usually do not get a review by those not immediately involved with them—or if they do, the reviews tend to be cursory rather than disciplined. The focus is honing the asset one knows and optimizing it to perfection. But what happens when tightly coupled units or activities use this approach?

The Japanese electronics industry is a particularly good case since it sparked the fascination of the American business community with incremental approaches to transformation in the 1980s. Japanese electronics companies dominated the world. They came out of nowhere to seize the high ground of innovation in low cost, high quality production.

When the DRAM chip was invented in the United States in 1969, Japan took the idea and put it through incremental product improvements. The five electronics giants—NEC, Toshiba, Hitachi, Fujitsu, and Mitsubishi—copied the approach other Japanese companies used in the 1970s in automobiles, steel, and ships. "Get a good design from anywhere and improve it continuously" was the doctrine. Japan used an incremental approach to pummel its rivals in America and Europe. Its global market share of chip production rose from 26 percent in 1980 to 49 percent in 1990.

But during the 1990s the competitive environment changed. The cheap capital that financed R&D and plant expansion in Japan vanished as its banks nearly went bankrupt from

28th Test Squadron, Detachment 2 (Michael Ammons)

F–16 dropping joint direct attack munition.

overlending to government-targeted industries. Employment at the big five grew while the economy did not. It became politically impossible to lay off workers.

The American electronics industry staged a comeback in the 1990s by beating the Japanese at systems integration. In U.S. firms, unlike those in Japan, different organizational units—R&D, production, or marketing—were tightly coupled so the interactions among the parts were managed to sharpen competitive advantage.

Japanese companies covered the R&D waterfront. American rivals focused only on those segments in which demand was growing and production advantages existed. Firms guaranteed lifetime employment in Japan. Companies in the United States targeted hiring in specialty skills for the chip business. Japanese firms did everything themselves. American firms competed in key links of the value chain and outsourced the rest.

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Incremental change rewards those who understand existing processes. If the environment does not change, and if structures hold stable, that works well. It favors a stable workforce, long production runs, and long-term suppliers. U.S. companies understood both the economic and cultural differences in the American economy: its dynamic labor markets, flexible contracting, and tradition of risk taking. But they did not just recognize them as building blocks. They integrated them into a tightly coupled business model.

Integration Tools

Choosing between incremental or revolutionary approaches is not the right framework for managing transformation. Systems integration, linking separate parts of an organization so weaker ones do not limit improving ones, is key. Since the Armed Forces are moving to more networked operations, this approach can be applied throughout the defense and intelligence communities from the highest levels to the lowest.

Three areas for improvement can be identified. On one level they might be considered as mundane parts of nuts-and-bolts activities like outsourcing and software, which usually do not get high-level attention. But downplaying them is a mistake. Poor integration in general, and certainly in outsourcing and software, wastes capital better deployed elsewhere. Moreover, innovations can disproportionaly improve the benefits of networking because they crosscut nearly every aspect of military transformation.

The industrial era was built on optimization, not innovation. Competitive advantage came about by grouping production factors in an optimal way, such as steel and labor. Tools of systems integration reflected the loose coupling of assets. The defense budget was restructured using one such tool in the planning, programming, and budgeting system in 1961. Strategic nuclear forces, conventional forces, and logistics were treated as separate factors, the steel and manpower of war. This approach assumed that, like the industrial corporation on which it was modeled in 1947, DOD was a machine whose assets could be separately improved and combined to achieve a seamless whole. What happened in the Air Force, for example, did not much affect the Navy under that kind of integration.

The difficulty was that as complexity and specialization increased, innovation become more important than top-down optimization. But old tools of systems integration, such as optimization and the planning, programming, and budgeting system, had no way to incorporate the payoff from innovations or networked forces. As a result it became harder to allocate resources in a way that encouraged military transformation.

The planning, programming, and budgeting system largely ignores synergies from network effects and understates their payoffs. Its replacement is not a new accounting system, but better horizontal integration to enable innovation. Mechanisms to do that have sprung up in recent years in response to increased complexity and tighter coupling. But they have not been identified in a systematic way to aid in transformation. For example, joint commands, integrated product/process teams, intelligence fusion centers,

U.S. Marine Corps (Kenneth E. Madden)

Setting coordinates for Dragon Eye, Enduring Freedom.

standing joint task forces, and integrating organizations are all mechanisms for horizontal coordination. They are more commonly used today than ten years ago because the new way of war, as shown in Afghanistan and Iraq, requires more integration. And computer tools are mechanisms of integration. GroupWare, collaboration technologies, and other systems help solve problems in coordinating different units. They are also a response to growing complexity and tighter coupling of activities.

The trouble is that these integration mechanisms and computer tools are not seen as part of a larger theory for factoring complex problems where strong interdependencies exist. Acquisition specialists, for example, see the benefits and limitations of integrated product/process teams. But it rarely occurs to them that there are other coordination mechanisms. Liaison offices, fusion centers, joint task forces, and specialized coordinating organizations such as the Joint Staff offer different approaches to integration.

There are many ways to put it all together. Which is best depends on considerations such as the degree of complexity, the amount of subunit interdependence, the degree of information to be shared, and the cost. There is no single best way. It depends on the problem and the budget.

Personnel must be trained on the new approaches to systems integration. Looking at the attributes of these approaches—information volume, cost, and dependence on information technology—allows leaders to choose. Rather than debating incremental or revolutionary alternatives, attention would be far better committed to choosing among integration alternatives matched to the tasks of a networked force.

Outsourcing Information Technology

Complex organizations require complex supply chains. Outsourcing is too important in the new way of war to be left to contractors. But when complexity makes a field opaque, leaders have difficulty allocating resources in a rational way that improves the performance of the whole organization.

Information technology (IT) contractors, for example, are critical for networked operations because they operate and even own many of the networks that are the backbone of the new way of war. But IT outsourcing is unlike contracting for catering or janitorial services. Rather, it is a highly fragmented industry that causes bewilderment. Yet managing it is as important as managing an ammunition supply system. The natural tendency is to deal with complexity by outsourcing it. While that gets rid of the problem, outsourced

55th Signal Company (Michelle Labriel)

M93A1 FOX, nuclear biological chemical reconnaissance system, Enduring Freedom.

networks are part of the total defense system. Leaders need to direct a networked organization the same way the Pentagon directs the building of the joint strike fighter or a new radar.

Outsourcing often leads to a confusing mixture of systems, personnel, and sites. Some IT staff members are civilian employees, some are military personnel, and some are private contractors. Responsibility is spread across so many individuals and organizations that getting a handle on it is hard. This degree of opaqueness would not be tolerated on the battlefield. Yet information technology is an important contributor to what happens on the battlefield.

What is needed is for government organizations to develop an IT outsourcing review that clearly maps this part of the defense value chain to overall performance. That would catalog exactly which activities are critical, what firms are doing the work, performance benchmarks, and the company innovation record. Some of the most important outsourced IT networks need to be analyzed as much as the organization of joint forces. This could be an opportunity for major innovations.

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Software

At the heart of network centric warfare is software, the glue that links the forces. Yet its importance is often overlooked because the Department of Defense, the services, and the intelligence community are platform focused. They have a history of concentrating on airplanes, ships, and satellites. They do not yet understand the significance of network operators, whose efforts could be deciding factors in future mission success.

Software needs to be put on as solid a foundation as platforms. As a discipline, software is only fifty years old, half the age of the aircraft industry and a small fraction of shipbuilding. It has very different traditions than the platform industries.

For example, when an airplane crashes there is a well-developed approach to determine the cause. Teams of engineers and safety experts investigate what went wrong and why. Their findings are reported to manufacturers and to Air Force and Navy organizations that exist for the purpose of making sure the lessons are factored into maintenance and training.

In the future, software crashes could be more deadly than airplane crashes. Such failure could cause more loss of life if, for example, a reconnaissance network crashed during a battle. Yet there is no comparable mechanism with the sophistication or experience as those the Air Force or Navy have for understanding airplane crashes. Indeed, software does not even have a tradition of post mortem analysis of analyzing past failures. After an intelligence setback, it is routine for the intelligence community to search for ways to improve the process. But in a world where networked operations are key, no such cultural approach is being created for one of the key ingredients that run networks—software.

A related issue is productivity and network manning levels. For example, as part of the effort to develop efficient platform manning requirements, the Navy DDX program will have about one half of the crew size of earlier ships. Similar programs exist in other services. Yet there is little attention to efficiently manning computer networks. Network operations centers have become so complicated that they add enormous staffs. Moreover, the desktop of a network professional is often a confusing hodgepodge of icons and yellow Post-it notes. If any battle is fought with such a system, senior commanders will immediately see the potential for disaster. Yet combat is likely to use such systems because computer networks are becoming so integral to joint warfighting.

Streamlining networks, making them as efficient as fighting forces, offers a great systems integration opportunity that will pay off because it affects so many areas of the new way of war. Systems integration is a powerful framework for considering alternative transformation strategies. It highlights critical areas such as better integration tools, information technology outsourcing, and software that need more sober analysis to meet the challenges of military transformation. JFQ