

Gait Lab Optical Motion Capture System

1. Background

A primary research priority at the RR&D Center for Limb Loss and Mobility is to study walking function and treatment efficacy in patients with mobility impairments and healthy individuals to improve the health of Veterans. The gait laboratory's optical motion capture system is an essential tool for completing work related to multiple funded research projects supported by the Center. Beyond the ability to track reflective marker positions at submillimeter accuracy, this system serves as the data hub for other existing measurement systems including in-ground AMTI force plates and Noraxon wireless EMG, enabling seamless integration and synchronization of all data signals for efficient data processing and analysis.

2. Salient Characteristics

The optical motion capture system must satisfy the following requirements:

- **Optical Motion Capture Cameras and Synchronized High Speed Video**
 - **Robust, accurate dynamic marker position tracking with 8 MP camera resolution (max capture rate = 260 Hz).** Many of the Center's funded grants involve complex maneuvers (i.e., turning, stair ascent and descent and uneven terrain) and tracking joint motion with small (9-14 mm) markers in close proximity, which increase the challenge of continuous marker tracking. This challenge is compounded by the large capture volume (~10 x 5 x 2.5 m³) with dual-camera focal points that is required to accommodate in-ground force plates and treadmill data collections. The result can be hundreds of marker trajectory gaps in a single data collection that must later be filled by-hand by a trained technician. Therefore, higher resolution cameras with a sufficient number of cameras for more line-of-sight coverage are required to improve marker tracking and reduce gap filling during studies of complex tasks in large, multi-focal capture volumes. These features will significantly improve robustness and accuracy, reducing data processing time and improving the Center's efficiency for analyzing human movement.
 - **Synchronized HD reference video aligned with the optical motion images** are required to improve visualization, interpretation and dissemination of findings to physicians and other research professionals.
 - **Availability of 16 MP cameras for future expansion.** The Center's research scope must be able to adjust and expand to maintain its relevance with advancements in patient care, which may require additional camera resolution. A pro-active, cost-effective approach to future expansion is to have the ability to upgrade to higher resolution cameras without replacing the entire system.
 - **Built-in Full Greyscale Centroid-fit Algorithms for < 1mm Accuracy Marker Tracking.** Submillimeter marker position tracking accuracy

achieved efficiently through on-board processors with built-in full greyscale centroid-fit algorithms is required to maintain the expected standard in gait analysis research.

- **Camera Position Mount Flexibility in 3 degrees of freedom.** To accommodate the large capture volume with dual-camera focal points, rails for mediolateral position adjustments, tripod mounts and different length clamps are required.
- **Control Box**
 - **Compatible with existing equipment.** Beyond optical motion capture, the system must connect, integrate and synchronize existing 3rd party devices with analog and digital outputs including AMTI in-ground force plates and Noraxon wireless EMG.
 - **External synchronization.** The system must be able to trigger at least 8 programmable devices.
- **Software and Modeling**
 - **Robust automatic gait event detection, cropping, capturing and gap filling algorithms** are required system software features that must be included to maintain the highest standard of accuracy and efficiency in data processing and analysis.
 - **Plug-In Gait full body model** is a widely referenced biomechanical model that uses a unique, simple marker set with proprietary algorithms for robust autolabeling and data processing techniques. The system software must include the Plug-In Gait full body model.
 - **Maintain continuity.** More than ten years of data stored in the data repository (VAPSHC IRB Approval# 00493) was collected using Vicon software and the Plug-In Gait model. The ability to explore new research questions with previously collected repository data enables future discovery without the additional burden on human subjects and the Center's resources. The system software must allow import and analysis of data collected with a Vicon system.

Salient Characteristics

Description/Part Number*	Qty
Vicon Vantage V8 Cameras (8 MP) - Standard	16
Vicon Vue video camera	1
Lock+ Control Box	1
25 way Lock to Omnimate Connector	5
Lock+ to BNC Cable 0.3 m	1
Vicon Active Wand IR	1
Vicon Camera Cable - 30 m (Included)	17
16 Port PoE+ Gigabit Switch	2
Level One Switch	1
PoE or Giganet to PC cable	1
Dual Video PC	1
Large PC Monitor	2
Custom Speed System - Large	1
Super Clamp	8
Double Super Clamp Kit	8
Standard Tripod Head (US)	16
Vicon Nexus 2.0 Standalone	1
System warranty, installation and training (Included)	1
Shipping	1
SUBTOTAL (Products)	

3. Other Pertinent Information or Special Considerations

- a.) This equipment will be used for VA research studies approved through the VAPSHC Research and Development Committee on the following protocols: IRB Approval# 00807, 00234, 00687, 00743, 01374, 00046, 00931, 00725, 00539, and 00949.

Delivery Information

- a.) **Delivery Address:**
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