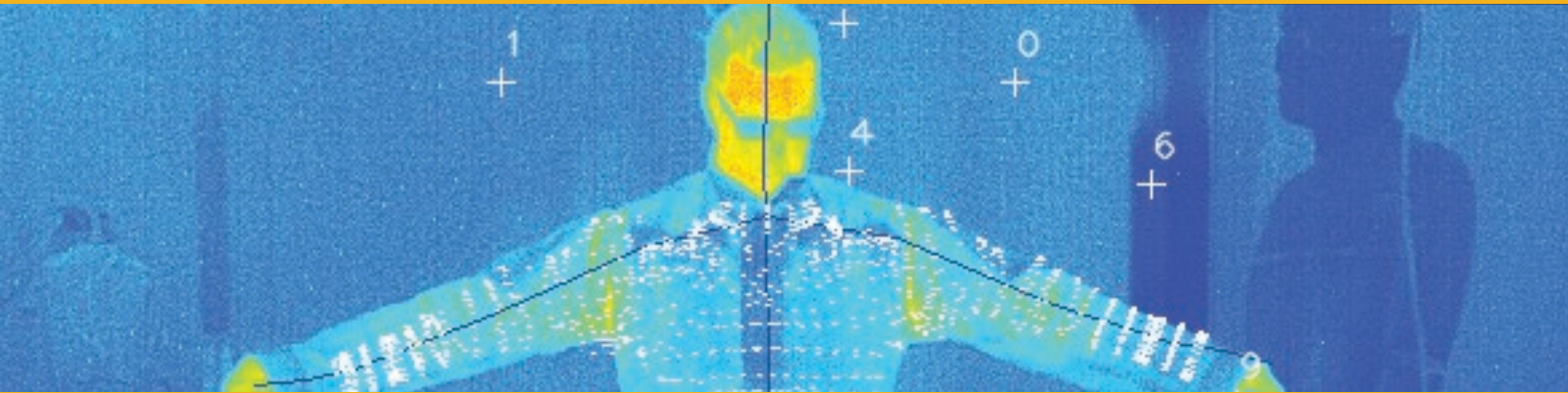


# TSAPE

## Thermal Analysis



### *Thermal Stress Analysis for Protective Equipment*

Infrared images are commonly used to evaluate thermal stress on Personal Protective Equipment (PPE). However, current methods rely on a qualitative assessment of these images and are subjective, prone to errors, and restricted to stationary human subjects or manikins. To address this, IAI has developed a prototype Thermal Image Comparison Software Tool that provides quantitative and objective thermal measurements for PPE.



#### **Data Collection and Registration**

TSAPE is a tool that allows PPEs and apparel to be analyzed objectively, accurately, and efficiently on moving subjects.

#### **Sampling on 3D Mesh**

TSAPE combines a thermal sensor with a 3D imaging sensor that estimate movement, determine body pose and locate body parts to map surface temperatures to a 3D model.

#### **Comparison Between Garments**

Commercial applications include design of outdoor apparel, clothing insulation, and sportswear. It can also be useful in physiology research for bioheat transfer modeling and medical thermal imaging applications.



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# Features

## Warfighter Value

### Body-Centric

TSAPE maps temperature measurements of different clothing to a common body reference model.

### Realistic Testing

TSAPE allows garments to be compared in realistic usage conditions with body movement.

### Objective Evaluation

TSAPE provides quantitative evaluation and comparison of protective clothing.

## Specifications

Max Range-----	8 m
Thermal Camera Resolution----	640x512 pixel
Thermal Sensitivity (NEDT)-----	< 50 mK
Data Sampling Rate-----	30 Hz
Sampling Resolution-----	1 inch <sup>2</sup>
Temperature Accuracy (Black Body)---	0.3° C

### Thermal and 3D Sensors

TSAPE integrates a thermal camera and a depth sensor to collect temperature data and 3D data.

### Sensors Registration

TSAPE's thermal and 3D sensors are calibrated and synchronized to align data.

### Human Mesh Mapping

TSAPE determines the body pose and maps thermal measurements to a 3D human mesh model.

### Moving Subjects

TSAPE collects thermal measurements from moving subjects, and tracks and aggregates the measurements over time.

### Comparison of Garments

TSAPE provides thermal stress analysis for protective garments as they move.

### Analysis and Visualization

TSAPE analyzes the data on multiple body regions and landmarks, and provides a visualization of thermal data on a 3D human model.

### Reporting

TSAPE automatically generates evaluation and comparison results, including recordings of temperature change during movement.