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EDGERTON, GERMESHAUSEN & GRIER, INC.

DOMINIC - SUNSET

FIREBALL YIELD PHOTOGRAPHY
AND CALCULATIONS

Preliminary Report

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REPORT NO. B-2399

5 OCTOBER 1962

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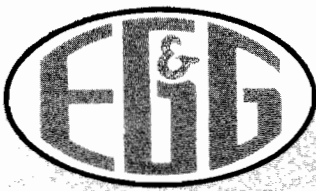
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Report No. B-2399
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DOMINIC - SUNSET
FIREBALL YIELD PHOTOGRAPHY
AND CALCULATIONS

Preliminary Report

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EDGERTON, GERMESHAUSEN & GRIER, INC.
Boston, Massachusetts • Las Vegas, Nevada
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ABSTRACT

This report contains a summary of EG&G fireball photography and a preliminary analysis of the results for Shot Sunset of Operation Dominic.

Sunset, a LASL-sponsored device, was detonated on 10 July 1962 at GZ-17, southwest of Christmas Island. Measured time of free fall from the B-52 delivery aircraft was 55.1905 seconds. The device was detonated at an altitude of 5000 ft + 25 ft above MSL. The local Christmas Island time of detonation was 0733:01.2372.

ϕ^5 scaling indicates a fireball yield of 810 kt + 30 kt, while Mach scaling shows a yield of 800 kt + 40 kt. Bhangmeters indicate a yield of 884 kt + 133 kt, based on an average time-to-minimum of 81.7 msec.

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1.0 BHANGMETER OPERATION AND DATA

Nine Bhangmeters were employed on Shot Sunset, three at the EG&G Timing Trailer at A Site, two each on the two C-130 aircraft, and two on the B-52 delivery aircraft. Table 1 summarizes Bhangmeter operation and the data obtained.

Table 1. Bhangmeter data.

Location	Type	Reading	
		No. of Pips	Time (msec)
A Site Trailer	RO-1 No. 1	10.5	84
A Site Trailer	RO-1 No. 2	20	80
A Site Trailer	RO-1 No. 3	Off scale at 40 msec - set on fast sweep	
Aircraft 298 (C-130)	MK-V, S/N 1	20.25	81
Aircraft 298 (C-130)	MK-V, S/N 2	20.5	82
Aircraft 299 (C-130)	MK-V, S/N 4	Off scale at 40 msec - set on fast sweep	
Aircraft 299 (C-130)	MK-VI, S/N 3	20.25	81
B-52 Aircraft	ASH 4	20.5	82
B-52 Aircraft	MK-VI	20.5	82

The average t_{\min} , 81.7 msec, corresponds to a yield of 844 kt \pm 133 kt at an ambient air density of 1.0162 grams/liter for an altitude of 5000 feet.

2.0 CAMERA INSTRUMENTATION AND OPERATION

Photographic coverage of fireball growth was provided by land-based camera installations at Sites A, MM, and D on Christmas Island and by airborne installations on two C-130 aircraft. The B-52 drop aircraft was also instrumented to record fireball formation. The exact instrumentation of these stations is detailed in Appendix A, and an evaluation of the operation of each camera is given on the Film

Comment Sheet, Table 2. Complete survey data for the actual GZ-17 for Sunset are given in Appendix B.

2.1 Position of Burst

Six theodolite cameras were operated, two at each of the ground stations. All six obtained good records and a phototriangulation of the position of burst was performed on the basis of these records. A diagram showing the angular off-axis position of the burst from the A, MM, and D Site stations is presented in Fig. 1. The calculated position of burst was:

N 171600 } referenced to H&N Universal Transverse Mercator Grid
E 695185 }
Height: 5000 ft + 25 ft above MSL

The resultant slant ranges from the camera stations at A and MM Sites are 92,365 feet and 88,717 feet, respectively, compared with the Sandia Corporation radar slant-range measurements of 92,550 feet and 88,980 feet from the A and MM Site radar positions.

2.2 Fireball Photography

Fireball growth was recorded and measured from all ground stations and from the two C-130 aircraft. All cameras operated as scheduled, though Photo-Sonic 4B-8 in the drop aircraft did not record the fireball, and the records from the D Site cameras showed some cloud cover. Fireball phenomena were, however, measurable from the D Site films.

At zero time, the radar mount at A Site was aimed slightly high and 1 degree to the right of the fireball. The fireball image on the films from the cameras on the MM Site radar mount was horizontally centered but was slightly high in the frame.

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On the records from the fixed aiming cameras at D Site, the image was 1 degree to the left of the frame center and vertically centered. The image on the Aircraft 298 records appeared 3 degrees to the right and 2 degrees below the frame center. Aircraft 299 recorded the fireball 3 degrees below and 2 degrees to the right of the frame center.

Results from the six cameras which used experimental XR film are not yet known. Because of its special processing requirements, the film will have to be processed at a later date. The records concerned are those from Mitchell No. 43 and Rapatronic 106 at D Site, Fastax WF8 No. 2 from Aircraft 298, Fastax WF8 No. 3 from Aircraft 299, Rapatronic No. 116 from A Site, and Rapatronic No. 108 from MM Site.

AFSWC furnished slant ranges between the aircraft and the device of 52,700 ft \pm 800 ft for the B-52 delivery aircraft, 87,910 ft \pm 130 ft for Aircraft 299, and 89,290 ft \pm 350 ft for Aircraft 298.

The Dynafax cameras at A and MM Sites obtained good fireball records. These will be read and included in the final report on Sunset.

The zero-frame time corrections for Sunset were made utilizing eight Rapatronic records, three from A Site, three from D Site, and two from MM Site. Figure 12 is a plot of the Rapatronic results. The diameter measurements for these records are contained in Appendix C.

3.0 YIELD DETERMINATION

The yield measured by the ϕ^5 scaling technique is 810 kt \pm 30 kt. This yield figure is based on the extensive analysis of six high-speed records from the three ground stations.

The Mach-scaling technique, whereby diameter-time behavior is scaled to a theoretical 1-kt diameter-time curve, indicates a yield of 800 kt \pm 40 kt. The Mach-scaling yield is also based on six of the high-speed records from the ground stations.

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The PS4B records from Aircraft 298 and 299 were analyzed for yield, utilizing the DME (Distance Measuring Equipment) data provided by AFSWC. Evaluation of these records, excluding all ground-station photography, indicates a ϕ^5 fireball yield of 845 kt \pm 30 kt for Aircraft 299 and 885 kt \pm 20 kt for Aircraft 298, representing variations of +4.3% and +9.3% respectively from the yield determined from the ground-station records. The aircraft yield figures are quoted here only for comparison; they were not incorporated into the calculation of the ground-station ϕ^5 yield reported above, which is considered to be the best figure.

A summary of the ϕ^5 yield calculations for each film read is presented in Table 3. Detailed ϕ^5 yield calculations for each film are given on the IBM printout sheets in Appendix D. The time interval of the ϕ^5 scaling represents the time over which all values were averaged to determine the yield reported for each film. The time limits indicated in Table 3 correspond to the selected constant- ϕ region, where the ϕ^5 technique is valid. This region is noted on each data printout sheet by marks outside the yield column.

Plots of diameter vs time for the data from each station and phi vs time from each ground station are shown in Figs. 2 through 9. Composite plots for the complete sets of data from the three ground stations are given in Figs. 10 and 11. Diameter measurements and camera data calculation sheets for each film are included in Appendix C.

The Mach-scaling method was applied to the diameter-time data from each film individually, as well as to the data from the six ground-station records combined (Appendix E). In this method of yield determination, a polynomial fit is made on all the data, and the resultant diameter-time curve, which represents the characteristic diameter-time behavior for this shot, is scaled to a theoretical 1-kt curve. It should be noted that the limits (DW(KT)) stated on the composite

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yield tabulation apply only to the particular fit which was made to the combined diameter-time data and do not represent the scatter which appears in the results from individual films. The limits quoted above, however, do include this scatter. The coefficients of the polynomial to which the diameter-time data were fitted by least squares are given below each tabulation, along with ambient pressure (mb), temperature ($^{\circ}$ K), ambient sound velocity (m/msec), and the time interval over which the fit was made.

An air density of 1.0162 grams/liter was calculated for an altitude of 5000 feet above MSL, based on an H+15 minute observation by JTF-8 Weather Central, which reported a pressure of 849 mb, a temperature of 16° C, and a relative humidity of 80% at that altitude.

Examples of fireball photography and the photo-theodolite records are included in Appendix F. Prints of the fireball at various times are shown from each of the photographic stations.

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Table 2. Film comment sheet - Sunset

<u>Camera</u>	<u>Film No.</u>	<u>Speed (frames/sec)</u>	<u>Comments</u>
		<u>A SITE</u>	
DFX-12	112030	26,000 (nom.)	Good record.
PS4B-1	112000	2550	Fireball at zero time slightly to the left and below frame center. Good record.
PS4B-2	112001	1800	Fireball at zero time slightly to the left and below frame center. Good record.
PS10B-1	112006	500	Fireball well centered. Good record.
M-46	112009	98	Fireball below frame center but horizontally centered. Some cloud cover. Good record.
Wild 233	112012	-	Good record.
Wild 164	112013	-	Good record.
Rap 109	112018	60.2 μ sec	Possible double exposure, questionable record.
Rap 116	112023	105.4 μ sec	XR film, to be processed later.
Rap 120	112026	235 μ sec	Good record.
Rap 118	112027	529 μ sec	Good record.
		<u>MM SITE</u>	
DFX-13	112031	26,000 (nom.)	Good record.
PS4B-3	112004	3000	Fireball slightly below and to the right of frame center. Good record.
PS4B-4	112005	2100	Fireball well centered. Good record.
PS10B-3	112008	475	Fireball well centered. Good record.
M-47	112010	96	Fireball slightly low, horizontally centered. Good record.
Wild 147	112016	-	Good record.
Wild 148	112017	-	Good record.

Table 2. Film comment sheet - Sunset (Con't)

<u>Camera</u>	<u>Film No.</u>	<u>Speed (frames/sec)</u>	<u>Comments</u>
Rap 103	112021	56.0 μ sec	Fireball image, possible double exposure.
Rap 101	112022	107.0 μ sec	Good record.
Rap 108	112025	248.8 μ sec	XR film, to be processed later.
Rap 114	112029	526.4 μ sec	No fireball.
<u>D SITE</u>			
PS4B-5	112003	3200	Fireball to the left and slightly above frame center. Good record.
PS4B-6	112002	2100	Fireball to the left and slightly below frame center. Light cloud cover in front of fireball. Good record.
PS10B-2	112007	500	Fireball well centered. Light cloud cover in front of fireball. Good record.
M-43	112011	100 (nom.)	XR film, to be processed later.
Gal 8903	112015	-	Good record.
Gal 8904	112014	-	Good record.
Rap 111	112019	54.4 μ sec	Good record.
Rap 117	112020	96.8 μ sec	Fireball image, possible double exposure.
Rap 107	112028	258.2 μ sec	Good record.
Rap 106	112024	492.2 μ sec	XR film, to be processed later.
<u>Station 298 (C-130 Aircraft)</u>			
PS4B-9	114754	2700	Fireball to the right and well below frame center. Good record.
WF8-2	114755	2000 (nom.)	XR film, to be processed later.
M-42	114756	110	Fireball to the right of frame center, vertically centered. Good record.

Table 2. Film comment sheet - Sunset (Con't)

<u>Camera</u>	<u>Film No.</u>	<u>Speed (frames/sec)</u>	<u>Comments</u>
<u>Station 299 (C-130 Aircraft)</u>			
PS4B-10	114750	2950	Fireball to the right and well below frame center. Two-thirds of fireball visible at minimum time. Good record.
WF8-3	114751	2000 (nom.)	XR film, to be processed later.
FD401-2	114752	1225	Fireball to the right and well below frame center. One-third of fireball visible at minimum time.
M-44	114753	100	Fireball to the right and below frame center. Good record.
<u>B-52 Aircraft</u>			
PS4B-8	114757	2650	Exposures but no fireball.
FD401-3	114758	1000	Fireball to the right and well above frame center. Only one half of fireball in frame at minimum time.

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Table 3. Summary of ϕ^5 yield calculations - Sunset

Camera	Film No.	Time interval of scaling (msec)		No. of data points used	Average yield (kt)	Limits (kt)	
		t_{\min}	t_{\max}			Lower	Upper
A SITE							
PS4B-1	112000	36.20	72.39	32	821.69	-11.36	+13.27
PS4B-2	112001	37.55	72.89	34	817.41	-13.98	+ 6.98
MM SITE							
PS4B-4	112005	36.25	77.11	45	789.29	-14.10	+15.36
PS4B-3	112004	34.57	68.12	35	808.75	- 8.98	+18.64
D SITE							
PS4B-5	112003	53.55	75.43	36	820.80	- 7.76	+8.74
PS4B-6	112002	36.86	74.64	28	807.69	-13.44	+12.23
Aircraft 298 (C-130)							
PS4B-9	114754	54.18	81.75	20	886.84	-17.48	+14.37
Aircraft 299 (C-130)							
PS4B-10	114750	54.54	77.63	18	845.04	-19.95	+15.00

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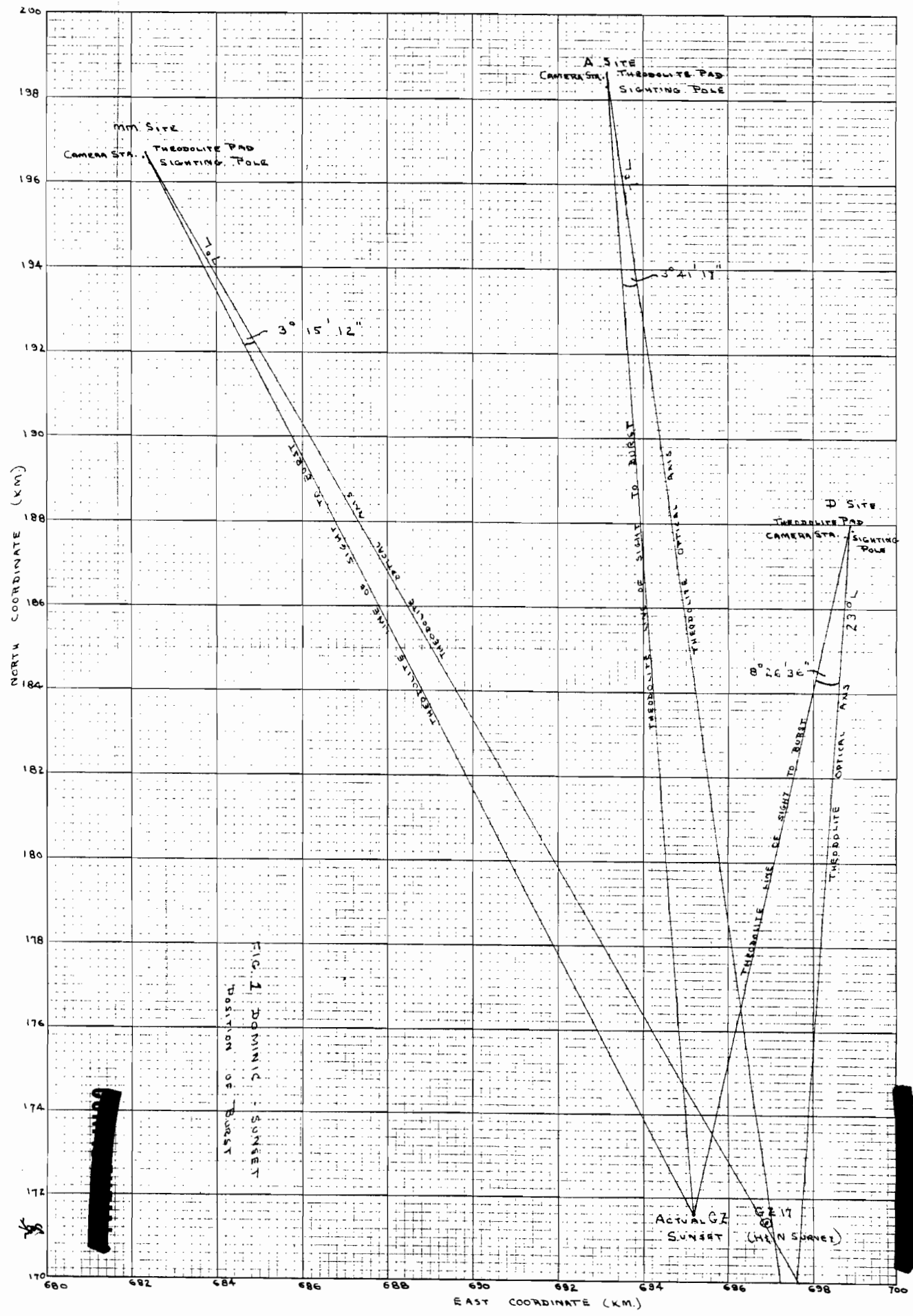
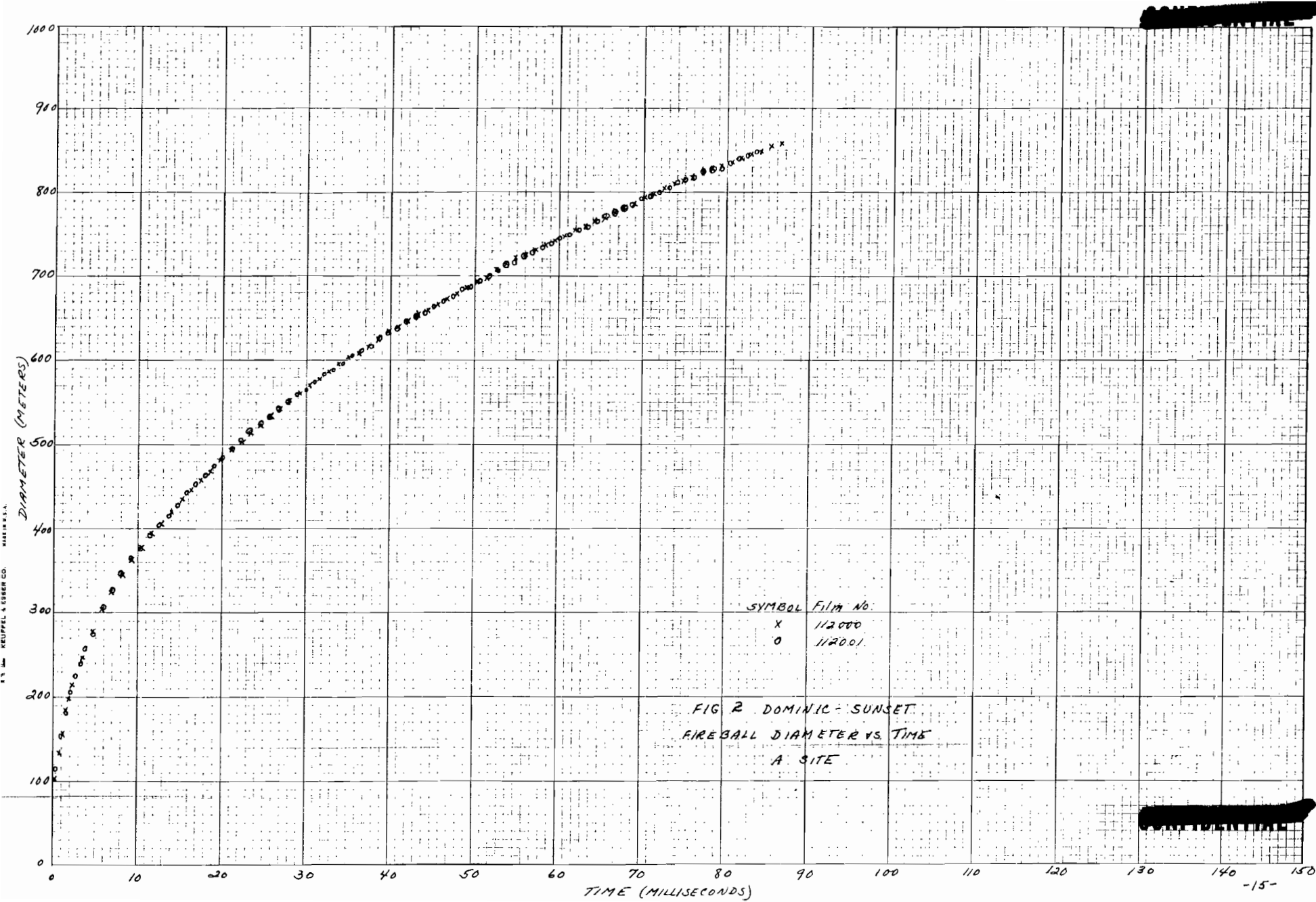
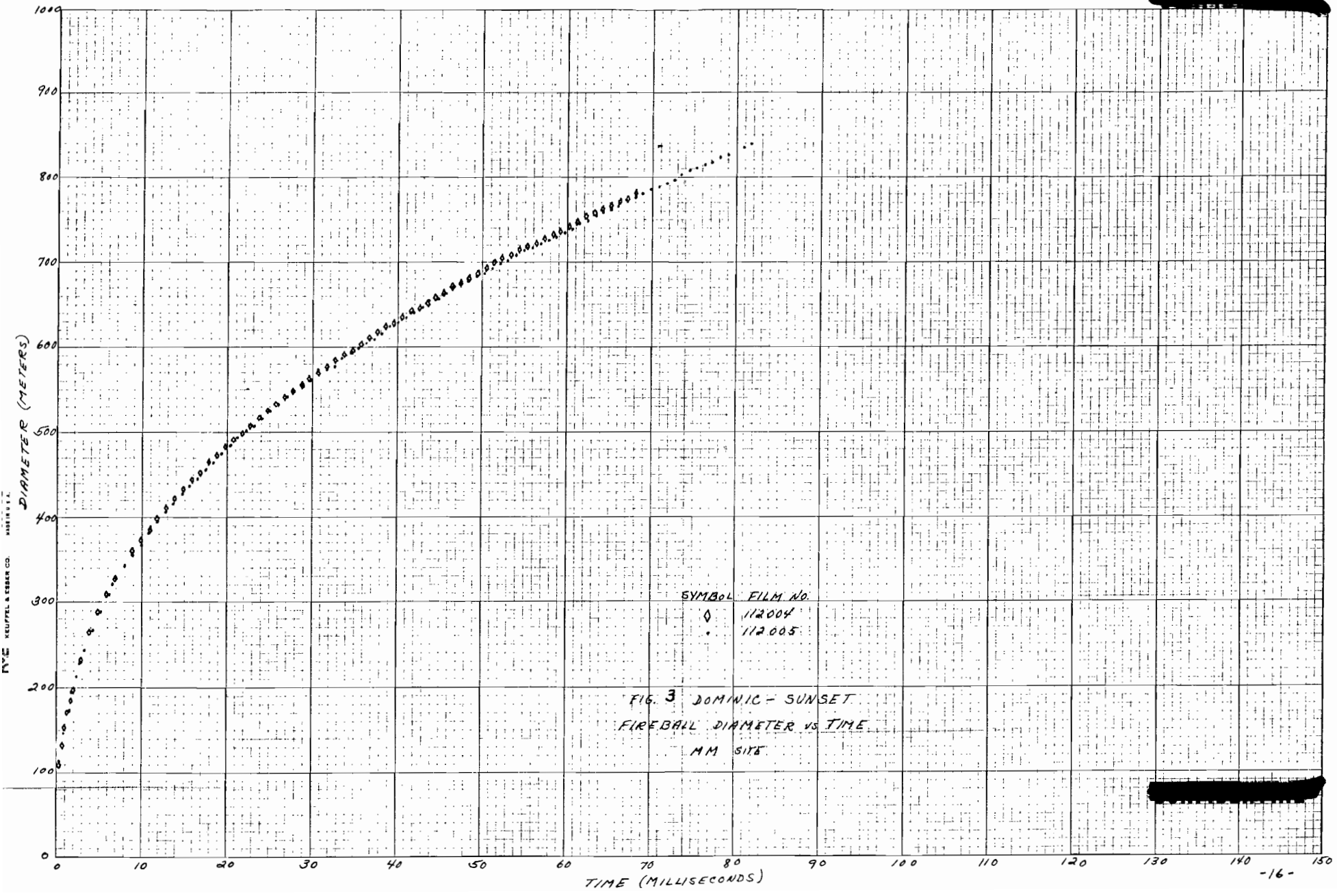


FIG. 1 DOMINIC: SUNSET
POSITION OF BURST

EAST COORDINATE (K.M.)

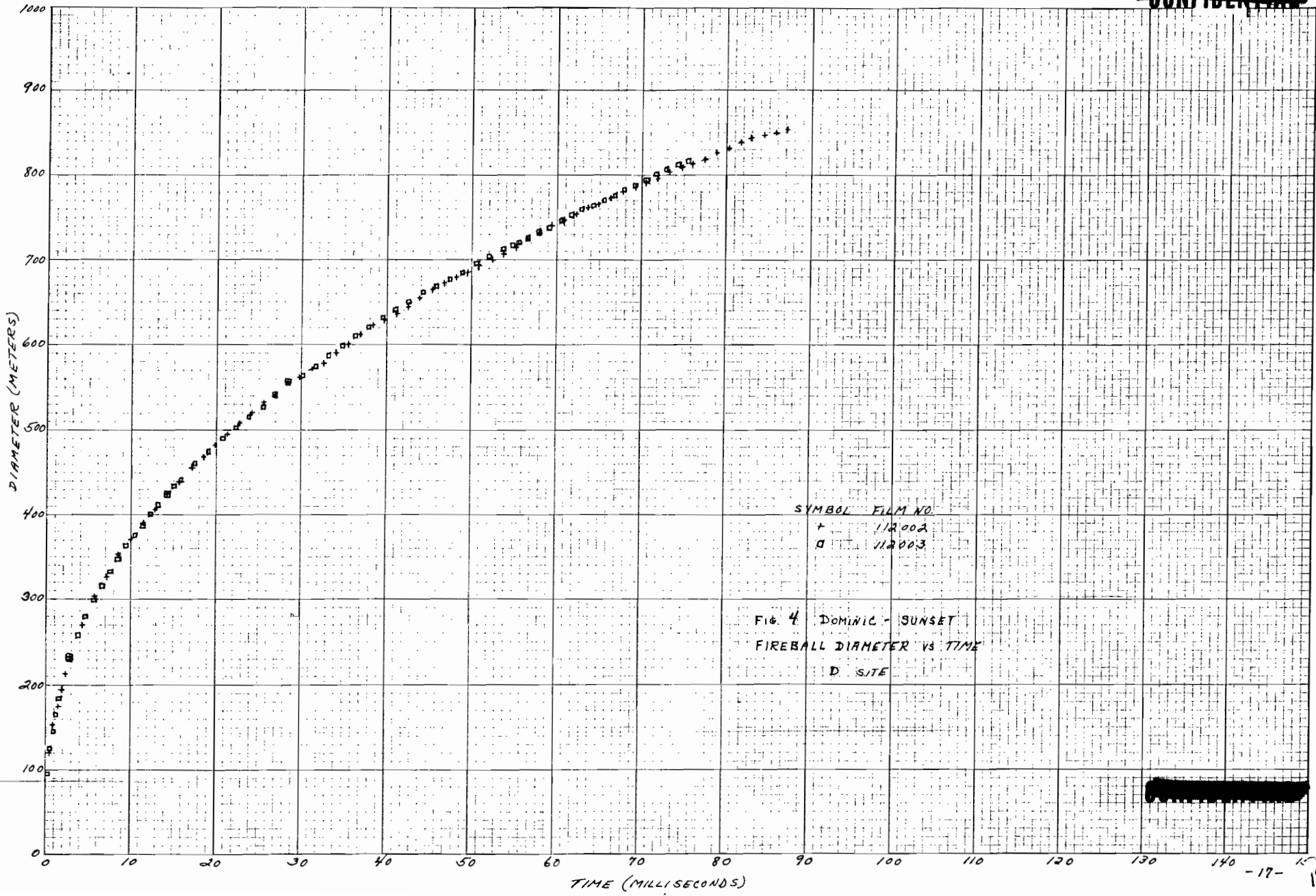


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K&E 10 X 10 TO THE INCH 359-BL
KEUFFEL & ESSER CO. MADE IN U.S.A.



SYMBOL FILM NO.
+ 112002
□ 112003

Fig. 4 DOMINIC - SUNSET
FIREBALL DIAMETER VS TIME
D. SITE

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K₂E 10 X 10 TO THE INCH
359-5L
Kruppel & Fisher Co.

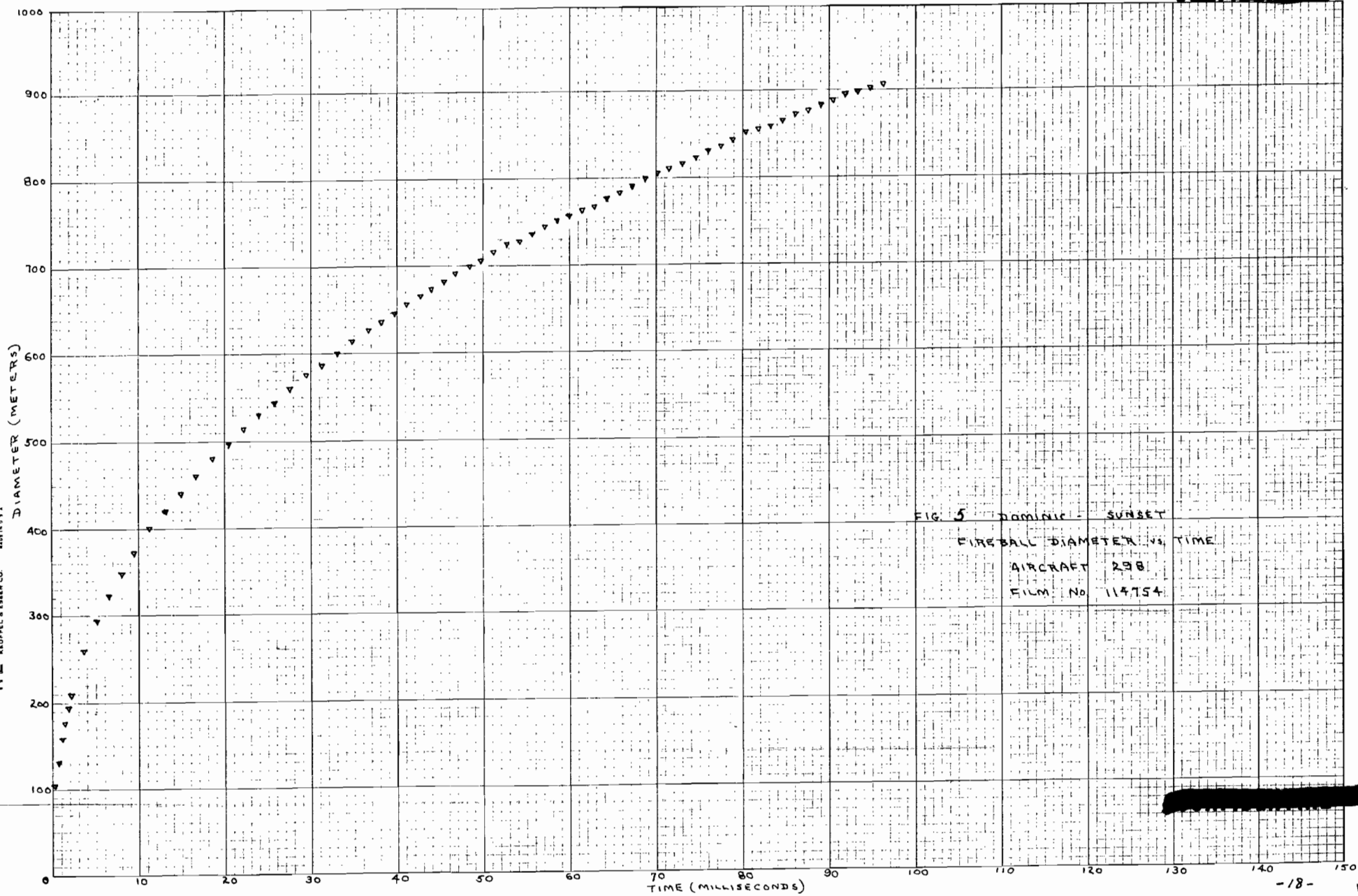
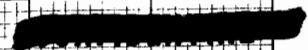


FIG. 5 DOMINIC - SUNSET
FIREBALL DIAMETER vs. TIME
AIRCRAFT 2981
FILM No 114754



10 X 10 TO THE INCH
KUPFFEL & ESSER CO.
MADE IN U.S.A.

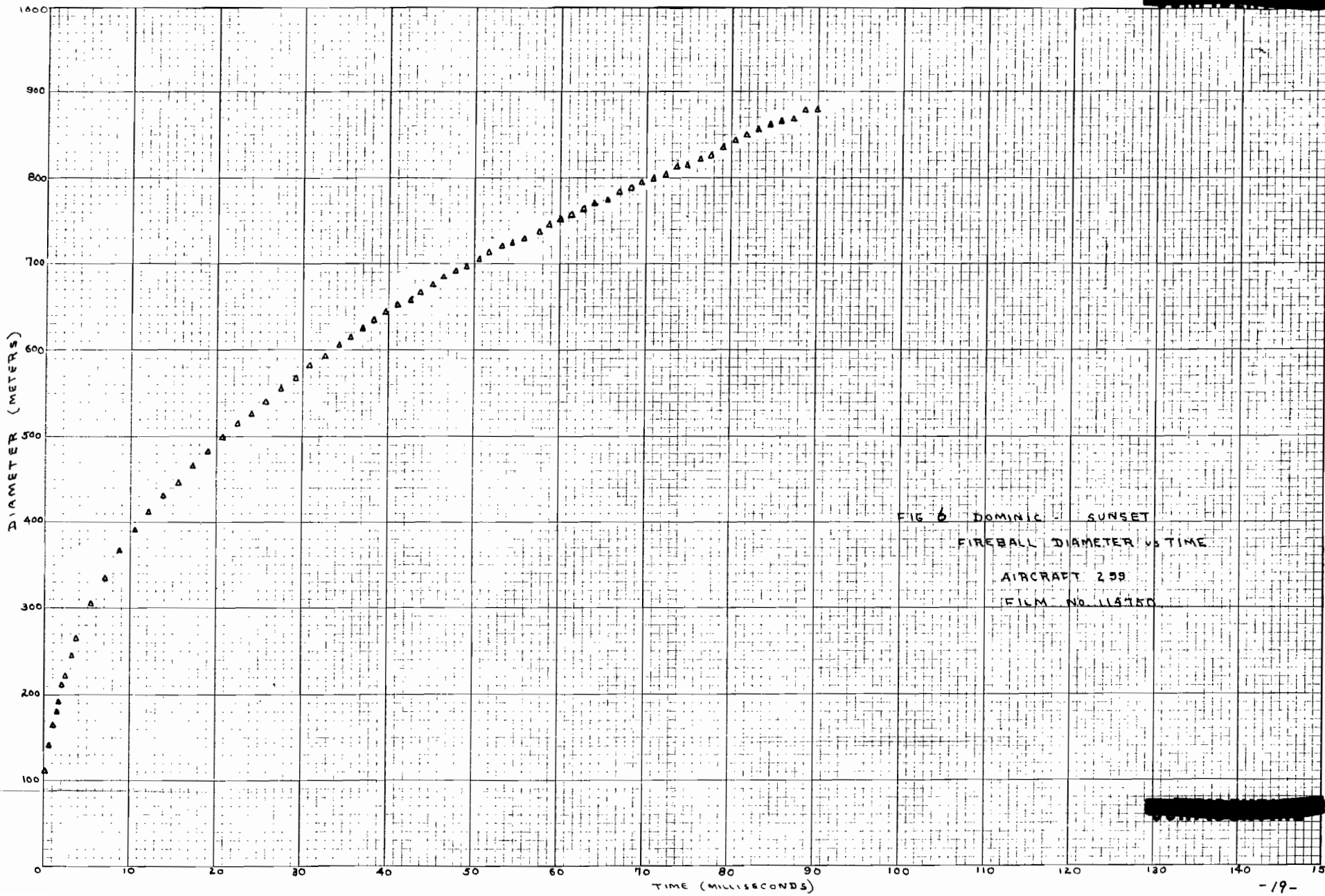
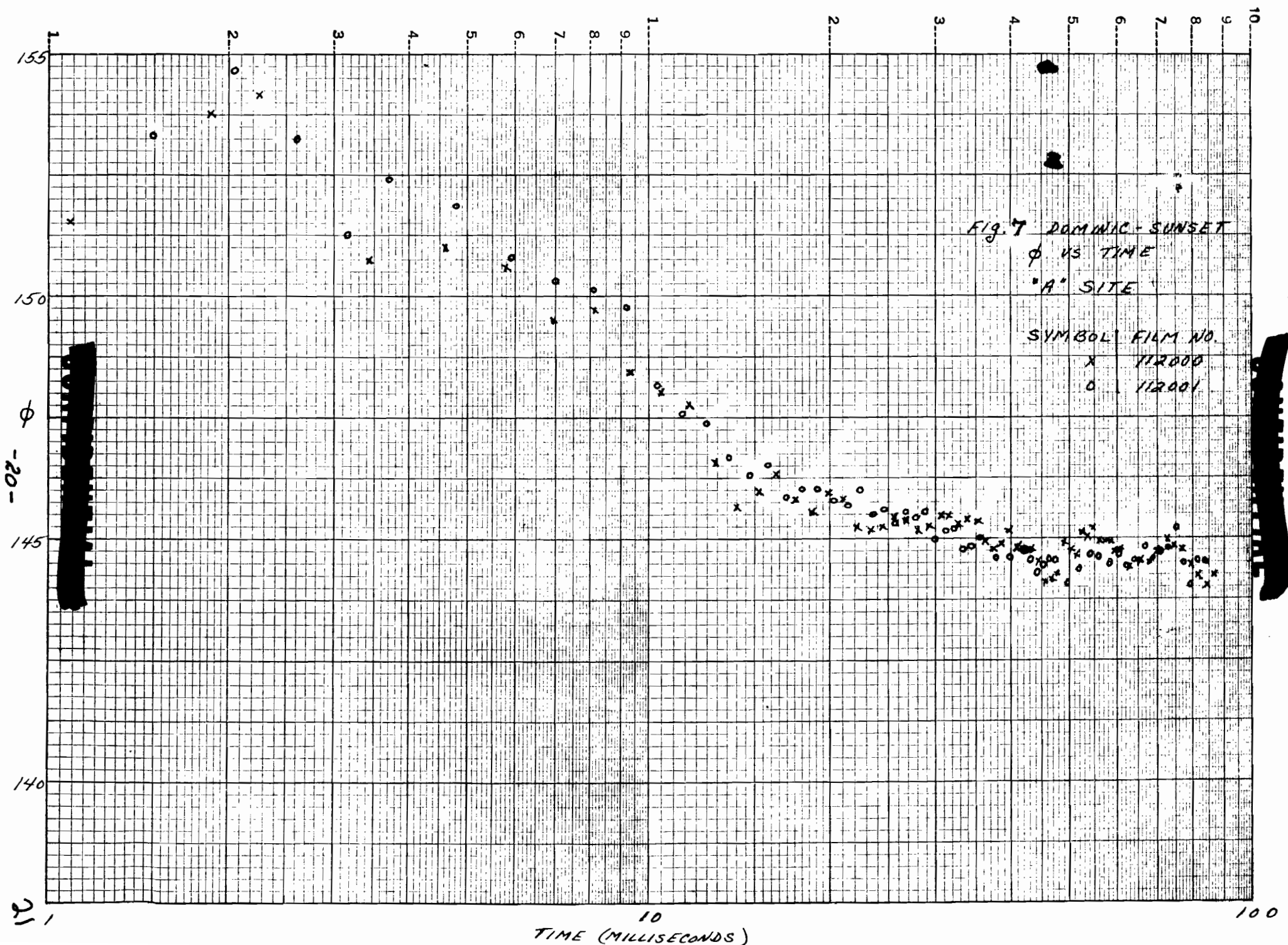


FIG 6 DOMINIC SUNSET
FIREBALL DIAMETER VS TIME
AIRCRAFT 299
FILM NO. 114750



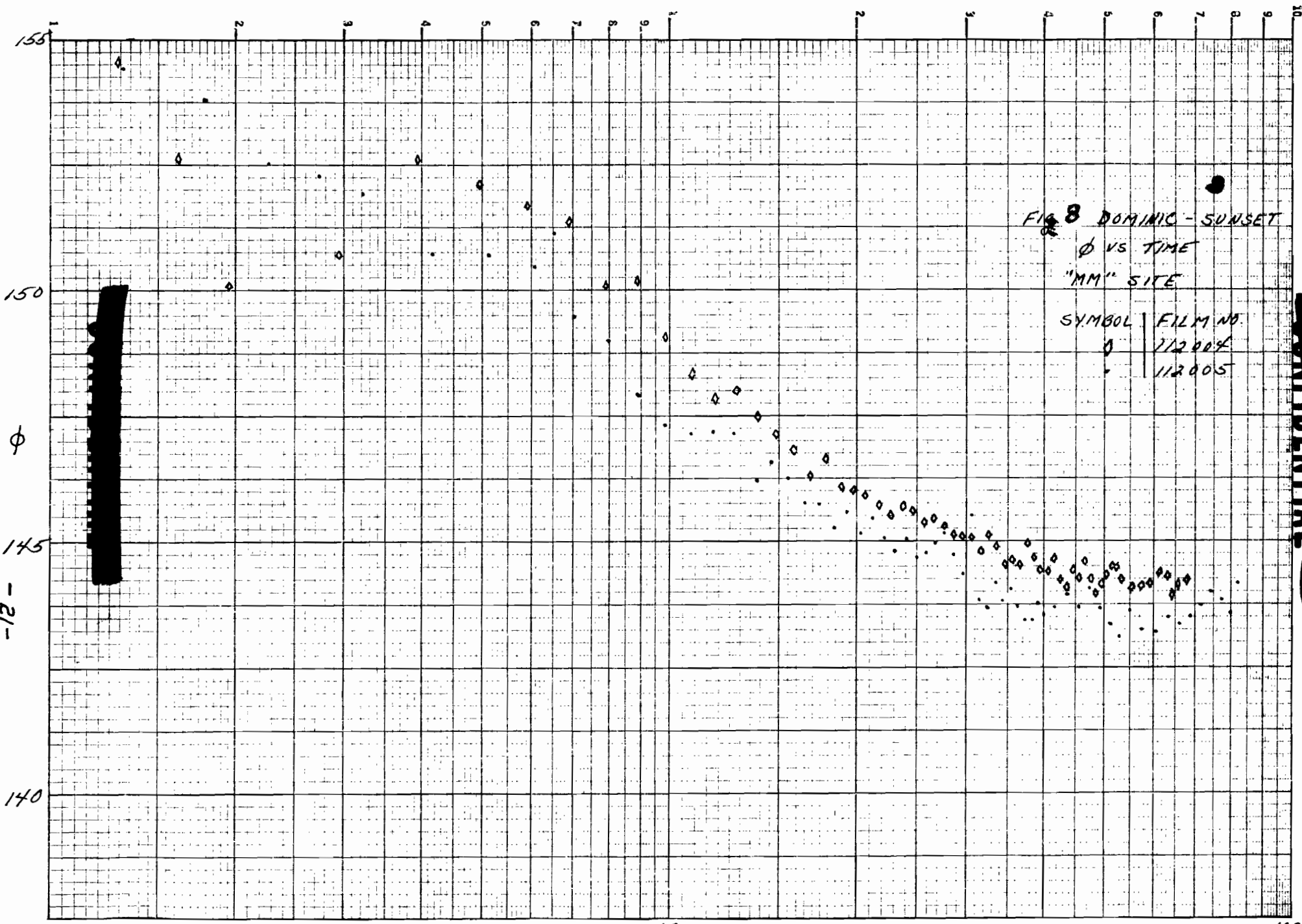


FIG 8 DOMINIC - SUNSET
 ϕ VS TIME
"MM" SITE

SYMBOL	FILM NO.
○	112004
●	112005

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12-

10
TIME (MILLISECONDS)

100

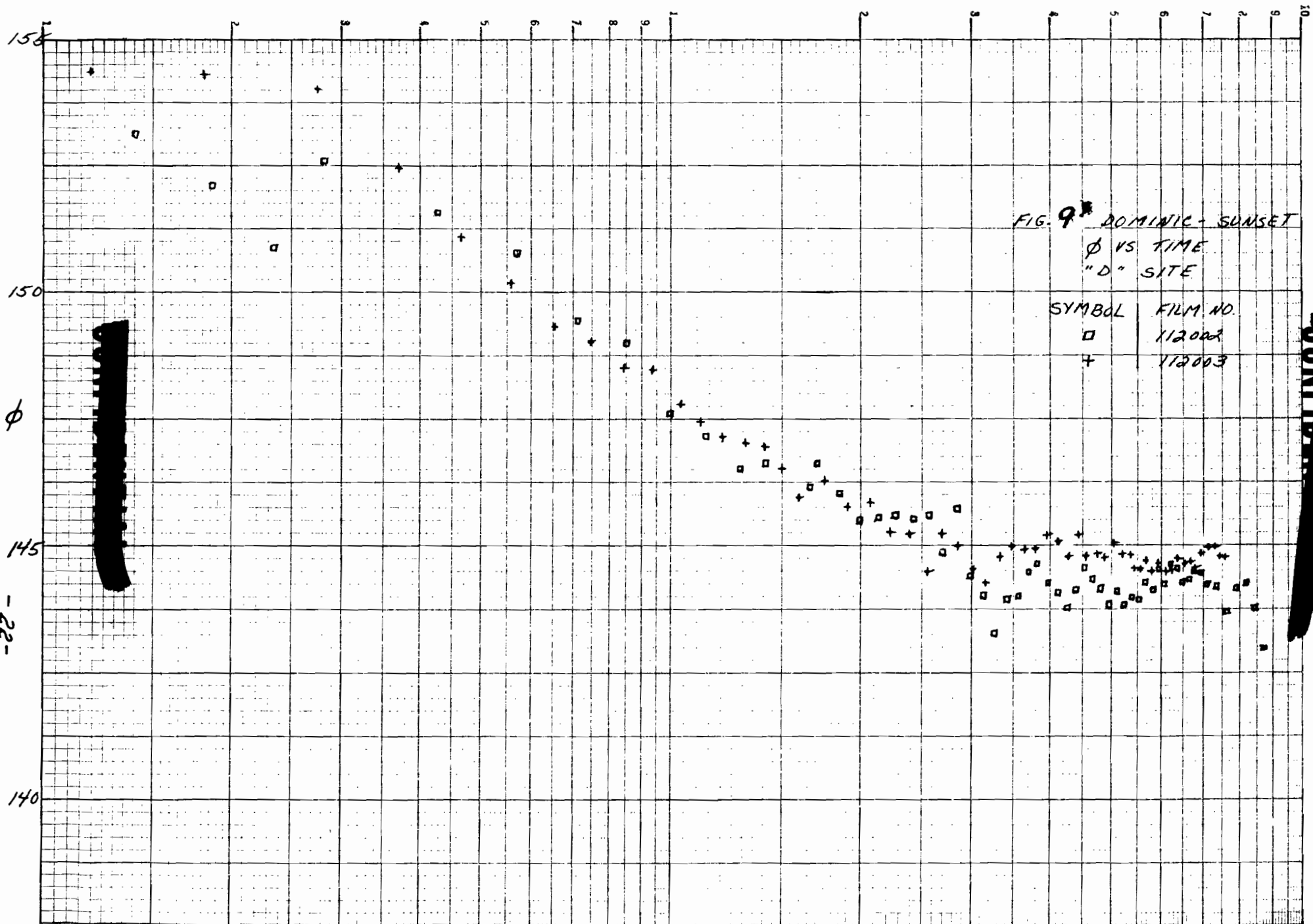
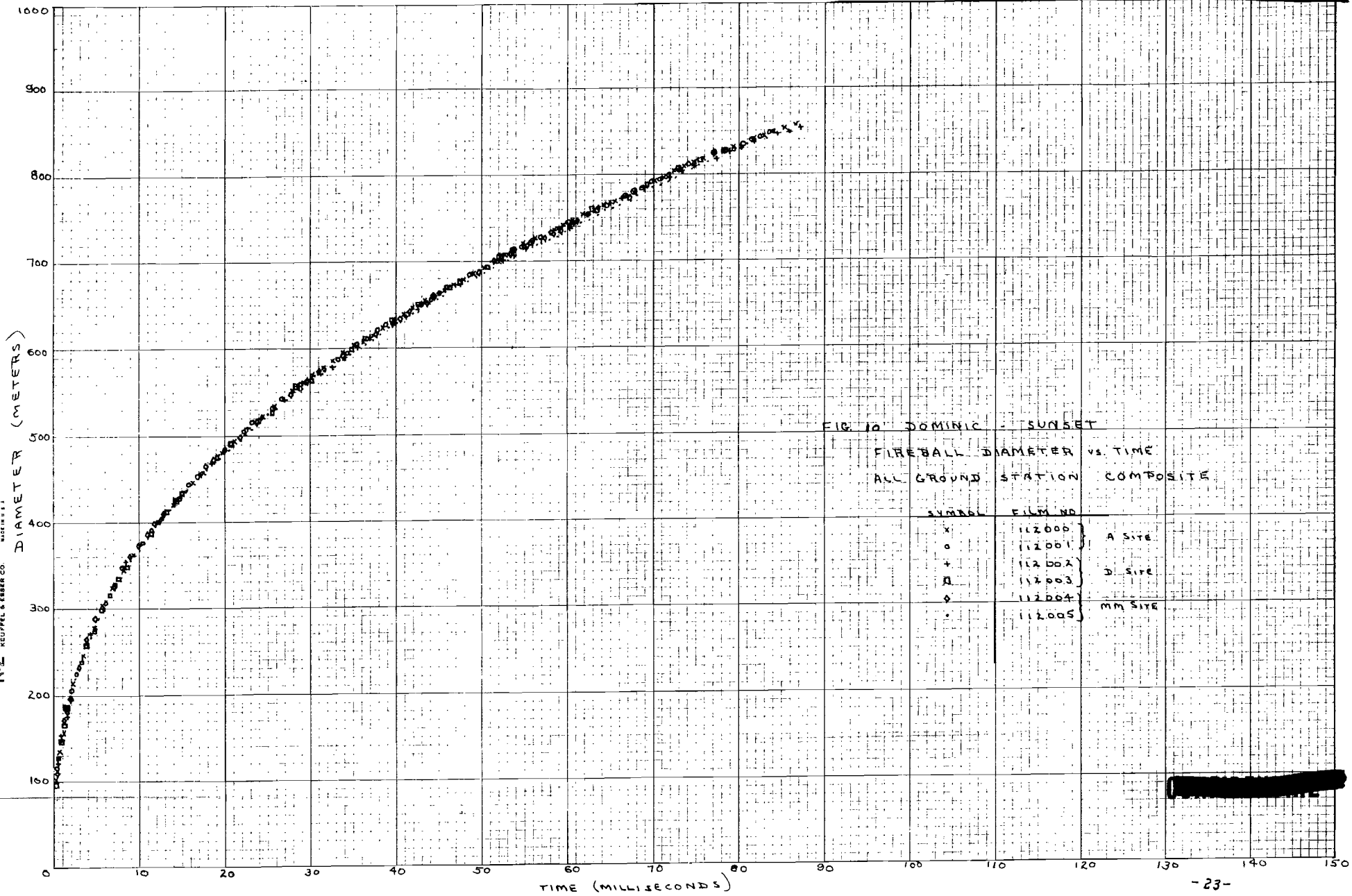
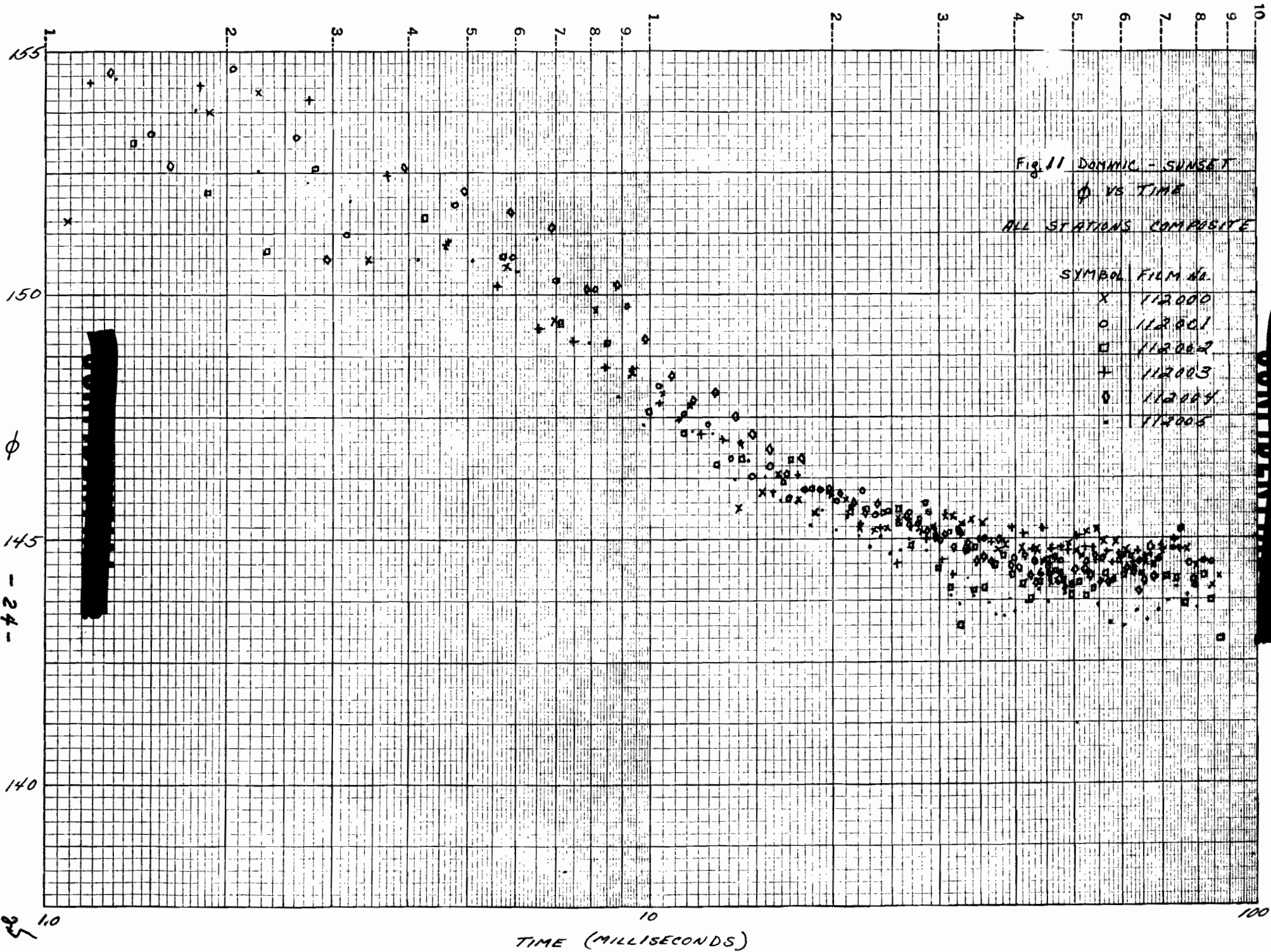


FIG. 9* DOMINIC - SUNSET
 ϕ VS. TIME
"D" SITE

SYMBOL	FILM NO.
□	112002
+	112003





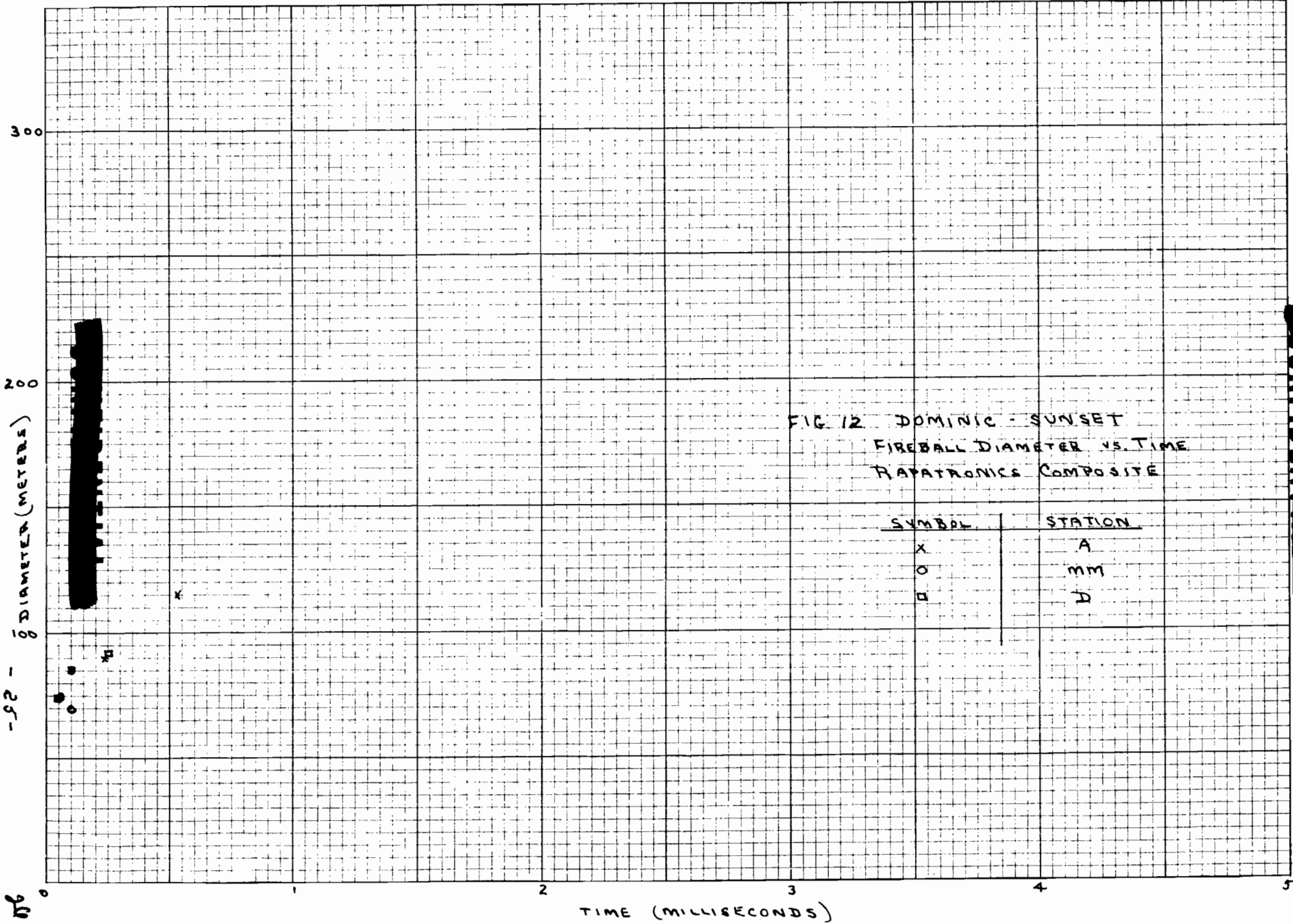


FIG 12 DOMINIC - SUNSET
 FIREBALL DIAMETER VS. TIME
 RAPATRONICS COMPOSITE

SYMBOL	STATION
x	A
o	MM
□	D

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APPENDIX A
Photo Plans and Photo Loading Charts

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STATION NO. A

PHOTO PLAN

BRG 175°35'54" EVENT SUNSET

STATION TYPE ME - 16

GZ STA. GZ-17

DISTANCE GZ 88,586.3 FT.

STATION
N 198521.8 (m)

GZ
171,600 M

DIFF.
26,921.8 M

TILT
GZ 0°00'

DATE 9/11/62

DISTANCE OBJECT 88,717.6 FT.

E 693112.6
Z ~ 10'

695,185 M
5000 FT

2,072.4 M
4985 FT.

OBJ 3°7'8"

POSTED

CAMERA			LENS			FIELD TARGET H/V K.F.T.	AIMING			POWER			MARKER		DELAY	FILM	PUR-POSE	REMARKS
NO.	NOM SPD.	RACK POS.	FOC. MM.	S/N	FILTER		OBJECT	H	V	VOLTS	SHUT RHEO.	TIME ON/OFF	TYPE	S/N				
DFX 12	26,000	ON & FWD	76	049855	W-12	12.14 8.87	BURST	ME-16	ME-16	90V DC	4.1μs	-2 SEC +6 MSEC	MAG. TAPE	M 2928	-	FX	EARLY FB	
PS4B 1	3250	1	150	6962373		14.78 10.29				110V DC	9°	-4 SEC +2 SEC	200	32	-	DXN	FB	
PS4B 2	3250	3	360	7118660		6.16 4.28					36°	-2 SEC +4 SEC	200	27	-	DXN	FB	
PS10B 1	720	2	135	578295		57.51 18.25					15°	-2 SEC +4 SEC	200	32	-	FX	FB	
M-46	100	LOWER RIGHT	50	FF1273		43.83 32.47		7°00'			60°	-5 SEC +55 SEC	200	27	-	MF	LATE FB	
WILD 233		THEOD. PAD	165	233		80.64 53.76		7°L 0°00'		B.B.	1/500	-	-	-	-	MF	POB	
SPEED GRAPHIC		THEOD. PAD	135	-	ND-3			7°L 0°00'		MAN.	~1/500	~φ	-	-	-	57	POB	
RAP 109		L-1	480	806419	W-12	9.23 9.23		ME-16	ME-16	120VAC 28VDC	4μs	-	-	-	58.2	RP	FB	
RAP 116		L-2		806424								-	-	-	103.4	XR	FB	
RAP 120		R-1		806417								-	-	-	233	FX	FB	
RAP 118		R-2		806423								-	-	-	527	FX	FB	
WILD 164		THEOD. PAD	165	164		80.64 53.76		7°L 0°00'		B.B.	1/500	-	-	-	-	MF	POB	

REMARKS ① Aiming Angle of THEODOLITE is 7°00' TO LEFT OF SIGHTING POLE.

② RAPATRONIC RACK POSITIONS ARE TAKEN LOOKING DOWN AT TOP OF ME-16 MOUNT. L INDICATING LEFT OF TELESCOPE BARREL & R INDICATING RIGHT

③ RAPATRONIC TIMES OF EXPOSURE TO BE INCREASED BY 2 μSEC 1/2 COIL DELAY.

PHOTO LOADING CHART

 STATION A

 EVENT SUNSET

 DATE 9/11/62

FILM					CAMERA			LENS		EXPOSURE			REMARKS
TYPE	EMULS. NO.	SIZE	HOLDER	PERF. NO.	NO.	RACK POS.	NOM. SPD.	FOC. MM.	FILTER	APER.	SHUTTER RHEO.	W/M ²	
FX	5240-225	35/33 ⁷ / ₈ "	CASSETTE	112030	DFX 12	ON & FWD	26,000	76	W-12	F = 100	4.1 μSEC	10 ¹	
DXN	5222-221	35/1000	MAG	112000	PS4B 1	1	3250	150	W-12	5.6	9°	4.5 x 10 ³	
DXN	5222-221	35/1000	MAG	112001	PS4B 2	3	3250	360	W-12	11	36°	4.5 x 10 ³	
FX	5240-724	70/400	MAG	112006	PS10B 1	2	720	135	W-12	5.6	15°	4.5 x 10 ³	
MF	0-112-13	35/400	MAG	112009	M-46	LOWER RIGHT	100	50	W-12	2.8	60°	250	
MF	075-01	10x15cm	PLATE HOLDER	112012	WILD 233	THEOD. PAD	-	165	W-12	-	1/500	-	
57	-	4" x 5"	HOLDER		SPEED GRAPHIC	THEOD. PAD	-	135	ND-3	-	1/500	-	
RP	06141-85	2 1/2 x 3 1/4	CUT FILM	112018	RAP 109	L-1	-	480	W-12	F = 120	4 μSEC	1.5 x 10 ⁶	
XR	0-184-1			112023	RAP 116	L-2	-	480	W-12			3 x 10 ⁶	
FX	06140-868			112026	RAP 120	R-1	-	480	W-12			1.3 x 10 ⁷	
FX	06140-868			112027	RAP 118	R-2	-	480	W-12			4.0 x 10 ⁷	
MF	075-01	10x15cm	PLATE HOLDER	112013	WILD 164	THEOD. PAD	-	165	W-12	-	1/500	-	

DATE FILM LOADED _____ DATE CAMERA LOADED _____ DATE EXPOSED _____

REMARKS _____

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STATION NO. MMSTATION TYPE ME-16DISTANCE GZ 92,240.1 FT.DISTANCE OBJECT 92,365.7 FT.

STATION

N 196,588.8 ME 682,300.1 MZ ~10'

PHOTO PLAN

BRG 152°43'24"

DIFF.

M 24,988.8 MM 12,884.9 MFT. 4990 FT.

TILT

GZ 0°00'OBJ 2°59'14"EVENT SUNSETGZ STA. GZ-17DATE 9/11/62

POSTED

CAMERA			LENS			FIELD TARGET H/V K.F.F.	AIMING			POWER			MARKER		DELAY	FILM	PUR- POSE	REMARKS
NO.	NOM SPD.	RACK POS.	FOC. MM	S/N	FILTER		OBJECT	H	V	VOLTS	SHUT RHEO.	TIME ON/OFF	TYPE	S/N				
DFX 13	26,000	ON F FWD	250	273626	W-12	9.84 2.81	BURST	ME-16	ME-16	90V DC	4.1 μs	-2 SEC +6 MSEC	MAG TAPB	M 2887	-	FX	EARLY F.B.	
P54B 3	3250	3	360	7118607	W-12	6.41 4.45				110V DC	36°	-4 SEC +2 SEC	200	33	-	DXN	FB	
P54B 4	3250	1	150	7248438	W-12	16.39 10.71				110V DC	9°	-2 SEC +4 SEC	200	30	-	DXN	FB	
RS106 3	720	2	135	578376	W-12	29.05 20.04				110V DC	15°	-2 SEC +4 SEC	200	30	-	FX	FB	
M-47 100		LOWER RIGHT	50	FF02	W-12	75.63 33.81				110V DC	15°	-5 SEC +8 SEC	200	33	-	MF	LATE FB	
WILD 47		THEOD PAD	165	147	W-12	83.96 55.97		7°L	0°00' 00"	BB	1/500	-	-	-	-	MF	POB	
Polaroid		THEOD. PAD.	~5.5"		ND-2.5	70.15 53.56		7°L	0°00'	MAN.	~1/50	~φ	-	-	-	42	POB	
RAP 103		L-1	480	806429	W-12	9.61 9.61		ME-16	ME-16	120V AC 28V DC	4 μSEC	-	-	-	54.0	RP	FB	
RAP 101		L-2		806428	W-12							-	-	-	105.0	RP	FB	
RAP 108		R-1		806413	W-12							-	-	-	246.8	XR	FB	
RAP 114		R-2		806427	W-12							-	-	-	524.4	FX	FB	
WILD 148		THEOD PAD	165	148	W-12	83.96 55.97				B.B.	1/500	-	-	-	-	MF	POB	

REMARKS ① AIMING ANGLE OF THEODOLITE IS 7°00' TO LEFT OF SIGHTING POLE.

② RAPATRONIC RACK POSITIONS ARE TAKEN LOOKING DOWN AT TOP OF ME-16 MOUNT, L MEANING LEFT OF TELESCOPE BARREL AND R MEANING RIGHT.

③ RAPATRONIC TIMES OF EXPOSURE TO BE INCREASED BY 2 μSEC 1/2 COIL DELAY.

PHOTO LOADING CHART

 STATION MM

 EVENT SUNSET

 DATE 9/11/62

FILM					CAMERA			LENS		EXPOSURE			REMARKS
TYPE	EMULS. NO.	SIZE	HOLDER	PERF. NO.	NO.	RACK POS.	NOM. SPD.	FOG. MM.	FILTER	APER.	SHUTTER RHO.	W/M ²	
FX	5240-225	35/33 ¹ / ₈ "	CASSETTE	112031	DFX 13	ON & FWD	26,000	250	W-12	f=100	41 μSEC	10 ⁷	
DXN	5222-221	35/1000	MAG	112004	PS4B 3	3	3250	360	W-12	11	36°	4.5x10 ³	
DXN	5222-221	35/1000	MAG	112005	PS4B 4	1	3250	150	W-12	5.6	9°	4.5x10 ³	
FX	5240-724	70/400	MAG	112008	PS10B 3	2	720	135	W-12	5.6	15°	4.5x10 ³	
MF	0-112-13	35/400	MAG	112010	M-47	LOWER RIGHT	100	50	W-12	2.8	15°	10 ³	
MF	075-01	10x15 CM.	PLATE HOLDER	112016	WILD 147	THEOD. PAD	-	165	W-12	-	1/500	-	
AZ		2 ³ / ₄ " x 3 ³ / ₄ "	ROLL		POLAROID	THEOD. PAD	-	~5.5"	ND-2.5	-	~1/50	-	
RP	06141-85	2 ¹ / ₄ " x 3 ³ / ₄ "	CUT FILM	112021	RAP 103	L-1	-	480	W-12	f=120	4 μSEC	1.5x10 ⁶	
RP	06141-85			112022	RAP 101	L-2	-	480	W-12			3x10 ⁶	
.XR	0-184-1			112025	RAP 108	R-1	-	480	W-12			1.3x10 ⁷	
FX	06140868			112029	RAP 114	R-2	-	480	W-12			4x10 ⁷	
MF	075-01	10x15 CM.	PLATE HOLDER	112017	WILD 148	THEOD. PAD	-	165	W-12	-	1/500	-	

DATE FILM LOADED _____ DATE CAMERA LOADED _____ DATE EXPOSED _____

REMARKS _____

STATION NO. D

PHOTO PLAN

BRG 192°44'28" EVENT SUNSETSTATION TYPE BX-CONTAINER

STATION

GZ

DIFF.

TILT

GZ STA. GZ-17DISTANCE GZ 54,967.7 FT.N 187,941.8 M171,600 M16,341.8 MGZ 0°00'DATE 9/11/62DISTANCE OBJECT 55,186.2 FT.E 698,880.2 M695,185 M3,695.2 MOBJ 5°7'4"

POSTED

Z ~15'5000 FT.4985 FT.

CAMERA			LENS			FIELD TARGET H/V KFT.	AIMING			POWER			MARKER		DELAY	FILM	PUR- POSE	REMARKS
NO.	NOM SPD.	RACK POS.	FOC. MM	S/N	FILTER		OBJECT	H	V	VOLTS	SHUT RHEO.	TIME ON/OFF	TYPE	S/N				
PS4B 6	3250	R-1	105	6964236	W-12	13.13 9.14	BURST	16°05'	5°	110V DC	9° -2 SEC +4 SEC	200	31	-	DXN	FB		
PS4B 5	3250	R-2	360	6923578		8.83 2.66				110V DC	9° -4 SEC +2 SEC	200	29	-	DXN	FB		
PS10B 2	720	R-3	135	578283		23.33 11.98				110V DC	15° -2 SEC +4 SEC	200	31	-	FX	FB		
M-43	100	L-4	35	FF1000		38.74 28.85				110V DC	15° -5 SEC +55 SEC	200	31	-	XR	LATE FB		
GALILEO 8904		THEOD PAD	168	8904		49.27 32.85		23°	0°00'	BB	1/400	-	-	-	MF	POB		
RAP 111		C-1	480	806426		5.74 5.74		16°05'	5°	120VAC 28VDC	4 μsec	-	-	52.4	RP	FB		
RAP 117		C-2		806411								-	-	94.8	RP	FB		
RAP 107		C-3		806414								-	-	256.2	FX	FB		
RAP 106		C-4		806415								-	-	490.2	XR	FB		
POLAROID		THEOD PAD	155"	-	ND-2	41.91 32.00		23°	0°00'	BB	-	-	-	-	42	POB		
GALILEO 8903		THEOD PAD	168	8903	W-12	41.27 32.85		23°	0°00'	1/400	-	-	-	-	MF	POB		

REMARKS ① AIMING ANGLE OF THEODOLITE IS 23° TO LEFT OF SIGHTING POLE.② AIMING ANGLE OF CAMERAS IS 16°05' TO LEFT OF SIGHTING POLE.③ RAPATRONIC TIMES OF ESPOSURE TO BE INCREASED BY 2 μsec 1/2 COIL DELAY.

PHOTO LOADING CHART

STATION D EVENT SUNSET DATE 9/11/62

FILM					CAMERA			LENS		EXPOSURE			REMARKS
TYPE	EMULS. NO.	SIZE	HOLDER	PERF. NO.	NO.	RACK POS.	NOM. SPD.	FOC. MM.	FILTER	APER.	SHUTTER RHEO.	W/M ²	
DXN	5222-221	35/1000	MAG	112002	PS4B 6	R-1	3250	105	W-12	8	9°	4.5x10 ³	
DXN	5222-221	35/1000	MAG	112003	PS4B 5	R-2	3250	360		11	9°	4.5x10 ³	
FX	5240-724	70/400	MAG	112007	PS10B 2	R-3	720	135		5.6	15°	4.5x10 ³	
XR	0-184-2	35/400	MAG	112011	M-43	L-4	100	35		4	15°	2x10 ³	
MF	075-01	10x15 CM.	PLATE HOLDER	112014	GALILEO 8904	THEOD PAD	-	168		-	1/400	-	
RP	C6141-85	2 1/4 x 3 1/4	CUT FILM	112019	RAP 111	C-1	-	480		f=120	4 μSEC	1.5x10 ⁶	
RP	C6141-85			112020	RAP 117	C-2	-	480				3x10 ⁶	
FX	C6140-868			112028	RAP 107	C-3	-	480				1.3x10 ⁹	
XR	0-184-1			112024	RAP 106	C-4	-	480				4x10 ⁹	
42		2 3/4 x 3 3/4	ROLL		POLAROID	THEOD PAD	-	~5.5"	ND-2.5	17	1/50	-	
MF	075-01	10x15 CM.	PLATE HOLDER	112015	GALILEO 8903	THEOD PAD	-	168	W-12	-	1/400	-	

DATE FILM LOADED _____ DATE CAMERA LOADED _____ DATE EXPOSED _____

REMARKS _____

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PHOTO LOADING CHART

STATION 298 C/30 EVENT SUNSET DATE 9/11/62

FILM					CAMERA			LENS		EXPOSURE			REMARKS
TYPE	EMULS. NO.	SIZE	HOLDER	PERF. NO.	NO.	RACK POS.	NOM. SPD.	FOC. MM.	FILTER	APER.	SHUTTER RHEO.	W/M ²	
DXN	5222-221-13	35/1000	MAG	114754	PS4B 4	L-2	3250	150	W-12	5.6	9°	4.5x10 ³	
XR	0-184-2-1	35/400	MAG	114755	NFP 2	R-2	2000	101	W-12	5.6	67°	4.5x10 ³	
MF	0-112-15-1	35/200	MAG	114756	M-42	R-1	100	75	W-12 +ND-1	8	15°	5x10 ⁴	

DATE FILM LOADED _____ DATE CAMERA LOADED _____ DATE EXPOSED _____

REMARKS _____

CONFIDENTIAL

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STATION NO. 299

STATION TYPE C 130

DISTANCE GZ _____

DISTANCE OBJECT 87,909.0 FT

PHOTO PLAN

STATION

GZ

DIFF.

BRG _____

TILT

GZ 0° 00'

OBJ _____

EVENT SUNSET

GZ STA. GZ-17

DATE 9/11/62

POSTED _____

CAMERA			LENS			FIELD TARGET H/V K FT.	AIMING			POWER			MARKER		DELAY	FILM	PUR- POSE	REMARKS
NO.	NOM SPD.	RACK POS.	FOC. MM	S/N	FILTER		OBJECT	H	V	VOLTS	SHUT RHEO.	TIME ON/OFF	TYPE	S/N				
PS4B 10	3250	L-2	150	688146	W-12	BURST	PERP TO E NE 1/2	0000	110V DC	90	-3 SEC +3 SEC	200				DXN	FB	
WF8 3	2000	R-2	101	A88342	W-12				110V DC	67%	-4 SEC +3 SEC	200				XR	FB	
FD401 2	1500	L-1	75	B1232	W-12				28V DC	60%	-4 SEC +6 SEC	200				MF	FB	
M-44	100	R-1	75	UF5725	W-12 +ND-1				110V DC	150	-5 SEC +25 SEC	200				MF	LATE FB	

REMARKS CAMERA POSITIONS L.T.O.R., TOP TO BOTTOM, VIEWED FROM REAR OF RACK

PHOTO LOADING CHART

STATION 299 C.130 EVENT SUNSET DATE 9/11/62

FILM					CAMERA			LENS		EXPOSURE			REMARKS
TYPE	EMULS. NO.	SIZE	HOLDER	PERF. NO.	NO.	RACK POS.	NOM. SPD.	FOC. MM.	FILTER	APER.	SHUTTER RHEO.	W/M ²	
DXN	5222-22-13	35/1000	MAG	114750	PS 4B 10	L-2	3250	150	W-12	8	9°	4.5x10 ³	
XR	0-184-2-1	35/400	MAG	114751	WFP 3	R-2	2000	101	W-12	4	67%	4.5x10 ³	
MF	0-112-16-01	16/400	MAG	114752	FD 401 2	L-1	1500	75	W-12	8	60%	4.5x10 ³	
MF	↓	35/200	MAG	114753	M-44	R-1	100	75	W-12 + ND-1	8	15°	5x10 ⁴	

DATE FILM LOADED _____ DATE CAMERA LOADED _____ DATE EXPOSED _____

REMARKS _____

CONFIDENTIAL

CONFIDENTIAL

STATION NO. B-52

STATION TYPE A/L 620

DISTANCE GZ _____

DISTANCE OBJECT 52,700 FT.

PHOTO PLAN

STATION

GZ

DIFF. _____

BRG _____

TILT _____

EVENT SUNSET

GZ STA. GZ-17

DATE 9/11/62

POSTED _____

N
E
Z

171,600 M

695,185 M

5000 FT.

GZ _____

OBJ _____

CAMERA			LENS			FIELD TARGET H/V K FT	AIMING			POWER			MARKER		DELAY	FILM	PUR-POSE	REMARKS
NO.	NOM SPD.	BACK POS.	FOC. MM	S/N	FILTER		OBJECT	H	V	VOLTS	SHUT RHEO.	TIME ON/OFF	TYPE	S/N				
P54B	3250	WELL	105	6964242	W-12	12.54 8.73	BURST	100° RR To R/C	41°	60 V DC	9°	-4 SEC +2 SEC	200	36		PXH	FB	
FD401 3	1500	TAIL	75	B1724	W-12	6.32 4.64	BURST			28 V DC	60%	-4 SEC +6 SEC	200	36		MF	FB	

REMARKS _____

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PHOTO LOADING CHART

STATION B-52 A/C 620

EVENT SUNSET

DATE 9/11/62

FILM				CAMERA			LENS		EXPOSURE			REMARKS	
TYPE	EMULS. NO.	SIZE	HOLDER	PERF. NO.	NO.	RACK POS.	NOM. SPD.	FOC. MM.	FILTER	APER.	SHUTTER RHEO.		W/M ²
DXN	5222-22-13	35/1000	MAG	114757	PS 4B 8	WELL	3250	105	W-12	8	9°	1.5x10 ³	
MF	0-112-15-01	16/400	MAG	114758	FD401 3	TAIL	1500	75	W-12	5.6	60%	1.5x10 ³	

DATE FILM LOADED _____ DATE CAMERA LOADED _____ DATE EXPOSED _____

REMARKS _____

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~~CONFIDENTIAL~~

APPENDIX B
Survey Data, GZ-17
Sunset Event

~~CONFIDENTIAL~~

DATE 9/11/62

SURVEY DATA

GZ STA. SUNSET

STA.	COORDINATES			FROM PHOTO STA.			DIST. HOR.		TANGENTS		ANGLES	
	N	E	Z	ΔN	ΔE	ΔZ*	FT.	M.	ΔE/ΔN	ΔZ/DIST.*	BRG	TILT*
GZ	171,600.	695,185.	1524.0									
Dcs	187,941.8	698,880.2	4.57	16,341.8	3,695.2	1500.5	54,967.7	16,754.4	.22612	.08956	192°44'28"	5°7'4"
D _{THEOD}	187,945.8	698,875.9	4.57	16,345.8	3,690.9	1500.4	54,903.9	16,734.9	.22580	.08966	192°43'26"	5°7'24"
Acs	198,521.8	693,112.6	3.05	26,921.8	2,072.4	1471.3	88,586.3	27,001.4	.07698	.05449	175°35'54"	3°7'8"
A _{THEOD}	198,615.3	693,129.8	3.05	27,015.3	2,055.2	1471.4	88,886.4	27,092.9	.07608	.05431	175°38'58"	3°6'30"
MMcs	196,588.8	682,300.1	3.05	24,988.8	12,884.9	1467.3	92,240.1	28,115.1	.51563	.05219	152°43'27"	2°59'14"
MM _{THEOD}	196,664.3	682,322.9	3.05	25,064.3	12,862.1	1467.2	92,519.9	28,200.4	.51316	.05203	152°50'5"	2°58'42"
* CORRECTED FOR REFRACTION AND CURVATURE												
BEARING ANGLES REPRESENT TRUE AZIMUTH FROM PHOTO STA. TO GROUND ZERO.												
TILT ANGLES ARE MEASURED FROM THE PHOTO STA. TO SHOT CAB OR AIR ZERO.												

FORM E17

NAME CLM.

EDGERTON, GERMESHAUSEN & GRIER INC.

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~~CONFIDENTIAL~~

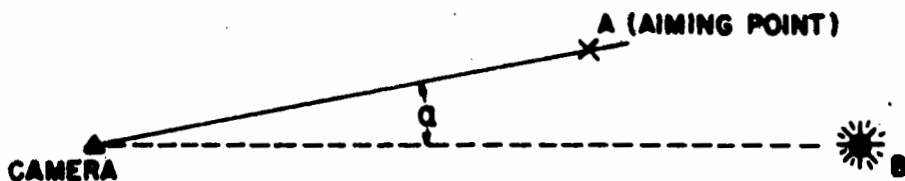
APPENDIX C
Diameter Measurements and Camera Data
Calculation Sheets

~~CONFIDENTIAL~~

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~~CONFIDENTIAL~~
CAMERA DATA & CALCULATIONS

FILM NO. 112000	STATION NO. A	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. P54B-1	EQ. AP.		DATE: 9/11/62



HORIZONTAL
PROJECTION

A. $R^{\circ}/A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$

$\alpha = -58'25''$	$\beta = 3^{\circ}30'28''$	$H_B = 1524.0 \text{ M}$
$\cos \alpha = .99986$	$\cos \beta = .99813$	$H_C = 3.05 \text{ M}$
$CB_h = 27,001.4 \text{ M}$	$\sin \beta = .06119$	$\Delta H = 1471.3 \text{ M}^*$
$CB_h \cos \alpha \cos \beta = 26,947.1 \text{ M}$	$\Delta H \sin \beta = 90.0 \text{ M}$	$R^{\circ}/A = \boxed{27,037.0 \text{ M}}$

B. FOCAL LENGTH 149.6 mm.

* CORRECTED FOR REFRACTION AND CURVATURE

C. MAGNIFICATION FACTOR (meters/in.)

48.41	94.88
29.05	157.96
19.30	237.84

D. ZERO TIME CORRECTION .30 m sec.

~~CONFIDENTIAL~~
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112000

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0000	48.41	0109	0108				
0001		0143	0141				
0002		0166	0165				
0003		0195	0191				
0004		0210	0207				
0005		0227	0224				
0008		0262	0259				
0011		0295	0292				
0014		0322	0319				
0017		0345	0340				
0020		0366	0364				
0023		0384	0380				
0026		0402	0397				
0029		0417	0415				
0032	29.05	0257	0258				
0035		0267	0265				
0038		0276	0274				
0041		0284	0282				
0044		0291	0289				
0047		0297	0297				
0050		0306	0304				
0053		0313	0311				
0056		0319	0316				
0059		0325	0323				
0062		0332	0329				
0065		0338	0336				
0068		0345	0341				
0071		0350	0347				
0074		0356	0353				
0077		0362	0359				
0080		0367	0365				
0083		0373	0369				
0086		0378	0380				
0092		0386	0385				
0095		0391	0389				

READ BY FG/JMT TYPED BY _____

DATE 7/13/62 DATE _____

REMARKS: Hauser No. 5771

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CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112000

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0098		0397	0393				
0101		0402	0399				
0104	19.30	0268	0269				
0107		0272	0271				
0110		0275	0274				
0113		0277	0277				
0116		0279	0280				
0119		0282	0283				
0122		0286	0285				
0125		0290	0288				
0128		0292	0291				
0131		0295	0293				
0134		0299	0296				
0137		0301	0299				
0140		0304	0302				
0143		0305	0305				
0146		0308	0307				
0149		0310	0310				
0152		0312	0312				
0155		0316	0313				
0158		0317	0317				
0161		0319	0318				
0164		0321	0322				
0167		0324	0323				
0170		0327	0325				
0173		0328	0328				
0176		0330	0330				
0179		0332	0334				
0182		0335	0335				
0185		0338	0338				
0188		0341	0340				
0191		0342	0342				
0194		0344	0344				
0197		0346	0346				
0200		0348	0347				
0203		0349	0350				

READ BY FG/JMT TYPED BY _____

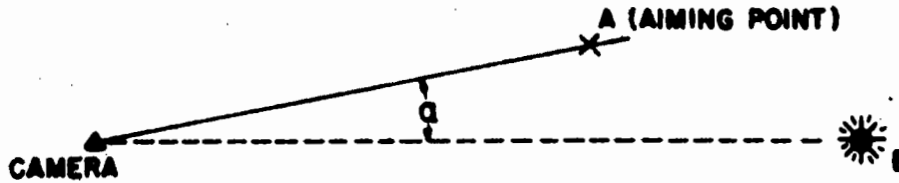
DATE 7/13/62 DATE _____

REMARKS: Hauser No. 5771

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~~CONFIDENTIAL~~
CAMERA DATA & CALCULATIONS

FILM NO. 112001	STATION NO. A	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. P54B-2	EQ. AP.		DATE: 9/11/62



HORIZONTAL
PROJECTION

A. $R^{\circ}_A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$		
$\alpha = -22' 20''$	$\beta = 3^{\circ} 19' 32''$	$H_B = 1524.0 \text{ M}$
$\cos \alpha = .99998$	$\cos \beta = .99832$	$H_C = 3.05 \text{ M}$
$CB_h = 27,001.4 \text{ M}$	$\sin \beta = .05801$	$\Delta H = 1471.3 \text{ M}^*$
$CB_h \cos \alpha \cos \beta = 26,955.5 \text{ M}$	$\Delta H \sin \beta = 85.4 \text{ M}$	$R^{\circ}_A = \boxed{27,040.8 \text{ M}}$
B. FOCAL LENGTH 352.1 mm.		

* CORRECTED FOR REFRACTION AND CURVATURE

C. MAGNIFICATION FACTOR (meters/in.)	
29.05	67.12
19.30	101.07
9.74	200.29
5.84	334.00
D. ZERO TIME CORRECTION .39 msec	

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SHOT SUNSET

FILM NO. 112001

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m)	t (ms)
0000	29.05	0173	0172				
0001		0230	0230				
0002		0267	0270				
0003		0307	0307				
0004		0335	0334				
0005		0356	0357				
0006	19.30	0255	0254				
0008		0281	0282				
0010		0303	0304				
0012		0324	0324				
0014		0343	0343				
0016		0360	0360				
0018	9.74	0188	0188				
0020		0195	0195				
0022		0202	0202				
0024		0208	0208				
0026		0214	0214				
0030		0226	0225				
0032		0232	0231				
0034		0237	0237				
0036		0242	0242				
0038		0247	0247				
0040		0252	0253				
0042		0256	0257				
0044		0262	0261				
0046		0265	0266				
0048		0270	0271				
0050		0274	0275				
0052		0279	0279				
0054		0282	0282				
0056		0287	0286				
0058		0290	0291				
0060		0293	0294				
0062		0297	0298				
0064		0301	0302				

READ BY JMT/FG TYPED BY _____

DATE 7/17/62 DATE _____

REMARKS: Hauser No. 5171

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CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112001

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0066		0305	0305				
0068		0308	0308				
0070		0312	0311				
0072		0315	0315				
0074		0319	0318				
0076		0322	0322				
0078		0325	0325				
0080		0328	0327				
0082		0331	0331				
0084		0335	0334				
0086		0338	0337				
0088		0341	0341				
0090		0343	0342				
0092		0347	0346				
0094		0349	0349				
0096		0353	0353				
0098		0356	0355				
0100		0358	0358				
0102		0361	0361				
0104		0364	0364				
0106		0366	0366				
0108		0369	0369				
0110		0372	0372				
0112		0374	0374				
0114		0376	0377				
0116		0379	0379				
0118		0382	0382				
0120		0384	0385				
0122		0387	0388				
0124		0389	0390				
0126		0392	0392				
0128		0395	0395				
0130		0397	0397				
0132		0399	0399				
0134	5.84	0241	0241				
0136		0243	0243				

READ BY JMT/FG TYPED BY _____

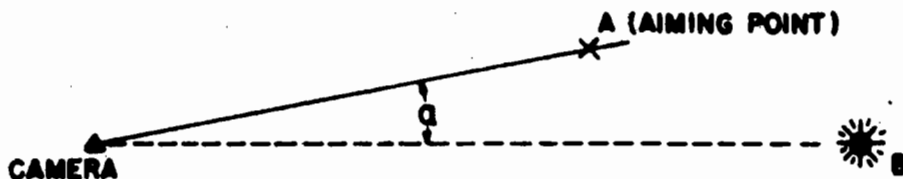
DATE 7/17/62 DATE _____

REMARKS: Hauser No. 5171

HA

~~CONFIDENTIAL~~
CAMERA DATA & CALCULATIONS

FILM NO. 112004	STATION NO. MM	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. PS4B-3	EQ. AP.		DATE: 9/11/62



HORIZONTAL
PROJECTION

A. $R^{\circ}/A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$		
$\alpha = 0^{\circ} 7' 26''$	$\beta = 3^{\circ} 21' 33''$	$H_B = 1524.0 M$
$\cos \alpha = 1.0$	$\cos \beta = .99828$	$H_C = 3.05 M$
$CB_h = 28,115.1 M$	$\sin \beta = .05860$	$\Delta H = 1467.3 * M$
$CB_h \cos \alpha \cos \beta = 28,066.7 M$	$\Delta H \sin \beta = 86.0 M$	$R^{\circ}/A = 28,152.7 M$
B. FOCAL LENGTH 352.2 mm.		

* CORRECTED FOR REFRACTION AND CURVATURE

C. MAGNIFICATION FACTOR (meters/in.)	
29.05	69.86
19.30	105.19
9.74	208.47
D. ZERO TIME CORRECTION .30 msec	

~~CONFIDENTIAL~~
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112004

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0000	29.05	0158	0156				
0001		0192	0189				
0002		0220	0216				
0003		0244	0246				
0004		0265	0265				
0005		0282	0279				
0008		0322	0322				
0011		0378	0377				
0014	19.30	0274	0273				
0017		0293	0294				
0020		0310	0313				
0023		0326	0326				
0026		0340	0344				
0029		0353	0355				
0032		0365	0367				
0035		0377	0379				
0038		0389	0392				
0041		0400	0402				
0044	9.74	0207	0208				
0047		0212	0213				
0050		0217	0217				
0053		0222	0223				
0056		0226	0227				
0059		0230	0232				
0062		0235	0236				
0065		0239	0240				
0068		0243	0244				
0071		0248	0248				
0074		0252	0252				
0077		0255	0256				
0080		0259	0260				
0083		0262	0260				
0086		0266	0267				
0089		0270	0270				
0092		0273	0274				
0095		0276	0277				

READ BY FG/JRM TYPED BY _____

DATE 7/16/62 DATE _____

REMARKS: Hauser No. 5171

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CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112004

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0098		0280	0281				
0101		0283	0284				
0104		0286	0286				
0107		0289	0290				
0110		0292	0293				
0113		0296	0297				
0116		0299	0299				
0119		0301	0302				
0122		0304	0305				
0125		0308	0308				
0128		0310	0310				
0131		0313	0312				
0134		0316	0316				
0137		0319	0318				
0140		0322	0322				
0143		0324	0324				
0146		0326	0326				
0149		0329	0329				
0152		0333	0331				
0155		0335	0335				
0158		0338	0337				
0161		0340	0339				
0164		0342	0342				
0167		0344	0344				
0170		0346	0347				
0173		0348	0350				
0176		0351	0352				
0179		0354	0354				
0182		0356	0356				
0185		0359	0359				
0188		0361	0361				
0191		0363	0364				
0194		0365	0365				
0200		0370	0370				
0203		0372	0371				
0206		0374	0375				

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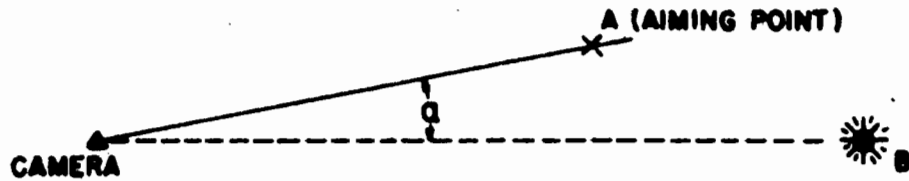
DATE 7/16/62 DATE _____

REMARKS: Hauser No. 5171

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CONFIDENTIAL
CAMERA DATA & CALCULATIONS

FILM NO. 112005	STATION NO. MM	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. PS4B-4	EQ. AP.		DATE: 9/11/62



**HORIZONTAL
PROJECTION**

A. $R^0_A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$

$\alpha = 0^\circ 8' 44''$	$\beta = 3^\circ 9' 26''$	$H_B = 1524.0 \text{ M}$
$\cos \alpha = 1.0$	$\cos \beta = .99848$	$H_C = 3.05 \text{ M}$
$CB_h = 28,115.1 \text{ M}$	$\sin \beta = .05508$	$\Delta H = 1467.3 \text{ M}^*$
$CB_h \cos \alpha \cos \beta = 28,072.4 \text{ M}$	$\Delta H \sin \beta = 80.8 \text{ M}$	$R^0_A = \boxed{28,153.2 \text{ M}}$

B. FOCAL LENGTH 149.9 mm.

* CORRECTED FOR REFRACTION AND CURVATURE

C. MAGNIFICATION FACTOR (meters/in.)

48.08	99.17
28.90	165.09
19.30	247.16

D. ZERO TIME CORRECTION .37 msec

DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112005

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX.XX	t (ms)
0000	48.08	0114	0113				
0001		0149	0148				
0002		0174	0174				
0003		0196	0196				
0004		0213	0214				
0005		0229	0231				
0006		0243	0246				
0008		0268	0270				
0010		0292	0292				
0012		0313	0311				
0013		0323	0323				
0014		0329	0328				
0016		0345	0344				
0018	28.90	0215	0215				
0020		0223	0223				
0022		0231	0231				
0024		0239	0239				
0026		0247	0246				
0028		0252	0252				
0030		0260	0259				
0032		0266	0265				
0034		0271	0271				
0036		0277	0277				
0038		0282	0282				
0040		0288	0289				
0042		0293	0293				
0044		0299	0299				
0046		0304	0303				
0048		0308	0308				
0050		0313	0314				
0052		0317	0318				
0054		0323	0322				
0056		0327	0328				
0058		0332	0333				
0060		0335	0337				
0062		0339	0340				

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DATE 7/13/62 DATE _____

REMARKS: Hauser No. 5779

CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112005

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m)	t (ms)
						XXX·XX	
0064		0346	0347				
0066	19.30	0231	0232				
0068		0234	0234				
0070		0237	0238				
0072		0239	0240				
0074		0243	0242				
0076		0244	0245				
0078		0247	0246				
0080		0249	0249				
0082		0252	0252				
0084		0254	0254				
0086		0256	0256				
0088		0259	0259				
0090		0262	0261				
0092		0264	0264				
0094		0266	0266				
0096		0268	0268				
0098		0271	0271				
0100		0273	0273				
0102		0274	0274				
0104		0276	0277				
0106		0277	0278				
0108		0280	0280				
0110		0283	0283				
0112		0283	0284				
0114		0287	0286				
0116		0288	0289				
0118		0289	0291				
0120		0292	0292				
0122		0293	0294				
0124		0295	0295				
0126		0297	0298				
0128		0299	0299				
0130		0302	0301				
0132		0303	0302				
0134		0305	0305				

READ BY JMT/FG TYPED BY _____

DATE 7/13/62 DATE _____

REMARKS: Hauser No. 5779

CONFIDENTIAL

DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112005

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX.XX	t (ms)
0136		0306	0307				
0138		0307	0309				
0140		0310	0310				
0142		0312	0313				
0144		0313	0315				
0146		0315	0316				
0148		0318	0318				
0150		0319	0319				
0152		0321	0321				
0154		0322	0323				
0156		0324	0325				
0158		0327	0326				
0160		0328	0328				
0162		0330	0329				
0164		0331	0331				
0168		0333	0333				
0168		0334	0334				
0170		0335	0335				
0172		0338	0338				
0174		0339	0340				

READ BY JMT/FG TYPED BY _____

DATE 7/13/62 DATE _____

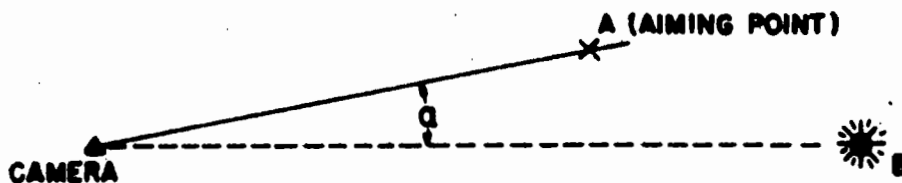
REMARKS: Hauser No. 5779

CONFIDENTIAL

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~~CONFIDENTIAL~~
CAMERA DATA & CALCULATIONS

FILM NO. 112002	STATION NO. D	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. P54B-6	EQ. AP.		DATE: 9/11/62



HORIZONTAL
PROJECTION

A. $R^{\circ}A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$		
$\alpha = -1^{\circ}16'48''$	$\beta = 5^{\circ}13'6''$	$H_B = 1524.0 \text{ M}$
$\cos \alpha = .99975$	$\cos \beta = .99586$	$H_C = 4.57 \text{ M}$
$CB_h = 16754.4 \text{ M}$	$\sin \beta = .09095$	$\Delta H = 1500.5 \text{ M}^*$
$CB_h \cos \alpha \cos \beta = 16680.8 \text{ M}$	$\Delta H \sin \beta = 136.5 \text{ M}$	$R^{\circ}A = \boxed{16817.2 \text{ M}}$
B. FOCAL LENGTH 108.4 mm.		

* CORRECTED FOR REFRACTION AND CURVATURE

C. MAGNIFICATION FACTOR (meters/in.)	
48.08	81.91
28.90	136.37
19.30	204.16
9.65	408.33

D. ZERO TIME CORRECTION .44 msec

~~CONFIDENTIAL~~
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112002

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0000	48.08	0146	0148				
0001		0184	0186				
0002		0214	0213				
0003		0239	0238				
0004		0259	0259				
0005		0283	0281				
0008		0330	0330				
0011		0370	0367				
0014	28.90	0240	0240				
0017		0257	0258				
0020		0272	0271				
0023		0284	0287				
0026		0298	0298				
0029		0310	0312				
0032		0322	0322				
0035		0335	0334				
0038		0344	0344				
0041		0354	0352				
0044		0364	0362				
0047		0373	0372				
0050		0383	0380				
0053		0391	0390				
0056		0398	0398				
0059		0408	0407				
0062	19.30	0274	0276				
0065		0279	0280				
0068		0283	0283				
0071		0288	0290				
0074		0293	0295				
0077		0299	0300				
0080		0304	0305				
0083		0307	0309				
0086		0312	0312				
0089		0316	0315				
0092		0320	0321				
0095		0324	0327				

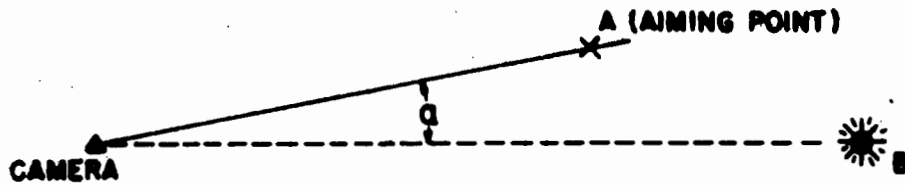
READ BY FG/AR TYPED BY _____

DATE 7/16/62 DATE _____

REMARKS: Hauser No. 5179

~~CONFIDENTIAL~~
CAMERA DATA & CALCULATIONS

FILM NO. 112003	STATION NO. D	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. P54B-5	EQ. AP.		DATE: 9/11/62



HORIZONTAL
PROJECTION

A. $R^{\circ}_A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$

$\alpha = 1^{\circ} 27' 18''$	$\beta = 5^{\circ} 7' 4''$	$H_B = 1524.0 M$
$\cos \alpha = .99968$	$\cos \beta = .99602$	$H_C = 4.57 M$
$CB_h = 16,754.4 M$	$\sin \beta = .08920$	$\Delta H = 1500.5 M^*$
$CB_h \cos \alpha \cos \beta = 16682.4 M$	$\Delta H \sin \beta = 133.8 M$	$R^{\circ}_A = \boxed{16,816.1 M}$

B. FOCAL LENGTH 351.4 mm

C. MAGNIFICATION FACTOR (meters/in.)

29.05	41.83
19.30	62.98
9.74	124.81
5.84	208.12

D. ZERO TIME CORRECTION

CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112003

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0000	29.05	0230	0229				
0001		0298	0299				
0002		0348	0348				
0003		0395	0395				
0004		0439	0439				
0005	19.30	0312	0310				
0008		0366	0368				
0011		0407	0410				
0014		0444	0443				
0017	9.74	0240	0239				
0020		0253	0254				
0023		0267	0267				
0026		0279	0279				
0029		0291	0291				
0032		0301	0301				
0035		0311	0311				
0038		0321	0320				
0041		0330	0330				
0044		0339	0339				
0047		0347	0347				
0050		0354	0354				
0053		0368	0369				
0060		0379	0381				
0065		0393	0392				
0070		0402	0403				
0075		0413	0414				
0080		0421	0423				
0085	5.84	0261	0260				
0090		0266	0266				
0095		0270	0272				
0100		0276	0276				
0105		0282	0283				
0110		0289	0287				
0115		0294	0292				
0120		0299	0297				
0125		0304	0303				

READ BY JRM/FG TYPED BY _____

DATE 7/20/62 DATE _____

REMARKS: Hauser No. 5771

W2

CONFIDENTIAL

DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 112003

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0130		0308	0308				
0135		0313	0311				
0140		0317	0318				
0145		0321	0321				
0150		0326	0325				
0155		0330	0329				
0160		0335	0334				
0165		0339	0337				
0170		0343	0341				
0172		0344	0342				
0174		0346	0344				
0176		0347	0345				
0178		0349	0347				
0180		0350	0349				
0182		0352	0350				
0184		0353	0351				
0186		0355	0353				
0188		0356	0355				
0190		0357	0356				
0192		0360	0357				
0194		0360	0359				
0196		0362	0361				
0198		0363	0362				
0200		0365	0364				
0202		0367	0365				
0204		0368	0366				
0206		0370	0368				
0208		0371	0369				
0210		0373	0371				
0212		0374	0372				
0214		0376	0373				
0216		0377	0374				
0218		0379	0376				
0220		0380	0378				
0222		0381	0380				
0224		0383	0381				

READ BY JRM/FG TYPED BY _____

DATE 7/20/62 DATE _____

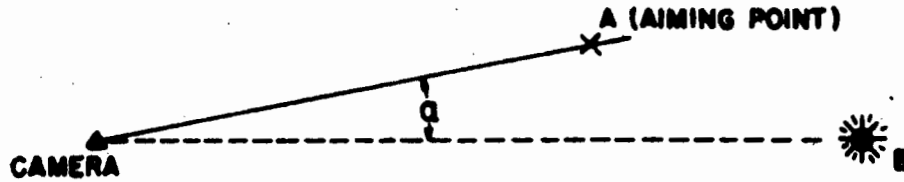
REMARKS: Hauser No. 5771

CONFIDENTIAL

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CAMERA DATA & CALCULATIONS

FILM NO. 114754	STATION NO. 298	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. PS4B-9	EQ. AP.		DATE: 9/11/62



**HORIZONTAL
PROJECTION**

A. $R^0_A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$

$\alpha = 3^\circ 13' 40''$	$\beta = 1^\circ 44' 50''$	$H_B = 15240 \text{ M}$
$\cos \alpha =$	$\cos \beta =$	$H_C =$
$CB_h =$	$\sin \beta =$	$\Delta H =$
$CB_h \cos \alpha \cos \beta =$	$\Delta H \sin \beta =$	$R^0_A = 27,160.0 \text{ M}$

B. FOCAL LENGTH 150.0 mm

AFSWC DME SLANT RANGE 27,216.0 M
89,290.0 FT.

C. MAGNIFICATION FACTOR (meters/in.)

48.08	95.60
28.90	159.16
19.30	238.28

D. ZERO TIME CORRECTION

65

CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 114754

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m)	t (ms)
0000	48.08	0111	0109				
0001		0137	0135				
0002		0167	0164				
0003		0185	0183				
0004		0204	0203				
0005		0219	0217				
0009		0270	0271				
0013		0309	0306				
0017		0338	0336				
0021		0365	0363				
0025		0390	0386				
0030		0421	0416				
0035	28.90	0265	0264				
0040		0277	0276				
0045		0289	0289				
0050		0303	0300				
0055		0313	0312				
0060		0323	0322				
0065		0333	0333				
0070		0343	0340				
0075		0353	0350				
0080		0361	0360				
0085		0370	0368				
0090		0377	0376				
0095		0386	0385				
0100		0394	0393				
0104		0401	0398				
0108		0406	0405				
0112		0412	0411				
0116		0418	0417				
0120		0422	0422				
0124		0428	0428				
0128		0434	0433				
0132		0439	0439				
0136		0443	0443				
0140		0450	0449				

READ BY AR/FG TYPED BY _____

DATE _____ DATE _____

REMARKS: Hauser No. 5779

CONFIDENTIAL

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CONFIDENTIAL
DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 114754

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX.XX	t (ms)
0144		0455	0454				
0148	19.30	0306	0305				
0152		0309	0308				
0156		0312	0312				
0160		0315	0315				
0164		0318	0318				
0168		0320	0320				
0172		0322	0322				
0176		0326	0325				
0180		0329	0328				
0184		0331	0332				
0188		0337	0334				
0192		0338	0338				
0196		0340	0340				
0200		0343	0343				
0204		0345	0345				
0208		0349	0348				
0212		0351	0351				
0216		0354	0353				
0220		0357	0357				
0224		0359	0359				
0228		0360	0361				
0232		0362	0363				
0236		0365	0366				
0240		0368	0368				
0244		0370	0370				
0248		0372	0373				
0252		0375	0375				
0256		0377	0377				
0260		0378	0378				
0264		0380	0380				

READ BY AR/FG TYPED BY _____

DATE _____ DATE _____

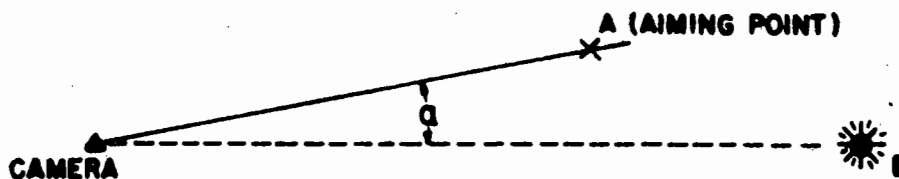
REMARKS: Hauser No. 5779



W1

~~CONFIDENTIAL~~
GAMERA DATA & CALCULATIONS

FILM NO. 114750	STATION NO. 299	TEST SUNSET	CALCULATED BY: CLM
CAMERA NO. PS4B-10	EQ. AP.		DATE: 9/11/62



HORIZONTAL
PROJECTION

A. $R^{\circ}/A = CB_h \cos \alpha \cos \beta + (H_B - H_C) \sin \beta$

$\alpha = 1^{\circ} 39' 0''$	$\beta = 3^{\circ} 0' 30''$	$H_B = 1524.0 M$
$\cos \alpha =$	$\cos \beta =$	$H_C =$
$CB_h =$	$\sin \beta =$	$\Delta H =$
$CB_h \cos \alpha \cos \beta =$	$\Delta H \sin \beta =$	$R^{\circ}/A = 26,747.0 M$

B. FOCAL LENGTH 149.8 mm.

AFSWC DME SLANT RANGE 26,795.0 M
 87,909.0 FT.

C. MAGNIFICATION FACTOR (meters/in.)

48.74	93.03
29.02	156.23
9.69	467.98
19.47	233.01

D. ZERO TIME CORRECTION .33

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DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 114750

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0000	48.735	0118	0117				
0001		0159	0154				
0002		0179	0178				
0003		0200	0197				
0004		0217	0217				
0005		0228	0229				
0006		0244	0241				
0008		0268	0264				
0010		0288	0284				
0015		0332	0329				
0020		0366	0366				
0025		0398	0394				
0030		0422	0420				
0035		0447	0444				
0040		0467	0466				
0045	29.020	0289	0290				
0050		0300	0303				
0055		0314	0310				
0060		0324	0322				
0065		0331	0331				
0070		0340	0341				
0075		0351	0351				
0080		0361	0361				
0085		0368	0369				
0090		0376	0373				
0095		0384	0383				
0100		0392	0392				
0104		0399	0396				
0108		0404	0405				
0112		0409	0409				
0116		0415	0415				
0120		0421	0420				
0124		0426	0427				
0128		0431	0433				
0132		0437	0438				

READ BY JMT/AR TYPED BY _____

DATE 7/21/62 DATE _____

REMARKS: **Hauser No. 3815**

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DIAMETER MEASUREMENTS

SHOT SUNSET

FILM NO. 114750

FR. NO.	MAG.	D ₁	D ₂	D ₃	D _{avg} (m)	FLEXOWRITER	
						D _{avg} (m) XXX·XX	t (ms)
0136		0443	0441				
0140		0446	0448				
0144		0453	0452				
0148		0455	0456				
0152		0458	0460				
0156		0463	0467				
0160		0468	0472				
0164	19.474	0315	0315				
0168		0319	0320				
0172		0321	0325				
0176		0325	0325				
0180		0329	0328				
0184		0330	0332				
0188		0332	0334				
0192		0335	0336				
0196		0338	0340				
0200		0340	0342				
0204		0343	0345				
0208		0347	0346				
0212		0349	0349				
0216		0351	0353				
0220		0354	0355				
0224		0356	0358				
0228		0359	0359				
0232		0362	0361				
0236		0364	0364				
0240		0367	0367				
0244		0369	0370				
0248		0371	0371				
0252		0373	0374				
0256		0375	0376				
0260		0377	0378				
0264		0379	0381				

READ BY _____ TYPED BY _____

DATE _____ DATE _____

REMARKS:

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APPENDIX D

ϕ^5 Yield Determination

A Site, Film No. 112000

A Site, Film No. 112001

MM Site, Film No. 112005

MM Site, Film No. 112004

D Site, Film No. 112003

D Site, Film No. 112002

Aircraft 298, Film No. 114754

Aircraft 299, Film No. 114750

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OPERATION DOMINIC
SHOT STATION CAMERA FILM
SUNSET A PS48-1 112000

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+102.88	+0.30	-1.17	+164.55	+1559.93
+1.	+134.65	+0.70	-0.35	+155.26	+1166.71
+2.	+156.93	+1.09	+0.08	+151.52	+1032.84
+3.	+183.01	+1.48	+0.39	+156.32	+1207.21
+4.	+197.71	+1.87	+0.62	+153.78	+1112.14
+5.	+213.83	+2.26	+0.81	+154.17	+1126.43
+8.	+247.02	+3.43	+1.23	+150.72	+1005.70
+11.	+278.31	+4.61	+1.52	+151.00	+1015.09
+14.	+303.91	+5.78	+1.75	+150.60	+1001.79
+17.	+324.77	+6.95	+1.93	+149.48	+965.17
+20.	+346.11	+8.13	+2.09	+149.68	+971.61
+23.	+362.23	+9.30	+2.23	+148.43	+931.85
+26.	+378.82	+10.47	+2.34	+148.04	+919.47
+29.	+394.47	+11.64	+2.45	+147.75	+910.55
+32.	+406.90	+12.81	+2.55	+146.67	+877.83
+35.	+420.33	+13.98	+2.63	+146.31	+866.91
+38.	+434.55	+15.16	+2.71	+146.47	+871.75
+41.	+447.19	+16.33	+2.79	+146.31	+867.04
+44.	+458.26	+17.50	+2.86	+145.83	+853.02
+47.	+469.32	+18.67	+2.92	+145.54	+844.35
+50.	+481.96	+19.84	+2.98	+145.87	+853.96
+53.	+493.02	+21.01	+3.04	+145.83	+853.00
+56.	+501.71	+22.18	+3.09	+145.22	+835.28
+59.	+511.98	+23.35	+3.15	+145.18	+834.08
+62.	+522.25	+24.52	+3.19	+145.23	+835.41
+65.	+532.53	+25.69	+3.24	+145.35	+838.95
+68.	+542.01	+26.86	+3.29	+145.33	+838.31
+71.	+550.70	+28.02	+3.33	+145.16	+833.59
+74.	+560.18	+29.19	+3.37	+145.27	+836.65
+77.	+569.66	+30.36	+3.41	+145.43	+841.22
+80.	+578.35	+31.53	+3.45	+145.43	+841.40
+83.	+586.25	+32.70	+3.48	+145.29	+837.30
+86.	+594.94	+33.86	+3.52	+145.39	+840.16
+89.	+602.84	+35.03	+3.55	+145.34	+838.64
+92.	+609.17	+36.20	+3.58	+144.95	+827.49
+95.	+616.28	+37.37	+3.62	+144.79	+823.01
+98.	+624.18	+38.53	+3.65	+144.86	+824.83
+101.	+632.87	+39.70	+3.68	+145.13	+832.70
+104.	+638.62	+40.87	+3.71	+144.77	+822.23
+107.	+645.76	+42.03	+3.73	+144.74	+821.65
+110.	+652.89	+43.20	+3.76	+144.75	+821.84
+113.	+658.84	+44.36	+3.79	+144.52	+815.36
+116.	+664.79	+45.53	+3.81	+144.32	+809.73
+119.	+671.92	+46.69	+3.84	+144.40	+812.03
+122.	+679.06	+47.86	+3.86	+144.51	+814.91
+125.	+687.38	+49.02	+3.89	+144.68	+825.44
+128.	+693.33	+50.19	+3.91	+144.77	+822.24

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FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+131.	+699.27	+51.36	+3.93	+144.67	+819.50
+134.	+707.60	+52.53	+3.96	+145.08	+831.19
+137.	+713.55	+53.70	+3.98	+145.02	+829.39
+140.	+720.68	+54.86	+4.00	+145.21	+834.96
+143.	+725.44	+56.03	+4.02	+144.94	+827.26
+146.	+731.38	+57.20	+4.04	+144.93	+826.88
+149.	+737.33	+58.37	+4.06	+144.93	+826.91
+152.	+742.09	+59.54	+4.08	+144.71	+820.74
+155.	+748.03	+60.71	+4.10	+144.74	+821.59
+158.	+753.98	+61.88	+4.12	+144.78	+822.79
+161.	+757.55	+63.05	+4.14	+144.39	+811.50
+164.	+764.68	+64.21	+4.16	+144.68	+819.78
+167.	+769.44	+65.38	+4.18	+144.53	+815.64
+170.	+775.39	+66.55	+4.19	+144.62	+818.15
+173.	+780.14	+67.72	+4.21	+144.50	+814.69
+176.	+784.90	+68.89	+4.23	+144.39	+811.59
+179.	+792.04	+70.06	+4.24	+144.72	+821.07
+182.	+796.79	+71.22	+4.26	+144.63	+818.50
+185.	+803.93	+72.39	+4.28	+144.98	+828.41
+188.	+809.87	+73.56	+4.29	+145.12	+832.42
+191.	+813.44	+74.73	+4.31	+144.85	+824.52
+194.	+818.20	+75.90	+4.32	+144.79	+822.98
+197.	+822.96	+77.07	+4.34	+144.75	+821.69
+200.	+826.52	+78.23	+4.35	+144.50	+814.77
+203.	+831.28	+79.40	+4.37	+144.47	+814.00
+206.	+836.04	+80.57	+4.38	+144.45	+813.45
+209.	+839.61	+81.74	+4.40	+144.24	+807.37
+212.	+845.55	+82.91	+4.41	+144.44	+812.97
+215.	+847.93	+84.08	+4.43	+144.04	+801.72
+218.	+853.88	+85.24	+4.44	+144.25	+807.63
+221.	+858.63	+86.41	+4.45	+144.26	+808.08

~~CONFIDENTIAL~~

	OPERATION	DOMINIC	
SHOT	STATION	CAMERA	FILM
SUNSET	A	PS48-2	112001

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+115.82	+0.39	-.92	+167.63	+1711.56
+1.	+154.43	+0.94	-.05	+157.77	+1264.03
+2.	+180.29	+1.49	+0.40	+153.33	+1096.12
+3.	+206.14	+2.04	+0.71	+154.69	+1145.48
+4.	+224.60	+2.60	+0.95	+153.24	+1092.91
+5.	+239.37	+3.15	+1.14	+151.25	+1023.54
+6.	+257.22	+3.70	+1.30	+152.38	+1062.56
+8.	+284.50	+4.80	+1.56	+151.88	+1045.28
+10.	+306.74	+5.90	+1.77	+150.79	+1008.09
+12.	+327.46	+7.00	+1.94	+150.34	+993.27
+14.	+346.66	+8.09	+2.09	+150.14	+986.72
+16.	+363.84	+9.19	+2.21	+149.77	+974.55
+18.	+376.50	+10.29	+2.33	+148.15	+922.90
+20.	+390.52	+11.39	+2.43	+147.57	+904.89
+22.	+404.54	+12.48	+2.52	+147.35	+898.18
+24.	+416.56	+13.58	+2.60	+146.70	+878.75
+26.	+428.57	+14.68	+2.68	+146.33	+867.49
+28.	+441.59	+15.77	+2.75	+146.49	+872.50
+30.	+451.60	+16.86	+2.82	+145.85	+853.51
+32.	+463.62	+17.96	+2.88	+146.02	+858.36
+34.	+474.63	+19.05	+2.94	+145.99	+857.72
+36.	+484.65	+20.14	+3.00	+145.79	+851.65
+38.	+494.66	+21.24	+3.05	+145.69	+848.84
+40.	+505.68	+22.33	+3.10	+145.98	+857.29
+42.	+513.69	+23.42	+3.15	+145.49	+843.01
+44.	+523.70	+24.51	+3.19	+145.65	+847.69
+46.	+531.71	+25.60	+3.24	+145.33	+838.35
+48.	+541.72	+26.69	+3.28	+145.62	+846.75
+50.	+549.74	+27.78	+3.32	+145.43	+841.22
+52.	+558.75	+28.86	+3.36	+145.56	+844.99
+54.	+564.76	+29.95	+3.39	+144.96	+827.86
+56.	+573.77	+31.04	+3.43	+145.19	+834.41
+58.	+581.78	+32.12	+3.46	+145.21	+834.86
+60.	+587.79	+33.21	+3.50	+144.77	+822.35
+62.	+595.80	+34.29	+3.53	+144.87	+825.14
+64.	+603.81	+35.38	+3.56	+145.00	+828.87
+66.	+610.82	+36.46	+3.59	+144.92	+826.68
+68.	+616.83	+37.55	+3.62	+144.64	+818.77
+70.	+623.84	+38.63	+3.65	+144.63	+818.48
+72.	+630.84	+39.71	+3.68	+144.65	+816.98
+74.	+637.85	+40.79	+3.70	+144.69	+820.21
+76.	+644.86	+41.88	+3.73	+144.76	+822.13
+78.	+650.87	+42.96	+3.76	+144.63	+818.37
+80.	+655.88	+44.04	+3.78	+144.30	+809.13
+82.	+662.89	+45.12	+3.80	+144.44	+812.96
+84.	+669.90	+46.19	+3.83	+144.59	+817.31
+86.	+675.91	+47.27	+3.85	+144.55	+816.08

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+88.	+682.91	+48.35	+3.87	+144.74	+821.40
+90.	+685.92	+49.43	+3.90	+144.10	+803.43
+92.	+693.93	+50.50	+3.92	+144.53	+815.54
+94.	+698.94	+51.57	+3.94	+144.36	+810.70
+96.	+706.95	+52.64	+3.96	+144.82	+823.74
+98.	+711.95	+53.71	+3.98	+144.68	+819.71
+100.	+716.96	+54.78	+4.00	+144.55	+816.15
+102.	+722.97	+55.85	+4.02	+144.64	+818.70
+104.	+728.98	+56.92	+4.04	+144.74	+821.58
+106.	+732.98	+57.98	+4.06	+144.46	+813.60
+108.	+738.99	+59.05	+4.07	+144.59	+817.15
+110.	+745.00	+60.12	+4.09	+144.72	+820.99
+112.	+749.00	+61.18	+4.11	+144.48	+814.16
+114.	+754.01	+62.25	+4.13	+144.44	+813.16
+116.	+759.02	+63.31	+4.14	+144.42	+812.47
+118.	+765.03	+64.38	+4.16	+144.59	+817.40
+120.	+770.03	+65.44	+4.18	+144.59	+817.25
+122.	+776.04	+66.51	+4.19	+144.78	+822.65
+124.	+780.05	+67.57	+4.21	+144.61	+817.73
+126.	+785.05	+68.64	+4.22	+144.63	+818.34
+128.	+791.06	+69.70	+4.24	+144.84	+824.39
+130.	+795.07	+70.76	+4.25	+144.70	+820.27
+132.	+799.07	+71.83	+4.27	+144.56	+816.43
+134.	+804.96	+72.89	+4.28	+144.77	+822.46
+136.	+811.64	+73.95	+4.30	+145.13	+832.72
+138.	+816.65	+75.01	+4.31	+145.20	+834.60
+140.	+818.32	+76.07	+4.33	+144.68	+819.81
+142.	+821.66	+77.13	+4.34	+144.47	+813.82
+144.	+825.00	+78.20	+4.35	+144.26	+808.12
+146.	+828.34	+79.26	+4.37	+144.07	+802.69
+148.	+835.02	+80.32	+4.38	+144.46	+813.67
+150.	+840.03	+81.38	+4.39	+144.57	+816.69
+152.	+843.37	+82.43	+4.41	+144.40	+811.78
+154.	+848.38	+83.49	+4.42	+144.51	+815.10

OPERATION DOMINIC
SHOT STATION CAMERA FILM
SUNSET MM PS48-3 112004

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+109.72	+0.30	-1.20	+177.52	+2279.85
+1.	+133.13	+0.63	-.46	+160.12	+1361.14
+2.	+152.35	+0.96	-.04	+154.83	+1150.81
+3.	+171.22	+1.29	+.25	+154.62	+1142.86
+4.	+185.20	+1.62	+.48	+152.68	+1072.98
+5.	+196.03	+1.95	+.66	+150.06	+984.07
+8.	+232.03	+2.94	+1.07	+150.72	+1005.79
+11.	+263.83	+3.93	+1.36	+152.59	+1069.96
+14.	+287.70	+4.92	+1.59	+152.11	+1052.97
+17.	+308.74	+5.90	+1.77	+151.69	+1038.65
+20.	+327.68	+6.89	+1.93	+151.33	+1026.21
+23.	+342.93	+7.88	+2.06	+150.10	+985.41
+26.	+359.76	+8.87	+2.18	+150.20	+988.61
+29.	+372.39	+9.86	+2.28	+149.04	+950.91
+32.	+385.01	+10.85	+2.38	+148.31	+927.98
+35.	+397.63	+11.84	+2.47	+147.92	+915.91
+38.	+410.78	+12.83	+2.55	+147.99	+918.00
+41.	+421.83	+13.82	+2.62	+147.52	+903.61
+44.	+432.52	+14.81	+2.69	+147.14	+891.91
+47.	+442.94	+15.80	+2.76	+146.84	+882.87
+50.	+452.32	+16.79	+2.82	+146.35	+868.32
+53.	+463.79	+17.78	+2.87	+146.67	+877.67
+56.	+472.13	+18.76	+2.93	+146.11	+861.03
+59.	+481.51	+19.75	+2.98	+145.98	+857.34
+62.	+490.89	+20.74	+3.03	+145.95	+856.33
+65.	+499.22	+21.73	+3.07	+145.69	+848.76
+68.	+507.56	+22.72	+3.12	+145.51	+843.57
+71.	+516.94	+23.71	+3.16	+145.70	+849.00
+74.	+525.28	+24.69	+3.20	+145.65	+847.59
+77.	+532.58	+25.68	+3.24	+145.37	+839.58
+80.	+540.91	+26.67	+3.28	+145.43	+841.42
+83.	+548.21	+27.66	+3.32	+145.27	+836.60
+86.	+555.50	+28.65	+3.35	+145.15	+833.19
+89.	+562.80	+29.63	+3.38	+145.08	+831.07
+92.	+570.10	+30.62	+3.42	+145.04	+830.10
+95.	+576.35	+31.61	+3.45	+144.78	+822.72
+98.	+584.69	+32.60	+3.48	+145.08	+831.23
+101.	+590.94	+33.59	+3.51	+144.89	+825.85
+104.	+596.15	+34.57	+3.54	+144.49	+814.33
+107.	+603.45	+35.56	+3.57	+144.62	+818.01
+110.	+609.70	+36.55	+3.59	+144.52	+815.38
+113.	+618.04	+37.53	+3.62	+144.95	+827.39
+116.	+623.25	+38.52	+3.65	+144.66	+819.21
+119.	+628.46	+39.51	+3.67	+144.40	+811.90
+122.	+634.71	+40.50	+3.70	+144.40	+812.03
+125.	+642.01	+41.48	+3.72	+144.66	+819.37
+128.	+646.18	+42.47	+3.74	+144.24	+807.45

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+131.	+651.39	+43.46	+3.77	+144.07	+802.80
+134.	+658.69	+44.44	+3.79	+144.39	+811.51
+137.	+663.90	+45.43	+3.81	+144.26	+807.87
+140.	+671.19	+46.42	+3.83	+144.59	+817.36
+143.	+675.36	+47.40	+3.85	+144.27	+808.34
+146.	+679.53	+48.39	+3.87	+143.97	+799.97
+149.	+685.78	+49.38	+3.89	+144.13	+804.34
+152.	+692.04	+50.36	+3.91	+144.30	+809.05
+155.	+698.29	+51.35	+3.93	+144.48	+814.03
+158.	+703.50	+52.34	+3.95	+144.45	+813.29
+161.	+707.67	+53.32	+3.97	+144.22	+806.95
+164.	+712.88	+54.31	+3.99	+144.22	+806.95
+167.	+717.05	+55.30	+4.01	+144.03	+801.43
+170.	+722.26	+56.28	+4.03	+144.05	+802.10
+173.	+727.47	+57.27	+4.04	+144.08	+803.05
+176.	+732.68	+58.26	+4.06	+144.13	+804.28
+179.	+737.90	+59.24	+4.08	+144.18	+805.77
+182.	+742.06	+60.23	+4.09	+144.04	+801.87
+185.	+748.32	+61.22	+4.11	+144.31	+809.50
+188.	+752.49	+62.20	+4.13	+144.19	+806.12
+191.	+757.70	+63.19	+4.14	+144.28	+808.59
+194.	+760.82	+64.18	+4.16	+143.98	+800.24
+197.	+766.04	+65.16	+4.17	+144.09	+803.16
+200.	+771.25	+66.15	+4.19	+144.20	+806.28
+203.	+774.37	+67.13	+4.20	+143.93	+798.77
+206.	+780.63	+68.12	+4.22	+144.25	+807.67

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SHOT	OPERATION		DOMINIC
SUNSET	STATION	CAMERA	FILM
	MM	PS4B-4	112005

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+112.61	+.37	-.99	+167.42	+1701.08
+1.	+147.33	+.84	-.16	+157.48	+1252.49
+2.	+172.64	+1.32	+.27	+154.39	+1134.25
+3.	+194.46	+1.79	+.58	+153.80	+1112.83
+4.	+211.83	+2.27	+.82	+152.52	+1067.45
+5.	+228.20	+2.74	+1.01	+152.29	+1059.44
+6.	+242.58	+3.22	+1.17	+151.89	+1045.47
+8.	+266.89	+4.17	+1.42	+150.71	+1005.34
+10.	+289.71	+5.12	+1.63	+150.71	+1005.50
+12.	+309.56	+6.07	+1.80	+150.45	+996.74
+13.	+320.47	+6.54	+1.87	+151.13	+1019.69
+14.	+325.93	+7.02	+1.94	+149.46	+964.64
+16.	+341.80	+7.97	+2.07	+149.00	+949.66
+18.	+354.89	+8.91	+2.18	+147.90	+915.18
+20.	+368.09	+9.86	+2.28	+147.33	+897.64
+22.	+381.30	+10.81	+2.38	+147.12	+891.23
+24.	+394.50	+11.76	+2.46	+147.19	+893.29
+26.	+406.88	+12.70	+2.54	+147.17	+892.96
+28.	+415.96	+13.65	+2.61	+146.20	+863.69
+30.	+428.34	+14.60	+2.68	+146.57	+874.69
+32.	+438.25	+15.54	+2.74	+146.24	+864.92
+34.	+447.33	+16.49	+2.80	+145.78	+851.58
+36.	+457.23	+17.43	+2.85	+145.73	+849.92
+38.	+465.48	+18.38	+2.91	+145.26	+836.38
+40.	+476.21	+19.32	+2.96	+145.66	+847.96
+42.	+483.64	+20.26	+3.00	+145.14	+832.84
+44.	+493.54	+21.21	+3.05	+145.44	+841.51
+46.	+500.97	+22.15	+3.09	+145.08	+831.21
+48.	+508.40	+23.09	+3.13	+144.80	+823.15
+50.	+517.48	+24.04	+3.17	+145.04	+830.19
+52.	+524.08	+24.98	+3.21	+144.65	+819.07
+54.	+532.33	+25.92	+3.25	+144.77	+822.46
+56.	+540.59	+26.86	+3.29	+144.94	+827.07
+58.	+548.84	+27.80	+3.32	+145.14	+832.80
+60.	+554.62	+28.74	+3.35	+144.72	+821.08
+62.	+560.40	+29.68	+3.39	+144.36	+810.84
+64.	+571.95	+30.62	+3.42	+145.51	+843.69
+66.	+572.20	+31.56	+3.45	+143.83	+795.94
+68.	+578.38	+32.50	+3.48	+143.69	+792.02
+70.	+587.03	+33.44	+3.50	+144.18	+805.84
+72.	+591.97	+34.38	+3.53	+143.80	+795.10
+74.	+599.39	+35.32	+3.56	+144.04	+801.82
+76.	+604.33	+36.25	+3.59	+143.71	+792.78
+78.	+609.27	+37.19	+3.61	+143.42	+784.65
+80.	+615.45	+38.13	+3.64	+143.44	+785.20
+82.	+622.87	+39.06	+3.66	+143.76	+794.16
+84.	+627.81	+40.00	+3.68	+143.54	+787.97

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FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+86.	+632.76	+40.94	+3.71	+143.34	+782.45
+88.	+640.17	+41.87	+3.73	+143.71	+792.74
+90.	+646.35	+42.81	+3.75	+143.82	+795.81
+92.	+652.53	+43.74	+3.77	+143.95	+799.30
+94.	+657.47	+44.68	+3.79	+143.82	+795.68
+96.	+662.42	+45.61	+3.82	+143.71	+792.57
+98.	+669.83	+46.54	+3.84	+144.14	+804.65
+100.	+674.77	+47.48	+3.86	+144.06	+802.29
+102.	+677.25	+48.41	+3.87	+143.46	+785.91
+104.	+683.43	+49.34	+3.89	+143.67	+791.63
+106.	+685.90	+50.28	+3.91	+143.12	+776.44
+108.	+692.08	+51.20	+3.93	+143.35	+782.85
+110.	+699.49	+52.13	+3.95	+143.85	+796.54
+112.	+700.73	+53.06	+3.97	+143.09	+775.72
+114.	+708.14	+53.99	+3.98	+143.60	+789.77
+116.	+713.09	+54.92	+4.00	+143.62	+790.32
+118.	+716.79	+55.85	+4.02	+143.41	+784.35
+120.	+721.74	+56.77	+4.03	+143.45	+785.47
+122.	+725.45	+57.70	+4.05	+143.25	+780.16
+124.	+729.15	+58.63	+4.07	+143.07	+775.19
+126.	+735.33	+59.56	+4.08	+143.38	+783.63
+128.	+739.04	+60.48	+4.10	+143.22	+779.16
+130.	+745.22	+61.41	+4.11	+143.54	+787.97
+132.	+747.69	+62.33	+4.13	+143.15	+777.50
+134.	+753.87	+63.26	+4.14	+143.49	+786.62
+136.	+757.58	+64.19	+4.16	+143.36	+783.08
+138.	+761.29	+65.11	+4.17	+143.24	+779.79
+140.	+766.23	+66.04	+4.19	+143.36	+783.04
+142.	+772.41	+66.96	+4.20	+143.71	+792.77
+144.	+776.12	+67.88	+4.21	+143.61	+790.02
+146.	+779.82	+68.81	+4.23	+143.52	+787.49
+148.	+786.00	+69.73	+4.24	+143.89	+797.62
+150.	+788.47	+70.66	+4.25	+143.58	+789.20
+152.	+793.42	+71.58	+4.27	+143.73	+793.38
+154.	+797.12	+72.50	+4.28	+143.67	+791.55
+156.	+802.07	+73.43	+4.29	+143.83	+796.01
+158.	+807.01	+74.35	+4.30	+144.00	+800.60
+160.	+810.72	+75.27	+4.32	+143.95	+799.21
+162.	+814.43	+76.19	+4.33	+143.90	+797.99
+164.	+818.13	+77.11	+4.34	+143.86	+796.92
+166.	+823.08	+78.03	+4.35	+144.05	+802.01
+168.	+825.55	+78.96	+4.36	+143.80	+795.24
+170.	+828.02	+79.88	+4.38	+143.57	+788.71
+172.	+835.44	+80.80	+4.39	+144.19	+805.98
+174.	+839.14	+81.72	+4.40	+144.17	+805.57

CONFIDENTIAL

	OPERATION		DOMINIC
SHOT	STATION	CAMERA	FILM
SUNSET	D	PS48-5	112003

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+96.02	+ .24	-1.41	+169.33	+1799.99
+1.	+124.89	+ .55	-.56	+157.87	+1268.00
+2.	+145.60	+ .87	-.13	+153.86	+1115.05
+3.	+165.27	+1.18	+.17	+154.38	+1134.16
+4.	+183.68	+1.50	+.40	+156.17	+1201.35
+5.	+195.86	+1.81	+.59	+154.32	+1131.86
+8.	+231.13	+2.75	+1.01	+154.03	+1121.29
+11.	+257.27	+3.70	+1.30	+152.42	+1063.74
+14.	+279.31	+4.64	+1.53	+151.11	+1019.01
+17.	+298.88	+5.58	+1.72	+150.18	+987.78
+20.	+316.35	+6.53	+1.87	+149.34	+960.66
+23.	+333.20	+7.47	+2.01	+149.03	+950.81
+26.	+348.17	+8.41	+2.13	+148.50	+934.04
+29.	+363.15	+9.35	+2.23	+148.45	+932.37
+32.	+375.63	+10.30	+2.33	+147.77	+911.18
+35.	+388.11	+11.24	+2.41	+147.43	+900.60
+38.	+399.96	+12.18	+2.50	+147.12	+891.17
+41.	+411.82	+13.12	+2.57	+147.03	+888.58
+44.	+423.05	+14.07	+2.64	+146.91	+884.96
+47.	+433.03	+15.01	+2.70	+146.53	+873.54
+50.	+441.77	+15.95	+2.76	+145.89	+854.65
+55.	+459.86	+17.52	+2.86	+146.27	+865.86
+60.	+474.21	+19.09	+2.94	+145.75	+850.50
+65.	+489.81	+20.66	+3.02	+145.86	+853.79
+70.	+502.29	+22.23	+3.10	+145.26	+836.39
+75.	+516.02	+23.80	+3.16	+145.22	+835.09
+80.	+526.63	+25.37	+3.23	+144.47	+813.74
+85.	+542.18	+26.93	+3.29	+145.21	+834.83
+90.	+553.63	+28.50	+3.35	+144.95	+827.61
+95.	+564.04	+30.07	+3.40	+144.55	+816.13
+100.	+574.44	+31.64	+3.45	+144.26	+807.85
+105.	+587.97	+33.20	+3.50	+144.82	+823.92
+110.	+599.42	+34.77	+3.54	+144.95	+827.39
+115.	+609.83	+36.34	+3.59	+144.89	+825.68
+120.	+620.23	+37.90	+3.63	+144.89	+825.85
+125.	+631.68	+39.47	+3.67	+145.20	+834.55
+130.	+641.05	+41.04	+3.71	+145.07	+831.04
+135.	+649.37	+42.60	+3.75	+144.77	+822.47
+140.	+660.82	+44.17	+3.78	+145.21	+835.08
+145.	+668.10	+45.73	+3.82	+144.79	+822.79
+150.	+677.47	+47.30	+3.85	+144.85	+824.71
+155.	+685.79	+48.86	+3.88	+144.74	+821.40
+160.	+696.20	+50.43	+3.92	+145.09	+831.56
+165.	+703.49	+51.99	+3.95	+144.83	+824.12
+170.	+711.81	+53.55	+3.98	+144.82	+823.80
+172.	+713.89	+54.18	+3.99	+144.57	+816.74
+174.	+718.06	+54.80	+4.00	+144.75	+821.76

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+176.	+720.14	+55.43	+4.01	+144.51	+815.04
+178.	+724.30	+56.05	+4.02	+144.70	+820.27
+180.	+727.42	+56.66	+4.03	+144.68	+819.72
+182.	+730.54	+57.30	+4.04	+144.66	+819.30
+184.	+732.62	+57.93	+4.05	+144.45	+813.20
+186.	+736.79	+58.55	+4.06	+144.64	+818.80
+188.	+739.91	+59.18	+4.08	+144.64	+818.73
+190.	+741.99	+59.80	+4.09	+144.44	+813.04
+192.	+746.15	+60.43	+4.10	+144.65	+818.90
+194.	+748.23	+61.05	+4.11	+144.46	+813.47
+196.	+752.40	+61.68	+4.12	+144.67	+819.49
+198.	+754.48	+62.30	+4.13	+144.49	+814.30
+200.	+758.64	+62.93	+4.14	+144.70	+820.47
+202.	+761.76	+63.55	+4.15	+144.73	+821.10
+204.	+763.84	+64.18	+4.16	+144.55	+816.25
+206.	+768.01	+64.80	+4.17	+144.78	+822.63
+208.	+770.09	+65.43	+4.18	+144.62	+817.99
+210.	+774.25	+66.05	+4.19	+144.85	+824.51
+212.	+776.33	+66.68	+4.19	+144.69	+820.06
+214.	+779.45	+67.30	+4.20	+144.73	+821.22
+216.	+781.54	+67.93	+4.21	+144.58	+816.99
+218.	+785.70	+68.55	+4.22	+144.82	+823.76
+220.	+788.82	+69.18	+4.23	+144.87	+825.14
+222.	+791.94	+69.80	+4.24	+144.92	+826.60
+224.	+795.06	+70.43	+4.25	+144.97	+828.12
+226.	+797.15	+71.05	+4.26	+144.84	+824.32
+228.	+800.27	+71.68	+4.27	+144.90	+826.00
+230.	+802.35	+72.30	+4.28	+144.77	+822.39
+232.	+806.51	+72.93	+4.28	+145.02	+829.54
+234.	+808.59	+73.55	+4.29	+144.90	+826.08
+236.	+810.67	+74.18	+4.30	+144.78	+822.73
+238.	+813.80	+74.80	+4.31	+144.85	+824.74
+240.	+815.88	+75.43	+4.32	+144.74	+821.55

MS

CONFIDENTIAL

	OPERATION STATION	CAMERA	DOMINIC FILM
SHOT SUNSET	D	PS4B-6	112002

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+120.47	+0.44	-.81	+166.86	+1672.56
+1.	+151.62	+0.91	-.08	+156.81	+1226.15
+2.	+174.97	+1.39	+0.33	+153.14	+1089.23
+3.	+195.46	+1.87	+0.62	+152.12	+1053.41
+4.	+212.26	+2.34	+0.85	+150.88	+1011.16
+5.	+231.12	+2.82	+1.03	+152.59	+1069.62
+8.	+270.45	+4.25	+1.44	+151.60	+1035.60
+11.	+302.01	+5.67	+1.73	+150.79	+1006.01
+14.	+327.23	+7.10	+1.96	+149.38	+961.76
+17.	+351.10	+8.52	+2.14	+148.96	+948.61
+20.	+370.19	+9.95	+2.29	+147.66	+907.63
+23.	+389.27	+11.37	+2.43	+147.18	+893.27
+26.	+406.32	+12.79	+2.54	+146.56	+874.34
+29.	+424.04	+14.21	+2.65	+146.64	+876.80
+32.	+439.04	+15.64	+2.74	+146.15	+862.27
+35.	+456.09	+17.06	+2.83	+146.63	+876.70
+38.	+469.04	+18.48	+2.91	+146.05	+859.50
+41.	+481.31	+19.89	+2.99	+145.51	+843.50
+44.	+494.95	+21.31	+3.05	+145.57	+845.20
+47.	+507.90	+22.73	+3.12	+145.58	+845.57
+50.	+520.17	+24.15	+3.18	+145.53	+844.30
+53.	+532.44	+25.56	+3.24	+145.61	+846.55
+56.	+541.30	+26.98	+3.29	+144.88	+825.50
+59.	+555.62	+28.39	+3.34	+145.70	+849.25
+62.	+561.47	+29.80	+3.39	+144.40	+812.03
+65.	+570.66	+31.22	+3.44	+144.07	+802.80
+68.	+577.80	+32.63	+3.48	+143.32	+782.02
+71.	+590.05	+34.04	+3.52	+143.90	+798.01
+74.	+600.26	+35.45	+3.56	+144.03	+801.68
+77.	+611.49	+36.86	+3.60	+144.46	+813.56
+80.	+621.70	+38.27	+3.64	+144.68	+819.92
+83.	+628.84	+39.67	+3.68	+144.25	+807.63
+86.	+637.01	+41.08	+3.71	+144.10	+803.46
+89.	+644.16	+42.49	+3.74	+143.77	+794.25
+92.	+654.37	+43.89	+3.78	+144.16	+805.07
+95.	+664.57	+45.30	+3.81	+144.57	+816.76
+98.	+671.72	+46.70	+3.84	+144.35	+810.60
+101.	+678.87	+48.10	+3.87	+144.17	+805.52
+104.	+684.99	+49.51	+3.90	+143.81	+795.47
+107.	+694.18	+50.91	+3.93	+144.12	+804.10
+110.	+700.30	+52.31	+3.95	+143.82	+795.77
+113.	+708.47	+53.71	+3.98	+143.97	+799.85
+116.	+715.62	+55.11	+4.00	+143.93	+798.81
+119.	+724.80	+56.51	+4.03	+144.32	+809.77
+122.	+730.93	+57.91	+4.05	+144.13	+804.25
+125.	+740.12	+59.31	+4.08	+144.55	+816.20
+128.	+745.22	+60.71	+4.10	+144.20	+806.29

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FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+131.	+754.41	+62.10	+4.12	+144.66	+819.11
+134.	+760.53	+63.50	+4.15	+144.54	+815.82
+137.	+765.64	+64.89	+4.17	+144.25	+807.68
+140.	+772.79	+66.29	+4.19	+144.36	+810.86
+143.	+779.93	+67.68	+4.21	+144.49	+814.45
+146.	+786.06	+69.08	+4.23	+144.44	+813.13
+149.	+791.16	+70.47	+4.25	+144.23	+807.01
+152.	+797.29	+71.86	+4.27	+144.21	+806.57
+155.	+803.41	+73.25	+4.29	+144.21	+806.52
+158.	+809.54	+74.64	+4.31	+144.22	+806.83
+161.	+812.60	+76.03	+4.33	+143.70	+792.44
+164.	+818.72	+77.42	+4.34	+143.74	+793.51
+167.	+826.89	+78.81	+4.36	+144.15	+804.78
+170.	+830.97	+80.19	+4.38	+143.85	+796.56
+173.	+839.14	+81.58	+4.40	+144.27	+808.30
+176.	+843.22	+82.96	+4.41	+144.00	+800.73
+179.	+847.31	+84.35	+4.43	+143.74	+793.60
+182.	+849.35	+85.73	+4.45	+143.15	+777.49
+185.	+853.43	+87.12	+4.46	+142.92	+771.27

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	OPERATION STATION 298	CAMERA PS4B-9	DOMINIC FILM 114754
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FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+	+105.22	+0.33	-1.09	+162.85	+1481.21
+1.	+130.09	+0.70	-.35	+150.01	+982.49
+2.	+158.30	+1.06	+0.06	+154.37	+1133.63
+3.	+176.00	+1.42	+0.35	+152.55	+1068.51
+4.	+194.65	+1.79	+0.58	+154.06	+1122.45
+5.	+208.52	+2.15	+0.76	+153.27	+1093.77
+9.	+258.74	+3.61	+1.28	+154.70	+1145.92
+13.	+294.13	+5.07	+1.62	+153.58	+1104.96
+17.	+322.35	+6.53	+1.87	+152.14	+1054.21
+21.	+348.18	+7.99	+2.07	+151.61	+1035.94
+25.	+371.14	+9.44	+2.24	+151.13	+1019.65
+30.	+400.31	+11.27	+2.42	+151.91	+1046.24
+35.	+420.92	+13.09	+2.57	+150.44	+996.53
+40.	+440.01	+14.91	+2.70	+149.28	+958.76
+45.	+459.90	+16.73	+2.81	+149.00	+949.86
+50.	+479.80	+18.55	+2.92	+149.16	+954.78
+55.	+497.30	+20.37	+3.01	+148.92	+947.17
+60.	+513.22	+22.19	+3.09	+148.51	+934.35
+65.	+529.93	+24.01	+3.17	+148.59	+936.78
+70.	+543.45	+25.83	+3.25	+148.00	+918.20
+75.	+559.37	+27.65	+3.31	+148.24	+925.77
+80.	+573.69	+29.47	+3.38	+148.21	+924.85
+85.	+587.21	+31.29	+3.44	+148.12	+921.87
+90.	+599.15	+33.11	+3.49	+147.75	+910.55
+95.	+613.47	+34.93	+3.55	+148.08	+920.81
+100.	+626.20	+36.74	+3.60	+148.12	+921.95
+104.	+635.75	+38.20	+3.64	+148.06	+920.15
+108.	+645.30	+39.65	+3.68	+148.06	+920.00
+112.	+654.85	+41.11	+3.71	+148.10	+921.32
+116.	+664.40	+42.56	+3.75	+148.18	+923.98
+120.	+671.56	+44.01	+3.78	+147.78	+911.55
+124.	+681.11	+45.47	+3.81	+147.95	+916.69
+128.	+689.86	+46.92	+3.84	+147.98	+917.55
+132.	+698.61	+48.37	+3.87	+148.04	+919.44
+136.	+704.98	+49.82	+3.90	+147.63	+906.82
+140.	+715.32	+51.28	+3.93	+148.08	+920.86
+144.	+723.28	+52.73	+3.96	+148.07	+920.36
+148.	+727.99	+54.18	+3.99	+147.42	+900.44
+152.	+735.13	+55.63	+4.01	+147.30	+896.82
+156.	+743.48	+57.08	+4.04	+147.45	+901.21
+160.	+750.62	+58.54	+4.06	+147.38	+899.07
+164.	+757.77	+59.99	+4.09	+147.33	+897.64
+168.	+762.54	+61.44	+4.11	+146.84	+882.98
+172.	+767.30	+62.89	+4.14	+146.39	+869.36
+176.	+775.65	+64.34	+4.16	+146.64	+876.72
+180.	+782.79	+65.79	+4.18	+146.67	+877.84
+184.	+789.94	+67.24	+4.20	+146.73	+879.45

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FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+188.	+799.47	+68.70	+4.22	+147.23	+894.78
+192.	+805.43	+70.15	+4.25	+147.10	+890.60
+196.	+810.20	+71.60	+4.27	+146.76	+880.48
+200.	+817.35	+73.05	+4.29	+146.87	+883.84
+204.	+822.11	+74.50	+4.31	+146.57	+874.83
+208.	+830.45	+75.95	+4.33	+146.92	+885.31
+212.	+836.41	+77.40	+4.34	+146.86	+883.47
+216.	+842.37	+78.85	+4.36	+146.81	+882.03
+220.	+850.71	+80.30	+4.38	+147.19	+893.41
+224.	+855.47	+81.75	+4.40	+146.96	+886.43
+228.	+859.05	+83.20	+4.42	+146.54	+873.84
+232.	+863.81	+84.65	+4.43	+146.34	+867.85
+236.	+870.96	+86.10	+4.45	+146.55	+874.17
+240.	+876.92	+87.54	+4.47	+146.57	+874.78
+244.	+881.69	+88.99	+4.48	+146.40	+869.78
+248.	+887.64	+90.44	+4.50	+146.44	+870.97
+252.	+893.60	+91.89	+4.52	+146.49	+872.42
+256.	+898.37	+93.34	+4.53	+146.35	+868.34
+260.	+900.75	+94.79	+4.55	+145.84	+853.23
+264.	+905.52	+96.24	+4.56	+145.73	+849.88

OPERATION DOMINIC

SHOT	STATION	CAMERA	FILM
SUNSET	299	PS4B-10	114750

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+.	+109.79	+0.33	-1.08	+169.58	+1813.48
+1.	+140.96	+0.67	-0.38	+164.67	+1565.84
+2.	+163.76	+1.01	+0.01	+162.55	+1467.70
+3.	+180.04	+1.35	+0.30	+159.24	+1324.06
+4.	+190.75	+1.69	+0.53	+154.27	+1129.92
+5.	+212.15	+2.04	+0.71	+159.49	+1334.55
+6.	+220.52	+2.38	+0.86	+155.86	+1189.41
+8.	+243.78	+3.06	+1.11	+155.81	+1187.41
+10.	+265.18	+3.74	+1.31	+156.40	+1210.34
+15.	+305.20	+5.44	+1.69	+154.94	+1154.83
+20.	+334.97	+7.14	+1.96	+152.53	+1067.83
+25.	+367.07	+8.84	+2.18	+153.47	+1101.04
+30.	+390.34	+10.54	+2.35	+152.12	+1053.34
+35.	+410.81	+12.24	+2.50	+150.81	+1008.81
+40.	+429.76	+13.94	+2.63	+149.78	+974.85
+45.	+446.17	+15.64	+2.75	+148.51	+934.33
+50.	+467.27	+17.34	+2.85	+149.26	+957.97
+55.	+482.90	+19.03	+2.94	+148.60	+936.93
+60.	+499.31	+20.73	+3.03	+148.49	+933.55
+65.	+514.15	+22.42	+3.11	+148.17	+923.62
+70.	+526.65	+24.12	+3.18	+147.42	+900.32
+75.	+539.94	+25.81	+3.25	+147.09	+890.30
+80.	+554.78	+27.50	+3.31	+147.34	+897.96
+85.	+568.07	+29.20	+3.37	+147.31	+896.96
+90.	+580.57	+30.89	+3.43	+147.19	+893.56
+95.	+593.07	+32.58	+3.48	+147.19	+893.49
+100.	+604.01	+34.27	+3.53	+146.90	+884.80
+104.	+614.17	+35.62	+3.57	+147.08	+890.13
+108.	+623.55	+36.98	+3.61	+147.12	+891.28
+112.	+634.49	+38.33	+3.64	+147.57	+904.92
+116.	+642.30	+39.68	+3.68	+147.33	+897.65
+120.	+650.90	+41.03	+3.71	+147.32	+897.23
+124.	+657.93	+42.38	+3.74	+146.99	+887.41
+128.	+667.30	+43.73	+3.77	+147.23	+894.60
+132.	+675.12	+45.08	+3.80	+147.15	+892.31
+136.	+683.71	+46.43	+3.83	+147.28	+896.16
+140.	+689.97	+47.77	+3.86	+146.93	+885.69
+144.	+697.00	+49.12	+3.89	+146.79	+881.33
+148.	+705.59	+50.47	+3.92	+147.00	+887.67
+152.	+713.41	+51.83	+3.94	+147.06	+889.43
+156.	+719.66	+53.18	+3.97	+146.82	+882.26
+160.	+723.25	+54.54	+3.99	+146.07	+860.04
+164.	+729.08	+55.90	+4.02	+145.81	+852.26
+168.	+736.06	+57.26	+4.04	+145.80	+852.00
+172.	+743.05	+58.62	+4.07	+145.81	+852.31
+176.	+751.20	+59.97	+4.09	+146.07	+859.81
+180.	+757.03	+61.33	+4.11	+145.88	+854.52

FRAME	DIA(M)	TIME(MS)	LN(TIME)	PHI	YIELD(KT)
+184.	+762.85	+62.69	+4.13	+145.72	+849.84
+188.	+768.67	+64.05	+4.15	+145.58	+845.74
+192.	+774.50	+65.41	+4.18	+145.46	+842.17
+196.	+782.65	+66.77	+4.20	+145.79	+851.70
+200.	+788.47	+68.12	+4.22	+145.69	+848.96
+204.	+794.30	+69.48	+4.24	+145.62	+846.68
+208.	+798.96	+70.84	+4.26	+145.34	+838.69
+212.	+803.61	+72.20	+4.27	+145.08	+831.24
+216.	+812.03	+73.56	+4.29	+145.51	+843.62
+220.	+814.37	+74.92	+4.31	+144.87	+825.09
+224.	+821.39	+76.27	+4.33	+145.07	+830.86
+228.	+826.07	+77.63	+4.35	+144.87	+825.14
+232.	+835.43	+78.99	+4.36	+145.50	+843.19
+236.	+842.45	+80.35	+4.38	+145.72	+849.74
+240.	+849.47	+81.71	+4.40	+145.95	+856.52
+244.	+854.15	+83.07	+4.41	+145.79	+851.81
+248.	+861.17	+84.43	+4.43	+146.04	+859.06
+252.	+865.85	+85.79	+4.45	+145.90	+854.91
+256.	+868.19	+87.15	+4.46	+145.38	+839.71
+260.	+877.55	+88.51	+4.48	+146.04	+858.97
+264.	+877.55	+89.87	+4.49	+145.15	+833.18

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APPENDIX E

Determination of Yield by Mach Scaling

- A Site, Film No. 112000
- A Site, Film No. 112001
- MM Site, Film No. 112005
- MM Site, Film No. 112004
- D Site, Film No. 112003
- D Site, Film No. 112002
- Aircraft 298, Film No. 114754
- Aircraft 299, Film No. 114750
- Six-film composite

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OPERATION STATION CAMERA FILM
DOMINIC
SHOT STATION CAMERA FILM
SUNSET A PS4B-1 112000

W(KT)= +812.23 DW(KT)= +7.32

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+483.09	+13.60	+808.67
+25.00	+526.77	+11.99	+811.63
+30.00	+565.74	+10.81	+813.98
+35.00	+601.15	+9.89	+815.41
+40.00	+633.75	+9.16	+815.88
+45.00	+664.06	+8.55	+815.43
+50.00	+692.46	+8.04	+814.13
+55.00	+719.22	+7.59	+812.04
+60.00	+744.57	+7.21	+809.25
+65.00	+768.67	+6.87	+805.83

A=+.52591E+02 B=+.11503E+03 C=+.57324E+01 D=-.37731E-00
D2=+.72000E+02 P=+.84900E+03 T=+.28900E+03 C0=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

OPERATION DOMINIC
SHOT STATION CAMERA FILM
SUNSET A P54B-2 112001

W(KT)= +805.71 DW(KT)= +12.64

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+483.46	+13.49	+797.48
+25.00	+526.80	+11.89	+798.59
+30.00	+565.46	+10.73	+800.64
+35.00	+600.63	+9.83	+802.97
+40.00	+633.05	+9.11	+805.24
+45.00	+663.24	+8.52	+807.33
+50.00	+691.58	+8.03	+809.17
+55.00	+718.34	+7.60	+810.73
+60.00	+743.74	+7.23	+812.00
+65.00	+767.95	+6.90	+812.99

A=+.48214E+02 B=+.12120E+03 C=+.36412E+01 D=-.17815E-00
D2=+.93000E+02 P=+.84900E+03 T=+.28900E+03 CO=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

SHOT	OPERATION	CAMERA	DOMINIC
SUNSET	STATION	PS4B-3	FILM
	MM		112004

W(KT)= +783.82 DW(KT)= +5.64

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+484.15	+13.37	+785.78
+25.00	+527.05	+11.77	+782.32
+30.00	+565.28	+10.60	+781.05
+35.00	+600.03	+9.71	+780.98
+40.00	+632.06	+9.00	+781.59
+45.00	+661.88	+8.42	+782.60
+50.00	+689.88	+7.93	+783.85
+55.00	+716.33	+7.51	+785.23
+60.00	+741.44	+7.15	+786.68
+65.00	+765.40	+6.83	+788.15

A=+.44604E+02 B=+.12639E+03 C=+.20792E+01 D=-.60729E-01
D2=+.34000E+02 P=+.84900E+03 T=+.28900E+03 CO=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

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OPERATION DOMINIC

SHOT	STATION	CAMERA	FILM
SUNSET	MM	PS4B-4	112005

W(KT)= +770.99 DW(KT)= +37.48

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+482.01	+13.29	+766.63
+25.00	+524.58	+11.66	+757.35
+30.00	+562.45	+10.50	+753.98
+35.00	+596.87	+9.63	+754.72
+40.00	+628.64	+8.94	+758.50
+45.00	+658.31	+8.39	+764.64
+50.00	+686.27	+7.94	+772.70
+55.00	+712.80	+7.55	+782.36
+60.00	+738.11	+7.23	+793.39
+65.00	+762.40	+6.95	+805.63

A=+.10939E+02 B=+.15295E+03 C=-.51089E+01 D=+.55557E-00
D2=+.13000E+03 P=+.84900E+03 T=+.28900E+03 CO=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

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SHOT	OPERATION	CAMERA	DOMINIC
SUNSET	STATION	PS4B-5	FILM
	D		112003

W(KT)= +814.55 DW(KT)= +19.59

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+482.86	+13.57	+804.28
+25.00	+526.42	+11.95	+804.55
+30.00	+565.26	+10.77	+806.35
+35.00	+600.56	+9.87	+808.95
+40.00	+633.11	+9.15	+811.97
+45.00	+663.42	+8.56	+815.20
+50.00	+691.89	+8.07	+818.54
+55.00	+718.79	+7.64	+821.90
+60.00	+744.35	+7.28	+825.24
+65.00	+768.73	+6.96	+828.55

A=+.35634E+02 B=+.12916E+03 C=+.18553E+01 D=-.34763E-01
D2=+.61000E+02 P=+.84900E+03 T=+.28900E+03 C0=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

[REDACTED]

SHOT	OPERATION STATION	CAMERA	DOMINIC FILM
SUNSET	D	PS4B-6	112002

W(KT)= +792.09 DW(KT)= +15.84

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+482.41	+13.45	+787.10
+25.00	+525.56	+11.83	+784.87
+30.00	+564.01	+10.67	+784.92
+35.00	+598.96	+9.77	+786.29
+40.00	+631.19	+9.06	+788.48
+45.00	+661.21	+8.48	+791.21
+50.00	+689.40	+7.99	+794.31
+55.00	+716.06	+7.58	+797.66
+60.00	+741.39	+7.22	+801.19
+65.00	+765.57	+6.90	+804.84

A=+.35562E+02 B=+.13089E+03 C=+.10967E+01 D=+.26092E-01
D2=+.13100E+03 P=+.84900E+03 T=+.28900E+03 CO=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

OPERATION DOMINIC
SHOT STATION CAMERA FILM
SUNSET 298 PS4B-9 114754

W(KT)= +869.70 DW(KT)= +72.90

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+493.82	+13.97	+911.37
+25.00	+538.56	+12.25	+905.71
+30.00	+578.26	+10.99	+898.46
+35.00	+614.16	+10.01	+889.70
+40.00	+647.05	+9.22	+879.60
+45.00	+677.48	+8.56	+868.35
+50.00	+705.85	+8.01	+856.13
+55.00	+732.45	+7.53	+843.10
+60.00	+757.53	+7.11	+829.40
+65.00	+781.26	+6.74	+815.15

A=+.45127E+02 B=+.12038E+03 C=+.63356E+01 D=-.54672E-00
D2=+.98000E+02 P=+.84900E+03 T=+.28900E+03 CO=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

OPERATION STATION CAMERA DOMINIC FILM
SHOT
SUNSET 299 PS4B-10 114750

W(KT)= +818.89 DW(KT)= +102.38

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+492.16	+13.72	+870.49
+25.00	+536.19	+12.07	+867.55
+30.00	+575.34	+10.84	+860.51
+35.00	+610.75	+9.86	+849.89
+40.00	+643.15	+9.07	+836.26
+45.00	+673.07	+8.41	+820.14
+50.00	+700.88	+7.84	+801.99
+55.00	+726.87	+7.34	+782.18
+60.00	+751.26	+6.90	+761.04
+65.00	+774.24	+6.51	+738.86

A=+.79609E+02 B=+.95702E+02 C=+.12119E+02 D=-.10377E+01
D2=+.30100E+03 P=+.84900E+03 T=+.28900E+03 C0=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

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SHOT	OPERATION STATION	CAMERA	DOMINIC FILM
SUNSET	A	PS4B-1	112000
SUNSET	A	PS4B-2	112001
SUNSET	D	PS4B-6	112002
SUNSET	D	PS4B-5	112003
SUNSET	MM	PS4B-3	112004
SUNSET	MM	PS4B-4	112005

W(KT)= +798.74 DW(KT)= +7.65 *

TIME(MS)	DIAM(M)	MACH NO.	W(KT)
+20.00	+482.51	+13.48	+791.27
+25.00	+525.82	+11.89	+793.94
+30.00	+564.49	+10.73	+796.67
+35.00	+599.66	+9.83	+798.95
+40.00	+632.07	+9.11	+800.62
+45.00	+662.23	+8.51	+801.63
+50.00	+690.52	+8.01	+802.00
+55.00	+717.21	+7.58	+801.75
+60.00	+742.52	+7.20	+800.94
+65.00	+766.61	+6.87	+799.59

A=+.55336E+02 B=+.11496E+03 C=+.52439E+01 D=-.31497E-00
D2=+.14100E+04 P=+.84900E+03 T=+.28900E+03 C0=+.34249E-00
DATA FIT BETWEEN T= +5.00 AND T= +80.00

* Limits apply to scatter in this tabulation only.

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APPENDIX F
Fireball Photographs

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Station: D Site

Film No: 112003

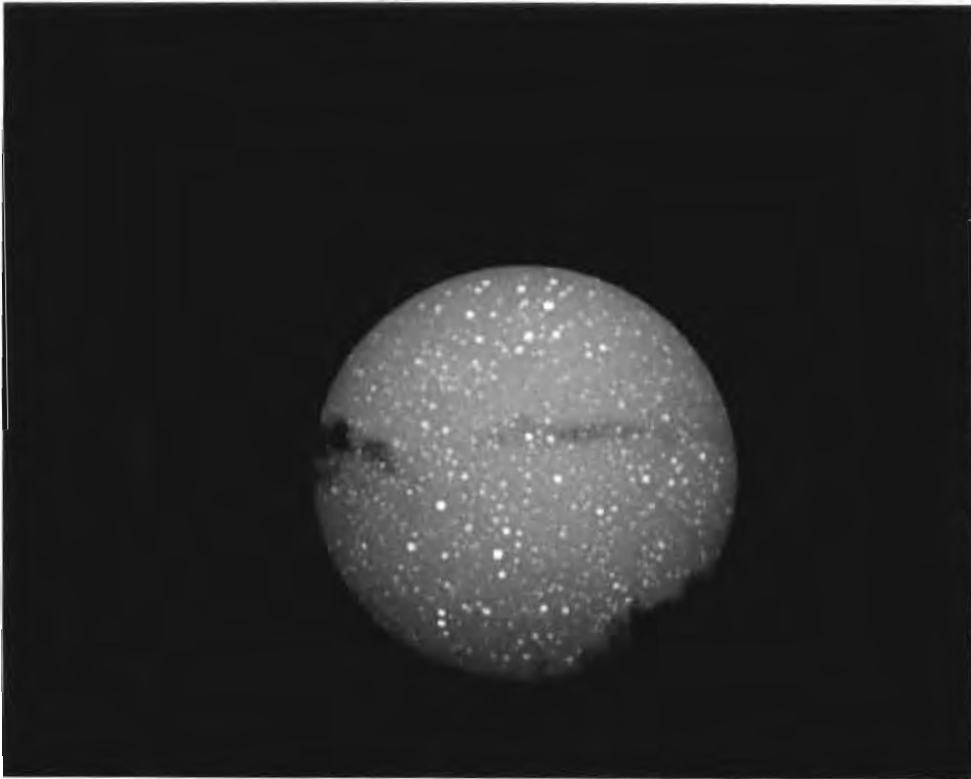
Camera: PS4B-5

Time: 0.24 msec (zero frame)

-99-

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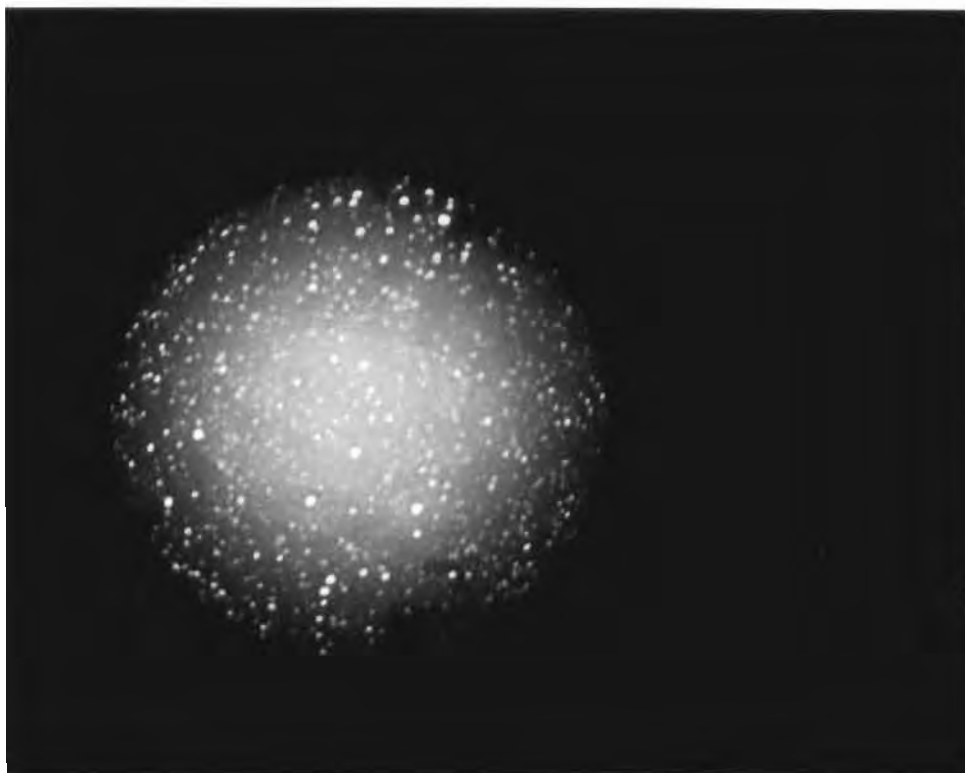


Station: MM Site
Film No: 112004
Camera: PS4B-3
Time: 63.19 msec

-100-

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Station: A Site

Film No: 112001

Camera: PS4B-2

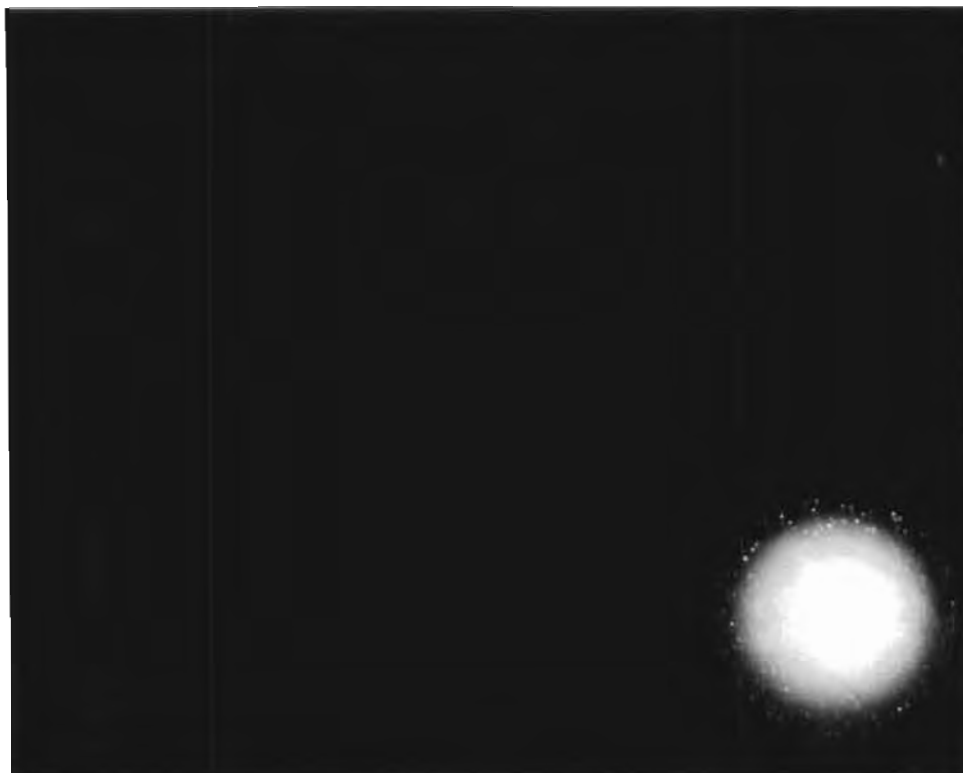
Time: 83.49 msec

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102

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Station: Aircraft 298

Film No: 114754

Camera: PS4B-4

Time: 119.08 msec

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103

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Station: Aircraft 299

Film No: 114753

Camera: M-44

Time: 0.47 sec

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104

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