



## Armored Helmet Hardtop® Product Description



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## General Description

The Lightweight Composite Armored Helmet Hardtop® (LCA HHT) built by Amtech Corporation is a monolithic composite armor covering for the HMMWV. It was designed to take the place of the roof and back wall supplied with other armor kits. The composite recipe being used to manufacture the current configuration of the LCA HHT provides protection against National Institute of Justice (NIJ) Standard-0101.04 level III threats and .50 caliber Fragment Simulating Projectiles. The LCA HHT was designed to allow increased threat protection levels to be spiraled into the configuration as they become available.

### Background

Amtech Corporation began producing the standard Helmet Hardtop (HHT) in 1991, as a more durable replacement for canvas tops for the HMMWV. The HHT was unique in that it provides a single compartment that is shared by the crew and the cargo, similar to a typical sport utility vehicle. The HHT has been made available in multiple configurations, including mid-height and tall tops for the HMMWV, and tops for trailers.

In 1998, PM – Soldier Support in Natick, Massachusetts requested that Amtech Corporation provide HHTs for testing at Aberdeen Test Center (ATC). Successful testing at ATC paved the way for the assignment of National Stock Numbers (NSNs) and a 10-year contract with Defense Supply Center Columbus (DCSC). Since that time, U.S. Military units have been able to purchase HHTs for their HMMWVs using Class Nine Funds.

Amtech has worked with various military programs to provide specialized communications and electronic attack versions of the HHT that integrate EMI Shielding and Antenna Mounting Hardpoints. These programs include:

- PROPHET – The U.S. Army’s principal signals intelligence and electronic warfare system for Division and Armored Cavalry Regiment commanders
- MBCOTM – Mounted Battle Command On-The-Move
- CESAS – Communications Emitter Sensing and Attacking System
- CONDOR – C2 On-The-Move Network Digital Over-The-Horizon Relay

In order to meet increased demand during the military build-up for Operation Iraqi Freedom, Amtech was able to ramp-up the production of HHTs from an average of 40 units per month in the second quarter of 2003 to over 900 per month in December of 2003. This represents an increase in production rate of over 1,250%. During this ramp-up period, Amtech Corporation was able to produce in excess of seven times its annual contract requirement while maintaining a 100% Quality Rating.

At the request of the Project Offices for CONDOR and CESAS, Amtech Corporation developed the LCA HHT to provide a composite armored solution for those programs. Working with the University of Delaware, Center for Composite Materials this top was developed per specifications outlined by the Project Offices. Testing of the LCA HHT began at Aberdeen Test Center in October 2005.

## Design Objectives

In developing the LCA HHT, several key design characteristics were set as objectives:

1. The initial design objectives for the LCA HHT were to provide a composite armor version of the HHT. The top was to provide a threshold level of ballistic protection equal to or better than NIJ Level III.
2. The top was to interface with existing armor kits.
3. The top was to be mounted so as not to cause damage to the HMMWV during operation.
4. The form of the top was to resemble the standard HHT as much as possible
5. The top was to be constructed from readily available materials.
6. The top was to provide Electromagnetic Interference (EMI) shielding equivalent to that provided in the unarmored CONDOR and CESAS HHTs.
7. The method of manufacture was to be such that increased levels of protection could be achieved by modifying the “ballistic recipe”, with no change to tooling.
8. The manufacturing process was to be designed to be fully documented for traceability and verifiability.

## Ballistic Performance

The ballistic recipe used to manufacture the LCA HHT provides ballistic performance equal to or greater than that specified in National Institute of Justice (NIJ) Standard-0101.04 level III. At this threat level, no spall is projected into the passenger compartment of the vehicle. The materials used to manufacture the LCA HHT have undergone preliminary ballistic testing at the H. P. White Laboratory in Street, Maryland.

## Physical Configuration

The Armored Hardtop is designed to be installed on the HMMWV, and to interface with the existing armor kits. It is very similar in shape and size to the standard HHT (see Figures 1 & 2). Key dimensions of the LCA HHT are shown in Figure 3. The overall weight of the LCA HHT including mounting hardware is approximately 1380 lb.

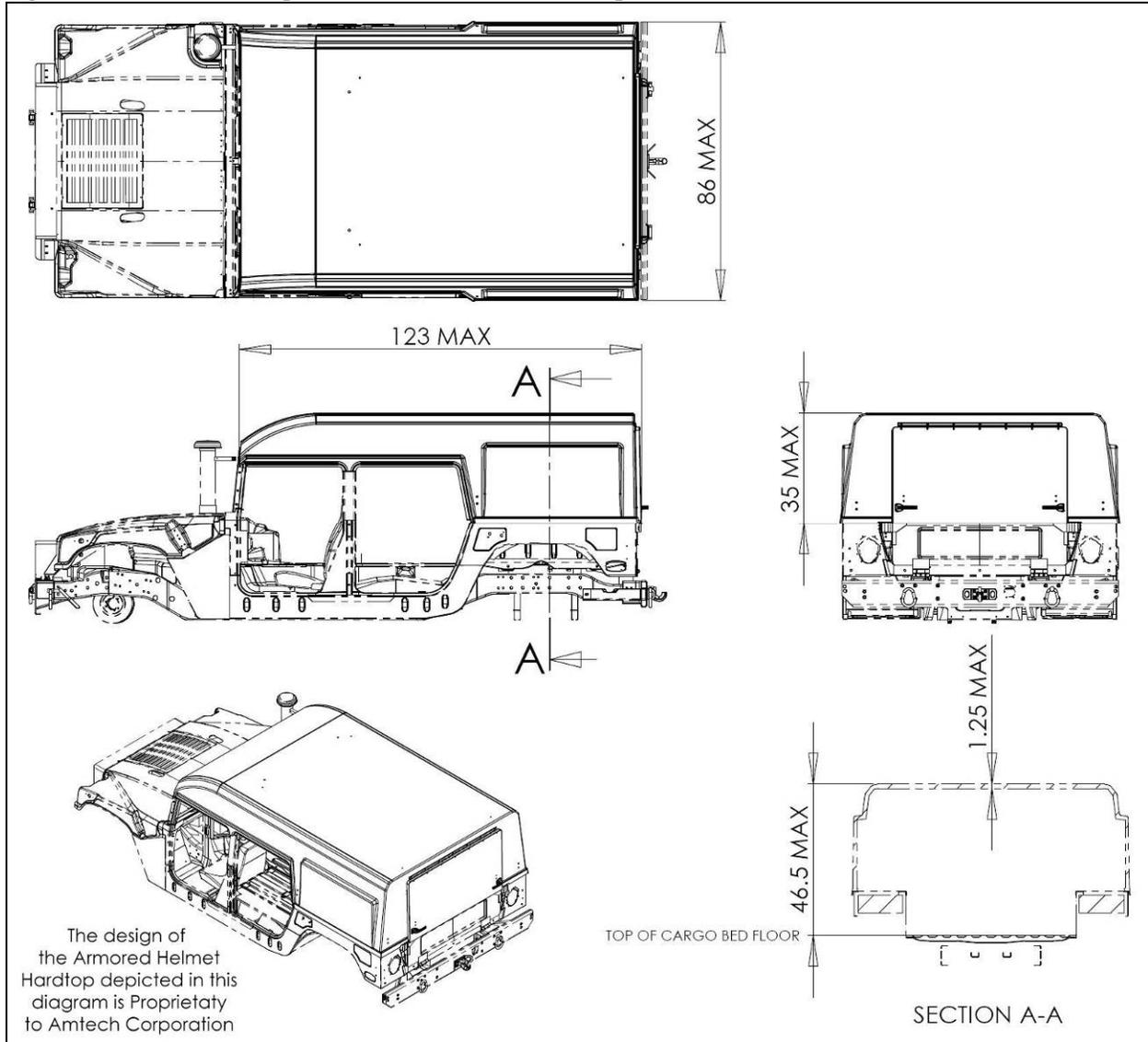
**Figure 1: Standard HHT**



**Figure 2: Armored HHT (with Marine Armor Kit)**



**Figure 3: Dimensional Requirements for Armored Hardtop**



### Mounting

The Hardtop is mounted securely to the vehicle so as not to cause damage to the vehicle during vehicle operations. Attachment points to the HMMWV are at the rear corners, behind the rear seats, and at the top of the roll bar. Because the LCA HHT is a very rigid structure, as compared to the flexible body of the HMMWV, Amtech developed a mounting suspension that allows for body flex between the top and the HMMWV (Figure 4).

**Figure 4: Rear, Mid Point, and Forward Mounting**



## **Aberdeen Test Center Testing**

### **Dynamics & Stability**

The LCA HHT, mounted on a MAK-equipped HMMWV was delivered to Aberdeen Test Center (ATC) for baseline testing in October 2005. The results of this testing will be made available as they emerge. The performance criteria include:

- Physical characteristics
- Gradeability
- Side Slopes
- Standard Obstacles
- Speed and Acceleration
- Braking
- Steering and Handling
- Human Factors Evaluation

### **Durability**

The LCA HHT, mounted to the MAK-Equipped HMMWV shall undergo 3000 miles of durability at ATC. The profile will include 30% Highway, 30% Cross Country, and 40% Trails, as defined in the HMMWV mission profile. During the testing, the integrity of the shelter is not to be compromised. Furthermore, the integrity of the vehicle is not to be compromised as a result of having the shelter mounted to it.

### **Ballistic**

The armored solutions used in the construction of the LCA HHT will be tested at ATC, as well. The current phase of testing will include coupon testing of all three solutions, as well as any specific geometry that is required by the testers. These coupon tests will verify NIJ Level III performance, and characterize performance on certain OIF/OEF threats as deemed appropriate by the testers. Follow-on phases may include full vehicle level testing against various threats, to include OIF/OEF.

### **Production**

The production process by which the LCA HHT is produced has been engineered so that full process documentation is maintained for each Hardtop. This is to ensure production consistency, allow for verification that each individual Hardtop was manufactured to specification.

The production process begins in the lay-up station, where each individual piece of fabric or core material is placed with the use of a Laser Projection System. A digital photo is taken at the completion of each step in the lay-up in order to verify that the operation was completed properly before the next piece is projected onto the mold by the laser.

Once the entire LCA HHT is through the lay-up process, the mold is vacuum bagged, and infused with resin. A post curing operation is then used to ensure that the Hardtop resin achieves the proper performance across a full operational temperature range. The part is then removed from the mold, trimmed, and painted with CARC paint.