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Army's Modifications to Improve the Bradley Fighting Vehicle's Survivability, Reliability, and Performance

Statement of
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Subcommittee on Procurement and Military Nuclear Systems
Committee on Armed Services
House of Representatives

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Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss our assessment of modifications the Army has proposed for the Bradley Fighting Vehicle in an effort to improve its survivability, reliability, and performance. A classified appendix to my statement has been provided to the Subcommittee.

BACKGROUND

Concerns about the Bradley's survivability center on its vulnerability to antiarmor weapons and its ability to function in a combat environment in which these types of weapons proliferate. These concerns led to the inclusion of a provision in the 1987 National Defense Authorization Act directing that the vehicle undergo further testing. The Army has been testing certain modifications designed to increase the vehicle's survivability. As a result of these tests, the Army has decided to modify the approximately 3,200 Bradleys still to be produced and to retrofit many of the vehicles already produced with certain survivability enhancements.

Also, reliability and performance problems concerning the vehicle's swim capability, transmission, electrical systems, and integrated sight unit have been reported. The Army has recently begun to incorporate modifications into the Bradleys, which it believes will correct these problems. However, experience with

most of these modifications on fielded vehicles is still too limited to permit us to fully assess the extent to which they may improve the Bradley's performance.

SURVIVABILITY MODIFICATIONS

The current vehicle, referred to as the "basic" Bradley, is designed to withstand munitions of up to 14.5-mm, but it contains a highly explosive cargo of 25-mm ammunition and TOW missiles. Thus, threat munitions that penetrate the vehicle's armor and hit either the 25-mm ammunition or the TOW missiles could cause a complete loss of the vehicle and its crew. Casualties in such an event would be high, since the infantry version of the vehicle carries up to nine troops and the cavalry version up to five.

The 1987 authorization act required the Secretary of Defense to perform live-fire and operational tests on the Bradley, with particular emphasis on how well certain modifications to the vehicle improved its survivability. The modifications were incorporated into two types of test vehicles: the high survivability vehicle and the advanced survivability test bed vehicle. Both the infantry version and the cavalry version were tested.

Four principal modifications to the high survivability vehicle were tested.

-- Reactive armor, which is designed to react or explode outward when hit, thereby deflecting or lessening the effect of certain munitions, was mounted on a large portion of the vehicle's surface.

-- Applique armor consisting of steel plate was added to the existing armor on parts of the turret and hull to provide protection from certain munitions.

-- A spall liner was added to the interior of the crew compartment to reduce the amount and dispersion of spall fragments, thereby reducing crew injury or interior damage.

-- The 25-mm ammunition and the TOW missiles were restowed to less vulnerable areas inside the vehicle.

These modifications would increase the vehicle's weight from about 50,000 pounds to about 60,000 pounds.

Four modifications to the advanced survivability test bed vehicle were also tested.

-- The fuel tanks were restowed to the outside of the vehicle to eliminate fires that could occur inside the vehicle.

-- The TOW missiles were restowed on the exterior of the vehicle, and the 25-mm ammunition was compartmentalized.

-- A spall liner, similar to the one in the high survivability vehicle, was installed.

-- Applique armor was added to increase the vehicle's protection from certain rounds.

As in the case of the high survivability vehicle, these modifications would increase this vehicle's weight to about 60,000 pounds.

Based on the results of the live-fire and operational tests, the Army has decided on the following Bradley survivability enhancements:

-- reactive armor and provisions to mount it,

-- heavier applique armor than what was tested,

-- a spall liner, and

-- internal restowage of the ammunition.

These modifications are similar to the high survivability vehicle's modifications. One difference is that the applique armor selected will be heavier than that which was tested. The added weight of this applique armor will increase the Bradley's combat weight to 65,000 pounds, a 30-percent weight increase over its current 50,000 pounds. Army officials report that the modifications will increase the current vehicle's total life-cycle costs by $1.6 billion. In 1988, the Army plans to equip about 600 vehicles, or 5 brigades, with the reactive armor used in the live-fire tests. Eventually, enough of the reactive armor will be bought to equip 4,500 of the total anticipated force of 6,800 Bradleys.

Our evaluation of the test results and the Army's decision is included in the classified appendix to this testimony.

RELIABILITY AND OPERATIONAL MODIFICATIONS

Overall, our work disclosed that the Army's modifications to the Bradley appear to be correcting the vehicle's recurring mechanical problems with its swim capability, transmission, electrical systems, and integrated sight unit. However, other problems with these components, as well as other areas, continue to affect the Bradley's reliability and its capability to perform its mission.

Table 1 shows the Army's progress in reducing the failure rates of the transmission, vehicle distribution box, turret distribution box, and integrated sight unit.

Table 1: Bradley Component Failure Rates During New Equipment Training in Europe

	1983	1984	1985	1986	1987
	percent				
Transmission	13	16	5	3	1
Vehicle distribution box	13	12	4	2	7
Turret distribution box	15	21	6	6	1
Integrated sight unit	53	20	8	12	8

New locking device should remedy swim problems

Since June 1980, 11 Bradleys have sunk or swamped during swimming operations. Nine of these sinkings occurred because the quick-drop mechanism of the trim vane, which supports the rubber-covered, canvas water barrier, collapsed. In April 1987, after a sinking at Fort Benning, Georgia, the Army suspended Bradley training swims worldwide until the trim vane problem could be corrected.

To reduce the number of sinkings, the Army replaced the quick-drop mechanism on the trim vane with a solid-support locking device. Since the locking mechanism was installed during June-November 1987, approximately 1,000 Bradleys have participated in swimming exercises with no reported sinkings. The initial success of the new mechanism appears to demonstrate that the Bradley's swim problem has been resolved.

Swim tests of the heavier 60,000-pound high survivability vehicle showed that the Bradley could enter the water from varying slopes without sinking or swamping. The weight increase caused by the modifications did not degrade the vehicle's ability to swim, accelerate, or turn in the water. However, exiting was more difficult for the high survivability vehicle than for the basic Bradley, especially on steeper slopes and in slippery soil. Swim tests have not been conducted on the 65,000-pound Bradley selected by the Army.

Transmission modifications appear to be correcting most significant problems

The Bradley transmission, consisting of almost 900 separate parts, provides vehicle propulsion, steering, and braking. Production of the transmission began in fiscal year 1980. In July 1983 the Army listed the transmission as the second most significant problem area on fielded Bradley vehicles.

The producer of the Bradley transmission introduced major modifications in mid-1985, primarily to strengthen specific components in the hydraulic unit. These design changes were incorporated into new factory-built transmissions on all vehicles fielded in 1987. These modifications corrected six of the top eight problems that were responsible for deadlining Bradley transmissions.

Bradley field exercises seem to show that the modifications incorporated in production units have increased the transmission's reliability. For example, during 1987 training exercises in West Germany, less than 1 percent of the factory-modified Bradley transmissions failed. In addition, since receiving new Bradleys in 1987 with the factory-modified transmission, the 2nd Armored Cavalry Regiment in West Germany has experienced few transmission problems.

The Bradleys fielded before 1987 are receiving some, but not all, of these modifications. According to an Army official, not all problems corrected by the factory can be made in the field; they are better incorporated at the depot level. To make these modifications at the depot level would deadline vehicles and degrade operational readiness.

The field modifications have improved the transmission reliability of the older Bradleys; however, because not all modifications have been made to fielded vehicles, these vehicles are continuing to experience some transmission problems. For example, during a 3-week field maneuver exercise in November-December 1987 at Hohenfels, West Germany, out of the 132 Bradleys that participated from the 3rd Infantry Division 12 transmissions had to be replaced. Five of these transmissions would not have been replaced if the vehicles had received the same modifications as those added to the new vehicles.

Electronic improvements made, but some problems exist

The turret distribution box and vehicle distribution box generally serve the purpose of tying together the Bradley's numerous electrical components, assemblies, and subsystems into an integrated, electrical system.

During developmental and operational testing, the turret and vehicle distribution boxes experienced higher than expected failure rates. In addition, deficiencies were found in automated test equipment. Numerous corrective engineering changes have been approved and are being added to the turret and vehicle distribution boxes as well as to the standard test equipment.

In 1987, the turret distribution box showed a marked improvement in reliability. Although 6 percent of the turret distribution boxes failed during training exercises in West Germany during 1986, only 1 percent of these components failed during these exercises in 1987. According to Bradley crews and mechanics in Europe, the modified turret distribution boxes are working well.

Although crews and mechanics from the 2nd Armored Cavalry Regiment say that they are having few problems with vehicle distribution boxes, replacements of these components increased during the European training exercises from 2 percent in 1986 to 7 percent in 1987. Army officials were unable to explain this increase.

Reliability problems on integrated sight unit persist

The integrated sight unit, which allows the crew to fire its weapons under virtually all conditions, including darkness or limited visibility, is the most complex component on the Bradley. Although its performance is much improved over what it was when first fielded, this unit continues to be a reliability problem, showing little improvement since 1985.

According to Bradley crews and mechanics from the 2nd Armored Cavalry Regiment, the integrated sight unit is the most frequently

replaced major component on their new vehicles. One particular difficulty identified by the gunners was that their lenses would not switch from high to low magnification. This problem forced the gunners to remain focused on a relatively small area and did not allow them to view the entire battlefield.

BRADLEY CANNOT PERFORM SUSTAINED OPERATIONS IN A CONTAMINATED ENVIRONMENT

The Bradley lacks a Nuclear Biological Chemical (NBC) system to conduct sustained operations in a contaminated environment, a problem that is not addressed in the modifications. Military experts as well as Bradley crews told us that this system is a necessity for the vehicle.

Military experts believe that the Soviets will contaminate the battlefield with chemical agents in any central European conflict. Should this occur, the Bradley's lack of an NBC system will limit the crew's ability to conduct sustained operations. The Bradley's companion vehicle in the Army's combined arms doctrine--the M1A1 Abrams tank--has an NBC system and, it is believed, will be able to survive in a contaminated environment. If these vehicles encounter chemical agents on the battlefield, the Bradley may be unable to fight with and support the Abrams tank.

HEATER FAILURE IS

A COMMON PROBLEM

Crews on older Bradleys said that their heaters fail regularly, while crews on the newer vehicles said that, although their heaters work, they do not provide sufficient heat for the entire crew.

We interviewed 25 drivers of the 60 older Bradleys in a 3rd Infantry Division battalion in West Germany. Only 1 of the 25 said that the heater in his vehicle worked properly during a 2-week, November-December 1987 training exercise. To stay warm, the crews wrapped themselves in sleeping bags while operating the vehicle.

According to Army officials, heater problems are not unique to the Bradley. They said that most Army vehicles have problems with their heaters. In view of the adverse effect the problem may have on soldiers' performances, we believe the Army should investigate a solution.

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Mr. Chairman, this concludes my prepared statement. We will be happy to respond to any questions.