



World Wide Student Laboratory

The white paper

What is WWSL?

The World Wide Student Laboratory, WWSL, is an Internet infrastructure for science experimentation and education, offering 24/7 remote access to laboratory experiments and science education resources. Experimental setups are located all over the globe, at some of the world's finest educational institutions, and these experimental setups can be accessed by students everywhere.

The WWSL is focused on improving the quality and reducing the cost of advanced educational laboratories. These laboratories represent the most difficult and expensive segment of science, engineering and medical education. The WWSL not only improves accessibility, it also makes ownership of such laboratories more economical. The WWSL can serve secondary and post-secondary and K-12 students anywhere in the world.

Using the WWSL's fundamentally new approach, educational institutions will be able to afford better facilities for the education they provide, access the best lab facilities in other institutions, and substantially broaden the number of lab study items in their curriculum.

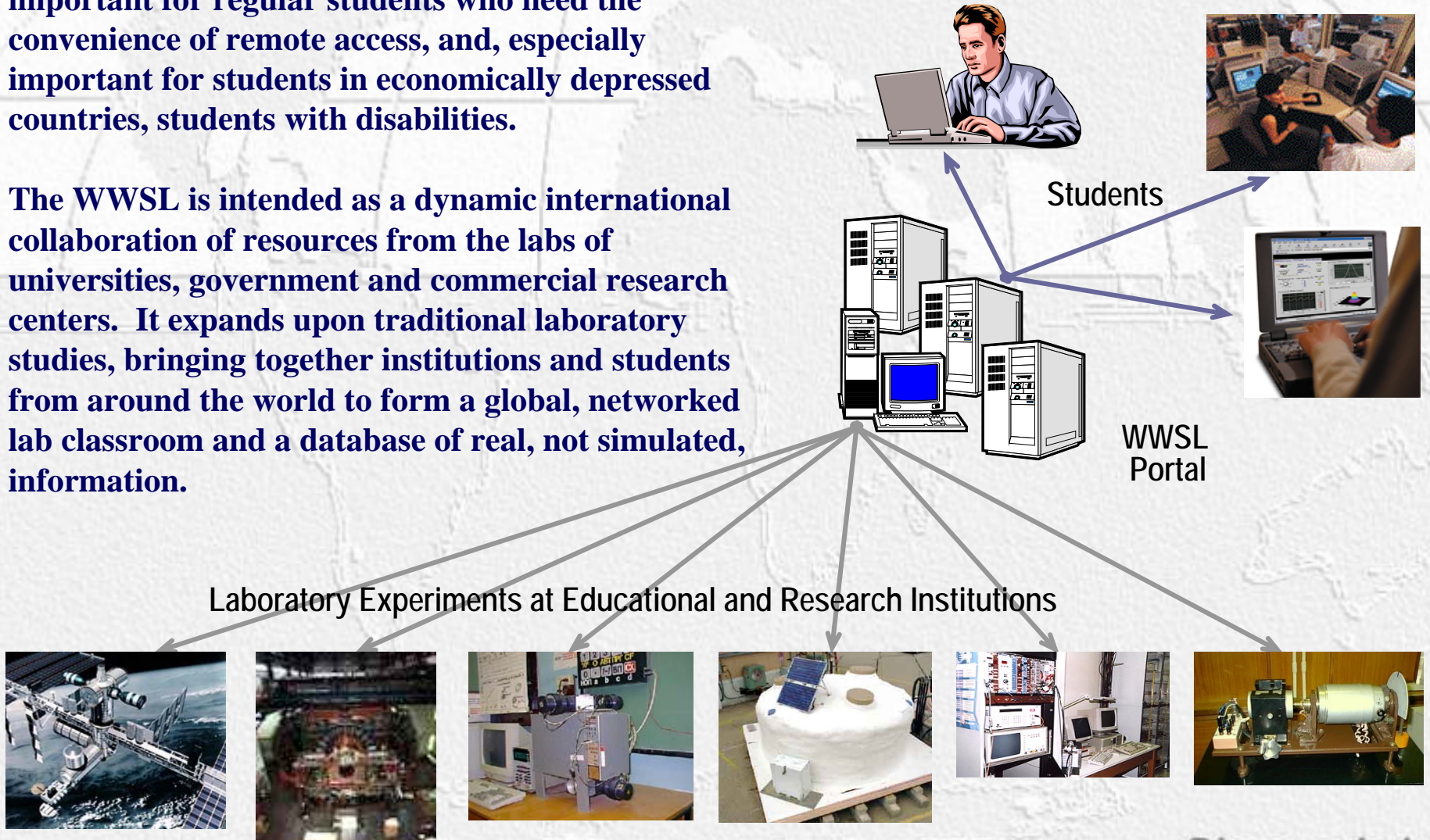
"... idea of having the universities (functioning as authors) financially vested in the success of the labs is superb and will insure the excellence and viability of the labs themselves."

- Michael Anderson, Senior Vice President, VCampus Corporation

What is WWSL? (continued)

Through the World Wide Student Laboratory students perform laboratory experiments remotely – important for regular students who need the convenience of remote access, and, especially important for students in economically depressed countries, students with disabilities.

The WWSL is intended as a dynamic international collaboration of resources from the labs of universities, government and commercial research centers. It expands upon traditional laboratory studies, bringing together institutions and students from around the world to form a global, networked lab classroom and a database of real, not simulated, information.

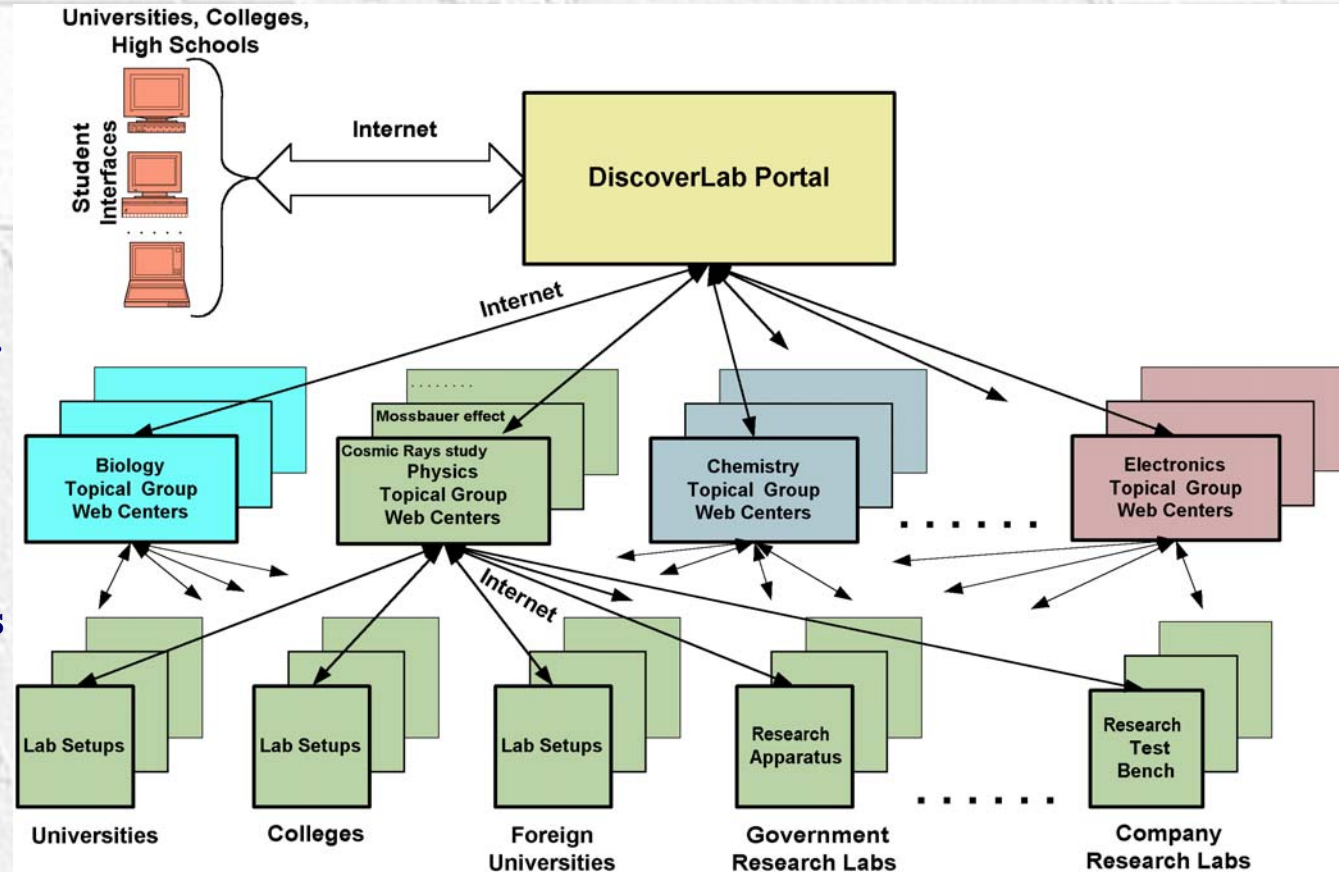


WWSL Infrastructure

A key feature of the WWSL is the **Topical Group Web Center**. Different topical group web centers cover different subject areas and each is led by a recognized expert.

To conduct a particular series of laboratory projects students connect to the sites of experimental setups at participating institutions through a Topical Group Web Center specific to their subject.

Students are presented with laboratory work at various levels of difficulty, as well as with various methods to obtain results.



WWSL Infrastructure (Continued)

Each topical group web center provides:

- **experiment schedule availability**
- **recommended lab content and methods**
- **software tools for experimental data analysis and modeling**
- **reference materials, lectures, articles, and more.**

This infrastructure allows students, under the instruction of an educator, to:

- **control lab experiments remotely**
- **gather, process and analyze data around the clock**
- **work in collaboration with students regardless of their location.**

The lab content and methods can be customized by individual instructors to fine-tune the content to a particular class level.

*"Great educational potential!" -James Spohrer, PhD, CTO,
IBM Almaden Research Center*

Example: Web Portal of Cosmic Ray, Statistics and Stochastic Processes Topical Group

WWSL Cosmic Ray, Statistics and Stochastic Processes Topical Group - Netscape

WWSL Cosmic Ray, Statistics and Stochastic Processes Topical Group

World Wide Student Laboratory

Cosmic Ray Center Schedule Your Professor Student Lab Report Joint Report Topical Chat Physical Constants

WWSL Experiments

- Experiments with Module at Florida site
- Experiments with Module at Oregon site
- Experiments with Modules at Moscow site
- Study of Time Correlations in Cosmic Rays (Oregon and Florida)

Data of Previous Experiments



- Composition and Penetration Properties
- Angular Distribution

Useful Links

- Data Analysis Tools (Under construction)
- Modeling Tools
- Physical Constants

Cosmic Ray Physics Current Scientific Experiments Cosmic Rays in the News References

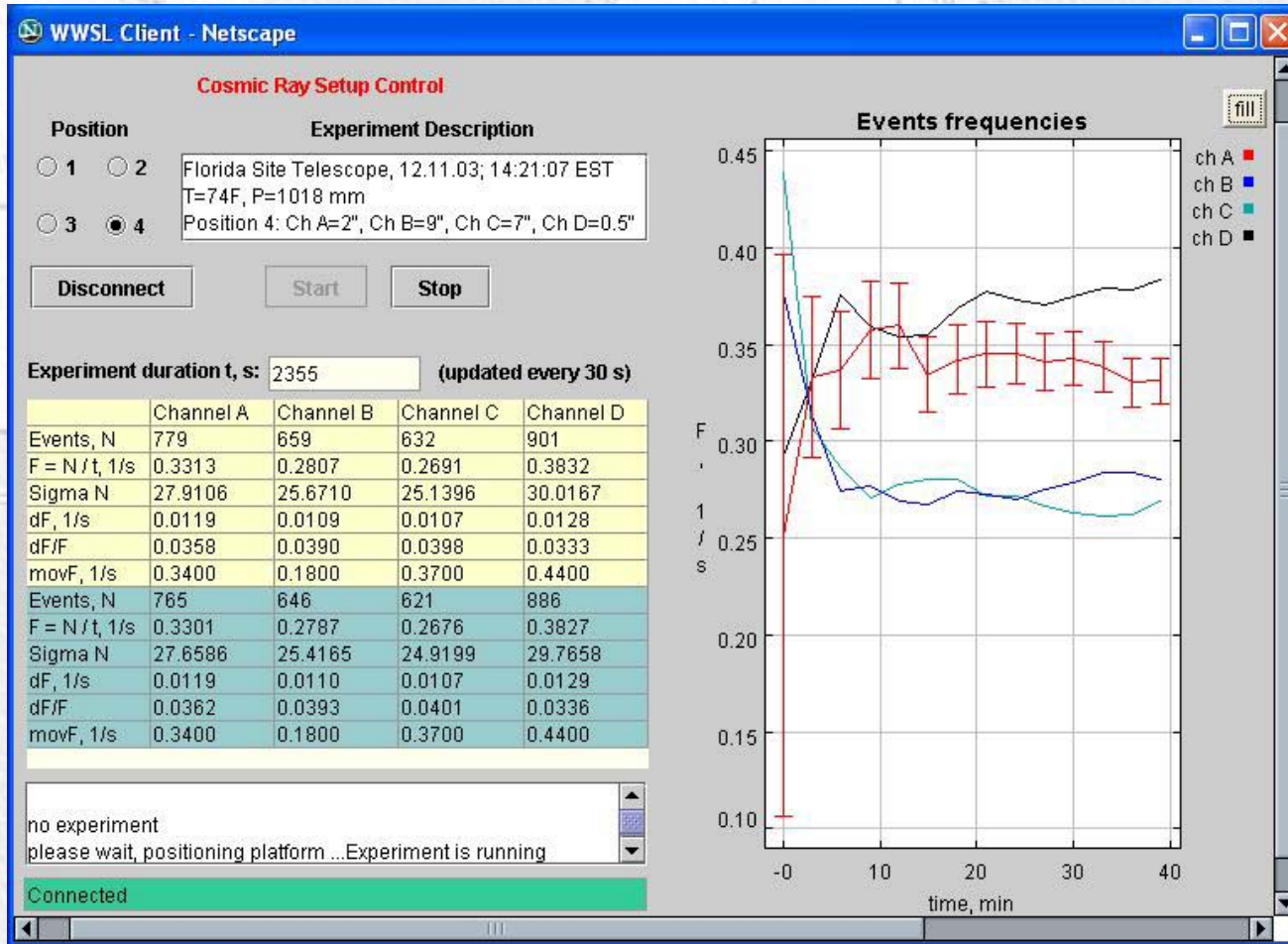
Introduction



The photographs above show WWSL's Cosmic Ray Experimental Modules at the Florida site, top, at the Oregon site, bottom left, and at the Moscow site, bottom center and right. Click pictures to enlarge.

Oregon and Moscow setups, [see layout](#), consists of two scintillating detectors. The signals from the detectors are read out to a coincidence unit. The unit selects events due to cosmic ray particles passing through both detectors. The output signals from coincidence units are collected by a data acquisition system and a computer. For study of penetration

Example: User Interface for Remote Operation



These setups can be used in the following projects:

- Composition of cosmic rays near the Earth;
- Angular distribution of cosmic ray flux;
- Fluctuations in energy loss of charged particles;
- Properties of Poisson statistical distribution;
- Relationship among binomial, Poisson and normal distributions;
- The "waiting time paradox" for Poisson processes

Interface for remote operation of the WWSL Cosmic Ray, Statistics and Stochastic Processes lab module

Traditional Approach vs. WWSL

Traditional Lab Classes:

- Limited to local students
- Access limited to class schedule
- Classes often too short to obtain persuasive research results
- Inefficient use of lab facilities (average only about 15%)
- Costly for universities and high schools
- Experiments limited to local, often simplified lab setups

WWSL:

- Available to all students around the world
- Access available 24x7
- Long duration experiments supported
- The efficiency of lab facilities can reach 95%
- Cost-efficient model
- Broad range of experiments available
- Experiments can include several geographically dispersed setups for data comparison
- Actual apparatus at leading research centers can be used

"I do think it would be wonderful to give students access to all of these current experiments, especially as they are getting ready for science fairs and whatnot." - *Alison Pruntel, Director of Programming, AOL@school, America Online*

WWSL Participants

World Wide Student Laboratory

Customers:

- Traditional Universities and Colleges
- High Schools
- Distance Education Institutions
- Corporate Training Departments
- Military Academies and Post Graduate Schools

Lab Contributors:

- Universities and Colleges Globally
- Government Research Labs and Centers
- DiscoverLab Corporation
- Research Labs of Private Companies

Alliance Participants:

- Computer, Electronics and Instrumentation Companies
- Publishers of Educational Materials
- Government and International Education Organizations
- Professional Scientific Societies and Associations

Interested Organizations

- **About 35 of 120 universities and research centers world-wide -- that are currently developing educational remote access laboratories -- are technically ready to participate in the WWSL Project. Those include such leading universities as Stanford University, Massachusetts Institute of Technology, University of Cambridge, University of Oregon*, California Institute of Technology, Russia's Moscow State Technical University*, University of Chicago, Stevens Institute of Technology.**
- **The WWSL approach may be used in programs sponsored by NSF, DOE, NASA, NIST and by other US Government agencies.**
- **UNESCO Institute for Information Technologies in Education (IITE) is interested in supporting WWSL relations with foreign educational institutions.**
- **A number of computer and instrumentation companies would like to support the WWSL project by providing hardware grants to participating universities and institutions. Some of these companies are as follows: Agilent Technologies, IBM, Hewlett-Packard, Keithley, Ocean Optics*, National Instruments.**

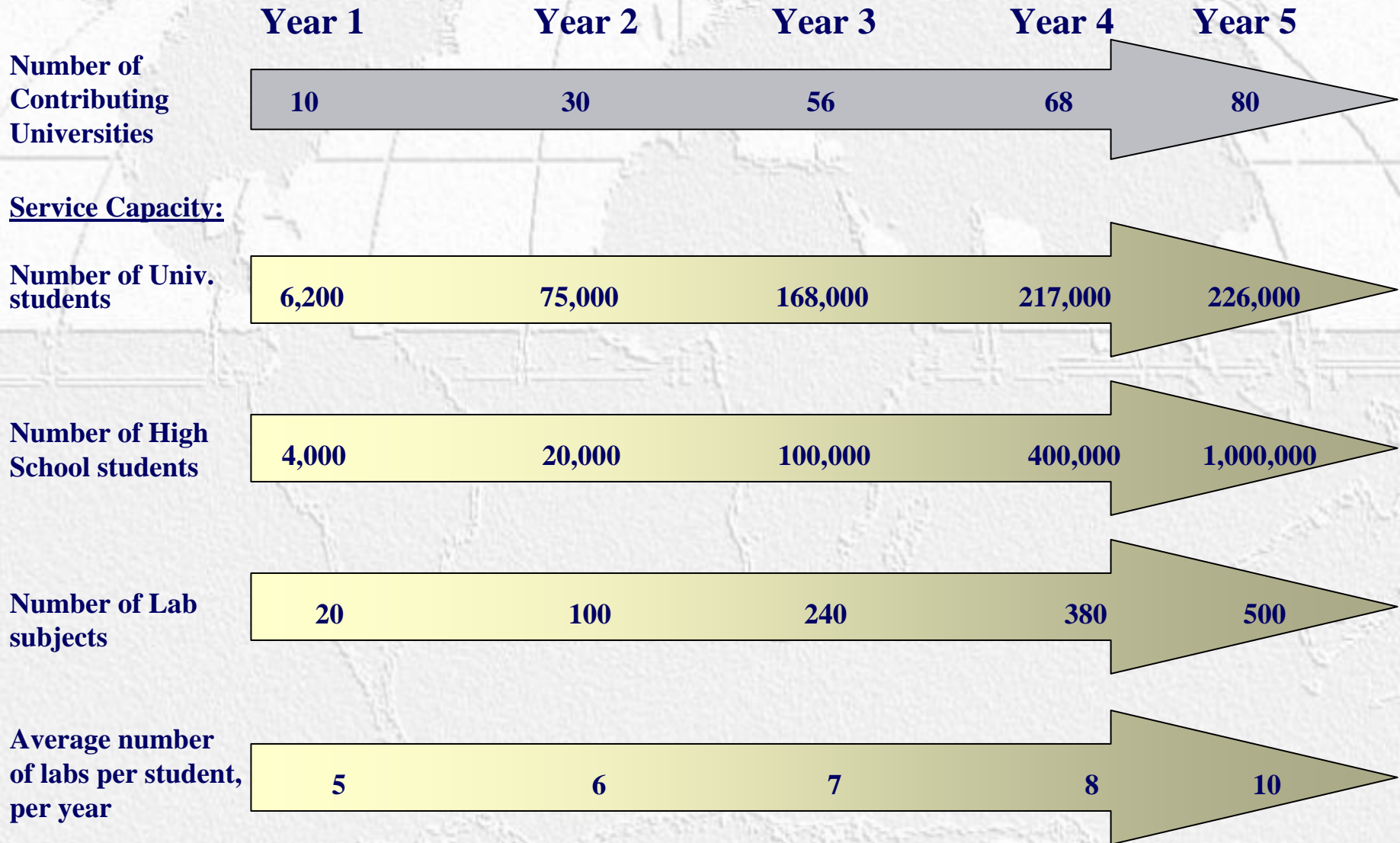
***Already participating in the WWSL**

"WWSL will offer students a tremendously enriched learning experience. This is also what is lacking in many degree programs: real experience". -Maha Ashour-Abdalla, Professor, Director of UCLA Center for Digital Innovation

WWSL: a Win-Win Proposition

- **WWSL offers a fundamentally new framework in education technology that will finally bring e-education to science and engineering students;**
- **WWSL provides more study options to students while lowering costs for universities;**
- **WWSL integrates real time experimentation into the learning experience and offers students insight into professional careers;**
- **WWSL makes use of existing computer-controlled lab equipment;**
- **WWSL Project fits into Federal programs involving the development of education technology (e.g., NSF Education Program, DOE Science Education and National Collaboratory Programs, NASA Education Program, NIST Adaptive Learning Systems, and DOD Army University Access Online);**
- **WWSL brings science study access to students in economically depressed regions and to students with physical disabilities, while offsetting the cost of lab maintenance for contributing universities;**
- **WWSL provides an additional market and advertising opportunities for participating companies.**

WWSL Service Development Plan



WWSL Revenue Stream

Primary revenue comes from charging participating educational institutions a small subscription fee per student per year. This subscription fee represents a fraction of the typical university expenditure per student.

- The fee for students in the Participant Category (students at traditional universities, colleges, etc. who operate laboratories remotely) is between \$15 – \$150 per student per year, depending on the level of activity (number of labs per year).**
- The fee for students in the Observer Category (high school students who only observe experiments and use laboratory data) is between \$1 – \$10 per student per year, depending on the level of activity.**
- Contributing universities (those who make their lab experiments available to the WWSL) receive a fee from WWSL to offset their maintenance costs – note that these costs are realized with or without the WWSL.**

Secondary revenue potential exists from co-marketing of software, hardware and instrumentation products and advertising on the WWSL and Discoverlab websites.

Summary

- **The World Wide Student Laboratory is an Internet portal for science experimentation and education, offering 24/7 remote access to lab experiments and science education resources. Experimental setups are located all over the globe, at some of the world's finest educational institutions, and these experimental setups can be accessed by students everywhere.**
- **Within 3 years WWSL will offer over 240 types advanced labs through 80 Topical Group Web Centers, and within 5 years, over 500 types of labs through 100 Topical Group Web Centers.**
- **An essential feature of the WWSL is that it is a scalable international collaboration of educators and scientists who are also the primary “marketers” of the system.**
- **The WWSL will provide secondary and post-secondary students access to laboratory experiments that would not otherwise be available to them for geographic, economic, physical disability, or scheduling reasons.**
- **Platform Independence - All the student needs is an internet connection and a web browser – no additional software or tools are required. (Does not require buying special add-ons).**
- **Lower Cost - Enables customers to provide more science lab opportunities at lower cost. Participants such as small universities or colleges will be able to offer coursework, which without the WWSL, would be unavailable to their students.**
- **Greater Efficiency - Participating universities will achieve greater utilization rates for their laboratories and offsetting of costs through usage fees.**

“...once you have hundreds of labs running, you will have built a serious barrier to entry with minimal capital investment, ...competitor would have to spend millions to replicate your network.” - *Michael Anderson, Senior Vice President, VCampus Corporation*