



US DEPARTMENT OF DEFENSE

# BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

## Protective Equipment

### Investigation of Injuries to Armored Vehicle Personnel Subject to Blast: Preliminary Study with Emphasis on Lower Extremity Fractures

Severe lower extremity injuries are being reported from occupants of MRAP vehicles exposed to under-vehicular blasts. Both the etiology of these injuries and effective means to predict these injuries are not currently known or understood. This proposal is developed to study both the mechanisms of injury from these loads, as well as to develop lower extremity injury criteria that can be immediately implemented in vehicle design. This study sponsored by MOMRP aims to identify the mechanisms of injury sustained by MRAP vehicle occupants during under-vehicular blasts. By identifying the threshold levels of injury, an injury criterion will be developed allowing designers to predict injury in their designs before fielding. By creating this injury criterion, existing numerical models can predict injury at load rates seen in theater, and optimize systems of injury mitigation and prevention. This team has created an underbody blast simulator named ODYSSEY. The simulator has been used to test and improve the Finite Element Model of lower extremity fractures to be more accurate to military needs. This specific model has also developed tibia and fibula fracture thresholds for injury criterion. Several additional experimental tests were performed in this study: 1) a test of sub-calcaneal heel pad component testing; and 2) an evaluation of injury-mitigation materials using the Hybrid-III Finite Element Leg Model. The results of these studies have helped supplement the data produced by the WIAMan program and identify remaining research gaps that will provide better protective equipment.