



Project: *Virtual Lab*

Last update: 30 September 2005

This report documents the project's objectives, deliverables, outcomes and ongoing progress. It also describes the project's plans for deployment, evaluation and continuation. This is a living document – it is modified and updated as the project progresses.

Project Objectives

1. Provide students and their educators with virtual but realistic software implementations of sophisticated scientific instruments and accompanying specimens.
2. Design and implement the virtual instruments such that additional specimens can be added easily and additional instruments can be used to study the same specimens.
3. Build on the LTP Phase 1 and Phase 2 Virtual Lab by expanding the set of specimens.
4. Provide mechanisms to enable independent applications to utilize the specimens and invoke and contain the virtual instruments.
5. Develop an open-source site and community for distribution and development of Virtual Lab specimens, instrument software and discussion.

Customers

1. Curriculum developers seeking to incorporate microscopy or microscopic study of specimens into their curriculum.
2. High school, university and technical-college students who must become familiar with the instruments to achieve their educational or research goals.
3. Junior high school science students learning the methods used to perform scientific investigation.
4. Museums and science centers wishing to educate their visitors in the tools of scientific investigation and engineering analysis, or desiring to display interesting specimens via virtual instruments.

Use Cases

1. Students studying to operate scientific instruments, either as a profession or as a skill necessary in their studies, use the Virtual Lab to gain familiarity with those instruments. Schools make the virtual instruments widely available at low cost for this purpose.
2. Researchers employ the instruments to form or practice investigation protocols for their experiments.
3. Science students in any grade use the virtual instruments to complete or augment their lab studies, reports or homework.
4. Museum and science center curators incorporate the virtual instruments in automated or interactive displays to explain mechanisms, processes, methods or other aspects of scientific or engineering investigation and discovery.
5. Curriculum developers include several specimens in their curriculum, which directs the student to study the specimens with the available virtual instruments.

6. Students participating in outreach programs that provide remote control (via web) of a scanning electron microscope use the Virtual Lab to familiarize themselves with the instrument and its operations prior to use of the real instrument.

People

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Partnerships

- Beckman Institute at University of Illinois
- KSC IT Simulation Group
- NASA Astrobiology Institute
- Australian Centre for Astrobiology
- Classroom of the Future (COTF)
- NASA Explorer Schools
- Brevard and Orange County Schools
- University of Central Florida

Deliverables and Schedule

- 15 Nov 2004 – Annual performance plan complete
- 15 Mar 2005 – Finalization of contract for third instrument and specimens.
- 1 April 2005 – Establishment of Virtual Lab open-source site.
- 1 August 2005 – Delivery from Beckman of beta versions of final scanning electron microscope and light microscope.
- 15 August – Completion of UCF educator evaluation.
- 30 May 2006 – Delivery from Beckman of final versions of all four virtual instruments and all specimens.

Dependencies

- Continuation and formation of the above partnerships.
- Funding available at KSC in time.

Assumptions

- Virtual Lab is to create the technology to be utilized by teachers and curriculum developers.

Accomplishments

All the project's accomplishments and deliveries are captured here:

1. 30 October 2004 – Annual Performance Plan delivered.
2. 15 December 2005 – Establishment of Virtual Lab open-source site (early).

3. 4 March 2005 – Finalization of contract for four instruments and associated specimens. The instruments are Virtual Scanning Electron Microscope, Virtual Light Microscope, Atomic Force Microscope, and Electron Dispersion Spectrometer, which is for use with the virtual scanning electron microscope.
4. 1 June 2005 – Dr. Blasi’s preliminary report of her research findings distributed to Project Office and Headquarters.
5. 30 September 2005 – Project has completed all requirements and deliverables.

Deployment and Evaluation Planning

This section identifies how the project specifically addresses NASA’s six Education Program Operating Principles. These principles are described in the NASA Learning Technologies Phase 2 Requirements Specification (a.k.a. the NLT Project General Requirements).

Customer Focus

Virtual Lab actively seeks customer involvement in the development of their virtual instruments and the addition of specimens. Through teacher and student evaluation and discussions, we continue to improve and refine our product. This year, an independent evaluation of our product’s use in Orange County schools will be provided for us by the University of Central Florida. Through workshops and class demonstrations in Brevard County schools, we continue to obtain teacher and student responses to our product. These discussions and comments from our annual evaluation have enabled us to focus on adding more biological specimens.

Content

The Virtual Lab makes direct use of NASA content, people, and facilities by providing a video for each instrument on how it is used at NASA. In the video, NASA scientists provide explanations on their daily use of the instruments and its important contribution to space related research and activities.

Pipeline

By connecting what the students are learning in class with actual careers at NASA, Virtual Lab aims to attract students to pursue careers in STEM. Virtual Lab gives the students a hands-on experience in which they can role-play these activities, further reinforcing the idea that they too can become a NASA scientist.

Diversity

The software is designed to be platform independent in order to assure accessibility by a wide audience. The Virtual Lab is provided free via CD/DVD to teachers and students throughout the country. Current enhancements will make the instrument and specimens easily downloadable from web servers. As we attain a community of developers, these servers will proliferate providing even greater access to a diverse group.

Evaluation

The Virtual Lab team actively seeks teacher and student input. During the design and implementation, prototypes are provided for evaluation. The feedback obtained from these evaluations is later incorporated in the further refinement of our product. Additional

demonstrations have been provided to teachers, museums, and students from varied ages. KSC has also established a partnership with the University of Central Florida. At UCF, Dr. Laura Blasi has obtained independent funding through Bell South to obtain the students voice in the use of the Virtual Lab in the classroom. This independent research study will provide us with valuable information on our product's usability from both the students' and teachers' views. As part of the research Dr. Blasi (UCF) is doing with Virtual Lab, we will be collecting recommendations/suggestions on specific curriculum cases and situations.

Partnership & Sustainability

By partnering with UCF, KSC will be provided an independent evaluation of our product. Dr. Blasi is also putting in a proposal for the Earth Science and Education announcement. If funded, she will have computer science graduate students, guided by the School of Education, do simulation modules around the Virtual Lab instruments to address specific curriculum needs. These simulation modules would be tested in Orange county schools for evaluation and usability. The data from the evaluation testing would then be fed back to the final. Note that both of these efforts are not using LTP money and the latter provides a demonstrable use of how our product can be enhanced and modified by others. Partnership with Beckman Institute further enhances our ability to reach additional audiences through their Bugscope outreach project. This partnership also affords us sustainability, as they are current prime developers of these instruments. By providing these instruments under an open source agreement, we hope to entice a community of developers and users that will carry these instruments even further. Through NLT's Space Act Agreement with Australia and the United Kingdom, a curriculum on the Origins of Life will be developed that will incorporate the use of the Virtual Lab instruments. This Space Act Agreement will open the door for international use and development of our product.

Actions in Response to the NLT Annual Project Review

In FY2005, Virtual Lab will continue to add specimens to our instruments with particular emphasis on biological samples. Labels and annotations that were suggested by the review team had already been scoped and therefore will be delivered with our final product. Other enhancements to our product include architecture changes to enable it to run similar to the World Wind model. In this new architecture, specimens will be available on web servers and the software will be able to search and download the latest desired specimen real time.

Continuation Plan

Current enhancements of the Virtual Lab provide standards to make integration of specimens from other developers even easier. A web server structure will also be designed that can easily be replicated by others as they contribute additional specimens and instruments. Providing the instrument software as open source with immediately available applications and clients will fuel a community of developers to further enhance our product.