KLASS

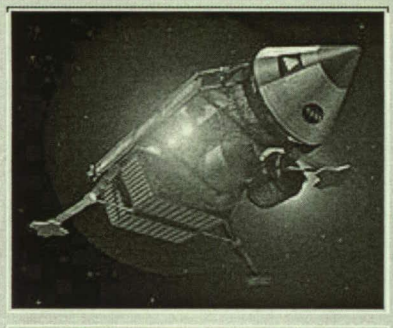
Kennedy Launch Academy Simulation System

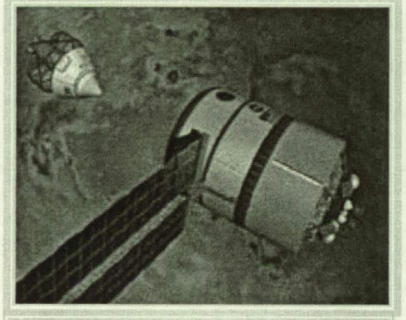
Lesley C. Garner, Ph.D

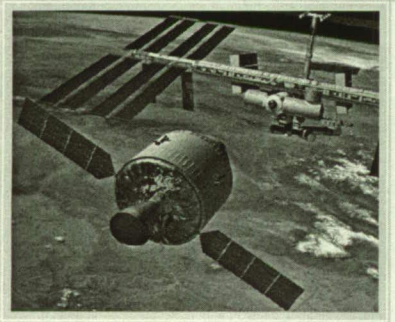
Overview

- NASA Vision for Space Exploration
- Education Standards
- KLASS
  - s/w description
  - s/w overview
- Background materials
  - Flexibility of use in classroom

Vision for Space Exploration







- The current generation of high school and college students will solve the problems to allow future explorers to travel to the moon, Mars, and beyond.
- According to our President, the fundamental goal of NASA directive is:
  - "to advance U.S. scientific, security, and economic interests through a robust space exploration program."
- Space exploration requires and resolves five critical problems – water, waste, propulsion, radiation, energy.
  - Same critical problems on earth.
- Strategic goals cannot be accomplished without education.

Inspire, Engage, Educate, Employ

- Evolving electronic world:
  - Portion of NASA's learning materials must be technology-enabled.
  - Our future astronauts are the 6th graders of today.
  - Available online without cost: science classrooms, computer labs, teachers.

Supports Educational Standards

- National Science Education Standards (NSES)
  - An inquiry-based approach to science
  - Student learning that is guided and facilitated
  - Emphasis on the assessment of student learning
  - The development of environments that enable students to learn science

Supports Educational Standards

- International Society for Technology in Education's (ISTE) National Educational Technology Standards (NETS)
  - Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.
  - Facilitate technology-enhanced experiences that address content standards and student technology standards.
  - Use technology to support learner-centered strategies that address the diverse needs of students.
- http://cnets.iste.org/

Supports Educational Standards

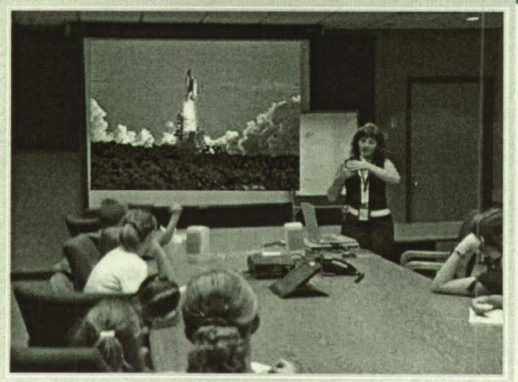
- NETS met through teacher support
  - Apply technology to develop students' higher order skills and creativity.
  - Apply technology in assessing student learning of subject matter using a variety of assessment techniques.
  - Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.
  - Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.

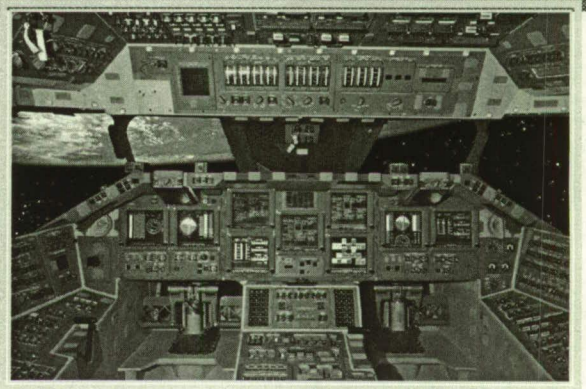
KLASS Description

- KLASS is a CD based program designed to run on networked computers.
  - downloadable
  - free
  - extremely versatile
- It allows students to command and control a launch countdown simulation.
  - Teachers select simulations that correlate to their curriculum
  - Students solve countdown related problems in order to get to a successful launch
  - Engaging launch video
  - Promotes critical thinking and team work (collaborative engineering)
- Based on the Shuttle Ground Operations Simulator (SGOS), the simulation software used at KSC for testing, training and launch readiness.

KLASS Background

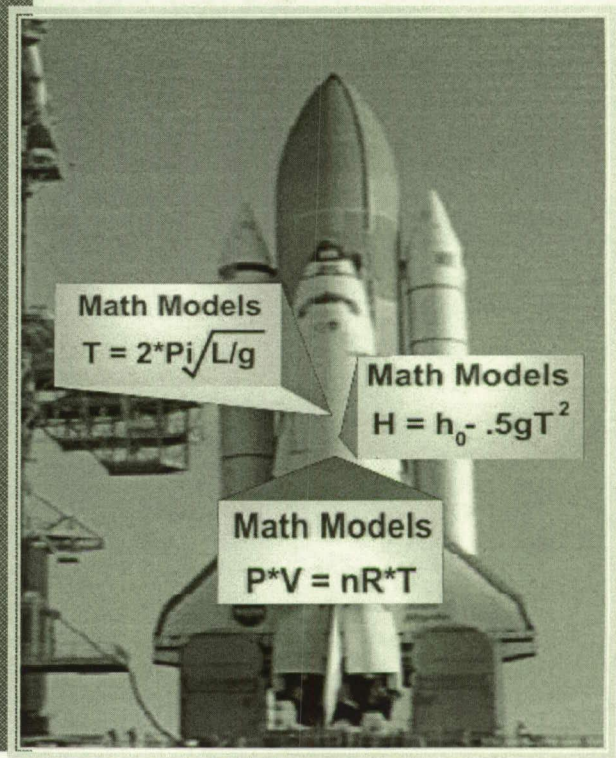
- Target audience: middle schools
  - Software designed to run on low end machines
  - All required s/w is freeware/shareware - provided with the CD/DVD or download
  - Teacher guides contain required information for setup
- Scenarios aligned with the national math, science, and technology standards, as well as supporting state assessment testing preparation.
  - Teachers defined these standards
- KLASS provides real-life scenarios
  - relevancy to understand the subject matter being taught and its importance
  - mechanism for students to use and reinforce concepts learned in class





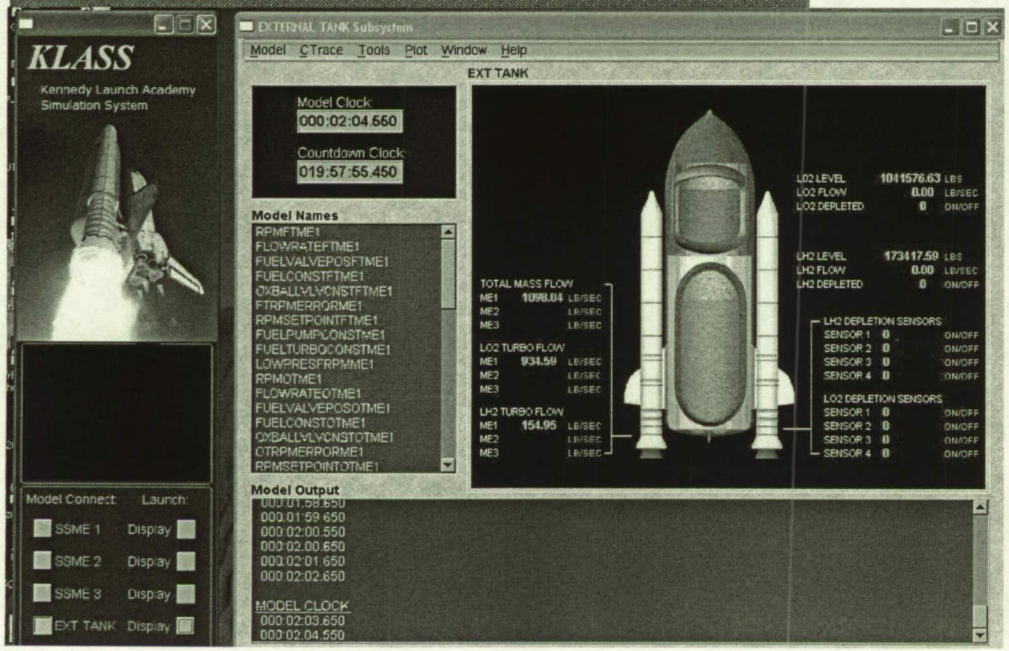
KLASS Overview

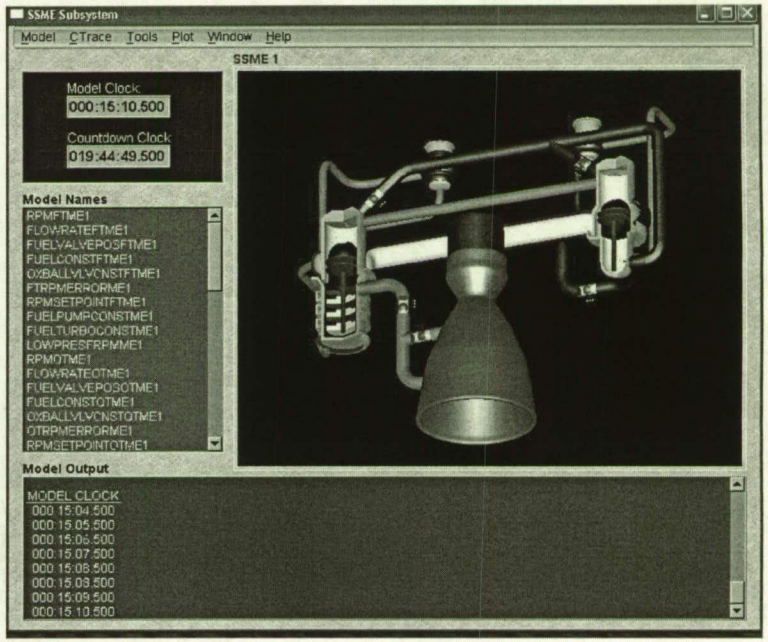
- KLASS ported the SGOS version to run on a PC
- Simplified Shuttle and ground systems models:
  - Main Engines
  - External Tank/SRB
  - Astronaut Biomedical Systems
  - Weather
  - Environmental Control System
- Launch Video
- Student applications will communicate with the model running on the teacher's computer.
- Documentation: Student worksheets, Teacher guide, software installation instructions



KLASS User Interface

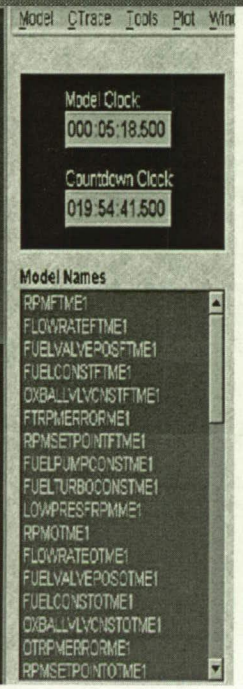
- 3D and 2D views
  - Allows the student direct control of commands
  - Visually shows actions such as the tank filling

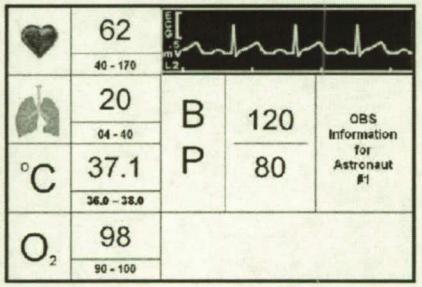


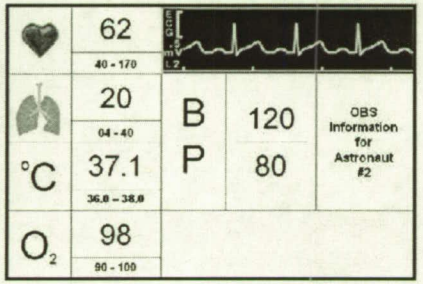


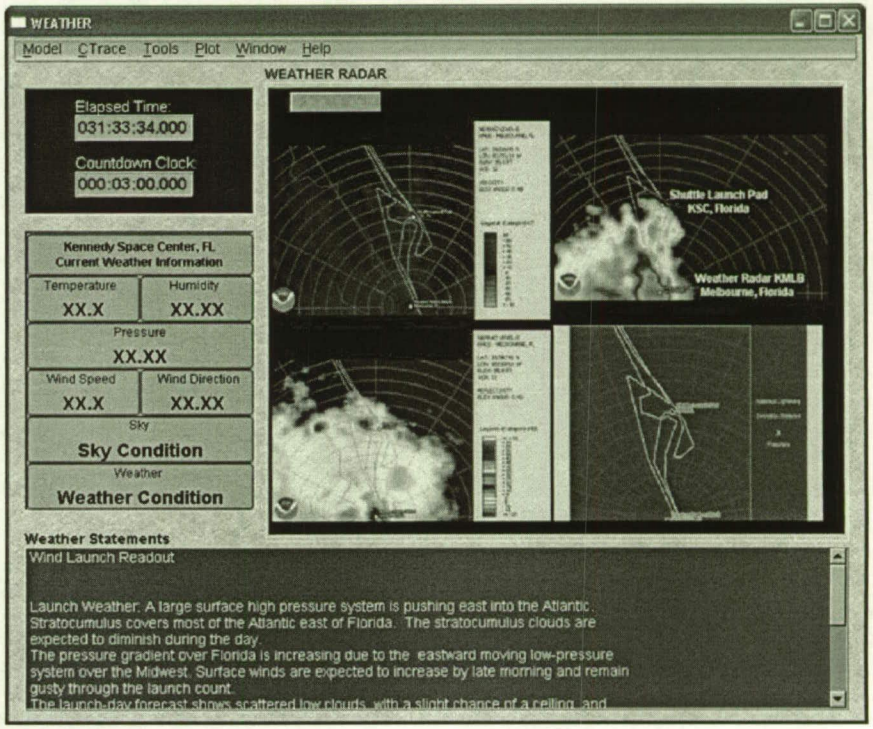
KLASS User Interface

- Various weather views
  - Lightning, cloud cover, wind speed
- Realistic biomedical systems







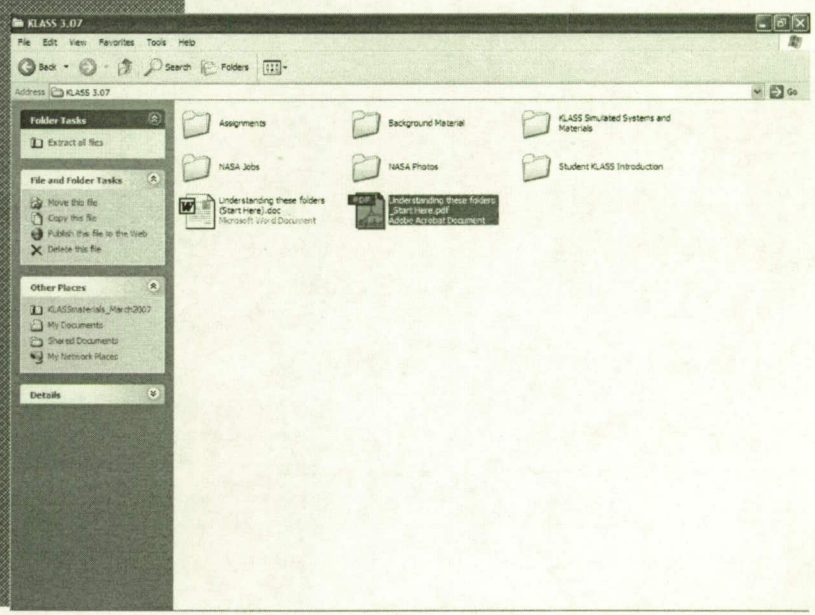


Schools needed for beta testing

- Networked system of computers
- One Linux based machine (teacher computer)
- Student PCs – Win2000 or WinXP
- Version 1 available by summer '07
- Current beta testing feedback:
  - Curriculum flexibility – from 1 day run to a 1 to 3 year curriculum
  - "Did we really launch the shuttle?"

KLASS Background Materials

- Student worksheets
- KLASS systems materials
- Student KLASS intro
- Shuttle Background
- NASA photos
- Assignments



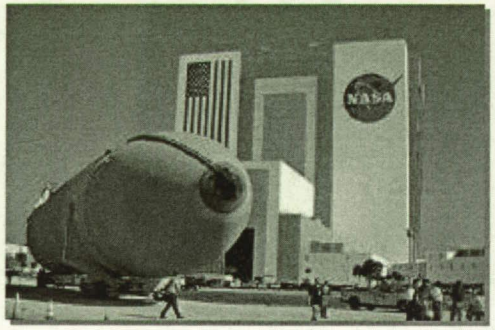
Inspiring the Next Generation of Explorers

KLASS lets students experience first hand why the science and math they are learning is important and how it can lead them to a career at NASA.

Contact us:
http://education.ksc.nasa.gov/edtech
Lesley.C.Garner@nasa.gov

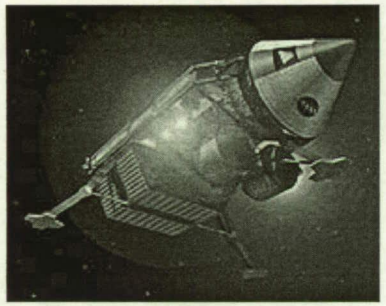
John F. Kennedy Space Center

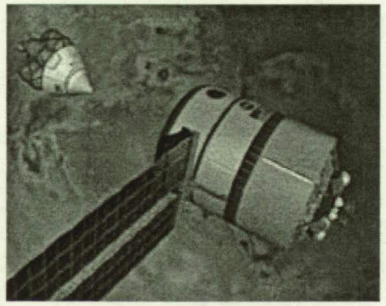
Home of the Space Shuttle

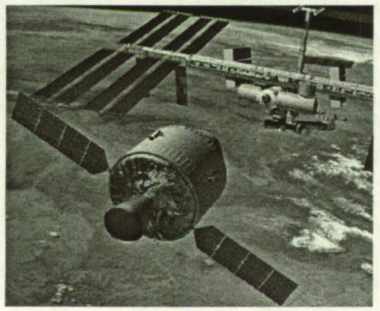


Lesley C. Garner, Ph.D.
NASA Kennedy Space Center

Exploration Vision







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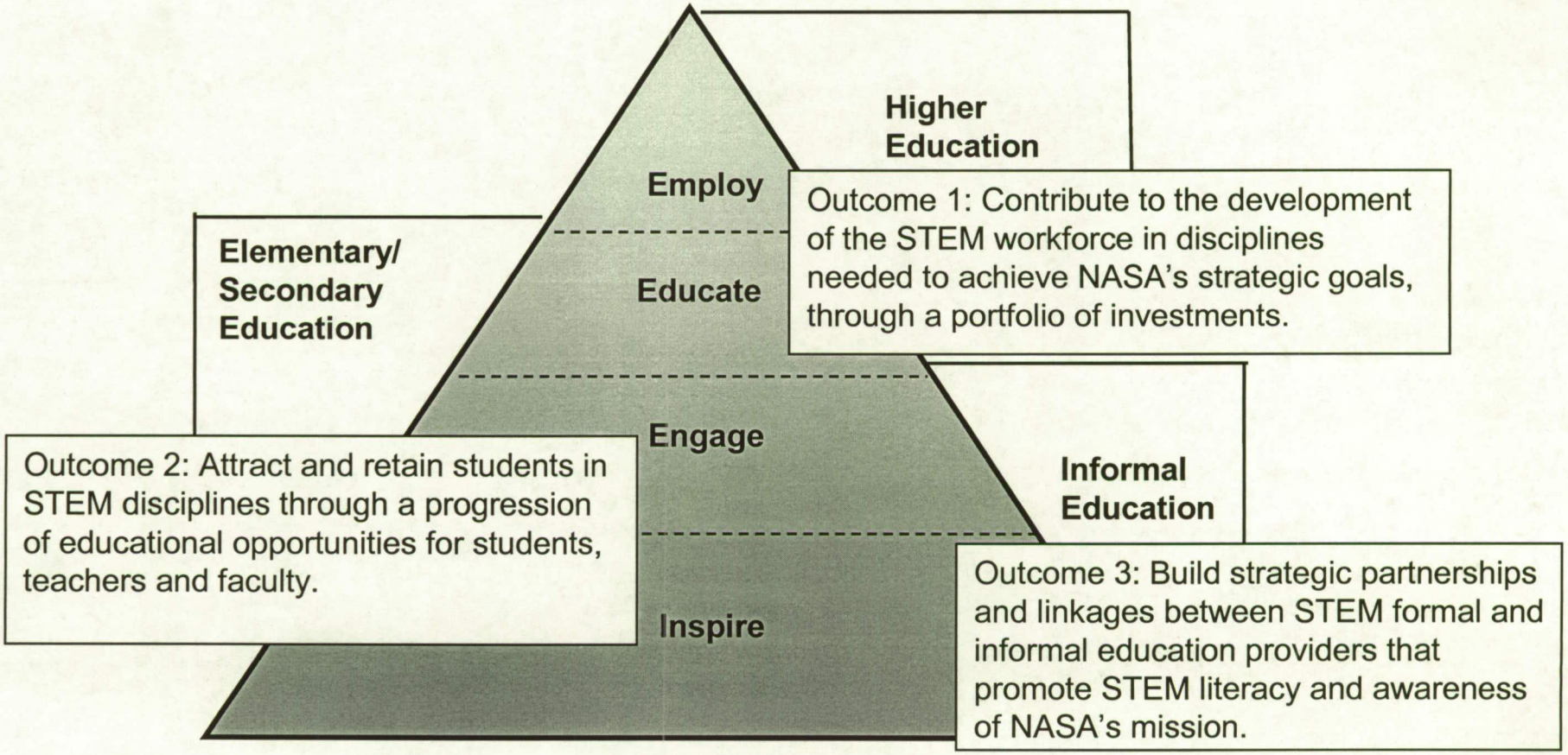
Supporting NASA strategic plan



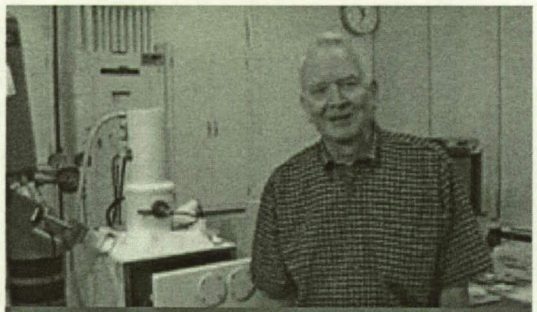
Inspire, Engage, Educate, Employ

- Evolving electronic world:
  - portion of NASA's learning materials must be technology-enabled
  - within this scope Virtual Lab was funded. It was
  - initiated out of a educator desire for access to expensive equipment
- High fidelity simulations of a suite of microscopes
  - developed by Beckman Institute Univ of IL Urbana-Champaign
  - brings extremely expensive hardware directly into the classroom
  - open source software, downloadable from the internet, easily accessible at no charge
  - defined in XML code, can be easily expanded by the developer community as well

- Software provides access to many sophisticated scientific instrumentation (Scanning Electron Microscope (SEM), a Light Microscope, a Scanning Probe Microscope (covering Scanning Tunneling, Atomic Force, and Magnetic Force microscopy), and an Energy Dispersive Spectrometer for the SEM).
  - Flash animation videos explain how each of the instruments work
  - Videos on how they are used at NASA and the sample preparation
  - Measuring and labeling tools provided with each instrument
  - Hands on experience of controlling the virtual instrument to conduct investigations, much like the real scientists at NASA do.
- Very open architecture
  - Open source on SourceForge
  - Extensive use of XML
- Target audience is high school and entry-level college students
- *"Many beginning students never get closer to an electron microscope than the photos in their textbooks. But anyone can get a sense of what the instrument can do by downloading this simulator from NASA's Kennedy Space Center."* Science Magazine, April 8th, 2005

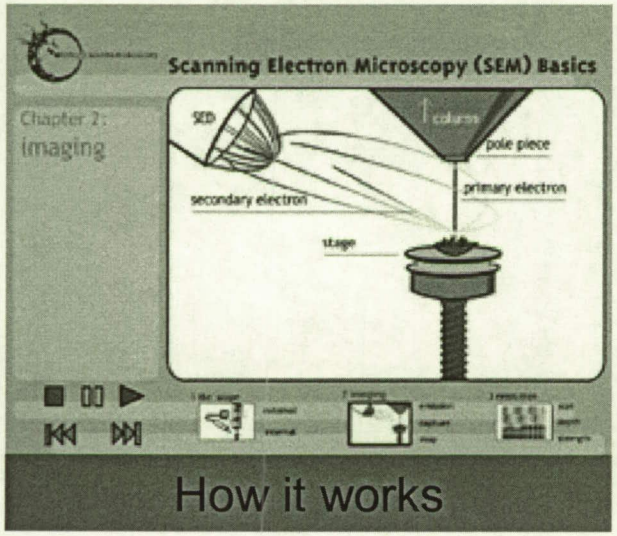
Our Future Explorers

Virtual Lab

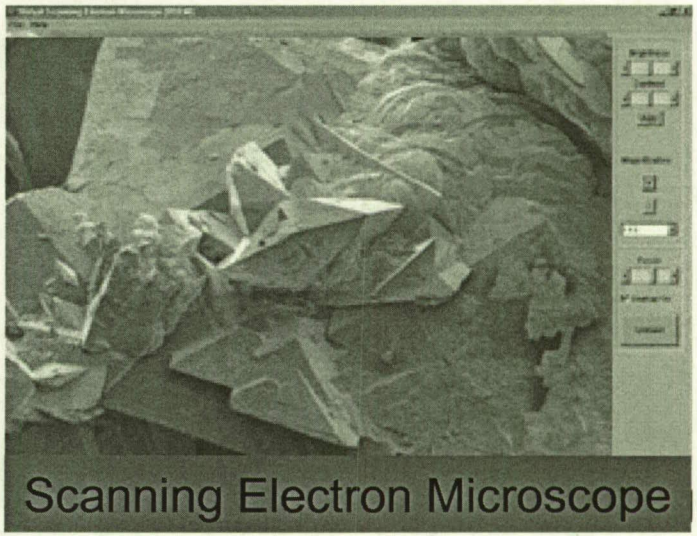


How its used at NASA

Specimen Preparation



How it works



Scanning Electron Microscope

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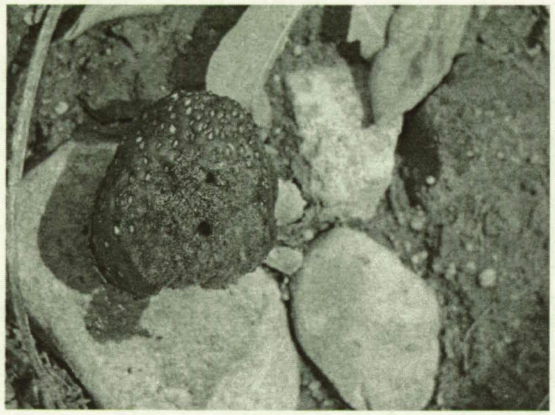
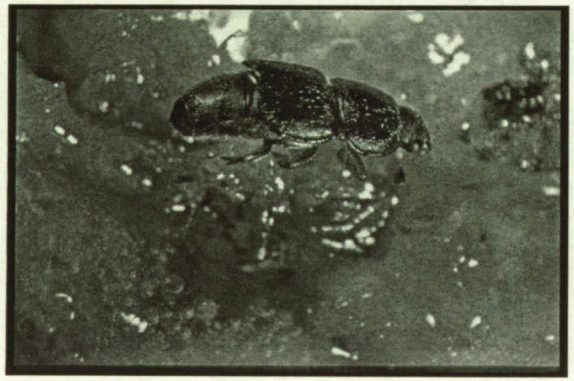
Different Audience Use

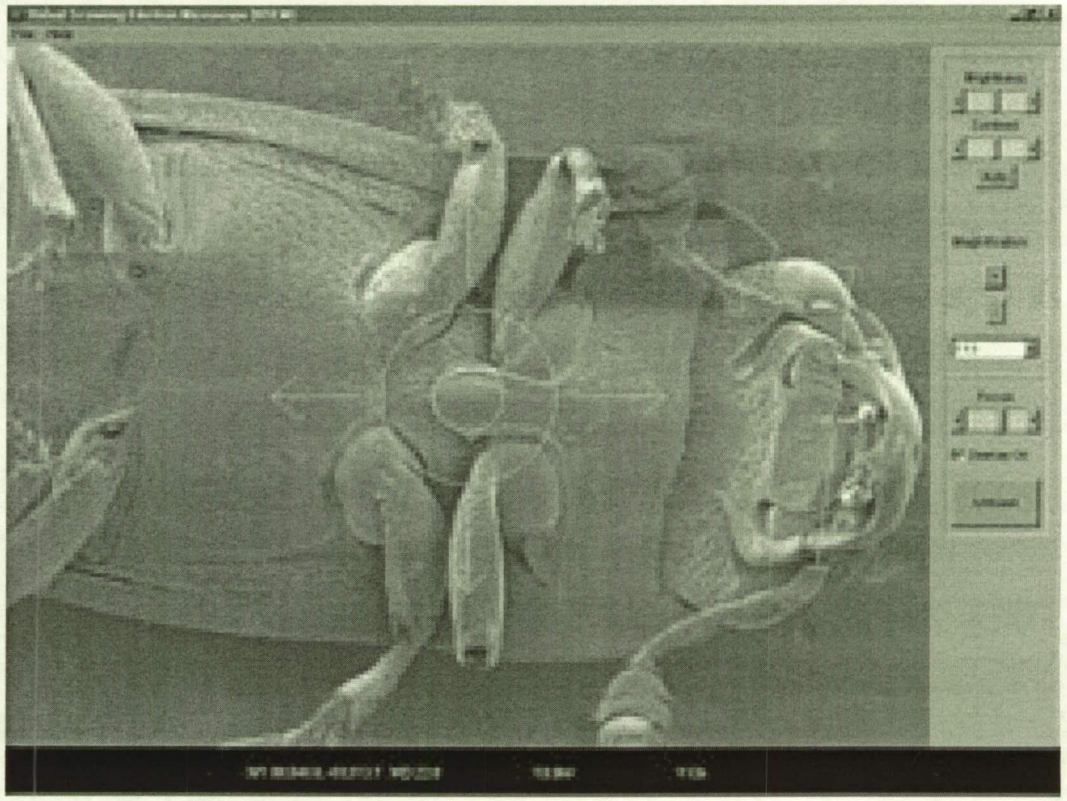
K-12	College	Professional	Informal
Science and Math class use to demonstrate concepts on real specimens.	Training vehicle Analysis Tool	Collaborative tool for scientists Sharing of Information	Museums sharing rare samples (example, echinoderms) "Who done it" books

Lesson Plan Example

- http://www.nasa-inspired.org







Transfer of Tools from NASA into Education

- Concept: The application of units of measurement (microns) and conversion.
- Training (from NASA): Investigating and documenting details of an unknown specimen.
- Tools (from NASA): The SEM, Microscopy.

Example of Standards Used

Virtual Lab: Metric Measurement Lesson
Using the Scanning Electron Microscope (SEM) Simulation

Sunshine State Standards

SC.H.1.4.1 Knows that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories.

SC.F.1.4.2 Knows that body structures are uniquely designed and adapted for their function

MA.B.1.4.3 Relates the concepts of measurement to similarity and proportionality in real-world situations.

MA.B.2.4.1 Selects and uses direct (measured) or indirect (not measured) methods of measurement as appropriate.

LA.A.1.4.4 Applies a variety of response strategies, including rereading, note taking, summarizing, outlining, writing a formal report, and relating what is read to his or her own experiences and feelings.

The lesson plan focuses on specific objectives…

Objectives:

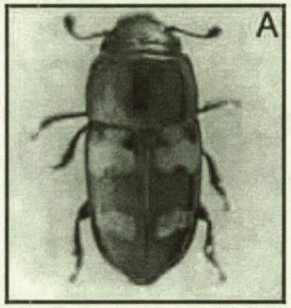
1. The student will be able to determine the metric units being used to measure the object or parts of the object.
2. The student will be able to demonstrate proficiency in manipulating the computer technology software.
3. The student will be able to use the computer measurement bar to measure various objects in the Virtual SEM.
4. The student will use the scientific method to solve a problem.
5. The student will be able to convert between millimeters and micrometers.

Linked to assessment….

Name: Period: Date:

Virtual Lab Lesson 1 Pre-test

1. What metric unit would you use to measure the following specimen?



http://www.na.fs.fed.us/spfo/pubs/howtos/ht_nitidulid/nitidulid.htm

A. meters B. kilometers C. millimeters D. micrometers

2. One millimeter equals _____ meters.
   A. 10 B. 0.001 C. 100 D. 0.01

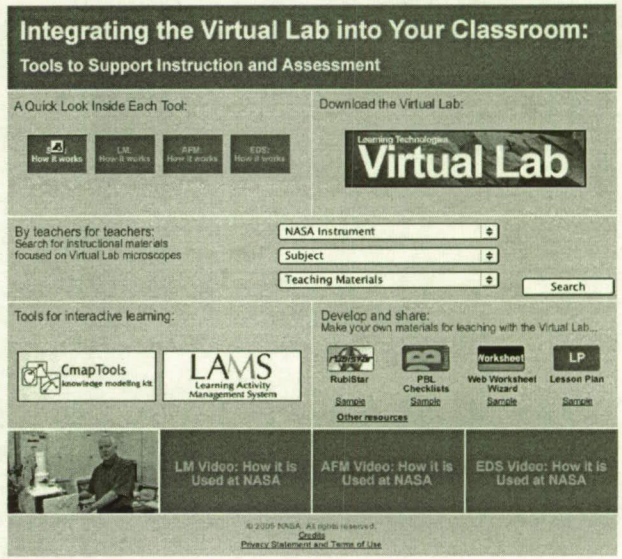
3. What does the symbol "μ" represent?
   A. milli- B. micro- C. minutae- D. macro-

4. What is magnification?
   A. The ability to enlarge an object.
   B. The ability to distinguish between very small objects.
   C. The working distance between the lens and the specimen.
   D. The contrast between different parts of an object.

5. 7.20 micrometers equals _____ millimeters.
   A. 0.0072 B. 0.072 C. 7200 D. 72,000

Integrating Into Education

- Virtual Lab's Response
  - To support teacher integration of the Virtual Lab into their science classrooms we developed a website this summer to provide tools to support instruction and assessment.
  - The site brings together the work of some of the most well-known scholars in the field of assessment, like the work of Grant Wiggins and Jay McTighe who together have authored Understanding by Design.
  - Under "Teaching Materials" we offer teachers links to content about recent NASA research using the microscopes.

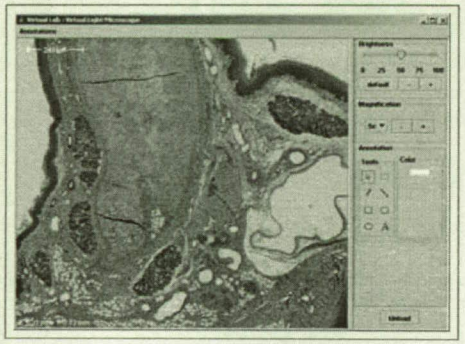


User/Developer Support Site

Imaging Technology Group
Virtual Projects

home | software | data | training | results | downloads

The Virtual Microscope



The Virtual Microscope is a NASA-funded project that provides simulated scientific instrumentation for students and researchers worldwide as part of NASA's Virtual Laboratory initiative. This site serves as home base for the Imaging Technology Group's contributions to that project—namely virtual microscopes and the multi-dimensional, high-resolution image datasets they view. Currently we offer a Virtual Scanning Electron Microscope (Virtual SEM or VSEM) and a Virtual Light Microscope (VLM), datasets for both, animated microscopy tutorials, and other related tools. The project is open source and the code is available on Sourceforge.

Our Virtual Instruments

Our virtual instrument code currently supports data from two different instruments in our Microscopy Suite: a Philips Environmental Scanning Electron Microscope (ESEM), and a Fluorescence Light Microscope.

The virtual microscope aims to present the user with a method for exploring

Latest News

- Virtual Lab in the journal Science
- ITG Releases New Beta
- Discussion Forum Added
- ITG Virtual Projects Site Launched

Latest Specimens

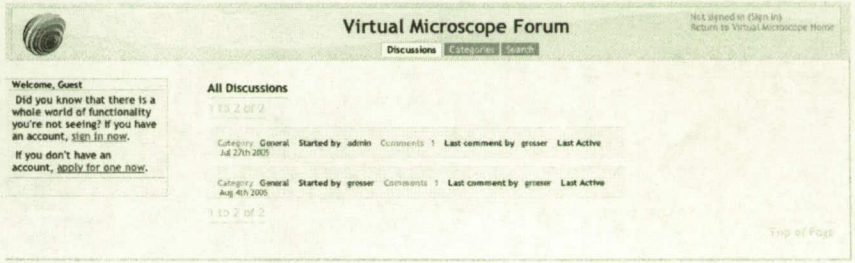
- VSEM: Collodial Crystal
- VSEM: DLP Chip
- VSEM: House Fly
- VLM: Algae

Related Sites

- Imaging Technology Group
- Bugscope
- Chickscope
- Beckman Institute
- NASA's Virtual Lab Site

More Information

- Ask Us a Question
- Discussion Forum
- Project Credits



Colloidal Crystal

The sample was made by sedimenting submicron particles, impregnating the interstitial space with hydrogel, and then removing the particles. Research by Robert Barry and Pierre Wiltzius.

Download the Hydrogel (104MB)

Digital Light Projection (DLP) Chip

This specimen is a Texas Instruments Digital Micromirror Device (DMD), a component of DLP TVs and projectors. Each square is an individual mirror which tilts to affect the lighting for each pixel of the image. Chip courtesy of Texas Instruments. More information on DMDs at www.dmddiscovery.com.

Download the DLP Chip (16MB)

NASA Heat Protection Tile

This specimen is a small portion of a foam heat protection tile from one of the space shuttle orbiters. Sample was provided by the NASA Kennedy Space Center.

Download the Tile (95MB)

House Fly

The common house fly is a stunning site up close, revealing a veritable world of structure that is unseen by human eye. This tiling of a complete house fly (underside) shows the legs, abdomen, head, and mouth parts clearly.

Download the Fly (160MB)

Sap Beetle

As with the house fly above, this sap beetle

Virtual Light Microscope (VLM)

All of our VLM samples are collected using on our Fluorescence Light Microscope. We have used various software packages to aid in the data collection, including MCID and Openlab. The tissue specimens are stained histology sections, and the rest are unmodified. Images are taken with a 40x objective.

Red Blood Cells (Human)

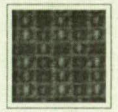
Red blood cells are the most common type of blood cell in the body, and are the principal means of delivering oxygen to body tissues (credit: wikipedia). Read more about red blood cells on Wikipedia's Red blood cell page.

Download the Red Blood Cells (180MB)

Charge Coupled Device (CCD)

Charge Coupled Devices (CCDs) are light-sensitive digital sensors commonly found in digital cameras. Each 'pixel' is a capacitor that transfers its charge to a control circuit that translates that information into digital images. The Bayer filter is clearly seen in this sample. Read more about CCDs at Wikipedia.

Download the CCD (24MB)



Algae

Algae, also known as pond scum, "comprise several different groups of living organisms usually found in wet places or water bodies that capture light energy through photosynthesis, converting inorganic substances into simple sugars wtih the captured energy." (credit: Wikipedia) Read more about algae on Wikipedia.

Download the Pond Scum (75MB)

Present (Build Support)

- Partnerships
  - Beckman Institute (http://virtual.itg.uiuc.edu)
  - University of Central Florida (http://nasa.ed.ucf.edu/main.html)
  - Lehigh University
  - NSF Nanoscale Science and Engineering Center
  - NSF Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS)
  - ARC NASA Quest "Here today gone to Mars"
  - Field Museum Chicago
  - Central Queensland University, Australia
  - Nanyang Technological University, Singapore
  - The Advanced Learning Technologies in Education Consortia (ALTEC) at the University of Kansas Center for Research on Learning (http://www.4teachers.org)

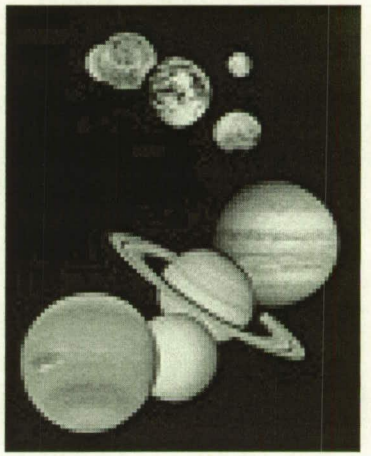
Future (Self Sustaining)

- For these e-products to flourish beyond NASA funding, however, there is a need for partnerships with education and with the user/developer community.
- In support of this goal, NASA has initiated partnerships with universities, medical centers, and museums.
- Virtual Lab is being used:
  - to share rare specimens of a new species of echinoderm with scientists worldwide, it is being
  - considered for use with a series of children's books, it is being
  - considered for use by various non-profit education curriculum developers, and
  - will be used for the study of the 3.5 billion year old Australian Pilbara structures by students worldwide through a Virtual Field Trip. The study of these ancient structures ties directly into the study for life on other planets, as they are also billions of years old.

Future (Self Sustaining)

- Continued goals that must be considered:
  - increasing the library of electronic specimens
  - increasing the library of microscopes
  - increasing the exposure of Virtual Lab to the medical and educational user community
- Continue developing partnerships and collaborations to expand base of developers and users
- Continue to strategically develop mechanisms that enable community to grow in the absence of NASA funding

Accomplishment of these goals
feeds directly back into
our strategic goal:
To the Moon, Mars and beyond.



Contacts

- http://virtual.itg.uiuc.edu
- http://learn.arc.nasa.gov/vlab
- http://www.nasa-inspired.org
- http://education.ksc.nasa.gov

- Please contact us if you are interested in partnering with NASA on any of our e-Education products:

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