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FIRING SITE OBJECTIVE LENS MOUNTS

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QUALITY DIVISION

OCTOBER - DECEMBER 1976

Normal Process Development
Endeavor No. 231

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ABSTRACT

Objective lens mounting systems were designed and installed at the test site bunkers. These systems will accept a variety of lens diameters and assure that a lens is optically aligned to the streak camera and other optical components. Lenses can be quickly installed (or interchanged) at various bunkers.

DISCUSSION

Objective lens holders were designed to eliminate the necessity of realigning a lens when changing an optical setup for a streak camera. The importance of proper lens alignment can be seen in the following conditions:

1. Laser alignment systems project a laser beam along the optical axis of the camera system. Displacement of an objective lens will deviate the beam, causing positional and angular errors of the laser beam at the test pad.

2. Objective lens displacement can cause a directional change in the image light cone within the camera. This can result with a complete image at the slit plate, while edge portions of the image are degraded (or lost) at the film plane.

3. Lens tilt (angular misalignment) induces astigmatism, resulting in lost image resolution.

Conventional lens mounts adequately align a lens angularly; however, axial alignment of the lens optical axis to the lens holder's outer diameter is often inadequate to optimize condition No. 1, as given above.

Concepts of the mounting system design are presented in Fig. 1. The conventional mount was remounted to allow one to position and secure the lens optical axis with respect to the mechanical axis of Piece B. Pieces B and C are compressed by tightening the nuts against Piece C. This assembly can then be attached to Piece A, which is aligned to the camera system optical axis.

The system requires an initial alignment of Piece A to the camera axis and an initial alignment of a lens to Piece B. Each bunker contains a Piece A which was aligned by observing the position to the laser beam (axial alignment) and the laser beam reflection (angular alignment) from a mirror attached to Piece A. Each lens (and its conventional mount) was aligned to its Piece B by observing the deflection of the laser beam when the assembly (Pieces B and C, lens, and conventional mount) is placed into Piece A. When no deflection is observed, the lens is optically centered to the camera optical axis. The deflection should be observed at some distance to the right of the lens (30 feet or more) to simulate condition No. 1, as mentioned above. Extension devices are being fabricated to allow positioning a lens farther from Piece A. This was necessary for the periscope systems at

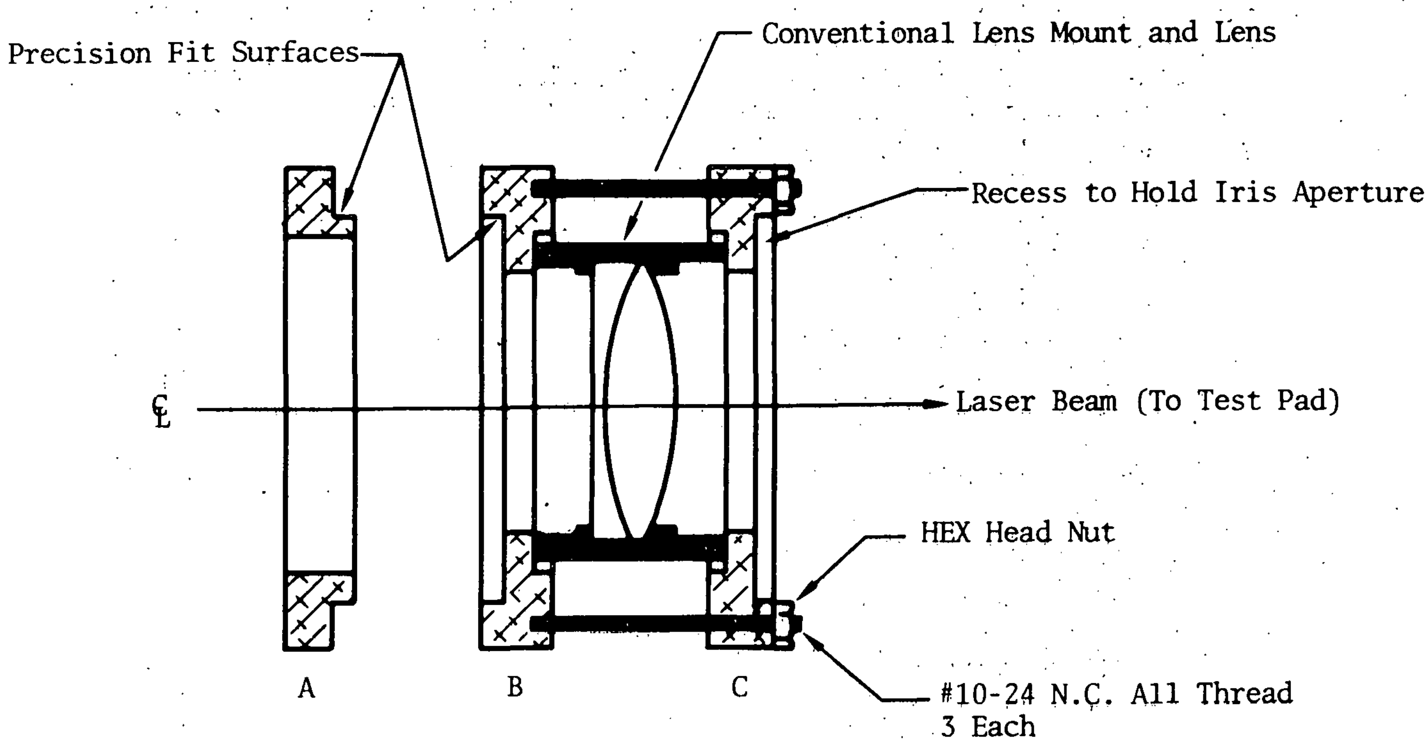

Fig. 1. Lens Mount System

FS-4 and FS-5 to allow using long focal length lenses within the confined boundaries of the camera bays. As a final note, Piece C will accept an iris aperture and is marked in F stops for its respective lens diameter.

CONCLUSIONS

The mounting systems allow a bunker operator to quickly install an objective lens. The lens will be in optical alignment with respect to the camera optical axis. The lenses are interchangeable from bunker to bunker, and each lens assembly can be stopped down to a desired aperture with reference to F stop markings on the lens mount. Image shift, astigmatism, and laser alignment deflection errors are minimized for the objective lens. This system is particularly suited to the production testing methods where setup time should be minimized, but good image quality must be maintained.