

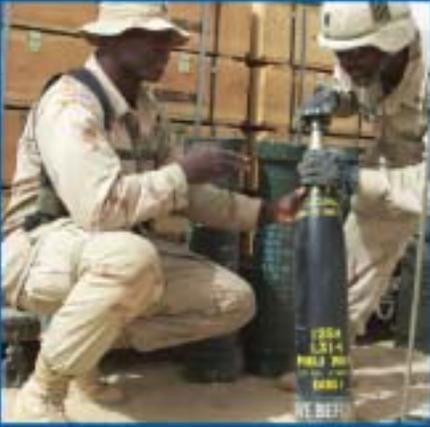


**Torchbearer  
National Security Report**

**Key Issues Relevant to**

***The U.S. Army's  
Transformation  
to the  
Objective Force***

VOLUME III



**An AUSA Torchbearer Issue**  
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# Preface

Continuing on the theme of earlier AUSA Torchbearers on key issues relevant to Army Transformation (Volumes I and II), this edition explores the Army's progress toward meeting its Objective Force goals. The issues transcend the fielding of new combat systems and fighting doctrines. Transformation means assessing change to doctrine, organizations, training, materiel, leader development, people and facilities (DOTMLPF) aspects. This volume highlights some of those aspects as part of a total Transformation to the Objective Force Army within this decade.

The irreversible momentum of Transformation has taken hold. The Army leads the way, making significant progress on its Unit of Action (UA)/Unit of Employment (UE) doctrine and on materiel developments with the Future Combat Systems (FCS). Shuffling personnel and introducing new hardware do not define true Transformation. Lasting change is contingent upon modifications in culture. While judgments of the Army's Transformation efforts thus far have rested on developments occurring in its tooth (the combat arms branches), it is the Army's tail (the combat support and combat service support branches) that will truly transform the Army to the Objective Force.

The Army has embraced the concept of change and has set the standard for other services to follow. Its development of **Fuel Cell Technology** has incorporated the work of civilian industry and academia through innovative collaboration. Strides made in alternative energy development respond directly to the doctrinal requirements for speed, agility and reduced logistical footprint. The **Joint Munitions Command** (JMC) consolidates responsibility for ammunition production, supply and management across the services. JMC exemplifies global logistical projection and industrial cooperation with consistent and accurate interfacing among the command, contractors and military consumers. Using information management as a tool for global reach, joint operations and industrial interface, **Virtual Planning, Operations, Rehearsal, Training and Simulation** (VPORTS) will establish a new process for assessing missions, decentralizing simulation and providing two-way information exchanges between field soldiers and command, doctrine and industry sources. **Battle Labs** are building on existing structures to better analyze and direct doctrine development and joint-service collaboration with real-time, remote exercises. The advancements are a function of improved information systems and simulation programs.

American ingenuity and an inherent culture of innovation drive Army Transformation. Using core competencies to sustain an advantage over existing and potential adversaries, the Army is exploiting technical progress and ongoing research in hardware and software. Management, leadership and teamwork have influenced achievements made in industry, among senior leadership and within the ranks. Those intangibles will affect further developments and ensure continued advancement—as long as we remember that technology will never replace the soldier on the ground.

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## Alternative energy sources are an integral part of the Army's transformation to the Objective Force.

While it's been said that an army marches "on its stomach," the Army's movement on future battlefields will depend on its appetite for energy. Fuel resources constitute over 70 percent of the tonnage in the Army's logistical tail. A significant portion of that resource is required to power the tanks, wheeled vehicles, aircraft and field generators that enable the Army's command, control, communications, computers, intelligence, surveillance and reconnaissance (C<sup>4</sup>ISR) and support assets.



The dangers of American reliance on limited fossil fuels have been evident for more than three decades. With varying projections, petroleum-based energy production is expected to peak within the next 20 years. According to a 1999 study, the Department of Defense (DoD) accounts for about 80 percent of the federal government's total energy use—about one percent of the nation's total. DoD purchases and consumes five billion gallons of fuel annually. Though the Army's total fuel purchases are a fraction of those required by the Air Force and Navy (mostly

for aviation operations), its fuel needs are inextricably tied to the combined totals because of the airlift and sealift requirements essential to rapid deployment.

### Objective Force requirements

As the civilian automotive and petroleum industries have begun serious pursuit of alternative energy use, the Army has led the uniformed services in embracing emerging fuel technologies. The Army's transformation to the Objective Force has hinged on rapid deployment, mobility, survivability and a reduced logistical footprint—changing the way the Army fights. By emphasizing lightweight and transportable vehicle designs, innovative engine solutions and networked, sensor-intensive system-of-systems principles in its requirements, the Army has broken significant ground for alternative energies. Nontraditional fuels are a function of the Objective Force doctrine and standards.



### Rethinking the tooth-to-tail ratio

The potential of hydrogen fuel cells, hybrid components, synthetic fuels and retrofitting may drastically reduce the Army's conventional petroleum-based energy consumption while diminishing the size and function of its logistical tail. The results will reduce the substantial tonnage and troops needed to put combat forces in place and sustain them. Force structure and refueling requirements will increase speed and lethality. More

efficient engine operation not only eliminates time-consuming maintenance but also improves survivability with suppressed engine noise, fewer noxious emissions and an overall reduced signature. In addition, these changes can cut defense spending for all services and reduce detrimental environmental impacts in training areas worldwide.

more . . .

## Fuel Cell Technology (continued)

A fuel cell is similar to a battery in its use of chemical energy (a petroleum or hydrogen fuel) mixed with an oxidant (typically air) to produce electricity. While batteries require recharging, a fuel cell will continue to produce electricity as long as the basic ingredients are supplied. The application of fuel cells to military use is largely contingent on cost and durability.

Molten carbonate and solid oxide fuel cells (MCFCs and SOFCs, respectively) operate at extreme temperatures but require material costs and protracted operating conditions for maximum effectiveness. While alkaline fuel cells (AFCs) have been used for onboard electrical generation since the early years of the NASA program, they are extremely sensitive to carbon dioxide poisoning in the oxidant exchange. Phosphoric acid fuel cells (PAFCs) are powerful, easily constructed and energy efficient throughout production and output. The Army already has put 30 PAFCs to use as installation power generators. But PAFCs are prone to carbon monoxide poisoning within the system and require a costly platinum catalyst for generation. Proton exchange membrane fuel cells (PEMFCs) generate more watts per kilogram and operate at lower temperatures. Higher power density, rapid start-up and flexible operation best suit PEMFCs to vehicle applications. Storing the pure hydrogen fuel presents a practical problem. To give hydrogen-powered vehicles the comparable 300–400-mile range of a petroleum engine, large pressurized tanks are needed for safe onboard hydrogen gas storage.



## Hybrid electric collaboration

As several civilian petroleum and automotive firms have devoted resources to alternative energy research and development, the Army's National Automotive Center (NAC) is developing a heavy-duty truck that produces up to 30 kilowatts of hybrid hydrogen-based electricity from an auxiliary power unit (APU) for operating components while idling, reducing fuel consumption by 20 percent and cleaning up emissions. Hybrid electric vehicles will be the most sensible solution for enabling all onboard C<sup>4</sup>ISR and weapon systems

on the future battlefield. Synthetic fuels offer a similar advantage for the Army by increasing engine efficiency as much as 300 percent, improving performance, reducing emissions and streamlining requirements into a "power-train neutral" resource that can supply all vehicles on the battlefield. United Defense, Syntroleum Corporation, Delphi and Ballard Power Systems, working with NAC, have been developing these transformational technologies.

## Soldier power applications

The Objective Force Warrior (OFW) dismounted soldier system also will present unprecedented power needs. Currently, infantry soldiers are weighted down with several days' worth of batteries for radios, global positioning system (GPS) devices, night vision, weapon sights and flashlights. One battalion on a 96-hour mission requires 4,400 disposable batteries, at 8,800 lbs., at a cost of \$500,000. To increase an infantryman's lethality and survivability without expanding his load, Army and Defense Advanced Research Projects Agency (DARPA) researchers are examining rechargeable batteries, power management systems and streamlined battery stocks. By adapting commercial battery technology in the near term and developing fuel cell or microdevice power generation in the long term, the substantial individual energy requirements can be met without the bulk and burden of today's disposable batteries.



***Alternative Energy Sources: A key strategic enabler***



## **U.S. Army Joint Munitions Command (JMC): New command has key role in supporting 21st century fighting forces.**

The U.S. Army Joint Munitions Command (JMC) was provisionally established on 17 January 2003 at a ceremony held in Rock Island, Illinois, site of JMC Headquarters. The formal establishment of JMC will take place when Fiscal Year 2004 begins on 1 October 2003. The new command has a key role to play in the ongoing transformation of America's armed services, and in supporting the fighting forces of the 21st century.

### **JMC's Mission**

JMC executes the mission formerly performed by the U.S. Army Operations Support Command (OSC). As the Defense Department's field operating agency for the Single Manager for Conventional Ammunition mission, JMC manages all aspects of ammunition logistics—the production, storage, issue and demilitarization of conventional ammunition for all U.S. military services.

To meet the needs of the transformed fighting forces of the 21st century, JMC is developing and modernizing systems to provide theater and field commanders with accurate, up-to-the-minute information on the status of munitions; make the most



effective use possible of the existing ammunition stockpile; and maximize the capabilities and cost effectiveness of munitions production facilities.

Through its Army Field Support Command (AFSC) component, JMC serves as a platform for projecting logistics power anywhere in the world. AFSC maintains prepositioned stocks of weapons and equipment stored at land-based sites around the world and aboard ships. As the "face to the field" for logistics, AFSC provides direct support to

combat units deployed to the front lines, and operates sites such as Logistics Support Elements (LSEs) near forward areas.

### **The "Ammunition Enterprise"**

Through the "Ammunition Enterprise" concept, JMC works closely and in tandem with the Program Executive Office for Ammunition (PEO-Ammo) at Picatinny Arsenal, NJ, in carrying out the complex mission of supplying the best possible ammunition to warfighters. PEO-Ammo will take the lead in areas such as research and development, acquisition strategy and budget planning, while JMC will take the lead in areas involving the direct performance of the ammunition mission. In all areas, the two organizations will coordinate plans and actions to assure that customer requirements are met in a timely, cost-effective manner.





## Joint Munitions Command (continued)

“Joint” is part of JMC’s name because the command supports all U.S. military services—the Army, Navy, Marine Corps, Air Force and Coast Guard. To meet the diverse needs of these customers, the command remains in close contact with leaders from the Army and the other services. JMC also acts in partnership with private industry when contracting for munitions production and shipment.



### JMC Locations

JMC operates a nationwide network of installations and facilities where conventional ammunition is produced and stored. Active JMC production and storage sites include:

- **Anniston Munitions Center**, Anniston, AL
- **Blue Grass Army Depot**, Richmond, KY
- **Crane Army Ammunition Activity**, Crane, IN
- **Hawthorne Army Depot**, Hawthorne, NV
- **Holston Army Ammunition Plant**, Kingsport, TN
- **Iowa Army Ammunition Plant**, Middletown, IA
- **Kansas Army Ammunition Plant**, Parsons, KS
- **Lake City Army Ammunition Plant**, Independence, MO
- **Letterkenny Munitions Center**, Chambersburg, PA
- **Lone Star Army Ammunition Plant**, Texarkana, TX
- **McAlester Army Ammunition Plant**, McAlester, OK
- **Milan Army Ammunition Plant**, Milan, TN
- **Radford Army Ammunition Plant**, Radford, VA
- **Red River Munitions Center**, Texarkana, TX
- **Riverbank Army Ammunition Plant**, Riverbank, CA
- **Scranton Army Ammunition Plant**, Scranton, PA
- **Tooele Army Depot**, Tooele, UT

### By the Numbers

JMC’s worldwide workforce comprises approximately 220 military personnel, 5,100 federal civilian employees and 8,200 contractor personnel. Of that total, about 1,050 work in JMC Headquarters at Rock Island Arsenal. JMC manages an estimated annual budget of \$1.2 billion.



All of JMC’s ammunition production facilities are owned by the government and operated by contractors, with the exception of two that are government-owned and operated: Crane Army Ammunition Activity and McAlester Army Ammunition Plant. McAlester is also home to the Defense Ammunition Center, a separate JMC facility that provides training to ammunition professionals and specialized services to ammunition customers.

In addition to the installations listed above, JMC retains some responsibility for other ammunition plants and facilities that are inactive or that have been declared excess to the government’s needs.

***Joint Munitions Command has a crucial role in the ongoing transformation of America’s armed forces.***



## VPORTS: Virtual Planning, Operations, Rehearsal, Training and Simulation

### The Challenge: Sustaining the Objective Force

A strategically responsive force operating in a high-tech, jointly integrated environment requires more than merely modernizing equipment and information systems. It calls for rethinking the fundamentals of preparing, deploying and supporting military operations, transforming not only the products but also the actual processes used for developing, updating and delivering doctrine, training and materiel to the field.



Emphasis must be placed on establishing processes and procedures that are as effective, adaptive and responsive as the warfighting units they are designed to support.



### VPORTS: Maneuver Sustainment “Fusion” Platform

Successful employment of 21st century technology cannot be realized using 20th century practices. The pace of transformation is too fast, the traditional “stovepipe” processes too slow, the complexities of a multicomponent, joint force structure too demanding, and the cost in terms of dollars and readiness too high. VPORTS will address this challenge, using technology to integrate, leverage and transform the processes

of combat, materiel, training and simulation development.

Using a virtual platform powered by a suite of local and remotely linked digital systems, VPORTS will provide a collaborative environment to plan and assess doctrinal concepts, conduct mission analysis, perform digital rehearsals, develop simulation-based training and support schoolhouses and Army/joint units during exercises, deployments and actual operations—an integrated approach to supporting an integrated force.

### Leveraging Knowledge to Sustain the Force

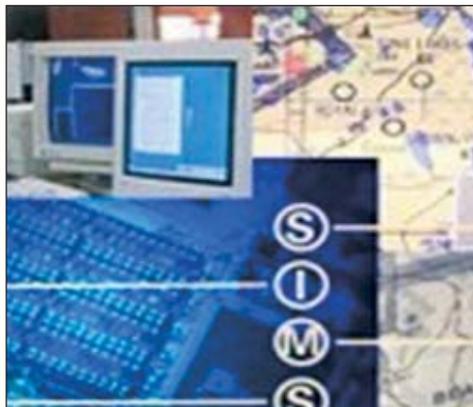
The cornerstone of maneuver sustainment is effective knowledge management. Information must be accurate, timely and responsive to the needs of the warfighter. Achieving this requires knowledge to be actionable, reused and repackaged—shared across the doctrine, organization, training, leader development, materiel, personnel and facilities (DOTLMPF)



domains and efficiently updated and repurposed within the array of information systems, publications and products delivered to the field. VPORTS will answer this challenge, using tools such as the Joint Computer-aided Acquisition and Logistics Support (JCALS) system to collaboratively develop, share and repurpose Stryker technical data establishing a real-time, global interface between the vehicle manufacturer, training developer and Stryker Brigade Combat Teams.



## VPORTS (continued)



This capability will improve combat readiness by providing operators and maintenance personnel with rapid access to authoritative source data, the means to quickly identify and report discrepancies in electronic technical/training publications and use of a logistics knowledge “reachback” capability linked directly to the vehicle engineers, materiel developers and training proponents. The result will be a fast and efficient means to update, train and sustain commanders, soldiers and their Stryker fleets, and a model for the development of the Future Combat Systems (FCS) and other emerging platforms.

### Transforming the Training Support System

Training Transformation involves moving toward an environment where individual soldiers, units and schoolhouses can access effective training whenever and wherever needed. Getting there will require a transformation of both the products and the processes by which they are developed, updated and delivered. Several VPORTS initiatives are underway.



As part of the Army’s digital training strategy, VPORTS is testing the use of digital training support packages linking training publications, online interactive multimedia instruction, scenario-based simulations and learning management systems using Army Knowledge Online and supporting information architectures.

The goal is to achieve an efficient and cost-effective means for establishing, integrating and maintaining “living” training products and globally distributing simulation-driven packages

that can be adapted, modified and reused by individual soldiers, unit commanders and school commandants to satisfy the unique training needs.

### Cost-effective Training, Modeling and Simulation

In an effort to expedite delivery of digital training—while at the same time reducing costs—VPORTS will be used to assess the ability to develop “digital training simulators,” allowing standard computers to emulate the functionality of actual battlefield operating systems. This initiative will significantly reduce the costs of implementing institutional digital training, and will allow soldiers to access digital training from wherever they are, without the need for the actual hardware/software systems.

VPORTS will also be used to experiment with various modeling and simulation programs, attempting to achieve a virtual, digital rehearsal capability that allows commanders, staffs and school commandants to collaboratively model, plan and assess military operations—a virtual “sand table” supporting training, exercises and warfighters deployed on actual missions.

***VPORTS propels Transformation with 21<sup>st</sup> century technology, changing the way the Army and joint forces will prepare to fight and win on the battlefield.***



## The future of TRADOC Battle Labs: Building on a model of innovation

The U.S. Army Training and Doctrine Command's (TRADOC's) Battle Labs are undergoing the first major reorganization since their creation a decade ago. They are being transformed into Objective Force Battle Labs to support the overall Army/Department of Defense Transformation. More than a singular dimension of technology—simply developing a new tank or radio—Transformation is a multidimensional effort to create a holistic revolution across doctrine, organizations, training, materiel, leader development, people and facilities (DOTMLPF).



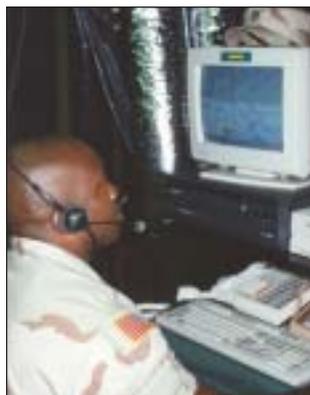
### Building on success

The Battle Labs, established in May 1992, were originally designed to address the changing nature of warfare during a period of ambiguous threats and to challenge existing paradigms through experimentation, providing qualitative and quantitative analysis. **Battle Labs viewed lessons learned from past engagements to provide insights and direction to future developments.**

The basic mission of the Battle Labs will not change. However, to meet the need for an Objective Force integrated arms/system-of-systems design construct, Battle Labs must be redefined for greater collaboration and teaming of traditional branch proponents. **The requirement for holistic DOTMLPF solutions drives the design of these organizations, growing from simply an experimentation agency to an element capable of full DOTMLPF study and analysis.** These Objective Force Battle Labs will work through the combat developments process from the initial mission area analysis and concept inception to the realization of a full mission solution across the DOTMLPF. Collaboration among Objective Force Battle Labs will help integrate capabilities throughout the development process.



### Rethinking the future



To ensure decisive ground combat dominance and avoid surprise within a world of uncertainty, the Army is shifting its requirements development process from the “threat-based” model that has guided its thinking in the past to a “capabilities-based” model for the future. Understanding of both the potential of technology and the operational environment within which the Army must operate will allow identification of those capabilities required to best address future threats and to make appropriate changes, incorporating DOTMLPF, to provide the Army with a continuing asymmetrical advantage over potential adversaries.

In April 2002, the first Objective Force Battle Lab, the Unit of Action Maneuver Battle Lab (UAMBL), was established at Fort Knox, KY. UAMBL consists of a full DOTMLPF developments organization, along with operational environment and experimentation directorates. This integrated arms team, in collaboration with the other branch and specified proponents, was key to the accelerated development of the Objective Force, the Unit of Action Operational and Organizational (O&O) Plan, the Future Combat Systems Operational Requirements Document (FCS ORD) and the Unit of Action Concept Experimentation Program (UA CEP).

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## Battle Labs (continued) Teaming across locations

In January 2003, the Unit of Employment/Battle Command Battle Lab (UE/BCBL) at Fort Leavenworth, KS, began its detailed O&O work for the UE. It is directly supported by the Battle Command Battle Lab satellites at the Intelligence Center at Fort Huachuca, AZ, and the Signal Center at Fort Gordon, GA. They team with the other proponents and additional emerging Objective Force Battle Labs in their ongoing UE design efforts.

Collaborative tools and experimentation will minimize the resource burden imposed by travel requirements previously needed to fully share expertise—key to success within an integrated arms construct. To this end, TRADOC is designing the Battle Lab Collaborative Simulation Environment (BLCSE). The BLCSE will provide collaborative tools and a means for distributed simulations to link the expertise of multiple proponents with other key development contributors, to include Joint Forces Command (JFCOM), the TRADOC Analysis Center (TRAC), the Army Materiel Command's Research, Development and Engineering (RDE) Command and the FCS Lead Systems Integrator (LSI), as required.

BLCSE's collaborative tools (i.e., online meetings with video, secure voice teleconferencing and application sharing), modeling and simulation standards and tools and integration software will provide the ability to conduct real-time analysis at one site and feed the results back into a model at a separate site using performance and employment data as well as a common scenario on a classified network.



All Battle Lab experimentation is conducted in a joint context. BLCSE will enable a simulation link to other service efforts through JFCOM's Distributive Continuous Experimentation Environment (DCEE), using common data and configuration protocols.

### Enacting change and shifting culture

TRADOC is well on its way to providing these capabilities. In March 2003, the command demonstrated the shared use of common scenario and information between two sites with its own models. In May 2003, the UAMBL at Fort Knox will lead a virtual experiment using three simulators and linking five sites. By incorporating the full span of DOTMLPF solutions, the Army can address Transformation in a holistic manner. The Army will develop more than just another materiel platform. It will build a combat-capable organization with the soldier as its centerpiece.

**This culture of innovation and collaboration is already strong, enabling great Unit of Action developments over the past year.**

As the Army improves upon the organization and the collaborative tools available to support, it will further this cultural shift. By enabling collaboration with service partners, the Army can ensure that Transformation solutions remain ever relevant to the joint warfighter.



**Transformation demands acceleration, innovation and collaboration. The Army Battle Lab, already a proven innovator, will serve as the centerpiece of the Objective Force developments process.**

# Torchbearer Message



Army Transformation is on the move. The undertaking is ambitious and irreversible. For the effort to be enduring, a cultural reinvention is required throughout the ranks. That reinvention has already taken hold and is manifesting itself in current logistics, maintenance, training, planning and knowledge management activities. The Objective Force will have an unprecedented structure, appearance and lethality on the battlefield. Its support corps will exhibit a similarly radical form and function with expanded information exchange, streamlined resource management, reduced supply lines and integrated joint-service considerations.

Responsive speed and joint operations are critical factors to Army Transformation. Recent events in Southwest Asia have illustrated the importance of faster deployability, in-theater mobility and logistical sustainment. Speed is not only a battlefield function but also a factor of improved industrial production and fielding. Information systems are as vital to the Army's "global reach" capability as its troops and equipment on the ground. The mutual benefit of jointness integrates forces, allowing the Army and its fellow services to arrive as a readily lethal package. Developments made in technology, resourcing and industrial advancements improve cost-effectiveness and share the wealth across the forces.

This Torchbearer volume is the third series of issue papers devoted to Army Transformation. These articles address major developments in Transformation, particularly in combat service support functions, since publication of Volume II in August 2002. Key points:

- **Fuel cell technology** stems from the Army's successful partnerships with civilian industry and researchers. The developments address pressing global and environmental realities. Moreover, nontraditional energy sources correlate directly to Objective Force requirements to reduce the logistics bulk that slows rapid strike capabilities and hinders mission flexibility.
- The **Joint Munitions Command** streamlines ammunition readiness across the services. Improved production, distribution and accountability measures assure warfighting units arrive in hostile locations with sufficient lethality and sustainability for survival and dominance.
- **Virtual Planning, Operations, Rehearsal, Training and Simulation** will use digital technology for timely information access to those who need it most. From crucial data for operators and mechanics, to training and rehearsal applications, VPORTS will eliminate the clutter and delay of stovepipe systems.
- Today's **Battle Labs** are building on their successful records of analytical modeling and simulation to continue assessing current and evolving warfighting doctrines, stressing information accessibility, real-time and multilocation participation and an emphasis on joint operations.

These developments reinforce the importance of soldiers at the center of Army Transformation. Soldiers constitute the mind of the organization. They make key decisions every day to win tactically, operationally and strategically while assuring the service's continued dominance in the 21<sup>st</sup> century. Soldiers are the muscle that gets the pieces in place, puts the assets into action, and wins and holds terrain. Today's soldiers are embracing the Army's changing culture and doctrine and are ensuring genuine Transformation for those soldiers who inherit the Army of the future.

*We firmly believe if you're going to control terrain and populations,  
you've got to do it with a force that can be sustained over time.*

*MG Franklin L. "Buster" Hagenback  
Commanding General, 10<sup>th</sup> Mountain Division (Light),  
in Vernon Loeb, "General Defends Tactics in Afghan Battle,"  
The Washington Post, 12 March 2003*



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