



Stepping Outside

the Reality Box

Fleet Combat Camera, Atlantic (Michael Sandberg)

By MARK R. LEWIS *and* JOHN C.F. TILLSON

A system resembles a chain in that it is only as strong as its weakest link. Consider the example of defense transportation. Regardless of the capacity of aircraft and ships to carry military forces, system throughput will be limited if ports cannot handle what is debarked. A chain is strengthened by reinforcing the weak link; alternatively one could disassemble the chain, replace the weak link, and thus

make the chain stronger. It is futile to strengthen links that are stronger than the weakest link. Regardless of the number of aircraft and ships in the system, if the ports cannot deal with arriving troops and equipment, throughput will be limited.

Most DOD missions are performed by a system of systems in which each subsystem is an interlocking and interdependent process operating in concert with other systems and subsystems within their parent systems. They all come together to accomplish a task. Each subsystem plays a role in the overarching system, but none can complete the mission on its own strength alone.

Mark R. Lewis is a member of the strategy, forces, and resources division at the Institute for Defense Analyses; John C.F. Tillson is also a member of the research staff at the Institute for Defense Analyses and has served in the Office of the Secretary of Defense.

Transformation Goals

Planning guidance released in April 2003 called for U.S. Joint Forces Command (JFCOM) and the services to address six goals (and joint operating concepts) in an annual endeavor to produce transformation roadmaps. The Secretary of Defense established critical operational goals in the *Report of the Quadrennial Defense Review*, using roadmaps to focus on developing service-unique capabilities to:

- protect critical bases of operations
- project and sustain forces in distant anti-access/area denial environments and defeat anti-access and area denial threats
- deny sanctuary through persistent surveillance, tracking, and rapid engagement by high-volume precision strike
- assure information systems to conduct effective information operations in an attack
- enhance capabilities and survivability of space systems and supporting infrastructure
- leverage information technology and innovative concepts to develop interoperable joint command, control, communications, computers, intelligence, surveillance, and reconnaissance architecture and capability to include a tailorable joint operational picture.

To meet those goals, a service or agency can assume that each goal statement is a mission—a set of tasks and subtasks that must be accomplished in a structured way.

For instance, the essential task of the third goal is denying sanctuary to an enemy. Several tasks and implied systems are cited in the goal statement. Surveillance, tracking, and engagement systems are subtasks of the overall mission. Furthermore, there are implied tasks in each specified system that may use the output of other systems and subsystems or contribute to them.

Surveillance requires multiple systems of various components, both services and agencies, to provide continuous and near-complete information. To cover potential sanctuaries and furnish useful, timely information, this task will likely require multiple, complementary ground, sea, air, and space capabilities, which in turn call for separate commands and agencies to execute



48th Communications Squadron (William Greer)

discrete tasks in common. Every organization and the overall system must have both a tasking mechanism and a feedback loop to enable accurate assessment and responsive reengagement.

Similarly, acquiring targets is only one major task under the Quadrennial

describing the mission in terms of a system of systems identifies cause and effect

Defense Review. Intelligence systems must process information from surveillance systems, tracking systems must retain targets, engagement systems must be able to deliver the desired effect, and maneuver systems must be appropriately positioned in the battlespace. In addition, both combat support and combat service support systems must sustain operations. Denying sanctuary also requires complex interaction by these various systems.

The Weak Link

Once the six transformational goals are understood as missions executed through a system of systems, the next step is determining where to focus the effort to transform the larger system. Where is the weak link? Are there components that can be leveraged to increase the capacity of the

system? Can a component be bypassed or its output improved in other ways?

The concept that the six goals are missions performed by a system of systems that are only as adept as its weakest component exposes a flaw in the call to “develop service-unique capabilities necessary to

meet the six critical operational goals.” How can a service know where to

focus until it knows how its systems contribute to the overall mission? Moreover, how will DOD know how to allocate resources to reinforce the weak links?

System of Systems

Describing the mission in terms of a system of systems identifies cause and effect relations between entities in the system and allows commanders on all levels to monitor contributions to desired outputs. The areas ripe for breakthrough or transformational solutions are best found once these complex missions are presented as systems of systems. Then detailed analysis can find the weak links—or the hidden potential in the system.

The challenge of diagramming complex missions is not limited to

Cargo awaiting transport, Dover Air Force Base.



1st Combat Camera Squadron (Dominic Hauser)

identifying the system of systems. The web of relationships linking tasks and systems must be perceived in enough detail to enable understanding that a change in one dimension may resonate throughout the system. Only when processes, subsystems, and relationships among them are identified can the overarching process be traced to find constraints inhibiting mission performance. Problems can be associated with hardware, resources, organizations, policy, or doctrine. Choke-points that impede the system can indicate problems that cannot be resolved normally and call for transformational solutions.

Sometimes commanders do not have needed technology or resources. For example, night vision devices represented a breakthrough that denies sanctuary in darkness. Suddenly an enemy could be seen at night, boosting capability and effectiveness.

At other times the problem is organizational. The Goldwater-Nichols Act sought to change the way that the defense establishment does business. By strengthening the operational chain of command and eliminating stovepipes to enhance jointness, this law overcame friction between unified commanders and the services.

Operational concepts also pose problems. France invested significant resources in the Maginot Line during the interwar years without resolving the fact that defensive barriers can be breached or avoided. It was faced by the demands of a fortified force versus a mobile reserve. Failure to resolve this tension, rather than technology, which was at least on a par with that of Germany, led to defeat.

Problems can exist in many dimensions—technology, organizations, and policy as well as operational concepts and doctrine. Once the system of systems is understood, the effort shifts to finding problems that restrict the potential or opportunities to enhance capability by restructuring it. Its problems are identified. The challenge is eliminating those things that inhibit the performance of the overarching system, clearing the way for transformation.

The Reality Box

With mission statements diagrammed, the primary issue is finding problems in the system. Surveying decisionmaking processes is the point of departure in creating a methodology to identify breakthroughs. The processes are ways to think about solving problems presented by a mission statement and discovered in mission analysis.

Each conventional solution-seeking process entails mission analysis that describes assumptions, limitations, and problems or constraints that bound the range of solutions.

Because such methods include operational risk assessments, they are conservative and take identified limiters as a given. Although some attention is paid to replacing assumptions with facts, the primary aim is identifying limiters to planning with complete situational understanding. Thus the processes are not designed to produce transformational solutions, but instead point to the most effective course of action while minimizing risk. That is reasonable in the context of operational planning, and it almost always generates a conventional solution.

In identifying facts, limitations, constraints, and assumptions, current processes define the reality box in which a solution might take shape. The effort is focused on defining the dimensions. If one conceives of the solution as a sphere and the reality box as a cube, the task becomes stuffing the largest possible sphere into the cube. The result is either the largest possible reality box (which is desirable because the bigger the box, the bigger the sphere that fits inside) or fitting a solution into a constrained reality box (which means effectively using all available resources). The existence of such a box, however, is rarely questioned or even recognized.

The reality box concept is related to outside-the-box thinking but is not identical. The term *outside the box* has come to mean unconventional approaches to solving problems. Supposedly its origin is a parlor game that presents players with nine dots arranged in a 3 by 3 square. The object is connecting nine dots with four straight lines without lifting the pencil from the paper. The only solution is drawing lines outside the box. Today the phrase is used as a hortative: *think outside the box*. But it rarely offers direction—it simply means considering alternatives. Such thinking can be unguided and result in plans that drift in white space. Any breakthroughs would be serendipitous. Hence the need for the reality box concept to direct efforts toward transformational solutions.

Vehicles arriving in Kuwait, Iraqi Freedom.



1st Combat Camera Squadron (Tammy L. Grider)

The image of a solution stuffed inside a reality box enables the visualization of concepts of potential and friction in the context of developing breakthroughs. The space between the solution sphere and the box represents potential; the sphere has room to grow before it contacts the limiting box walls. The task of conventional planners is fitting a solution sphere into that space defined by the box. Expanding the sphere as far as possible represents a qualitative refinement of the solution within the limits discovered through mission analysis.

Similarly, points where the solution sphere makes contact with the inside of the box can be understood as problems that hamper system performance; the solution sphere wants to expand but is constrained. Those points of friction are generally regarded as an unmovable part of the box and efforts usually turn to expanding the sphere into empty spaces. When every option for developing a solution to fit inside

the reality box is exhausted, some limiters must be relaxed enough to allow expansion for the solution to fit. That might mean requesting added resources to use in mission accomplishment, redefining the mission objective, or rethinking the level of risk acceptable. The result is that the reality box is stretched to enable the solution

by definition, transformational solutions fall outside the reality box

to fit inside the box. This effort will not cause breakthroughs because it does not fundamentally alter the way solutions are shaped.

A distinction can be made between conventional problem solving and a method that might produce a breakthrough. Instead of accepting the limitation, transformational solution seekers look at points of contact to determine the nature of the constraint. Is the sphere rubbing against an actual limiter or merely the fabric of assumptions covering holes between facts? Is the point of friction vulnerable to

puncture? Are the facts really facts, or are they assumptions? By definition, transformational solutions fall outside the reality box. This is the nature of a breakthrough; it penetrates limiters that box in solution sets.

Even though processes like the joint operation planning and execution system or the Army decisionmaking process may not lead to transformational solutions, they may be a reasonable start in building the reality box. This step is critical because it offers an exquisite definition of reality. Ultimately what one does with the completed box is what distinguishes transformational solution seeking from conventional decision-making processes.

Identifying Assumptions

Care is taken to identify assumptions on the situation and environment in mission analysis. An assumption is a statement or condition accepted as valid without any substantiation or proof. It is a supposition

Tactical automated sensor system, Iraqi Freedom.



1st Combat Camera Squadron (Matthew Hennen)

Underlying reasons are lost as assumptions pass down the chain. Soon they become facts. Similarly, policy constraints take on a life of their own. Sometimes unbreakable rules arise for lack of focus on the overall system, which reinforces the need for a systems diagram that enables planners to trace undesirable effects in the system to an original conflict and to judge the validity of the assumption.

Windows of Opportunity

Transformational solution seekers, unlike planners, think that holes in the box are windows of opportunity. Covered only by assumptions, these are points where the box becomes vulnerable to breakthroughs. When assumptions are identified, addressing them is a straightforward process. If the source of conflict is clear and the choice deliberate, organizations can weigh options, make informed decisions, then adopt ways to mitigate the consequences.

Transformational solution seekers look specifically for assumptions that can be broken with transformational solutions. The box represents reality, but conditions that define reality—political, social, economic, military, and other factors—are complex adaptive systems that change human and environmental interaction. Indeed, technology develops and scientific understanding evolves. Thus the bases of assumptions constantly change. According to one analyst, “Assumptions that were valid yesterday can become invalid and, indeed, totally misleading in no time at all.” Thus, while the next phase is beginning to generate solutions that fit in the reality box, the transformational solution begins by identifying assumptions.

If assumptions are identified, the challenge is straightforward. Unfortunately, it is not easy to identify assumptions that point to transformational solutions. Planners need a different way to locate assumptions to break. First, they must understand the system of systems so the web of tasks, organizations, and relationships that interact to accomplish the mission becomes clear. Today this web of interaction takes place within the reality box,

about current or future situations held to be true that replaces the unavailable facts. Identifying assumptions is vital in planning and pivotal in military transformation.

Valid assumptions combine with facts to become the framework that shapes the reality box. The structural integrity of the box is relevant to planners. From their perspective, holes are windows of vulnerability through which an unforeseen event could compromise the solution. Thus as the box

takes shape, planners naturally seek to identify holes and plug them. At first they use assumptions, replacing them when they acquire facts.

In dealing with recognized assumptions, facts must be scrutinized. Often they are deeply held convictions whose basis is not understood. Hidden assumptions are insidious because they take considerable effort to expose. Constraints may be based on assumptions that are seemingly unbreakable rules. Commanders are advised in Joint Pub 5.00-1, *Joint Doctrine for Planning*, to consider “assumptions handed down from higher echelons as facts.”

OH-58 crews,
Iraqi Freedom.1st Combat Camera Squadron (Tammy L. Grider)

and problems that limit the ability of the system can be seen as points where the system meets the box. Problems can arise from conflicts over choices regarding policy, organization, doctrine, technology, or resources. Thus the next step for transformational solution seekers is using the reality box to identify problems in the system and then focusing analysis on them.

Analytical Tools

Most management concepts deal with transforming corporations, but they offer little insight into the process. Among them is the theory of constraints, which began as a technique based on scientific method that could be applied to industrial production. It developed into an approach for analyzing organizations to address

problems that hinder attaining organizational goals. Simply put, this theory provides analytical tools to answer three questions:

- *what to transform*—causes of problems faced by organizations and systems, conflicts that prevent eliminating problems, and explicit and implicit assumptions underlying conflicts
- *what to transform to*—changes that resolve problems and facts that can replace or modify faulty assumptions
- *how to achieve transformation*—obstacles to change, finding means to overcome them, and taking the necessary steps.

The first step is identifying problems that affect organization. Once identified, the theory of constraints facilitates the recognition of assumptions, policies, practices, and measures that cause them. To remain abreast of evolving reality, one must identify what to change. Then, in deciding

what to transform to, the theory offers a technique for deciding changes in policies, practices, and measures. Finally, it provides a way of deciding how to transform.

Military transformation calls for breakthroughs in problems confronting the Armed Forces. Operational goals should be regarded as mission statements that describe a system of systems. The services bring unique capabilities to these goals, but they interact within the context of a larger system. Thus the system must be diagrammed in a manner that illustrates its constraints across the defense community. Developing transformational capabilities without such an understanding runs the risk of suboptimizing or squandering resources. **JFQ**