



# MALUM TERMINUS: A US Marine Corps Simulation System for Injury Avoidance

## AT A GLANCE

### WHAT IS IT?

MALUM TERMINUS is a simulation platform for Musculoskeletal Injury avoidance and prevention with an ultimate objective to enhance Warfighter performance by maximizing the training load and providing customized strength and conditioning interventions for the individual Warfighter. The simulation platform will also serve as an open environment for researchers to import injury data and models into the human simulation.

### HOW DOES IT WORK?

Building upon the SANTOS® human simulation environment, MALUM will create a virtual avatar of an individual Warfighter by taking in various physical, physiological, and biomechanical parameters. A user will then be able to prescribe high intensity tasks to the virtual Warfighter. The software will then simulate the Warfighter and use data available from other commercially available human monitoring systems to predict injury risk to the Warfighter in performing these tasks.

### WHAT WILL IT ACCOMPLISH?

The software will thus be able to help reduce injuries and reduce lost-duty days while helping train the Warfighters to enhance their performance. The software will also serve as an open environment for other researchers to import injury data and models and implement into the human simulation.

### POINT OF CONTACT:

Dr. Peter Squire  
peter.squire@navy.mil

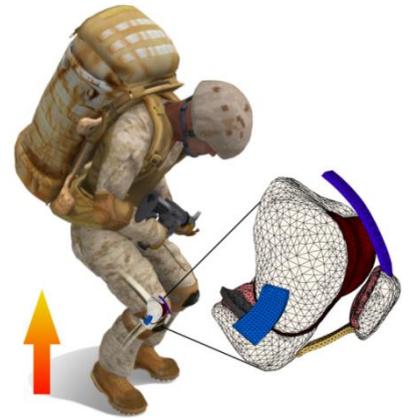
### ABOUT:

Work for this effort is performed by The University of Iowa under ONR Grant N00014-16-1-2220.

Musculoskeletal injuries (MSK-I) of Warfighters are substantial, cause millions of lost-duty days, and are arguably the leading medical problem eroding military readiness. Most of these injuries are non-battle injuries.

The Need:

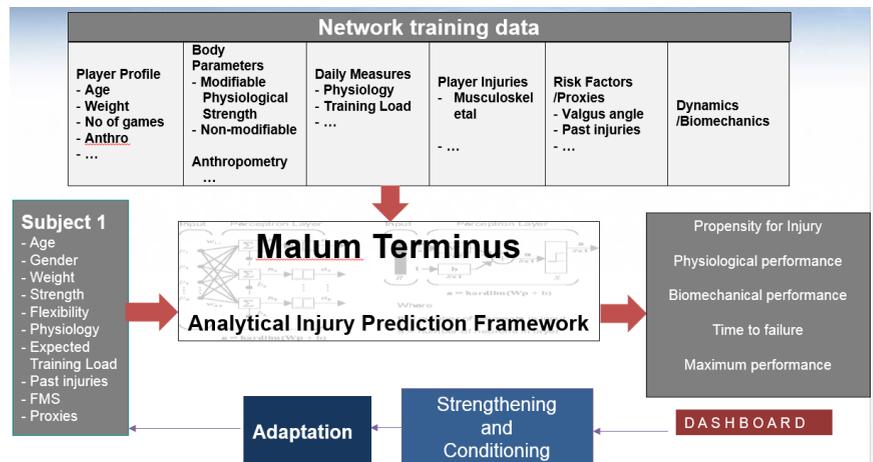
- Human modeling and simulation accelerates the design of better military products
- A centralized platform to support complex and fully integrated predictive models of the Warfighter to address the injury issue.
- A need for a comprehensive and expandable human model that will help reduce injuries and decrease MSK-I health care costs
- Simulation for the prevention and better understanding of the mechanisms that cause injury.



### Objective

To develop a simulation platform for understanding the mechanisms of Warfighter Musculoskeletal Injury (MSK-I) in order to reduce their occurrence and identify training interventions to enhance Warfighter performance.

The output of the system is a determination of the propensity of injury for a specific MSK injury and for a particular task that have been specified. An additional output is a dashboard that shows a real-time simulation. A significant capability of the MALUM TERMINUS simulation system is its ability to import experimental data and existing models. This effort will enable capabilities to import related data, process these data through computational models to yield mathematical representations, and implement these representations in functioning modules that interact with other modules within the overall simulation system.



### RESEARCH CHALLENGES AND OPPORTUNITIES:

- Designing formulations for predictive human motion
- Modeling of MSK injuries
- Deriving theory and mechanisms for large data
- Securing MSK injury data
- Predicting biomechanics and physiological performance