An early Bradley maneuvers at the National Training Center.

Chariots of Fire:

Building the Bradley Fighting Vehicle

by Major General Stan R. Sheridan (Ret.)

Chariots of Fire may be the title of a 1981 Oscar-winning Hollywood movie, but it is also a fitting description of the "soldier-carrying" vehicles that went into production in 1981 and today carry the Bradley Systems name. In fact, chariots of one kind or another have carried soldiers into battle, and on and around the battlefield, throughout the recorded history of warfare, dating as far back as the early Egyptians and the Romans. Even today, the Israeli indigenous tank carries the name chariot in Hebrew — Merkava. So, some 20 years after departing the program as the U.S. Army's first Program Manager for what has become known to the world as the Bradley Fighting Vehicle System, and some 6,724 Bradleys built and in the hands of U.S. Army soldiers, it seems appropriate for me to tell the story of how the Bradley evolved into the finest fighting Chariot of Fire of its type in the world today.

The history of the Bradley was long and tortured. While today we take the design and the vehicle's outstanding warfighting performance for granted — its two-man turret, the two TOW antitank missile launcher, the highly effective 25mm cannon system, the very reliable power train with its outstanding cross-country mobility, and the overall fightability of the system — this was not always so. In the beginning, in the late 1960s and early 1970s, the Army was struggling to determine and define just what it wanted as the replacement for the M113 armored personnel carrier (APC). The M113 had been a workhorse during the Vietnam War and was the backbone of the Army's mechanized infantry. Was the replacement to be another APC that brought fighting men to the battle in a protected "battlefield taxi" and then placed them in harm's way to fight on foot; or was it to be a true fighting vehicle, giving the soldier a protected place from which to assault, fight, and kill the enemy? The result, in the early 1970s, was the latter, a fighting vehicle concept called the Mechanized Infantry Combat Vehicle, or MICV, which, when translated to an all-up prototype in the mid-1970s, proved to be unfightable. The gunner was in a one-man turret; the vehicle commander was in the hull behind the driver where he could not see to command or fight the vehicle; the crew/squad compartment was a crowded "arms room" and an inadequate fighting platform; and the main armament, a 20mm cannon, had no armor-killing capability.

In 1975, the MICV program was reoriented and combined with the Army's SCOUT and Bushmaster (25mm cannon) programs into a single vehicle program, the Infantry and Cavalry Fighting Vehicle System, renamed in 1981 for General of the Army Omar N. Bradley. With that reorientation came a reaffirmation of the Army's requirement and a redesign that resulted in today's Bradley Fighting Vehicle. Its two-man turret placed the vehicle commander up high where he could see, command, and fight the vehicle. The addition of a two TOW antitank missile launcher gave the mechanized infantry battalion a long-range, front-line, tank killing capability without increasing the Army's force structure. The vehicle's crew compartment stowage was revised and redesigned into a fighting compart-

ment from which mounted infantrymen could fight. And the less-than-capable 20mm cannon was replaced with the battlefield-worthy 25mm Bushmaster, with its armor piercing and high explosive multipurpose ammunition. With this redesign and reorientation, the technical design challenge for the developer of the new vehicle was on a par with that of designing a tank, but with the added human factors of carrying an infantry squad, allowing the vehicle to swim, and ultimately making it an acceptable fighting platform for mounted infantrymen and cavalrymen.

With these changes, the mechanized infantry found itself in much the same position, from a doctrine standpoint, as the horse-mounted cavalry did when the machine gun first appeared on the battlefield. The design of the new mobile weapons system, when translated into fightable hardware, required changes in mounted infantry doctrine and the development of new operational concepts and tactics in order to take full advantage of the new vehicle's battlefield capabilities. Firing on moving targets with the 25mm cannon, for example, now required the infantry gunner to use tank gunnery techniques, which were totally foreign to the infantrymen of the late 1970s and early 1980s, whose largest automatic weapon until then had been a .50 caliber machine gun. As a result of this and other operational capabilities and requirements of the new system, mounted Bradley infantrymen required totally new training packages.

To the Army's credit, it bridged the doctrine, training, and tactics gaps, and has produced the world's most capable and finest mounted warriors.

The Bradley development program proceeded successfully through the late 1970s and early 1980s, sucessfully fighting off the "Too Big, Too Bulky, Too High" naysayers, a presidential program cancellation, and three U.S. Army general officer reviews, in 1976, '77, and '78. With the program re-started after the presidential cancellation in 1977, and the reaffirmation of the requirement, the concept, and the design by the three general officer reviews, the program proceeded to meet its congressionally mandated first production delivery date of May 1981 without further delays. In fact, the Bradley was the first, and I believe the only, tracked vehicle to be approved for production by the Army and the Office of the Secretary of Defense (OSD) on the first request. This was due primarily to the vehicle exceeding its overall designed-in system Reliability-Availability-Maintainability requirements during independent government acceptance testing.

But there is more to the Bradley story. The real questions facing the fielded Bradley system were: What do soldiers think of the vehicle? Is it really fightable? Does it meet the Army's needs? And how does it do in combat? The proof of any piece of equipment issued to soldiers is its performance and soldier acceptance in combat, and the Bradley was no exception. The Bradley's combat test and proof was Desert Storm, where it received not only its baptism of fire, but complete soldier acceptance. The experience of the lead brigade of the 24th Mechanized Infantry Division's "Left Hook" operation was typical of the Bradley's superb combat performance in the 100 hours of Desert Storm. The brigade's 120 Bradleys traveled 360 miles, fighting all of the way with no vehicle drop-outs or losses. While the 25mm armor-piercing round did kill some T-72 tanks with shots to the side and rear, it proved to be an overkill against the Iraqi BMP infantry carriers, often passing right through the BMP and calling for use of the more appropriate HEAT-MP (High Explosive Antitank-Multi Purpose) round. The Bradley soldiers of Desert Storm, and those using the vehicle in places like Somalia and Bosnia, have resoundingly endorsed the system and put to bed the naysayers, the questioners, and the critics by affirming that the Bradley is a highly mobile and effective battlefield killing machine. It is not an APC nor a battlefield taxi, but it does take soldiers to the battle and lets them fight while mounted and protected. It is not a boat, but it does have a swimming capability. It is not a tank, nor is it heavily armored, but it does have a long-range tank killing capability; and it exceeds the tank's cross-country mobility and effectively complements the tank on the battlefield. Today, with over 6,700 infantry and cavalry fighting vehicles in the hands of U.S. Army soldiers around the world, the Bradley is justly touted and soldier accepted as the finest fighting vehicle of its kind in the world.

Having said all of this, and having painted the fielded Bradley infantry and cavalry system in justifiable glowing praise, I do not want this article to look like a "whitewash" of the program, which at this point, some readers might say it is. I say this in view of the recent HBO movie about the Bradley, which said just the opposite, described the vehicle and the program as a flaming disaster, and depicted me and my two successor general officer program managers (Phil Bolté and Don Whalen) as a composite evil incarnate. Certainly, in all honesty, the program did have its problems along the way, both fiscal and technical, but no more so than are to be expected in any combat vehicle development program, and certainly less than some of its predecessor programs. These are examples of some of the problems that we really did encounter:

- From a fiscal standpoint, we all — government and contractors alike — grossly underestimated the impact of inflation and the cost of doing business in the 1970s and early 1980s, which drove up the system's final unit production cost.

- Technically, the early transmission was a show stopper. The problems caused me to stop government testing in late 1975 and introduce into the program a full transmission competition between two different technical approaches. The current fielded transmission is the result of that competition, and I might add is the "fixed" and winning version of the original MICV show stopper.

- The gun, too, had its development problems. One evening, I received a call from one of the two competing 25mm cannon developers asking which news I wanted first, the good or the bad? The good news answer I asked for first was that the explosion had put out the fire; the bad news was that the cannon had blown up in a test stand. Again, this development problem was fixed prior to weapon selection and acceptance by the Army.

- As I said earlier, the Bradley is not a boat, but it does swim today. While trying to make it work, we sank some (without casualties) during the development of the final swim kit.

- Long after I had left the program, and the Army and OSD had given the production go-ahead, there was a "tempest in a teapot" over the ballistic protection of the vehicle's aluminum armor, the lack of Army live-fire verification tests of the Bradley's armor in a complete, all-up vehicle, and a claim by some at the Office of the Secretary of Defense that aluminum armor would burn catastrophically when hit. All of this was emphasized in the HBO movie. Protection levels for the vehicle are still classified today, but in general, standards called for protection at various ranges against direct fire weapons up to 14.5mm, small antitank shaped charge missiles, various size mines, and overhead artillery bursts nearby. Although the movie doesn't give this impression, we also knew from the beginning that, if the vehicle was hit by large mines, large antitank missiles, or

tank rounds of any size, there would be major penetrations and serious damage. These risks, as a trade-off between mobility, protection, and weight, were accepted by the Army from program inception and were reconfirmed by the three general officer reviews of the late 1970s. As a result, ballistic testing was limited to firings on representative armor arrays and technical calculations based on previous ballistic test results, and not on an all-up, very expensive vehicle, testing it to destruction. Initially, the Army and OSD were satisfied with these results, but later, due to the persistence of testers in OSD, the Army conducted full vehicle live-fire testing to destruction. Seventeen production Bradleys, a mech infantry company's worth, were taken from the Army and used in these tests, which OSD directed and paid for. Of those 17, four were tested to destruction, and the remaining 13 were used for various other live-fire tests, but all were lost to the Army's inventory. When it was all said and done, the testing reconfirmed what we already knew to be the protection levels of the vehicle, what would happen to the vehicle if hit by large missiles, tank rounds, or large mines, as well as the fact that aluminum armor does not burn catastrophically as claimed by the OSD testers.

An interesting aside to the live-fire story was the use of a MICV prototype (the vehicle is now displayed as a monument in front of Infantry Hall at Fort Benning) for early mine testing. Initially our program master plan called for 12 prototype vehicles; but due to funding limitations, we bought only eight — hardly enough to meet all the demands for prototypes, let alone ballistic testing. But the program made do with the eight and received a production go-ahead based on the testing of that number. When a requirement for live-fire vehicle testing against large mines came along, my successor, Brigadier General Phil Bolté, looked long and hard for ways to meet the requirement without destroying one or more of his limited number of prototypes. Hence the use of the MICV monument vehicle from Fort Benning as a cost-, time-, and prototype-saving measure. The MICV could be used because its chassis, from a ballistic protection standpoint, was identical to that of the Bradley. The MICV "monument vehicle" was shipped to Aberdeen Proving Ground, exposed to mines of various sizes, and finally, partially destroyed by a large mine. It was externally refurbished and then returned to Fort Benning, where it stands today.

While expensive and probably unnecessary, the OSD-directed live-fire to destruction ballistic testing did reveal some things about the Bradley vehicle that resulted in refinements to its protection prior to Desert Storm. These included the addition of Kevlar spall liners inside the vehicle (which had been recommended earlier, but not approved due to cost); the restowing of some ammunition from inside to outside of the vehicle; some restowing and rearrangement of the fighting compartment to better protect the crew; some fuel storage tank relocation; and the addition of external, bolt-on armor to enhance protection over critical areas. As a result, the A2 Bradley of Desert Storm and later is a better protected vehicle than the early production vehicles, which are now all being upgraded to the A2 configuration or better.

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Finally, a question that begs answering is, "Why didn't the Army, on its own, plan for and conduct vehicle live-fire testing?" The answer is simple: it couldn't afford the cost, nor did it deem such testing necessary. In the final analysis, the accomplishment of the testing required specific direction and extra funding from OSD. One has to wonder, was the result that cost the Army a company of Bradleys worth the time and expense? I don't know the answer, but I can say that the Army did not learn very much from this testing which it did not already know. But the protection afforded America's soldiers by today's A2 Bradley is superior to that of early production vehicles and may be responsible for saving soldiers' lives.

And what of the Bradley derivatives, or support vehicles, during this process? In 1975, the U.S. Army had a need for a tracked vehicle platform for the Artillery's Multiple Launch Rocket System (MLRS), and the Bradley vehicle chassis was chosen as the candidate platform. In reality, what the Army really wanted was a highly mobile, tracked "pick-up truck" whose truck bed could be used for many battlefield missions, but at the time the only money available was for the development of the MLRS carrier. Adopting the very successful and reliable automotive and suspension components of the original MICV chassis, the MLRS carrier was developed, tested, accepted, and fielded with almost complete commonality with the chassis of its sister fighting vehicle. The differences between the two are in the physical, rather than mechanical, aspects of the chassis. Again, the proof of this derivative was its complete success and soldier acceptance in the combat of Desert Storm. At the same time, the Army got its "pick-up truck." Today the derivative carrier's time has come. Among other uses, it is being strongly considered by the Army as the basis for a command and control vehicle, an ambulance, and a communications vehicle.

Looking back, and forgetting the pain along the way, one can say that the Bradley was a success story. This was primarily due to the Army's belief in, and support for, a fighting vehicle and its MLRS derivative, along with the dedicated hand-in-hand team effort by all those directly involved in its development, production, and fielding — the U.S. Army Program Manager's Office, the infantry, cavalry, and artillery users, and all of the many dedicated civilian contractors who went the extra mile for the program. The development buzzword today is PARTNERING, or the joining together of all those involved in a development program toward a common goal. Without knowing it, that is what was done with the Bradley in the 1970s and early 1980s, long before the word or the thought was in vogue in the Defense Department.

While the birthing process may have been difficult and lengthy, the Bradley systems turned out to be worthy members of the U.S. Army's force of mounted warriors, joining and complementing the Abrams tank and the Apache helicopter, forming a combined arms team to be reckoned with on any battlefield, anywhere in the world.

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