Operations Other Than War (OOTW): The Technological Dimension

Written By

THE CENTER FOR ADVANCED COMMAND CONCEPTS AND TECHNOLOGY (ACT)

NATIONAL DEFENSE UNIVERSITY

NDU Press Book

November 1995

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Foreword

This report documents the fourth in a series of workshops and roundtables organized by the INSS Center for Advanced Command Concepts and Technology (ACT). These meetings bring together operators, planners, researchers, and analysts to identify and examine those aspects of command and control in operations other than war (OOTW) and advance the process of developing one or more Mission Capability Packages (MCPs) to support combined and coalition operations.

ACT seeks to improve the state of the art and practice of command and control by undertaking selected research and analysis initiatives and by serving as a bridge between the operational, technical, analytical, and educational communities. The Center focuses on emerging requirements and mission areas where new concepts are needed. OOTW is one of those areas.

Individuals interested in participating in this initiative or other ACT-sponsored activities are invited to contact either myself or ACT Director, Captain W. Oscar Round, U.S. Navy, at (202) 287-9210, ext. 545.

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Acknowledgments

The authors want to acknowledge the efforts of several colleagues who supported this work in a variety of ways. The materials from ACT workshops are the product of serious work by dozens of professionals representing not only all the military services and The Joint Staff, but also staff members at NDU, outside academics, civilian researchers, and representatives of the Department of State, the Office of Technology Assessment (OTA), and other interested U.S. Government agencies. Captain W. Oscar Round, U.S. Navy, of the ACT staff was untiring in his efforts to collect and validate factual materials about U.S. experience in operations other than war and provided excellent comments and feedback. Karen Nickens and Rosemarie Bell of Evidence Based Research, Inc. took the report from draft to print quality, coordinating with the NDU printing section. Finally, Mary Beth Stewart handled the myriad of details involving making the workshop a smooth running success and a most productive experience.

Executive Summary

The "Operations Other Than War (OOTW): The Technological Dimension" Workshop was held at the National Defense University as the fourth in a series exploring advanced command relationships and technologies. This topic was selected because earlier workshops that explored command and control issues in peace operations had consistently highlighted the important role of technology in OOTW. This emerged as a qualitatively different problem from command and control in peace operations and a subject that needed to be examined in detail.

The workshop sought insights into the process of determining what technologies are required for OOTW. The group also examined the complexities of introducing relevant technologies and discussed general and specific OOTW technologies and devices.

This workshop was a departure from its predecessors in that the agenda was rich in presentations, with relatively little time available for detailed discussions.

Because of its training and culture, the U.S. military has been somewhat reluctant to engage in OOTW. Nevertheless, such operations are becoming more common, in many cases subsuming traditional military missions. There are many reasons for this increased involvement. Some nations and groups tend to avoid direct confrontation with the U.S. military, but they still find ways to challenge the U.S. directly or indirectly. In other cases, internal problems in foreign countries cause conditions that U.S. policy makers cannot ignore. These can include, for example, loss of government control and resulting internal violence (as in Rwanda) or concerns about the possible spill-over of ongoing hostilities (as in the former Yugoslavia). In such cases, OOTW is seen as a way to lessen the effects of war or prevent it altogether. Further, U.S. forces are increasingly being tasked to respond to other non-traditional military missions (such as disaster relief or restoration of democracy).

WORKSHOP FINDINGS

One of the most important findings was that OOTW operations and the research and development communities have much to discuss and relatively few opportunities for dialogue.

The *requirements process* presently lacks structure. The efforts of different agencies overlap and duplicate each other. The operational community is, for reasons both structural and cultural, not active in the requirements process.

Application of technology to OOTW is often neither simple nor straightforward; it can be influenced by diverse factors, such as public opinion and the environment.

Systems that work in deserts may be use- less in jungles, forests, or urban centers. Tools that are safe in open areas may have unacceptable consequences in crowded areas. Where the immediate threat is low, technologies that work slowly or require detailed preparation are useful, but they can- not help in urgent situations.

Technological solutions to OOTW problems bring with them numerous implications. These implications include legal, doctrinal, rules of engagement-related, and training questions, as well as concerns about combat readiness for warfighting and what may be shared with coalition partners.

The workshop identified several technologies that are needed today, including: mine clearing, counter-sniper and counter-mortar capabilities, language interpretation, and improved training capabilities. The latter two were deemed particularly significant in light of the trend towards coalition operations.

Logistics and training would benefit greatly from adoption of existing concepts and systems, such as "just in time" inventory control and virtual reality.

These missions are typically poorly defined, complex, difficult, and dangerous.

Technology is not a cure-all, but its innovative use can help to achieve better performance with lower risk of casualties.

The military participants were unanimous in their view that any technology considered for OOTW must have "dual use" capability; that is, it must add value to war fighting capability as well as OOTW.

Technological solutions to three key problems dominated the discussions. First, technologies are needed that *create time and space* and thereby create opportunities for alternative courses of action and prevent inadvertent escalation of dangerous situations. Second, systems that *help control the level of violence* are potentially desirable. Finally, technologies that help *fill the gap between inaction* and *use of deadly force* often enhance the likelihood of mission accomplishment and are valuable in OOTW. Many proponents also stressed technologies that will *minimize casualties* among both U.S. forces and civilian populations.

The workshop concluded that technologies for OOTW could best be developed in the context of Mission Capabilities Packages (MCP).

Given the above finding regarding the need for increased dialogue between the operational and technical communities, more workshops and discussions, perhaps focused more narrowly, should be held to facilitate communication between these two groups. Topics suggested for later review include:

- Training for OOTW;

- Command and control (C2) technologies such as automatic translation devices and automated decision support systems for coalition planning;

- Tactical level application issues, such as ROE for non-lethal technologies, media strategies in OOTW, and information sharing with NGOs and PVOs;

- Technology for OOTW in urban environments, including crowd control, anti-sniper, and advanced sensors; and

- "Dual application" technologies that improve warfighting as well as OOTW capabilities.

The workshop also concluded that future meetings should be scheduled for two days to allow more time for discussion and that bringing law enforcement and other civilian agencies likely to be present into the workshop atmosphere could be important.

Chapter 1: Introduction

BACKGROUND AND PURPOSE

The workshop on Technologies for Operations Other Than War (OOTW) was held at the National Defense University as the fourth in a series sponsored by the Center for Advanced Concepts and Technology (ACT) to explore advanced command relationships and technologies. Earlier workshops on command and control issues in peace operations identified the role of technology in OOTW as being a unique problem and a subject that needed to be examined in detail. The subject is particularly important as the frequency of OOTW missions is increasing and because the appropriate use of technology offers ways to improve effectiveness and safety for OOTW operators. Given the breadth of material discussed, it is clear that no single workshop could adequately air the issues associated with the potential of technology to improve the effectiveness of OOTW operations. This initial workshop's purpose was to identify the OOTW and technology broad issues, leaving it to subsequent ACT workshops to deal with the issues identified in depth.

The ultimate objective of ACT's work-shop series is to conceptualize and develop Mission Capability Packages (MCPs) that will support improved command and control for coalition operations, and other operations important to U.S. national security. These workshops bring together select groups of senior analysts and operators to explore linkages between the military operational and technical communities. The participants include the activity's sponsors, and representatives from The Joint Staff (TJS) and the Assistant Secretary of Defense for C3I, the Services, U.S. Commanders in Chief (CINCs), other selected U.S. Government agencies, and academic and private organizations with relevant expertise.

Evidence Based Research, Inc. acts as rapporteur for the discussions.

The first ACT workshop focused on identifying unique command and control requirements and essential functions of coalition peace operations. The second dealt with designing ideal command arrangements for peace operations involving a U.S. combined joint task force (CJTF), and the third expanded the perspective to include the experience of Western Hemisphere peace operators. While the first two workshops looked at the issues from the U.S.-only perspective, the third (with the benefit of an experienced and senior group of peace operators from seven other countries in the Western Hemisphere) validated previously-examined concepts and added new insights.

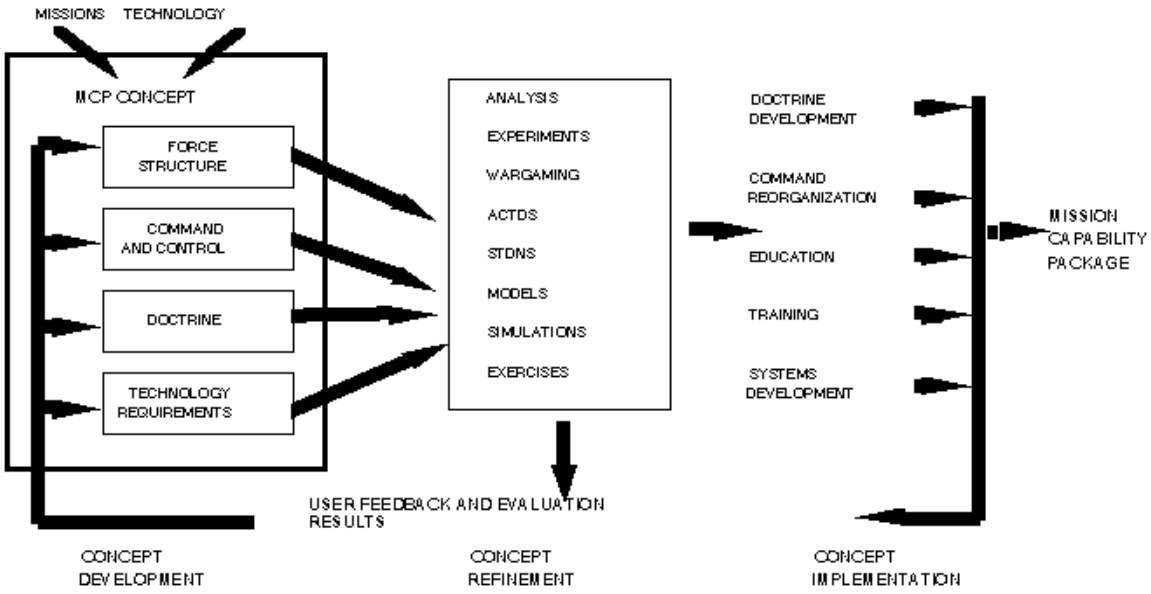
The workshops are conducted on a non-attribution basis and work toward consensus on major issues. Hence, the origin of particular ideas and the give-and-take of discussion and debate are not reported. The groups achieve a high level of candor, work together effectively on complex and difficult topics, and provide excellent inputs for MCP development.

ACT has the responsibility to develop concepts for MCPs. These are coherent, comprehensive approaches to a particular set of missions and levels of technology that

enable the effective integration of the force structure, doctrine, command and control arrangements, and technologies required to accomplish the mission.

Figure 1 illustrates the MCP development process. Note the feedback required at each stage of development. In addition to facilitating the development of MCPs, ACT serves as the bridge between the technical and operating communities and creates venues for communication between the two groups. The resulting dialogue provides the operating community with a better understanding of the opportunities that technology can provide and the technology community with a better understanding of the needs of the operational community.

Figure 1. Developing Mission Capability Packages



This paper describes how workshop participants, using the MCP concept, explored the unique requirements of OOTW technologies, examined the technologies available and under development, and developed insights about how OOTW and OOTW technologies impact war fighting effectiveness. It includes their novel interpretation of dual-use technology" and their discussion of priorities for high-pay-off technologies. This workshop was unusual in that the agenda included a number of presentations with limited time for discussions. Indeed, one of the most important insights from the effort is that the OOTW and technology communities have a great deal to discuss and few natural opportunities for dialogue. Hence, more round table discussions of this type, each focused on a selected issue and each structured to foster in-depth dialogue, will be required to adequately explore these rich subjects.

WHY OOTW?

OOTW includes peace operations, as well as a wide range of other non-traditional military operations. The U.S. Army's Field Manual 100-5 defines OOTW as consisting of "support to U.S., state, and local governments, disaster relief, nation assistance, drug interdiction, peacekeeping, support for insurgencies and counterinsurgencies, noncombatant evacuation, and peace enforcement." Peace operations, particularly those conducted under the auspices of the UN Charter, have become more common in the post-Cold War world.

Because of its training and culture, the U.S. military has been somewhat reluctant to engage in OOTW. Nevertheless, such operations are becoming more common, in many cases subsuming traditional military missions. There are many reasons for this increased involvement. Some nations and groups tend to avoid direct confrontation with the U.S. military, but they still find ways to challenge the U.S. directly or indirectly. In other cases, internal problems in foreign countries cause conditions that U.S. policymakers cannot ignore. These can include, for example, loss of government control and resulting internal violence (as in Rwanda) or concerns about the possible spill-over of ongoing hostilities (as in the former Yugoslavia). In such cases, OOTW is seen as a way to lessen the effects of war or prevent it altogether. Further, U.S. forces are increasingly being tasked to respond to other non-traditional military missions (such as disaster relief or restoration of democracy).

Given the trend towards military involvement in disaster relief, counterterrorism/counterinsurgency, and counternarcotics operations, most armed forces throughout the world conduct OOTW in one form or another. *Figure 2* shows nations that have contributed to recent peace operations, and *Figure 3* shows the locations of these operations.

Figure 2. Nations Contributing to Recent Peace Operations

Figure 3. Locations of Peace Operations

These missions are typically poorly defined, complex, difficult, and dangerous. What started as a humanitarian mission in Somalia degraded into urban guerrilla war-fare. Idealistic expectations of what the UN forces could accomplish were frustrated by a power struggle among local tribal warlords. In such cases, unclear mission goals and guidance and a changing environment place great strains on the military forces involved. Worldwide weapons proliferation adds danger in many of these situations.

The workshop explored ways to improve OOTW effectiveness and safety through the application of technology. Technology is not a cure-all, but its innovative use can help to achieve better performance with lower risk of casualties.

Chapter 2: Requirements for OOTW Technologies

This section describes the current state of technology requirements analysis, identifies some common OOTW requirements, then presents functional analysis as a model for technology requirements analysis. In closing, it also suggests how requirements planning can be more closely linked with operational experience.

CURRENT SITUATION

At present there appears to be no coherent, comprehensive approach to framing OOTW technology requirements. Many agencies are developing technologies relevant to OOTW, but their efforts are not fully coordinated. For example, it became apparent during the first workshop session that agencies were not always aware of efforts similar to their own that were occurring "just down the hall." The operators attending the workshops (and, by extension, those in the field) were not well informed about developments in the technology field, nor did they have a good system for communicating OOTW requirements to the technology community.

Further, each agency has a different focus on the technology issues involved. For example, the Office of Technology Assessment (OTA) focuses on issues of feasibility. TJS, on the other hand, looks at requirements, but from specific perspectives developed in the Joint Required Operational Capability (JROC) process, rather than from a comprehensive viewpoint. The Advanced Research Projects Agency (ARPA) maintains its traditional focus on technologies and methods, but is seeking to ensure utility to the commanders on the scene. Finally, the Office of the Secretary of Defense is developing policy options for the future, but without the benefit of an approach fully coordinated with the research and development community. Thus, requirements are formed by various offices with widely different perspectives. Coordination between these technology planners and the operational community is not apparent.

Moreover, the development time window varies extensively depending on the technology, from "off the shelf," to a thirty-year research and development process. In general, OTA and the Joint Chiefs of Staff are focused on the short term and need to apply existing technology. They are obviously concerned with making technology available to forces conducting current operations. ARPA and the Department of Defense (especially the special operations/low intensity conflict [SO/LIC] community) are looking at mid-to long-term technologies. SO/LIC sets their horizon at thirty years.

Complicating the process further is the fact that technical requirements vary with location, type of operation, and the time avail able for application. Technology that works well in a desert scenario may be useless in heavy vegetation or an urban environment. In Desert Storm, for example, soldiers reported that they could spot buried mines using night vision devices. While this worked in that desert environment, it does not work in forest or jungle areas. Likewise, technologies that work in fields may not work in hills and probably won't work in urban environments.

If time is not critical, technology application may be simpler than in a time-sensitive case. The sophistication, complexity, and availability of technology are other considerations.

For purposes of this discussion, the authors used the language "low," "medium," and "high technology" to describe these factors. A "low technology" solution is one that can be applied off the shelf or with minimum modification. A "medium-technology" solution is one that exists in some functional form but requires development of a specific application. The "high-technology" solution is one that will require research and development. These factors, as well as political and legal issues, must all be considered in the requirements process.

COMMON REQUIREMENTS

The workshop was able to develop and isolate some common instances where application of technology could provide productive solutions. These technology applications are not exclusive to OOTW. Many of them can also support traditional military operations. In fact, technologies that do not fill a warfighting need are less likely to be funded or accepted by the military. "Dual-use" assumes a new meaning here (it is usually employed to indicate items that have both peaceful, civilian value and military utility), but the workshop concluded that it is important that OOTW technologies have a warfighting application if they are to be developed and used.

The first, and perhaps most important requirement is for technologies that *create time and space*. Peace operators need time to keep situations from escalating, to allow development of alternative courses of action. Space is a visible or invisible barrier that separates antagonists or protects one's own forces. For example, a system that can stop a vehicle could provide both time and space: time to inspect for explosives and space between the vehicle and potential targets until the inspection is completed.

Another common requirement is for systems that *control or help control levels of violence*. These complement the "create time and space" requirements. Included are methods for individual and crowd control, ways to separate belligerents from other belligerents and from noncombatants and to monitor the separation. Also needed are technologies that incapacitate machines and that find concealed weapons (e.g., in buildings or vehicles, on persons) or that neutralize or disarm them. Anything that can provide the force commander with more options fills a common need. Technologies that can I *help fill the gap between inaction and the use of deadly force* I have the potential both to enhance the chances for mission success and reduce casualties on all sides. Many non-lethal weapons (NLW) technologies might fit here and complement the commander's other options.

ANALYSIS OF REQUIREMENTS

Workshop participants suggested various factors that influence requirements. Requirements can be generated by analyzing (1) personnel factors, (2) intelligence needs, and (3) logistics needs. The type of operation or mission context is the fourth important

determinant of requirements. There may be other compelling factors, but these four can generate most requirements in a coherent and methodical way.

Personnel Factors

Technologies that are critical to improving the effectiveness of personnel include those that contribute to training, translation, and personnel protection.

Mission-Training Requirements. Many OOTWs are complex enough to impose mission-specific training requirements. If non-lethal weapons (NLW) are introduced, troops must not only be trained in the use of these weapons systems, but also instructed in the legal implications to their use and the related rules of engagement (ROEs). Simulation and gaming systems can help with this potentially onerous training load. Further, simulation and gaming can explore the scenarios where NLW would provide an advantage or where their use may be counterproductive. Virtual-reality systems offer promise across the full spectrum of training, from individual and unit training to mission planning and rehearsal. For example, in an urban scenario, sniper alleys and fields of fire can be plotted and tested. Finally, for some coalition partners who may have much less training than U.S. troops, virtual reality offers a quick way to raise their capability.

Translation Capabilities and Language Substitutes. Language difficulties impose barriers between coalition partners as well as between OOTW operators and local populations. The operators at the workshop showed strong interest in acquiring systems that could lower or eliminate these barriers. Communication was clearly one of the most important dimensions for them. One low-technology solution identified was the Defense Language Institute 800 number. The number provides access to a bank of translators who can be patched into phone calls. The operators present were not aware of this capability. Medium-technology solutions include development of "language-free" equipment, such as radios that use icons rather than words for functions and laptop computer programs that turn text into cartoons. Auto-translation technologies are at the high technology end and may not become available for some time. A very limited (250 words) Hangul/English system is presently under development for use in Korea.

Protection and Life-Saving Technologies. These include warning and identification technologies, ways to find concealed weapons, body armor, and other personal protection devices. These have considerable potential to reduce casualties in OOTW environments and are of considerable interest to operators.

Intelligence Needs

The need for improved intelligence is critical in nearly every OOTW scenario. The force commander requires accurate intelligence to protect his troops, to control the situation, and to avoid taking sides. Further he needs ways to disseminate the intelligence to the coalition members and sometimes even to belligerents. Technologies that can help fall into three broad categories:

Sensors range from humans with enhanced capability (night vision, etc.) to micro-sensors that monitor and report on the operational and tactical situations. Unmanned or

remote sensors can substitute for humans and thereby limit troop exposure in dangerous areas.

Displays incorporating translation capability or easily understood symbols can present intelligence to a wider range of OOTW partners.

Dissemination Methods/Devices can be shared with coalitions/private volunteer organizations (PVO) or non-governmental organizations (NGO). This goes beyond displays, to address the issues of protecting intelligence sources and methods.

Logistic's Needs

OOTW logistics are most often characterized by low technology and a non-standard environment. Contractor logistics is the norm for most general support, such as transportation, food, and housing. But better technology can be applied here with potentially dramatic impact. The workshop concluded that systems are needed to address three key issues:

Transportation and Tracking Applications: Technologies that are used by the USAF to perform on-time tracking of airlifts could be adapted to the less complex but critical OOTW logistics support. These movements, more often than not, will be made up of smaller and perhaps more numerous segments than a military load. State-of-the-art asset visibility and "just-in-time" inventory tools would be helpful. A three-dimension planning tool could help with the load planning, and provide accurate, current location information.

Standardized Contracting Modules: Since most of the OOTW logistics support is commercial, such tools could be used to expedite contract awards and to monitor performance.

Adaptation of Applicable Commercial Technologies/Methods: The technologies employed by commercial companies, such as DHL and Federal Express, are available and do not require development; they merely need to be adapted and adopted.

Mission Context

The type of operation and the potential for mission change over time (e.g., mission creep) together create a set of constraints within which the force commander must operate. Earlier workshops identified the basic types of peace operations and observed that the type of operation has profound implications on command and control structures. *Figure 4* shows how four important dependent variables can change, given change in the nature of the peace operator's role.

Figure 4. Nature of Peace Operations

NATURE OF OPERATIONS	LEVEL OF RISK TO PEACE OPERATOR	UN MANDATE	UN RESPONSE TO VIOLATION	PUBLIC RESPONSIBLE FOR FAILURE
OBSERVER	GENERALLY LOW	UN CHAPTER VI	DISENGAGE/ WITHDRAW	BELLIGERENT
PEACEKEEPING	MODERATE RISK, WEAPONS ARE IN A POSITION TO THREATEN PEACE	UN CHAPTER VI	DISENGAGE/ WITHDRAW	BELLIGERENT
GREAT DIVIDE				
PEACE ENFORCEMENT	GENERALLY HIGH, ONE BELLIGERENT WANTS TO FIGHT	UN CHAPTER VII	MILITARY RESPONSE	PEACE OPERATOR
PEACE IMPOSITION	HIGH, BELLIGERENTS WANT TO FIGHT	UN CHAPTER VII	MILITARY RESPONSE	PEACE OPERATOR

Particularly difficult are those operations that fall near the region labeled the "Great Divide," where mission creep tends to migrate. Understanding the boundaries between operations types is essential for mission success. Some of the factors to be considered include:

The Type of Operation and Its Charter: UN Chapter Six peacekeeping operations, Chapter "Six and a Half" (the Great Divide reached through mission creep), Chapter Seven peace enforcement and peace imposition, and other OOTW that include counter-narcotics, humanitarian, etc.

The Kind of Participation: How is the U.S. going into the operation? Will it be unilateral, coalition, interagency? Will it include NGO, PVO? What will be the command structure?

The Mission Environment: Urban, jungle, desert, etc.; the nature of the threat(s); political, social, and cultural contexts. The relationship between the OOTW forces and the general population is a crucial driver when selecting and applying technologies.

LINKING TECHNOLOGY, OPERATIONAL, AND POLICY CONSIDERATIONS

As part of the process to develop MCP concepts and subsequently technical requirements, a link must be established between operational experience and potential technology solutions. Many technologies are being developed for many purposes, but these technical "solutions" often appear out of step with operational priorities. The

workshop suggested a number of ways to improve the linkage between operators and technology/research planners.

A key part of this process involves educating operators about what is available and feasible. This workshop was a small step in this direction. To begin to make a dent in this area, a much more structured approach is necessary to develop an institutional process that bridges the present gaps between technology, policy, and operations.

Once technology requirements are identified, they must be subjected to selection criteria like those listed in *Figure 5*. The criteria are listed in descending order of importance; however, all are interrelated to a greater or lesser degree. With agreed selection criteria, an overall cost/benefit analysis can then prioritize those technologies. The most promising can be developed as resources and benefits dictate. The present situation appears uncoordinated and there is some duplication of effort. Also, the present process does not address the embedded problems that relate to training, doctrine, ROE, and so on. Policy issues must be addressed up front and at the appropriate level to prevent costly starts and stops.

Figure 5. Technology Selection Criteria/Considerations

- **Does it save lives:** US/coalition/local nationals? This is the primary factor to be considered when considering a technology for use or development.
- **Feasibility.** While many good ideas have emerged, the competition for resources dictates that we select only those most feasible.
- **Dual use.** It must have a warfighting application.
- **Political acceptability.** With out acceptance by the general public (as in the case of some NLW), the solutions won't supported and probably won't be used, however effective. Further complications arise from the public expectation of no or low casualties in OOTW.
- **Cost effectiveness.** As with feasibility, a balance between what is possible and affordable must be struck.
- **Trainability.** Since most OOTW will likely be coalition operations, the systems developed must not only be trainable to US troops, but also to coalition partners.

Chapter 3: Technologies and Their Implications

This section describes some of the general technologies that may be of use to OOTW operators; it then describes two technology areas of particular interest (mine clearing and NLW). A description of specific hardware implementations is followed by an attempt to anticipate some of the implications that adoption of OOTW technologies might have.

TECHNOLOGY TOOLS

Workshop discussions identified several generic technologies that appear to have wide application across representative OOTW. *Figure 6* compares typical OOTW mission areas with generic technologies that could support the missions. Neither the missions listed nor the generic technologies are comprehensive; however, these were the areas highlighted in the discussions.

Figure 6. OOTW Missions and Generic Technologies

OOTW TECHNOLOGIES/ MISSIONS	INFORMATION DISSEMINATION	INFORMATION SHARING	INFORMATION HANDLING	DAY/NIGHT/ALL WEATHER	SIGNATURES	TRAINING AND SIMULATION	SENSORS	DATA BASES	NON-LETHAL WEAPONS
COUNTER-INSURGENCY	+	+	+	+	+	+	+	+	+
COUNTER-TERROR	+	+	+	+	+	+	+	+	+
PEACE ENFORCEMENT	+	+	+	+	+	+	+	+	+
PEACE OPERATIONS	+	+	+	+	+	+	+	+	+
COUNTER DRUG	+	+	+	+	+	+	+	+	+
CIVIL OPERATIONS	+	+	+	+		+		+	+
NON-COMBAT EVAC	+	+	+	+		+		+	+
DISASTER RELIEF	+	+	+	+		+	+	+	+

The generic technologies apply across almost all the listed missions to some degree, and many apply to warfighting capability as well. In the military context, most of the technologies require integral C2, or are them-selves a C2 application. Command and Control requirements for each new technology must be thoroughly analyzed and then should be developed as an integral part of each new technology or capability. Use of non-lethal weapons, for example, may demand rigid constraints, depending on the scenario. If responsive C2 is not available, the results may be ineffective or even pose possible danger to one's own forces. Each technology and its appropriate C2 requires extensive

testing and should be gamed through various likely scenarios. Coalition partners, PVO/NGO, and others should participate, when appropriate.

Figure 7 displays the same OOTW mission areas (as Figure 6) versus technology applications that support each mission.

Figure 7. OOTW Missions and Technologies

OOTW TECHNOLOGIES/ MISSIONS	DEMINING	PSYSOPS	SNIFFERS	COMPUTERS	MECHANICAL DISABLERS	ACOUSTICS	SEE THR WALLS	PSY WAR	LASERS	TERR ISO	RADIO-FREQ	COUNTERSNIPER	BODY ARMOR	AP/AM	ANTI-SAM	AUTO TRANSLATION	CROWD CNTRL	LOCATION RECOVERY
COUNTER INSURGENCY	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
COUNTER-TERROR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
PEACE ENFORCEMENT	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
PEACE OPERATIONS	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
COUNTER DRUG		+	+	+	+	+	+	+	+	+	+		+	+		+		+
CIVIL OPERATIONS		+		+							+					+	+	+
NON-COMBAT EVAC		+		+							+					+	+	+
DISASTER RELIEF			+	+							+					+	+	+

Note that there is again near-universal application across many mission areas. Further analysis of the matrices shows areas of high payoff for dual-use in both OOTW and warfighting missions. Anti-SAM, counter-sniper/mortar, and mine-clearing technologies are examples with strong dual-use correlation.

TWO TECHNOLOGIES OF PARTICULAR INTEREST

Mine Clearing

The world is now littered with an estimated 80 million to 110 million anti-personnel land mines in 64 countries. These hidden killers maim or kill an estimated 500 people every week, mostly innocent civilians. Further, they complicate and sometimes degrade the effectiveness of OOTW (as well as combat operations). A variety of technologies offer promise. However, the mine-field environment and terrain dictate what may work. Further, combat requirements may not coincide with PKO or OOTW needs. For example, a mine field may need only to be breached or marked during combat. In post-combat and OOTW, the mines must be cleared to protect innocents, to allow displaced people to migrate back to their homes, and to return the land to peaceful uses. Mine clearing can be accomplished by a wide range of technologies. Some low- technology solutions, such as explosive-sniffing dogs, have proven quite effective. Other technologies, such as mine field clearing vehicles, can be very high technology and very expensive. Promising work in this area was explored by the workshop.

Non-Lethal Weapons (NLW)

Some of the applications shown in Figure 7 fit in the category of NLW. This class of weapons has generated considerable interest in the media and elsewhere; however, it is not a panacea and should be viewed as a two-edged sword. While NLW can add valuable options for the commander, they can also create some very real problems. First, the concept and use of NLW is widely misunderstood. The name itself is confusing and has created in the public and media expectations that cannot be delivered. Attempts to rename NLW in terms such as "disabling," "less-than-lethal," or "pre-lethal" fail to communicate the concept adequately. In some cases, the public has been outraged by law enforcement use of NLW like stun guns. Similarly, there has been widespread condemnation of blinding lasers. Moreover, non-lethal is neither a guarantee nor a promise, but rather a goal. The concept does not mean "no casualties" but rather an attempt to avoid fatalities.

Second, NLW are not replacements for lethal force and use of NLW should not preclude use of deadly force if needed. Ideally, NLW should add to the suite of options available to the commander. Properly employed as part of a system to buy time and space (to protect own forces for example), and backed up with lethal force, NLW can fill an important void in areas such as crowd control. Having denounced the use of chemical weapons for war, the U.S. needs a way to control crowds without the use of chemical riot agents. Finally, NLW further complicate the commander's life because they cause additional requirements for training, employment doctrine, logistics, and so on.

ROE for NLW may be complex particularly if they address the transition from NLW to deadly force. Command and Control to manage the ROE may be correspondingly complex. These requirements also compete for scarce resources, personnel, and training time. Notwithstanding all these complications, NLW do offer the promise of reduced casualties in many situations.

SPECIFIC TECHNOLOGIES

In addition to discussions of generic technologies and capabilities, the workshop discussed some specific technologies that are either being currently fielded or presently under development. Some of the applications reviewed include:

Soldier 911, PRC-112/GPS Tracking and Warning System. This system was developed from off-the-shelf items and is a good example of applying existing technology to the problems of location, tracking, and warning. In this application the system is programmed with geographic border lines and provides proximity warning to the soldier as well as transmits his position back to HQ. When the soldier gets within a preprogrammed distance from the border, the system alerts him with a beeping signal. Other warning and distress features can also be programmed into the system. Additional applications are communication with and tracking of individuals, vehicles, and so on.

Livermore Labs "Lifeguard" Anti-Sniper IR System. This prototype system uses infra-red sensors to track the heat of a sniper's bullet back to point of origin. The system can be coupled with an automatic response that either shoots back along the bullet track to the point of origin or illuminates the sniper. Operators were particularly interested in

this technology, especially in urban environments. The complex ROE issues involved were also discussed in some depth.

Livermore Labs People/Vehicle/Metal Sensors (Border Patrol). This system has been deployed with the U.S. Border Patrol on the U.S./Mexican border. It can distinguish between people, metal, people carrying metal, etc. In the tested environment, its range was several hundred meters.

Hovering UAV. These systems are air-breathing vehicles that can remain stationary or nearly stationary and provide long endurance (several to many hours) sensor platforms. Sensors can vary to fit the mission and environment. In essence, they function like "local area satellites" that provide the force commander with near real time intelligence data.

MHD. This technology (Magneto Hydro-Dynamics) refers to a range of NLW applications that use electromagnetic power impulses for a variety of actions, such as disabling equipment and stopping vehicles. Practical issues remain, but successful development would be valuable.

High Power, Low Frequency Sound Systems. These are a class of acoustic NLW that disable humans. Low frequency sound waves can potentially cause intestinal distress and disorientation. Testing this technology involves serious ethical and political considerations.

High Intensity Lights/Laser Weapons. These devices can flash-blind people and/or disable optical and infrared systems used for target acquisition. These also raise ethical and political issues.

Stink Bombs. These are described as non-toxic alternatives to gas agents which are illegal under the Chemical Weapons Convention. An agent that is merely offensive rather than toxic may serve as a barrier or impediment in some situations.

Sticky Foam/Deployable Nets. These are another class of NLW technologies designed to stop or impede human passage or activity by creating barriers, or physically restraining people without the use of deadly force.

Micro Sensor Networks. These sensing networks are conceptually composed of thousands of micro sensors that are deployed from a wide range of delivery platforms. Scattered in random, the sensors form themselves into monitoring networks that then transmit data to remote sites.

IMPLICATIONS OF TECHNOLOGY

Training

The use of advanced technologies in OOTW not only generates training requirements, but also can provide efficient training aids and methods. The complexities of OOTW coupled with the training required for the application of NLW could be so great as to be impractical. At the same time, technology applications, such as imbedded training

systems, and virtual reality applications can make the task doable. In addition to individual and unit training is the requirement for training with coalitions and the non-military players likely to be present in any OOTW scenario.

Doctrine

Like training, doctrinal implications emerge from each of the areas discussed. These need to be carefully developed and analyzed prior to operations and the developed doctrine shared and gamed with potential participants. Doctrinal implications need analysis early in the requirements pro-cess and through each stage of development.

Rules of Engagement

Given the complexity of many OOTW, the ROE may be correspondingly complex and require different actions as dictated by the situation. Political factors and media spotlight may exert influence on ROE interpretation. Different coalition partners may also interpret ROE in different ways. ROE interpretation must be addressed in these contexts as well as in the context of the latitude allowed to own forces.

Sharing with Allies and Coalition Partners

Technologies that share intelligence (without compromising sources and methods), that train in several languages, that rationalize and coordinate logistics requirements would all be useful. In coalition OOTW the complete team of U.S. and UN forces, and civilian organizations need common, trusted sources and sharing to be effective.

COMBAT READINESS IMPLICATIONS

Several of the workshop participants were concerned about the impact of OOTW on combat readiness for warfighting missions. It is clear that OOTW divert resources that could otherwise be used for training and/or combat. These resources include both talent and equipment. Training for OOTW missions reduces the time to train for the primary combat missions. Consumption of assets from both within and out of theater further degrades readiness. One participant reported that during the Somalia OOTW some pre-positioned assets were heavily depleted. For example, all the pre-positioned AM-2 "Marston Matting" (linkable and flexible steel mats that are connected to make runways, aprons, and roads) in theater was consumed. Further, a significant amount of U.S. equipment was left in Somalia when the U.S. forces were withdrawn. The question was asked: "Do we really want to draw down stocks of important warfighting supplies for an OOTW?" The answer - only if and because it prevents wars or protects larger U.S. national interests - must (according to the workshop) be coupled with adequate resources to restore readiness promptly.

Chapter 4: OOTW Technology Workshop Insights

This workshop examined issues relating to OOTW technologies at a number of different levels. The participants came to a correspondingly diverse set of conclusions, some very specific, others broader and further-reaching.

SPECIFIC RECOMMENDATIONS: TECHNOLOGIES NEEDED TODAY

Mine-clearing technologies are the highest priority for OOTW. The workshop concluded that the technology for mine clearing may or may not be revolutionary. Feasible solutions and costs depend largely on the mine field environment.

Counter-sniper systems are needed, especially in urban environments. Prototype systems that trace the bullet path back to the shooter show promise. Automatic engagement or shoot-back capabilities need doctrine and ROE to govern employment.

Language interpretation capability was the need most frequently cited by the operators. A variety of systems from low to high technology are under development.

CONCLUSIONS AND RECOMMENDATIONS

Given that the U.S. will be involved in more, not fewer, OOTW missions, the value of technology in OOTW must be carefully examined. The workshop concluded that while technology itself is important, it cannot solve all the problems faced in OOTW. Properly applied, technology can be used to minimize (but cannot eliminate) risk and to provide the force commander with more options with which to respond to the wide variety of OOTW situations.

The process should start with a better way to frame operational MCP technology requirements. The agencies and people working on OOTW technologies are responding to a very wide range of operational requirements that are not all well articulated. The requirements process needs to be better focused; there is presently too little coordination among organizations dealing with OOTW issues. While understanding that different agencies have different time horizons, the workshop agreed that there must be better coordination and less duplication of effort in the research and development of OOTW technologies. Those technologies developed primarily by and for law enforcement also need to be evaluated carefully. This workshop was a good first step towards requirements analysis and should be repeated at appropriate intervals.

Once requirements are identified, the full MCP framework should be applied to each OOTW problem and operational environment. Solutions that best match the MCP criteria (e.g., systems, training, doctrine) should be developed first. Technologies that show promise should be tailored to the MCP approach.

Non-lethal weapons offer the promise of reduced casualties, but they also create real problems that can greatly complicate the commander's life. Properly employed as part of a system to buy time and space to protect people and things (e.g., crowd control) they can add to the commander's options. But NLW alternatives require employment doctrine, training, ROE, C2, and they must not cause the commander to forfeit the ability to use lethal force.

Further, before the U.S. military will invest in and adopt NLW, the technologies must have "dual-use" (both warfighting and OOTW) applications. It is unlikely that technologies with only OOTW applications will be championed or accepted by the military services. On the other hand, if the system does fill a valid military requirement, the services will use and train with it. Procurement will still be a matter of prioritization of scarce defense dollars, with warfighting requirements receiving the highest priority.

Rules of engagement require careful analysis and must be tailored to each operation. What worked in the last operation may be completely irrelevant in subsequent ones. Each new technology and application may require new or modified ROE.

Environmental conditions complicate OOTW technology applications. In many applications the environment is the overriding factor in effectiveness.

OOTW create their own specific training requirements. Systems that improve and expand OOTW training are sorely needed. The training also needs to be transferable to coalition partners. Virtual-reality systems offer promise for both training effectiveness and affordability.

In summary, technology has much to offer the OOTW operator. But there is much work to be done before the promise of technology can be realized. Requirements analysis must be focused and feedback from field operators integrated. Technologies must be assessed, and the implications of their use (both positive and negative) clearly under-stood. The U.S. is in OOTW to stay; we should use our technological advantages to make our operations safer and more effective.