



Center for Computer Aided Design



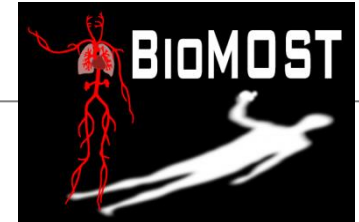
Karim Abdel-Malek



Virtual Soldier Research Program



Biomechanics of Soft Tissue



National Advanced Driving Simulator (NADS)



Musculoskeletal Imaging Modeling and Experimentation



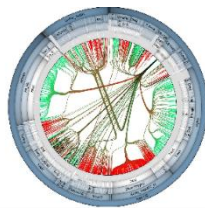
Reliability & Sensory Prognostic Systems

**RSPS**

Operator Performance Research Program



Threat Detection Networks



Advanced Manufacturing Technology



# Our People

Faculty: 30

Scientific staff: 52

Graduate students: 52

Undergraduate students: 35



National Advanced  
Driving Simulator  
(NADS)





# What Do We Do?

Global Warm Mix Asphalt Workshop



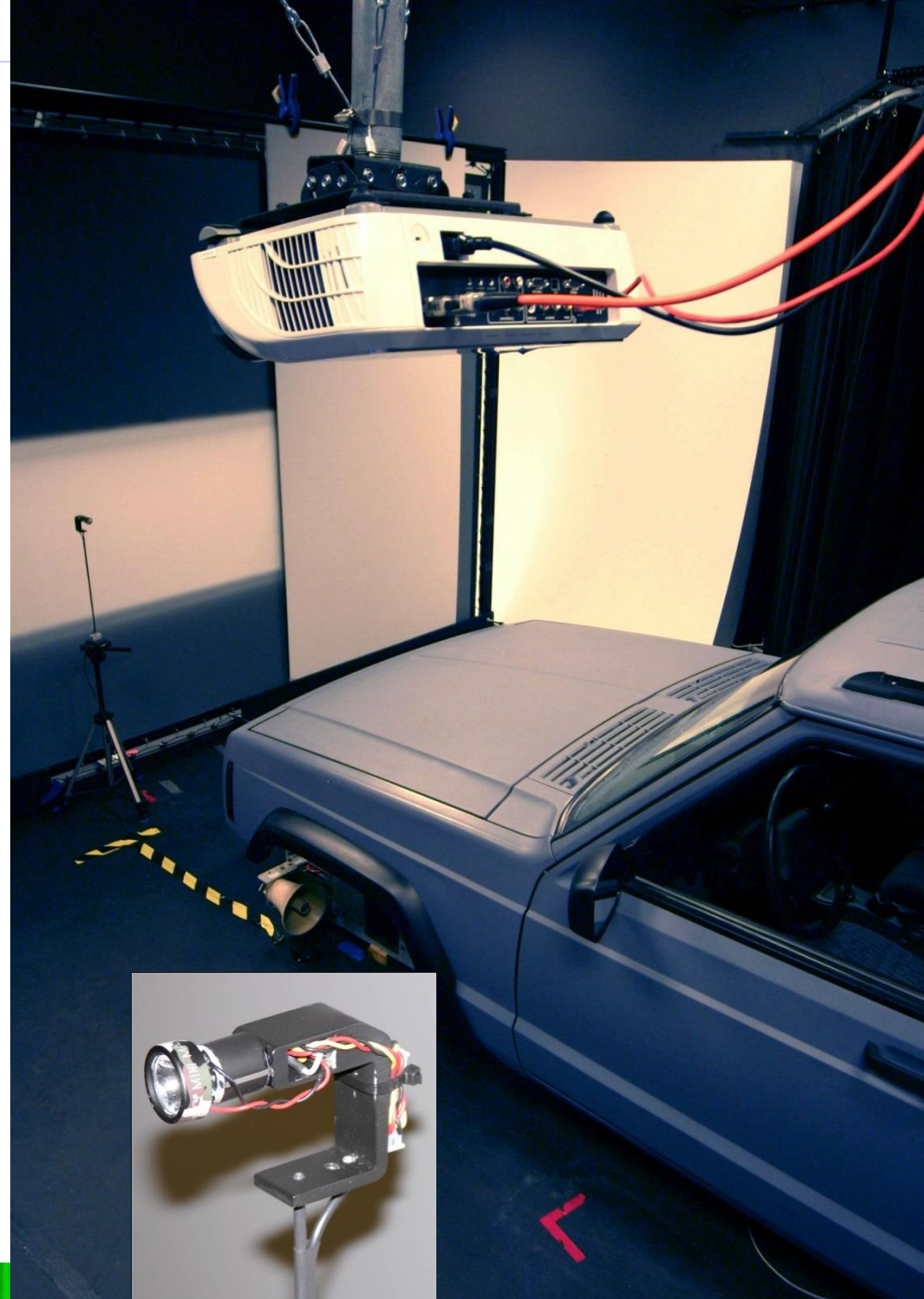
NADS-2 with Freightliner Heavy Truck Cab



NADS MiniSim



# NADS-2 High Resolution Visuals Simulator



# NADS-2 Rural Highway Images





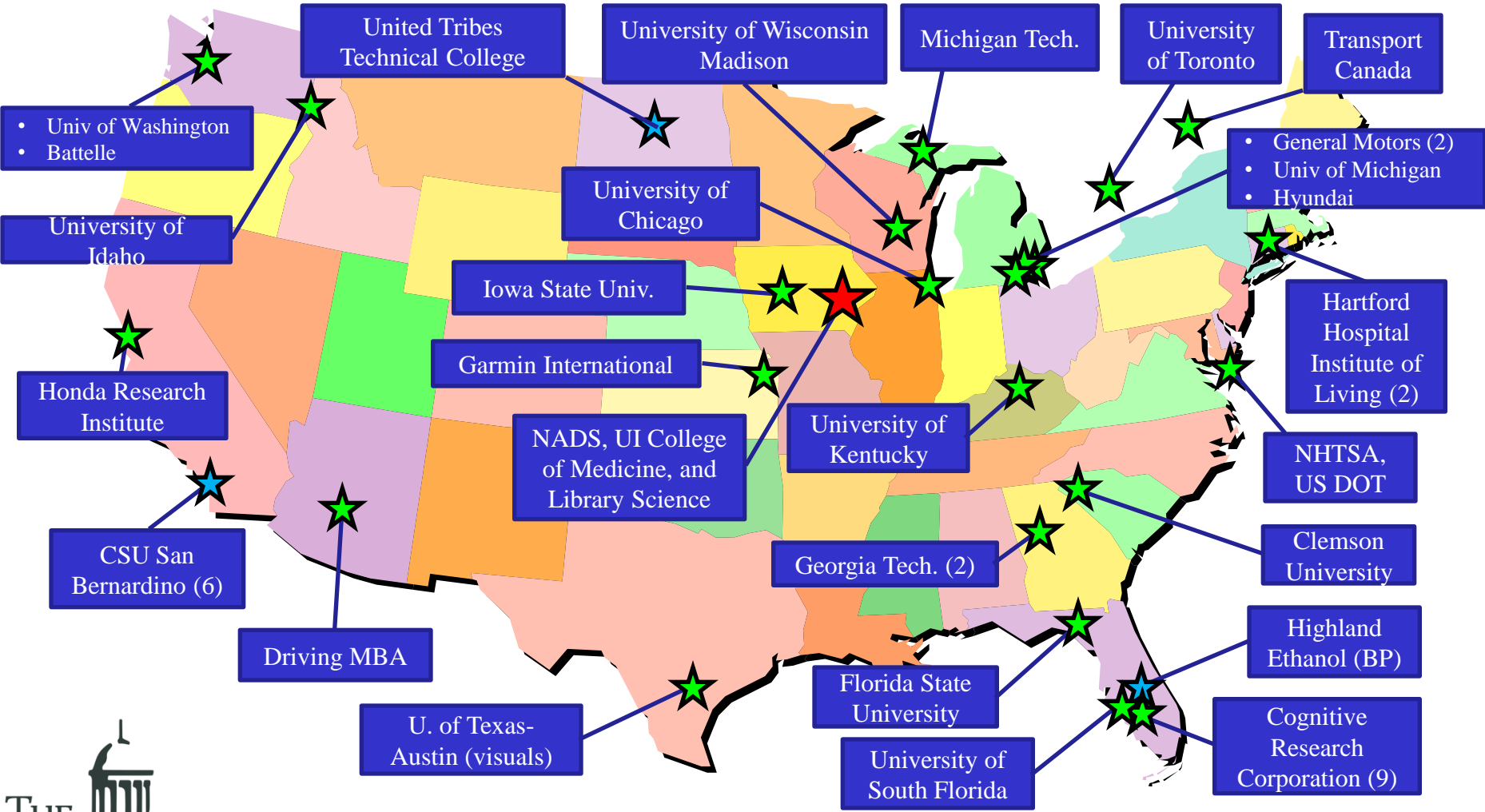
# NADS MiniSim™

- Portable, small footprint
- Off-the shelf parts, easy to service
- Reliable
- Cost effective
- Multiple configurations
- Collaboration



# NADS MiniSim™ Partners

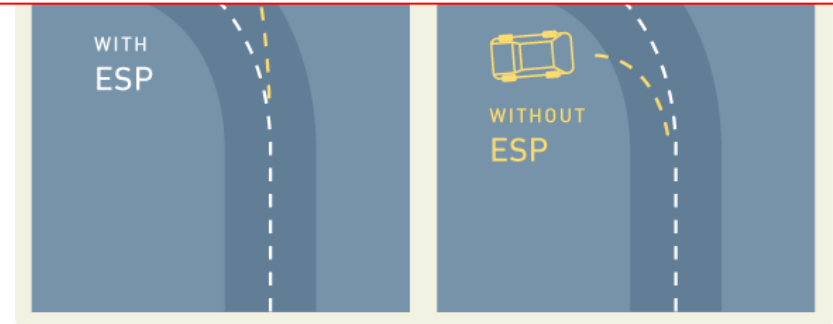
(Green=Vehicles, Blue=Heavy Trucks, Red=Both)





# Electronic Stability Control

Led to NHTSA-proposed regulation to make ESC mandatory for all vehicles sold in US by 2012

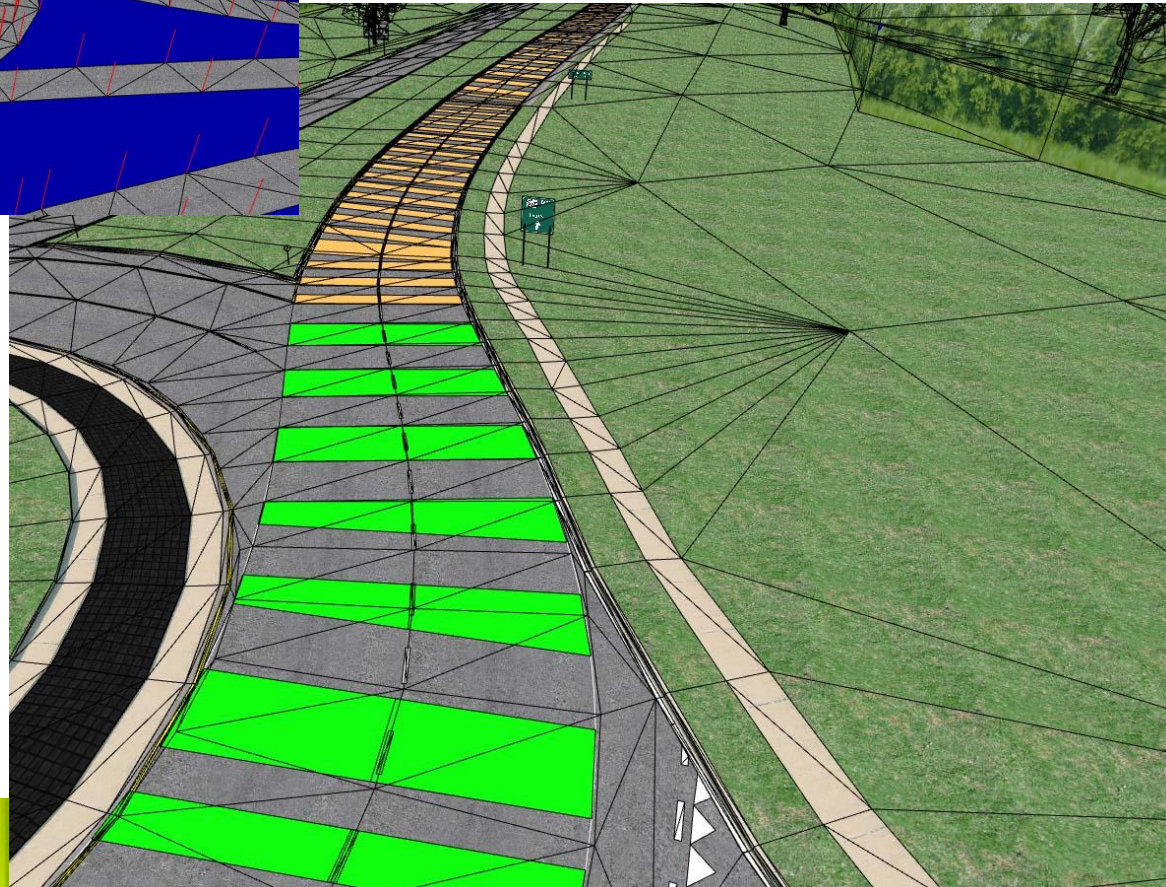
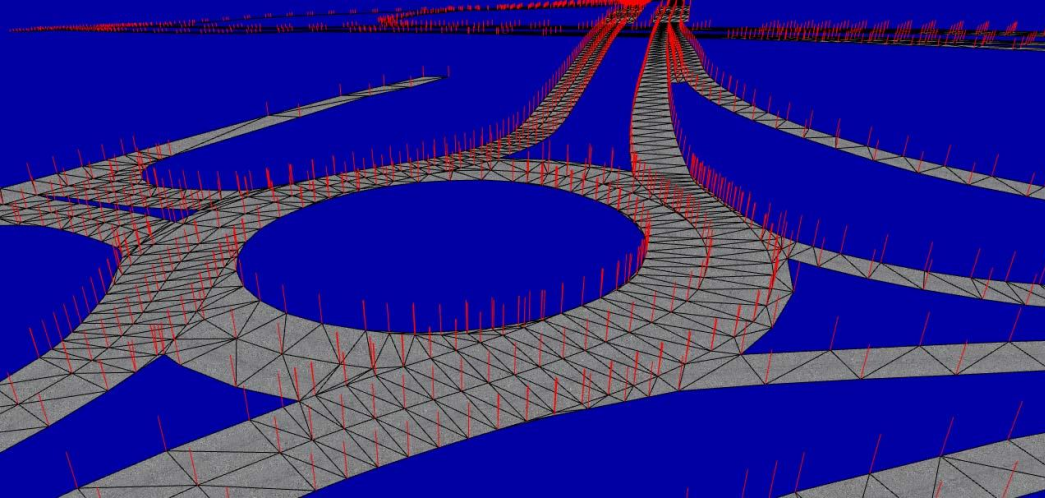


# Simulating Roadway Designs



U.S. Department  
of Transportation

**Federal Highway  
Administration**



# FHWA Exploratory Research Project



# Instrumented Vehicles



# Operator Performance Research Program



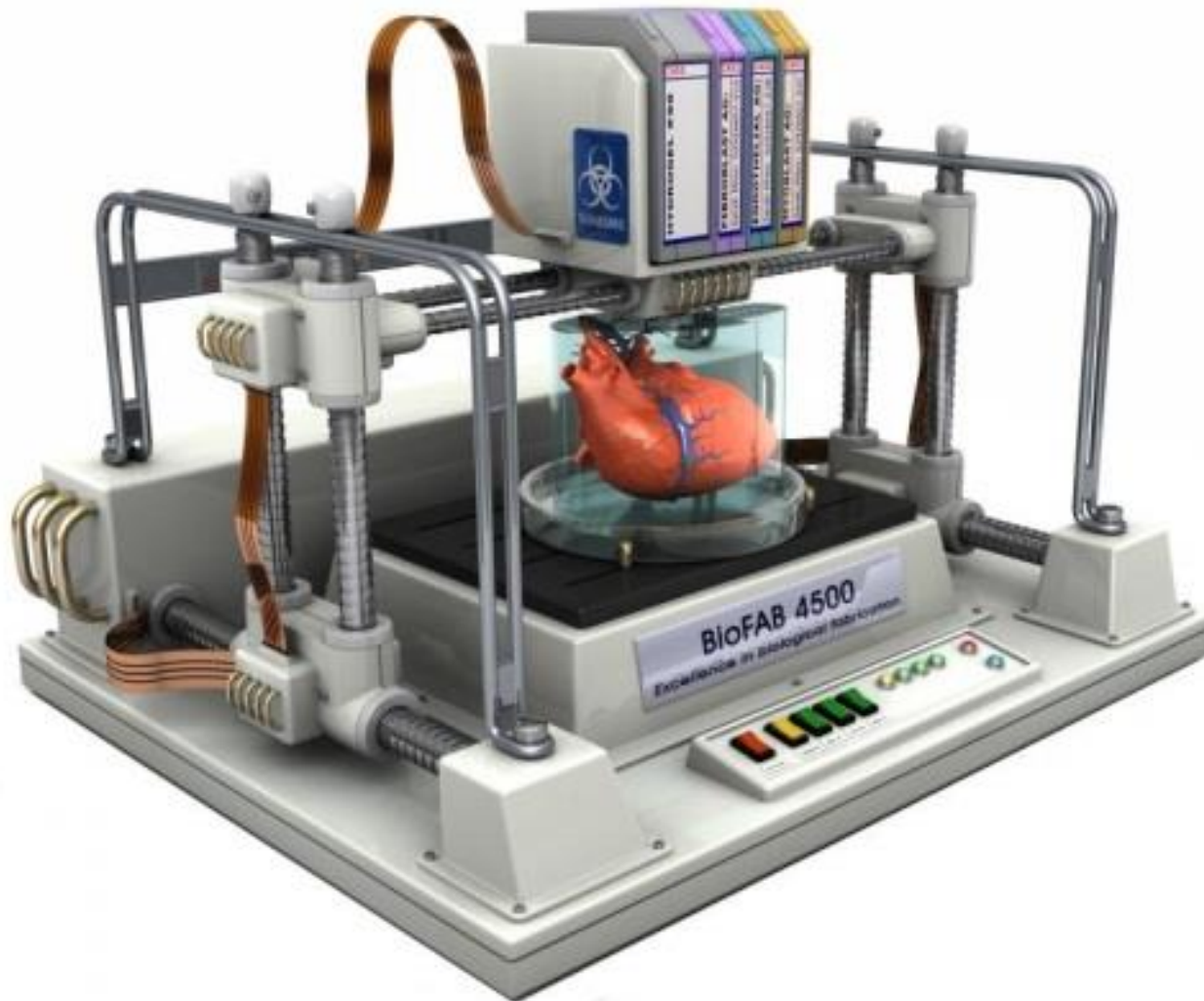
# Global Warm Mix Asphalt Workshop





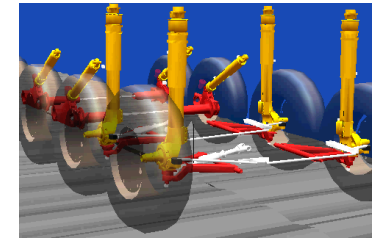
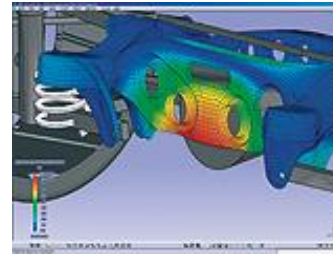
**AMTECH**  
ADVANCED MANUFACTURING TECHNOLOGY





# Economic Development

Ford Motor Company



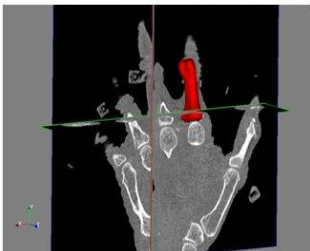
NADS MiniSim™



Santos Human Inc.



IA-FEMesh Version 1.0

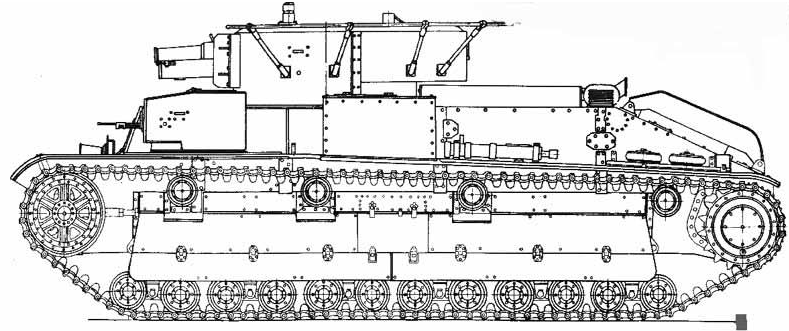




SANTOS®: The Virtual Soldier



# Why Human Simulation



Physical  
prototypes



## Engineering Analysis

Stress tests

Vibration

Sound

Dynamics analysis (motion)

Aerodynamics

Thermal analysis

Fluid analysis

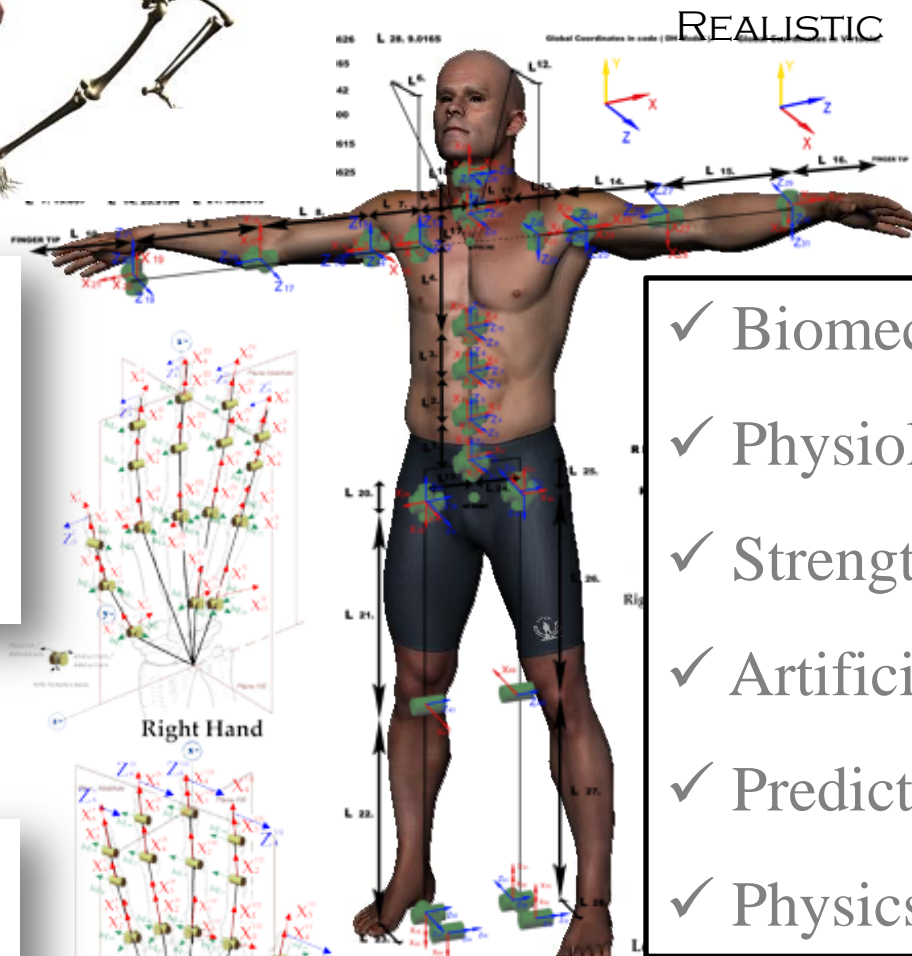


Human integration

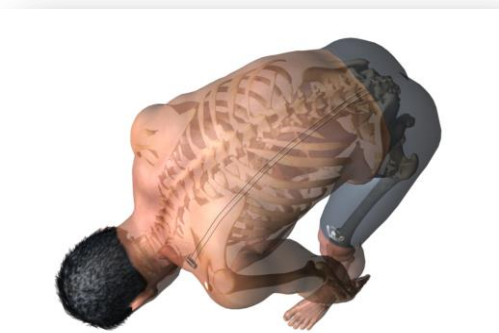
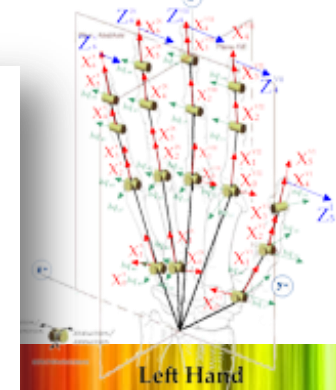
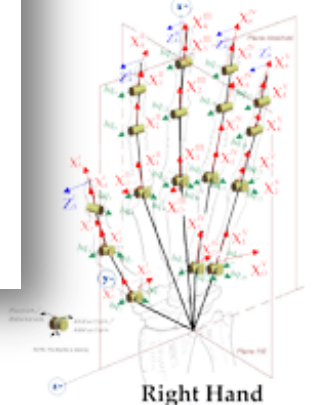
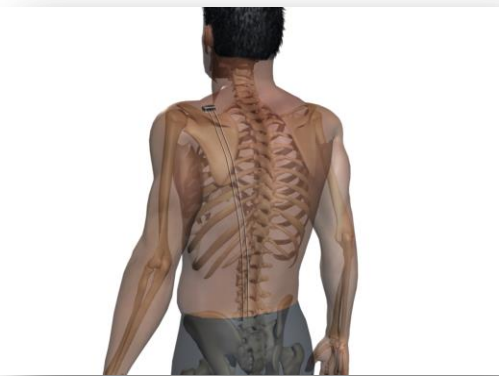


# The Underlying Model

Global Warm Mix Asphalt Workshop



- ✓ Biomechanics
- ✓ Physiological modeling
- ✓ Strength & Fatigue
- ✓ Artificial intelligence
- ✓ Predicts behavior
- ✓ Physics-based



Default link lengths: HANDS (mm)

L. 1. 2.36	L. 1. 2.36	L. 17. 2.14
L. 2. 5.02	L. 2. 5.02	L. 18. 2.164011
L. 3. 3.92	L. 3. 3.92	L. 19. 6.115989
L. 4. 3.16	L. 4. 3.16	L. 20. 4.12
L. 5. 9.26	L. 5. 9.26	L. 21. 2.36
L. 6. 5.3	L. 6. 5.3	L. 22. 1.96
L. 7. 2.86	L. 7. 2.86	
L. 8. 1.84	L. 8. 1.84	



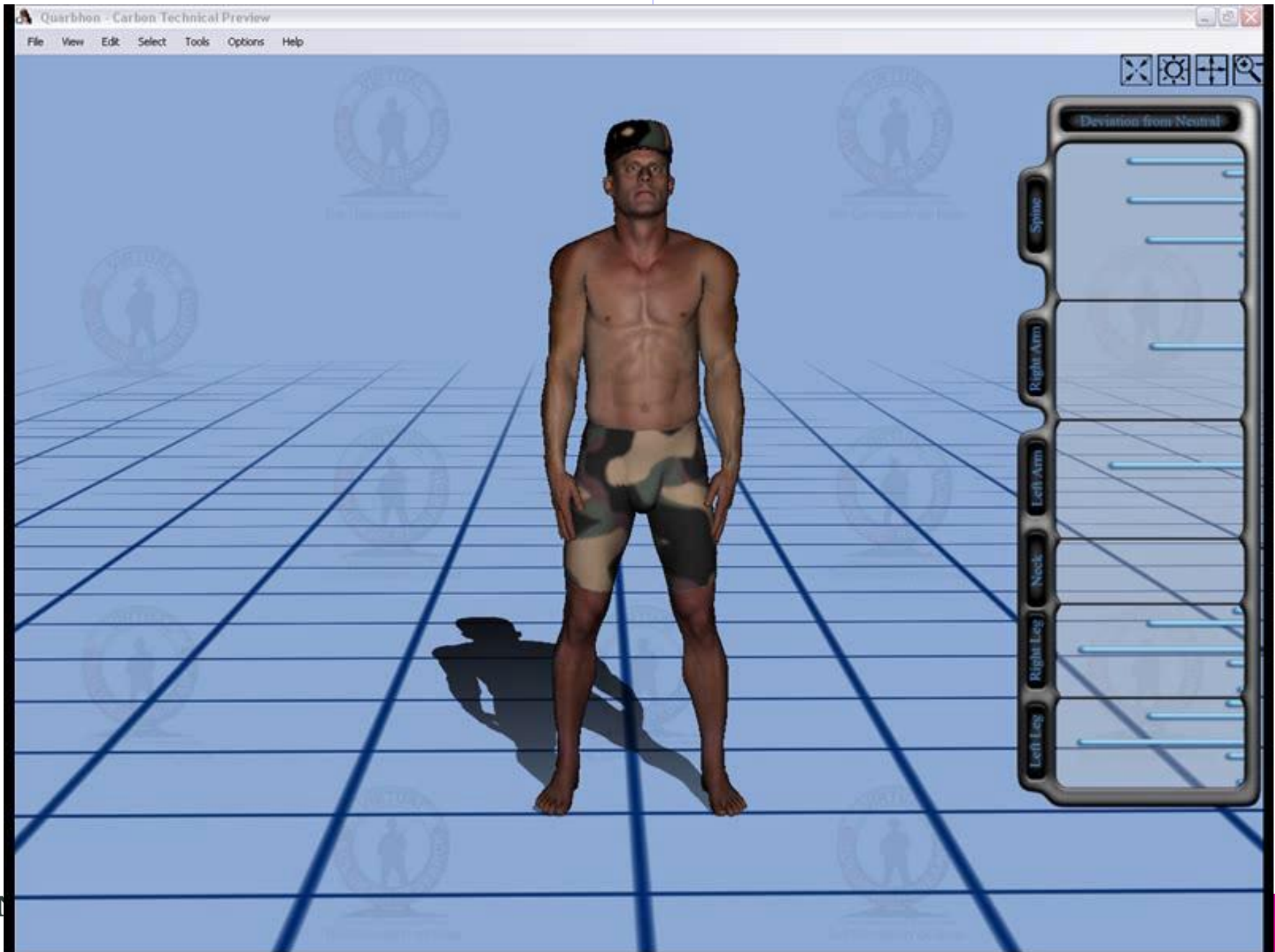
# *Anthropometry*



Body Size  
Body Type  
Body Mass  
Strength

# Interactive

## Global Warm Mix Asphalt Workshop





*In 2005/06....*

# Tank Ingress with Posture Tweening



ToolBox

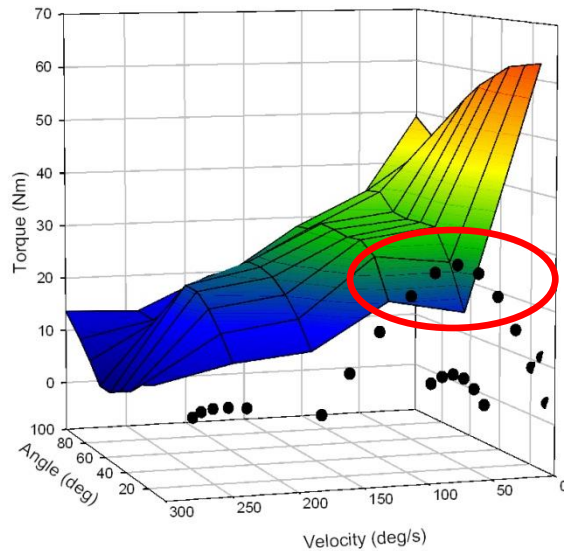
- ✂
- 📄
- 🏠
- ✕
- 🔍
- 🔍
- 📁
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- 🏠
- ✂
- 🏠
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- 👁
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- 🖱
- 🔄
- 👤

# Strength (Static and Dynamic) Global Warm Mix Asphalt Workshop

Peak torque (speed and position)

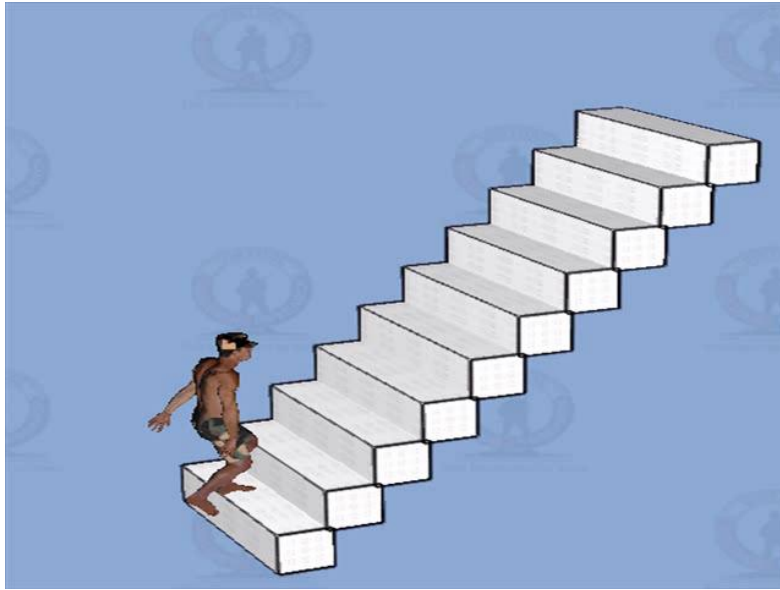
Static – no inertia considered:  
Percent Capable

Dynamic – inertia considered  
Percent Capable

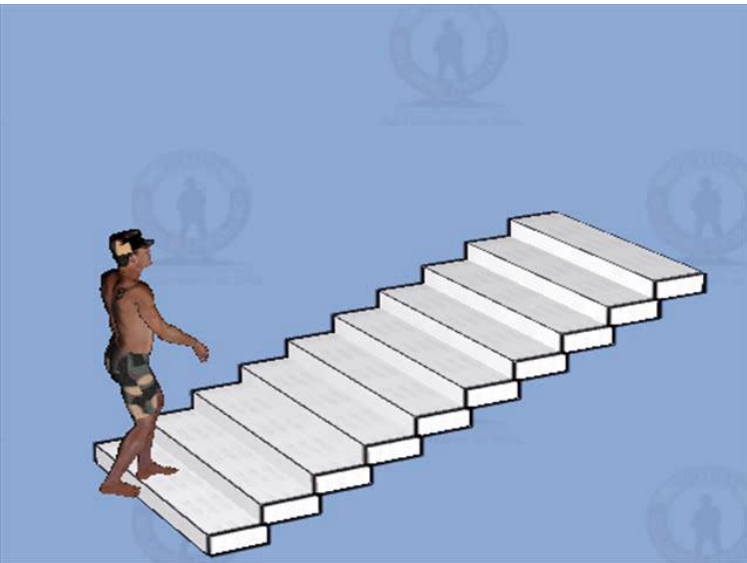


gait with 40 lb  
backpack  
knee joint  
5% strength

# PD Early Results



High rise steps



Low rise steps



- Asymmetric
- Predictive
- Cause and effect
- Extensible

Viewport

Camera: CsCamera Snapping: Off



Normal Selection

Sequencer

Playback: 1 x

Santos Marine

TsDyn... 1.83298..

Timeline View 00:00:72 / 00:05:28

No object currently selected.

Height (m)

2.498672

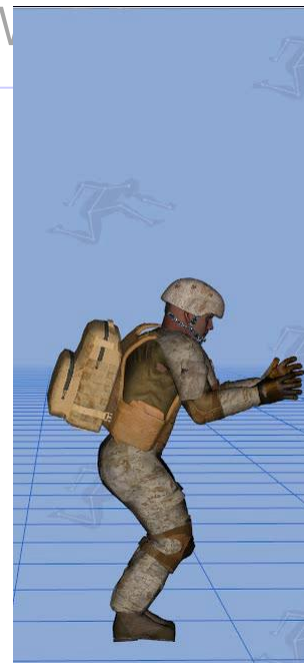
2.401209

2.310071

2.131725

1.990143

Santos  
79 kg



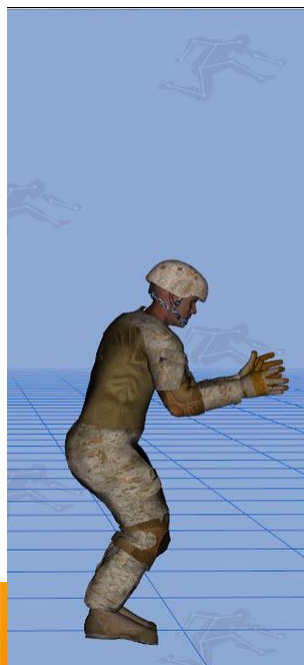
2.180130

2.174497

2.119108

2.015748

1.946092



Man3  
111 kg

# Global Warm Mix Asphalt Workshop





## The Future!

- Child SANTOS®
- Grandpa SANTOS®
- Sports SANTOS®





Thank you.

