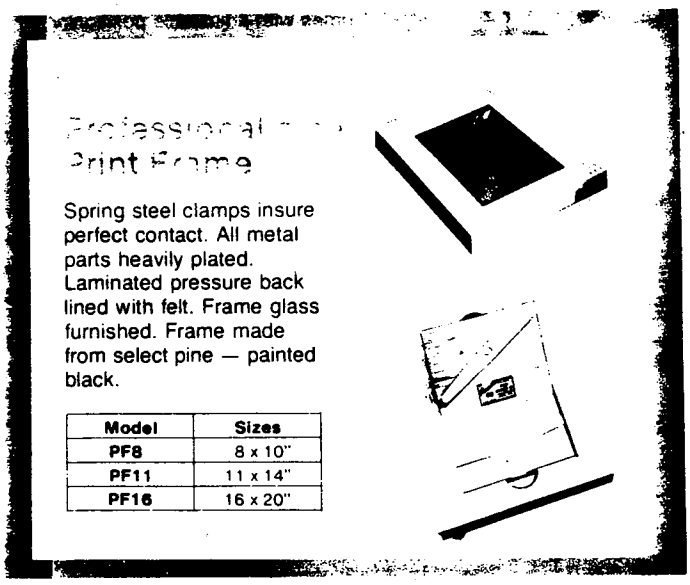
FILM AND PLATEHOLDERS

It is the job of these pieces of equipment to hold your holographic recording materials in position stably, without letting the material move in any way. Although this piece is the last component that the laser light hits, it should be first in your consideration in laying out a holographic set up. Because this is where all the interference action takes place, it deserves the utmost in stability. Going the lowest center of gravity route by letting it rest on the table, or by straddling the magnetic bases in a goalpost situation, is the optimum, and if it is necessary to support it above the tabletop a tail should be used just like in **"LARGE MIRROR MOUNTS"** to stabilize it. The center of the plate then determines the beam's height above the table.

Holding a holographic plate for reflection holography means grasping it around the edges, and stability is ensured by the glass substrate. Plastic based film is always moving if care is not taken to stop it. Many different approaches have been taken to hold film steady during reflection hologram recording, mainly the use of clear glass plate sandwiches, with or without index-matching fluids, however they are not 100% successful. There is inevitably a black area on the hologram caused by the film itself moving locally during the exposure, brought on by pockets of air trapped in the sandwich. If there is a need for many copies of the same reflection hologram, it is best to make a good glass plate and then make contact copies on the cheaper plastic, as shown in the handout, **"IMAGE PLANE SBR"**.

The air pockets occur in the center, not at the edges, where there is the clamping tension. But for transmission holograms, where there is no need for the light-sensitive coating to be accessed from both sides, a filmholder can be designed so that pressure can be applied evenly to the whole of the film and not just at the edges. Vacuum frames, water-soluble adhesives, or electrostatics have been tried, but what is in use here at the SAIC are contact print frames.

WOODEN FRAMES: There are several different sizes of holders that are modelled on the traditional contact copying print frames from photography. Some are of photographic grade, but the heavy duty ones were made here in the woodshop by Dean Randazzo. They are commonly used for holding film or plates in transmission hologram set ups because of the backing plate, but they have been used for contact printing reflection holograms onto film in a Single Beam style. There are tee nuts with threads for attaching rods to them on either side for horizontal or



vertical formats. There are velcro loops on the filmholders so that mirror covers can be used to shield live film in the holder while masters or slits are changed in Transfer or One Step Rainbow Set Ups. We have this type in sizes from 3 1/4" by 4", 5" by 7", (no 4" by 5" but if anyone finds one...), 8" by 10", 30 by 40 centimeters, 16" by 20", and 50 by 60 cm.

A complete set of components for holding film includes not only the film (or plate) holder but also the following accessories:

CLEAR FRONT GLASS	BLACK CLEAR GLASS
BACKING PLATE WITH SPRINGS	GNOMON ANGLE FINDER
WHITE LINE UP CARD	QUADRANT EXPOSURE TESTER

GROUND GLASS FOR FOCUSSING REAL IMAGES

A film sandwich is made with the clear glass in front, the film, and the black glass with the paint away from the film! Look at the difference between the painted and unpainted sides; the former acts as a weak diffuse reflector, while the other side looks very black because all the light is specularly reflected off in a certain direction. You can of course find the specular reflection by following angle of incidence = angle of reflection law, but nobody would look at a hologram like that because they would get the specular reflection of the reference beam into their eyes! If the painted side were toward the film, its non-uniform thickness would not hold the film very flat, causing motion pockets in some areas and Single Beam Reflection holograms of the specular highlights to mar others.

Elimination of pockets of air trapped in the film-glass sandwich is effected by placing the sandwich on a flat table top with a clean Photo-Wipe on it, and pressing down on it using the back plate from the Plateholder to squeeze the air out. If done well, it is very difficult to separate the two plates by any other way except by sliding the pieces across each other. The force of the air pressure of the atmosphere against the two pieces of glass keeps them in intimate contact. It is not unlike "wringing" out the air between two Gage Blocks in a machine shop.

Always use an insulating object to do the squeezing, not the direct pressure of hands, because they will heat up the glass and you may have to wait a very long time, like tens of minutes, for it to cool off and settle down. For the same reason it is best to handle the sandwich as delicately as possible when loading it into the plateholder, or with cotton gloves.

Usually the emulsion side of the film is placed outwards, towards the object or master, but it doesn't really matter all that much. Sometimes there may be a need for the emulsion to be in a certain orientation when the final holographic display is framed, so plan ahead and think backwards to determine the true orientation!

The film holders can of course be used to hold holographic plates instead of film sandwiches. The best way to avoid making a Single Beam Reflection hologram of the back pressure plate in this case is to pre-coat the back of the plate with some #33 Antihalation Spray. Putting some black paper or cloth behind it still makes a hologram, but the light returned from the back of the plate will be minimized. Sometimes you might

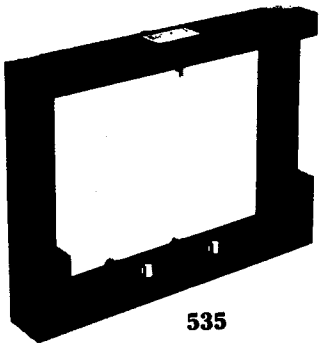
find an interesting Single Beam Reflection hologram of the backing, with bright patterns alternating with dark pockets of movement of the backing material.

BIG NEWPORT PLATE HOLDERS: We have two each of each of the sizes of these pieces of junk. (I didn't order them!) Although they could probably be run over by a tank without losing their ability to function, they have serious design flaws that make them almost totally unacceptable for display holography.

First off, they are designed to accept reference beams coming from the long side of the plates, as there is a severe overhang that casts a major shadow when the reference beam comes parallel to the short side, making the usable holographic area smaller than the nominal plate size. Another design defect is in the spring loaded clamps whose chrome-plated dowel pins always come out in the hologram, necessitating cropping again.

Film Plate Holders

Model 520 and **535 Film Plate Holders** have identical plate holding mechanisms that incorporate three spring-loaded movable pins, one on the top and two on the bottom, to hold the film plate against matching reference pins. Model 520 can handle plates up to 5 in. (127 mm) wide, and Model 535 can handle plates up to 10 in. (254 mm) wide. Made of heavy black-anodized aluminum with stainless fittings, the holder is rugged and can be tied down to a Newport table using three 1/4 in. (6 mm) clearance holes. For applications requiring precise micropositioning of the film plate to a specific location, Model 520 can be mounted on the **Model 525A Micropositioning Base**.



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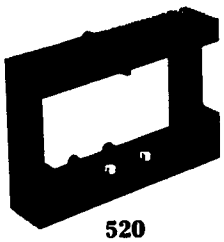
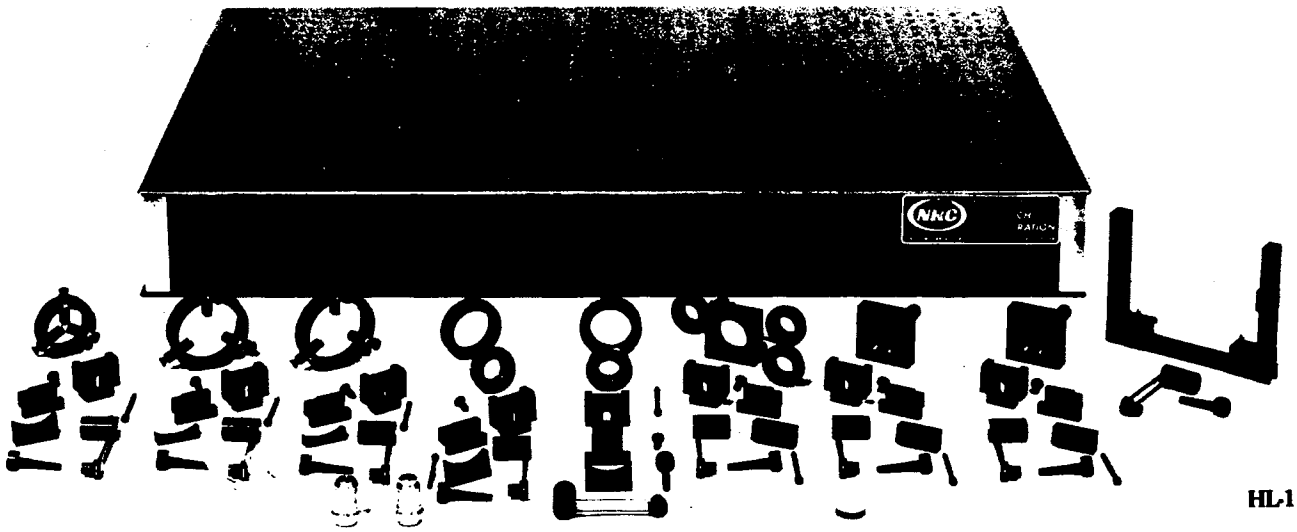


520

They were provided with milled slots for attaching to the table with the long side down. We have modified these things so that they can be attached to the table on the short side, or attached to magnetic bases, or supported between a pair of "goalposts".

They are not totally useless, as they could be used as master holders for rainbow transfers, or plate holders for two beam reflection holograms if you can tolerate the loss of usable area. They have been used successfully in holding film sandwiches in reflection holography.

NEWPORT'S BEST FOUR BY FIVE INCH PLATEHOLDER is actually based on



a JODON design, which is very good, but NEWPORT refuses to sell it separate from their silly Tinkertoy "HOLOGRAPHY LABS" HL-1 and HL-1a (pictured). Which is to their disadvantage, as it would easily outsell the clunky and virtually useless Film Plate Holder 520. The CNC milled U-shape has a convenient notch cut into it for fingers loading plates. Its dimensions have been engineered to provide an offset so that when the holder is removed from the support post and reconfigured from a horizontal composition to a vertical one the center of the plate remains at the exact same position with respect to the incident laser beams.

This plateholder is part of an assembly that includes a GAERTNER Magnetic Base, a NEWPORT Base B-2, a NEWPORT Post Holder VPH-3, and a NEWPORT Support Post SP-2. The latter is jammed very tightly into the Post Holder, and is set so that the center of the four by five inch plate, in either horizontal or vertical orientation is at the height of the Cylindrical Laser on the Beginning Table. Please don't do anybody a favor by changing this base assembly. If you need the Plateholder, and at a different height, scrounge up some other parts for fixturing.

The plate is held in its plane by three panhead Allen head bolts. These do such a good job of locating that you can many times replace the plate right back into the holder after processing and observe "REAL TIME INTERFEROMETRIC FRINGES" on the object by having the stored holographic image interfere with the actual object's wavefront.

BLADEHOLDER: This plateholder has its roots in holding electronic circuit board during their assembly. Stability is not of great concern in this application, so it takes a bit of gentle persuasion and tender alignment to get this unit to hold the holographic plate so that it is not loose in the mount, but also not so tight that it distorts the plate, causing it to bow during exposure. If a hologram subjected to this stress comes out at all, it usually has bands across it. It is a good idea to practice loading a dud plate into it with the room lights on to get the feel for it.

TO SET BOTH BLADES PARALLEL: Set the blades on a tabletop. Loosen one so that it falls onto the same plane as the other.

We also have the PANAVISE BASE that came with the holder, and it may have some applications not necessarily in the recording of holograms but elsewhere in the studio.

JUMBO PLATEHOLDER: This unit was machined here many years ago by an alumnus, Steve Wolf, and it is a great design. It is useful for holding 30 by 40 centimeter masters in transfer set ups, or the copy plate in a large reflection transfer. Unfortunately it can be used in only one orientation, but it works very well in this manner.

The glass is held by two bars whose pressure is adjusted by the bolts on either side. It is heavy and sturdy enough to stand on its own, but to take no chances attach it to the table with the Newport Base Clamps BC-2. The top of it may have a tendency to flap in the breeze a bit, so add a rod and clamp and magnetic base to the side to stabilize the summit.

There are other ways of holding plates during the recording of a hologram, especially in Single Beam Reflection style, by laying the plate on the object itself, either by a clever design of the object or with three screws or bolts screwed into a NEWPORT Table top or a piece of wood with the object laying on its back. The key to success is three point support! Also watch out for light entering the thin edge of the plate, and bouncing around inside it, causing those colorful but pesky strips along the plate edge.

STORAGE: There are certain places for the holders to be stored when not in use. The small WOODEN FRAMES, up to 8 by 10 inches, go on the CONCRETE BLOCK SHELVES, along with the NEWPORT PLATE HOLDERS. The larger WOODEN FRAMES, 30 by 40 cm, go in the LARGE WOODEN CABINET. See also the handout, **"STORAGE MAP"**, for more details.