

UNCLASSIFIED

AD NUMBER	
ADB804858	
CLASSIFICATION CHANGES	
TO:	UNCLASSIFIED
FROM:	RESTRICTED
LIMITATION CHANGES	
TO: Approved for public release; distribution is unlimited. Document partially illegible.	
FROM: Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 08 OCT 1945. Other requests shall be referred to Office of Scientific Research and Development, Washington, DC 20301. Document partially illegible.	
AUTHORITY	
OSRD list no. 39 dtd 20 Jan-21 Feb 1947; OTS index dtd Jun 1947	

THIS PAGE IS UNCLASSIFIED

Reproduced by
AIR DOCUMENTS DIVISION



HEADQUARTERS AIR MATERIEL COMMAND

WRIGHT FIELD, DAYTON, OHIO

The
U.S. GOVERNMENT

IS ABSOLVED

FROM ANY LITIGATION WHICH MAY

ENSUE FROM THE CONTRACTORS IN -

FRINGING ON THE FOREIGN PATENT

RIGHTS WHICH MAY BE INVOLVED.

REEL - C

690

A.T.I.

9909

Office of Scientific Research and Development
NATIONAL DEFENSE RESEARCH COMMITTEE

Section 16.1 - Optical Instruments

Institute of Optics
UNIVERSITY OF ROCHESTER

Report on

Contract No. OEMsr - ☐ ☐ ☐

Section 16.1 Report No.

112

Caps. No.

OSRD Report No.

3

Office of Scientific Research and Development
National Defense Research Committee
Section 16.1 - Optical Instruments

Institute of Optics
UNIVERSITY OF ROCHESTER

Report on
WIDE FIELD TELESCOPES

Contract No. OEMsr-160

October 8, 1945

Section 16.1 Report No. 112
OSRD Report No. 6033

Copy No. 26

Distribution List
of Report on
WIDE FIELD TELESCOPES

<u>Copy Addressed to</u>	<u>Copy Number</u>
Office of the Executive Secretary, OSRD	1
Liaison Office, OSRD	2 - 17
Dean G. R. Harrison, Chief, Division 16	18
<u>Section 16.1 Members:</u>	
T. Dunham, Jr., Chief	19
R. R. McMath	20
G. W. Morey	21
F. E. Wright	22
<u>Section 16.1 Contractor</u>	
University of Rochester - Dr. E. O'Brien (OEMsr-160)	23
<u>Army-Navy Liaison Officers - Project AC-26</u>	
ATSC, Wright Field (Col. R. E. Jarmon, Col. F. C. Wolfe, Col. G. E. Patterson)	24 - 26
Bureau of Ordnance, Navy Department (Comdr. S. S. Ballard)	27
Bureau of Aeronautics, Navy Department (Lt. H. London)	28
Bureau of Ships, Navy Department (Lt. C. G. Hamaker)	29
<u>Other Distribution</u>	
Dr. Donald Marquis, Army-Navy-NRC Vision Committee	30
Office of Research and Inventions	31 - 34
Naval Research Laboratory	35
War Dept. Liaison Officer for the NDRC	36
Section 16.1 Files	37 - 75

FOREWORD

The Army Air Forces requested in 1944, under Project AC-80, that an investigation of night vision devices be carried out by NDRC. Wide field binoculars with large exit pupils seemed likely to prove extremely useful for this purpose. The present report describes several designs for wide field optical systems, including ones which employ a modification of the Schmidt straight-in-line erecting system, rather than the usual Porro prisms.

Thaddeus Dunham, Jr.
Chief, Section 16.1, NDRC
Optical Instruments

EE-161 Radiation Laboratory
Massachusetts Institute of
Technology
Cambridge 38, Massachusetts
June 7, 1946

RESTRICTED

SUMMARY

The need for very compact wide angle telescopes with large exit pupils and high quality optical performance has led to the development of several instruments utilizing modified Porro prisms as well as a slight modification of the erecting system first described by Schmidt. In this erecting system which makes use of two special prisms, the light path is folded upon itself in such a way as to result in a very short instrument with substantially straight through viewing. The usual objection to the Schmidt type of erecting system, namely, bad ghost reflections, has been largely eliminated by the use of non-reflecting coatings on appropriate surfaces. The result has been very satisfactory telescopes of magnification 3X, 6X and 7X with unusually wide

In the case of the 7X, the product of field in degrees by magnification is approximately 85 by the use of one aspheric surface in the eyepiece. This surface is produced by a molding process which has been very much refined by the Institute of Optics and supplied in large production in other instruments.

The design and performance of the Schmidt erecting telescopes is here described in some detail. The design and performance of these systems using modified Porro prisms has been discussed in OSRD Report No. 1482 (Section 16.1, Report No. 23).

Small production of the 6 x 42 Porro type instrument in anti-oscillation form was undertaken by the Army Air Force. Substantial production of a wide field 7 x 50 binocular for conventional use was undertaken by the Navy Bureau of Aeronautics. The latter instrument was entirely redesigned for production by the Bausch & Lomb Optical Company. This included the return to the conventional non-tapered prism which made the instrument more bulky but facilitated production.

RESTRICTED

RESTRICTED

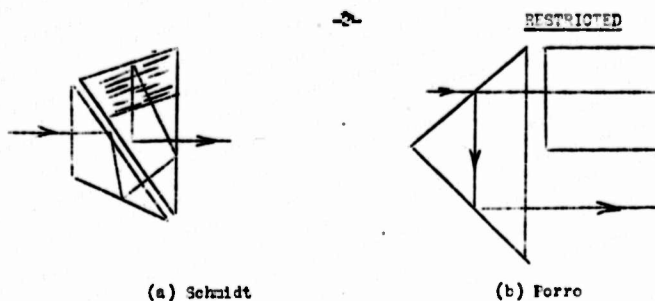
WIDE FIELD TELESCOPES

1. Introduction

Requests for improvements in almost all the figures of merit in prower telescopes resulted in new designs at The Institute of Optics. Those instruments using the Porro type of erecting system have already been described and will not be treated here except for the addition of Figures 18 & 19, showing the optical assembly of the 7 x 50 binocular and the original 6 x 42. In this report the principal emphasis is on instruments using the Schmidt type of erecting systems. In low power telescopes, the space between the objective and eyepiece becomes very short, and it is difficult to use conventional erecting systems. Also, because of the lack of space, the field must be quite restricted. The Schmidt system, on the other hand, is very compact and can easily be fitted into a low power telescope, having the added advantage that the axes of the eyepiece and objective can be made to coincide, a very desirable feature in a monocular instrument where ease of viewing is important. These systems are also much lighter than those using Porro prisms, and thus easier to carry and use.

Figure 1 is a comparison of the Schmidt erecting system (a) modified by closing the gap between the two prism elements and a Porro system (b) of approximately the same field. It can be seen that the Schmidt system is smaller in every dimension than the Porro and that it deviates the optical axis by only a small amount. The slight offset in the axis is not inherent in the Schmidt system, but is necessary for a prism of minimum size.

RESTRICTED



(a) Schmidt

(b) Ferro

Figure 1

II 6 x 42 Monocular

In the spring of 1942, a 6 x 42 telescope with a product of real field (in degrees) by magnification equal to 70 was designed to be used in an anti-oscillation mounted sight described in CSRD Report #1482 (Section 16.1 Report #23). Development of this "night sight" showed the need for a more compact prism system than the modified Ferro prisms used there, and accordingly a new 6 x 42 monocular was designed with a Schmidt erector. The same eyepiece was used as in the "night sight" and only slight changes were necessary in the objective design. This new monocular has a real field of view of 11.6 degrees, an eye relief of 19.66 mm and an exit pupil of 7 mm. An Erfle-type eyepiece ($f' = 25\text{mm}$) is used, with a cemented doublet of speed $f/3.68$ as the objective.

The objective was designed to fully correct the spherical and chromatic aberration of the prism and eyepiece.

RESTRICTED

RESTRICTED

-3-

At full aperture the total spherical aberration is ± 0.032 mm, while at 7/10 aperture it is -0.107 . Chromatic aberration is -0.00022 at full aperture and is -0.00040 at 7/10 aperture. This correction is as good as it is possible to make with a cemented doublet and glasses now available. Although there is some evidence of axial color when the telescope is used in daylight, due to secondary spectrum and spherical chromatism, the spherical aberration is imperceptible without the aid of an auxiliary telescope. The instrument is chromatically corrected for the C and F rays at 7/10 aperture so that the axial bundle is slightly undercorrected and the marginal rays overcorrected.

Coma is completely corrected by the objective. Lateral color from the eyepiece and prisms cannot be entirely eliminated by the objective, but the residual amount is less than the spherical chromatism of the oblique rays mentioned above. The tangential field of the eyepiece is backward curving and has been matched by that of the objective, but the Petzval fields of the objective and eyepiece curve in opposite directions in the instrument, resulting in a large amount of total field curvature of 4.3 diopters at 30° , most of which (3.5 diopters) is due to the eyepiece. There is no distribution of astigmatism (even with change of eyepiece) that will compensate for the large field curvature, and at the best the resultant image quality of the system has about 2.8 diopters of astigmatism, which is the most objectionable image error in the instrument.

RESTRICTED

RESTRICTED

Figure 2 shows the Schmidt prism system made of DF-3 for the 6 x 42 monocular, Figure 3 the objective and Figure 4 the eyepiece specifications. A cut-away assembly drawing of the complete instrument is shown in Figure 5. The original model was made with LP-2 prisms, but if more are to be made, DF-3 is recommended as shown in the drawings.

III 3 x 21 Monocular

A request was received for another monocular with three power magnification and a wide field. Although it used the same eyepiece as the 6X and the same Schmidt erecting system with LP-2 prisms, this three power instrument needed a new objective.

Since the focal length of the objective of a 3X system is half that of a 6X, its field curvature is doubled if a simple cemented doublet is used. Thus if a similar objective to that of the 6X telescopes were used, the total field curvature would be about 5 diopters, due to the sagittal fields. Redesign of the eyepiece could reduce the tangential field curvature to zero but the sagittal field would be still inward curving by 3.4 diopters and the resulting imagery would show very little improvement. In spite of this very bad curvature, however, a cemented doublet was designed, since it forms a simple and useful instrument for some applications. This is shown in Figure 6. The image quality is as good on axis and over the equivalent field as any three power of narrower field, with field curvatures out to 24 degree half field no worse than the 6 X at the edge.

RESTRICTED

RESTRICTED

Field curvature is always a very difficult problem in telescopes, since all known eyepieces give very large curvatures which must be compensated for in the objective. Even if the complete telescope is corrected for curvature, however, the image in the focal plane of the eyepiece and objective is still curved, and parallax with a plane reticle is inevitable. Such an objective has been made at The Institute of Optics, with the realization that if the necessity for eliminating reticle parallax arises, a reticle could be curved or reflexed in through the objective.

Cooke triplets similar to those used in ordinary camera objectives were first tried in the hope that they might improve the field curvature sufficiently but were discarded when the improvement was found to be negligible. It was found, however, that a five element objective could be designed with an over-corrected Petzval radius that would completely cancel the curvature of the eyepiece. Astigmatism of the objective was adjusted to match that of the eyepieces, resulting in an almost completely flat field astronomical telescope. At the edge of the field the astigmatism is less than one diopter.

Figure 7 is a plot of the longitudinal spherical aberration curves for the axial bundles in C, D, and F light. Coma in the objective was corrected to practically zero. Lateral color was carefully adjusted to less than $2'$ for the complete system and is not noticeable in the instrument; there is a slight appearance of color near the edge of the field due to secondary spectrum.

RESTRICTED

Figure 8 shows results from tests on the 3X telescope with the five element objective, demonstrating the remarkably good image quality over the entire field. The blur circle at the edge of the field is actually smaller than in the center, although this is in part due to vignetting. Resolving power tests have not been made with this telescope, but from visual inspection the image quality appears equally good over the entire field. An optical drawing of the objective is shown in Figure 9 and in Figure 10 is shown an assembly drawing of the instrument. It has a real field of view of 23° , eye relief of 20 mm and exit pupil of 7mm.

IV 7 x 35 Monocular with Aspheric Eyepiece

The third monocular designed at The Institute of Optics was a seven power instrument of 5 mm exit pupil and 16 mm eye relief. The product of field by magnification of the whole instrument was 85.4 degrees. For such a wide angle system an eyepiece with spherical surfaces only would either have a large amount of negative distortion or a large zone of positive astigmatism. By making an aspheric curve on the front surface, however, the distortion can be removed without introducing an excessive amount of astigmatism. Such an instrument has been made in Rochester, with the aspheric curve formed by a dropping process described in another report.

In addition to correcting the astigmatism and distortion of spherical eyepieces, the aspheric surface greatly reduces the spherical aberration of the principal rays, so that the eye position remains fixed for the oblique rays as well as the axial rays.

Correction of lateral color is difficult in a wide angle system;

RESTRICTED

with the 7 x 35 instrument only partial correction was accomplished in the eyepiece and the rest eliminated by a specially designed objective of two separated elements and a special chromatic plate. The Chromatic plate is made of one plano-concave and one plano-convex lens cemented together to act as a single plate of glass for D light but to introduce a large amount of negative axial and lateral color. The separated objective removes the rest of the color and also corrects for spherical aberration. Figure 11 shows the complete design of the system.

V 7 x 50 Monocular with Parabolic Surface in Eyepiece

Before the above 7 x 35 monocular with the thin aspheric corrector plate in the eyepiece was developed, a 7 x 50 monocular with an aspheric eyepiece of a different type was designed. The particular requirements for this telescope were those of a wide field night glass, and thus it was very important to have a long eye relief. In order to obtain the long eye relief, an eyepiece of 25.8 mm focal length was designed, with the curved surface of the eye lens ground to a parabolic shape by the Bausch & Lomb Optical Co.

The rest of the telescope is much the same as the 7 x 35 instrument. The objective is separated and the chromatic plate also used to correct for lateral color. A real field of view of 12.4 degrees, an eye relief of 22 mm and exit pupil diameter of 7 mm are attained in this telescope. The optical system is shown in Figures 12, 13, 14, and 15.

RESTRICTED

This telescope has been constructed and appears as in Figure 16. The performance is excellent, although the transmitted images appear yellow due to the long path through the dense flint Schmidt prisms. Since this instrument weighs 2 pounds 10 ounces, considerably more than the 7 x 35, it is now made obsolete by the development of the other monocular. Also the eaphoric in the 7 x 35 is much easier to produce and the mechanical design is much better; if a 7 x 50 were desired in the future it could be made by scaling up the 7 x 35.

VI 3X Monocular for Lt. Comm. Fockham

In maneuvering pilotless planes, operators have found that they need some magnifying power in order to help them guide the planes at the great distances required. Lt. Comm Fockham, of the Navy Bureau of Medicine and Surgery, requested a light weight low power wide field monocular to meet this need, which could be strapped to the operators head.

This request was met by scaling down the 5 x 21 monocular described in section III in the ratio of 1 : 0.771. The resulting instrument has a real field of 23 degrees and eye relief of 15.2 mm and an exit pupil of 5.4 mm; it was not reduced further in size because the eye relief of 15.9 was considered as short as it was practical to use.

The complete design was sent to Dr. Rayton of the Bausch & Lomb Optical Co., for consideration and possibly for the building of a sample instrument.

RESTRICTED



Figure 16

7 X 50 Wide-Angle Nonocular

RESTRICTED

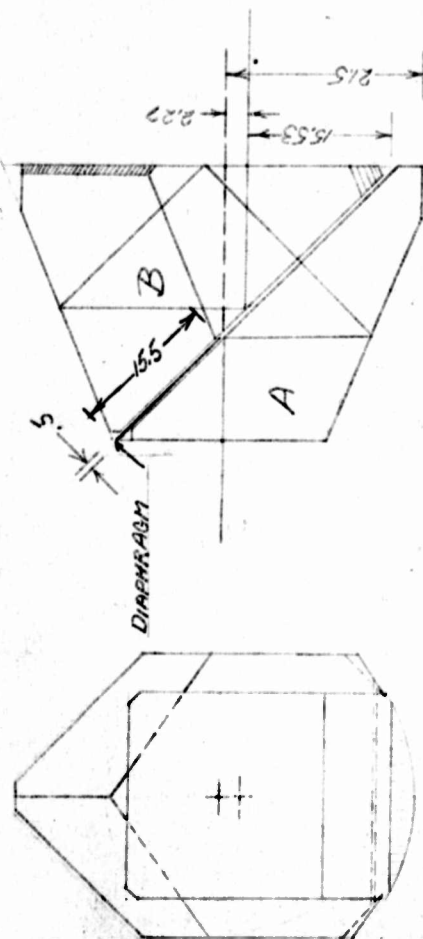
The Institute of Optics considered the possibility of inserting an aspheric eyepiece with a focal length of 16.24 mm, which would result in a 3.69 power telescope with the same real field as the 3X telescope. This eyepiece has not, however, yet been designed. Figure 17 is an assembly drawing of the monocular designed for Commander Ferkham.

RESTRICTED

FIGURE 2

SCHMIDT PRISM SYSTEM
 OFFSET OF OPTICAL AXIS 2.27
 ENTRANCE APERTURE = 20.4
 EXIT APERTURE 29.5

RESTRICTED



DIMENSIONS MM

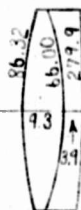
INSTITUTE OF OPTICS			
UNIVERSITY OF ROCHESTER			
MATL	PRISM	FIN	CHK
DWGN BY	REH	✓	SCALE 2:1
DATE	11/3/44		
DWG NO	05321		

RESTRICTED

FIGURE 2

FIG. 3

RESTRICTED

[illegible]

EYE PIECE

FIGURE 4

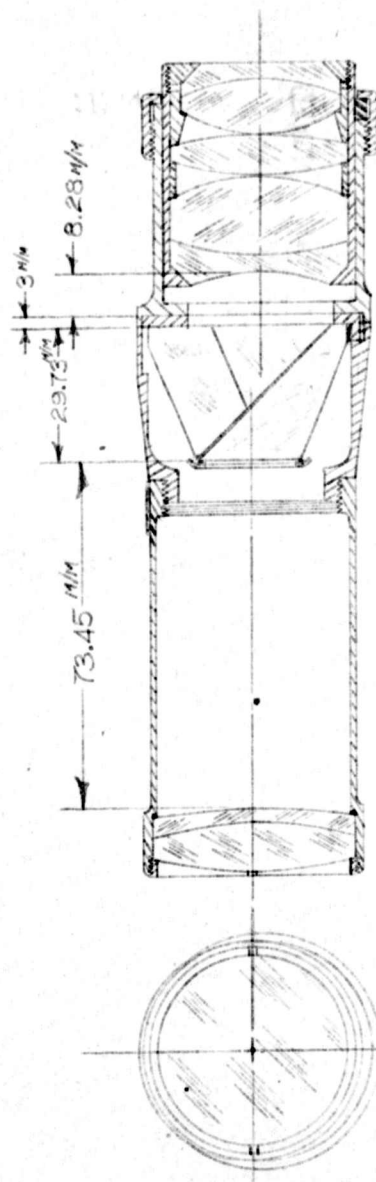


ALL DIMENSIONS IN MM

RESTRICTED

GLASS	n_d	v	t	EDGE DIAMETER	RADIUS	CLEAR APERTURE	SAG - EDGE	SAG - CLEAR
DF-2	1.617	36.6	2.7	34.8	∞	26.82		
BSC-2	1.517	64.5	12.9	34.8	35.20			
			.1		-29.32	33.10		
DBL-2	1.617	55.0	8.7	39.0	91.02	38.0		
			.1		-71.28	38.0		
LBC-1	1.541	59.9	16.3	39.0	36.70	38.00		
DF-3	1.621	36.2	4.7	39.0	-58.99			
					48.50	30.86		
$r = 25.9$				D'R'G PERTAINS TO:		INSTITUTE OF OPTICS		
$v = 8.28$						UNIVERSITY OF ROCHESTER		
$v =$						D'WN BY: EP	UNIT	
EYE POINT				RESTRICTED		DATE: 6/22/45	SCALE: 2:1	
TOLERANCE ON EDGE DIAMETER						D'W'G No: 05041		

RESTRICTED



6 X 42 MONOCULAR

FIG. 5

RESTRICTED

FIGURE 9

[illegible]

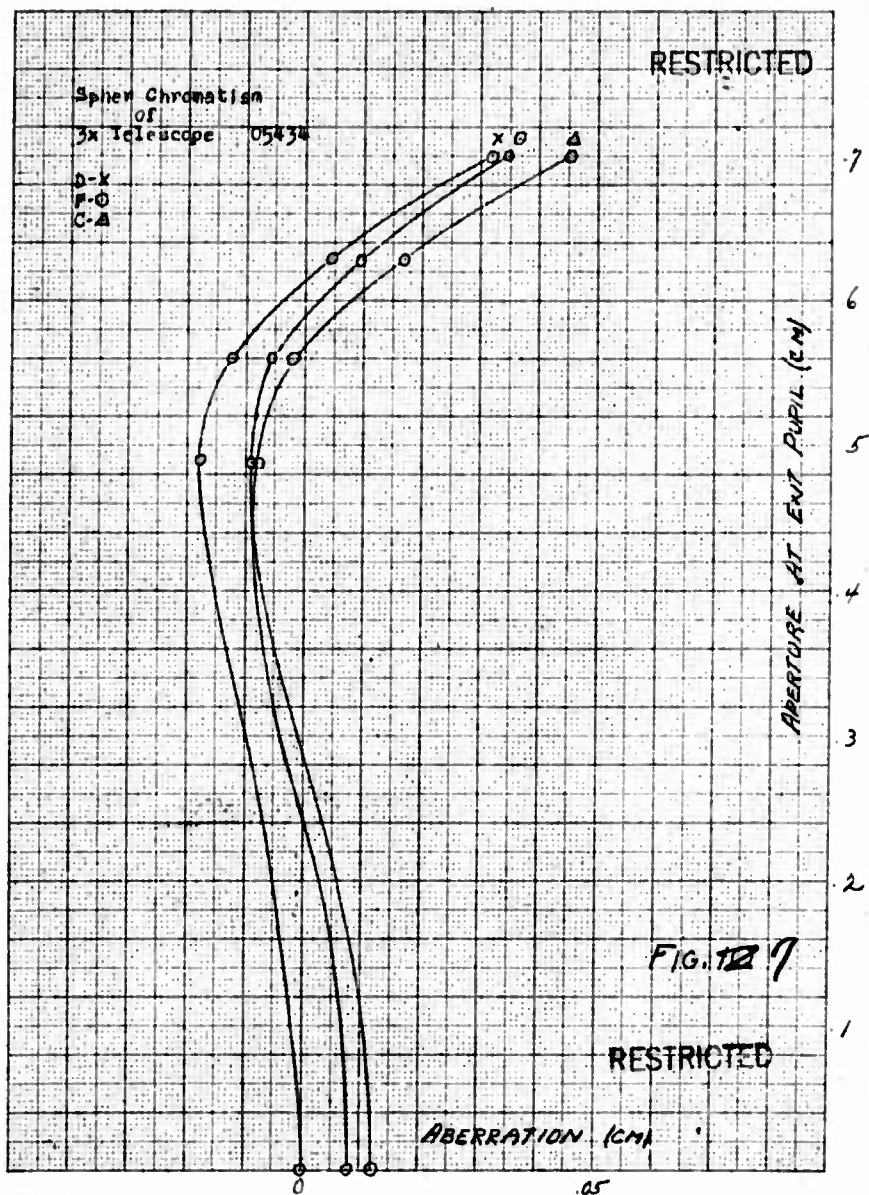


FIG 8

3X TELESCOPE

10-26-44

J.M.

5 ELEMENT OBJECTIVE DRAW NO-05434

RESTRICTED

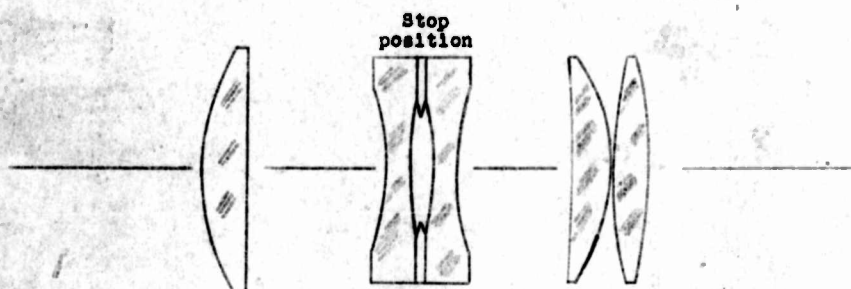
RIGHT	APPARENT FIELD	IMAGE	SAGITTAL IMAGE	TANGENTIAL IMAGE	BEST IMAGE	VIGNETTING %
0	0		X	X	Same as Image	0
2°	6° 20'		X	X	Same as Image	6.5
4°	12° 4'		X	X	Same as Image	19.6
6°	17° 58'		X	X	 +12 D	37.0
8°	23° 50'		X	X	 +12 D	54.4
10°	29° 10'		X	X	Same as Image	76.1
10° 5'	30° 40'		X	X	Same as Image	95.7
LEFT						
2°	5° 45'		X	X	Same as Image	4.4
4°	11° 40'		 -12 D	X	Same as Image	15.3
6°	17° 32'		 -25 D	 +12 D	Same as Image	30.3
8°	23° 3'		 -50 D	 +25 D	 -25 D	50
10°	29° 5'		 -62 D	 +62 D	 -25 D	71.7
11°	31° 16'		 -62 D	 +100 D	 -50 D	91.3

Field Limit R 31°15' L 33°20'

Av 32°18' RESTRICTED

ANASTIGMATIC 3X OBJECTIVE

RESTRICTED



r	t	GLASS	N _D	V	EDGE DIAM	CLEAR APERTURE
25.71	5.00	BSC-2	1.617	55.0	27.0	25.0
	15.25					
- 27.04	2.50	EDF-3	1.720	29.3	24.0	14.0
40.00	2.50					
- 29.64	2.50	EDF-3	1.720	29.3	24.0	14.0
29.64	12.70					
-170.00	4.40	BSC-2	1.517	64.5	24	22.2
- 21.54	.10					
54.08	4.0	BSC-2	1.517	64.5	24	22.2
- 54.08						

ALL DIMENSIONS IN MILLIMETERS

EF1 = 77.65

BF = 77.97

* STOP DIAMETER = 11.66

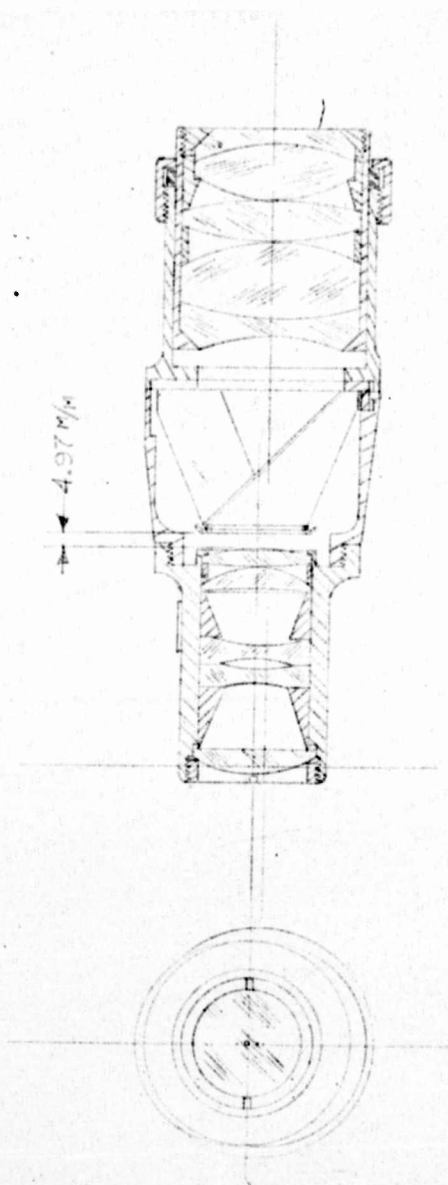
FIG. 9

RESTRICTED

INSTITUTE OF OPTICS	
UNIVERSITY OF ROCHESTER	
ATL.	FIN.
OWN BY <i>Fedar</i>	DATE
DATE <i>2-12-44</i>	FILE <i>11</i>
NO. <i>05250</i>	

RESTRICTED

4.97 M/4



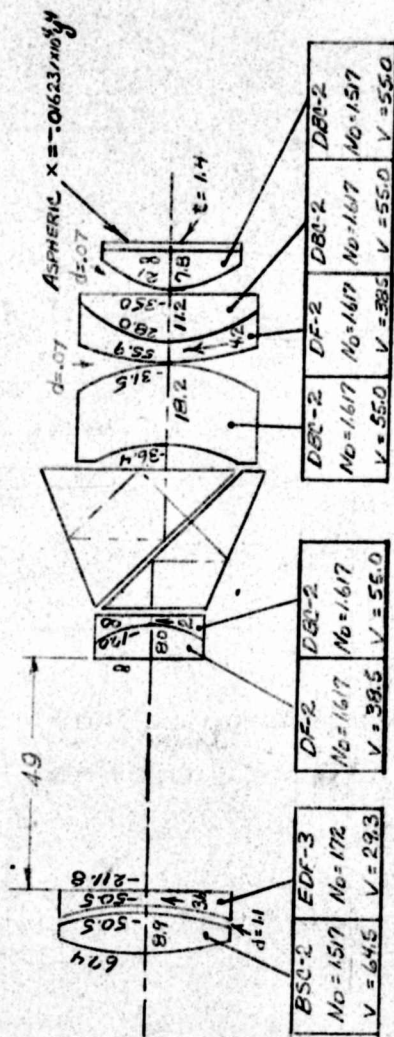
3 x 21 MONOCULAR

FIG. 10

RESTRICTED

RESTRICTED

7x35 WIDE ANGLE TELESCOPE



SCHMIDT PRISM SYSTEM

PRISM LENGTH = 10.7

GLASS - DF-2 No. 16.7

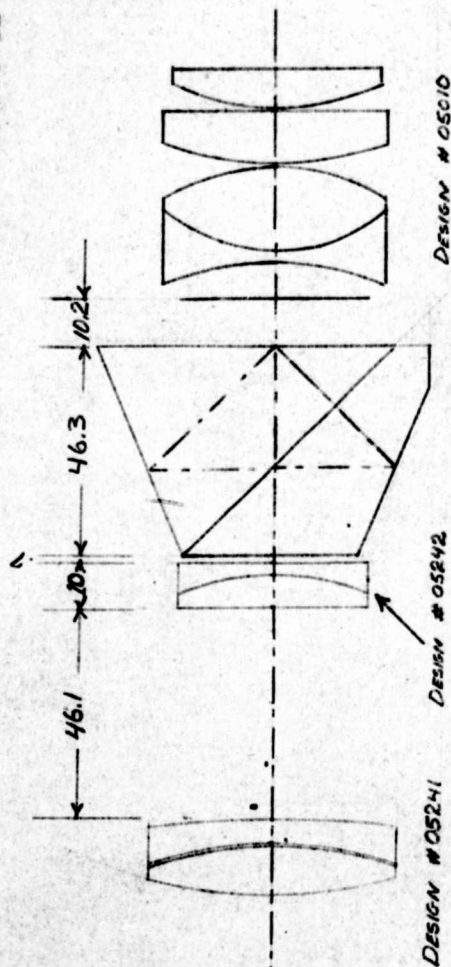
DRAWING NO. 05321 (FIG. 2)

FIG. 1

RESTRICTED

7X50 MONOCULAR TELESCOPE

RESTRICTED



DESIGN #05316

FIELD = 6.2° (half)
EYE DISTANCE 22mm
DIA. OBJECTIVE 50mm

FIG. 12

RESTRICTED

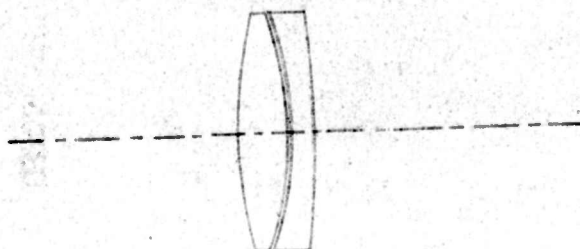
INSTITUTE OF OPTICS			
UNIVERSITY OF ROCHESTER			
MAT'L	Monocular	FIN.	
DW'N BY	REH	CHK	
DATE	11/4/44	SCALE	1:1
DWG			
NO.	05425		

RESTRICTED

7X50 MONOCULAR OBJECTIVE

$f' = 180$

$v' = 170.5$



R_{mm}	t_{mm}	DIA (CLEAR)	DIA (EDGE)	GLASS	ND	V
101.4	11.0	50	55	BSC-2	1.517	64.5
-82.8	.7					
-82.8	5.0	50	55	EDF-3	1.72	29.3
-249.0						

INSTITUTE OF OPTICS
UNIVERSITY OF ROCHESTER

MAT'L	OBJECTIVE	FIN.
DWN BY	J.E.N.	CHK ☒
DATE	1/4/49	SCALE III
DWG NO.	05241	

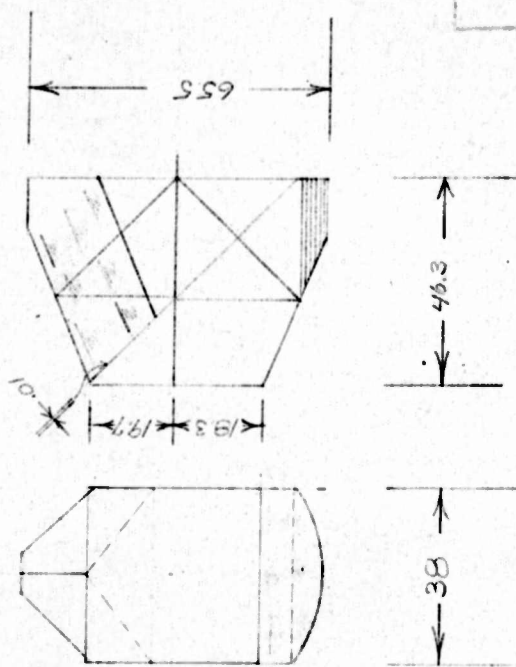
FIG. 13

RESTRICTED

PRISM ASSEMBLY

GLASS NO 1.621 V = 36.2

RESTRICTED



INSTITUTE OF OPTICS			
UNIVERSITY OF ROCHESTER			
MAT'L	PRISM	FIN.	✓
DRAWN BY	REH	CHECK	✓
DATE	10/5/43	SCALE	1/1
DWG'S NO.	05316		

FIG. 14
RESTRICTED

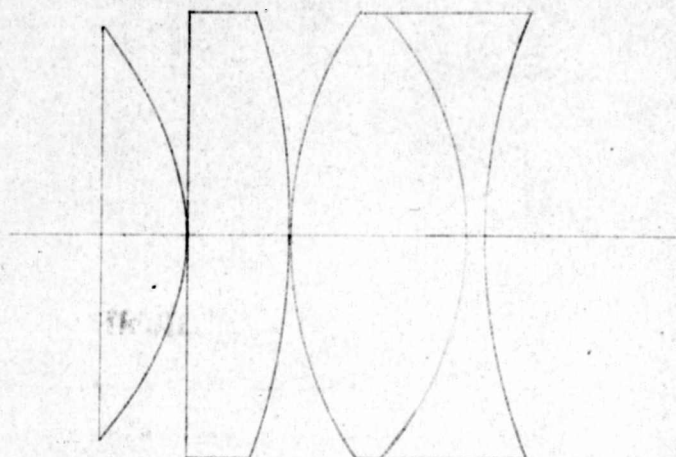
DESIGN H5

$f' = 25.8 \text{ mm.}$

$v' = 7.98$

Eyepoint with 6X = 22.7

RESTRICTED



r (mm)	t (mm)	Glass	Diem. (mm)
∞	9.34	DBC-3	45.5
+27.57*	.1		
∞	11.15	Corning 838	48.8
71.5	.1		
45.45	19.04	Corning 838	48.8
36.32	2.0	DF-3	48.8
64.66			

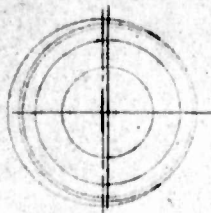
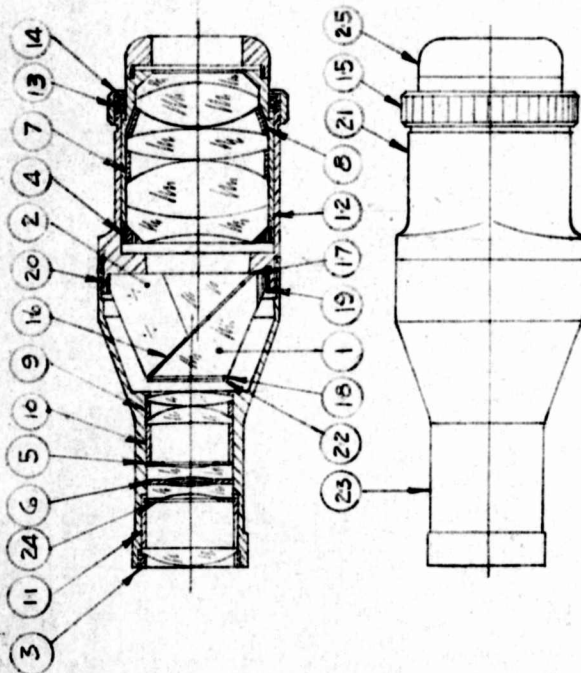
* Radius of a Parabola $y^2 = 55.14x$

FIG. 15

RESTRICTED

INSTITUTE OF OPTICS	
UNIVERSITY OF ROCHESTER	
MAT. <i>Asph Eyepiece</i>	FIN.
OWN BY <i>REN</i>	CHK <i>V</i>
DATE <i>6/7/42</i>	SCALE <i>1/1</i>
DWG NO. <i>05010</i>	

RESTRICTED



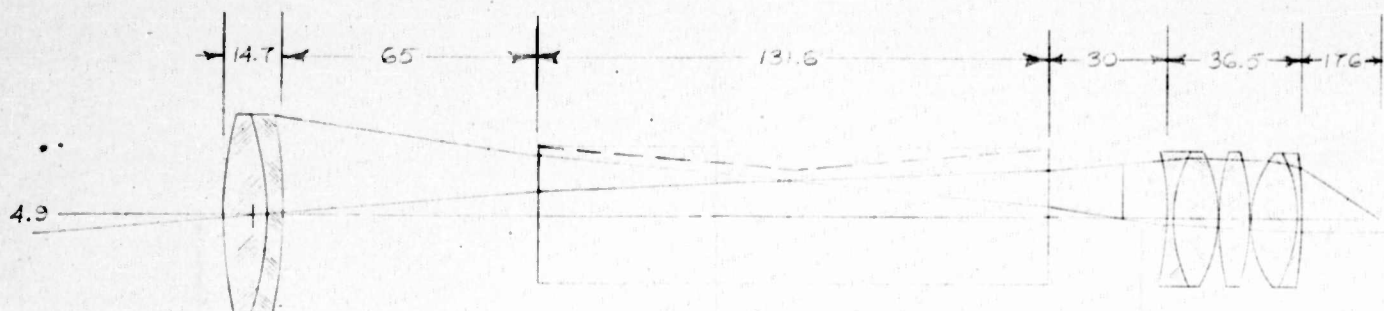
RESTRICTED

INSTITUTE OF OPTICS	
UNIVERSITY OF ROCHESTER	
DATE	FIN
DWG BY A. M. H. T. A.	NO.
DATE 4-18-45	NO.
DWG 5211-A-1	NO.

FIG. 17

7 x 50 Binocular Telescope
Field of View = 9.8
Eye Distance = 17.6 mm.

RESTRICTED



OBJECTIVE

Glass	n_D	R mm	t mm
BSC - 1	1.511	$111.1 \pm .2$	$11.7 \pm .2$
EDF - 1	1.649	$75.0 \pm .2$	$3.0 \pm .2$
		$209.0 \pm .2$	

$f = 172.2$ mm
 $v' = 165.1$ mm
Clear Aperture = 50 mm

Drawing # 05202

PRISM

131.6 mm OF LBC-2
 $n_D = 1.5725$
Prism shift of focal plane = 47.91

Drawing # 05300

EYEPiece

$f' = 24.2$
 $v = 9.66$
Drawing # 05070

RESTRICTED

Drawing # 05417
originally 05200B
0-02-20

Figure 16

RESTRICTED

6 x 42 Binocular Telescope
Field of View = 11.6 degrees
Eye Distance = 19.7 mm



OBJECTIVE

GLASS	n_D	R mm	t mm
C-2	1.5125	84.3	9.8
EDF-1	1.649	67.6	4.2
		25.3	

$f' = 150$ mm
 $v' = 143$ mm
Clear Aperture = 42 mm
Edge diameter = 42 mm
Drawing # 05211

PRISM

131.6 mm of LBG-2
 $n_D = 1.5725$
Prism Shift of Focul Plane = 47.91 mm
Drawing # 05300

EYEPiece

$f' = 24.8$
 $v = 71.30$
Drawing # 05021

Drawing # 05415
Originally 0-11-21

FIGURE 19

RESTRICTED

ADDENDUM

Any dimensions not given in the accompanying figures may be obtained approximately from the scale of the diagram. The thickness of the erector in Figure 2 is 111 mm.

RESTRICTED

6.67° (Real Field) Meridional Rays

3X Telescope

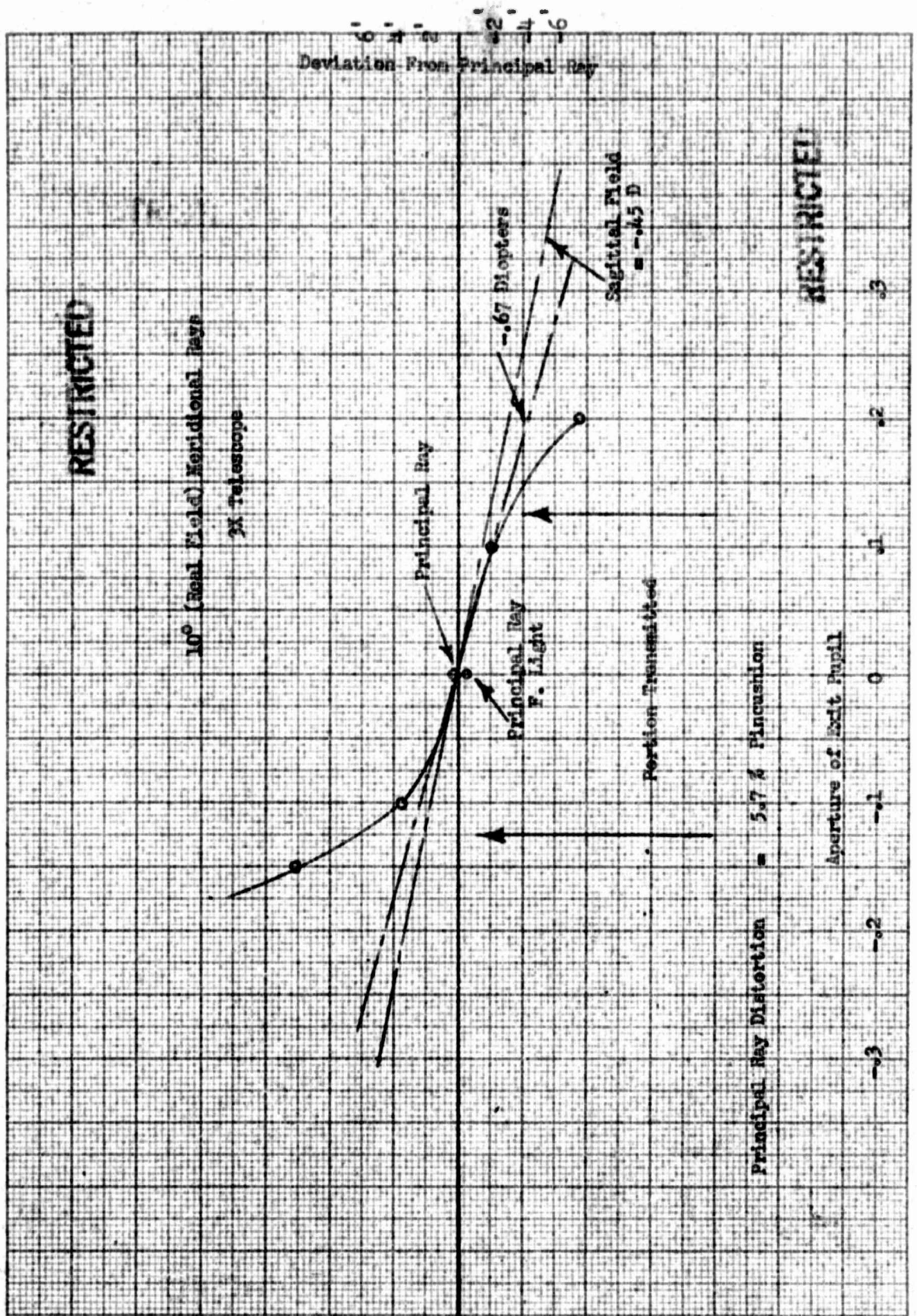
Deviation from Principal Ray

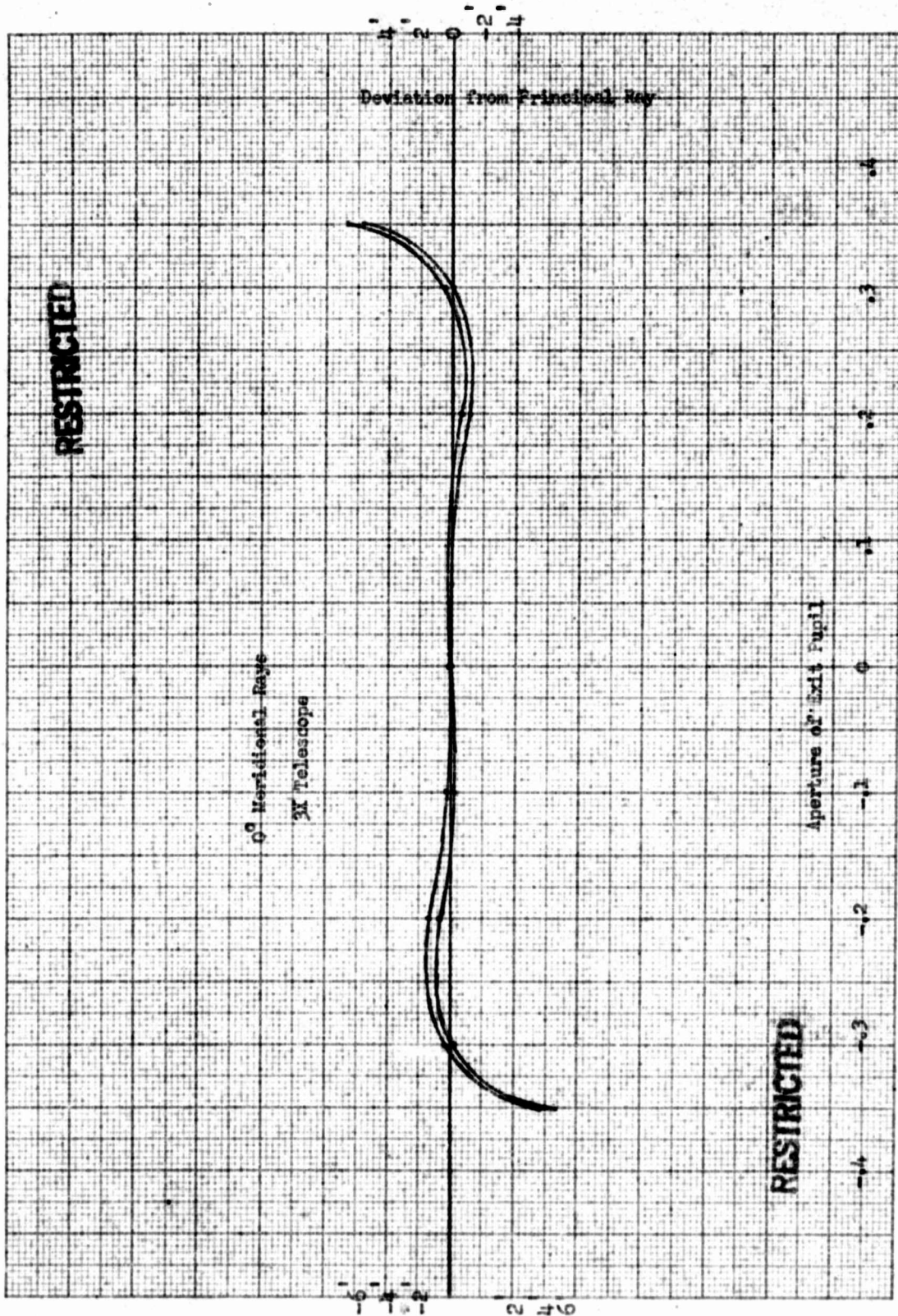


RESTRICTED

Aperture of Exit Pupil

4 -0.3 -0.2 -0.1 0 1 2 3 4

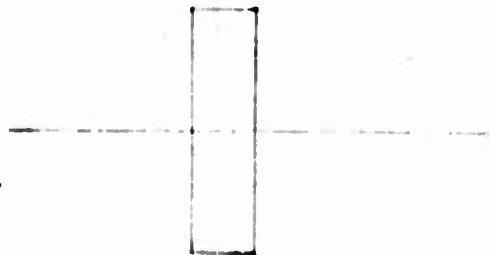




RESTRICTED

RESTRICTED

EXAMINATION PLATE
7X50 MONOCULAR 05425



KNOWN	TIME	DATA	LENGTH	DEPTH	NO.	
(x)	7.	40	41.28	DF-2	1.617	36.6
-55	3.	-10	41.28	DF-2	1.617	550
2						

INSTITUTE OF OPTIC	
UNIVERSITY OF ROCHESTER	
MADE OFFENSIVE	FILE
OWNED BY T.F.H.	FILE NO.
DATE 1/7/44	EXPIRY DATE
DWG NO.	05242

RESTRICTED

REEL - C

690

A.T.I.

9909

FORM 60 A (19 FEB 47)

Rochester. Univ.

DIVISION: Ordnance and Armament (22)

SECTION: -Fire Control (4)

CROSS REFERENCES: Telescopes (92697)

RESTRICTED

ATI- 9909

ORIG. AGENCY NUMBER

O.S.R.D. - 6033

REVISION

AUTHOR(S)

AMER. TITLE: Wide field telescopes

FORG'N. TITLE:

P2016 & Telescopes

ORIGINATING AGENCY: O.S.R.D., N.D.R.C., Sect. 16, Washington, D. C.

TRANSLATION:

265 650

COUNTRY	LANGUAGE	FORG'N. CLASS.	U. S. CLASS.	DATE	PAGES	ILLUS.	FEATURES
U.S.	Eng.		Restr.	Oct '45	37	25	photos, tables, graphs, drwgs

ABSTRACT

Description is given of several designs of wide field binoculars with large exit pupils to aid in night vision. Devices include some which employ a modification of the Schmidt straight-in-line erecting system, rather than the usual Perro prisms. Design and performance of the Schmidt erecting telescope is described in detail. As a result of investigations, very satisfactory telescopes of magnification 3X, 6X, and 7X with unusually wide fields have been developed.

AD-B804 858

NICAL INDEX

WRIGHT FIELD, OHIO, USAAF

WFO-21 MAR 47 2250

RESTRICTED

UNCLASSIFIED per Authority of OSRD List #39, dated
20 January-21 February 1947