The focus of research projects in the Intelligent Machines Laboratory (IML) has varied over the years from Robotics in the 1980’s to Artificial Intelligence in the 1990’s to 3D Graphics, Surgical Simulation, and Video Game Programming in the 2000’s, but always our thrust is state-of-the-art, internally and externally funded computer science research with undergraduate student involvement. Today the Intelligent Machines Laboratory performs research into such emerging technologies as 3D game programming, real-time game physics, computer animation, virtual reality, and virtual surgical simulation. Out of the work performed in the IML laboratory a new course has been developed: CSCI475 – 3D Game Programming and Computer Animation. This course and related research projects will provide students with the skills necessary to design, develop, and deploy 3D games and related entertainment technology applications. The intent of this area of study and research is to provide the student with a solid technical foundation for developing, animating, and controlling articulated systems used in interactive computer games, virtual reality simulations, and high-end animation applications. Research topics include 3D game programming architectures, 3D graphics, video game programming, collision detection algorithms, force and motion calculations, software for networking multiplayer games, manipulating sound objects, physical modeling, projectiles, physical constraints, particle systems, surface deformation, computer animation techniques, forward and inverse kinematics; key frame, motion capture and procedural animation; skinned meshes, quaternion interpolation; soft- and rigid-body game physics; Bayesian networks for character learning, and deformation of virtual 3D objects.

Many of the projects in the IML laboratory are funded, in part, by grants from the National Science Foundation, Penn State University College of Medicine, Pennsylvania Lions Sight Research fund, the William O. and Dr. Katherine Gibson Havemeier fund, the MU Noonan fund, the MU Neimeyer-Hodgson Grants Program, and by the Faculty Grants Committee of Millersville University. A detailed list of research funding and publications resulting from the research is provided below.
IML Laboratory External Grants and Research Projects:

1. Telemedicine and Advanced Technology Research Center (TATRC) Phase II STTR award ($30,000) entitled "Continuation of The Development of an Intracranial Hematoma (ICH) Surgical Simulator", a joint project with Verefi Technologies Incorporated and Millersville University (June 2008 – December 2008). Awarded to Dr. Gary Zoppetti (MU) and Dr. Roger Webster (MU).

2. National Science Foundation (NSF CCLI) Course, Curriculum, and Laboratory Improvement Program grant ($148,030) entitled "A Computer Graphics and Game Development Track in Computer Science" (June 2007 – August 2009). The goal of this grant project is to implement an exemplary curriculum track called Computer Graphics and Game Development (CGGD) that combines Computer Science with mathematics, physics, art, and digital media classes. NSF awarded to Dr. Roger Webster, Computer Science principle investigator.

3. Telemedicine and Advanced Technology Research Center (TATRC) Phase II Small Business Technology Transfer (STTR) grant ($786,000) entitled "An Intracranial Hematoma/Burr Holes Simulation System", in collaboration with Verefi Technologies Inc (December 2006 – November 2008). Awarded to Dr. Randy Haluck (Verefi Technologies PI) and Dr. Gary Zoppetti (Millersville University PI).

4. Pennsylvania Keystone Innovation Zone (KIZ) summer grant ($10,000) entitled "Development of an Application Program Interface (API) for SimPod, a Multiapplication Simulator for Training Healthcare Professionals", a joint project with Millersville University and Verefi Technologies Inc, (June 2007 – August 2007). This grant provides summer funding for the development of an API software module for the SIMPOD surgical simulator. Awarded to Dr. Roger Webster (MU).

5. Lions Club Research Grant, ($30,000) entitled "Continuation of the Development of a Surgical Simulator for the Capsulorhexis Procedure during Cataract Surgery", (June 2006 – January 2007). This grant provides continuation funding for the development of software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Joseph Sassani (PSU), Dr. Roger Webster (MU) and Matt Harris (MU).

6. Pennsylvania Keystone Innovation Zone (KIZ) grant ($10,000) entitled "Development and Commercialization of a Capsulorhexis Cataract Surgical Simulator for Ophthalmology", a joint project with Millersville University, Verefi Technologies Inc, and the Pennsylvania State University College of Medicine Department of Ophthalmology", (June 2006 – August 2006). This grant provides summer funding for the development of a software module for a surgical simulator for capsulorhexis skills training in cataract surgery. Awarded to Dr. Roger Webster (MU) and Matt Harris (MU).

7. Lions Club Research Grant, ($25,000) entitled "Development of a Surgical Simulator for the Capsulorhexis Procedure during Cataract Surgery Joint Project with the Pennsylvania State University College of Medicine Department of Ophthalmology", (June 2005 – January 2006). This grant provides funding to complete the development of software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Joseph Sassani (PSU) and Dr. Roger Webster (MU).

8. Telemedicine and Advanced Technology Research Center (TATRC) grant ($186,681) entitled: "Development of RapidFire – A Dynamic Smart Tutor
Surgical Simulation Trainer”, (April 2004 – April 2006), awarded to Dr. Randy Haluck and Dr. Roger Webster of Verefi Technologies Incorporated, Elizabethtown, Pennsylvania.

9. Pennsylvania State University College of Medicine, Department of Ophthalmology Medical Research grant ($10,000) entitled “Development of a Surgical Simulator for the Capsulorhexis Procedure during Cataract Surgery on the EYESI System”, (November 2004 – January 2005). This grant provides funding to develop software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Roger Webster, Computer Science principle investigator.

10. Life Sciences Greenhouse of Central PA (LSGPA) grant ($98,681) entitled: “Development of Novel Medical and Surgical Simulation Trainers”, (April 2003 – April 2004), awarded to Dr. Randy Haluck and Dr. Roger Webster of Verefi Technologies Inc. Hershey, Pennsylvania.

11. Pennsylvania State University College of Medicine, Department of Ophthalmology Medical Research Innovation grant ($10,000) entitled “The Development of a Virtual Surgery Simulator for the Capsulorhexis Procedure during Cataract Surgery”, (July 2003 – December 2003). This grant provides funding to develop software modules for a virtual surgical simulator for skills training in cataract surgery. Awarded to Dr. Roger Webster, Computer Science principle investigator.

12. National Science Foundation Major Research Initiative (NSF MRI) Program ($242,075) matching grant entitled “Development of Haptic Instrumentation for Computer Science Research and Training Using Surgical Simulation as the Application” (September 2001 – August 2004). This grant provides faculty release time, high performance graphics computers, and haptic force feedback equipment for research in 3D Computer Graphics, Virtual Reality, Haptic Surgical Simulation, and Human-Computer Interaction. NSF number EIA-0011661 awarded to Dr. Roger Webster, Computer Science principle investigator.

13. Pennsylvania State University College of Medicine, Department of Surgery and Eberly Medical Research Innovation grant ($32,050) entitled “The Development of a Laparoscopic Virtual Surgery Simulator”, (July 2000 – December 2001). This grant provides continued funding to develop software modules for a virtual surgical simulator for skills training in laparoscopic surgery. Awarded to Randy Haluck, M.D., Penn State University College of Medicine, Department of Surgery, and Dr. Roger Webster, Computer Science principle investigator.

14. Pennsylvania State University College of Medicine, Department of Surgery feasibility grant ($72,280) entitled “The Development of Computer-Based Visuospatial Skills Trainer for Laparoscopic Surgery”, (February 2000 – January 2001). This grant provides funding to develop software modules for skills training in laparoscopic surgery using the Immersion Virtual Laparoscopic Interface simulation hardware. Awarded to Randy Haluck, M.D., Penn State University College of Medicine, Department of Surgery, and Dr. Roger Webster, Computer Science principle investigator.

15. Pennsylvania State University College of Medicine, Department of Surgery feasibility grant ($46,020) entitled “Analysis of Surgical Skills in Haptic Virtual Surgery and its Transfer to Physical Surgery” (July 1999 - July 2001). This grant provides funding for focused investment in instrumentation and software development to investigate skill acquisition in haptic virtual surgery and its transfer to physical surgery. The experimental goal of the project is to provide a proof-of-concept software development system to be able to measure the skills of
expert surgeons against novice surgeons. Awarded to Randy Haluck, M.D., Penn State University College of Medicine, Department of Surgery, and Dr. Roger Webster, Computer Science principle investigator.

16. National Science Foundation (NSF CCLI) Course, Curriculum, and Laboratory Improvement Program matching grant ($56,030) entitled "Integrating Haptics into an Undergraduate Computer Science Curriculum" (July 1999 – July 2002). This grant provides haptic force feedback equipment for Computer Graphics, Virtual Reality, Scientific Visualization, and Human-Computer Interaction. NSF number DUE-9950742 awarded to Dr. Roger Webster, Computer Science principle investigator.

17. National Science Foundation (NSF) Instrumentation and Laboratory Improvement Program matching grant ($97,969) entitled "A Virtual Reality and Scientific Visualization Laboratory for Undergraduates in Computer Science" (January 1996 - 1998). This grant has provided greatly improved, modern research equipment for Computer Graphics, Virtual Reality, and Scientific Visualization. Scientific Visualization research is focused on high-performance 3D computer graphics for scientific modeling, virtual world modeling, and virtual reality simulations for research training and experimentation in the natural and physical sciences. NSF number DUE-9651237 awarded to Dr. Roger Webster, Computer Science principle investigator.

18. National Science Foundation ARI Grant. Principle Investigator in project entitled: "Replacement and Renovation of Computer Science Research and Research Training Laboratories". Awarded $141,827 from the National Science Foundation's Academic Research Infrastructure Program (February 1995 - 1999) to provide funds for focused investment in the revitalization of facilities for undergraduate research in computer science. NSF number 93-166 awarded to Dr. Albert Hoffman, Dean, Donald Stollenwerk Facilities Manager, and Dr. Roger Webster, Computer Science principle investigator.

19. National Science Foundation Grant. Co-participant in project entitled: "Providing and Integrating Educational Resources for Faculty Teaching Artificial Intelligence", National Science Foundation Grant ($81,115), Summers 1994 and 1995, NSF Faculty Enhancement Program - Collaborative grant project with Temple University, Drexel University, Villanova University and Millersville University. Awarded to: Dr. Giorgio Ingargiola and Dr. Robert Aiken, Temple University, Philadelphia, Pennsylvania.

20. National Science Foundation Grant. NSF Instrumentation and Laboratory Improvement Program ($53,039) matching grant entitled "A Real-Time Systems Laboratory to Improve Undergraduate Instruction in Computer Science", Awarded to Dr. Roger W. Webster and Dr. Paul Ross, Millersville University, Grant No. DUE-9350841 (June 1993 to November 1995). Project Director.

21. National Science Foundation Grant. Co-participant in project entitled: "FLAIR - Flexible Learning with an Artificial Intelligence Repository ", National Science Foundation ($410,000), September 1991- February 1995, NSF Grant # CDA-9115254, Collaborative research project with Temple University, Drexel University, Villanova University and Millersville University. Awarded to: Dr. Robert Aiken and Dr. Giorgio Ingargiola, Temple University, Philadelphia, Pennsylvania, USA.

22. National Science Foundation Grant. NSF Instrumentation and Laboratory Improvement Program ($86,600) matching grant entitled "A Workstation Laboratory to Improve Undergraduate Instruction in Artificial Intelligence",
Awarded to Dr. Roger W. Webster, and Dr. Paul Ross, Millersville University, Grant No. USE-9050371 (July 1990 to December 1992). Project Director.

23. ISC Research and Development Project. Awarded for research project entitled: "A Computer Vision System to Locate and Track Moving Objects in 3-Space". Sponsored by the International Signal and Control Corporation, Lancaster, PA. This project used a binocular stereo computer vision system to compute the location of practice missiles in 3-space in real time. Academic year 1990/91.
IML Laboratory Publications and Presentations:


the Annual IASTED International Conference on Modeling and Simulation (MS 2004), Marina Del Rey, California, March 1-3, 2004, pps. 262-265.


Click here for a list of Student Undergraduate Research Projects done in the IML Lab over the years: IMLLabResearchProjects.xls