



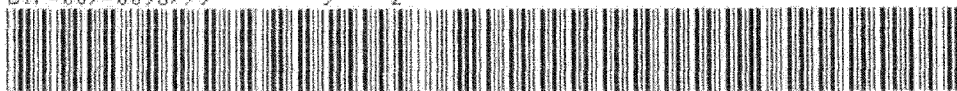
This document consists of 20 pages

S³ PRESENTATION

*Refile
Pro Abe (4/16)
Metric Pan*

BIF-007-0058/75

3 2



25 JANUARY 1975

WARNING NOTICE - SENSITIVE INTELLIGENCE
SOURCES AND METHODS INVOLVED.

NATIONAL SECURITY INFORMATION
UNAUTHORIZED DISCLOSURE
SUBJECT TO CRIMINAL SANCTIONS

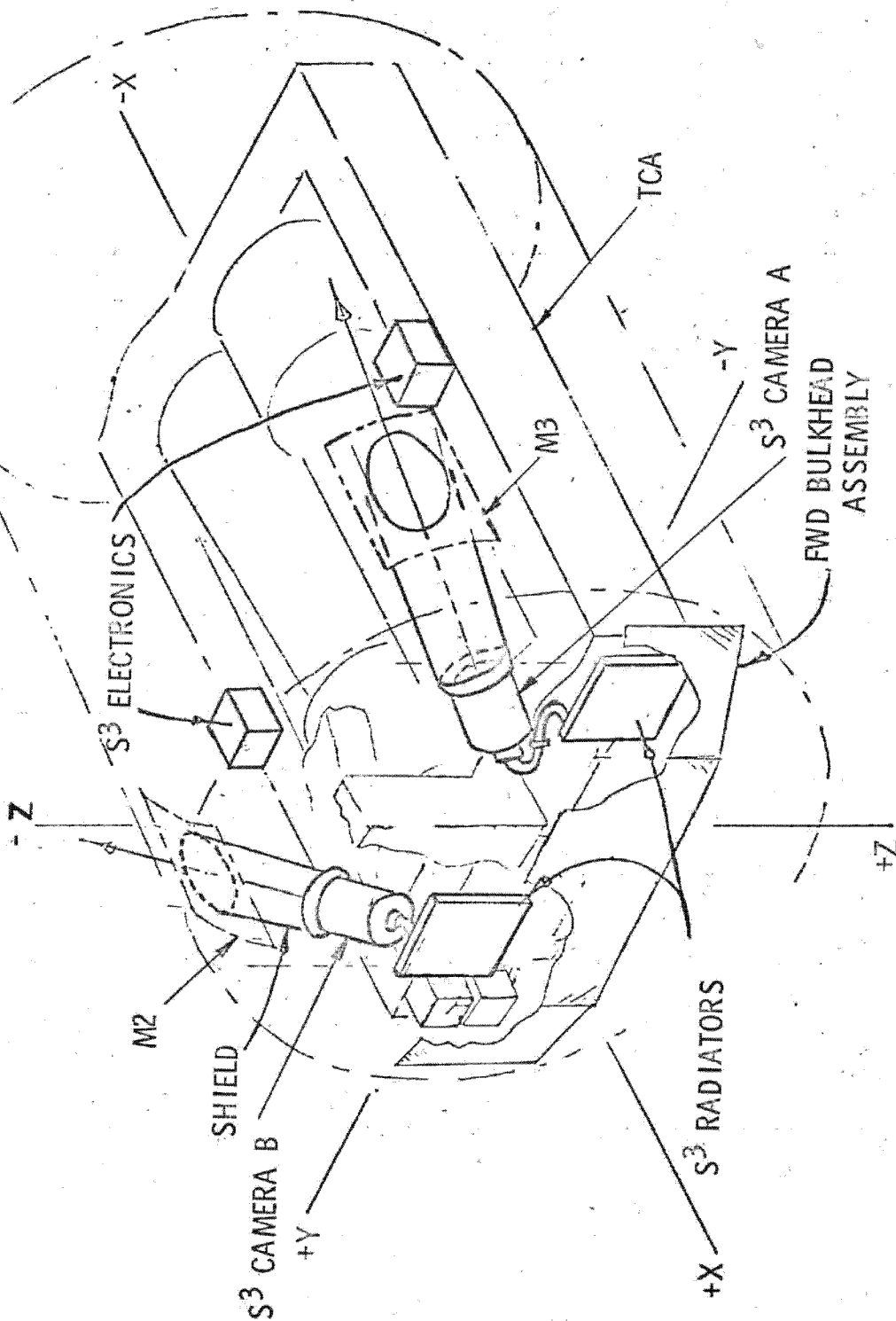
CLASSIFIED BY BYEMAN 1
EXEMPT FROM GENERAL DECLASSIFICATION
SCHEDULE OF EXECUTIVE ORDER 11652
EXEMPTION CATEGORY 5B (1), (2) (3), OR (4)
AUTOMATICALLY DECLASSIFIED ON: _____
IMPOSSIBLE TO DETERMINE

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

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S³ INSTALLATION

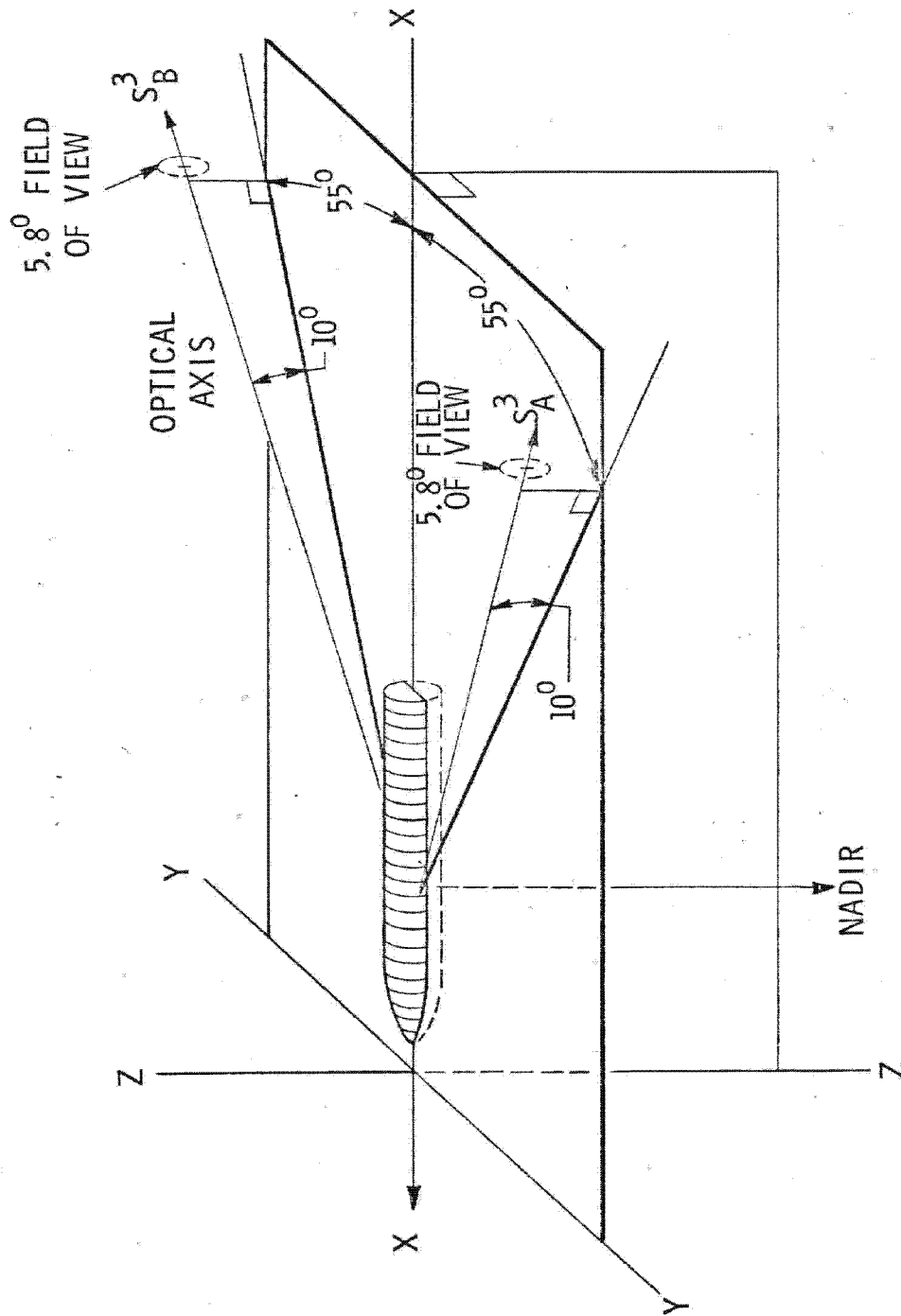


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S³ OPTICAL AXES

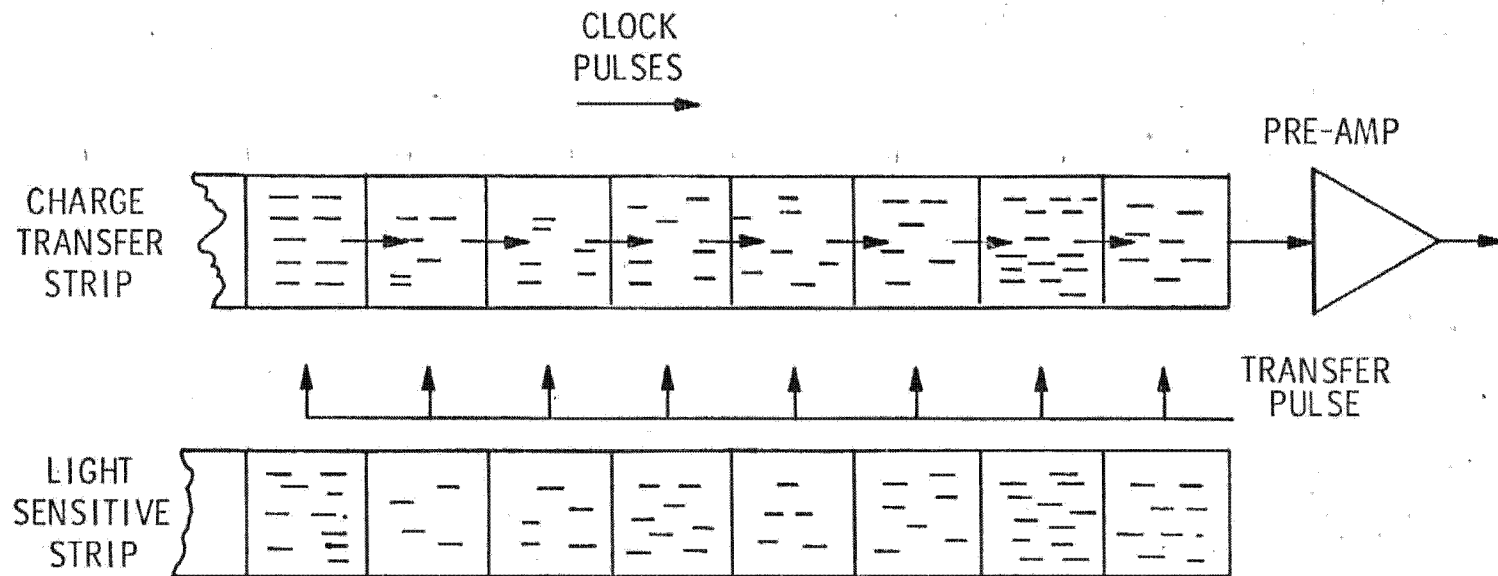


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28851

CHARGE COUPLED DEVICE (CCD)



CHARACTERISTICS

ELEMENT SIZE $13 \times 17 \mu m$ (1x1728)
 SENSITIVITY 1.2×10^{-14} W/ ELEMENT @ S/N 10:1
 IN 0.5 TO 1μ BAND FOR
 INTEGRATION TIME OF 50 MSEC

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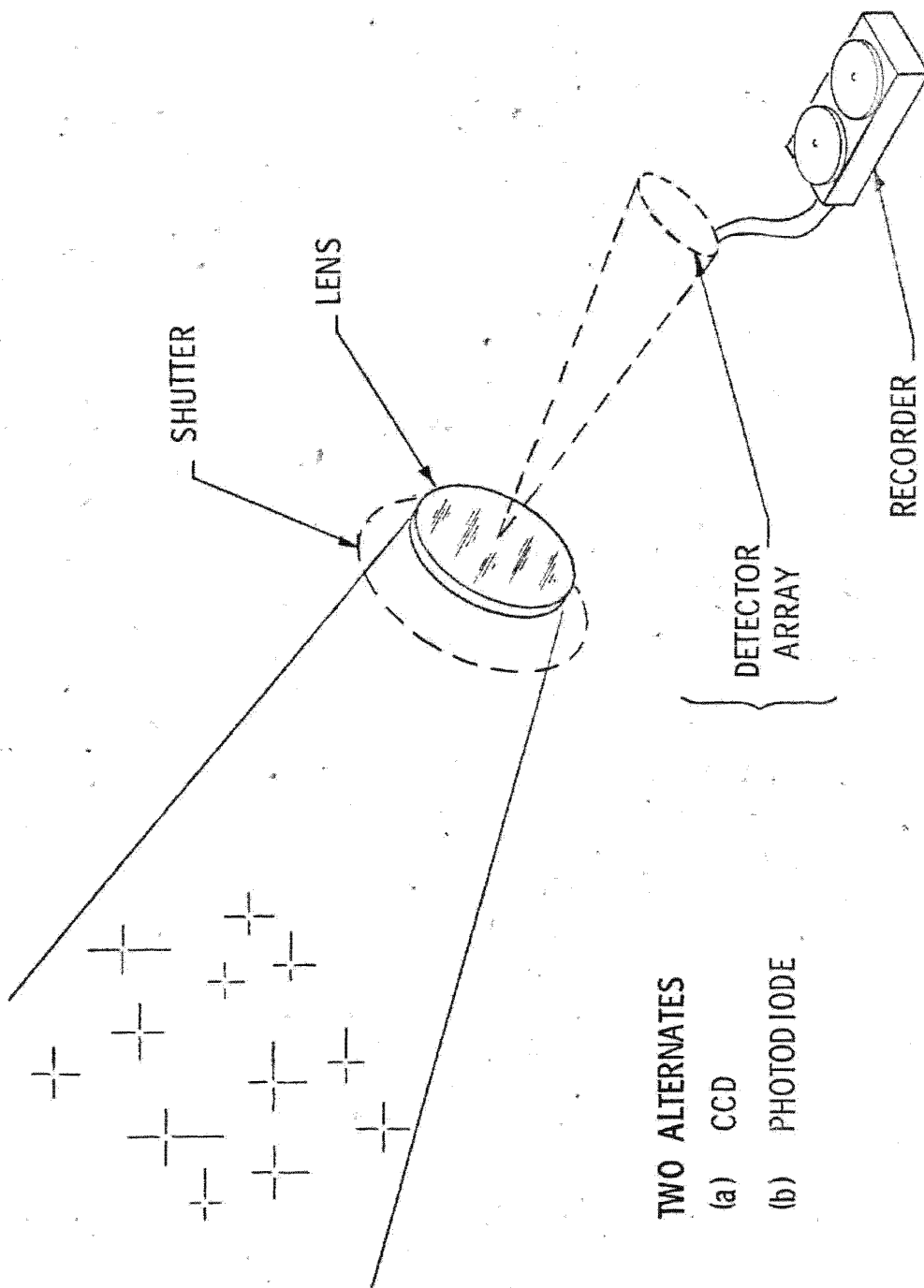
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S³ ATTITUDE SYSTEM



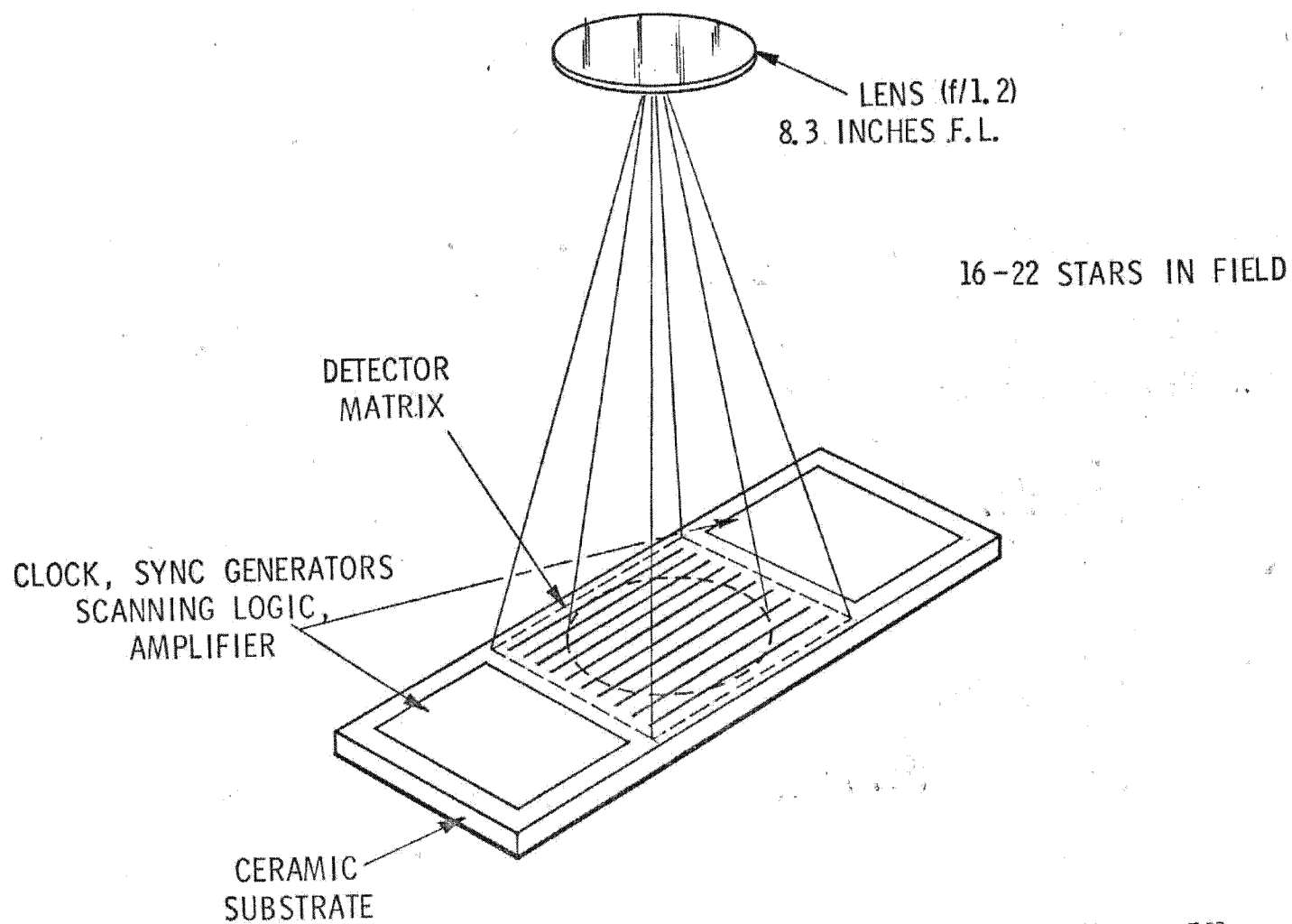
TWO ALTERNATES

- (a) CCD
- (b) PHOTODIODE

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SOLID STATE CAMERA SCHEMATIC



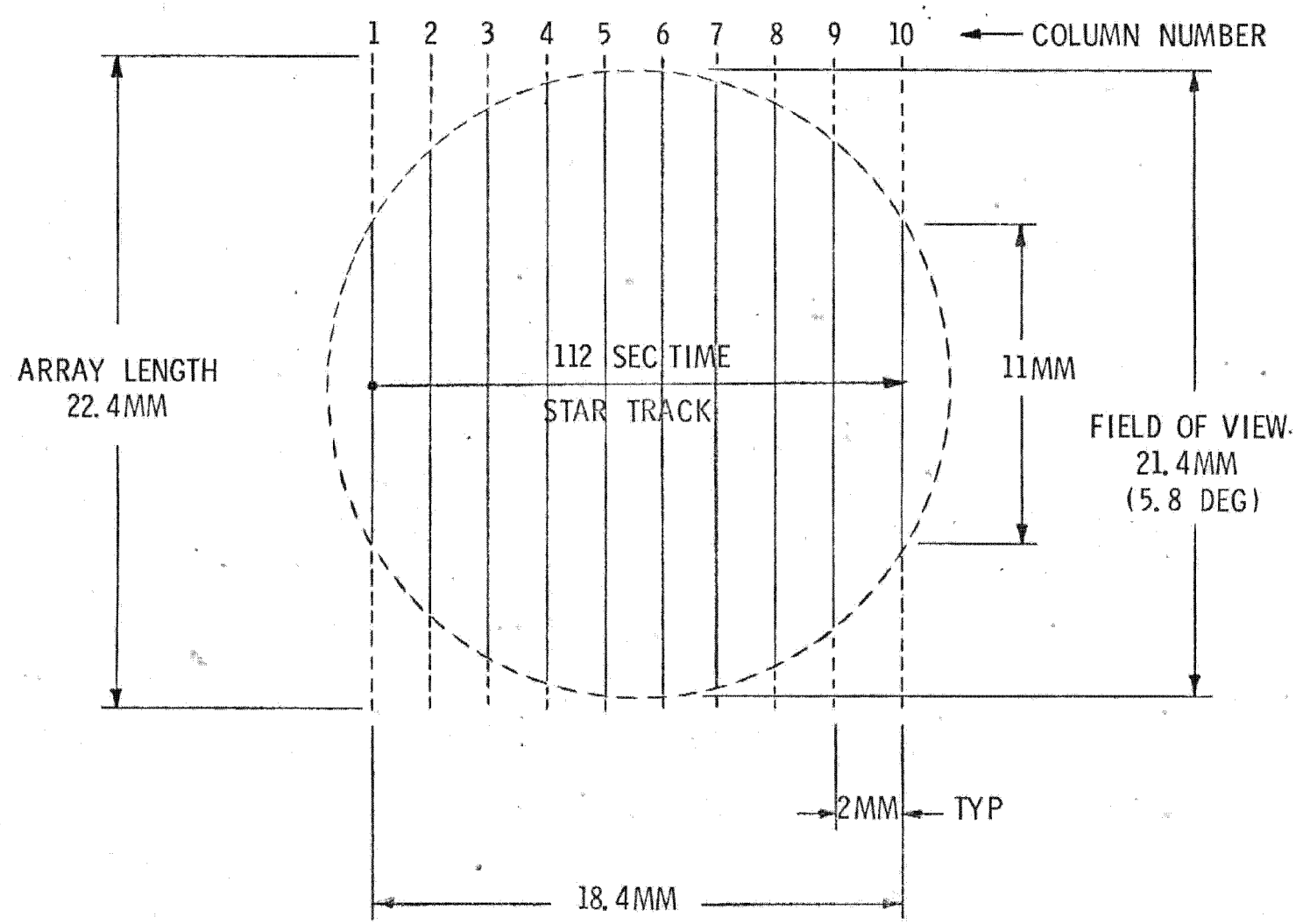
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FOCAL PLANE ARRAY



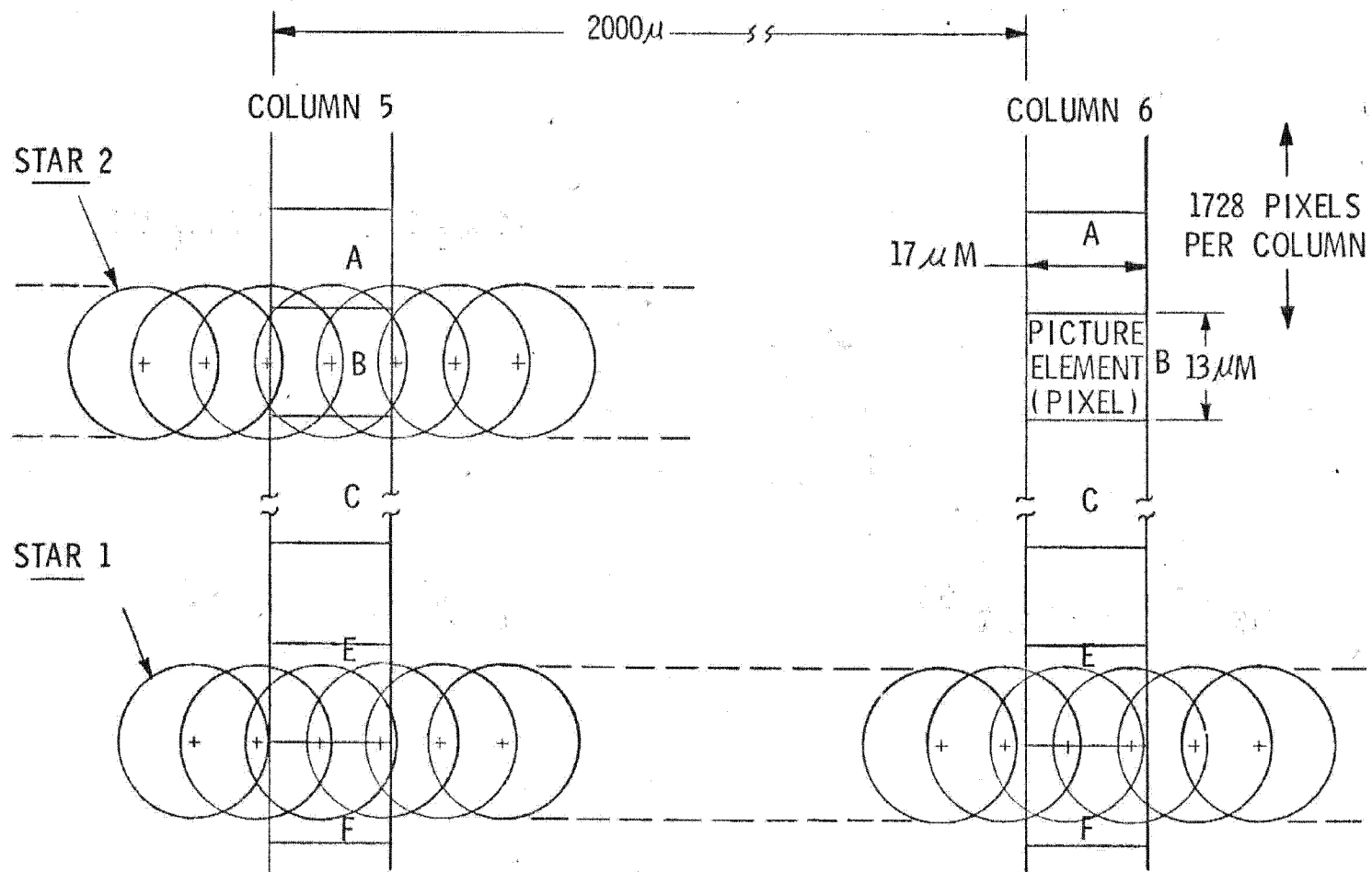
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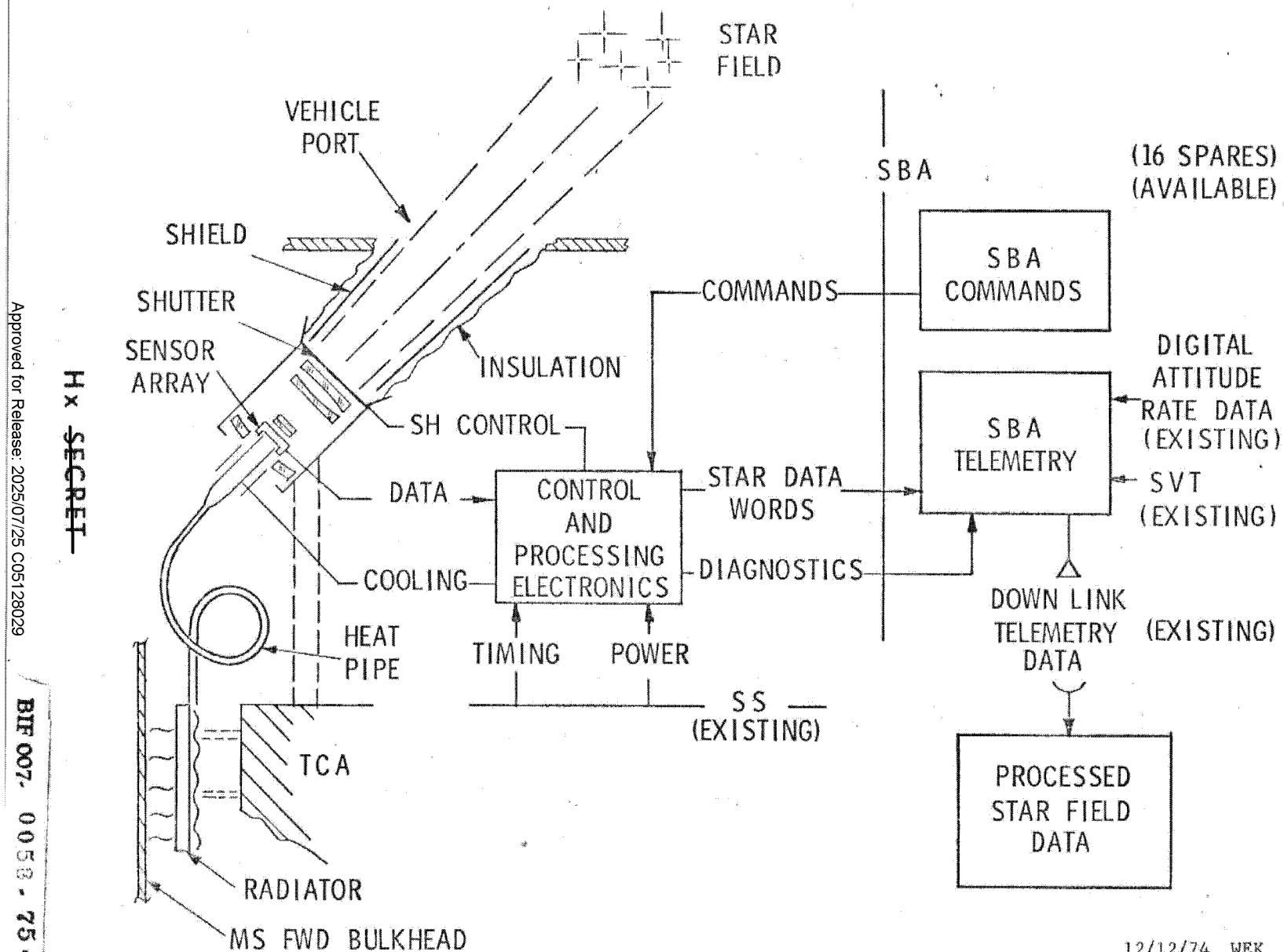
STAR TRACK IN FOCAL PLANE



STAR MOTION IS $8\mu/50$ MS DUE TO VEHICLE PITCH RATE 0.00116 RAD/SEC.

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S³ ATTITUDE CAMERA INTERFACES



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S³/PAN CAMERA POINTING ERROR BUDGET

<u>ERROR SOURCE</u>	<u>POINTING ERROR - ARC SECONDS (1σ)</u>		
	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
STELLAR SENSOR POINTING ERROR	1.7	2.1	1.3
INTERLOCK CALIBRATION ERROR	2.2	2.6	1.8
ENVIRONMENTAL STABILITY	<u>3.0</u>	<u>3.8</u>	<u>3.9</u>
RSS	4.1	5.0	4.5

ARC SECONDS

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STELLAR SENSOR POINTING ERROR

ERROR SOURCE	POINTING ERROR - ARC SEC.* (1σ) (S ³ CAMERA COORDINATES)	
	Y _A	Z _A
CENTROIDING ERROR	5.0	5.0
DETECTOR LOCATION ERROR	2.0	2.0
RESIDUAL OPTICAL DISTORTION	2.0	2.0
FOCAL PLANE RESIDUAL THERMAL ERROR	1.0	1.0
ATTITUDE RATE ERROR	3.7	3.7
FOCAL LENGTH CALIBRATION	<u>1.0</u>	<u>1.0</u>
POINTING ERROR STAR RSS	7.0	7.0
FOR 15 DETECTIONS/FIELD		
$e = \frac{e_0}{\sqrt{N}}$	1.8	1.8
POINTING ERROR TRANSFERRED TO TCA COORDINATE SYSTEM USING 2 - S ³ SENSORS AT 55° ANGLE TO VEHICLE AXIS		
ROLL	1.7	
PITCH	2.1	
YAW	1.3	
	ARC SEC. - 1σ	

* FOR 210 MM F.L. 1 MICRON = 1 ARC SEC.

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INTERLOCK CALIBRATION ERROR
STELLAR/PAN CAMERAS

<u>ERROR SOURCE</u>	<u>POINTING ERROR - ARC SECONDS (1σ)</u>		
	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
STELLAR SENSOR POINTING ERROR	1.7	2.1	1.3
PAN PHOTO MENSURATION ERROR	0.8	0.9	0.7
ANGULAR VIBRATION OF TCA	1.0	1.0	1.0
SVT CORRELATION	-	0.3	-
RSS	2.2	2.6	1.8

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POINTING ERRORS DUE TO ENVIRONMENT EFFECTS

<u>ERROR SOURCE</u>	<u>POINTING ERROR - ARC SECOND (1σ)</u>		
	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
ALIGNMENT CHANGE OF PAN CAMERA LOS TO S ³ SENSOR MTS. DUE TO THERMAL ENVIRONMENT			
SIDE TO SIDE GRADIENT IN TCA (ΔT = 2 ⁰ F)	-	-	3.0
FRONT TO REAR GRADIENT IN TCA (ΔT = 3 ⁰ F)	-	0.9	0.8
TOP TO BOTTOM GRADIENT IN TCA (ΔT = 0.2 ⁰ F)	1.5	1.5	-
DEFORMATION IN TCA DUE TO VEHICLE DISTORTION	1.5	2.0	-
PRIMARY MIRROR TILT (ΔT = 0.5 ⁰ F, METERING RODS)	0.4	0.4	-
FOLD FLAT TILT (ΔT = 2.0 ⁰ F in TEMP. LEVEL	-	0.7	0.5
RSS ₁	2.2	2.8	3.2

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POINTING ERRORS DUE TO ENVIRONMENT EFFECTS (Continued)

<u>ERROR SOURCE</u>	<u>POINTING ERROR - ARC SECOND (1σ)</u>		
	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
ALIGNMENT CHANGE OF S ³ Sensor LOS TO SENSOR MOUNT ON TCA			
THERMAL GRADIENTS IN SENSOR HOUSING (ΔT = 0.25 F)	1.6	1.6	1.6
THERMAL SHIFT OF FOCAL PLANE DETECTOR ARRAY	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>
RSS ₂	1.9	1.9	1.9
ANGULAR VIBRATION OF TCA RELATIVE TO THE ARM	1.0	1.0	1.0
FOLD FLAT STABILITY WITH OB VELOCITY VARIATION	-	<u>1.5</u>	<u>1.0</u>
RSS ₃	1.0	1.8	1.4
RSS _{tot}	3.0	3.8	3.9

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SS IMPACTS

A. TCA - FRAME

- RELOCATE TWO SERVO BOXES
- MOUNTING FOR TWO S³ CAMERAS
- MOUNTING FOR TWO S³ CAMERA ELECTRONIC BOXES
- MOUNTING FOR TWO THERMAL COOLING RADIATORS

B. ELECTRONIC BOXES

- NO CHANGES

C. CABLES

- SOME BRANCHLINE REROUTING ON TCA
- SEVERAL NEW BRANCHLINES ADDED TO EXISTING CABLES
- S³ CABLES TO FOLLOW EXISTING ROUTINGS TO MINIMIZE NEW TIE POINTS

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SBA IMPACTS

A. COMMANDS

- 12 NSPC'S FROM EACH DECODER

B. TELEMETRY

- 4 SERIAL DIGITAL DATA WORDS
- 20 DISCRETE DIAGNOSTICS
- 22 TEMPERATURE MEASUREMENTS
- DATA RATE - 3000 BITS/SECOND IN MODES B AND C

C. POWER

- AVERAGE FOR TWO S³ CAMERA SYSTEMS 90 WATTS

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SBA IMPACTS (Continued)

D. STRUCTURAL/MECHANICAL

- M2/M3 ACCESS DOORS MODIFIED
 - STRUCTURALLY EQUIVALENT
 - WILL HAVE S³ VIEWPORT
 - WILL HAVE ATTACHMENT FOR S³ VIEWPORT SHIELD
 - MINIMUM MS MODIFICATION
 - AGE DOOR FOR SV INTEGRATION TESTS
- WEIGHT INCREASE PER VEHICLE 150 POUNDS

E. THERMAL

- MODIFICATION TO DOOR INSULATION
- ADDITION TO INTERNAL BLANKETS AROUND S³ VIEWPORT SHIELD
- RADIATOR MAXIMUM RADIANT ENERGY - 5 WATTS (FOR COOLING FP TO 0°C IN 93°F AMBIENT)

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PHOTODETECTOR INVESTIGATION

- WORKING WITH FAIRCHILD AND RETICON
- FAIRCHILD IS CCD AND RETICON IS A PHOTODIODE ARRAY SUPPLIER
- FAIRCHILD PERFORMED SPECIAL SENSITIVITY TEST
- SSC HAS TESTED FIVE SAMPLES OF FAIRCHILD'S 256 ARRAY (CCD-110). RESULTS ARE GOOD.
- PREPARING TO TEST FAIRCHILD'S 1728 ARRAY (ILID-1728)
- RETICON TO DO SPECIAL SENSITIVITY TESTS OF THEIR 1024 LINEAR ARRAY AND RL 1800F ARRAY
- OPTION IS OPEN TO INCLUDE RETICON ARRAY IN DESIGN VERIFICATION EXPERIMENT

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CONCLUSIONS

- S³ IS FEASIBLE
 - NO RISK TO BASIC SYSTEM
 - OPTO/MECH NOT CRITICAL
 - INTERFACE WITH SPACECRAFT IS REASONABLE
 - COMMANDS AND TELEMETRY AVAILABLE
 - DETECTOR IS THE MAJOR CONCERN
- GO AHEAD IS NEEDED

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S³ SCHEDULE

