

KOLLSMAN'S RATIONALE REGARDING

APOLLO 16 INVERTED IMAGE

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## KOLLSMAN's RATIONALE REGARDING APOLLO 16

### INVERTED IMAGE

#### 1.0 INTRODUCTION

1.1 Astronaut Tom Mattingly reported that he observed an inverted earth mirror - like image on the SXT reticle during the "P23" optical sight maneuver. It was also reported that the inverted image was very much less intense (brightness) than the earth horizon (limb) observed at the same time on the SXT reticle. (Refer to the attached Appendix A for the voice down-link transcript).

#### 2.0 FLIGHT PARAMETERS AT TIME OF P23 OBSERVATION

2.1 The following data are obtained from MSC Mission Control data down-link and from MIT Mission Support Center.

a) Distance of Space Vehicle from earth = approx. 48,900  
nautical miles.

b) Star Code and GET

No. 235: 9 hr. 58 min. 23.1 sec

No. 234: 10 hr. 13 min. 14.4 sec.

\* c) SXT trunnion angle =  $10.179^{\circ}$

SXT shaft angle =  $76.340^{\circ}$

\* Actual markings between star Code No. 235 and No. 234.

d) Space Vehicle Substellar Point =

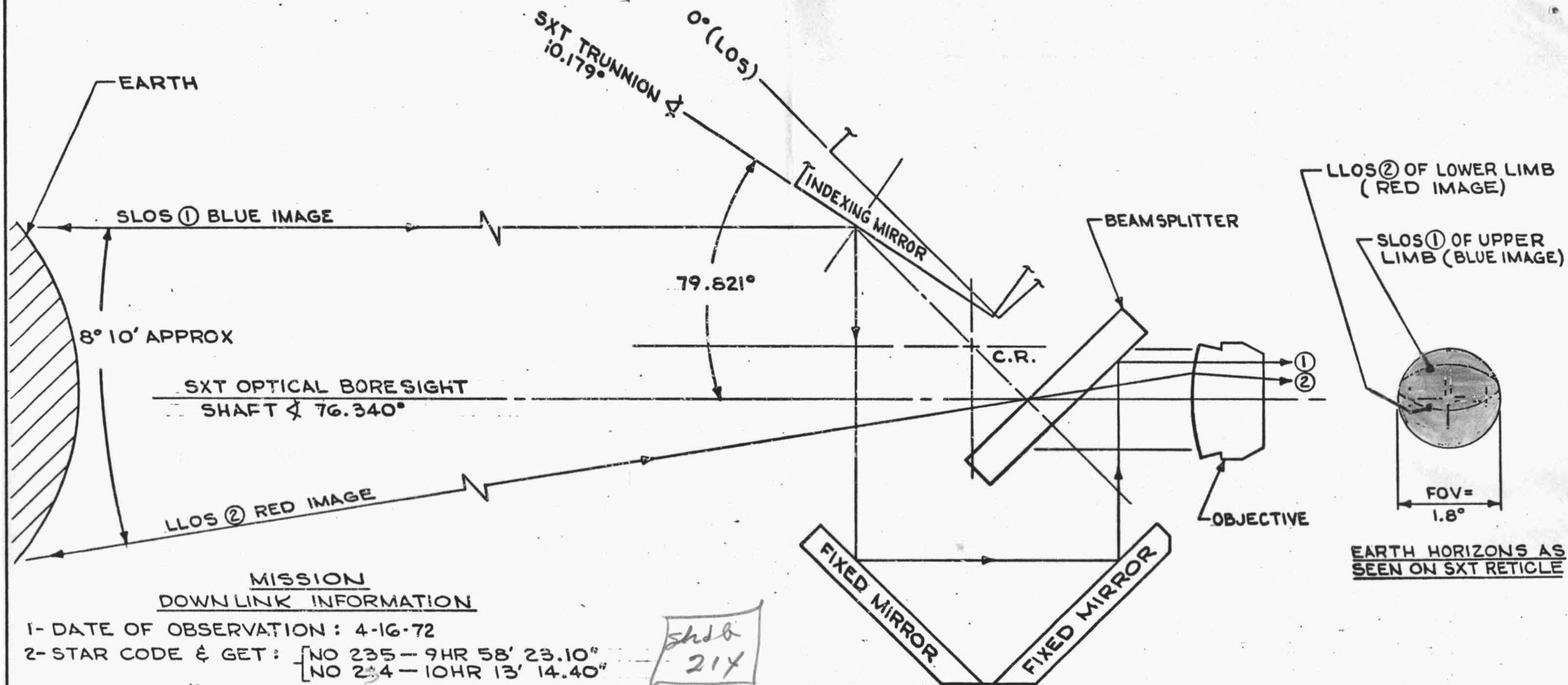
latitude:  $N29^{\circ}$

longitude:  $E80^{\circ}$

### 3.0 RATIONALE FOR OBSERVATION OF INVERTED EARTH IMAGE IN THE SXT

Based upon the actual known parameters of Paragraph 2.0, it appears that the Astronaut did not see an inverted earth image through the SXT; but was actually sighting on both of the upper and lower curvature - limbs of the earth. Kollsman further rationalizes that the SXT LLOS (Landmark - Line-of-Sight) was directed on the lower limb, and the SLOS (Star - Line-of-Sight) trunnion indexing mirror was sighting on the upper limb of the earth. Refer to Figure 1 and Figure 2 for a better pictorial correlation. The SLOS of the upper limb would be more intense (brightness - approx. 7X) than the LLOS of the lower limb. This condition was normal since the luminous transmission ratio of the SLOS to LLOS of OUA S/N 17 was seven to one.





#### MISSION DOWNLINK INFORMATION

- 1- DATE OF OBSERVATION : 4-16-72
- 2- STAR CODE & GET : [NO 235 - 9HR 58' 23.10"  
NO 214 - 10HR 13' 14.40"]
- 3- TRUNNION  $\angle$  AND SHAFT  $\angle$  BETWEEN STAR CODE NO 235 & 214 [TRUNNION  $\angle$  : 10.179°  
SHAFT  $\angle$  : 76.340°
- 4- POSITION OF C/M AT TIME OF SIGHTING : LATITUDE = 29°N  
LONGITUDE = 30°E [SUBSTELLER LOCATION
- 5- P23 PROGRAM (SUN BEHIND VEHICLE)
- 6- ATTENUATION =  $\frac{\text{SLOS}}{\text{LLOS}}$   
FACTOR "d"  $\alpha = \frac{45.0}{6.2}$   
 $\alpha = 7.2/1$
- 7- C.R. = CENTER OF ROTATION OF INDEXING MIRROR.

KOLLSMAN'S RATIONAL TO  
"INVERTED EARTH'S IMAGE"  
OBSERVED IN APOLLO 16TH  
MISSION

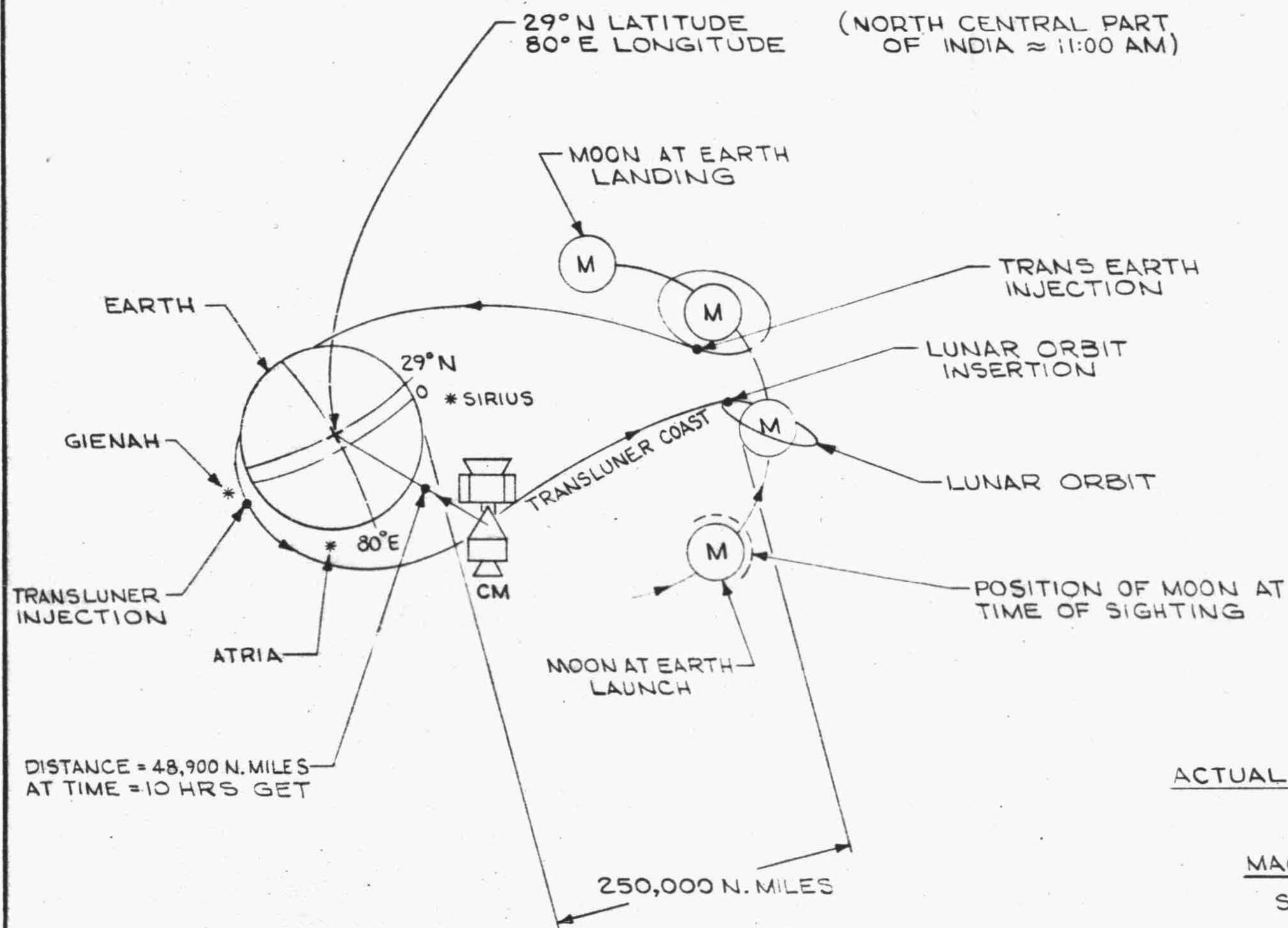
FIGURE 1

SCALE - NONE

Kollsman Instrument Corporation  
875 Underhill Boulevard, Syosset, New York 11791  
Subsidiary of Standard Kollsman Industries Inc. **sk**

(5-2-72) CONCEPT INITIATED BY - W. CHIN & W. MAYO





ACTUAL PRESELECTED STARS USED IN  
P23 SIGHTING

MAGNITUDE

SIRIUS ——— -1.6

GIENAH ——— +2.8

ATRIA ——— +1.9

OTHER STARS USED IN P23

STAR CODE NO 235 } GHA \* AND DECLINATION \*s  
NO 234 } PRESENTLY NOT KNOWN BY  
KOLLSMAN

SCALE - NONE

APOLLO 16 ATTITUDE AND MISSION PHASE  
FIGURE 2

**Kollsman Instrument Corporation**  
575 Underhill Boulevard, Syosset, New York 11791  
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## APPENDIX A

10:00 GET Tom Mattingly's comments on P-23 --

"About those reflections in SXT when doing P-23's and the beautiful picture of the earth's horizon. The Optics are just super and we got a what looks like an inverted sort-a-like a mirror image in the opposite side away from the horizon. Its really quite obvious and you can just see the bright areas ((ground control) that's in the SXT)..yes.. just in the SXT and its about-oh-I don't know how to give you a percentage of the intensity, but its very much less intense than the thing of the earth-its very bright-on-the star is a match between the earth's horizon and the fixed LOS and the SLOS is just perfect."