TeraScan Curriculum

Target Audience: K-12 Teachers, Governmental Agencies & Higher Ed Faculty & Students
Standard: SeaSpace Training Guide

1. Introduction
2. Pre-test (30 min)
    a. Find subject matter
3. Remote Sensing (1 hr)
    a. Definition
    b. History
    c. Examples (Telemetries)
    d. Sensors (Passive & Active)
        i. Resolutions
        ii. Spectrum (ir,rgb,microwave)
    e. How it can be used
    f. Online assessment
4. Linux Basics (1 hr)
5. Intro to TeraScan - SeaSpace Training (1 hr)
6. TeraScan Graphical User Interface (30 min)
7. Advanced Satellites and Sensors (30 min)
8. Exploring TeraVision and TeraVision 11 (30 min)
9. Overview of Data Capture and Processing (30 min)
10. Operating Procedures (30 min)
11. TeraScan File System (30 min)
12. System Setup (30 min)
13. TeraMaster (30 min)
14. MODIS Data Processing (30 min)
15. NPPDB Data Processing (30 min)
16. Navigating TDF Images with TeraNav (30 min)
17. Vulcan- TeraScan Fire Detection/Thermal Anomoly Software (30 min)
18. Final Assessment (30 min)

1. A brief look at everything you will be learning.

2. Pre Test over Subject matter you desire

3. Remote Sensing is The art and science of obtaining information from an electromagnetic radiation signature without being in direct physical contact.In this module you will learn the basics associated with it.It ranges on The Electromagnetic Spectrum with seven frequencies along with two main sensors, Active and Passive. Remote Sensing is generalized as a Passive Sensor because we observe many things from a satellite. It began with the evolution of technology and has allowed for numerous things to be discovered. Learning about Remote Sensing will open your eyes up to the way we retrieve and interpret data.

4. Linux is an operating system. It is the software on a computer that enables applications and the computer operator to access the devices on the computer to perform desired functions. The operating system relays instructions from an application to, for instance, the computer's processor. The processor performs the instructed task, then sends the results back to the application via the operating system.

5. TeraScan is an integrated system of hardware and software designed for automated reception of data from meteorological/environmental satellites and for processing the data into images and data overlays. The data files for these images and overlays are of a special format called TeraScan Data Format (TDF) and can be displayed with the TeraScan viewer called TeraVision. TDF files (also referred to as datasets) can also be converted to picture products in various graphics and common scientific data formats. Both TDF products and picture products can be automatically distributed to any number of local or off-site destinations across the network.

6. A program interface that takes advantage of the computer's graphics capabilities to make the program easier to use. In addition to their visual components, graphical user interfaces also make it easier to move data from one application to another. TeraScan graphical user interfaces include 19 choices that will allow the user to have a preference in how they want their data to be analyzed. Examples are CloudView3D which is a TeraScan visualization tool for displaying cloud-top data over an earth-surface background in 3D, Dvork objectively determines tropical

cyclone intensity from geostationary satellite infrared imagery, and Log Viewer generates a log of data-capture events and a series of data-processing logs.

7. As satellites travel around the Earth, a polar-orbiting satellite continuously scans the atmosphere and surface of the Earth below it and concurrently transmits the data it collects back to Earth. Whenever the satellite passes over a TeraScan receiving site, the TeraScan system can capture the data being transmitted. In this you learn not only about satellites but the types of sensors and what they are best used for.

8. This module provides step-by-step tasks intended to familiarize you with TeraVision, a graphical user interface (GUI) specifically designed for displaying and working with images from TeraScan Data Format (TDF) files. All TeraScan data is stored in the TDF format. TeraVision II is the TeraScan GUI for basic image viewing. It provides zooming and panning, animation, color enhancement, and value query capabilites.TeraVision II is being released in phases, with new tools and/or features available with each phase.

9. TeraScan Acquisition System captures signals broadcast from remote-sensing environmental satellites and demodulates and frames the data embedded in the signals. The reception system can then also process the data into images and image overlays, or can send the data to another TeraScan system for processing. The TeraScan software is capable of working with data from many different types of environmental satellites. The reception capabilities of a TeraScan system are determined by the system's hardware configuration (antenna(s), receiver(s), and other related hardware). SeaSpace produces several different configurations of the TeraScan system to accommodate the different types of satellites in operation.

10. This module presents basic procedures for operating the TeraScan System, including system startup and shutdown, system monitoring, and updates of orbital elements and ancillary data.

11.This module provides a quick look at the layout of the TeraScan file system, i.e., the organization of the directories and files that make up the TeraScan software. It also shows the environment variables used in TeraScan.

12. After power-up of the TeraScan system for the first time, the system operator should follow the procedures outlined below to ensure that the system is prepared for correct operation. It would be a good idea to run through Steps 2 through 9 any time the system has been powered down and powered up again. Create one or more TeraScan user accounts,Check/update system date and time,Check/update orbital element, TestUPS, Test Computer-to-receiver communication,Test Computer-to-antennas communication,Verify antenna movements,Align antenna (Necessary only if the antenna has been moved or repaired.),Schedule data capture (See 'Scheduling Data Capture in TeraCapCon” in the Operating Procedures module of this training manual.)

13. In this module you'll learn how to create areas of interest (masters) using the TeraMaster GUI. An area of interest is used during *ingestion* to limit (subset) the data processed from a raw pass, and is used during *registration* (or *remapping*) to remap the data from the sensor view to an earth-located map projection.

14. The acquisition and processing of MODIS data requires at least two TeraScan systems: one for data acquisition and the other for data processing. The Acquisition System acquires the raw data as it is broadcast from the satellite, then sends the data to the Processing System 1, where data products are generated.Multi-threaded parallel (MTP, also known as "batch") processing, the automated processing control, is designed to run on a single computer with multiple CPUs or a multi-node cluster configuration for the MODIS data of the teradb and aquadb telemetries

15.The acquisition and processing of NPPDB data requires at least two TeraScan systems: one for data acquisition and the other for data processing. The Acquisition System acquires the raw data as it is broadcast from the satellite, then sends the data to the Processing System1, where data products are generated. The NPP direct broadcast passdisk data is processed to Level 0 Raw Data Records (RDRs) using NASA's Real-Time Software Telemetry Processing System (RT-STPS), to Level 1B Sensor Data Records (SDRs) using the University of Wisconsin's Community Satellite Processing Package (CSPP), and Level 2 Environmental Data Records (EDRs) for VIIRS and CrIS. Both packages are installed on your TeraScan processing system under /opt/npp/rt-stps and /opt/npp/cspp/cspp-sdr-1.3, opt/npp/cspp/cspp-edr-1.0.

19.When a coastline overlay does not exactly match up with the land masses of a TDF image, the disparity can be corrected by a process known in TeraScan jargon as "navigation." Navigation can be done using a GUI called TeraNav which is a feature of TeraVision II.To navigate a TDF image, you will open the image in TeraNav, then click on areas of the image where a land/water boundary is clearly distinguishable.

16. processing uses NOAA/MODIS fire detection with nighttime NOAA AVHRR thermal channels 3 and 4 or MODIS thermal channels 20, 22, and 31 to create a mask of possible anomaly locations. This identifies active hot spots.The data is then scanned for adjacent hot-spot "pixels". These pixel groups are used to form a rough polygon where the centroid is then computed. This is the location used to identify a fire pixel group. These groups form the "fire locations" reported by the software.Repeat detections at the same earth location will not be reported. This aids in the elimination of detection errors as the error will only be reported once until the fire history ("burned areas") mask is reset by the operator. The finest resolution of detection is within a single AVHRR/MODIS sensor element. Fires may occupy the entire pixel or only a small portion. That cannot be determined by this algorithm. The smallest earth element (pixel) of an AVHRR sensor can be 1.1 km at best. The smallest pixel of a MODIS sensor (for the channels used) can be 1 km at best.