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Tip: The Adaption of the Video Slider into a 'Microscope Bridge' as a Practical Alternative for Using a Stereomicroscope to Examine and Treat Oversize Paper Artifacts

ABSTRACT

One of the most regularly used instruments in most conservation labs is the stereomicroscope. In many ways it has become the 'workhorse' of many labs. While there are many types of stereomicroscopes available on the market, the ability to use a microscope on oversize materials can present a challenging problem. This is primarily due to the limitations of currently available designs for microscope stands that allow for a microscope to reach into the middle of a large artifact such as an oversize map or print where the viewing area desired is beyond the reach of a typical stereomicroscope stand. At present, currently available stereomicroscope stand designs are primarily limited to either an articulating arm, a boom stand, or a floor stand, all of which have limitations when an extended reach is required. These limitations can become apparent in the form of vibration issues, the inability to clamp the stand to a table, the danger of damage to the microscope due if the stand tips over, the need to access an area beyond the reach of the stand, and finally the weight of the microscope head itself.

The solution for this problem has often been to employ an alternative microscope stand design that operates in gantry or bridge style. The use of the 'bridge' design has been available for conservation for many years, but as yet this design has only been available in a custom built set-up by a few select manufacturers. These custom built 'bridge' set-ups are often very expensive and custom built to a specific location.

The video sliding track is a device that has been used by both professional and amateur videographers for decades. It allows for the attachment of a device to a glider that can then glide smoothly along a track of varying lengths. Video sliding tracks are often very inexpensive and very lightweight. They are designed to be easily dismantled and packed away for travel, and video sliding tracks can also be purchase with both a motorized slider or manually operated. In addition, a video slider can be set directly on a surface without the need for additional clamping or a heavy base plate.

This paper will show how to easily and inexpensively adapt a video sliding track to a stereomicroscope focusing mechanism. This stand will accept most standard stereomicroscopes and will allow for a conservator to reach desired viewing areas that are beyond the reach of most microscope stands. This will hopefully allow for a practical and economical method of using a stereomicroscope on oversize material.

INTRODUCTION

At the University of Hawaii Hamilton Library Preservation Department, the Paper Conservation Lab is frequently asked to work on large paper objects from many of the various departments and collections throughout the library. The large object can often reach sizes of four by six feet. In 2013 when an attempt was made to bring the lab's Leica MZ7s stereomicroscope out of storage and back into working order it was discovered that the only stand that was purchased for the microscope was a dissection stand. While this type of stand would have worked well for many other types of laboratories, it was unsuitable for virtually everything that the Paper Lab was asked to work on. It was also determined that due to lack of funding it would not be possible to purchase a better suited stereomicroscope stand for basic treatment work.

After assessing the need to get the lab's stereomicroscope back to operation status, combined with no funding to purchase a new stand, a plan was put into place to use the rack and pinion part from the existing focusing stand and adapt it to a retrofitted 'bridge style' stand constructed out of available materials and spare parts from around the lab (fig. 1). After the retrofit and many months of use it was determined that this design was ideal for active day to day treatments, but due to the extensive amount of work needed to build it, as well as the likely expense of the materials used, the author decided to attempt to find an easier and more cost effective method of making a bridge style stand that would accommodate most stereomicroscopes. The goal for this project was to devise

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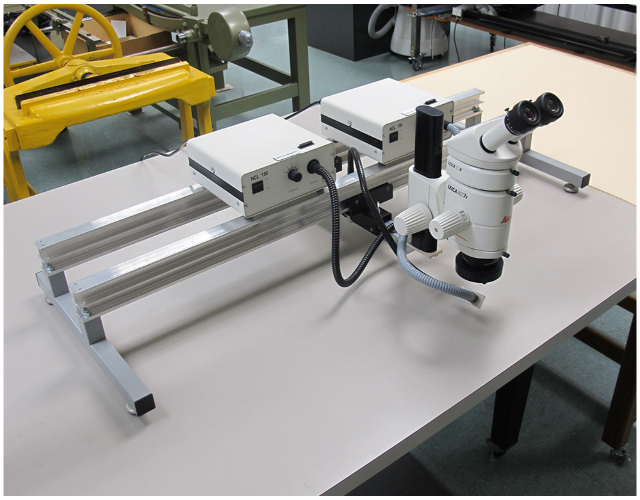

Fig. 1. Leica® Mz75 stereomicroscope in custom built bridge stand at the University of Hawaii Preservation Department Paper Lab.

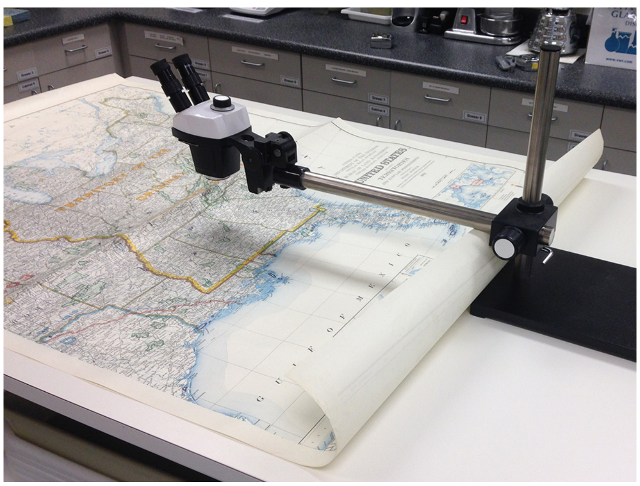

Fig. 2. Attempting to get a stereomicroscope, on a boom stand, into the middle of a large map. This required that the map be rolled at one end under the boom arm.

Fig. 3. Leica® S6D on a Unitron® Articulating (Flex Arm).

a way to take the benefits and functionality of the retrofitted bridge system and give the design greater practicality by removing it deficiencies such as weight, size, and cost. The design also had to be easily adaptable without requiring the use of the metal shop equipment that the retrofitted version required to make.

AN OVERVIEW OF STEREOMICROSCOPE STANDS

One of the benefits to purchasing a stereomicroscope body manufactured in the last thirty or so years is it adaptability to many components made by other microscope companies. A modern stereomicroscope head made by one company would generally be able to be used in a focus mechanism by a different company, and that focus mechanism could then in-turn be used on a stand from a third company. This flexibility between companies allows for many options and customizations to suit the needs of the users. While there is no doubt of the usefulness of the stereomicroscope in conducting daily treatment work in a paper lab, the currently available stand options present some functionality problems in doing treatment work on many paper objects.

Currently there are two main types of stands offered on the market for using table-based stereo microscopes and each one has both benefits and deficiencies. For reference purposes it should be noted that the following observations were made by the author based on usage of actual microscopes in various stands. It should also be noted that while floor stands are available and have many advantages and disadvantages they were not considered for this project due to their high cost and portability issues.

BOOM STANDS

This is the most common stand available and most of the companies manufacture a version of their own that might vary slightly from company to company. This style usually comes in either a table clamp or a heavy base plate. A boom stand provides the greatest stability to eliminate vibration, and is generally not too expensive. The boom style does have several obvious limitations in paper lab bench top treatment work, the greatest being its very limited extension abilities. Often boom arms have limited extensions. This can present difficulties when trying to get your microscope to access the center of large paper objects. Other limitations include the portability of an often heavy base plate. For boom stands that use the table clamp option, extension limitation still exists and the user can gain the advantage of portability without the heavy base plate, but for the safety of the microscope and to reduce vibration, a very sturdy table is needed that usually needs to be at least 1" inch thick. A heavy weight tabletop is not always possible. (fig. 2)

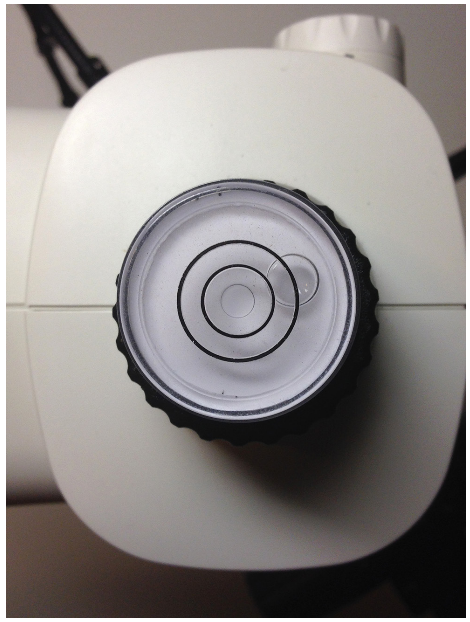

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Fig. 4. Images shows bubble level on top of microscope at shortest extension.

Fig. 5. Images shows bubble level on top of microscope at full extension.

ARTICULATING ARM STANDS

This style has become more common on the market and most of the microscope companies also offer a version of this style. This type of stand, like boom style stands, is also available in either a base-plate design or a table clamp design. Articulating arms offer greater flexibility for positioning as well as a greater length of extension (fig. 3). Articulating arm stands do have some disadvantages. What the stand gains in increased extension it loses in stability. The microscope is prone to a greater increase of vibration problems when the arm is fully extended. Weight of the microscope also becomes a factor that can result in problems such as drift in the stand as well as causing a leveling issue of the microscope in relation to the surface when the arm is fully extended, thus requiring the user to constantly re-level the microscope head (figs. 4-5). In addition, while this design can come in a base plate option, it is often necessary to use additional weights on the plate to prevent tipping of the scope, an issue that is compounded with the more weight that is added to the microscope. The articulating arm style does share many of the same functionality problems that the boom style has when it comes to benchtop treatment work.

BRIDGE OR GANTRY STAND

This style of microscope stand is not generally available on the microscope market and is usually built to a specific location. It is generally considered to have no mobility other than that of the tables or benches they are installed on. Often the microscopes adapted to these custom built systems are not designed to be removed from the system either. There are many benefits to the bridge design that allow for it to potentially be a more functionally useful stand then both the boom stand and articulating arm.

Observation of the University of Hawaii library paper lab bridge stand found it to be more stable then mounting the microscope on either a boom-stand or an articulating arm due to its four-point or two-point contact with the table surface. The bridge design also allowed for greater access of the microscope to the difficult to reach areas of large paper objects, and it did this without sacrificing stability. The bridge stand could also work on any flat surface without a heavy base plate, and while also not requiring the need to clamp the stand to a table for added stability.

The design goal was to have a stand that would have equal or greater stability then a boom or articulating arm stand at any point along its track while also preserving its alignment to the surface. The stand would also need to be portable, relatively inexpensive, and also accept most common stereomicroscope heads.

In order to do this the idea was very simple. Find an already available table-top track system and then find a way to attach a focus mechanism to it. Due to the interchangeability of most stereomicroscopes to almost any focus mechanism for any stereomicroscope would work.

THE CAMERA TRACK SLIDER AND FOCUS MECHANISM

After extensive research on currently available track systems, the style of system that showed the most promise is a family of products designed for professional and hobbyist videographers called camera track sliders. These systems are designed to allow videographers to do smooth panning shots

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Fig. 6. Glide Gear® DEV 470 Camera Track Slider 47”. *Image Retrieved from Amazon©

Fig. 7. The bottom of a used Nikon® vertical post and focus block that was used for this paper.

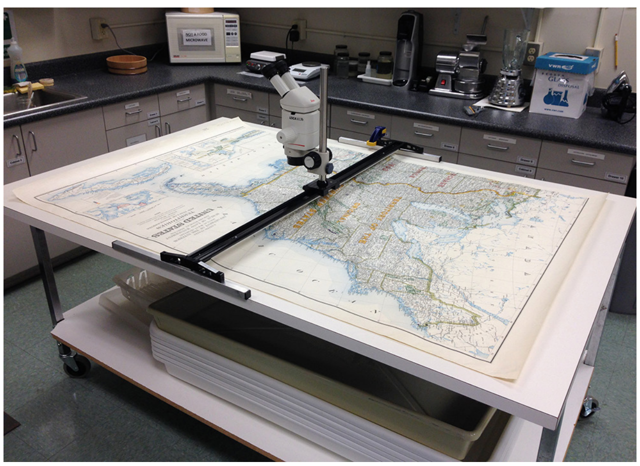

Fig. 8. Leica® Mz7s stereomicroscope mounted on adapted Glide Gear® Camera Slider with a used Nikon® focus mechanism.

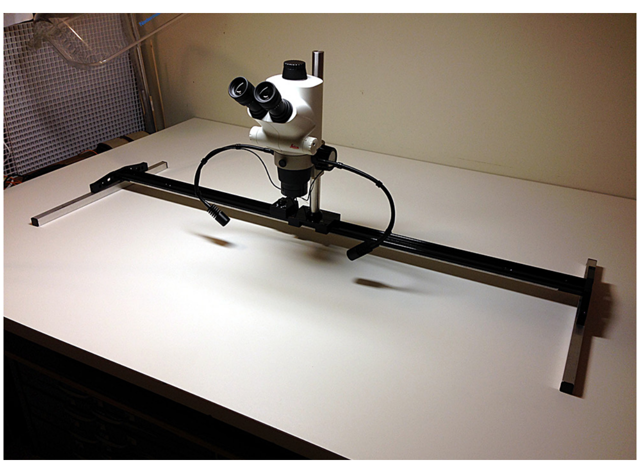

Fig. 9. Leica® S6D stereomicroscope mounted on adapted Glide Gear® Camera Slider with a used Nikon® focus mechanism.

Fig. 10. Sled for Glide Gear® Camera Slider.

by sliding their cameras on a sled that rides a track. The most common specifications to consider when looking at which one to purchase are the maximum weight load the track will allow and the length of the track. These systems generally will also be offered in either a motorized or manual option. The system is available with either smooth Teflon guides or ball bearings. For this project it was determined that a manual operating track was sufficient for most treatment work. In addition, since most of the work tables in the UH Paper Lab are 4’ x 6’ feet, the most usable length to start with for testing purposes would be a 47” track. For this project the camera track slider that was chosen is a 47” Glide Gear Camera DEV 470 Track Slider (fig. 6). It was purchased on Amazon for approximately $150.

For the focusing mechanism, the focus block that was chosen was a standard focus mechanism or pole stand with a 32mm diameter vertical post and a focus block with a 76mm diameter ring. A pole stand would ordinarily consists of a focus block that slides on a single metal vertical post that would be attached to a base, usually by a single screw or bolt (fig. 7). By removing the vertical post from the base of the microscope and attaching it to the sliding plate on the camera track slider most modern stereomicroscope heads can be safely placed anywhere on the track pointing directly down at the artifact. (figs. 8-9). The sled on the camera track also contains a built in bubble level to allow for easy to read leveling of the track, as well as lock knob to lock the sled (fig. 10).

ADAPTING A CAMERA SLIDER, WHAT YOU WILL NEED...

A STEREOMICROSCOPE POLE STAND ASSEMBLE AND FOCUS MECHANISM

The most important part when choosing a pole stand is how the pole is mounted to a base. For this to attach easily the

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Fig. 11. 32mm stainless steel vertical post. *Image courtesy of Terrald Knorr from Martin Microscope®

Fig. 12. Unitron® focus block for a 32mm vertical post. *Image courtesy of Unitron®

stand needs to have a single screw or bolt which will generally be a 3/8" diameter thread. When purchasing a focus mechanism make sure that the diameter of the focus mount ring for your stereomicroscope matches with the focus mount you are purchasing. The focus mount is the part of the stereomicroscope head that sits into the ring on the focus block. For most modern stereomicroscope heads this diameter is 76mm. There are several companies that make versions of this where the entire stand needs to be purchased, but after extensive research the easiest, most cost effective, and best quality way of doing this is just to purchase the individual parts. The best source for this is Martin Microscopes®. A 12" long vertical post with a 3/8" threaded mounting hole at the bottom (fig. 11), a Unitron® Focus Block with a 76mm ring (fig. 12), and a safety collar will cost approximately $340 before shipping. There are less expensive focus blocks, but the savings is negligible and there is a significant loss in quality, which will greatly impact user experience when using the microscope.

A CAMERA TRACK SLIDER

There are many companies that manufacture these tracks. For this project the Glide Gear® DEV 470 Camera Track Slider was used. Be aware of the cumulative weight of your microscope head when choosing which one to purchase. The weight of a stereomicroscope head can add up very quickly once you consider the added weight of a potential camera and any illuminators, as well as any other accessories. The heavier your microscope head is the thicker the metal support that will need to be added to the bottom of the track to increase the weight capacity of the track.
(Can be purchased at most camera suppliers)

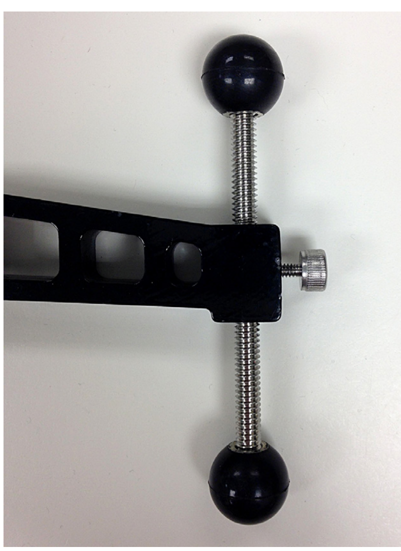
- A 36" Section of ¾" aluminum square tubing (Can be found at most hardware stores)
- A 43.5" Section of ¼" x 1.5" thick aluminum or steel Bar. If your microscope is very heavy, a thicker bar might be required. (Can be found at most hardware stores)
- 7 - ¼" Diameter x ½" long screws and appropriate washers. (Can be found at most hardware stores)

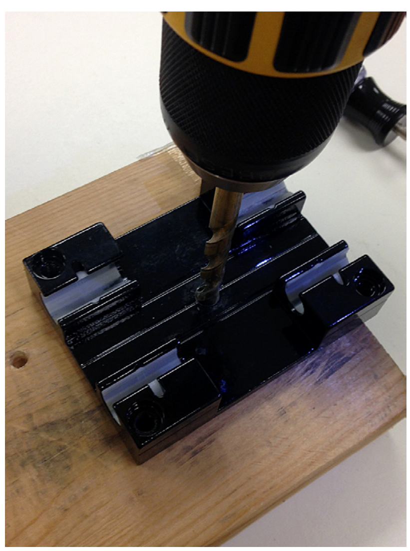
STEP 1: PREPARING THE MATERIALS

Remove the adjustable leveling legs by first unscrewing the lock screw, followed by unscrewing one of the balls from the threaded rod, and finally completely unscrewing the threaded rod from the leg. (fig. 13)

STEP 2: MOUNTING THE VERTICAL POST

Remove the 'sled' from the track by unscrewing and removing the end sections. Using a drill, expand the center mounting hole in the sled from ¼" to a 5/16" hole to accommodate the larger screw for the vertical post. Insert the mounting screw into the sled and slide the sled back onto the track. Depending





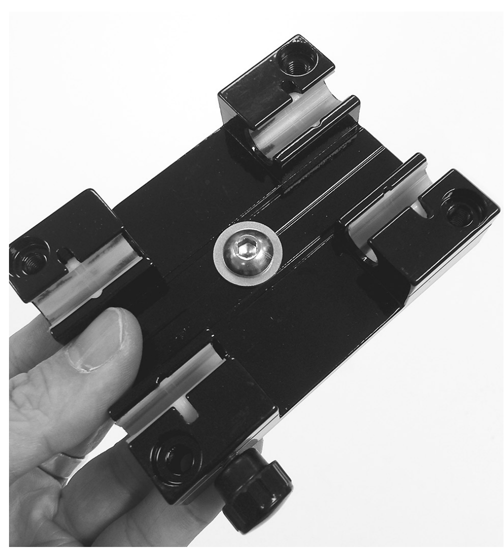


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Fig. 13. Adjustable threaded leveling leg.

Figs. 14-15. Expand the mounting hole in the sled from ¼" to 3/8" using a drill and insert the new 3/8" mounting screw for the post.

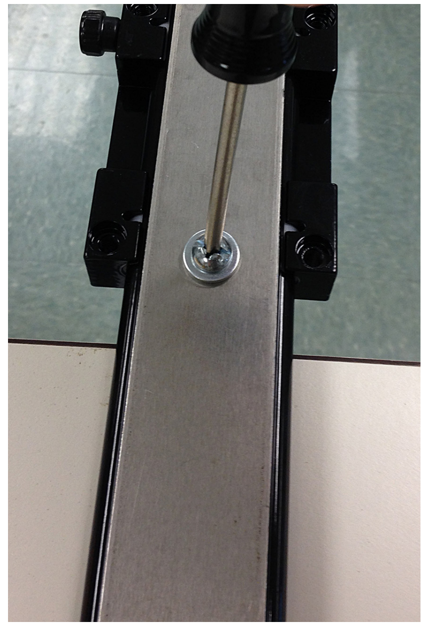

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Fig. 16. Bottom of the track on the left and ¼” aluminum bar on the left.

Fig. 17. Drilling ¼” hole that lines up with threaded hole in the track.

Fig. 18. Mount additional ¼” bar to the bottom of the track using ¼” screws.

Fig. 19. Bottom of track with additional bar screwed in.

on the size of the original mounting screw it might be necessary to replace it with one with a smaller head in order to allow it to fit between the bottom of the sled and the track. The vertical post screw can now be inserted into the sled from below, the sled put back onto the track. (figs. 14-15)

STEP 3: BRACING THE TRACK

To increase the weight load of the track it will need additional bracing. Attach the aluminum or steel bar to the bottom of the track by first drilling holes that line up with the smaller threaded holes in the track, and then screw the additional bar to the bottom of the track using the ¼” screws. (figs. 16-19)

STEP 4: EXTENDING THE FEET

The Glide Gear ® Slider is designed to have the center of gravity directly over the track, but when a heavy microscope is added it offsets the center of gravity. Without compensating for this it could cause the track to tip forward or throw the leveling of the microscope off. In order to prevent this the removable legs need to be extended past the microscope. This can be easily and cheaply done using the ¾” aluminum square tubing. First cut the 36” tubing in half to give two give two 18” sections and then drill two holes in each of section that align with the threaded holes where the adjustable feet were. A second larger hole can be drilled in the bottom to accommodate the head of the screws. The aluminum tubing

Fig. 20. Detachable legs with additional aluminum tubing for extension.

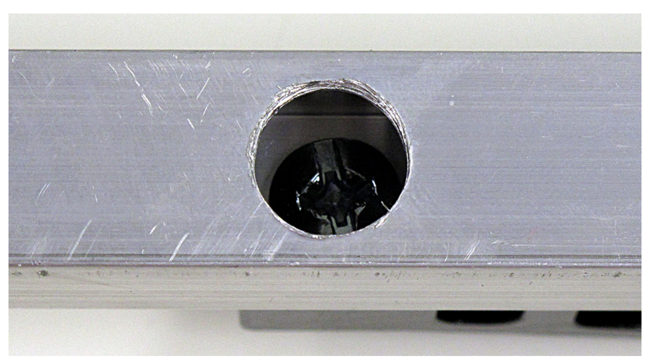

Fig. 21. Close up of the bottom of the aluminum tubing after mounting holes are drilled for screws.

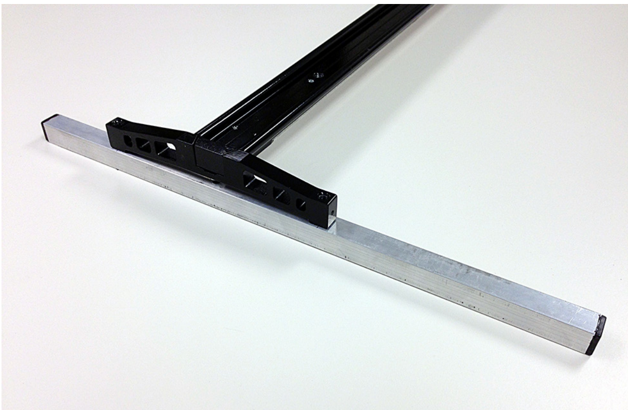

Fig. 22. Aluminum tubing mounted into the bottom of the detachable legs and installed back onto the track.

can then be screwed into the removable feet from the bottom using four of the ¼" screws. (figs. 20-22)

SUMMARY

The stereomicroscope is one of the most important tools in a conservation studio, allowing conservators to do treatments and examinations. While the microscope's functionality is rarely debated, the ability to safely maneuver the microscope to its most needed locations has been dependent on the limitations of the few stereomicroscope stand designs provided by the microscope market. The two most popular designs, the boom stand and the articulating arm stand, have both benefits and deficiencies. The most important deficiency for both being their inability to allow a user to maneuver a microscope into the middle of a large area without sacrificing stability, cost, and portability. These issues can be resolved with the use of a bridge or gantry style stand that allows a user to mount a stereomicroscope, positioned perpendicular to a table surface, anywhere on a track in a stable manner allowing large two dimensional objects to easily slide under the track. This adaption can be easily done by mounting the vertical post from a stereomicroscope pole stand onto the sliding sled from a camera track slider. This adaption gives the conservator the ability to place virtually any modern stereomicroscope anywhere on a track. It is the authors hope that this adaption might be beneficial for any conservator that works on large two dimensional objects.

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