Implementing Cyberinfrastructure In Support Of Greenland And Antarctic SAR Data Sets

Elizabeth City State University

Dr. Linda Hayden

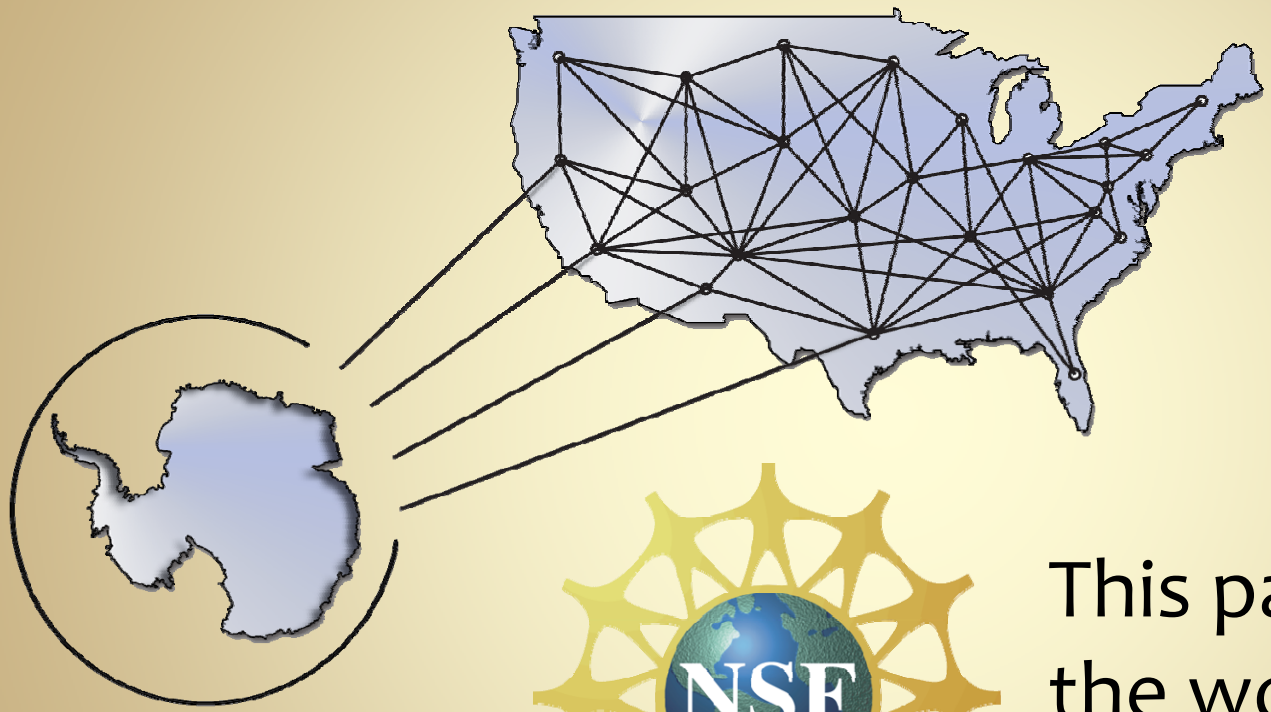
haydenl@mindspring.com

Mr. Anthony Adade

akadade@mail.ecsu.edu

TeraGrid™

Polar Grid



This paper will detail the work of the Polar Grid project

Polar Grid

The Polar Grid project is the designing and building of the hardware and software for Polar Grid, which supports data analysis and simulations for Polar Science.

Polar Grid

Polar Grid is a National Science Foundation (NSF) Major Research Instrument (MRI) funded partnership of Indiana University and Elizabeth City State University.

Key Areas

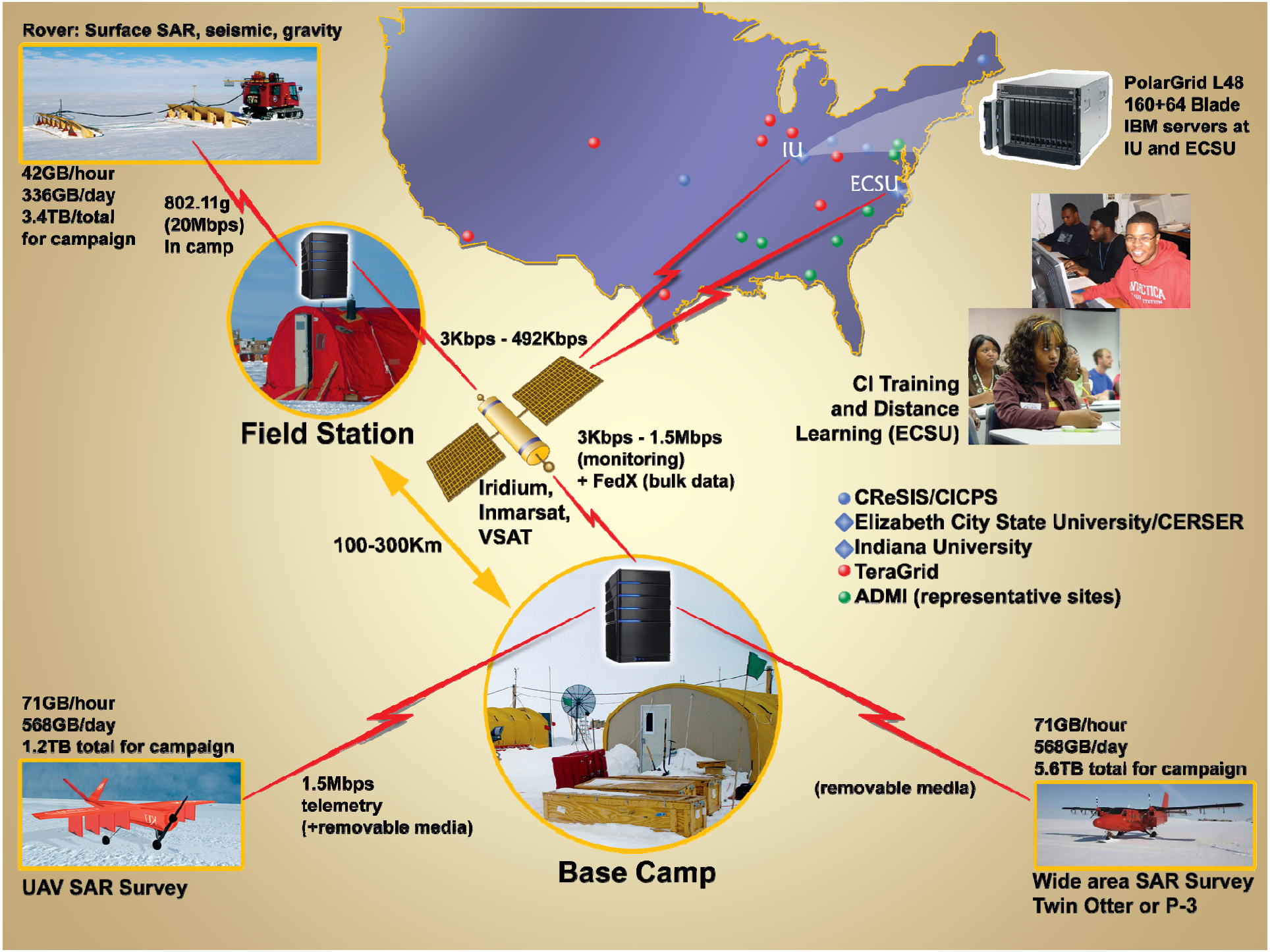
The Polar Gird implementation and development focuses on the following key areas:

- Field data collection system to be taken with the Polar Science researchers as they collect data.
- A base camp 64-core cluster, allowing near real-time analysis of radar data by the polar field teams.
- An educational videoconferencing Grid to support educational activities.

Key Areas

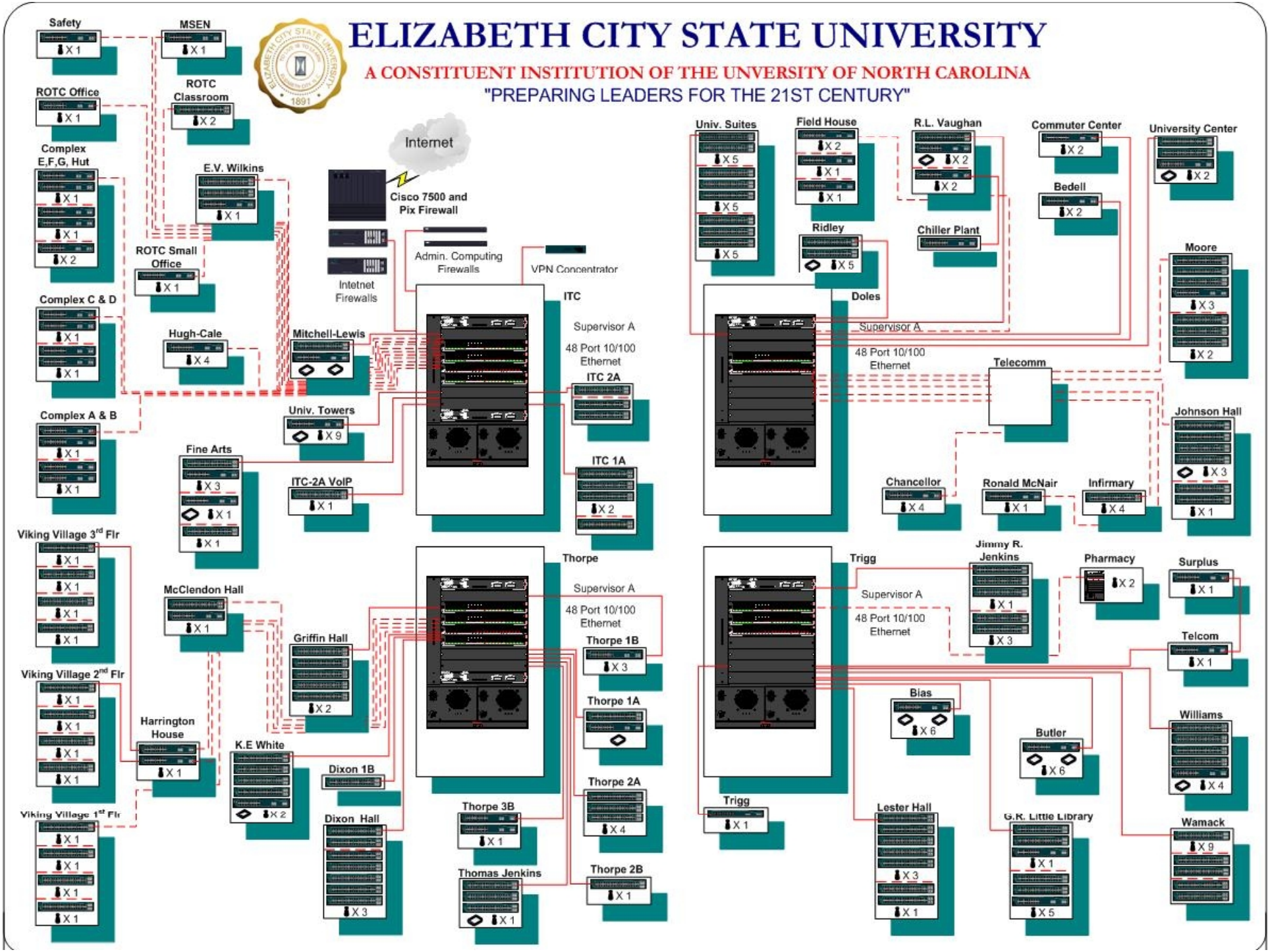
continued…

- A large 17 Teraflops cluster to be integrated with the NSF-funded TeraGrid, to serve the polar research community in final processing of data and supporting simulations. This is split between IU and ECSU to support research and education training respectively.
- The implementation of new improvements to the speed and capabilities of ice sheet models, and implementation of web portals to make the data, data products, and resources easily accessible to the polar research community.
- Is seen to add value to the business


Rover: Surface SAR, seismic, gravity
42GB/hour
336GB/day
3.4TB/total
for campaign
802.11g
(20Mbps)
In camp
IU
ECSU
PolarGrid L48
160+64 Blade
IBM servers at
IU and ECSU
CI Training
and Distance
Learning (ECSU)
3Kbps - 492Kbps
Field Station
3Kbps - 1.5Mbps
(monitoring)
+ FedX (bulk data)
Iridium,
Inmarsat,
VSAT
100-300Km
CReSIS/CICPS
Elizabeth City State University/CERSER
Indiana University
TeraGrid
ADMI (representative sites)
71GB/hour
568GB/day
1.2TB total for campaign
1.5Mbps
telemetry
(+removable media)
(removable media)
71GB/hour
568GB/day
5.6TB total for campaign
Base Camp
UAV SAR Survey
Wide area SAR Survey
Twin Otter or P-3

Involvement of ECSU's IT Department

Elizabeth City State University
Network Infrastructure

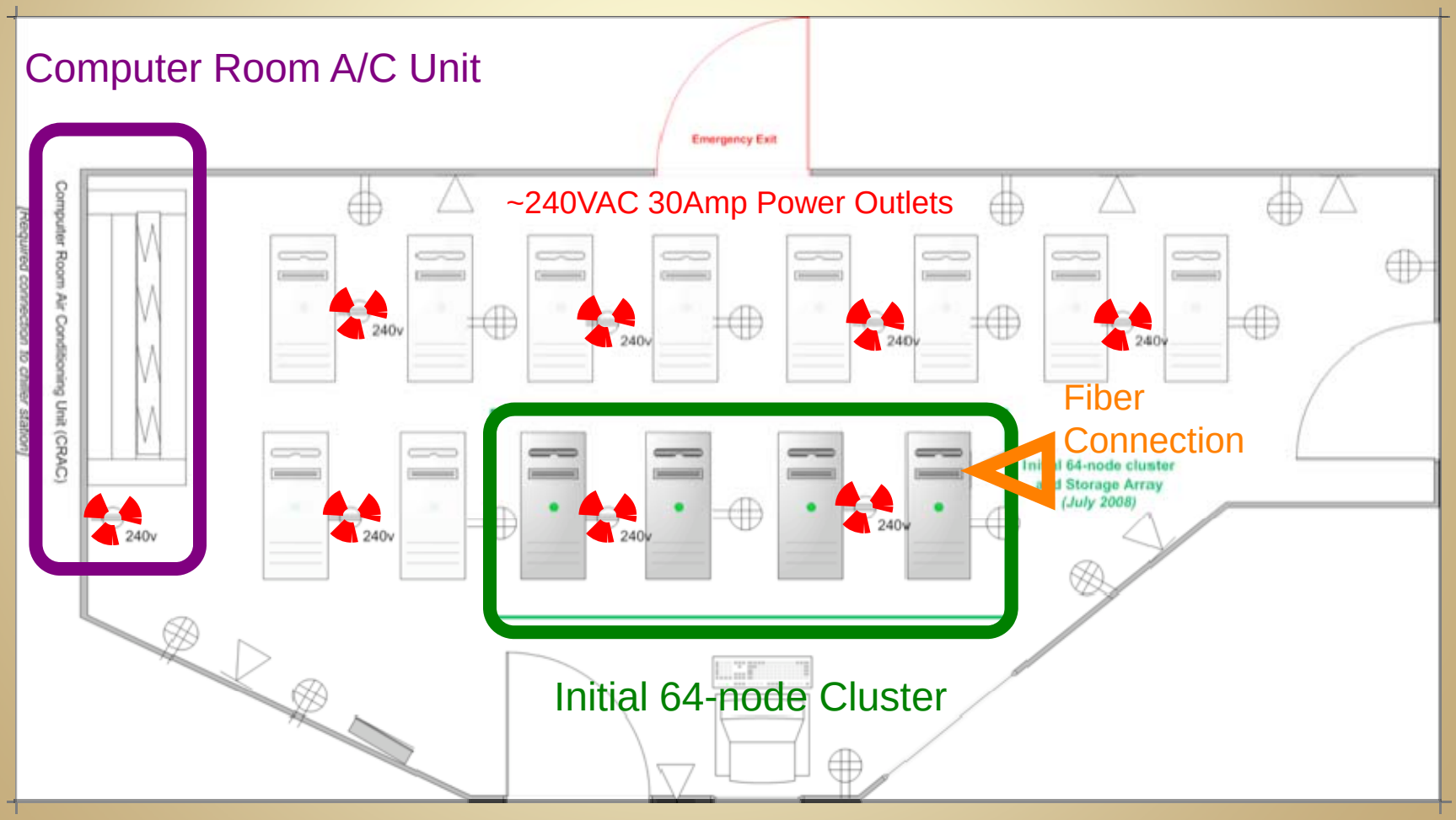

ELIZABETH CITY STATE UNIVERSITY
A CONSTITUENT INSTITUTION OF THE UNVERSITY OF NORTH CAROLINA
"PREPARING LEADERS FOR THE 21ST CENTURY"
Internet
Cisco 7500 and Pix Firewall
Intetnet Firewalls
Admin. Computing Firewalls
VPN Concentrator
ITC
Supervisor A
48 Port 10/100 Ethernet
ITC 2A
ITC 1A
Thorpe
Thorpe 1B
Thorpe 1A
Thorpe 2A
Thorpe 2B
Thorpe 3B
Thomas Jenkins
Doles
Ridley
Univ. Suites
Field House
R.L. Vaughan
Chiller Plant
Commuter Center
Bedell
University Center
Moore
Johnson Hall
Telecomm
Chancellor
Ronald McNair
Infirmary
Trigg
Jimmy R. Jenkins
Pharmacy
Surplus
Telcom
Bias
Butler
Williams
Wamack
Lester Hall
G.K. Little Library
Safety
MSEN
ROTC Office
ROTC Classroom
Complex E,F,G, Hut
E.V. Wilkins
ROTC Small Office
Complex C & D
Hugh-Cale
Mitchell-Lewis
Complex A & B
Univ. Towers
Fine Arts
ITC-2A VoIP
Viking Village 3rd Flr
Viking Village 2nd Flr
Viking Village 1st Flr
McClendon Hall
Griffin Hall
Harrington House
K.E White
Dixon 1B
Dixon Hall

E. V. Wilkins Academic Computing Center

- Centrally located
- Purposed as a computer center

Building Plans

Server Room



General Server Specs

Duplicate "Base Camp" Server from Polar Grid

- 1 - Management Node (RedHat Enterprise based)
- 16 - Quad-Core Worker Blades (64 Total Nodes)
- 4 - SATA based storage array units (32 TB total storage)
- 4 - UPS battery backup units
- 1 - KVM switch and console

Image from "Base Camp" Cluster and Storage Array at University of Indiana

Electrical Power Specs

- Cluster(s) Requirements
  - – Total power 200amps
  - – 208V (3 phase)
  - – ~50kW
- UPS
  - – 80kVA
  - – 480V (3 phase)
  - – Modular for Growth

Clusters

PG Ilulissat (64cluster/48TB disk)

A) ~11KW
B) 20 amps
C) (2) L6-30 (locking 30

Lower 48 Cluster

A) ~6TF : iDataplex
B) 600 Cores
C) ~35KW
E) 180 amps (connector)
D) 208V (3 Phase)
E) ~500lbs
F) ~37,000 BTU's
G) (5) IEC309 (60 amp)
H) 208V (3 phase)
I) ~3000lbs
J) 120,000 BTU's

Cooling

- A) 320, 000 BTU/HR
- B) 1 Ton = 12,000 BTU/hr
- C) 26 Ton CRAC requirement (really a 30 ton CRAC)
- D) * Consider the future expansion possibilities
- E) 208V 3-Phase

Security

Campus Police

- Alarms to police
- Remove top glass
- 1-2 Security Cameras
- Doors
- How do we bring in large equipment into Room?

TeraGrid Connection

Generalized Network Connection

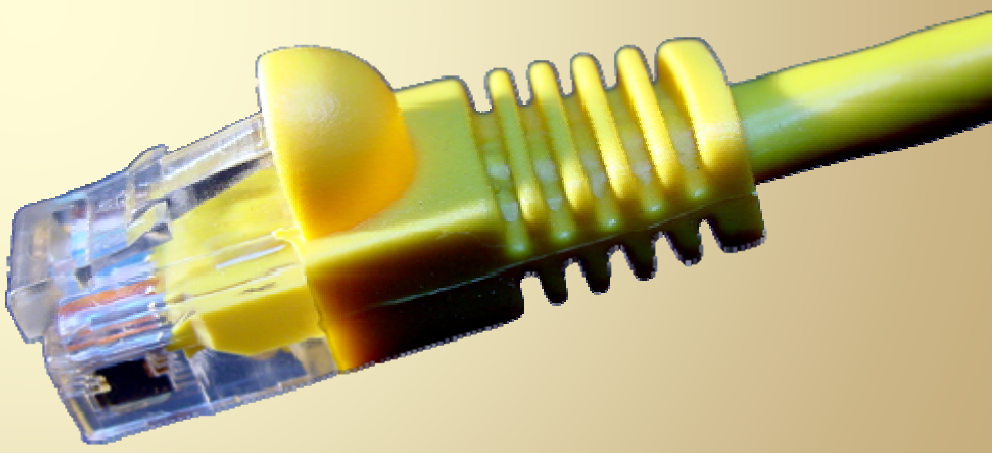
- 64-node Grid Cluster with web-based portal using Globus Toolkit
- Public IP accessible through ECSU firewall
- User submits jobs through the web portal

TeraGrid™

TeraGrid Networking

Network Connection

- Inside the firewall on its own vlan subnet and with an ssh port on it
- Increase pipe to 10G



Proposed Timeline

Action Item	Percent Complete	Due Date
Planning Stage	50%	April 08
Flooring	0%	May 08
Electrical Upgrades	0%	May 08
A/C Installation	0%	June 08
Fiber Installation	0%	June 08
Cluster Delivery	15%	July 08
Conversion to Condor - G	0%	October 08
Portal Connection	15%	March 09

Design

- Bigger Door to bring equipment (Tall Double Door)
- Do we have enough space?
- Concern with windows
- Door access to outside
- Seal room for efficiency and heat
- Seal ceiling at the top

ECSU's Polar Grid Lab

TeraGrid™

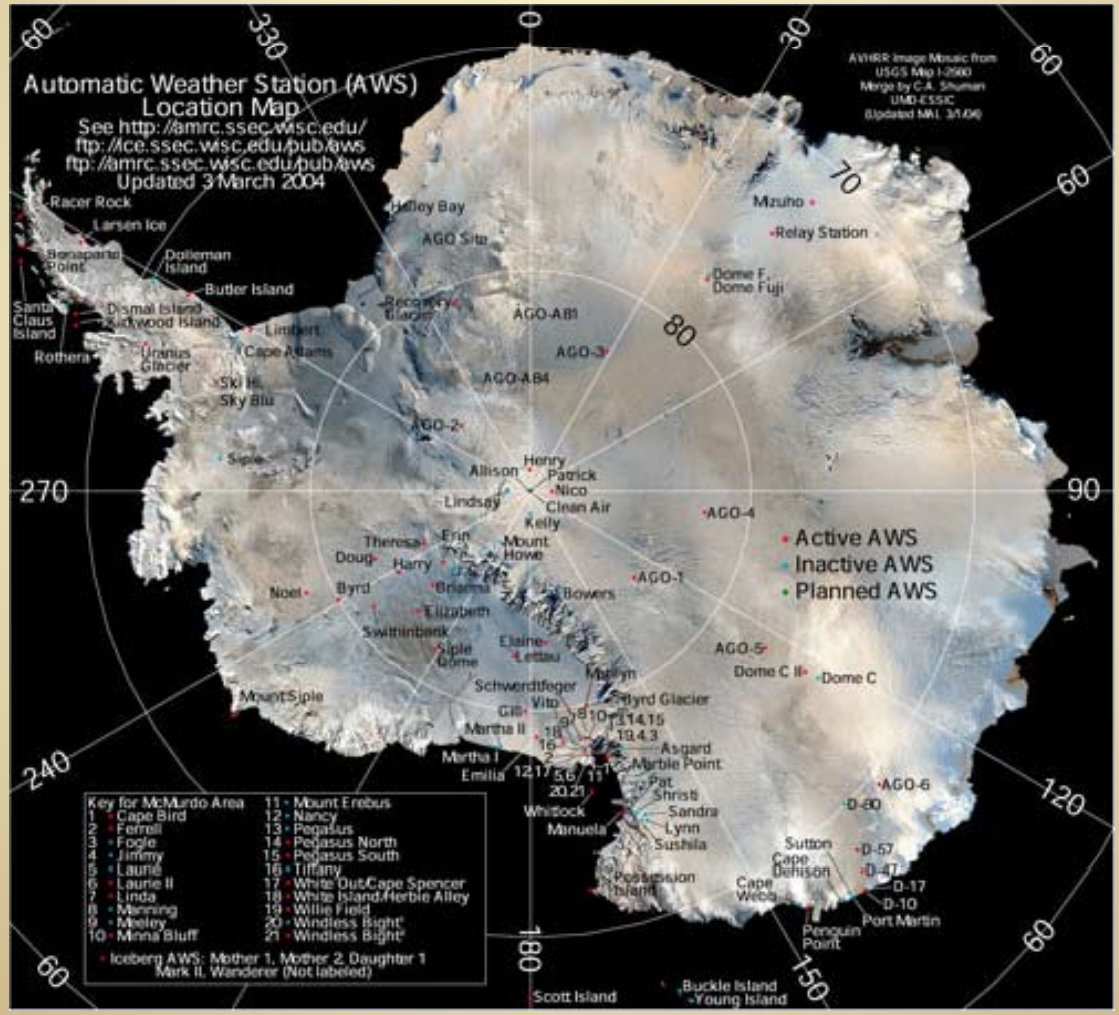
Polar Grid Lab

- Mac OS X Public IP accessible through ECSU firewall
- Ubuntu Linux
- Windows XP

Additional Software

- Desktop Publishing
- Ubuntu Linux
- Word Processing
- Web Design
- Programming
- Mathematical Applications
- Geographic Information Systems (GIS)

Weather Stations

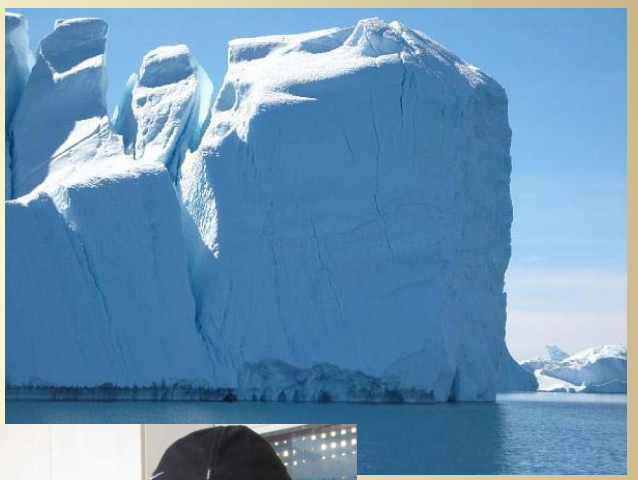


ECSU Research Students

Antarctica

Polar Grid July 2008 Field Season

Iiulissat, Greenland



Center for Remote Sensing of Ice Sheets

CReSIS

CReSIS
Center for Remote Sensing of Ice Sheets

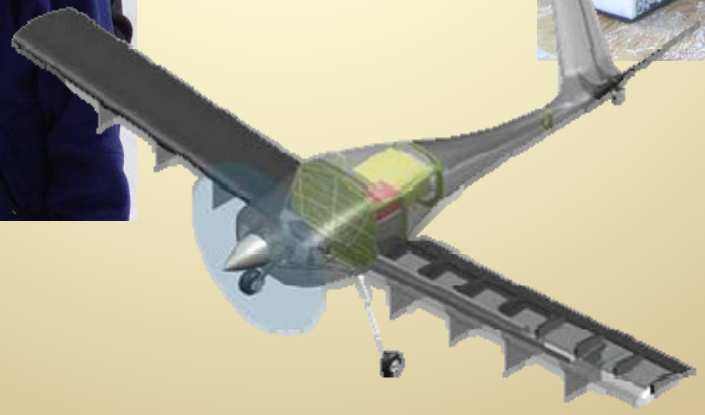
CReSIS

- National Science Foundation Science and Technology Center established in 2005
- Mission –
  - Develop new technologies and computer models to measure and predict the response of sea level change to the mass balance of ice sheets in Greenland and Antarctica
  - Provide students and faculty with opportunities to pursue research in a variety of disciplines
  - Collaborate with scientists and engineers in the US and abroad
  - Make meaningful contributions to the ongoing, urgent work of addressing the impact of climate change

What is CReSIS?

CReSIS

Center for Remote Sensing of Ice Sheets



CReSIS

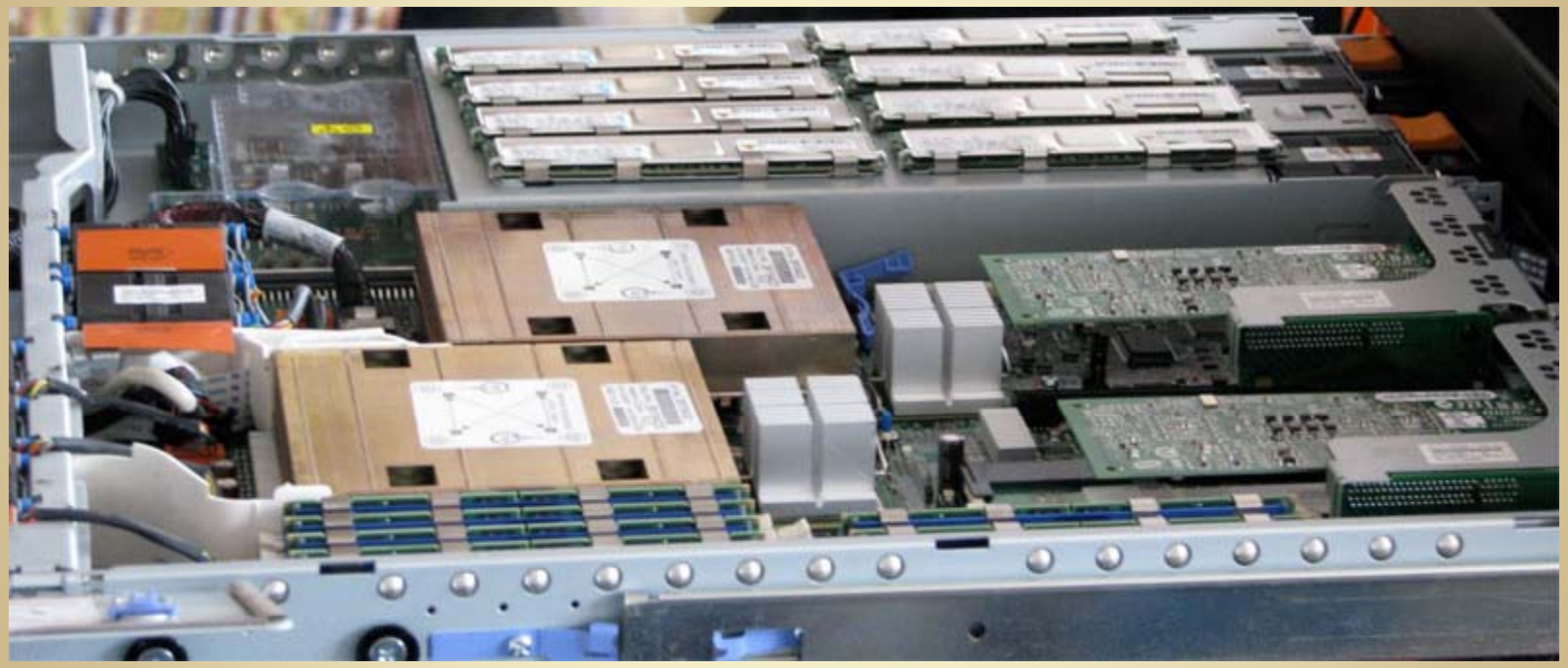
CReSIS is comprised of six partner universities, with the headquarters located at the lead institution, the University of Kansas.
Elizabeth City State University
Haskell Indian Nations University
The Ohio State University
The Pennsylvania State University
University of Maine

In addition to this core group, CReSIS collaborates with several international institutions and industry partners.
ECSU's CERSER lab contributes to the:

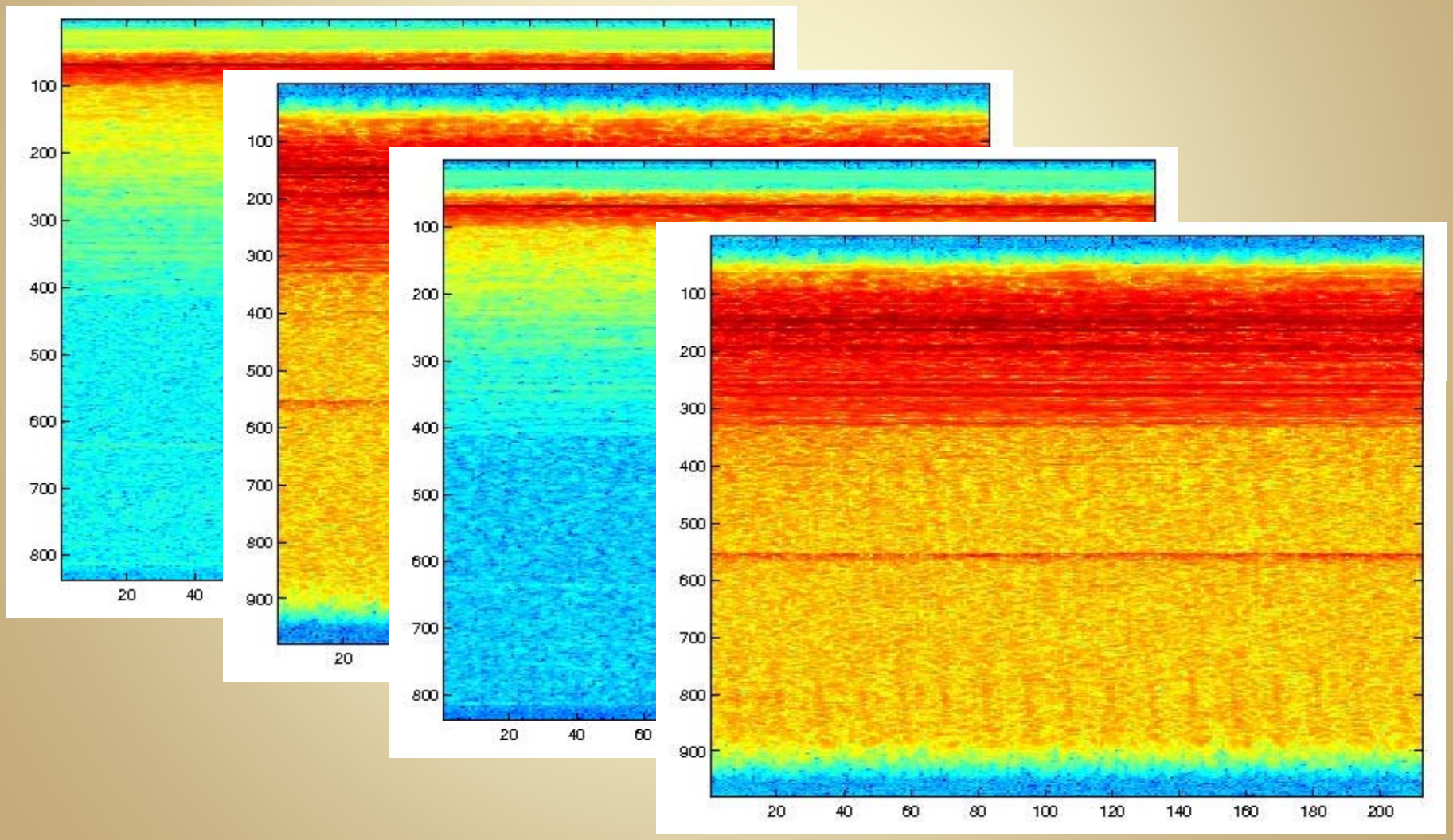
- Satellite Measurements Research Team
- Data Products & Modeling Research Team

Major Components and Concept of Operations

Major Components and Concept of Operations

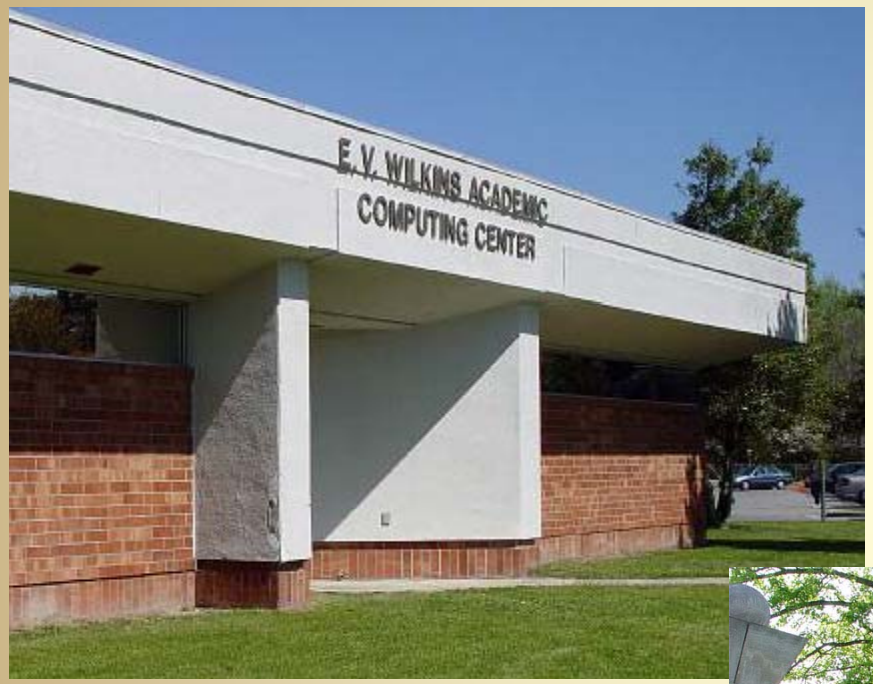


Major Components and Concept of Operations



Major Components and Concept of Operations

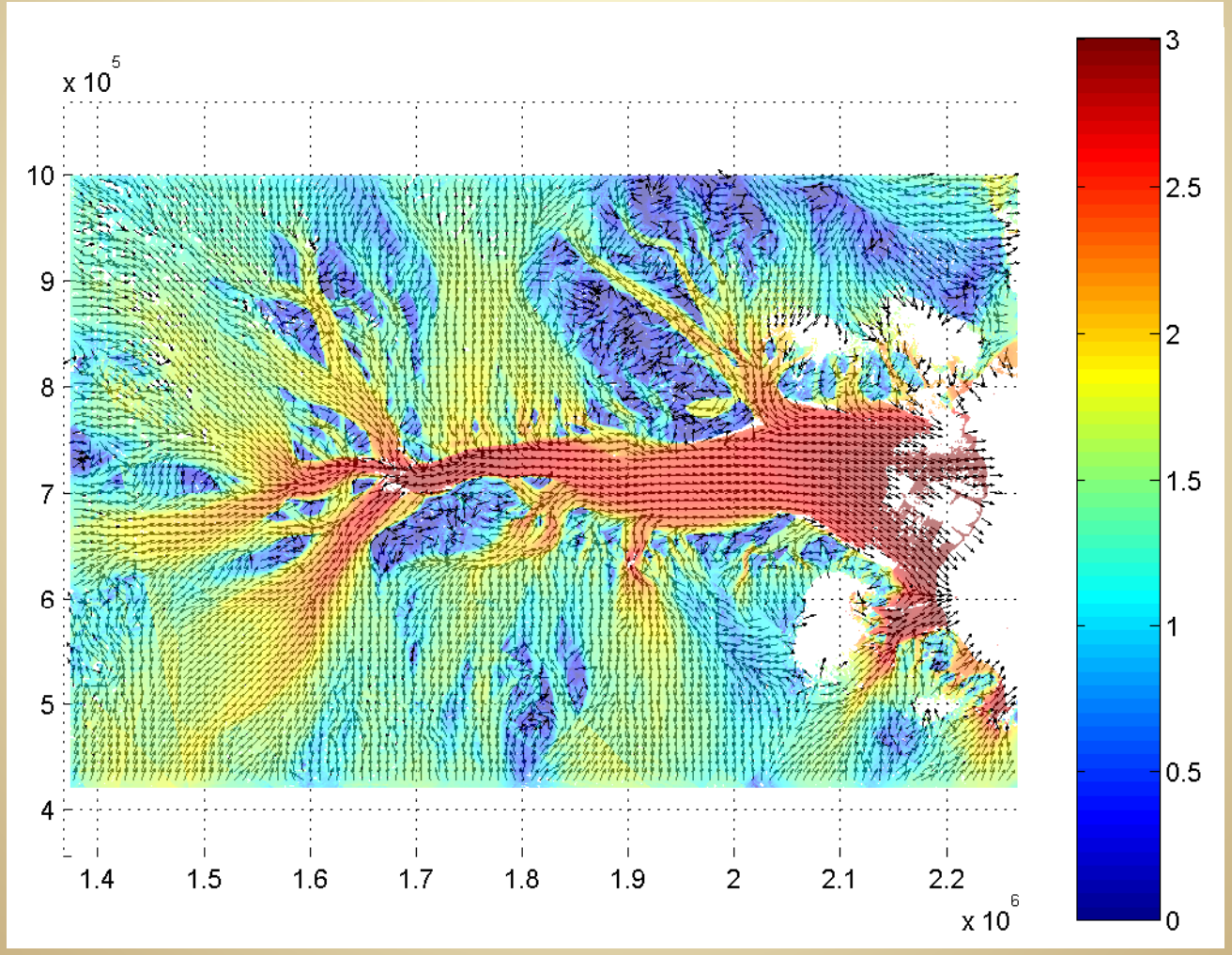
Typical Glacial Change Data



TeraGrid™

Typical Glacial Change Data

Lambert Glacier



Reference Links

- Polar Grid main website: http://www.polargrid.org/polargrid/index.php/Main_Page
- National Science Foundation: http://www.nsf.gov/
- Center of Excellence in Remote Sensing Education and Research: http://cerser.ecsu.edu/
- CI Team @ ECSU: http://cerser.ecsu.edu/citeam/
- TeraGrid: http://www.teragrid.org/
- Open Science Grid http://www.opensciencegrid.org/

Links to Partners

- EDUCAUSE http://www.educause.edu/
- Internet2 http://www.internet2.edu/
- Renaissance Computing Institute (RENCI) http://www.renci.org/
- North Carolina Research & Education Network (NCREN) http://www.ncren.net/
- Southeastern Universities Research Association (SURA) http://www.sura.org/
- Minority Serving Institutions Cyberinfrastructure Empowerment Coalition (MSI-CIEC) http://www.msi-ciec.org/
- Community Grids Lab, Indiana University http://communitygrids.iu.edu/index.php
- Shodor Education Foundation http://www.shodor.org/
- University of North Carolina, Chapel Hill http://www.unc.edu/

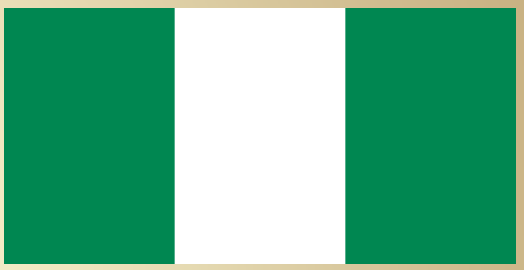
Thanks to the following people:

Dr. Geoffrey Fox
Community Grids Laboratory
Indiana University
gcf@cs.indiana.edu

Dr. Prasad Gogineni
Center for Remote Sensing of Ice Sheets
University of Kansas
gogineni@cresis.ku.edu

Recognition of African Students

Omotilewa Oluwatoba
Nigeria



Taibou Ba Dakar
Senegal

Kwame Agyekum
Ghana