Equipment List

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Science On a Sphere® Hardware Specifications

We have tested out a limited set of system components that we know work with Science On a Sphere®. While other components may work, we can only guarantee a fully functional system that is built using these brands and models

Detailed Parts List

- Complete System -- Detailed Parts List (PDF)
- Complete System -- Detailed Parts List (XLS)

PC Specifications

DELL T5820 - Recommended Computer Specification. Two of these units are required, one operational and one for a hot spare. Each machine **requires** one additional third-party video cards from NVIDIA - the GeForce GTX 1070. See video card specifications for details.

Video Projector Specifications

SOS uses video projectors to display images onto a sphere, however not every projector is well suited for SOS. The system needs high quality, bright, long duty cycle projectors for proper system operation. Of extreme importance is the choice of the projector lens.

One of the projector characteristics we look at closely is brightness. While this is somewhat subjective, we have found that projectors need to produce a nominal 3500 ANSI LUMENs. This can vary depending on the ambient light conditions but 3500 LUMENs is the minimum -- many of our sites use 4000 LUMEN projectors.

The duty cycle of the projector is important for reliability. Since the projectors operate for 8 to 10 hours per day, often 7 days a week, the projectors need to be designed to run for that many hours. Generally, "board room" class projectors fit into this category. We find that these board room class projectors have the appropriate number of fans and filters to operate well in a museum environment.

As you might expect, the projector lens choice is critical. In most cases, the standard lens is usually adequate and always gives the best price. However the zoom and throw ranges need to be checked against the specifics of each sphere installation. The general rule of thumb used is that the projected image needs to be 72" in height at the distance given between the projector lens to the center of the sphere. We've used the "lens" calculator found at the web site, http://www.projectorcentral.com to checkout the throw/zoom ranges for a particular projector lens. Because this component is so critical, we request that each site check with NOAA before procuring a projector.

Here are a few projectors that we've used at other SOS installations and we have high confidence that they work properly with SOS within the distances listed below (again, the distance is measured from the projector lens to the center of the sphere). Other projectors will work, but we will only support projectors that have been pre-approved by NOAA.

- DLP with Laser Lamp (1920x1200 resolution, 5400 lumens, 20,000 hour lamp life)
  - Panasonic PT-RZ570u - standard zoom lens (14'0" - 28'2" for a 72" tall sphere)

- DLP with Laser/LED Hybrid Lamp (1920x1080 resolution, 3500 lumens, 20,000 hour lamp life)
  - Panasonic PT-RZ470u - standard zoom lens (15'7" - 31'4" for a 72" tall sphere)
  - Panasonic PT-RZ370u - standard zoom lens (15'9" - 31'5" for a 72" tall sphere)

In order to mount the projector, it is recommended to buy a projector mount that allows for adjusting the pitch, yaw, and height. The RPA series of projector mounts from Chief is customizable for every projector and works well for SOS. Make sure to order the RPA custom projector mount based on your projector selection, and not the universal projector mount. Also, we have found the RPA custom mount is better for our purposes than the RPA

Elite custom mount, so don't order any of the Elite versions. For example, for the Panasonic PT-DZ570u, we recommend the RPA278 mount and for the Panasonic PT-RZ370 or 470, we recommend the RPA313 mount. Use the MountFinder on the righthand side of the Chief page to find the right custom RPA mount.

Video Card Specifications

Each SOS computer will have a total of **two** video cards installed. The original card that ships with the computer, the NVIDIA Quadro P400, is used for the desktop and each computer needs one additional NVIDIA 3-D card which drives the SOS projectors that has to be purchased separately, for a total of two cards per computer, which means four cards for the whole system.

Therefore, we need a total of two additional NVIDIA 3-D video cards - one for the operational system, one for the spare. Each of these video cards has one DVI output, one HDMI output and three DisplayPort outputs. We use the three DisplayPort outputs and one HDMI output. **In order to use the four outputs, make sure to have the right cables and adapters.** If you are using HDMI extenders, you will need three DisplayPort to HDMI active adapters (it's critical that these are active and not passive) and four HDMI to HDMI cables. If you are using DVI extenders, you will need three DisplayPort to DVI cables and one HDMI to DVI cable.

We recommend the use of GTX 1070 video cards, which can be purchased from most online computer stores. We have found that some GTX 1070 video cards don't fit into the Dell 5810 due to the power input configuration. The card listed below has a configuration that does work with the Dell 5810. If you want to buy a different GTX 1070 video card, please check with us first.

- Newegg Link: EVGA GeForce GTX 1070 8Gb Video Card

Video Extenders

In order to connect the projectors to the SOS computer, we recommend the use of videos extenders. The extenders you use will vary depending on your projector selection. DVI or HDMI cables (depending on the extenders) are run from the SOS computer to four video extenders and then Cat6a **(not Cat5e or Cat6)** cables are run to the corresponding extenders positioned near each projector. Another DVI or HDMI cable is then used to connect the extender at the projector to the projector (unless you select projectors with built in extenders). As most extenders come with only one cable, make sure to have enough cables on hand to connect the extenders.

- Newegg Link: Gefen DVI Video Extender

The Panasonic PT-RZ370 or 470 projectors have a built in extender receiver, so you only need to use an extender sender at the computer. Here is the extender that we recommend using if you want to utilize the built in extender on the projector side:

- Amazon Link: Atlona HDMI Extender

To be able to automatically power the projectors on and off, an addition Ethernet cable will need to be run. An extender with a built in LAN connection allows you to avoid running a second cable, though it does cost more. That option is here:

- Atlona Link: Atlona 4k/UHD HDMI Extender

NOTE: If you have cable runs that are less than 100 feet, then you can use long HDMI cables without the need for extenders.

Audio System (Reference System)

Science On a Sphere requires an audio system, however there are numerous ways to build audio components. Here is one example of how to build an audio system for SOS. It includes a basic, 4 input, mono mixer with four speakers. The speakers are two powered speakers and two un-powered slave speakers. The mixer is used to

combine audio that comes from the SOS computer system and a wireless microphone. The shopping list for the reference system can be found here (SOS_Audio_Equipment.pdf). If the reference audio system is used, here is the suggested cabling layout.

For a higher-end audio installation, David Eltzroth has written a white paper discussing a Dolby stereo surround audio system for SOS.

Bluetooth Adapter

The Bluetooth adapter plugs into the main computer via USB and is required for the SOS software key. The following model is regularly used with Science On a Sphere:

- TRENDnet TBW-106UB

Apple iPad Remote Control

As of SOS release 3.4.2, SOS supports the Apple iPad and other iOS devices for sphere operations. For simplicity, we refer to this as the iPad interface, but it can be installed on a recent version of any the following devices:

- iPad
- iPad Mini
- iPod Touch (limited functionality)
- iPhone (limited functionality)

The iPad and iPad Mini provide a richer interface with more information available to the user. The iPod Touch and iPhone are no longer being developed for and have limited functionality. The free app is named "SOS Remote" and is available in the Apple App Store.

In addition to one of the above devices, the use of this interface requires Wi-Fi access to the SOS computer. There may be an existing Wi-Fi infrastructure at your site that you can use. If not, you will need to purchase an additional Wi-Fi router.

Further information about the iPad app, including Wi-Fi requirements, is available in the SOS Remote App Manual.

Many sites find that having an iPad case with a hand strap that makes it easy to hold during presentations is really nice to have. There are lots of options available online.

Optional Hardware

SOS comes with additional optional software that is available to all SOS sites. This software includes the automated alignment software and the SOS Public Kiosk software. To utilize this software, additional hardware is needed, as described below.

SOS Public Kiosk Hardware

The Public Kiosk software runs on a PC running Microsoft Windows. It is officially supported on Windows 7 and 8, but may also run okay on Windows 10 or XP. The User Interface scales automatically for different screen sizes, including both 4:3 and 16:9 ratios. It requires a touch screen, which can be separate from the computer or in an all-in-one configuration. The touch screen works best when mounted either in a kiosk housing near the sphere or mounted to the railing that surrounds the sphere. The kiosk PC must be on the same network as the SOS machine, either directly connected with Ethernet or by Wi-Fi. More details about the kiosk can be found in the kiosk manual.

Automated Alignment Hardware

Automated alignment uses machine-vision cameras to do an alignment automatically, with no human intervention, except for starting each step. Hardware required for this includes:

- Four Point Grey BlackFly GigE cameras - Model BFLY-PGE-12A2C-CS
- Four Point Grey BlackFly Tripod Mount Adapters - Model ACC-01-0003
- Four Tamron Camera Lenses - Model 13FM08IR
- Four Pedco Ultra Clamp Camera Mounts
- One Trendnet PoE Gigabit Switch - Model TPE-TG50g
- Two Intel Gigabit Ethernet Cards - Model EXPI9301CTBLK
- Five lengths of Cat5e cabling

The set up is described in the alignment manual.