# MOUT-ACTD — A Positive Training Experience

## ATEC's Perspective for Program Managers

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"Victory is the main object of war. If this is long delayed, weapons are blunted and morale depressed. When troops attack cities, their strength will be exhausted."

Sun Tzu (Fifth Century B.C.)

As Somali shoppers watch, U.S. Marines march into Mogadishu, Somalia's Bakara Market to begin a sweep of the market for arms and munitions as part of Operation Nutcracker. The crowded market is the hub of Mogadishu's small arms trade.

DoD photo by Navy PHCM Terry C. Mitchell

Throughout the world, urban centers are increasingly becoming likely sites for U.S. military operations, and they are likely to remain hotbeds well into the 21st century. The complexities of this environment, such as line-of-sight restrictions, inherent fortifications, limited intelligence, densely constructed areas, and the presence of noncombatants, constrain our current forces and technology. More worrisome is the fact that the Army and Marine Corps do not currently possess an overwhelming technological advantage in an urban environment, unlike most other hostile environments where, technologically, they maintain weapons and information superiority.

Bridging the gap between mission and capabilities is the Military Operations in Urban Terrain Advanced Concept Technology Demonstration (MOUT-ACTD), which has proven and is still proving its worth as a beneficial partnership among developers, users, testers, and evaluators.

The Army Test and Evaluation Command (ATEC) first became involved with the MOUT-ACTD in October 1998. Since then, Army and Marine Corps developers and users received and continue to receive the benefit of independent assessment by ATEC, while testers and evaluators gained and will continue to

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Marine from Charlie Company rushes to his objective during Exercise Urban Warrior at the Military Operations in Urban Terrain facility at Camp Lejjeune, N.C.

DoD photo by Marine Lance Cpl. Scott A. Harwood

Italian soldiers guard three men suspected of setting fires in the town of Gorbavice, a suburb of Sarajevo, the day before it is to be handed over to Bosnian control.

DoD photo by Army Spc. Jean-Marc Schaible

gain data and insights to support future testing efforts. Equally important, the MOUT-ACTD demonstrated and continues to demonstrate how teamwork and cooperation between all the key players can strike a reasonable balance between the need to gather data and the need to provide warfighters with a positive training experience.

ATEC, which is formally known as Operational Test and Evaluation Command, became involved with the MOUT-ACTD in October 1998. In this article, we provide a general background, overview, assessment opportunities, ATEC's Assessment Methodology, and finally insights into the overall ACTD process from our perspective as lead analysts and evaluators. These insights include such issues as clearly defined requirements early on; advantages of multiple experiments; good idea cutoff date; transition to the acquisition process; and transition to the test and evaluation process.

## Pressing Deficiencies Prompt Action

In 1994, the Department of Defense established the ACTD process to exploit mature technologies and improve rapid-response rates for urgent military requirements. From its inception, the ACTD process was designed so that the end user — the warfighter — could evaluate proposed technological solutions to military needs earlier in the acquisition life cycle.

In FY97, DoD established the Joint Army and Marine Corps MOUT-ACTD, to address the most pressing deficiencies facing our troops in a MOUT environment. After a thorough review, identified deficiencies were then translated into 32 operational requirements agreed upon by the Army and Marine Corps. Covering a broad range, the resultant requirements addressed deficiencies in several areas: intelligence collection and dissemination; virtual mission planning; providing a stand-off breaching capability; the need for a blunt training round; as well as the need for more effective personnel restraints and casualty evacuation. These requirements were derived from operational deficiencies experienced by sol-

diers and Marines in past MOUT operations in Grenada, Panama, Somalia, and Haiti. With troops currently deployed to Bosnia and Kosovo, resolutions of these deficiencies are as critical today as they were in past conflicts.

## Force-on-Force Experiments

The MOUT-ACTD objective is to improve a unit's tactical capabilities to dominate the MOUT environment. Accordingly, the MOUT-ACTD Program Team designed this ongoing ACTD to assess the military utility of emerging technologies combined with supporting tactics, techniques, and procedures. When placed in the hands of soldiers and Marines, these technical capabilities should increase their Command, Control, Communications, Computers, and Intelligence (C4I) engagement, force protection, and mobility.

Arguably, the key to a successful transition of any of these products into the acquisition process will be the thoroughness of the technical and operational assessments. To provide the supporting data for this assessment, the MOUT-ACTD Program Manager scheduled a series of 10 force-on-force experiments, which focused on establishing military utility of the individual technology candidates at the squad- and platoon-levels. The Army conducted six force-on-force experiments at Fort Benning, Ga., while the Marine Corps conducted four at Camp Lejeune, N.C. (Figure 1).

The best candidate technologies were selected from the 10 experiments; these selected technologies then underwent further experimentation at the company- and battalion-levels during the Joint Experiments. Those technologies demonstrating operational utility during the Joint Experiments will be integrated into the Culminating Demonstration, followed by a two-year Extended User Evaluation.

While the Joint Experiments and Culminating Demonstration focus on the operational utility of the integrated technology package, many candidate technologies are stand-alone products. These stand-alone products are expected to transition as individual technology solutions for specific user requirements. Such transition could include a combination of several initiatives: a streamlined acquisition process; nomination for the Warfighter Rapid Acquisition Program; inclusion into the Soldier Enhancement Program and the Marine Corps Enhancement Program; or placement on the General Services Administration schedule.

## Participating Organizations

The U.S. Army Training and Doctrine Command is the lead executing agency. The MOUT-ACTD Technology Program Office (TPO), U.S. Army Soldier and Biological Chemical Command, is responsible for program management function, while the U.S. Army Dismounted Battlespace Battle Lab and the Marine Corps Warfighting Lab oversee the planning and execution of the ACTD field experiments. The Experimental Forces were drawn from the 10th Mountain Division, XVIII Airborne Corps, and the 2nd Marine Division, II Marine Expeditionary Force (II MEF), Marine Forces Atlantic. The Opposing Force included a mix of Army and Marine Corps infantry units.

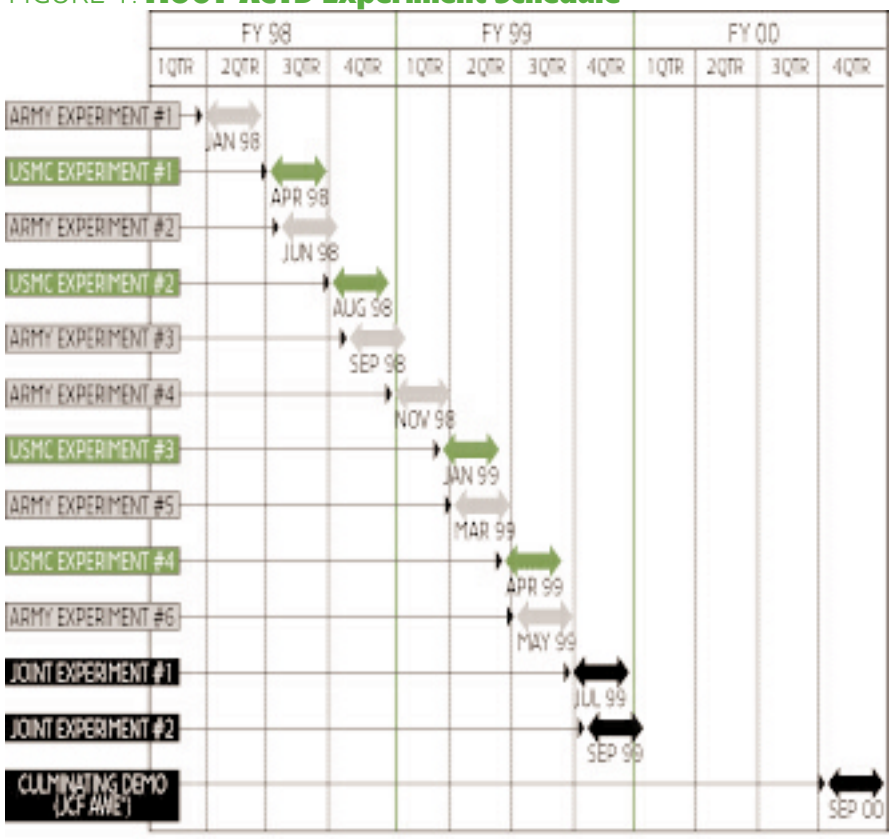
## ATEC'S Responsibilities

Our ATEC System Team (AST) was comprised of evaluators, analysts, and technicians from the Army Evaluation Center, the Operational Test Command, and the Infantry Test and Evaluation Coordination Office. As members of AST, our responsibilities were to observe all MOUT experimentation activities and provide technical advice in experimental design and data collection. Additionally, we provided an independent assessment report for each of the 10 MOUT experiments, along with an integrated assessment at conclusion. Currently, our Team is preparing the Joint Experiment Assessment Report, and an additional report will be submitted following the Culminating Demonstration.

## Assessment Opportunities

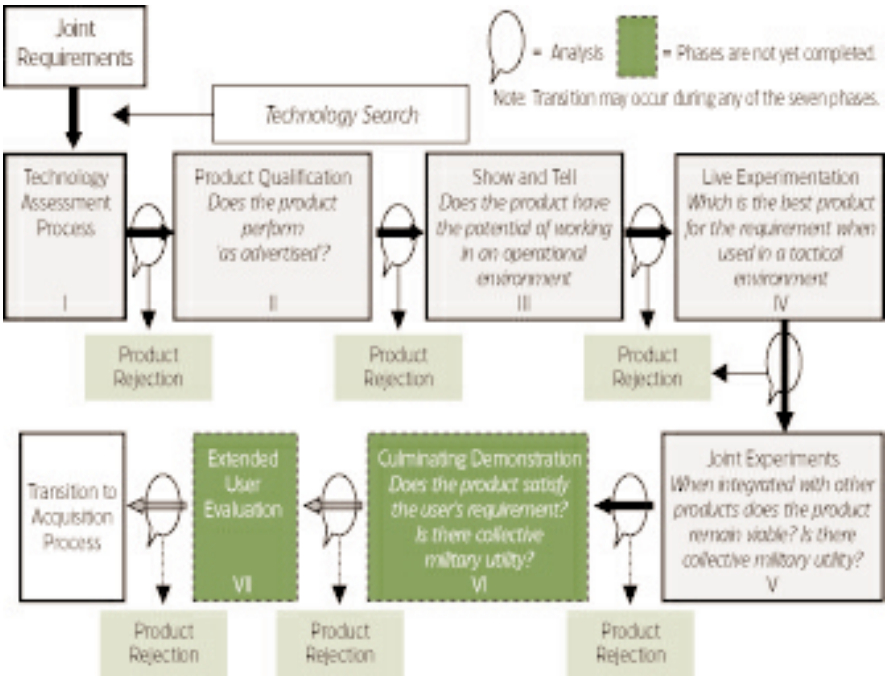
The assessment process will occur in seven phases. To date, the MOUT-ACTD

FIGURE 1. **MOUT-ACTD Experiment Schedule**




* Two-year extended user evaluation period following culminating demo. Joint Contingency Force Advanced Warfighting Experiment (JCF-AWE) from OCT 00 to OCT 02.

FIGURE 2. **Vertical Experimentation Assessment Methodology**




Program Team has completed five of these phases (Figure 2):

### Phase I
### Technology Assessment Process

The Technology Assessment Process, which exploited commercial, multi-attribute decision support software, was a systematic, consistent, and objective method used to assess the relative value-added of the technology candidates for each individual requirement, resulting in a ranking of those candidates. The rank order of the technology products resulted from user-defined and -weighted criteria.

### Phase II
### Product Qualification

Entering Phase II, the MOUT-ACTD Program Team designed the product qualification process to assess whether commercial and government off-the-shelf technologies would perform as advertised. Initially, the TPO evaluated each technology to determine whether a candidate met the minimum standards established by the Technology Assessment Process criteria. Eliminated from further experimentation were candidates that did not have a performance index within 10 percent of the candidate with the highest performance index. Considered viable candidates, those technologies remaining were selected to participate in Phase III.

### Phase III
### "Show and Tell" Operational Performance

Prior to each of the 10 Phase IV experiments, personnel from the Dismounted Battlespace Battle Lab or Marine Corps Warfighting Lab conducted a qualified assessment of the candidates to determine if the candidate was operationally viable.

### Phase IV
### Live Experimentation

Each of the 10 experiments focused on gathering technical and operational insights from side tests and tactical vignettes. Each experiment included several technical side tests that were non-tactical in nature. These were intended to focus solely on the technical performance characteristics of each technology that were otherwise difficult to evaluate as part of a tactical scenario. The side test provided a side-by-side comparison of each technology under similar conditions.

Each experiment also included several tactical vignettes, using tactical scenarios to evaluate each individual technology against the baseline technology. These vignettes provided operational data to assess the technology's effectiveness within a tactical framework.

### Phase V
### Joint Experiments

During the Joint Experiments' force-on-force scenarios, ATEC evaluated the tactical interoperability of the integrated technology package against baseline technologies. These experiments provided operational data to assess the technology's effectiveness as part of a package within a tactical framework. ATEC relied on user comments to determine if these technologies improve the unit's C4I, engagement, force protection, and mobility.

### Phase VI
### Culminating Demonstration

The MOUT-ACTD Program Team will conduct a battalion-level Joint Army/Marine Corps Culminating Demonstration in conjunction with the Joint Contingency Force Advanced Warfighting Experiment in September 2000 at the Joint Readiness Training Center, located at Fort Polk, La. The purpose of this demonstration is to confirm the overall operational utility of the integrated technology package from the Joint Experiments.

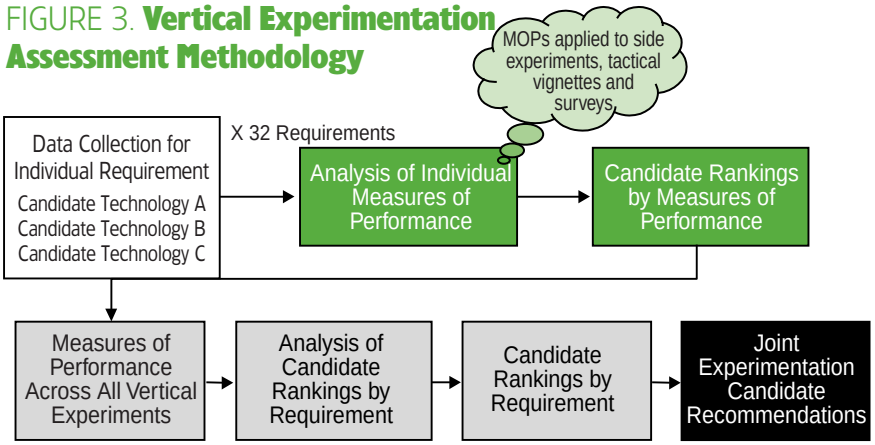
### Phase VII
### Extended User Evaluation

The technologies demonstrating significant military utility during the Culminating Demonstration will constitute a residual package and remain with the Experimental Force for a two-year Extended User Evaluation. Designed to provide the Experimental Force with an interim operational capability with associated tactics, techniques, and procedures, this phase will also provide some additional data collection and assessment opportunities to support the technology transition.

## ATEC Assessment Methodology

During various stages of the assessment process, ATEC used different types of measurements. The following discussion provides an overview of our as-

FIGURE 3. **Vertical Experimentation Assessment Methodology**




sessment methodology during the vertical and joint experiments.

### Vertical Experiment Assessment Methodology

The 10 vertical experiments focused on finding the technology candidate that best satisfied a given requirement. The data analyzed from the 10 experiments consisted of quantitative and qualitative data from surveys, side tests, and tactical vignettes Figure 3 summarizes the assessment methodology for the vertical experiments and their integration.

The analysis from each vertical experiment resulted in a ranking of each candidate technology for each measure of performance. Tabulating cumulative rankings for each of the candidates across all measures of performance, we used the results to conduct an integrated analysis of all the candidates, by requirement. Using this data, we then conducted Correspondence Analyses, calculating the high-level figures of merit for each candidate, by requirement. The analysis results, along with common sense and sound military judgment led to candidate recommendations of the most suitable technologies for inclusion in the Joint Experiments. These recommendations provided the nucleus for the MOUT-ACTD Integrated Technology Package.

### Joint Experiment Assessment Methodology

While the previous 10 experiments focused on finding the technology candidate that best suited a given requirement, the Joint Experiments assessed the MOUT-ACTD Integrated Technology Package as a whole. As such, the analysis focused on three measures of effectiveness for each of four mission functional areas:

- Engagement
- Force Protection
- C4I
- Mobility.

The three measures of effectiveness included:

- Technology Functions
- Technology Package Essential Elements of Analysis
- Technology Package Measures of Outcome.

The technology functions analysis focused on an individual candidate technology's capability and military utility, as perceived by the user. The analysis of the technology packages focused on enhancement and utility, relative to the essential elements of analysis and measures of outcome as perceived by the users and observers/controllers. Figure 4 further summarizes the analysis methodology for the Joint Experimentation.

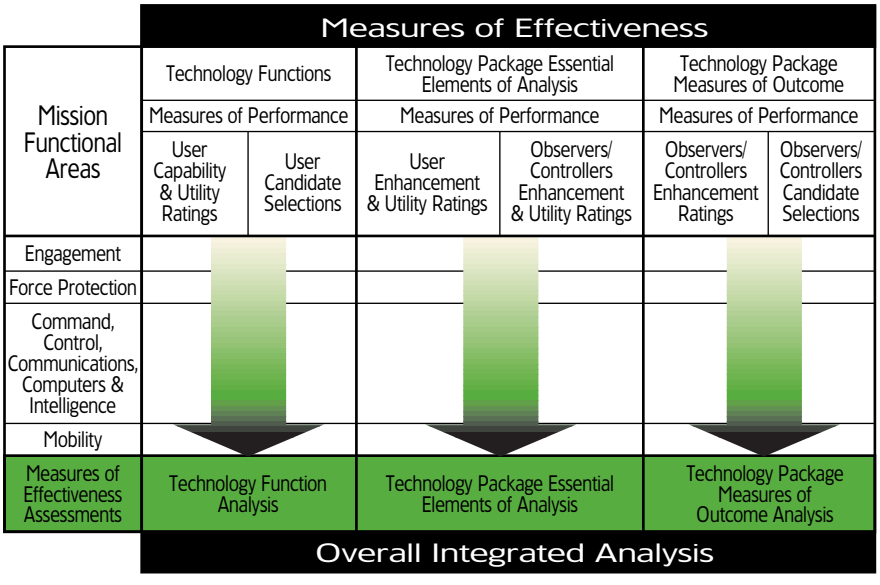
## ATEC's Recommendations

The MOUT-ACTD TPO initially assessed over 500 technology candidates against the 32 MOUT-ACTD joint requirements as part of the Technology Assessment Process. They recommended over 230 candidates to participate in the "show and tell"; user representatives then selected 118 technology candidates for the 10 vertical experiments. During the experiments, the TPO evaluated the technology candidates on their ability to satisfy 24 requirements. Based on the results, they ultimately recommended 26 technologies – satisfying 19 requirements – to participate in the Joint Experiments. Figure 5 highlights the results of the down-selection process.

## Insights

Surviving its initial growing pains, the MOUT-ACTD, as with all programs, has enjoyed and will continue to reach for its share of successes. Key to our successes to date, we believe, are a number of actions the ACTD Program Manager can take to smooth the ACTD process:

FIGURE 4. **Joint Experimentation Analysis Methodology**



U.S. Marines attack role-playing terrorists during a tactical maneuver demonstration at the Military Operations in Urban Terrain facility, Camp Lejeune, N.C.
DoD photo by Marine Lance Cpl. Timothy A. Pope

Bridging the gap between mission and capabilities is the Military Operations in Urban Terrain Advanced Concept Technology Demonstration (MOUT-ACTD), which has proven and is still proving its worth as a beneficial partnership among developers, users, testers, and evaluators.

### Clearly Define Requirements Early-On

In general, ACTD requirements are evolutionary in nature, and the MOUT-ACTD was no exception. The ACTD process is designed so that, as insights and additional data are collected, the combat developer can refine requirements. This ensures the operational requirements document represents what the user needs, based on what has been effectively demonstrated.

Throughout the 10 experiments, there were several requirements that were not clearly defined, hampering the candidate selection and assessment process. The requirements definition process has always been a challenge. Clear, concise, and unambiguous requirement statements that define the deficiency are critical to the ATEC assessment process.

Defining the "user" requirements is critical to the acquisition process. Given this, the "user" deserves to know — early on in the process — ambiguous requirement statements may weaken the ability to accurately evaluate the system. To alleviate this problem, the combat developer (the user's representative), and the test and evaluation community, should play an active role throughout the ACTD process. The combat developer's active participation facilitates open discussion and clarification of the users' requirements essential for post-ACTD transition. This not only focuses the testing community on the users' needs, but also expedites development of the operational requirements documents needed to transition these products to the acquisition process.

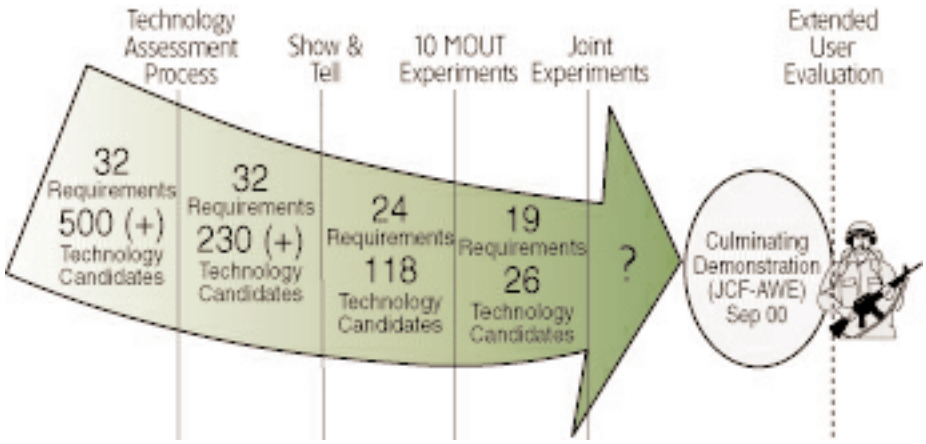
### Advantage of Multiple Experiments

The multiple experiments scheduled were the strength of the MOUT-ACTD program. With each experiment, the MOUT-ACTD Team grew in experience and better applied lessons learned from previous experiments to the next. As the team matured, the members grew increasingly focused on the key issues of each requirement. This, in turn, led to more focused "show and tells," side experiments, and tactical vignettes. Over the course of these experiments, the team not only grew increasingly focused on the experiment's objectives, but also improved their capacity to analyze a course of action, develop solutions, and execute the subsequent experiments successfully.

### Good Idea Cutoff Date

As the Joint Experiments started, the MOUT-ACTD Program Team allowed introduction of several new technologies

FIGURE 5. **MOUT-ACTD Down-Selection Results**



not present in the vertical experiments. While the 10 vertical experiments provided the structure necessary to evaluate the technical capabilities of a system or concept for the initial candidates, this was not possible with the new candidates.

While the users clearly endorsed some of these new candidates, the experimental data needed to support a fully integrated analysis were limited at best. Bringing these candidates into the process earlier would have eliminated this situation.

This late introduction of upgraded technologies into a situation or experiment is common throughout the testing community. As program managers strive to balance cost, schedule, and performance, they must first establish a good idea cutoff date. If a new product is to be brought forward after that date, the ramifications of that action must be evaluated in total. From our perspective, the decision to allow the introduction of new products into the Joint Experiments may ultimately shortchange the individual soldier or Marine "user" in the long run unless some mechanism emerges to obtain additional data supporting an integrated analysis. These candidates were not evaluated head-to-head against the baseline or other technology candidates; therefore, the final integrated analysis is not, in fact, a fully integrated analysis.

### Transition to the Acquisition Process

The MOUT-ACTD has provided an excellent transition mechanism for the Army and the Marine Corps to expedite their respective acquisition processes. During the 10 experiments, the MOUT-ACTD TPO evaluated over 118 technology candidates to satisfy 24 joint user requirements. While many of these candidates were not selected, 19 requirements were satisfied through this process, and the Department of the Army approved one technology candidate as a Warfighter Rapid Acquisition Program candidate. To improve technology and focus future testing, the team made additional recommendations for the 13 remaining requirements. In the long run, this will expedite the acquisition process for the 13 unsatisfied user requirements by eliminating much of the legwork for the Concept Exploration (Phase 0), and Program Definition and Risk Reduction (Phase 1).

### Transition to the Test and Evaluation Process

The data collected and assessments made during this ACTD will reduce future developmental and operational test costs. ATEC provided necessary support to the Combat Developer and Program Manager through the recommendations based on a candidate technology's ability to satisfy a given requirement and its technical maturity. The early soldier feedback, supported by ATEC's Assessment, will assist future ACTD Program Managers' efforts in recommending their systems for one of the following decisions: return for further development (government or commercial); discard the system; enter the Extended User Evaluation Period; or commercial procurement.

### Final Thought

Over the past decade and continuing today, declining budgets, changing threats, and the acceleration in the pace of technology development pose significant challenges for the acquisition community and its ability to provide technological solutions for the warfighter. While we do not presume the ACTD process is a panacea for all challenges facing the acquisition community today, from both an experimental and management perspective we believe the insights highlighted in this article do indeed provide significant value-added for future ACTD Program Managers, Material Developers, and the Battle Labs as they enter their own ACTD process. Clearly, the ACTD process is on the right path.

**Editor's Note:** The authors welcome questions and comments on this article. Contact McVeigh or Ryan at (703) 681-9166. Or E-mail Ryan at **ryanmike@hq.atec.army.mil.**

## 1999 Top 100 Contractors Report Released

The Department of Defense announced today [Feb. 15, 2000] that the fiscal year 1999 report of "100 Companies Receiving the Largest Dollar Volume of Prime Contract Awards (Top 100)" is now available on the World Wide Web. The Web site address for locating this publication and other DoD contract statistics is:

**http://web1.whs.osd.mil/peidhome/procstat/p01/fy1999/top100.htm**

According to the new report, the top 10 defense contractors for fiscal 1999 were:

| | | ($ in billions) |
|---|---|---|
| 1. | Lockheed Martin Corp. | 2.7 |
| 2. | The Boeing Co. | 11.6 |
| 3. | Raytheon Corp. | 6.4 |
| 4. | General Dynamics Corp. | 4.6 |
| 5. | Northrop Grumman Corp. | 3.2 |
| 6. | United Technologies Corp. | 2.4 |
| 7. | Litton Industries Inc. | 2.1 |
| 8. | General Electric Co. | 1.7 |
| 9. | TRW Inc. | 1.4 |
| 10. | Textron Inc. | 1.4 |

In fiscal 1999, DoD prime contract awards totaled $125 billion; $6.9 billion more than in fiscal 1998.

**Editor's Note:** This information, published by the Office of the Assistant Secretary of Defense (Public Affairs), is in the public domain at **http://www.defenselink.mil/news** on the Internet.