



SURVIVABILITY



Armor Non-Destructive Testing/Non-Destructive Evaluation (NDT/NDE) Laboratory

The U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) Survivability NDT/NDE Laboratory's MISSION is to:

- Develop methods to evaluate armor design integrity during manufacturing and while in use at the depot, in the field and on vehicles.
- Use various nondestructive testing methods for armor structural assessment.
- Establish real-time armor NDT/NDE for ground vehicles using sensor enhanced armor.

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



Background

In an ongoing effort to enhance technologies and methods for vehicle armor measurements, TARDEC initiated the Armor NDT/NDE Laboratory. The laboratory, which was established in February 2008 in Warren, MI, is collaborating with Argonne National Laboratory in Argonne, IL, to develop imaging technologies for manufacturing, depot and field NDE. In particular, it serves an important role for Program Manager Future Combat Systems (Brigade Combat Team) manufacturing. The facility has 1,200 square feet for test and instrument stations, as well as space for a vehicle.

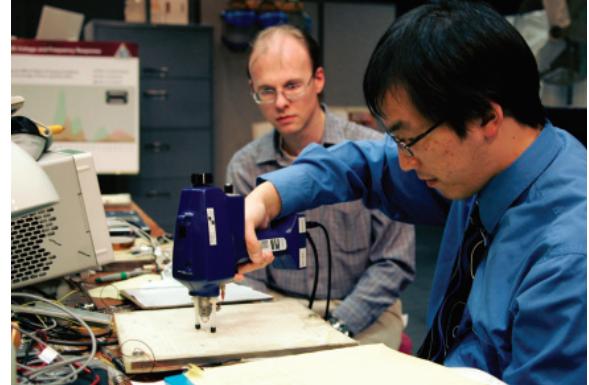
Application Areas

The NDT/NDE Laboratory investigates various factors that must be taken into consideration for the incorporation of embedded sensors in armor such as: sensor configuration and location, use of computer models of ultrasonic wave propagation, sensor resonant frequency determination using an impedance analyzer and ballistic testing of armor samples. Already, the laboratory has produced a technique for differentiating damaged and undamaged body and vehicle armor. Past work at the NDT/NDE Laboratory includes testing and evaluating technologies for remote infrared detection of ice on the external tanks of the NASA space shuttles under a *Space Act Agreement* between TARDEC and NASA.

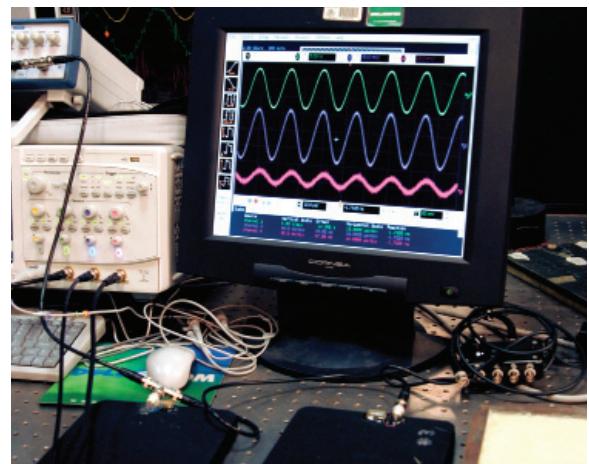
Capabilities

Using various imaging technologies and embedded sensors, the NDT/NDE Laboratory is able to provide the following capabilities for evaluating armor before and after ballistic testing:

- Ultrasonic phased array immersion tank imaging.
- X-ray imaging.
- Microwave imaging.
- Integration laboratory for building sensor-integrated armor panel networks on ground vehicle prototypes.
- Transducer characterization for use in Sensor Enhanced Armor.
- Neural fuzzy models of crack initiation, growth and identification.



An electric impact hammer is used to test vibration location results. A computer triangulates the location of each hit using three embedded sensors in the armor plate. (U.S. Army TARDEC photo by Bill Dowell.)



An LCD connected to the oscilloscope shows various vibration through armor plates. A crack is detected by the pink, unclear wave the oscilloscope produces. (U.S. Army TARDEC photo by Bill Dowell.)



A U.S. Army TARDEC scientist holds a ceramic pellet armor test plate with embedded sensors. (U.S. Army TARDEC photo by Bill Dowell.)