“Global LambdaGrid Applications Driving Innovation"

Acceptance Speech for Maxine Brown and Tom DeFanti
Innovation Award for Experimental / Developmental Applications – iGrid2005
CENIC 2006
Oakland, CA
March 14, 2006

Dr. Larry Smarr
Director, California Institute for Telecommunications and Information Technology;
Harry E. Gruber Professor,
Dept. of Computer Science and Engineering
Jacobs School of Engineering, UCSD

iGrid 1998 at SC'98
November 7-13, 1998, Orlando, Florida, USA

- **10 countries:** Australia, Canada, CERN, Germany, Japan, Netherlands, Russia, Singapore, Taiwan, USA
- **22 Demonstrations** Featured Technical Innovations and Application Advancements Requiring High-speed Networks, With Emphasis on Remote Instrumentation Control, Tele-immersion, Real-Time Client Server Systems, Multimedia, Tele-Teaching, Digital Video, Distributed Computing, and High-Throughput, High-Priority Data Transfers







www.startap.net/igrid98

Source: Maxine Brown-EVL, UIC

iGrid 2000 at INET 2000
July 18-21, 2000, Yokohama, Japan

- **14 Countries:** Canada, CERN, Germany, Greece, Japan, Korea, Mexico, Netherlands, Singapore, Spain, Sweden, Taiwan, United Kingdom, USA
- **24 Demonstrations** Featuring Technical Innovations in: Tele-Immersion, Large Datasets, Distributed Computing, Remote Instrumentation, Collaboration, Streaming Media, Human/Computer Interfaces, Digital Video & High-Definition TV, and Grid Architecture Development, and Application Advancements in Science, Engineering, Cultural Heritage, Distance Education, Media Communications, Art and Architecture
- **100mb Transpacific Bandwidth Carefully Managed**







www.startap.net/igrid2000

Source: Maxine Brown-EVL, UIC

iGrid 2002

September 24-26, 2002, Amsterdam, The Netherlands

- **28 Demonstrations from 16 Countries:** Australia, Canada, CERN/Switzerland, France, Finland, Germany, Greece, Italy, Japan, Netherlands, Singapore, Spain, Sweden, Taiwan, the United Kingdom and the USA.
- Applications Demonstrated: Art, Bioinformatics, Chemistry, Cosmology, Cultural Heritage, Education, High-Definition Media Streaming, Manufacturing, Medicine, Neuroscience, Physics, Tele-Science



- **Grid Technologies** Demonstrated: Major Emphasis on Grid Middleware, Data Management Grids, Data Replication Grids, Visualization Grids, Data/Visualization Grids, Computational Grids, Access Grids, Grid Portals
- **25GbTransatlantic Bandwidth (100Mb/Attendee, 250x iGrid2000!)**

www.startap.net/igrid2002

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Source: Maxine Brown-EVL, UIC

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Maxine Brown and Tom DeFanti, iGrid2005 Co-Chairs



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Larry Smarr and Ramesh Rao, Calit2 Hosts

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Global Connections
Between University Research Centers at 10Gbps

Maxine Brown, Tom DeFanti, Co-Chairs

iGrid 2005

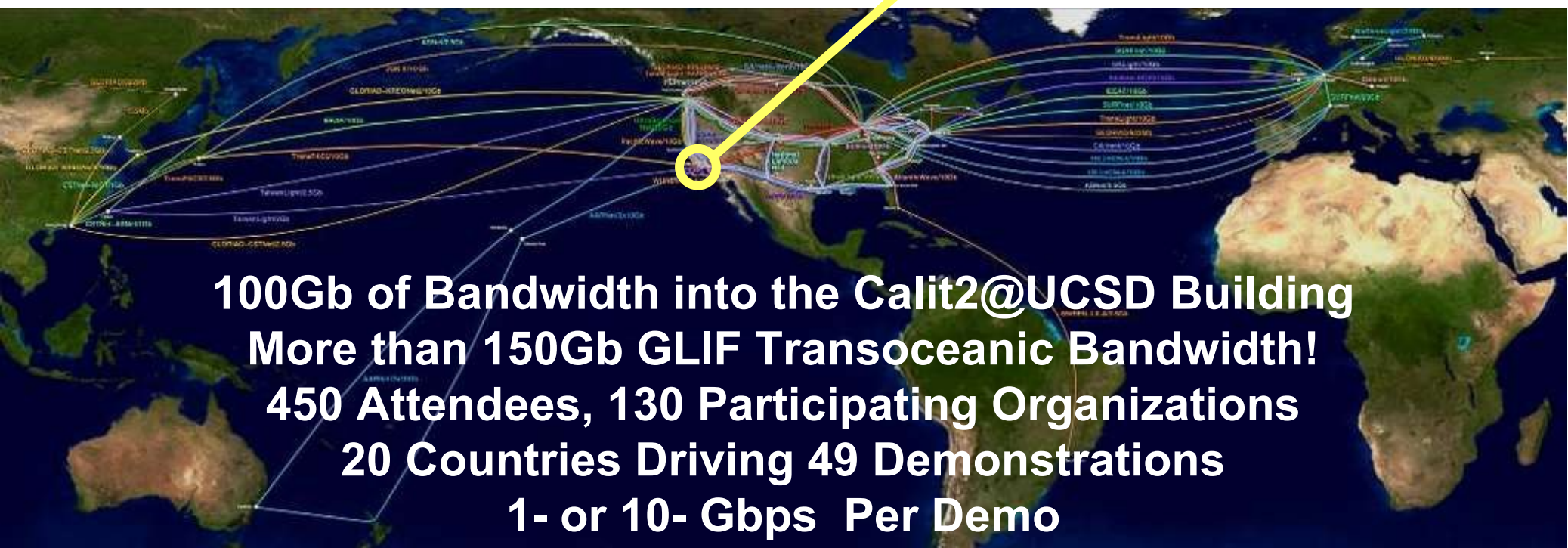
THE GLOBAL LAMBDA INTEGRATED FACILITY

www.igrid2005.org



the UC Discovery Grant

September 26-30, 2005
Calit2 @ University of California, San Diego
California Institute for Telecommunications and Information Technology



100Gb of Bandwidth into the Calit2@UCSD Building
More than 150Gb GLIF Transoceanic Bandwidth!
450 Attendees, 130 Participating Organizations
20 Countries Driving 49 Demonstrations
1- or 10- Gbps Per Demo

iGrid's Biggest Challenge: Transforming a Construction Site…





Source: Maxine Brown-EVL, UIC

…into a Leading-Edge Cyberworld











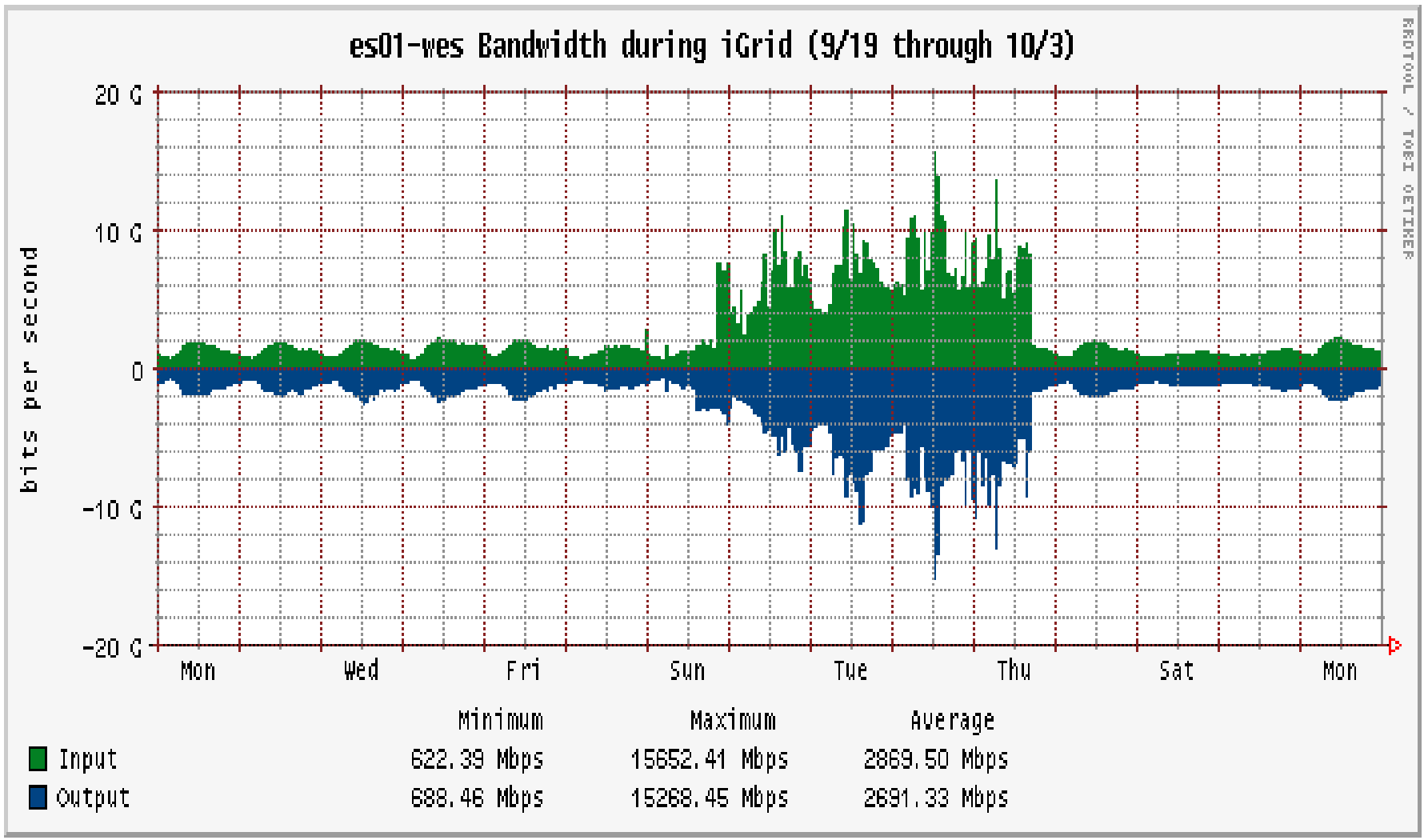


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Source: Maxine Brown-EVL, UIC

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iGrid2005 Data Flows Multiplied Normal Flows by Five Fold!



Data Flows Through the Seattle PacificWave International Switch

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iGrid 2005: Demonstrating Emerging LambdaGrid Services

- Data
- High-Definition Video & Digital Cinema Streaming
- Distributed High-Performance Computing
- Lambda Control
- Lambda Security
- Scientific Instruments
- Visualization And Virtual Reality
- e- Science

Maxine Has Classified All 49 iGrid2005 Demonstrations Into These Categories

Source: Maxine Brown-EVL, UIC

iGrid Lambda Data Services: Sloan Sky Survey Data Mining and Visualizing Data Using OptIPuter

- **SDSS-I**
  - Imaged 1/4 of the Sky in Five Bandpasses
    - 8000 sq-degrees at 0.4 arc sec Accuracy
  - Detecting Nearly 200 Million Celestial Objects
  - Measured Spectra Of:
    - > 675,000 galaxies
    - 90,000 quasars
    - 185,000 stars
- **SDSS-II**
  - Underway till 2008

~200 GigaPixels!

iGRID2005
From Federal Express to Lambdas: Transporting Sloan Digital Sky Survey Data Using UDT
Robert Grossman, UIC with

Johns Hopkins University, USA; Korea Astronomy and Space Science Institute, KISTI, Korea; University of Tokyo, Japan; National Astronomical Observatory, Chinese Academy of Sciences, China; University of Melbourne, Australia; Max-Planck-Institut fur Plasmaphysik, Germany

SDSS

Sloan Digital Sky Survey

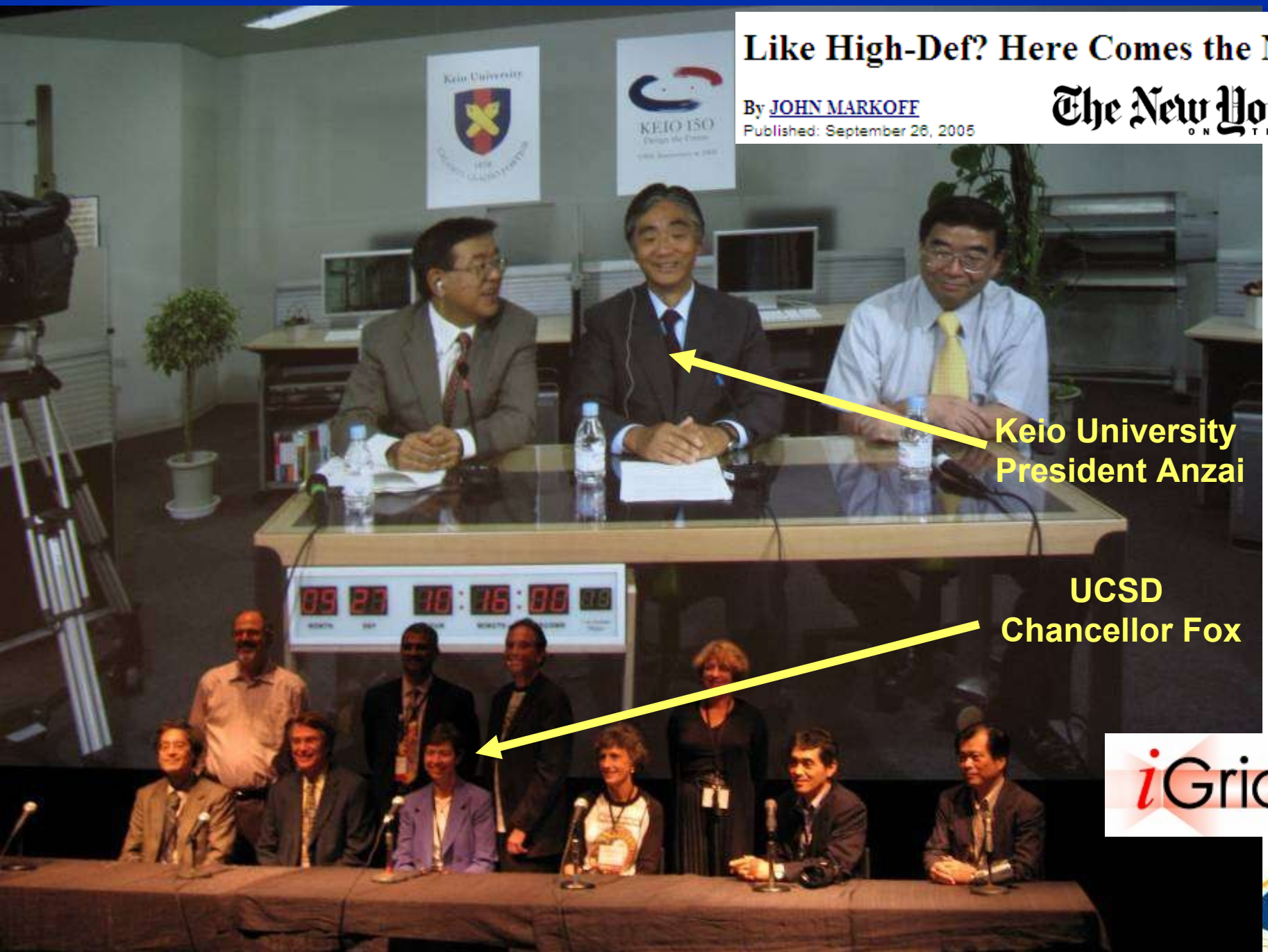


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www.sdss.org

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iGrid Lambda Digital Cinema Streaming Services: Telepresence Meeting in Calit2 Digital Cinema Auditorium



Like High-Def? Here Comes the Next Level

By JOHN MARKOFF
Published: September 26, 2005

The New York Times ON THE WEB

Lays Technical Basis for Global Digital Cinema

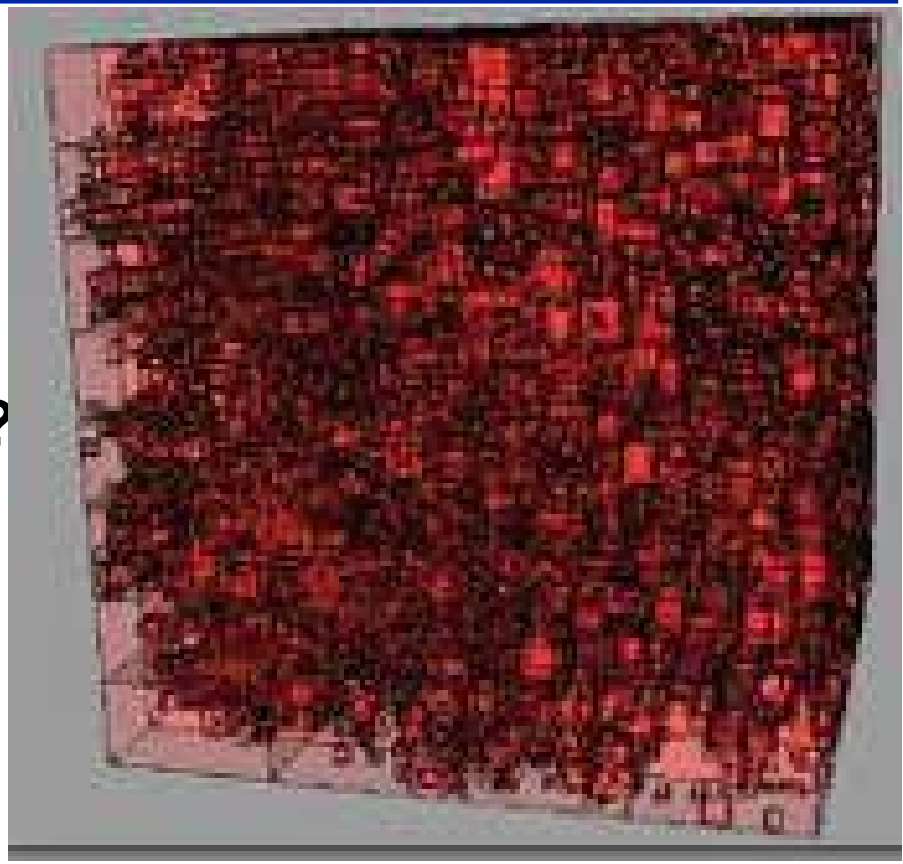
Sony
NTT
SGI

iGrid 2005

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iGrid Lambda High Performance Computing Services: Distributing AMR Cosmology Simulations

- **Uses ENZO Computational Cosmology Code**
  - Grid-Based Adaptive Mesh Refinement Simulation Code
  - Developed by Mike Norman, UCSD
- **Can One Distribute the Computing?**
  - iGrid2005 to Chicago to Amsterdam
- **Distributing Code Using Layer 3 Routers Fails**
- **Instead Using Layer 2, Essentially Same Performance as Running on Single Supercomputer**
  - Using Dynamic Lightpath Provisioning



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Source: Joe Mambretti, Northwestern U

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iGrid Lambda Control Services: Transform Batch to Real-Time Global e-Very Long Baseline Interferometry



- Goal: Real-Time VLBI Radio Telescope Data Correlation
- Achieved 512Mb Transfers from USA and Sweden to MIT
- Results Streamed to iGrid2005 in San Diego

Optical Connections Dynamically Managed Using the DRAGON Control Plane and Internet2 HOPI Network

Source: Jerry Sobieski, DRAGON

iGrid Lambda Security Services: Enabling 10Gb Line-Speed Security

- In the Real World, Users will Demand Secure Lambdas
- They Require it to be Invisible and Add No Perceptible Latency
- iGrid Nortel Prototype Demoed
  - AES-256 Encryption [e.g. NSA Approved for U.S. Top Secret]
  - Less than 500 nsecs Latency Added
  - Used on Lightpaths from Amsterdam and Canada thru Starlight to San Diego

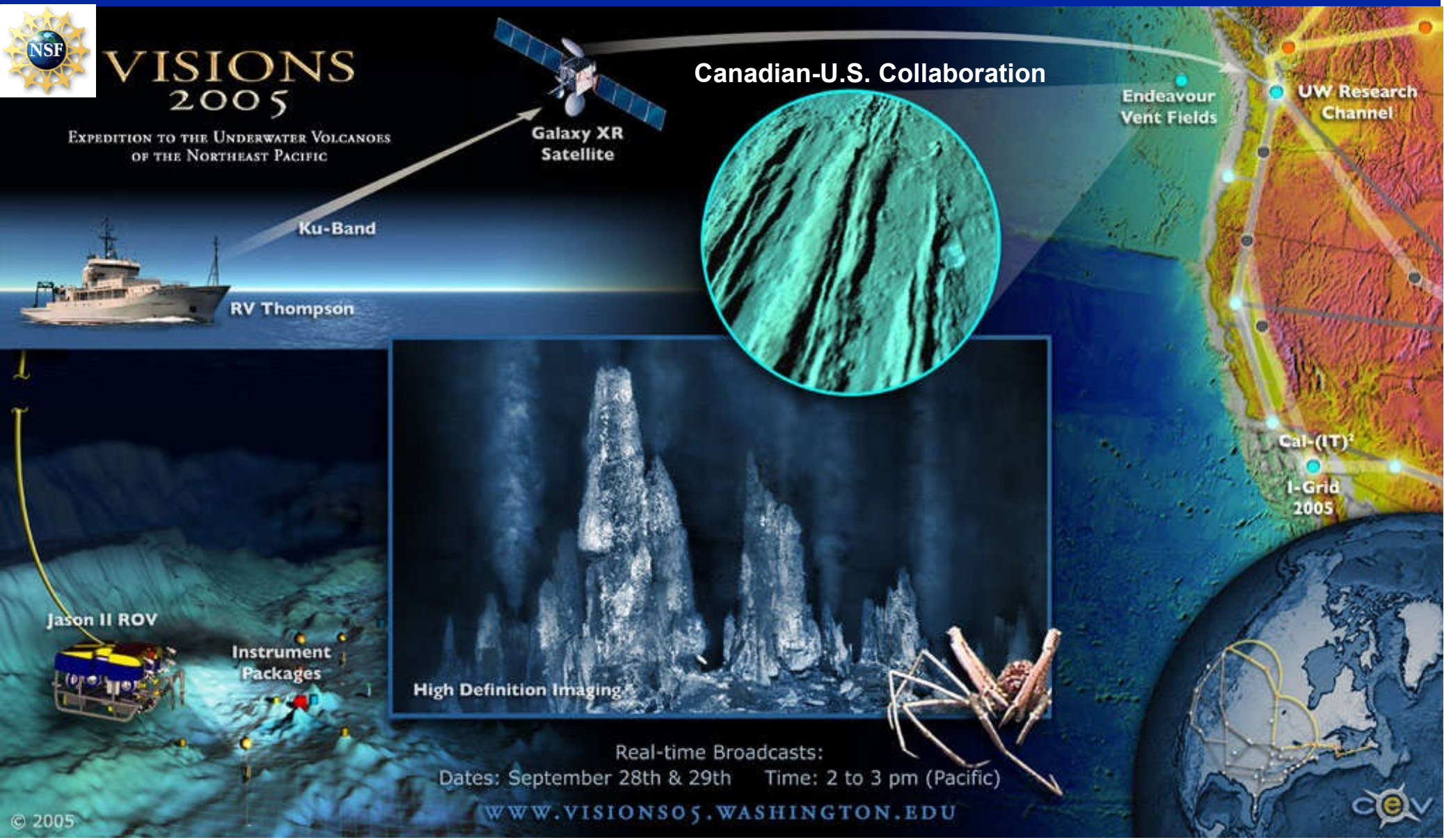
Nortel, Canada; UIC, Argonne National Laboratory, Calit2, Northwestern University, USA; SARA Computing and Networking Services, NL



At iGrid, Nortel demonstrated 256-bit AES encryption at 10 Gbps line speeds -- integrated into a standard Nortel Optical Multiservice Edge (OME) 6500 switch.

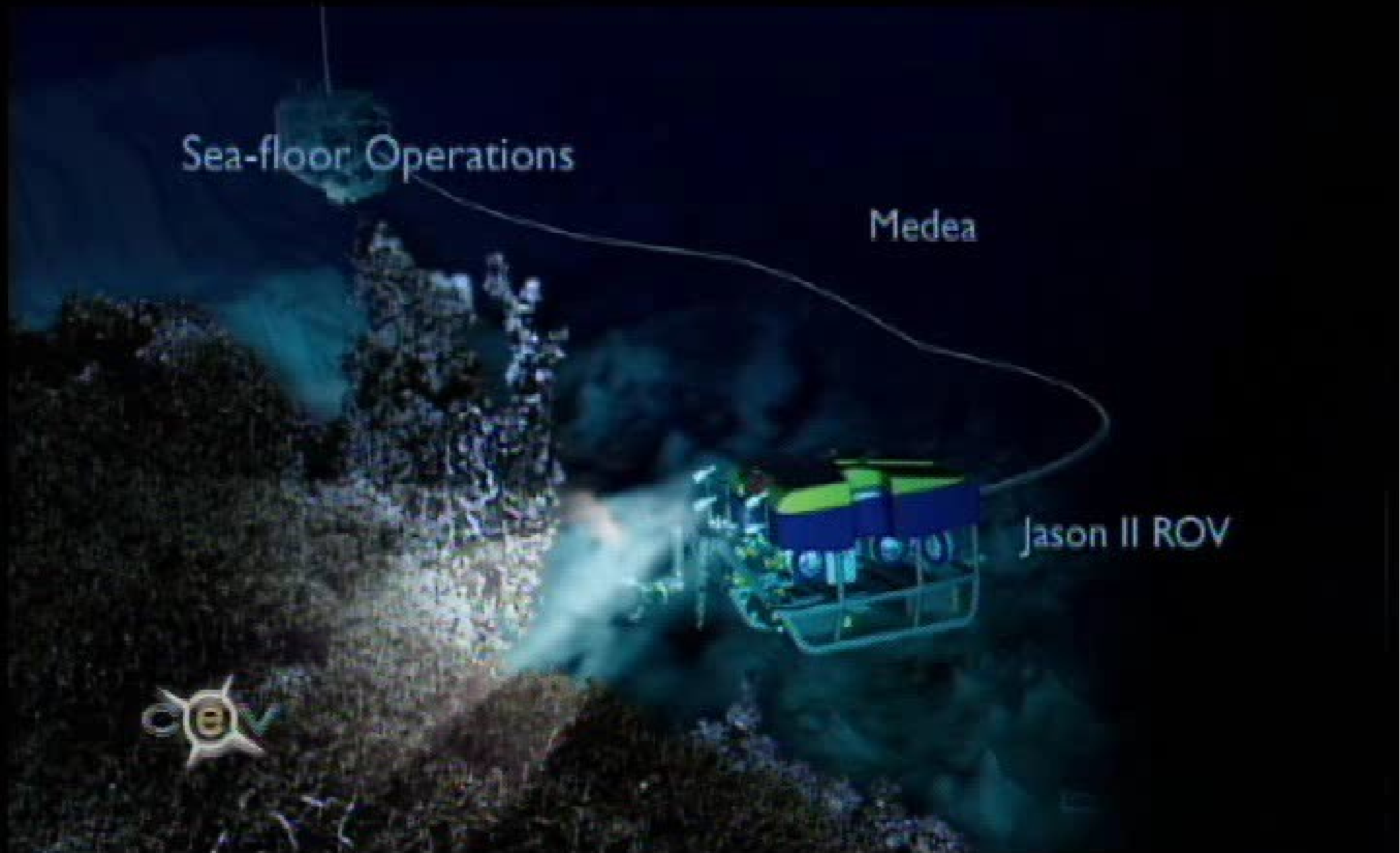
Source: Kim Roberts, Nortel

iGrid Scientific Instrument Services: Enable Remote Interactive HD Imaging of Deep Sea Vent



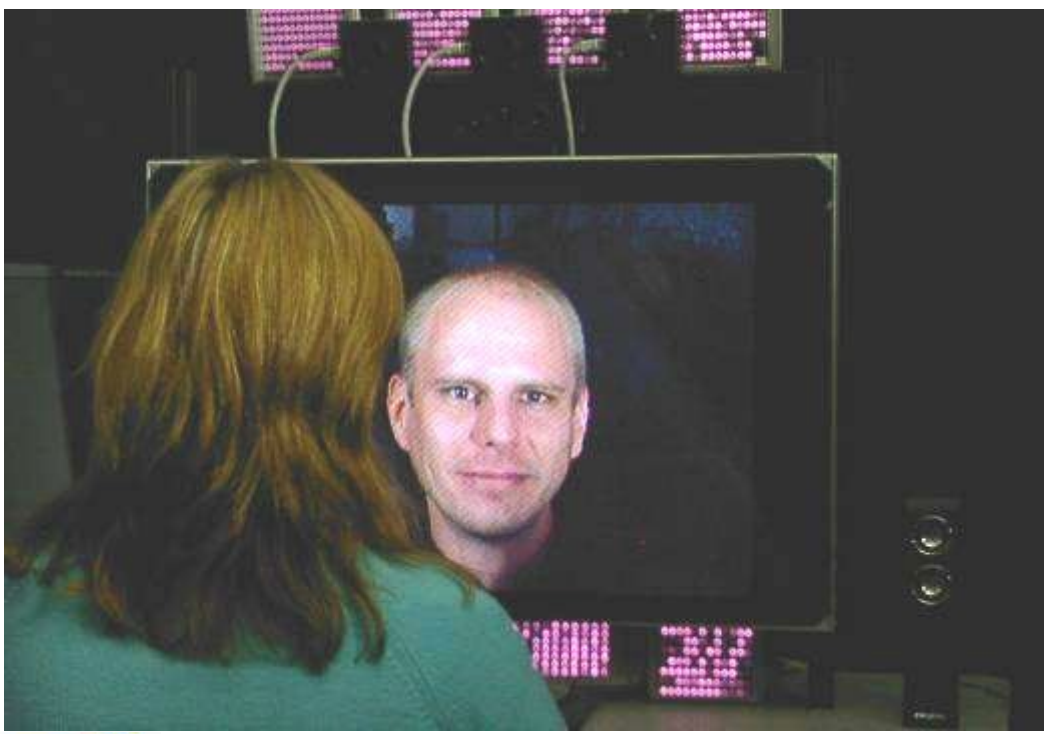
Source John Delaney & Deborah Kelley, UWash

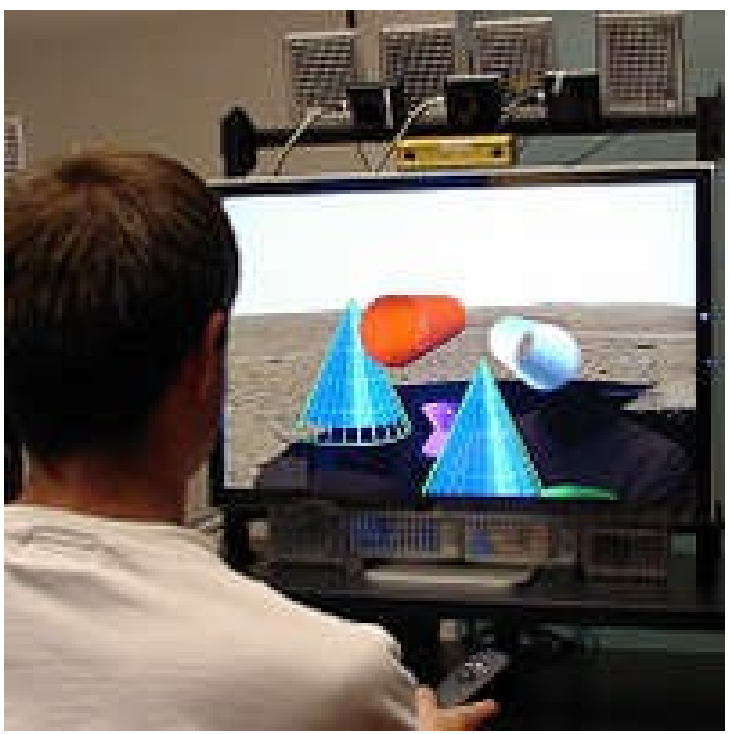
High Definition Video - 2.5 km Below the Ocean Surface



iGrid Lambda Visualization Services: 3D Videophones Are Here! The Personal Varrier Autostereo Display

- Varrier is a Head-Tracked Autostereo Virtual Reality Display
  - 30” LCD Widescreen Display with 2560x1600 Native Resolution
  - A Photographic Film Barrier Screen Affixed to a Glass Panel
    - The Barrier Screen Reduces the Horizontal Resolution To 640 Lines
- Cameras Track Face with Neural Net to Locate Eyes
- The Display Eliminates the Need to Wear Special Glasses





Source: Daniel Sandin, Thomas DeFanti, Jinghua Ge, Javier Girado, Robert Kooima, Tom Peterka—EVL, UIC

iGrid Lambda e-Science: Enabling U.S. / Mexico Scientific Collaborations

Opening a University Fiber Highway between Mexico and the USA

http://iGridMX.cicese.mx

contact

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Optical fiber newly installed between San Diego and Tijuana, and ultimately extending down to CICESE in Ensenada in the Baja California Peninsula, is enabling collaborative USA/Mexican research in Earth, oceanographic and atmospheric sciences. At iGrid, 3D visualizations of shared terrain enable scientists to better understand the consequences of fires, floods, and earthquakes, which have no geographical boundaries. Environmental modeling and simulation visualizations fed by real-time sensor information combined with legacy visualizations provide hybrid visualizations for situational awareness for public safety, economic effect assessment, and shared Homeland Security.

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Source: iGrid 2005 Brochure--Maxine Brown

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