Science On a Sphere®

User Manual

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Introduction

This User Manual is meant to provide a general overview of the operation and daily use of Science On a Sphere®. In some cases, more detailed reference manuals are available. You can find a list of all the reference manuals in the Appendix on page 43. The reference manuals can be viewed and downloaded from the Support page at: http://sos.noaa.gov/Support/index.html

Overview and Basic System Use

The Science On a Sphere® software has evolved over time with the goal of being intuitive and easy to use. This section is meant to familiarize users with the basics of the Science On a Sphere®, SOS, system.

Definitions

1. **Content** – General term that we use for anything that can be displayed on the sphere and should be stored somewhere in /shared/sos/media - mp4, jpg, png, pip, overlay, label, colorbar…
2. **Dataset** – A packaged collection of coherent content, which may include multiple layers, labels, legends, colorbars, etc…
    a. **Texture** – A single, static image on the sphere that rotates
    b. **Time series** – animates through time and by default doesn't rotate. Can be an image sequence or a mpeg4
        i. **Image sequence** – a directory of images that are played in sequence
        ii. **MPEG4** – the only video format accepted by SOS
3. **Presentation playlist** – A collection of datasets grouped together in a list for a presentation
4. **Playlist.sos** – A text file that specifies how a dataset should be displayed on the sphere. Each dataset must have its own playlist.sos file

Basic Setup

SOS is a collection of hardware that integrates computers and video projectors to display animated images onto the surface of a large sphere. Taken in pieces, the system consists of a sphere situated in a room, surrounded by four video projectors, numbered one to four starting with number one closest to the computer and then going counterclockwise. The video projectors are connected and driven by the primary computer. Each projector is responsible for its own quadrant of the sphere. The computer has two dual output graphics cards to

support the four projectors and a third graphics card to run the user interface. The computer pulls in content, usually some type of planetary imagery, renders it to an Earth projection, subsets it, and upon command displays it onto the sphere. The computer is responsible for many things, namely among them: running the main user interface to the system, real time data collection, and providing the interface to the automation control protocol. All of the computers use the Linux operating system Ubuntu (currently version 12.04). Most sites buy a "hot" spare that is identical to the primary computer in terms of hardware, as a backup system. All of the software that drives and controls the SOS system is written and maintained by NOAA.

Turning the System On and Off

When you turn on the primary computer, it will automatically log into the user sosdemo. The primary computer should be always on. The spare computer doesn't have to be on, but it is recommended to leave it on for backup purposes. If you want to change users you will have to log out and then log in using your user name and password. There is an icon that looks like a power button in the top right menu bar for logging in and out.

To shut the system off use the icon that looks like a power button in the top right menu bar. This lists many options including log out, shut down, and reboot. Typing "sudo shutdown -h now" to shutdown or "sudo reboot" to reboot in a terminal also works. To force a sudden power off hold the power button for 5 seconds. This last option is to be used only as a last resort.

SOS Stream GUI

Once you are logged in, find the icon on the Desktop labeled "SOS Start" and double click it. This will bring up the Science On a Sphere® interface, called the SOS Stream GUI. The SOS Stream GUI must be open in order for you to use SOS. At the top of SOS Stream GUI you will see five menus: "SOS," "File," "Library," "Controls," and "Utilities." Below that is a window with information about the current dataset, buttons similar to those on a DVD player that allow you to control the opened playlist, a full list of the current playlist, and a place at the bottom to search for datasets.

SOS Menu

The SOS Menu only has two items, "About SOS" and "Quit." Clicking on "About SOS" will give you the version of SOS that you're currently running. Often if support is required, we'll ask for the version of SOS that you're running. The "Quit" button closes the SOS Stream GUI. You can also close the software using the "x" at the top of the window.

File Menu

The File menu gives you to options to open, reload or update a playlist, install new data, edit playlists, open data, and turn on Autorun. The "Open Playlist"

option will open a dialog box where you can select a playlist to open. Any time a modification is made to a playlist, you must reload the playlist in order for the changes to be reflected. You can do this with the "Reload Current Playlist" option. The "Update Playlist Data" option will scan through your playlist and download any files that are missing. This is a useful feature if you have a playlist with new content that you haven't yet downloaded. By default, all new content from NOAA is updated on your system every Monday. The "Install New Data" option requires a .sosx file, which is similar to a tar file, which the NOAA staff will supply to you if you request help in downloading a new dataset.

You can launch the Playlist Editor using the icon on the desktop or by clicking on the "Edit Playlists" option in the "File" menu. The next three options in the "File" menu, "Open Texture," "Open Image Sequence," and "Open MPEG-4 File" allow you to open either JPEGs, PNGs, or MPEG4s directly, without a playlist file. This is a useful feature for testing new frames or movies. The final option is "Autorun," which will turn on Autorun. When running, a window will appear to let you know that Autorun is on. By default, each dataset in the open playlist will be displayed for three minutes.

Library Menu

The Library menu provides access to the datasets, sorted by category. In addition to all the main categories (air, extras, land, people, snow and ice, space, and water), there is also live programs, earthnow, all, and custom site categories. The all category is simply an alphabetical list of every dataset on the system. The live programs datasets have accompanying scripts that can be found here: http://sos.noaa.gov/Datasets/live-programs.php. All datasets can only be included in one category for the library listing in the GUI. The datasets in the earthnow category are special datasets that are generated about twice a month and have an accompanying blog: http://sphere.ssec.wisc.edu/. Additionally, there is a special custom site category for special datasets added by a particular SOS site. In order for custom datasets to appear in the SOS Data Catalog, they must be put in a subdirectory of /shared/sos/media/site-custom.

To update the library, including site-custom, use the "Update Library" option. This needs to be done every time a new dataset is added to the system.

Controls Menu

The Controls Menu provides options for controlling the sphere and gives you the keyboard shortcuts that are available. In addition, there are a few options for adjusting the display of the current dataset. The "Frame Delay" option allows you to adjust the frames per second, first dwell and last dwell. The "Sphere Tilt" option allows you to adjust the tilt on the x, y, and z axis. And the "Reset Sphere Tilt" option will reset the tilt of the sphere. All of these modifications are reflected in real time. Any changes made are not saved. If you like the modifications that you've made, you'll need to set those in your playlist. These options are good for testing out different settings.

Utilities Menu

The Utilities Menu has four options: “View a SphereCast…”, “Host a SphereCast…”, “Set Up a Shared PIP…” and “Run SOS Diagnostic Utilities…” The “View a SphereCast…” button allows you to connect your SOS system in order to receive SphereCasting commands from a host site. The Hosting button is for sites hosting a SphereCast. For more information about SphereCasting, visit: http://sos.noaa.gov/Support/spherecasting.html The “Set Up a Shared PIP…” button allows you to play a live streaming video over a whole playlist of datasets. You can find more information in the Content Creation section. The Diagnostics button will open a new window with several utilities for troubleshooting your system. This window can also be launched from the “SOS Diagnostics Utilities” icon on your Desktop. You must be logged in as the user sos in order to run the Diagnostic Utilities.

The Utilities include:

'Fix file permissions...'

- The program will attempt to change the access permissions on SOS files. Typically it is useful if you receive any errors about not having the required permissions or access to files. This can only be run as user sos.

'Make a diagnostics log file...'

- This will generate a sos_diagnostics.log file in your home directory that can then be emailed to the SOS support team at sos.gsd@noaa.gov. Please provide a description of your problem in the email. The log file aids in identifying the problem with your system.

'Start TeamViewer...'

- Launches the TeamViewer application so the SOS support team can work to fix your computer remotely.

'Change projector model...'

- Launches a program that lets you change the type of projector SOS is configured for. If SOS is open when this program is run it will crash. This can only be run as user sos.
- Note there are two options for each projector type - 'CRT' and 'DFP'. If your new projectors are connected to the computer with UXGA or VGA cables, choose the option ending in 'CRT', if your projectors are connected with DVI cables, choose the option ending in 'DFP'. If you choose the wrong option, nothing will display on the sphere.

'Reset video configuration...'

- This can be useful if you are having issues with your display such as blank projectors, projectors displaying incorrect colors or your monitor isn't blank. It restarts the X server. (Your displays will all go dark for a bit

before they restart, this is normal.) This can only be run as user sos.

'Stop SOS program...'

- If something goes wrong with your SOS program and you need to terminate it, select this option.

Dataset Details

For more information about the currently loaded dataset, click the “Details” button in the SOS Stream GUI. This will open a window with all the parameters that are set for this dataset.

Searching

To find a particular dataset, use the Search Bar at the bottom of the SOS Stream GUI to browse through the whole library. A new playlist will open with all the datasets that match your search. To return to your original playlist, simply clear the Search Bar. By default, the search is based on the title of the datasets, but under the advanced search, you can search by title, keywords, and all parameters. To open the advanced search, click on the “+” in the Search Bar.

Opening a Playlist

A generic playlist, called normal-demo.sos, is automatically opened when the SOS Stream GUI is started. To open a user-generated playlist, click on the “File” menu and select “Open Playlist.” In the window that appears, select the playlist that you would like to use. All of the playlists are saved in the directory **/home/sos/sosrc** for the user sos and **/home/sosdemo/sosrc** for the user sosdemo. If a playlist contains errors, a warning message will pop up with the names of the offending datasets and the paths that they use. Clicking on a dataset in the playlist will load it on the sphere. The dataset bar will turn yellow while loading, and then turn green if it loads properly or red if it is unable to load.

If you make changes to your playlist while it is open, it will not automatically reflect those changes. You will need to reload the playlist by clicking the “Reload Current Playlist” button in the “File” menu.

A playlist can also be opened with the SOS Remote (app for iOS mobile devices) by tapping “Datasets” at the bottom of the app, and then tapping “Load Playlist” in the upper left-hand corner. You can scroll through the available playlists or jump around using the index on the right-hand side. Tapping a playlist will load it.

Using a Playlist

Once a playlist is open, there are several options for using it. The first is to set the system on Autorun mode. In this mode, the system will run through the

playlist on an automatic timer. To turn on Autorun, click “Autorun” under the “File” menu. In Autorun mode, the system will display each dataset for a default three minutes unless otherwise specified in the playlist. The second option is to control the playlist from the primary computer. To do this you can use the buttons across the top of the window, the commands in the “Control” menu or the keyboard. The buttons across the top of the window are similar to those on a VCR. There is a timeline across the top with a slider bar to indicate the frame number of the dataset. You can move the slider bar around with the mouse to fast forward or fast backward through the dataset. The commands in the “Control” menu provide all the same functions as the buttons across the top. The controls for the keyboard are listed the right side of the commands in the “Control” menu. The most common keyboard commands are the up and down arrows that allow you to move through the selected playlist, and the space bar which pauses and plays the datasets. The third way to control the playlist is using a remote control. There are two remote controls for SOS: a Wii remote and the SOS Remote app for iOS devices such as iPads and iPhones.

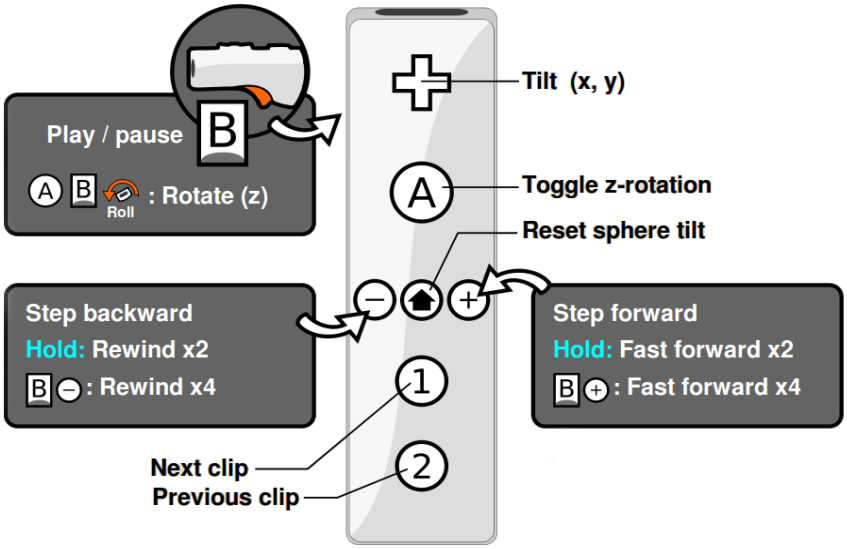
Using the Wii Remote

The Wii remote is a great tool for docents to use while giving live presentations. Before the remote can be used, it has to be paired to the computer. Remotes only have to be paired once. To pair a remote, launch the SOS Stream GUI. Once that is open, double-click the “Alignment” icon on the Desktop. In the window that opens, select “Wii remotes.” Another window will open where you can select “Pair a Wiimote”. A window will appear giving you instructions to press the red button on the back of the remote. After that, the address of the Wii remote is permanently stored and should appear in the top window of the Wii remote software. Only remotes that are paired will connect to the system and you should only have to pair your remotes once. After pairing, the remote will need to be connected to the software each time you restart the SOS software. In order to connect the remote, start the SOS Stream GUI (if it’s not already open), and then press any button on the remote. After pressing any button, you should see the blue lights flashing at the bottom of the remote. Once the remote is connected it will vibrate once and one blue light will be on. If the remote won’t work, close the SOS Stream GUI and restart it. Try connecting the remote again. If it still won’t connect, unplug the Bluetooth dongle and try again.

If there is no Wii charger, turn the remote off between uses to preserve the battery life. Use the power button in the top corner to turn it off. To turn it on, press any button. The remotes will stay connected as long as the SOS Stream GUI is open. Any time the SOS Stream GUI is closed, the remotes will disconnect and will have to be reconnected when the SOS Stream GUI is opened. The remotes will also disconnect if they go outside of the range of the Bluetooth dongle. The range will vary depending on the particular dongle that is used and the location of the dongle. In ideal conditions, the Bluetooth signal typically extends up to 100 feet.

Functions of the Wii Remote

All of the basic functions need to give a presentation are available through the Wii remote. You can use the remote to navigate through the playlist. The “1” button will load the next dataset and the “2” button will load the previous dataset. Use the “B” button to pause and play a dataset. To step backward or forward frame by frame use the “-” or “+” buttons respectively. To fast forward or fast backward slowly hold the “+” or “-” buttons respectively. To fast forward or fast backward quickly, hold the “B” button while pressing the “+” or “-” buttons respectively. To toggle the z-rotation on and off, use the “A” button. All of the buttons are very responsive and one light press is all that is needed.



The Wii remote can also be used to tilt and position the image on the sphere. The left and right arrows tilt the dataset on its x-axis, the up and down arrows tilt the dataset on its y-axis. (*NOTE – the orientation of the x and y axis is not the same for all datasets*) To rotate the sphere on the z-axis, hold down the “A” and “B” button while rotating your wrist in the desired direction of rotation. If you want to reload the dataset in its original orientation, press the “Home” button.

Using the SOS Remote App

In addition to the Wii remote, the iPad, iPhone and iPod Touch can be used to control the sphere. A separate manual for the SOS Remote App is available online: http://sos.noaa.gov/Docs/SOSRemoteUserManual.pdf The SOS Remote Manual contains much more detail on the functions of the remote. For convenience, we’ll just refer to the iPad for the remainder of the document. The iPad has all the same control options as the Wii remote plus many other features. In order to connect the iPad to the SOS system, it must be on the same Wi-Fi network as the SOS system. Refer to the Network paragraph in the Operation and System Administration section for specifics of the network. The SOS

Remote App is freely available through the Apple App Store for download onto Apple devices (iPad, iPhone and iPod Touch) with iOS version 5.1 and above.

Once the iPad is connected, a user has the option to load a playlist, navigate through a playlist, tilt and orient the sphere, browse through the library, draw on the sphere and much more. Along the bottom of the page there are five icons: Presentation, Datasets, Layers, Web Page, and Settings.

Functions of the SOS Remote App

The Presentation icon will open the SOS Presentation page, which consists of orientation and playback controls, as well as a preview of the current playlist. To jump between datasets, simply tap the dataset in the list on the left-hand side that you would like to open. The controls on the right-hand side of the screen are used for tilting, rotating and controlling the dataset. The "i" button provides information gesture shortcuts are available.
The Datasets icon provides access to the library, as well as a list of all the playlists on stored on the system. The Layers icon is only useful when a dataset with multiple layers is loaded. On this page you are able to turn layers on and off and fade them in and out. The Web Page icon takes you to the SOS data catalog online if your iPad has an internet connection. Under the Settings icon you can check the connection to SOS, turn auto run on or off and run alignment.

Organization of Data

Before you think about making a playlist, it's helpful to understand how the data is organized. All of the Science On a Sphere® datasets are put into one of the seven main categories. These categories are:

- Air
- Extras
- Land
- People
- Snow and Ice
- Space
- Water

The "Extras" category contains assorted datasets that don't fit into the other categories. Within each category there are many subcategories. Datasets can be put into multiple categories and subcategories. A full list of all of the datasets available in the categories is on the SOS website at: sos.noaa.gov/Datasets/index.html.

The datasets are all stored in their own folders in an organization that follows an old scheme. You will see all of these directories at /shared/sos/media/ on each computer. Each dataset folder contains (if available):

- JPEG or PNG file named for resolution (if still image)
- Folder with images named for the resolution of the images
- An equatorial cylindrical equidistant video (.mp4) of the data
- Text file labeled labels.txt
- Text file labeled playlist.sos
- Color bars and other supporting images
- Media folder with thumbnails, videos, and supporting documents

A uniform naming convention has been used among the folders. Images that are projected onto the sphere are named for their resolution, movies that are projected onto the sphere are named for their dataset name and resolution, all labels are named labels.txt etc. This has been done to make it easy for the user to know what is available in each folder.
Datasets that are related to one another are all grouped into one folder. Each dataset still has its own folder, but then those folders are all put into one folder. For instance, in the "atmosphere" category there is an "aerosol" folder. This "aerosol" folder contains three folders, one for each of our related aerosol datasets.

Two Types of Datasets

There are two main types of datasets, textures and time series. Textures are the simpler of the two. They consist of one still image that can be set to rotate on the sphere. A good example of a texture is Mars. In the Mars folder you will find just one image, named for its resolution, which is projected on the sphere. Often, the textures are available in several different resolutions. As the resolution increases, so does the loading time on the sphere. Textures can be rotated in any way using the functions either in the "Control" menu or on the remotes.

The second type of dataset is a time series. An example of a time series is the Indian Ocean Tsunami; you can watch the waves propagate across the globe. There are several different ways that time series work. In its raw form a time series is a collection of images. The images are named numerically, in ascending order. All of these images are in a folder named for the resolution of the images. These images can be displayed directly on the sphere. The raw images can also be converted to a MPEG4. MPEG4s are named for the dataset and the resolution of the movie. This is the preferred format for showing time series because the system can play the MPEG4 files at a faster frame rate than the image sequences. The MPEG4s and raw images can also be set to rotate while they are animating through a feature in the playlist and a button on the remotes.
NOTE: Even if you make an MPEG4, it's good to keep the raw data available.

Playlist.sos

Within each dataset folder is a text file named playlist.sos. This file is used to specify how the data is displayed on the sphere. There is a fairly strict format that must be followed within the playlist.sos file. Any specifications that are made in the playlist.sos will be used in all of the playlists that include that dataset. For

a complete listing of keywords available for the playlist.sos file, visit: http://sos.noaa.gov/Docs/Playlist.html

Because all of the data is stored in the same folder as the playlist.sos file, it is not necessary to include the entire path to the file. You only need to include the data name. For example, to include labels all you need to type is *label = labels.txt*. If the data is stored in another location, then the path needs to be included. For example, *label = /shared/sos/media/atmosphere/dataset/labels.txt*

A typical playlist.sos file will not include all of these parameters. At very minimum, "name" and "data" must be included. It is also recommended to always include keywords, publisher, creator, and category. Anything with a "#" in front of it is considered a comment and won't affect how the dataset is displayed. If the data was found online, it is often useful to include the web address of the data's original location.

There can be multiple playlist.sos files in one folder for different versions of the dataset. The file names simply need to start with playlist and end with sos. For example you could have playlist.sos, playlist_with_audio.sos, and playlist_extra_labels.sos all in the same folder.

SOS Playlists

A playlist is an ordered list of datasets. It is often helpful to think of a SOS playlist as a music playlist in iTunes. Playlists can be saved and repeatedly used. Different playlists can be made for different presentations or shows. Also, docents can have their own playlists. All playlist file names have to end with the extension .sos and are stored in either /home/sos/sosrc or /home/sosdemo/sosrc depending on the user. The basic format of a playlist is a file that points to all of the playlist.sos files for the datasets that you want to show. For example, here is a playlist that includes three datasets:

include = /shared/sos/media/oceans/indian_tsunami/playlist.sos
include = /shared/sos/media/astronomy/xray_sun/playlist.sos
include = /shared/sos/media/models/ipcc_temp/gfdl/playlist.sos

Each "include" is used to point to a different dataset. This example playlist includes the Indian Ocean Tsunami, the X-Ray Sun and the GFDL Temperature Change Model. All of the information about the labels, color bars and timing is saved in each of the separate playlist.sos files. The nice thing about this format is that everyone's playlists will be using the same versions of the data. However, if you do want to edit some of the options for a dataset, within only your personal playlist, you can do that. Simply include the changes in your demo playlist under the include. For example, if you want a faster rotation rate on the sun and a longer lastdwell for the tsunami in your playlist, you can change it like this:

include = /shared/sos/media/oceans/indian_tsunami/playlist.sos
lastdwell = 7000
include = /shared/sos/media/astronomy/xray_sun/playlist.sos
fps = 50
include = /shared/sos/media/models/ipcc_temp/gfdl/playlist.sos

As of SOS version 4.3, Presenter Notes may be added to any presentation playlist file. Presenter notes are accessed from the iPad's SOS Remote app's Presentation tab, and can be edited either from the app's Playlist Builder tab, or manually using a text editor. If editing a playlist file manually, each line that is to be a presenter note should begin with "#>". Presenter note lines should go at the very bottom of the presentation playlist. Following is an example.

One thing to note is that if you add presenter notes to a presentation playlist manually and then open them in the iPad app's Playlist Builder and make edits, any normal comment lines (lines that begin with a "#" symbol) that were originally in the playlist will get deleted.

include = /shared/sos/media/land/blue_marble/blue_marble/playlist.sos
include = /shared/sos/media/astronomy/mars/original/playlist.sos
#> Features to note about blue marble:
#> - Vastness of the Sahara Desert
#> - Shading done in true color: gives Earth's appearance from space
#>
#> Features to note about mars:
#> - Olympus Mons: highest point in the solar system at 88,500 feet

Making a Playlist

There are four basic ways to make a playlist. The first is to manually type the playlist in a text editor and save the file with a .sos extension in either /home/sos/sosrc or /home/sosdemo/sosrc depending on the user. For this you will need to know the path to each of the datasets on your computer. The other three options involve using programs created for making playlists. The first is the Playlist Editor on the SOS computer, the second is the Playlist Builder on the SOS website, and the third is the Playlist Builder on the iPad remote app. These are simpler options because you don't need to know the location of the datasets on the computer.

The Playlist Editor is a drop and drag program that lets you drop and drag datasets into your playlist and then rearrange them as you please. The playlist editor can be launched from the "Playlist Editor" icon on the Desktop, or through the SOS Stream GUI with the "Edit Playlists" option under "File."

The Playlist Editor has two main tabs at the top, "Playlists" and "Clip Library." The Playlist tab has a list of all the playlists on the left and shows the contents of a selected playlist in the main window. The Clip Library shows the data categories on the left and has all the datasets in a selected category in the main

window. To create a new playlist, click “New Playlist” under the Playlists tab. Give it an appropriate name (avoid using spaces and special characters in Linux) and press enter. The playlist will be automatically alphabetized with the other playlists. Find yours and then double click on the name to open it in a new window. Then select the Clip Library tab and drag the desired clips into the playlist that was opened in a new window. There is a search option in the playlist editor to help you find the desired datasets. Entire playlists can also be dragged into a new playlist. To edit a clip, select the “Edit Clip” button and make adjustments as desired. With the playlist editor you can edit a clip and add layers, icons, pips, labels, colorbars, KML layers, and WMS layers.

One important note about the playlist editor is that it saves continuously, so there is no “Save” button. This means that you can view your playlist as you create it in the SOS Stream GUI by using the “Reload current playlist” button under “File”. When the playlist editor is closed, a prompt appears that asks if the changes should be saved. This is the only time to undo any changes that have been made.

The Playlist Builder on the SOS website allows you to make a simple playlist from any computer that can be saved and transferred to the SOS computer in the method you choose, such as with a thumb drive, using online storage space, or through email. The playlist should be copied to /home/sos/sosrc or /home/sosdemo/sosrc depending on which user you are logged in as on the SOS computer.

When you view a dataset description on the SOS website, you’ll see a Playlist Builder box in the upper right-hand corner with an “Add to Playlist” button. Clicking that will add the current dataset to your playlist. Clicking the cart will open your playlist in a pop up window and let you rearrange the datasets or save the playlist. By default, your playlist will be called custom_playlist.sos, but you can rename that to anything you want. Use the “Empty Playlist” button to clear your current playlist. The Playlist Builder lets you create a playlist, but it does not let you modify the individual datasets. You will need to open the playlist in the Playlist Editor if you want to make modifications.

The Playlist Builder on the iPad remote app allows you to make or edit a playlist directly on the iPad, while saving it directly to the SOS computer for immediate use. See the iPad User Manual for complete details on this new feature in version 4.3. The Playlist Builder also allows you to add presenter notes to your playlist that you can refer to in a popup window on the iPad during your presentation.

Giving a Presentation

Presentations with Science On a Sphere® can take on several different formats. Presentations can be broad and include datasets from all of the categories, or

narrowly focused on a topic such as climate change or the solar system. The type of programming is entirely up to the users.

Live Presentations

The preferred way to present Science On a Sphere® is with a live presenter to lead the audience through a playlist using either the Wii remote or the SOS Remote app. The presenter can either be around to answer questions as visitors wander through or lead a structured presentation on a schedule. The length of a presentation can vary widely depending on the audience and topic. A standard presentation at the David Himes Planet Theater at NOAA in Boulder, CO is 30 – 45 minutes and includes 10 datasets on average. Presentations in a museum setting tend to be shorter, focused presentations with less datasets.

Presentation Tools

The SOS Remote App offers many tools for enhancing a live docent presentation. These tools include annotation, zooming, and layering. The annotation and zooming tools can be accessed through the Presentation icon. The layering tool can be accessed through the Layers icon on the bottom of the app. For more information about these tools, reference the SOS Remote App User Manual: http://sos.noaa.gov/Docs/SOSRemoteUserManual.pdf

Autorun

The simplest presentation mode is Autorun. In the Autorun mode, the system displays each dataset for a default three minutes. This is a good option when a docent is not available to lead a presentation. If this format is used, it's nice to have supporting audio or text so that the audience knows what they are looking at. There are audio tracks available with a limited number of datasets. Many sites give live presentations with the sphere throughout the day, and in between presentations leave the sphere on Autorun.

SOS Add-ons

Side wall projectors or flat screen televisions can be linked to the Science On a Sphere® software to sync a PowerPoint presentation with a SOS demo. This can be used to display supporting information for each dataset, which is particularly useful in Autorun mode. You can find more information about the PowerPoint syncing software here: http://sos.noaa.gov/Support/cu_side_projectors.html. In addition to the PowerPoint software, there are also kiosk software packages available to accompany SOS. They typically utilize a touch screen monitor that allows visitors to select which datasets they would like to view and provides a description of each of the datasets.

Audience Considerations

Another aspect of the presentation that needs to be considered is if the audience will sit in one location or move about the sphere. With the rotation capabilities of SOS, it is possible to have your audience seated on one side of the sphere and rotate all of the datasets to be ideally positioned in front of them. The second option is to have the audience walk around to different sides of the sphere, rather than rotating the data. There are pro's and con's to both options, so it's up to the

users to decide which option best fits their needs. Be aware that sometimes your audience will be distributed around the sphere and they will not all be able to see the same thing at the same time. In this case, it's helpful to allow a dataset to play through several times, rotating it so that everyone gets to see everything.

Content Creation

Knowing how to create and add content to your Science On a Sphere® allows your site to have the latest and most up-to-date datasets. Members of the SOS Users Collaborative Network often share content that they create with the other SOS sites. This session is meant to familiarize users with the process of customizing, adding, and creating content. All of the datasets are owned by the user sos and cannot be edited or deleted by the user sosdemo. There is one folder in /shared/sos/media/ called site-custom where the user sosdemo can add, delete and edit content that is created by the site. For any modifications to the content from NOAA, you must be logged in as the user sos.

Data Organization

Each dataset has its own folder that contains all of the pieces that are needed to display the dataset on the sphere. The only two pieces that you must absolutely have in order to display a dataset are the image or images/mp4 and a playlist.sos file. All of the other pieces, such as the labels and color bars, are optional, but nice to have. Every dataset from NOAA is stored in one of six categories (land, ocean, atmosphere, astronomy, model and simulations, and extras). It is recommended that any new datasets developed by your site be stored the site-custom folder. All of the data from NOAA is synced regularly with the NOAA FTP server, so any local changes will be overwritten. By only making changes in the site-custom folder, you are sure to not lose any of your work. Also, by keeping your content only in this site-custom folder you can keep track of which datasets are local to your site and which are provided by NOAA. You can create as many folders as you want in the media tree. Only the user sos has permission to create folders in the media directory. In some cases, it is useful to create a folder called "Proto" or "Prototype" where you can store new datasets that you are working on.

Any content that is added to the system should be stored somewhere in /shared/sos/media. Do not store any content on the Desktop or in the sosrc playlist directories.

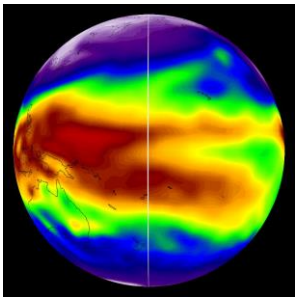
Types of Datasets

We've already mentioned that there are two main types of datasets: textures and time series. Textures are a single, static image that can be set to rotate on the

sphere. Texture datasets are relatively simple to make because you only have one image to work with. You can set the rotation rate of a texture by setting the frames per second (fps) setting in the playlist.sos file. Time series can either be image sequences or MPEG4 videos. Making a time series can be a little more difficult. There is no limit to the number of frames that you include in a time series, except for available disk space. You can animate the time series at any rate, but 30 frames per second is the recommended speed. We try to create our time series so that they look smooth and animate well at 30 fps. The frame rate is sometimes limited based on the time resolution of the data and the type of data. It is important to keep this in mind when creating a time series so that you make enough images to ensure that the dataset plays for a reasonable length. If you only make 30 images, then it will only take one second to loop through the dataset at 30 frames per second. The optimal playback speed is chosen based on the number of frames and the degree of change between each frame in the sequence. To get smooth time series, the changes between each frame should be small and the playback speed high. If a time series is coarse, then it might animate better at a slower frame rate such as 10 – 15 fps.

File Format

In order for the data to wrap properly around the sphere, it is imperative that you follow the specifications for the data format closely. Images in the wrong format will project on the sphere, but they will not correctly represent the size of the continents. The images need to be plotted using the Equatorial Cylindrical Equidistant (ECE) projection. An ECE projection is commonly referred to as a simple lat/lon grid, where the image is a standard cartographic map projection that is twice as wide as it is tall (rectangular). It is important that the data fill the entire image space. If there are borders or extra space around the edges then a seam will appear on the sphere with spots on the poles. It is also important that the data match on either side of the edges of the image.

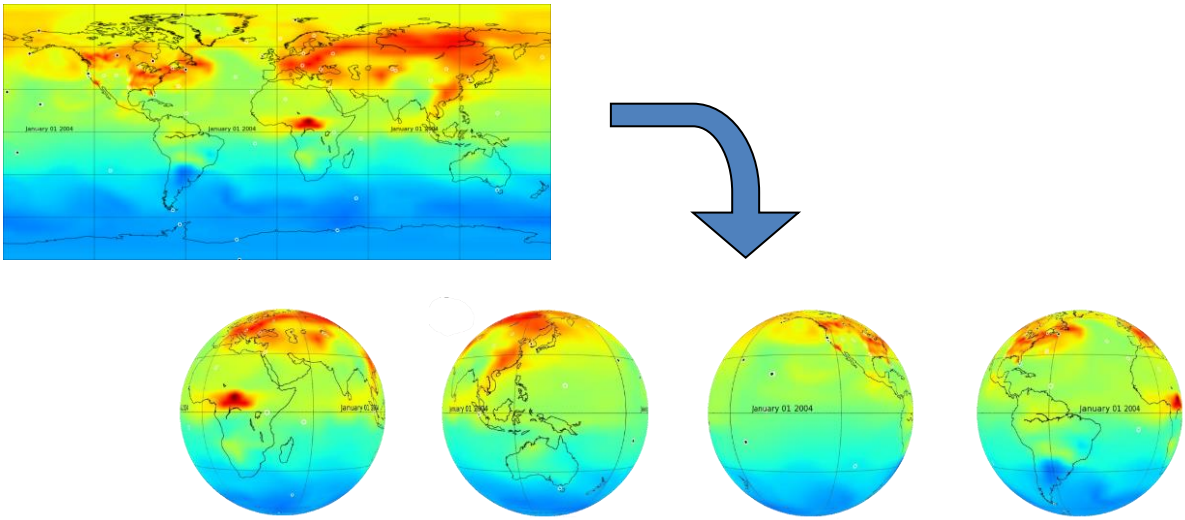

Example of a border seam

For textures, 2048x1024 is the suggested minimum size, though 4096x2048 is recommended to optimize the appearance of the image on the sphere. For time series, 2048x1024 is the recommended size. The SOS system is fairly flexible as to what file formats it can handle. It will accept most common formats such as JPEG, PNG, GIF, TIF, etc for textures. We prefer JPEG or PNG. If you want to use layers with transparency, then you should use PNG because it allows for transparency. For image sequences, the same image formats for textures apply. For videos, the only acceptable format is MPEG4. Render time series with the MPEG4 video codec at a minimum of 25 mbps. Just because a file has a .mp4 extension does not mean it will play perfectly on SOS. Be sure to use a constant bit rate. The H.264 codec can cause errors in the SOS software when used with a variable bit rate.

For a texture you just need one image. If you want to be consistent with the current organization, the textures that you create should be named for their resolution, such as *4096.jpg*. For a time series, you will have either an image sequence or a video. In an image sequence, the frames should sort in ascending order from earliest to latest. To do this, we usually use the date in the name of the file or embed a frame number in the file name, with a sufficient number of leading zeros to sort correctly. The frames for a time series should be kept in a folder named for the frames' resolution. Name MPEG4 files with the name of the dataset along with the resolution, such as *currents_2048.mp4*.

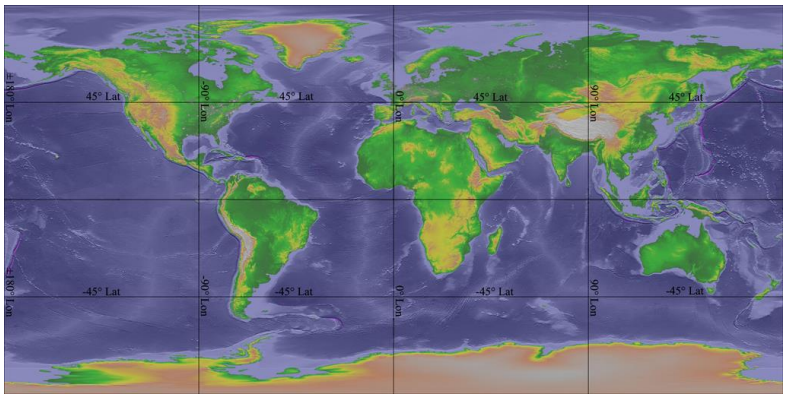
System Interactions with Data

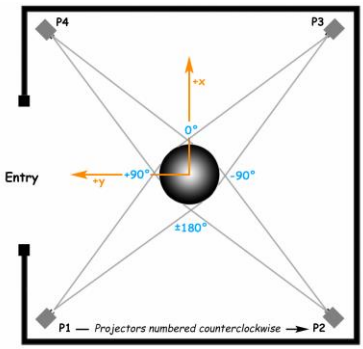
When a dataset is projected on the sphere, you are really looking at four images that have been merged together seamlessly around the sphere. The Science On a Sphere® software splits the ECE images that you load using the SOS Stream GUI into four disk images every time you load a new dataset on to the sphere. Because all of the work is done by the software automatically, you don't need to do anything except point the system to where the data is located by creating a playlist.



Orientation of Data

The maps created for SOS should be centered on the Prime Meridian, so that 0°N,0°E is the center of the image, as seen below left. The map below is from the dataset in the extras category called SOS Coordinate System that is useful when learning how datasets are loaded on the sphere. The center of the map loads between projectors three and four with the edges of the map lining up between projectors one and two, as seen in the diagram below right.





Tools to Create Datasets

Because Science On a Sphere® uses common image and video formats, you can use many tools to create and edit datasets. Some of the common tools used are Photoshop, FinalCut Pro, ImageMagick, GIMP, etc. You can use whatever you have available and are comfortable using. A program like FinalCut Pro can be used to add transitions, special effects and other computer graphic techniques. At a higher level, tools like IDL, AWIPS, McIDAS, and other image analysis applications are typically used to create imagery from scientific datasets. As an example, we have used AWIPS (Advanced Weather Information Processing System) to create images from numerical forecast models. A graphics designer can use a 3D modeling application, such as 3D Studio, to create advanced visualizations for SOS.

Basic Options in the Playlist

You can optimize how a dataset is displayed by understanding all of the options that are available to you in the playlist.sos files. You can do much more than simply display the dataset. All of the functions available in the playlist can be found online here: http://sos.noaa.gov/Docs/Playlist.html

There are two places where you can modify a dataset: in your presentation playlist (such as weather_overview.sos) or in the playlist.sos file. When you modify a dataset in a presentation playlist, the changes will only apply in that specific playlist. If you modify a playlist.sos file, then every presentation playlist that points to that playlist.sos file will reflect those changes. The playlist.sos files that you create should be considered the master copy. *Note:* Changes made to playlist.sos files that are provided by NOAA will be overwritten every week when the sync with NOAA FTP server occurs. If you want to make changes to those playlist.sos files, first copy them into your site-custom folder.

Texture Datasets

For a texture dataset, there are only a few options that you need to consider. When a texture dataset is initially loaded on the sphere, you can set whether you want it to rotate immediately or only after play is pressed. The function “animate” in the playlist controls this. If “animate” is not included in the playlist, then the

default is for the dataset to automatically start rotating. “animate” can be set to either 0 or 1. 0 will prevent the dataset from animating until play is pressed, and 1 will cause the dataset to start rotating immediately when loaded. For a texture, “fps” is used to define how fast the dataset will rotate, while for a time series, it defines the animation rate. Another common function used with textures is the tilt option. For instance, we have our Earth textures set to load at a 23.5° tilt to resemble the Earth’s actual tilt. This is also useful if you are loading a dataset that highlights the poles, which are hard to see if there is no tilt. To set the tilt, set “tiltx,” tilty,” and “tiltz” to the number of degrees that you want each axis tilted. The tilt can be positive or negative.

Time Series Datasets

For a time series, you have all of the options mentioned for the texture, plus many more. Rather than causing a dataset to rotate, “animate” causes a time series to start animating, but the functionality is the same. The default is for the dataset to start animating immediately. When a presentation is docent-led, it is often helpful to have the time series animate only after play has been pressed. This gives the docent time to provide background information about the dataset and explain what is going to happen. (In Autorun mode “animate” is automatically set to 1 regardless of what is in the playlist.) Another option is to set “firstdwell,” which is an amount of time that the system lingers on the first frame before animating. The default is zero seconds. The time is listed in milliseconds, so “firstdwell = 4000” will dwell on the first frame for 4 seconds. You can also dwell on the last frame by setting “lastdwell.” When “lastdwell” is not set, the dataset loops continuously without pausing. Especially with model data, it is nice to set “lastdwell” so that the audience can get a good look at the last frame before the dataset loops again.

With particularly long datasets it’s sometimes nice to show only a piece of the dataset. You can do that by setting the “startframe” and “endframe” to the frame numbers that you want to start and end on. An example of when to use this would be if you just want to show a loop of Hurricane Katrina, not the entire 2005 season. You would use the 2005 Hurricane dataset, but set the “startframe” and “endframe” so that only the piece of the dataset when Hurricane Katrina was visible is shown. The “endframe” can be a negative number, which counts back from the end. Another way to shorten a dataset is to set the “skip” option, which allows you to set a skip factor. When “skip” is set to one, it skips every other image, and when it’s set two, it plays every third image.
To stop an animation you can simply pause a dataset with the remote. But if you want to stop on an exact frame, then you should use “stopframe” in the playlist. This lets you set an exact frame that you want the animation to stop on and start animating again after you press play. This is a good feature to use with model data when you want to look at a particular year.

Another option that you have for times series is to not only have them animating, but also rotating. For example, the default for the Indian Ocean Tsunami dataset is for the base image to stay stationary while the waves propagate across the

ocean. This means that only the audience standing in front of the Indian Ocean can see the waves. When “zrotationenable” is set to 1, then the dataset will rotate about its z axis while it animates. You can also use “zfps” and “zrotationangle” to set the frames per second rate for the dataset and the angle at which the dataset rotates. Make sure that you set your “zfps” at a rate that allows your audience to still grasp what they are looking at before it rotates out of site. For especially busy animations, it could be distracting to the audience to see both the animation and the rotation.

Autorun Datasets

There are also some functions in the playlist that should be specified when using Autorun. Autorun cycles through the datasets in a playlist automatically, showing each dataset for a specific amount of time. You can specify the amount of time each dataset is shown by setting “timer” to the number of seconds desired. If this is not specified, then each dataset is shown for 180 seconds. If “timer” is specified and you are not showing the playlist in Autorun mode, then “timer” will be ignored. It’s important to use “timer” when you also have accompanying audio tracks so that the dataset is shown for the length of the audio track. You will want to make sure that the audio is synced with the playlist. You can set audio for each dataset by specifying the desired track with the “audio” keyword. The audio tracks must be compatible with the Linux Mplayer such as .mp3, .mp4, .wav, or .ogg. Audio tracks are available from NOAA for a limited number of datasets. They provide a good way to give your audience information when a docent is not available.

Picture in a Picture

Picture in a Picture (pip) allows you to display single pictures (any of the previously mentioned image formats works), an image sequence, or videos (MPEG4 only) on top of any dataset. This feature can be used to display any image, but is commonly used to display color bars, charts and graphs, and other images that supply supplemental information. Also, you can have multiple pips which can be either displayed all at once, or set to run like a slide show on the sphere. For example, there is a Moon dataset that has all of the landing sites on Moon labeled. To compliment this, pips are set to cycle through a slide show of images taken from different exploration trips to Moon. You can find this example in /shared/sos/media/astronomy/moon/landings. Images that you are going to use as pips can be stored in the dataset folder that they go with. When a pip is included, there are several options that you have to set.

Pipstyle

There are three different styles for pips: projector, room, and globe. “Projector” is the default, where the pip is replicated four times and placed with the default position centered in front of each projector. As the imagery rotates, the pip remains stationary in “pipstyle projector.” A “pipstyle” of “globe” places one pip on the globe, by default with latitude and longitude both zero. As the sphere is tilted and rotated, this pip moves with the globe. This allows you to use pips as

geo-referenced markers. A “pipstyle” of “room” places one pip on the globe, by default with latitude and longitude both zero. As the sphere is tilted and rotated, this pip remains stationary relative to the room, with the sphere data sliding underneath it.

Pip Timing

The “piptimer” has to be set (in seconds) so that the system knows how long to display the pip. If the “piptimer” is set to 0, then the pip will be displayed for the duration of the dataset, which is the default. You can delay the appearance of a pip by using “pipdelay,” which is in seconds. Rather than having the pips appear abruptly, you can use the “pipfadein” and “pipfadeout” to fade the pip in and out in a specified number of seconds. The time to fade in and out a pip is excluded from the total amount of time allotted for the “piptimer.” By default, a series of pips will play through only once. You can set “duration” to a given number of seconds and the pips and underlying dataset will restart based on the set duration.

Pip Size

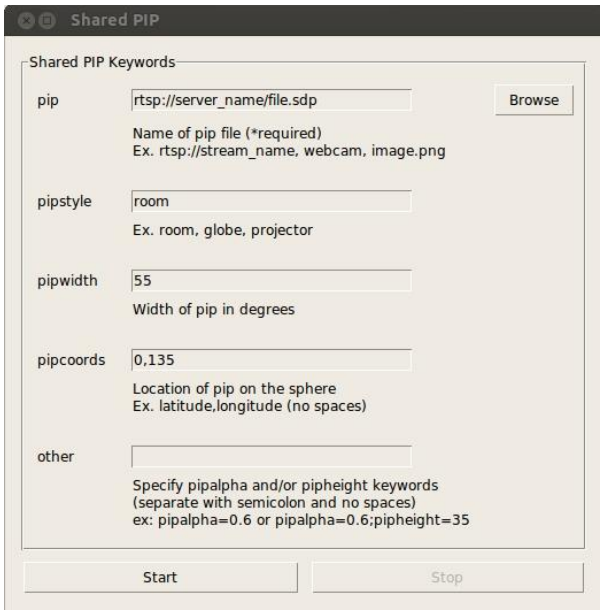
In order for the pip to be an appropriate size for the sphere and in the proper proportions, you have to set the “pipwidth” and “pipheight.” The width and height are measured in degrees latitude and longitude. If you set just the height or the width, the software will automatically scale the image. If you are using “pipstyle” “projector” you won’t want to make your pip more than 90 degrees wide because the pip appears four times (once for each projector) and it will start to overlap. In addition to the pip size, you will also need to determine where you want it displayed on the sphere. If nothing is specified, then the pip will appear in the middle of each of the projector views. To adjust the position of the pip, use “pipvertical” and “piphorizontal.” Both of these are in degrees. “pipvertical” is the vertical position of the image relative to the equator, with positive degrees above the equator. Be careful as you move the pip up and down as images near the poles become warped. The horizontal position is relative to the center of the projector, with positive degrees east of the project. An alternative to using “pipvertical” and piphorizontal” is to use “pipcoords,” which is set in degrees latitude and longitude. The benefit of using “pipcoords” is that there is no warping of the images, even near the poles. “pipcoords” is also used with “pipstyle” “room” and “globe” to position the pip.

When a pip is a mp4 file, the default playback speed is the frame rate of the dataset on which it is overlaid. If you want to control the frame rate of the pip, then use “pipfps” to set a new frame rate. The final option to set with a pip is “pipalpha,” or opacity. If not specified, the pip shows up opaque. If you don’t want your pip to completely block the underlying image you can adjust the opacity of the image from 0, which is completely transparent to 1, which is completely opaque.

Shared PIP

A Shared PIP is a special PIP that can display continuously over multiple clips in a playlist or between playlists. Such a PIP is useful during a SphereCast, for example, where you might have a video feed of a remote presenter on the sphere talking about a series of clips in the playlist. The Shared PIP stays active until you explicitly stop it. In its current implementation, a Shared PIP supports Live Video PIPs as described in the next section and static PIP images.

A Shared PIP is set up through the Shared PIP dialog box, located in the SOS Stream GUI's Utilities menu. In the Shared PIP dialog box that pops up, you specify a Live Video PIP in the same way as detailed in the section below. For a static PIP image, you can click the "Browse" button to locate the image on your SOS computer.The following PIP keywords work with a Shared PIP: pip, pipstyle, pipwidth, pipheight, pipcoords, piphorizontal, pipvertical, pipalpha



Once you press "Start", the PIP will show up on the sphere, and will remain active even if you switch to a different clip. Press "Stop" to delete the Shared PIP.

Live Video PIP

A Live Video PIP is a PIP that contains a video that is streaming either from a webcam connected to a local SOS computer, or from an RTSP stream. RTSP (real time streaming protocol) is an application-level protocol that controls the delivery of a real-time data stream, such as live audio and video. This feature may be useful for sites receiving SphereCasts, where, instead of needing a separate display in the SOS room to show video of the host site's presenter, the video can be shown directly onto the sphere. This feature may also be useful if a site wants to show a real-time video feed of a remote presenter onto their sphere for a particular in-house presentation.

Incorporating in a Playlist

A Live Video PIP is specified in a presentation playlist file (or in a clip's playlist.sos file) similar to how a normal PIP is specified. For example, if you are showing a tsunami dataset and you want to show a live video on the sphere of a remote presenter discussing the dataset (assuming the presenter is setup to broadcast an RTSP stream), one entry in your presentation playlist file might look like:

include = /shared/sos/media/oceans/japan_tsunami_waves/playlist.sos
rename = Japan Tsunami with Live Presenter
pip = rtsp://server_name/file.sdp
pipstyle = room
pipcoords = 0,135
pipwidth = 65

In the above example, “server_name/file.sdp” would need to be replaced by the actual name of the remote presenter’s RTSP stream.

If you are using a webcam attached to your SOS computer, simply type “webcam” for the “pip” keyword, as in: pip = webcam

The following PIP keywords work with a Live Video PIP: pip, pipstyle, pipwidth, pipheight, pipcoords, piphorizontal, pipvertical, pipalpha

Once you select this clip via the iPad or SOS Stream GUI, the live stream should pop up on your sphere as a normal pip does (note, however, it may take a few extra seconds to a minute for the stream to show up on the sphere, depending on network speed etc).

Requirements

- An RTSP source to broadcast the remote presenter: There are various live video streaming solutions available. Currently, we use Apple’s streaming QuickTime technology with the freely available QuickTime Broadcaster. Other streaming technologies that support RTSP may be used. If using QuickTime Broadcaster with the NOAA SOS video server for hosting a SphereCast, you would need to contact us in advance for setup instructions (see http://sos.noaa.gov/Support/host_spherecasting.html for more information).
- A reasonably high-speed internet connection is required to send/receive a live video feed. We recommend a dedicated bandwidth of at least 1.5 MBits/sec, though a higher 3-4 Mbits/sec is preferred.

Limitations

- The webcam currently does not support audio, and may exhibit a delay in frame rate overtime.
- Although RTSP supports both live data feeds and stored video/audio clips, in our current implementation, only live data feeds are supported for display in a PIP.
- If the live stream is stopped by the host while a Live Video PIP is being shown on the sphere, SOS Stream GUI will hang for about two minutes, and then it will resume normal activity. So, the best thing to do if you notice a live video stream is no longer working on the sphere is to wait for at least two minutes before using any controls on the iPad or SOS Stream GUI, otherwise, you may have to manually stop SOS and restart it.

Annotation Icons

The SOS Remote app, through the annotation feature, gives presenters the ability to draw on the sphere and place icons on the sphere. There is a set of default

icons that come with the SOS Remote app. In addition, sites have the ability to create custom icons. If you would like to create your own icons, use a transparent PNG with a minimum resolution of 256x256. To the right is an example of one of the default icons. Custom icons can either be specified for specific datasets, or made available in the default icon library.

Dataset Specific

To add an icon to your dataset's playlist.sos file so that it shows up in the Icons dialog when you load the dataset, simply add an **icons = value** keyword/value pair to the dataset's playlist.sos file and place the icon in the dataset directory. Note that you can specify more than one icon by making a comma separated list with **no** spaces.

For example, if you create a satellite icon and a rocket icon and want to add those icons to your Blue Marble dataset, your Blue Marble playlist.sos file might look like this:

```
name = Blue Marble (23 degree tilt)
data = 4096.jpg
category = land
icons = satellite.png,rocket.png
```

In this case, the icon files should be placed in the same directory as the playlist.sos file. In other words, use relative paths when specifying the icons in the playlist.sos file. Once you load the dataset on SOS and then open the Icons dialog, the two icons you added will appear at the top of the list of available icons.

Another way to specify an icon is via the presentation playlist located in the sosrc directory. You specify the **icons = value** keyword/value pair for a clip here as well, however, the pathname of the icon file must be specified relative to the location of the clip's playlist.sos file. For example, if you have an icon called turtle.png located in your site-custom folder, and you would like to make this icon available with the Loggerhead Sea Turtle dataset, you can add that to your playlist as follows:

```
# Loggerhead Sea Turtle Tracks
include = /shared/sos/media/oceans/LoggerheadSeaTurtleTracks/playlist.sos
icons =  ../../site-custom/turtle.png
```

General Icons

Finally, if you have a general set of icons that you create and that your site may use often, you can add these icons to the default icon library so that they are automatically available with every dataset. To do this, simply add your icons to the directory **/shared/sos/etc/AnnotationIcons/.**

Layers

The layering capability in SOS allows presenters to dynamically turn layers on and off. A multi-layer display can be created either statically in the dataset playlist beforehand, or interactively using the SOS Remote. By using the new Layers tab in SOS Remote, the user can toggle individual layers on and off, adjust the level of transparency of each layer, or delete a layer. Any labels or PIPs associated with a clip are now automatically placed in dedicated layers named Labels and PIPs. These can be interactively manipulated like any other layer.

Predefined Layers

A multi-layer dataset may be defined by using the new “layer” keyword. Each use of a “layer = name” keyword/value pair within a playlist.sos file defines a new layer and specifies the name of the layer. The specified name of the layer is used to identify it in the layer table in SOS Remote’s Layers tab. Each new layer specified appears visually on top of any previous layers.

The “layerdata” keyword is repeated for each layer to specify the corresponding data file for the layer. A layer defined this way may have a “layervisible = no” keyword/value pair defined to specify that the layer is not initially visible. A layer may also have a “layeralpha” keyword pair to further specify the initial opacity of the layer. An alpha value of 0.0 means that the layer is totally transparent, and 1.0 means the layer is totally opaque. A slider in the SOS Remote interface is available to interactively manipulate the opacity of each layer.

Note: For compatibility with versions of SOS prior to SOS Version 4, a default layer is created when the "data = " playlist keyword is seen in a playlist before the "layer = " keyword. The name of this default layer will be the same as the name of the dataset, given by the "name = " keyword.

Orienting Layers

In order for layers to overlap properly, it is important to make sure that the maps are oriented identically. In the case where two layers have different center points, you can set “layereast,” “layerwest,” “layernorth,” and layersouth.” These commands specify the geographic extent of the data within the layer. They specify the east and west edges of the data in degrees east longitude, and the north and south edges in degrees north latitude.

Overlays

In addition, we have created new overlays which are located in the /shared/sos/media/overlays directory, and which will show up as a library category on SOS Stream GUI and on the iPhone/iPad. You will find them accessible through a button on the presentation tab of the iPad. The overlays contain useful earth-related transparent layers (specified as clips in a standard playlist.sos file format) that can be used for both pre-programmed layering, as

well as, interactive layering. An example of a layer that will be in this category is Country Borders. If a site wants to add more overlays for general use, they should be placed in the site-custom folder with a playlist.sos file that has the category defined as overlay. Examples of playlist.sos files for overlays can be found in the /shared/sos/media/overlays directory.

Using KML Data

SOS supports Keyhole Markup Language (KML) data in addition to the previously existing movie and image formats. KML is a popular specification and actively used with Google Earth for displaying data on a sphere. The initial SOS KML capability supports a limited set of the entire specification, which includes many of the commonly used KML features you would typically display in Google Earth. More information on KML itself can be found here: https://developers.google.com/kml/documentation/kmlreference

An SOS playlist can reference both KML and the compressed KMZ formats using the layerdata keyword. See the SOS 4.1 Playlist Reference Format Manual for more details, along with the KML playlist provided with the SOS 4.1 Release Notes.

Implementation Notes

Typically, KML files are used with Google Earth which allows users to display information on a virtual sphere similar to SOS. There are a couple of differences to be aware of. Google Earth has additional space around the sphere where legends, icons, or other meta information can be displayed. SOS has only the sphere for displaying data. By default, all ancillary information is displayed at point 0° North, 180° East. Each subsequent piece is staggered from this starting point. This is user configurable. Within the playlist, use kmllegendxoffset and kmllegendyoffset to specify a new location.

KML Placemarks or Icons referenced in KML may appear small on the sphere. Additional playlist parameters have been included to scale icon's to make them more visible on the sphere. Use kmlplacemarkscale to scale these features if necessary.

More information on these commands can be found in the SOS 4.1 Playlist Reference Format Manual.

Special Notes

Often, KML files reference remote data via a web address. KML files of this nature require SOS to have access to the internet to retrieve these files. Depending upon your network connectivity and the number of external links

referenced in the KML file, the initial load may take some time. SOS will perform local caching of downloaded files and subsequent loads will perform faster.

It is strongly recommended to test KML files prior to any presentation to insure data is cached locally and the presentation is not delayed by waiting for remote files to be retrieved. When an SOS playlist references a KML dataset, SOS will parse the file and store any temporary or cache information in the system temporary directory. The default is "/tmp" on SOS systems.

Limitations

The SOS software does not support the entire KML specification. Here is a list of major items not currently supported in this release: Tours, Fly To, Features with 3 Dimensions, Resource Map, Model's, Regions. If KML data or KML data isn't displaying correctly, please contact the SOS support team and include the problem KML file in your message.

You cannot have multiple KML layers defined within a single playlist item because we do not support time matching capabilities between various KML files. Future versions should allow multiple static KML files.

Using WMS Data

SOS supports loading imagery directly from the Open GeoSpatial Consortium (OGC) Web Mapping Service (WMS). This feature requires an internet connection and will not work unless the SOS system has access to the internet and the referenced WMS Server. More information on the WMS standard is available here: http://www.opengeospatial.org/standards/wms

A WMS provides a service allowing users to request data through URLs using specific key value pairs defining terms such as the width, height, image type, etc... A unique feature of the WMS standard allows users to request subsets of imagery by defining a bounding box using a lower left and upper right latitude and longitude coordinates. The combination of these features allows users to host very large high resolution imagery and users can request smaller versions or subsets of the original imagery. SOS takes advantage of this functionality through the magnifying glass, allowing users to see more detail as you increase the zoom level on the sphere.

A typical WMS URL, will look like the following:
http://neowms.sci.gsfc.nasa.gov/wms/wms?version=1.3.0&service=WMS&REQUEST=GetMap&LAYERS=MODAL2_D_CLD_CI&CRS=CRS:84&FORMAT=image/png&HEIGHT=1800&WIDTH=3600&TRANSPARENT=TRUE&BBOX=-180.0,-90.0,180.0,90.0&STYLES=rgb&STYLE=

To use this URL with SOS, you would specify data as the following (note: only the **layerdata** keyword may be used to specify WMS data):

#WMS Data Example
layerdata=//WMS//http://neowms.sci.gsfc.nasa.gov/wms/wms?version=1.3.0&service=WMS&REQUEST=GetMap&LAYERS=MODAL2_D_CLD_CI&CRS=CRS:84&FORMAT=image/png&HEIGHT=<IMAGE_HEIGHT>&WIDTH=<IMAGE_WIDTH>&TRANSPARENT=TRUE&BBOX=<BOUNDING_BOX>&STYLES=rgb&STYLE=

Four (4) things have changed:

//WMS//
HEIGHT=<IMAGE_HEIGHT>
WIDTH=<IMAGE_WIDTH>
BBOX=<BOUNDING_BOX>

All 4 items are required in order for WMS data to work correctly with SOS. The first item indicates the following path to data is a dynamic WMS URL. The last 3 are placeholders for dynamic fields that change while in use for SOS. For each WMS URL used within SOS, these values must be replaced exactly as above. SOS will automatically replace these values when loading the data.

Special Notes

All WMS URL's are remote data and require SOS to have access to the internet to retrieve the corresponding imagery. Depending upon your network connectivity and the performance of the remote WMS server, the initial load may take some time. SOS will perform local caching of downloaded files and subsequent loading will perform faster.

* It is strongly recommended to test WMS Playlists prior to any presentation * to insure data is cached locally and the presentation is not delayed by waiting for remote files to be retrieved.
When SOS playlist references a WMS dataset, SOS will retrieve and store any temporary zoom files or cache information in the system temporary directory. The default is "/tmp" on SOS Systems.

Limitations

With the SOS magnifying glass enabled, SOS will determine a bounding box for the area currently under view and dynamically retrieve and load that image. A bounding box cannot be determined around either the North or South Pole. The nearest image that does not cross the pole will be used.

Labels and Color bars

Labels and color bars can be in the frames or projected on top of them externally. It is recommended that you do not add the labels and color bars directly to the frames that you create. By keeping them as external images, you have much more flexibility with their size and position within the playlist.sos file. If you do

choose to put your labels and color bars directly on the images that you create, make sure that you make them big enough so that they are legible on the sphere and that they are far enough from the poles that they don't get too warped.

One of the nice things about keeping the labels and color bars external is that they don't move as you rotate a dataset. They stay in the same position relative to the projectors. Labels and color bars that are part of the frame rotate with the frame, which can cause viewing trouble for the audience as you move the sphere about. Within the playlist.sos file you can set the position using "labelposition," which is set by the x and y position as a pair of coordinates (x,y). Both x and y can vary from -1 to 1. The default position is (-0.3, -0.5). The label color can be changed with "labelColor" which can be set to R, G, B, Alpha, (or the symbolic names: white, black, red, green, blue…). The default color for the labels is white. While you can change the position and color, you cannot change the size or font.

The labels are a simple text file that contains one line for each frame in the dataset. If you have labels for a times series that contains 2000 frames, then you need a text file that has 2000 lines. In the playlist.sos file, if *label* = *default*, then the image file names appear as the labels on the sphere. You can easily create your labels using any text editor. The label file is stored in the dataset folder and is named labels.txt. Typically the labels contain the date and maybe a title. Here are some examples of labels.txt files:

```
07/24/2004 06:45
07/24/2004 07:15
07/24/2004 07:45
07/24/2004 08:15
07/24/2004 08:45
07/24/2004 09:15
07/24/2004 09:45
07/24/2004 10:15
```

```
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Maria Katrina
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
```

If you don't want to include the title in your labels file, then you can make an image of title that you can include as a pip. This allows you to choose the font and color scheme of your choosing when you make the title image. This is also a nice option because then you don't need to insert the title into every line of your labels file. Here is an example of a title that was made into an image for pip:

There is a lot of flexibility with the color bars. They are inserted into the playlist.sos file as a pip. Using this function, you can not only set the position, size and transparency, but also when the color bar appears, how long it stays visible, and how quickly it fades in and out. The color bars can be any common image format such as GIF, JPEG, PNG, TIF, etc. Color bars are generally named color_bar in order to keep all of the various images in the file separate.

Playlist Editor

All of the above features for the playlist.sos file can also be used within the playlist editor. When you use the playlist editor, changes you make will affect only your presentation playlist that you are editing. Any edits that you make with the playlist editor will overwrite in only your presentation playlist the existing settings that are in the playlist.sos file. The playlist.sos file is the master copy of how the dataset is displayed, so if you make changes in the playlist.sos files, the changes will appear in everyone's playlists. To modify a dataset with the playlist editor, simply double click on a dataset in your playlist to open a window that has all of the options listed or select a dataset in your playlist and click the "Edit Clip" button at the top of the window. There are three tabs across the window that will pop up: "Layers," "Sphere Settings," and "Picture in Picture."

Under "Layers," you can add additional layers to the base layer, in "Sphere Settings" you can adjust the display options, such as animation speed, tilt, endframe, and stopframe, and the "Picture in Picture" tab allows you to add new pips.

Adding New Datasets

The SOS computers are configured to download new content from the NOAA FTP server once a week and update the library catalog in the SOS Stream GUI. Make sure to check often to see what is new. A list of new datasets is available on the SOS website in the Datasets section by sorting the datasets by Date Added.

For new datasets created by your site, there are just a couple of steps to follow to get the dataset on the sphere. First you need to store the file on the primary computer in the /shared/sos/media/site-custom directory. At very minimum the folder you create for a new dataset should contain the image or image sequence or mp4 and a playlist.sos file. You can use existing playlist.sos files as an example for your new playlist.sos files. These can be created using the text editor that is available on the computer. Remember that the playlist.sos file is used in all of the playlists that contain the dataset, so use default settings that everyone will want to use. You can personalize it within your own playlists. If you have any other pieces such as labels or colorbars or pips, those should go in the folder as well.

In the playlist.sos file, make sure to specify a majorcategory and subcategory. The SOS software uses the majorcategory in the playlist.sos file as a tag to populate the library in the SOS Stream GUI and it uses the subcategory to place it in a subcategory of Site-Custom in the iPad Datasets tab. For example, every dataset that has atmosphere listed as its subcategory in its playlist.sos file will appear under the Site-Custom main category in the SOS Data Catalog on the

iPad remote app. If you forget to specify a subcategory for a dataset, then it will be put into an uncategorized subcategory in the site-custom category. You may also wish to include keywords and creator in your site-custom playlist.sos are, which will also be added to the SOS Data Catalog entry for you dataset as well.

To view your new dataset you can either make a playlist that contains it, or you can update the library (which also updates the SOS Data Catalog for the iPad) and then locate it on the Datasets tab on the iPad remote app (after pressing Update Now on the iPad - see the iPad manual for details on how to do that). You can also find it in the Library of the GUI under the majorcategory that you tagged it with.

It is a good idea to view and tweak a dataset before using it in a demo, especially it's you've added labels, color bars or pips. Make sure that everything looks good and appears when and where you want it too.

For more information, consult the Content Creation Guidelines: http://sos.noaa.gov/Docs/SOSContentGuidelines.pdf

Real-time Datasets

There is a collection of over 40 real-time datasets that are provided by NOAA. Because these datasets tend to be quite large and internet speeds vary from site to site, the SOS computers come configured to download just the five most popular datasets. Typically sites are set to download real-time data either every hour or every three hours. The frequency of the downloads and the amount of real-time datasets downloaded can be adjusted for each site. In /shared/sos/media/playlists are various real-time dataset playlists that vary from just a few datasets to all of the real-time datasets. You can also create your own playlist of the real-time datasets that your site is interested in using. A crontab is then used to keep all of the real-time datasets in your playlist up to date. For more information on the crontab, visit: http://sos.noaa.gov/Support/flash/

Sharing Datasets

If your site does not have the necessary tools or the expertise to create datasets, you can still get new datasets. NOAA is constantly adding new datasets to their library that are available. The SOS computer is set to download any new datasets once a week from the NOAA FTP server. Collaboration with other Science On a Sphere® users is encouraged and recommended. This is a good way to get help making new datasets. Check out the list of other SOS sites here: http://sos.noaa.gov/What_is_SOS/sites.php. Sites are also encouraged to provide the datasets that they create to the NOAA library so that all of the other SOS sites can use them as well. A SOS users group has been created as a Yahoo Group. This is a place to ask questions, get advice and work with other

sites. To join, please provide your email address to the NOAA SOS team in Boulder, CO.

Operation and System Administration

This section is intended for System's Administrators and others that have responsibility for maintaining the hardware and software components of the Science On a Sphere® system (SOS).

Overview of Setup

SOS is a collection of hardware that integrates computers and video projectors to display animated images onto the surface of a large sphere. Taken in pieces, the system consists of a sphere situated in a room, surrounded by four video projectors, numbered one to four starting with number one closest to the computer and then going counterclockwise. The video projectors are connected and driven by the primary computer. Each projector is responsible for its own quadrant of the sphere. The computer has two dual output graphics cards to support the four projectors and a third graphics card to run the user interface. The computer pulls in content, usually some type of planetary imagery, renders it to an Earth projection, subsets it, and upon command displays it onto the sphere. The computer is responsible for many things, namely among them: running the main user interface to the system, real time data collection, and providing the interface to the automation control protocol. All of the computers use the Linux operating system Ubuntu (currently version 12.04). Most sites buy a "hot" spare that is identical to the primary computer in terms of hardware, as a backup system. All of the software that drives and controls the SOS system is written and maintained by NOAA.

System Specifications

The computer in the SOS system is a standard computer system with mid- to high-end graphics cards. The system is generally specified so that both the primary and spare computers are identical from a hardware perspective to allow easy swapping of components (in case of system failures).

Projectors are usually specified so that they work well in high duty hour environments. Mostly, projectors classified as "board room" projectors meet this requirement. These projectors typically have multiple fans to provide adequate cooling during the day. The projectors are also specified so that they produce a high light output (LUMENS), mostly in the range of 3500 to 5000 LUMENS. The supported resolution for the projectors should be at least 1024x768.

An audio system is part of a standard SOS exhibit. A typical setup includes a mixer, microphones, and four speakers. Some of the content that comes with Science On a Sphere includes a narration track with background music, requiring the use of the audio system. Also, presenters often use the microphones, if available, during large presentations. Each site is responsible for designing their audio system to meet their needs.

System Maintenance

For system maintenance, the main priority is keeping the projectors aligned. The rest of the components in SOS tend to be rather maintenance-free. Projector alignment should be checked frequently (once a week ideally) to ensure that the system is aligned properly. Usually, the system only gets out of alignment when there has been some disturbance to the projectors. It is recommended to check it weekly just to ensure that the system is displaying data in an optimal manor. If the alignment is really off, it will be visible in the display of datasets.

Power Down Schedule

Generally, it is recommended that both of the SOS computers remain powered up all the time in order to receive real time data and for system backups. The projectors only need to be on during operation and should be powered down to save lamp life when not in use. If the projectors have network capability, it's possible to set the projectors on a timer with schedule power on and power off times. If a complete system power down is required, then it is recommended to close the SOS software before powering down the computers. A single press of the power button starts a clean shutdown.

Projector Filters and Lamps

Projector lamps are the main consumable for SOS. A typical projector lamp lasts anywhere from 1500 to 3000 hours. In darker settings, the economy mode can be used to extend the life of the lamp. As a projector lamps ages, it will start to dim or show discoloration and then in many cases, suddenly go out. Generally, the projector will turn on a lamp warning light indicating a new lamp is needed. It's a good idea to have a spare lamp on hand in case of a sudden failure. It is suggested to follow the manufacturer's recommendations on lamp replacement. When lamps are replaced because of age, it is recommended to replace all of them at the same time, since the color and intensity difference between an old lamp and a new lamp will make the sphere visualization look bad. Projector alignment will need to be adjusted after replacing the lamps. When replacing the lamps, change one lamp and then fix the alignment of that projector before moving on to the next projector. If you replace all the lamps without adjusting the alignment along the way, then you will have to start from scratch on the alignment.

For LCD projectors, projector air filters should be checked monthly to ensure proper airflow. At minimum, check the filters every quarter, though this depends largely on the projectors environment. Dusty areas require more frequent filter cleaning. Dirty filters reduce cooling capacity and shorten projector lamp

life. This is probably the most important of the maintenance tasks to perform. For DLP projectors, the optics are sealed and dust is not as much of a concern. In fact, many DLP projectors do not have air filters. Check your specific model to determine if there is an air filter to clean.

Computer Maintenance

The SOS systems are like any other computer system. In general they run and run without the need for maintenance. Ubuntu releases operating system patches frequently and patches that affect security should be applied as needed. Notification of patches will appear in the left-hand menu in the Ubuntu Update Manager. If NOAA comes across an operating system patch that adversely affects system operation, sites will be informed through the SOS Yahoo Forum.

Periodically, software upgrades from NOAA for the SOS software will be distributed. The SOS software upgrades will also appear in the Ubuntu Update Manager. It is up to each site to decide if they want to install the upgrade. An announcement with full instructions for the upgrade and a description of the new features in the upgrade will be posted to the SOS Yahoo Forum when available. Should you encounter problems with the SOS software, the log files can be a good place to turn to try to diagnose what is happening. The log files for SOS are stored in the home folder for each user in a directory called soslogs. The logs vary from crash reports to download progress reports.

Network

The computers are connected via a gigabit network to enable high speed communication and data transport. The primary and spare computers reside in a private, non-routable network space (usually in the 10.x.x.x network range). The primary computer, however, also usually sits on the border between the private SOS network and the sites local Intranet. The primary computer sits at the border of the network to enable outside access for remote systems administration, software updates, and download of real time data from the NOAA servers. While the local, private SOS network is gigabit, the external connection can be whatever the local site supports in their network infrastructure. If supported by the projector infrastructure, the projectors can also be connected to the private network to allow for remote power on/off.

In many cases a Wi-Fi network is also set up to allow use of the iPad/iPhone SOS Remote App. An existing Wi-Fi infrastructure can be used, or a dedicated Wi-Fi network can be set up for use with SOS. A dedicated Wi-Fi network provides the most responsive control of your SOS system by the app. Doing this in a secure way requires some network expertise. You may need to select a Wi-Fi channel that doesn't conflict with other Wi-Fi networks, for example. Using the minimum transmitter power that you need is always a good idea. And WPA2 encryption is probably the minimum level of encryption you will want to use. You might want to turn off the beacon identifier for your Wi-Fi router to make it less obvious to casual visitors at your site. You might also consider limiting access to

the specific MAC addresses of your portable devices. SOS personnel work with the site staff to determine the best options for each individual site.

System Control

There are several ways to operate Science On a Sphere® remotely. The two options that come supported by the NOAA SOS team are the Wii remote and the iPad/iPhone app (referred to as iPad for the remainder of document). Through the Automation Control Protocol, it's possible for sites to create their own interfaces to control SOS. Documentation on the Automation Control Protocol can be found online: http://sos.noaa.gov/Docs/automation.html

The Wii remote uses a Bluetooth connection to communicate with the control computer, while the iPad uses a Wi-Fi network. The Wii remote is required for every SOS installation and the iPad is optional, though provides many additional features not available with the Wii remote.

Wii Remote Control

To control SOS with the Wii remote, it must first be paired to the SOS computer. This is setup as a security feature so that visitors with their own Wii remotes will not be able to control the SOS. To pair a remote, launch the SOS Stream GUI. From the Desktop, open the Alignment software. From there select "Wiimotes." Use this to launch the Wii remote software and in the window that pops up, select "Pair a Wiimote". Another pop up window will appear giving you instructions to press the red button on the back of the remote. After that, the address of the Wii remote is permanently stored and should appear in the top window of the Wii remote software. Only remotes that are paired will connect to the system. After pairing, the remote will need to be connected to the software each time it is started. In order to connect the remote, start the SOS Stream GUI (if it's not already open), and then press any button on the remote. After pressing any button, you should see the blue lights flashing at the bottom of the remote. Once the remote is connected it will vibrate once and one blue light will be on. If the remote will not connect, close the SOS Stream GUI and restart it. Try connecting the remote again. If it still won't connect, pull out the Bluetooth dongle, plug it in again, and try again.

iPad Remote Control

The iPad has all the same control options as the Wii remote plus many other features. In order to connect the iPad to the SOS system, it must be on the same Wi-Fi network as the SOS system. Refer to the Network section above for specifics of the network. The SOS Remote App is freely available through the Apple App Store for download onto Apple devices (iPad, iPhone and iPod Touch) with iOS version 5.1 and above. To get started, tap on the Settings app icon on the homepage of your device, and then tap on SOS Remote located under the Apps category. In the Name or IP field under SOS computer to control, enter the host name or IP address of your SOS computer. Now, return to the homepage and tap on the SOS Remote app icon to open the application. Tap on the

Settings icon located in the tab bar to open the SOS Settings page. The host name or IP address you just entered should appear under the section labeled Connection. If the Connection switch is set to OFF, tap the ON/OFF slider to the ON position. This should initiate the connection between the device and the SOS computer. The SOS Stream GUI must be running in order for the iPad to connect. If the device is unable to connect to the SOS machine, a red badge with a question mark will automatically appear on top of the Settings tab.

While visitors have access to the SOS Remote App through the Apple App Store, they won't be able to take control of the SOS unless they have the Wi-Fi password and the IP address of the SOS computer. The user manual for the SOS Remote App is here: http://sos.noaa.gov/Docs/SOSRemoteUserManual.pdf

Backups

The computers are set to run backup scripts early every morning to push data from the primary computer to the spare computer. In general, all of the data that comes with the system can be retrieved from NOAA, however, there are some data files that are customized to be site specific. Examples of site specific data include the custom playlist data in the SOS home directory, the alignment configuration files that are in the home directory, and any custom or local site content that was developed and installed on the system.

All of the media files and playlist files are synced from the primary to the spare computer so that there is a backup copy on the spare computer. Backup copies of the playlist and alignment files are stored on the spare computer in /shared/sos/site-backup.*hostname.* In case of failure, the spare computer has a duplicate copy of everything needed, though the alignment files will have to be moved from the backup folder to /shared/sos/site-config. Sites are still encouraged to backup data on a separate system as well. Generally, the playlist and alignment data are just a few megabytes (usually much less). In terms of content, only the content developed by the site needs to be backed up on a separate system. All of the content that comes preloaded on the system is always available from NOAA. The custom content can sometimes be many gigabytes, but is definitely worth backing up.

In addition to syncing the computers, backups are also stored on the local computer in /shared/sos/site-backup.*hostname*. In this directory, you will find dated files for every day that contain all of the same files that are synced to the other computer (excluding the media tree), including configuration files and playlists. In addition, backups of the playlist files are tarred and stored every time the playlist editor is opened. Those files are in the home folder for each users in a directory called sosrc-backups: /home/sos/sosrc-backups and /home/sosdemo/sosrc-backups

Site Configuration

Each site is configured differently in regards to projector height, distance and resolution. All of this information is stored in /home/sos/sos_stream_control.config. The parameters in this file are set during installation and normally should only be changed if the exhibit is reconfigured.

However, to modify the default volume setting, add the following line to /home/sos_stream_control.config:

```
set defaultVolume [0 … 100]
```

where [0 … 100] specifies an integer in the range 0 - 100. In new SOS installs (as opposed to upgrades), this line may already be present, in which case the line may be edited.

Every site also has individual alignment files that are stored in /shared/sos/site-config. In this directory you will find the alignment files as well as the information about the Wii remotes that have been paired to the system. All of these files are included in those that are backed up and synced daily.

SOS Crontab

Cron is a time-based job scheduler that is used to automate processes on the computer. The crontab is the file that contains all the information about the jobs that are scheduled. The SOS computers come with a default crontab that can be edited by each site. Included in the default crontab are hourly realtime data downloads, daily data syncs and backups, and weekly downloads of new datasets. The crontab can also be configured to include the automatic power up and down of the projectors if desired. In a terminal, entering “crontab –l” will display everything that is included in the cron. For more information about the cron, watch these video tutorials:
http://sos.noaa.gov/Support/tutorials.html#cron1
http://sos.noaa.gov/Support/tutorials.html#cron2
http://sos.noaa.gov/Support/tutorials.html#cron3

Remote Login

In order facilitate support, maintenance, and troubleshooting, the SOS computers come loaded with a program called TeamViewer. This program allows the SOS support team to logon remotely to the SOS computers and temporarily take over the desktop. The site must launch the software and provide log in information to the SOS team in order for them to logon. The SOS team will only log in at the request of the site and at a schedule time when it is convenient for the site

Usage Statistics

There are a set of features in the SOS software that show statistics about how often specific SOS data sets are displayed across the SOS network. At each SOS site, every SOS play event is logged in a usage log, in the $HOME/soslogs directory. Periodically, these log files are automatically collected and sent to the SOS developers in Boulder, CO. There, the logs are processed and the resulting aggregate statistics are displayed on the SOS web site.

Four main parameters are recorded: Plays, Autoplays, Duration, and Autoplay Duration.

> **Plays** represent all plays of clips on the SOS machine. Statistics are only shown for NOAA distributed datasets, but the proportion of site created to NOAA-provided datasets is shown.
>
> **Autoplays** represent the plays that occurred while SOS is in autorun mode. This number will be a subset of Plays and is recorded so a distinction can be made between docent-led presentations and autorun presentations.
>
> **Duration** is the total amount of time a clip has been played, while **Autoplay Duration** is the fraction of duration that a clip has been in autorun mode.

The web interface on the SOS website shows the number of times data sets were displayed and the total amount of time they were played. The information is further subdivided by whether the play occurred during autorun or not. The queries can be refined by time period and other attributes. Information about specific site usage is not publically available on the website, but if you would like to track the usage statistics at your site, the SOS team can provide you with a specific web page link corresponding to your site. Below is the basic view for the SOS usage statistics webpage.

Filtering Results

The usage statistics results on the website can be filtered by different attributes, such as dataset category, who played the dataset, the dataset's format, and when the dataset was played. When multiple attributes are selected, the results are additive. This just means that if you select 'Atmosphere' and 'Ocean' from the 'Dataset Category' filter, sites categorized as Atmosphere or Ocean will be returned.

Played By: These filters allow you to filter play events by site categorizations. This is useful if, for example, you're a planetarium interested in the most popular datasets among all planetariums.

Dataset Category: These filters allow you to filter datasets based on their categorization. Selecting different categories will activate the category by changing the button's font to black. By default, datasets for all categories are shown, so the 'All Categories' button is active.

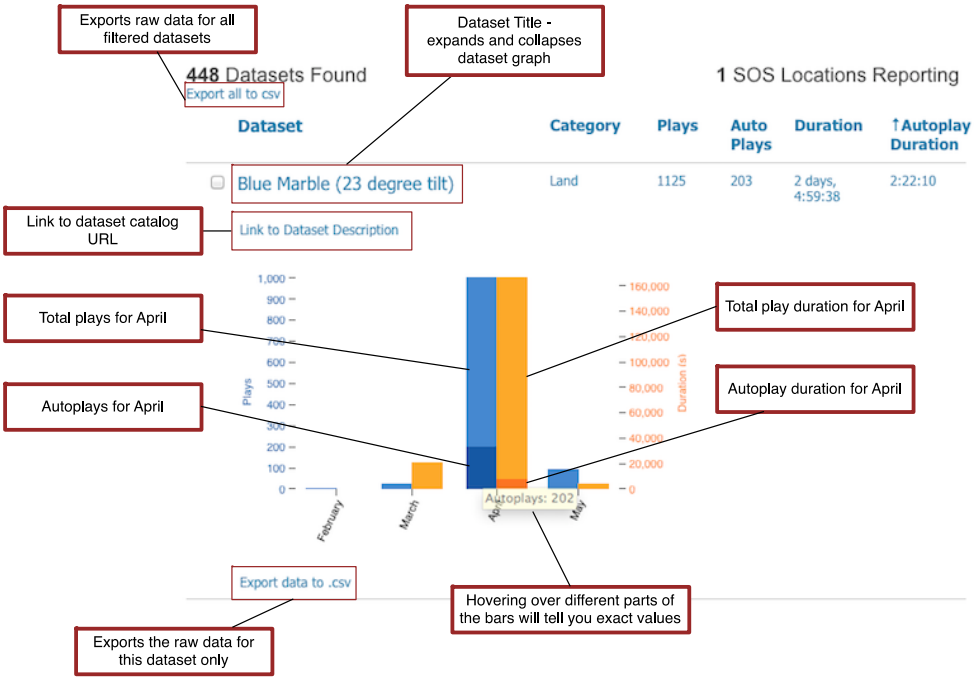
Time Period: These filters allow you to pick play events that occur during a specified window of time. If you select 'week', 'month', or 'year', play events for the week/month/year so far will be returned. Specific dates may also be specified. Keep in mind, play event information will always be one day behind.

Filter By: These filters allow you to filter datasets by their format. For example, 'Movies' gets datasets that have movies associated with them. 'Static Images' gets datasets composed of static images. 'Real-time Data' selects our real-time datasets. 'KML Files' gets datasets that have KML type files associated.

Once you have specified your search filters, be sure to click the 'Display' button to apply them! 'Clear' will remove active search filters.

Dataset Results

Clicking on a dataset title will expand the section to show a graph of specific play event information by month. You'll notice that there are two bars for each month on the x-axis and two y-axes. The left y-axis specifies number of plays and corresponds to the blue (left) bar. The right y-axis specifies length of play duration and corresponds to orange (right) bar. The play bar and duration bar both have embedded bars, which represent autoplays and autoplay duration, respectively. Hovering your mouse over any of the bars will tell you what the bar represents and its value.



For sites interested in doing their own number crunching, an ‘export to csv’ function has been provided. The ‘Export all to csv’ will export raw data for all the datasets on the page. If you just want data for a single dataset, there is an ‘Export data to .csv’ under each dataset’s graph. If you want raw data for some selected datasets, activate the checkbox next to the datasets you’re interested in, click the ‘Display’ button, then click ‘Export all to .csv’.

User Accounts

Every process that runs under Linux must have a user id. The SOS system uses two user id's: sos and sosdemo. The user id sos is an administrative account that has the ability to download new data, run the alignment software, install updates and manage the real-time data downloads. The user id sosdemo is used for day to day system operation and running the SOS software. The user sosdemo does not have permission to delete data, edit the software or run alignment. This user is intended to serve as a “safe” mode, where the computer operator will be able to do very little damage to the software or the data. Administrators of Linux sometimes need access to the super user account (similar to the Windows "administrator" privileges). The super user account in Linux is called "root". The password is set at machine installation and can be changed locally at the site. It is generally considered safer, or at least a better practice, to not use root directly, but rather use the "sudo" command that temporarily raises a normal users privilege to root for the duration of a single command. Only the sos user has sudo privileges.

Alignment

In order to optimize the appearance of Science On a Sphere®, it is important to have the sphere properly aligned. Because of this, it is suggested that more than one person at the site learns how to align the sphere. For the most up-to-date alignment directions, please consult the following reference manuals:

Alignment with the Wii Remote:
http://sos.noaa.gov/Docs/WiiProjectorAlignment.pdf

Alignment with the iPad/iPhone/iPod Touch:
http://sos.noaa.gov/Docs/iPhoneProjectorAlignment.pdf

Contact

Please contact sos.gsd@noaa.gov if you have any questions regarding Science On a Sphere®.

Appendix

Because this User Manual is meant to provide a general overview of the operation and daily use of Science On a Sphere®, it does not contain all the details you might be wanting. In some cases, more detailed reference manuals are available. Here is a complete list of reference manuals available for Science On a Sphere®:

Projector Alignment for SOS Using a Nintendo Wii Remote Control
http://sos.noaa.gov/Docs/WiiProjectorAlignment.pdf

Projector Alignment for SOS Using an iPhone, iPod Touch, or iPad
http://sos.noaa.gov/Docs/iPhoneProjectorAlignment.pdf

Playlist Format Reference
http://sos.noaa.gov/Docs/Playlist.html

Content Submission Guidelines
http://sos.noaa.gov/Docs/SOSContentGuidelines.pdf

SOS Remote App
http://sos.noaa.gov/Docs/SOSRemoteUserManual.pdf

Automation Control Protocol Reference
http://sos.noaa.gov/Docs/automation.html

SOS Docent Best Practices
http://sos.noaa.gov/Docs/SOS_Docent_Best_Practices_2012.pdf

SphereCasting
http://sos.noaa.gov/Support/spherecasting.html