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September 1964

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TECHNICAL PUBLICATION

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9 OCT 1964

PHOTOGRAPHIC EVALUATION REPORT

MISSION 4008

19 MAY 1964

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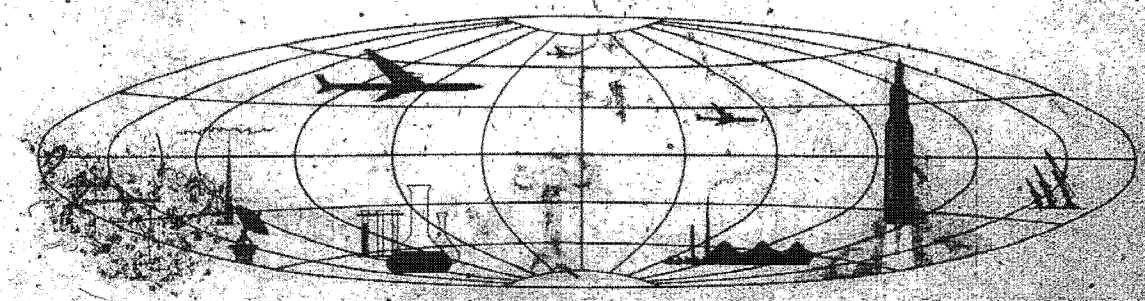

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PHOTOGRAPHIC EVALUATION REPORT
MISSION 4008
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September 1964

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LIST OF ILLUSTRATIONS

All photographs are positives, produced directly from the original negatives.

LIST OF ILLUSTRATIONS (CONTINUED)

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SYNOPSIS

Mission 4008 was launched 19 May 1964. The camera system was operational through pass D16, completing ten photographic passes before initiation of the recovery command on pass D34. The decision to recover the payload capsule before the programmed mission duration was completed came about because of indications of control gas problems and vehicle instability on pass D16. The imagery on pass D16 photography was severely degraded by this vehicle instability.

Mission 4008 included successful orbit adjustments on two passes. The first orbit adjust was during pass D02. It was necessary because of high temperatures caused by the low perigee (57 nm) on pass D01. The orbit adjust increased the perigee to 84 nm. The second orbit adjust was on pass D11. This was a programmed adjustment which reduced the perigee to 70.2 nm and allowed more accurate coverage of programmed targets.

The best photography on this mission is equal to the best obtained from previous missions in the 4000 series. The payload consisted of 128 photographic frames (109 operational, 19 domestic) which covered 55 targets in the preliminary target readout. Mission 4008 obtained coverage of two Controlled Range Network (CORN) targets, and photographed for the first time the RB-47 "Blackbird". The main camera fiducial line, timing track, and timing track binary words were operational throughout the mission. Clouds obscured 40 percent of the mission. The stellar and index cameras were operational for 20 exposures before a circuitry malfunction occurred in the system. The 20 index camera exposures contained intermittent transverse bands of fog, dendritic static along both edges and vignetted corners. The stellar material was grossly overexposed, but to a lesser extent than in Mission 4007.

GENERAL FLIGHT DATA

Date of Launch: 19 May 1964 19217Z

Orbital Parameters

	Planned	Actual (revolution 1 preceded by orbit adjust on revolution 2)
Period:	89.9 Min	89.87 Min
Perigee:	92 NM	82.0 NM
Apogee:	210 NM	222.2 NM
Eccentricity:	0.01730	0.019009
Inclination Angle:	101.0°	113.971°

PART I. CAMERA OPERATION

1. Main Camera No FM-8: The main camera was operational throughout the mission. Four fine minus density streaks occur parallel to the film edges throughout the mission. One streak is 2.26" from the timing track edge of the film, and the center streak of the remaining closely aligned three is 3.75" from the same edge. Rows of small static discharges, associated with the group of streaks, are noticeable in the wrap-up of passes D10 and D14. A continuous scratch,

with a plus density area bordering it, is present 0.42" from and parallel to the non-timing-track edge of the film. Transverse banding (parallel to the minor axis of the film) associated with looper loading action is present on long strip frames. Groups of emulsion digs, similar to those reported on Mission 4007, are noted occasionally along the non-timing-track edge of the format area. Dendritic static, emanating from the non-timing-track edge of the film, occurs on pass D05, frame 06.

2. Stellar Camera No D-32: The stellar camera was operational for only 20 exposures.* All 20 frames are grossly overexposed and contain no stellar imagery.

3. Index Camera No D-26: The index camera was operational for only 20 exposures.* All 20 frames are affected by a light leak which caused intermittent fogged transverse bands extending edge to edge. These, plus density bands, seem to be emanating from the side opposite the camera number. Both film edges have intermittent dendritic static discharges. Slight vignetting of the four format corners occurs on each frame.

4. Collateral Equipment: The fiducial line, timing track, and binary time track were well defined and operational throughout the mission.

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*A [illegible] malfunction affected both stellar and index cameras and is the probable cause of the [illegible] operating times.

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FIGURE 1. DEGRADATIONS PRESENT ON INDEX CAMERA FRAMES

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Dendritic static discharges and light leak degradations on a typical index camera frame.

Pass: D04
Frame: 08
Index: 09
Enlargement: 2x

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PART II. FILM

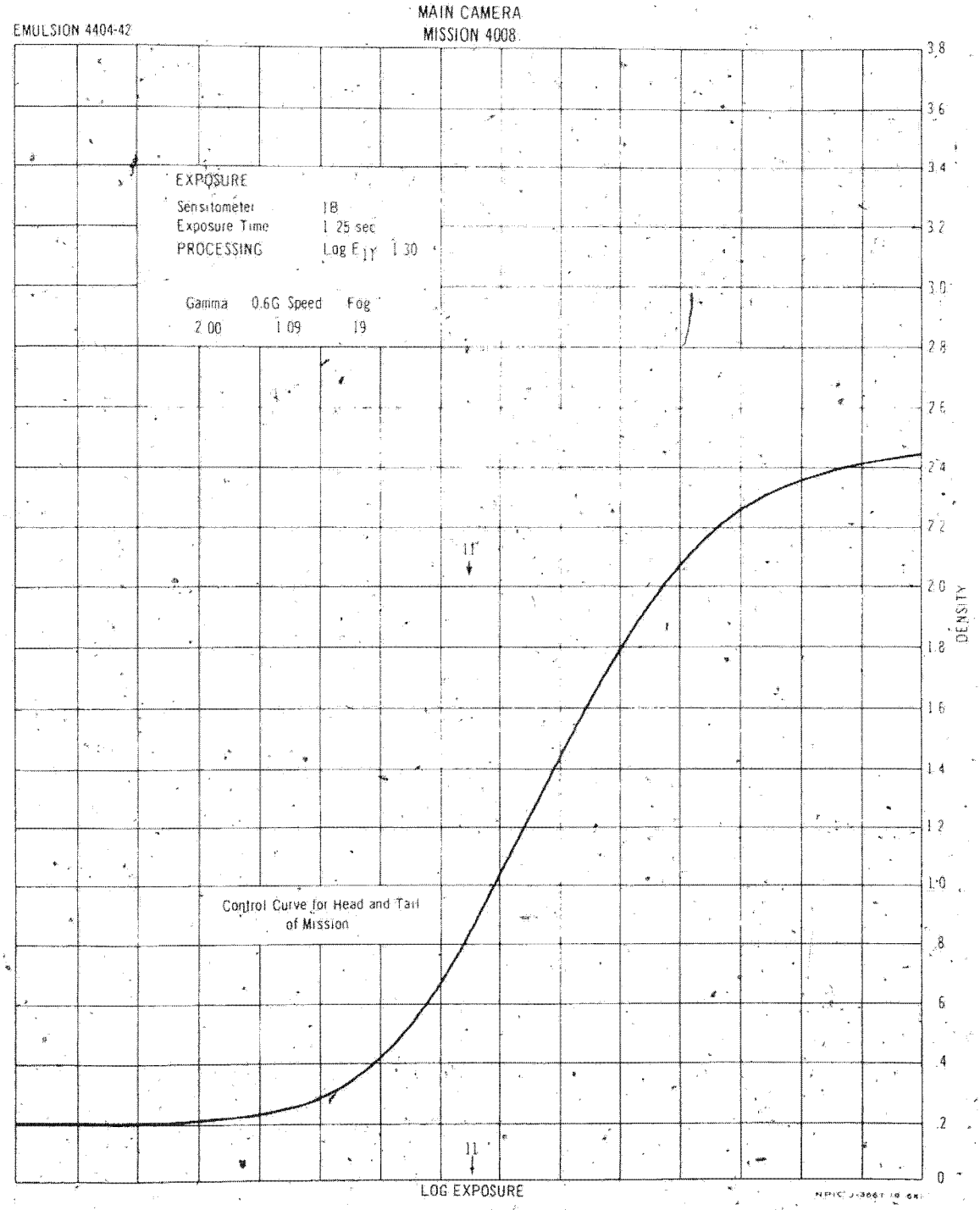
1. Film Processing: This section provides a descriptive evaluation of the exposure and processing, and comments on the exposure, density, processing, and the physical condition of the original negatives. Pertinent data were collected during various phases of the processing and again during the evaluation of the negatives. This is a standard procedure. The community is immediately informed by cable of any defects in the photography which seriously affect the PI suitability of the mission.

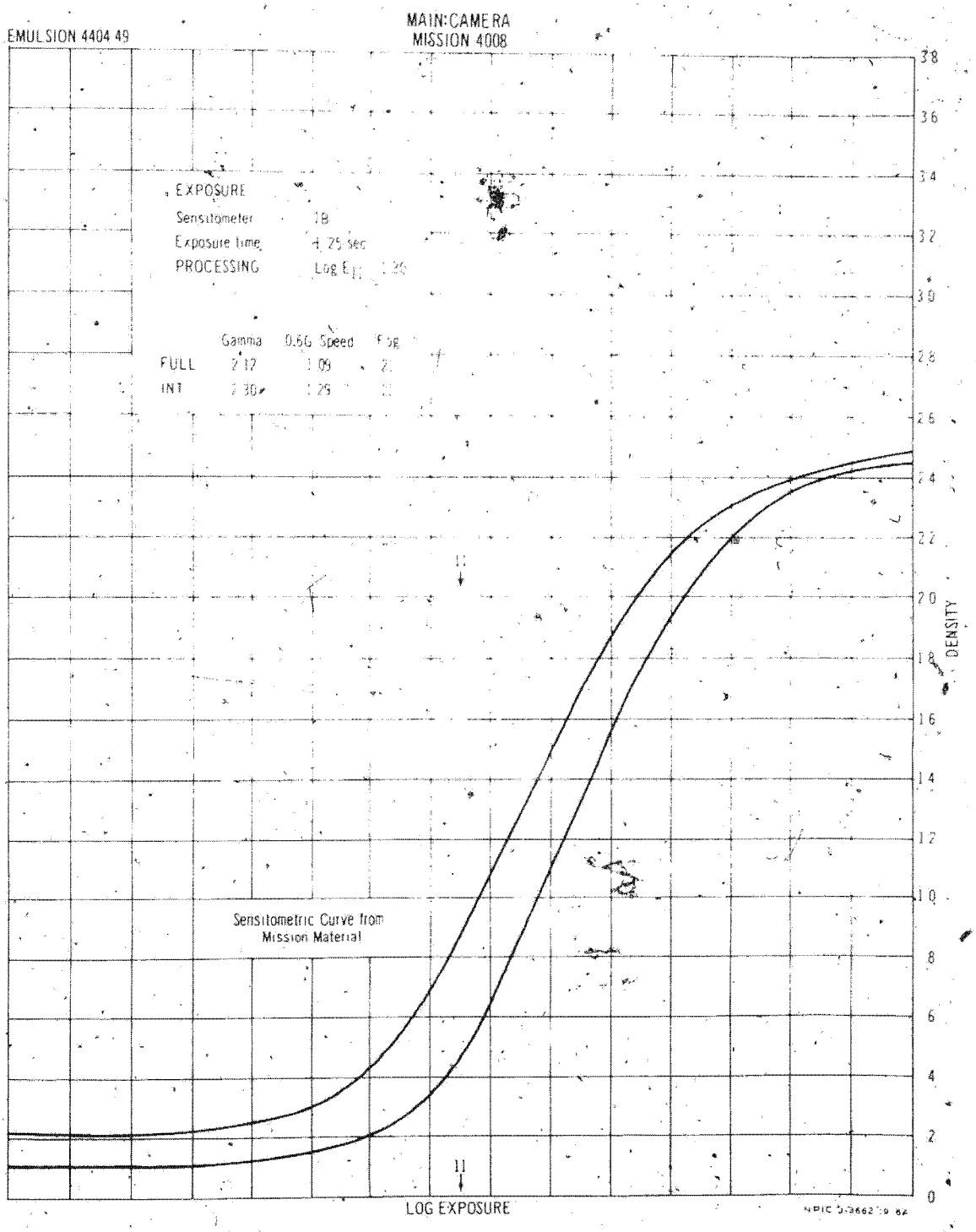
While the film was being prepared for processing, it was inspected for physical damages which could cause processing difficulties. During processing, data were recorded giving the processing conditions and film footage locations where processing changes occurred. Deviations from the normal course of processing which may affect the film quality were recorded. After processing, the original negatives were examined frame by frame for defects and damage.

Most of the film on this mission received adequate exposure. The solar elevation varied from 23.3° in pass D10 to 81.3° in pass D14. Most of the film was exposed at high (above 50°) solar elevations. Eighty-nine percent of this mission was processed at the full development level and the remaining eleven percent was processed at the intermediate development level. This percentage includes transition periods. The gross fog density readings range from a minimum of 0.15 to a maximum of 0.22.

2. Film Degradations: This section lists the film degradations and the frames on which examples of each may be found.

Static	A dendritic static discharge is noted to originate at the non-timing-track edge of the film on pass D05 frame 006. Static discharges are noticeable in the wrap-up of pass D10 and D14.
Minus Density Streaks	Four, continuous, fine, minus density streaks appear parallel to the film edges throughout the mission.
Scratch	A continuous scratch is noted 0.42" from and parallel to the non-timing-track edge of the film.
Plus Density Area	A plus density area borders the scratch, 0.42" from the non-timing track edge of the film.





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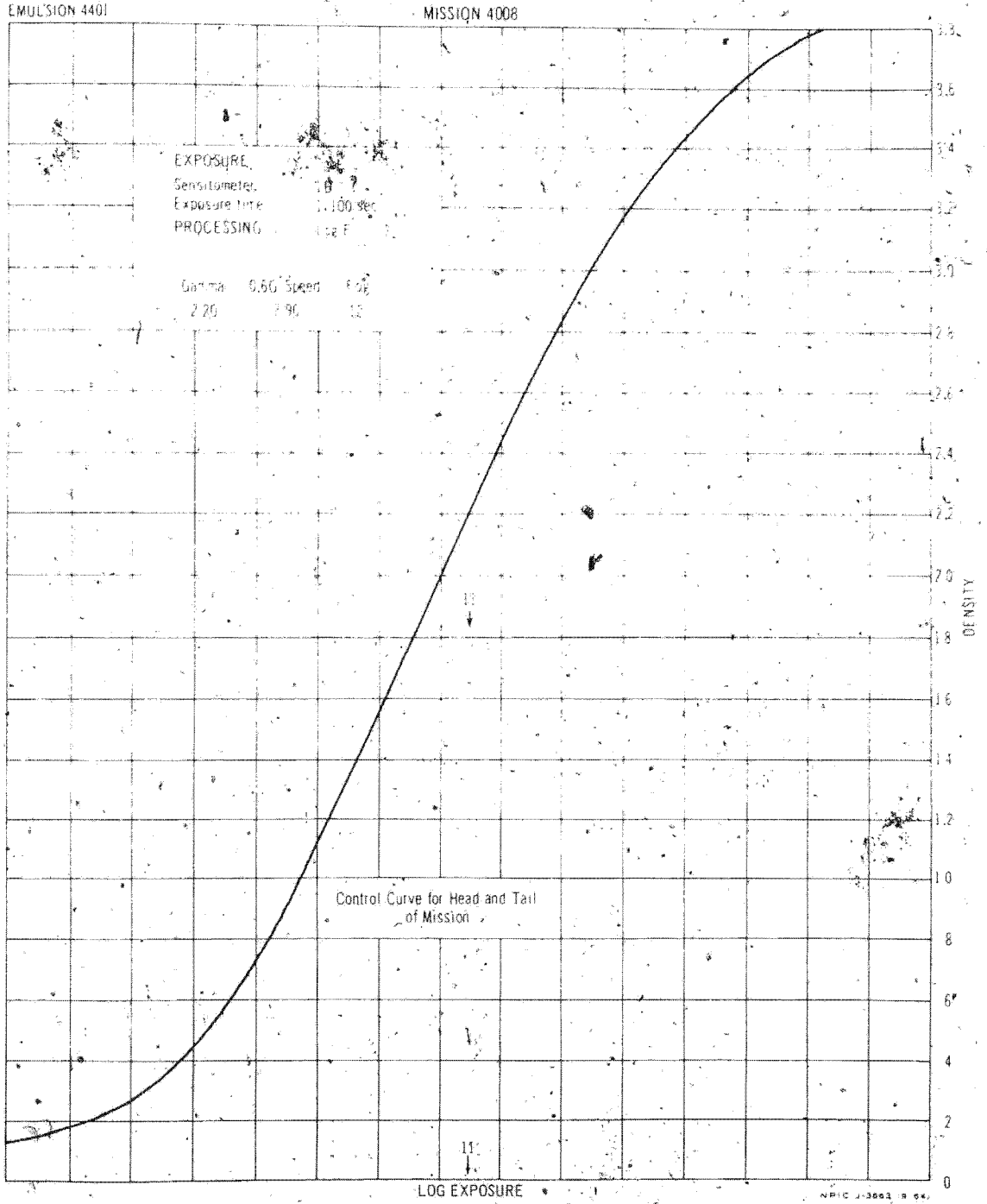
JCS-7879/64
NPIC/TP-22/64

STELLAR CAMERA
MISSION 4008



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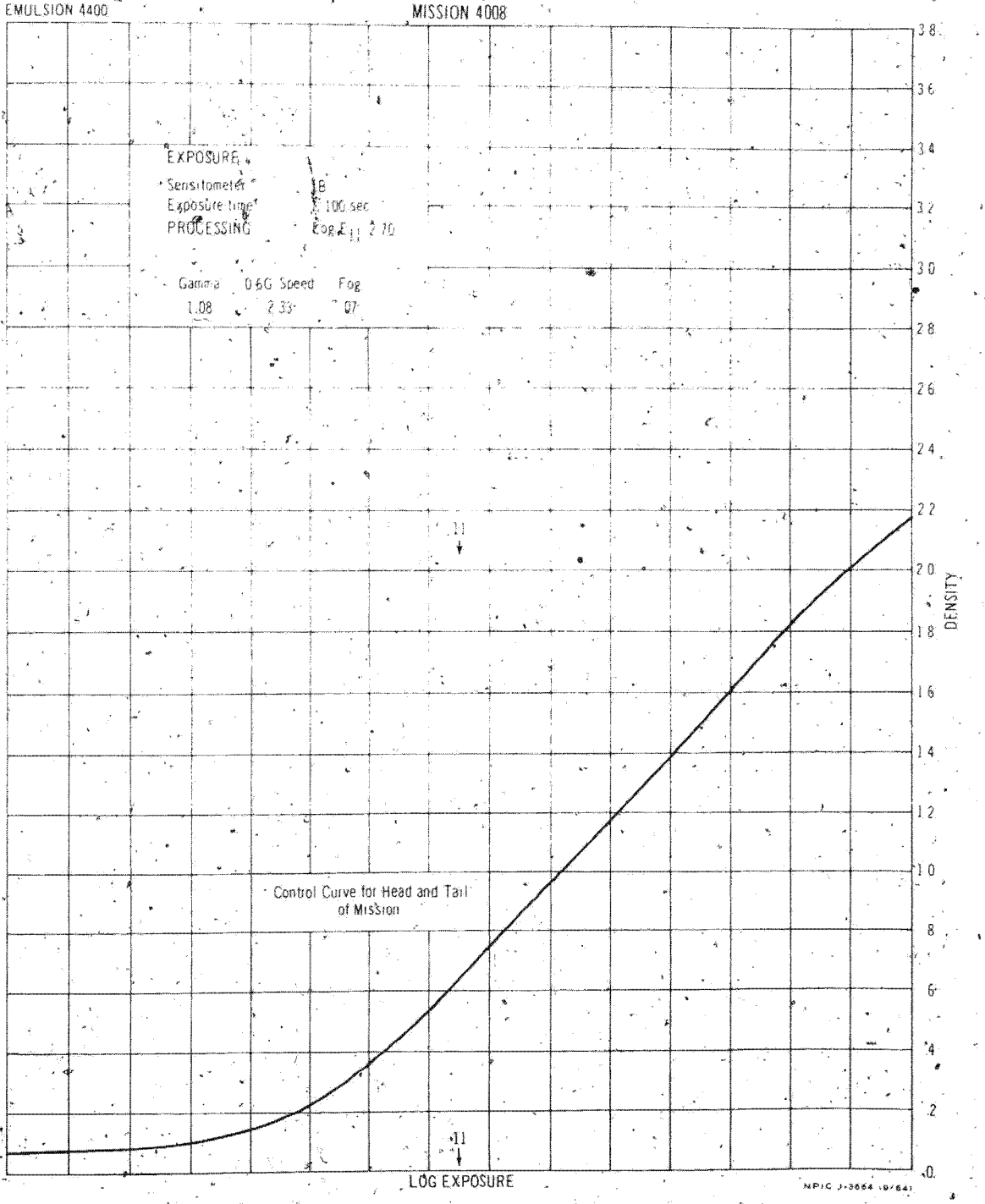
INDEX CAMERA
MISSION 4008

EMULSION 4400

EXPOSURE
Sensitometer B
Exposure time 1.00 sec
PROCESSING Fog E_{11} 2.70

Gamma	0.6G Speed	Fog
1.08	2.33	07



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PART III. IMAGE QUALITY

1. Photographic Interpretation (PI) Suitability: This is an assessment of the information content of photographic reconnaissance material and its interpretability. A number of interrelated factors are involved, such as the quality of the photography, the extent of target coverage, scale, weather limitations, and similar considerations. However, the criteria for assigning a PI suitability rating may be reduced to (a) the scope of the photographic coverage and (b) the degree to which a photo interpreter may extract useful and reliable information from the material.

PI suitability ratings are categorized as Excellent, Good, Fair, Poor, and Unusable. These ratings refer to the overall interpretive value of the photography obtained from a particular reconnaissance mission. Individual targets may also be assigned PI suitability ratings if that is necessary or desirable. The standards that determine assignment of the various ratings are as follows:

Excellent: The photography is free of degradation by camera malfunctions or processing faults and weather conditions are favorable throughout. The imagery contains sharp, well-defined edges and corners, with no unusual distortions. Contrast is optimal and shadow details, as well as details in the highlight areas, are readily detectable. Observation of small objects and a high order of mensuration are made possible by the consistently good quality of the photography.

Good: The photography is relatively free of degradation or limiting atmospheric conditions. Edges and corners of objects are well-defined. No unusual distortions are present. Detection and accurate mensuration of small objects is feasible, but to a lesser degree than in material rated as "Excellent".

Fair: Degradation is minimal but the acuity of the photography is less than optimum. Edges and corners of objects are not crisply defined and there is loss of detail in shadow and/or highlight areas. Detection and identification of small objects is possible but accuracy of mensuration is reduced by the fall-off in image quality and the less-than-optimum contrast that prevails.

Poor: Camera-induced degradations and/or weather limitations severely reduce the quality of the photography. Definition of edges and corners is not sharp. Only gross terrain features and culture may be detected or identified and distortion of form may exist. Accurate mensuration of even large objects is doubtful.

Unusable: Degradation of the photography completely precludes detection, identification, and mensuration of cultural details.

2. PI Suitability for Mission 4008: The PI suitability of Mission 4008 ranges from good to very good. Pass D10, frames 10 and 11 yielded the best imagery yet obtained from satellite photography. Selected portions of these frames have been reproduced at 100X magnification. Photo interpreters reported on 55 targets in the preliminary target readout. Heavy clouds precluded full photo interpretation on two of these targets. Low solar elevation, haze, clouds, and cloud-shadow degraded several other targets but not to such a degree that they did not contain some information value. Target highlights include:

a. Identification of a new surface-to-air missile site.

b. A detailed interpretation of a surface-to-air missile site.

c. Identification of a nuclear storage site with a conventional weapons storage site.

d. Observation of an aircraft plant modifi-

cation which suggests a change in the function of the facility.

No serious problems were encountered in the operation of the main camera. Those factors which degrade the imagery and could directly affect PI suitability are:

Photography Degraded by Improper IMC

Start-up - The time required for the film to achieve proper operational speed at the beginning of each camera operation produces a small area of error in IMC. This area, in any case, is not excessive and is within specifications. No targets are knowingly programmed for this area.

Slowdown - The time required for the film to coast to a stop after completion of each camera operation also causes an error in IMC. The film speed for each camera operation varies, causing the area of coast error to vary. This area is not excessive or beyond specifications and no programmed targets fell within this area.

Banding - An interruption of proper film speed, associated with looper loading action, caused an error in IMC approximately every 12 inches on long monoscopic frames. This error appears as plus or minus transverse bands on the film and is most serious at the start-up and stopping of the looper loading action.

Image Streaking - PI suitability is poor on pass 1016 when vehicle instability caused extreme image streaking.

Other Minor Degradations - A scratch and four fine minus density streaks, which degrade the imagery to a lesser degree, occur parallel to the film edges throughout the mission.

Atmospherics

Forty percent of the photography on Mission 4008 is degraded by clouds or haze.

Solar Elevation - Low solar elevation affects the PI suitability in varying degrees depending upon the terrain reflectivity and the bearing of the solar azimuth from the principal ray. In most cases, the higher the solar elevation, the better the quality of the photography.

GOOD IMAGERY, MAIN CAMERA

Figures 2 through 12 are examples of good photographic imagery, suitable for photo interpretation. These examples include monoscopic and stereo prints in various roll angle positions.

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FIGURE 2. GOOD QUALITY STEREO PHOTOGRAPHY.

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TCS-7879/64
NPIC/TP-22/64

Pass: D15
Frame: 04
Index: 11 (73.2-21.7)
Enlargement: 40X
Solar Elevation: 64.8°
Solar Azimuth: 171°
Solar Bearing: 273°
Roll Angle: -32.61°

Handle Via
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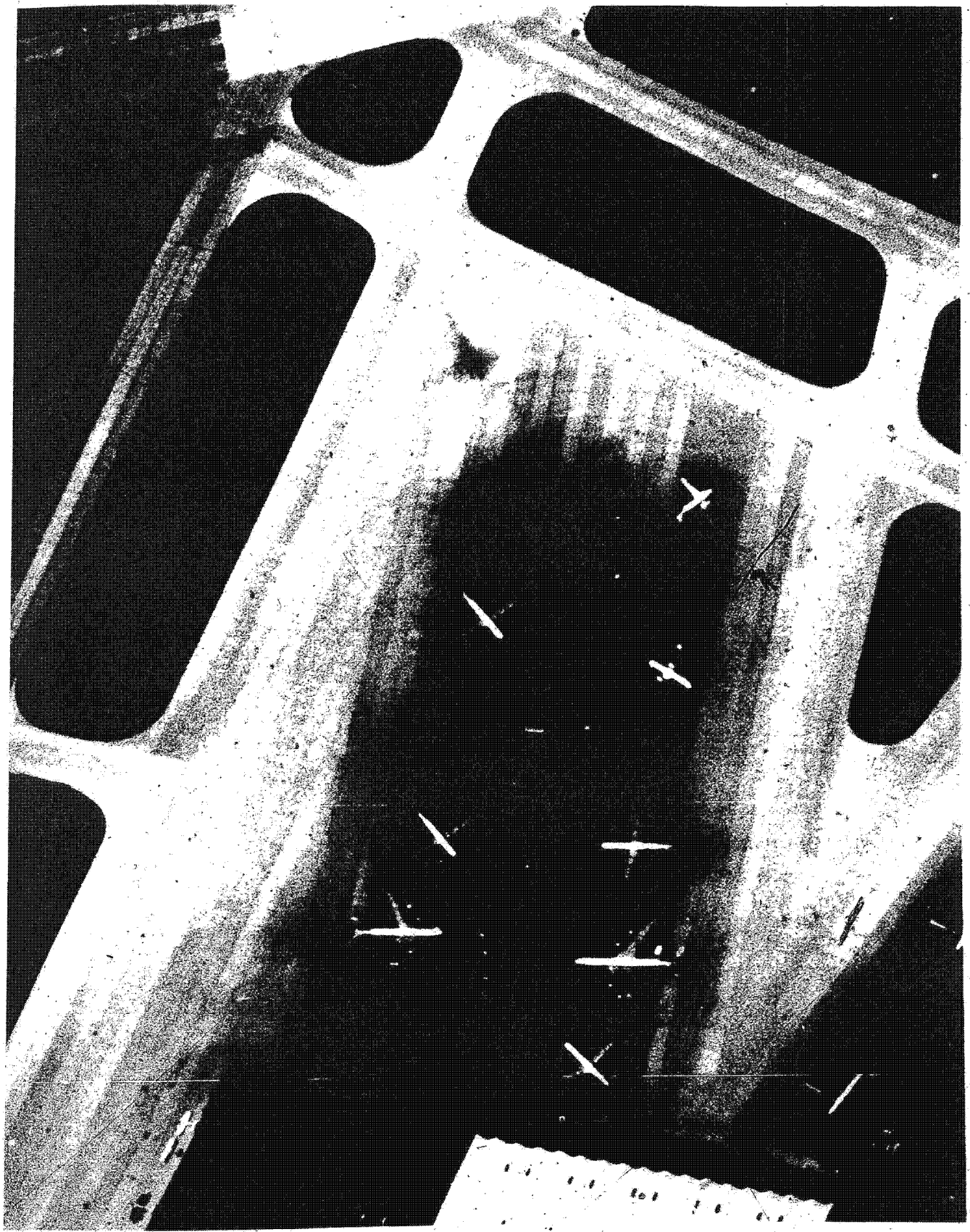

FIGURE 3. GOOD QUALITY STEREO PHOTOGRAPHY.

Handle Via
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TCS-7879/64
NPIC/TP-22,64

Pass: D15
Frame: 05
Index: 13 (71.2-19.9)
Enlargement: 40X
Solar Elevation: 64.8°
Solar Azimuth: 171°
Solar Bearing: 218°
Roll Angle: -31.90°

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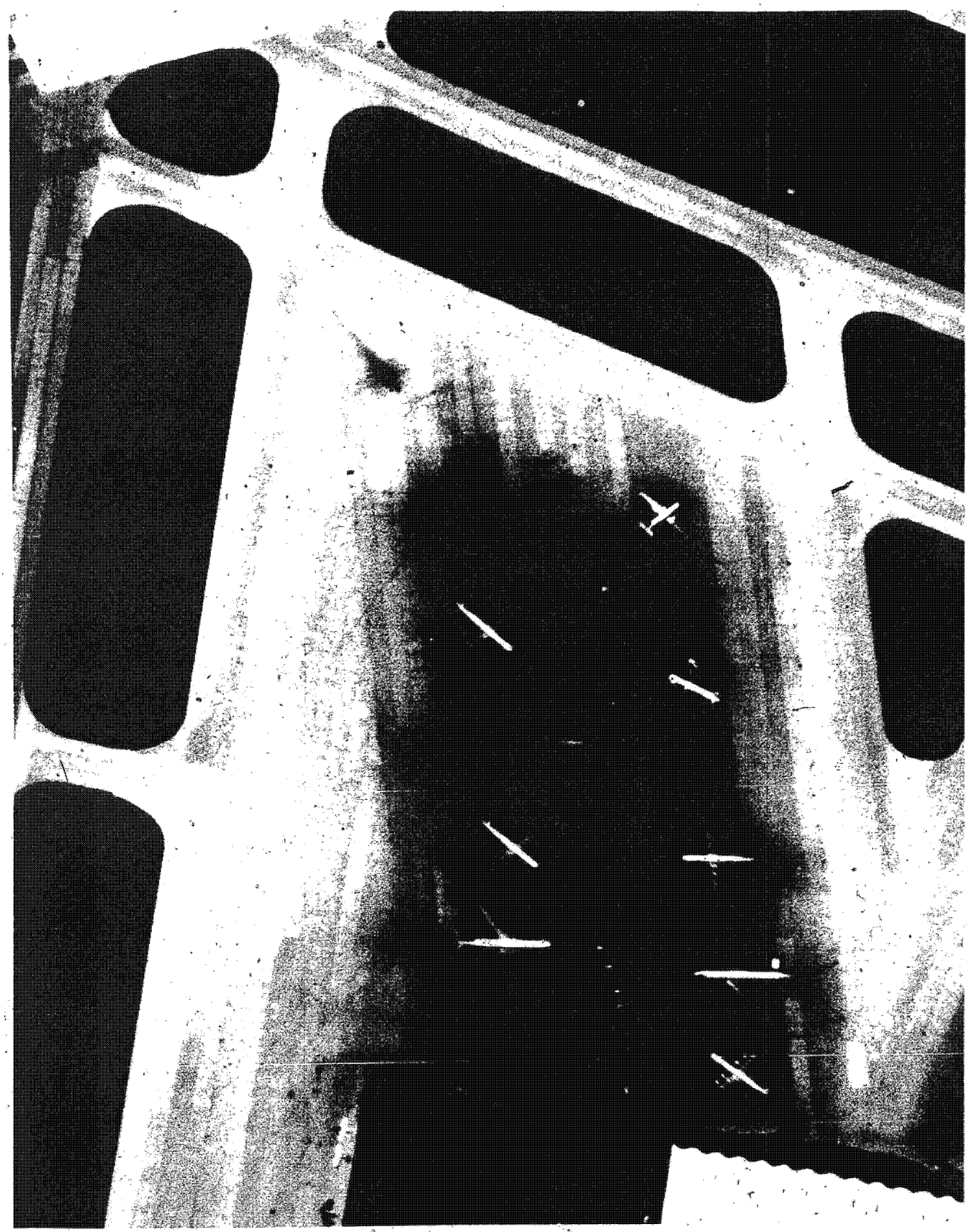

FIGURE 4. GOOD QUALITY STEREO PHOTOGRAPHY.

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TCS-7879/64
NPIC/TP-22/64

Pass: 1010
Frame: 10
Index: 20-59.0 - 9.7
Enlargement: 10X
Solar Elevation: 49.0°
Solar Azimuth: 188°
Solar Bearing: 337°
Roll Angle: -3.54

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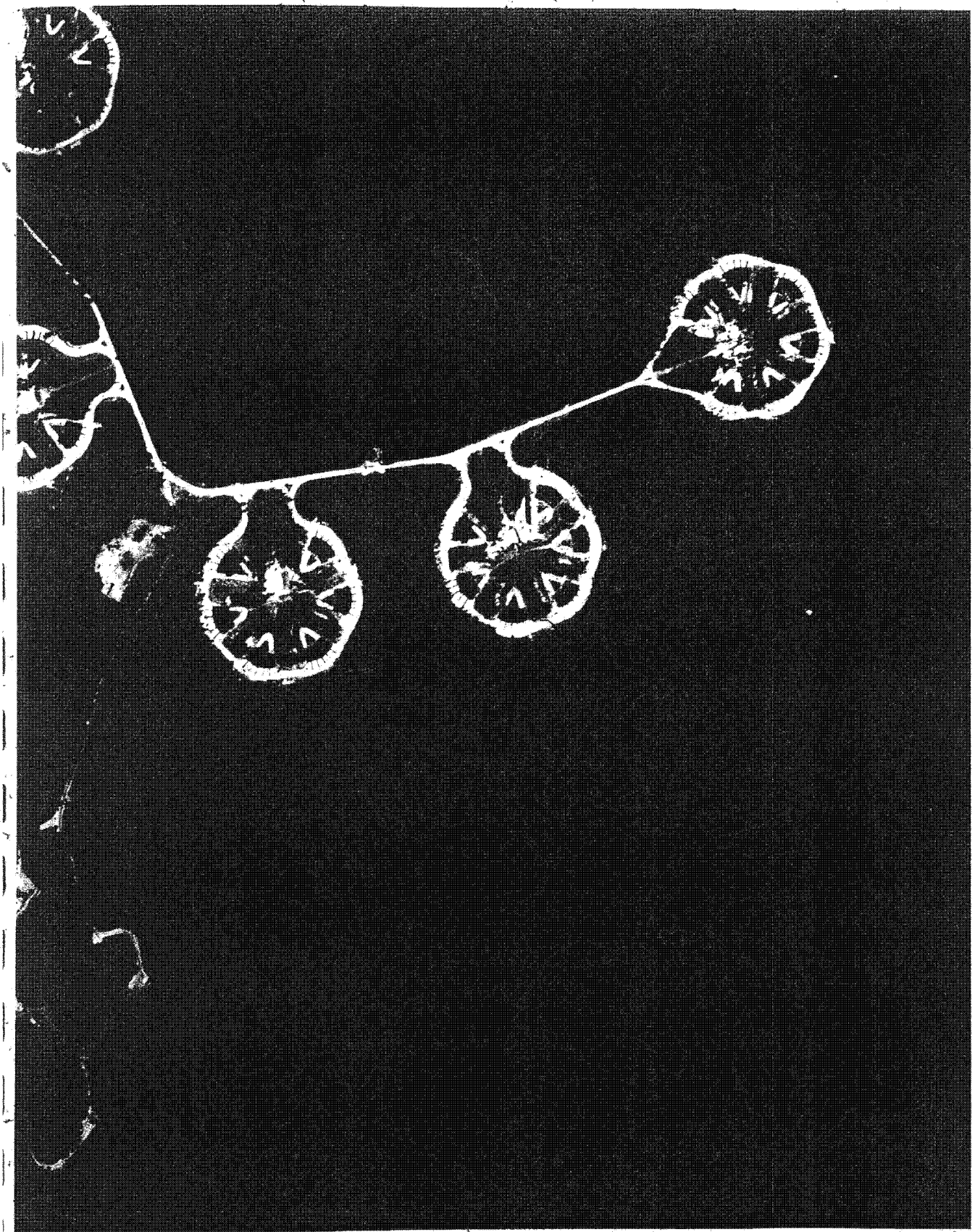

FIGURE 5. GOOD QUALITY STEREO PHOTOGRAPHY.

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TCS-7879/64
NPIC/TP-22/64

Pass: D10
Frame: 11
Index: 22 (52.8 - 8.2)
Enlargement: 10X
Solar Elevation: 48.9°
Solar Azimuth: 188°
Solar Bearing: 173°
Roll Angle: -3.54°

Handle Via
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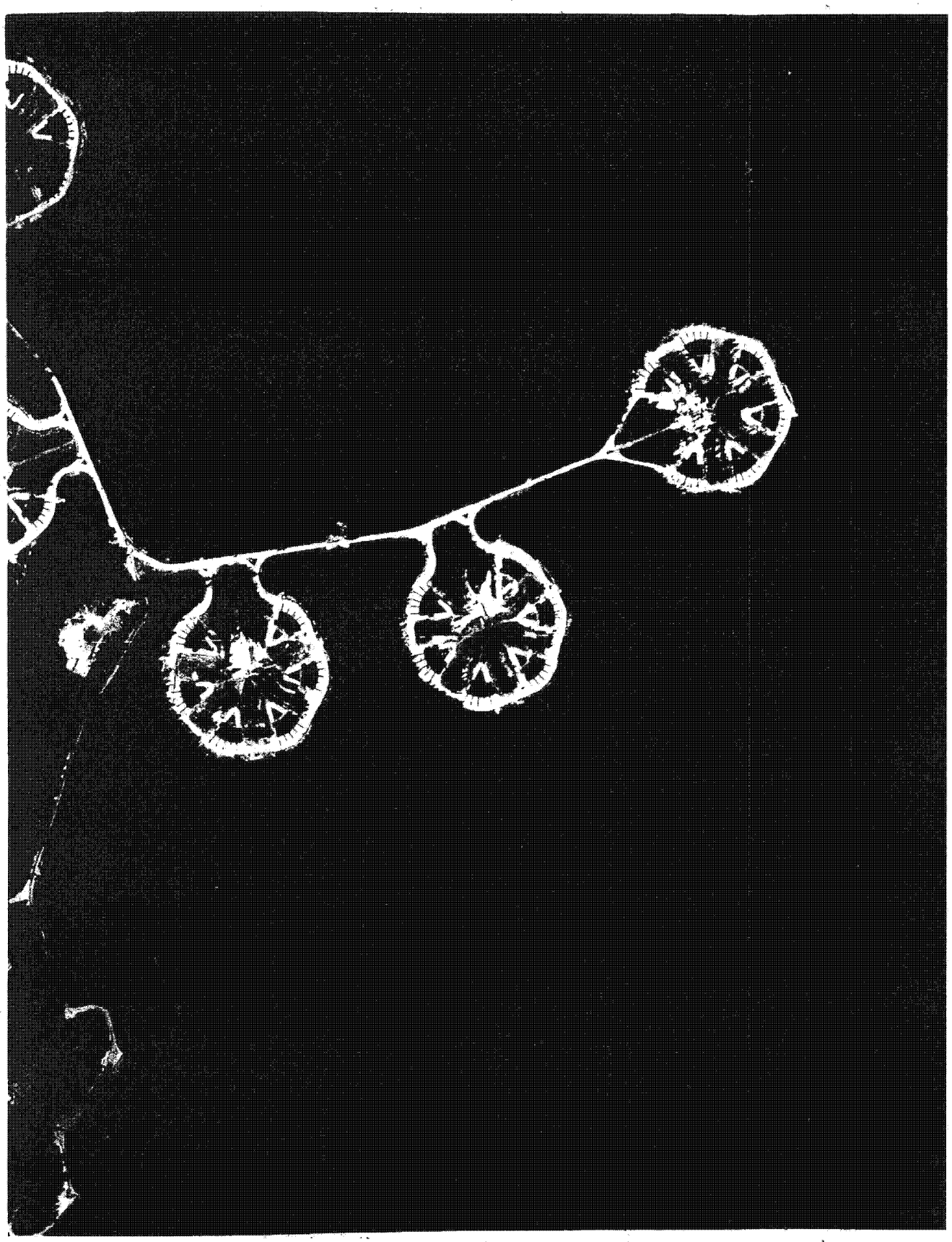

FIGURE 6. GOOD QUALITY PHOTOGRAPHY.

TCS-7879/64
NPIC/TP-22/64

Pass: DI0
Frame: 22
Index: 45 (59.2 - 11.2)
Enlargement: 20X
Solar Elevation: 62.2
Solar Azimuth: 177
Solar Bearing: 70
Roll Angle: 9.93

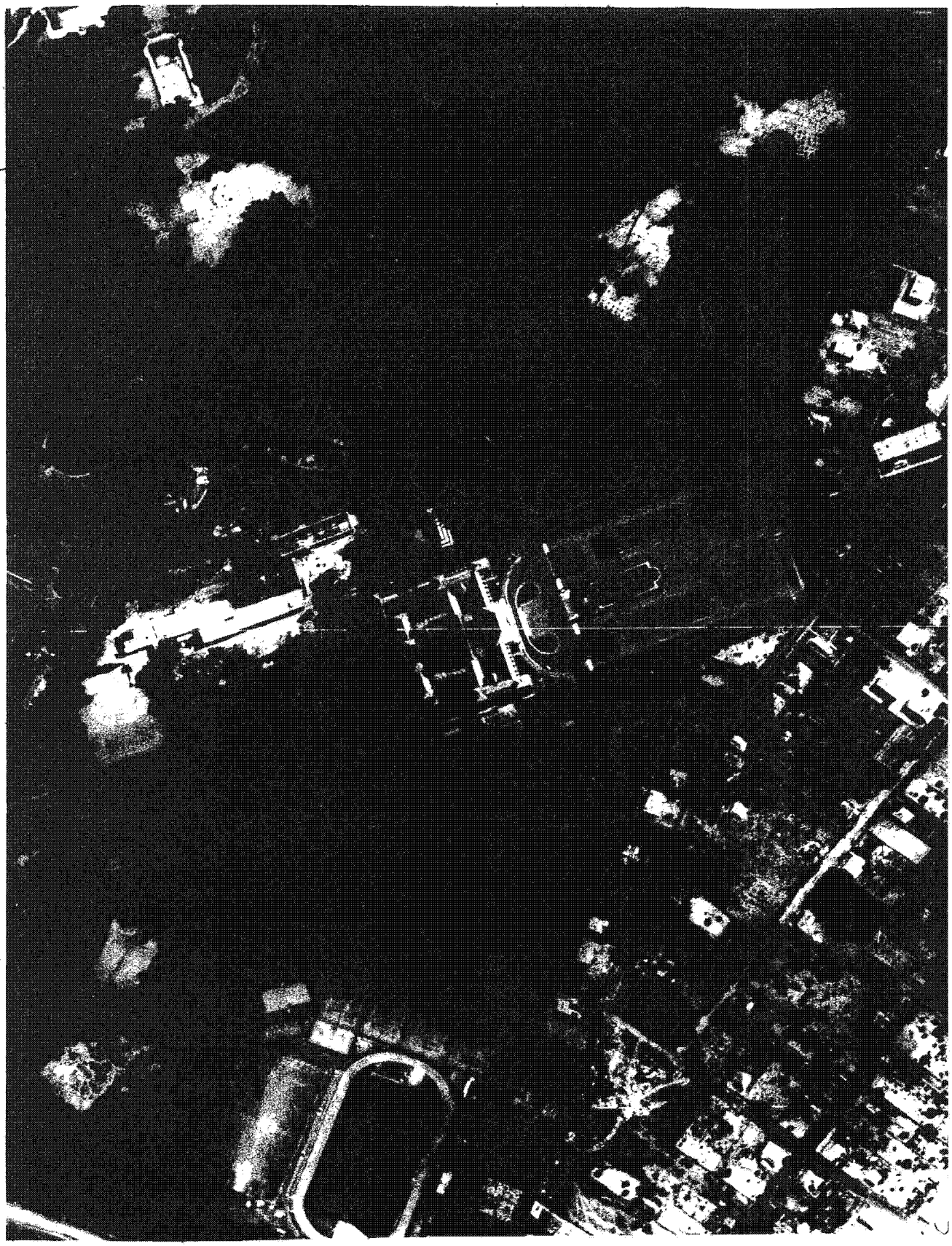

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FIGURE 7: GOOD QUALITY PHOTOGRAPHY.

- 10m -

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Handle Via
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TCS-7879/64
NPIC/TP-22/64

Pass: D15
Frame: 10
Index: 26 (87.0 - 15.0)
Enlargement: 10X
Solar Elevation: 75.0
Solar Azimuth: 155
Solar Bearing: 235
Roll Angle: -4.96

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FIGURE 8. GOOD QUALITY PHOTOGRAPHY.

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TCS-7879/64
NPIC/TP-22/64

Pass: D10
Frame: 22
Index: 45-50.9 - 9.2
Enlargement: 20X
Solar Elevation: 62.2°
Solar Azimuth: 177°
Solar Bearing: 70°
Roll Angle: 9.93°

- 10p -

Handle Via
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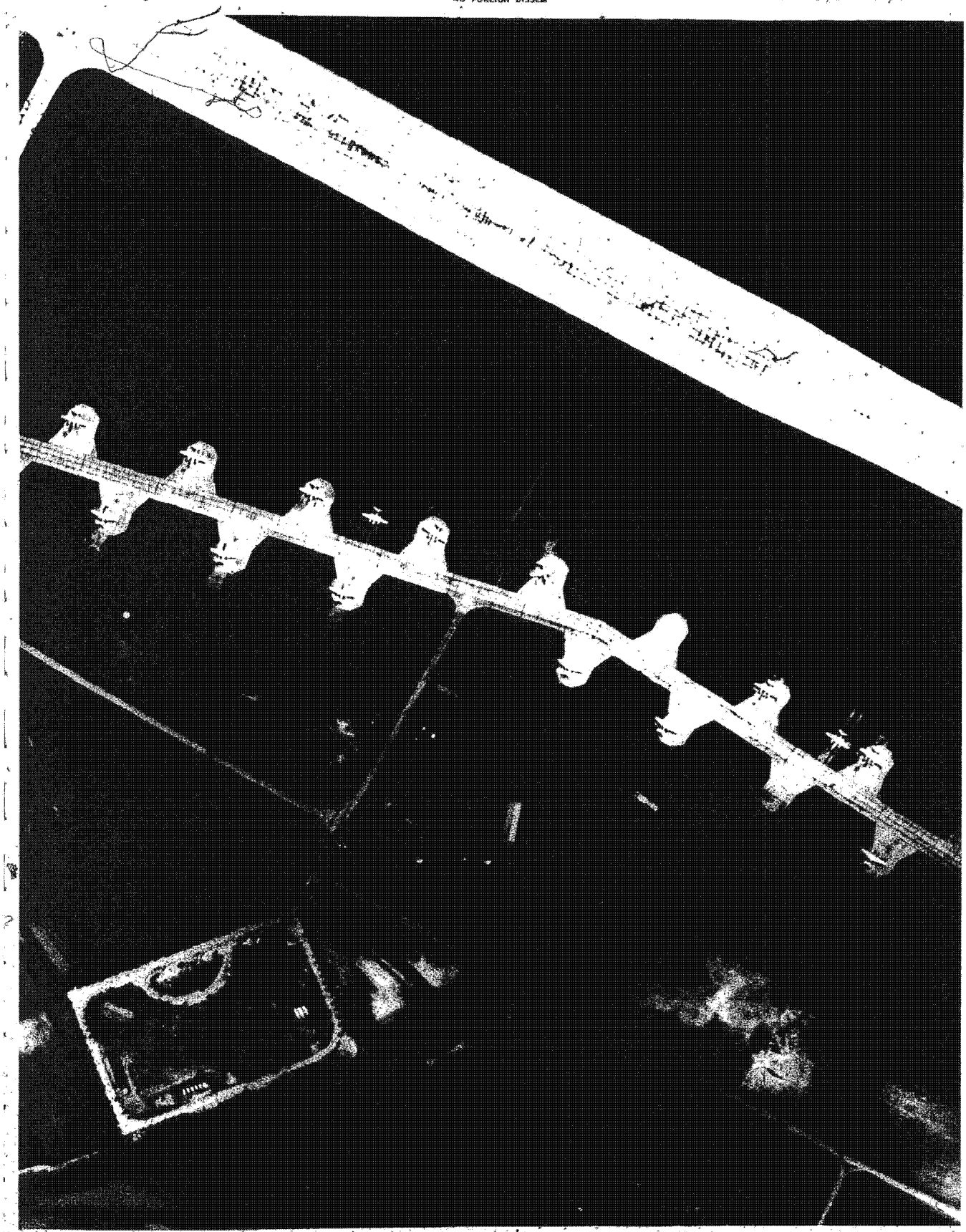

FIGURE 9. OBLIQUE STEREO.

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TCS-7879/64
NPIC/TP-22/64

Pass: D15
Frame: 04
Index: 11 (79.9 - 16.1
Enlargement: 10X
Solar Elevation: 64.8°
Solar Azimuth: 171°
Solar Bearing: 273°
Roll Angle: -32.61

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Handle Via
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NPIC/TP-22/64

FIGURE 10. OBLIQUE STEREO.

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Pass: D15
Frame: 05
Index: 13179.9 - 14.2
Enlargement: 10X
Solar Elevation: 64.8
Solar Azimuth: 171
Solar Bearing: 218
Roll Angle: -31.90

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TCS-7879/64
NPIC/TP-22/64

Pass: 1015
Frame: 05
Index: 13°59.9' - 11.2'
Enlargement: 10X
Solar Elevation: 04.3°
Solar Azimuth: 171°
Solar Bearing: 218°
Roll Angle: -31.90°

Handle Via
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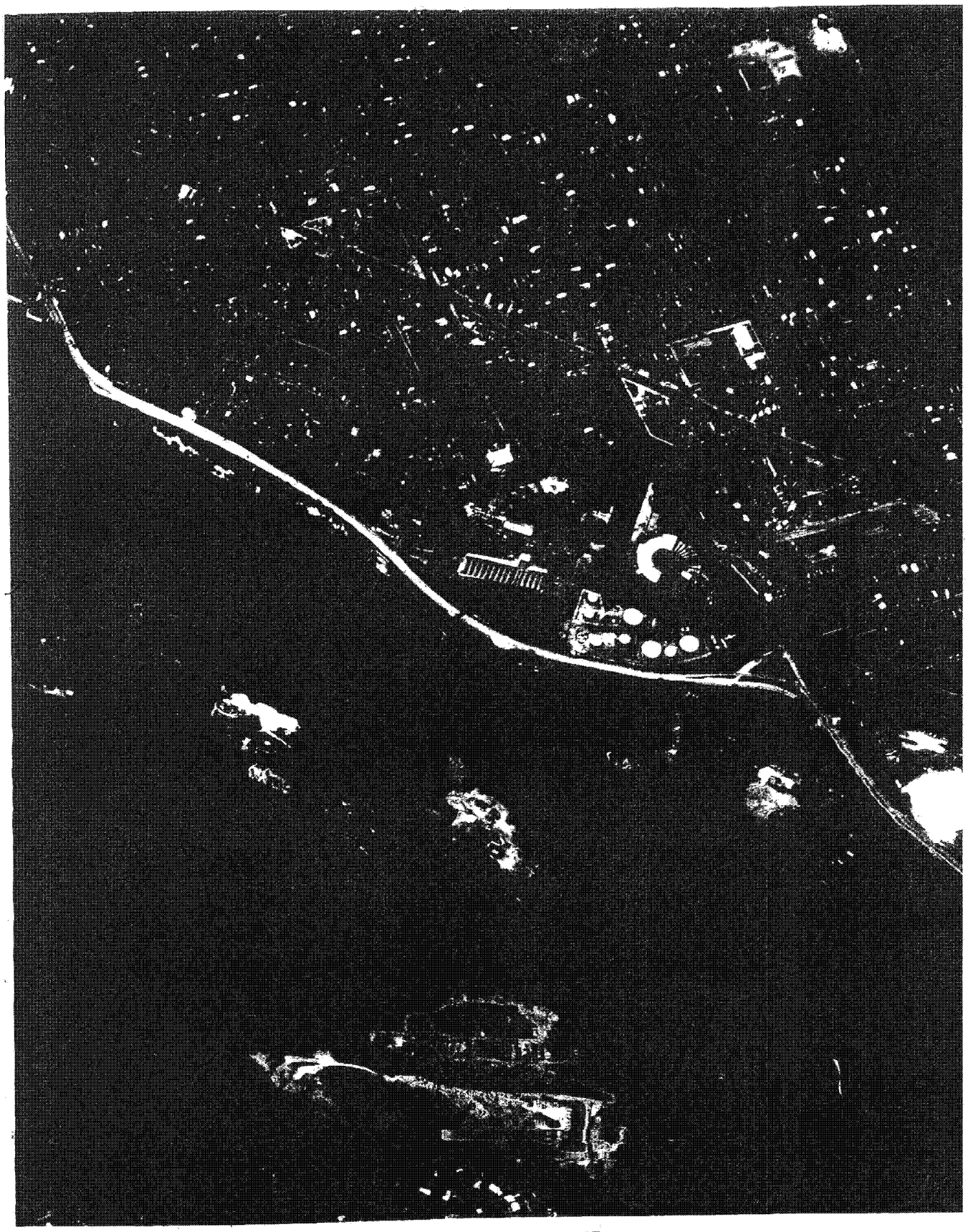

FIGURE 11. OBLIQUE STEREO.

TCS-7879/64
NPIC/TP-22/64

Pass: 015
Frame: 02
Index: 07/61.0 - 8.0
Enlargement: 20X
Solar Elevation: 62.9
Solar Azimuth: 174
Solar Bearing: 276
Roll Angle: -31.90

FIGURE 12. OBLIQUE STEREO.

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TCS-7879/64
NPIC/TP-22/64

Pass: 015
Frame: 03
Index: 09 -60.7 - 50.0
Enlargement: 20X
Solar Elevation: 62.9°
Solar Azimuth: 154
Solar Bearing: 221
Roll Angle: -31.90

- 10x -

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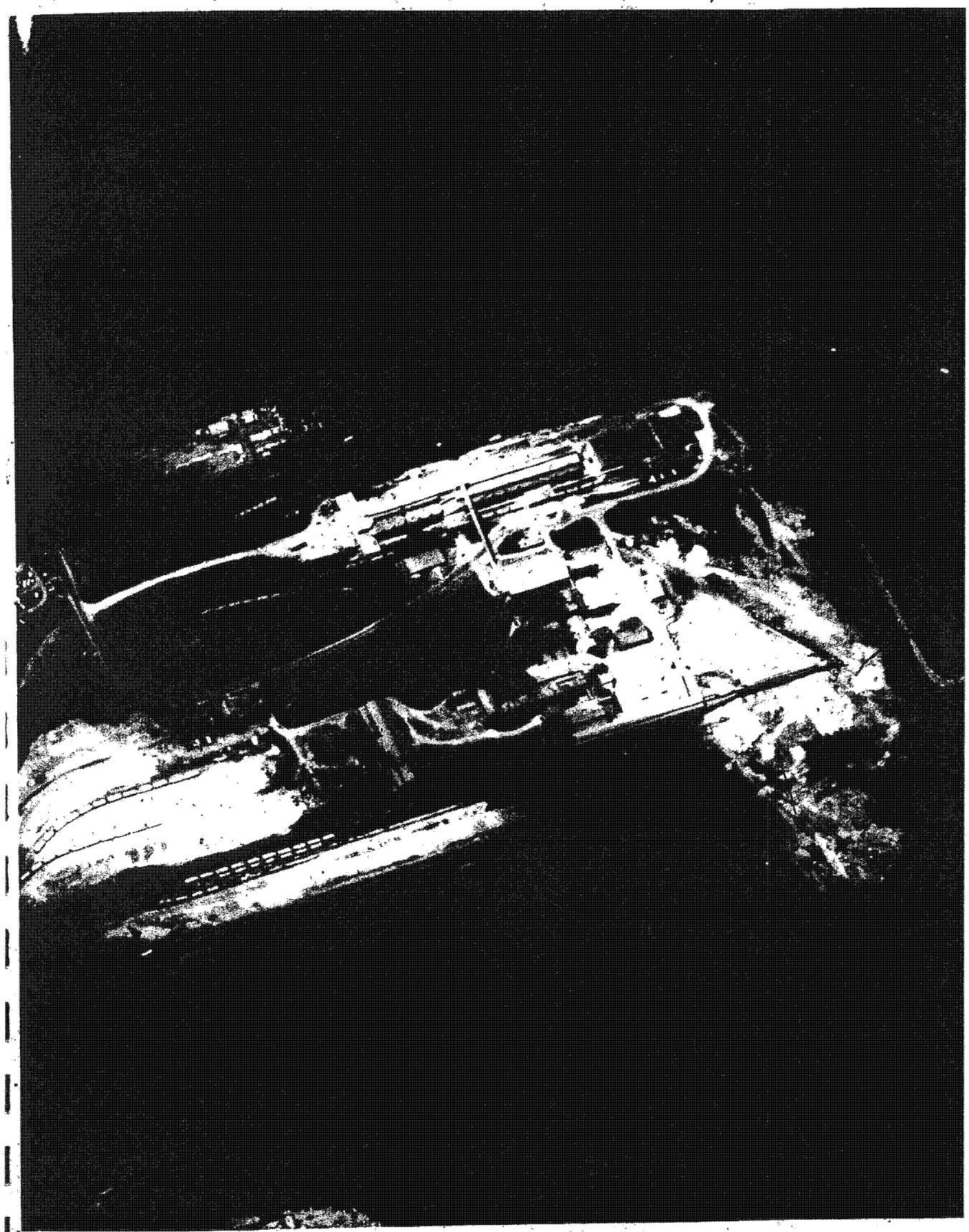

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3. Mensuration Study: Mensuration of images on Mission 4008 was confined to passes D8, D10, D14, and D15. All other passes were largely cloud covered or off the target path. The early passes (D4, D5, and D6) were slightly off the target path due to the early orbit adjust. After telemetry check on pass D7, the track was updated for proper pointing of the camera. The orbit adjust for lower perigee was accomplished on pass D11. The lower altitude on the later passes gave the best imagery to date.

The mensuration of the CORN targets and other imagery on passes D14 and D15 revealed resolution of approximately 2.2 feet. This agrees very well with the design specifications for the instrument and shows that the camera was operating at its maximum effectiveness before the attitude problem on pass D16.

All measurements in this study were accomplished with a one micron Mann comparator and the average of all measurements shows less than a 0.5 of one percent error when all parameters are available. The accuracy of the mensuration of the imagery was verified on domestic areas where relative orientation to known dimensions was available.

Stellar camera images are used in attitude determination, and since pitch, roll, and yaw data are essential for accurate mensuration, the loss of the Stellar camera after only 20 frames caused considerable mensuration difficulty.

Small objects when measured do not fall within the 0.5 of one percent error because of the resolution of the system. An approximate error range for all measurements is plus or minus 1.1 feet; therefore, for most small objects the percent error is large and for large objects the percent error is small.

[illegible]

Object	Actual Size	Measured Size	% Error
Building	[illegible] by 54	79 by 52	0.6
Highway	[illegible] by 300	301 by 455	0.05 and 0.6
Building	60 by [illegible]	60 by 58	0.0 and 3.7
Road Distance	5,280	5,256	0.17
	5,280	5,269	0.02
	5,280	5,284	0.11
	2,640	2,642	0.05
	2,640	2,645	0.30

FIGURE 13. CORN TARGET.

TCS-7879/64
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Pass: D15
Frame: 08
Index: 19 (55.3 - 11.7)
Enlargement: 20X
Solar Elevation: 72.0
Solar Azimuth: 163
Solar Bearing: 241
Roll Angle: -6.38

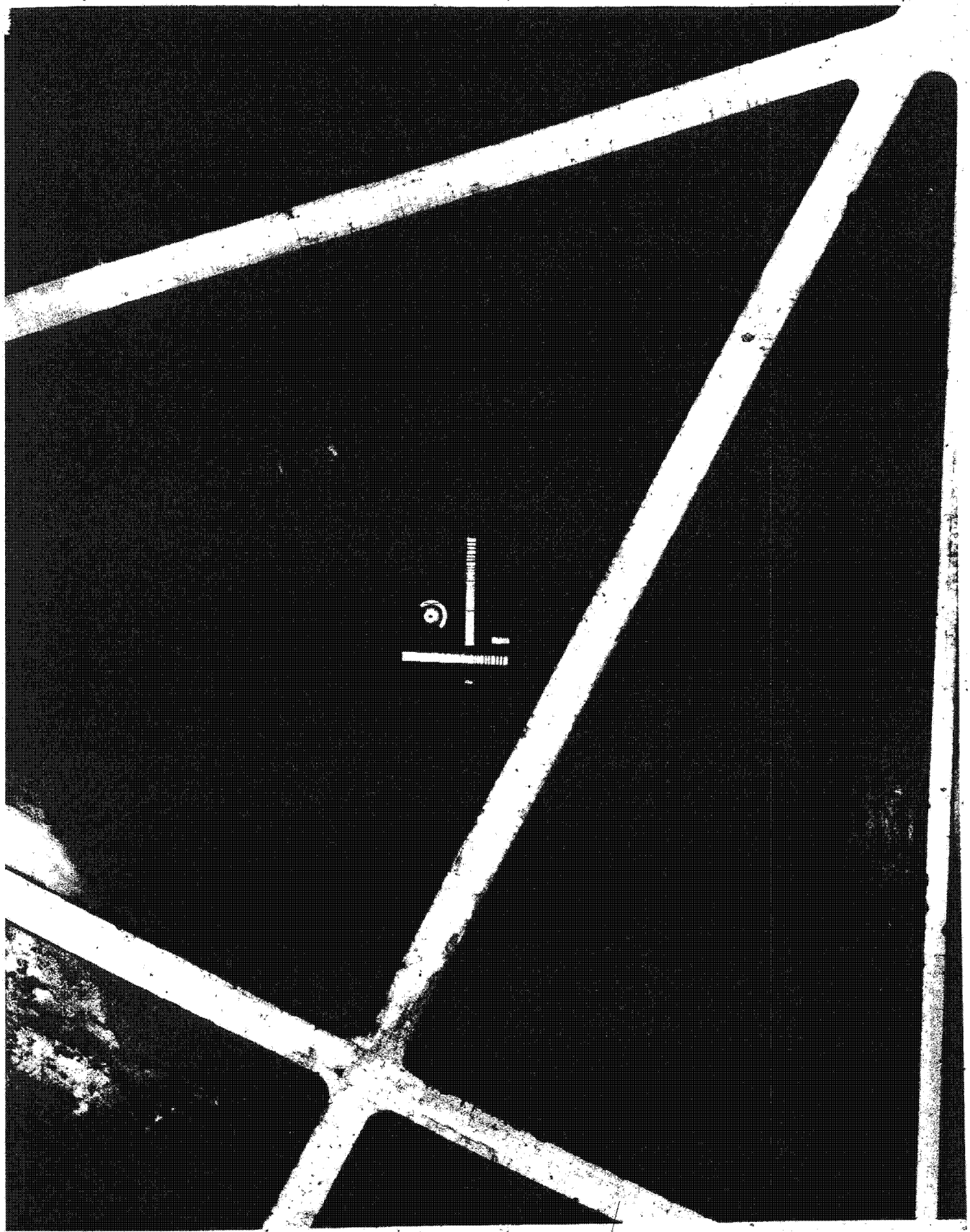

FIGURE 14. RB-47 "BLACKBIRD" TARGET.

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Pass: 015
Frame: 08
Index: 20°69.1-11.7
Enlargement: 40X
Solar Elevation: 72.0°
Solar Azimuth: 163°
Solar Bearing: 241°
Roll Angle: -6.38°

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DEGRADATIONS, MAIN CAMERA

Figures 15 through 23 are examples of the image degradations encountered during the mission.

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FIGURE 15. AIRFIELD PHOTOGRAPHED WITH CORRECT IMC

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Pass: D15
Frame: 06
Index: 15-83.7 - 124.0
Enlargement: 3X
Solar Elevation: 68.1
Solar Azimuth: 169
Solar Bearings: 315
Roll Angle: -7.80

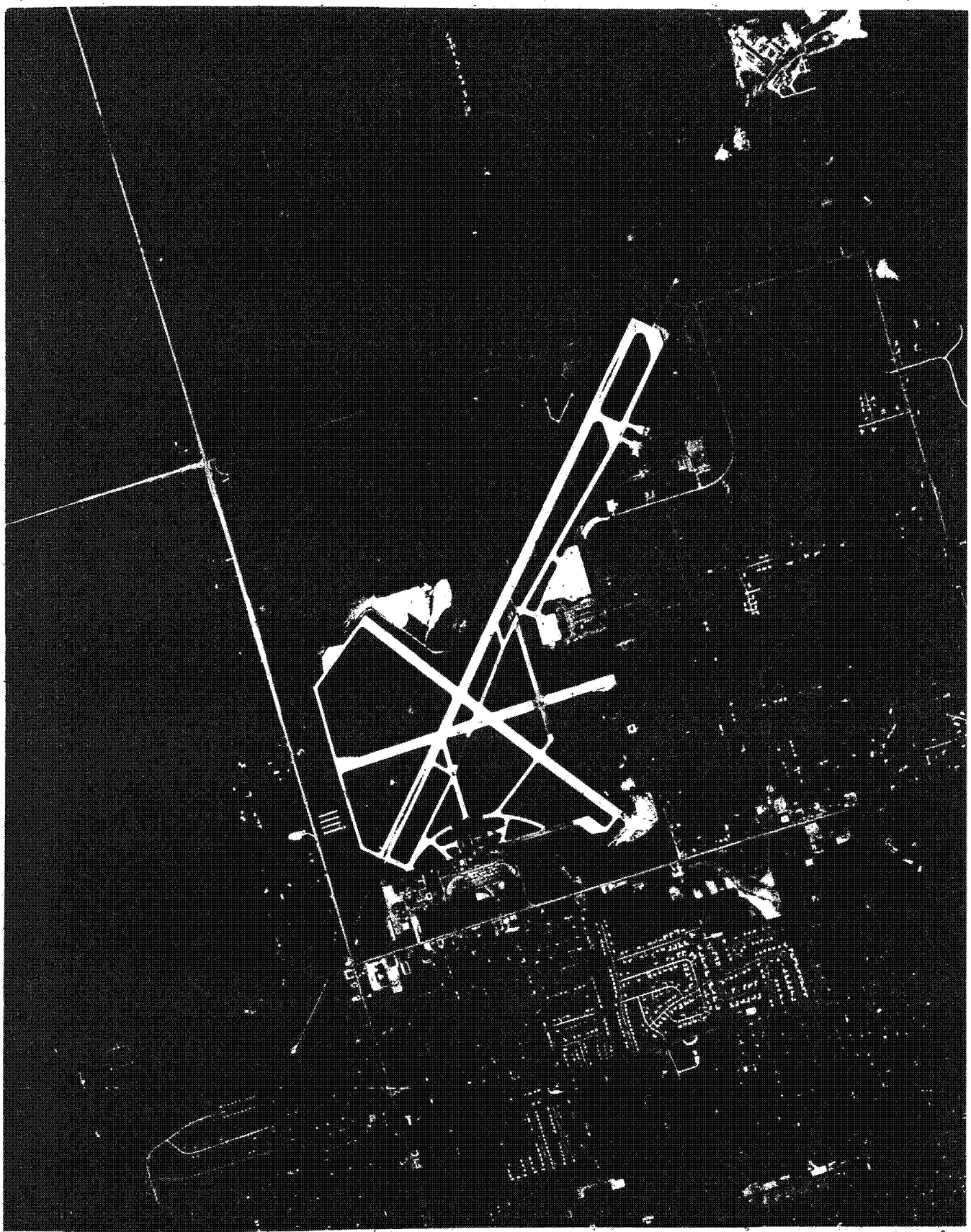
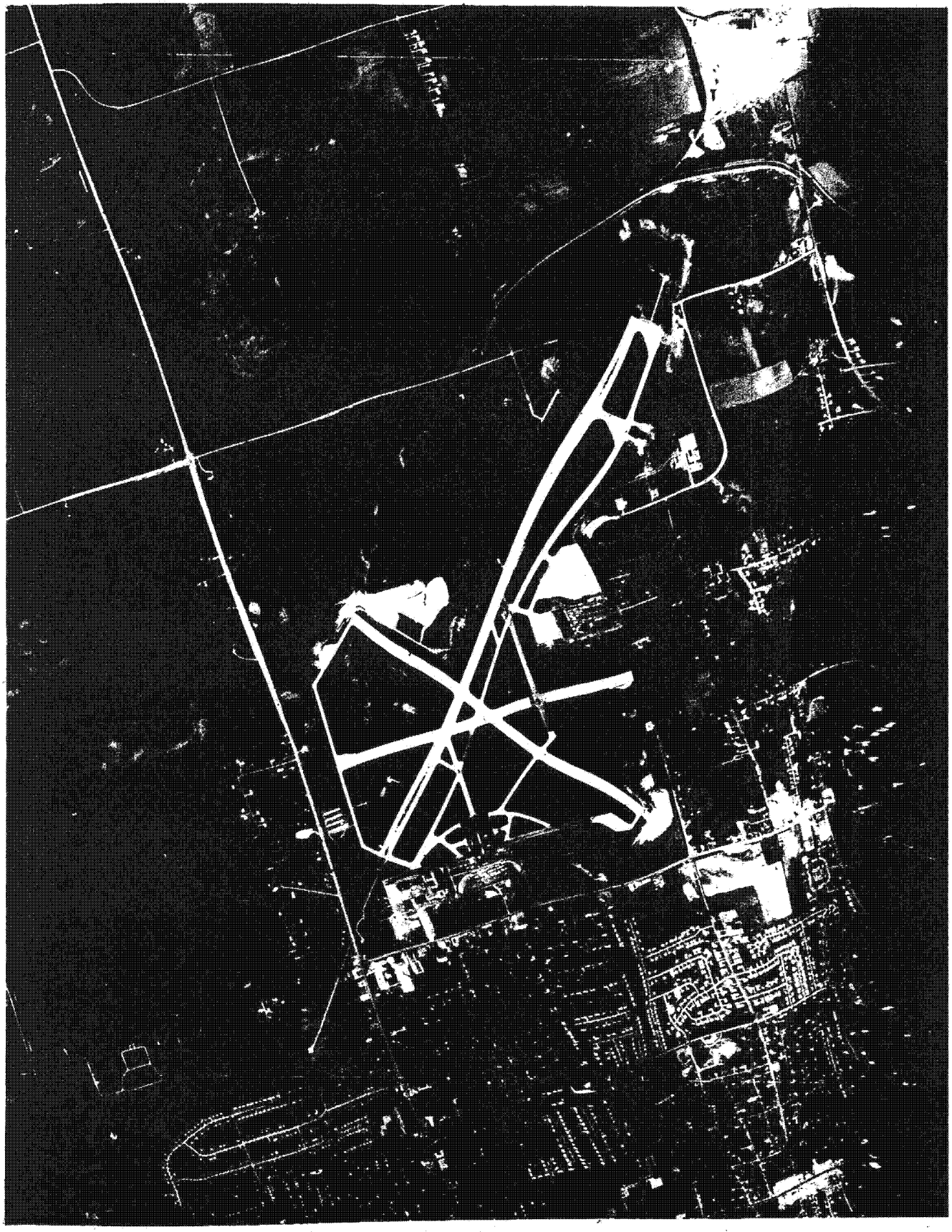


FIGURE 16. AIRFIELD PHOTOGRAPHED WITH INCORRECT IMC AT START-UP.

Pass: D15
Frame: 07
Index: 16 (50.0-9.0)
Enlargement: 3X
Solar Elevation: 68.1
Solar Azimuth: 169
Solar Bearing: 174
Roll Angle: -7.80



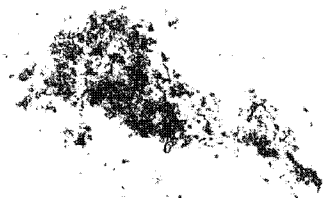
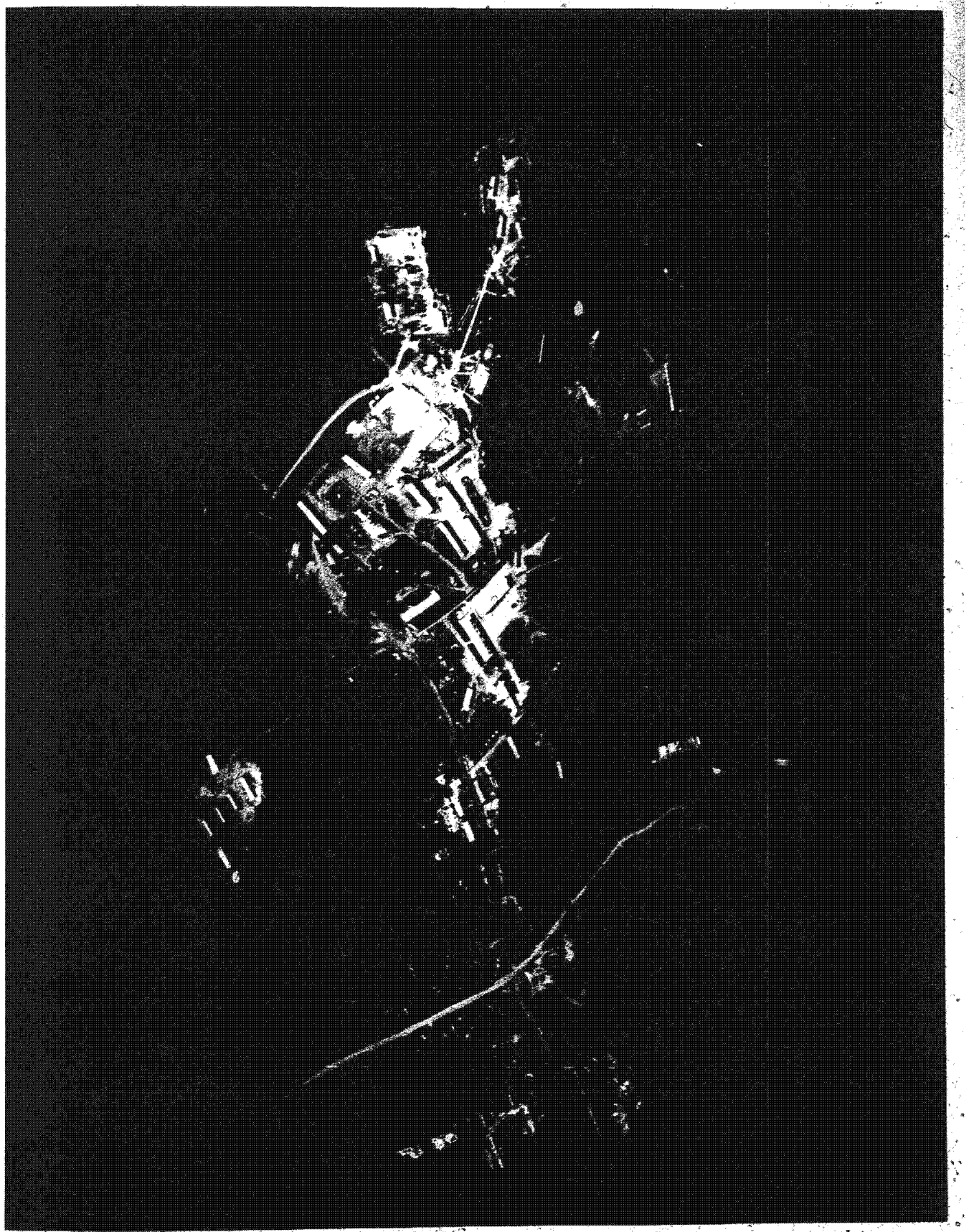


FIGURE 17. START-UP ERROR IN IMC.

Pass: D10
Frame: 11
Index: 21 (51.9 - 9.9)
Enlargement: 10X
Solar Elevation: 48.9°
Solar Azimuth: 188°
Solar Bearing: 173
Roll Angle: -3.54°



Handle Via
~~TALENT-KEYHOLE~~
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FIGURE 18. LOOPER LOADING ACTION, INCORRECT IMC.

12m

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Pass: DIO
Frame: 12
Index: 25 153.2 / 5.3
Enlargement: 10X

~~Handle Via~~
~~TALENT-KEYHOLE~~
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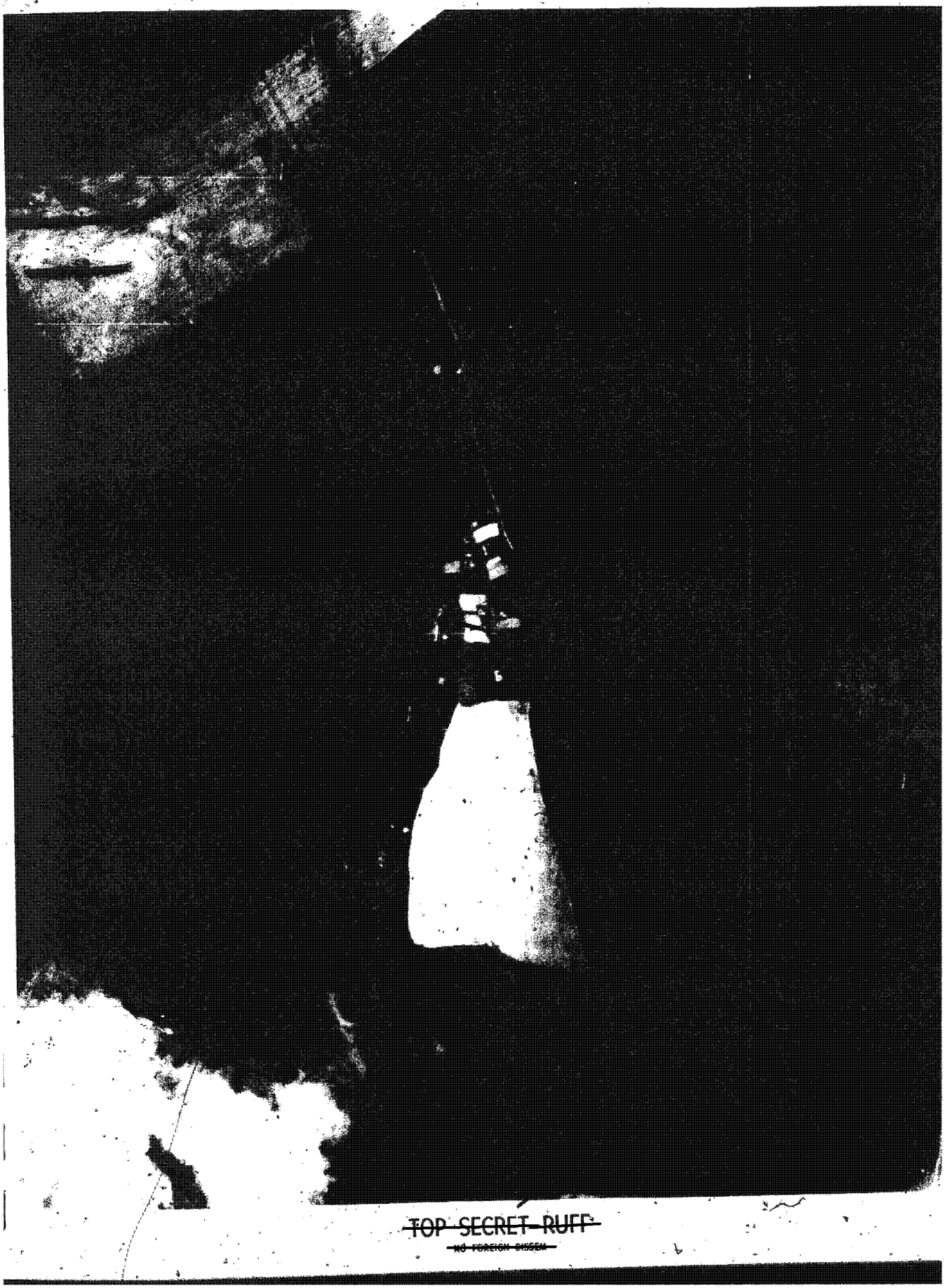
~~NO FOREIGN DISSEM~~

Approved for Release: 2021/05/05 C05133959



TOP SECRET RUFF
NO FOREIGN DISSEM

FIGURE 19. IMAGE DEGRADATION CAUSED BY VEHICLE INSTABILITY.

Pass: D16
Frame: 03
Index: 10 (75.0 - 12.0)
Enlargement: 1X

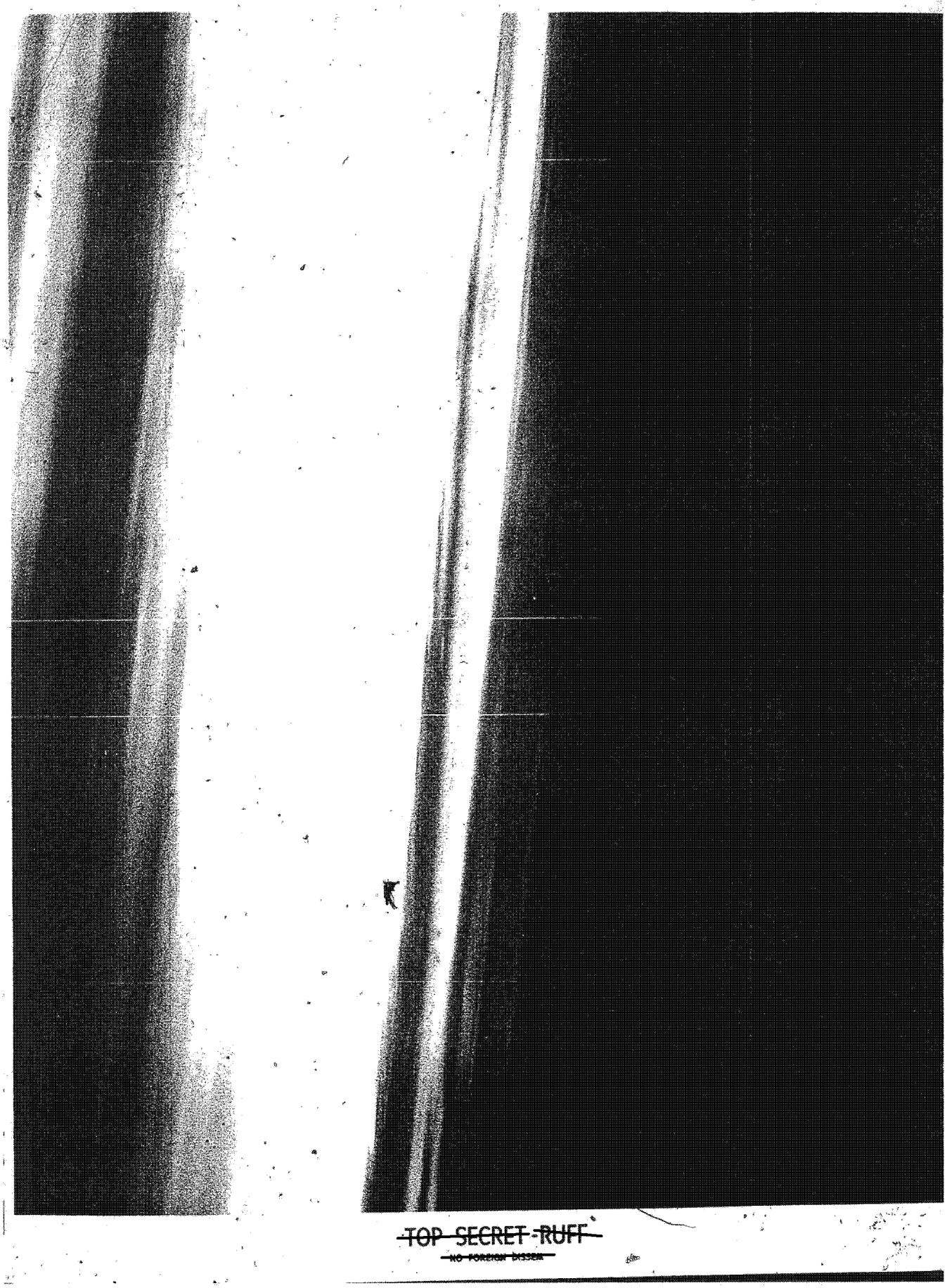
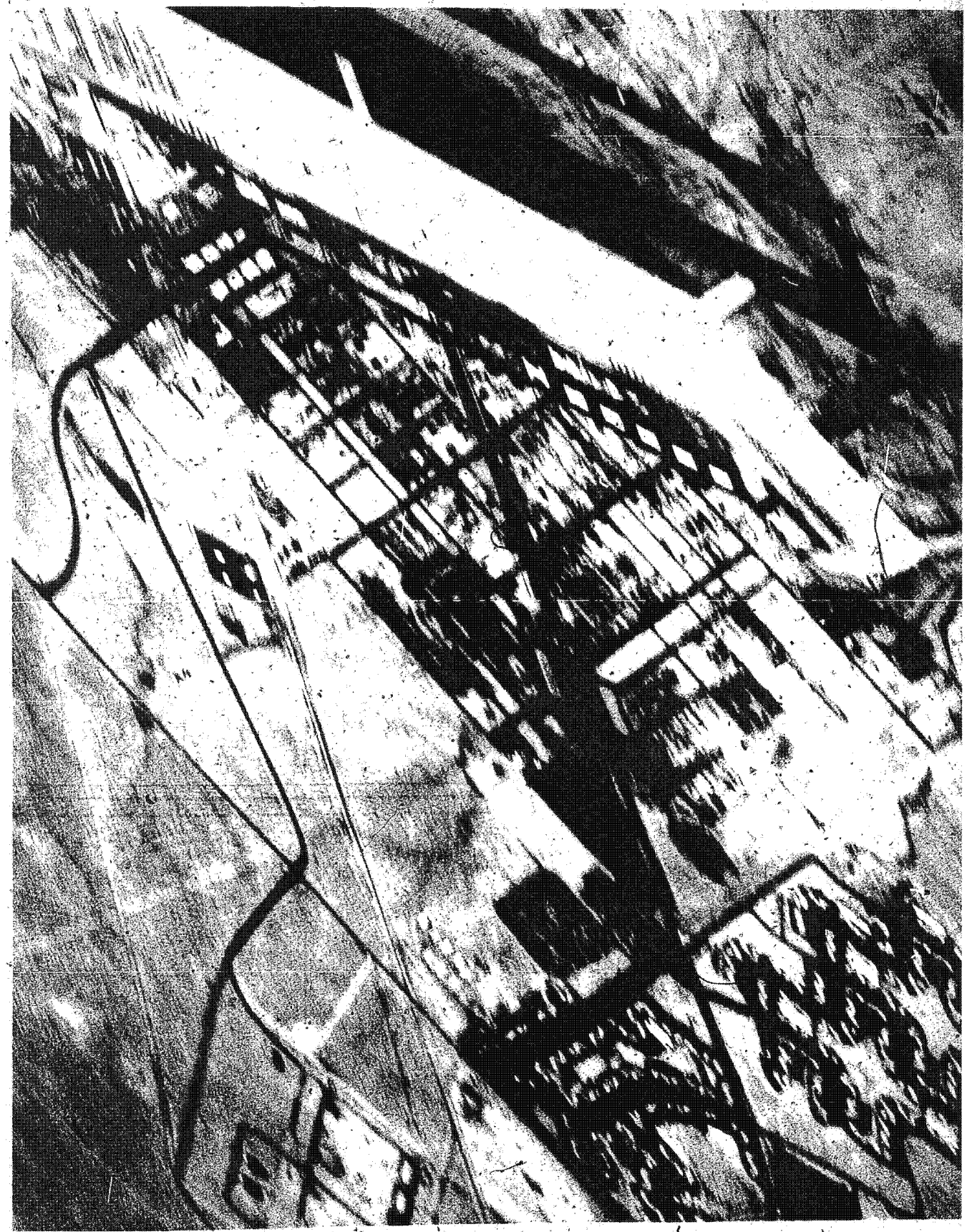


FIGURE 20. IMAGE DEGRADATION CAUSED BY VEHICLE INSTABILITY.

Pass: D16
Frame: 04
Index: 15 (86.0-10.0)
Enlargement: 7X



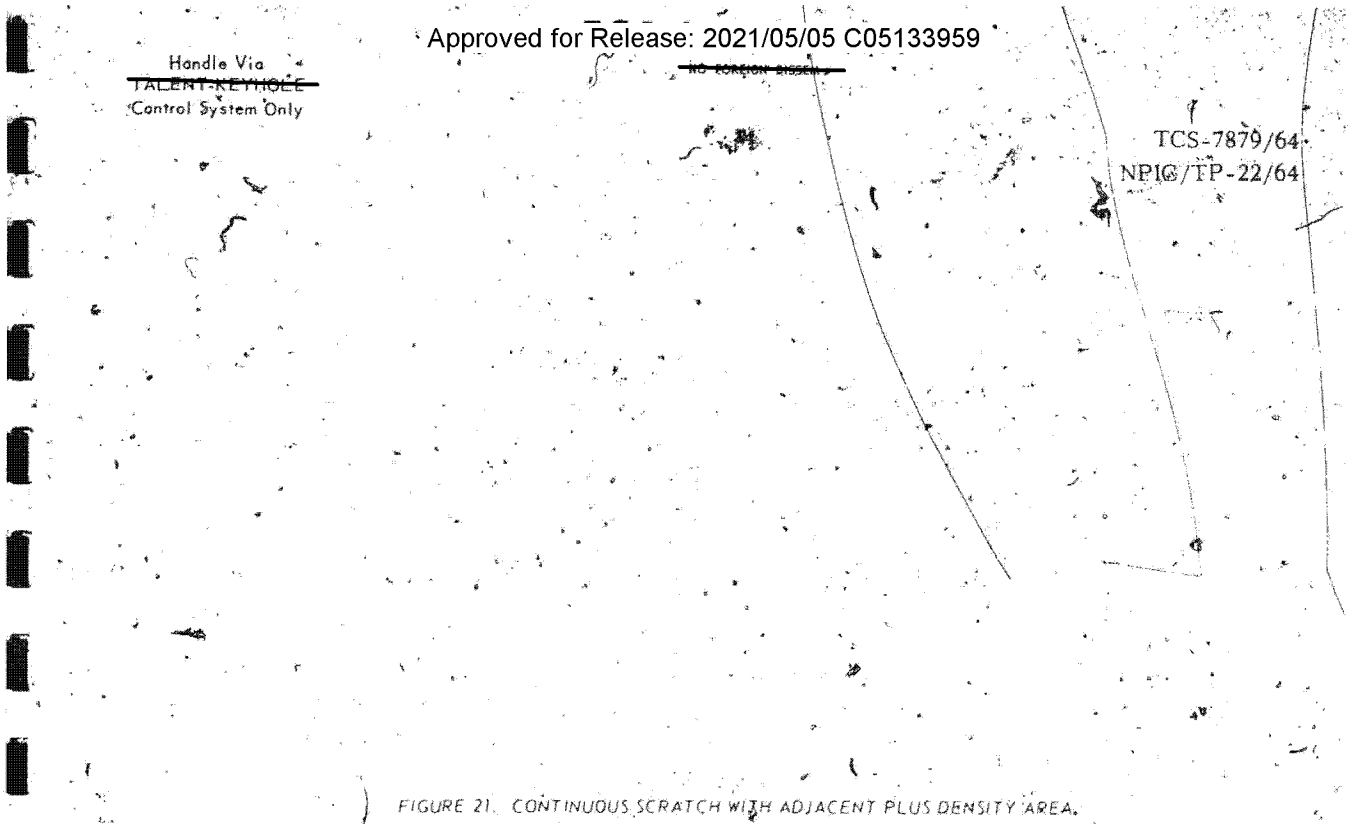


FIGURE 21. CONTINUOUS SCRATCH WITH ADJACENT PLUS DENSITY AREA.

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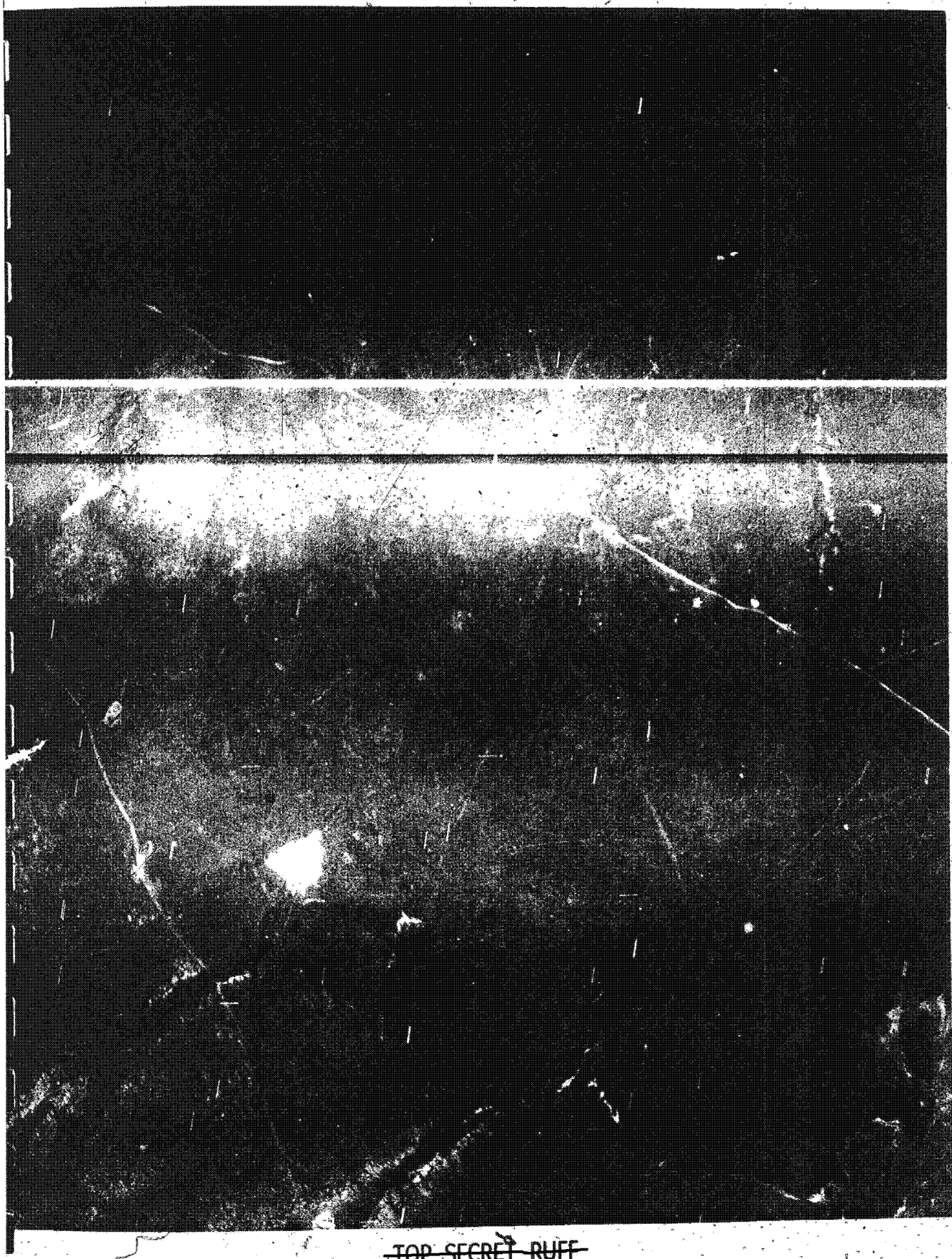
NPIC-TP-22/64

Pass: DIS
Frame: 08
Index: 20.62.0 - 22.6
Enlargement: 10X

~~TOP SECRET RUFF~~
NO FOREIGN DISSEM

Handle Via
~~TALENT-KEYHOLE~~
Control System Only



~~TOP SECRET RUFF~~

~~NO FOREIGN DISSEM~~

FIGURE 22. MINUS DENSITY STREAKS AND EFFECTS OF ATMOSPHERICS.

~~TOP SECRET RUFF~~
~~NO FOREIGN DISSEM~~

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

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NPIC/TP-22/64

Pass: 1015
Frame: 13
Index: 33 (63.7 - 9.2)
Enlargement: 10X
Solar Elevation: 78.1
Solar Azimuth: 155
Solar Bearing: 235
Roll Angle: -4.96

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

~~TOP SECRET RUFF~~

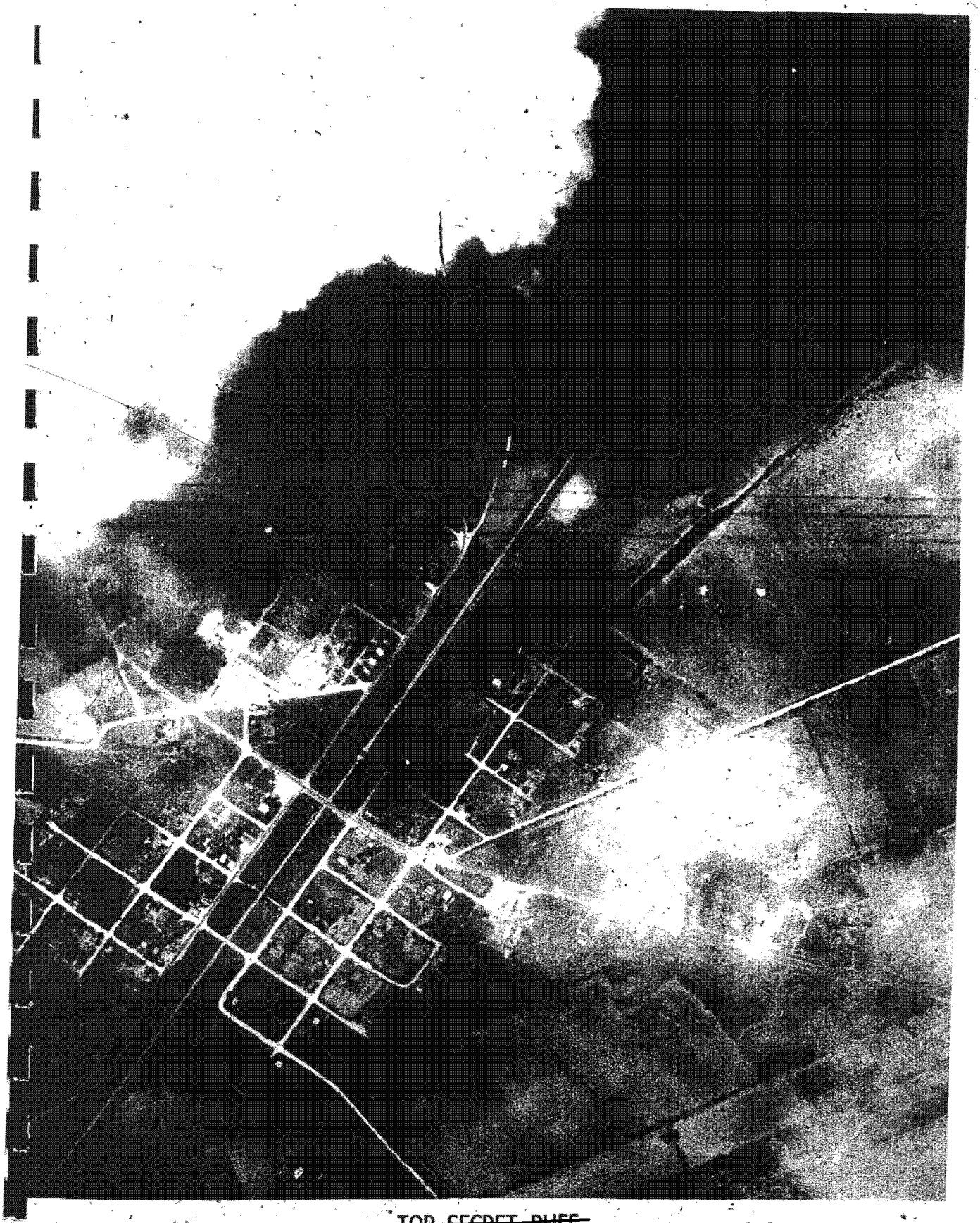
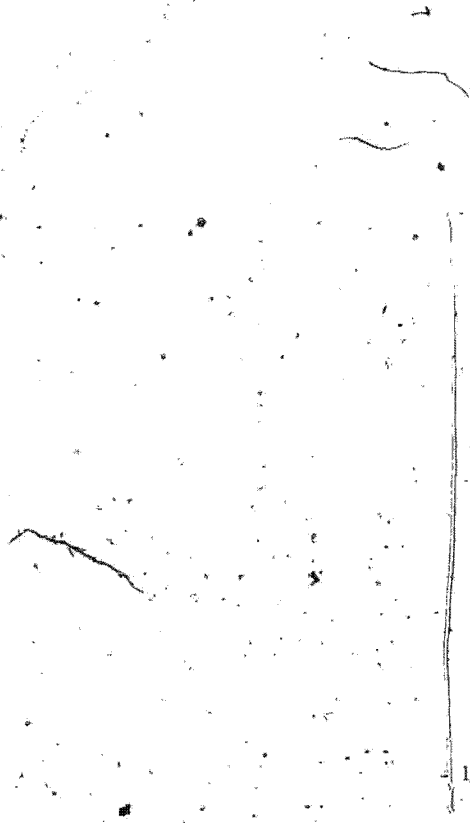


FIGURE 23. MINUS DENSITY STREAK AND EFFECTS OF ATMOSPHERICS.

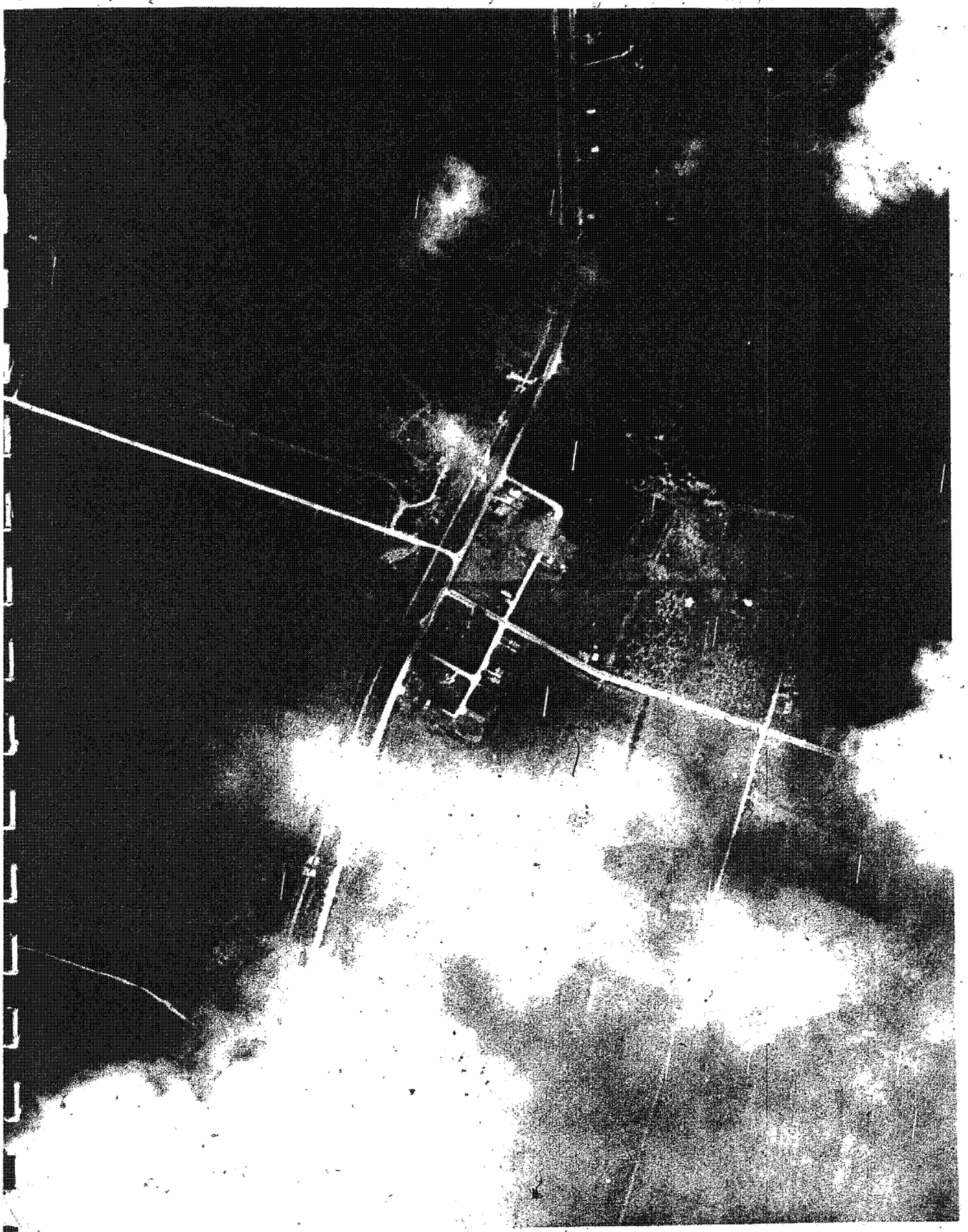


TCS-7879/64
NPIC/TP-22,64

Pass: D15
Frame: 14
Index: 35 -54.2 - 5.4
Enlargement: 10X
Solar Elevation: 58.0
Solar Azimuth: 140
Solar Bearing: 178
Roll Angle: -21.2°

- 12x -

NPIC/TP-22/64



~~TOP SECRET RUFF~~
~~NO FOREIGN DISSEM~~

4. Yaw Analysis. The yaw separation was measured in both yaw slits on pass D15 frame 4. The computations for the separations are shown below.

	Major	Minor
Yaw Slit No. 1	[illegible]	[illegible]
Yaw Slit No. 2	[illegible]	[illegible]

Computation for the Obliquity Angle

[illegible]

Computation for the Yaw Angle

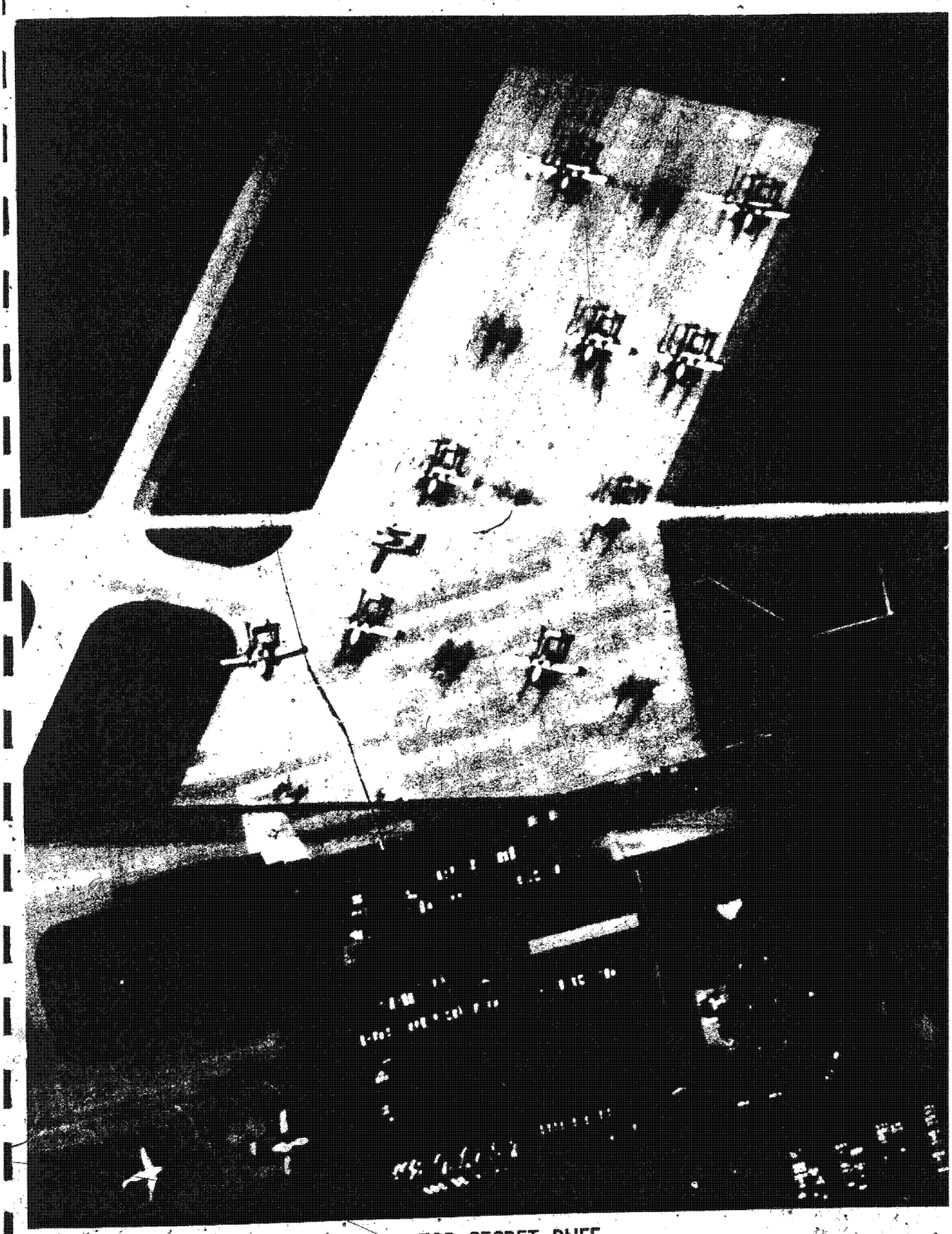
[illegible]

Note: [illegible]

FIGURE 13 - RAM STUDY

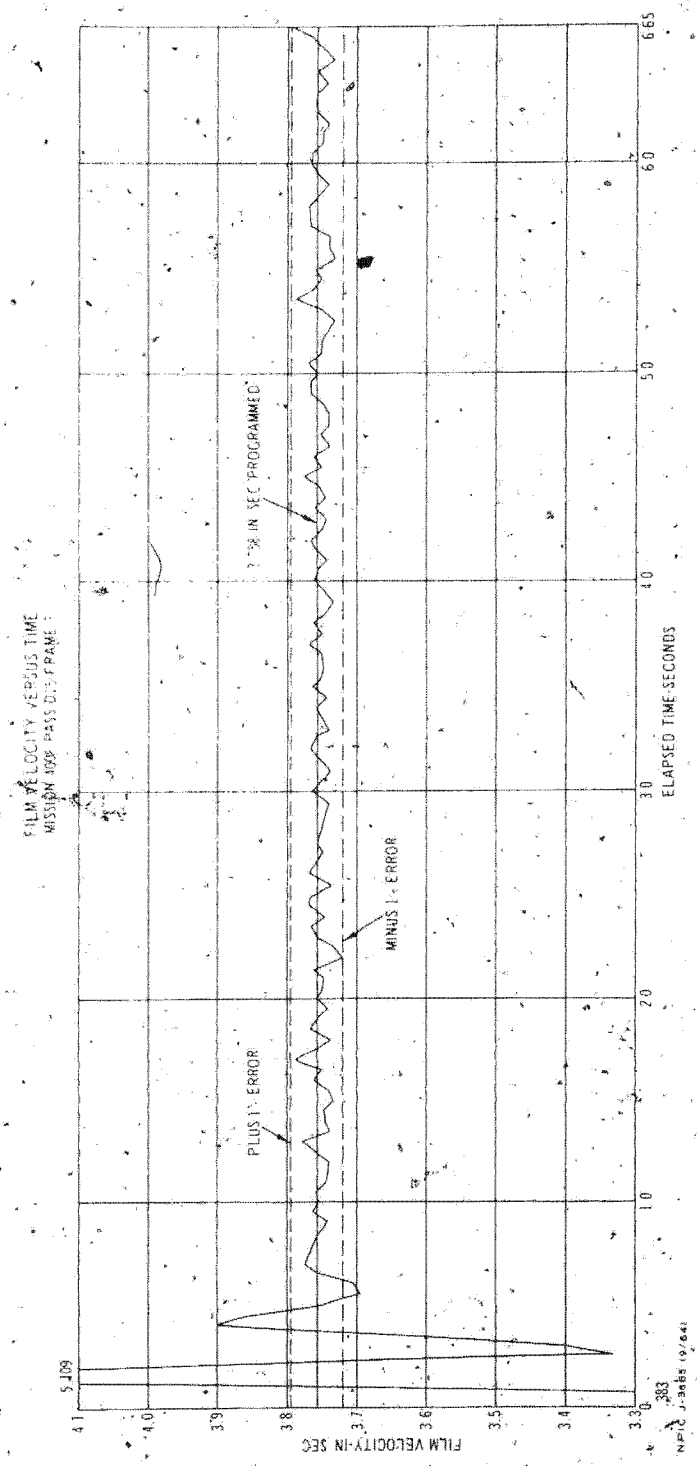
IOS-7879.64
NPIC TP-22'64

Pass: 1085
Frame: 204
Index: [illegible]
Enlargement: 20X
Solar Elevation: 64.5°
Solar Azimuth: 171°
Solar Bearing: 273°
Roll Angle: -32.61



5. Film Velocity Measurements. The film velocity for this mission was within the design specifications plus or minus 0.5 of one percent on almost all frames. The few frames that were outside the specifications were the first frames after long shutdown periods.

The film velocities were measured on a one micron comparator and all measurements were made on the 1/20th second time track. The graph showing the variations in speed was made from these time track readings and depicts the early variations due to the starting motion of the platen and film feed system. This start-up transient is about 0.5 second. After this the speed is relatively constant with a maximum excursion of about one percent. The nominal film speed and the one percent variation lines are shown on the graph. The variation is usually within 0.5 of one percent of the nominal line.

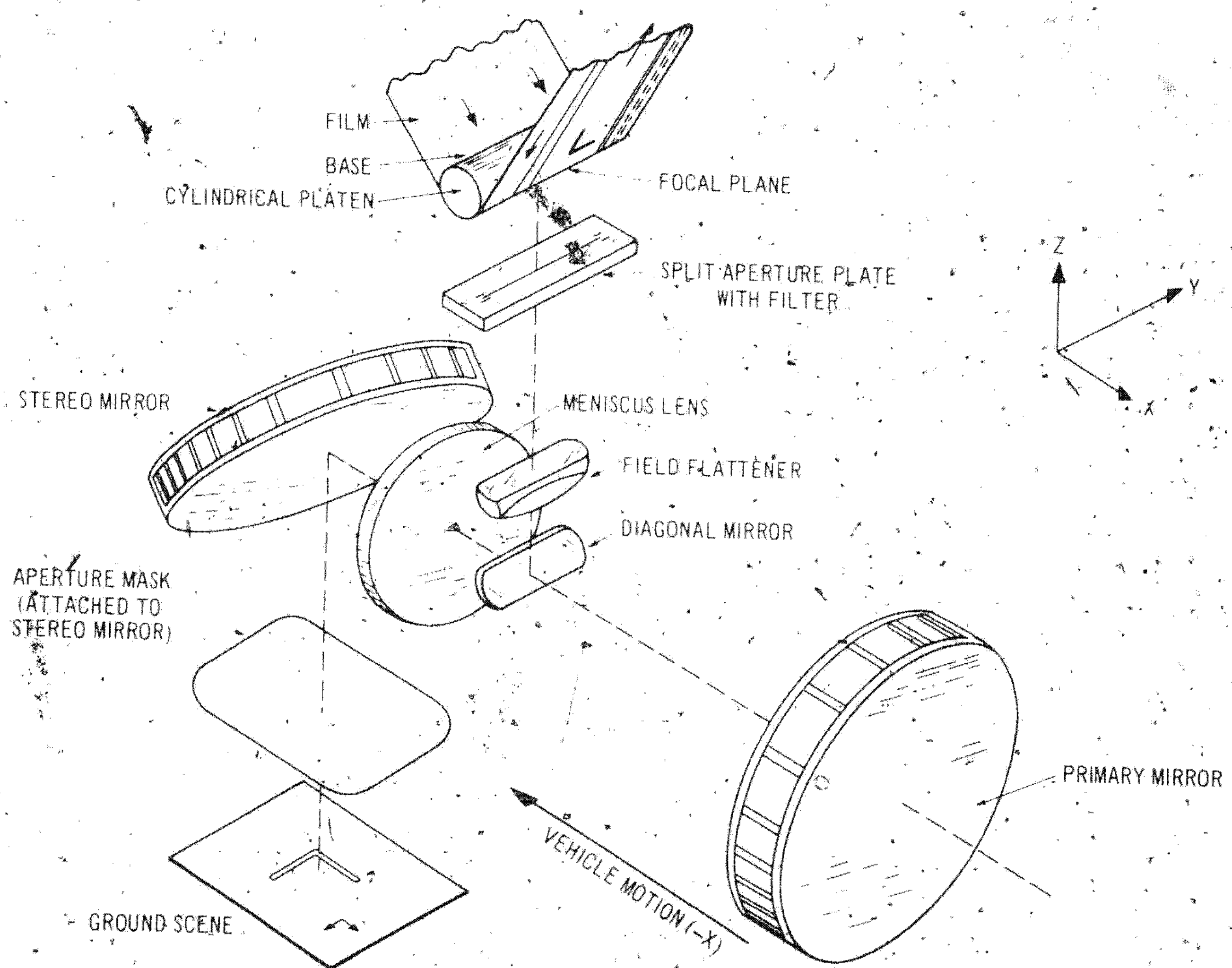


APPENDIX A. SYSTEM SPECIFICATIONS

TOP SECRET RUFF

NO FOREIGN DISSEM

- 18 -



NPIC J-2530 (8/64)

EXPANDED SCHEMATIC OF OPTICAL COMPONENTS

TCS-7879/64
NPIC/TP-22/64

TOP SECRET RUFF

NO FOREIGN DISSEM

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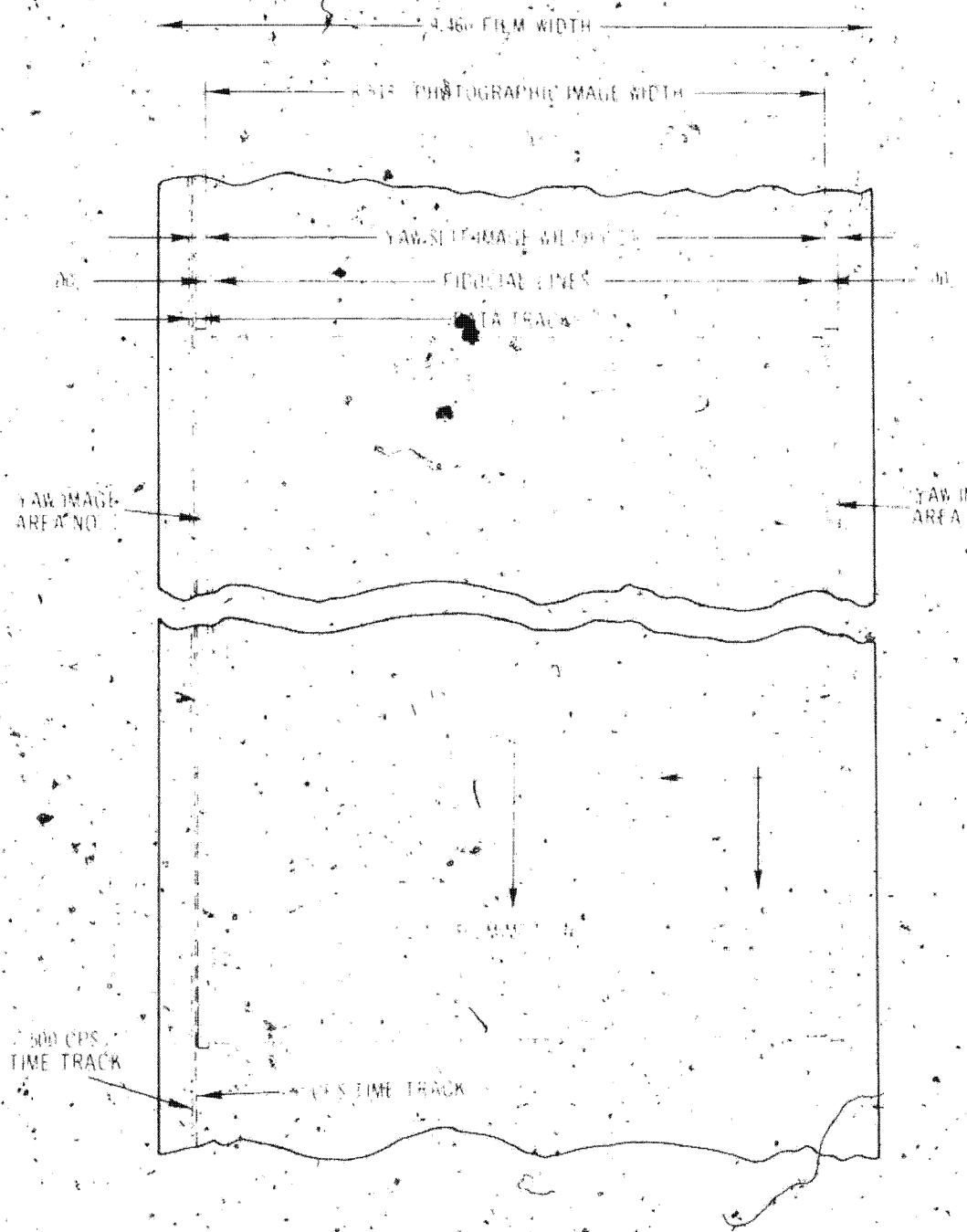
NPIC-TR-22-64



FILM FORMAT VIEWED FROM EMULSION SIDE

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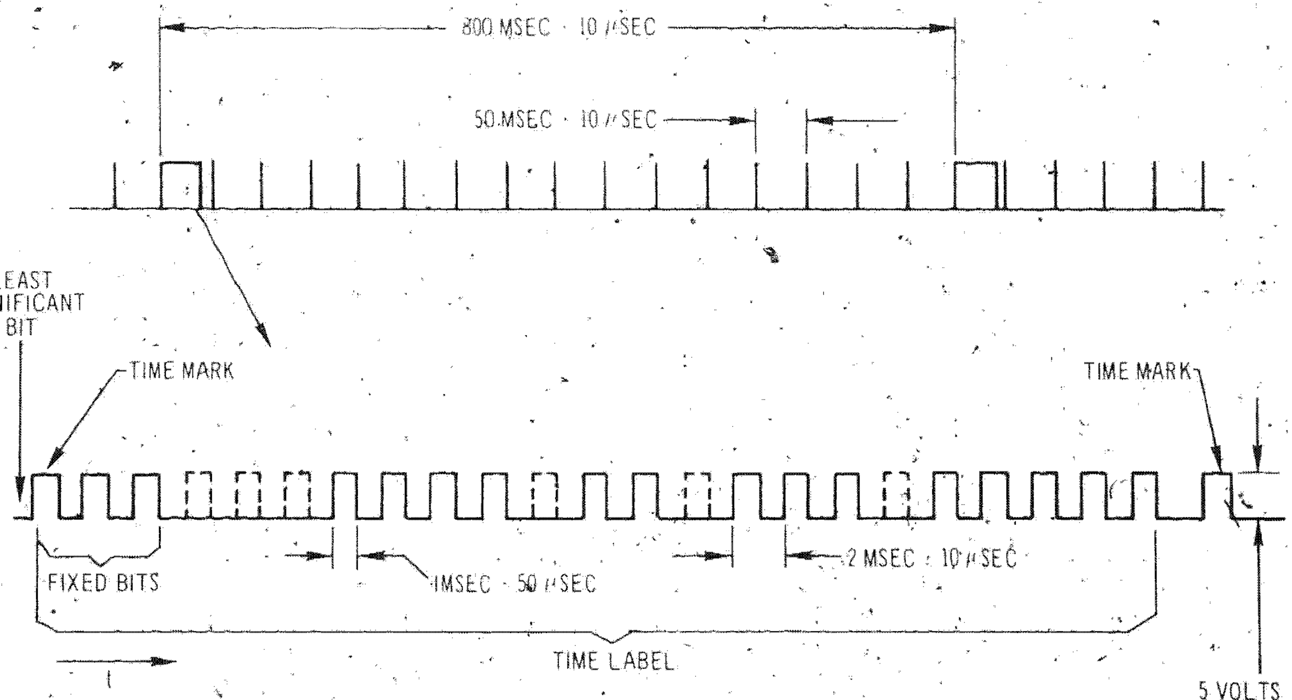
~~TOP SECRET RUFF~~

~~NO FOREIGN DISSEM~~

Handle Via TALENT-KEYHOLE Control System Only

TOP SECRET RUFF

NO FOREIGN DISSEM



NPIC J-2532 (8/64)

TIME-TRACK FORMAT

TCS-7879/64
NPIC/TP-22/64

Handle Via TALENT-KEYHOLE Control System Only

TOP SECRET RUFF

NO FOREIGN DISSEM

from highly reflective surfaces.)

Limiting Dmin: The least dense area within the format that can be detected with an aperture of 0.5 mm in a Macbeth QuantaLog Densitometer Model EP 1000. Usually surfaces of low reflectivity in cloud shadows.

Limiting Delta: The arithmetical difference between the most dense and least dense area in the format.

Terrain Dmax: The most dense area of a topographical feature (discounting glare from water surfaces) that can be detected in the format. Usually beaches, roof tops, fields of crops, etc.

Terrain Dmin: The least dense area of a topographical feature (discounting cloud shadows) that can be detected in the format--usually forest areas, black-top roads, shadows of buildings, etc.

Terrain Delta: The arithmetical difference between the most dense and least dense topographical feature of the frame.

Gross Fog: The base plus fog density read outside the format along the non-titled edge. Usually indicative of the level of processing.

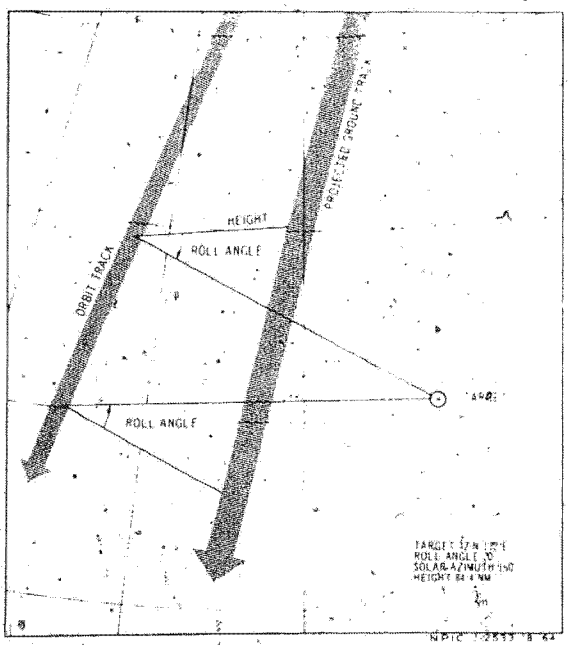


FIGURE 1. RELATIVE ORBITAL TRACK AND THE PROJECTED GROUND TRACK AT 20° RIGHT WING DOWN ROLL, AND AT THE CONVERGENCE ANGLE FOR STEREOGRAPHIC COVERAGE OF A TARGET.

FIGURE 2. MIRROR POSITIONS OF THE STEREO MIRROR RELATIVE TO THE VEHICLE AND THE TARGET.

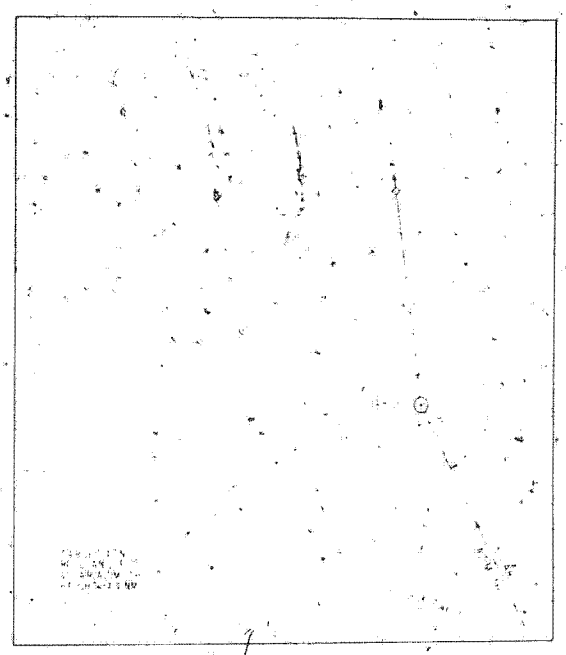


FIGURE 3. RELATIVE POSITIONS OF THE SOLAR AZIMUTH, TRUE NORTH AND THE TARGET.

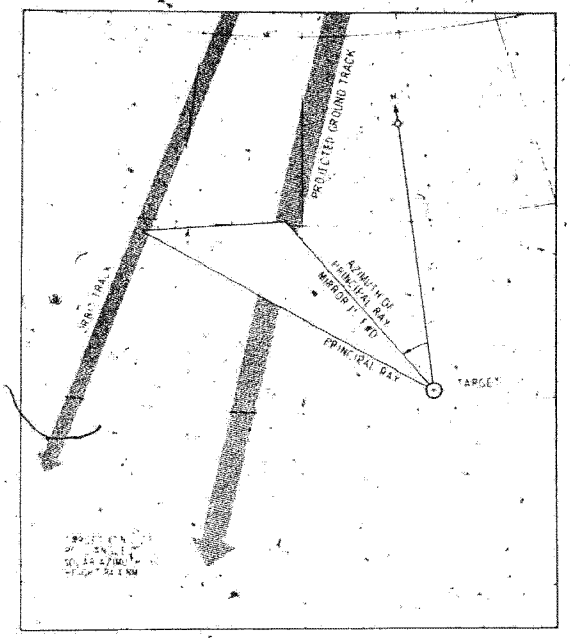


FIGURE 4. RELATIVE LOCATION OF THE PRINCIPAL RAY AND THE AZIMUTH OF THE PRINCIPAL RAY WITH THE MIRROR IN THE 15 FWD POSITION.

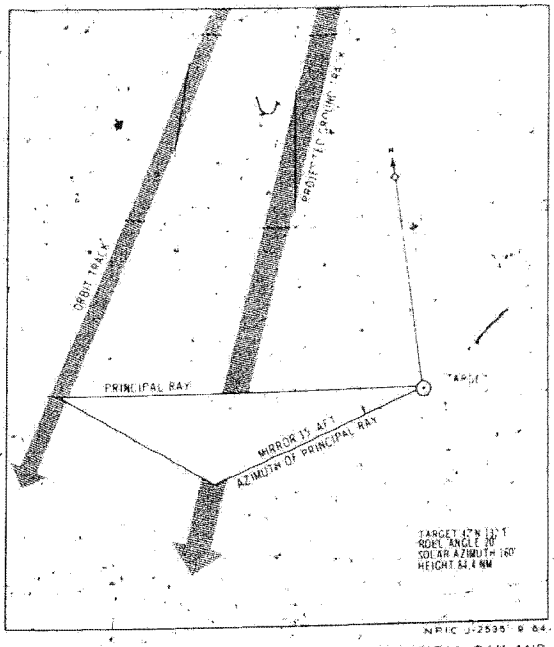


FIGURE 5. RELATIVE LOCATION OF THE PRINCIPAL RAY AND THE AZIMUTH OF THE PRINCIPAL RAY WITH THE STEREO MIRROR IN THE 15° AFT POSITION.

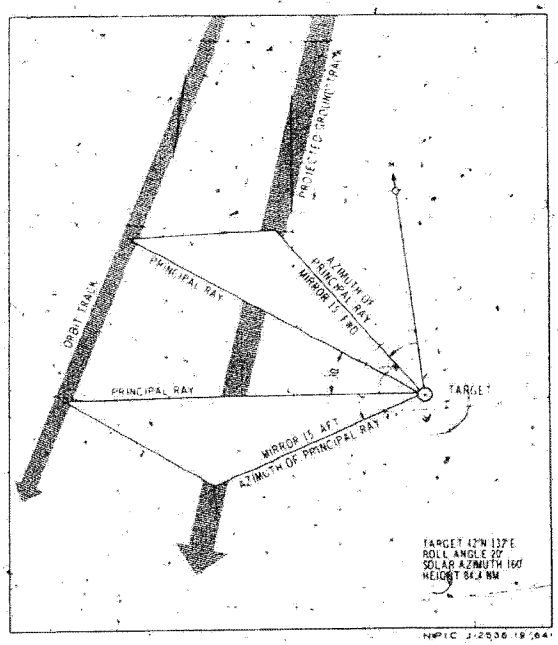


FIGURE 6. ALTHOUGH THE CONVERGENCE OF THE TWO PRINCIPAL RAYS ALWAYS FORMS A 30° ANGLE, THE CONVERGENCE OF THE AZIMUTHS OF THESE PRINCIPAL RAYS FORMS AN ANGLE THAT IS A FACTOR OF THE VEHICLE ATTITUDE AND ALTITUDE.

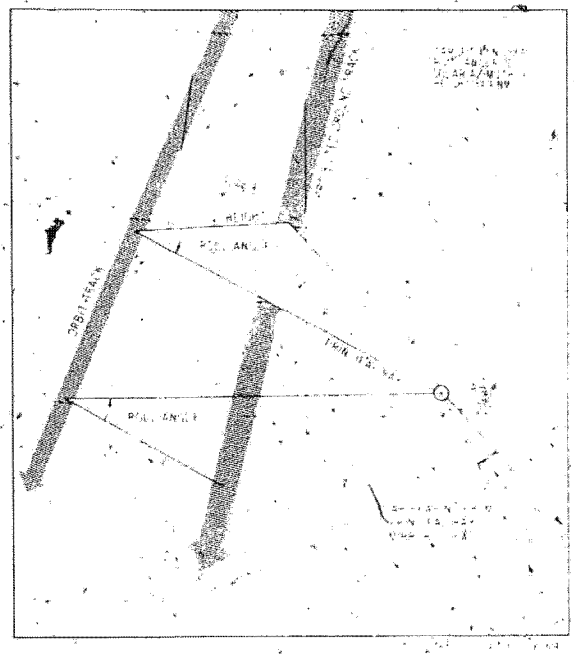


FIGURE 7. RELATIVE LOCATION OF THE SOLAR BEARING, THE PRINCIPAL RAY AND THE TARGET WHEN THE STEREO MIRROR IS IN THE 15 FWD POSITION. THIS BEARING IS MEASURED CLOCKWISE FROM THE PRINCIPAL RAY.

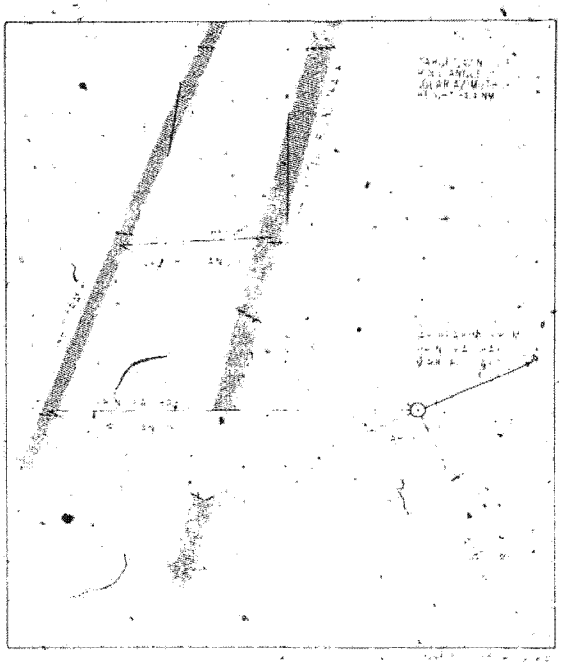
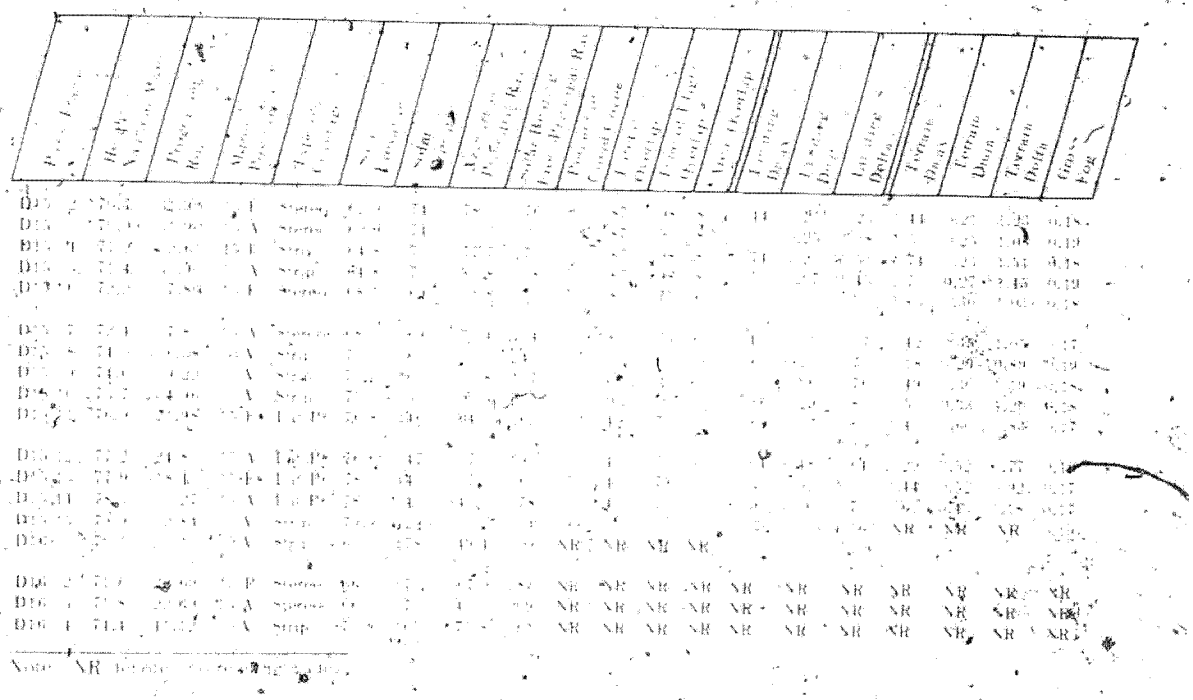


FIGURE 8. RELATIVE LOCATION OF THE SOLAR BEARING, THE PRINCIPAL RAY AND THE TARGET WHEN THE STEREO MIRROR IS IN THE 15 AFT POSITION. THIS BEARING IS MEASURED CLOCKWISE FROM THE PRINCIPAL RAY.

Pass	Frame	Height in Nautical Miles	Programmed Roll °	Mirror Position	Type of Coverage	Solar Elevation	Solar Azimuth	Magnitude of Principal Ray	Solar Bearing From Principal Ray	Percent of Cloud Cover	Inland Overlap	Line of Flight Overlap	Area Overlap	Leading Data	Lateral Data	Following Data	Torque Data	Forward Data	Inverse Data	Cross Freq
D04	1	85.6	9.98	15 F	Stereo	44.5	207	4.9	25	[illegible]	NR	NR	NR	[illegible]	[illegible]	0.59	NR	NR	NR	[illegible]
D04	2	85.4	9.98	15 A	Stereo	44.5	207	-105.1	142	100	NR	NR	NR	2.09	0.42	0.58	NR	NR	NR	0.17
D04	3	82.0	28.36	15 F	Stereo	52.1	187	-10.2	17	2	90	98	88	2.68	0.28	1.37	NR	NR	NR	0.18
D04	4	82.0	28.36	15 A	Stereo	52.0	187	- 95.9	103	4	90	98	88	2.68	0.29	1.41	NR	NR	NR	0.19
D04	5	81.8	-11.34	15 F	Stereo	55.6	181	59.2	311	96	85	98	82	2.12	0.12	1.70	2.12	0.12	1.70	0.20
D04	6	81.8	-11.34	45 A	Stereo	55.6	181	167.0	191	96	85	98	82	2.11	0.11	1.70	2.11	0.11	1.70	0.20
D04	7	81.9	-31.90	15 F	Strip	57.8	177	79.4	278	95	85	98	77	2.11	0.45	1.76	2.11	0.40	1.74	0.19
D04	8	81.9	-31.90	15 A	Strip	57.8	177	-134.9	225	93	85	97	82	2.04	0.31	1.70	2.04	0.42	1.62	0.19
D05	1	82.8	4.25	0 V	Strip	45.7	192	- 63.7	76	2	98	99	99	2.00	0.26	1.74	2.00	0.26	1.71	0.15
D05	2	81.9	40.41	15 F	Strip	57.1	184	- 49.1	53	96	90	100	90	2.11	0.11	1.67	0.81	0.11	0.87	0.18

Pass, Frame	Height of Vehicle at Mid	Programmed Roll	Mirror Position	Type of Coverage	Solar Elevation	Solar Azimuth	Azimuth of Principal Ray	Solar Bearing From Principal Ray	Percent of Cloud Cover	Lateral Overlap	Line of Flight Overlap	Area Overlap	Limiting Dmax	Limiting Dmin	Limiting Delta	Terrain Dmax	Terrain Dmin	Terrain Delta	Gross Fog
D05 3	81.9	40.41	15 A	Strip	57.8	184	- 92.5	96	[illegible]	90	85	77	2.13	0.38	1.75	1.23	0.38	0.85	0.19
D05 4	82.0	36.87	15 F	Strip	59.4	182	- 48.7	[illegible]	[illegible]	[illegible]	[illegible]	79	2.31	0.54	[illegible]	1.18	0.54	0.64	0.19
D05 5	82.0	36.87	15 A	Strip	59.4	182	- 94.3	96	[illegible]	[illegible]	100	[illegible]	2.35	0.64	1.71	2.20	0.64	0.56	0.19
D05 6	82.1	28.36	15 F	Stereo	61.2	179	41.5	44		[illegible]	85	68	1.76	0.52	1.24	1.61	0.52	0.79	0.19
D05 7	82.2	28.36	15 A	Stereo	62.2	179	91.8	90	[illegible]	[illegible]	85	75	[illegible]	0.52	[illegible]	1.42	0.52	0.90	0.19
D05 8	82.6	-34.74	15 F	Stereo	64.2	174	73.2	272	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	0.18
D05 9	82.8	-34.74	15 A	Stereo	64.2	177	[illegible]	226	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.77	NR	NR	NR	0.18
D05 10	82.1	28.36	15 F	Stereo	66.2	169	73.4	270	[illegible]	[illegible]	[illegible]	[illegible]	2.04	0.42	1.62	[illegible]	0.42	0.63	0.18
D05 11	82.2	28.36	15 A	Stereo	66.2	169	[illegible]	[illegible]	[illegible]	[illegible]	85	[illegible]	[illegible]	0.49	1.52	[illegible]	0.49	0.59	0.19
D06 1	82.8	[illegible]	0 A	Strip	40.4	204	[illegible]	[illegible]	72	[illegible]	[illegible]	[illegible]	1.96	[illegible]	[illegible]	1.64	0.34	1.30	0.18
D06 2	82.5	[illegible]	0 A	Strip	47.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.78	2.06	0.41	1.65	0.18
D06 3	81.9	[illegible]	8 A	Strip	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.04	[illegible]	1.74	1.82	0.30	1.52	0.19
D06 4	81.9	[illegible]	15 F	Strip	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99	79	[illegible]	0.32	1.77	[illegible]	0.32	0.73	0.19
D06 5	82.0	[illegible]	15 A	Strip	[illegible]	182	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	74	2.10	[illegible]	1.78	1.54	0.32	1.22	0.20
D06 6	82.1	22.60	0 A	Strip	59.7	177	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.19	0.39	[illegible]	2.04	0.39	1.79	0.20
D06 7	[illegible]	-28.36	15 F	Stereo	[illegible]	[illegible]	72.9	272		80	93	79	1.69	0.69	[illegible]	1.69	0.69	1.00	0.20
D06 8	84.0	-28.36	15 A	Stereo	[illegible]	166	145.1	241	[illegible]	80	98	78	1.71	0.67	1.04	[illegible]	0.67	[illegible]	0.20
D06 9	84.8	-36.16	0 A	Strip	69.6	162	193.9	258	100	[illegible]	[illegible]	[illegible]	2.02	1.17	0.85	NR	NR	NR	0.19
D06 10	85.2	40.41	15 A	Strip	72.7	166	96.9	[illegible]	100	NR	NR	NR	2.15	[illegible]	0.25	NR	NR	NR	0.19
D06 11	85.9	30.49	15 F	Strip	74.7	160	[illegible]	[illegible]	100	NR	NR	NR	[illegible]	1.61	0.50	NR	NR	NR	0.19
D06 12	86.6	12.05	0 A	Strip	[illegible]	152	102.6	229	80	[illegible]	[illegible]	[illegible]	[illegible]	0.39	[illegible]	1.24	0.39	0.85	0.19
D06 13	87.5	6.38	15 F	Stereo	[illegible]	147	18.4	345	60	75	100	75	2.15	0.36	1.79	1.82	0.36	1.46	0.19
D06 14	87.9	6.38	15 A	Stereo	[illegible]	147	134.7	102	60	75	92	69	2.11	0.40	1.71	1.28	0.40	0.88	0.19
D06 15	89.2	17.72	15 F	Stereo	79.5	[illegible]	40.5	[illegible]	[illegible]	80	98	78	2.14	0.34	1.80	1.74	0.34	1.40	0.19
D06 16	89.7	17.72	15 A	Stereo	79.5	[illegible]	113.6	68	[illegible]	80	98	78	2.17	0.31	1.86	1.58	0.31	1.27	0.19
D06 17	90.2	-29.07	0 A	Strip	[illegible]	139	102.0	197	[illegible]	90	100	90	2.13	0.30	1.83	1.59	0.30	1.29	0.19
D06 18	91.8	- 6.38	0 A	Strip	80.3	[illegible]	101.0	192	5	90	00	00	2.14	0.28	1.86	1.55	0.28	1.27	0.19
D07 1	86.8	37.58	15 F	Stereo	27.8	221	- 15.0	[illegible]	100	NR	NR	NR	2.05	1.80	0.25	NR	NR	NR	0.20
D07 2	86.4	37.58	15 A	Stereo	27.7	221	61.9	[illegible]	100	NR	NR	NR	2.03	1.80	0.23	NR	NR	NR	0.20
D07 3	83.0	-34.74	0 V	Strip	41.8	193	117.9	255	15	00	00	00	2.12	0.34	1.78	1.98	0.34	1.64	0.20
D07 4	81.7	-31.90	15 F	Stereo	50.5	184	[illegible]	281	20	92	93	86	2.04	0.32	1.72	1.92	0.40	1.52	0.20
D07 5	[illegible]	-31.90	15 A	Stereo	50.5	184	138.0	226	20	92	93	86	2.08	0.34	1.74	1.92	0.44	1.48	0.20
D07 6	81.6	-20.56	0 V	Strip	58.5	178	107.3	251	85	00	00	00	2.18	0.33	1.85	2.10	0.44	1.66	0.20
D07 7	82.1	19.14	15 F	Stereo	63.1	177	37.5	35	30	78	96	75	2.16	0.44	1.72	1.60	0.62	1.18	0.22
D07 8	82.2	19.14	15 A	Stereo	63.1	177	108.5	106	30	78	98	76	2.07	0.49	1.58	1.72	0.63	1.09	0.21
D07 9	82.6	-38.29	15 F	Stereo	65.2	169	80.7	268	95	80	100	80	2.09	0.52	1.57	1.85	0.52	1.33	0.20
D07 10	82.8	-38.29	15 A	Stereo	65.2	160	128.5	221	95	80	98	78	2.08	0.60	1.48	2.05	0.60	1.45	0.19
D07 11	83.4	- 8.51	0 V	Strip	68.1	168	103.7	244	80	00	00	00	2.13	0.47	1.66	2.13	0.72	1.41	0.18
D08 1	84.6	17.72	15 F	Stereo	38.9	203	- 16.0	39	99	NR	NR	NR	1.96	1.80	0.16	NR	NR	NR	0.17
D08 2	84.4	17.72	15 A	Stereo	38.9	203	- 94.9	118	99	NR	NR	NR	1.96	1.69	0.27	NR	NR	NR	0.18
D08 3	82.8	-22.69	0 V	Strip	46.5	189	114.1	255	30	00	00	00	1.99	0.39	1.60	1.97	0.39	1.56	0.21
D08 4	82.2	-24.81	0 V	Strip	54.0	182	109.2	253	10	00	00	00	2.10	0.34	1.76	1.10	0.42	0.68	0.17
D08 5	82.3	-13.47	15 F	Stereo	57.8	179	54.6	304	90	85	92	78	2.11	0.44	1.67	NR	NR	NR	0.21
D08 6	82.4	-13.47	15 A	Stereo	57.8	179	160.5	199	90	85	90	77	2.13	0.43	1.70	NR	NR	NR	0.19
D08 7	82.9	-17.72	0 V	Strip	62.2	175	105.9	249	80	00	00	00	2.07	0.39	1.68	1.13	0.60	0.53	0.17
D08 8	83.0	-34.03	15 F	Strip	63.4	172	78.9	273	60	82	100	82	2.20	0.52	1.68	1.89	0.59	1.30	0.19
D08 9	83.2	-34.03	15 A	Strip	63.4	172	131.6	220	60	82	90	74	2.07	0.42	1.65	1.72	0.82	0.90	0.19
D08 10	84.6	31.20	15 F	Strip	70.3	169	- 49.2	38	85	00	00	00	2.16	0.63	1.53	1.42	0.63	0.79	0.17
D08 11	85.2	- 0.71	15 F	Strip	71.3	164	- 7.4	337	5	82	98	80	1.99	0.37	1.62	1.53	0.59	0.94	0.17
D08 12	85.4	- 0.71	15 A	Strip	71.3	164	158.8	143	5	82	92	75	1.97	0.41	1.56	1.59	0.43	1.16	0.17

Pass Frame	Height in Nautical Miles	Programmed Roll	Mirror Position	Type of Coverage	Solar Elevation	Solar Azimuth	Azimuth of Principal Ray	Solar Bearing from Principal Ray	Percent of Cloud Cover	Lateral Overlap	Line of Flight Overlap	Area Overlap	Leeward Dmax	Leeward Dmin	Leeward Delta	Terrain Dmax	Terrain Dmin	Terrain Delta	Gross Fog
D09 1	86.5	-35.99	15 F	Stereo	33.9	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 2	86.2	-35.99	15 A	Stereo	36.0	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 3	84.4	-34.03	15 F	Stereo	39.0	[illegible]	96.8	[illegible]	[illegible]	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 4	84.2	-34.03	15 A	Stereo	39.0	199	146.6	[illegible]	[illegible]	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 5	82.9	-27.65	15 F	Stereo	45.[illegible]	19[illegible]	[illegible]	256	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 6	82.8	-27.65	15 A	Stereo	45.7	19[illegible]	144.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 7	82.4	-34.03	15 F	Stereo	50.4	184	85.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D09 8	82.3	-34.03	15 A	Stereo	50.[illegible]	184	136.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D09 9	82.2	9.93	15 F	Strip	52.7	185	17.4	22	58	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 10	82.2	-9.93	15 A	Strip	54.7	185	-120.9	[illegible]	[illegible]	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 11	82.2	16.31	15 F	Strip	56.3	184	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 12	82.2	16.31	15 A	Strip	[illegible]	184	-100.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D09 13	82.3	22.69	15 F	Stereo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 14	82.3	22.69	15 A	Stereo	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 15	82.4	9.93	15 A	Strip	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D09 16	82.6	42.54	15 F	Strip	61.[illegible]	181	[illegible]	52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 17	82.7	42.54	15 A	Strip	61.[illegible]	181	-94.7	41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 18	83.3	-37.58	15 F	Stereo	64.3	17[illegible]	[illegible]	[illegible]	100	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 19	83.4	-37.58	15 A	Stereo	64.3	17[illegible]	128.2	224	100	NR	NR	NR	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 20	83.7	-44.89	15 F	Stereo	66.3	[illegible]	[illegible]	[illegible]	95	80	[illegible]	[illegible]	2.08	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 21	83.9	-44.89	15 A	Stereo	66.4	170	155.5	[illegible]	95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NR	NR	NR	[illegible]
D09 22	84.4	24.11	15 A	Strip	68.5	[illegible]	-105.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D10 21	82.[illegible]	11.34	15 A	Stereo	61.1	[illegible]	-123.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D10 22	82.9	-9.93	30 V	Strip	62.2	177	-72.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D10 23	83.1	22.69	15 F	Stereo	64.8	176	-41.0	47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D10 24	83.2	22.69	15 A	Stereo	63.7	170	-105.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
D10 25	84.1	31.90	15 F	Strip	68.1	172	-49.[illegible]	41	95	95	[illegible]	79	[illegible]	[illegible]	1.41	[illegible]	[illegible]	0.54	[illegible]
D10 26	84.3	31.90	15 A	Strip	68.1	172	-99.6	92	95	95	[illegible]	90	2.04	0.49	1.55	[illegible]	0.49	0.66	0.18
D10 1	90.5	-24.51	15 F	Stereo	23.5	251	-139.9	291	100	95	80	76	[illegible]	1.48	0.35	NR	NR	NR	0.19
D10 2	90.4	-24.81	15 A	Stereo	23.3	251	-155.7	227	100	95	85	[illegible]	1.78	1.48	[illegible]	NR	NR	NR	[illegible]
D10 3	86.2	9.93	15 F	Stereo	33.4	214	10.0	24	98	92	97	83	1.99	0.92	1.07	[illegible]	[illegible]	[illegible]	0.19
D10 4	86.0	9.93	15 A	Stereo	33.4	214	-98.3	133	98	92	97	89	2.00	0.85	1.15	[illegible]	[illegible]	[illegible]	0.18
D10 5	84.3	34.74	15 F	Stereo	39.6	204	-31.6	56	99	95	98	93	2.03	0.67	1.36	1.76	1.02	0.74	0.16
D10 6	84.1	34.74	15 A	Stereo	35.5	204	-80.3	104	99	95	98	93	1.99	1.02	0.97	1.66	1.02	0.64	0.18
D10 7	83.2	-7.09	15 F	Stereo	44.2	193	47.1	326	5	87	97	84	1.75	0.20	1.55	1.19	0.24	0.95	0.19
D10 8	83.1	-7.09	15 A	Stereo	44.1	193	-173.4	156	5	87	87	76	1.69	0.22	1.47	1.14	0.23	0.91	0.19
D10 9	82.6	-14.18	0 V	Strip	47.5	189	113.6	256	2	00	00	00	1.79	0.20	1.59	1.03	0.20	0.83	0.17
D10 10	82.5	-3.54	15 F	Stereo	49.0	188	30.6	337	0	92	93	91	1.38	0.22	1.16	0.79	0.22	0.57	0.19
D10 11	82.4	-3.54	15 A	Stereo	48.9	188	-164.6	173	0	92	85	78	1.49	0.23	1.26	0.93	0.23	0.70	0.17
D10 12	82.4	2.13	15 A	Strip	49.7	188	-143.4	151	3	00	00	00	1.80	0.21	1.59	0.87	0.21	0.66	0.18
D10 13	82.3	14.17	0 V	Strip	51.9	187	-68.2	75	20	00	00	00	2.03	0.27	1.76	1.32	0.29	1.03	0.19
D10 14	82.2	41.12	15 F	Strip	53.9	188	-47.5	56	100	92	80	74	2.12	0.67	1.45	NR	NR	NR	0.17
D10 15	82.2	41.12	15 A	Strip	53.8	188	-90.0	98	99	92	90	83	2.12	0.60	1.52	0.72	0.60	0.12	0.18
D10 16	82.3	34.03	15 F	Stereo	56.5	184	-45.9	50	95	83	80	66	2.01	0.37	1.64	1.13	0.52	0.61	0.17
D10 17	82.3	34.03	15 A	Stereo	56.4	184	-94.5	99	97	83	75	62	2.15	0.45	1.70	1.20	0.52	0.68	0.18
D10 18	82.4	4.25	15 A	Strip	57.6	181	-138.6	140	0	00	00	00	1.25	0.31	0.94	1.25	0.31	0.94	0.16
D10 19	82.5	34.03	15 A	Strip	59.2	182	-95.8	98	50	00	00	00	2.09	0.35	1.74	1.47	0.47	1.00	0.19
D10 20	82.7	11.34	15 F	Stereo	61.1	178	-23.7	22	0	80	95	76	1.15	0.29	0.86	1.15	0.29	0.86	0.17
D14 1	82.9	10.63	0 V	Strip	81.3	103	-77.7	1	35	00	00	00	2.02	0.34	1.68	1.64	0.42	1.22	0.20
D15 1	70.3	-29.07	0 V	Strip	60.4	176	106.6	249	0	00	00	00	1.03	0.24	0.79	1.03	0.24	0.79	0.19



APPENDIX C. MICRODENSITOMETRY

In an attempt to establish an objective measurement of image quality in photography, the technique of obtaining the spread function from microdensitometric edge traces is being investigated. The spread function curve represents the whole photographic system, and is a summation of the separate elements: lens, film, and uncompensated image motion due to vibration, velocity, roll, pitch, yaw, and aerial turbulence.

To assign a single number to the spread function, the width is measured at 50% amplitude. This number, usually expressed in microns, may be converted by use of the scale factors to ground distance in feet.

Edges meeting the criteria described below have been found on domestic passes of missions in the same frame as resolution targets and have been scanned. The ground distance in feet, thus determined, has been close to that determined from the resolution target. Although the techniques used are not refined and are considered to be still in the development stage, the poten-

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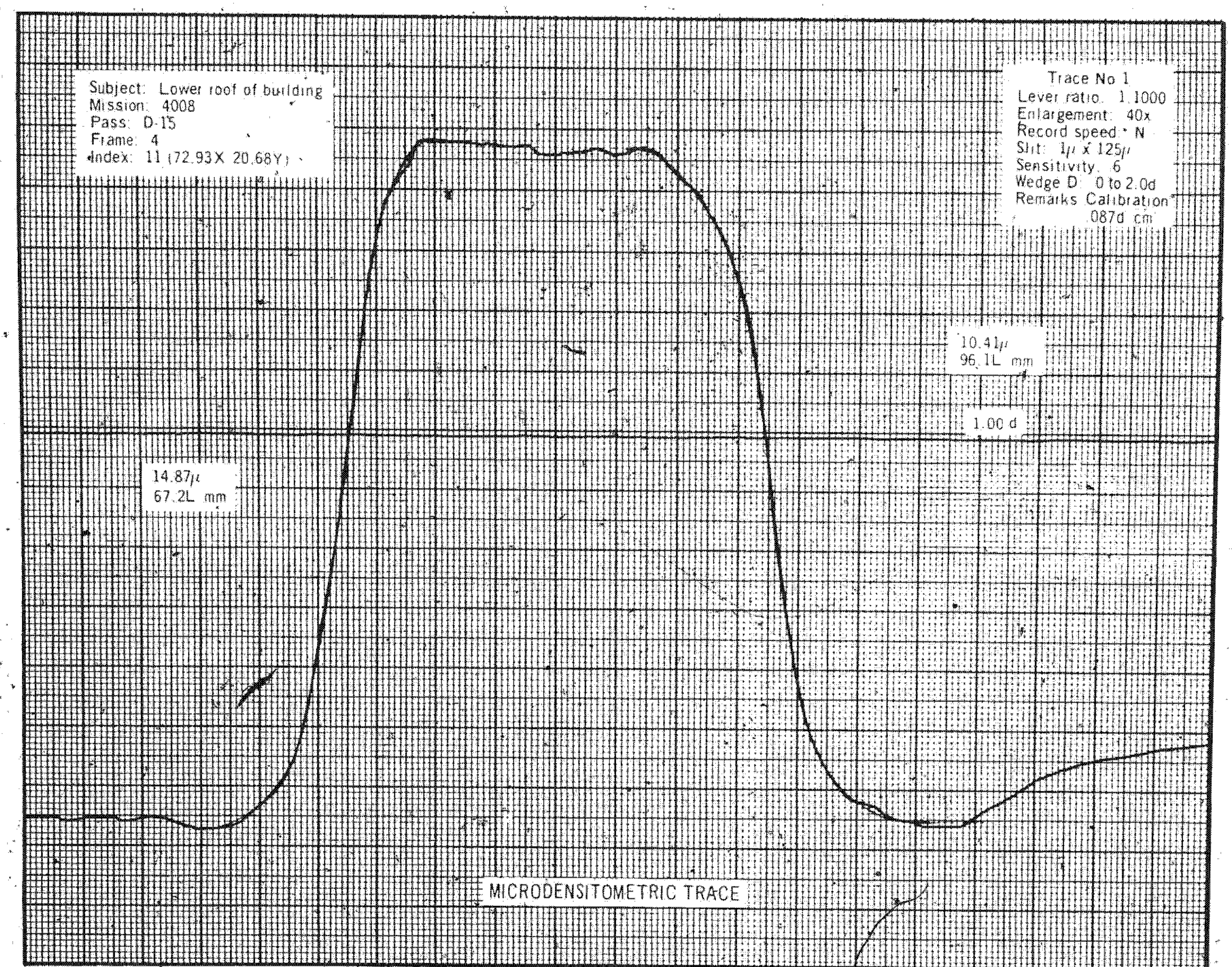

MICRODENSITOMETRIC TRACE

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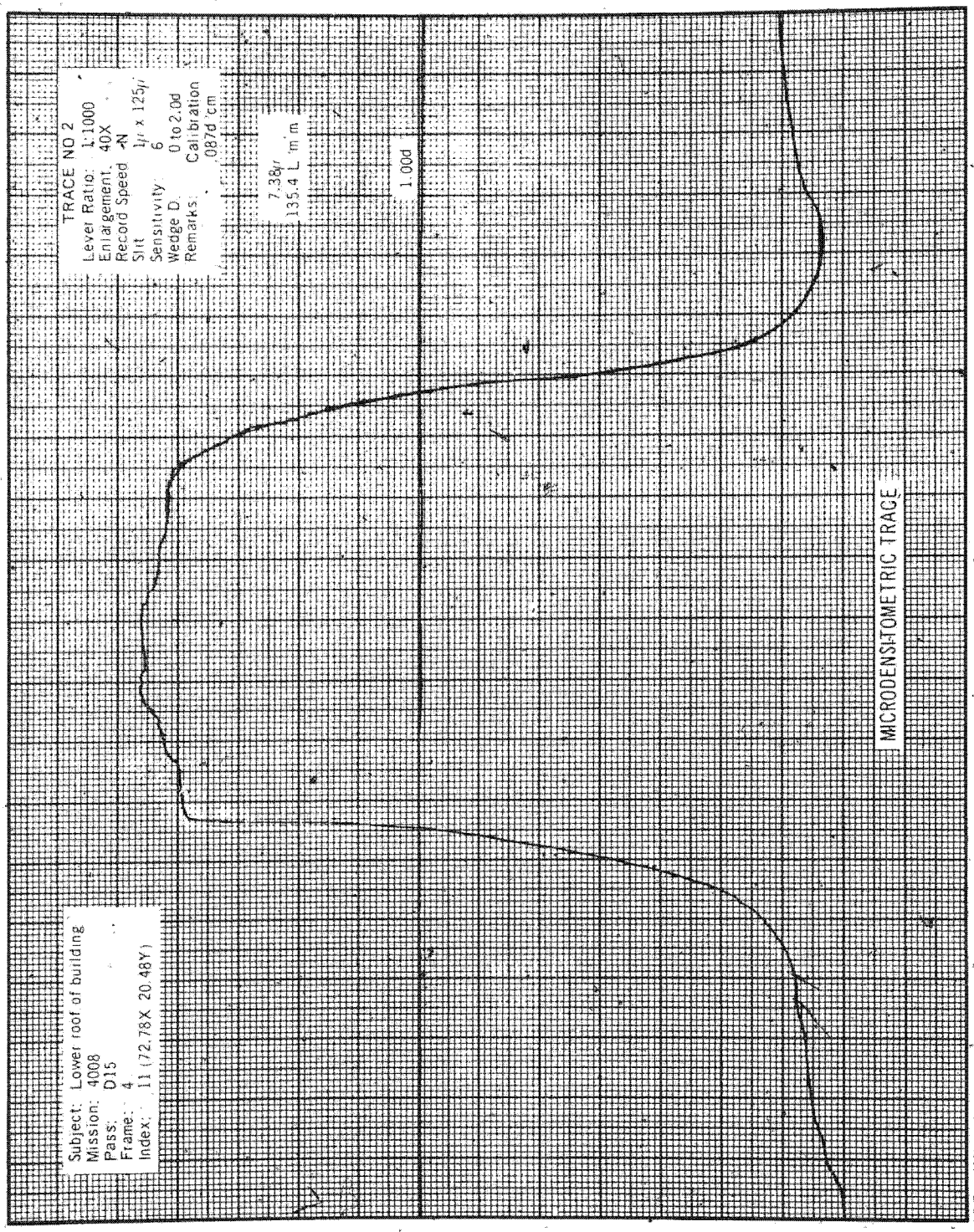
NPIC/TP-22/64



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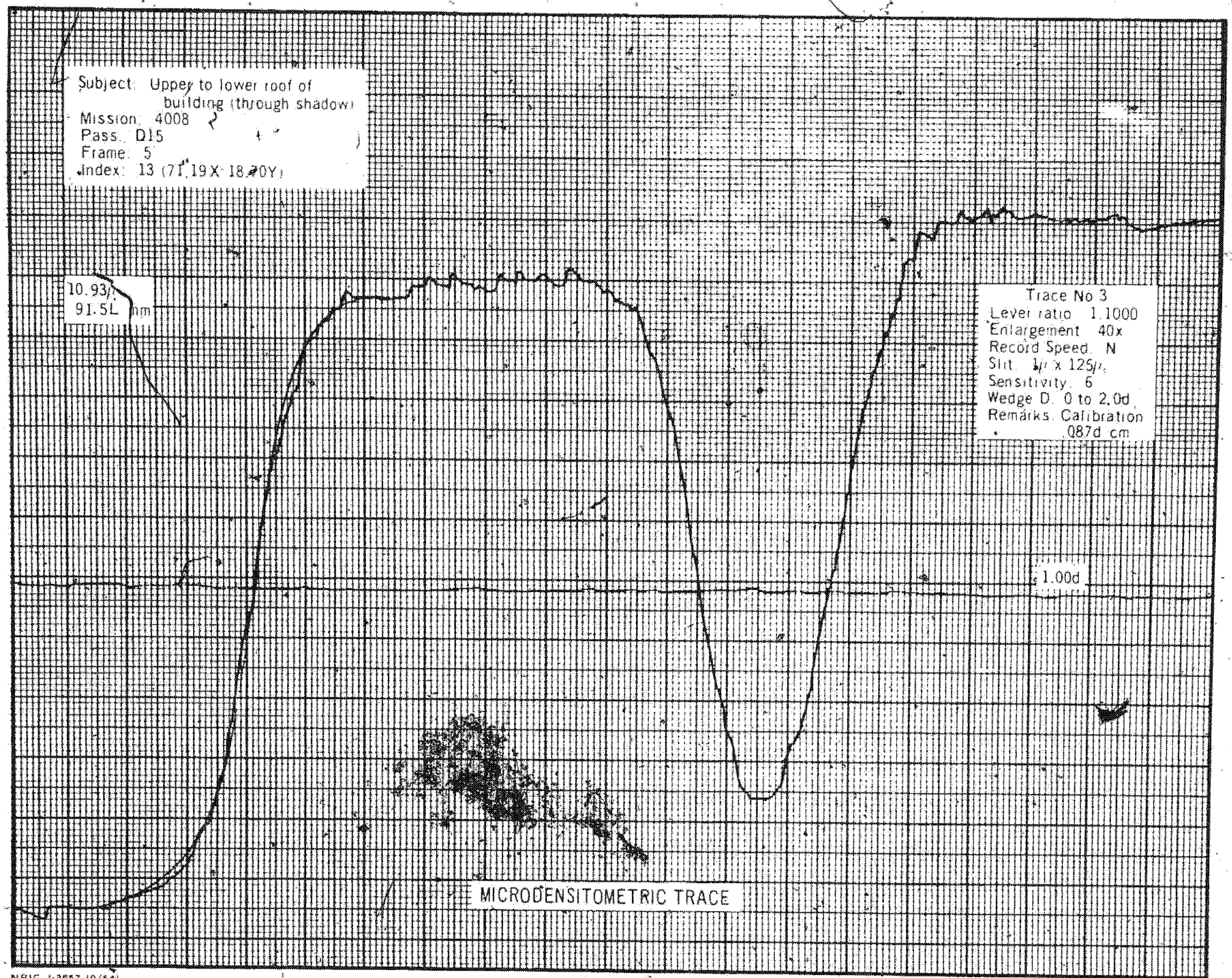

TCS-7879/64
NPIC/TP-22/64

FIGURE 25 LOCATION OF MICRODENSITOMETRIC TRACE NO 1

TCS-7879/64
NPIC/TP-22/64

Pass: 1015
Frame: 404
Index: 11 72.93 - 20.69
Enlargement: 20X
Solar Elevation: 64.5
Solar Azimuth: 171
Solar Bearing: 273
Roll Angle: -32.61

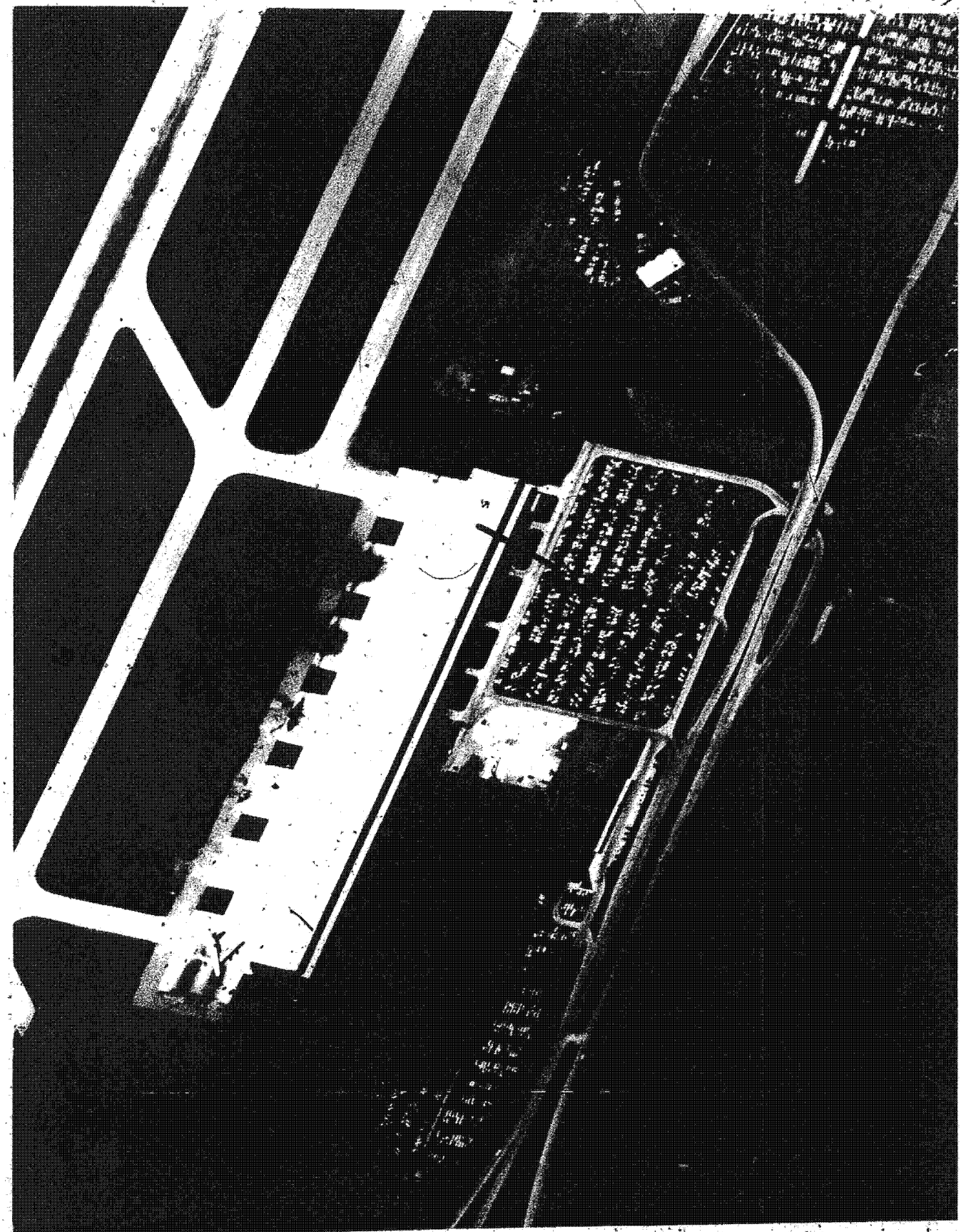

FIGURE 26 LOCATION OF MICRODENSITOMETRIC TRACE NO 2.

TCS-7879/64
NPIC/TP-22/64

Pass: 015
Frame: 04
Index: 11°27'S, 20.4°
Enlargement: 20x
Solar Elevation: 64.8°
Solar Azimuth: 171°
Solar Bearing: 273°
Roll Angle: -32.6°

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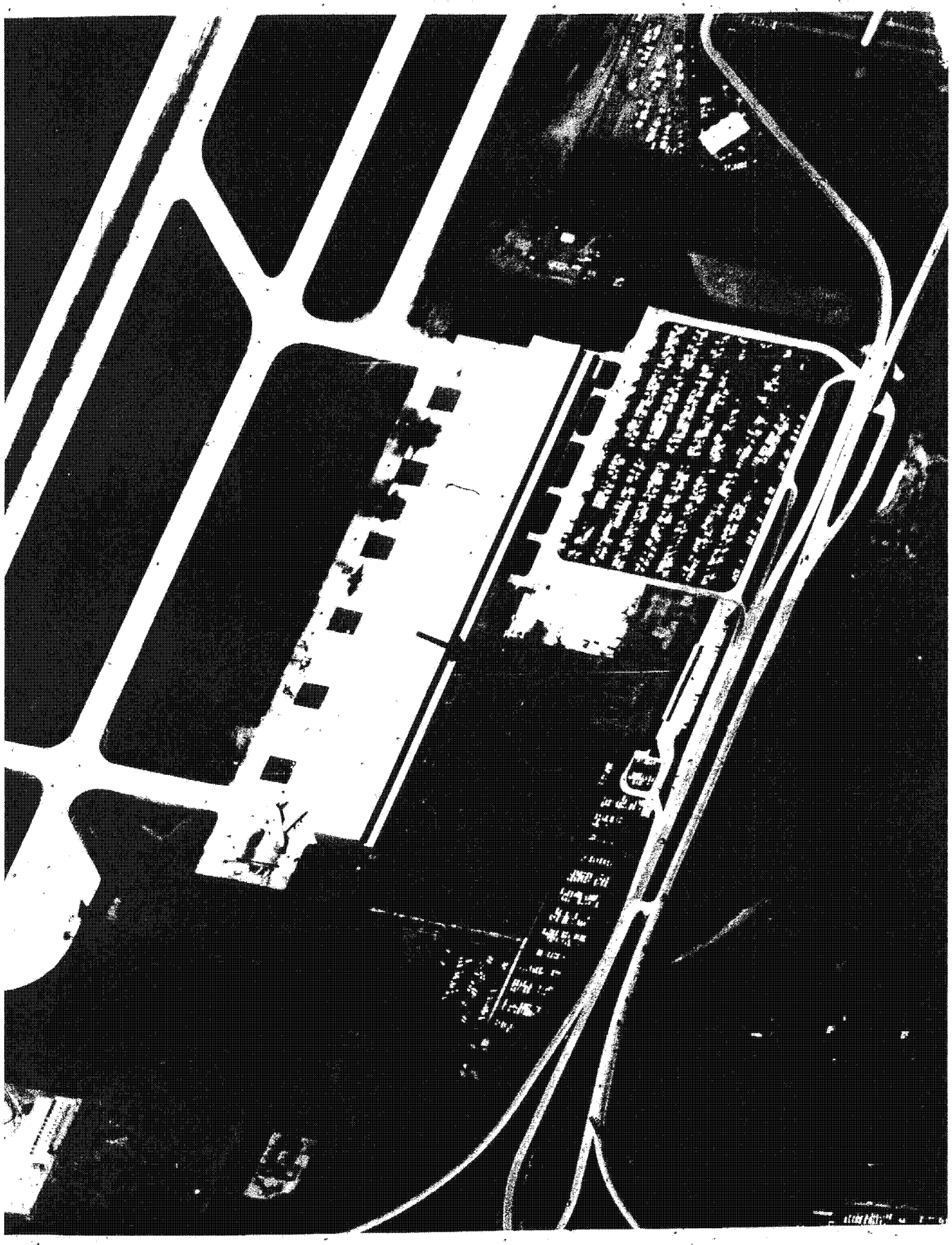
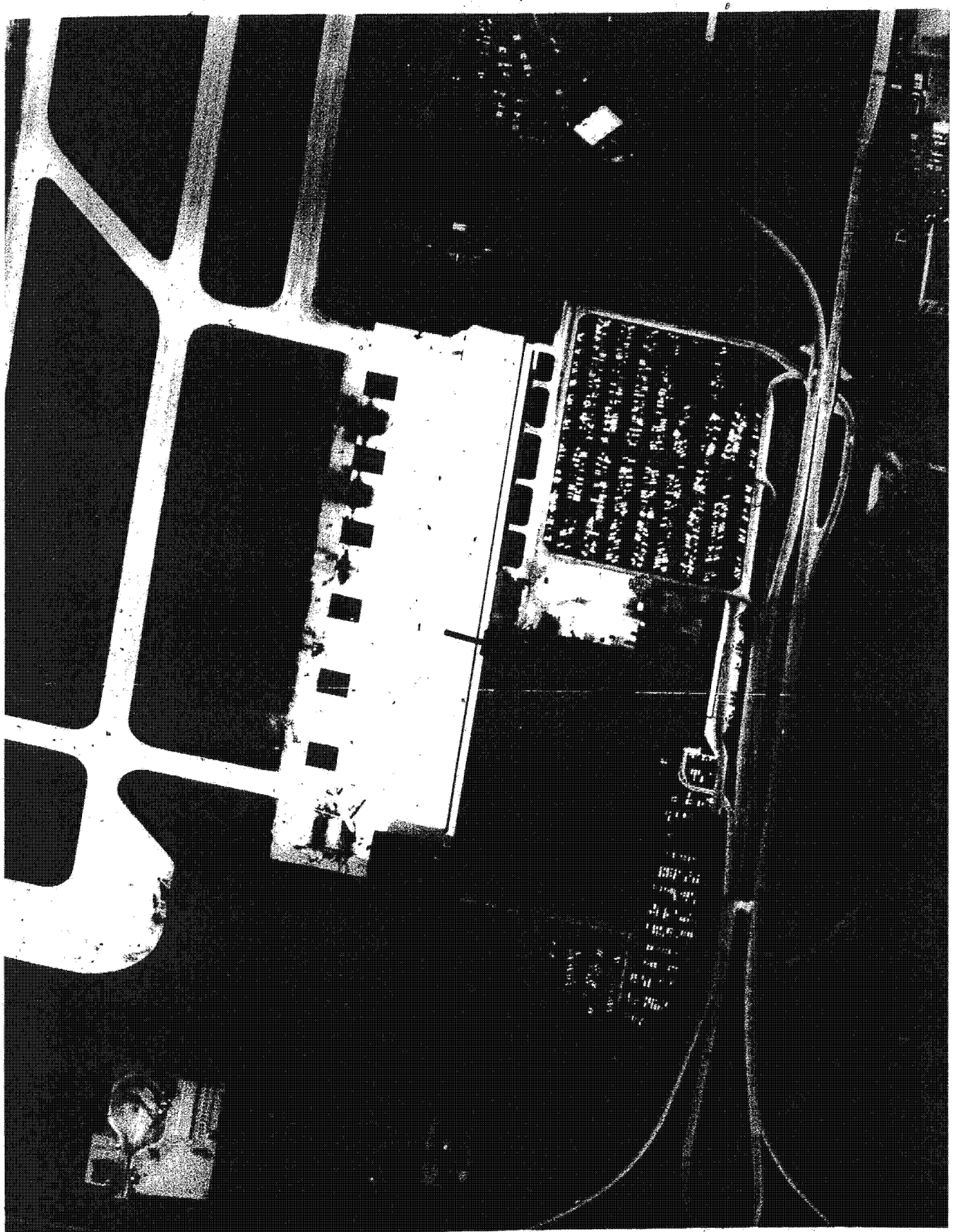


FIGURE 27. LOCATION OF MICRODENSITOMETRIC TRACE NO 3.

NPIC J-3658 9-64

TCS-7879/64
NPIC/TP-22/64

Pass: 1015
Frame: 05
Index: 13.71N - 18.70
Enlargement: 20X
Solar Elevation: 64.8°
Solar Azimuth: 171°
Solar Bearing: 2S8°
Roll Angle: -31.90°



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MICRODENSITOMETRICALLY DERIVED IMAGE QUALITY DATA

This is an extract of data derived from microdensitometric image traces performed by the film processing contractor. The data are presented as spread function width in microns and resolving power in lines per millimeter 1/mm. A statistical summary of the edge data is included, giving the arithmetic mean, standard deviation, coefficient of dispersion, and number of edges. Also included is a summary of all 4000 series missions traced to date, and two frequency plots of the spread function and resolving power data for Mission 4008.

The image quality data were obtained from sharp scene edges in the original negative by scanning with a Kodak Model 5 microdensitometer. A 1 x 320 micron slit was used. The data reduction consisted of the following steps:

(a) hand smoothing of the microdensitometer strip chart recording

(b) key punching of chart (density) values at sample distance increments of 0.35 microns

(c) IBM 1620 computer conversion of chart values to relative exposure values

(d) computer conversion of exposure data to line spread function and modulation transfer function by numerical methods.

The edge resolving power was predicted graphically as the intersection of the MTF curve and the aerial image modulation curve for 4404 film at a test object contrast of 2:1. The spread function width was calculated from the first differences of relative exposure as the width at which the gradient became 50% of the maximum gradient.

Resolution in 1/mm based on the aerial image modulation - 4404 curve from edge trace data reduced by computer techniques.

Arithmetic Mean	100.6
Standard Deviation	28.1
Coefficient of Dispersion	28%
Number of Edges	32

Spread function width at 50% amplitude in microns from edge trace data reduced by computer techniques.

Arithmetic Mean	9.5
Standard Deviation	2.7
Coefficient of Dispersion	29%
Number of Edges	32

Trace Summary

Mission Number	Number of Edges	Spread Function Width at 50% Amplitude in Microns, Computer Calculations			Resolution in lines/mm from A.I.M. 4404 Curve, Computer Calculations		
		Arithmetic Mean	Standard Deviation	Coefficient of Dispersion	Arithmetic Mean	Standard Deviation	Coefficient of Dispersion
4001	15	16.5	5.1	31%	78.5	27.3	37%
4002	30	14.2	5.7	40%	74.7	26.1	35%
4003	82	12.3	2.9	24%	84.8	18.1	21%
4005	16	64.4	32.7	51%	19.3	8.5	44%
4006	106	13.6	6.1	45%	85.4	28.8	34%
4007	106	14.4	4.8	33%	70.5	21.0	30%
4008	32	9.5	2.7	29%	100.6	28.1	28%

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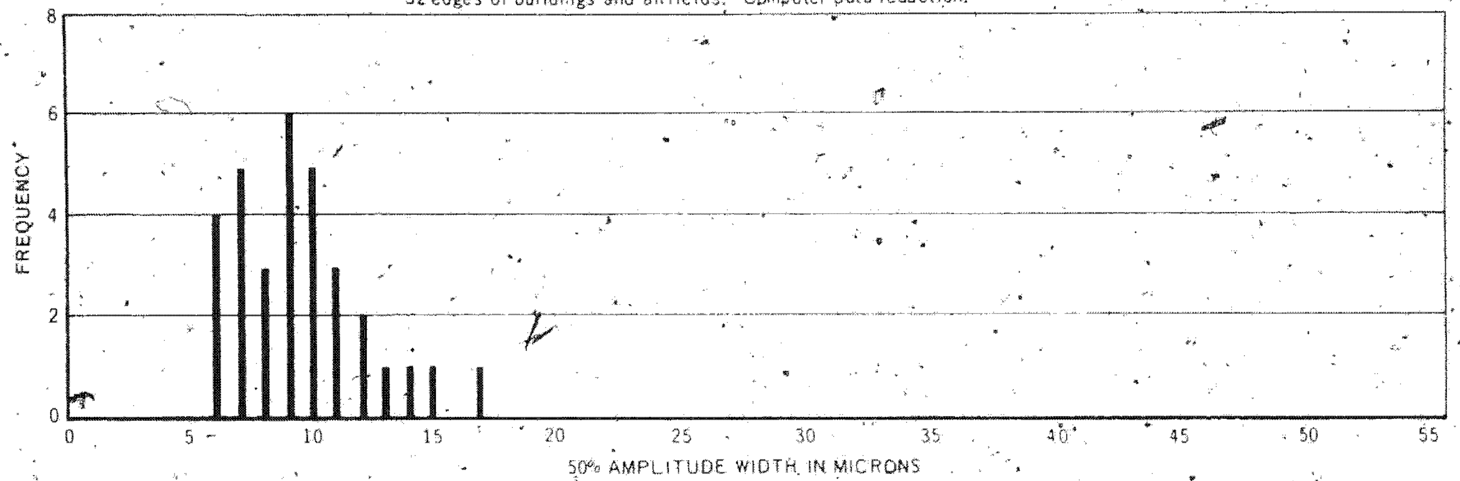
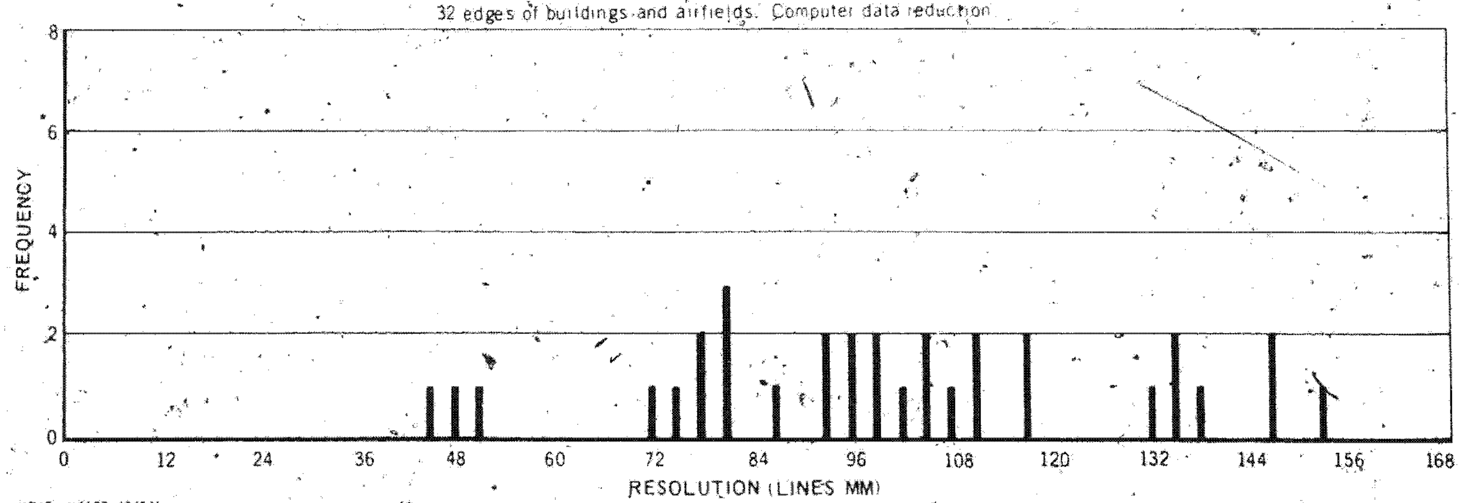
~~TOP SECRET RUFF~~

NO FOREIGN DISSEM

Frequency vs. 50% amplitude width in microns, of line spread function.
32 edges of buildings and airfields. Computer data reduction.



Frequency vs Resolution (lines MM) A.I.M., 4404 Curve.
32 edges of buildings and airfields. Computer data reduction



NPIC J-4107 (9/64)

-34-

TCS-7879/64
NPIC/TP-22/64

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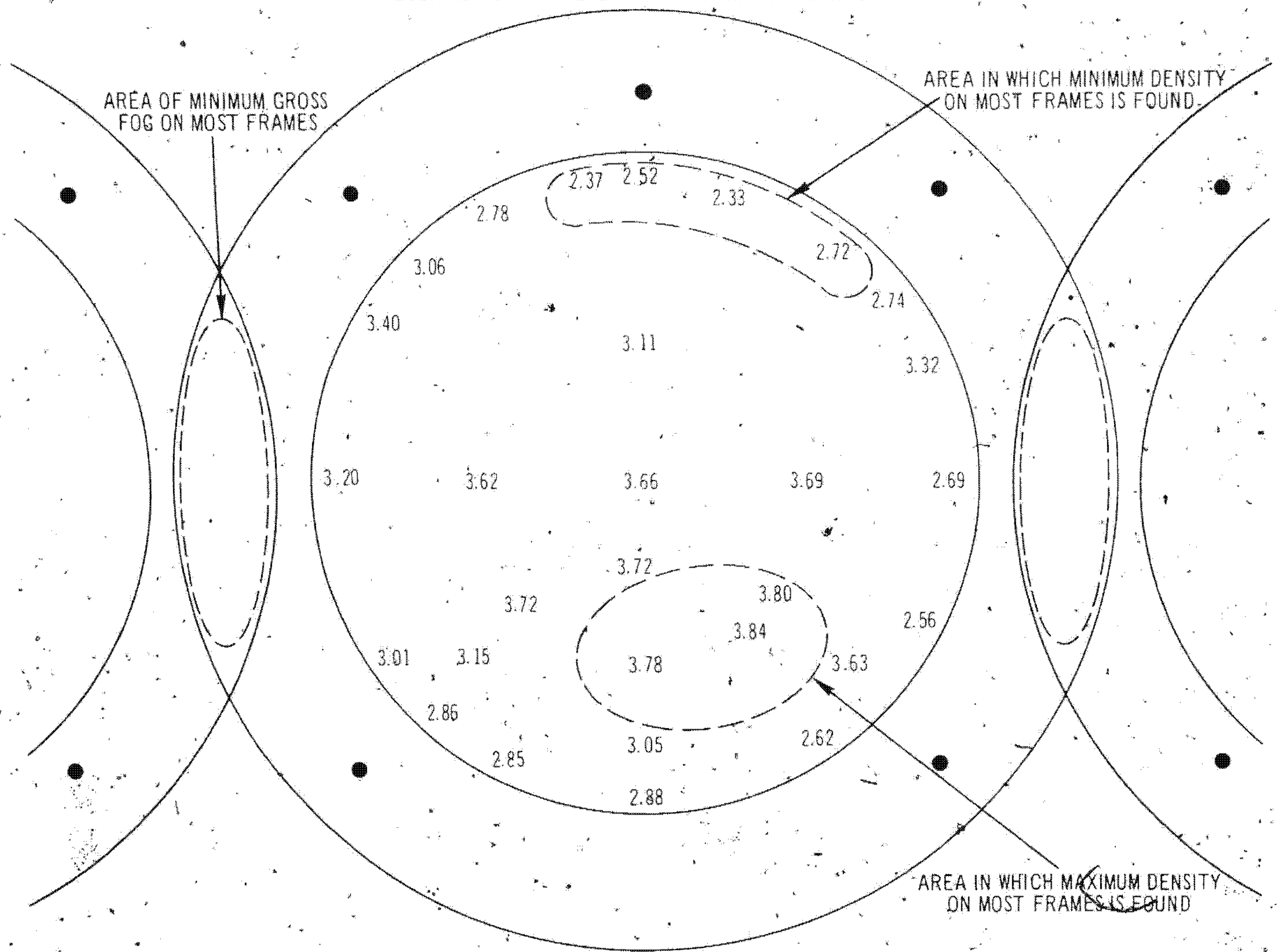
~~NO FOREIGN DISSEM~~

LOCATION OF REPRESENTATIVE DENSITY READINGS



NPIC J-3668 (9/64)

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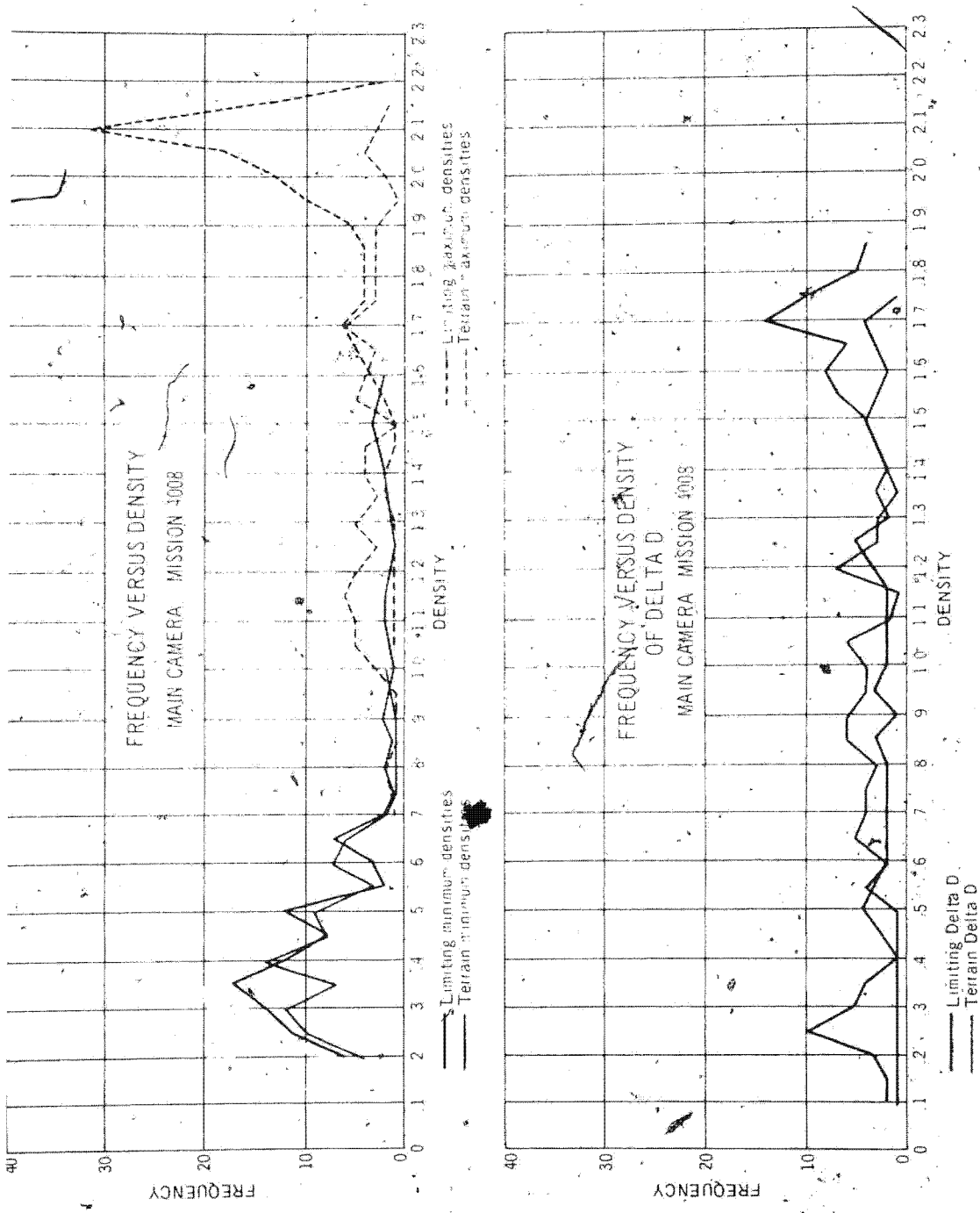
TCS-7879/64
NPIC/TP-22/64

APPENDIX E. DENSITY CHARTS



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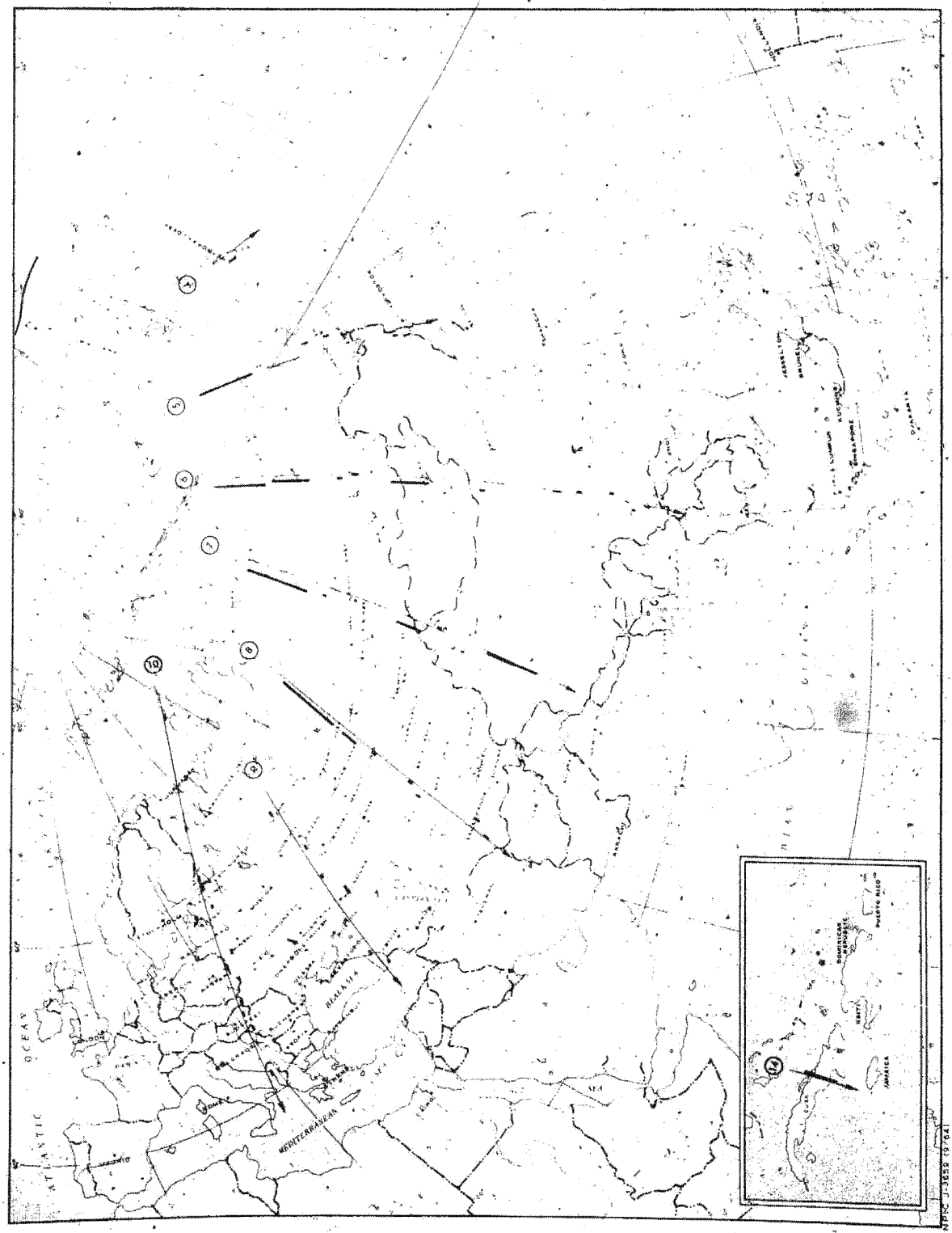

FIGURE 28. PLOTTABLE PHOTOGRAPHIC COVERAGE.

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END

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