



Documentation of Site Preparation for the Installation of SeaSpace Ground Stations at ECSU



Mentors:

Michael Osterhouse

Andrew Brumfield

Members:

Nigel Pugh

Jefferson Ridgeway

Tori Wilbon

Abstract

In September 2014, a transition was made to a direct purchase and installation of Seaspac hardware and software. The installation of the Seaspac hardware included: 15 Visualization Stations, two monitoring systems, a TeraVault raw storage device, and a TeraScan Rapid Environmental X-treme , TREX ,high-powered processor. The installation of the Seaspac software on the 15 Visualization workstations included: an updated version of TeraScan,which includes the Graphical User Interfaces TeraVision and TeraMaster, and CentOs , which is a Linux-based Operating System. Also two 5.0m L band system were installed on Dixon-Patterson hall in the summer of 2012. The purpose of this project was to document the installation requirements and internal processes at ECSU for Seaspac Hardware and Software Equipment, with also addressing; the location of engineering findings, location of installation requirements, repositioning and securing current ground stations, and proper training center needs.

SeaSpace

Established in 1982, SeaSpace Corporation has been leading the remote sensing ground station business for 30 years. SeaSpace has installed more than 550 ground stations and processing systems in over 47 countries. SeaSpace pioneered low-cost satellite ground station technology.

SeaSpace personnel are subject matter experts in the fields of meteorological, oceanographic, and environmental remote sensing.

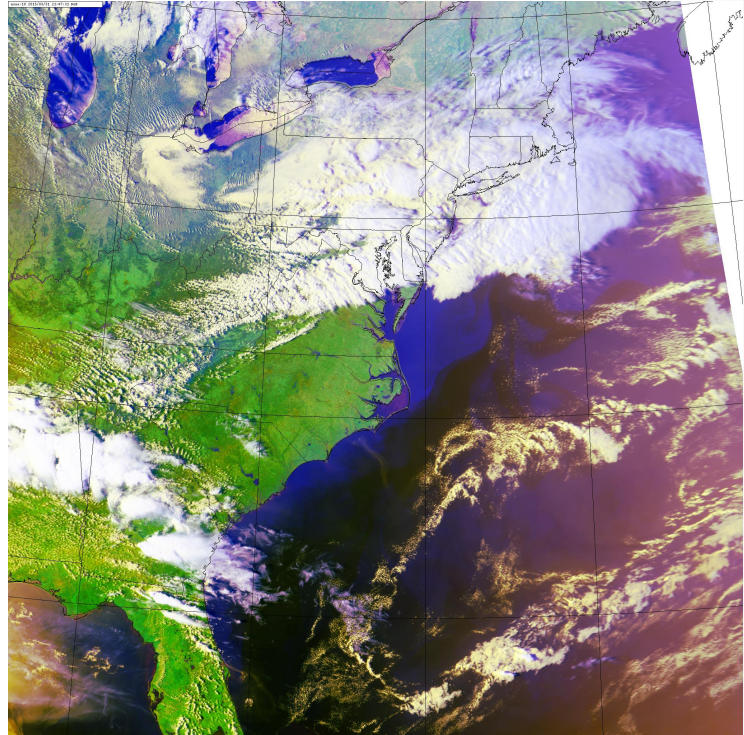


TeraScan

- Combination of hardware and software designed for automated reception of satellite data
- Data is being received from meteorological/environmental satellites
- Images and overlays are special format called TeraScan Data Format (TDF)
- Files can produce images in various formats

TeraVision

- A GUI component of TeraScan system
- Can be manipulated by user to include image enhancements



Products

- The products directory contains specific algorithms and scripts that produce images depending on the satellite information. For example some products of GVAR (GOES Variable Data Set) include:
- `gvar_sst`: Computes sea surface temperature from GOES GVAR imager data. The basic formulas for the algorithm are:

$$\begin{aligned} \text{DAY SST} &= A + B \cdot T_4 + C \cdot (T_4 - T_5) + D \cdot (T_4 - T_5)^2 + E \cdot \text{ANGLE} \\ \text{NIGHT SST} &= A + B \cdot T_3 + C \cdot (T_3 - T_4) + E \cdot \text{ANGLE} \end{aligned}$$

where $\text{ANGLE} = (1/\text{COS}(\text{SAT ZENITH})) - 1$, and T_n are degrees Kelvin

Products (cont.)

For example some products of NOAA include:

- cloudtops – a script used in batch processing to create the following cloud products: cloud_top heights, cloud pressure, cloud temperature, and cloud levels [25].

The script uses the following TeraScan processing sequence:

- 1) topomask – to generate a temperature mask
 - 2) cloudmask_script – to generate a cloudmask
 - 3) cloudprod – to generate the cloud image products
- [25].

- avhrr – generates global coverage roughly twice daily[26].

Satellite Frequency Bands

- Satellite data is transmitted to antenna on L- band frequency
- TeraScan system can receive satellite frequencies:
 - L- band
 - C- band
 - X- band

L-band frequency is used for:

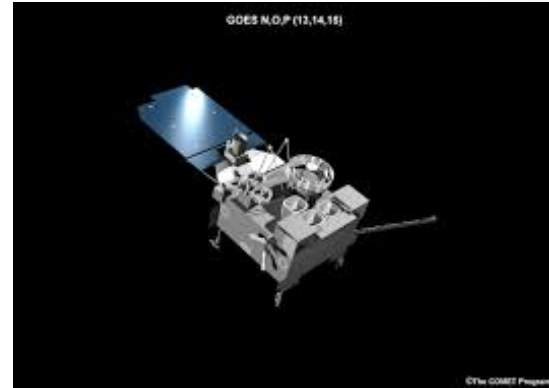
- Global Positioning Systems Carriers
- Satellite mobile phones

SeaSpace Antenna's Installed on Dixon Hall

- Two 5.0m ground stations (GOES East and GOES West)
- One 1.5m ground station
- Operate on L-band Frequency
- Frequency range of 1-2 GHz

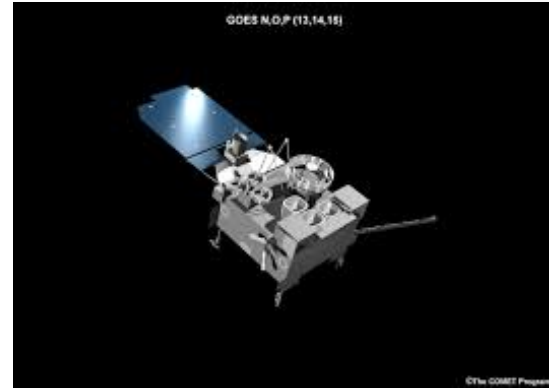
GOES 13 (East) Satellite

- Launched May 24, 2006
- Located at 135°W longitude
- Observes and measures meteorological phenomena in real time
- Has a geostationary orbit



GOES 15 (West) Satellite

- Launched March 4, 2010
- Sits at 75° W longitude
- Observes and measures meteorological phenomena in real time
- Has a geostationary orbit



NOAA Polar Orbiting Satellite

- Receiving data for NOAA satellites 15-19
- Provides accurate weather forecasts
- Polar Orbit
- Resolution of module sensors of 1.1 km per pixel



SeaSpace Considerations

- Training
- Equipment/ Software
- Contracted Services

Training



Train Students and Faculty

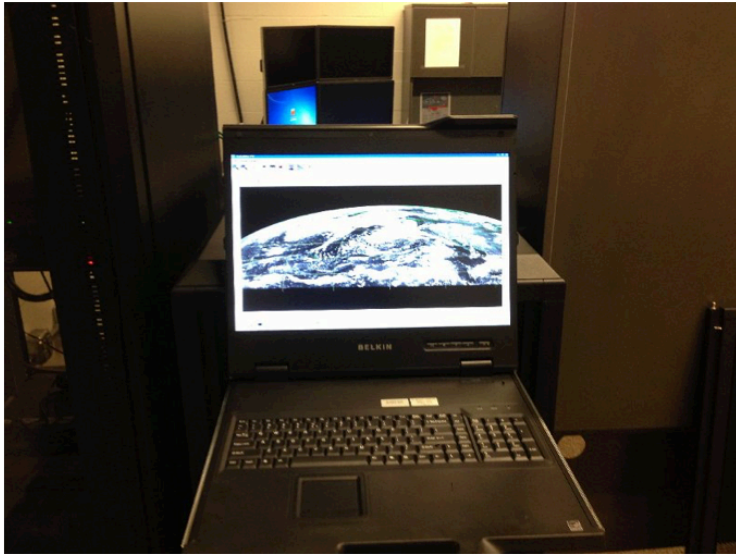
Proposed Location

Dixon-Patterson
Hall



Equipment/Software

Provided Hardware



Provided Software

SeaSpace Contractual Services

- Repositioned Ground Stations
- Conduit was re-wired
- Configured all hardware and software

ECSU Contractual Services



Monitoring Stations



Two 220 Volt Connections



Generator

Terascan Breakdown

- “The-Front-End” (Hardware)
- “The Back-End” (Software)

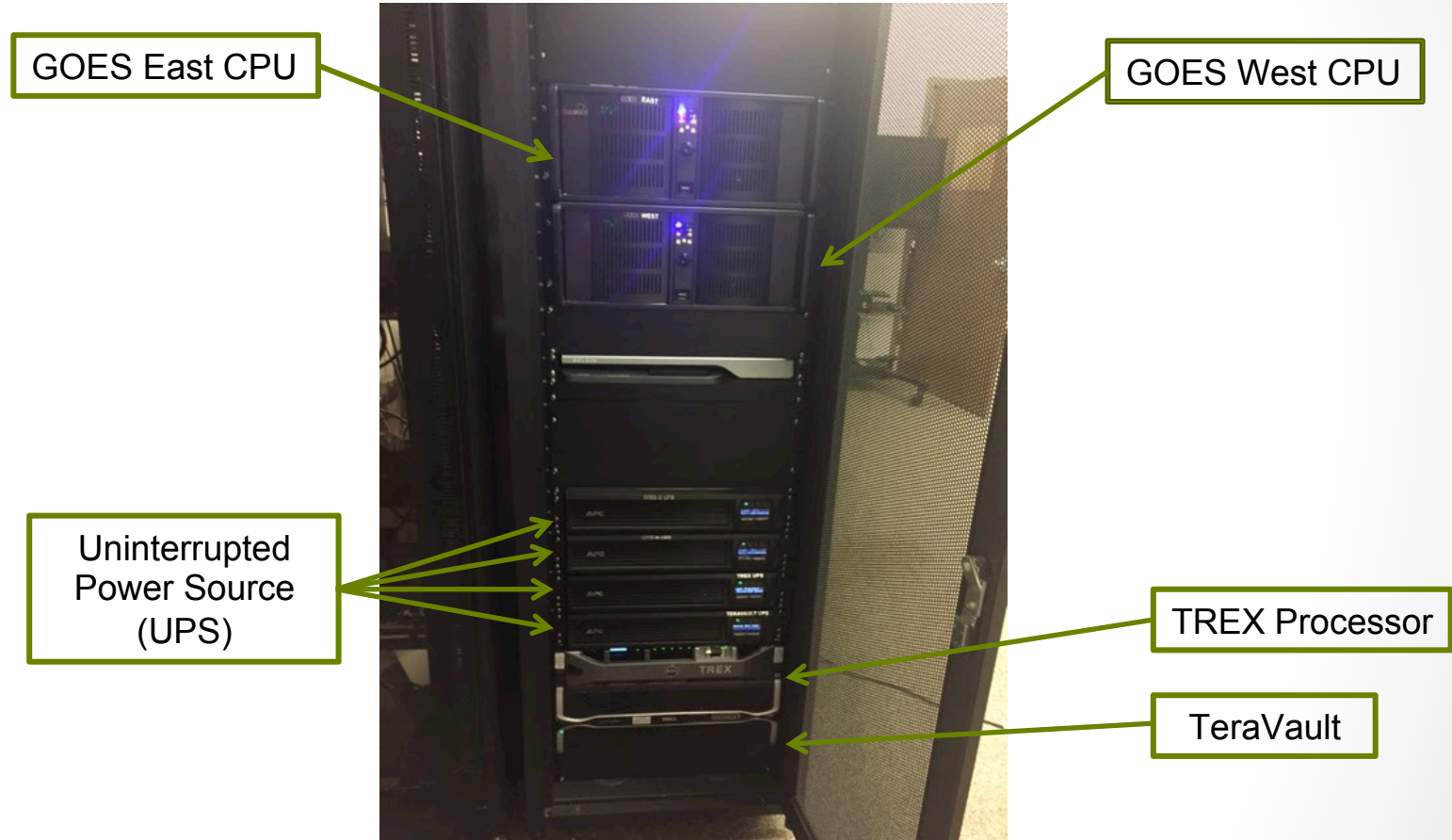
“The Front-end”



Ground Stations:

- GOES East
- GOES West
- 1.5 m polar orbiting antenna

“The Front-end”



Hardware

GOES East and GOES West CPU



- Acquires data from Ground Stations



- Fast-tracked to the TRES Processor

TREX Processor



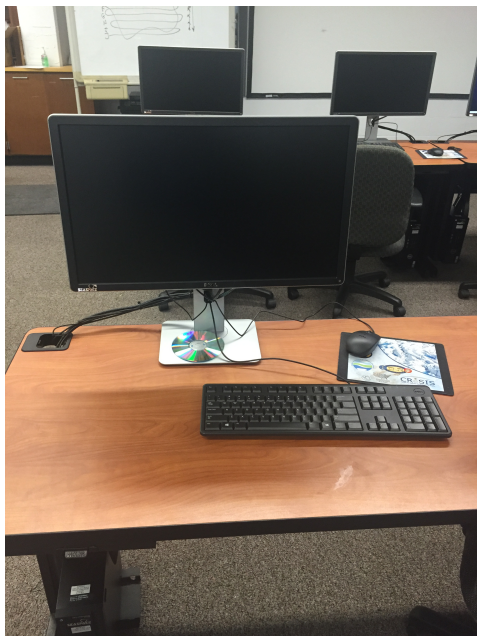
- Dell R720 E 16- core E5-2667 3.30 GHz
- 128 GB of RAM
- 32 processors
- Processes collected whole pass data sets from GOES East and West antennas

TeraVault

- Collects and stores raw satellite data
TREX processor
- 60 TB (RAW) storage
- Can store max of 180 TB of storage



Visualization Stations



- DELL T1700n Computer
- Runs Linux Operating System
- I7-4777 processor, 3.4 GHz 4 core
- 8GB of Ram
- Access and manipulate the satellite data from TeraScan systems

Monitoring Stations

- Two monitoring stations installed (24 inch and 42 inch)
- Access and satellite data from TeraScan systems
- Used for training purposes



GOES Satellite Data Path

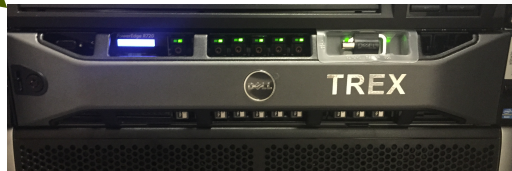
GOES West



GOES West CPU



TREX Processor



GOES
Satellites



GOES East CPU



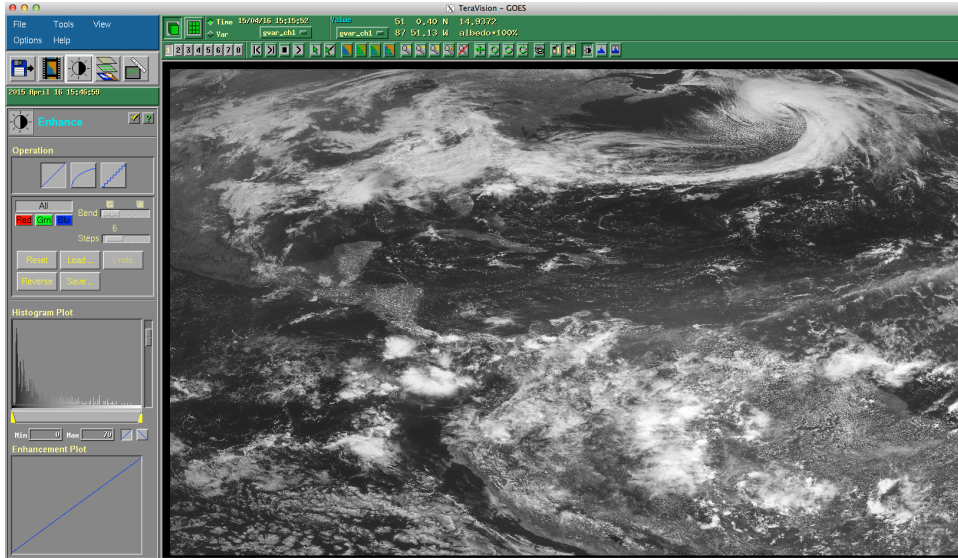
TeraVault Storage



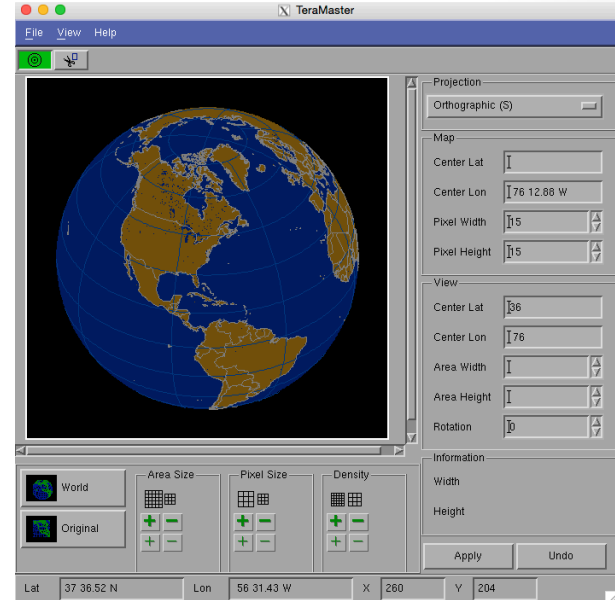
GOES East



“The Back-End” (Software)



TeraVision



TeraMaster

Visual Documentation





DO NOT

SEASPACE

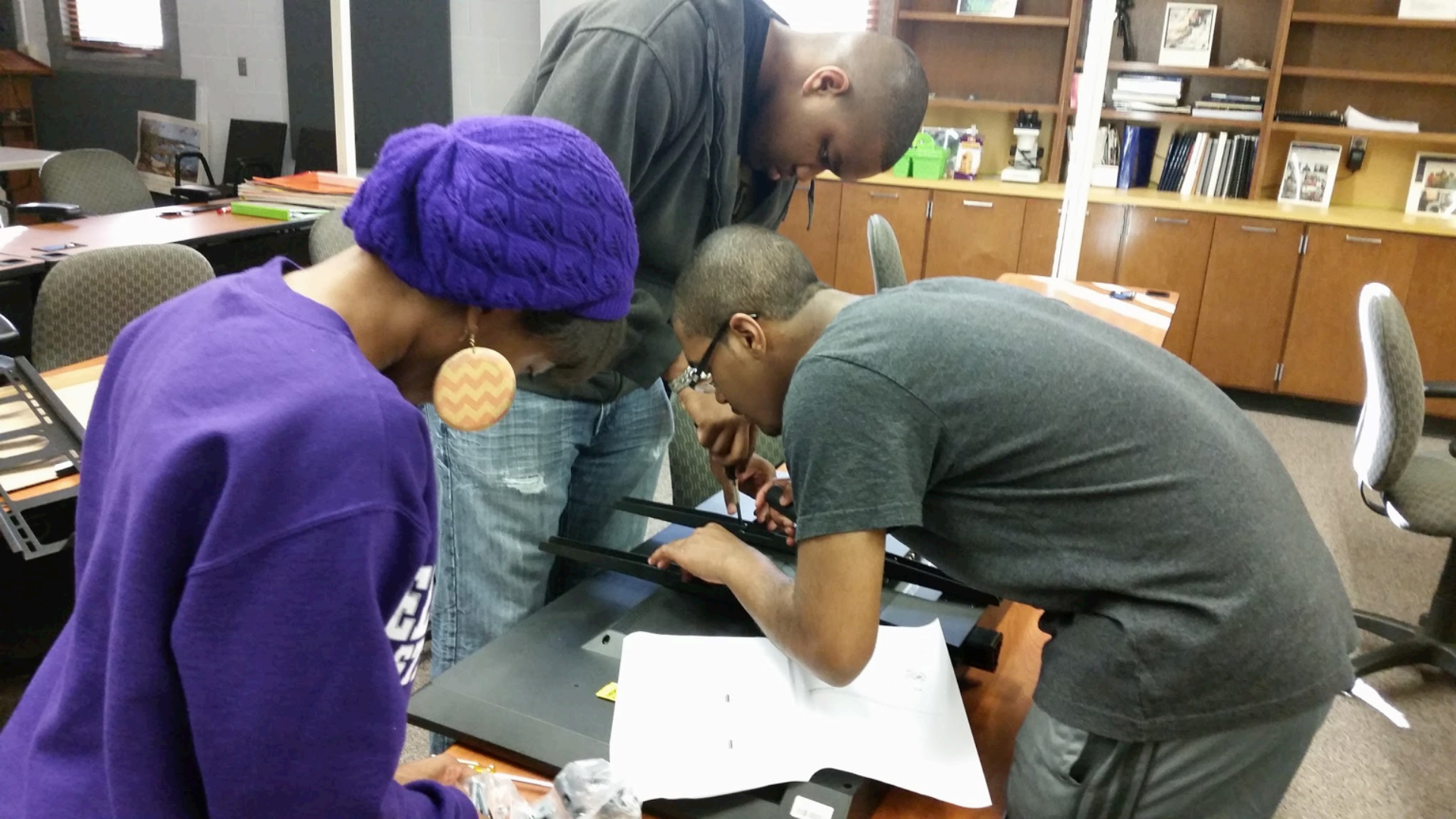
DO NOT

SEASPACE

SEASPACE

SEASPACE

















ECSU Training Site Requirements

- Contractual Services
- Scheduled training event
- Integrate into ECSU curriculum

Conclusion

- Fifteen visualizations stations installed
- Two monitoring stations
- New rack filled with TREX and TERAFAULT
- GOES antennas repositioned and secured

Future Work

- Complete server room
- Ground lightning arrestor for GOES antennas
- Produce web applications to share images
- Develop data archives batch operations (scripts)

Acknowledgements

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Questions?
Comments?