The Simulation Group @ CIMIT

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CIMIT Simulation Group / Harvard Medical School
http://simcen.usuhs.mil/mmvr2004

CIMIT (*www.cimit.org*)

- CIMIT (Center for Integration of Medicine & Innovative Technology) is a non-profit consortium of world-leading academic and research institutions:
  - Massachusetts General Hospital
  - Brigham and Women's Hospital
  - Massachusetts Institute of Technology
  - Draper Laboratory
- CIMIT's mission is to improve patient care by bringing together scientists, engineers, and clinicians to catalyze development of innovative technology, emphasizing minimally invasive diagnosis and therapy.

The Simulation Group

(www.medicalsim.org)

- The team: 7 people of mixed backgrounds
- Main focus: medical simulation
- Emphasis on:
  - soft tissue modeling
  - validation / metrics
  - systems integration
  - applications

Past & current projects

- ICTS: Interventional Cardiology Training System
- VIRGIL: Chest Trauma Training System
- CELTS: Computer Enhanced Laparoscopic Training System
- Interventional Neuroradiology Training System
- CAML: Generic Framework for Medical Simulation
- Real-time Soft Tissue Modeling
  - Linear Elastic Behavior using FEM (hepatic surgery)
  - Spring Mass Models (eye surgery)
  - New approaches for non-linear elasticity & more complex behavior
- Soft Tissue Properties Measurement Devices:
  - Tempest, Rosa
- Truth Cube

Past & current projects

- **ICTS: Interventional Cardiology Training System**
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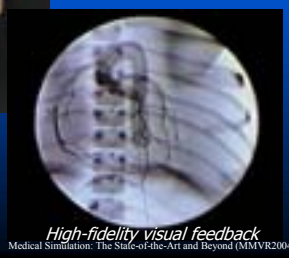
ICTS Architecture

Multi-axial haptics device

Realistic physical modeling
Real-time multi-processor system



High-fidelity visual feedback

ICTS Today

- Sold by Mentice AB and named VIST®
- Eight systems installed at the *Guidant European Cardiac and Vascular Institute* in Brussels
- New center created in Tokyo in 2003
- About 4,000 physicians trained

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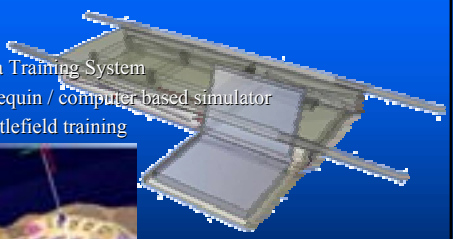
VIRGIL®

- Chest Trauma Training System
- Hybrid mannequin / computer based simulator
- Ready for battlefield training



Virgil Video Clip
(*News7*)

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CELTS

- Training system for technical skills
- Incorporate new metrics for accurate skills assessment
- Integrates a task-independent standardized scoring system

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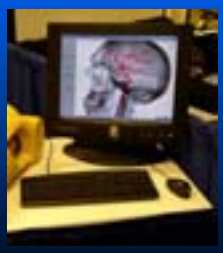
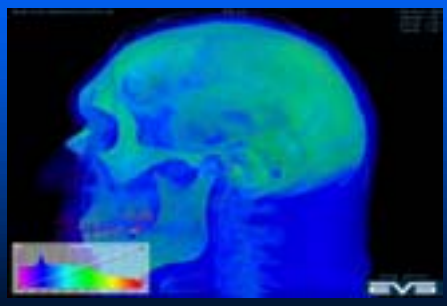
Interventional Neuroradiology Training System

- Design of a new tracking interface
- Development of accurate, real-time models of flexible devices
- Integration of soft tissue models of vascular network



Interventional Neuroradiology Training System



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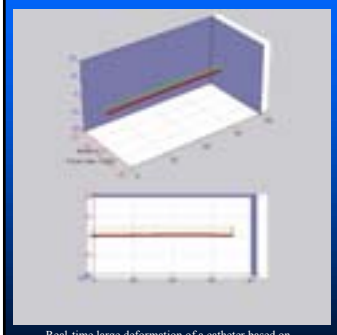
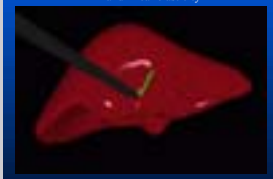
Real-Time Deformation



Real-time large deformation of a catheter based on non-linear FEM and quadratic programming

Real-time volumetric deformation based on FEM and linear elasticity



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Eye Surgery Simulator

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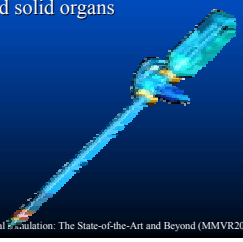
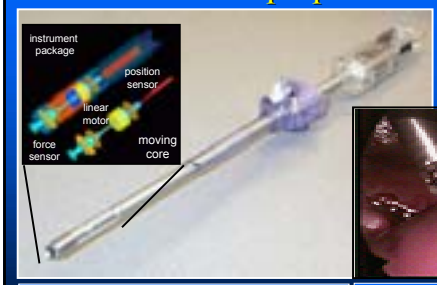
Soft-Tissue Modeling

- Four-year research program
- Collaboration with Harvard Biorobotics Lab

- *First phase*: measurement of mechanical properties of soft tissue in solid organs, *in vivo*
- *Second phase*: develop real-time deformable models of soft tissue and solid organs



TeMPeST device for measuring soft tissue properties *in vivo*



TeMPeST 1-D shown with 12mm surgical port (for use during laparoscopic surgery). Upper inset shows detail of sensor/actuator package, with force sensor, linear motor (voice-coil type), position sensor (LVDT) and flexural bearings.

Laparoscopic view of TeMPeST 1-D measuring porcine liver tissue during minimally invasive surgery.

"Truth Cube"

- Validate real-time (and non real-time) soft tissue deformation algorithms



Additional Information

- Web sites
  - www.medicalsim.org
  - www.truthcube.org
- Email:
  - cotin.stephane@mgh.harvard.edu
  - dawson.steven@mgh.harvard.edu
- Workshop on Simulation
  - When: June 17-18, 2004
  - Where: Cambridge, MA - USA

Work supported by research grant DAMD 17-02-2-0006
Telemedicine and Advanced Technology Research Center and RAD II Combat Casualty Care
United States Department of Defense