

7-17-2003

# University of Maine Connection to the vBNS

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**Final Report for Period:** 09/1998 - 02/2003

**Submitted on:** 07/17/2003

**Principal Investigator:** Dube, Gerald F.

**Award ID:** 9810437

**Organization:** University of Maine

**Title:**

University of Maine Connection to the vBNS

### Project Participants

#### Senior Personnel

**Name:** Dube, Gerald

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

My involvement with this project has been that of PI and Project Director. In that capacity I have:

1. Worked with carriers to obtain the necessary DS-3 connection for the University of Maine
2. Worked with the Northern Crossroads (NoX) gigapop in Boston to establish a UMaine connection there.
3. Have attended regular meetings, generally monthly, of the NoX gigapop consortium.
4. Have organized, with George Markowsky (see other participants), an Internet2 conference at the University of Maine on January 19-20.
5. Have attended the NLANR conference in Miami in December 1999.
6. Attended the NLANR conference in Minneapolis in May, 2000
7. Have overseen the upgrade of the University's campus network to provide appropriate facilities to faculty and researchers.
8. Have overseen the upgrade of the University of Maine System's network to provide greater collaboration between researchers in Maine.
9. Am involved in a number of partnerships (see partnerships) in the state related to this project.

The source of funds for my time is from E&G University funds and 10 per cent of my time is allocated to this project as matching to the grant.

**Name:** Patton, James

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

J Patton I2 related activities

Attended the Alliance Chautauqua conference in Boston in September 99.

Developed a twelve-module web-based certificate program in Power Systems and, in the absence of an I2 connection, tested delivery technologies using the commodities internet.

Established a collaborative relationship with the University of Wisconsin to import distance ed courses on power electronic drives. UW videotape material was encoded to streaming media for presentation via the commodities internet as well as I2.

Established a connection with Prof . Younggap You of Chungbuk National University, the second largest university in Korea. Dr. You is very

interested in exchanging graduate seminars and experimenting with distance collaboration.

Committed to providing all graduate courses offered by the Department of Electrical and Computer Engineering via distance education. Presented two grad courses, Electromagnetics and Fuzzy Logic, via the web and streaming media.

Investigated the most efficient way to introduce faculty to telecommunications presentation tools, including a pre-proposal to the Sloan Foundation to develop a sequence of modules, 'Preparing New Faculty in Effective Teaching and Communications Using Technology'.

**Name:** Letourneau, Jeffery

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Jeff is Manager of Network Operations. In that capacity he has worked on the acquisition, installation, and operation of the I2 equipment and circuit. He is also managing the deployment of the campus network upgrade necessary for this project.

Jeff's time on activities related to this project is supported by University funds and is matching for this grant.

## Post-doc

## Graduate Student

## Undergraduate Student

## Technician, Programmer

**Name:** Irelann, Anderson

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Irelann is a senior networking architect. He has worked with the University personnel and staff at the NoX gigapop to establish the connection to I2 and to set up appropriate peering. Irelann also worked closely with the NoX to properly configure Multicasting to UMaine's network.

Irelann works closely with the staff in network operations to establish the necessary configurations.

Irelann attended the NLANR conference in Miami in December 1999.

Irelann is supported by University funds, 8 percent of which is matching for this grant.

**Name:** Garret, Peirce

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Garret is a Network Analyst with Network Operations. In this capacity garret works closely with carriers and network operator as well as with internal staff (see Irelann Anderson above) to establish and maintain the necessary configuration and operational environment in support of the network.

Garret has setup the upgrade equipment in UMaine's on-campus network.

Garret has worked closely with Irelann Anderson (above), both the in-state and out-of-state carriers for this project, and the NoX operations staff to establish UMaine's I2 connection.

Garret's support comes from University E&G funds, 8 percent of which are matching for this grant.

**Name:** Eric, Damboise

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Eric has been involved with acquiring and setting up multimedia collaborative tools in support of this project.

Eric provided technical support for the Internet2 conference held at the University of Maine on January 19-20, 2000. He set up the broadcasting of all the conference sessions using RealPlayer.

Eric has also installed an H323 MCU for use in this project and is experimenting with various end user equipment from VCONN and Polycom.

He has acquired the necessary equipment and has set up a demonstration model of an Access Grid node. He is traveling to Boston University to participate remotely in the August Chautauqua conference at the University of Kansas. He will also discuss with BU staff the issues of setting up and Access grid node.

Eric's support is entirely from University E&G funds.

**Other Participant**

**Name:** Markowsky, George

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

I am very interested and committed to developing a high performance computing and high speed networking capability in the Computer Science Department at the University of Maine. To this end I have been attending and organizing meetings and working on possible collaborations.

On August 18-19, 1999, I attended a DOE EPSCOR meeting at the Oak Ridge National Lab focusing on high performance computing. There I met several interesting researchers including Guy Cormier of the University of Puerto Rico.

On September 13-16, 1999, I attended a Chautauqua on high performance computing at Boston University. I learned a lot about the Access grid and various connectivity options.

In Fall 1999 the Department of Computer Science began work on a Beowulf Cluster funded by a grant from the Maine Science and Technology Foundation.

On January 19-20, 2000 the Computer Science Department at the University of Maine held its own Internet 2 day. This day featured a variety of speakers I had met at previous meetings. A detailed description of the Internet 2 meeting is below. The attendance was about 60 people.

In late Spring -- early Summer I was part of a team that put together a grant proposal dealing with Crisis Management. The grant is originating out of the National Center for Supercomputing Applications.

On July 20-21, 2000 I attended a meeting on High Speed Networking and Ubiquitous Computing held at the San Diego Supercomputer Center. At that conference I spoke about the grant on crisis management.

High performance computing and networking is an area of great interest and importance to the Computer Science Department at the University of Maine. We are appreciative of the resources supplied by the Internet 2 project on our campus and expect to benefit greatly from its presence.

In the summer of 2000, I was one of the founders of the Multi-Sector Crisis Management Consortium (MSCMC). We have worked hard to put together outreach meetings that are transmitted over the Access Grid, which uses Internet 2. Through 2002, these meetings were generally held monthly.

Especially since September 2001, there has been a lot of interest in Crisis Management, or as it is now called, Homeland Security. The MSCMC has been working hard on plans to create a large number of Access Grid centers across the entire country and even throughout the world. Various plans, including one entitled Access 250, have been proposed and the entire plan is under careful development.

I have helped set up Virtual Conferences that use Internet 2 technology on the topics of Rural Connectivity and also Interoperability. The sessions from the Interoperability Conference are available at <http://www.homeland.maine.edu>.

I have been using Internet 2 and Internet 2 type connectivity in connection with teaching this past year. Included were lectures from Florida International University and lectures in support of our department's statewide Ph.D program. The Internet 2 connection will be critical to our ability to deliver the CS Ph.D program statewide. We are actively using the link with the University of Southern Maine to deliver lectures.

In connection with this project, I attended the ANIR PI's meeting in January 2003. I also spoke on homeland security at the NSF co-sponsored AMPATH meeting, also in January 2003.

I am very interested and committed to expanding the role that high speed video-enhanced communications can play in building our homeland security infrastructure.

Time spent on activities directly related to this project is between 160 and 200 hours and is supported by University E&G funds.

Note: Dr. Markowsky is Chair of the Computer Science Department at the University of Maine, and is also Chair of the Department of Mathematics & Statistics.

## Research Experience for Undergraduates

### Organizational Partners

#### **Maine Marine Research Network**

##### Marine Science Connectivity Project

In November of 1998, the voters of Maine approved a \$20 million Research and Development bond to fund infrastructure development in Maine's R&D community. One million of this bond is to be used to help build a Maine Marine Research Network to assist in collaborative research and teaching among various institutions involved in marine science research and education. Twelve institutions have now received funding for equipment to establish this network. The participants include the University of Maine with its Marine Science research center along the coast of Maine, two other campuses of the University of Maine System, Maine Maritime Academy, the Maine Department of Marine Resources, hatcheries, and some independent research laboratories. Approximately half the institutions will be connected to the University's network at DS-3 speeds while the others will initially connect at T1 speeds.

As part of this connectivity project, the University of Maine will apply for secondary membership in UCAID for this consortium to allow these researchers and educator to access Internet2 to collaborate with others outside our region involved with Marine Science.

#### **Maine Biotechnology Initiative**

Funds from the Research and Development bond issue mentioned above were also allocated to establish network to facilitate the collaboration of four institutions involved in research and education in the biosciences. This includes the University of Maine, the University of Southern Maine, the Jackson Laboratories, and the Maine Medical Center Research Institute. In addition to facilitating collaboration it is expected that this initiative will lead to offering of a statewide doctorate in the biosciences with students and faculty being at any of these geographically dispersed locations.

As with the Marine Science initiative mentioned above, it is expected that the University will apply for secondary to include the other three institutions as secondary members of UCAID and thereby enable their collaborations with institutions elsewhere

#### **Maine School and Library Network**

The University operates a network that interconnects over 1100 sites of K12 and public libraries in the state. This network is directly connected to the University of Maine System's and in particular to the UMaine's network. A recent initiative of the Department of Education in Maine is the deployment of a broadband network for distance learning. Currently more than 55 high schools in the state have signed up for this network that brings DS-3 connectivity to those schools. This network is operated by the University under contract to the Department of Education.

There is on the part of these high schools connected at DS-3 speeds to work with K12 in other states. They are interested in becoming secondary members of UCAID through sponsorship of the University of Maine's membership. The University intends to apply on their behalf unless UCAID relaxes its AUP to include statewide networks for K12 automatically.

### **State of Maine**

The University of Maine System acts in the capacity of an ISP to all of state government. The state agencies are connected to the University of Maine's network over a broadband ATM connection. As a result there are a number of collaborations between the University and state agencies.

### **Other Collaborators or Contacts**

The only major collaborators to this date have been in setting up the original connection. In that regard we have been working with the Northern Crossroads (NoX) gigapop and with others in the consortium.

According to Max Engenhofer of the NCGIA, Internet-2 at UMaine enabled several research and education efforts in the National Center for Geographic Information and Analysis and the Department of Spatial Information Science and Engineering. The initiation of a new master's program in Information Systems addressing professionals throughout the State of Maine was possible, because the entire course content could be delivered remotely through the web. In a similar way, a new Graduate Certificate in Geographic Information Systems was approved in the Spring of 2002, the content of which will be available through the Web. With the advancement of Web mapping technologies and Internet-2, it is becoming possible to run such data intensive operations as spatial analysis over the Web.

NCGIA researchers are relying more and more on the high-bandwidth communication to collaborate remotely with researchers at other locations. The NCGIA consortium (UMaine, UC Santa Barbara, and University at Buffalo) uses the web extensively for project management across the three sites. In a similar way, under a new NSF-funded ITR project (UMaine, Iowa State University, and UC San Diego) NCGIA researchers are working on shared imagery, video, and map archives to develop the foundation of the GeoGrid. Two new research directions, which were started in 2002, include the development of a shared Web resource for a geographic information commons and the foundations for the Geospatial Semantic Web with the National Imagery and Mapping Agency.

Internet 2 usage has been made transparent to many people on campus who use it regularly, without always realizing that they are using it. Many people in the Computer Science Department, Spatial Engineering Department and NCGIA have used and continue to use Internet 2 regularly in support of their activities.

### **Activities and Findings**

#### **Research and Education Activities: (See PDF version submitted by PI at the end of the report)**

See attached report.

#### **Findings:**

As the details in the Activity Report show, the Internet 2 connection has been of great value to the University of Maine and is used in a variety of applications. Its use is predicted to continue to grow.

#### **Training and Development:**

As documented in the Activity Report, we have been able to expand our programs in Computer Science, Homeland Security, Geographic Information Systems and in support of the Library.

#### **Outreach Activities:**

There have been a number of Outreach activities.

1. The University has been working with other institutions involved with marine Science. This is reported elsewhere under partnerships.

2. The University has been working with the other institutions in Maine involved with the biosciences. This is reported under partnerships.
3. The University is involved with K12 on a number of projects. This is reported under partnerships but is also an outreach activity. The K12 community is well aware of the University's connection to Internet2 and has interests in using the technology.
4. As reported elsewhere, an Internet2 conference was set up at the University of Maine on January 19-20. This conference included speakers from NSF, EPSCOR, external researchers, representatives from the Northern Crossroads gigapop, and from the University of Maine. The conference was broadcast at various speeds statewide using RealPlayer. A number of positive comments were received from individuals who were not able to attend in person. Details of this conference are given in our Activity Report.

Working with Dan Van Belleghem we have shared our experience on setting up Internet 2 Days with the various Universities. We have also helped people with setting up ACCESS Grid nodes.

### Journal Publications

### Books or Other One-time Publications

### Web/Internet Site

**URL(s):**

<http://www.cs.umaine.edu/~markov/inet2.html>

**Description:**

### Other Specific Products

**Product Type:** See conferences and workshops in report.

**Product Description:**

We have staged several conferences and workshops. The results are available at various websites: <http://homeland.maine.edu> and <http://www.cs.umaine.edu/~markov>. In addition, the sensor workshop report is available on the web and also in hardcopy (while supplies last).

**Sharing Information:**

We share all our products through our websites and also by continuing a vigorous seminar series that uses Internet 2 when appropriate.

### Contributions

**Contributions within Discipline:**

On this campus we have taken Internet 2 from being a curiosity to being a tool that is actively used by a wide variety of researchers. Creating our own ACCESS Grid node, for example, has enabled artists, biologists, computer scientists and other researchers participate in very exciting collaborations. We are in the process of extending the reach of Internet 2 to the K-12 community.

**Contributions to Other Disciplines:**

See Activity report and previous comments.

**Contributions to Human Resource Development:**

See Activity report and previous comments.

**Contributions to Resources for Research and Education:**

See Activity report and previous comments.

**Contributions Beyond Science and Engineering:**

See Activity report and previous comments.

### Categories for which nothing is reported:

Any Journal

Any Book



## Activities Associated with the Internet 2 Project

During August 18-19, 1999, George Markowsky attended a DOE EPSCOR meeting at the Oak Ridge National Lab focusing on high performance computing. There George Markowsky met several interesting researchers including Guy Cormier of the University of Puerto Rico.

During September 13-16, 1999, George Markowsky attended a Chautauqua on high performance computing at Boston University. George Markowsky learned a lot about the Access grid and various connectivity options.

In the fall of 1999 the Department of Computer Science began work on a Beowulf Cluster funded by a grant from the Maine Science and Technology Foundation.

During January 19-20, 2000 the Computer Science Department at the University of Maine held its own Internet 2 day. This day featured a variety of speakers George Markowsky had met at previous meetings. A detailed description of the Internet 2 meeting is in Appendix A below. The attendance was about 60 people.

In late spring -- early summer of 2000, George Markowsky was part of a group that organized the Multi-Sector Crisis Management Consortium as a non-profit corporation with a Maine charter, but with its headquarters at the Access center in DC. At UMaine we participate in meetings and briefings using the Internet 2 connection to the Access center. More details about this activity can be found at [www.msccmc.org](http://www.msccmc.org).

On July 20-21, 2000 George Markowsky attended a meeting on High Speed Networking and Ubiquitous Computing held at the San Diego Supercomputer Center. At that conference George Markowsky spoke about crisis management.

High performance computing and networking is an area of great interest and importance to the Computer Science Department at the University of Maine. We are appreciative of the resources supplied by the Internet 2 project on our campus and expect to benefit greatly from its presence.

During 8/29/00-8/30/00 George Markowsky visited the Access Center in DC with Gerry Dube to determine what needed to be done so that UM could become an Access Node, and make full use of Internet 2 conferencing. Since that trip we put together a system in a small room that we call "ACCESS Grid Lite". This system permits us to participate in ACCESS Grid activities. We also began planning for a much larger conference room that will have not only full Internet 2 conferencing capabilities, but be able to handle any sort of video conferencing capability available at this time. Our plan is to keep the technology in this room current so we can participate in any use of advanced communication technology.

We expect this room to serve as the gathering place for future broadcasts of the Multi-Sector Crisis Management Consortium, along with other teleconference meetings as well.

On 4/18/01-4/23/01 George Markowsky visited the University of Puerto Rico to speak at an EPSCOR Internet 2 day and to discuss cooperation between the UM CS Department and the University of Puerto Rico.

On May 9, 2001 Peter Brown, a writer for Satellite magazine, and George Markowsky presented a mini-seminar on high-speed connectivity. The details are presented in Appendix B.

On September 19, 2001 we used our Access Grid connectivity to participate in one of the monthly meetings of the Multi-Sector Crisis Management Consortium. We expect to do this monthly. A full list of meeting from January 2002 can be found at [www.mscomc.org](http://www.mscomc.org). We participated in most of these meetings and also a few in 2001 which are not listed on that website.

On September 20, 2001 George Markowsky organized an organizational meeting of the Computational Modeling Institute. This group is dedicated to high-speed computation and will make heavy use of Internet 2 connectivity.

On January 14-15, 2002, George Markowsky received NSF Funding to hold a workshop on sensor systems bringing together the field science and homeland security communities. More details on this workshop are available in Appendix C.

On November 6, 2002, George Markowsky and Peter Brown organized an Interoperability Virtual Symposium that was broadcast over the ACCESS Grid using Internet 2 Technology. For more details on this see Appendix D.

On November 8, 2002, George Markowsky and other staff at the University of Maine organized a transcontinental/transatlantic lecture of Benoit Mandelbrot as the first part of a pilot of the Global Threads Project of the Souillac Group (see <http://www.souillac.org>). Dr. Mandelbrot was in Oregon, and we successfully connected him to a conference in Lisbon Portugal. The Global Threads project uses high-speed internet connectivity to connect artists and scientists worldwide so that they can interact with each other.

On December 10, 2002, George Markowsky and other staff at the University of Maine organized the second part of the pilot mentioned in the preceding paragraph. This involved the internationally known musician, Jean Claude Risset lecturing to a worldwide audience via Internet 2 connections as part of the Global Threads Project.

In Fall 2002, the UMaine and University of Southern Maine (USM) Computer Science Departments began to interact using Internet 2 technology to help establish a statewide computer science PhD program.

In Spring 2003, the first graduate course, Algorithms, was offered over the Internet 2 connection between UMaine and USM.

# APPENDIX A

## UNIVERSITY OF MAINE INTERNET 2/000 DAY

The University of Maine will be hosting an Internet 2 meeting on Thursday, January 20, 2000. There will be a pre-conference gathering on Wednesday January 19, 2000. The purpose of the meeting will be to introduce people to Internet 2 and to illustrate some of the applications and exciting projects that are being done with Internet 2 both in Maine and around the world. We also hope to provide opportunities for people interested in working with Internet 2 to find potential collaborators.

All are invited to attend. There is no cost to attend, but the number of attendees is limited, so you must register in order to attend. Food and refreshments will be supplied through the generosity of UNET. You can register by e-mail, fax or telephone. Consult the directions at the bottom of this e-mail note for details. If you need any sort of special accommodation to attend the meeting, please let us know and we will do our best to help.

We plan to provide streaming video of the meeting for those unable to attend. More details are at the end of this note.

### SCHEDULE OF EVENTS

WEDNESDAY, JANUARY 19, 2000

6:00 PM - 7:30 PM Reception

7:30 PM - 8:30 PM A Review of NSF Internet 2 Programs

Dan VanBelleghem

NSF EPSCOR

NCSA

THURSDAY, JANUARY 20, 2000

7:30- 8:30 AM REGISTRATION & BREAKFAST

8:30- 9:00 AM WELCOME

Dr. Daniel Dwyer

Vice President for Research

University of Maine

9:00- 9:45 AM ALLIANCE AND NLANR PRESENTATION

Ginny Hudak-David

NCSA

9:45-10:45 AM VISUALIZATION PANEL

Vic Baker

Computer Science, EE Department

West Virginia University

Guy Cormier

High Performance Computing Facility

University of Puerto Rico

Jim Fastook

Computer Science Department

University of Maine

Ginny Hudak-David

NCSA

10:45-11:00 AM BREAK

11:00-12:00 NOON NORTHERN CROSSROADS (NOX) PRESENTATION

Leo D. Donnelly, Jr  
University Information Systems  
Harvard University  
Michael Krugman, Executive Director  
Information Technology  
Boston University

Gerry Dube

UNET

University of Maine System

12:00- 1:00 PM LUNCH

1:00- 2:00 PM INTERNET 2 APPLICATIONS TALK AND DISCUSSION

Greg Wood -- Internet 2

2:00- 2:15 PM BREAK

2:15- 3:30 PM INTERNET 2 IN MAINE PANEL

Various panelists from Maine

3:30- 3:45 PM BREAK

3:45- 4:30 PM INTERNET 2 DEMO

Gerry Dube

Director UNET

University of Maine System

4:30- 5:00 PM NEXT STEPS FOR INTERNET 2 IN MAINE

George Markowsky

Computer Science Department

University of Maine

Note that NCSA stands for the National Center for Supercomputing Applications.

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Streaming Video

We will provide streaming video of Thursday's sessions at:

<rtsp://media.unet.maine.edu/real-live/I2-conf.rm>

To access this feed you will need to use RealPlayer, which you can download from [www.real.com](http://www.real.com). They have a free version along with fancier versions that you can purchase. We recommend that you try accessing the site on January 19, 2000 to make sure that everything is working and that your system is set up correctly.

We plan to be streaming video using at least three different speeds:

1. 28.8K modem speed (about 20 Kbps)
2. 56K modem speed (about 34 Kbps)
3. LAN speed (about 200 Kbps)

## APPENDIX B

# HIGH SPEED PLATFORMS: A REALITY CHECK

George Markowsky, Chair

Peter J. Brown, Moderator

The University of Maine Computer Science Department presents a live videoconference on May 9 at 2pm (EDT).

This is the third event organized by Peter Brown for the UMaine Computer Science Department on the topic of the evolution of high speed platforms. The previous two sessions focused exclusively on satellite-based solutions. He is a freelance writer and resident of Mount Desert. He is the senior multimedia editor for Via Satellite magazine, and his articles appear in numerous trade magazines including Broadcasting & Cable, TV Technology and Broadband Week. Among other things, he serves as the rural satellite technology advisor to the National Indian Telecommunications Institute in Santa Fe, New Mexico.

### Participants

Jim Albriycht, VP of Broadband Academy, YAS Broadband Ventures, LLC will explore the latest developments in high speed cable including what broadband services DOCSIS supports, where DOCSIS is today and where it plans to be tomorrow as broadband migrates as well as how DOCSIS relates to other CableLabs initiatives.

Dr. Richard Chernock, IBM Research Staff Member at the IBM T.J. Watson Research Center and co-author of the book, "Data Broadcasting: Understanding the ATSC Data Broadcast Standard" will discuss the ATSC data broadcast standard, why digital TV broadcasting is attractive, and the various situations that lend themselves to this type of distribution.

David L. Klimek, Director of Engineering and Chief Technology Officer at mPhase Technologies, Inc. will explore the history of DSL. The market implications of the Telcom Act of 1996, network design requirements and Video-over-IP issues will be reviewed as well as two recently awarded patents. He is based the Georgia Center for Advanced Telecommunications Technology (GCATT) center and oversees the collaborative effort between mPhase and Georgia Tech Research Institute.

Jack Phiel, Major Accounts Manager at Lockheed Martin Global Telecommunications Products Division will discuss IP protocol connectivity over satellite, developments in high speed digital satellite links, and, the emergence of modern Very Small Aperture Terminal (VSAT) systems with both hub and hubless architectures.

Dr. Ramesh Rao, Director of the Center for Wireless Communications (CWC) at the University of California/San Diego (UCSD), and UCSD director of the California Institute of Telecommunications and Information Technology (Cal IT2), will speak about the NSF-funded High Performance Wireless Research and Education Network (HPWREN) project, among other things. This is a 45 Mbps high performance, wireless WAN prototype in San Diego County.

Harry Thibedeau, manager of satellite industry relations for the National Rural Telecommunications Cooperative (NRTC) will discuss recent developments in the effort to close the "digital divide" between rural and urban America. Specifically, he will focus on wireless technologies -- primarily satellite -- and how these technologies will likely be the only economically-viable options for high-speed Internet service to rural America. The presentation will cover both the current Ku-Band and emerging Ka-Band satellite projects.

Michael Wellings is Video Networking Engineer at the University of Washington and Director of Video Engineering for the ResearchChannel consortium. He pioneered efforts in MPEG-2 high-quality on-demand video distribution and HD over IP networks with streams ranging up to 200 Mbps. He will talk about HD over IP, and audio over IP applications, and, where this technology is going in the future.

The UMaine link for this event is:

<http://media.unet.maine.edu:8080/ramgen/encoder/I2-may9.rm>

## Appendix C: NSF Sponsored Sensor Workshop



*The ACCESS Center*



**ANYWHERE, ANYTIME, ANYSIZE, ANY SIGNAL:**

***Scalable Remote Information Sensing and Communication Systems***

January 14-15, 2002  
ACCESS Center  
Arlington, VA

### ***OVERVIEW OF WORKSHOP***

This material is found at <http://homeland.maine.edu>.

Several recent meetings, have highlighted the growing interest in the biological, ecological, environmental and other research communities in the development and deployment of large distributed systems for information collection, aggregation, analysis, simulation, predictive modeling and realtime analysis within their respective disciplines. Likewise, recent events have caused concern and raised interest in the need for similar systems in the context of homeland security. It seems apparent that a structured discussion of the needs for these systems could create opportunities for synergistic efficiencies between the various user communities. To date, however, no such discussions have been held among these differing user communities, nor among these communities and the groups providing and developing technologies to support their needs.

It is with the possibility of identifying such potential synergies that the Multi-Sector Crisis Management Consortium (MSCMC), with **National Science Foundation support**, is

organizing a series of workshops to discuss the design, development and deployment of such systems "From Sensor to Supercomputer and Back: Systems for Information Collection, Aggregation, Analysis, Assessment and Realtime Simulation." MSCMC is presenting this workshop as is one of the first steps to begin exploring these synergies.

The purpose of this workshop is to summarize the current and projected states of the art for sensor, communication and power technologies for collection and communication of information from distributed sensor systems with large numbers of nodes, and to survey the present and expected needs for such systems in environmental, facility, medical, crisis management, public safety and homeland security arenas. A succinct summary of the current and projected technologies mapped to current and projected user requirements is envisioned to result from this workshop.

This workshop will bring together experts in field sensor, processing, wireless, field power source technologies, to structure solutions for the common problem of collecting and communicating data, including from remote field locations, by cost-effective, scalable, integrated devices and networks.

The workshop will examine the user needs and technologies involved in field deployable systems for information gathering including sensors, wireless communications and power supplies, up to the local aggregation point. While the integration of "locally" gathered information into larger infrastructures for purposes of analysis is also required, such integration is beyond the specific focus of this workshop.

It is intended that this two day workshop will produce:

1. An understanding by participants of the current state of the art and availability of technologies of sensors, power, integrated circuits, and wireless, and how they may be employed in our society.
2. A determination of current and future needs for better capabilities
3. Suggested courses of action to integrate available technologies into scalable, reliable, cost-effective devices and networks of value to meet those needs, including for both the general scientific and research community and to government agencies seeking better ways to protect the public from chemical and biological incidents
4. Proposed designs and production of devices not now available or suitable for the above purposes
5. Recommendations for regulatory relief, especially for design, manufacture, and use of workshop-proposed wireless technologies for the above purposes
6. Recommendations for further work in these areas, and identification of potential collaborations and partners.

## **PROGRAM**

The first day consisted of half-hour presentations by users presenting some key needs and successes, and by technologists describing the state of the art and future



developments. The second day was dedicated to creating a report describing the state of this field and the key steps that must be taken in order to make progress.

**Note about the Videos:** *The videos below can be played with either a Quicktime Player or a Real Player. You can either play them directly from the website or download them (use the right button with Windows machines and select the "Save Target as..." option). You will probably get better results by downloading the videos you are interested in and playing them directly on your machine. The main videos are 25-35 MB in length and the Q&A videos are in the 5 MB to 10 MB range.*

*In most cases there was a clean separation between the presentation and the Q&A session that followed. In these cases you will see two videos listed. In some cases, there was no clean break so we just left everything in one video. The running time of the presentation and the Q&A session is just about 30 minutes in each case.*

Day 1

## **PART I -- USER PERSPECTIVES**

8:00 -- 8:15 Coffee, Registration



8:15 -- 8:20 **Welcome -- Syed Qadir**

Executive Director, National Response Center

Acting Chair, Multi-Sector Crisis Management Consortium

[Slides](#) [Video](#)



8:20 -- 8:30 **Opening Remarks -- George Markowsky**

Chair Department of Computer Science

Department of Mathematics/Statistics

University of Maine

Secretary, Multi-Sector Crisis Management Consortium

[Slides](#) [Video](#)



8:30 -- 9:00 **Crisis Management -- Capt. Dennis Egan**  
Chief, Office of Command Control and Preparedness  
US Coastguard  
Member, Multi-Sector Crisis Management Consortium

[Slides](#) [Video](#) [Q&A Video](#)



9:00 -- 9:30 **Biological & Ecological Sciences -- Tim Kratz**  
Associate Director for Trout Lake Station Center for Limnology  
University of Wisconsin-Madison

[Slides](#) [Video](#) [Q&A Video](#)



9:30 -- 10:00 **Environmental Monitoring & Public Safety -- Neil Gray**  
Executive Director  
International Bridge, Tunnel, Turnpike Authority

[Slides](#) [Video](#) [Q&A Video](#)

10:00 -- 10:30 Break



10:30 -- 11:00 **Facility Monitoring -- Richard Holm**  
Reactor Administrator  
Nuclear Reactor Laboratory  
University of Illinois

[Slides](#) [Video](#) [Q&A Video](#)



11:00 -- 11:30 **Communications -- David Hughes**  
Partner  
Old Colorado City Communications

[Slides](#) [Video](#) [Q&A Video](#)



11:30 -- 12:00 **The Big Picture -- Larry Smarr**  
Professor  
Computer Science and Engineering Department  
University of California San Diego  
Director of the California Institute for Telecommunications and Information Technology  
Universities of California at San Diego and Irvine

[Slides](#) [Video](#)

12:00 -- 1:30 Lunch

## PART II -- TECHNOLOGY PERSPECTIVES



1:30 -- 2:00 **Sensor Technologies and Applications -- David Nagel**

Research Professor

School of Engineering and Applied Science

George Washington University

[Slides](#) [Video](#)



2:00 -- 2:30 **Sensors -- The Present -- Gregory Bonito**

Research Assistant

Long Term Ecological Research Network Office

[Slides](#) [Video](#) [Q&A Video](#)



2:30 -- 3:00 **Communication Security -- Leslie Owens**

Founder and CTO

Vectara Innovations, LLC

Adjunct Assistant Professor, Georgetown University

Technical Editor, *Wireless Security Perspectives*

[Slides](#) [Video](#) [Q&A Video](#)

3:00 -- 3:30 Break



3:30 -- 4:00 **Power -- Robert Nowak**  
Manager, Advanced Energy Technologies  
DARPA

[Slides](#) [Video](#) [Q&A Video](#)



4:00 -- 4:30 **Medical Systems -- Jim Wilson**  
WHO/NASA Ebola/Marburg/VEE Remote Sensing Projects  
GDIN Infectious Diseases Working Group - Global Epidemic Intelligence and Disease  
Forecasting Systems (GEIFFS)  
Pediatrician, Georgetown University

[Slides](#) [Video](#) [Q&A Video](#)



4:30 -- 5:00 **Regulatory Issues -- William Lane**  
Chief Technologist, Wireless Communications Bureau  
Federal Communications Commission

[Slides](#) [Video](#) [Q&A Video](#)

5:00 -- 5:15 **Closing Remarks -- George Markowsky**  
[Slides](#)

## Day 2

### **PART III -- WORKING GROUPS**

8:00 -- 8:15 Coffee

8:15 -- 8:30 **Organization of Groups -- George Markowsky**



8:30 -- 12:00 The **Technology Group**, chaired by David Nagel and the **User Group**, chaired by George Markowsky, will work through the material presented on Day 1 and organize it so needs and possibilities will be highlighted.



12:00 -- 1:30 Lunch

## **PART IV -- DRAFTING OF REPORT**

1:30 -- 2:30 **Presentations of Working Group Results** and discussion -- David Nagel, George Markowsky, group

2:30 -- 3:00 **Outlining of Final Report -- George Markowsky**

3:00 -- 3:30 Break

3:30 -- 4:00 **Outlining of Final Report -- George Markowsky**



4:00 -- 4:30 **Task Assignments -- George Markowsky**

4:30 -- 5:00 **Planning for the Next Workshop & Close -- George Markowsky**

## **IMPACT ON DISCIPLINE**

To the best of our knowledge, this is the first time that such a wide ranging group of scholars and practitioners is being assembled to look at all aspects of sensors and communication systems. This is driven by the unprecedented need to develop both a more robust scientific network and for the needs for greater homeland security. This workshop is also drawing international interest as you can see from the participation by Russian delegates. It is vitally important for us to better understand the capabilities that others have developed in this area.

## **DISSEMINATION OF RESULTS**

Information about the workshop will be presented through a web archive here at <http://homeland.maine.edu> and also at <http://www.msccmc.org>, which is the website of the Multi-Sector Crisis Management Consortium.

# Appendix D

**THE HOMELAND SECURITY LAB OF  
THE UNIVERSITY OF MAINE COMPUTER SCIENCE DEPARTMENT  
AND  
THE MULTI-SECTOR CRISIS MANAGEMENT CONSORTIUM**



**PRESENT**

**INTEROPERABILITY HEADING DOWN THE RIGHT ROAD**

**NOVEMBER 6, 2002 1:00 PM - 4:30 PM**

**SODERBERG CENTER, UM CAMPUS, ORONO**

The Soderberg Center is part of Jeness Hall. The link above takes you to a map of the campus that shows the location. For more detailed information about visiting the UM campus and parking go to <http://www.go.umaine.edu/visit.html>. The following material is found at <http://homeland.maine.edu>.

(This event will be broadcast over the Grid and will also be available via streaming video -- a link will be provided here on the day of the event.)

The events of a year ago have placed a renewed emphasis on interoperability. As the following excerpt from [\*America Still Unprepared - America Still in Danger\*](#), a report prepared under the auspices of the Council on Foreign Relations (released October 24, 2002) states:

"In virtually every major city and county in the United States, no interoperable communications system exists to support police, fire departments, and county, state, regional, and federal response personnel during a major emergency. Radio frequencies are not available to support the post-incident communication demands that will be placed on them, and most cities have no redundant systems to use as backups. Portable radios will not work in high-rise buildings unless the buildings are equipped with repeater systems. Most U.S. cities have separate command-and-control functions for their police and fire departments, and little to no coordination exists between the two organizations. Furthermore, with few exceptions, first-responder commanders do not have access to secure radios, telephones, or video-conferencing capabilities that can support communications with county, state, and federal emergency preparedness officials or National Guard leaders."



On July 3, 2002, Governor Jeb Bush today that Florida received the first of nine portable interoperable communications systems that will improve the coordination of emergency responders in the event of a disaster or crisis situation. The nine Emergency Deployable, Interoperable Communications System ([EDICS](#)) field packages will be assigned to the State Division of Emergency Management, Florida Department of Law Enforcement, and the seven Regional Domestic Security Task Forces. Funding for the communications equipment is a small part of a \$9-million dollar, U.S. Department of Justice, Domestic Security grant that provides for emergency response equipment.

What is driving unified command models? How can incident managers execute multi-layered emergency response and consequence management plans? When the quick surge in resources and manpower happens, what will hold it together and keep it on track? In small rural towns where mutual aid is a long established practice, what needs to happen to take this to the next level? These are just some of the questions that need to be asked, while the answer is not interoperability alone. However, interoperability is a vital ingredient in a successful game plan. During this virtual symposium, top experts will explore ways in which interoperability can be achieved, what tools might work, what programs are in motion, and where we are heading.

1:00 PM **George Markowsky**, chair of the UMaine Computer Science Department will open this session.

Moderator **Peter J. Brown**, is a Maine-based freelance writer who specializes in satellite communications. He is serving on a voluntary basis as a satellite technology and communications advisor to the multi-agency team which is creating and implementing the homeland security strategic plan for the state of Maine. Mr. Brown will give a quick overview of the subject to be addressed, the speakers and their topics. He will then introduce the first speaker.

1:10 **John P. Caruso** is the chief of the executive agent (EA) for Theater Joint Tactical Networks Action Office (EA-TJTN) at the US Army Communications-Electronics Command (CECOM) at Fort Monmouth, New Jersey. Mr. Caruso currently chairs two DoD forums including the Theater Joint Tactical Network Configuration Control Board (TJTN-CCB) which coordinate unified-command, military-service, and Defense-agency programs for joint interoperability assurance purposes. He also directs the conduct of an annual joint networked-communications exercise of considerable size designed to experiment with and assess various notional concepts, interfacing schemes, untried network arrangements, new technologies, emerging systems, and operational approaches in hybrid joint networks, simulating deployed joint communications operations while focusing on joint networked-system interoperability.

Mr. Caruso will discuss what went on during the 2002 Joint Users Interoperable Communications Exercise or JUICE, and what is on tap for next year. JUICE is an annual exercise designed to resolve interoperability issues throughout the DoD's tactical networked-communications community. The exercise is focused on developing near-term practical solutions to interoperability shortfalls in tactical networked communications. Exercise alignment with Joint Forces Command (JFCOM) has broadened to include Joint Task Force Civil Support (JTF-CS) and the Federal Emergency Management Agency (FEMA) planning activities, as well as their operational requirements. This exposure has advanced the DoD's capability to support Homeland Security planning processes and execution requirements.

[VIEW OR DOWNLOAD JOHN CARUSO'S SLIDES \(2.2 MB\)](#)

**NO VIDEO YET**

1:30 **Gene Davenport** serves as telecommunications manager for the Federal Emergency Management Agency (FEMA) Mobile Emergency Response Support (MERS) in Denton, Texas. Mr. Davenport will discuss interoperability with the federal government during disasters, Weapons of Mass Destruction (WMD), or terrorist incidents. He will focus on FEMA's deployment of the MERS comprehensive telecommunications support system, and its links to the local incident command via Civil Support Team, Crisis Management

Center (FBI), Consequence Management Center (FEMA) and Joint Forces Command - Civil Support (JTF-CS) (DOD).

[VIEW OR DOWNLOAD GENE DAVENPORT'S SLIDES \(1.4 MB\)](#)

**NO VIDEO YET**

1:50 **John W. Loonsk**, M.D. works at the Centers for Disease Control and Prevention (CDC) in Atlanta where he is Associate Director for Informatics and Director at the Information Resources Management Office, the CDC's central information technology organization. He received his medical training at the State University of New York at Buffalo after graduating from the Johns Hopkins University. At the State University of New York at Buffalo, he implemented the first mandatory course in the US in medical informatics for medical students. At the University of North Carolina at Chapel Hill, he oversaw the development of an electronic learning and decision support environment which included the electronic resources of the Health Sciences library, the medical school curriculum and the Internet. Since joining the CDC in 1999, he has become instrumental in the planning and development of the National Electronic Disease Surveillance System (NEDSS). In 2000, he was named CDC Associate Director of Informatics and assumed responsibility for the CDC's , the Information Resources Management Office.

Dr. Loonsk will focus on the Public Health Information Network (PHIN) which will connect the diverse groups participating in public health using standards-based collaboration, communications and alerting capabilities. PHIN is a live, secure, Internet-based network for exchanging comparable critical health information between all levels of public health (local, state and federal) and other critical information systems (clinical care, laboratories, first responders, etc.). Improved data analysis and visualization including automated algorithms for event detection will aid in more timely public health decision-making.

**NO SLIDES**

**NO VIDEO YET**

2:10 **Ross Merlin**, Telecommunications and Information Resources Manager at the U.S. Public Health Service Office of Emergency Preparedness, will discuss interoperability from the standpoint of his group's emergency response plans.

**NO SLIDES**

**NO VIDEO YET**

**Contact Info**

Ross Merlin  
US Dept. of Health and Human Services  
Office of Emergency Response  
Suite 360, 12300 Twinbrook Pkwy  
Rockville MD 20857  
Tel. 1-800-872-6367 x925  
E-mail [RMERLIN@OSOPHS.DHHS.GOV](mailto:RMERLIN@OSOPHS.DHHS.GOV)

2:30 Brief Intermission

2:40 **Robert E. Lee, Jr.** has more than thirty years experience in public safety, and he currently serves as the Public Safety Wireless Network (PSWN) Program Manager for the Department of Justice. A Supervisory Special Agent with the FBI, Mr. Lee has been with PSWN since June, 2001. He has served as an instructor both at the FBI National Academy at Quantico, Virginia, and at the International Law Enforcement Academy

in Budapest, Hungary. He presently serves on the Law Enforcement Liaison Council of the American Society of Industrial Security (ASIS) and the Communications and Technology Committee of the International Association of Chiefs of Police (IACP).

Mr. Lee will provide an overview of the PSWN Program, the program's view of interoperability, success stories, and current assistance projects. Lee will outline a series of steps that government officials can take to enhance interoperability. In existence since 1996, PSWN is a joint program of the U.S. Department of Justice and the U.S. Department of the Treasury which promotes interoperable communications solutions for Public Safety at all levels of government.

[VIEW OR DOWNLOAD ROBER E. LEE'S SLIDES \(.6 MB\)](#)

**NO VIDEO YET**

3:00 **Michael Skurla** is the Chief of Combatant Command Integration and Interoperability Initiatives, Combatant Command Interoperability Program Office (CIPO), US Army Communications Electronics Command (CECOM). His duties include developing and assisting in the execution of technical objectives that advance the Combatant Command's Command, Control, Communications, Computers, Intelligence, Electronic Warfare and Sensors (C4IEW&S) capabilities and to ensure that all Service C4ISR systems provide fully integrated / interoperable command and control capabilities to the joint forces. Previously, he was assigned to the Army's Program Executive Office Command, Control, and Communications Systems (PEO C3S), and he has provided system and software engineering support on network management systems, tactical radio systems and Special Operation Forces programs.

Michael Skurla will provide an overview on the National Emergency Support Center that is being proposed as a foundation element in DoD's efforts to build an integrated military strategy to support our national Homeland Security effort. A key element of this national strategy is the ability to leverage and make available to the civilian disaster response community the large and largely untapped (from a technology transfer perspective) military technology baseline together with the Department of Defense material acquisition, training and support infrastructure to provide effective, high quality, affordable, interoperable equipment, training, and sustainment support to civil First Responders. One goal is to address known critical shortfalls in equipment and technology assets, information fusion, and communication architectures at all First Responder levels - local, multi-state, and national.

[VIEW OR DOWNLOAD MICHAEL SKURLA'S SLIDES \(1.7 MB\)](#)

[VIEW PRELIMINARY MICHAEL SKURLA VIDEO VIEW PRELIMINARY MICHAEL SKURLA VIDEO VIEW PRELIMINARY MICHAEL SKURLA VIDEO \(SOME AUDIO IS MISSING -- REPAIRS UNDER WAY\) \(87 MB\)](#)

3:20 **David R. Beering**, is the Principal Partner of Infinite Global Infrastructures, LLC, based in Chicago. IGI's current work focuses on the design, integration, and deployment

Mr. Beering will discuss trends in fixed and mobile satellite systems with regard to protocols, bandwidth efficiency and spectrum allocation. With the rapid proliferation of federal-owned and municipal-owned mobile / portable satellite and wireless systems, specific discussion will focus what needs to happen in order to support the rapid evolution of satellite, and, wireless systems and services. Mr. Beering will identify ways to provide for the maximum level of cooperation and interoperability among users of these new systems.

[VIEW OR DOWNLOAD DAVID BEERING'S SLIDES \(1.5 MB\)](#)

**[VIEW PRELIMINARY DAVID BEERING VIDEO \(SOME AUDIO MISSING -- REPAIRS UNDER WAY\) \(134 MB\)](#)**

3:40 Richard Wolf is executive vice president, and, director of sales and marketing at Wolf Coach In Auburn, Massachusetts. He has been a part of Wolf Coach since the late 1960's, working in the manufacturing area and rising to the level of President. Wolf Coach is well-known for its innovative work in the area of mobile platforms designed to provide communications support to law enforcement and governmental agencies at all levels. For example, Wolf Coach recently delivered two mobile satellite uplink vehicles to the Connecticut State Police. Wolf Coach also built the 32 Unified Command Suite (UCS) - Communications Vans which are used by Civil Support Teams in numerous states as part of their WMD response capabilities, and five Enhanced Multi Radio Vehicles (EMRV's) for FEMA.

Mr. Wolf will discuss the best ways to leverage existing technologies to provide current day solutions to the First Responder on the ground, wherever that is, and to enable the First Responder to reach back for support from wherever it is available. An assortment of communications pipelines are available today to work in the immediate area, or, on a regional or on a nationwide basis. The need for speed, the set up time involved, how robust the path has to be, and how many pipelines are needed will all factor into the decision making process.

**[VIEW OR DOWNLOAD RICHARD WOLF'S SLIDES \(24.8 MB\)](#)**

**[VIEW PRELIMINARY RICHARD WOLF VIDEO \(110 MB\)](#)**

4:00 Randall Berry is the Fire Chief for the Town of Livermore, Maine (population 2000), where he has been a firefighter for approximately 25 years. Until recently, he also served as the Town's Emergency Management Director. He serves in the Maine House of Representatives, and he is the House Chair of the Joint Standing Committee on Appropriations and Financial Affairs. He is a member of the Emergency Response Team at Wausau-Mosinee Paper Corporation where he is employed as a papermaker.

Chief Berry will discuss challenges at the local level of effective inter-agency communications from his own perspective. He will examine coordination with mutual aid departments and other emergency response agencies, along with funding, geography and other challenges for a fire chief. He will also discuss comprehensive planning efforts, and how these can be undertaken in light of the adverse economic climate in many states. He will explore ways in which states can invest and bring about effective improvements in interoperability.

NO SLIDES

**[VIEW PRELIMINARY RANDALL BERRY VIDEO \(106 MB\)](#)**

4:20 Closing Remarks

NO SLIDES

**[VIEW PRELIMINARY VIDEO OF CLOSING REMARKS \(31.4 MB\)](#)**

## Connection of the University of Maine to Internet2

This award was for the connection of the University of Maine to the Internet2 backbone. This report summarizes the activities and results of this project.

The primary goals and objectives of the project were:

1. To connect the University of Maine network to a High Performance Research Network
2. To upgrade the University's own internal network to high performance network services to researcher laboratories and desktops.
3. To assist faculty and researchers in the use of these services for collaboration.

The original award covered the period of September 1, 1998 to October 31, 2000. Due to delays in acquiring bandwidth this timeframe was moved forward to October 31, 2001 as reported in the first annual report. The grant was later extended as a no cost extension to February 28, 2003.

The original proposal included CO-PI Professor James Patton who was involved in the project during the first year. Professor Patton left the University during the project. A request was made and granted to have Professor George Markowsky serve as CO-PI for the remainder of the project. Professor Markowsky has been directly involved with many of the projects using Internet2. The other CO-PI, Gerald Dube, has concentrated on the infrastructure, upgrades, and the deployment of the various video technologies.

### Infrastructure

As reported previously, the connection was made to the Northern Crossroads gigapop (NoX) in Boston. The NoX is a participant in the Abilene Internet2 backbone. The initial connection was a DS-3 and finally became operational on February 22, 2000. The University of Maine was one of the first institutions connected to the NoX to fully support multicasting.

Traffic on this connection began to grow as more University researchers, faculty and students used the bandwidth to support their academic activities. The use of video, reported under activities, over this network became more commonplace and drove the total traffic up to 75 percent of the capacity of the DS-3. It became clear that, with other initiatives in the planning stage, an upgrade of this was necessary. A procurement process was undertaken to upgrade this connection to an OC-3. The upgrade to the OC-3 became operational in December of 2002.

In addition to the connection to the Abilene the University of Maine has upgraded its campus network to a gigabit backbone and is completing upgrading academic building networks to 10/100 switched connections.

The award has enabled the University to make the initial connection and upgrade to its present level. The connection is in place, operational, and funding is allocated for its ongoing support. The project as planned is now complete.

## **Applications over Internet 2**

The connection to Internet2 has benefited research and teaching faculty at the University of Maine by providing them with a greater quality of service which facilitated collaboration with other institutions. Much of the work done at Maine has revolved around the use of various video technologies across the Internet2 backbone. Those technologies are listed here and their use highlighted in the activities section.

### **Access Grid**

Within the first year, the University of Maine established a pilot Access Grid room to allow researchers to participate remotely in various conferences multicast across the Grid. This has also allowed researchers to schedule meetings and video conferences with collaborators nationally and, in some cases, internationally. This has been sufficient demand for this that the University is in the process of developing a larger and more formal facility that will support Access Grid technology. This will accommodate groups large and small and support other video standards such as those that follow. Planned completion of this facility is September, 2003.

During the project, a staff member attended a Chautauqua conference at the University of Kansas, and also traveled to Boston University to participate remotely from BU's Access Grid room to and to gain practical insight on establishing such a facility.

### **MPEG2 Projects**

The University of Maine, along with other institutions in the State, has a number of projects using MPEG2 video technologies. These projects provide for multiple high quality video streams to each location, thus providing a 'full presence' among multiple sites. Projects in Maine using this technology include 85 K12 sites and about 15 research sites involved in biotechnology and marine science research.

In Maine, these projects make use of an ATM transport. However, the equipment used in Maine also support a native IP transport and allows for sites using either transport to be mixed in the same conference. The University has been involved in some demonstrating the use of this technology over Abilene. This is highlighted in the activities section. The University expects increasing use of this technology as part of future initiatives.

### **H.323**

Given the widespread use of this technology, the University has also acquired and installed enterprise H.32x MCU's to support initiatives where other alternatives do not exist. This has been used extensively over Abilene with good results.

Finally, the University has experimented with transcoding between these three technologies in the same conference. A number of conferences over Abilene incorporated all three technologies. These are mentioned in the activities section.

## **National Center for Geographic Information and Analysis**

### **Spatial Information Science & Engineering Department**

Internet-2 at UMaine enabled several research and education efforts in the National Center for Geographic Information and Analysis and the Department of Spatial Information Science and Engineering. The initiation of a new master's program in Information Systems addressing professionals throughout the State of Maine was possible, because the entire course content could be delivered remotely through the web. In a similar way, a new Graduate Certificate in Geographic Information Systems was approved to start in the Spring of 2002, the content of which will be available through the Web. With the advancement of Web mapping technologies and Internet-2, it is becoming possible to run such data intensive operations as spatial analysis over the Web.

NCGIA researchers are relying more and more on the high-bandwidth communication to collaborate remotely with researchers at other locations. The NCGIA consortium (UMaine, UC Santa Barbara, and University at Buffalo) uses the web extensively for project management across the three sites. In a similar way, under a new NSF-funded ITR project (UMaine, Iowa State University, and UC San Diego) NCGIA researchers are working on shared imagery, video, and map archives to develop the foundation of the GeoGrid. Two new research directions, which were started in 2002, include the development of a shared Web resource for a geographic information commons (NSF proposal pending) and the foundations for the Geospatial Semantic Web (Proposal pending with the National Imagery and Mapping Agency).

### **Fogler Library**

The many activities carried out at the Fogler Library of the University of Maine are described in Appendix E.

## **Activities**

### **DOE EPSCOR meeting at Oak Ridge on High Performance Computing**

**August 18-19, 1999,**

George Markowsky attended a DOE EPSCOR meeting at the Oak Ridge National Lab focusing on high performance computing. There George Markowsky met several interesting researchers including Guy Cormier of the University of Puerto Rico.

### **Chautauqua on High Performance Computing At Boston University**

**September 13-16, 1999,**

George Markowsky attended this meeting and learned a lot about the Access grid and various connectivity options.

## **Beowulf Cluster – Department of Computer Science**

**Fall 1999**

The Department of Computer Science began work on a Beowulf Cluster funded by a grant from the Maine Science and Technology Foundation.

## **Internet 2 Day at UMaine**

**January 19-20, 2000,**

The Computer Science Department at the University of Maine held its own **Internet 2 day**. This day featured a variety of speakers. A detailed description of the Internet 2 meeting is in Appendix A below. The attendance was about 60 people.

## **Multi-Sector Crisis Management Consortium**

**Late Spring -- early Summer of 2000**

George Markowsky was part of a group that incorporated the **Multi-Sector Crisis Management Consortium** as a non-profit corporation with a Maine charter, but with its headquarters at the Access center in DC. At UMaine we participate in meetings and briefings using the Internet 2 connection to the Access center. More details about this activity can be found at [www.mscom.org](http://www.mscom.org).

## **High Speed Networking and Ubiquitous Computing held at the San Diego Supercomputer Center**

**July 20-21, 2000,**

At this conference George Markowsky spoke about crisis management.

## **Trip to ACCESS Center in Arlington, VA**

August 29-30, 2000

Gerry Dube and George Markowsky visited the Access Center to determine what needed to be done so that UMaine could become an Access Node, and make full use of Internet 2 conferencing. Since that trip we put together a system in a small room that we call "ACCESS Grid Lite". This system permits us to participate in ACCESS Grid activities. We also began planning for a much larger conference room that will have not only full Internet 2 conferencing capabilities, but be able to handle any sort of video conferencing capability available at this time. Our plan is to keep the technology in this room current so we can participate in any use of advanced communication technology. This room serves as the gathering place for broadcasts of the Multi-Sector Crisis Management Consortium, along with other teleconference meetings as well.

## **Internet 2 Day – University of Puerto Rico**

**April 18-23, 2001**

George Markowsky visited the University of Puerto Rico to speak at an EPSCOR Internet 2 day and to discuss cooperation between the UM CS Department and the University of Puerto Rico.



## **Mini-Symposium On High-Speed Connectivity**

**May 9, 2001**

Peter Brown, a writer for Satellite magazine, and George Markowsky organized this mini-symposium. The details are presented in Appendix B.

## **Disaster Recovery Communications over Internet2**

**September 11, 2001**

The events of 9/11 prompted an electronic mailing from Columbia University requesting information about available voice gateways that could be made available for disaster recovery communications over the Internet2 network. The University of Maine offered the use of its existing IP gateway with a PRI to the public network. As the events developed, this was not needed but the existence of the Internet2 connection made this option available to others.

## **Multi-Sector Consortium Outreach Meeting**

**September 19, 2001**

We used our Access Grid connectivity to participate in one of the monthly meetings of the Multi-Sector Crisis Management Consortium. We have done this on roughly a monthly basis since September 2001. A full list of meeting starting from January 2002 can be found at [www.mscom.org](http://www.mscom.org). We participated in most of these meetings and also a few in 2001, which are not listed on that website.

## **Computational Modeling Institute**

**September 20, 2001**

George Markowsky organized an organizational meeting of the Computational Modeling Institute. This group is dedicated to high-speed computation and its members are heavy users of Internet 2 connectivity.

## **Wave Conference, Providence Rhodes Island**

**November, 2001**

In **November of 2001**, the OSHEAN Network in Rhodes Island sponsored the first annual **Wave Conference** in Providence. The purpose of the conference was to focus on applications of multimedia applications over IP. The University of Maine was invited to make a presentation on the MPEG2 initiatives in Maine.

As part of this presentation a demonstration of the technology was delivered over the Internet2 connection to a conference room in Providence Rhodes Island. Equipment was installed at the conference site to support MPEG2 video at the conference to participate with two other sites in Maine. Participants at both Maine locations, one of which is the Governor Baxter School for the deaf, were deaf students. For the Providence location, students from the Rhodes Island School for the deaf were invited to the conference to participate in a discussion with their counterparts in Maine.

The demonstration involved multiple streams of MPEG2 video over IP so that all three sites had full presence with the other sites. The topic of discussion for the students was the subject of the 9-11 events as this was still very fresh in students' minds. The demonstration worked flawlessly and the effect on the audience was dramatic, given the topic of discussion. The high quality video and the full presence of all sites made it easier for the participants to communicate using American Sign Language.

Presenters were Gerald Dube, Jeff Letourneau, Ray Poulin, and Barbara Keefe.

Power Point slides: [www.Maine.edu/OSHEAN/Wave/Maine.ppt](http://www.Maine.edu/OSHEAN/Wave/Maine.ppt)

Video clips: [www.Maine.edu/OSHEAN/Wave/Mainevideo.wmv](http://www.Maine.edu/OSHEAN/Wave/Mainevideo.wmv)

Note: The video clip was captured from an H.323 system to capture all 3 sites and the interpreter into one view and, as such, does not represent the high quality video that was delivered to the conference but gives a sense of what was presented.

## **Course Delivery in the Native American Studies Program**

### **Fall 2001 and Spring 2002 Semesters**

We used our Internet 2 connection to. G. Thomas Colonnese (Santee Sioux) and Marvin Oliver (Quinault/Isleta-Pueblo), professors at the University of Washington's American Indian Studies Program, one of the premier programs of its kind in the country, taught courses at the University of Maine during the 2001-2002 academic year through a unique arrangement involving two-way video technology.

Colonnese and Oliver were named Visiting Diversity Libra Professors in UMaine's Division of Lifelong Learning. Colonnese taught a course, *The American Indian Novel*, which began on October 1. The course was be offered by UMaine's Native American Studies Program and its English Department through UMaine's Continuing Education Division. Oliver's course, *Two-Dimensional Art of the Northwest Coast Indian*, began in the Winter Session (January) and continued into the Spring semester. It was offered by UMaine's Native American Studies Program and its Art Department.

In each case, the professor presented the course to an on-site class at the University of Washington, with that class was linked to a UMaine classroom through compressed video technology delivered via Interne2. Students in Orono and Seattle were able to interact with each other in real time.

"This partnership enabled UMaine to enrich its curriculum while addressing aspects of its diversity initiatives," according to Robert White, Dean of UMaine's Division of Lifelong Learning. "This is an exciting first step which could lead to any number of similar ventures using distance learning technologies."

As part of the courses, Colonnese and Oliver visited UMaine and presented a public lecture. They were also involved in outreach and planning activities, and interacted with UMaine students,

faculty members, people in Maine's Native American community, and were able to beam the course back to their Seattle classroom, teaching live in Orono.

"Both have expressed enthusiasm about having the opportunity to expand their own knowledge, and to learn more about Native Americans in the northeast," White said. Maureen Smith, director of UMaine's Native American Studies Program, said that the connection between the programs at UMaine and the University of Washington made sense, because of the effect of the coastal environment on the culture and history of Native people in the northeast and northwest. "Since the Wabanaki tribes and the northwest tribes have been so influenced by similar environments, we have a built-in focus and basis for comparison," she says. "Through this connection, we can examine the environment and compare and contrast the ways in which people formed their lives and cultures around it."

Libra Professorships were established in the University of Maine System through a gift from Elizabeth B. Noyce. Each year, two of the professorships at UMaine are designed to increase diversity in University programs.

## **NSF Workshop: ANYWHERE, ANYTIME, ANYSIZE, ANY SIGNAL: Scalable Remote Information Sensing and Communication Systems**

**January 14-15, 2002**

George Markowsky received a grant from NSF to fund a workshop bringing together the field science and homeland security communities. More details on this workshop are available at <http://homeland.maine.edu> and Appendix C.

## **SURA/ViDe Workshop, Birmingham, Alabama**

**April 23-25, 2002**

Gerald Dube was invited to present at the 4<sup>th</sup> annual Sura.ViDe workshop at the University of Alabama in Birmingham. The presentation, titled 'Leveraging Multiple Initiatives into a Statewide Network', focused on the various video projects in Maine with specific focus on the various initiative using the MPEG2 technology now deployed in Maine

<http://www.vide.net/conferences/spr2002/index.shtml>  
<http://www.vide.net/conferences/spr2002/presentations/dube/vide4.ppt>

## **K12 Conference, St. Clair County, Michigan**

**June, 2002**

A number of K12 schools in St. Clair County, Michigan, use the same MPEG2 technology that is used in Maine. In June of 2002, two pilot conferences were scheduled over I2 to allow students in Maine and Michigan to communicate with each other on topics of common interest. This occurred during the end of a school year while many students were taking exams. Nonetheless students found the experience very worthwhile and expressed interest in future conference of that nature. We hope to explore greater collaborations of this nature in the coming year.

## **Gallaudet University Videoconferencing Workshop for Deaf Education, Washington, DC**

**October 13-15, 2003,**

Gerald Dube attended the Gallaudet Videoconferencing workshop for Deaf Education. Maine has a School for the deaf and is interested in collaborating working with other schools for the deaf nationally. Educators involved in with deaf education in Maine are pursuing a number of collaborative initiatives that would allow a number of similar schools to collaborate over the University's Internet2 connection.

## **UMaine Interoperability Virtual Symposium**

**November 6, 2002**

Peter Brown and George Markowsky organized a virtual symposium on interoperability that was broadcast over the ACCESS Grid using Internet 2 Technology. For more details on this see <http://homeland.maine.edu> or Appendix D.

## **The Global Threads Project Of The Souillac Group**

**November 8, 2002**

George Markowsky and other staff at the University of Maine organized a transcontinental and transatlantic lecture of **Benoit Mandelbrot** as the first part of a pilot of the Global Threads Project of the Souillac Group (see <http://www.souillac.org>). Dr. Mandelbrot was in Oregon, and we successfully connected him to a conference in Lisbon Portugal. The Global Threads project uses high-speed Internet connectivity to connect artists and scientists worldwide so that they can interact with each other.

## **The Global Threads Project Of The Souillac Group**

**December 10, 2002**

George Markowsky and other staff at the University of Maine organized the second part of the pilot mentioned in the preceding paragraph. This involved the internationally known musician, **Jean Claude Risset** lecturing to a worldwide audience via Internet 2 connections as part of the Global Threads Project.

## **UMaine Statewide PhD Program**

**Fall 2002 and Spring 2003**

In Fall 2002, the UMaine and University of Southern Maine (USM) Computer Science Departments began to interact using Internet 2 technology to help establish a statewide computer science PhD program.

In Spring 2003, the first graduate course, Algorithms, was offered over the Internet 2 connection between UMaine and USM.

## **Organizational Partners**

As indicated in a previous report, the University is involved in a number of partnerships with the research and educational community. The major partnerships that have developed are:

### **Maine Marine Research Network**

As previously reported, Maine has provided research funds to interconnect twelve institutions in Maine involved in Marine Science research and education. This includes the University of Maine, its Darling Marine research center on the coast, Maine Maritime Academy, other institutions of the University of Maine system, a number of locations of the Maine Department of Marine Resources, and the Wells national Estuarine Research Reserve. Six of these twelve institutions have now been interconnected with broadband connections (45 Mbps) while the other have connected over T1 links. At the 6 larger sites, the same high quality MPGE2 video systems have been installed and support concurrent multiple streams providing full presence for participating sites. The smaller sites have been equipped with H.323 systems with the capability to participate with the other sites using transcoding to link the two technologies. All the equipment has been installed with only room controls remaining to be completed by summer 2003. Researchers at all these locations will then be able to collaborate with other Marine Science Researchers over Internet2.

### **Maine Biotechnology Initiative**

This initiative is similar in nature and technology to the Marine Science Research Network. This effort, funded with state research funds, interconnects two University locations and two private research laboratories with the same broadband connections and MPEG2 video capabilities used in the Marine Science project. Courses leading to a doctorate in biotechnology are now being offered across these institutions using an interim videoconferencing system. As in the Marine Science project the full system will become available in the summer of 2003 when room controls are completed. This will allow researchers at participating institutions to fully utilize the University's Internet2 connectivity.

### **Department of Education Distance Learning Network**

The department of Education in Maine has funded a number K12 schools to support multiple stream full presence high quality video systems. These sites are connection with broadband (45 Mbps links) and teacher controlled multimedia classrooms using MPEG2 compression technology. This allows schools to offer advanced placement or specialized courses that would not otherwise be available in the rural areas of Maine. Courses such as Japanese and American Sign Language have been offered over this system. This also provides a conduit to provide teachers in these same rural areas with professional development opportunities.

The technology used for this project is exactly the same and is fully interoperable with the research initiatives mentioned above. The DOE has contracted with the University to operate this network on their behalf, and to have all sites operate from a common scheduler, facilitating the scheduling

of conferences between University, research, and DOE sites. There are currently 85 DOE sites now in operation across the state.

### **Maine Schools and Library Network (MSLN)**

As mentioned in a previous report, the University operates the Maine School and Library network in addition to the Distance Learning locations. This network provides a variety of services to the K12 and Library community, including a help desk service. Over 1100 sites across Maine are served by this common network.

The University is in the process of applying to UCAID for a Sponsored Education Group Participation (SEGP) agreement. This will allow these K12 sites and the Distance Learning sites across the state to benefit from the Internet2 connectivity. This will facilitate collaboration of these K12 and Library sites with counterparts around the country.

### **St. Clair County Intermediate School District, Michigan**

The School District in St. Clair County, Michigan, has deployed distance learning classrooms using the same equipment that is used here in Maine. There is great interest in providing mechanisms for K12 students in both states to be able to share experiences. There is also interest in experimenting with the sharing courses available in one of the states but otherwise unavailable in the other. Some initial experimental meetings have been done to prove the concept. When Maine becomes authorized to carry K12 traffic over its Internet2 connection it is expected that this partnership will grow to include more activities.

### **State of Maine**

As reported earlier, the University provides ISP services to all of state government over a broadband ATM connection. This provides access to research entities within state agencies, such as the Department of Marine Sciences, to participate in research activities with other institutions in the state and nationally. We anticipate that these research agencies will be able to participate in Internet2 activities through the SEGP agreement.

## APPENDIX A

### UNIVERSITY OF MAINE INTERNET 2/000 DAY

The University of Maine will be hosting an Internet 2 meeting on Thursday, January 20, 2000. There will be a pre-conference gathering on Wednesday January 9, 2000. The purpose of the meeting will be to introduce people to Internet 2 and to illustrate some of the applications and exciting projects that are being done with Internet 2 both in Maine and around the world. We also hope to provide opportunities for people interested in working with Internet 2 to find potential collaborators.

All are invited to attend. There is no cost to attend, but the number of attendees is limited, so you must register in order to attend. Food and refreshments will be supplied through the generosity of UNET. You can register by e-mail, fax or telephone. Consult the directions at the bottom of this e-mail note for details. If you need any sort of special accommodation to attend the meeting, please let us know and we will do our best to help.

We plan to provide streaming video of the meeting for those unable to attend. More details are at the end of this note.

#### SCHEDULE OF EVENTS

WEDNESDAY, JANUARY 19, 2000

6:00 PM - 7:30 PM Reception

7:30 PM - 8:30 PM A Review of NSF Internet 2 Programs

Dan VanBelleghem

NSF EPSCOR

NCSA

THURSDAY, JANUARY 20, 2000

7:30- 8:30 AM REGISTRATION & BREAKFAST

8:30- 9:00 AM WELCOME

Dr. Daniel Dwyer

Vice President for Research

University of Maine

9:00- 9:45 AM ALLIANCE AND NLANR PRESENTATION

Ginny Hudak-David

NCSA

9:45-10:45 AM VISUALIZATION PANEL

Vic Baker

Computer Science, EE Department

West Virginia University

Guy Cormier

High Performance Computing Facility

University of Puerto Rico

Jim Fastook

Computer Science Department  
University of Maine  
Ginny Hudak-David  
NCSA

10:45-11:00 AM BREAK

11:00-12:00 NOON NORTHERN CROSSROADS (NOX) PRESENTATION

Leo D. Donnelly, Jr  
University Information Systems  
Harvard University  
Michael Krugman, Executive Director  
Information Technology  
Boston University  
Gerry Dube  
UNET

University of Maine System

12:00- 1:00 PM LUNCH

1:00- 2:00 PM INTERNET 2 APPLICATIONS TALK AND DISCUSSION

Greg Wood -- Internet 2

2:00- 2:15 PM BREAK

2:15- 3:30 PM INTERNET 2 IN MAINE PANEL

Various panelists from Maine

3:30- 3:45 PM BREAK

3:45- 4:30 PM INTERNET 2 DEMO

Gerry Dube  
Director UNET

University of Maine System

4:30- 5:00 PM NEXT STEPS FOR INTERNET 2 IN MAINE

George Markowsky  
Computer Science Department  
University of Maine

Note that NCSA stands for the National Center for Supercomputing Applications.  
We will provide streaming video of Thursday's sessions at:

<rtsp://media.unet.maine.edu/real-live/I2-conf.rm>

To access this feed you will need to use RealPlayer, which you can download from [www.real.com](http://www.real.com). They have a free version along with fancier versions that you can purchase. We recommend that you try accessing the site on January 19, 2000 to make sure that everything is working and that your system is set up correctly.

We plan to be streaming video using at least three different speeds:

1. 28.8K modem speed (about 20 Kbps)
2. 56K modem speed (about 34 Kbps)
3. LAN speed (about 200 Kbps)



## **APPENDIX B**

### **HIGH SPEED PLATFORMS: A REALITY CHECK**

George Markowsky, Chair

Peter J. Brown, Moderator

The University of Maine Computer Science Department presents a live videoconference on May 9 at 2pm (EDT).

This is the third event organized by Peter Brown for the UMaine Computer Science Department on the topic of the evolution of high-speed platforms. The previous two sessions focused exclusively on satellite-based solutions. He is a freelance writer and resident of Mount Desert. He is the senior multimedia editor for Via Satellite magazine, and his articles appear in numerous trade magazines including Broadcasting & Cable, TV Technology and Broadband Week. Among other things, he serves as the rural satellite technology advisor to the National Indian Telecommunications Institute in Santa Fe, New Mexico.

#### Participants

Jim Albriecht, VP of Broadband Academy, YAS Broadband Ventures, LLC will explore the latest developments in high speed cable including what broadband services DOCSIS supports, where DOCSIS is today and where it plans to be tomorrow as broadband migrates as well as how DOCSIS relates to other CableLabs initiatives.

Dr. Richard Chernock, IBM Research Staff Member at the IBM T.J. Watson Research Center and co-author of the book, "Data Broadcasting: Understanding the ATSC Data Broadcast Standard" will discuss the ATSC data broadcast standard, why digital TV broadcasting is attractive, and the various situations that lend themselves to this type of distribution.

David L. Klimek, Director of Engineering and Chief Technology Officer at mPhase Technologies, Inc. will explore the history of DSL. The market implications of the Telcom Act of 1996, network design requirements and Video-over-IP issues will be reviewed as well as two recently awarded patents. He is based the Georgia Center for Advanced Telecommunications Technology (GCATT) center and oversees the collaborative effort between mPhase and Georgia Tech Research Institute.

Jack Phiel, Major Accounts Manager at Lockheed Martin Global Telecommunications Products Division will discuss IP protocol connectivity over satellite, developments in high speed digital satellite links, and, the emergence of modern Very Small Aperture Terminal (VSAT) systems with both hub and hubless architectures.

Dr. Ramesh Rao, Director of the Center for Wireless Communications (CWC) at the University of California/San Diego (UCSD), and UCSD director of the California Institute of

Telecommunications and Information Technology (Cal IT2), will speak about the NSF-funded High Performance Wireless Research and Education Network (HPWREN) project, among other things. This is a 45 Mbps high performance, wireless WAN prototype in San Diego County.

Harry Thibedeau, manager of satellite industry relations for the National Rural Telecommunications Cooperative (NRTC) will discuss recent developments in the effort to close the "digital divide" between rural and urban America. Specifically, he will focus on wireless technologies -- primarily satellite -- and how these technologies will likely be the only economically viable options for high-speed Internet service to rural America. The presentation will cover both the current Ku-Band and emerging Ka-Band satellite projects.

Michael Wellings is Video Networking Engineer at the University of Washington and Director of Video Engineering for the ResearchChannel consortium. He pioneered efforts in MPEG-2 high-quality on-demand video distribution and HD over IP networks with streams ranging up to 200 Mbps. He will talk about HD over IP, and audio over IP applications, and, where this technology is going in the future.

The UMaine link for this event is:

<http://media.unet.maine.edu:8080/ramgen/encoder/I2-may9.rm>

## Appendix C: NSF Sponsored Sensor Workshop



The ACCESS Center

### **ANYWHERE, ANYTIME, ANYSIZE, ANY SIGNAL:**

#### ***Scalable Remote Information Sensing and Communication Systems***

January 14-15, 2002  
ACCESS Center  
Arlington, VA

### **OVERVIEW OF WORKSHOP**

This material is found at <http://homeland.maine.edu>.

Several recent meetings have highlighted the growing interest in the biological, ecological, environmental and other research communities in the development and deployment of large distributed systems for information collection, aggregation, analysis, simulation, predictive modeling and real-time analysis within their respective disciplines. Likewise, recent events have caused concern and raised interest in the need for similar systems in the context of homeland security. It seems apparent that a structured discussion of the needs for these systems could create opportunities for synergistic efficiencies between the various user communities. To date, however, no such discussions have been held among these differing user communities, or among these communities and the groups providing and developing technologies to support their needs.

It is with the possibility of identifying such potential synergies that the Multi-Sector Crisis Management Consortium (MSCMC), with **National Science Foundation support**, is organizing a series of workshops to discuss the design, development and deployment of such systems "From Sensor to Supercomputer and Back: Systems for Information Collection, Aggregation, Analysis, Assessment and Realtime Simulation." MSCMC is presenting this workshop as one of the first steps to begin exploring these synergies.

The purpose of this workshop is to summarize the current and projected states of the art for sensor, communication and power technologies for collection and communication of

information from distributed sensor systems with large numbers of nodes, and to survey the present and expected needs for such systems in environmental, facility, medical, crisis management, public safety and homeland security arenas. A succinct summary of the current and projected technologies mapped to current and projected user requirements is envisioned to result from this workshop.

This workshop will bring together experts in field sensor, processing, wireless, field power source technologies, to structure solutions for the common problem of collecting and communicating data, including from remote field locations, by cost-effective, scalable, integrated devices and networks.

The workshop will examine the user needs and technologies involved in field deployable systems for information gathering including sensors, wireless communications and power supplies, up to the local aggregation point. While the integration of "locally" gathered information into larger infrastructures for purposes of analysis is also required, such integration is beyond the specific focus of this workshop.

It is intended that this two-day workshop will produce:

1. An understanding by participants of the current state of the art and availability of technologies of sensors, power, integrated circuits, and wireless, and how they may be employed in our society.
2. A determination of current and future needs for better capabilities
3. Suggested courses of action to integrate available technologies into scalable, reliable, cost-effective devices and networks of value to meet those needs, including for both the general scientific and research community and to government agencies seeking better ways to protect the public from chemical and biological incidents
4. Proposed designs and production of devices not now available or suitable for the above purposes
5. Recommendations for regulatory relief, especially for design, manufacture, and use of workshop-proposed wireless technologies for the above purposes
6. Recommendations for further work in these areas, and identification of potential collaborations and partners.

## **PROGRAM**

The first day consisted of half-hour presentations by users presenting some key needs and successes, and by technologists describing the state of the art and future developments. The second day was dedicated to creating a report describing the state of this field and the key steps that must be taken in order to make progress.

**Note about the Videos:** *The videos below can be played with either a Quicktime Player or a Real Player. You can either play them directly from the website or download them (use the right button with Windows machines and select the "Save Target as..." option).*

*You will probably get better results by downloading the videos you are interested in and playing them directly on your machine. The main videos are 25-35 MB in length and the Q&A videos are in the 5 MB to 10 MB range.*

*In most cases there was a clean separation between the presentation and the Q&A session that followed. In these cases you will see two videos listed. In some cases, there was no clean break so we just left everything in one video. The running time of the presentation and the Q&A session is just about 30 minutes in each case.*

Day 1

## **PART I -- USER PERSPECTIVES**

8:00 -- 8:15 Coffee, Registration

8:15 -- 8:20 **Welcome -- Syed Qadir**

Executive Director, National Response Center  
Acting Chair, Multi-Sector Crisis Management Consortium

8:20 -- 8:30 **Opening Remarks -- George Markowsky**

Chair Department of Computer Science  
Department of Mathematics/Statistics  
University of Maine  
Secretary, Multi-Sector Crisis Management Consortium

8:30 -- 9:00 **Crisis Management -- Capt. Dennis Egan**

Chief, Office of Command Control and Preparedness  
US Coastguard  
Member, Multi-Sector Crisis Management Consortium

9:00 -- 9:30 **Biological & Ecological Sciences -- Tim Kratz**

Associate Director for Trout Lake Station Center for Limnology  
University of Wisconsin-Madison

9:30 -- 10:00 **Environmental Monitoring & Public Safety -- Neil Gray**

Executive Director  
International Bridge, Tunnel, Turnpike Authority

10:00 -- 10:30 Break

10:30 -- 11:00 **Facility Monitoring -- Richard Holm**

Reactor Administrator  
Nuclear Reactor Laboratory  
University of Illinois

11:00 -- 11:30 **Communications -- David Hughes**

Partner  
Old Colorado City Communications

11:30 -- 12:00 **The Big Picture -- Larry Smarr**

Professor

Computer Science and Engineering Department

University of California San Diego

Director of the California Institute for Telecommunications and Information Technology

Universities of California at San Diego and Irvine

12:00 -- 1:30 Lunch

## **PART II -- TECHNOLOGY PERSPECTIVES**

1:30 -- 2:00 **Sensor Technologies and Applications -- David Nagel**

Research Professor

School of Engineering and Applied Science

George Washington University

2:00 -- 2:30 **Sensors -- The Present -- Gregory Bonito**

Research Assistant

Long Term Ecological Research Network Office

2:30 -- 3:00 **Communication Security -- Leslie Owens**

Founder and CTO

Vectara Innovations, LLC

Adjunct Assistant Professor, Georgetown University

Technical Editor, *Wireless Security Perspectives*

3:00 -- 3:30 Break

3:30 -- 4:00 **Power -- Robert Nowak**

Manager, Advanced Energy Technologies

DARPA

4:00 -- 4:30 **Medical Systems -- Jim Wilson**

WHO/NASA Ebola/Marburg/VEE Remote Sensing Projects

GDIN Infectious Diseases Working Group - Global Epidemic Intelligence and Disease

Forecasting Systems (GEIFFS)

Pediatrician, Georgetown University

4:30 -- 5:00 **Regulatory Issues -- William Lane**

Chief Technologist, Wireless Communications Bureau

Federal Communications Commission

5:00 -- 5:15 **Closing Remarks -- George Markowsky**

Slides

## Day 2

### **PART III -- WORKING GROUPS**

8:00 -- 8:15 Coffee

8:15 -- 8:30 **Organization of Groups -- George Markowsky**

8:30 -- 12:00 The **Technology Group**, chaired by David Nagel and the **User Group**, chaired by George Markowsky, will work through the material presented on Day 1 and organize it so needs and possibilities will be highlighted.

12:00 -- 1:30 Lunch

### **PART IV -- DRAFTING OF REPORT**

1:30 -- 2:30 **Presentations of Working Group Results** and discussion -- David Nagel, George Markowsky, group

2:30 -- 3:00 **Outlining of Final Report -- George Markowsky**

3:00 -- 3:30 Break

3:30 -- 4:00 **Outlining of Final Report -- George Markowsky**

4:00 -- 4:30 **Task Assignments -- George Markowsky**

4:30 -- 5:00 **Planning for the Next Workshop & Close -- George Markowsky**

### **IMPACT ON DISCIPLINE**

To the best of our knowledge, this is the first time that such a wide ranging group of scholars and practitioners is being assembled to look at all aspects of sensors and communication systems. This is driven by the unprecedented need to develop both a more robust scientific network and for the needs for greater homeland security. This workshop is also drawing international interest as you can see from the participation by Russian delegates. It is vitally important for us to better understand the capabilities that others have developed in this area.

### **DISSEMINATION OF RESULTS**

Information about the workshop will be presented through a web archive here at <http://homeland.maine.edu> and also at <http://www.msccmc.org>, which is the website of the Multi-Sector Crisis Management Consortium.

# Appendix D

**THE HOMELAND SECURITY LAB OF  
THE UNIVERSITY OF MAINE COMPUTER SCIENCE DEPARTMENT  
AND  
THE MULTI-SECTOR CRISIS MANAGEMENT CONSORTIUM**

**PRESENT**

**INTEROPERABILITY HEADING DOWN THE RIGHT ROAD**

**NOVEMBER 6, 2002 1:00 PM - 4:30 PM**

**SODERBERG CENTER, UM CAMPUS, ORONO**

The Soderberg Center is part of Jeness Hall. The link above takes you to a map of the campus that shows the location. For more detailed information about visiting the UM campus and parking go to <http://www.go.umaine.edu/visit.html>. The following material is found at <http://homeland.maine.edu>.

(This event will be broadcast over the Grid and will also be available via streaming video -- a link will be provided here on the day of the event.)

The events of a year ago have placed a renewed emphasis on interoperability. As the following excerpt from **America Still Unprepared - America Still in Danger**, a report prepared under the auspices of the Council on Foreign Relations (released October 24, 2002) states:

"In virtually every major city and county in the United States, no interoperable communications system exists to support police, fire departments, and county, state, regional, and federal response personnel during a major emergency. Radio frequencies are not available to support the post-incident communication demands that will be placed on them, and most cities have no redundant systems to use as backups. Portable radios will not work in high-rise buildings unless the buildings are equipped with repeater systems. Most U.S. cities have separate command-and-control functions for their police and fire departments, and little to no coordination exists between the two organizations. Furthermore, with few exceptions, first-responder commanders do not have access to secure radios, telephones, or video-conferencing capabilities that can support communications with county, state, and federal emergency preparedness officials or National Guard leaders."

On July 3, 2002, Governor Jeb Bush today that Florida received the first of nine portable interoperable communications systems that will improve the coordination of emergency responders in the event of a disaster or crisis situation. The nine Emergency Deployable, Interoperable Communications System (EDICS) field packages will be assigned to the State Division of Emergency Management, Florida Department of Law Enforcement, and the seven Regional Domestic Security Task Forces. Funding for the communications equipment is a small part of a \$9-million dollar, U.S. Department of Justice, Domestic Security grant that provides for emergency response equipment.

What is driving unified command models? How can incident managers execute multi-layered emergency response and consequence management plans? When the quick surge in resources and manpower happens, what will hold it together and keep it on track? In small rural towns where mutual aid is a long established practice, what needs to happen to take this to the next level? These are just some of the questions that need to be asked, while the answer is not interoperability alone. However, interoperability is a



vital ingredient in a successful game plan. During this virtual symposium, top experts will explore ways in which interoperability can be achieved, what tools might work, what programs are in motion, and where we are heading.

1:00 PM **George Markowsky**, chair of the UMaine Computer Science Department will open this session.

Moderator **Peter J. Brown**, is a Maine-based freelance writer who specializes in satellite communications. He is serving on a voluntary basis as a satellite technology and communications advisor to the multi-agency team, which is creating and implementing the homeland security strategic plan for the state of Maine. Mr. Brown will give a quick overview of the subject to be addressed, the speakers and their topics. He will then introduce the first speaker.

1:10 **John P. Caruso** is the chief of the executive agent (EA) for Theater Joint Tactical Networks Action Office (EA-TJTN) at the US Army Communications-Electronics Command (CECOM) at Fort Monmouth, New Jersey. Mr. Caruso currently chairs two DoD forums including the Theater Joint Tactical Network Configuration Control Board (TJTN-CCB) which coordinate unified-command, military-service, and Defense-agency programs for joint interoperability assurance purposes. He also directs the conduct of an annual joint networked-communications exercise of considerable size designed to experiment with and assess various notional concepts, interfacing schemes, untried network arrangements, new technologies, emerging systems, and operational approaches in hybrid joint networks, simulating deployed joint communications operations while focusing on joint networked-system interoperability.

Mr. Caruso will discuss what went on during the 2002 Joint Users Interoperable Communications Exercise or JUICE, and what is on tap for next year. JUICE is an annual exercise designed to resolve interoperability issues throughout the DoD's tactical networked-communications community. The exercise is focused on developing near-term practical solutions to interoperability shortfalls in tactical networked communications. Exercise alignment with Joint Forces Command (JFCOM) has broadened to include Joint Task Force Civil Support (JTF-CS) and the Federal Emergency Management Agency (FEMA) planning activities, as well as their operational requirements. This exposure has advanced the DoD's capability to support Homeland Security planning processes and execution requirements.

1:30 **Gene Davenport** serves as telecommunications manager for the Federal Emergency Management Agency (FEMA) Mobile Emergency Response Support (MERS) in Denton, Texas. Mr. Davenport will discuss interoperability with the federal government during disasters, Weapons of Mass Destruction (WMD), or terrorist incidents. He will focus on FEMA's deployment of the MERS comprehensive telecommunications support system, and its links to the local incident command via Civil Support Team, Crisis Management Center (FBI), Consequence Management Center (FEMA) and Joint Forces Command - Civil Support (JTF-CS) (DOD).

1:50 **John W. Loonsk**, M.D. works at the Centers for Disease Control and Prevention (CDC) in Atlanta where he is Associate Director for Informatics and Director at the Information Resources Management Office, the CDC's central information technology organization. He received his medical training at the State University of New York at Buffalo after graduating from the Johns Hopkins University. At the State University of New York at Buffalo, he implemented the first mandatory course in the US in medical informatics for medical students. At the University of North Carolina at Chapel Hill, he oversaw the development of an electronic learning and decision support environment, which included the electronic resources of the Health Sciences library, the medical school curriculum and the Internet. Since joining the CDC in 1999, he has become instrumental in the planning and development of the National Electronic Disease Surveillance System (NEDSS). In 2000, he was named CDC Associate Director of Informatics and assumed responsibility for the CDC's Information Resources Management Office.

Dr. Loonsk will focus on the Public Health Information Network (PHIN) which will connect the diverse groups participating in public health using standards-based collaboration, communications and alerting capabilities. PHIN is a live, secure, Internet-based network for exchanging comparable critical health information between all levels of public health (local, state and federal) and other critical information systems (clinical care, laboratories, first responders, etc.). Improved data analysis and visualization including automated algorithms for event detection will aid in more timely public health decision-making.

2:10 **Ross Merlin**, Telecommunications and Information Resources Manager at the U.S. Public Health Service Office of Emergency Preparedness, will discuss interoperability from the standpoint of his group's emergency response plans.

**Contact Information**

Ross Merlin  
US Dept. of Health and Human Services  
Office of Emergency Response  
Suite 360, 12300 Twinbrook Pkwy  
Rockville MD 20857  
Tel. 1-800-872-6367 x925  
E-mail [RMERLIN@OSOPHS.DHHS.GOV](mailto:RMERLIN@OSOPHS.DHHS.GOV)

2:30 Brief Intermission

2:40 **Robert E. Lee, Jr.** has more than thirty years experience in public safety, and he currently serves as the Public Safety Wireless Network (PSWN) Program Manager for the Department of Justice. A Supervisory Special Agent with the FBI, Mr. Lee has been with PSWN since June 2001. He has served as an instructor both at the FBI National Academy at Quantico, Virginia and at the International Law Enforcement Academy in Budapest, Hungary. He presently serves on the Law Enforcement Liaison Council of the American Society of Industrial Security (ASIS) and the Communications and Technology Committee of the International Association of Chiefs of Police (IACP).

Mr. Lee will provide an overview of the PSWN Program, the program's view of interoperability, success stories, and current assistance projects. Lee will outline a series of steps that government officials can take to enhance interoperability. In existence since 1996, PSWN is a joint program of the U.S. Department of Justice and the U.S. Department of the Treasury, which promotes interoperable communications solutions for Public Safety at all levels of government.

3:00 **Michael Skurla** is the Chief of Combatant Command Integration and Interoperability Initiatives, Combatant Command Interoperability Program Office (CIPO), US Army Communications Electronics Command (CECOM). His duties include developing and assisting in the execution of technical objectives that advance the Combatant Command's Command, Control, Communications, Computers, Intelligence, Electronic Warfare and Sensors (C4IEW&S) capabilities and to ensure that all Service C4ISR systems provide fully integrated / interoperable command and control capabilities to the joint forces. Previously, he was assigned to the Army's Program Executive Office Command, Control, and Communications Systems (PEO C3S), and he has provided system and software engineering support on network management systems, tactical radio systems and Special Operation Forces programs.

Michael Skurla will provide an overview on the National Emergency Support Center that is being proposed as a foundation element in DoD's efforts to build an integrated military strategy to support our national Homeland Security effort. A key element of this national strategy is the ability to leverage and make available to the civilian disaster response community the large and largely untapped (from a technology transfer perspective) military technology baseline together with the Department of Defense material acquisition, training and support infrastructure to provide effective, high quality, affordable, interoperable equipment, training, and support to civil First Responders. One goal is to address known critical shortfalls in equipment and technology assets, information fusion, and communication architectures at all First Responder levels - local, multi-state, and national.

3:20 David R. Beering, is the Principal Partner of Infinite Global Infrastructures, LLC, based in Chicago. IGI's current work focuses on the design, integration, and deployment

Mr. Beering will discuss trends in fixed and mobile satellite systems with regard to protocols, bandwidth efficiency and spectrum allocation. With the rapid proliferation of federal-owned and municipal-owned mobile / portable satellite and wireless systems, specific discussion will focus what needs to happen in order to support the rapid evolution of satellite, and, wireless systems and services. Mr. Beering will identify ways to provide for the maximum level of cooperation and interoperability among users of these new systems.

3:40 Richard Wolf is executive vice president, and, director of sales and marketing at Wolf Coach In Auburn, Massachusetts. He has been a part of Wolf Coach since the late 1960's, working in the manufacturing area and rising to the level of President. Wolf Coach is well-known for its innovative work in the area of mobile platforms designed to provide communications support to law enforcement and governmental agencies at all levels. For example, Wolf Coach recently delivered two mobile satellite uplink vehicles to the Connecticut State Police. Wolf Coach also built the 32 Unified Command Suite (UCS) - Communications Vans which are used by Civil Support Teams in numerous states as part of their WMD response capabilities, and five Enhanced Multi Radio Vehicles (EMRV's) for FEMA.

Mr. Wolf will discuss the best ways to leverage existing technologies to provide current day solutions to the First Responder on the ground, wherever that is and to enable the First Responder to reach back for support from wherever it is available. An assortment of communications pipelines is available today to work in the immediate area, or, on a regional or on a nationwide basis. The need for speed, the set up time involved, how robust the path has to be, and how many pipelines are needed will all factor into the decision making process.

4:00 Randall Berry is the Fire Chief for the Town of Livermore, Maine (population 2000), where he has been a firefighter for approximately 25 years. Until recently, he also served as the Town's Emergency Management Director. He serves in the Maine House of Representatives, and he is the House Chair of the Joint Standing Committee on Appropriations and Financial Affairs. He is a member of the Emergency Response Team at Wausau-Mosinee Paper Corporation where he is employed as a papermaker.

Chief Berry will discuss challenges at the local level of effective inter-agency communications from his own perspective. He will examine coordination with mutual aid departments and other emergency response agencies, along with funding, geography and other challenges for a fire chief. He will also discuss comprehensive planning efforts, and how these can be undertaken in light of the adverse economic climate in many states. He will explore ways in which states can invest and bring about effective improvements in interoperability.

4:20 Closing Remarks

## APPENDIX E

### Activities at the Fogler Library of the University of Maine

#### Marilyn Lutz

Director, Information Technology Planning  
Fogler Library, University of Maine

The past two decades have been a time of tremendous social, economic, and institutional change for all sectors of higher education, including the research library. In a world that has come to be dominated by distributed computing, the Internet, and the World Wide Web, many individuals and institutions have the basic capabilities of publishing and creating “libraries.” In response to this dramatic change, Fogler Library has embraced new technologies and a collaborative role, while sustaining traditional functions of collecting, organizing and preserving. The emerging role of the library is based in part on existing functions, but it also represents a fundamentally new role for the academic library. *Internet 2 has made it possible for Fogler Library to shift with the change and realize a distinct identity in the digital age, while contributing to the definition and shape of the digital library.*

Rather than being defined by its collections or the services that support them, Fogler Library has initiated a plan in which the library becomes more deeply engaged in the fundamental mission of the University, that is, the creation and dissemination of knowledge. The Library, as a collaborator within and outside the institution is able to produce digital content with new partners, and is integrating and representing the content in a larger access system made possible with Internet 2. Fast connections and responses from the servers, and the ability to transfer extremely large, interactive, multimedia files has positioned the Library to obtain funding for such initiatives as:

- The Maine Music Box --- a collaborative project among the University of Maine, the Bagaduce Music Lending Library and the Bangor Public Library to deliver a multimedia archive and instructional tool to access scores, sheet music and associated audio files. This project grew out of the Library’s desire to leverage its investment in information technology infrastructure by supporting access to significant public library music collections in a digital learning environment for educators, scholars and students. The OAI compliant database will be linked to a national repository of harvested metadata for other sheet music collections.
- In collaboration with Hudson Museum and the University Museum of Art, the Library has created images of the museum. Art images will be made accessible through a virtual gallery. The Hudson Museum will use its digital files to develop online educational programs that will be delivered statewide.

The Library’s traditional collection development and management responsibilities are giving way to new variations of this expertise: creating digital content, providing access to digital content the

Library neither owns nor manages, preserving and archiving content that is not accessible to users, serving as an access portal for digital datasets, and hosting services for other campus units. High speed Internet access is the underpinning for this evolution of the Library's role.

- The Library delivers statewide access to the full text of licensed resources for all libraries and any Maine citizen located anywhere in the state. For the business, scientific and technology community, the Library delivers access to specialized digital content. The speed of the Internet enhances the usefulness of these resources to users.
- PEARL, the Maine on-line GIS-based environmental information resource is hosted on the Library's servers. The Library is a key collaborator in this project to collect environmental data from distributed sources statewide and regionally. The goal is to create an integrated, map-based, information and monitoring resource for environmental information ranging from precipitation to groundwater, biodiversity information to the coastal monitoring program. PEARL is a facilitator for lake research, monitoring, and education activities statewide.
- Fogler Library's Listening Center Online provides access to music that supports the music curriculum of the University of Maine. Music included in the database is selected from the Compact Disc collection in Fogler's Media Resource Center and converted to MP3 format for online access. Currently, the collection includes over 6,000 jazz and classical tracks, which are streamed on demand throughout the campus.

The Library is becoming more engaged in the publishing process, including content presentation, management, and distribution policies and practices. This moves the Library closer to the point of creation and distribution in the publishing process and broadens its functions beyond archiving and mediation for published works. Fogler Library is carrying out publishing ventures in partnership with other organizations, combining expertise in information dissemination and use with a partner's editorial skills.

- The Cooperative Forestry Research Unit (CFRU) is a partnership between forest landowners and managers in the state of Maine and the University of Maine. The purpose of the CFRU is to help its member organizations advance forest management practices in the state of Maine through scientific research and education. Fogler Library has digitized CFRU's publication list of annual, research and management reports and delivers full text documents to the desktop statewide. A similar project is underway with the Agricultural Experiment Research Station.

Fogler Library is creating a knowledge network that integrates distributed and heterogeneous information sources through a common portal. By continuing its descriptive role and using new virtual mechanisms to convey context for users, the Library can continue its traditional trusted role as a signifier that the resource or collection has been examined and formally described, and that a decision has been made about inclusion.

- The Library is implementing a federated search tool that will simultaneously search and return results from local catalogs, catalogs in all the New England Land Grant universities,

full text resources indexed in databases, content specific web sites --- resources located anywhere on the Internet, and automatically pass the user through a network of context sensitive links. Vital to the success of this research tool is the speed of the network.

- The Library is seeking funding for “Windows on Maine History,” a project that will create an interactive “encyclopedia” of Maine’s history by developing learning modules that exploit the use of broadband technologies. The project will create an archive that will deliver educational programming drawing on the content from libraries, museums, and public radio. Live and pre-recorded educational presentations, museum tours, and unique collections that document the history of Maine will be available on demand.

Fogler’s digital library supports more distributed approaches to user services, extending traditional services in the networked world to a broader set of user needs that can only be addressed in systems of user support that depend on a dynamic, robust telecommunications network.

- Electronic reference is a multi-institutional service that is collaboratively staffed to deliver 24x7 reference service to library patrons. In partnership with libraries across the country (Washington University) and around the world (libraries in Australia), library staff will offer reference service online that includes real-time chat, full co-browsing, and complete email reference capability. Reference librarians converse directly with patrons as they guide them through Web sites and other online resources or respond to inquiries. E-Reference is a vital part of the Library’s online presence.