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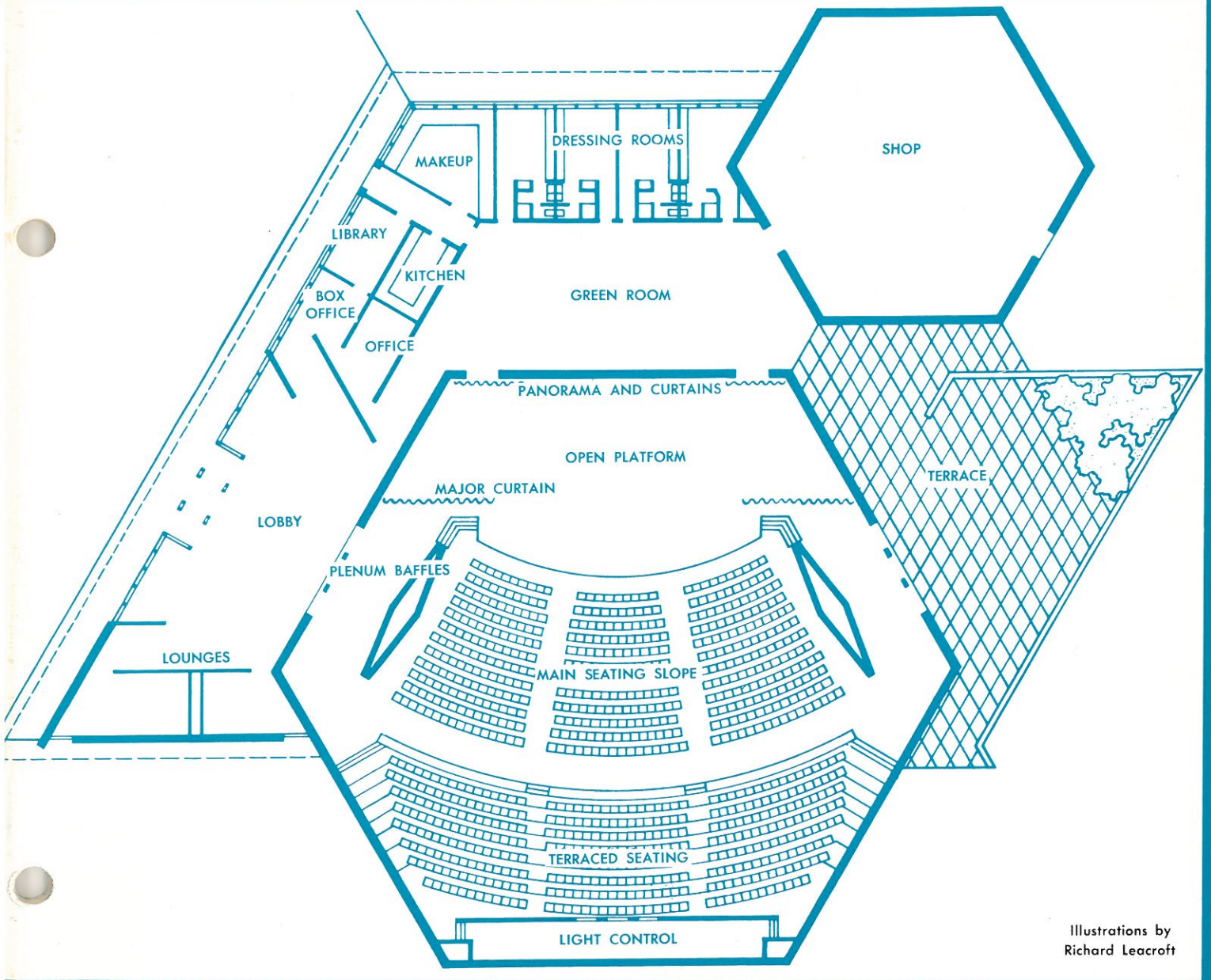
THE OPEN STAGE

BASED ON THE DESIGNS OF JAMES HULL MILLER



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HUB ELECTRIC COMPANY · Chicago, Ill.

Background Projection

Why It Is Needed . . . an Introduction

With the development of changeable scenery, especially during the eighteenth and nineteenth centuries, there was evolved a system of handling stage decor of a simplicity akin to the shuffling of a deck of cards. Areas to the sides and above the stage were reserved for the storage of the flat pieces such as wings and backdrops, and from these areas the flat pieces were easily maneuvered onto the visible portion of the stage.

By the twentieth century, the modern flyloft was perfected with a variety of equipment such as sets of ropes and steel lines operated both manually and mechanically.

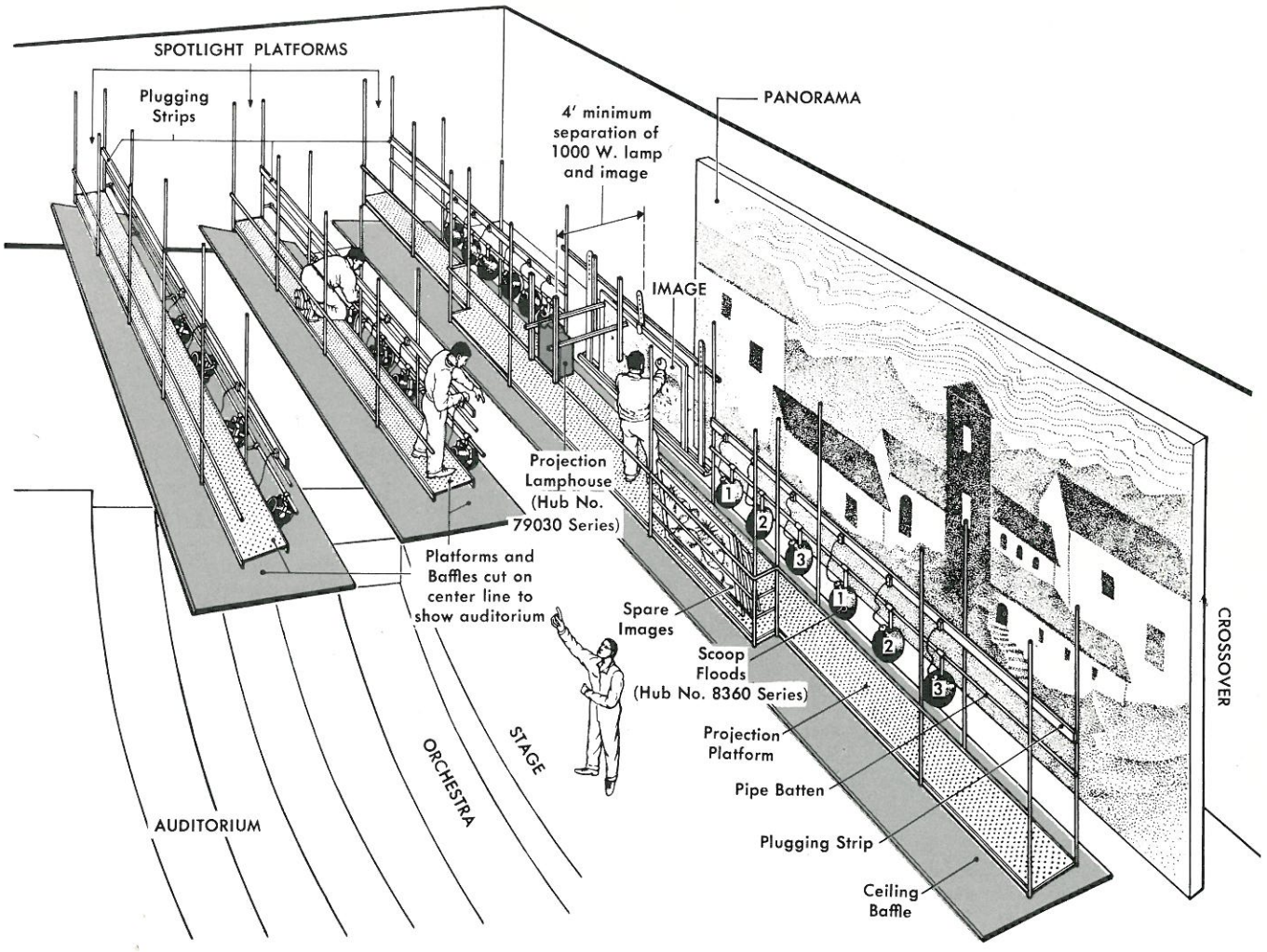
However, on the stage below, emphasis had shifted to the more three-dimensional arrangement of scenic units, frequently mounted on movable platforms, and the loft rigging was required only generally, for the suspension of the large cyclorama cloth and backdrops, curtains and masking pieces, lighting equipment and the ceiling portion of musical concert shells.

With the open stage, these loft requirements are met in the following manner:

1. Substitution of a plaster panorama wall with projection system for the cloth cyclorama.
2. Use of lateral tracks for curtains of closure.
3. Continuation of auditorium ceiling over stage, with functional breaks for curtains and lights.
4. Mounting of lights on catwalks above ceiling.
5. Replacement of a portable concert ceiling by the permanent ceiling.

Simultaneously with the emphasis on three-dimensional scenery comes an increasing enthusiasm for a playing area both larger and more freely formed than that of the proscenium. The shape and mechanics of the proscenium theatre evolved from the practice of setting one scene at a time. Now many playwrights demand a stage across which uninterrupted dramatic action may flow from scene to scene.

Along with the new requirements in scene design comes the necessity for backgrounds that are capable of changing form and color while the play continues. It is obvious that the conventional backdrop consisting of paint on cloth and controlled by rigging must be replaced by backgrounds conceived in terms of light and controlled by dimmers.



The Parts of the System

Item	*Function*	*Source*
Panorama wall	to receive color and imagery	architect
Projection platform	for the mounting and servicing of the projection system	architect, electrical and structural engineers.
The scoop floods	to wash panorama wall with color blends	Hub No. 8360 series
The lamphouse	to furnish the light which applies the imagery to the panorama wall	Hub No. 79030 series
The image	the artistic background pattern	scene designer
Auditorium-stage ceiling design	for the proper position and masking of the projection platform	architect and structural engineer

Note: In many theatres of the pavilion type it is not possible to develop the space arrangements necessary for background projection from overhead. In these theatres an arcade may be developed as an important architectural feature, the arcade forming the support for temporary translucent panels which receive their color and imagery from the rear in a manner identical to that above. In this case, the lamphouse, floods and the image consist of portable units, floor-based, as shown in detail at the end of this Section.

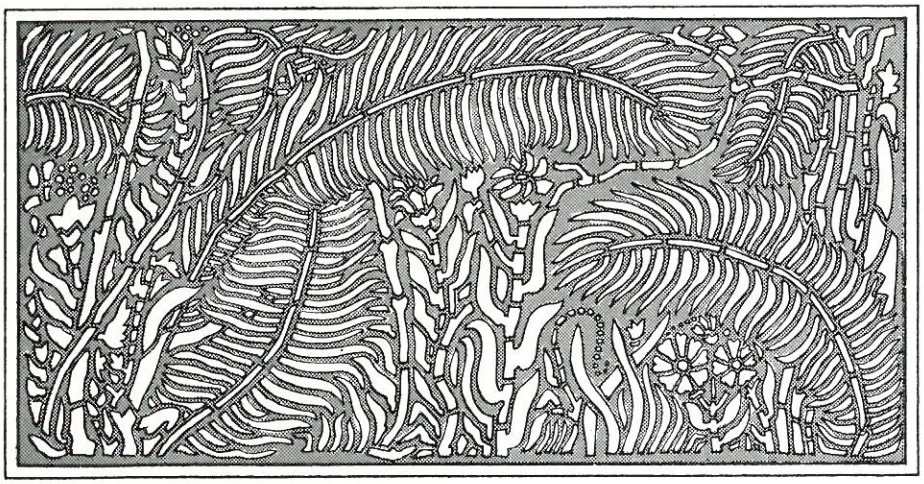
The Operation of the System

The HUB background projection system involves the use of a compound image, that is, *pattern,* in terms of light or shadow, superimposed upon *color wash,* as determined by the color media and dimmer settings of the scoop floodlights.

In the example of the bamboo rain forest, below, the plant and tree detail is removed from a large sheet of heavy Kraft paper. The remaining pattern is transferred to the panorama wall by the light rays from the projection filament in the lamphouse passing through the openings in the Kraft paper image.

The panorama wall is already illuminated by the scoop floodlights. The pattern, at a greater intensity, replaces the background color wash.

Let us suppose the pattern color is yellow-green, the color wash, dark green. The dynamics of the system are apparent when we move the time of the scene from day to night. The pattern is slowly dimmed out. At the same time, scoops with the dark green color medium are dimmed down as scoops with a blue-green are dimmed up.



Background projection image for bamboo rain forest. Plant and tree detail is removed from a large sheet of heavy kraft paper. The pattern is transferred to the panorama wall by light rays from the projection lamphouse passing through the openings.

It is entirely possible to fabricate the scene in a manner entirely opposite in technique. The image might consist of a framework containing silhouettes of tropical foliage. In this case, the lamphouse gate color will be dark green, the floods, yellow green. For the transition from day to night, the projection lamp and the yellow-green floods are dimmed down, the blue-green floods dimmed up.

However, working with these particular colors, the former method, the application of light upon light, rather than the application of light upon silhouette, will give better results.

There are other very distinct advantages to the first method. The image, for example, need not be as large as the panorama, only as large as required for the *pattern area* that is superimposed on the *full area of color wash.* Secondly, instead of a color medium at the lamphouse gate for the entire pattern, one may overlay upon the cuts in the Kraft pattern many separate colors, thus achieving a multicolor image that is then projected upon the color wash of the floods.

Other Methods . . . and Materials

Below are listed some other materials and methods of image construction:

1. On clear acetate sheets, use artist's brushing lacquer, felt pen transparent inks such as Flomaster (Esterbrook) and lamp dip for transparencies, or flat black enamel for silhouettes. If vertical ribbing lines appear on panorama, the acetate has been poorly milled and should be discarded. These techniques on acetate are not as clear as are the images created by stencil knife cuts in Kraft paper.

2. Join plastic color media, mosaic style, with narrow (1/4 inch) strips of transparent Scotch tape, keeping the tape running parallel with the joints.

3. Use 1/8 inch mesh, metal hardware cloth to give effect of gray, with areas removed for white (such as a "moon" disc) and attach cutouts such as branches and leaves for silhouettes.

4. Use the frame to support natural objects, such as twigs for a forest, and transparent cutouts of plastic color media for leaves, perhaps in montage with fine threads for support.

The Case Against Lenses

The Hub projection system does not involve lenses. Apparent sharpness of detail is relative, and is achieved by the proper distance of the image from the projection lamp filament.

For example, at the maximum recommended distance of five feet, even a No. 50 thread will be discernible, though only to those eyes searching for it.

On the other hand, moving the image closer to the projection lamp introduces an effect of haze. Frequently an image is broken up into planes that are placed at different distances to achieve both clarity and haziness, such as a foreground of palm trees framing a distant isle across a body of water.

Despite the true sharpness of detail possible with lens projection, there are certain disadvantages to a lens system:

1. The maximum of one foot spread for each foot of throw would require two units for the same panorama area as serviced by the single Hub system.
2. Tilting a lens instrument introduces a distortion factor which must be corrected in each image, whereas the Hub system is inherently distortion-free.
3. There is a definite time element involved in preparing photo-reproductions or sketches or in working on miniature imagery.
4. There is a far higher cost of equipment and materials for imagery.

While it is artistically impossible to pass hard and fast judgement on any system of projection, it should be remembered that background projection systems are functional replacements rather than literal substitutes for the painted backdrop. Even the reflection of colored light itself from an off-white plaster wall, regardless of source, provides a sensation quite different from that furnished by the illumination of pigment colors applied to the surface of a backdrop.

Planning the Installation

From the examples in the ARCHITECTS' and ENGINEERS' Section, it is obvious that there are two constants to be considered for installation of the Hub background projection system:

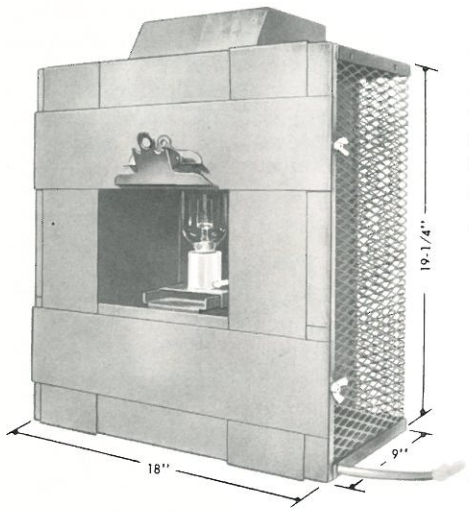
1. The angle of the projection throw to the base of the panorama.
2. The distance of the image from the projection lamp filament.

Ideally, the angle is 50 degrees between the stage floor and the lower projection line, and it should never drop below 45 nor exceed 55 degrees. The 45 degree limit has reference to such practical matters as actor movement and scenery placement, while the 55 degree limit has reference to a noticeable intensity imbalance in the overall illumination.

For the greatest degree of projected image clarity consistent with such practical matters as the ceiling trim and the size of the image itself, a 4′ to 5′ filament-to-image distance is recommended for the 1000 watt (Hub. No. 79031) and the 2100 watt (Hub No. 79030) projection lamps, respectively. Certainly four feet would be considered the workable minimum.

Somewhere along the 50 degree line from the panorama wall base, the lower side of the image frame will rest, and in this vicinity the auditorium ceiling canopy will terminate. The distance from floor level at this intersection may vary according to the depth of the stage and to the ceiling trim height desired. But, in view of the capabilities of the system, this distance should not be less than 15′ or more than 22′.

A line drawn from the projection filament to the top of the panorama wall will establish the minimum clearance for upstage ceiling pieces, tracks, downlights, and the backlighting walkway.



Hub No. 79032 Lamphouse for background projection

Mounting the Projection System

The Hub No. 79030 series lamphouses must be mounted sturdily to the structure of the theatre itself rather than to the catwalk hanger system. Obviously, vibration of the lamphouse will cause the image to "dance" on the panorama wall. Suggested details for the mounting of both the lamphouse and individual images are available on Drawings No. 420 and No. 421 which may be obtained from the Hub Electric Company, Inc.

The temptation to reduce image handling to a system such as an image magazine is great, yet here are some of the obstacles:

1. The large images (often 5′ by 12′ for exceptionally large panoramas) cannot be slid sideways, for the scoops which provide the panorama color washes will be blocked.
2. There is often insufficient room overhead to raise the larger images vertically.
3. Even if there is sufficient room over head, racking the images in a magazine in conjunction with the wide projection angle prevents a standardization of image area used, not to mention the different degrees of clarity involved. For example, in a magazine 12″ deep, sufficient for a six-pack rack with clearance for gelatin appliques, a forward image of 4′ by 8′, when moved to the rearward slot, projects only 2′ 10″ by 5′ 8″ of its total area, with a 20% loss of apparent sharpness over its previous position.

By planning the production properly there will be ample time for manual image removal from an image holder in a standard position, together with the assurance that nothing mechanical can go wrong. In reality, because the projection is manually operated, in all probability a greater creative use will be made of it.

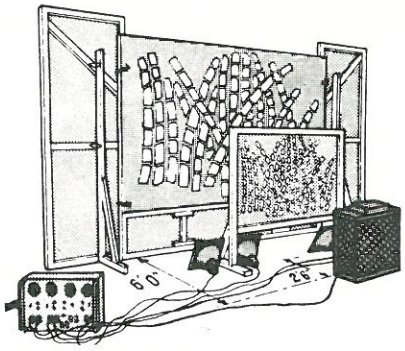
Distance of Throw and Degree of Spread

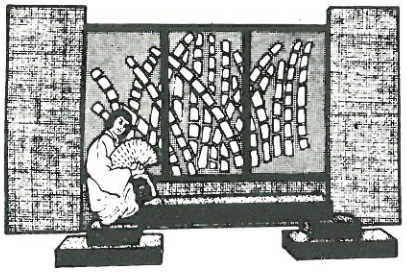
Possibly the most frequently asked questions concern the *distance of throw* (distance between the lamp filament and the background surface receiving the image . . . labeled "Operational Distance" in the chart below), the *degree of spread* (or size of the projection surface in relation to the throw), and the *sizes of images*.

Rigid specifications are not required for the Hub projection system but certain dimension limits which have been proven through experience are useful to know.

Generally speaking, one may anticipate for the projection area an effective maximum vertical dimension of 1½ times the distance of throw and a horizontal dimension of twice the throw. The actual width of the panorama or other background projection surface need not be equated with these dimensions if the image is conceived in terms of light rather than silhouette (cf. page 70) for it may then be overlaid in part upon a total field by color wash from the scoops.

By consulting the chart below, the reader may select the proper lamp intensity for the distance of throw. In the case of overhead background projection, assuming the 50 degree maximum projection angle to the panorama base, this distance of throw has been re-calculated in terms of the projection platform height (or the distance from the stage floor to the lower edge of the image).





Rear projection of scenery is accomplished by a combination of floodlights upon the panel cloth and superimposed patterns of light created by cutouts. Cutouts can be made in heavy wrapping paper which is framed and placed parallel to the cloth screens.

Unit Cat. No.	Lamp Description	Code	Lamp Base	Min. Distance: Filament to Image	Operational Distances
79032	PH/500/T-10P	CZX	Medium Prefocus	2′-6″	From 6′ to 12′ behind screen panels
				3′-6″	For fine detail from overhead platform not above 15′ from stage floor
	PH/1000/T20MP	DRS		4′-0″	15′ to 17′ projection platform height
79031	PH/1000/T20/40	DSB	Mogul Prefocus		Note: DSB lamp burns cooler and lasts longer than DRS—same filament
	PH/1500/T20/39	DTJ		4′-6″	18′ to 21′ projection platform height
79030	2100W 60 Volt T-24/8		Mogul Bipost	5′-0″	22′ and above

Finding the Image Size

A maximum image size is determined by the location of the projection platform and its relationship to the panorama and panorama area. Smaller images are determined by the amount of area to be covered by projection for any given production design.

To find the image size for a particular situation it is best to prepare a plan and section to scale showing the relationship of the projection lamp filament to the panorama or translucent screens.

Draw lines between the edges of the projection area and the filament. Then measure the recommended filament-to-image distance and establish the image plane parallel to the projection surface. By measuring this plane in plan and section, the image size is found.

For an example, refer to the illustration of the set for *The Lovers* (Dramatic Section). The arch arcade behind the low platform was 9½′ high by 16′ wide and contained screened archways whose total effective width was 14′, and whose exposed archway height was from 2′ to 9′ from the floor.

Dividing the screen height of 9′ by 1½ (maximum vertical dimension = 1½ times the distance of throw) we get 6′. However, by dividing the screen width of 14′ by 2 (maximum horizontal dimension = twice the distance of throw) we get 7′ so this latter figure, being greater, would apply. In other words, the lamphouse would be placed so that the filament-to-screen distance would be 7′.

Since there was ample space, actually a 9′ distance was allowed to obtain a more uniform intensity. Checking with our chart, Hub No. 79032 with the CZX filament is indicated.

By placing the image plane 2½′ from the filament an overall image size of 2′ by 4′ is called for (your plan and section scale drawings mentioned previously will give this exact dimension). Again, since space was not at a premium, a 3′ separation with an image size of 2½′ by 5′ was used. Since the total screen area was rather wide, each color was obtained by three Hub No. 8365 floods per color circuit, laid out in the manner shown above.

The method of positioning and calculating sizes of overhead images is similar, and some image planes are indicated in the architectural and engineering section drawings.

Production Tips

Always keep the image parallel to the projection surface, thus avoiding distortion.

Always use correct projection unit with correct lamp. Note that spotlight service filaments are proportionally larger and are *not applicable* to this projection system.

[If working with an unlisted filament, a proper image distance can be established by multiplying the filament width by 100].

If ghost images or "flares" appear on the panorama just above or below horizontal cuts or lines, tilt the projection lamp slightly until the ghost image disappears. This is caused by reflection from the glass envelope directly behind the lamp filament. The Hub lamphouse has a pivoting socket platform for this purpose.

The composite image, detail and color wash, under separate dimmer controls, may continue without a break from one image pattern to another via intermediate color washes. Unlike the backdrop, the projection system must always be regarded as a dynamic force. At the same time, the system must be manipulated with caution and subtlety, for living color creates a tremendous visual excitement.

The Projection Surface

It is not the purpose of background projection to replace scenery that has a practical relationship to the actor, such as doorways, windows, and defining walls; rather, it is descriptive of the background beyond a particular scenic island. Where an interior scene may be designated by a folding screen surrounded by furniture, the background projection can add detail descriptive of the neighborhood or town in which the room is located.

Those familiar with that proscenium background control device known as the cyclorama will notice at once that all the panorama walls shown in this bulletin terminate in space and do not attempt the encirclement of the visible stage area.

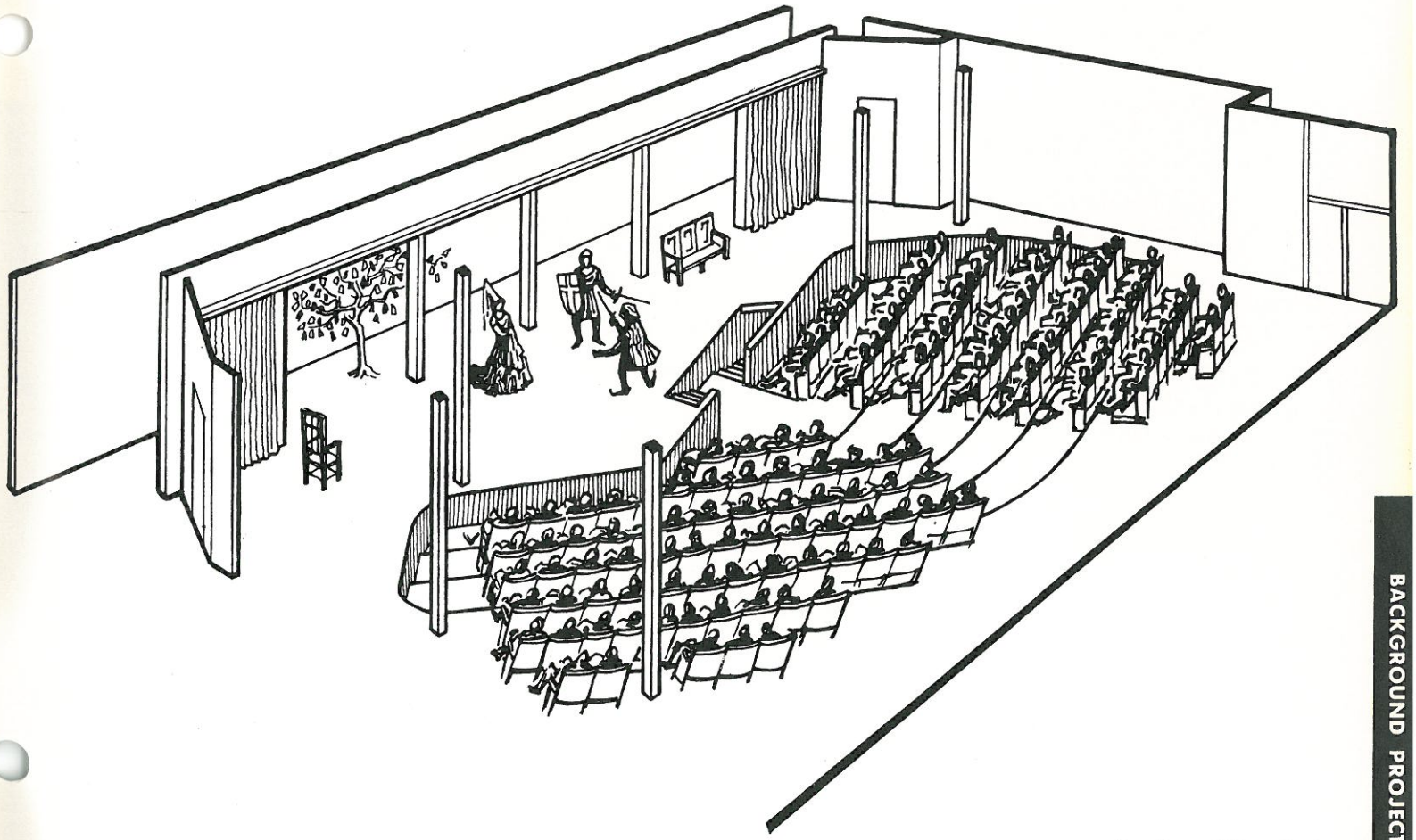
Now, one of the great visual experiences of the proscenium theatre is the unusual illusion of depth where scenery or pictorial fidelity is placed before a curving cyclorama which surrounds the scenery space. This relationship expresses completely the basic objectives of the proscenium theatre, to stage a scene pictorially correct, one scene at a time, one scene to follow another, in the same stage area!

The operation of the open stage is dedicated to principles precisely contrary to the above. On the open stage, one transcribes, in part, essential environments and places these on a stage that is suitable for various time-space combinations simultaneously apparent and used in regular or irregular order. Open stage environment is, first of all, the architectural environment of the theatre itself, to which the elements of the dramatic are added *only as or if needed.*

It is obvious that the cyclorama of the proscenium theatre must be reduced to a form that exists in space rather than embraces a space. Therefore, the more successful surfaces for background projection range from a panorama wall as a "slab in space" to the small translucent panels built into portable screen units, such as shown on pages 57, 63 and 70. For simple distortion-free projection there should be no curves in the panorama surface. Where a curve exists the image frame must be curved accordingly.

Lying between the "slab-in-space" panorama and the portable translucent scenic panels are the theatres which use background arcades. This very ancient architectural arrangement provides openings for entrances, embrasures for partially enclosed scenes, support for scenic panel inserts, and a framework for translucent screens, as, for example, the La Junta project described on page 8 and the Swarthmore College stage as shown in illustration below and in Hub Bulletin No. 107.

In many ways the permanent arcade is a device far more useful than the full panorama, for it presents in a forthright manner slices of life, using architectural justification for the arrangement of fragmentary patterns. On the larger panoramas, however, separate curtain panels on tracks immediately adjacent will assist with the subdivision of the projection surface.



Swarthmore College Theatre
Swarthmore, Pa.