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ANYWHERE, ANYTIME, ANYSIZE, ANY SIGNAL: Scalable Remote Information Sensing and Communication Systems

George Markowsky Principal Investigator; University of Maine, Orono, markov@maine.edu

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Final Report for Period:01/2002 - 08/2005Principal Investigator:Markowsky, George

Submitted on: 01/13/2006 Award ID: 0210619

Organization: University of Maine

Title:

ANYWHERE, ANYTIME, ANYSIZE, ANY SIGNAL: Scalable Remote Information Sensing and Communication Systems

Project Participants

Senior Personnel

Name: Markowsky, George Worked for more than 160 Hours: Yes Contribution to Project:

Name: Bonito, Gregory

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm. Actually, over 50 people participated in the two workshops.

Name: Egan, Dennis

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Holm, Rich

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Hughes, Dave

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Kratz, Tim

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Lane, William

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Nagel, David

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Nowak, Robert

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Owens, Leslie

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Smarr, Larry

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Wilson, Jim

Worked for more than 160 Hours: Yes

Contribution to Project:

Speaker. Presentations and videos are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Brett, George

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Chritton, Michael

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Fall, Kevin

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Franz, David

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Gamble, Kevin

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Gilmore, James Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Morley, Richard

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the first and second reports which are available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Chepponis, Michael

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the second report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Cook, Gordon

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the second report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Gao, Robert

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the second report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Hendricks, Dewayne

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the second report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Lopez-Anido, Roberto

Worked for more than 160 Hours: Yes

Contribution to Project:

Contributor to the second report which is available on the website that I set up for this workshop: http://homeland.maine.edu/anywhere.htm.

Name: Thot-Thompson, Janet Worked for more than 160 Hours: Yes Contribution to Project: Participated in writing the first report.

Post-doc

Graduate Student

Undergraduate Student

Technician, **Programmer**

Other Participant

Organizational Partners

Other Collaborators or Contacts

Activities and Findings

Research and Education Activities:

We produced many hours of video, one extensive report, many slide presentations and a summary of recommendations. For details see http://homeland.maine.edu/anywhere.htm.

Findings: (See PDF version submitted by PI at the end of the report)

We produced many hours of video, one extensive report, many slide presentations and a summary of recommendations. For details see http://homeland.maine.edu/anywhere.htm.

Training and Development:

We produced many hours of video, one extensive report, many slide presentations and a summary of recommendations. For details see http://homeland.maine.edu/anywhere.htm.

Outreach Activities:

1. I have maintained a website since the first workshop.

2. The website contains videos of all the presentations along with the powerpoint presentations.

3. We published the first report and distributed hundreds of copies, along with a CD that contains all the videos and powerpoint presentations.

4. We had a second workshop that produced a series of recommendations which we will upload and also display on We produced many hours of video, one extensive report, many slide presentations and a summary of recommendations. For details see http://homeland.maine.edu/anywhere.htm.

5. I traveled to the IDAACS 2005 meeting held in Sofia Bulgaria in September 2005 and ran slides from the first workshop and distributed copies of the first report.

6. I traveled to the TEHOSS 2005 meeting held in Gdansk Poland in October 2005 and ran slides from the first workhop and distributed copies of the first report.

7. I created a video presentation setup in my homeland security lab to feature the presentations and videos generated by the workshops.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Product Type: Audio or video products Product Description: We produced videos of all the presentations and these are available on http://homeland.maine.edu/anywhere.htm. Sharing Information: Available on http://homeland.maine.edu/anywhere.htm. Also, hundreds of copies were distributed on CDs.

Contributions

Contributions within Discipline:

The materials on http://homeland.maine.edu/anywhere.htm provide a good overview of how field scientists and homeland security scientists have many concerns in common. Our workshop inspired a workshop held under the auspices of polar programs, for which I was asked to assist.

Contributions to Other Disciplines:

We had some influence on a polar workshop.

Contributions to Human Resource Development:

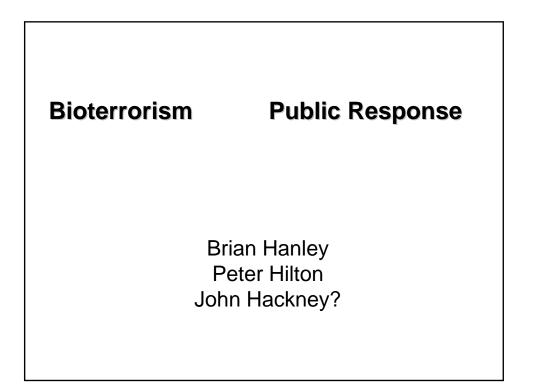
Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Categories for which nothing is reported:

Organizational Partners Any Journal Any Book Contributions: To Any Human Resource Development Contributions: To Any Resources for Research and Education Contributions: To Any Beyond Science and Engineering



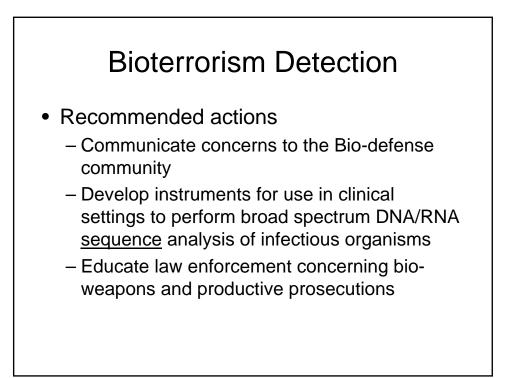


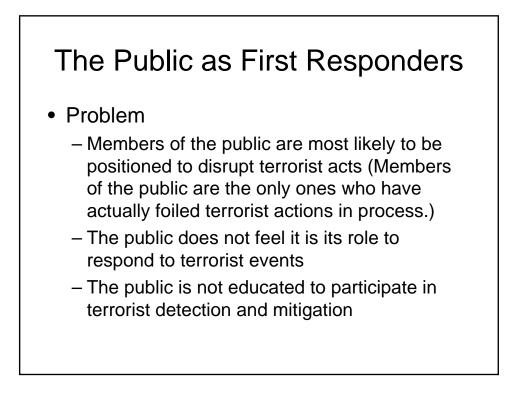
Bioterrorism Detection

- Next Problem engineered viruses (designer biological super weapons)
 - Current detection is observations of fatalities
 - Delayed fatality enables near 100% penetration of population
 - Many alternatives available
 - Limited cost and resources required



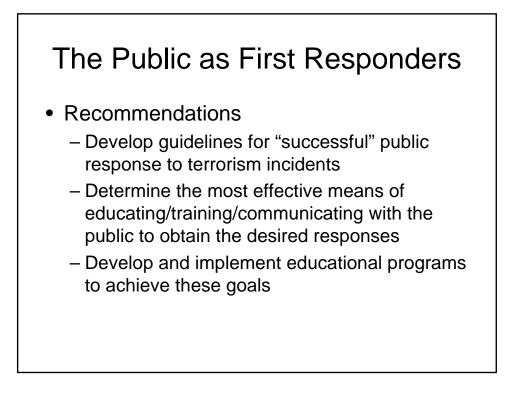
- Needs
 - Detection of designer viruses and forward projection of possible effects on victims, particularly relative to potential fatalities
 - Responses appropriate to virus sanitation and quarantine
 - Education of bio-defense community about designer bio-weapons
 - Education of healthcare community

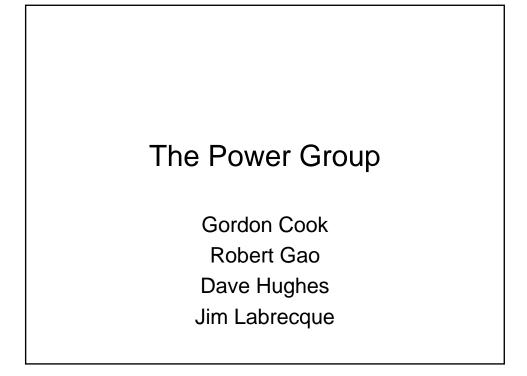


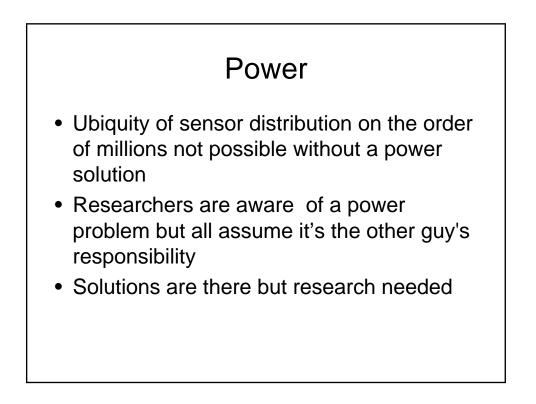


The Public as First Responders

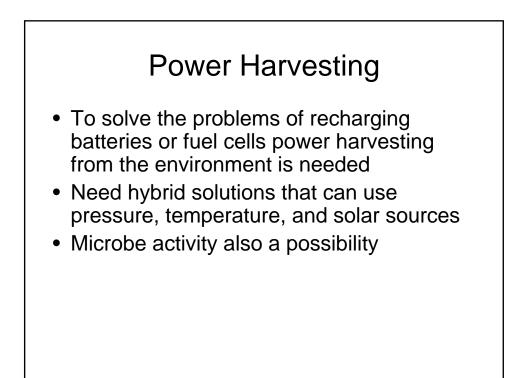
- Needs
 - Determine what the public should know and how they should respond to terrorist actions in various contexts
 - Position the public to be able and inclined to respond to mitigate terrorism events





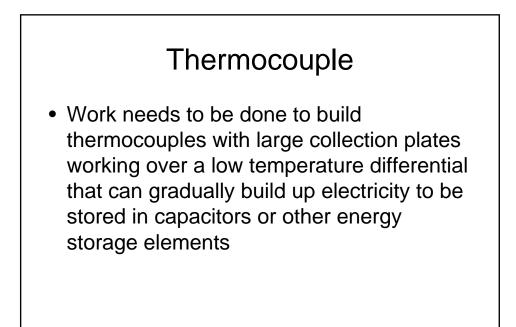


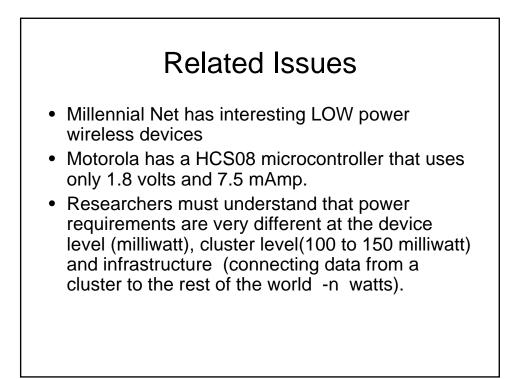
Fuel cells are becoming practical Case Western Reserve has small cells that can produce 10 mw using hydride fuel at one atmosphere of pressure Fuel cells demand replacement or recharging which creates a problem of scaling They do last longer than batteries and can deliver tiny long lived power sources Power density is higher

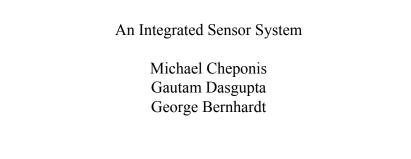


Pressure Differential as a Means of Power Harvest

- Injection molding at u mass amherst using piezo ceramic chip has been demonstrated
- Mathematical calculations show that it is theoretically possible to use small changes in atmospheric pressure to generate small amounts of electricity that can be stored in a capacitor
- Using a membrane driven piezo device
- Research needs to be done to determine wide scale feasibility & cost





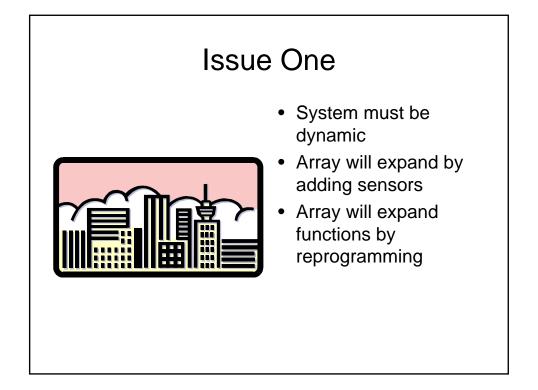


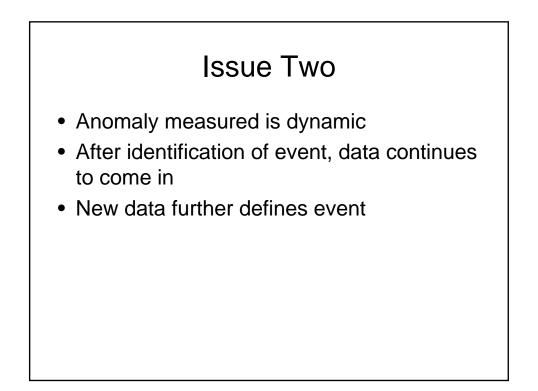
Outline

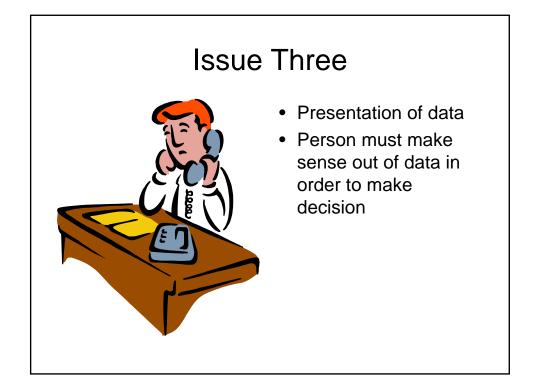
- Characteristics of Integrated System
- Issues needing consideration
- Recommendation

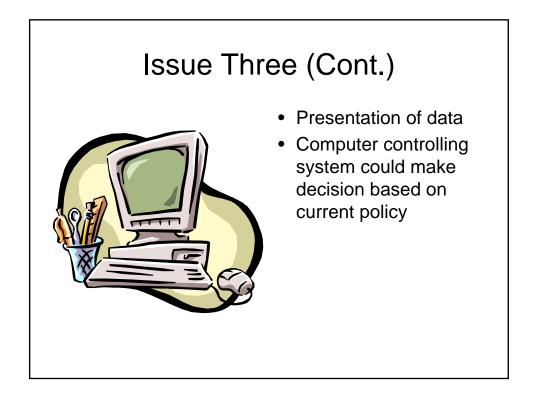
Characteristics

- Array will have many sensors measuring different fundamental quantities
- Redundant Array
- Searches for anomalies (∆x not x)
- Secure information



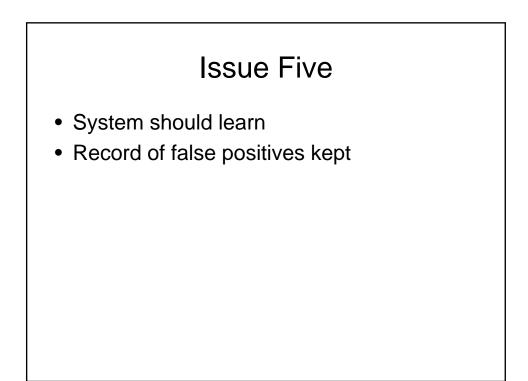


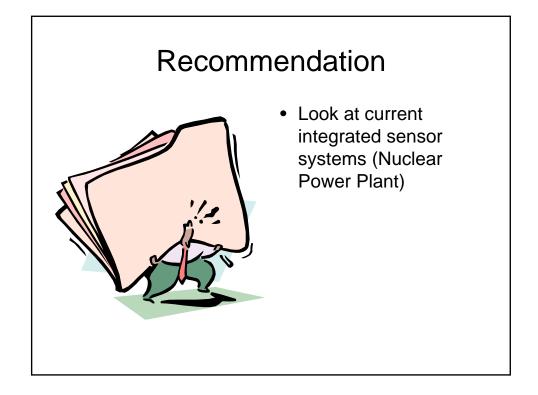




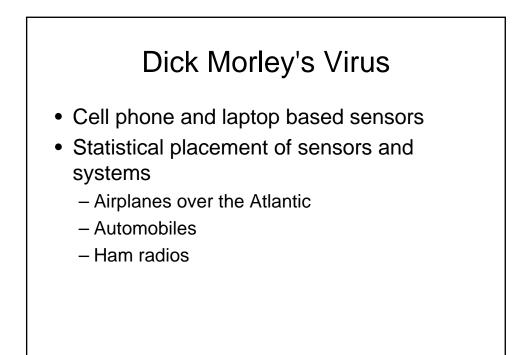
Issue Four

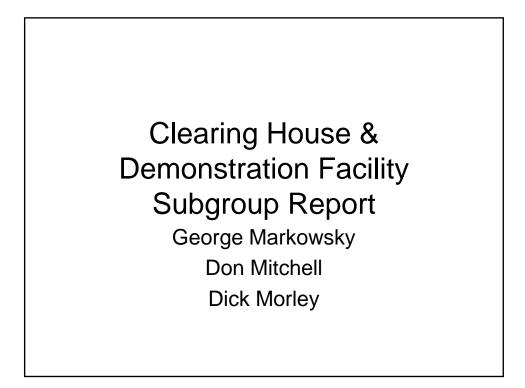
- System does not have to be for homeland security
- Could be safety/security system
- Homeland Security is an auxiliary use











Outline

- A Clearing House?
- A Demonstration Facility?
- The Importance of Persistence
- Building Communities
- Recommended Implementations
- Conclusions

A Clearing House?

- Center dealing with current information related to sensors, communication technology, and power, as used in field science, homeland security and citizen safety
- Include as much information as possible, references to current information – should include sources of supply
- Tools for searching information
- Will service the first responder, academic, international, government, consumer, industrial sectors

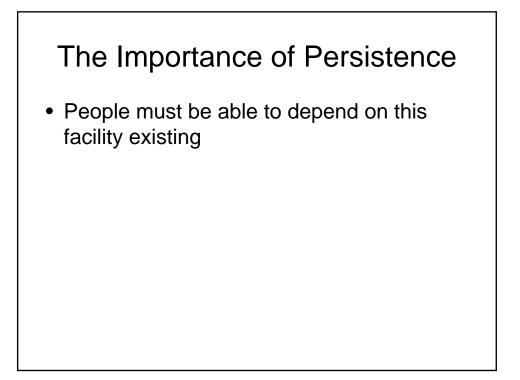
A Clearing House?

- Distributed
- Mechanism for building communities

A Demonstration Facility? A place where people can come and have hands-on experience with applicable technologies. Vendors can come, test, demonstrate and develop their wares in-situ. Consumers, e.g., first responders, can test procedures and technologies. It is a environment where equipment is tested and demonstrated physically. Prototype to set the stage for others. Mobile centers.

Characteristics of a Demonstration Facility

- Should be able to test marine and landbased systems
- Should have adequate land area for serious demonstrations

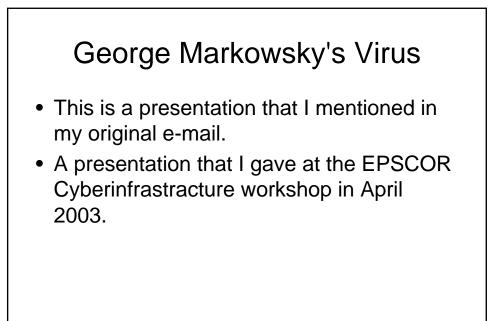


Building Communities

- Tending to existing communities
- Build a new community to get different groups

Recommended Implementations

- Establish a clearing house with the initial prototype in a university environment
- Figure out a strategy for long-term support of the clearing house (at least 5 years)
- Establish a demonstration facility at an appropriate group of locations
- Figure out a strategy for long-term support of the demonstration facility (at least 5 years)



Global Connectivity

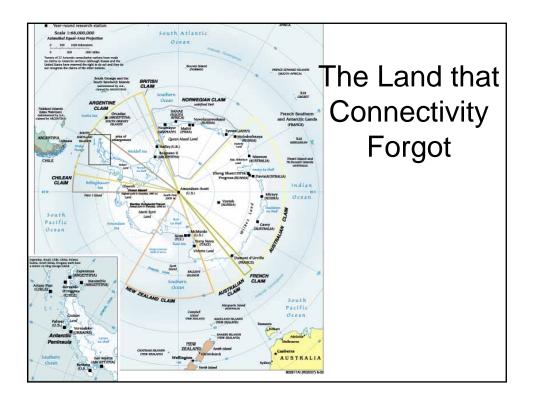
George Markowsky, Chair Department of Computer Science Department of Mathematics & Statistics University of Maine

Connectivity & The Atkins Report

 (p. 35) Networks -- A major shift in computing has come from the practical availability of high-bandwidth data networks. Network connections up to 45 megabits are easily available, connections over 155 megabits/s are still aggressive, and some research institutions are beginning to connect at 2.5 Gb/s and faster.

The Picture for Field Science is not that Rosy

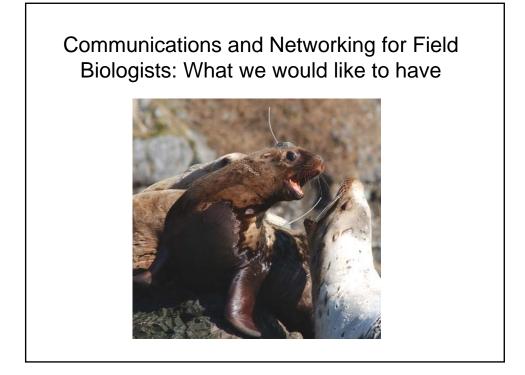
- Just concluded an NSF-sponsored workshop between OPP (Office of Polar Programs) & CISE entitled -- Polar Science and Advanced Networking
- Connectivity is a real issue for polar research programs
- Antarctica & the Arctic are continental in size with marginal connections to the rest of the world

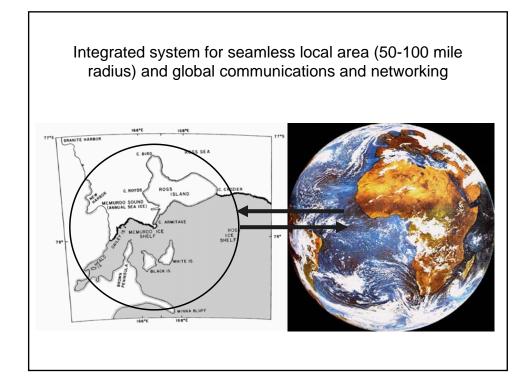














Motivation

The Problem

• Long term observed rise in sea level

Devastating consequences of sea level rise on populated coastal areas

The Need

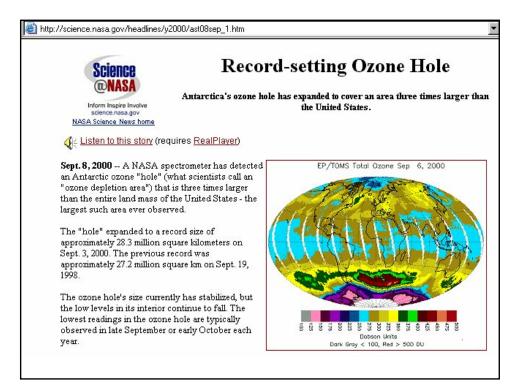
• Accurate determination of mass balance (the net gain or loss of glacial The Approach ice)

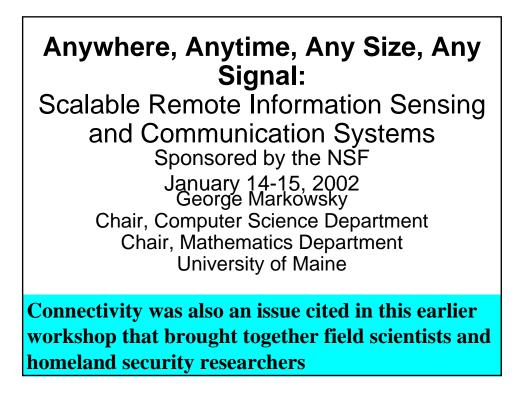
internal dynamic processes that control mass balance



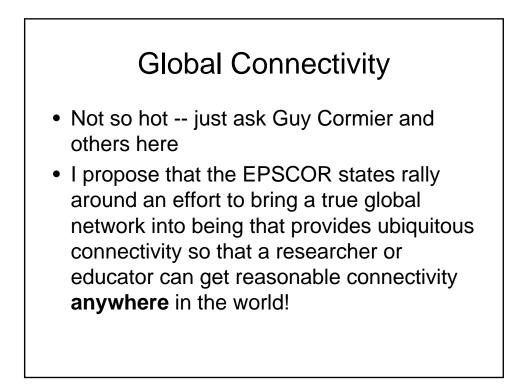
ice) • Design and develop intelligent radar sensors • Establish a better understanding of for polar ice sheet measurements

• Implement a mobile data collection system that relies on robotics and innovative information technology.









The Atkins Report

 (ES 2) The emerging vision is to use cyberinfrastructure to build more ubiquitous, comprehensive digital environments that become interactive and functionally complete for research communities in terms of people, data, information, tools, and instruments and that operate at unprecedented levels of computational, storage, and data transfer capacity.

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	International Polar Year IPY-2007
About Support Newsroom Events Resources For Scientists Images	site map home Austrian Navy Lieutenant Karl Weyprecht after a cruise in the Barents Sea aboard TEGETHOFF became convinced that scientific study should take preference over exploration and began a campaign that led to the International Polar year (IPY) form 1882-1883. This was followed by a second polar year during the years 1932 to 1933 that was significantly reduced due to the undefinite dominant during during the years 1932 to 1933 that was significantly reduced
Contact Kasa GSFC home	due to the worldwide depression during these years (<u>www.arctic.at</u>). The third IPY evolved into the International Geophysical Year (IGY) 1957-1958 with a broader geographical scope. June 24-26 an international symposium on Perspectives of Modern Polar Research, was convened in Bad Durkeim, Germany to celebrate the 175th anniversary of the birth of Georg von Neumayer . Arising from the participant discussions was a strong consensus that a program should be formulated to commemorate the 125th anniversary of the IPY (International Polar Year) in 2007.

