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PHOTOGRAPHIC INTELLIGENCE MEMORANDUM

EVALUATION OF [illegible]

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PHOTOGRAPHIC INTELLIGENCE MEMORANDUM

EVALUATION OF 127 MM "SOLMAR M" LENS

Purpose: To investigate the physical and performance characteristics of the Solmar M lens in comparison with other lenses and to determine its area of application in intelligence photography.

Background: The Solmar Lens was designed and produced in 1952 by the General Scientific Corp. of Chicago, Ill. Manufactured in response to a requirement from the Physical Security Equipment Agency, the lens was reputed to resolve a phenomenal 250 lines per millimeter.

With the claimed resolving power in mind it was theorized that when used with a high resolution film, such as Adox KB-14, the Solmar lens should produce photographs of quality equal or superior to those exposed through the various twenty inch focal length mirror optic lenses presently in use. This report covers the tests and results of an investigation made to determine the accuracy of that theory.

Test procedures and results:

1. Testing was conducted on a comparative basis using the following four lenses: (see photo enclosure 1)
   a. 50mm Fl. "Summar" - max. aperature F 2.0
   b. 127mm Fl. "Solmar M" - max. aperture f 2.0
   c. 135mm Fl. "Hector" - max. aperture f 4.5
   d. 450mm Fl. "Old Delft" - Fixed aperture f 5.6
2. Physical Characteristics:

	Weight	Length(less Camera)	Max. Diam.	Finish
50mm	.37 lb	1-3/8 inches	2 in.	Bright Chrome
127mm	.70 lb	5-1/2 inches	2 3/4 in.	Satin Chrome
135mm	3.19 lb.	6½" & lens shade	3-1/2 in.	Low Gloss Black

	Weight	Length(less Camera)	Max. Diam.	Finish
450mm	2.75 lbs	7" and lens shade	4 inches	Low Gloss Black

3. Optical Characteristics:

	Horizontal / of view	Focuses From	to	Field at 100 Ft
50mm	46°	3'	inf.	105 ft.
127mm	16°	6'	inf.	34 ft.
135mm	15°	5 ft.	inf.	31 ft.
450mm	6°	20 ft.	inf.	13.5 ft

4. Resolution tests were made at maximum apertures with the results listed below:

50mm 42 lines per mm at center

127mm 120 lines per mm in corner higher in center

135mm 60 lines per mm in center

450mm 30 lines per mm (not tested - mfgs rating)

Resolution tests were made on microfile film developed in Kodak D-11 developers. The maximum resolving power of microfile is approximately 150 lp mm. Resulting resolutions were read with a microscope. Lenses were further tested outdoors again with microfile over a 250 foot range using a test target composed of high contrast letters and numerals. A photo of this target is attached as photo enclosure 2. The size of the smallest letter clearly resolved by each lens is as follows:

50mm 7" letter readible but very fuzzy

127mm 1.25" letter easily read with microscope

135mm 2" letter easily read with microscope

450mm 3" letter readible but very fuzzy

This target test was repeated using Adox KB-14 film, with development in Neodyne Blue organic developer. Adox 14 is reported to have a resolving capability only slightly below that of microfile. Results are attached hereto as enclosures 3 through 6.

As a final empirical test all four lenses were used on the "cat cracker" and fractionating towers of the Baltimore Esso refinery. Adox film was used and all photos were taken from the same camera station. Photo enclosures 7 through 12 present the results of this testing. It must be remembered in viewing these photographs that they can only be as "sharp" as the enlarger lens through which they were projected. Therefore photo quality will appear to be about the same. Proper evaluation is best accomplished again via the microscope from the negative.

Discussion:

Examination of the data presented here and the accompanying photographs establishes the soundness of the premise that the Solmar lens will produce photographic results equal to the particular 450mm lens used in these tests. However, the testing officer does not feel the 450mm lens results that form a part of this report are true measure of the lens' capability. They do represent a fair example of field use results. This type of lens is very susceptible to vibration and the experimental poor results represent the image degradation caused by moderate winds despite every effort to achieve vibration free exposures.

The collection of intelligence photography under discreet or clandestine conditions must be planned to produce photographs yielding a maximum amount, or at least a predetermined amount, of detail.

Too, in the interests of operational security it is frequently necessary that such photographs be taken at a point some distance from targets. These two requirements have made the telephoto lens an integral part of the intelligence photographic system.

Since the conventional folded optic type of long focal length lens has drawbacks in bulk, complexity, vibration problems, and conspicuousness, it is therefore felt that the Solmar lens earns for itself a very solid position as a member of the family of intelligence lenses.

It should be noted also that the maximum aperture of f2.0 allows a considerably greater latitude in illumination, and access to slower films with better grain and resolution characteristics. Also, the angle of coverage of the 127mm lens encompasses roughly nine time the field of view of the 18" to 20" telephotos. This allows a particular target to be photographed more quickly with fewer exposures and with less danger of interception or compromise.

It is to be noted that the tests herein reported were conducted with only one of each of the lenses and that the results are open to challange from this point. Based however, on a general knowledge of resolving capabilities it is felt that the lenses used were of average or better quality. The results and conclusions deduced therefrom would therefore present an accurate determination of the capability and value of the Solman "M" lens.