Pushing/Dragging Users Towards Better Utilisation.

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Overview

- *Short Introduction to ARSC.*
  - Mission, Resources, Projects.
- *Improve Users.*
  - Code development, tools,
  - Training,
  - Support and Assistance.
- *Improve System.*
  - Make it easier for users to be productive.
  - Changing system and users.

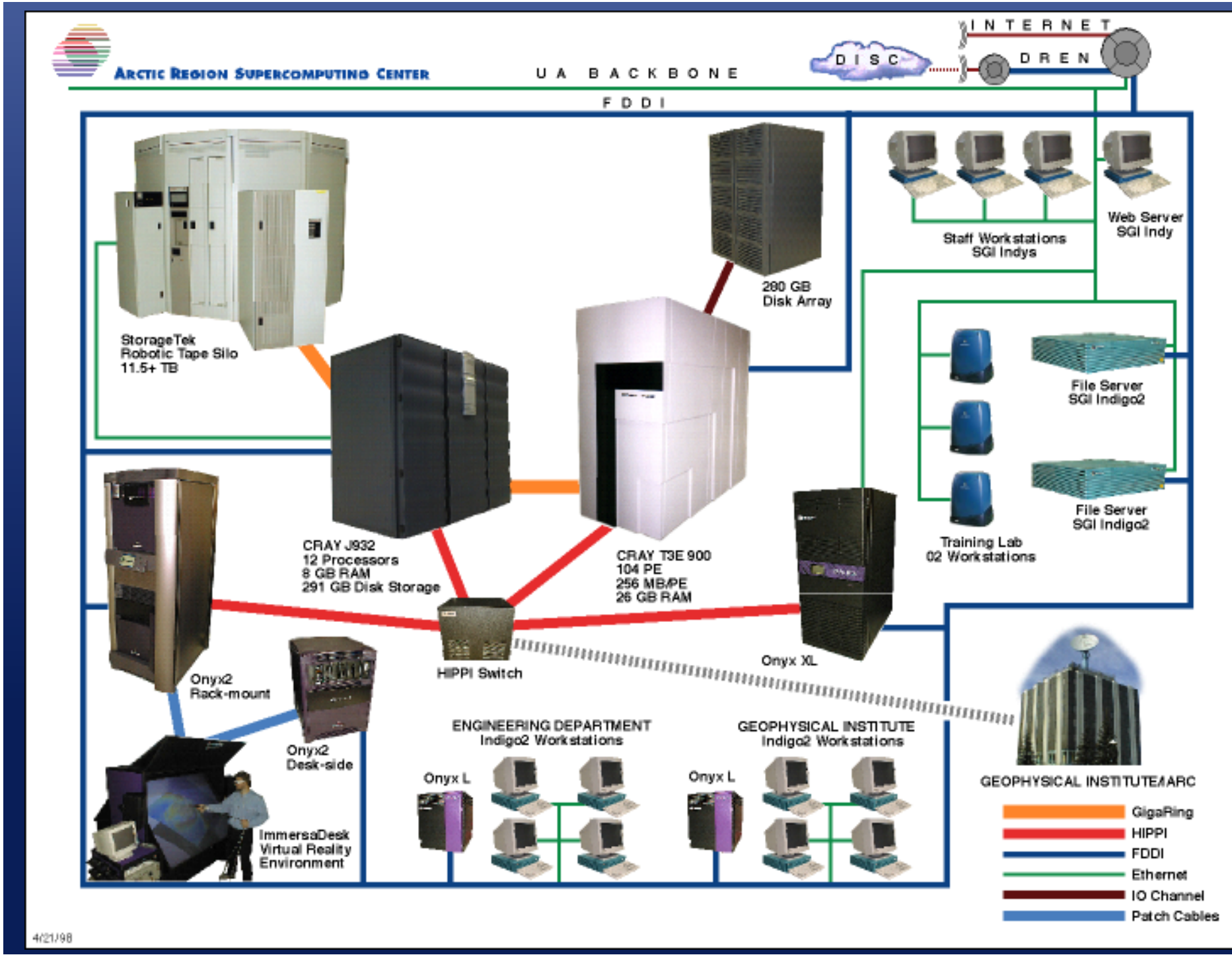
Mission

To support computational research in science and engineering – with emphasis on high latitudes and the Arctic

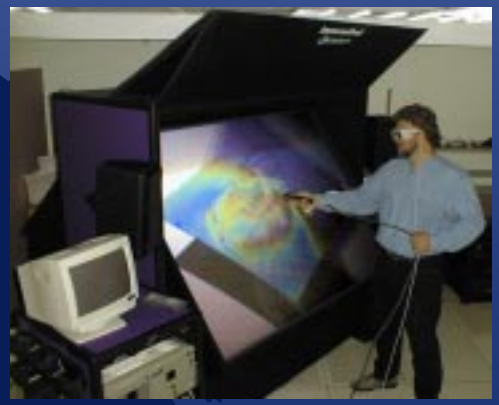
http://www.arsc.edu/

To Facilitate that Mission...

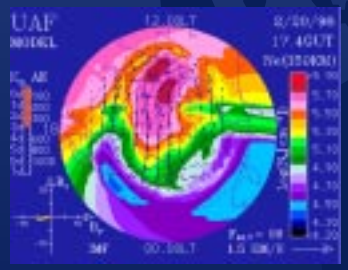
- *ARSC provides:*
  - Hardware
    - *Large Memory Vector and MPP Computing Resources*
    - *Visualization Resources*
  - Software
    - *Various Packages for Various Platforms*
  - People
    - *Specialists in HPC for Technical Support*
    - *User Training*

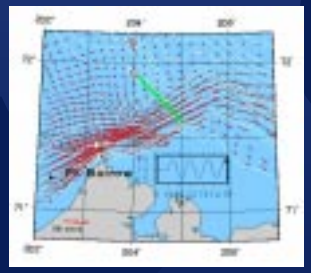

ARCTIC REGION SUPERCOMPUTING CENTER
UA BACKBONE
DISC
INTERNET
DREN
FDDI
StorageTek
Robotic Tape Silo
11.5+ TB
280 GB
Disk Array
Staff Workstations
SGI Indys
Web Server
SGI Indy
File Server
SGI Indigo2
File Server
SGI Indigo2
Training Lab
02 Workstations
CRAY J932
12 Processors
8 GB RAM
291 GB Disk Storage
CRAY T3E 900
104 PE
256 MB/PE
26 GB RAM
Onyx XL
HIPPI Switch
Onyx2
Rack-mount
Onyx2
Desk-side
ImmersaDesk
Virtual Reality
Environment
ENGINEERING DEPARTMENT
Indigo2 Workstations
Onyx L
GEOPHYSICAL INSTITUTE
Indigo2 Workstations
Onyx L
GEOPHYSICAL INSTITUTE/ARC
GigaRing
HIPPI
FDDI
Ethernet
IO Channel
Patch Cables
4/21/98

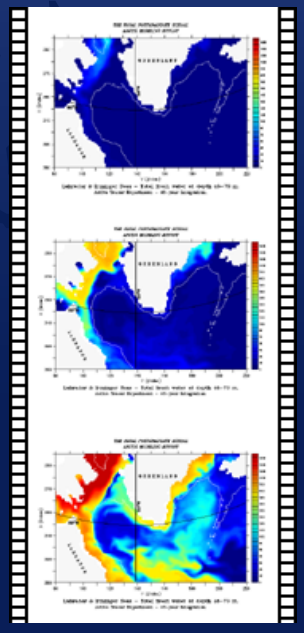
From Numbers to Images

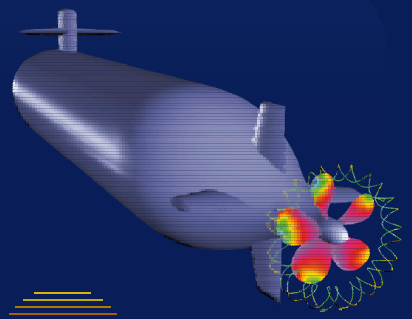


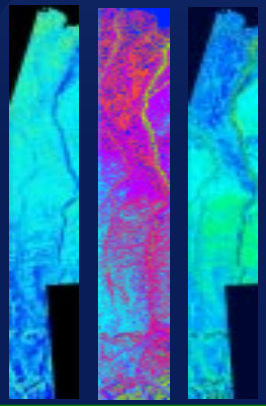
Compute ⟷ **Store** ⟷ **Visualize**

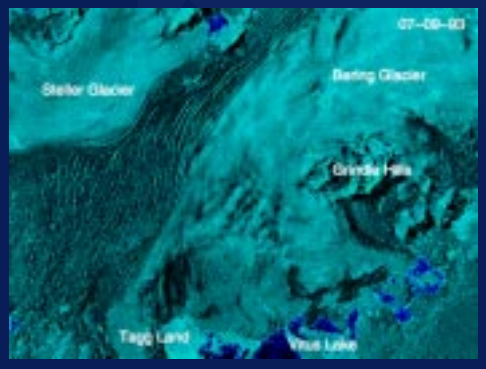










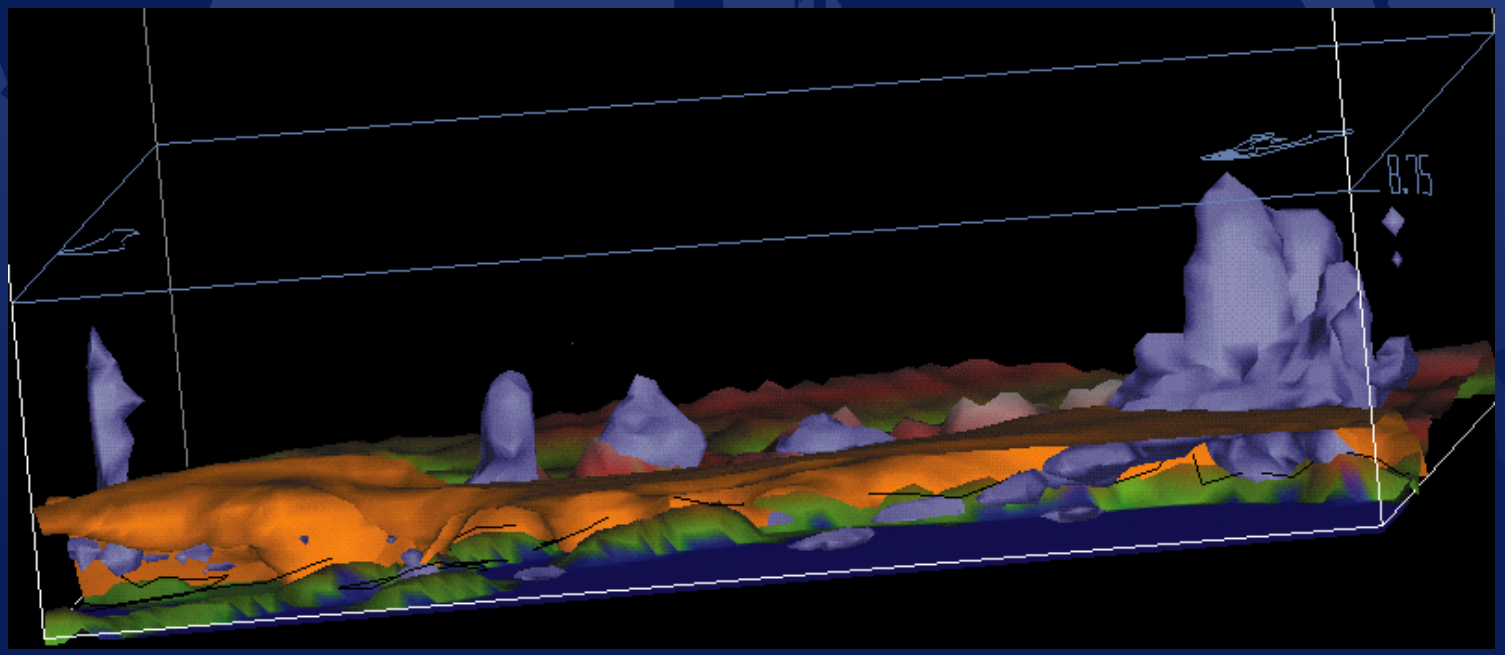


Monitoring Users.

- *NQS usage.*
  - actual jobs in terms of number of processors and runtimes.
- *grmview.*
  - memory usage.
    - *'try to fill processors memory', but still allow small memories/ large processor numbers.*
- *Ensuring our big users get results.*
  - but, remembering to bring forward smaller users.

High Resolution Weather Forecasting

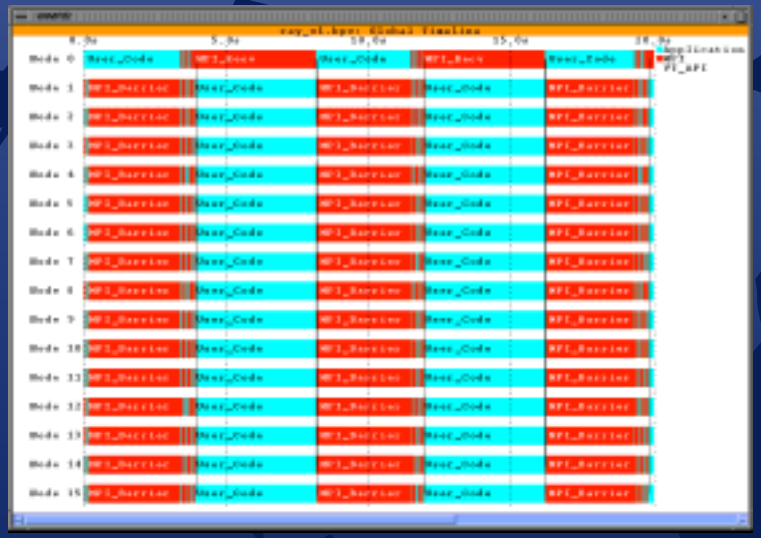
- *Jeff Tilley, Geophysical Institute*
  University of Alaska Fairbanks

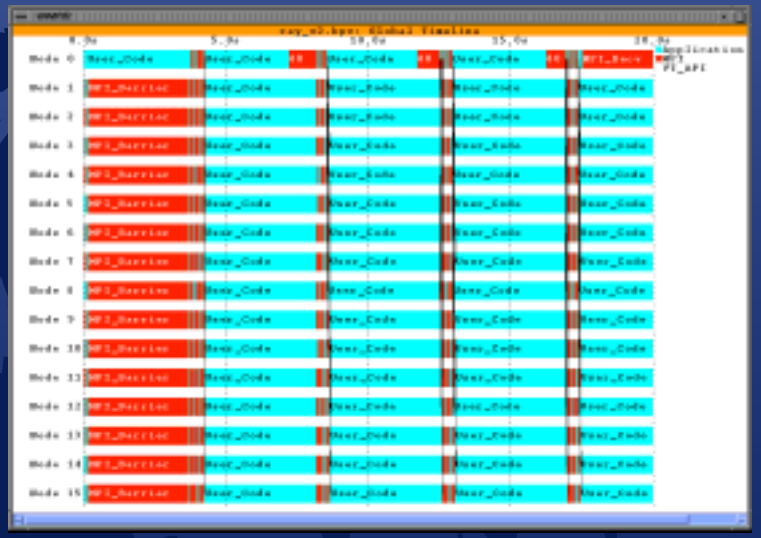


Code development.

- *higher levels of performance.*
  - hpm monitor on parallel vector systems.
    - *impact of multiprocessor usage.*
  - user applied tools on MPP.
    - *PAT, Apprentice, VAMPIR etc.*
    - *streams on/streams off comparison.*
    - *set a goal of 100/200/300Mflops.*
  - algorithm must be parallel, perform(scale) and be portable.

VAMPIR tool example.





- ***VAMPIR allows users to inspect message passing.***
  - Considerable detail and information available.
  - Easy to identify areas for improvement in algorithm. Great help when fine tuning across different architectures/problem sizes etc.
  - Also VERY useful for training and explaining to others how code works.

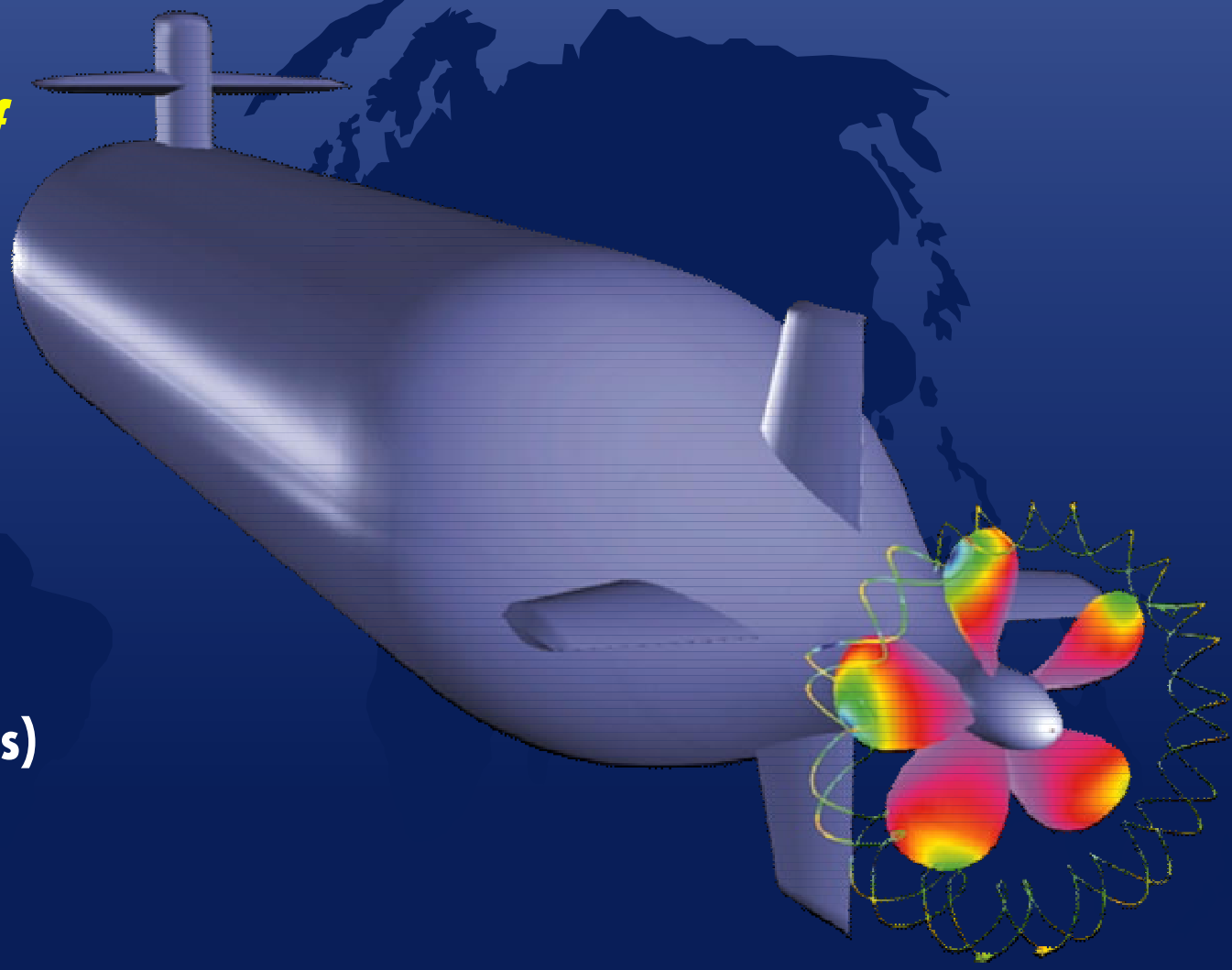
Improvements in the longer term.

- ***Changes to code.***
  - don't fix the number of processors!
  - better, real parallel algorithms.
  - algorithms for the size of problem the user wishes to solve.
- ***Leading by example.***
  - forward success stories to the userbase.
  - progress isn't a smooth growth.
    - *sudden increases in problem size/complexity brings new needs.*

DoD Grand Challenge Project

Unsteady Hydrodynamics of the Maneuvering Submarine

This grand challenge project has been granted 170,000 processor hours (approximately 25% of the available cycles) on the CRAY T3E for the current year.

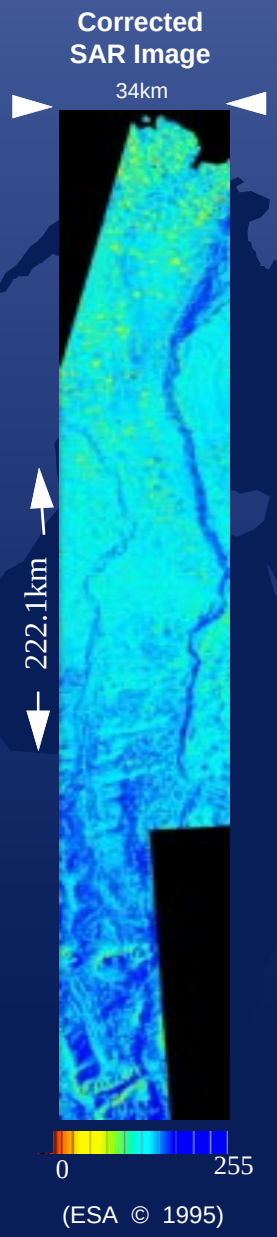


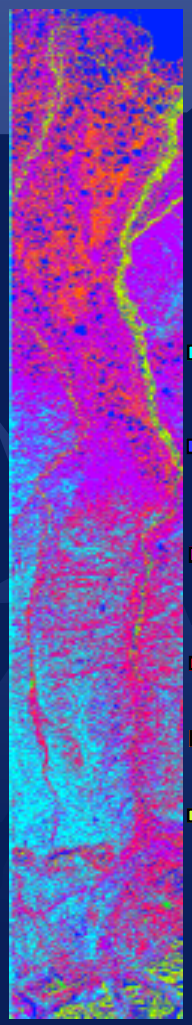
Embarrassingly Parallel!

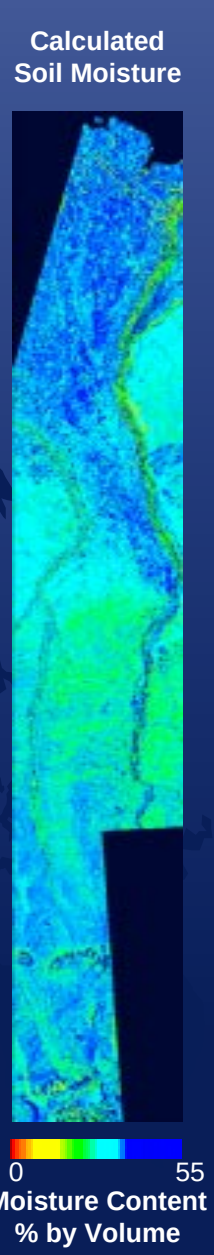
- *Not a failure. Lots of productive science done this way.*
  - Does take effort. Management of files and putting answers together to review all results is key.
    - *visualisation efforts, weather/climate and groundwater parameterisation studies.*
  - System advantage is it can fill the system CPU resources.
    - *Users must be flexible in job sizes.*
    - *Taken our MPP utilization to 95%/75%/85% for first quarter of 98.*
      - Currently often running 4 jobs which fill system.

SAR Imagery to Measure Arctic Soil Moisture

- *Doug Kane, Larry Hinzman, University of Alaska Fairbanks*







System Improvements at ARSC.

- ***Queues.***
  - A migration exit in NQS. Rearranges work to combine any holes in processor space and permit large jobs to run.
  - Checkpointing allows big jobs at night and interactive/Quick jobs to run during the day.
  - Could newer software schedulers improve matters?!
- ***Many improvements only work if users also change.***
  - In particular users with flexible processor demands get a better turnaround.

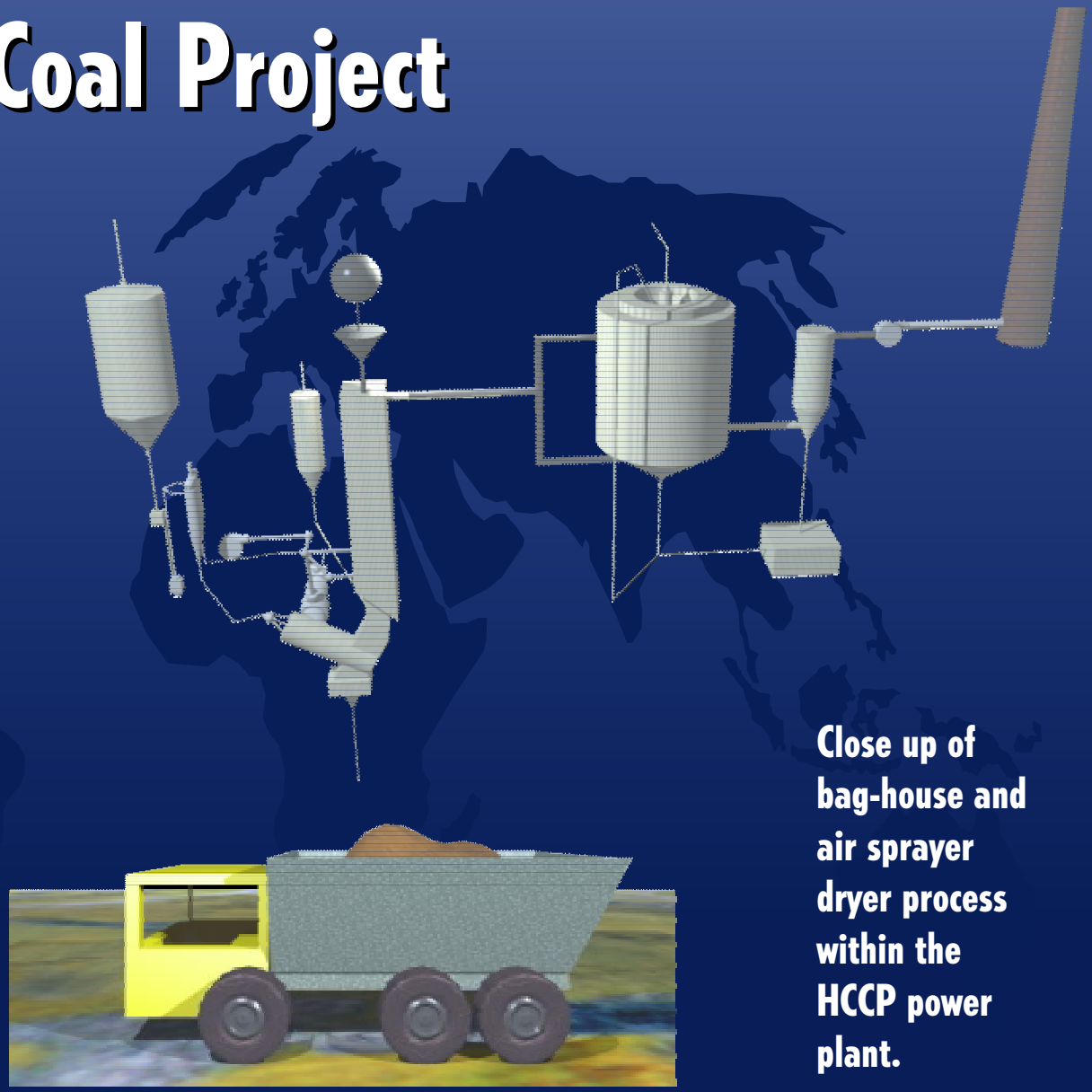
People.

- *Specialists in:*
  - Parallel Vector Computing
  - Massively Parallel Computing
  - Visualization Systems
  - HPC Consulting
  - Network Systems
  - Mass Storage
  - Computer Security
  - Cray Hardware/Software
- *Joint Faculty Appointments with University of ALASKA*
- *Visiting Researchers*
- *Administration*

Healy Clean Coal Project

◆ *Bill Brody, University of Alaska Fairbanks*

Visualization created with AliasWavefront software. This animation shows the process of scrubbing the emission gases.



Close up of bag-house and air sprayer dryer process within the HCCP power plant.

Getting messages to users.

- *Most of ARSC cycles are consumed by remote users.*
  - newsletter, web pages, hardcopy publications etc.
    - *success stories by peers are more successful than pushing computing science.*
    - *addressing a users needs is better than just telling.*
    - *newsletter is sent by email and available for reference on the web. http://www.arsc.edu/pubs/MPPnews.shtml*
    - *a few basic manuals with local information and local examples of best/preferred user practices are most productive use of centre effort, e.g. NQS, CRL etc.*

User Support: www.arsc.edu

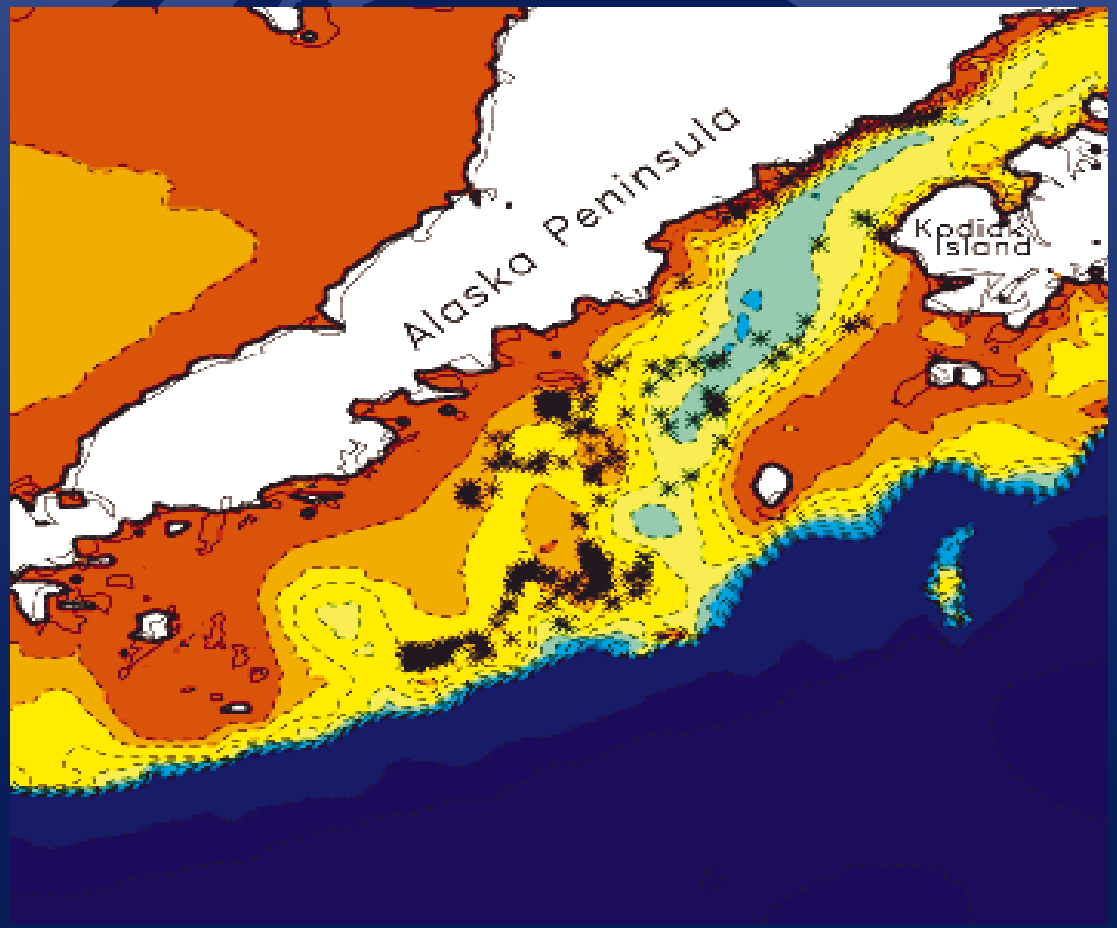
- ***On-Line: August 19, 1994 (8th UA Site)***
  - Policies & technical documentation.
  - Cray online manuals.
  - Application, re-registration, software request, and other forms.
    - *FPT (form pre-processing tool)*
  - Publications.
    - *transitions bulletin, getting users into habit of regular change and 'hopefully' self evaluation. f77 to f90, D to E, Y to J to SV1?*

Future plans.

- *Advanced schedulers.*
  - Only if there is a clear reward!
  - Can 95% be improved on for an MPP?!
- *Continued user education.*
  - Real parallel codes.
    - *Improved algorithms for problem sizes/type.*
    - *Validation, tools for inspection, portability improvements.*
    - *Closer links between computation, visualisation, storage.*

Pollock Larvae

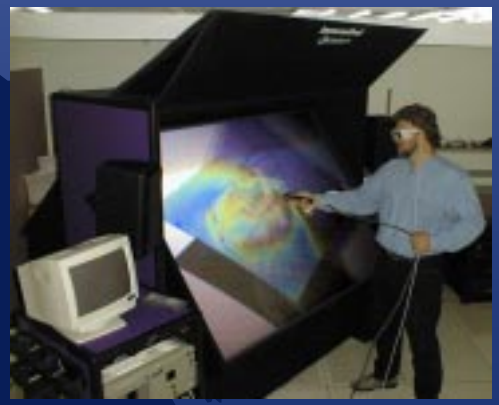
- *Al Hermann, Pacific Marine Environmental Laboratory*



Conclusion.

- *Users can,*
  - Do nothing or do everything?
    - *Work with a small number of tools in a simple manner.*
    - *Tell other users and the centre of both good and bad experiences.*
    - *Be flexible.*
- *Centres can,*
  - Do everything or do nothing?
    - *Make a number of simple changes which greatly reinforce good user behaviour.*
    - *Lead users forwards by promotion/example.*
    - *Be flexible.*

From Numbers to Images



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