DEPARTMENTAL MEMORANDUM

Del Mar Engineering Laboratories

TO: F. H. McCollum

NO.:

FROM: R. E. Murray

DATE: 23 September 1957

SUBJECT: Thornton Flare Test, Data Reduction

Summary:

A Del Mar Engineering Laboratories target flare and a missile tracking flare type MK II may be resolved at sea level with a slant range of 18,920 feet when separated 3.6 feet. The flare images separate at 4.09 feet from center to center. Photographic flare diameters are more than 100 times the emulsion grain cross section.

Data and Calculations:

Photographic Film: Type RK, Plus X

Development: STD. DK76 Normal

Camera: Eyemo #71 by Bell and Howell

Frame Rate: 20 F/Sec.

Slit Angle: Approx. 32°

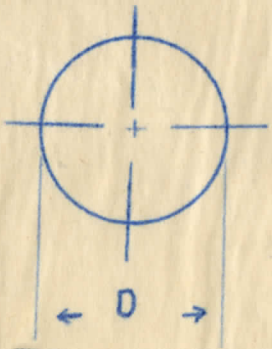
Lens: f16; focal length: 10 in., f4.5

Background: Hazy blue sky, back lighting at 24:00 P.S.T.

Roll: #3; Take: #1

Magnification: 100:1 from optical comparator

Frame: #6; Slide: #1



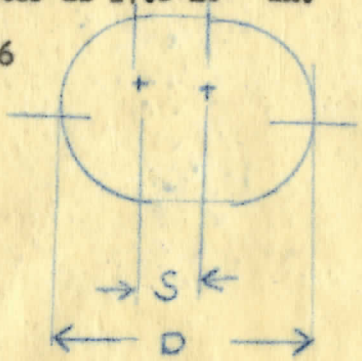
10^{-4} $\frac{\text{Units}}{\text{inch}}$

Oper. #1			Oper. #2		
$A \cdot 10^{-4}$	$B \cdot 10^{-4}$	$D \cdot 10^{-4}$	$A \cdot 10^{-4}$	$B \cdot 10^{-4}$	$D_2 \cdot 10^{-4}$
+36.5	+7.5	29.0	25.0	0.5	24.5
36.0	8.2	27.8	29.0	2.0	27.0

Oper. #1					Oper. #2
36.0	4.0	32.0	28.5	2.9	25.6

$\therefore$ Flare photo diameter is $27.6 \cdot 10^{-4}$ In.

Frame: #88 Slide: #6



Oper. #1	Oper. #2
$D \cdot 10^{-4}$	$D \cdot 10^{-4}$
46.0	47.0
45.0	48.5
45.0	48.0

$\therefore$ Flare photo eliptical major

Axis (D) is $46.6 \cdot 10^{-4}$ In.

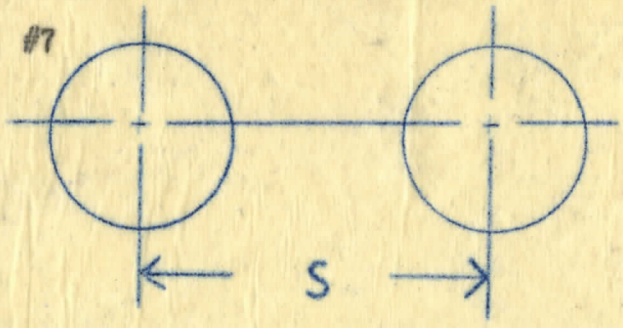
Subtracting two times one half photo flare diameter of Frame #6 from above gives -

$$S = 46.6 \cdot 10^{-4} \text{ In.} - 27.6 \cdot 10^{-4} \text{ In.}$$

$$S = 19.0 \cdot 10^{-4} \text{ In.}$$

$\therefore$ Flare photo center separation is $19.0 \cdot 10^{-4}$ In.

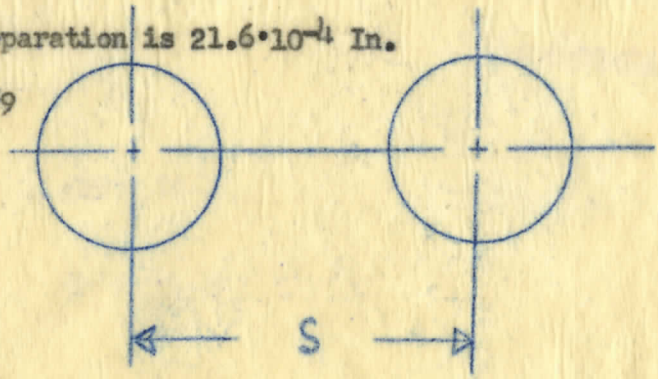
Frame: #93 Slide: #7



Oper. #1	Oper. #2
$S \cdot 10^{-4}$	$S \cdot 10^{-4}$
21.0	22.0
20.5	22.5
21.5	22.0

∴ Flare photo center separation is $21.6 \cdot 10^{-4}$ In.

Frame: #356 Slide: #9



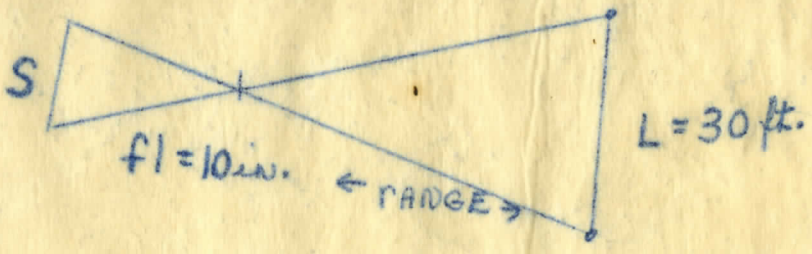
Constant separation of flares at 30 feet and 3 frames before MK II burnout.

MKII burnout at frame #359

Oper. #1	Oper. #2
$S \cdot 10^{-4}$	$S \cdot 10^{-4}$
158.0	155.0
163.0	157.5

∴ Flare photo center separation is $158.4 \cdot 10^{-4}$ In. at 30 feet separation.

Range Solution:



From: Frame #356

Camera lens focal length (fl) 10 In., assumed to be accurate.

Photographic image = S

We have

$$R = \frac{L \cdot FL}{S} \text{ ft.}$$

$$R = \frac{10 \cdot 30 \text{ Ft.}}{1.584 \cdot 10^{-2}} = 1.892 \cdot 10^{+4} \text{ Ft.}$$

∴ Slant Range of test is 18,920 feet from Trancas Cafe to Point Dume

Eleptical Separation Solution:

From Frame #88 $S_6 = 19 \cdot 10^{-4}$ In.

From Frame #356 $S_9 = 158.4 \cdot 10^{-4}$ In.

$$\text{Eleptical Separation} = 19 \cdot 10^{-4} \cdot \frac{1.89 \cdot 10^{-4} \text{ Ft.}}{10}$$

Eleptical Separation = 3.6 feet

∴ Best separation is .36 feet at 18,920 feet range for eliptically merging flares.

Individual Separation Solution:

From Frame #93 $S_7 = 27.6 \cdot 10^{-4}$ In.

From Frame #356 $S_9 = 158.4 \cdot 10^{-4}$ In.

$$\text{Individual Separation} = 21.6 \cdot 10^{-4} \cdot \frac{1.89 \cdot 10^{+4}}{10}$$

Individual Separation = 4.09 feet

R. E. Murray, E.E.

REM/k
cc: File (3)