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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT

MISSION 1028-1

24-29 DECEMBER 1965

MISSION 1028-2

29 DECEMBER 1965 - 2 JANUARY 1966

[redacted]
SEPTEMBER 1966
COPY [redacted]
185 PAGES

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NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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SYNOPSIS

Launching of Mission 1028 (J-26) occurred at 2106Z on 24 December 1965. Recovery of both SRV's (Satellite Re-entry Vehicles) was achieved by air catch -- the first at 0015Z on 30 December 1965, and the second at 2325Z on 2 January 1966. The mission accomplished 57 operational, 11 domestic, and 9 engineering passes.

Both panoramic and stellar cameras functioned properly throughout the mission. The index camera on the first phase of the mission (1028-1) was also operational throughout its portion of the mission. The shutter of the index camera employed in the second phase (1028-2) failed to close on frame 1 and remained open throughout the mission. Therefore, no usable index photography was obtained on the second half of the mission. The forward panoramic camera was subject to intermittent failure of the frequency mark track throughout the mission. An area of out-of-focus imagery at the supply end of the frame is present on 2 passes of the forward record. The aft panoramic footage was affected by an extremely slight loss of optimum focus along the frequency mark edge of numerous frames throughout the mission. All horizon cameras operated properly; however, the veiled imagery noted on previous missions was present.

The photography on this mission is considered to be of slightly better quality than that obtained on the last few missions. A Mission Information Potential (MIP) of 85 was assigned to both portions of the mission.

The interpretation of the material is limited by cloud cover which degrades or obscures approximately 30 percent of the photography. Snow cover and cloud shadow also reduce its usability.

Despite the failure of the index camera on 1028-2 and the presence of minor anomalies, overall, the mission is considered good.

GENERAL FLIGHT DATA

1. Launch and Recovery Dates

Launch -- Mission 1028-1: 24 December 1965/2106Z
Recovery -- Mission 1028-1: 29 December 1965/0015Z
Reactivation -- Mission 1028-2: 29 December 1965
Recovery -- Mission 1028-2: 2 January 1966/2325Z

2. Orbital Parameters

	Mission 1028-1 (Rev 42)
Period:	90.775 min.
Perigee:	97.655 nm
Apogee:	243.580 nm
Eccentricity:	0.02020
Inclination Angle Deg:	80.016
Perigee Latitude Deg. N:	28.442

3. Photographic Operations

Pass Information

	Mission 1028-1	Mission 1028-2
Operational Passes	28	29
Domestic/Operational	1	0
Domestic	5	5
Engineering	5*	4

*Includes one complete pass which was edited out.

4. Recovery Revolution

a. Mission 1028-1: 81
b. Mission 1028-2: 141

PART I. CAMERA OPERATIONS

1. Forward-Looking (Master) Panoramic Camera No 176

The forward-looking panoramic camera functioned properly throughout the mission. The photography was, however, affected by the following degradations.

a. Degradation of the photography by fog patterns due to light leaks was extremely minor. The location and configuration of these patterns are shown below.

Approximate Location of Fog Patterns

1. First frame of camera operation (present on only the first frame of a few passes).

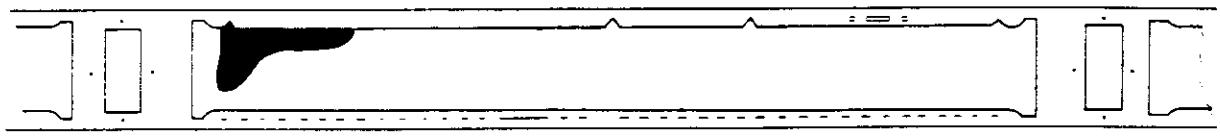
2. Fifth frame of camera operation (present only at the beginning of some passes).

3. Present at the supply end of the last frame or the take-up end of the first frame of a few passes.

4. Present on the first frame of pass 1D.

b. An area of out-of-focus imagery was detected at the supply end, camera number edge of the format in passes 130D and 131D. The out-of-focus condition is first noticeable in frame 12 of pass 130D but the degradation is slight. The condition becomes progressively more severe and reaches maximum degradation by frame 15. Thereafter, the degree of severity remains fairly consistent, being slightly less in some instances. The out-of-focus area thus continues through frame 85 of pass 131D. It is not present in frames 86 through 111 of pass 131D, but is detectable in frames 112 through 127. The degradation in frame 127 is slight and there is no out-of-focus area present in any succeeding frame. The maximum area affected by this condition

is a band which extends approximately 4 inches to the right of the supply shrinkage marker, is approximately 0.5 inch wide, and is adjacent to the camera number edge of the format. Beginning close to the supply shrinkage marker it extends approximately half way across the width of the format area. The shape of this area is illustrated below.



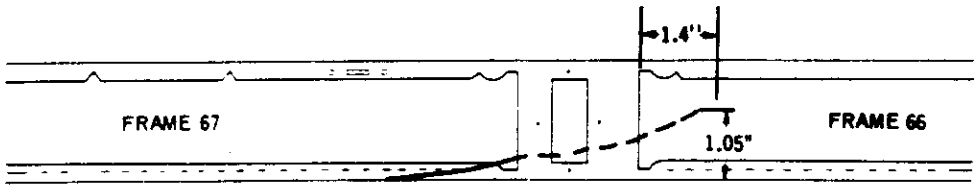
Pitch measurements (measurements between the film edge and format edge at each end of the frame) show that the format has a greater bias in those frames which display the focus degradation. The location of a manufacturer's splice in frame 50 of pass 130D suggests the possibility that either a change in film tension due to the adhesion of the splice to a successive film wrap or a bias in the joined material caused a slight mistracking of the film.

c. Fine emulsion scratches located under the camera number just inside the format at the binary edge are present on most frames of the mission. An occasional series of short, fine, emulsion scratches oriented parallel to the major axis of the film is located at the take-up end of a few frames.

d. Dendritic static discharge traces are intermittently present along both edges of the film throughout the mission. The frequency and severity of traces on this mission are considerably greater than on recent missions. Cause of all the static discharges is unknown. Although the number of static discharges noted during the pre-slice operation was greater than normal, the increase was not significant enough to explain the numerous discharge traces which slightly degrade the material.

e. A series of crimps, indented from the base side, begin in frame 66 of pass 22D. These crimps join to form a continuous crease which runs off of the frequency mark edge of the film in frame 67. Associated with these crimps are emulsion cracks and abrasions. A manufacturer's splice located in frame 64 is suspected to be the cause of the crimps, crease, and abrasions. Pitch measurements

indicate no extreme bias in the platten area during exposure. It is quite probable that the material was creased during the splicing or spooling process. An illustration of the orientation of the crease follows.



2. Aft-Looking (Slave) Panoramic Camera No 177

The aft-looking panoramic camera operated properly throughout the mission. There were no serious degradations of the photography; however, some of minor consequence were present.

a. The fog patterns due to light leaks, although of only minor severity, are more frequent, larger, and more intense than those imaged on the forward panoramic material. These patterns generally affect the last few frames of the last camera operation in a pass. The density of the fogged areas is commensurate with the duration between camera operations and the solar elevation during that period. The approximate location and configuration of the fog pattern is illustrated below:

1. First frame of camera operation (present on only the first frame of some passes).

of these traces could have been imaged during the process of film transport through the camera and, if so, whether humidity conditions during the film loading procedure are a factor in the generation of the static discharges. This question is, as yet, unanswered.

f. Fine emulsion scratches oriented parallel to the major axis are present intermittently throughout the mission. The most continuous of these is located 1.43 inches from the frequency park edge of the film. The scratch appears to be independent of the camera scan mechanism since it is present through the horizon formats.

g. Transverse banding was occasionally detectable throughout the mission but degradation was nonexistent to slight for the most part. Severe banding is present on frames 73 through 83 of pass 121D. Although these bands are usually confined to approximately 3 inches at the beginning of scan, some of these frames contain a series of bands which begin after approximately 4 inches of scan. This condition is unusual but can be possibly attributed to dirt in the scan mechanism.

7. Second frame from end of camera operation (present only at end of pass 121D).

8. Last frame of camera operation (present only at end of passes 1D, 9D, 21D, 36D, 45D, and 121D).

9. Present at the supply end of the last frame or the take-up end of the first frame of most passes.

b. Under high magnification (40X plus) it was discovered that the imagery along the frequency mark edge of some frames was not as good as that along the camera number edge. The imagery along the frequency mark edge of the format is slightly out-of-focus. The transition from good focus at the camera number edge of the format to slightly out at the opposite format edge is gradual with no definite line of demarcation. Although this condition prevails throughout the mission, it is considered only a slight degradation since it is just perceptible under high magnification.

c. Fine emulsion scratches located just inside both format edges under the camera number and at the take-up end of the frame are present intermittently throughout the mission. A series of short fine emulsion scratches is also present in the take-up bonus area of most frames of the mission. Since this raking is located in the bonus area of the format, none of the useable image area is degraded.

d. Numerous minus density streaks (on the ON) are intermittently present throughout the mission. Most are biased and appear to follow the path of the field flattener. Many, however, are randomly oriented. Frame 9 of pass 5D contains the image of a particle of foreign matter and the resulting minus density streak as the particle is swept along by the field flattener. A thin line of minus density located approximately one inch from and parallel to the frequency mark edge of the film begins in frame 70 of pass 102D and is intermittently detectable to the end of the mission.

e. Traces of dendritic static discharges are numerous along both edges of the material throughout the mission. Many traces extend into the format area but most are confined to the borders. Reports from the processing contractor state that more static discharges than usual were noted during the pre-inspection and processing phases of their operation. However, this increase does not account for all of the traces present on the material. It is questioned whether a portion

of these traces could have been imaged during the process of film transport through the camera and, if so, whether humidity conditions during the film loading procedure are a factor in the generation of the static discharges. This question is, as yet, unanswered.

f. Fine emulsion scratches oriented parallel to the major axis are present intermittently throughout the mission. The most continuous of these is located 1.43 inches from the frequency park edge of the film. The scratch appears to be independent of the camera scan mechanism since it is present through the horizon formats.

g. Transverse banding was occasionally detectable throughout the mission but degradation was nonexistent to slight for the most part. Severe banding is present on frames 73 through 83 of pass 121D. Although these bands are usually confined to approximately 3 inches at the beginning of scan, some of these frames contain a series of bands which begin after approximately 4 inches of scan. This condition is unusual but can be possibly attributed to dirt in the scan mechanism.

FIGURE 1. DESCRIPTION OF PHOTOGRAPHIC DATA

The data pertaining to photographs contained in this publication are defined as follows:

PASS: A pass is the operational portion of an orbital revolution. A suffix D indicates that the photography was acquired during the descending portion, a suffix A indicates that the photography was acquired during the ascending portion, and a suffix M indicates that the photography was acquired during a pass that includes both ascending and descending portions. An additional suffix E indicates that the pass was an engineering operation or that a portion of the pass has been edited.

DATE OF PHOTOGRAPHY: The date of photography indicates the day, month, and year (GMT) that the photography was acquired.

UNIVERSAL GRID COORDINATES: These coordinates are included to locate the illustrated photography within the panoramic format.

ENLARGEMENT FACTOR: The enlargement factor is included to indicate the number of diameters the original material has been enlarged in the photographic illustration.

GEOGRAPHIC COORDINATES: These coordinates are included to indicate the latitude and longitude of the center of the panoramic format.

ALTITUDE: This measurement is the vertical distance from the vehicle to the Hough Ellipscid at the time of the acquisition of the photography.

PITCH: Rotation of the camera about its transverse axis. Using appropriate aeronautical terminology, positive readings indicate nose-up attitude and negative readings indicate nose-down attitude.

ROLL: Rotation of the camera about its longitudinal axis. Using appropriate aeronautical terminology, positive readings indicate left wing-up attitude and negative readings indicate right wing-up attitude.

YAW: Rotation of the camera about its vertical axis. Positive readings indicate counterclockwise rotation when viewing the ground nadir from the vehicle-mounted camera in flight.

LOCAL SUN TIME: This time is included to present to the viewer a realistic time of acquisition of the photography illustrated.

SOLAR ELEVATION: The solar elevation is the angular elevation of the sun above a plane tangent to the surface of the earth at the center of the panoramic format. A negative solar elevation indicates that the sun is below the plane.

SOLAR AZIMUTH: The solar azimuth is the angular measurement of the rays of the sun measured from true north in a clockwise direction.

EXPOSURE: The exposure is the duration of the photographic exposure expressed in a fraction of a second and is computed from the scan rate and slit width.

PROCESSING LEVEL: The particular degree of development given to the film to attain negatives of the highest possible quality. Three levels of processing, Primary, Intermediate, and Full, are currently employed.

VEHICLE AZIMUTH: The clockwise measurement from true north to the longitudinal axis of the vehicle heading.

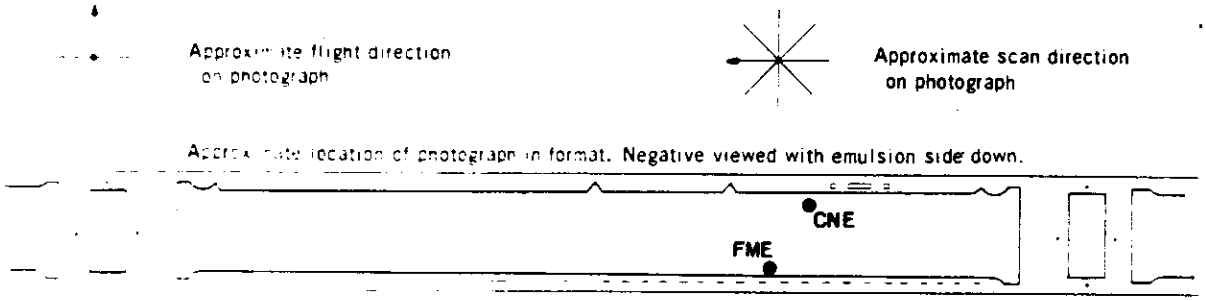
FIGURE 2. EXAMPLE OF THE RESOLUTION ALONG THE CAMERA NUMBER EDGE OF AN AFT FRAME

FIGURE 3. EXAMPLE OF THE RESOLUTION ALONG THE FREQUENCY MARK EDGE OF THE SAME AFT FRAME

The resolution along the camera number edge of a frame can be compared to that along the frequency mark edge of the same aft frame in Figure 3. The loss in quality along the frequency mark edges is readily detectable at magnifications of 40X and greater.

NPIC K-8937 (8/66)
NPIC K-8938 (8/66)

	FIGURE 2	FIGURE 3
	Camera No Edge	Freq Mark Edge
Camera	Aft	Aft
Pass	45D	45D
Frame	10	10
Date of Photography	27 Dec 65	27 Dec 65
Universal Grid Coordinates	61.2 - 14.5	61.2 - 9.5
Enlargement Factor	40X	40X
Geographic Coordinates	32-49S 59-58W	32-49S 059-58W
Altitude	837,013	837,013
Camera Attitude:		
Pitch	-14°30'	-14°30'
Roll	-0°10'	-0°10'
Yaw	0°01'	0°01'
Local Sun Time	1332	1332
Solar Elevation	68°06'	68°06'
Solar Azimuth	253°	253°
Exposure	1/193	1/193
Vehicle Azimuth	170°59'	170°59'
Processing Level	Intermediate	Intermediate



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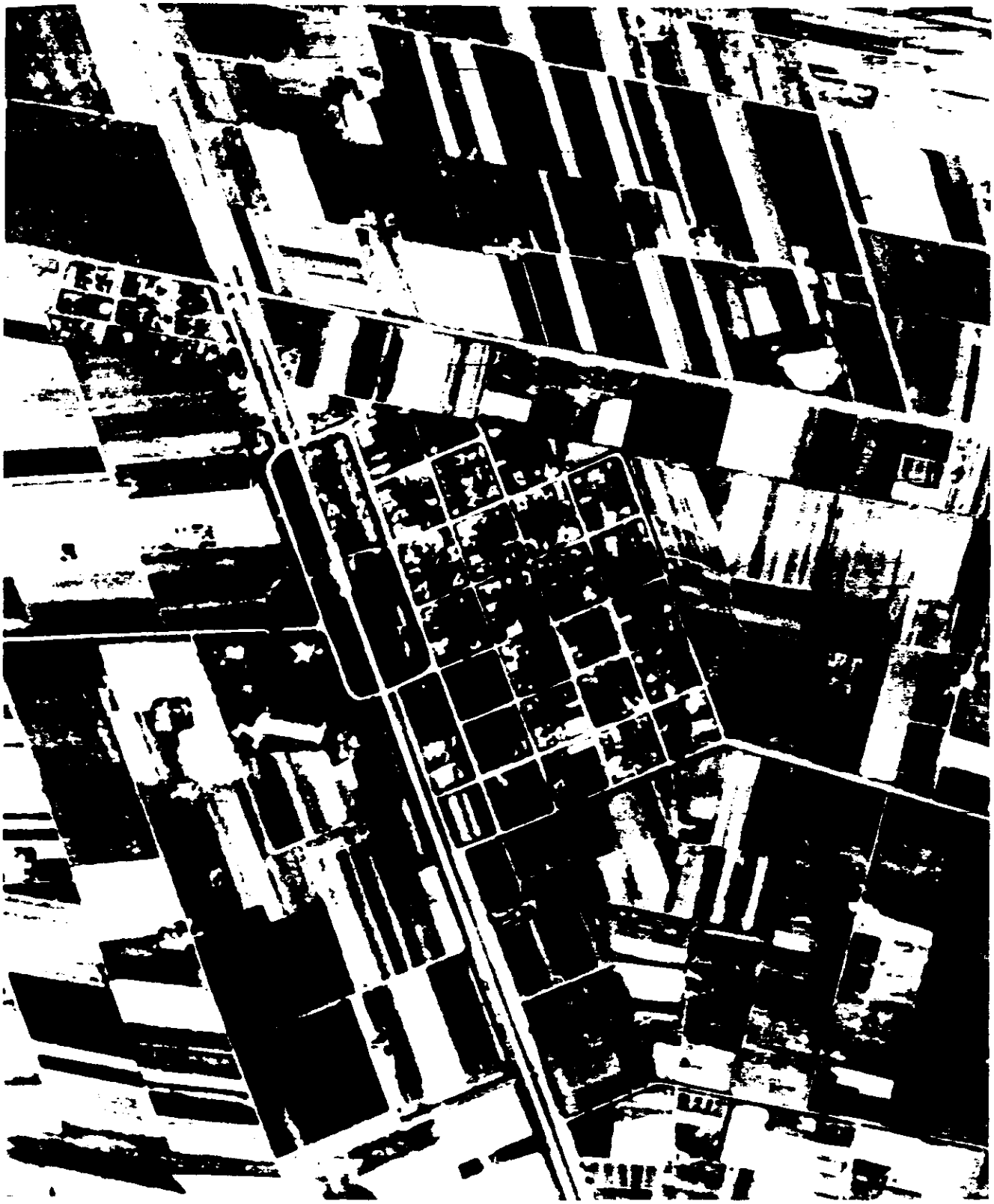

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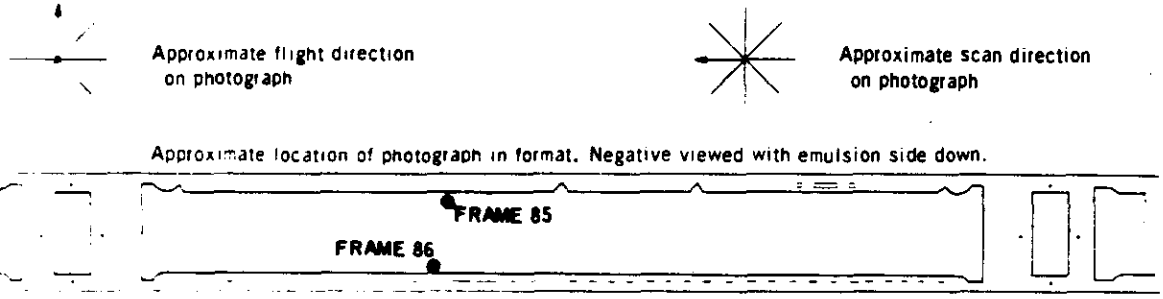
FIGURE 4. EXAMPLE OF THE RESOLUTION ALONG THE CAMERA NUMBER EDGE OF AN AFT FRAME

FIGURE 5. EXAMPLE OF THE RESOLUTION ALONG THE FREQUENCY MARK EDGE OF THE SUCCESSIVE AFT FRAME

The identical coverage illustrated here clearly shows the loss of image quality. This slightly out-of-focus condition was present along this edge on all aft frames throughout the entire mission.

NPIC K-8939 (8/66)
NPIC K-8940 (8/66)

	FIGURE 4	FIGURE 5
Camera	Aft	Aft
Pass	36D	36D
Frame	85	86
Date of Photography	27 Dec 65	27 Dec 65
Universal Grid Coordinates	37.5 - 14.7	37.4 - 9.7
Enlargement Factor	40X	40X
Geographic Coordinates	34-33S 145-59E	34-46S 146-02E
Altitude	839,274	840,893
Camera Attitude:		
Pitch	-15°58'	-15°58'
Roll	0°02'	0°01'
Yaw	0°18'	0°19'
Local Sun Time	1339	1339
Solar Elevation	66°02'	65°55'
Solar Azimuth	251°	250°
Exposure	1/195	1/195
Vehicle Azimuth	170°40'	170°38'
Processing Level	Intermediate	Intermediate



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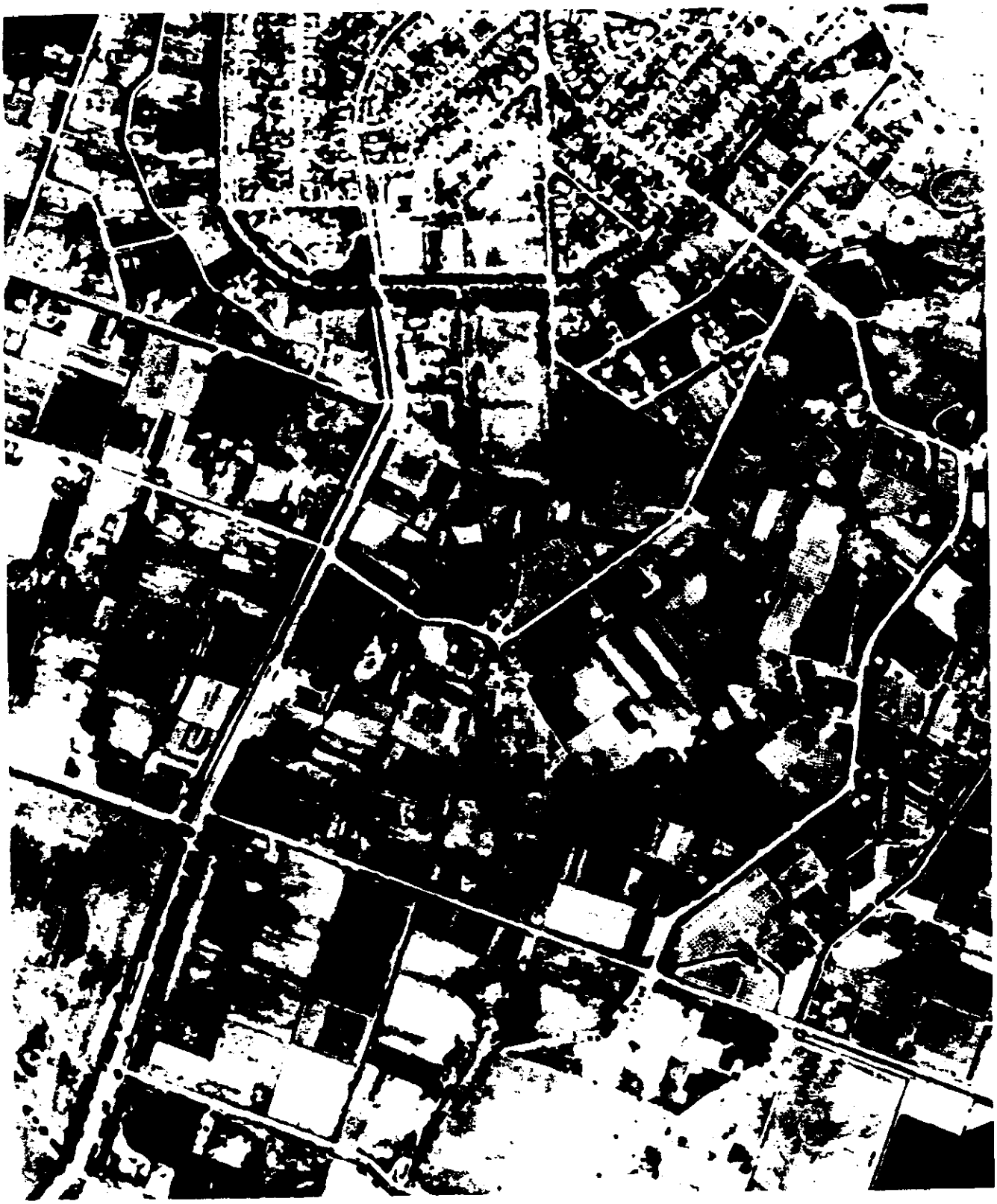

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3. Forward-Looking (Master) Horizon Cameras

Both master horizon cameras were operational throughout the mission. The imagery ranges from under to over exposed as is normal for these cameras. The horizon arcs, however, are of good quality and are usable for attitude determination throughout the mission. A small plus density trace resulting from a dendritic static discharge is present at the supply end of all take-up horizon formats of the mission.

4. Aft-Looking (Slave) Horizon Cameras

Both slave horizon cameras were operational throughout the mission. The starboard horizon displays a veiled appearance on all passes from 1D through 68D. When examined under magnification the photography is found to be sharp (in focus). This phenomenon has been noted on previous missions and is being investigated. This condition does not seem to affect the horizon arcs which were suitable for the determination of attitude throughout the mission. Both horizons contain small traces of dendritic static which occur along the frequency-mark edge of the format and do not affect the horizon readout.

5. Stellar Camera No D77 Reseau No 97 (Mission 1028-1)

The stellar camera operated properly throughout the mission. The record is exceptionally clean and free of degrading factors. Most stellar images appear doubled or streaked; however, they are adequate for stellar reduction and the quality of the imagery is considered to be good. Streaked images, believed to be particles of crystallized jettisoned fuel, are present on the following frames:
1,2,3,4,7,8,10,11,14,17,18,19,20,22,23,25,26,29,32,34,35,36,46,47,48,52,55,58, 60,61,63,71,75,77,80,94,104,106,116,120,129,136,140,152,246, and 273.

Approximately 40 percent of each stellar format is affected by fog resulting from light reflecting on the baffle and side curtain. The density of this fog is commensurate with the solar elevation and look angle during exposure. A slight band of fog perpendicular to the film edges is detectable between frames 99/100 and 187/188. A plus density line located between the correlation mark and the stellar format runs parallel to the film edges from frame 369 through frame 417. This line appears to be caused by a slight abrasion of the film and is located 0.15 inches from the correlation mark edge of the film. Dendritic static discharge traces appear intermittently along this line. Emulsion cracks parallel to the minor axis begin in frame

324 and are present intermittently throughout the remainder of the material. The last 2 feet of film were abraded by runout. This includes only one foot of stellar imagery, the last foot being intended as wrap-up. No major problems were encountered in the stellar reduction.

6. Stellar Camera No D74 Reseau No 95 (Mission 1028-2)

The stellar camera was operational throughout its portion of the mission. Although it affects approximately 40 percent of each stellar format, the flare level is considered to be slightly less than normally experienced and stellar images are readily detectable. Although most star images are elongated or doubled they are suitable for attitude reduction. Intermittent areas of fog patterns containing images of equipment are present throughout the record. In many cases the degree of fogging is so severe that the stellar images are obscured. These fogged areas were caused by the large amount of light entering the S/I unit through the malfunctioning index shutter.

Since the index record on 1028-2 was not usable, there was no stellar reduction on the second portion of the mission because both the S and I records are necessary for attitude determination.

7. Index Camera No D77 Reseau No 91 (Mission 1028-1)

The index camera operated well throughout the mission and the photographic quality is good. Most frames contain an image of a portion of the edge of the reseau. These images are caused by internal light scatter within the reseau being refracted by the edge. The last frame is fogged and abraded by runout.

8. Index Camera No 74 Reseau No 76 (Mission 1028-2)

The shutter failed in the open position on the first frame and remained open throughout the second phase of the mission. All but 2 formats are fogged. Those not fogged were exposed during night engineering passes and contain no imagery. No imagery is detectable in the second phase of the mission and no portion of the record is usable for attitude determination.

9. Associated Equipment

This equipment records part of the information required for correlation and mensuration of the panoramic cameras.

a. The frequency marks are missing on approximately one-third of the [illegible] mission material. They do not fade out but stop abruptly, usually at the end of a frame. They always restart after the smeared

pulse and continue for at least the remainder of that frame. No failure pattern is detectable and the cause for intermittent operation is believed to lie in marginal operation of the neon bulb or drive transistor Q109.

b. The smeared pulse on the forward material which indicates stellar/index operation failed twice during the flight. It was not recorded as required on frame 44 of pass 87D and frame 28 of pass 196AE. The length of these smeared pulses varies from 0.8 inches on frame 23 of pass 133D to 5.1 inches on 6 frames throughout the mission (Example: frame 146 of 22D).

c. The shrinkage markers and data block edge of the formats from both cameras display ragged edges throughout the mission. This was caused by an emulsion build-up on the film guide rails.

FIGURE 6. EXAMPLE OF STELLAR PHOTOGRAPHY, MISSION 1028-1

The middle stellar frame in the series shown contains an image of what is possibly a particle of jettisoned fuel. The degree to which the flare pattern affects the imagery can also be seen. The stellar record from both portions of the mission was good.

NPIC K-8941 (8/66)

Camera	Stellar
Pass	7D
Frame	68 through 74
Date of Photography	25 Dec 65
Enlargement Factor	Contact
Geographic Coordinates	30-07N 080-06E
Altitude	609,064
Attitude of Forward-Looking (Master) Panoramic Camera:	
Pitch	15°20'
Roll	-0°11'
Yaw	-0°01'
Local Sun Time	1307
Solar Elevation	34°15'
Solar Azimuth	198°
Exposure	2 sec
Vehicle Azimuth	171°23'

[redacted]

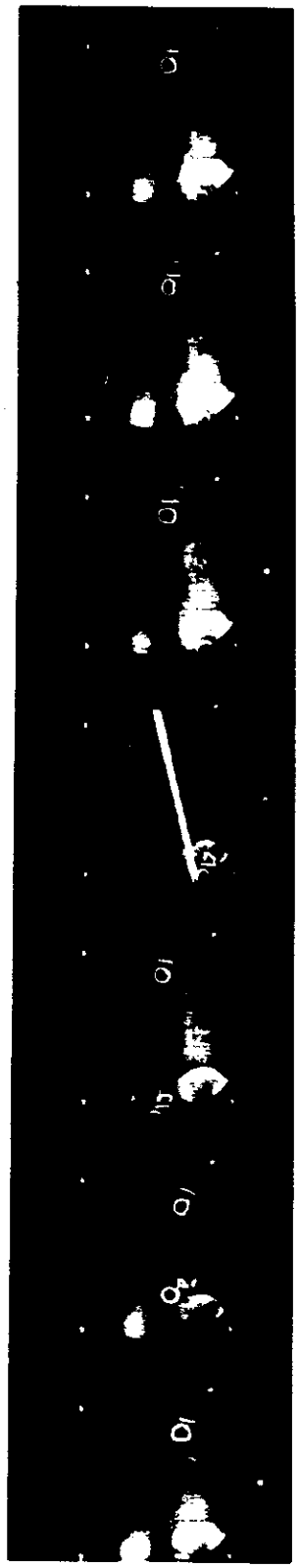

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FIGURE 7. EXAMPLE OF INDEX PHOTOGRAPHY ON MISSION 1028-1

The good quality of the index photography is easily seen in the accompanying illustration. The grid lines are well imaged and the resolution of the imagery is good.

NPIC K-0942 (8/66)

Camera	Index
Pass	7D
Frame	71
Date of Photography	25 Dec 65
Enlargement Factor	2X
Geographic Coordinates	30-07N 080-06E
Altitude	609,064
Attitude of Forward-Looking (Master) Panoramic Camera:	
Pitch	15°20'
Roll	-0°11'
Yaw	-0°01'
Local Sun Time	1307
Solar Elevation	34°15'
Solar Azimuth	198°
Exposure	1/500 sec
Vehicle Azimuth	171°23'

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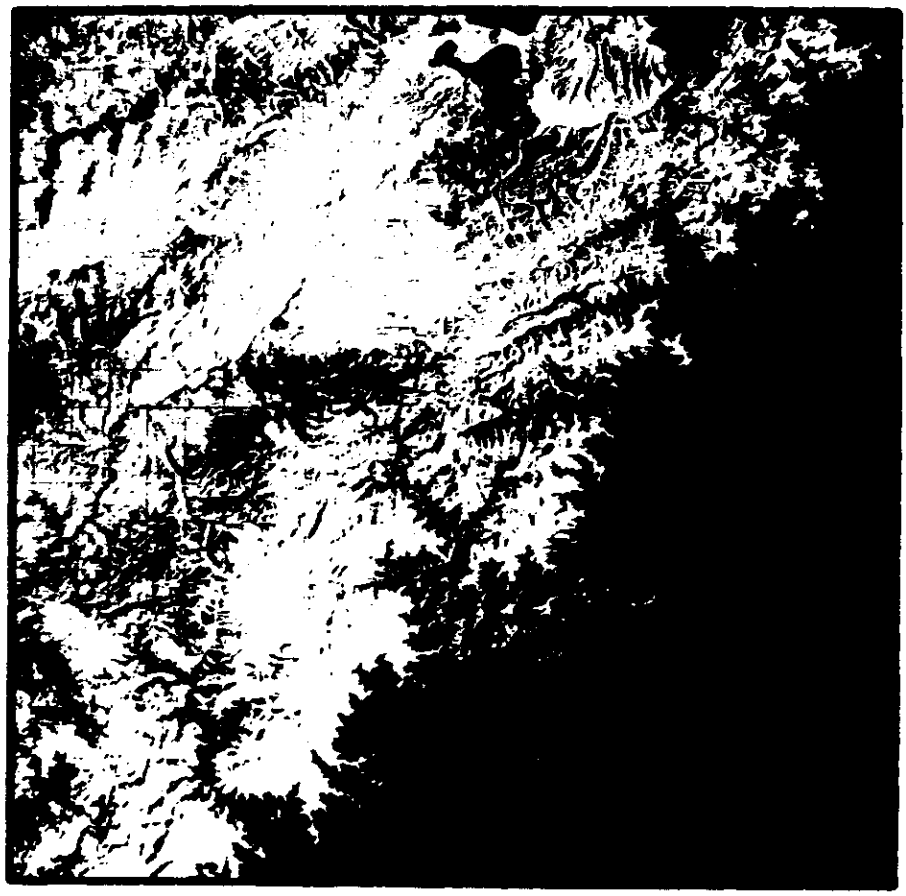

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PART II. FILM

1. Film Processing

This section provides an evaluation of exposure, processing, and densities of the original negatives from Mission 1028.

a. Exposure was mostly good throughout the mission. Excluding engineering passes, solar elevations ranged from 2°04' to 74°13'. As is normal, acquisition in areas with low solar elevations coupled with low reflectivity produced by wet terrain provided minimal exposure even when processed at the full level of development. Likewise, areas illuminated by high solar elevations combined with the extreme reflectivity of fresh snow cover produced the maximum exposure recorded by this mission. The processing contractor reported that even though a large percentage of both the forward and aft material was processed at the full level of development, their overall minimum density levels tended to be low.

b. Twenty-eight changes in the development level were made on the forward material and 35 on the aft material. The necessity for a change in the level of development in order to provide optimum processing of the material was determined by visual observation and infra-red detection densitometry. The percentages of film processed at the various levels are:

Development Level	1028-1		1028-2	
	Forward	Aft	Forward	Aft
Primary	0%	0.1%	1%	0%
Intermediate	4%	16.0%	9%	6%
Full	96%	83.9%	90%	94%

Eleven parts of the forward film and 9 parts of the aft film required printing at 2 density levels to provide duplicate positives of optimum quality.

2. Physical Film Degradations

a. Some minor abrasions, pinholes, and comets were noted throughout the mission; however, degradation is considered minor.

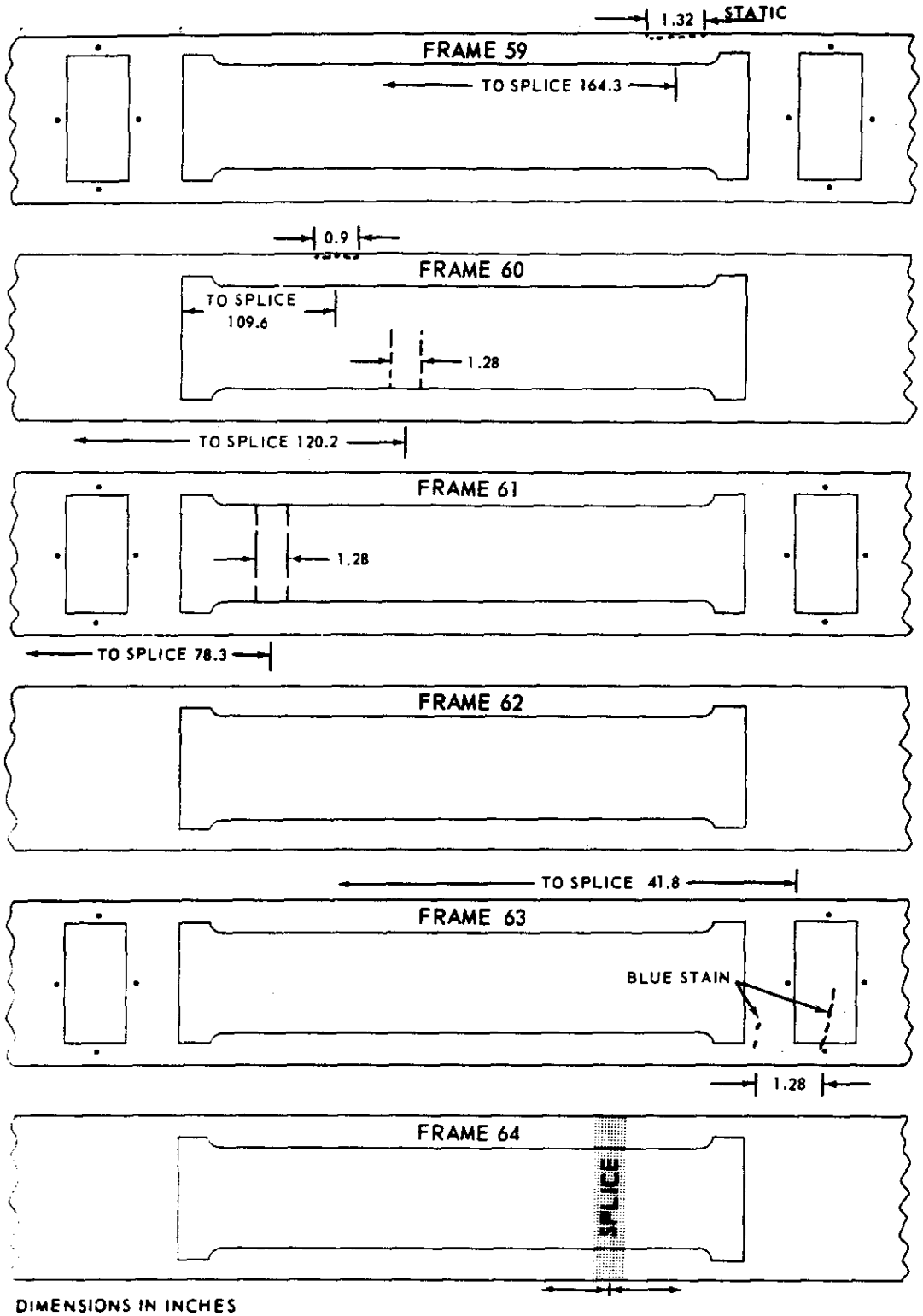
b. The crimps and creases in frames 66 and 67 of pass 22D of the forward footage is described in Part I, paragraph 1, sub-paragraph e of this report.

c. Any abnormal tension transient of the film is a potential hazard to system performance. Such a transient is produced when the cold flow of adhesive from a manufacturer's splice causes adjoining film wraps to adhere. Adhesive transfers, static discharge traces, plus density streaks, and emulsion lifts are usually present in association with manufacturer's splices. The following diagrams give the location of these anomalies in relation to all splices on the forward and aft material.

ILLUSTRATIONS OF SPLICES AND ASSOCIATED ANOMALIES ON MISSION 1028

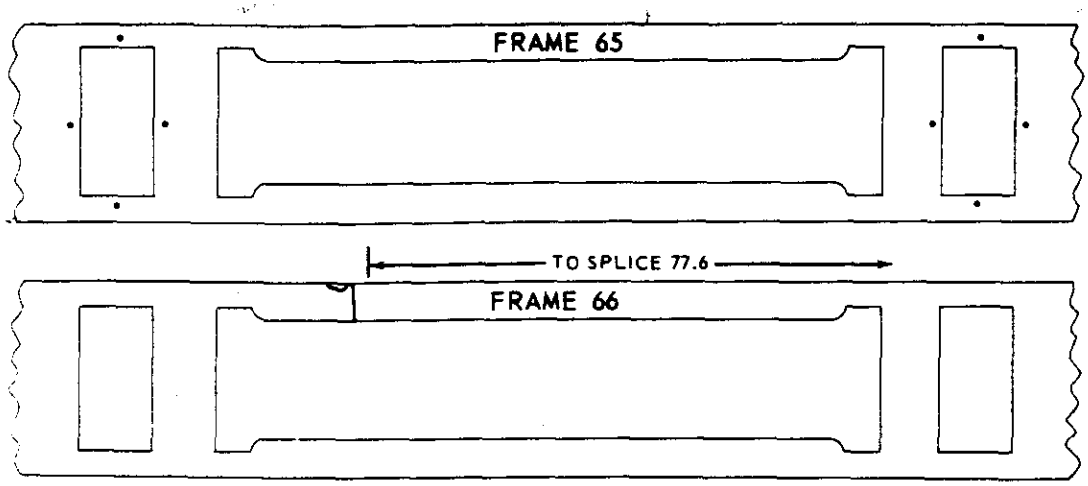
FORWARD PASSES

FWD 22D

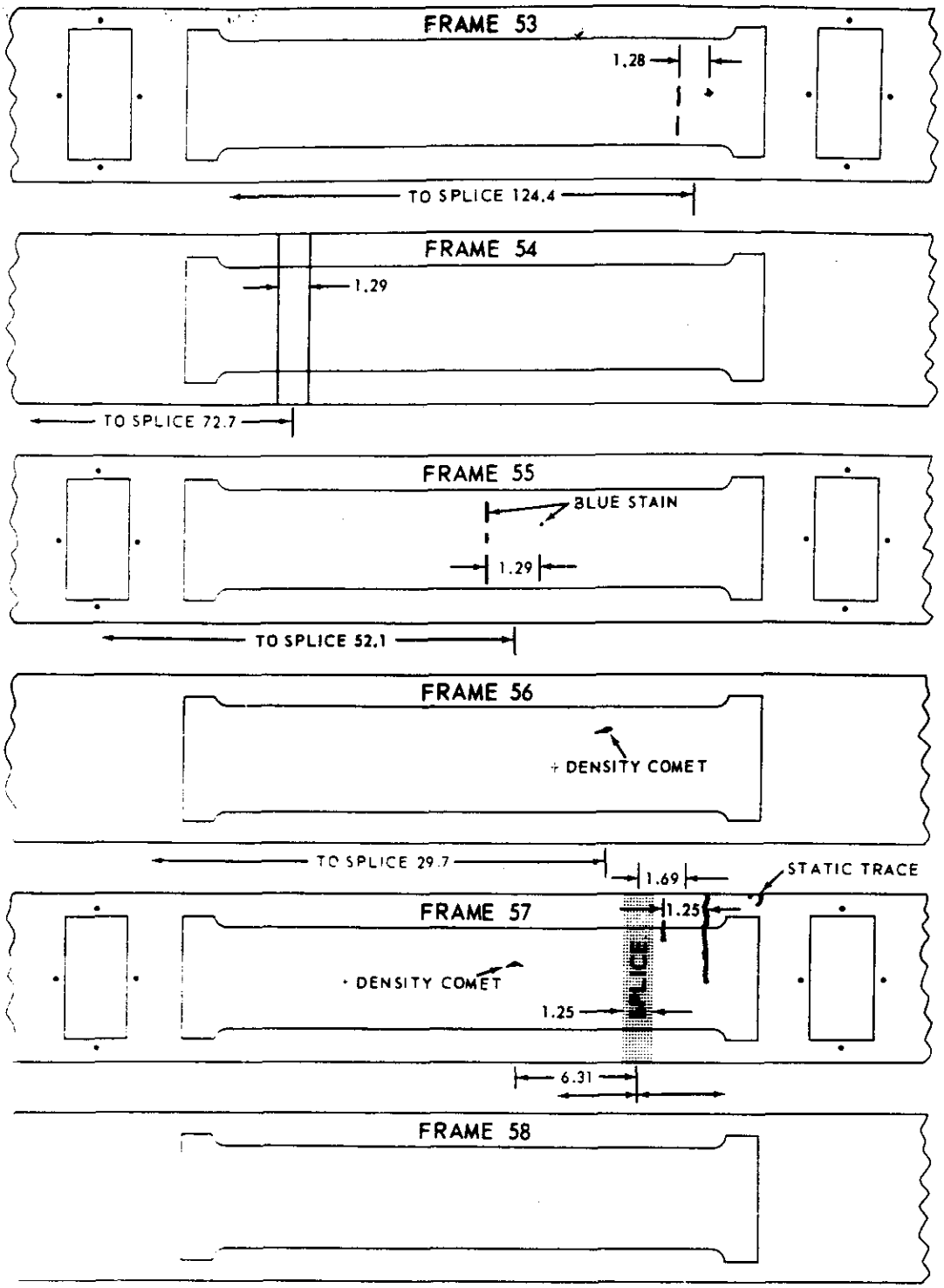


DIMENSIONS IN INCHES

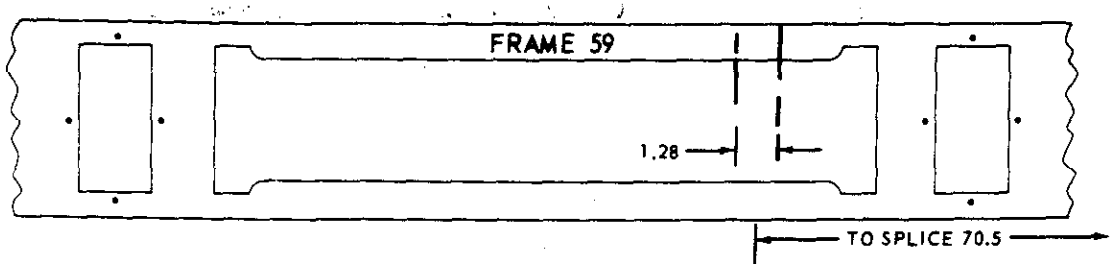
FWD 22D



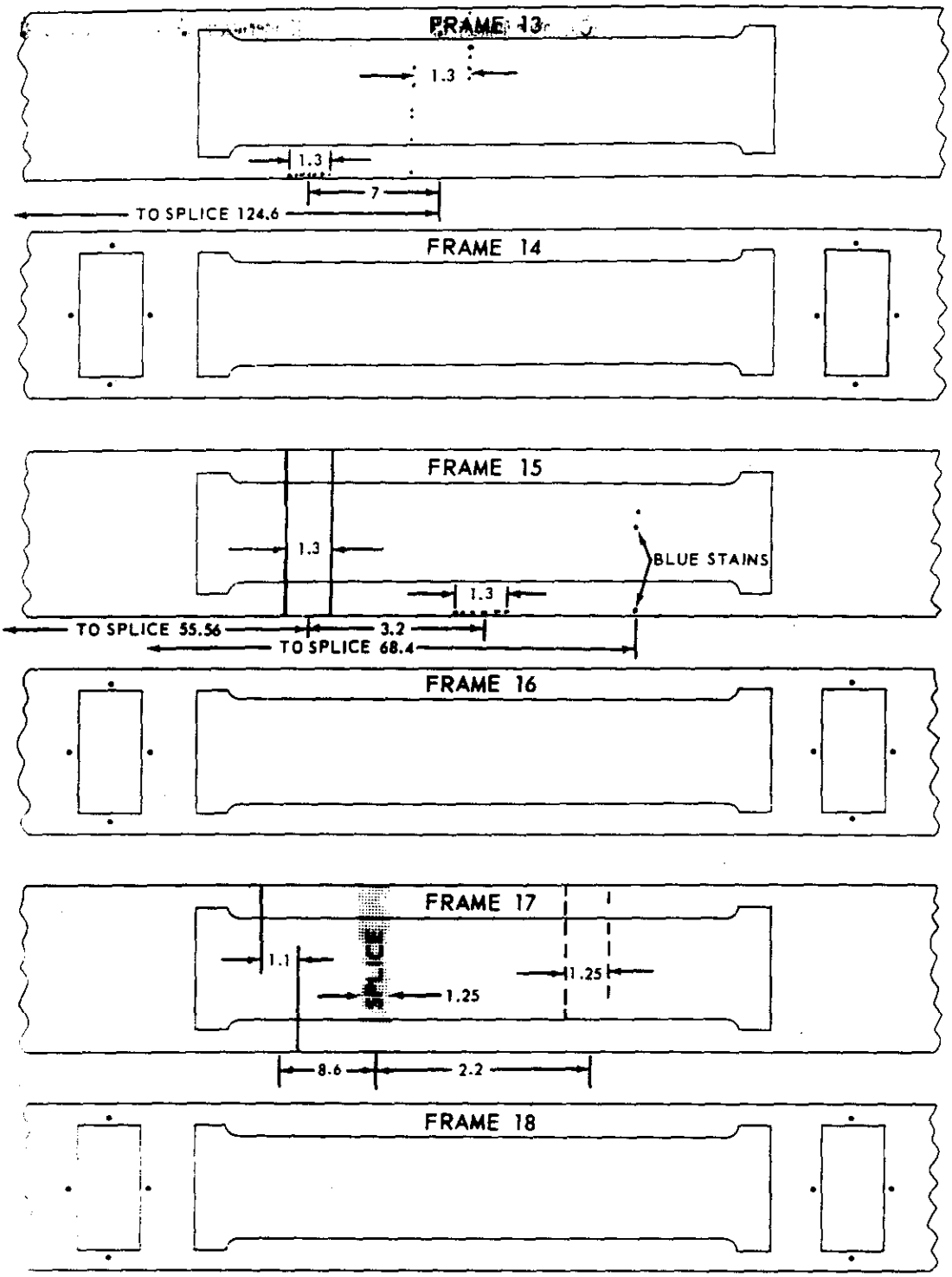
FWD 41D


FRAME 53
1.28
TO SPLICE 124.4
FRAME 54
1.29
TO SPLICE 72.7
FRAME 55
BLUE STAIN
1.29
TO SPLICE 52.1
FRAME 56
DENSITY COMET
TO SPLICE 29.7
1.69
STATIC TRACE
FRAME 57
1.25
DENSITY COMET
1.25
6.31
FRAME 58

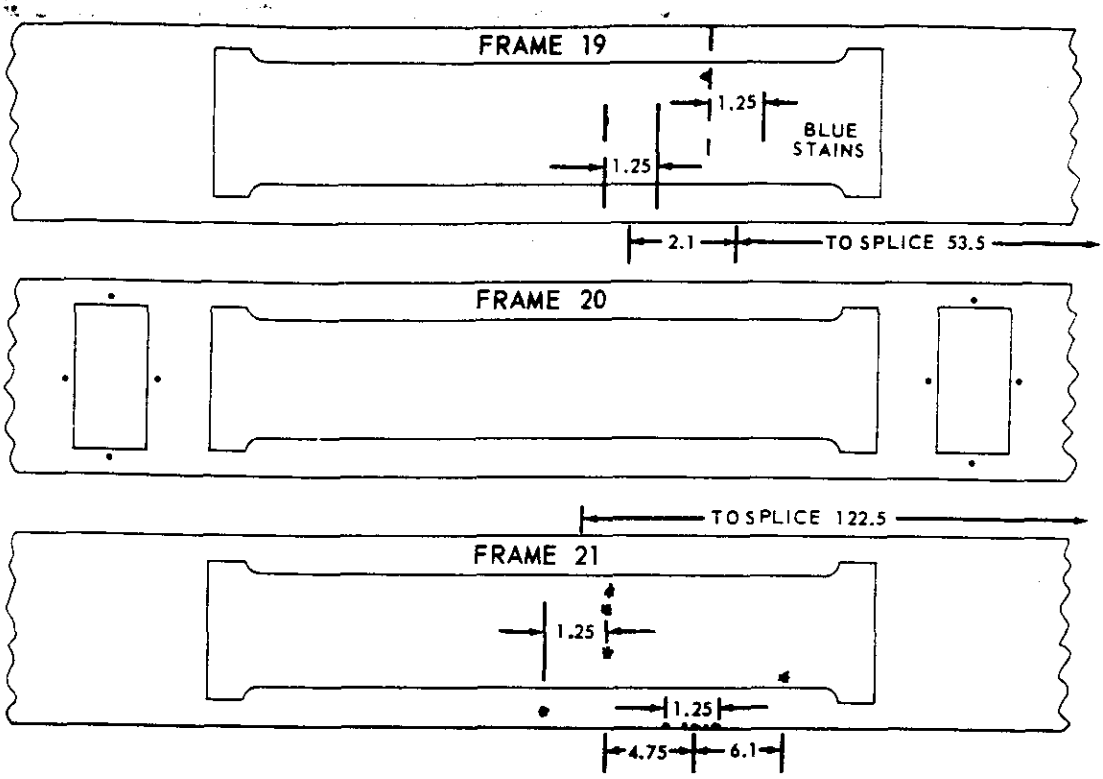
FWD 41D



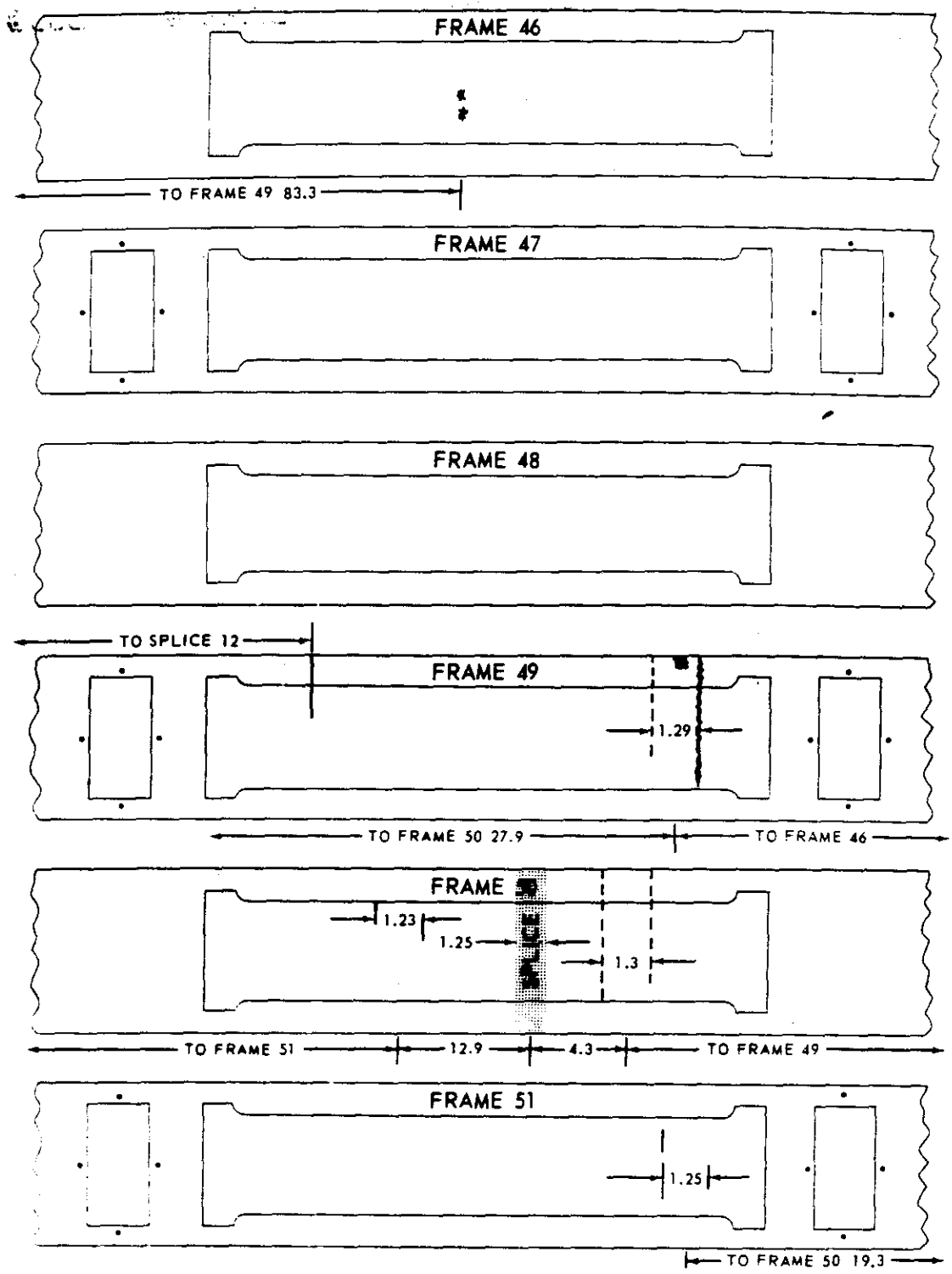
FWD. 88D


FRAME 13
1.3
1.3
7
TO SPLICE 124.6
FRAME 14
FRAME 15
1.3
BLUE STAINS
1.3
TO SPLICE 55.56
3.2
TO SPLICE 68.4
FRAME 16
FRAME 17
1.1
1.25
1.25
8.6
2.2
FRAME 18

FWD 88D

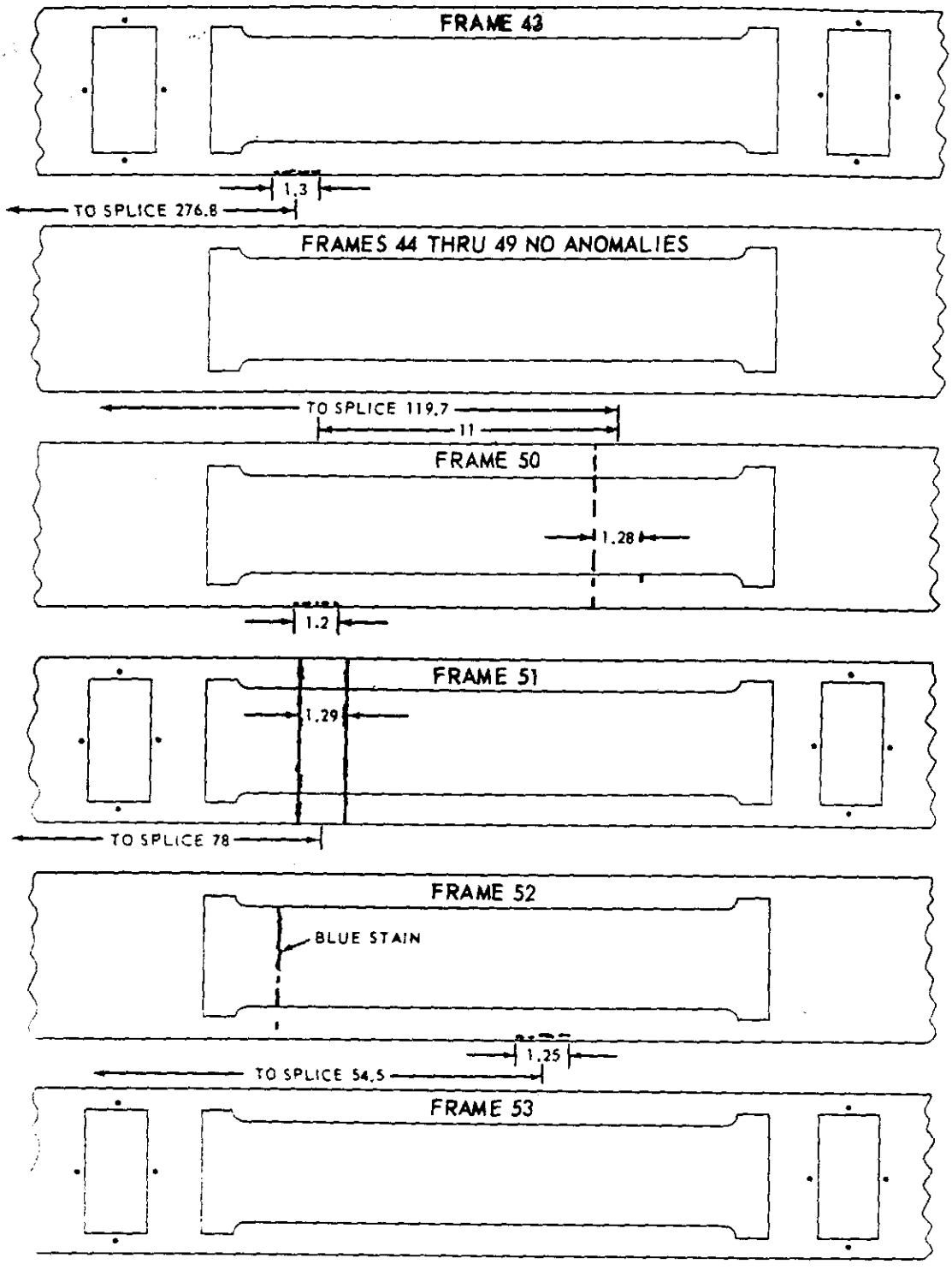

FRAME 19
1.25
BLUE STAINS
1.25
2.1
TO SPLICE 53.5
FRAME 20
TO SPLICE 122.5
FRAME 21
1.25
1.25
4.75
6.1

FWD 130D

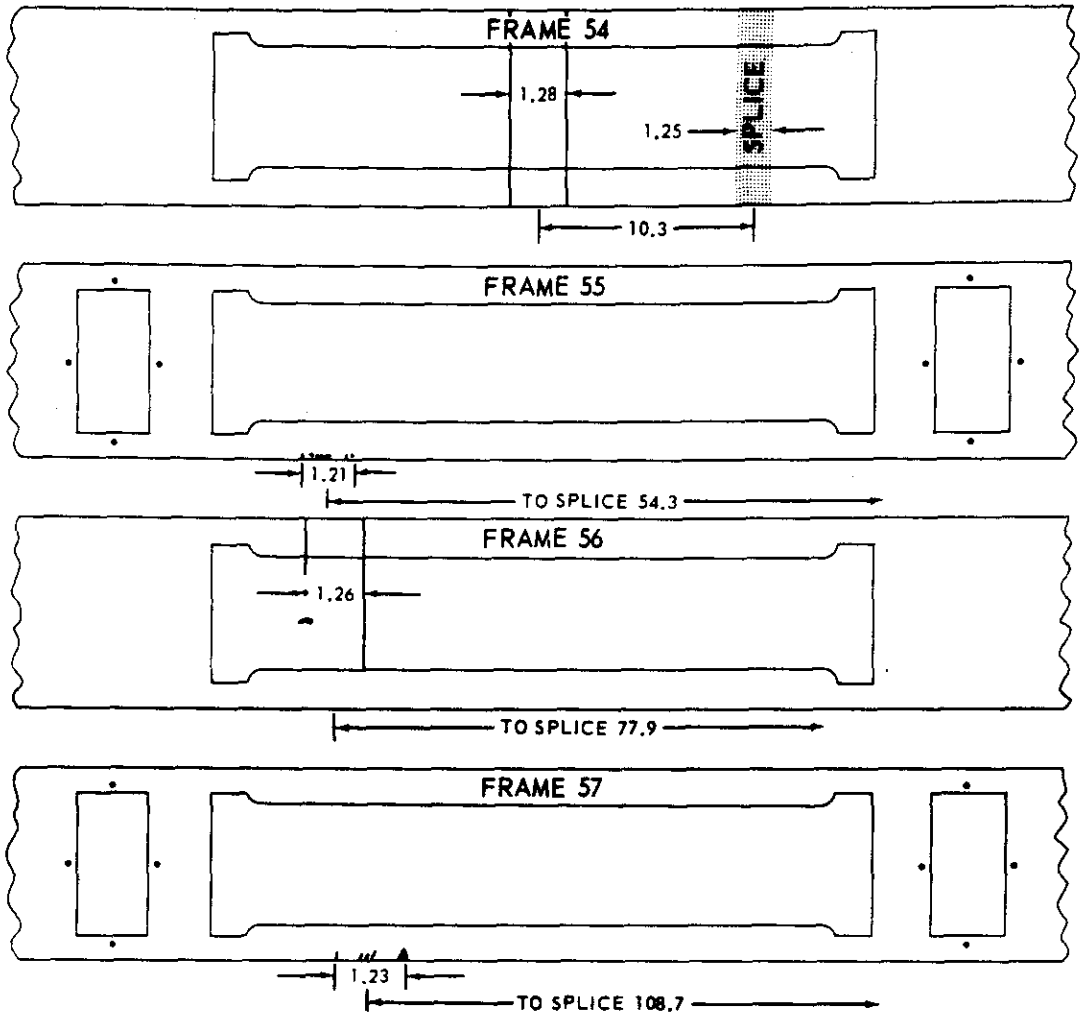

FRAME 46
TO FRAME 49 83.3
FRAME 47
FRAME 48
TO SPLICE 12
FRAME 49
1.29
TO FRAME 50 27.9
TO FRAME 46
FRAME
1.23
1.25
1.3
TO FRAME 51
12.9
4.3
TO FRAME 49
FRAME 51
1.25
TO FRAME 50 19.3

AFT PASSES

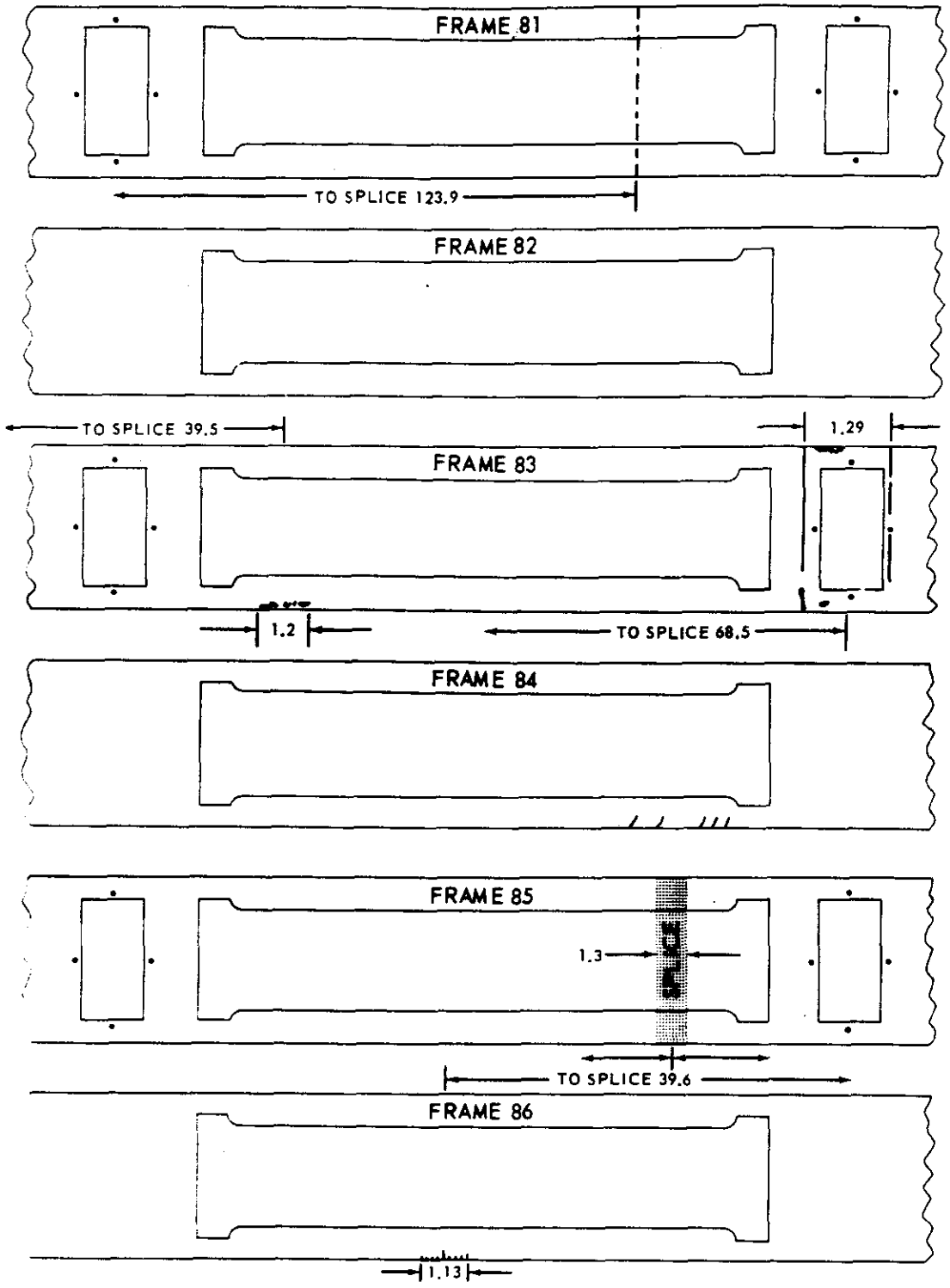
AFT 22D


FRAME 43
1.3
TO SPLICE 276.8
FRAMES 44 THRU 49 NO ANOMALIES
TO SPLICE 119.7
11
FRAME 50
1.28
1.2
FRAME 51
1.29
TO SPLICE 78
FRAME 52
BLUE STAIN
1.25
TO SPLICE 54.5
FRAME 53

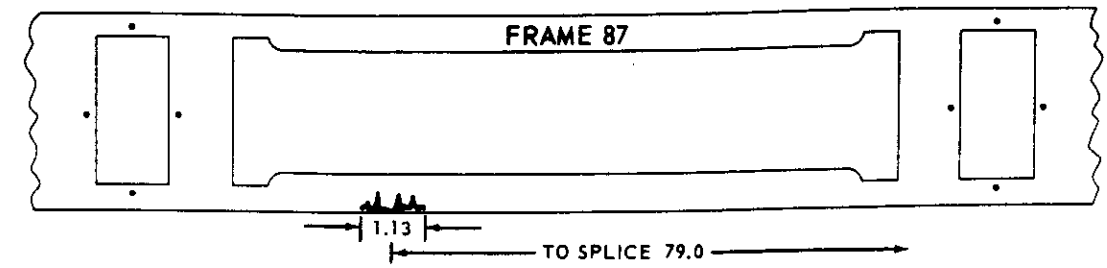
AFT 22D


FRAME 54
1.28
1.25
SPLICE
10.3
FRAME 55
1.21
TO SPLICE 54.3
FRAME 56
1.26
TO SPLICE 77.9
FRAME 57
1.23
TO SPLICE 108.7

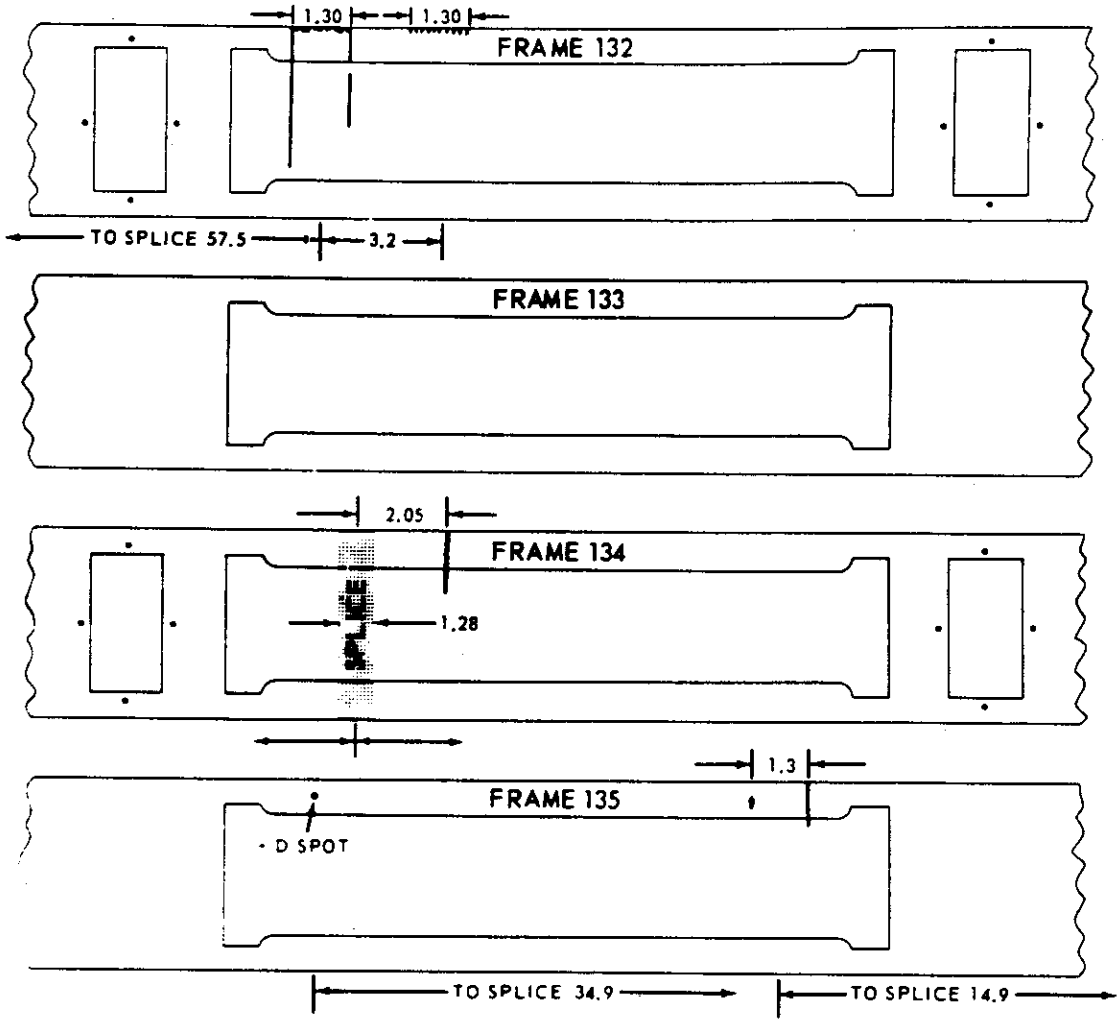
AFT 53D


FRAME 81
TO SPLICE 123.9
FRAME 82
TO SPLICE 39.5
1.29
FRAME 83
1.2
TO SPLICE 68.5
FRAME 84
FRAME 85
1.3
TO SPLICE 39.6
FRAME 86
1.13

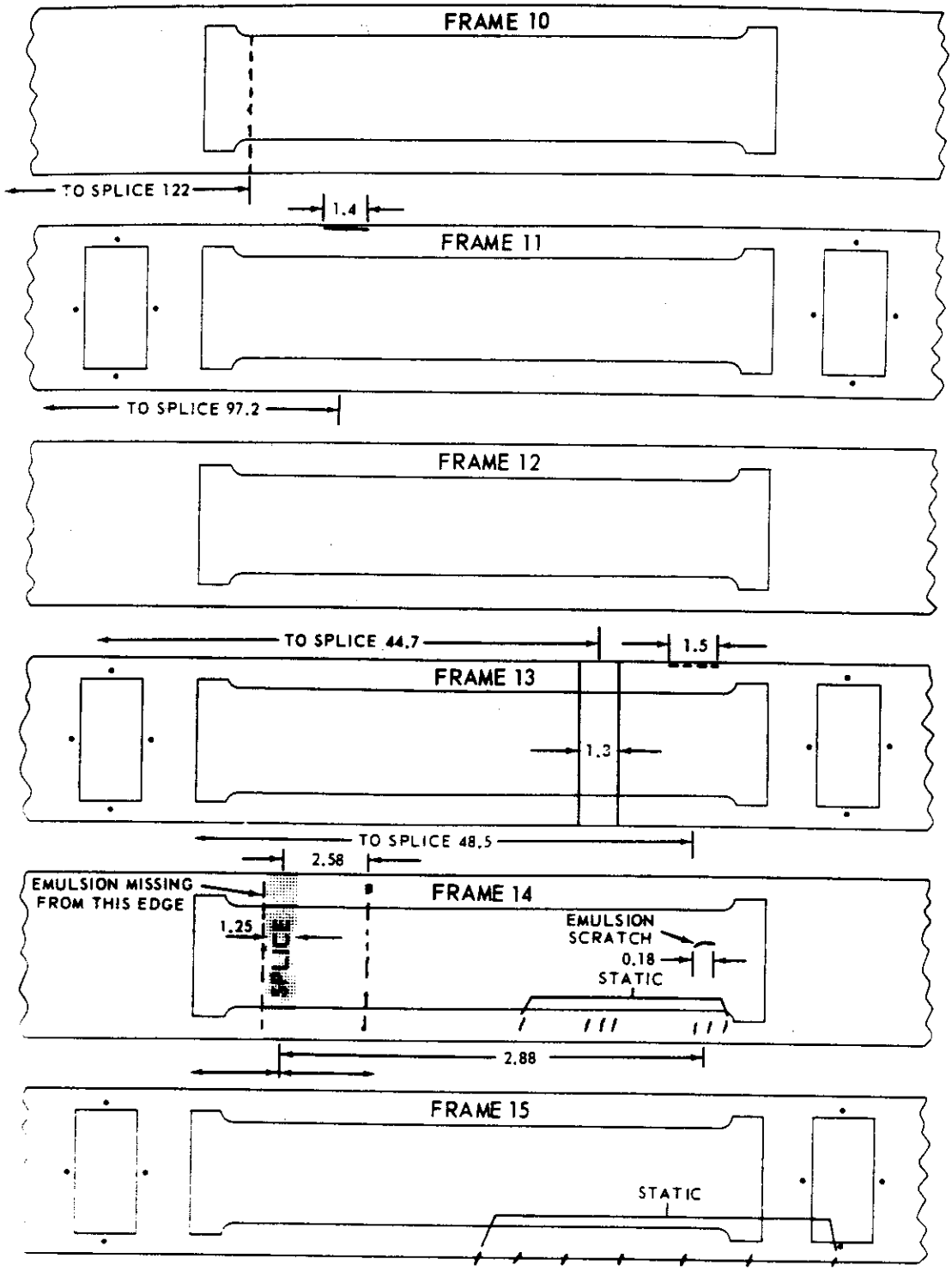
AFT 53D



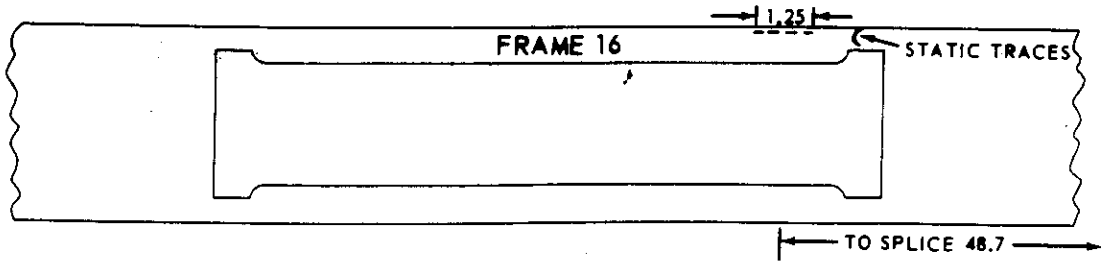
AFT 85D



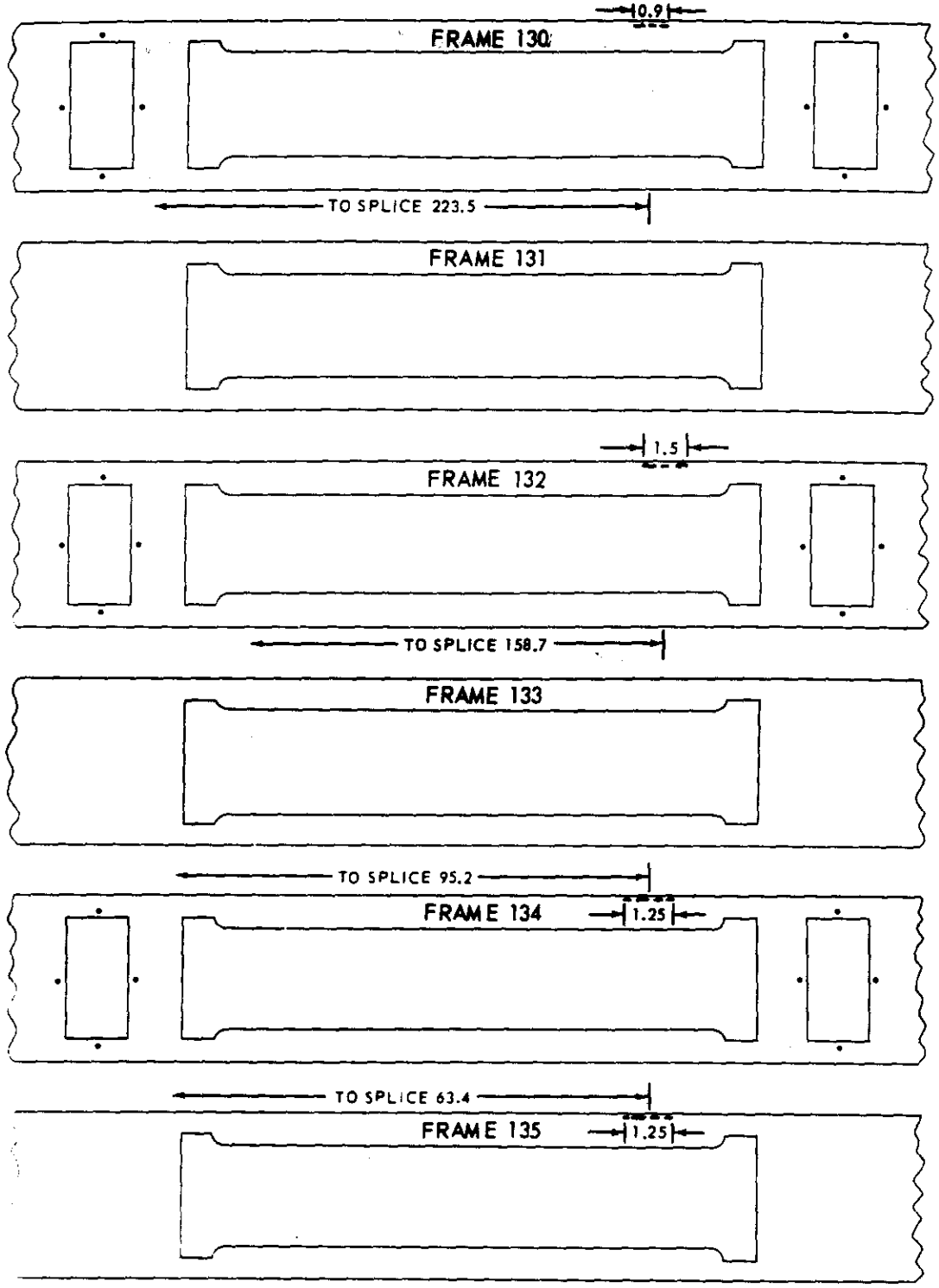
AFT 109D


FRAME 10
TO SPLICE 122
1.4
FRAME 11
TO SPLICE 97.2
FRAME 12
TO SPLICE 44.7
1.5
FRAME 13
1.3
TO SPLICE 48.5
2.58
EMULSION MISSING FROM THIS EDGE
FRAME 14
1.25
SPLICE
EMULSION SCRATCH
0.18
STATIC
2.88
FRAME 15
STATIC

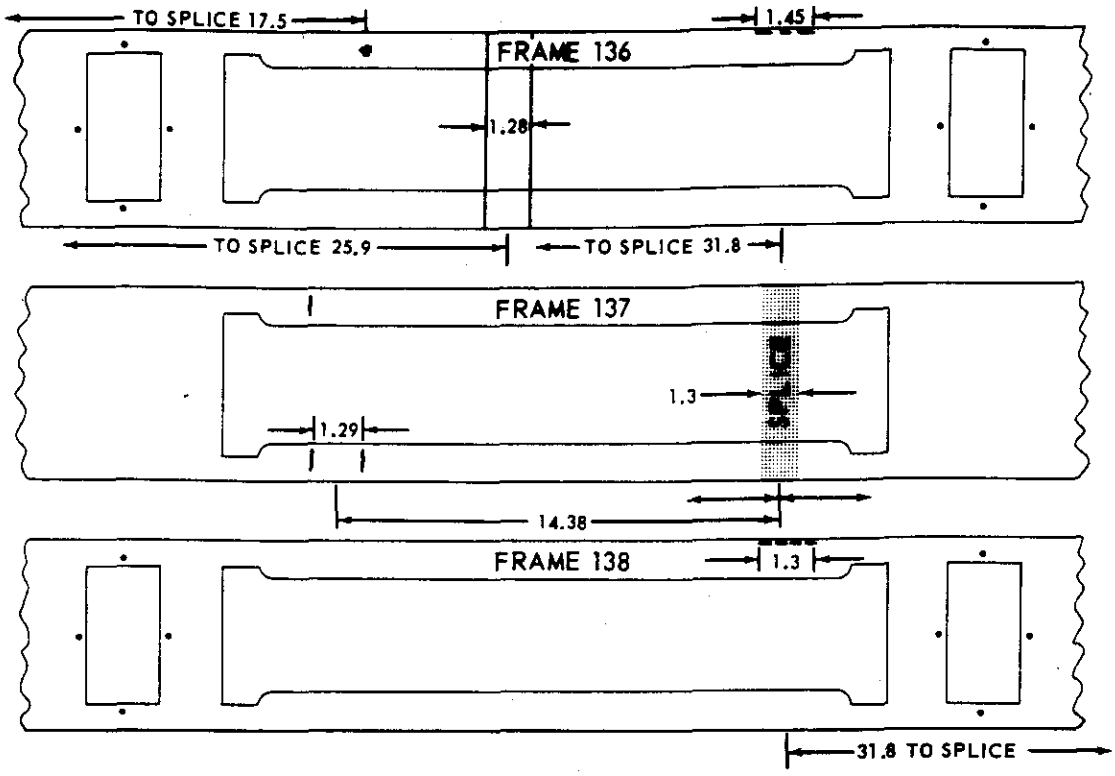
AFT 109D



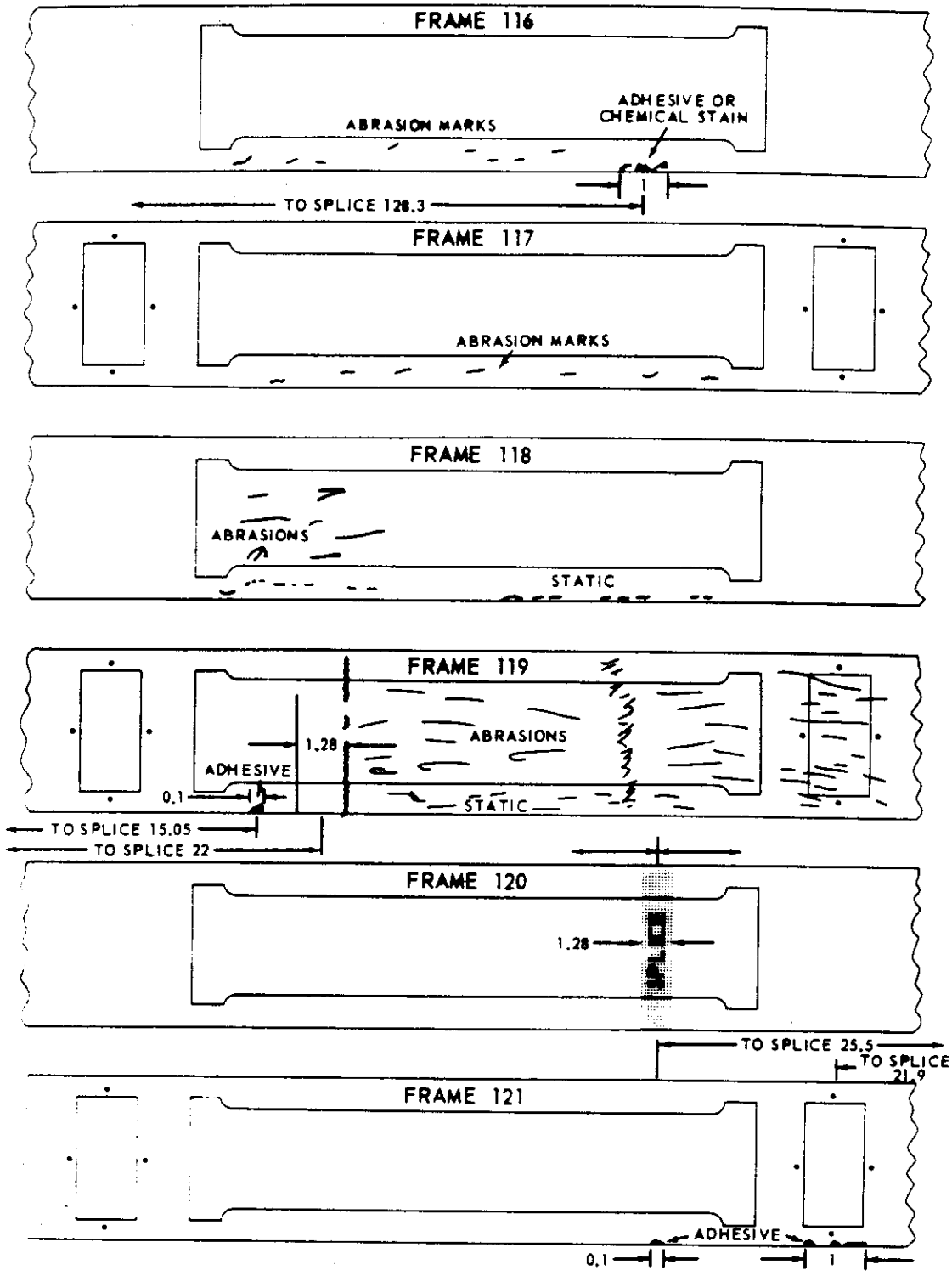
AFT 132D


0.9
FRAME 130
TO SPLICE 223.5
FRAME 131
1.5
FRAME 132
TO SPLICE 158.7
FRAME 133
TO SPLICE 95.2
FRAME 134
1.25
TO SPLICE 63.4
FRAME 135
1.25

AFT 132D


TO SPLICE 17.5
1.45
FRAME 136
1.28
TO SPLICE 25.9
TO SPLICE 31.8
FRAME 137
1.3
1.29
14.38
FRAME 138
1.3
31.8 TO SPLICE

AFT 133D


FRAME 116
ABRASION MARKS
ADHESIVE OR CHEMICAL STAIN
TO SPLICE 128.3
FRAME 117
ABRASION MARKS
FRAME 118
ABRASIONS
STATIC
FRAME 119
1.28
ABRASIONS
ADHESIVE
0.1
STATIC
TO SPLICE 15.05
TO SPLICE 22
FRAME 120
1.28
TO SPLICE 25.5
TO SPLICE 21.9
FRAME 121
ADHESIVE
0.1
1

3. Film Footage

Camera	Footage	Frames
Forward-Looking Panoramic Camera No 176 Mission 1028-1	8,130	2,974
Aft-Looking Panoramic Camera No 177 Mission 1028-1	8,227	3,001
Stellar Camera No 97 Mission 1028-1	46	425
Index Camera No 91 Mission 1028-1	90	418
Forward-Looking Panoramic Camera No 176 Mission 1028-2	7,807	2,947
Aft-Looking Panoramic Camera No 177 Mission 1028-2	7,700	2,911
Stellar Camera No 95 Mission 1028-2	49	433
Index Camera No 76 Mission 1028-2	121	439*

NOTE: Footages include pre- and post-flight material.
*Approximate since the individual frames were not titled.

4. Minus Density Comets

Much concern was expressed by the photographic interpreters when an image resembling a missile in flight was discovered on forward frame 17 of pass 55D. Isodensity traces were made, subjective analysis was accomplished, and mensuration was performed on the image in question. It was felt that the image was too sharply defined to have been optically formed; however, no definite answer to its origin could be given.

No record of the image in question is present on any of the corresponding aft material and, thus, no stereo examination is possible. It was calculated that a missile traveling at a high velocity could have escaped coverage by the aft camera and, therefore, lack of complete coverage did not rule out the missile hypothesis.

Further examination of the mission record revealed 6 additional images similar to the one in question. They are present on pass 121D in frames 70 and 71 of the forward material. The newly discovered images are located 1.3 inches from the frequency mark edge of the film and are oriented approximately parallel to the major axis of the film. It was concluded that the image in question on pass 55D was due to physical contact with the material and was not a rocket in flight.

Subsequent consultation with the film manufacturer disclosed that such images are currently under study by their production quality control personnel since these minus density comet-shaped images have been discovered on raw stock shortly after manufacture.

The following photomicrographs illustrate the original image in question and one of those subsequently discovered. The similarity of the original image to the configuration of a missile in flight is remarkable and it is understandable why such concern was expressed.

FIGURE 8. EXAMPLE OF PLUS DENSITY COMET RESEMBLING A MISSILE IN FLIGHT

FIGURE 9. EXAMPLE OF AN ADDITIONAL PLUS DENSITY COMET-TYPE EMULSION DEFECT

The missile configuration of the plus density comet illustrated on the left page caused much concern. The resemblance of the emulsion defect to a missile in flight is remarkable and only after extensive study was the image discounted as being optically formed. The right photograph illustrates a similarly formed image which does not resemble a missile.

The spots scattered throughout the entire format of the illustration are images of bubbles in the base support backing. These are the result of the depth-of-focus of the photomicrograph system employed to produce the negative from which the subsequent prints were made.

NPIC K-0943 (8/66)
NPIC K-0944 (8/66)

Both illustrations are photomicrographs of the original negative. The photomicrograph negatives were produced at magnifications of 30X. The following photographs are 10X enlargements of those negatives which brings the total magnification of these illustrations to 300X.

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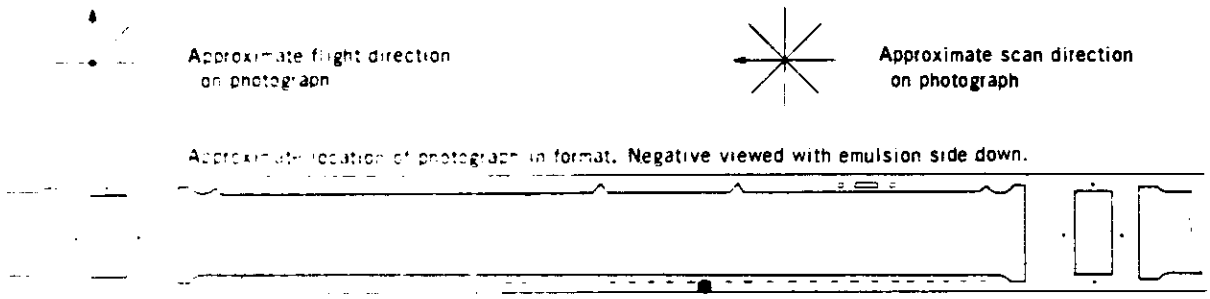
FIGURE 10. EXAMPLE OF DENDRITIC STATIC DISCHARGE TRACE

One of the more severe dendritic static discharge traces is illustrated. Such traces were numerous throughout the mission and degrade the imagery which they cover.

Camera	Aft
Pass	130D
Frame	44
Date of Photography	2 Jan 66
Universal Grid Coordinates	52.5 - 9.2
Enlargement Factor	10X
Geographic Coordinates	58-20N 142-04E
Altitude	623,194
Camera Attitude:	
Pitch	-14°46'
Poll	0°26'
Yaw	Not Determined
Local Sun Time	1106
Solar Elevation	7°57'
Solar Azimuth	166°
Exposure	1/267
Vehicle Azimuth	162°50'
Processing Level	Full



[redacted]

[redacted]

FIGURE 11. IMAGE OF FOREIGN MATTER

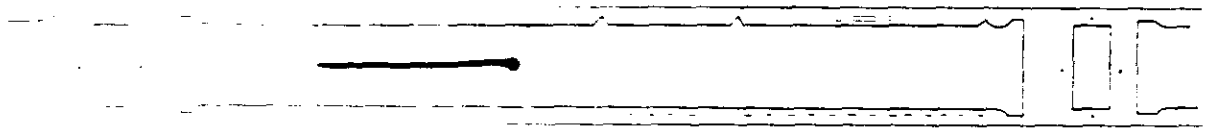
The first few passes of the aft photography contain streaks of minus density. These minus density streaks have been noted on previous missions and have been attributed to obstructions in the optical path caused by particles of foreign matter in the system. It is seldom that the streak-causing particles are imaged as a stationary object rather than as a streak. The minus density streak caused by this particle, although not visible in the illustration, is present in the scan direction trailing the stationary image.

Camera	Aft
Pass	5D
Frame	9
Date of Photography	25 Dec 65
Universal Grid Coordinates	37.8 - 12.5
Enlargement Factor	10X
Geographic Coordinates	46-24N 122-01E
Altitude	661,991
Camera Attitude:	
Pitch	-14°25'
Roll	0°37'
Yaw	-0°56'
Local Sun Time	1249
Solar Elevation	19°23'
Solar Azimuth	208°
Exposure	1/246
Vehicle Azimuth	168°01'
Processing Level	Full

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



MINUS DENSITY STREAK

[redacted]

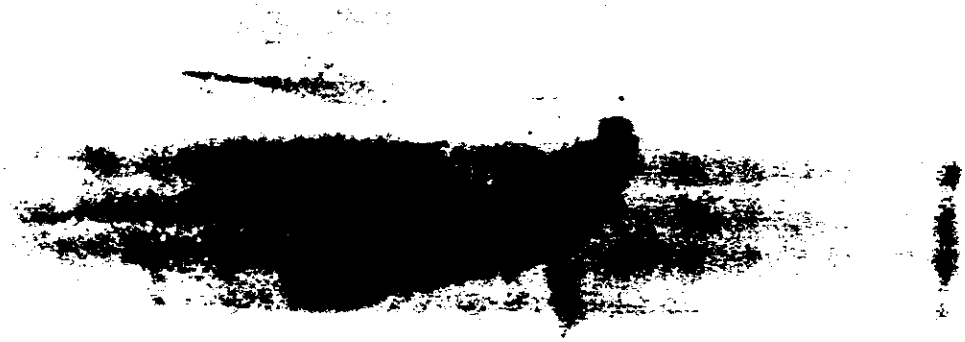


FIGURE 12. EXAMPLE OF SOLAR REFLECTIONS

Highly reflective surfaces such as ice formations, shiny metal rooftops, and calm water combined with the proper look angle and solar elevation can produce severe glare conditions. The photography illustrated here is so severely degraded by solar reflections that the information content of the aquatic regions and surrounding areas is lost. Since such glare is a product of look angle and solar elevation the forward photography is not affected by this set of conditions.

NPIC K-8947 (8-68)

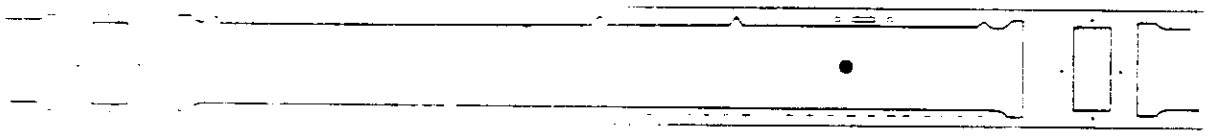
[redacted]

Camera	Aft
Pass	36D
Frame	93
Date of Photography	27 Dec 65
Universal Grid Coordinates	65.5 - 13.0
Enlargement Factor	20X
Geographic Coordinates	36-12S 146-19E
Altitude	852,403
Camera Attitude:	
Pitch	-15°57'
Roll	0°02'
Yaw	0°20'
Local Sun Time	1341
Solar Elevation	65°04'
Solar Azimuth	251°
Exposure	1/192
Vehicle Azimuth	170°21'
Processing Level	Intermediate

Approximate flight direction of spacecraft

Approximate scan direction on photograph

Approximate [illegible] of panoramic format. Negative viewed with emulsion side down.



[redacted]

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PART III. IMAGE QUALITY

1. Definition of Photographic Interpretation (PI) Suitability

PI suitability 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, and weather limitations. However, the fundamental 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 photographic interpreter may extract useful and reliable information from the material.

PI suitability ratings are: Excellent, Good, Fair, Poor, and Unuseable. 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. The standards that determine assignment of the various ratings are:

Excellent: The photography is free of degradations 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 optimum 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 are well defined. No unusual distortions are present. Detection and accurate mensuration of small objects are feasible, but to a lesser degree than in material rated as Excellent.

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

Poor: Camera-induced degradations or weather limitations severely reduce the effectiveness of the photography. Edges and corners are not well defined. 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.

Unuseable: Degradation of photography completely precludes detection, identification, or mensuration of cultural details.

2. PI Suitability, Missions 1028-1 and 1028-2

The PI suitability of the photography obtained on this mission is considered to be good. The imagery has a crispness not obtained since last winter when similar atmospheric conditions prevailed. The quality of the aft material is slightly better than that of the forward as is customary for the system. This judgment is based on imagery contained in the camera number two-thirds of the frame since that nearer the frequency mark edge is less than optimum. Although snow cover, semi-darkness, and obliquity affect the quality of the mission, adverse atmospheric conditions are, by far, the largest degrading factor.

A total of 435 targets was read out and reported on in the preliminary evaluation. Many targets were rated as poor to fair in quality due to the aforementioned restriction imposed by atmospheric conditions affecting approximately 30 percent of the mission.

FIGURE 13. EXAMPLE OF FORWARD PHOTOGRAPHY OF SNOW-COVERED TERRAIN

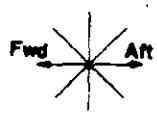
FIGURE 14. EXAMPLE OF AFT PHOTOGRAPHY OF SNOW-COVERED TERRAIN

The contrast extremes afforded by the high reflectivity of snow cover and the snow-free areas in cloud shadow are shown. Detail is detectable in both the high and low density portions of the photograph. The slightly better quality of the aft-looking photography can be seen.

NPIC K-8948 (8/66)
NPIC K-8949 (8/66)

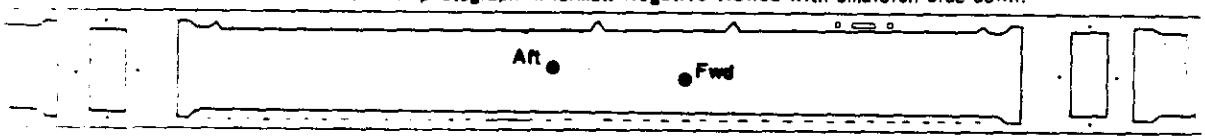
	FIGURE 13	FIGURE 14
Camera	Fwd	Aft
Pass	7D	7D
Frame	50	56
Date of Photography	25 Dec 65	25 Dec 65
Universal Grid Coordinates	50.3 - 12.8	40.4 - 13.0
Enlargement Factor	20X	20X
Geographic Coordinates	54-54N 073-04E	54-57N 072-59E
Altitude	707,329	702,196
Camera Attitude:		
Pitch	14°56'	-14°52'
Roll	-0°01'	0°04'
Yaw	0°17'	0°21'
Local Sun Time	1333	1233
Solar Elevation	11°26'	11°23'
Solar Azimuth	201°	187°
Exposure	1/324	1/231
Vehicle Azimuth	164°14'	164°42'
Processing Level	Intermediate	Intermediate

Approximate flight direction on photograph



Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



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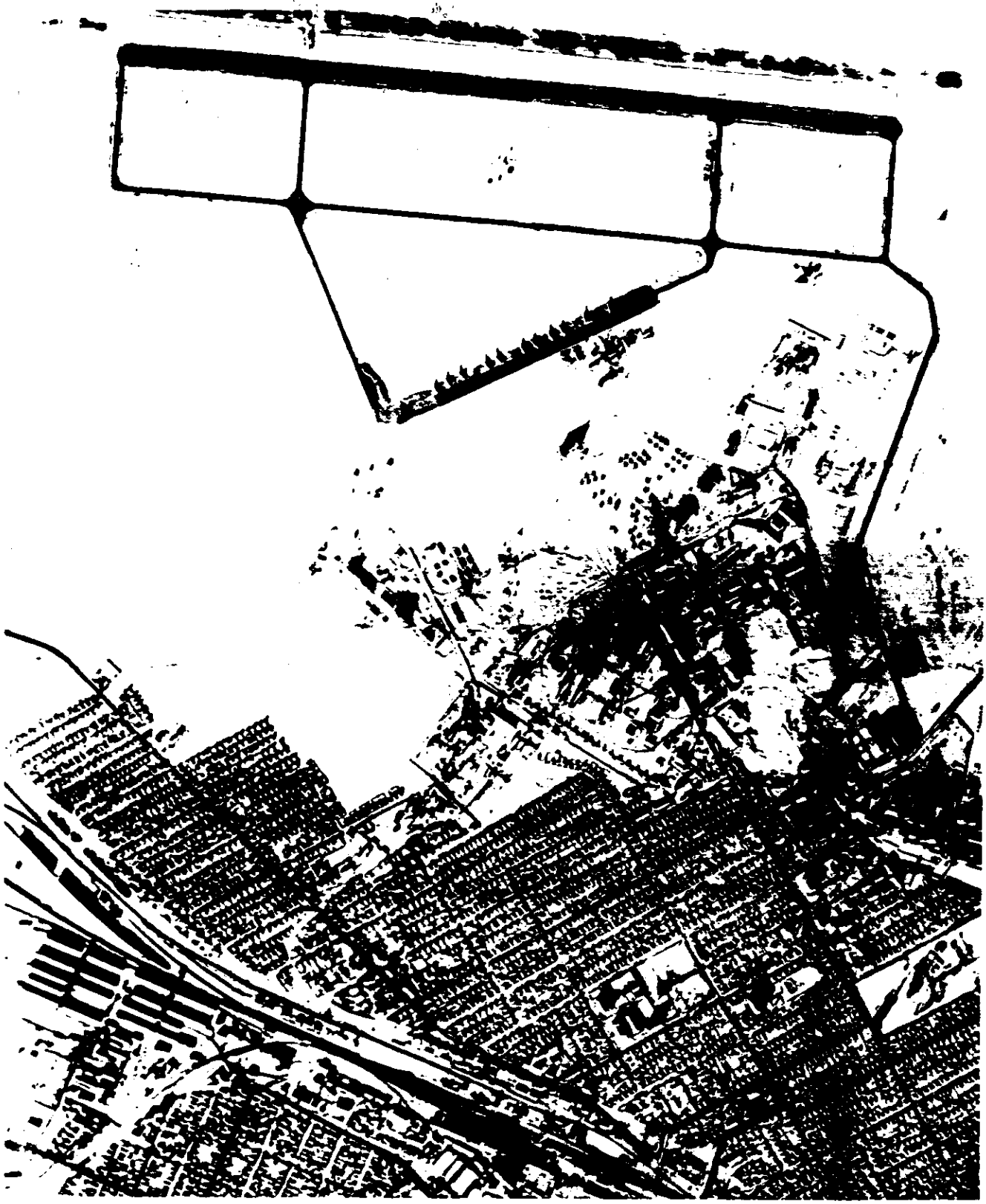

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FIGURE 15. EXAMPLE OF FORWARD, SNOW-FREE PHOTOGRAPHY

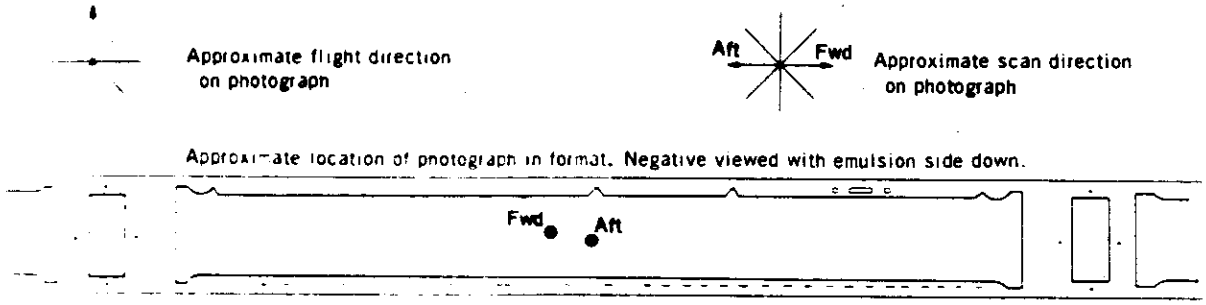
FIGURE 16. EXAMPLE OF AFT, SNOW-FREE PHOTOGRAPHY

The slightly better quality of the aft-looking photography can be observed in the following illustrations. The additional detail present in snow-free photography is readily seen when these photographs are compared with those of the preceeding illustration.

NPIC K-8980 (8/66)
NPIC K-8981 (8/66)

[redacted]

	FIGURE 15	FIGURE 16
Camera	Fwd	Aft
Pass	21D	21D
Frame	31	38
Date of Photography	26 Dec 65	26 Dec 65
Universal Grid Coordinates	44.5 - 12.7	46.3 - 12.4
Enlargement Factor	20X	20X
Geographic Coordinates	39-39N 118-12E	39-41N 118-08E
Altitude	627,321	624,582
Camera Attitude:		
Pitch	15°11'	-14°42'
Roll	0°17'	0°23'
Yaw	0°8'	0°12'
Local Sun Time	1249	1248
Solar Elevation	26°05'	26°03'
Solar Azimuth	192°	190°
Exposure	1/371	1/266
Vehicle Azimuth	169°34'	169°46'
Processing Level	Full	Full



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3. Definition of Mission Information Potential (MIP)

The MIP is an arbitrary number, not limited by terminal values, which is subjectively assigned to the panoramic photography of a mission and which compares it to the other missions. It is meant to be a measure of the camera's maximum capability for recording information, discounting adverse atmospheric conditions, minimum solar elevations, camera malfunctions, or other factors which reduce the quality of the photography.

The MIP is based on the best photography found in a mission, even though the photography may be limited to a few frames. Since these frames are considered to be the best in the mission, they do not indicate the overall success, average quality, or general interpretability of the photography.

Criteria for selection of the MIP frame:

a. Eliminate all portions of the mission affected by system malfunctions.

b. Select frames which are free of clouds or atmospheric attenuation.

c. Eliminate the first 10 frames and last frame of a pass because these may be affected by incorrect scan speed.

d. Select frames that are in a continuous strip of approximately 10 cloud-free frames because cloud shadows from weather fronts are seen for great distances.

e. Determine from the horizon cameras that the panoramic photography is not affected by apparent vehicle perturbations.

f. Select targets that are near the center of the format and on frames as close as possible to perigee for scale purposes and to eliminate obliquity.

g. Select frames having near optimum solar elevation.

h. Select a high-contrast target (preferably an airfield) and compare the frame to a previous mission which has been given an MIP rating.

4. MTP, Missions 1028-1 and 1028-2

Based on the foregoing criteria, frame 11 of pass 46D from the aft-looking panoramic camera was selected as the MTP frame on Mission 1028-1.

This frame displays good exposure and contrast. The solar elevation during acquisition was 27°24' and the film received the full level of processing. Small objects are readily detectable and the edges and corners of buildings are well defined. The aft photography is slightly better than the forward as is generally the situation for flights at this time of the year.

Aft frame 16 of pass 126D was chosen as the MTP frame on the second portion of the mission. The solar elevation at the time of photography was 32°46' and the film received the full level of processing. The quality throughout the second half of the mission is equal to that of part one. No new anomalies developed to impare or improve the image quality. An MTP rating of 85 was assigned to both parts of Mission 1028.

FIGURE 17. EXAMPLE OF FORWARD FRAME CORRESPONDING TO MIP FRAME, MISSION 1028-1

FIGURE 18. EXAMPLE OF MIP FRAME, MISSION 1028-1

The MIP frame and corresponding forward frame on Mission 1028-1 are illustrated. The good quality of the imagery is apparent in the 20X photographs. Corners and edges of buildings are sharp and clearly defined, vehicles are easily distinguishable, and other small objects are readily detectable. The better quality of the aft-looking photography is plainly visible.

NPIC K-8952 (8/66)
NPIC K-8953 (8/66)

FIGURE 17

FIGURE 18

MIP Frame

Camera	Fwd	Aft
Pass	46D	46D
Frame	5	11
Date of Photography	27 Dec 65	27 Dec 65
Universal Grid Coordinates	60.5 - 11.0	64.5 - 13.5
Enlargement Factor	20X	20X
Geographic Coordinates	38-54N 092-52W	38-54N 092-56W
Altitude	612,888	610,865
Camera Attitude:		
Pitch	15°19'	-14°45'
Roll	0°20'	0°34'
Yaw	-0°52'	-0°44'
Local Sun Time	1233	1233
Solar Elevation	27°24'	27°24'
Solar Azimuth	190°	188°
Exposure	1/360	1/267
Vehicle Azimuth	169°44'	169°56'
Processing Level	Full	Intermediate

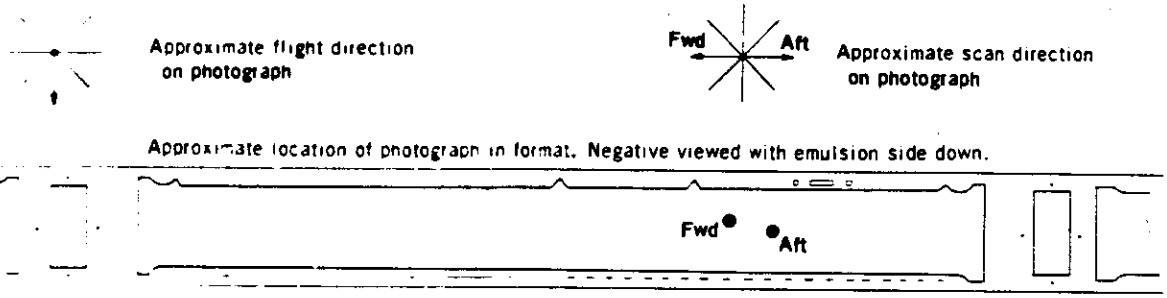

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FIGURE 19. EXAMPLE OF FORWARD FRAME CORRESPONDING TO MIP FRAME, MISSION 1028-2

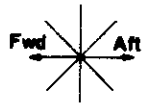
FIGURE 20. EXAMPLE OF MIP FRAME, MISSION 1028-2

The MIP frame and corresponding forward frame on the second portion of the mission are presented at 20X magnification. The quality of the photography accomplished on 1028-2 is equal to that of 1028-1. Vehicles on the roadways are easily located and engine nacelles, on the larger aircraft, are readily detectable. The aft-looking photography continues to be of better quality than that of the forward-looking photography.

NPIC K-8964 (8/66)
NPIC K-8956 (8/66)

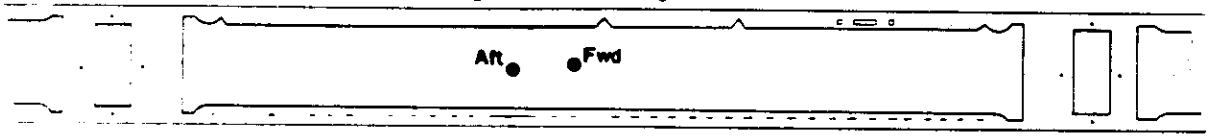
	FIGURE 19	FIGURE 20
		MIP Frame
Camera	Fwd	Aft
Pass	126D	126D
Frame	10	16
Date of Photography	1 Jan 66	1 Jan 66
Universal Grid Coordinates	45.6 - 12.8	40.5 - 12.8
Enlargement Factor	20X	20X
Geographic Coordinates	34-12N 118-29W	34-11N 118-32W
Altitude	603,213	603,846
Camera Attitude		
Pitch	14°42'	-15°21'
Roll	0°01'	0°03'
Yaw	Not Determined	Not Determined
Local Sun Time	1144	1147
Solar Elevation	32°44'	32°46'
Solar Azimuth	158°	167°
Exposure	1/379	1/269
Vehicle Azimuth	170°42'	170°52'
Processing Level	**Full**	**Full**

Approximate flight direction on photograph



Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



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5. Highlights of the Mission

Highlights of the mission include:

a. Four new launch groups were identified.

b. Two new missile launch sites were discovered on this mission.

c. Preparations for an approaching test were observed at a nuclear test site.

d. It was determined that a new building at a nuclear warhead handling facility is the drive-in-type.

e. It was detected that a recently constructed radar position is now occupied.

6. Image Analysis of Resolution Targets

A single target display was photographed under good weather conditions on this mission. The ground resolution, as read by 3 experienced photographic analysts on the original negatives and on second generation positive prints, is presented in the following table. In target orientation, those bars which are most perpendicular to the line of flight determine the resolution in the flight direction. Those which are most perpendicular to the direction of scan determine the resolution in the scan direction. There is no indication that the relation between the flight and scan direction resolution is systematic in nature. This bias was not evident in other portions of the mission.

The resolution of the fixed targets are also presented; however, in the target readings it must be noted that these targets were inactivated and their condition at the time of acquisition is unknown.

RESOLUTION TARGET DATA

Target Designator	A	A_1	B	B_1	C	C_1
Camera (Looking)	Fwd	Aft	Fwd	Aft	Fwd	Aft
Pass	46D	46D	126D	126D	126D	126D
Frame	8	14	7	13	7	13
Date of Photography	27 Dec 65	27 Dec 65	1 Jan 66	1 Jan 66	1 Jan 66	1 Jan 66
Universal Grid	14.2X	10.2X	69.3X	21.3X	69.3X	21.3X
Coordinates	63.0Y	28.5Y	12.8Y	10.8Y	12.8Y	10.8Y
Geographic Coordinates	38°26'N	38°27'N	34°40'N	34°38N	34°40'N	34°38'N
of Format Center	92°45'W	92°50'W	118°35'W	118°37 W	118°35'W	118°37'W
Altitude	611,809	609,872	602,927	603,506	602,927	603,506
Camera						
Pitch	15°17'	-14°35'	14°45'	-15°08'	14°45'	-15°08'
Roll	00°26'	00°40'	00°00'	-00°04'	-00°00'	-00°04'
Yaw	-00°50'	-00°41'	ND	ND	ND	ND
Local Sun Time	1234	1234	1147	1147	1147	1147
Solar Elevation	27°50'	27°50'	32°17'	32°18	32°17'	32°18'
Solar Azimuth	112°	112°	158°	158°	158°	158°
Exposure (Fractions						
of Second)	1/374	1/264	1/375	1/266	1/375	1/266
Processing Level	Full	Full	Full	Full	Full	Full
Vehicle Azimuth	169°51'	170°02'	170°37'	170°47'	170°37'	170°47'
Wratten Filter	25	21	25	21	25	21
Target Type	Mobile	Mobile	Fixed Mil-Std Type B	Fixed Mil-Std Type B	Fixed Mil-Std Type C	Fixed Mil-Std Type C
Target Contrast	Medium	Medium	High	High	High	High
Weather Conditions	Clouds	Clouds	Good	Good	Good	Good

NA - Denotes not available

RESOLUTION TARGET READINGS

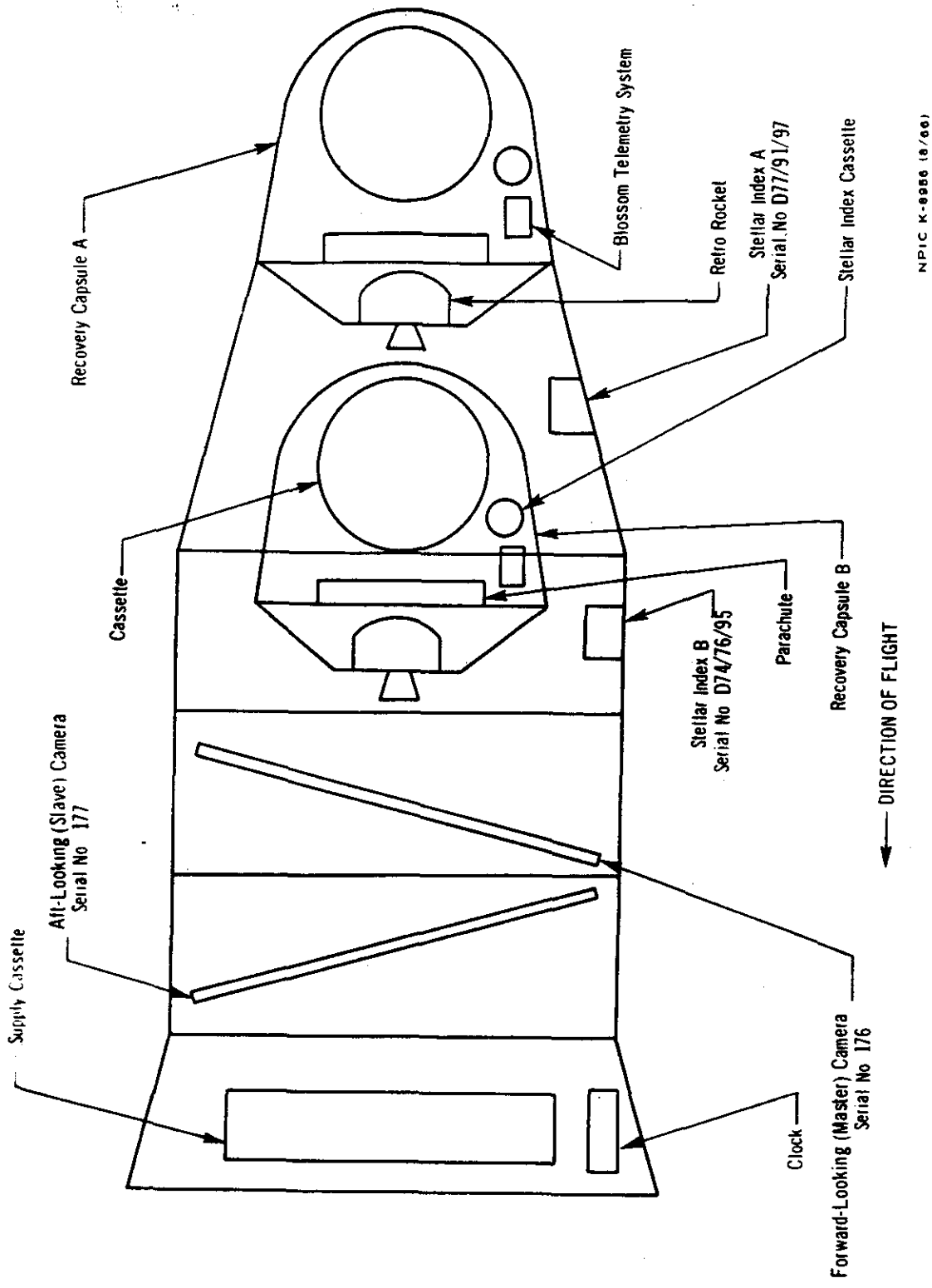
Target Designator	Pass	Frame	Camera (Looking)	Target Type	Orientation On Film	READING OF ORIGINAL NEGATIVE Analyst I	Analyst II	Analyst III
A	46D	8	Fwd	Mobile	Flight	0	0	0
					Scan	0	0	0
A_1	46D	14	Aft	Mobile	Flight	16'0"	16'0"	16'0"
					Scan	16'0"	16'0"	16'0"
B	126D	7	Fwd	Fixed	Flight	10'1"	10'1"	10'1"
					Scan	0	0	10'4"
B_1	126D	13	Aft	Fixed	Flight	7'2"	7'2"	7'2"
					Scan	11'4"	0	11'4"
C	126D	7	Fwd	Fixed	Flight	14'3"	14'3"	16'0"
					Scan	25'4"	25'4"	25'4"
C_1	126D	13	Aft	Fixed	Flight	12'7"	14'3"	12'7"
					Scan	0	0	0

APPENDIX A. SYSTEM SPECIFICATIONS

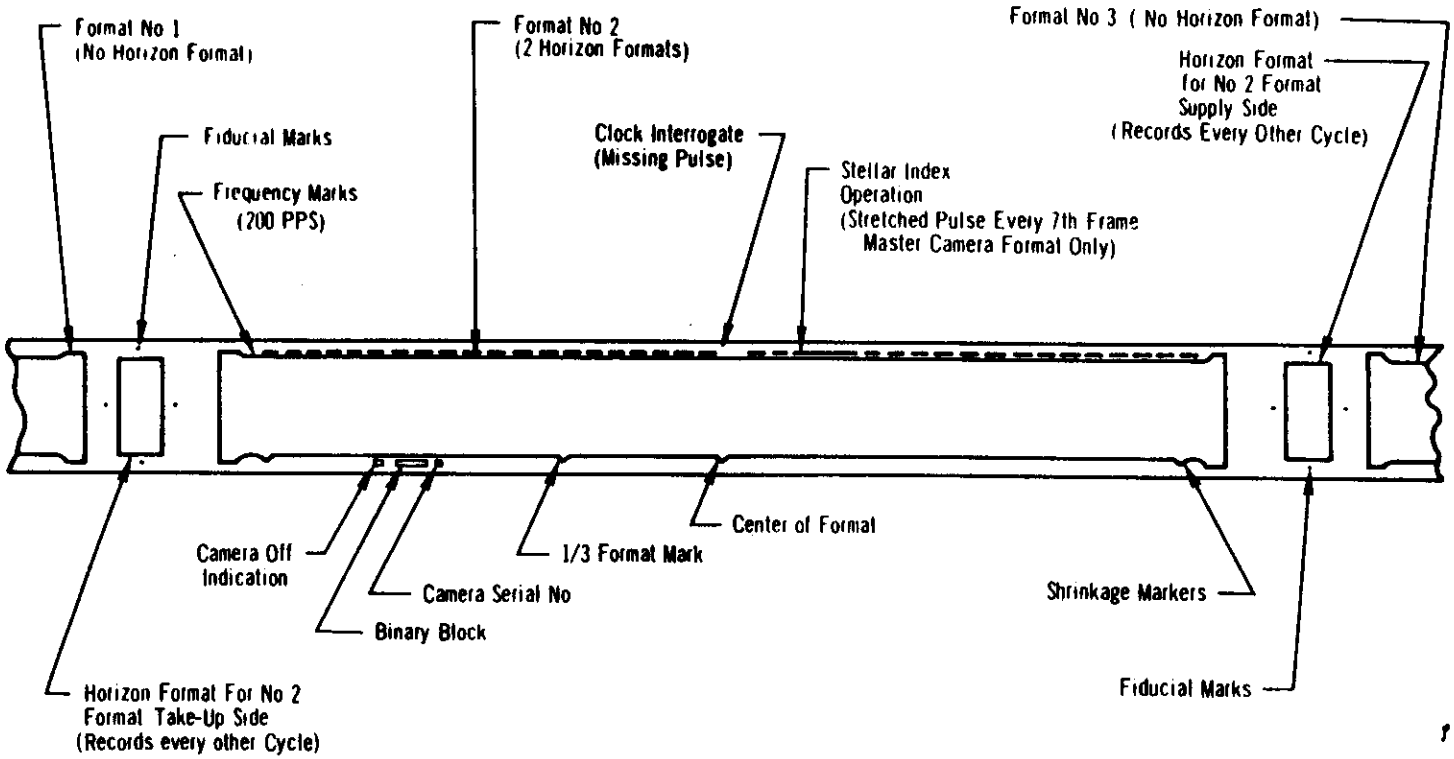
	MASTER PAN	MASTER TAKE-UP HORIZON	MASTER SUPPLY HORIZON	SLAVE PAN	SLAVE TAKE-UP HORIZON	SLAVE SUPPLY HORIZON	MISSION 1028-1 STELLAR	MISSION 1028-1 INDEX	MISSION 1028-2 STELLAR	MISSION 1028-2 INDEX
[illegible]	[illegible]	*	*	177	*	*	D77/91/97	D77/91/97	D74/76/95	D74/76/95
[illegible]	NA	NA	NA	NA	NA	NA	97	91	95	76
[illegible]	[illegible]2435	816635	[illegible]	1752435	81663*	[illegible]	[illegible]	[illegible]	10580	819186
[illegible]	.050	NA	NA	0.175	NA	NA	NA	NA	NA	NA
Accuracy	3.5	8.0	[illegible]	3.5	6.3	[illegible]	1.8	4.5	1.8	4.5
[illegible] Time Sec	1/240 Avg	1/100	[illegible]	1/340 Avg	1/100	[illegible]	2.0	1/500	2.0	1/500
[illegible]		25	[illegible]	21	25	[illegible]	None	21	None	21
[illegible]	[illegible]	54.30	[illegible]	609.602	54.60	[illegible]	84 Nom.	38.47	84 Nom.	38.52
[illegible]	[illegible],000	NA	NA	16,000	NA	NA	46	92	46	92
[illegible]	[illegible]	NA	NA	6	NA	NA	None	None	None	None
Emulsion	233-3-4/ 1-12-5	233-3-4/ 1-12-5	233-3-4/ 1-12-5	233-1-12-5	233-1-12-5	233-1-12-5	124-35-10-5	106-14-8-5	124-35-10-5	106-14-8-5
Film Type	3404	3404	3404	3404	3404	3404	3401	3400	3401	3400
Resolution Data (L/mm)										
Static										
High Contrast	256	187(A)	209(A)	257	209(A)	209(A)	*	70(A)	*	72(A)
Low Contrast	149	*	*	146	*	*	*	*	*	*
Dynamic										
I High Contrast	203	*	*	205	*	*	*	*	*	*
I Low Contrast	131	*	*	134	*	*	*	*	*	*
P High Contrast	180	*	*	186	*	*	*	*	*	*
P Low Contrast	109	*	*	114	*	*	*	*	*	*

NA Not Applicable
* Not Available
(A) AWAR

2. VEHICLE CONFIGURATION AND EQUIPMENT LAYOUT



3. PANORAMIC FORMAT CONFIGURATION



Forward-Looking (Master)
Panoramic Camera No 176
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↓

Aft-Looking (Slave)
Panoramic Camera No 177
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↑

NPIC K-8957 (8/66)

APPENDIX B. MICRODENSITOMETRY

1. Edge Spread Function

The technique of obtaining the spread function from microdensitometer edge traces is used as an objective measure of the image quality in mission photography. The spread function curve represents a summation of the separate elements of the photographic system. By taking the Fourier Transform of the spread function the modulation transfer function of the system may be obtained.

To satisfy the desire to express image quality in terms of a value, a single number is determined from the spread function curve by measuring its width at 50 percent amplitude. This width is expressed as a micron distance in image space and may be converted to a distance on the ground. On domestic passes, where three bar resolution targets have been available the ground distance determined from edge trace analysis and from the targets has been found to be comparable.

The microdensitometric analysis of edges in the image requires that the object edge fulfill the conditions of a unit step function, i.e., exist for an appreciable distance at a fixed brightness level and change abruptly to a new level which exists for an appreciable distance. This requirement is usually achieved by rooftops of buildings in large-scale photography, and aircraft runways or taxiways in small-scale photography.

The mission is examined to determine the MIP frame (Mission Information Potential) which is a subjective selection of the best photography. Straight edges in this imagery meeting the criteria of a step function for a length of at least 120 microns are selected for scanning with the microdensitometer.

The microdensitometer used for the traces in this report is located at the SPPF facility. The location of the traces was directed by representatives from NPIC at SPPF. The instrument is the Mann-Data Micro-Analyzer used with an effective slit of 1 micron by 80 microns. A scan speed of 0.05 mm/minute and a chart speed of 4.1 inches/minute was used for a recording to specimen expansion of 2083:1. One inch on the recording equals 12.2 microns on the specimen. The traces produced represent a plot of deflection versus distance. The deflection of the pen is essentially linear with density and the horizontal lines on the chart numbered 1 to 7 equal 0 to 1.0 density. At the same time the traces were made, the electronic output signals from the instrument were digitized as density values and recorded on paper tape for direct analysis by an IBM 1710 computer.

In the table on the next page the following computer outputs are listed for each edge traced: The 50 percent amplitude width of the Line Spread Function in microns, the reciprocal of the 50 percent width in millimeters, and the intersection point of the modulation transfer curve and the aerial image modulation curve. The procedure used in the derivation of these values is described in the SPPF Technical Report No. 101-31 (page 79-82). The edge orientation angle is determined in the microdensitometer and is 0^{o} when the edge is parallel to the major axis of the film and 90^{o} when the edge is perpendicular to the major axis of the film.

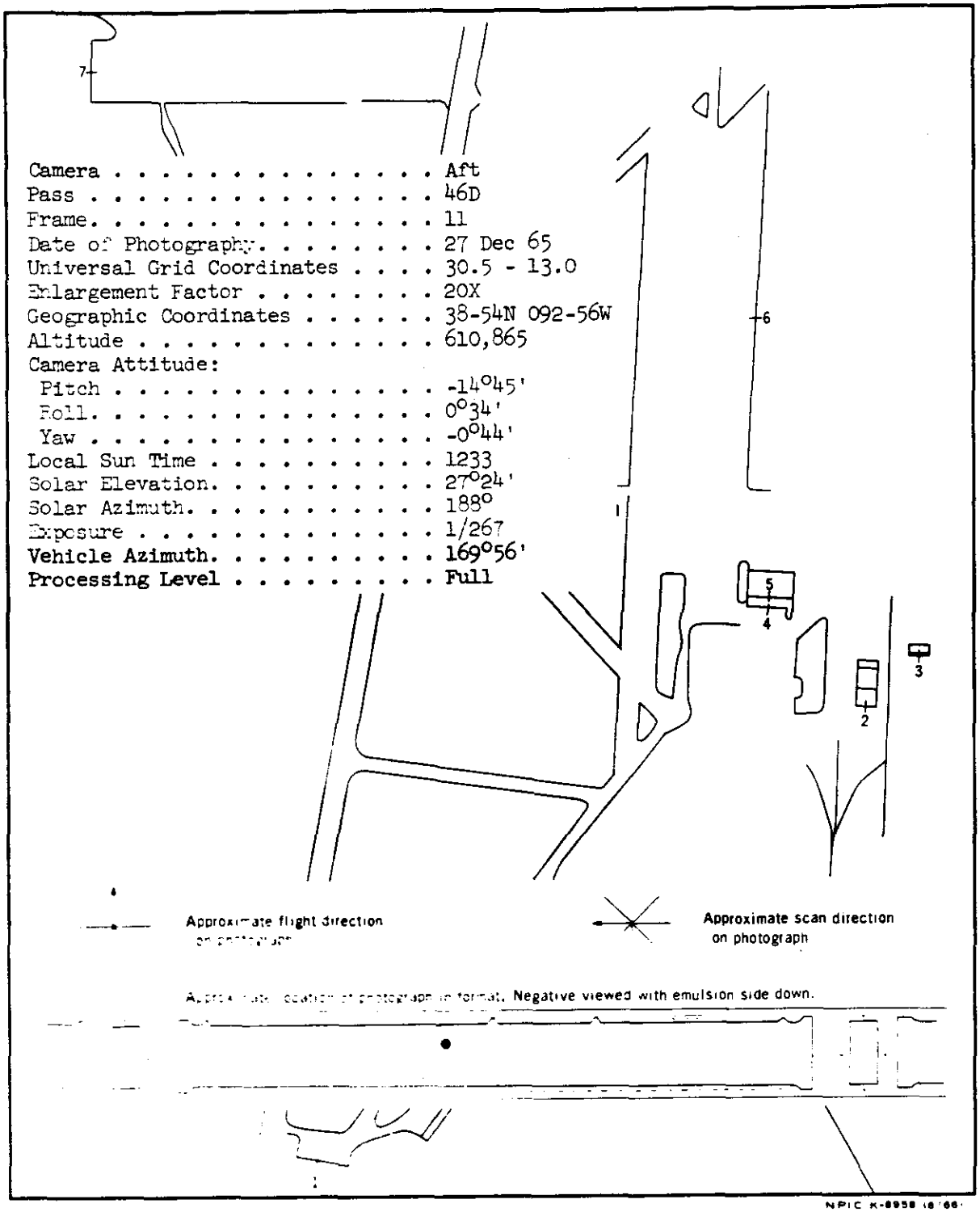
The edge traces were made on the original negative of this mission. The imagery traced is contained in the frames considered to be typical of the best in the mission.

2. Summary Table of Edge Traces

Trace Number	Pass/ Frame	LINE SPREAD FUNCTION 50% Width	1000/50% Width	MTF/AIM Intersect	Edge Orientation
1 C92A	46D/11A	11.0μ	91	79	154.0°
2 C94A	46D/11A	10.2μ	97	118	162.6°
3 C96A	46D/11A	10.4μ	96	99	162.6°
4 C98A	46D/11A	11.5μ	87	97	163.0°
5 C100A	46D/11A	6.9μ	145	151	163.0°
6 C102A	46D/11A	10.1μ	98	97	70.0°
7 C104A	46D/11A	11.3μ	88	86	70.4°
8 C110A	126D/16A	11.1μ	89	76	165.0°
9 C112A	126D/16A	11.9μ	83	85	165.8°
10 C114A	126D/16A	9.3μ	107	96	91.0°
11 C116A	126D/16A	10.5μ	95	96	150.6°
12 C118A	126D/16A	8.8μ	113	115	119.6°
13 C120A	126D/16A	14.9μ	67	66	120.6°

FIGURE 21. ORIENTATION OF MICRODENSITOMETRIC TRACES ON MISSION 1028-1

Those edges across which microdensitometric edge traces were made are illustrated in the accompanying photograph. Arrows indicate the approximate location of each trace.


7
6
5
4
3
2
1
Camera . . . . . Aft
Pass 46D
Frame. 11
Date of Photography. . . . . 27 Dec 65
Universal Grid Coordinates . . . . 30.5 - 13.0
Enlargement Factor 20X
Geographic Coordinates 38-54N 092-56W
Altitude 610,865
Camera Attitude:
Pitch . . . . . -14°45'
Roll. . . . . 0°34'
Yaw . . . . . -0°44'
Local Sun Time 1233
Solar Elevation. . . . . 27°24'
Solar Azimuth. . . . . 188°
Exposure 1/267
Vehicle Azimuth. . . . . 169°56'
Processing Level . . . . . Full
Approximate flight direction on photograph
Approximate scan direction on photograph
Approximate location of photograph in format. Negative viewed with emulsion side down.
NPIC K-8958 (8'66)

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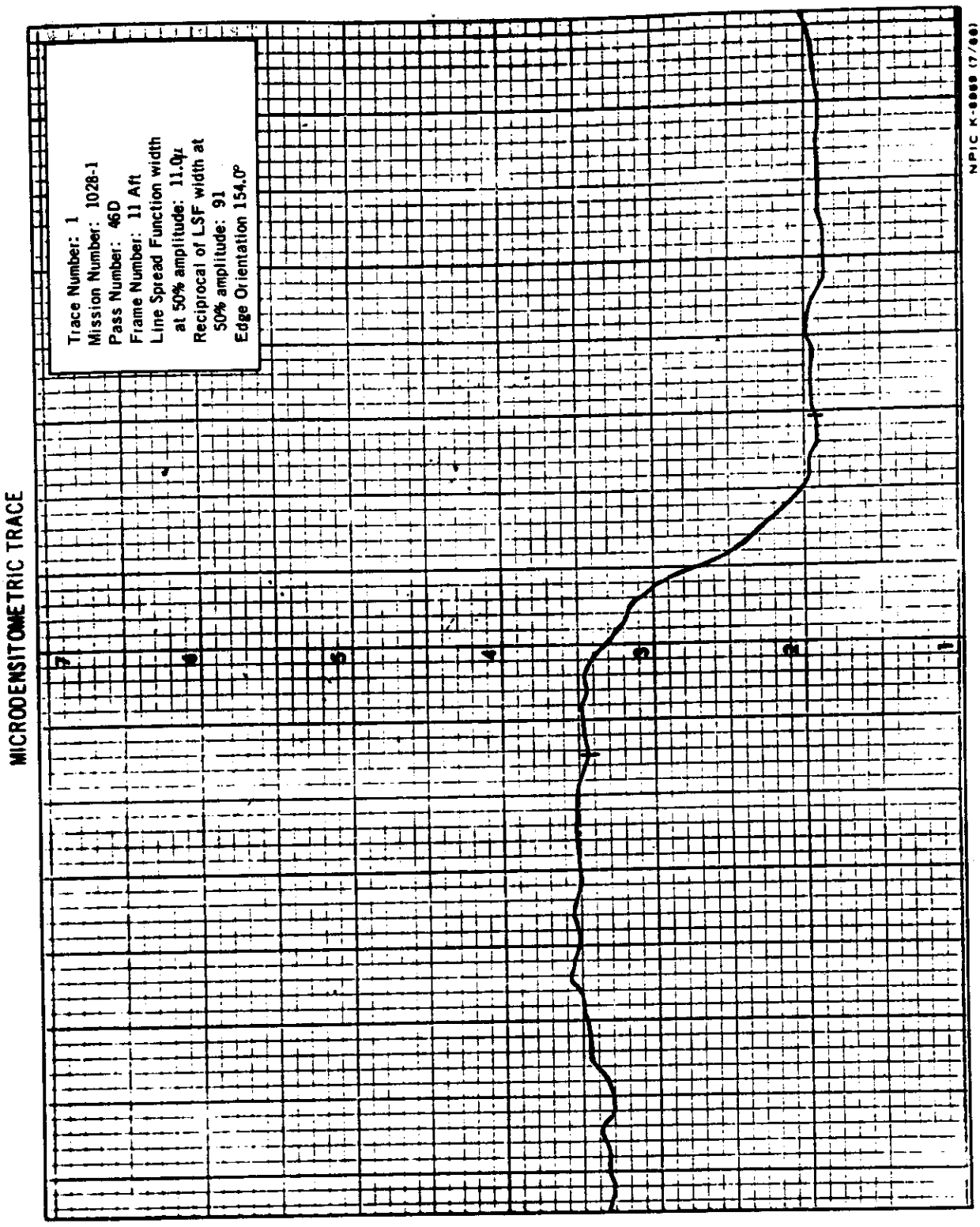
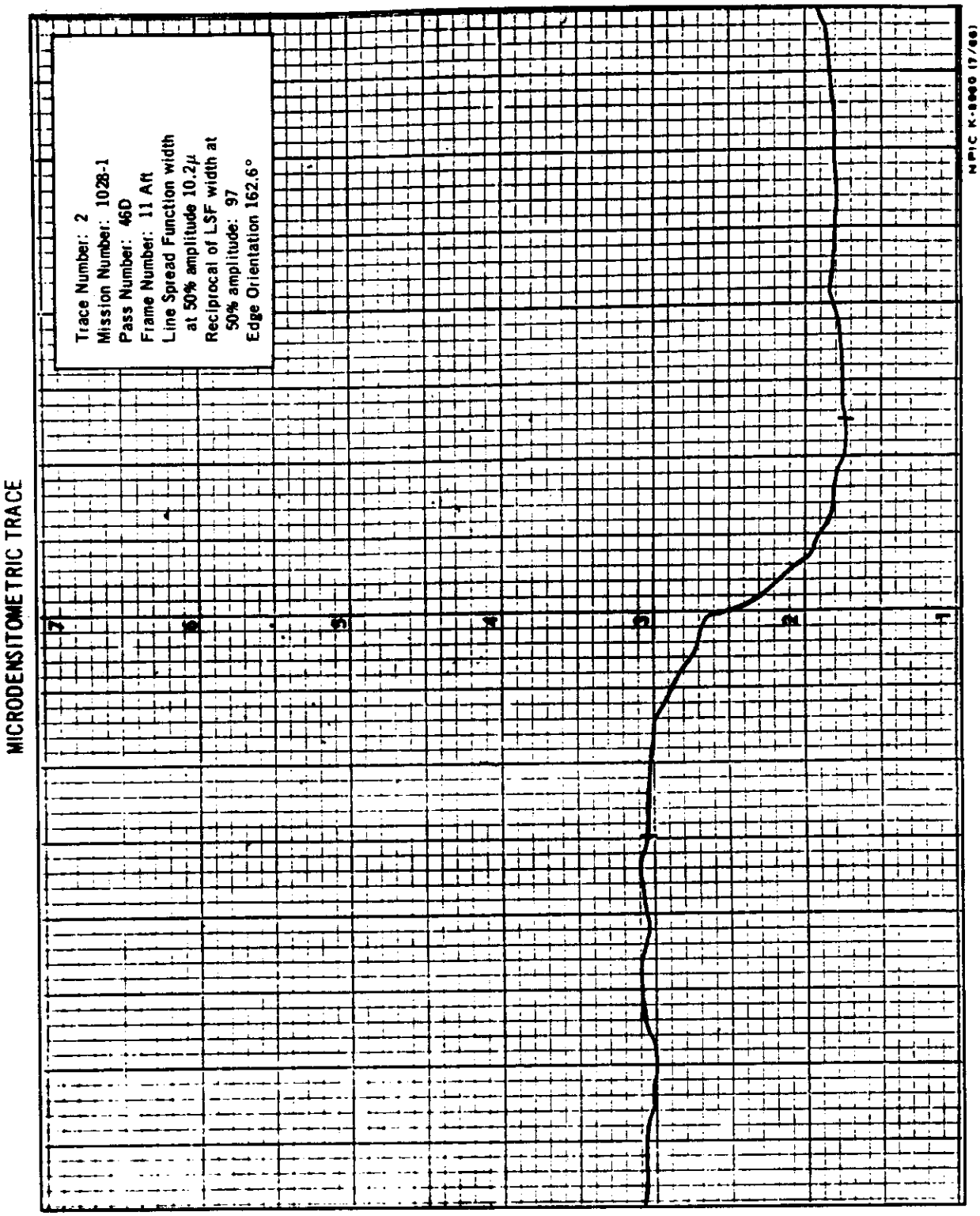
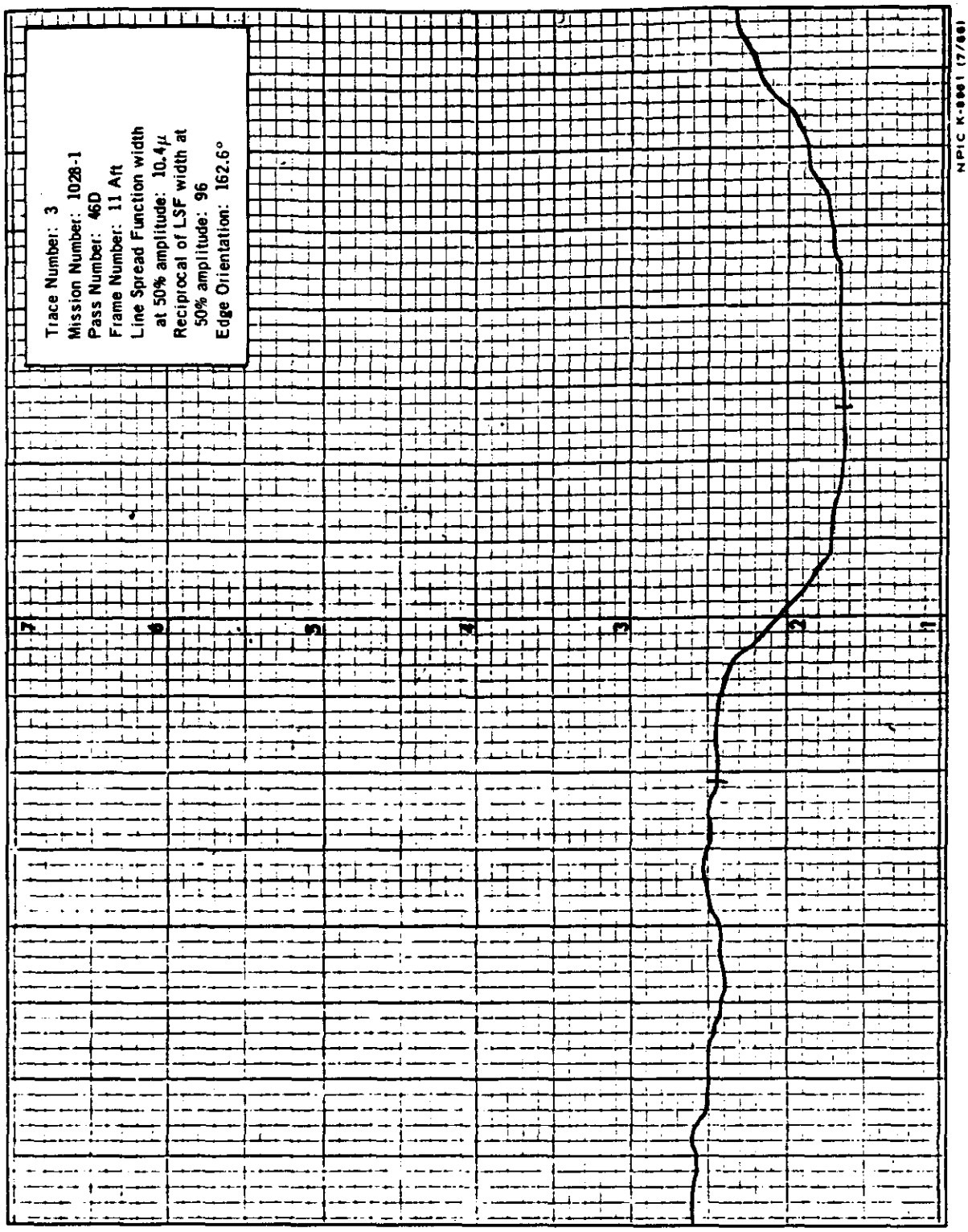
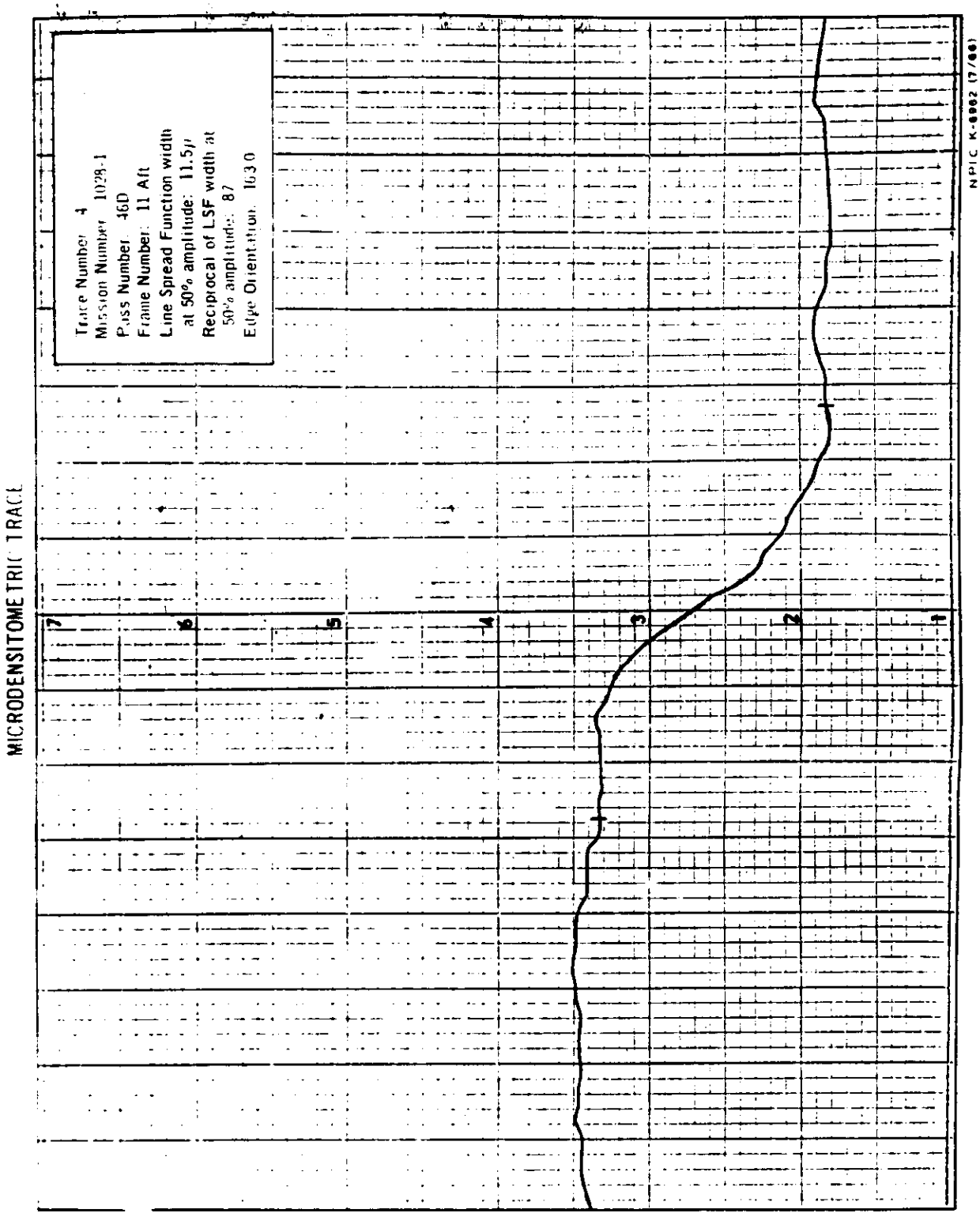
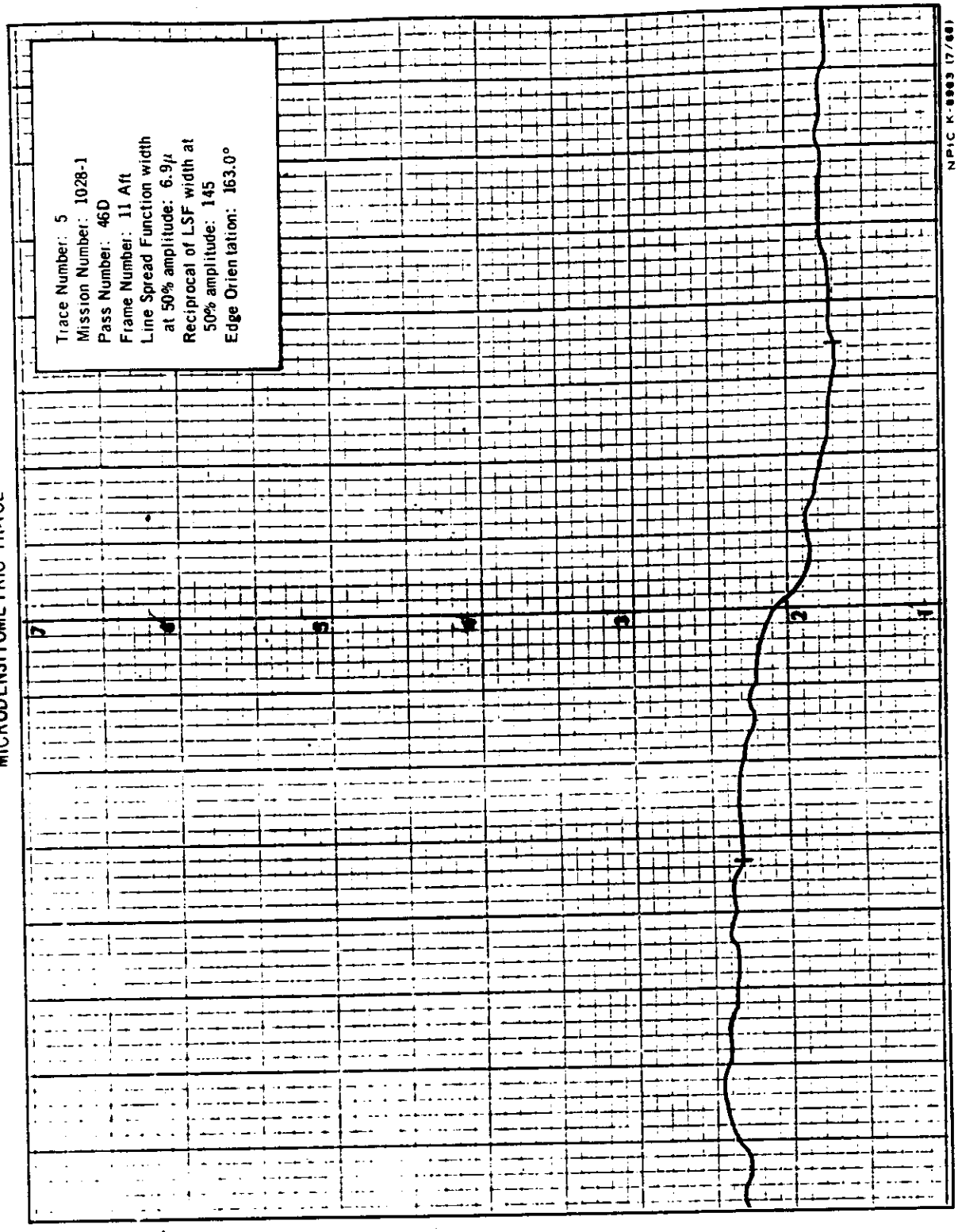
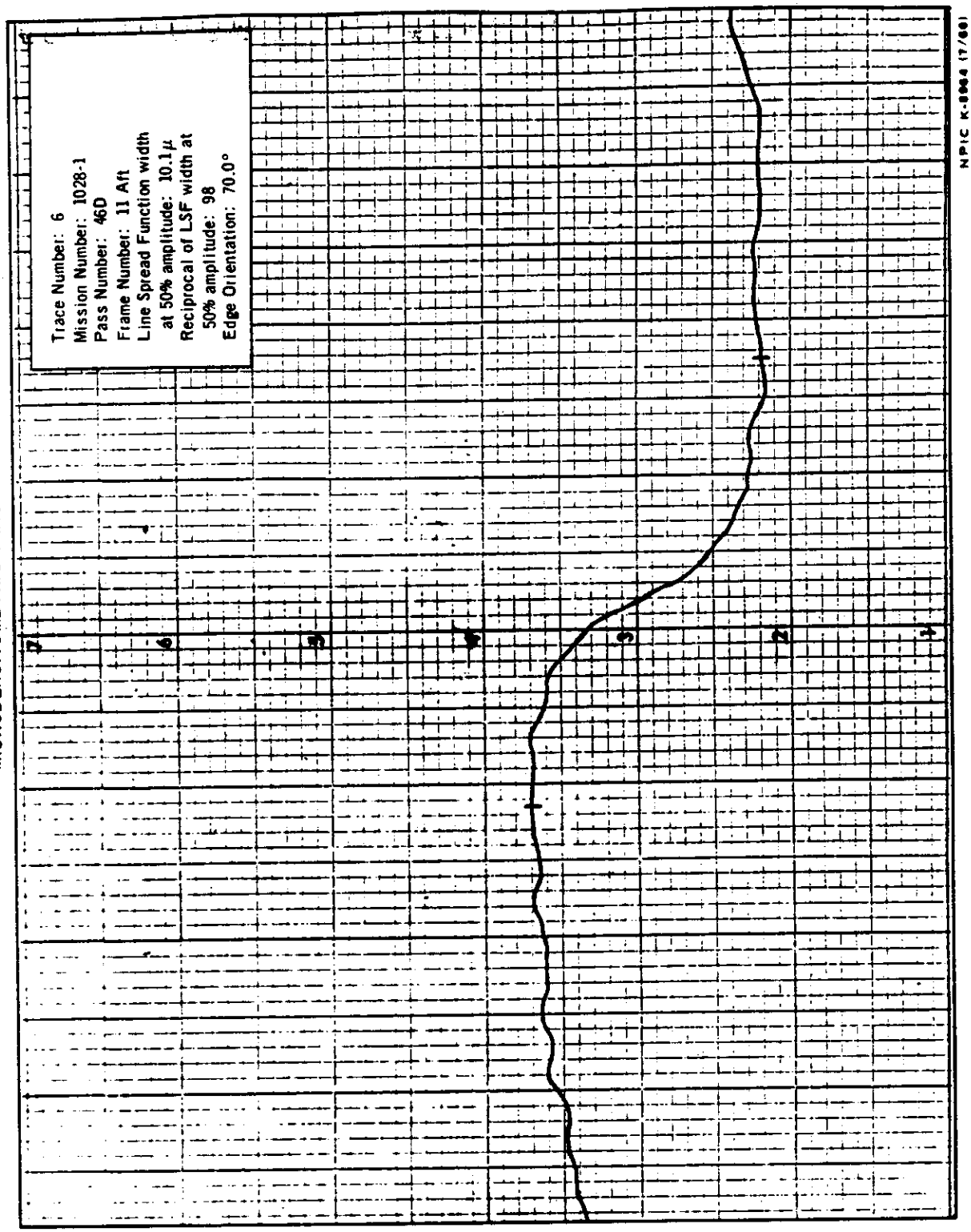

Trace Number: 1
Mission Number: 1028-1
Pass Number: 46D
Frame Number: 11 Aft
Line Spread Function width at 50% amplitude: 11.0μ
Reciprocal of LSF width at 50% amplitude: 91
Edge Orientation 154.0°
MICRODENSITOMETRIC TRACE
NPIC K-6088 (7/80)


Trace Number: 2
Mission Number: 1028-1
Pass Number: 46D
Frame Number: 11 Aft
Line Spread Function width at 50% amplitude 10.2μ
Reciprocal of LSF width at 50% amplitude: 97
Edge Orientation 162.6°
MICRODENSITOMETRIC TRACE
NPIC K-8860 (7/68)


Trace Number: 3
Mission Number: 1028-1
Pass Number: 46D
Frame Number: 11 Aft
Line Spread Function width at 50% amplitude: 10.4μ
Reciprocal of LSF width at 50% amplitude: 96
Edge Orientation: 162.6°
MICRODENSITOMETRIC TRACE
NPIC K-8061 (7/68)


Trace Number 4
Mission Number 1029-1
Pass Number 46D
Frame Number 11 Aft
Line Spread Function width at 50% amplitude: 11.5μ
Reciprocal of LSF width at 50% amplitude: 87
Edge Orientation 163.0
MICRODENSITOMETRIC TRACE
7
6
5
4
3
2
1
NPIC K-6002 (7/66)


Trace Number: 5
Mission Number: 1028-1
Pass Number: 46D
Frame Number: 11 Aft
Line Spread Function width at 50% amplitude: 6.9μ
Reciprocal of LSF width at 50% amplitude: 145
Edge Orientation: 163.0°
MICRODENSITOMETRIC TRACE
NPIC K-8803 (7/68)



MICRODENSITOMETRIC TRACE

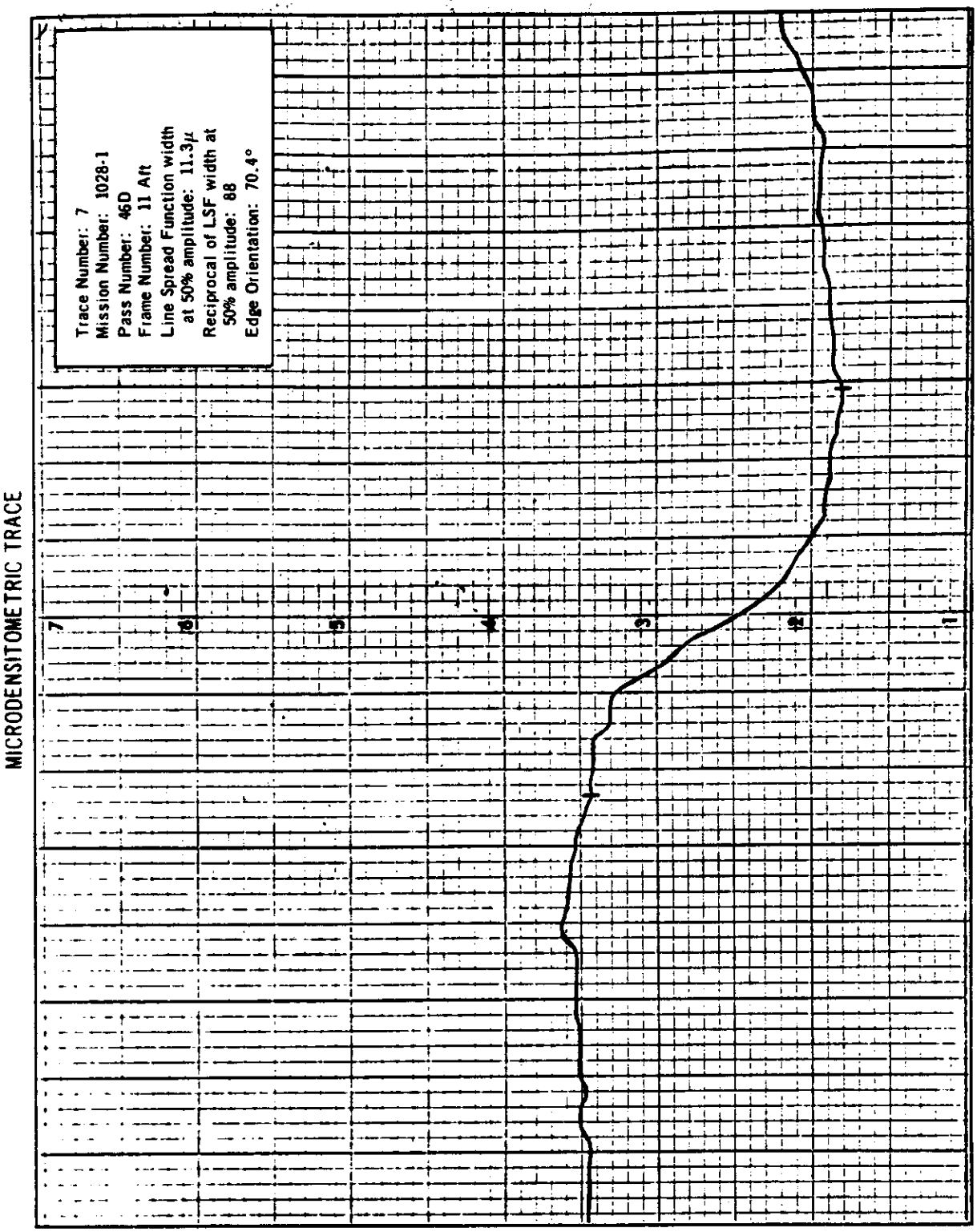
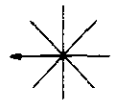

Trace Number: 7
Mission Number: 1028-1
Pass Number: 46D
Frame Number: 11 Aft
Line Spread Function width at 50% amplitude: 11.3μ
Reciprocal of LSF width at 50% amplitude: 88
Edge Orientation: 70.4°
MICRODENSITOMETRIC TRACE
NPIC K-6868 (7/68)

FIGURE 22. ORIENTATION OF MICRODENSITOMETRIC TRACES ON MISSION 1028-2

Those edges across which microdensitometric edge traces were made are illustrated in the accompanying photographs. Arrows indicate the approximate location of each trace.

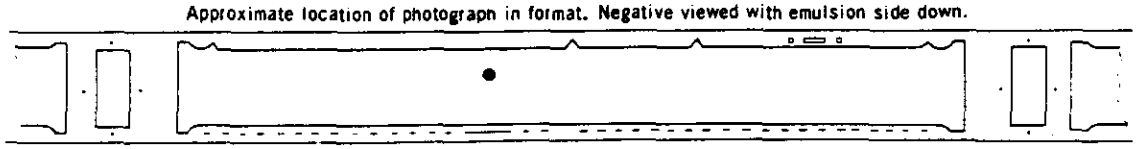
[redacted]

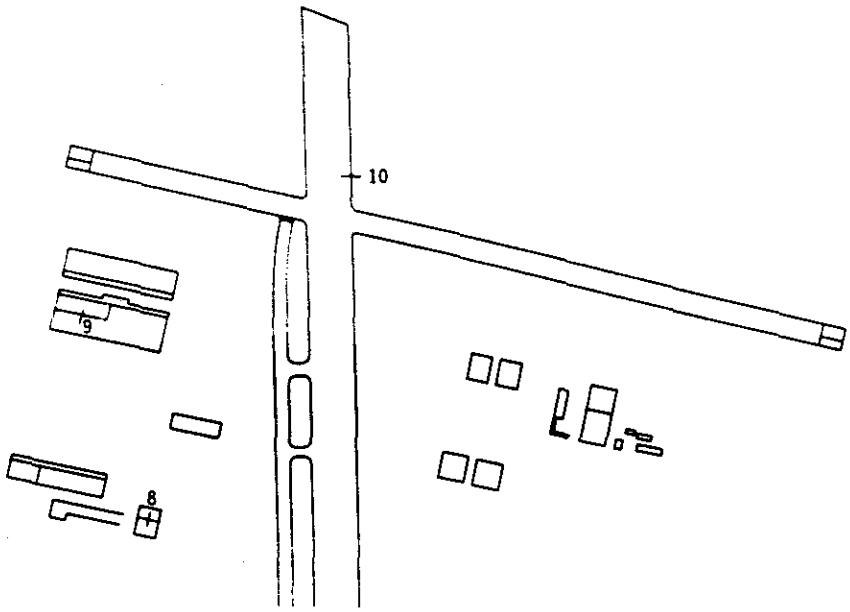
Approximate flight direction on photograph



Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.





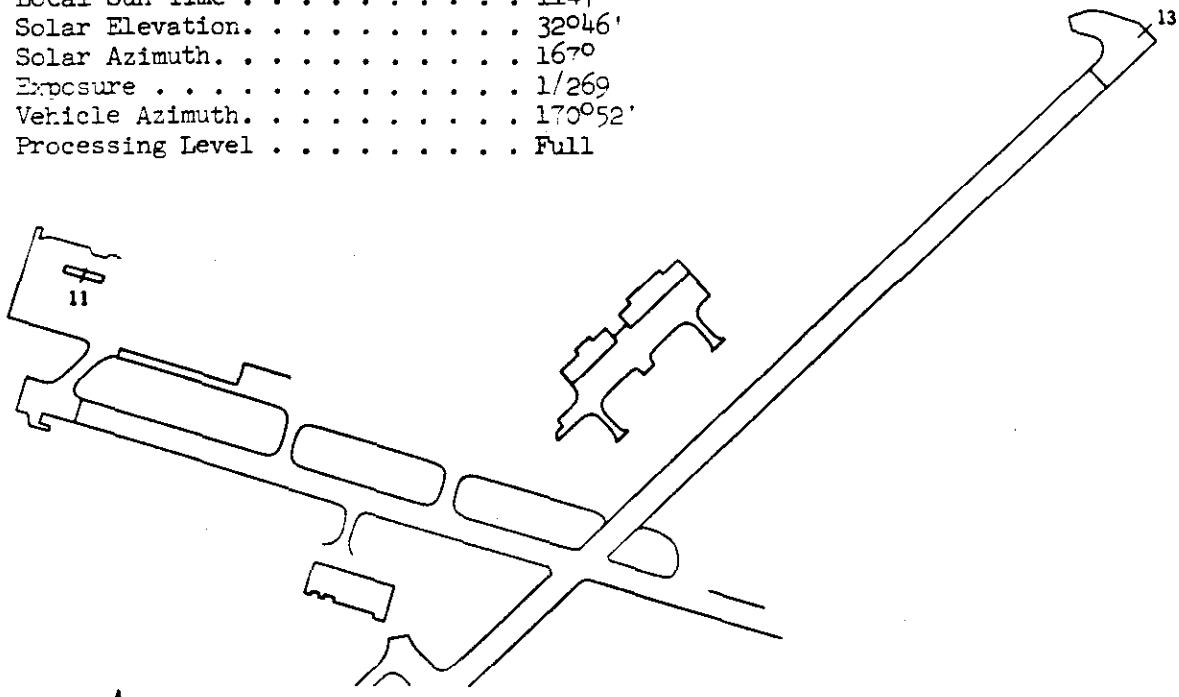
Camera	Aft
Pass	126D
Frame	16
Date of Photography	1 Jan 66
Universal Grid Coordinates	40.5 - 12.5
Enlargement Factor	20X
Geographic Coordinates	34-11N 118-32W
Altitude	603,846
Camera Attitude:	
Pitch	-15°21'
Roll	0°03'
Yaw	Not Determined
Local Sun Time	1147
Solar Elevation	32°46'
Solar Azimuth	167°
Exposure	1/269
Vehicle Azimuth	170°52'
Processing Level	Full

NPIC K-8966 (8 66)

FIGURE 23. ORIENTATION OF MICRODENSITOMETRIC TRACES ON MISSION 1028-2

Those edges across which microdensitometric edge traces were made are illustrated in the accompanying photographs. Arrows indicate the approximate location of each trace.

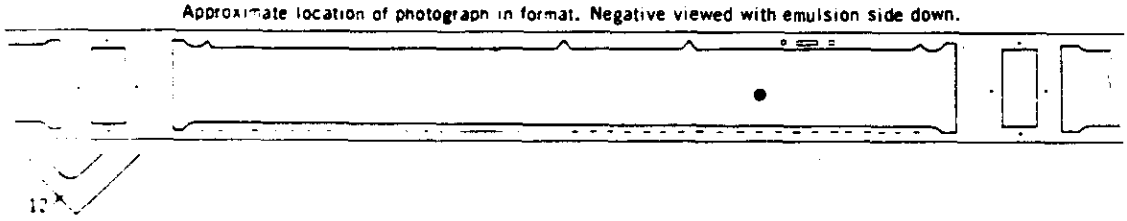
Camera	Aft
Pass	126D
Frame	16
Date of Photography	1 Jan 66
Universal Grid Coordinates	62.5 - 10.5
Enlargement Factor	20X
Geographic Coordinates	34-11N 118-32W
Altitude	603,846
Camera Attitude:	
Pitch	-15°21'
Roll	0°03'
Yaw	Not Determined
Local Sun Time	1147
Solar Elevation	32°46'
Solar Azimuth	167°
Exposure	1/269
Vehicle Azimuth	170°52'
Processing Level	Full



Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



NPIC K-8967 (8-66)

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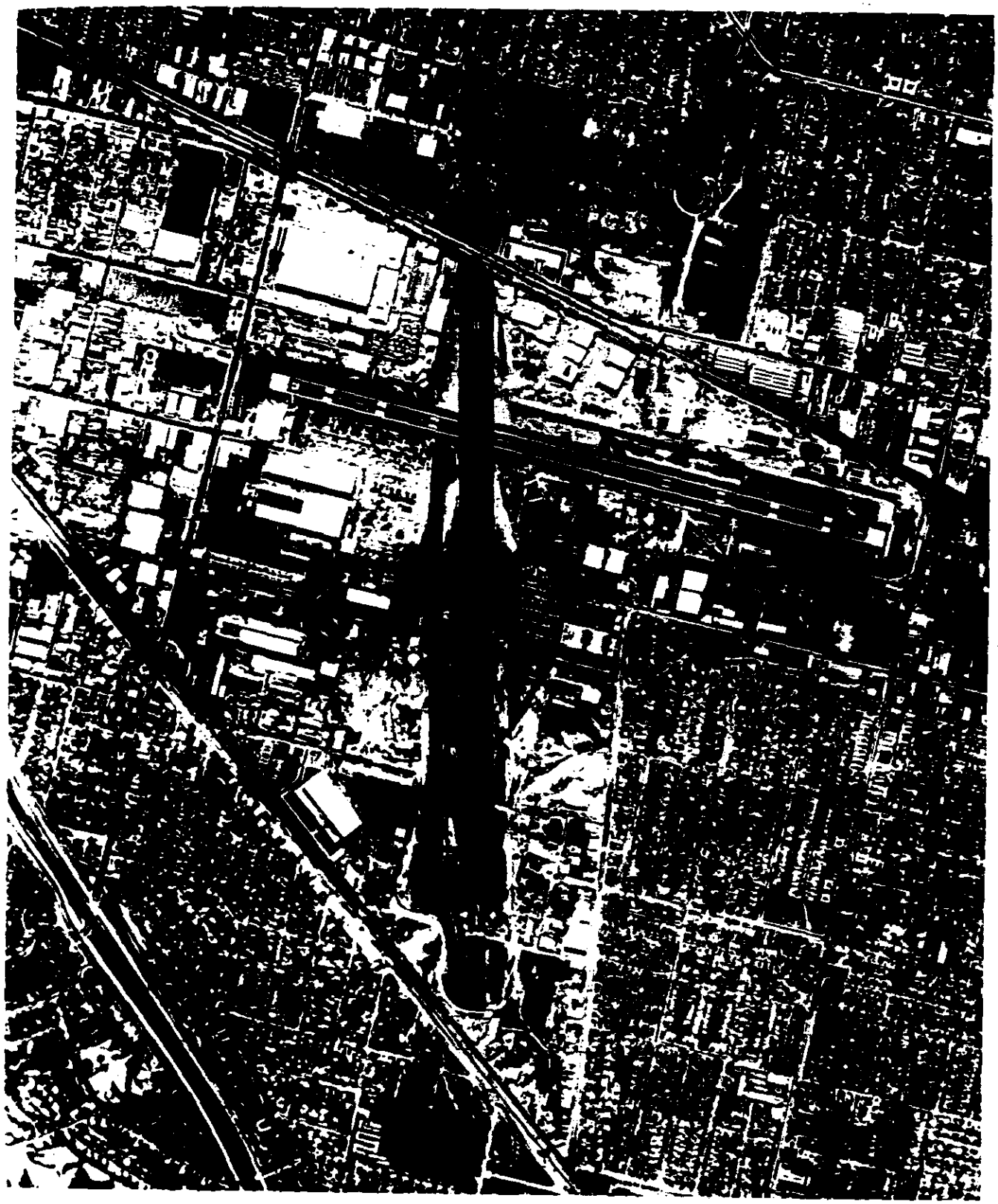

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Control System Only

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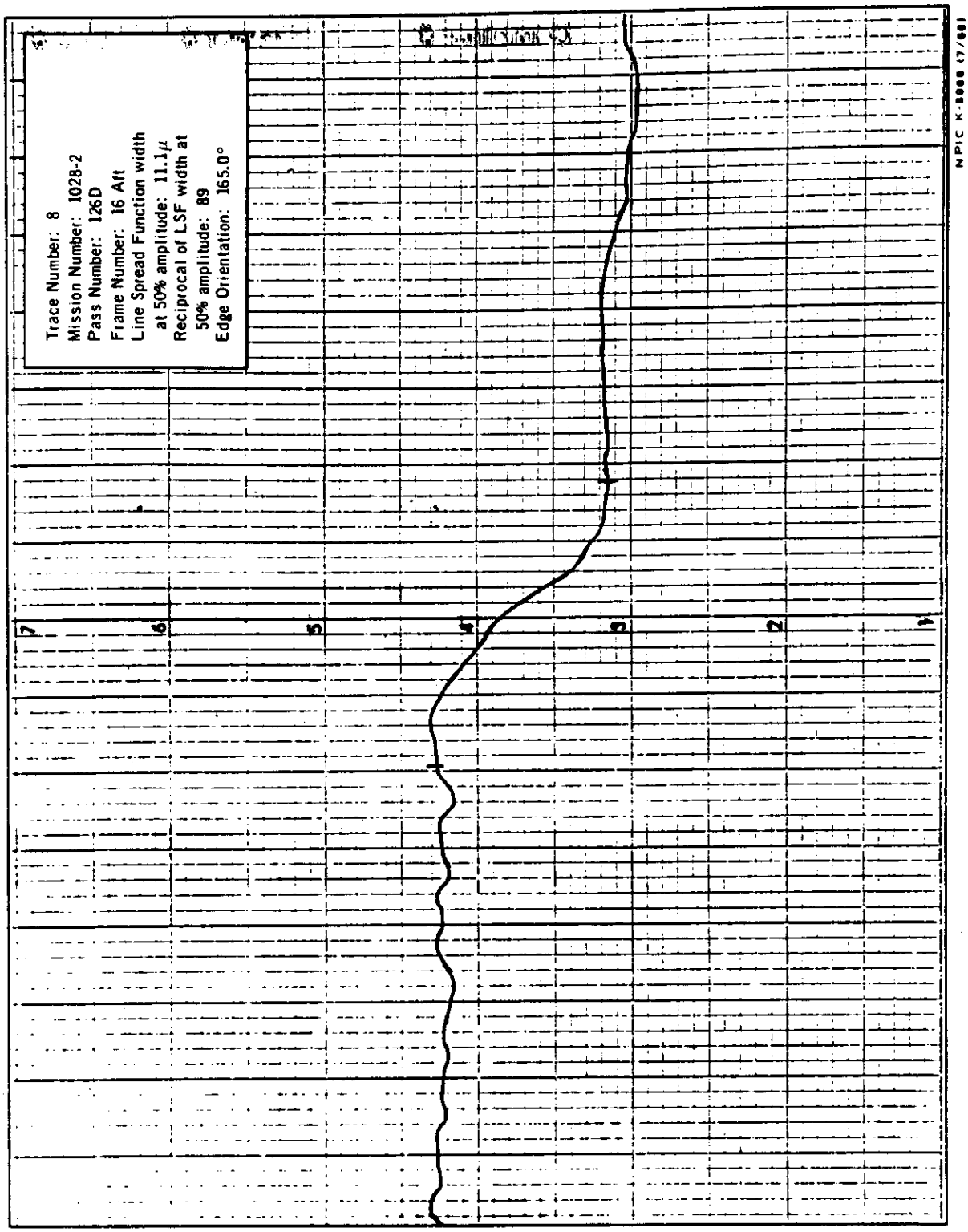
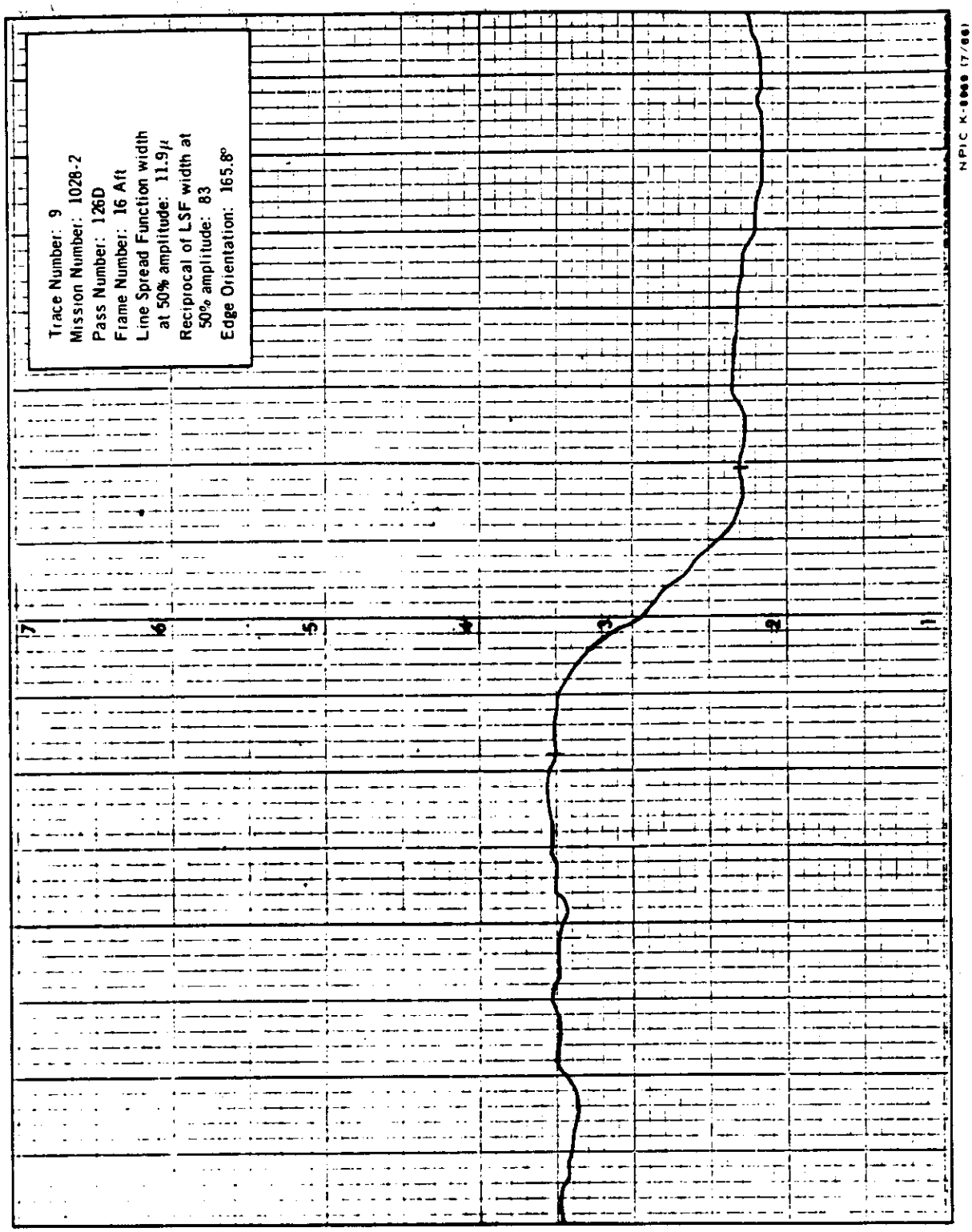
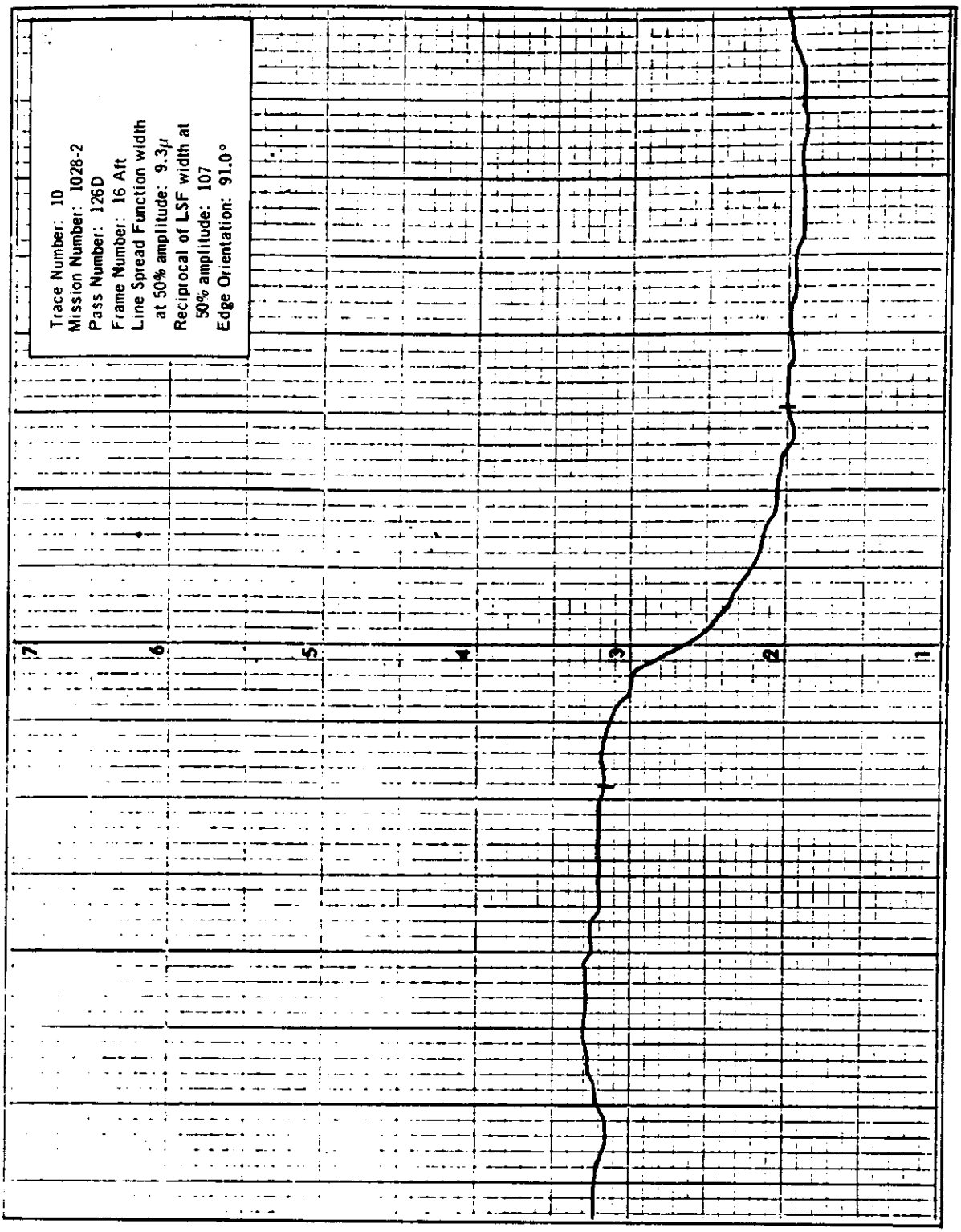
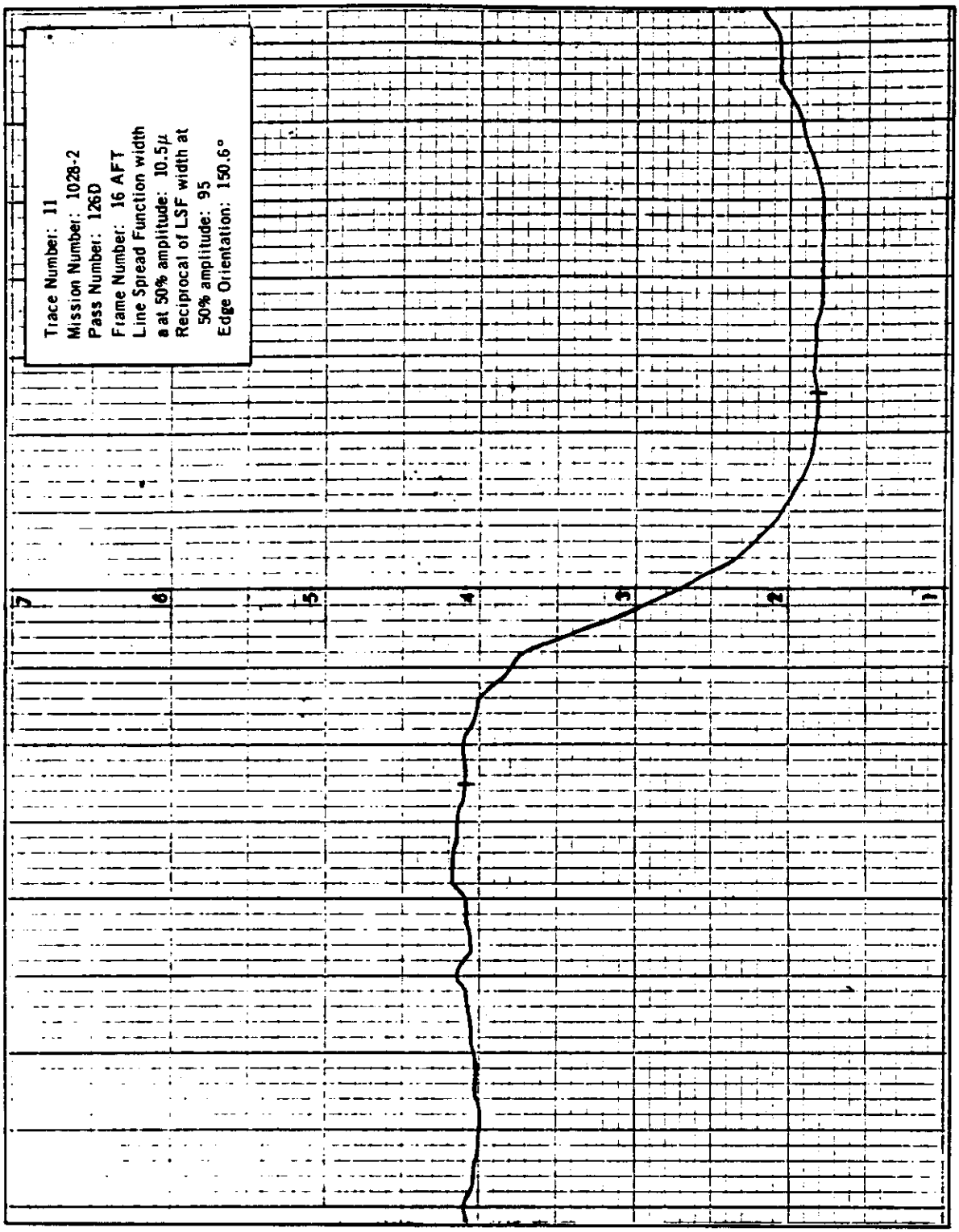
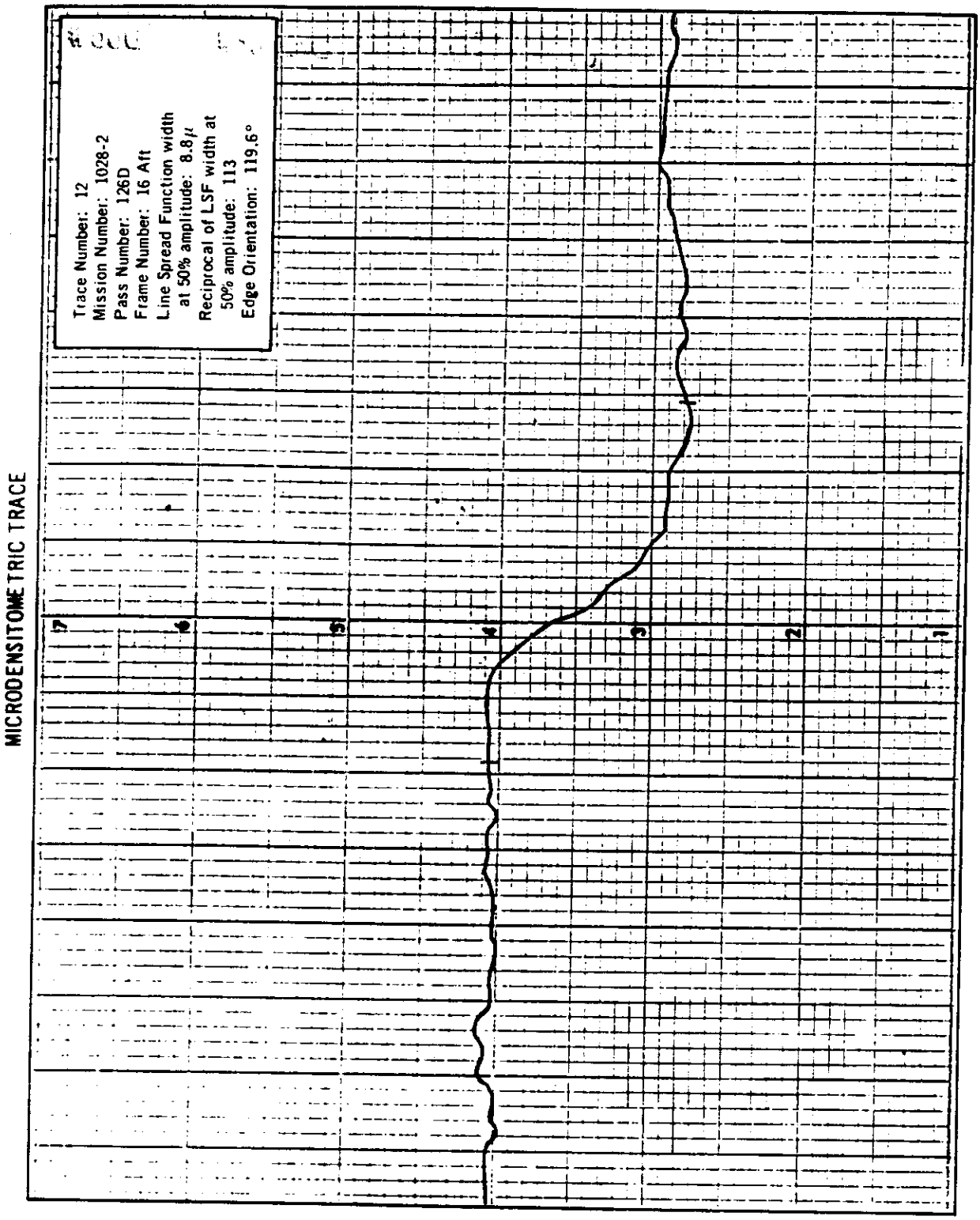
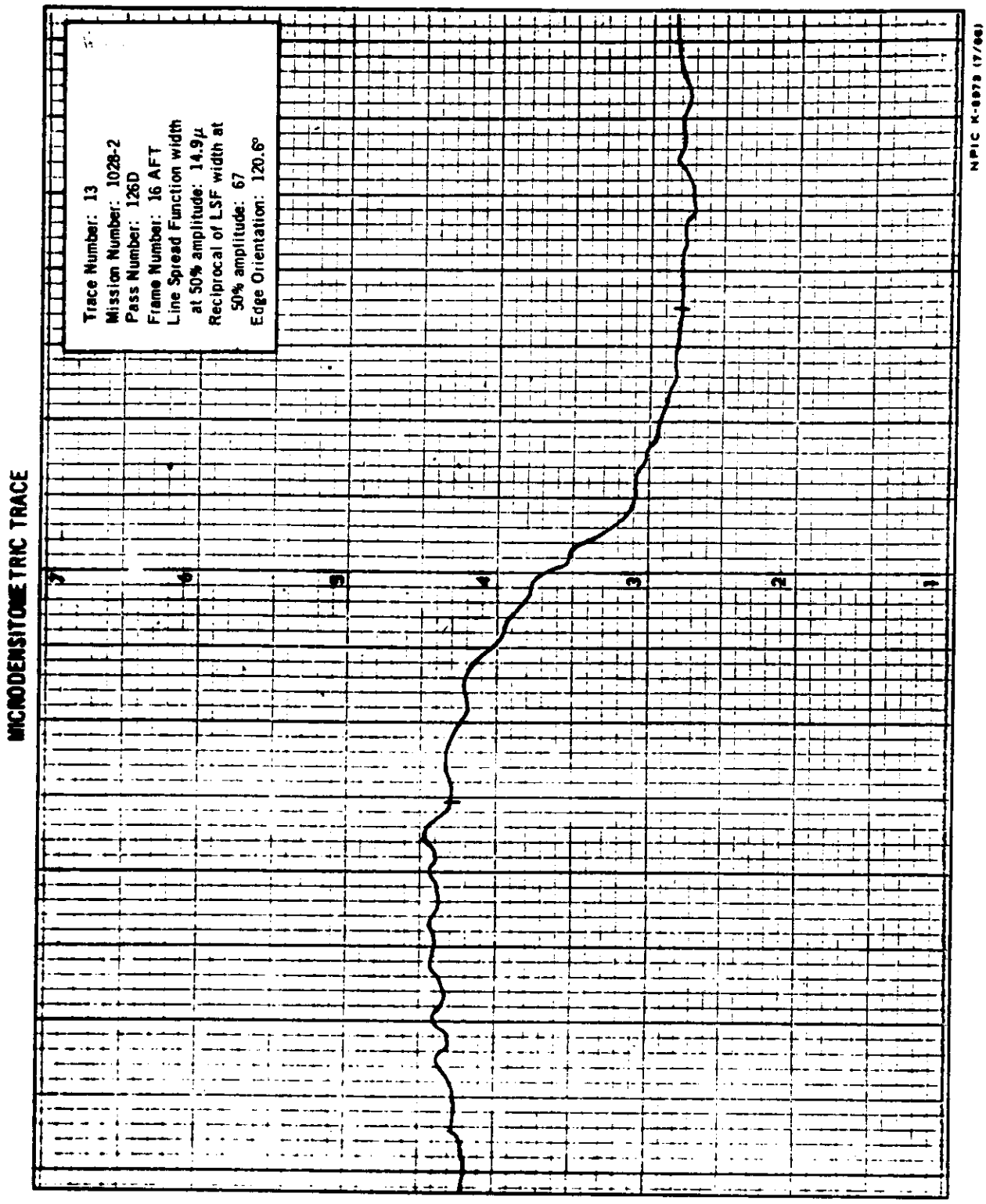

Trace Number: 8
Mission Number: 1028-2
Pass Number: 126D
Frame Number: 16 Aft
Line Spread Function width at 50% amplitude: 11.1 μ
Reciprocal of LSF width at 50% amplitude: 89
Edge Orientation: 165.0°
MICRODENSITOMETRIC TRACE
7
6
5
4
3
2
1
NPIC K-8000 (7/68)


Trace Number: 9
Mission Number: 1028-2
Pass Number: 126D
Frame Number: 16 Aft
Line Spread Function width at 50% amplitude: 11.9μ
Reciprocal of LSF width at 50% amplitude: 83
Edge Orientation: 165.8°
MICRODENSITOMETRIC TRACE
7
6
5
4
3
2
1
NPIC K-0868 (7/68)


Trace Number: 10
Mission Number: 1028-2
Pass Number: 126D
Frame Number: 16 Aft
Line Spread Function width at 50% amplitude: 9.3μ
Reciprocal of LSF width at 50% amplitude: 107
Edge Orientation: 91.0°
MICRODENSITOMETRIC TRACE
7
6
5
4
3
2
1
NPIC K-8870 (7/66)


Trace Number: 11
Mission Number: 1028-2
Pass Number: 126D
Frame Number: 16 AFT
Line Spread Function width at 50% amplitude: 10.5μ
Reciprocal of LSF width at 50% amplitude: 95
Edge Orientation: 150.6°
MICRODENSITOMETRIC TRACE
NPIC K-8971 (7/66)


Trace Number: 12
Mission Number: 1028-2
Pass Number: 126D
Frame Number: 16 Aft
Line Spread Function width at 50% amplitude: 8.8μ
Reciprocal of LSF width at 50% amplitude: 113
Edge Orientation: 119.6°
MICRODENSITOMETRIC TRACE
NPIC K-8672 (7/68)


MICRODENSITOMETRIC TRACE
Trace Number: 13
Mission Number: 1028-2
Pass Number: 126D
Frame Number: 16 AFT
Line Spread Function width at 50% amplitude: 14.9μ
Reciprocal of LSF width at 50% amplitude: 67
Edge Orientation: 120.6°
NPIC K-8878 (7/66)

APPENDIX C
MISSION PROFILE

APPENDIX C. MISSION PROFILE

Each frame of the mission is listed in consecutive order as it appears on the forward and aft film footage. The passes, frames, and camera off/on's within a pass are identified. The following information is also given.

1. Light Leak induced Fog

Areas of fog due to extraneous light are present on the indicated frames.

2. Dendritic at Camera Number Edge

Dendritic (tree-like) static discharge traces, which appear as plus density on the negative, are present emanating from the camera number edge of the film on these frames.

3. Dendritic at F-Mark Edge

Dendritic (tree-like) static discharge traces, which appear as plus density on the negative, are present, emanating from the frequency mark edge of the film on these frames.

4. Manufacturer's Splice

A manufacturer's splice is present in the indicated frame.

5. Frequency Marks Missing

A complete star indicates that no frequency marks were recorded on that frame. A partial star indicates that only a portion of the required frequency marks was recorded on that frame.

6. Length of Smeared Pulse (Forward Material Only)

The length of the smeared pulse as measured to the closest 0.1 of an inch is given for that frame. The measurement is given in inches.

7. Pitch Measurement (Take-up)

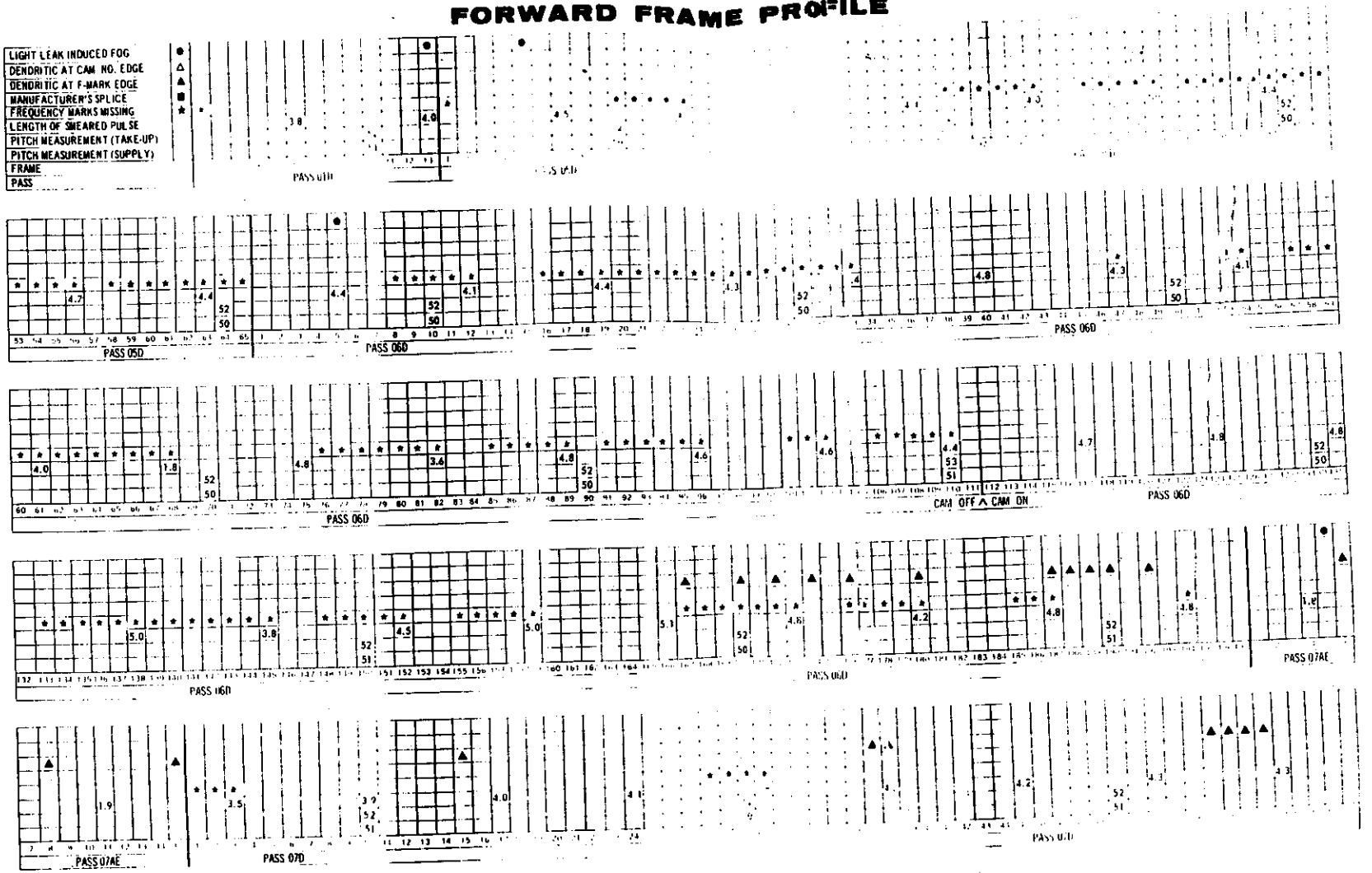
This [illegible] edge of the film and the edge of the [illegible] take-up shrinkage marker at the camera number [illegible] equals 0.[illegible] inch. (i.e., 20 units = .1 in.)

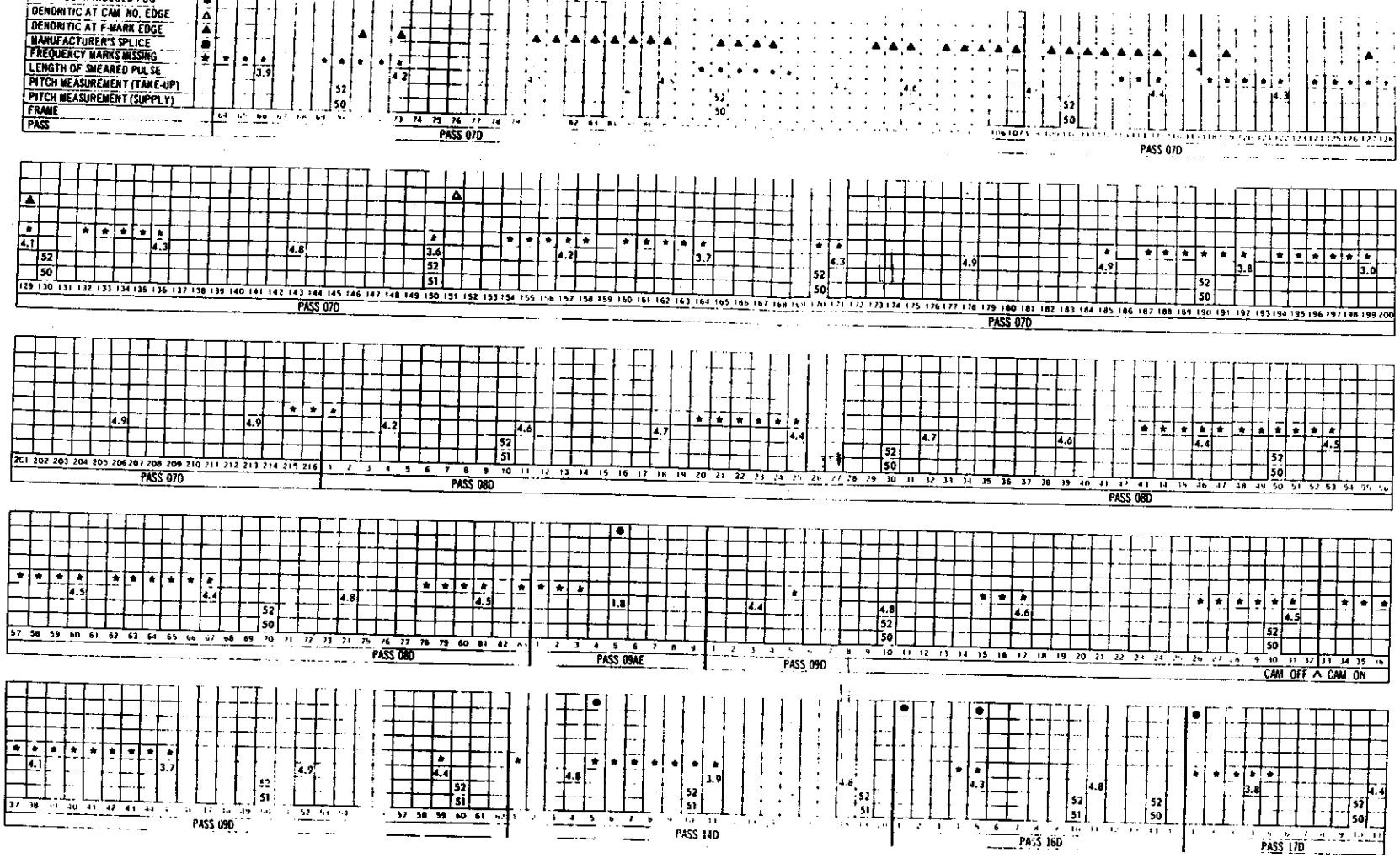
8. [illegible]

This [illegible] edge of the film and the edge of the [illegible] shrinkage marker at the camera [illegible] inch. (i.e., 2[illegible] units = .1 in.)

FORWARD FRAME PROFILE

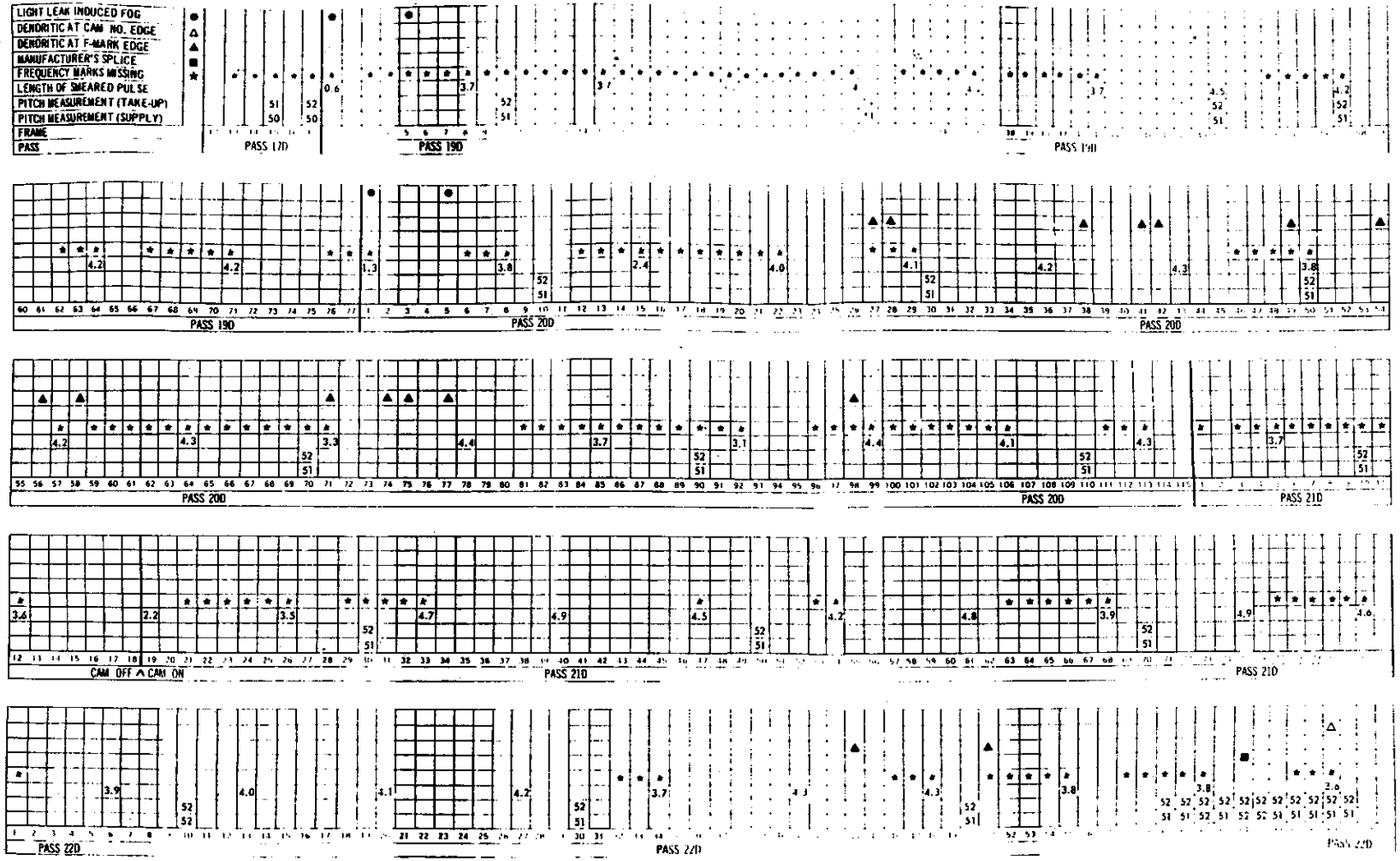
LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS





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

Handle Via
~~Talent KEYHOLE~~
Control System Only



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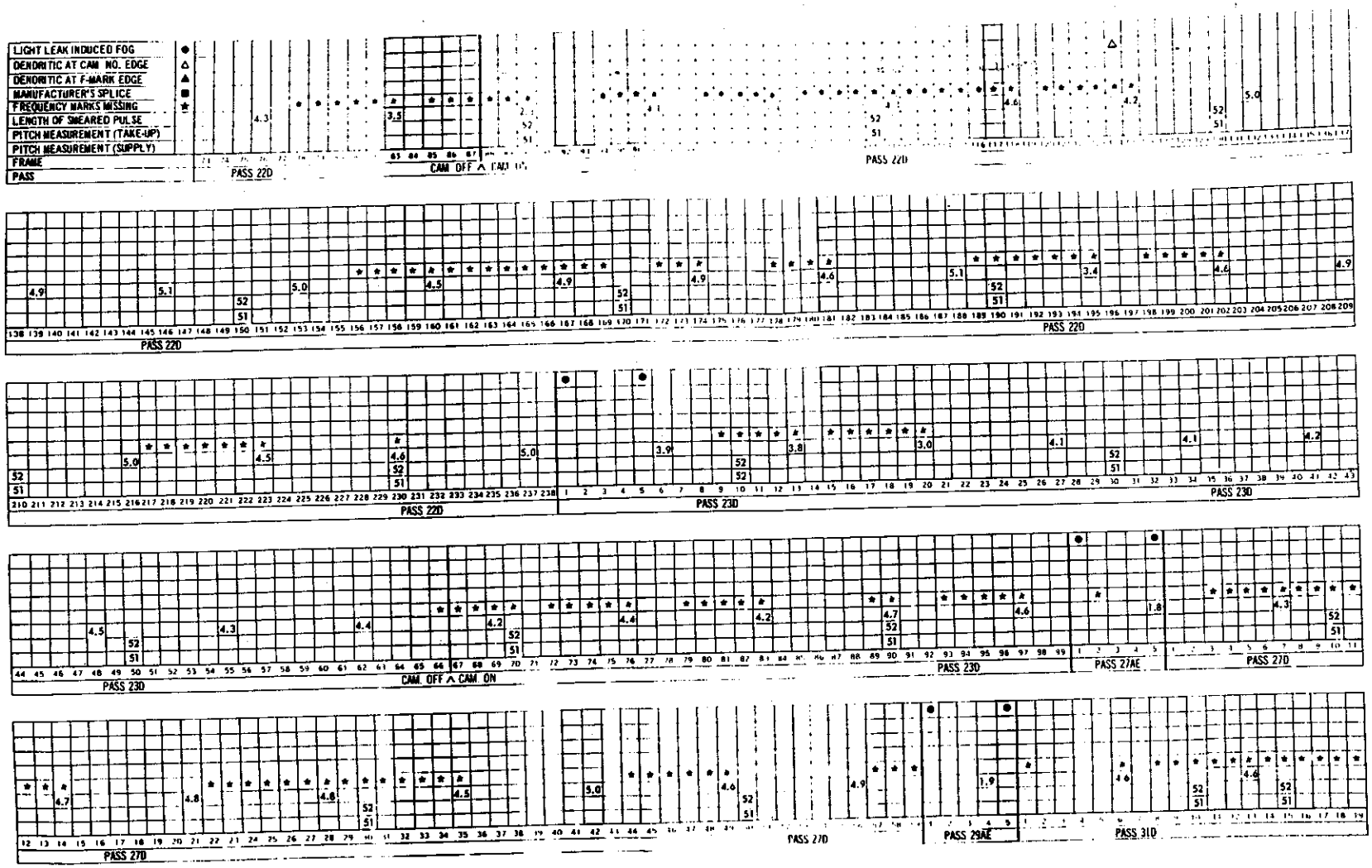
Handle Via
~~TALENT-KEYHOLE~~
Control System Only



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~~NO FOREIGN DISSEM~~

Handle Via
~~Talent-Keyhole~~
Control System Only

Handle Via
Talent KEYHOLE
Control System Only

~~TOP SECRET RUFF~~
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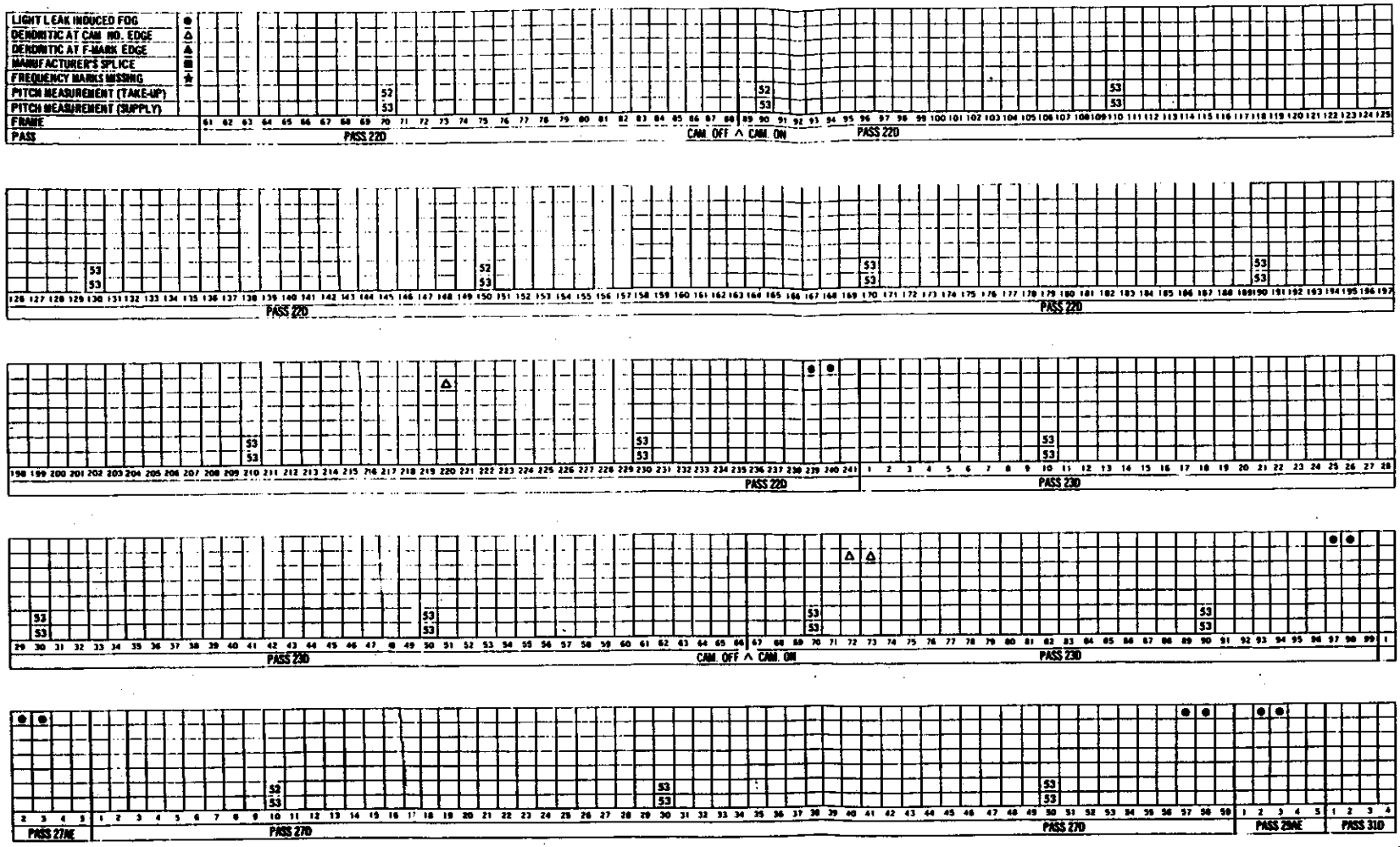

Handle Via
~~Talent-KEYHOLE~~
Control System Only

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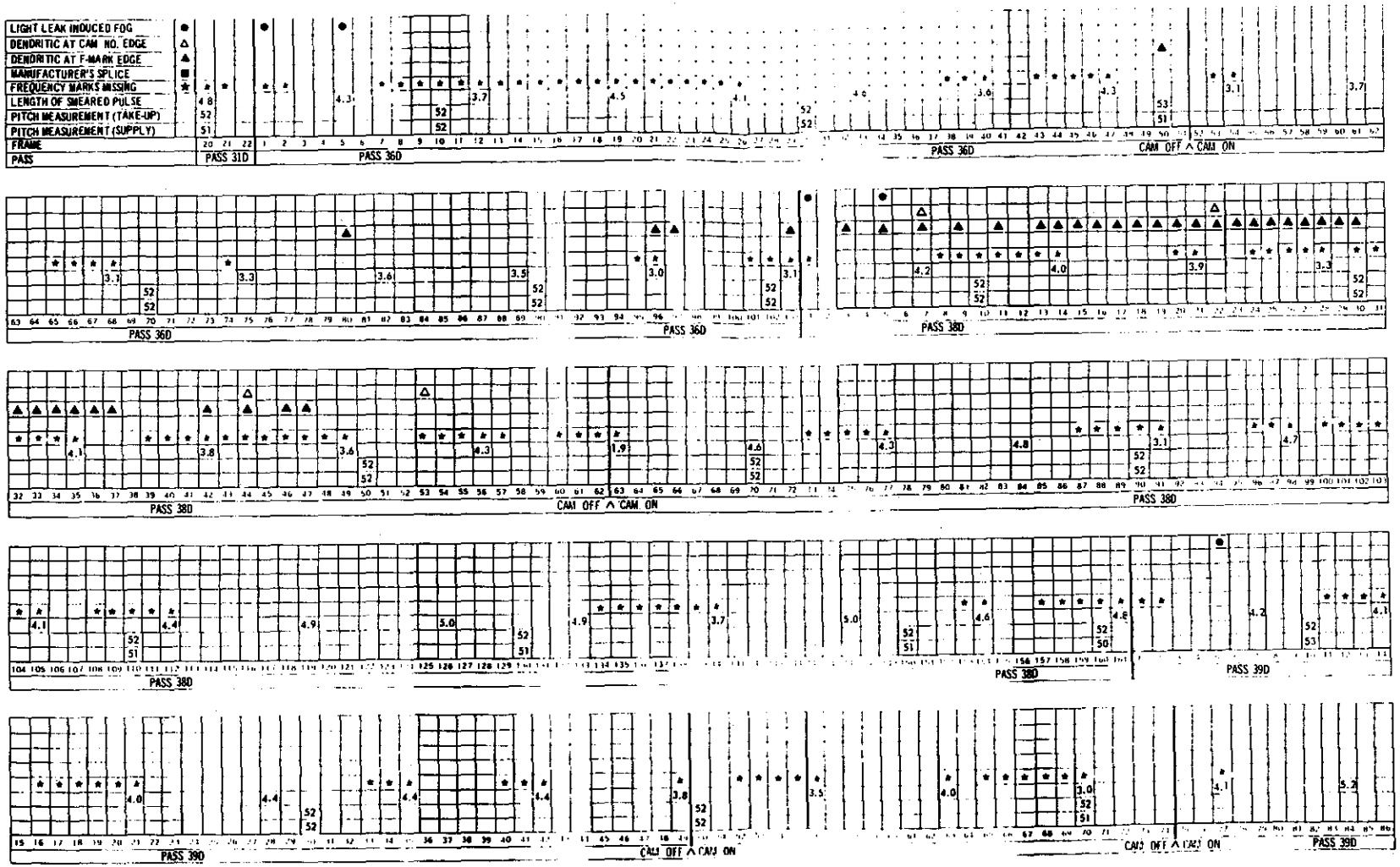

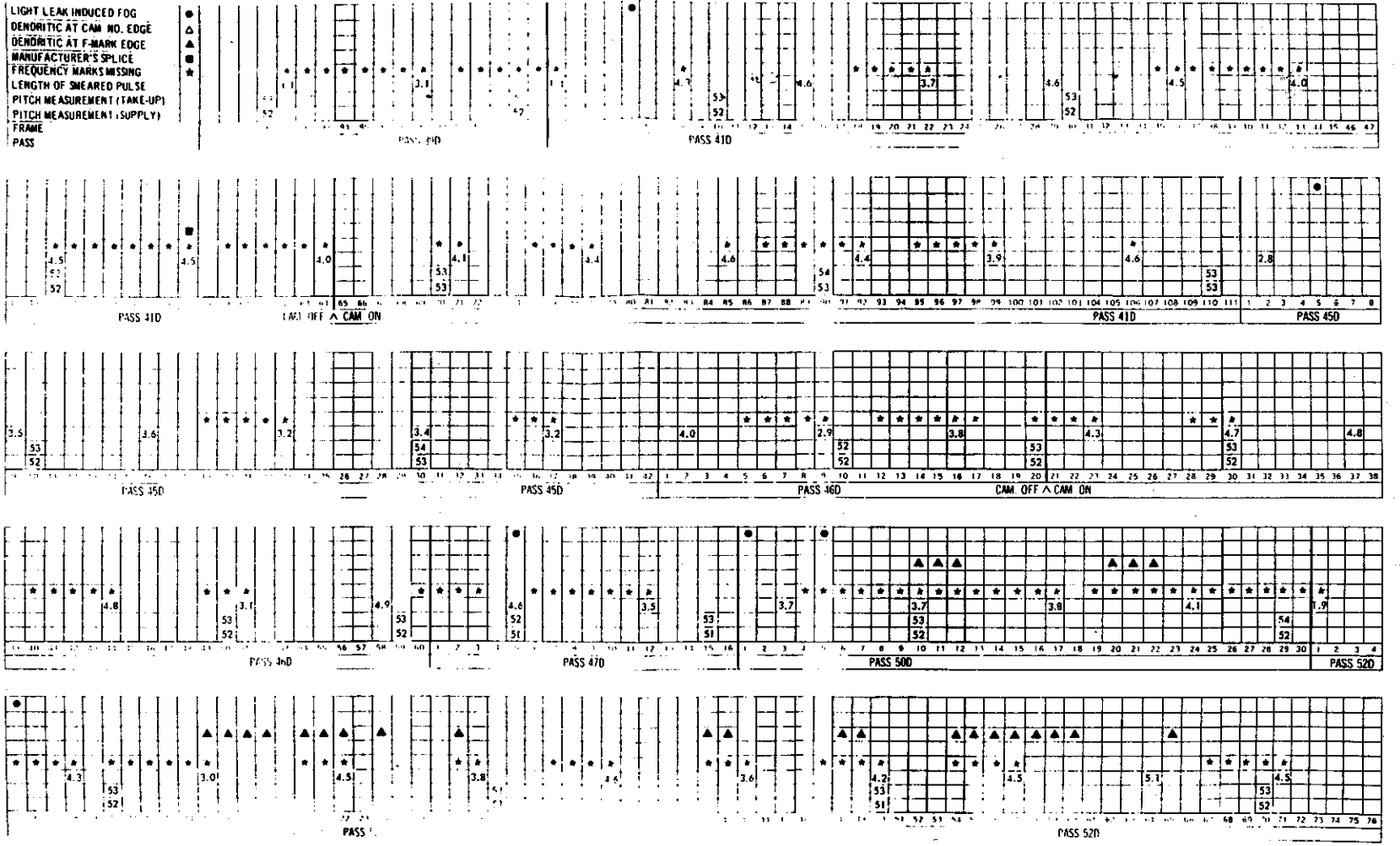

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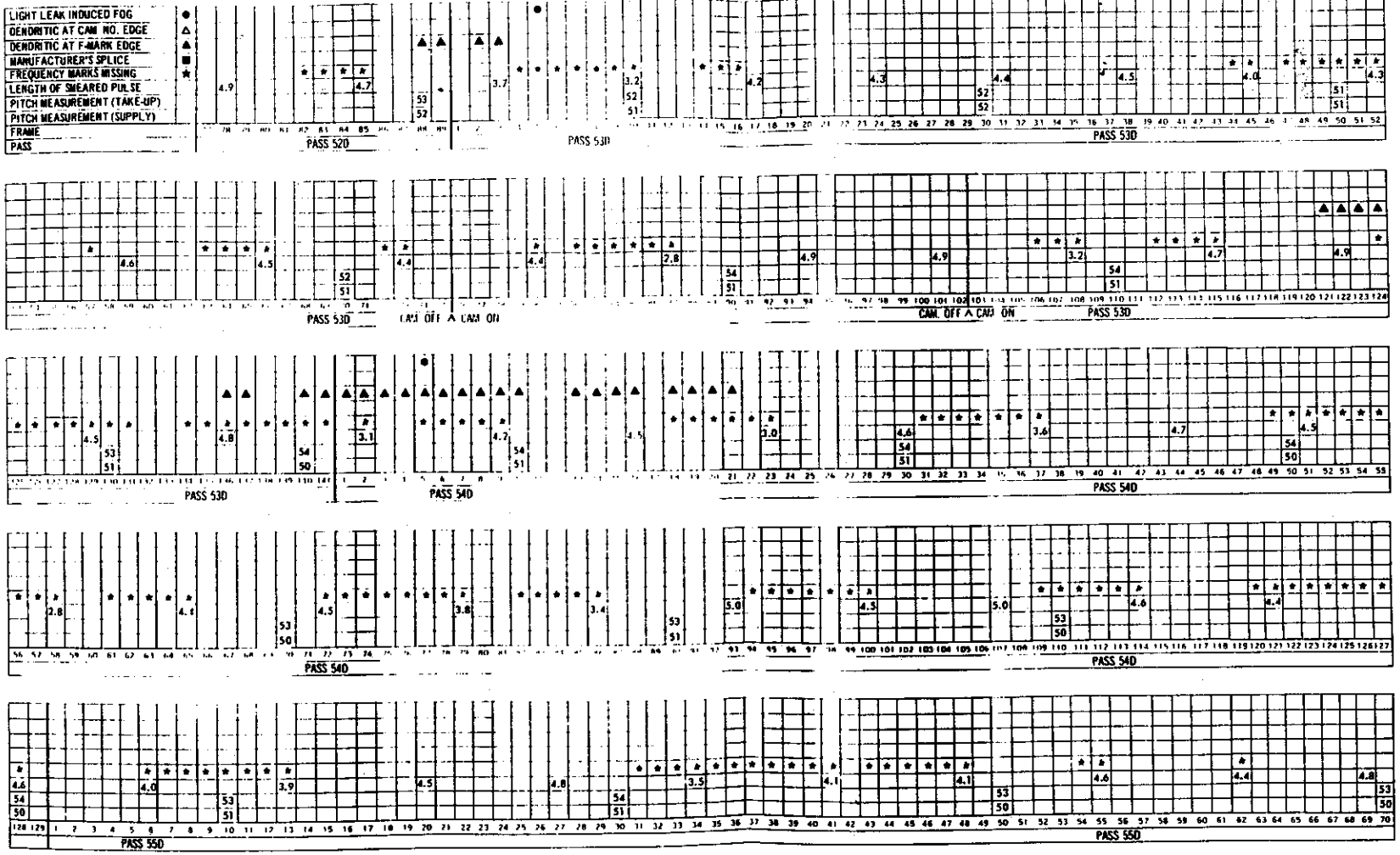
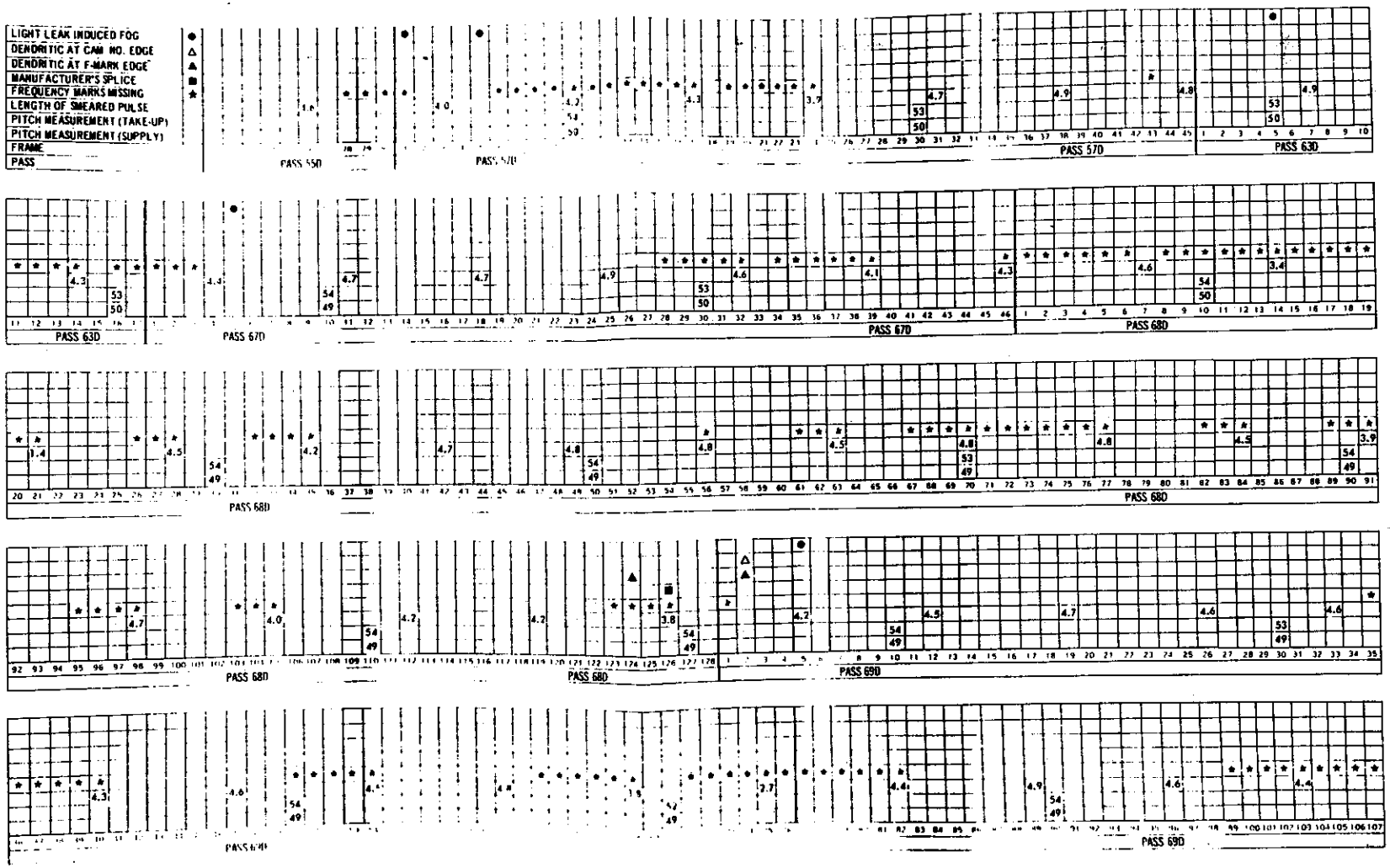
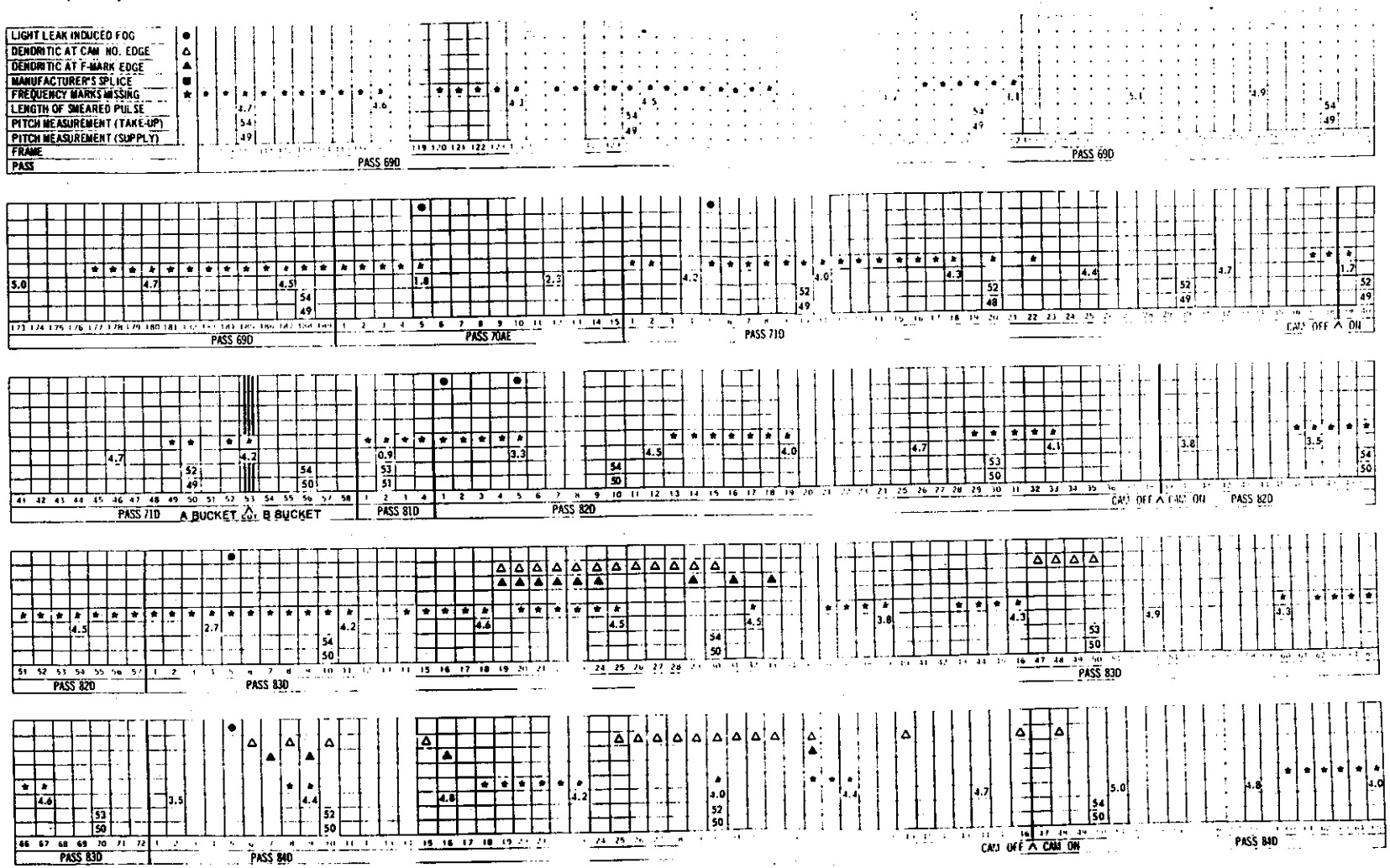
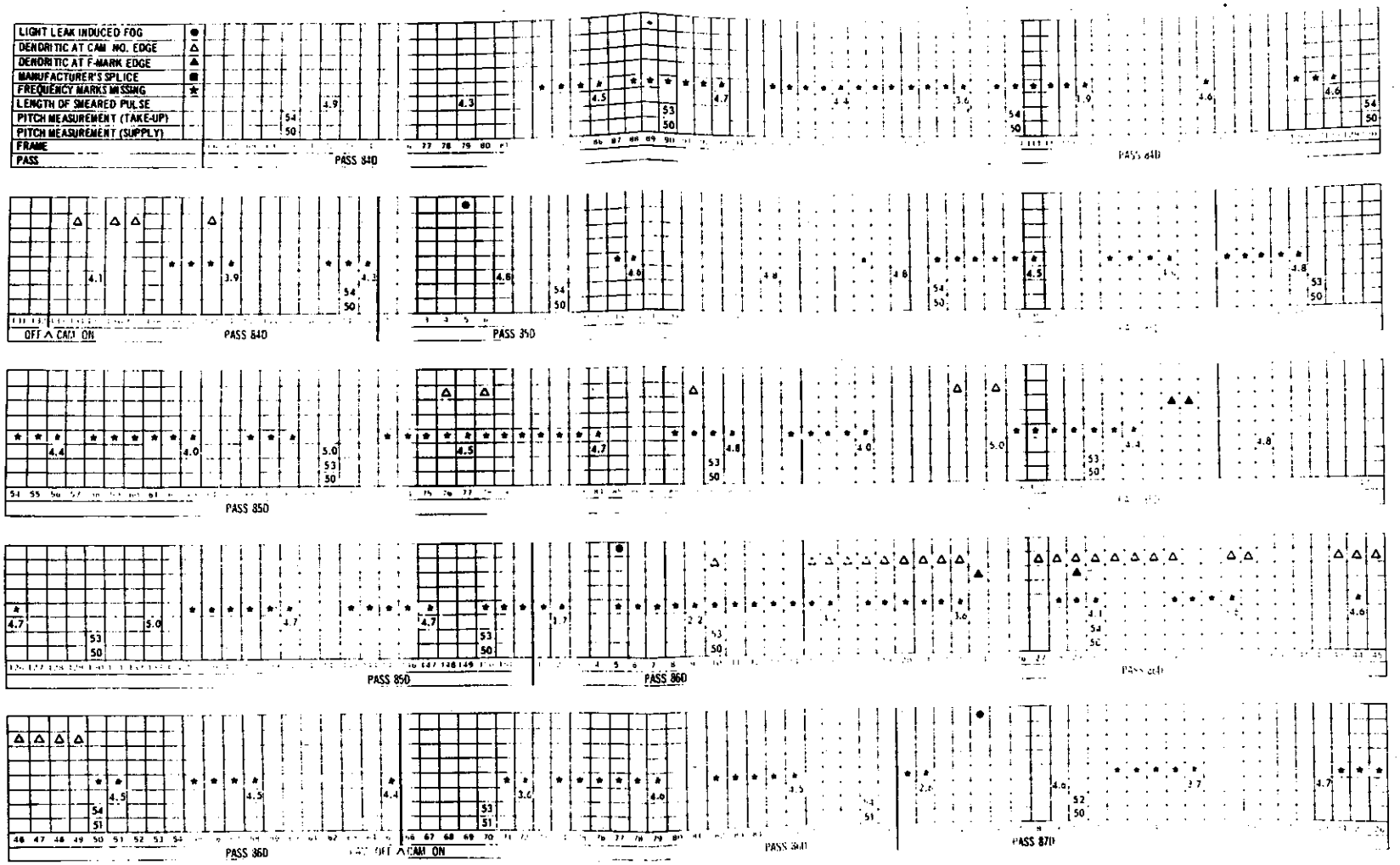
Handle Via
~~TALENT-KEYHOLE~~
Control System Only



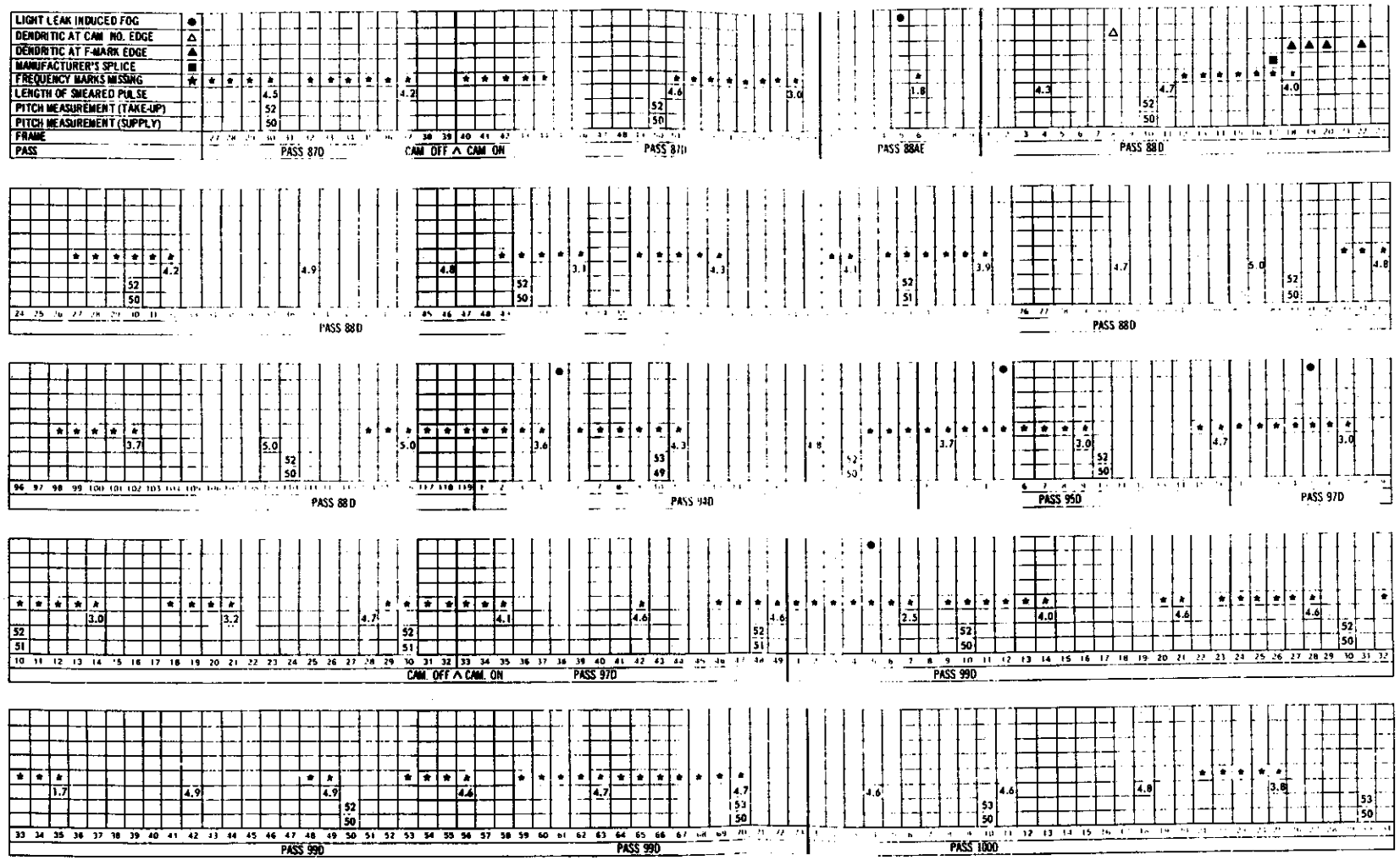

LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 55D
PASS 57D
PASS 57D
PASS 63D
PASS 63D
PASS 67D
PASS 67D
PASS 68D
PASS 68D
PASS 68D
PASS 68D
PASS 68D
PASS 69D
PASS 69D

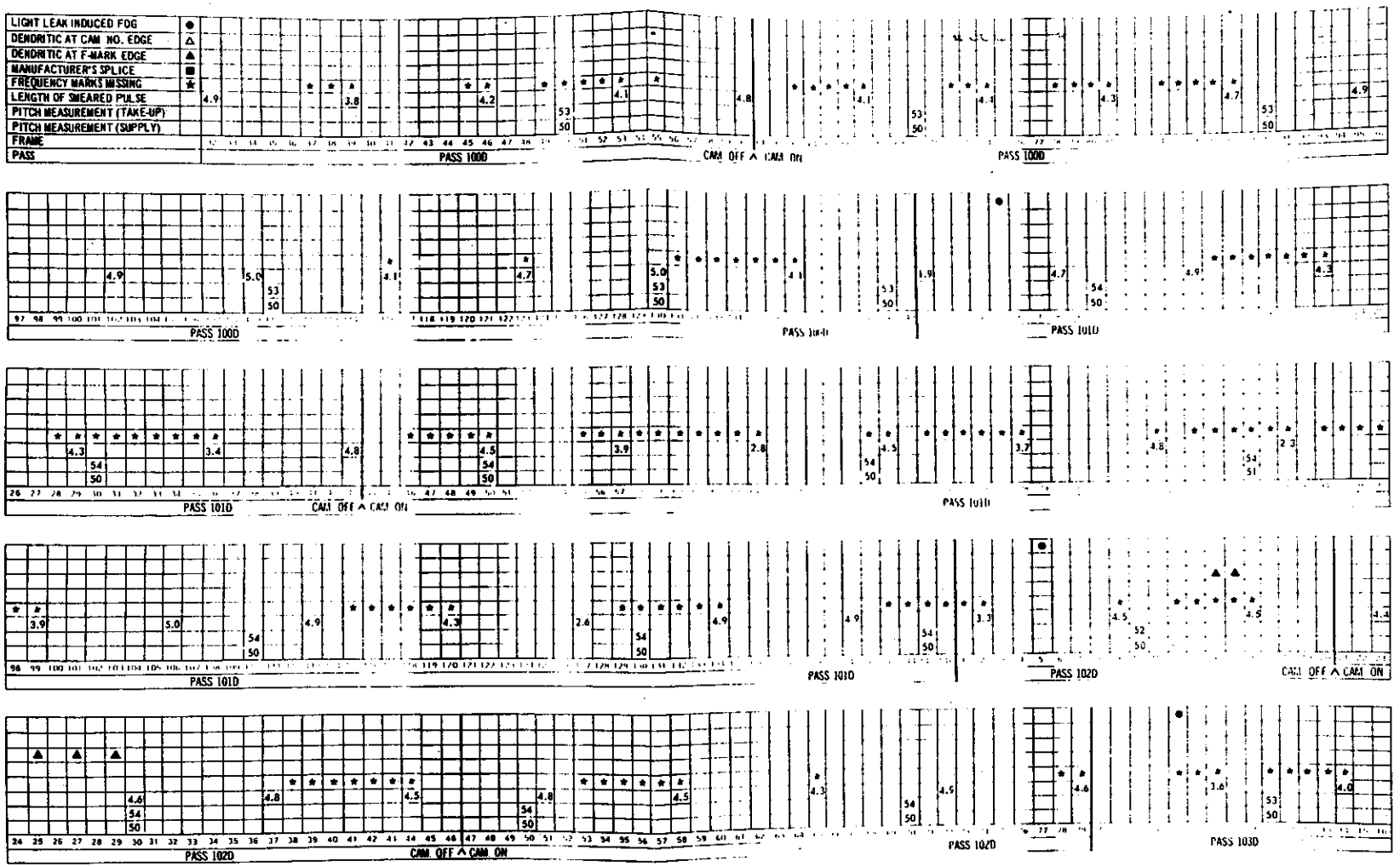

LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 69D
PASS 69D
PASS 70AE
PASS 71D
CAM OFF ^ ON
PASS 71D
A BUCKET
B BUCKET
PASS 81D
PASS 82D
CAM OFF ^ CAM ON
PASS 82D
PASS 82D
PASS 83D
PASS 83D
PASS 83D
PASS 84D
CAM OFF ^ CAM ON
PASS 84D

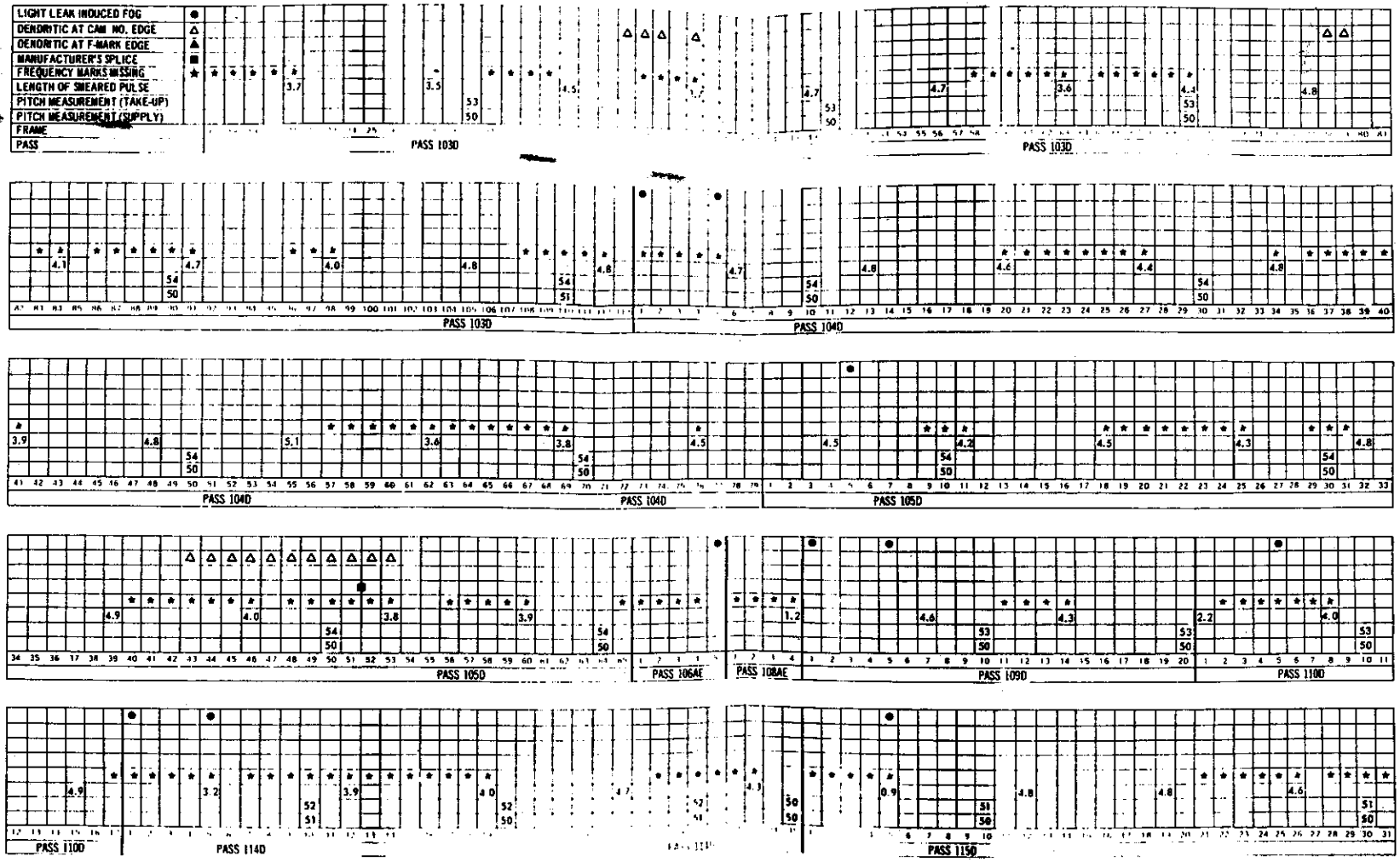

LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S Ssplice
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 840
PASS 640
OFF ∧ CAM ON
PASS 840
PASS 850
PASS 850
PASS 850
PASS 860
PASS 860
OFF ∧ CAM ON
PASS 870

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

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




LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 100D
CAM OFF ^ CAM ON
PASS 101D
PASS 102D
PASS 103D



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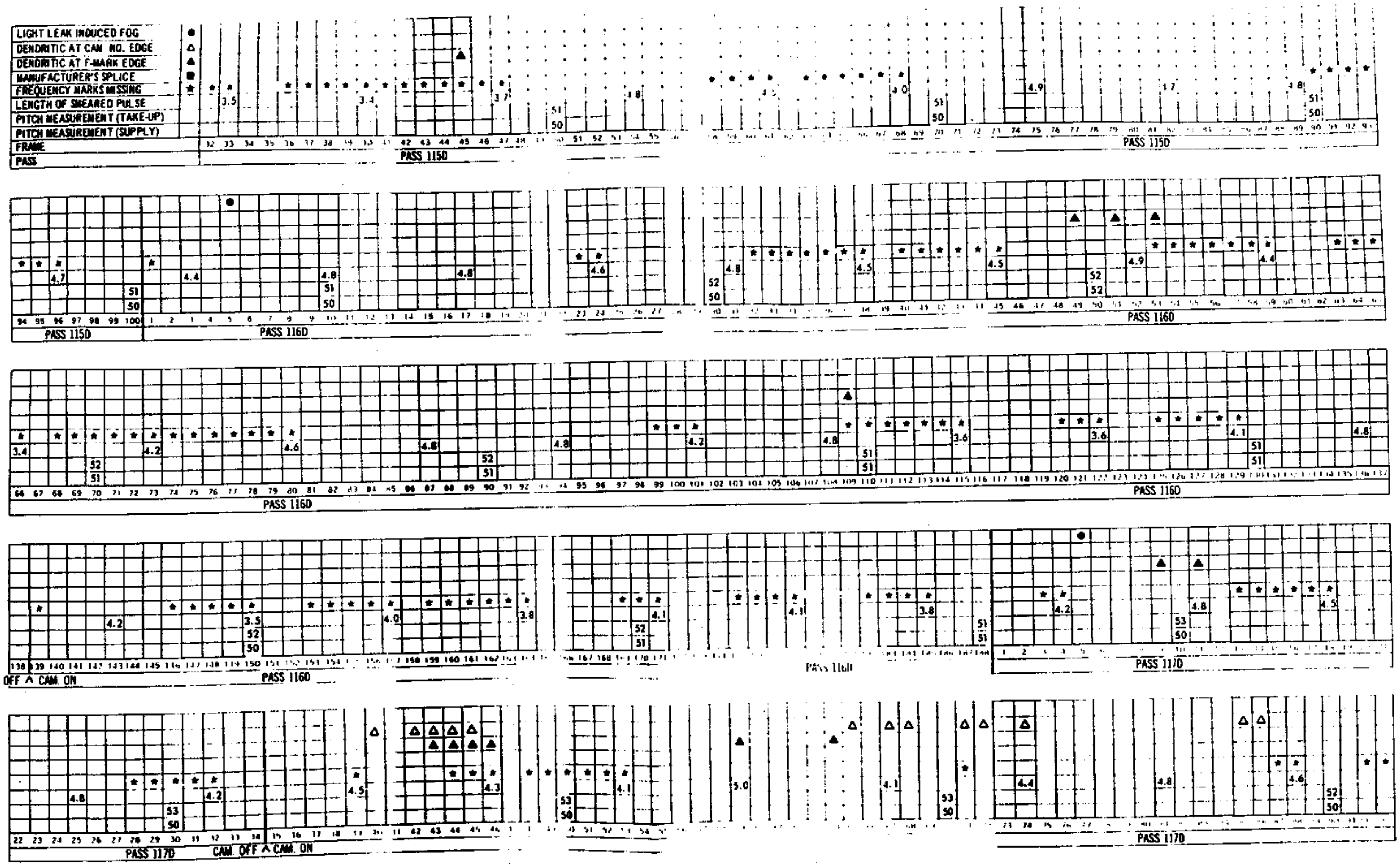
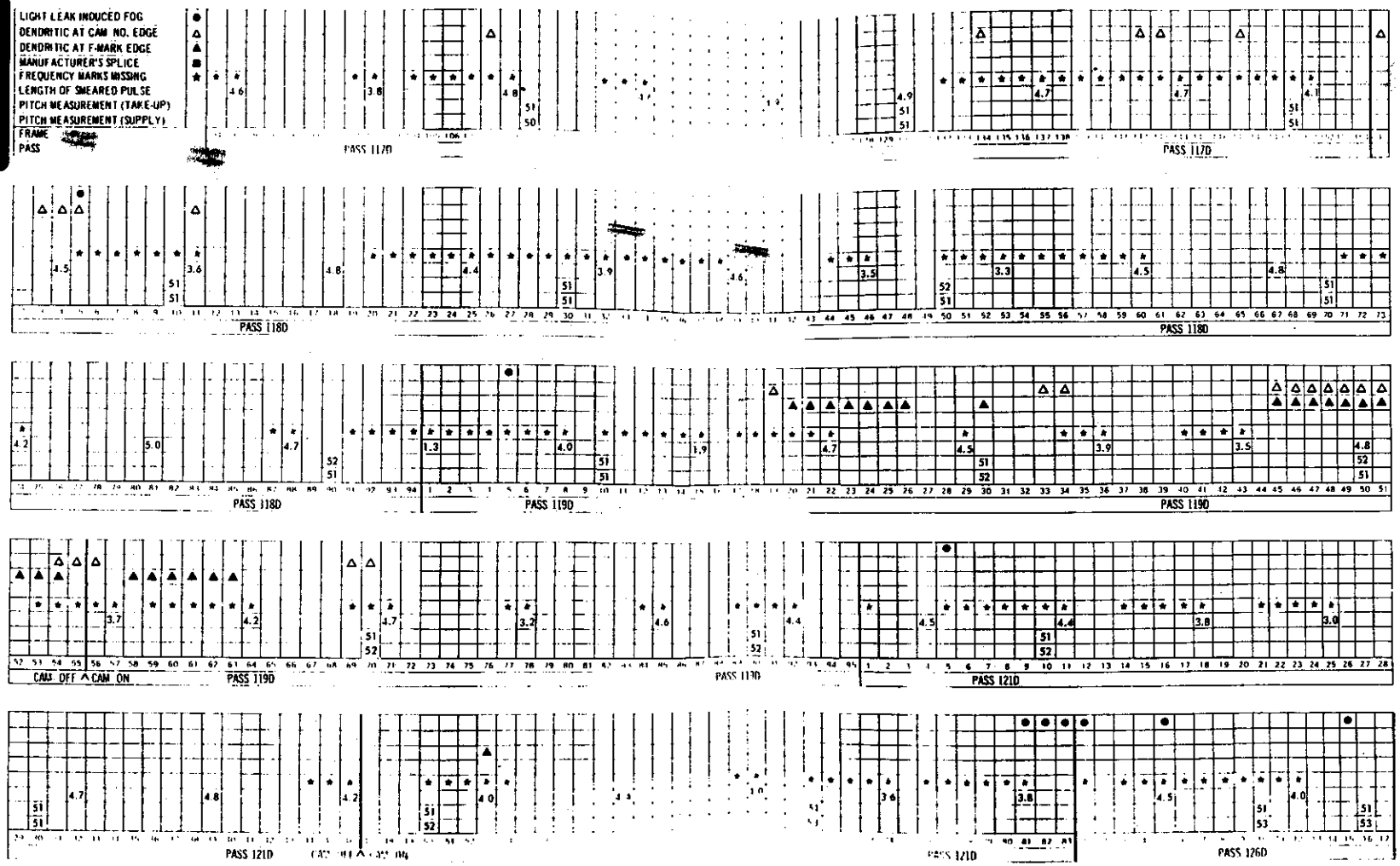
Handle Via
~~Talent-Keyhole~~
Control System Only


LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 115D
PASS 116D
PASS 117D
OFF ^ CAM ON
CAM OFF ^ CAM ON



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Handle Via
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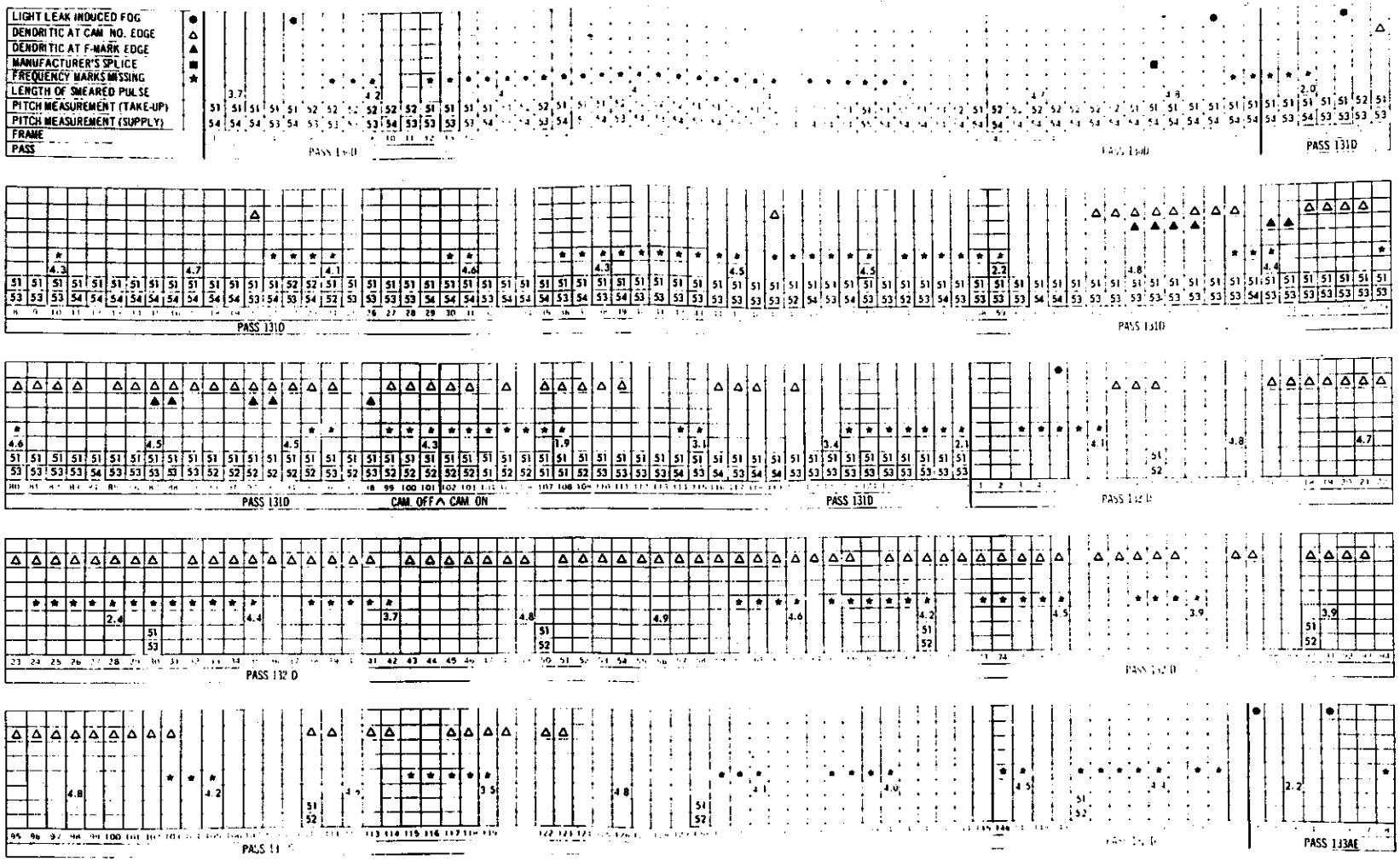
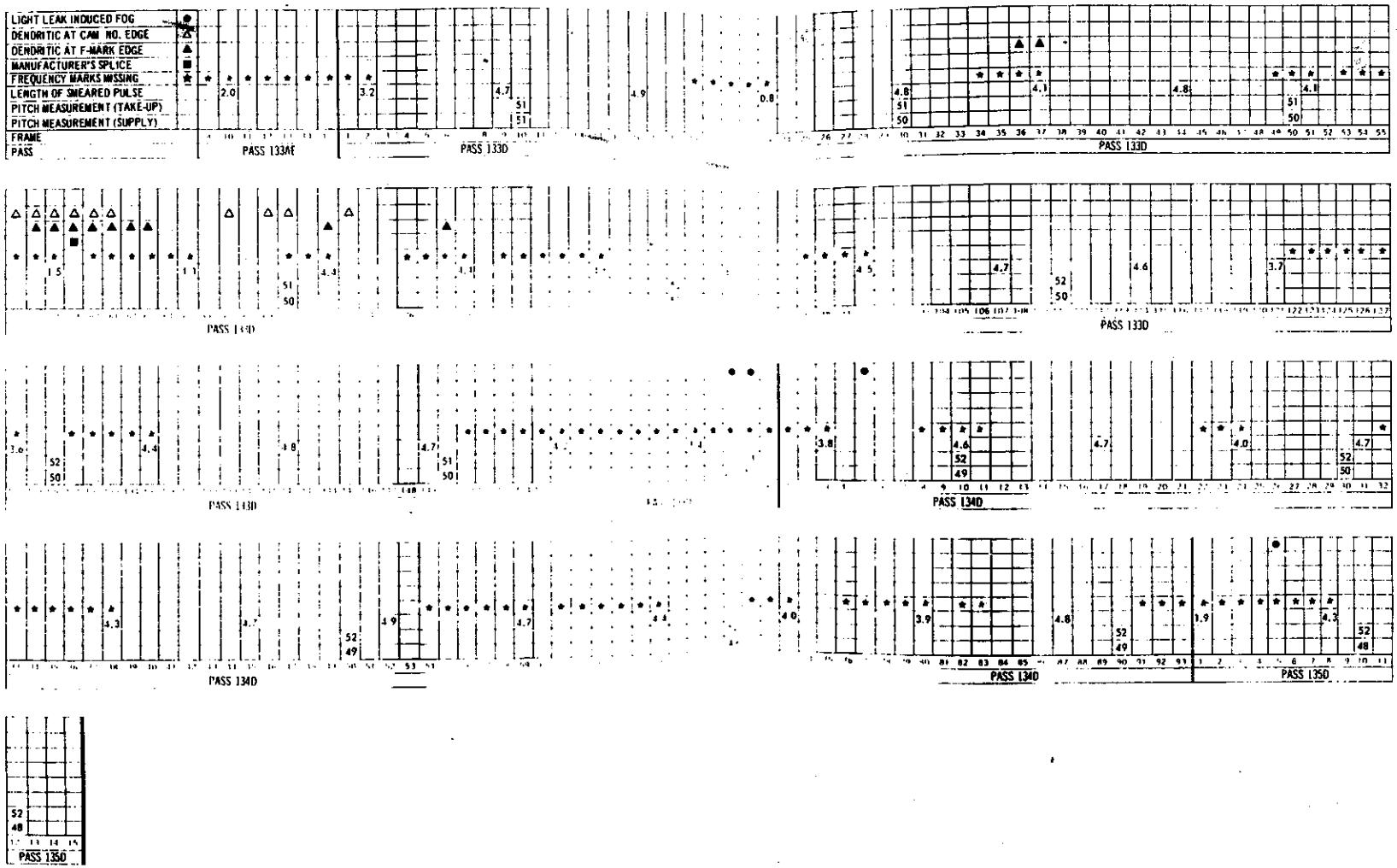
Control System Only


LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
LENGTH OF SMEARED PULSE
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 131D
PASS 131D
PASS 131D
CAM OFF ∧ CAM ON
PASS 131D
PASS 132 D
PASS 132 D
PASS 133AE



Handle Via
~~Talent KEYHOLE~~
Control System Only

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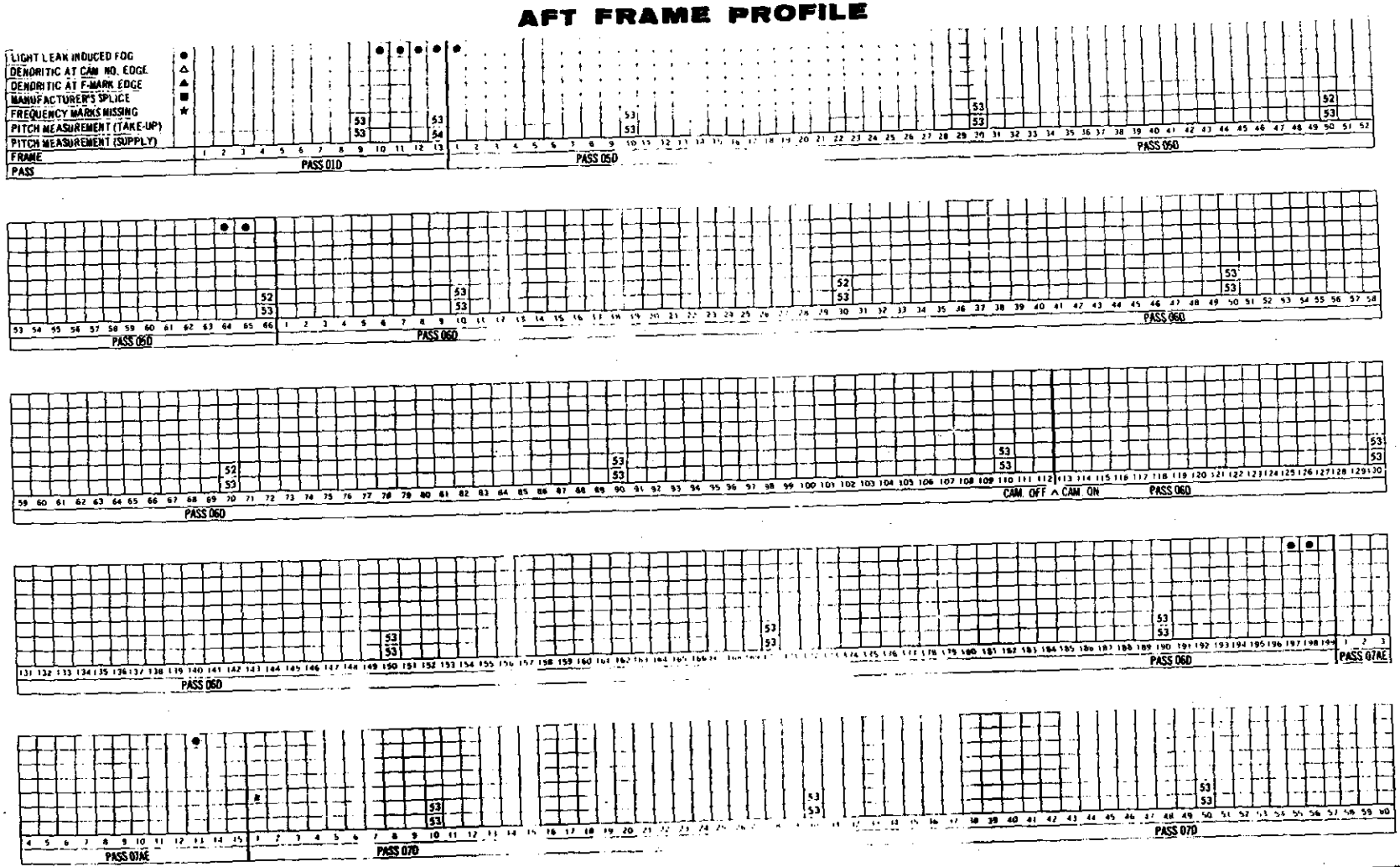
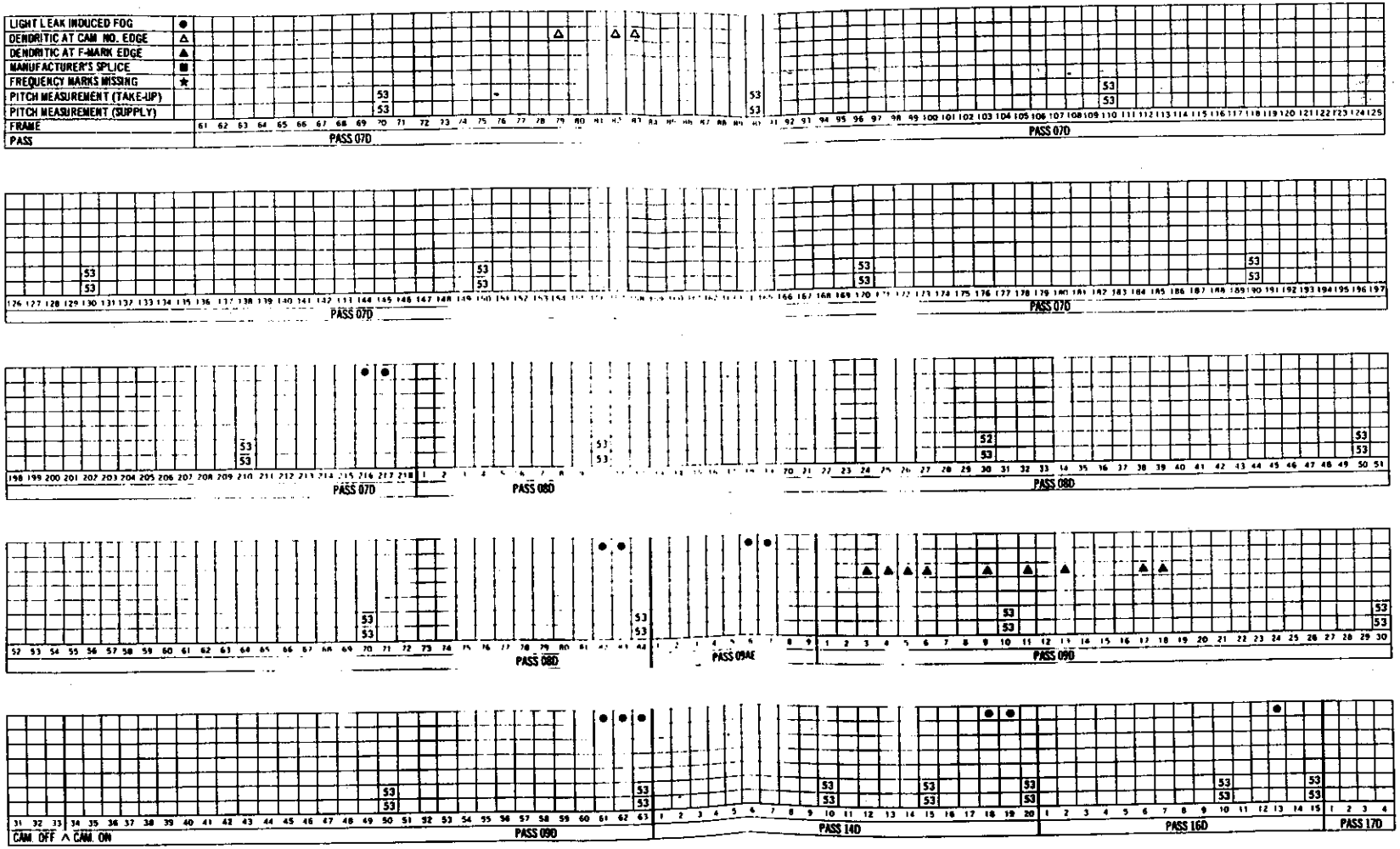
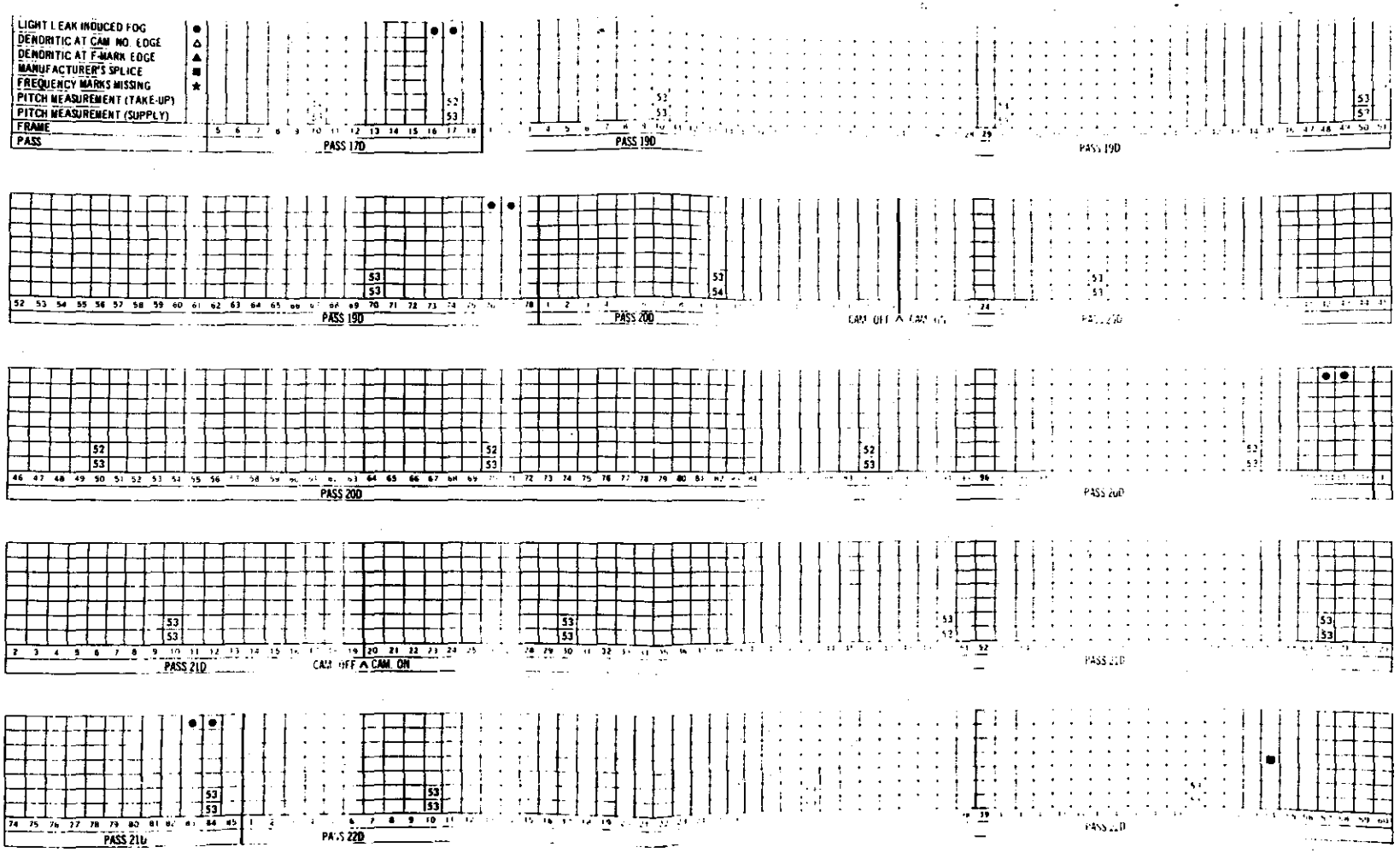
AFT FRAME PROFILE

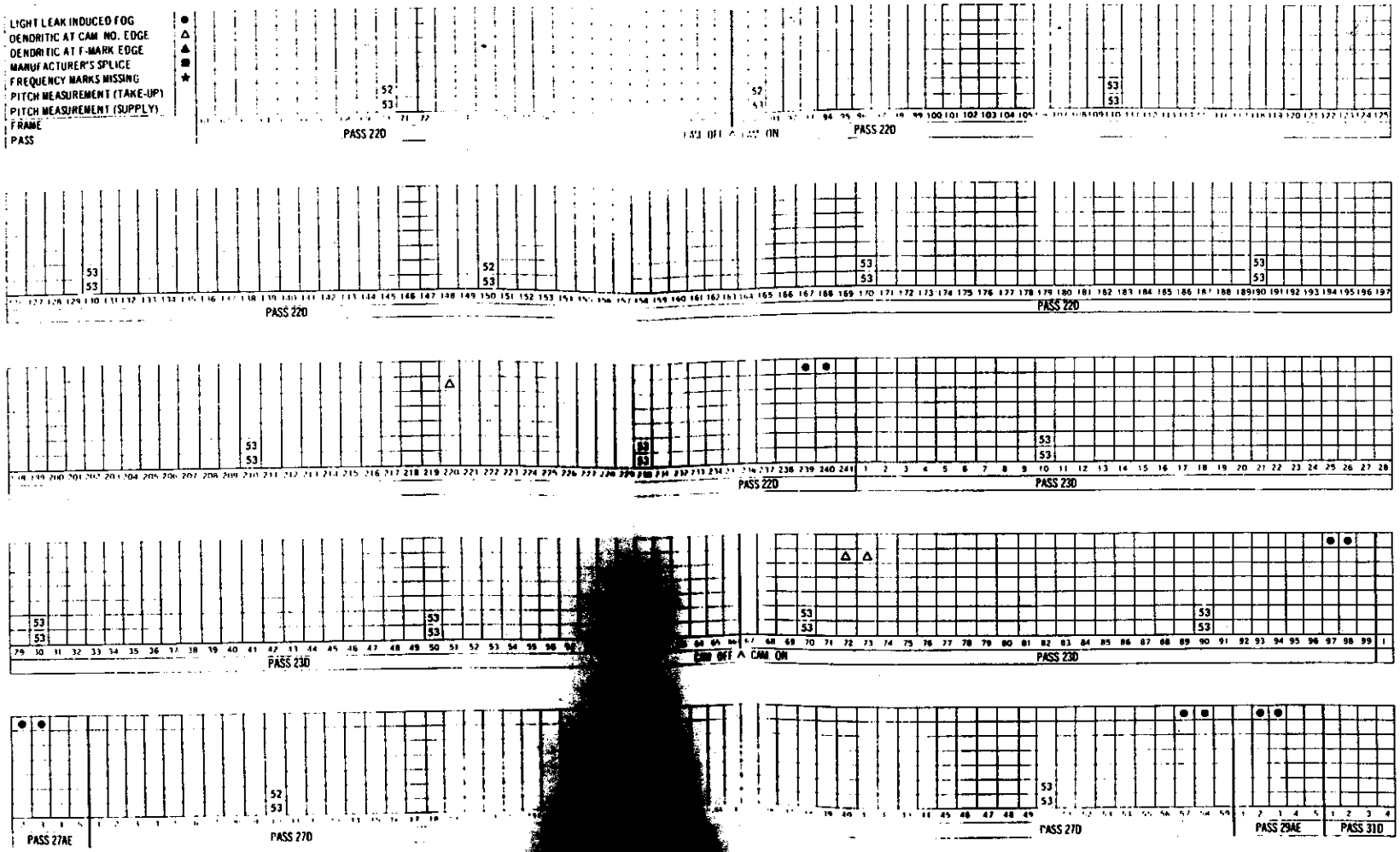




Control System Only

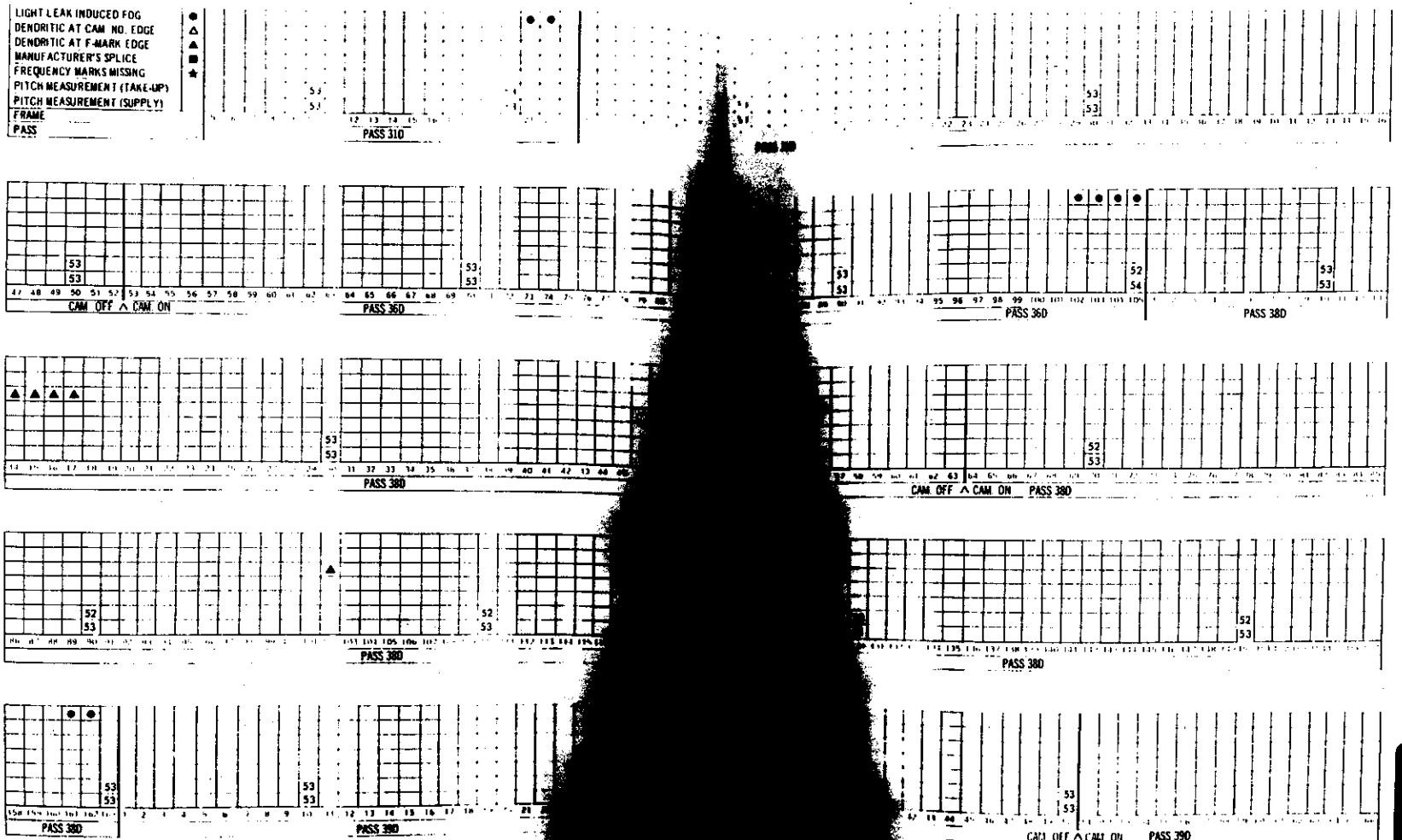


Control System Only

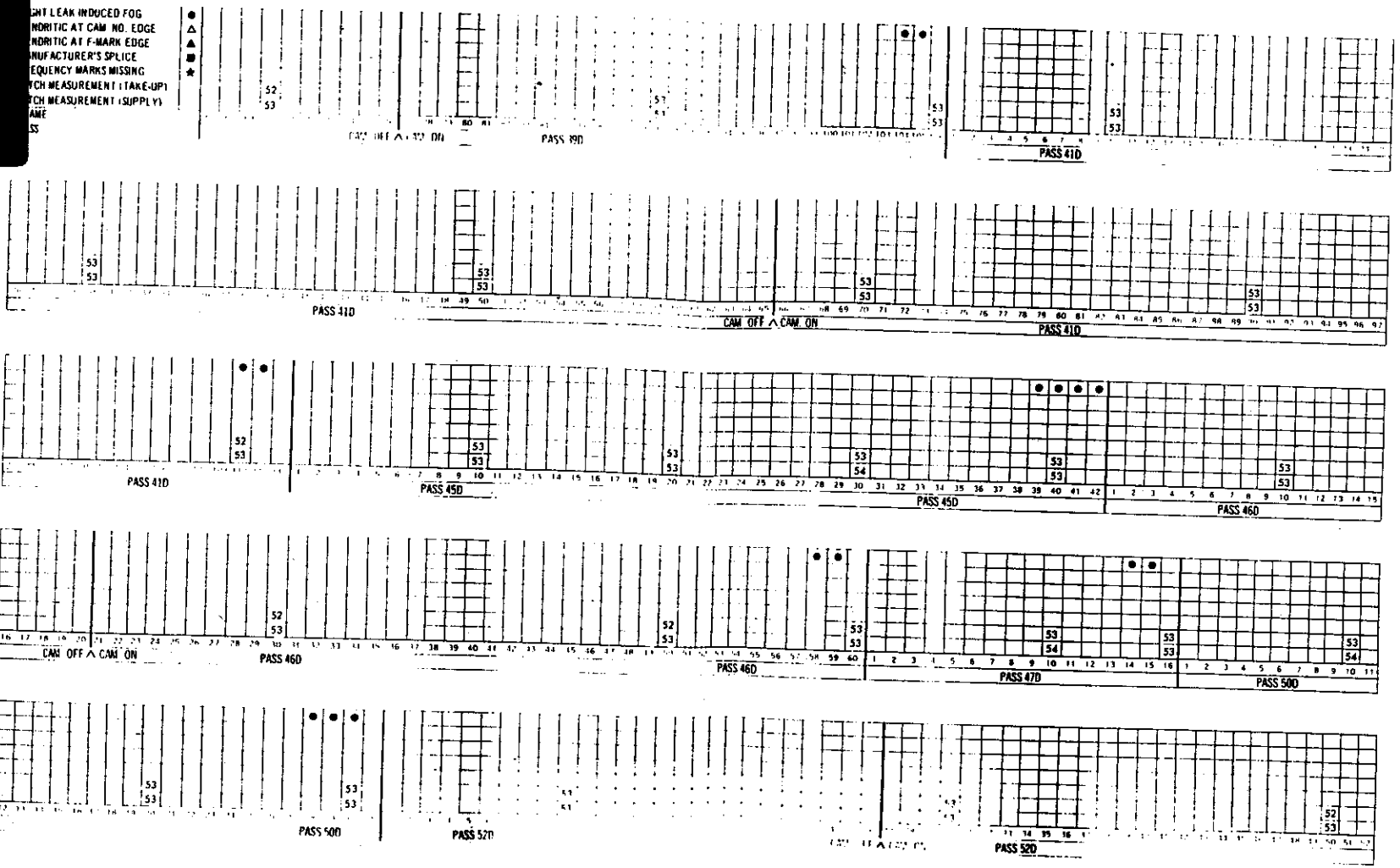


Handle Via
~~Talent-Need-to-Know~~
Control System Only

[redacted]

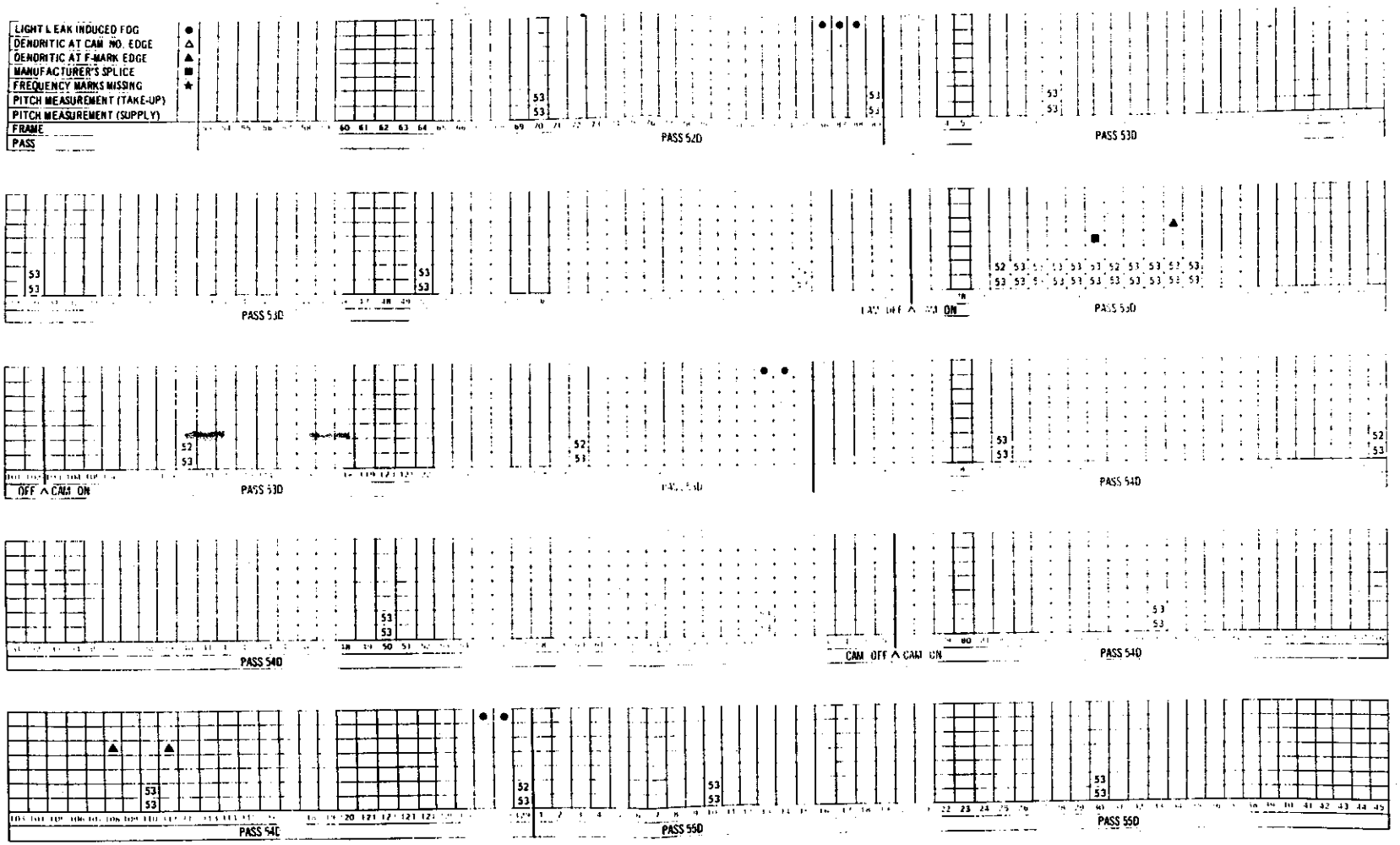

LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S Ssplice
FREQUENCY MARKS MISSING
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 310
PASS 36D
CAM OFF ^ CAM ON
PASS 38D
PASS 380
CAM OFF ^ CAM ON PASS 380
PASS 390
CAM OFF ^ CAM ON PASS 390

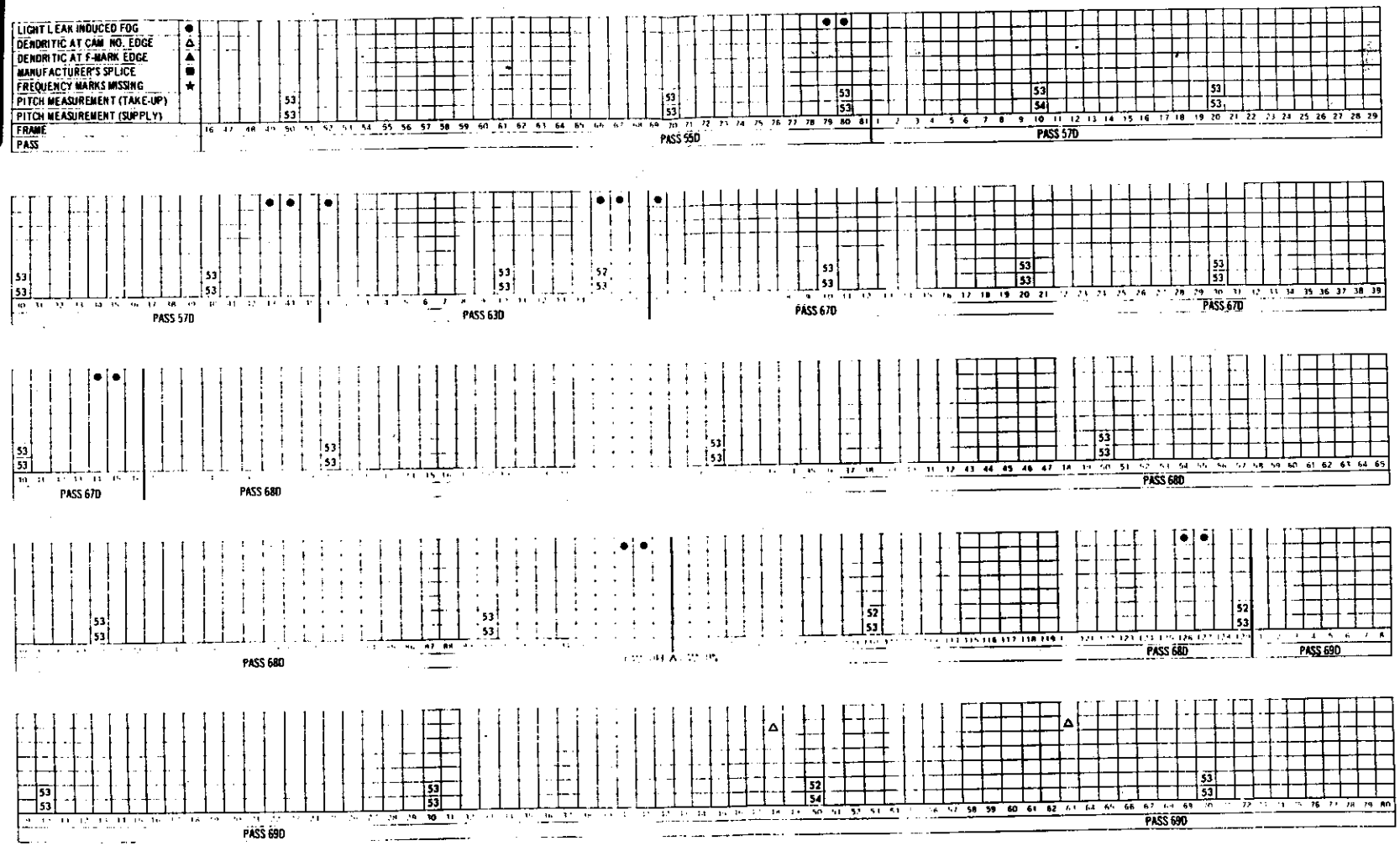
GHT LEAK INDUCED FOG ●
NDRITIC AT CAM NO. EDGE △
NDRITIC AT F-MARK EDGE ▲
NUFACTURER'S SPLICE ■
EQUENCY MARKS MISSING ★
TCH MEASUREMENT (TAKE-UP)
TCH MEASUREMENT (SUPPLY)
AME
SS



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

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


LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 52D
PASS 53D
PASS 53D
PASS 53D
PASS 53D
OFF ^ CAM ON
PASS 54D
PASS 54D
CAM OFF ^ CAM ON
PASS 54D
PASS 54D
PASS 55D
PASS 55D



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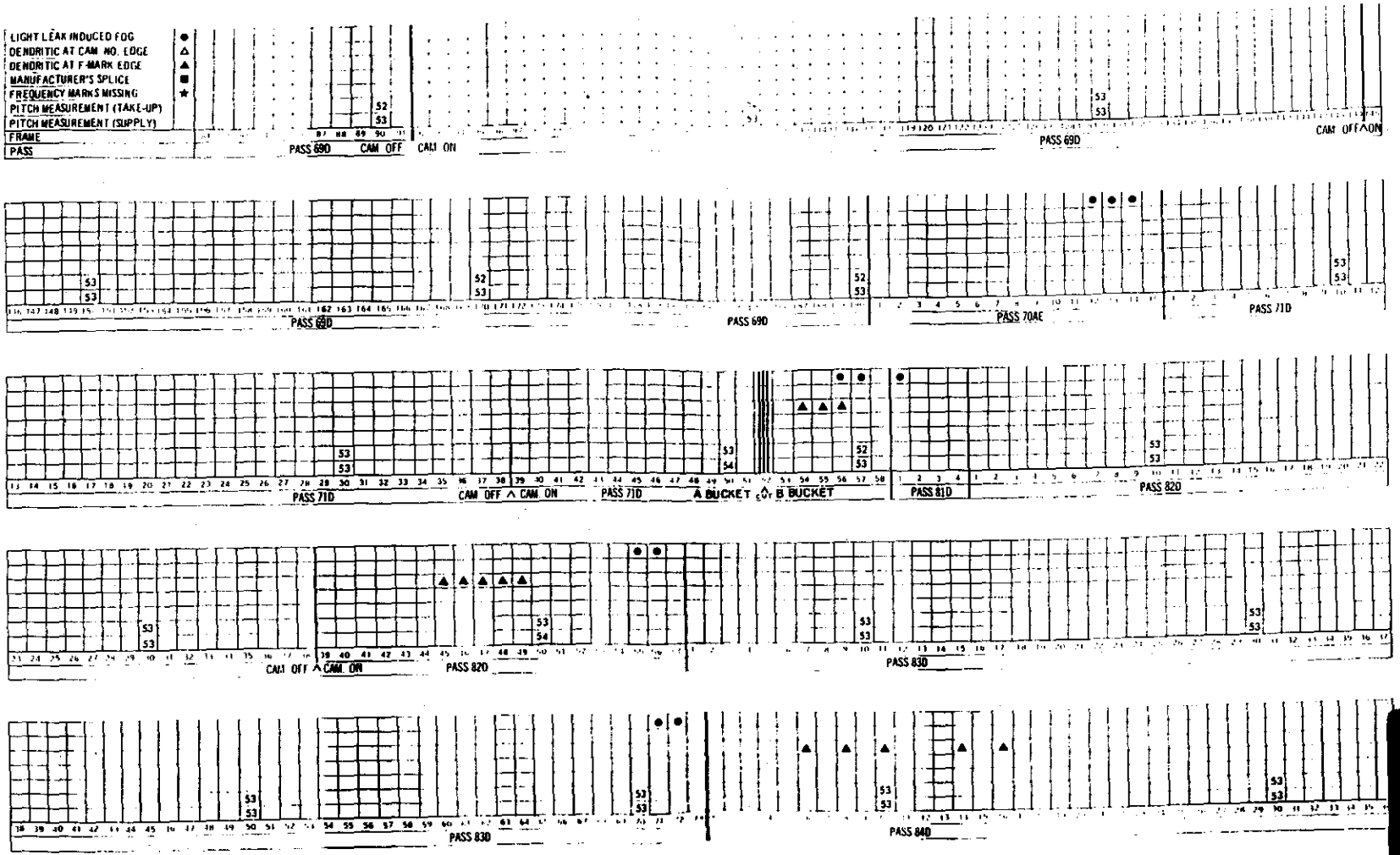
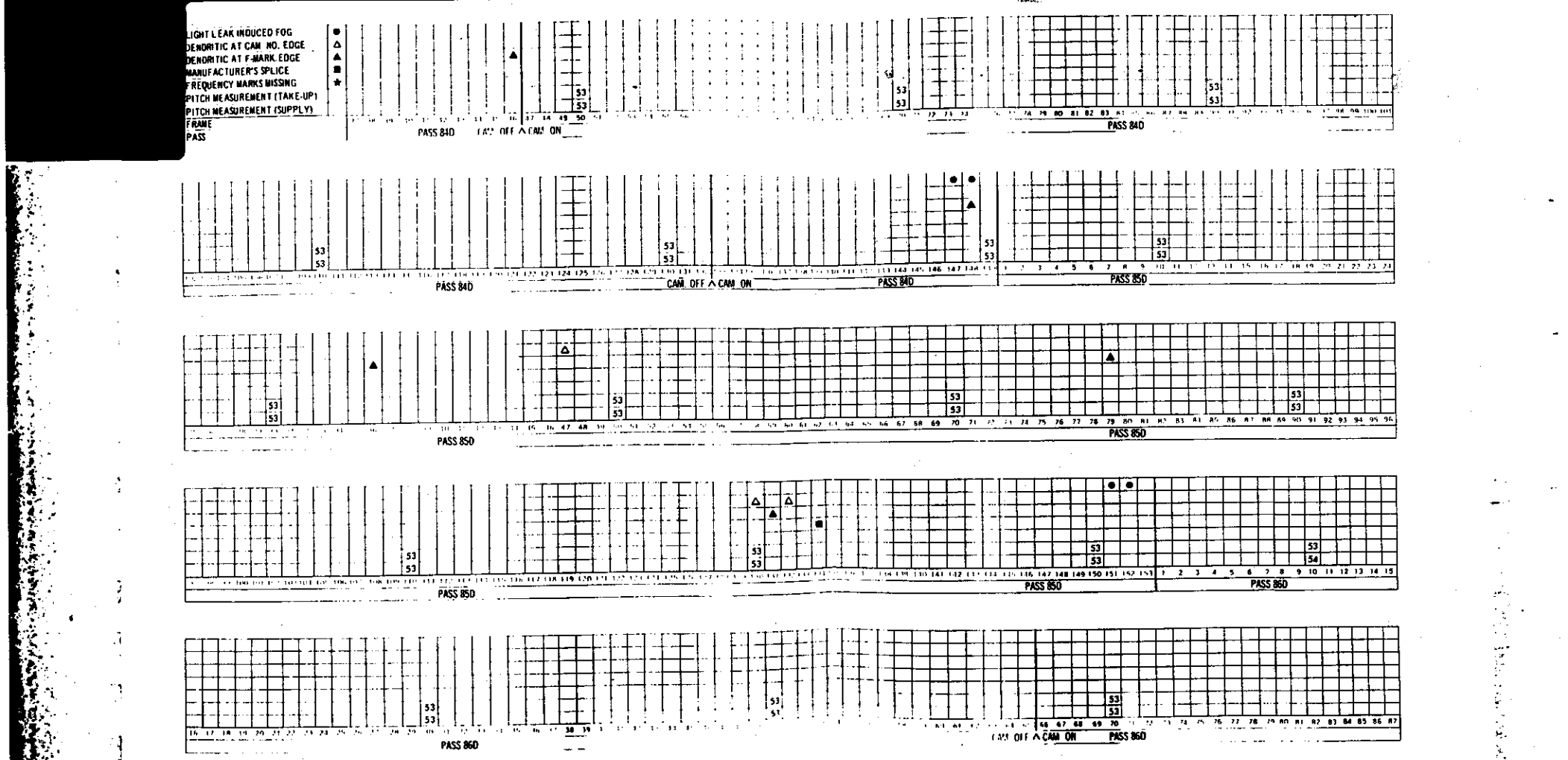
~~NO FOREIGN DISSEM~~

Handle Via
~~Talent KEYHOLE~~
Control System Only


LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 69D
CAM OFF
CAM ON
PASS 69D
CAM OFF^ON
PASS 69D
PASS 69D
PASS 70AE
PASS 71D
PASS 71D
CAM OFF ^ CAM ON
PASS 71D
A BUCKET or B BUCKET
PASS 81D
PASS 820
CAM OFF ^ CAM ON
PASS 820
PASS 830
PASS 830
PASS 840



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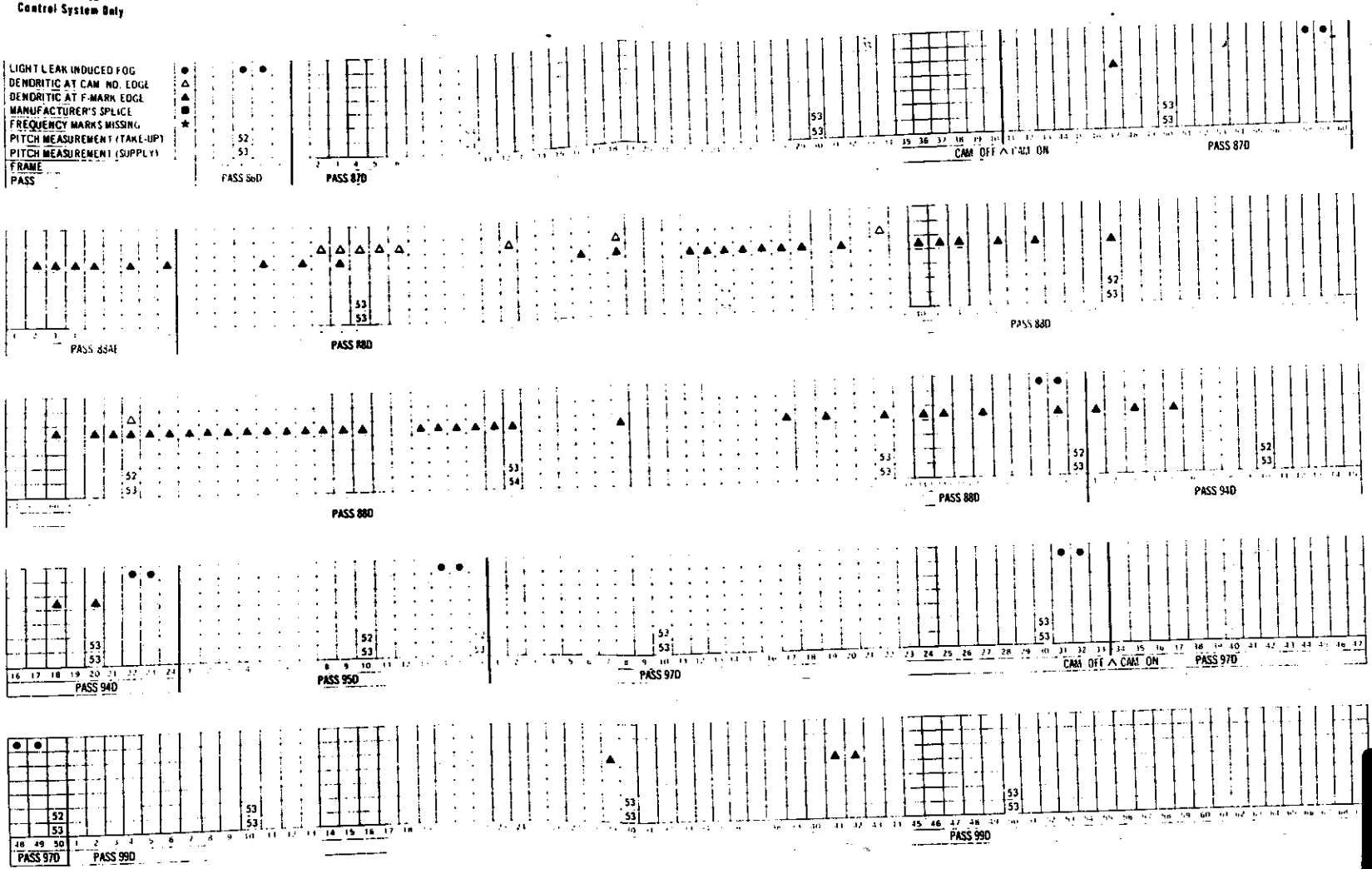
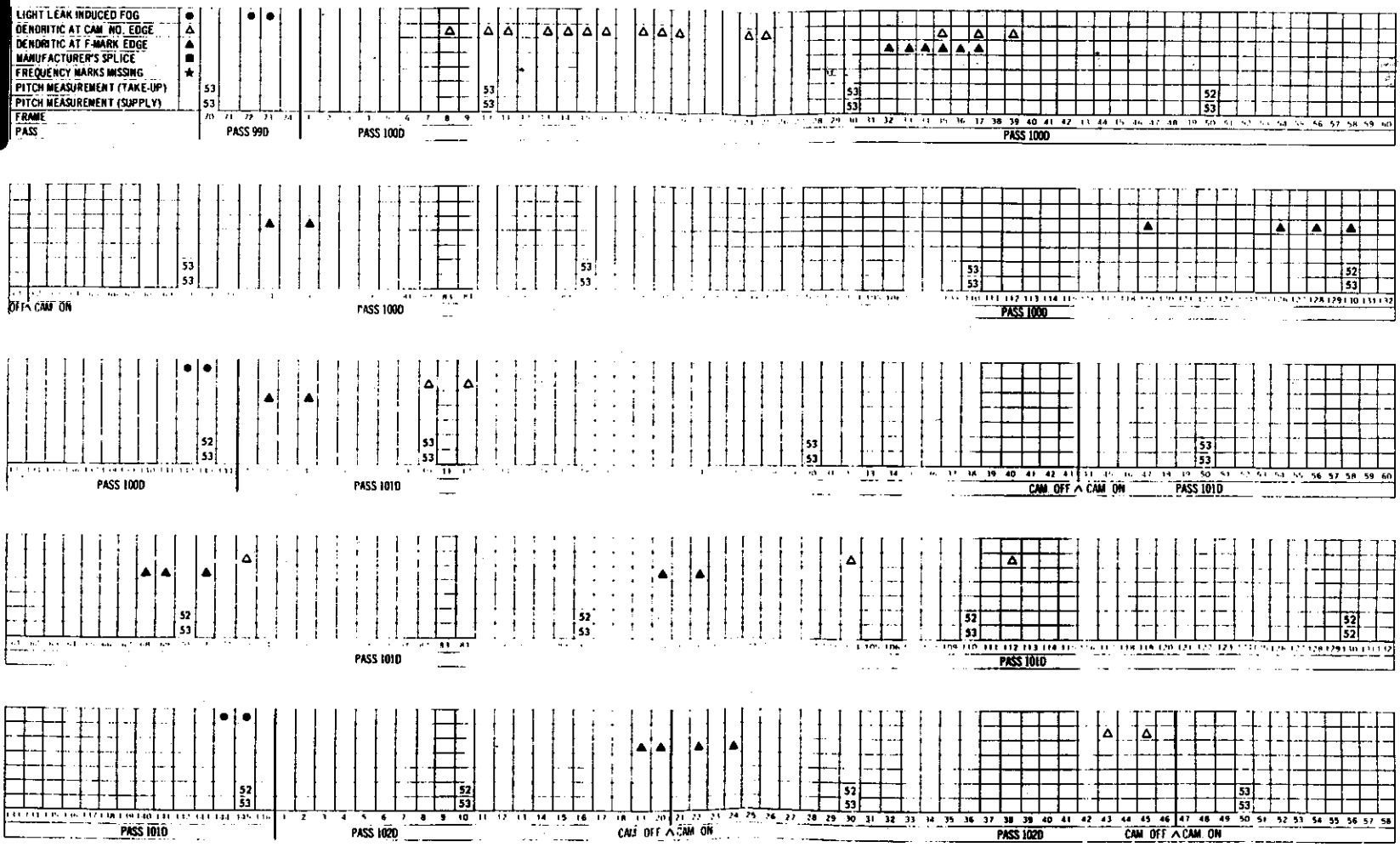
~~NO FOREIGN DISSEM~~

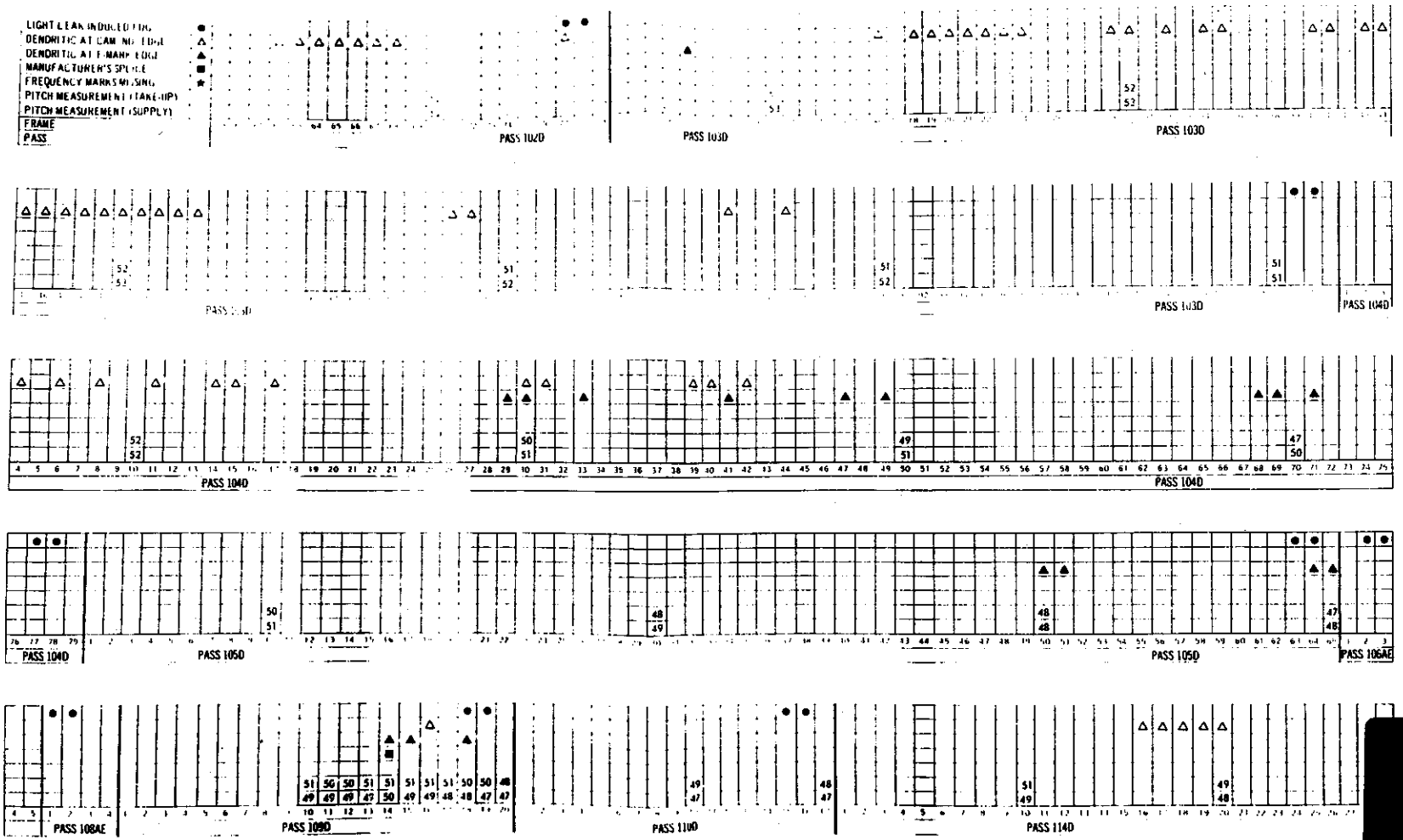
Handle Via
~~Talent Keyhole~~
Control System Only

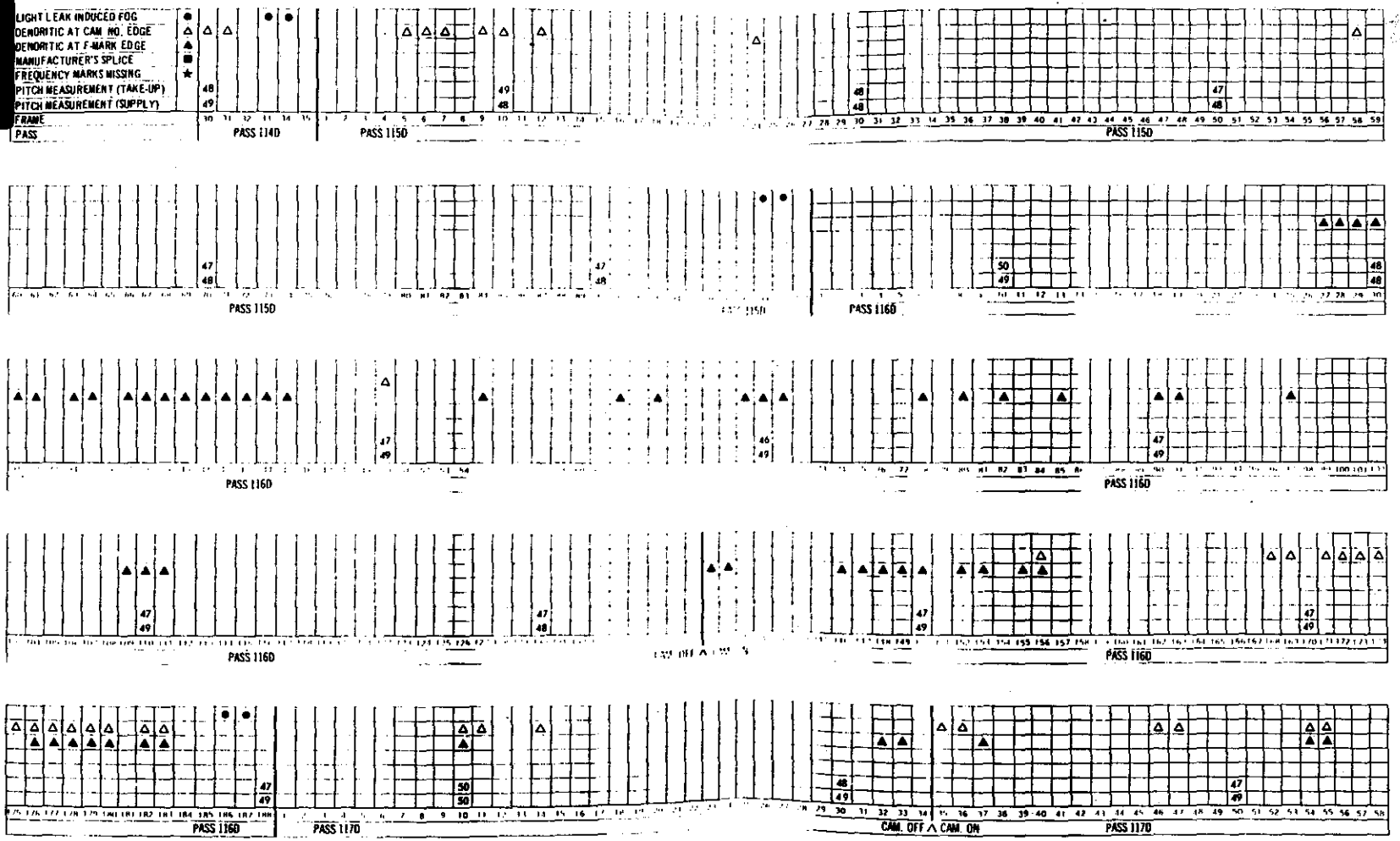

LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM IND. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 86D
PASS 87D
CAM OFF ∧ CAM ON
PASS 87D
PASS 88E
PASS 88D
PASS 88D
PASS 88D
PASS 94D
PASS 94D
PASS 95D
PASS 97D
CAM OFF ∧ CAM ON
PASS 97D
PASS 97D
PASS 99D
PASS 99D

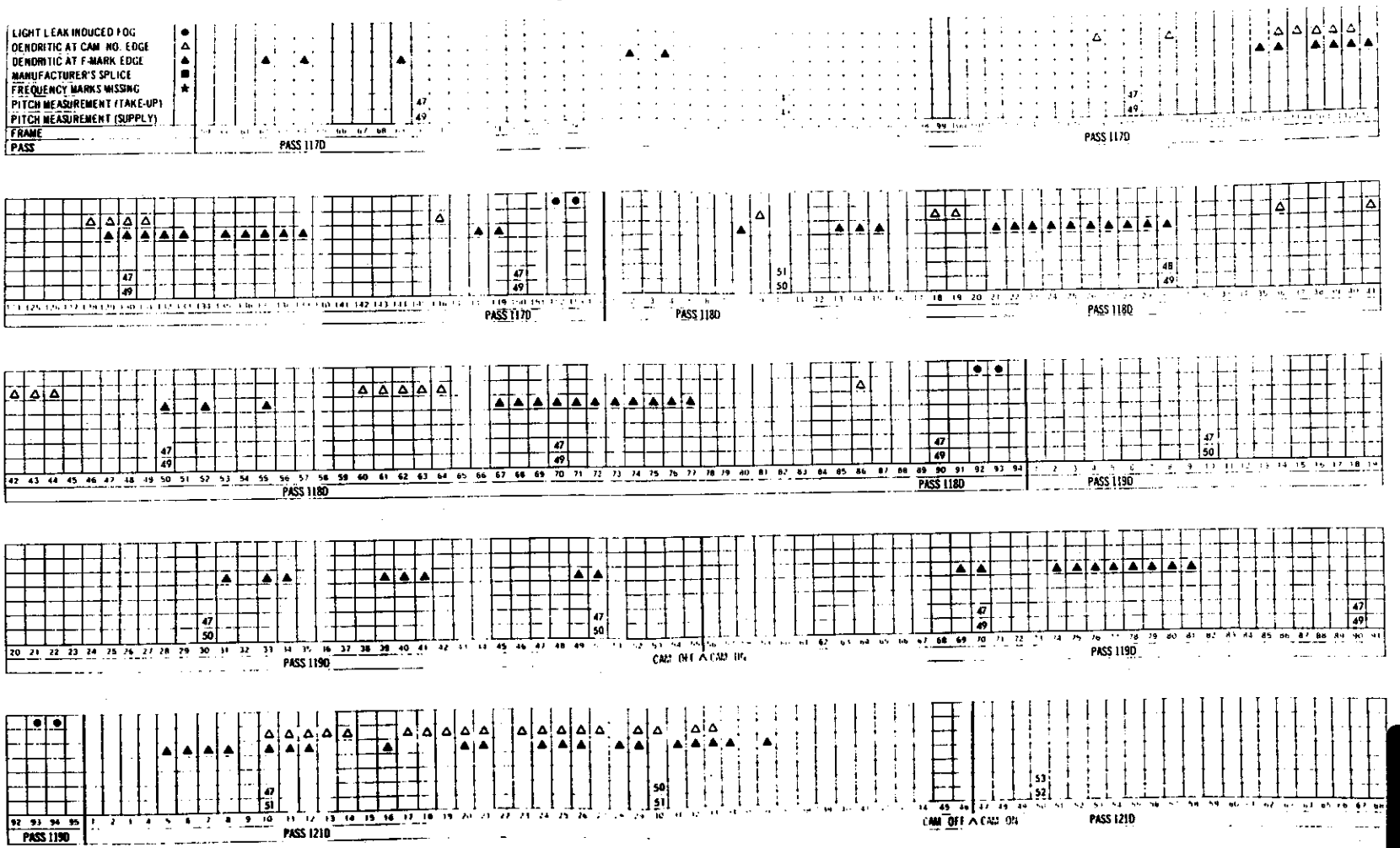


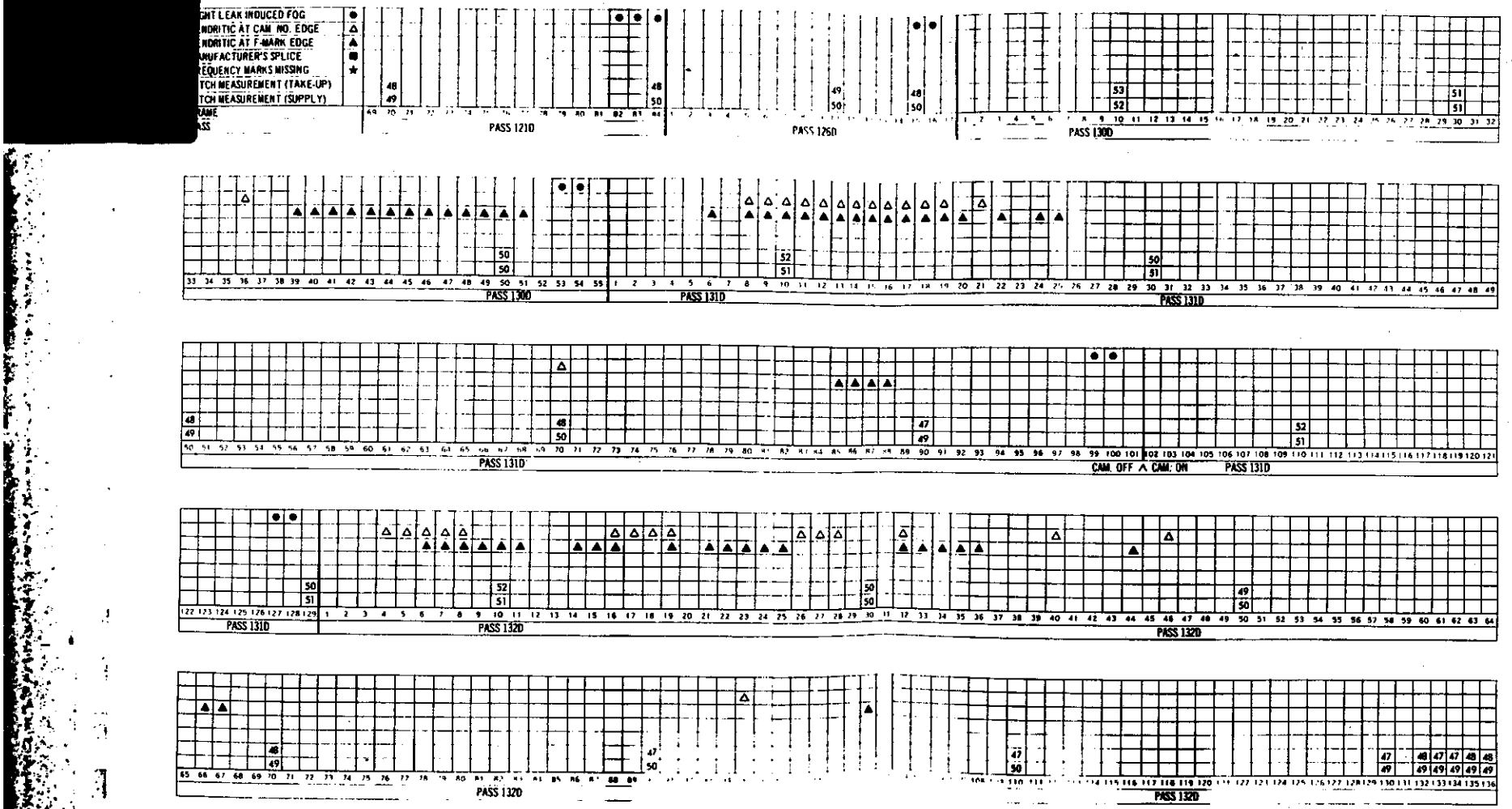
Handle Via
[redacted]
Control System Only

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





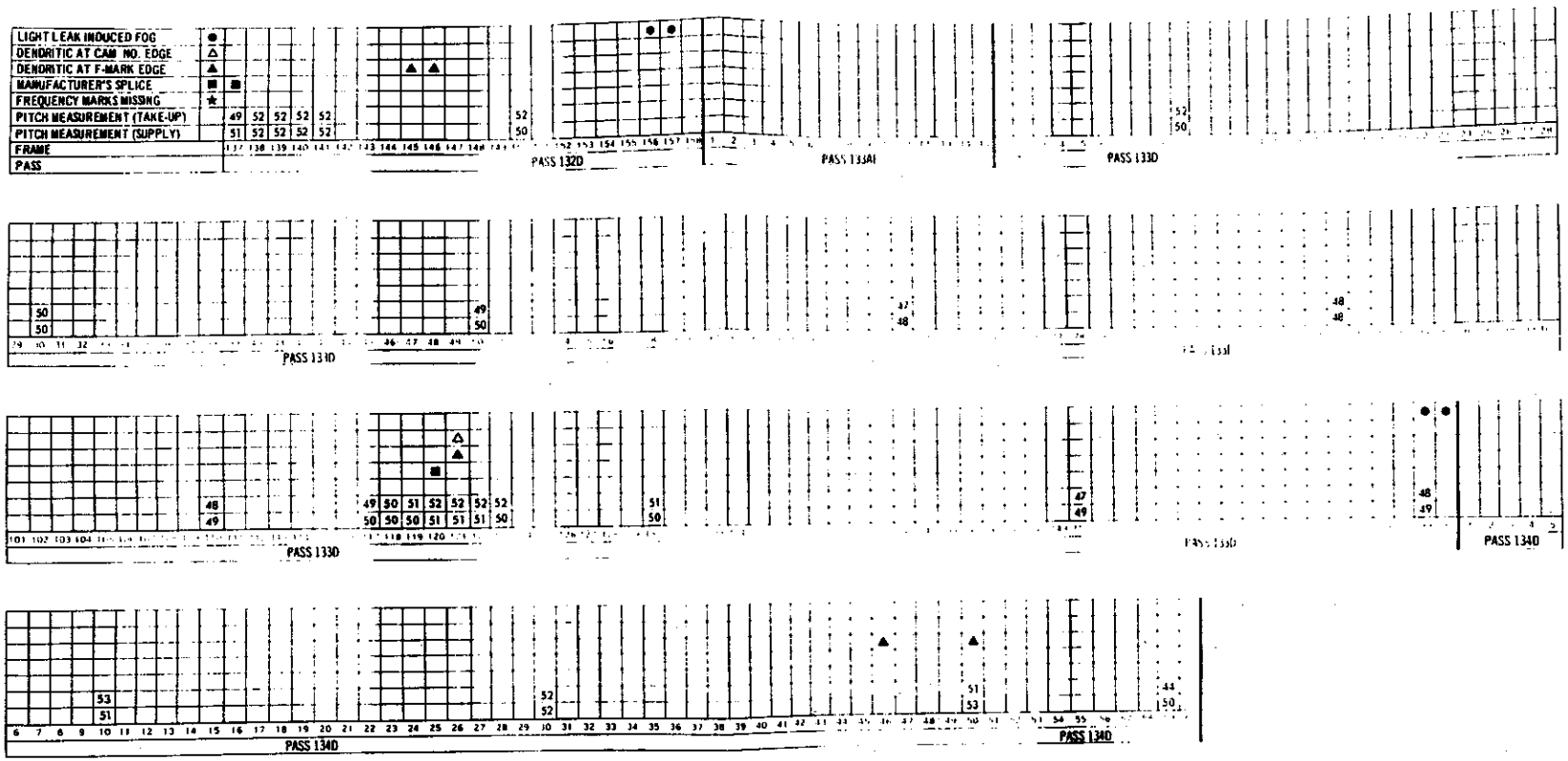

LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 117D
PASS 117D
PASS 117D
PASS 118D
PASS 118D
PASS 118D
PASS 119D
PASS 119D
CAM OFF
PASS 119D
PASS 119D
PASS 121D
CAM OFF
PASS 121D



~~TOP SECRET RUFF~~

~~NO FOREIGN DISSEM~~

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


LIGHT LEAK INDUCED FOG
DENDRITIC AT CAM NO. EDGE
DENDRITIC AT F-MARK EDGE
MANUFACTURER'S SPLICE
FREQUENCY MARKS MISSING
PITCH MEASUREMENT (TAKE-UP)
PITCH MEASUREMENT (SUPPLY)
FRAME
PASS
PASS 132D
PASS 133AI
PASS 133D
PASS 133D
PASS 133D
PASS 134D
PASS 134D
PASS 134D

APPENDIX D. DENSITY READINGS

Density readings were taken using a Macbeth QuantaLog Densitometer, Model EP 1000, with an ET 20 attachment and a 0.5 mm aperture. All values include gross fog.

1. STELLAR DENSITY READINGS MISSION 1028-1

Pass	Frame	Dmax	Dmin	Delta	Gross Fog
1D	1	0.23	0.18	0.05	0.17
	2	0.85	0.18	0.67	0.17
5D	3	0.69	0.20	0.49	0.17
	11	0.76	0.21	0.55	0.17
6D	12	0.60	0.19	0.41	0.17
	39	1.00	0.22	0.78	0.17
7D	42	0.24	0.17	0.07	0.16
	72	0.72	0.21	0.51	0.16
8D	73	0.59	0.18	0.41	0.16
	84	0.90	0.21	0.69	0.16
9AE	85	0.17	0.16	0.01	0.16
9D	86	0.92	0.21	0.71	0.16
	94	1.87	0.23	1.64	0.16
14D	95	1.12	0.23	0.89	0.16
16D	98	0.83	0.21	0.62	0.16
	99	0.95	0.24	0.71	0.16
17D	100	0.77	0.19	0.58	0.16
	101	0.80	0.20	0.60	0.16
19D	102	0.27	0.16	0.11	0.16
	112	0.92	0.18	0.74	0.16
20D	113	0.27	0.16	0.11	0.16
	129	0.80	0.19	0.61	0.16
21D	130	0.80	0.22	0.58	0.16
	141	1.01	0.25	0.76	0.16
22D	142	0.32	0.16	0.16	0.16
	175	1.30	0.27	1.03	0.16
23D	176	0.35	0.16	0.19	0.16
	189	0.93	0.20	0.73	0.16
27AE	190	0.18	0.17	0.01	0.16
27D	191	1.18	0.24	0.94	0.17
	198	0.93	0.24	0.69	0.17
29AE	199	0.18	0.17	0.01	0.17
31D	200	1.10	0.23	0.87	0.17
	202	1.04	0.24	0.80	0.17
34D	203	0.84	0.22	0.62	0.17
	217	0.77	0.17	0.60	0.17
37D	218	0.35	0.17	0.18	0.17
	240	1.12	0.21	0.91	0.17
41D	241	0.42	0.21	0.21	0.17
	254	1.22	0.21	1.01	0.17

Pass	Frame	Dmax	Dmin	Delta	Gross Fog
41D	255	0.67	0.18	0.49	0.17
	270	1.25	0.24	1.01	0.17
45D	271	1.08	0.18	0.90	0.17
	276	0.80	0.19	0.61	0.17
46D	277	1.28	0.21	1.07	0.17
	285	1.42	0.20	1.22	0.17
47D	286	1.19	0.21	0.98	0.17
	287	1.15	0.21	0.94	0.17
50D	288	0.22	0.18	0.04	0.17
	291	0.42	0.19	0.23	0.17
52D	292	0.77	0.19	0.58	0.17
	304	1.27	0.21	1.06	0.17
53D	305	0.30	0.18	0.12	0.17
	324	1.48	0.22	1.26	0.17
54D	325	0.45	0.18	0.27	0.17
	343	1.07	0.18	0.89	0.17
55D	344	0.47	0.17	0.30	0.17
	354	1.03	0.21	0.82	0.17
57D	355	0.73	0.20	0.53	0.17
	361	1.10	0.21	0.89	0.17
63D	362	1.43	0.23	1.20	0.17
	363	1.31	0.21	1.10	0.17
67D	364	0.68	0.20	0.48	0.17
	370	0.80	0.21	0.59	0.17
68D	371	0.61	0.18	0.43	0.17
	385	1.41	0.21	1.20	0.17
69D	389	0.35	0.19	0.16	0.17
	415	1.63	0.21	1.42	0.17
71D	419	0.40	0.17	0.23	0.17
	425	0.92	0.19	0.73	0.17
Averages		0.83	0.20	0.63	0.17
Ranges		0.17 - 1.63	0.18 - 0.27	0.01 - 1.64	0.16 - 0.17

STELLAR DENSITY READINGS MISSION 1028-2

Pass	Frame	Dmax	Dmin	Delta	Gross Fog
82D	1	2.25	0.30	1.95	0.22
	8	2.92	0.32	2.60	0.22
83D	9	2.80	0.37	2.43	0.25
	18	3.20	0.50	2.70	0.22
84D	19	2.78	0.26	2.52	0.19
	40	2.97	0.40	2.57	0.21
85D	41	2.75	0.33	2.42	0.21
	61	3.10	0.45	2.65	0.20
86D	62	2.42	0.20	2.22	0.18
	74	3.12	0.49	2.63	0.33
87D	75	3.06	0.44	2.62	0.27
	83	2.90	0.32	2.58	0.18
88AE	84	0.18	0.18	--	0.18
88D	85	2.75	0.28	2.47	0.21
	101	3.60	0.45	3.15	0.28
94D	102	3.07	0.40	2.67	0.21
	104	3.00	0.38	2.62	0.22
95D	105	2.90	0.32	2.58	0.23
	107	3.40	0.50	2.90	0.24
97D	108	2.30	0.27	2.03	0.21
	114	2.90	0.31	2.59	0.20
99D	115	3.07	0.30	2.77	0.20
	124	3.00	0.42	2.58	0.21
100D	125	2.95	0.30	2.65	0.20
	144	3.22	0.55	2.67	0.21
101D	145	3.00	0.29	2.71	0.20
	165	2.70	0.40	2.30	0.22
102D	166	3.12	0.47	2.65	0.20
	177	2.85	0.34	2.51	0.21
103D	178	2.78	0.23	2.55	0.20
	193	3.12	0.44	2.68	0.22
104D	194	3.20	0.41	2.79	0.21
	213	3.24	0.70	2.54	0.40
105AE	214	3.08	0.72	2.36	0.37
105AE	215	3.85	1.00	2.85	0.52
106D	216	3.25	0.55	2.70	0.21
	217	3.24	0.85	2.39	0.35
110D	218	3.10	0.60	2.50	0.28
	220	3.17	0.65	2.52	0.60
114D	221	2.70	0.22	2.48	0.20
	225	2.86	0.28	2.58	0.21

Pass	Frame	Dmax	Dmin	Delta	Gross Fog
115D	226	3.00	0.30	2.70	0.22
	239	3.12	0.38	2.74	0.21
116D	240	2.90	0.32	2.58	0.20
	266	3.20	0.34	2.86	0.20
117D	267	3.08	0.35	2.73	0.20
	288	2.85	0.30	2.55	0.20
118D	289	3.02	0.33	2.69	0.20
	301	3.12	0.43	2.69	0.21
119D	302	2.57	0.23	2.34	0.21
	315	3.10	0.36	2.74	0.22
121D	316	3.04	0.38	2.66	0.22
	327	3.12	0.39	2.73	0.22
126D	328	2.98	0.38	2.60	0.22
	329	2.97	0.37	2.60	0.23
130D	330	2.64	0.23	2.41	0.22
	337	3.02	0.29	2.73	0.21
131D	338	2.97	0.29	2.68	0.22
	356	2.86	0.27	2.59	0.21
132D	357	3.10	0.42	2.68	0.21
	378	3.10	0.50	2.60	0.21
133AE	379	0.21	0.21	--	0.21
	380	0.21	0.21	--	0.21
133D	381	3.15	0.32	2.83	0.20
	416	2.95	0.33	2.62	0.20
134D	436	3.15	0.38	2.77	0.21
	417	2.95	0.35	2.60	0.20
135D	418	3.12	0.39	2.73	0.20
	419	3.10	0.39	2.71	0.20
Averages		2.85	0.39	2.46	0.23
Range		2.25 - 3.15	0.20 - 1.00	1.95 - 3.15	0.18 - 0.60

2. INDEX DENSITY READINGS MISSION 1028-1

Pass	Frame	Limiting			Gross Fog	Terrain		
		Dmax	Dmin	Delta		Dmax	Dmin	Delta
1D	1	0.70	0.15	0.55	0.14	0.70	0.20	0.50
	2	0.72	0.16	0.56	0.14	0.72	0.24	0.48
5D	3	1.45	0.34	1.11	0.12	1.12	0.58	0.54
	11	1.59	0.48	1.11	0.13	--	--	--
6D	12	1.03	0.39	0.64	0.12	1.03	0.39	0.64
	39	1.66	0.27	1.39	0.12	1.02	0.27	0.75
7AE	40			EDITED FROM ORIGINAL NEG.				
	41			EDITED FROM ORIGINAL NEG.				
7D	42	0.46	0.14	0.32	0.13	0.46	0.20	0.20
	72	1.40	0.23	1.17	0.12	1.40	0.23	1.17
8D	73	1.04	0.53	0.51	0.12	0.84	0.53	0.31
	84	1.46	0.42	1.04	0.12	1.20	0.42	0.78
9AE	85			EDITED FROM ORIGINAL NEG.				
9D	86	1.52	0.57	0.95	0.12	1.05	0.57	0.48
	94	1.23	0.30	0.93	0.12	1.03	0.34	0.69
14D	95	1.52	0.48	1.04	0.12	--	--	--
	97			EDITED FROM ORIGINAL NEG.				
16D	98	1.61	0.25	1.36	0.12	--	--	--
	99	1.69	0.20	1.49	0.12	--	--	--
17D	100	2.02	0.26	1.76	0.12	--	--	--
	101	1.98	0.30	1.68	0.12	--	--	--
19D	102	0.58	0.15	0.43	0.13	0.58	0.18	0.40
	112	1.34	0.34	1.00	0.13	1.34	0.56	0.78
20D	113	0.48	0.14	0.34	0.12	0.48	0.23	0.25
	129	1.48	0.40	1.08	0.12	0.82	0.51	0.31
21D	130	1.13	0.34	0.79	0.12	0.72	0.34	0.38
	141	1.67	0.94	0.73	0.12	--	--	--
23D	142	0.49	0.14	0.35	0.10	0.49	0.20	0.29
	175	1.77	0.21	1.56	0.11	0.64	0.21	0.43
23I	176	0.40	0.12	0.28	0.11	0.40	0.16	0.24
	189	1.81	0.43	1.38	0.12	1.12	0.43	0.69
27AE	190			EDITED FROM ORIGINAL NEG.				
27I	191	1.37	0.27	0.90	0.11	1.37	0.70	0.67
	198	2.05	0.50	1.58	0.11	0.90	0.66	0.24
29AE	199			EDITED FROM ORIGINAL NEG.				
31D	200	1.88	0.46	1.42	0.12	1.88	0.46	1.42
	208	1.22	0.46	0.76	0.12	1.22	0.46	0.76
33D	209	1.11	0.43	0.68	0.13	0.86	0.43	0.43
	217	1.67	0.35	1.32	0.11	1.02	0.35	0.67

Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
38D	218	0.71	0.18	0.53	0.12	0.71	0.18	0.53
	240	1.74	0.22	1.52	0.13	1.74	0.22	1.52
39D	241	0.81	0.20	0.61	0.14	0.81	0.28	0.53
	254	1.42	0.69	0.63	0.06	0.90	0.52	0.38
41D	255	1.12	0.20	0.92	0.06	--	--	--
	270	1.16	0.68	0.48	0.06	0.83	0.62	0.21
45D	271	2.02	0.32	1.70	0.05	1.03	0.70	0.33
	276	0.92	0.30	0.62	0.05	0.91	0.61	0.30
46D	277	1.49	0.49	1.00	0.05	1.49	0.47	1.02
	285	1.48	0.14	1.34	0.04	0.77	0.31	0.46
47D	286	1.30	0.18	1.12	0.05	1.30	0.76	0.54
	287	1.39	0.19	1.20	0.06	1.39	0.88	0.51
50D	288	0.66	0.11	0.55	0.04	0.53	0.11	0.42
	291	0.75	0.11	0.64	0.04	0.64	0.25	0.39
52D	292	0.98	0.24	0.74	0.06	0.90	0.29	0.61
	304	1.34	0.14	1.20	0.05	0.52	0.30	0.22
53D	305	0.53	0.09	0.44	0.05	--	--	--
	324	1.99	0.23	1.76	0.04	--	--	--
54D	325	0.72	0.14	0.58	0.04	0.66	0.31	0.35
	343	1.23	0.16	1.07	0.05	1.02	0.16	0.86
55D	344	0.69	0.20	0.49	0.05	0.69	0.29	0.40
	354	1.27	0.23	1.04	0.04	0.50	0.43	0.07
57D	355	1.30	0.19	1.11	0.04	0.86	0.34	0.52
	361	1.46	0.21	1.25	0.04	1.04	0.21	0.83
63D	362	1.55	0.67	0.88	0.05	--	--	--
	363	1.75	0.72	1.03	0.04	--	--	--
67D	364	1.08	0.46	0.62	0.04	0.72	0.69	0.03
	370	1.36	0.29	1.07	0.05	--	--	--
65D	371	1.04	0.23	0.81	0.04	1.04	0.29	0.75
	388	1.83	0.44	1.39	0.04	--	--	--
69D	389	0.44	0.07	0.37	0.04	--	--	--
	415	1.78	0.11	1.67	0.04	0.35	0.18	0.17
70AE	416	--	--	--	--	--	--	--
	417	--	--	--	--	--	--	--
71D	418	0.78	0.11	0.67	0.04	0.70	0.31	0.39
	42[illegible]							

LIMITING	
Average Dmax	1.27
Average Dmin	0.30
Average Gross Fog	0.09
High Dmax	2.08
High Dmin	0.94
High Gross Fog	0.14
Low Dmax	0.40
Low Dmin	0.07
Low Gross Fog	0.04

TERRAIN	
Average Dmax	0.91
Average Dmin	0.38
High Dmax	1.88
High Dmin	0.88
Low Dmax	0.35
Low Dmin	0.16

APPENDIX E. CLOUD COVER ANALYSIS

1. Introduction

This study represents a statistical analysis of the cloud cover on the photography of Mission 1028. The basis of this study is the cloud cover data for each quarter segment of every individual frame of photography. The data is obtained by analysts specifically trained in estimating cloud cover by designated categories.

Five cloud categories have been formulated for use in this photography (Reference, Table 1). These categories allow for the wide latitude of cloud cover conditions commonly found on a frame of this photography. Note in Table 1 that a mean cloud percentage value has been calculated for each category for use in determining a combined cloud cover percentage for all operational passes of the mission.

The occurrence of each cloud category within an operational pass is expressed as a percentage of 100 and appears in Table 2. Each percentage is a ratio of the number of occurrences of a given cloud cover category to the total number of cloud observations in a photo pass. For example: if the number of category 1 occurrences in a given pass is 200 out of a total of 1000 (250 frames x 4 quarters), all categories combined, then 20 percent of the pass would be classed as category 1.

Also a cloud cover percentage per pass is included in the last column of Table 2 under "Cloud Cover % Per Pass". This value is determined by the summation of the products of category percentage in each pass and the mean cloud percentage for that category as established in Table 1. For example: if it is determined that the following percentages exist in a given pass:

20% Category 1
15% Category 2
30% Category 3
25% Category 4
10% Category 5

Then, by using the mean cloud percentage established in Table 1 the following computations are made:

$$
\begin{aligned}
0.20 \times 5.0 &= 1.00\% \\
0.15 \times 17.5 &= 2.63\% \\
0.30 \times 38.0 &= 11.40\% \\
0.25 \times 75.0 &= 18.75\% \\
0.10 \times 100.0 &= 10.00\% \\
&\overline{43.78\%}
\end{aligned}
$$

Hence, 43.8 percent of this pass is cloud covered.

CLOUD COVER CATEGORIES

CATEGORY NUMBER	PERCENT OF CLOUD COVER	DESCRIPTION	MEAN CLOUD PERCENTAGE
1	Less than 10%	Clear	5%
2	10% - 25%	Small Scattered Clouds	17.5%
3	26% - 50%	Large Scattered Clouds	38%
4	51% - 99%	Broken or Connected Clouds	75%
5	100%	Complete Overcast	100%

2. Cloud Cover Data, Missions 1028-1 and 1028-2

MISSION 1028-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
5D	48.6	10.6	10.2	30.6	0.0	31.1
6D	61.0	5.8	4.8	16.4	12.0	30.2
7D	86.0	1.5	5.1	7.4	0.0	12.1
8D	34.3	5.0	9.0	51.7	0.0	44.8
9D	100.0	0.0	0.0	0.0	0.0	5.0
17D	9.8	19.6	19.5	51.1	0.0	49.7
19D	47.0	9.7	9.6	33.7	0.0	33.0
20D	88.7	0.8	7.0	3.5	0.0	9.8
21D	51.1	12.4	9.7	16.3	10.5	31.2
22D	84.5	5.5	3.7	6.3	0.0	11.3
23D	70.1	0.7	4.8	14.0	10.3	26.3
27D	100.0	0.0	0.0	0.0	0.0	5.0
36D	70.7	6.7	6.7	15.0	0.9	19.4
38D	86.2	2.7	4.8	6.3	0.0	11.3
39D	56.0	9.4	8.4	23.8	0.4	27.4
41D	45.3	3.7	8.5	42.5	0.0	38.0
45D	87.5	8.3	4.2	0.0	0.0	7.4
50D	79.8	4.2	12.5	3.5	0.0	12.1
52D	66.9	4.9	6.1	21.3	0.8	23.3
53D	54.8	13.0	5.6	9.1	17.5	31.4
54D	75.2	5.0	6.5	13.3	0.0	17.1
55D	74.7	5.2	3.5	14.3	2.3	19.0
57D	17.1	16.7	11.3	54.9	0.0	49.2
67D	21.1	5.8	9.6	63.5	0.0	53.3
68D	67.6	1.4	1.2	12.2	17.6	30.8
69D	68.0	1.7	3.2	4.6	22.5	30.8
71D	21.9	10.2	10.9	44.7	12.3	52.9
81D	0.0	0.0	0.0	0.0	100.0	100.0
	66.4*	5.4*	5.9*	16.8*	5.5*	24.6**

*Average percentage by category for mission.
**Overall mission cloud cover percentage.

MISSION 1028-2

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
82D	69.9	7.3	7.6	15.2	0.0	19.1
83D	65.4	0.6	1.6	32.4	0.0	28.3
84D	52.1	6.7	11.1	29.5	0.6	30.7
85D	73.9	13.9	9.5	2.7	0.0	11.8
86D	30.3	6.6	10.7	52.4	0.0	46.0
87D	37.8	9.4	20.8	26.4	5.6	36.8
88D	33.4	4.0	13.0	45.4	4.2	45.6
97D	61.9	23.0	10.2	4.9	0.0	14.7
99D	91.2	0.6	3.8	4.4	0.0	9.4
100D	69.9	4.1	3.4	21.6	1.1	22.8
101D	50.6	5.4	10.6	32.3	1.1	32.8
102D	72.9	0.5	0.8	11.2	14.6	27.0
103D	29.2	10.1	14.1	50.6	0.0	46.4
104D	100.0	0.0	0.0	0.0	0.0	5.0
105D	89.8	2.4	3.5	4.3	0.0	9.5
114D	98.8	0.6	0.6	0.0	0.0	5.3
115D	82.1	3.0	3.8	11.1	0.0	14.4
116D	55.7	5.5	9.4	28.1	1.3	29.7
117D	50.0	2.9	7.8	13.6	25.7	41.9
118D	26.3	8.5	9.0	22.5	33.7	56.8
119D	33.2	7.7	20.1	39.0	0.0	39.9
120D	90.4	6.5	2.3	0.8	0.0	7.1
130D	97.6	1.2	1.2	0.0	0.0	5.6
131D	76.4	3.2	8.7	11.7	0.0	16.5
132D	29.3	9.0	7.9	38.6	15.2	50.2
133D	37.3	5.8	20.1	32.9	3.9	39.1
134D	13.0	6.4	7.6	73.0	0.0	59.4
135D	0.0	0.0	0.0	35.0	65.0	91.3
	55.8*	5.7*	8.8*	24.6*	4.9*	30.5**

*Average percentage by category for mission.
**Overall mission cloud cover percentage.

APPENDIX F. MISSION COVERAGE STATISTICS

1. Summary of Plottable Photographic Coverage, Mission 1028-1

Mission 1028-1

Country	Forward Camera		Aft Camera		Totals	
	Lin nm	Sq nm	Lin nm	Sq nm	Lin nm	Sq nm
USSR	11,521	1,698,722	12,230	1,804,376	23,751	3,503,098
China	6,008	870,122	6,196	890,952	12,204	1,761,074
Mongolia	743	109,054	654	95,484	1,397	204,538
Australia	917	161,284	694	135,136	1,611	296,420
Sudan	287	42,194	350	51,428	637	93,622
North Vietnam	341	48,034	267	38,982	608	87,016
North Korea	290	24,646	252	18,542	542	43,188
Poland	271	39,566	271	41,192	542	80,758
Burma	258	37,668	258	37,668	516	75,336
India	238	35,478	231	33,726	474	69,204
East Germany	236	35,872	236	35,872	472	71,744
Czechoslovakia	229	33,998	182	27,664	411	61,662
Mexico	217	30,948	174	24,908	391	55,856
Kashmir	181	26,426	154	22,484	335	48,910
Ethiopia	160	22,720	134	19,028	294	41,748
Somalia	145	24,940	145	24,940	290	49,880
South Korea	205	7,738	83	3,358	288	11,096
Tuamatu Archipelago	112	3,784	174	6,020	286	9,804
Egypt	154	17,466	131	16,756	285	34,222
Alaska US	124	21,080	124	21,080	248	42,160
Hungary	135	19,710	135	20,520	270	40,230
Mauritania	97	16,684	145	24,940	242	41,624
Guinea	145	24,940	97	16,684	242	41,624
West Germany	124	14,288	142	21,584	236	35,872
Saint Paul	100	14,400	100	14,400	200	28,800
[illegible] Arabia	42	5,544	148	11,076	190	21,584
[illegible]	198	24,840	72	10,800	180	27,000
Iran	80	11,680	80	11,680	160	23,360
Nepal	117	17,082	34	4,964	151	22,046
Yugoslavia	102	14,892	54	8,208	156	23,100
Afghanistan	131	19,126	19	2,774	150	21,900
[illegible] African Republic	72	10,800	72	10,800	144	21,600
British Honduras	67	7,776	67	7,776	134	15,552

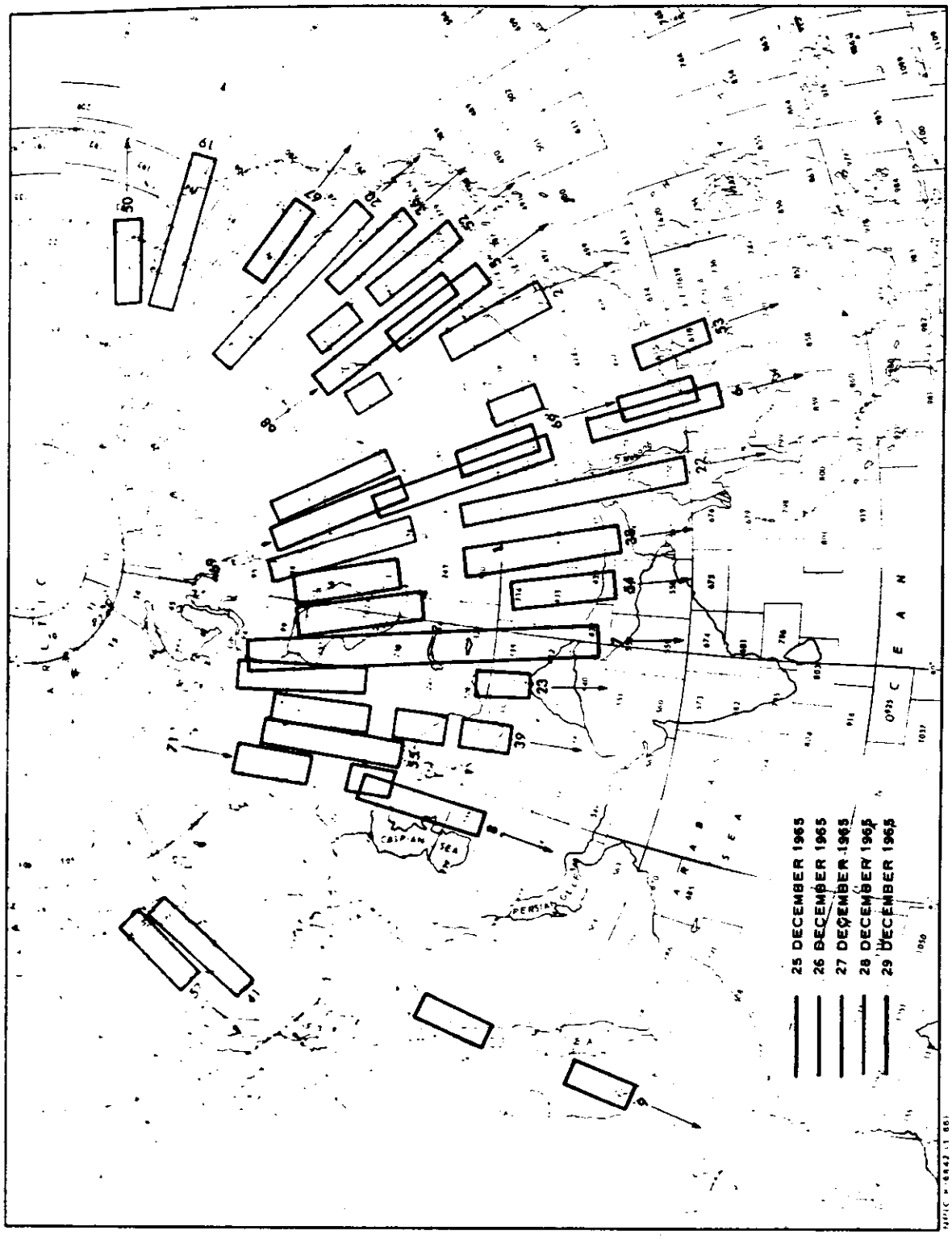
Mission 1028-1

Country	Forward Camera		Aft Camera		Totals	
	Lin nm	Sq nm	Lin nm	Sq nm	Lin nm	Sq nm
Thailand	70	10,220	62	9,052	132	19,272
El Salvador	67	7,776	34	4,896	101	12,672
Israel	31	4,402	66	1,846	97	6,248
Portuguese Guinea	24	4,128	73	12,556	97	16,684
Pakistan	49	7,154	25	3,650	74	10,804
Denmark	24	760	47	7,144	71	7,904
Honduras	34	4,896	34	4,896	68	9,792
Sweden			68	1,064	68	1,064
Jordan	31	4,402	33	4,686	64	9,088
Austria	38	5,692	14	2,128	52	7,820
Gambia	24	4,128	24	4,128	48	8,256
Bhutan	42	6,132			42	6,132
Rumania	20	2,920			20	2,920
TOTAL	24,436	3,552,436	24,535	3,571,848	48,971	7,124,284
Continental US	781	73,662	819	89,744	1,600	169,406
GRAND TOTAL	25,217	3,626,098	25,354	3,661,592	50,571	7,293,690

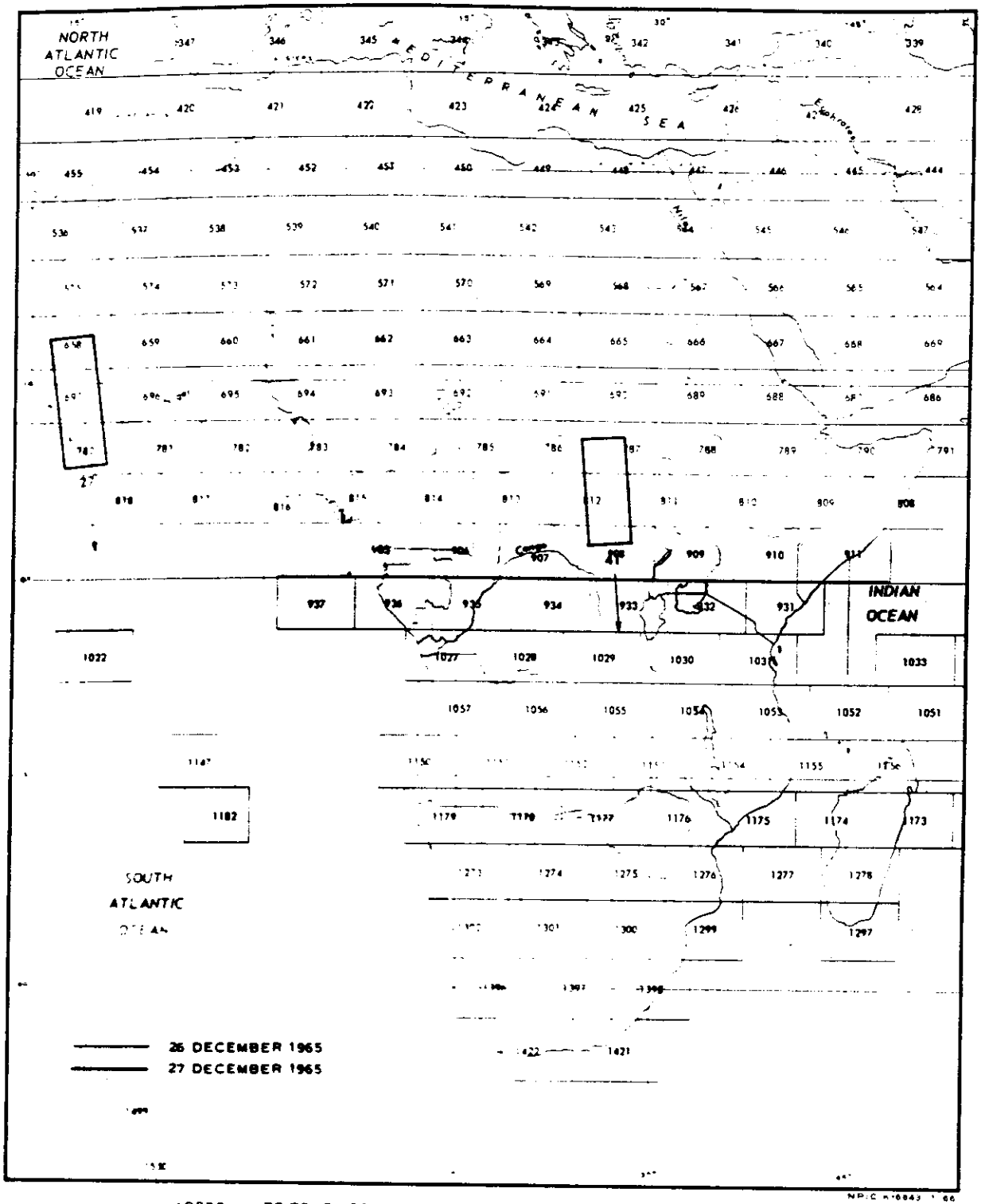
2. Summary of Plottable Photographic Coverage, Mission 1028-2

Mission 1028-2

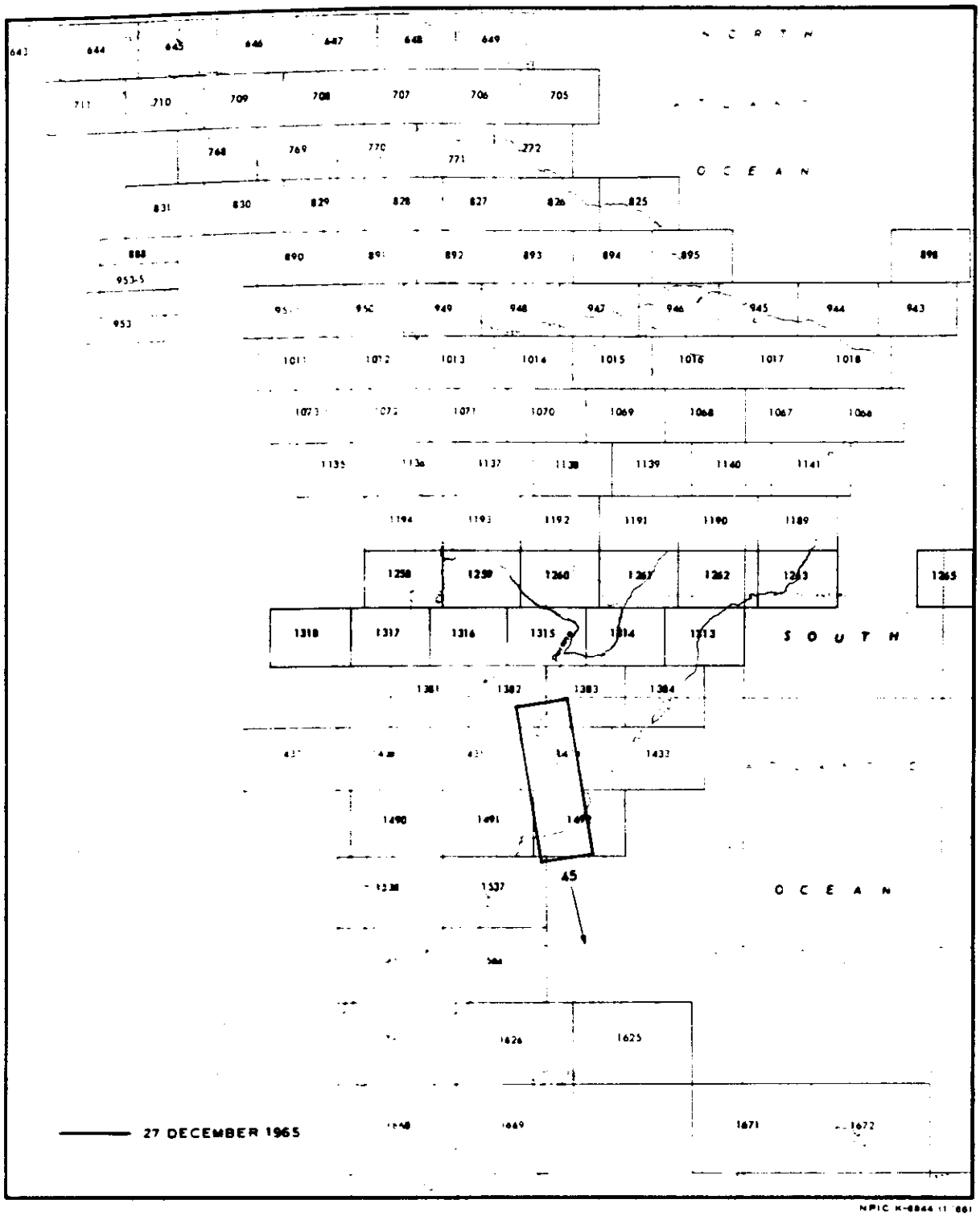
Country	Forward Camera		Aft Camera		Totals	
	Lin nm	Sq nm	Lin nm	Sq nm	Lin nm	Sq nm
USSR	8,807	1,286,072	9,215	1,342,770	18,022	2,628,842
China	7,901	1,094,270	8,166	1,190,882	16,067	2,285,152
Indonesia	421	49,716	406	52,698	827	102,414
Mali	331	47,214	351	50,170	682	97,384
Libya	303	43,026	379	53,818	682	96,844
India	350	43,564	295	45,068	645	88,632
Mongolia	288	42,426	311	45,196	599	87,622
Ghana	285	41,610	258	37,668	543	79,278
Rumania	283	43,016	259	39,368	542	82,384
Australia	298	45,560	236	32,130	534	77,690
North Vietnam	262	29,820	271	30,814	533	60,634
Nigeria	240	35,040	273	39,858	513	74,898
Iran	242	26,910	240	18,054	482	44,964
Egypt	227	32,234	227	32,234	454	64,468
Burma	249	36,354	172	25,112	421	61,466
Pakistan	205	29,110	211	29,962	416	59,072
Sudan	227	32,234	152	21,584	379	53,818
Iraq	185	26,640	185	26,640	370	53,280
Malaysia	154	19,738	148	16,756	302	36,494
Poland	**139**	**21,128**	**148**	**22,496**	**287**	**43,624**
North Korea	**162**	**20,216**	**121**	**13,832**	**283**	**34,048**
Algeria	**160**	**22,720**	**115**	**16,330**	**275**	**39,050**
Niger	**160**	**23,360**	**109**	**15,914**	**269**	**39,274**
Syria	**148**	**21,312**	**111**	**15,984**	**259**	**37,296**
Sweden	70	2,128	148	4,560	218	6,688
Bulgaria	94	11,400	86	10,488	180	21,888
Turkey	71	7,600	102	12,320	173	19,920
Nepal	129	18,834	36	5,256	165	24,090
Hungary	81	11,688	82	11,972	162	23,652
United Arab Rep	119	16,464	37	5,328	156	11,792
Finland	39	5,928	90	13,680	129	19,608
Mexico	71	10,082	47	6,674	118	16,756
Afghanistan	45	6,390	68	9,656	113	16,046
Belgium	65	9,434	8	1,568	73	11,002
Japan	70	2,128			70	2,128
Upper Volta			64	9,344	64	9,344
Greece	24		22	3,344	46	6,992
Italy	2	304			28	4,088
TOTAL	23,434	3,212,880	23,149	3,309,528	46,081	6,522,622
Miscellaneous	47	6,458	499	69,318	974	130,908
GRAND TOTAL	23,481	3,219,338	23,648	3,378,846	47,055	6,653,530



APPROXIMATE TRACK OF MISSION 1028-1, 25-29 DECEMBER 1965 OVER USSR, FAR AND MIDDLE EAST.

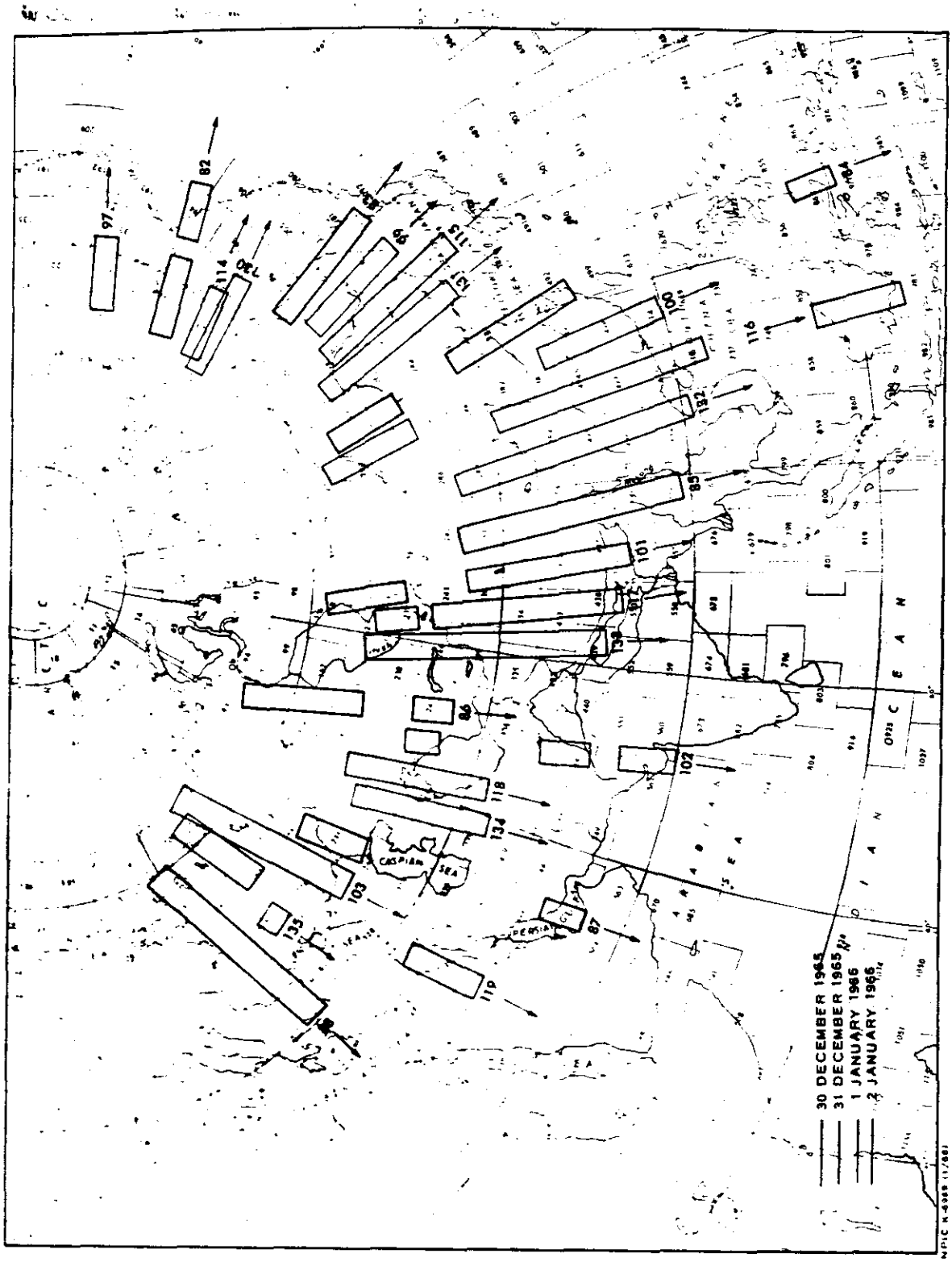


APPROXIMATE TRACK OF MISSION 1026-1, 25-29 DECEMBER 1965 OVER AFRICA.

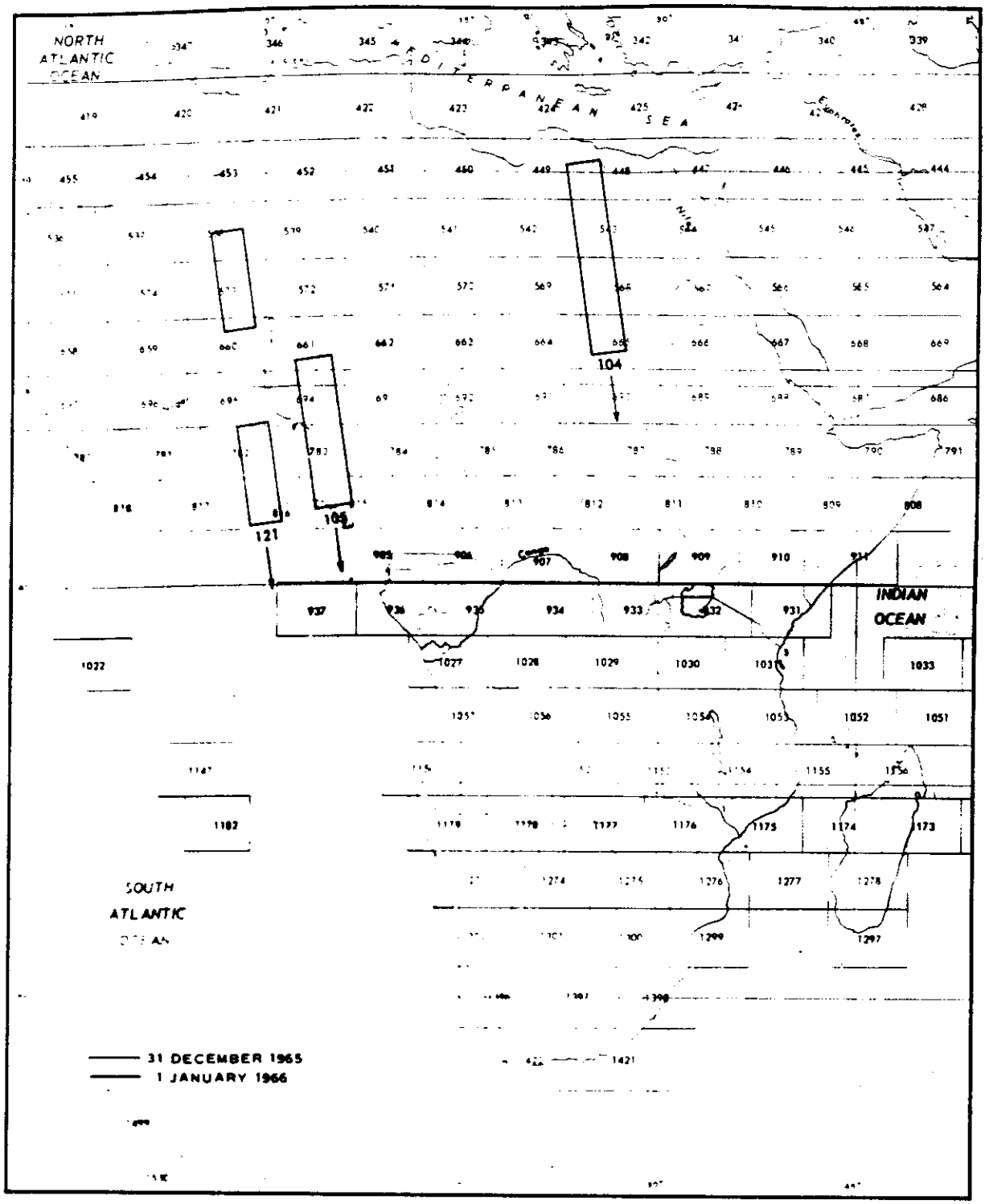


APPROXIMATE TRACK OF MISSION 1028-1, 25-29 DECEMBER 1965 OVER SOUTH AMERICA.

APPROXIMATE TRACK OF MISSION 1028-1, 25-29 DECEMBER 1965 OVER TUAMOTU ARCHIPELAGO.



APPROXIMATE TRACK OF MISSION 1028-2, 30 DECEMBER 1965 - 2 JANUARY 1966 OVER USSR, FAR AND MIDDLE EAST.



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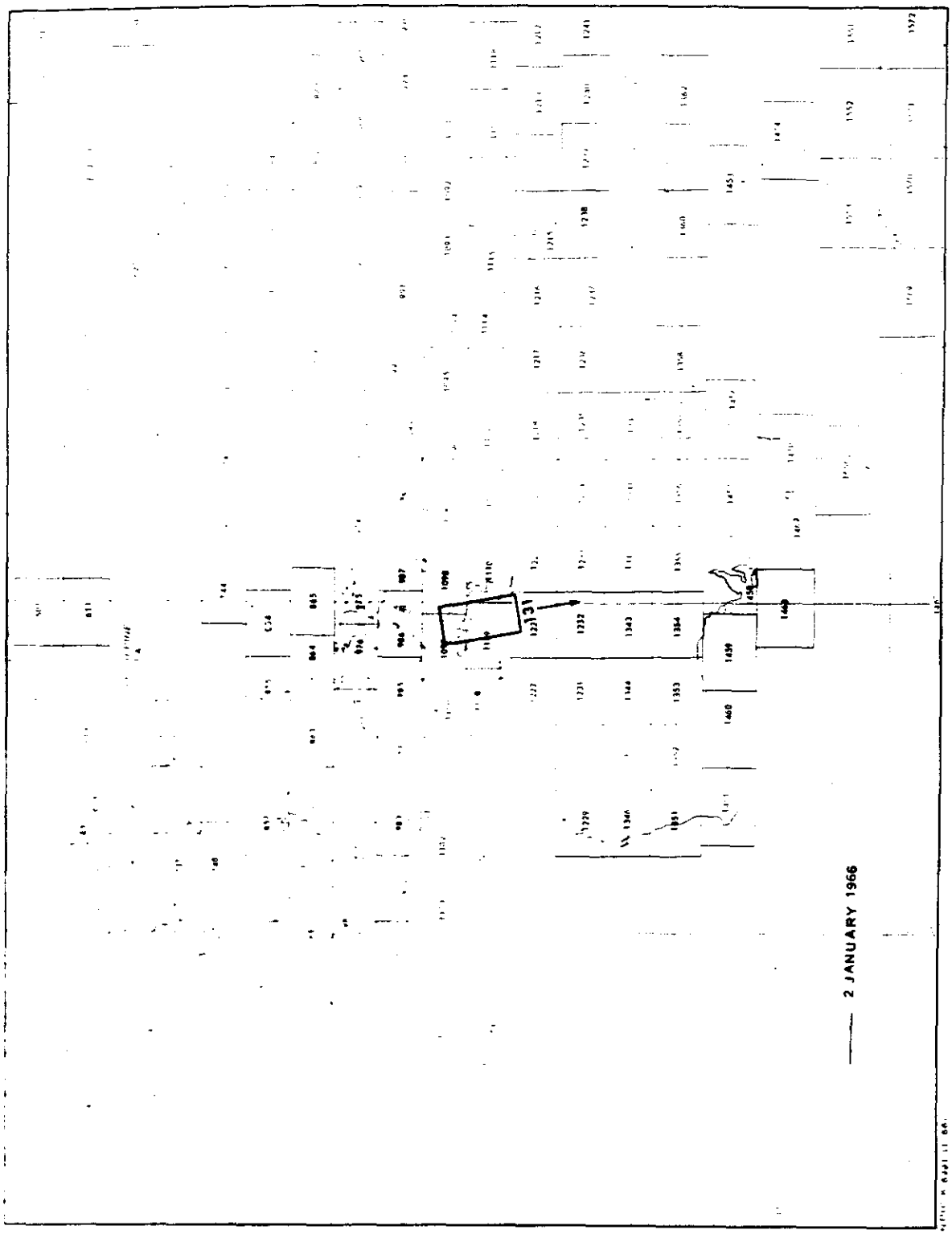

APPROXIMATE TRACK OF MISSION 1028-2, 30 DECEMBER 1965 - 2 JANUARY 1966 OVER AUSTRALIA