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JFK Routing Slip 008217

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Document I.D. Incoming Report
Letter

INDEX

Geological Survey
Calibration
of Camera
Imperial Reflex

COPY TO

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Special Instructions: Howarth

Form #2 cover letter

00 8217

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092
526 National Center

May 3, 1978

Mr. Michael Goldsmith
Select Committee on Assassinations
U.S. House of Representatives
3331 House Office Building, Annex 2
Washington, D.C. 20515

Dear Mr. Goldsmith:

Enclosed is U.S. Geological Survey Report of Calibration No. 419 covering measurements made on a 620 Imperial Reflex Camera, Commission Exhibit No. 750. These measurements have been made in accordance with instructions contained in your letter of March 2, 1978. The fee for this work is $320. You will be billed for this amount at a later date by our Finance Office.

Sincerely yours,

Arthur R. Shope Jr
for Roy R. Mullen
Chief, Branch of Research
and Technical Standards

Enclosure

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

REPORT OF CALIBRATION May 5, 1978

of 2 1/4 X 2 1/4 Camera

Camera type 620 Imperial Reflex
Lens type DUO
Nominal focal length 77 mm

Camera Commission
Identification Exhibit No. 750
Maximum aperture f/4.5
Test aperture f/4.5

Submitted by
Select Committee on Assassinations
U.S. House of Representatives
Reference: Letter dated March 2, 1978 from Mr. Michael Goldsmith

These measurements were made on Kodak Verichrome Pan film type 620, developed in D-19 at 68° F for 3 minutes with continuous agitation. This film was exposed on a multicollimator camera calibrator using a white light source rated at approximately 3500K.

I. Equivalent Focal Length: 77.55 mm

This measurement is considered accurate within 0.02 mm

II. Radial Distortion:

Field angle (degrees)	$\overline{D}_c$	D_c for azimuth angle 0	90	180	270
7.5	0	61	-25	-44	7
15	388	611	331	260	350
22.5	1706	---	---	1646	1767

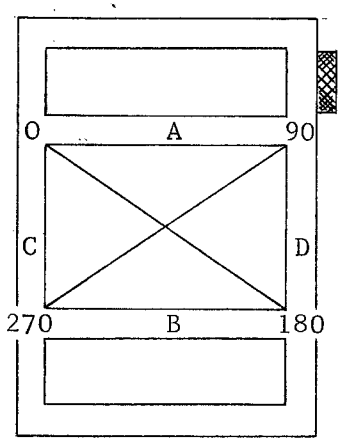
The radial distortion is measured for each of 4 radii of the focal plane separated by 90° in azimuth. $\overline{D}_c$ is the average distortion for a given field angle. Values of distortion D_c are based on the equivalent focal length referred to the field angle co-tangent for 7.5°. The radial distortion is given in micrometres and indicates the radial displacement of the image from its distortion free position. A positive value indicates a displacement away from the center of the field. These measurements are considered accurate within 10 µm. It is clear from these variations in the values reported among the four radii from the average that a substantial amount of asymmetric distortion is present in this lens.

III. Resolving power in cycles/mm

Field angle:	0°	7.5°	15°	22.5
Radial lines	14	16	20	---
Tangential lines	20	20	10	---

The resolving power is obtained by photographing a series of test bars and examining the resulting image with appropriate magnification to find the spatial frequency of the finest pattern in which the bars can be counted with reasonable confidence. The series of patterns has spatial frequencies from 10 to 223 cycles/mm in a geometric series having a ratio of the 4th root of 2. Radial lines are parallel to a radius from the center of the field, and tangential lines are perpendicular to a radius.

IV. Indicated Principal Point



Indicated Principal Point
to Midsides of focal frame

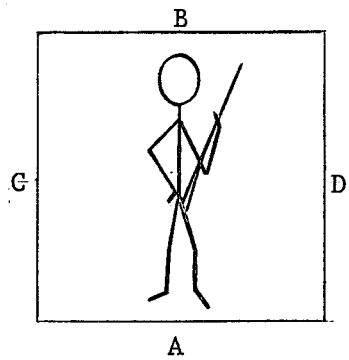
Positions of all points are referenced to the indicated principal point as origin. The diagram indicates the orientation of the referenced points when the camera is viewed from the back. The direction of film travel is to the top.

A	Unable to Measure
B	28.79 mm
C	27.96 mm
D	29.34 mm

These measurements were made from a shadow image formed in the focal plane. The method of measuring these distances is considered accurate within 0.01 mm.

The camera was aligned for calibration by autocollimating on the mounting surface where the front of the test camera-lens was placed for the film exposures. It is evident however that this is an indirect procedure, but the only method possible for a camera of this type. This alignment process made the front of the lens ring normal to the axis of the collimator bean emergent from the 0° collimator.

V. Camera Negative



The diagram indicates the orientation, with emulsion - up of a negative submitted for focal frame measurements.

Distances between midsides

A-B	57.10 mm
C-D	57.14 mm

The method of measuring these distances is considered accurate within 0.01 mm.

William P. Tayman
Branch of Research and Design
Topographic Division