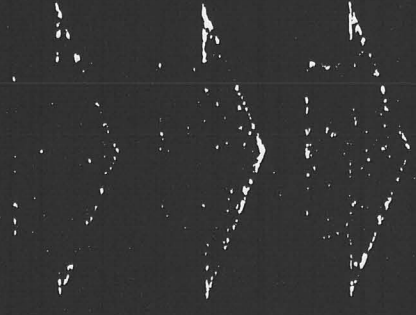
DISCOVERER RESEARCH

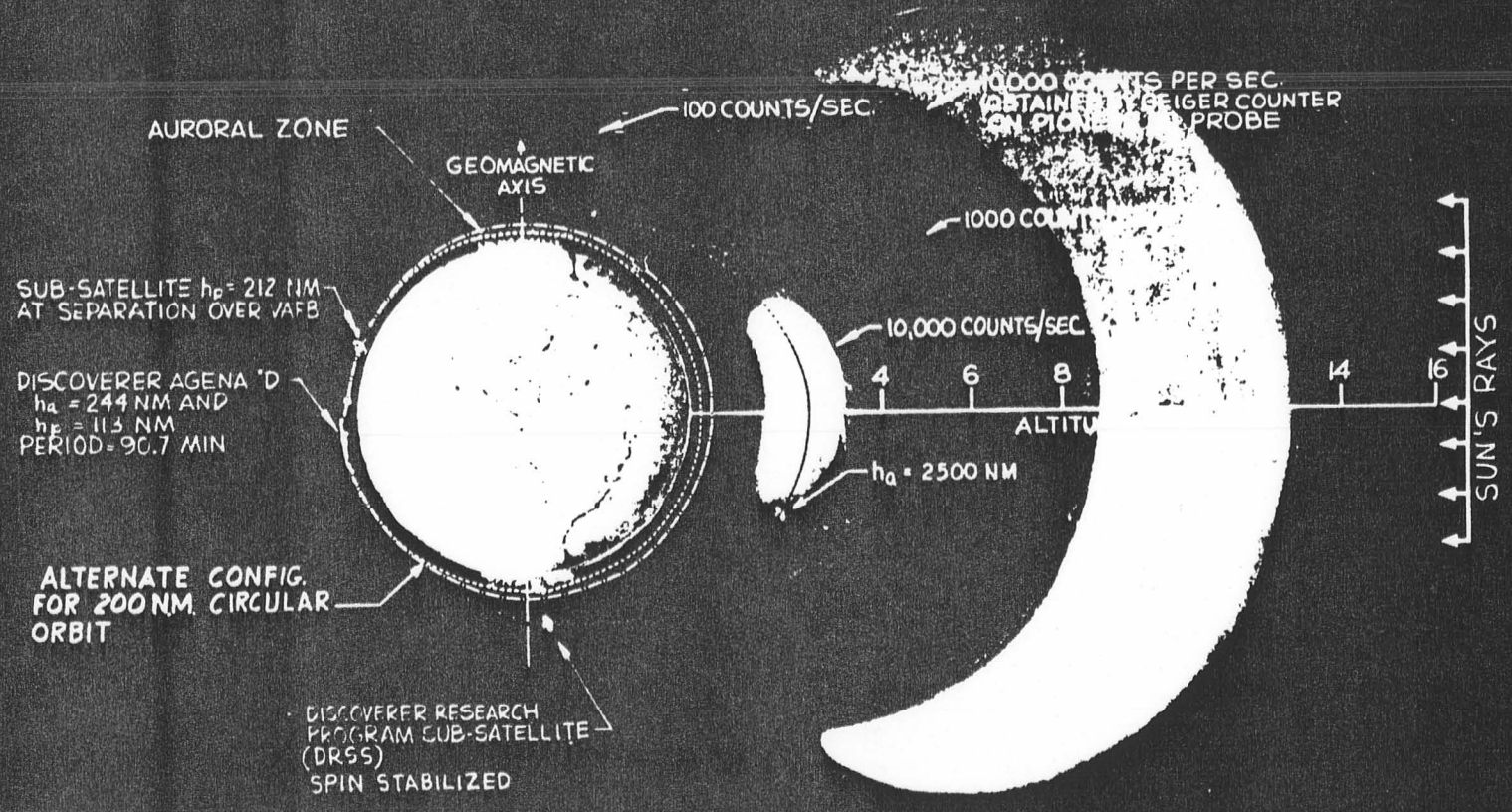


SUBSATELLITE

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE FLT CHARACTERISTICS



P-61/6(1) "ISC" 1/30/62

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE

OBJECTIVE

- TO PROVIDE A VEHICLE
  1. CAPABLE OF INCREASED ORBIT RANGES
  2. WITH EXTENDED ACTIVE LIFE (2 TO 6 MONTHS)
  3. TO CARRY A WIDE VARIETY OF RESEARCH EXPERIMENTS

DESIGN DESCRIPTION

- SUBSATELLITE CONFIGURED TO FIT ON AGENA D AFT RACK.
- THE SUBSATELLITE PROPULSION UNIT MAY BE VARIED TO ACHIEVE DIFFERENT ORBITS.
- BASIC STRUCTURE AND ELECTRONIC EQUIPMENT SUITABLE TO ACCOMMODATE RESEARCH EXPERIMENTS.
- ELECTRIC POWER MAY BE BATTERIES AND/OR SOLAR CELLS.

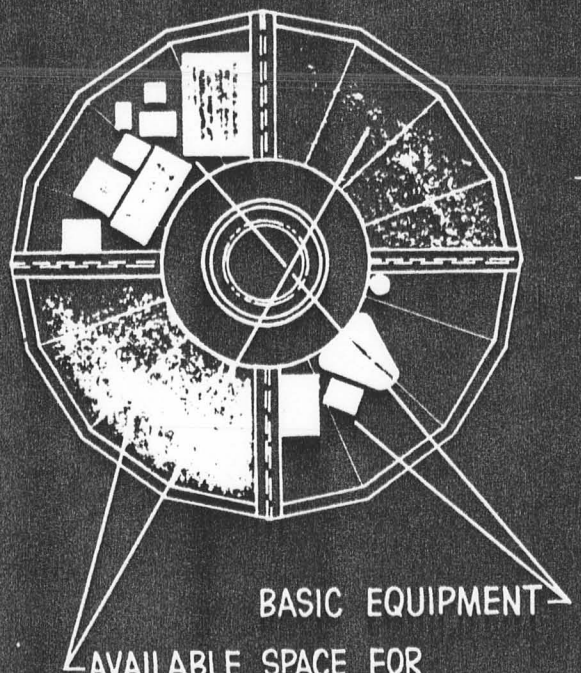
P-6946 "DISC" 4-30-62
CY-5-1

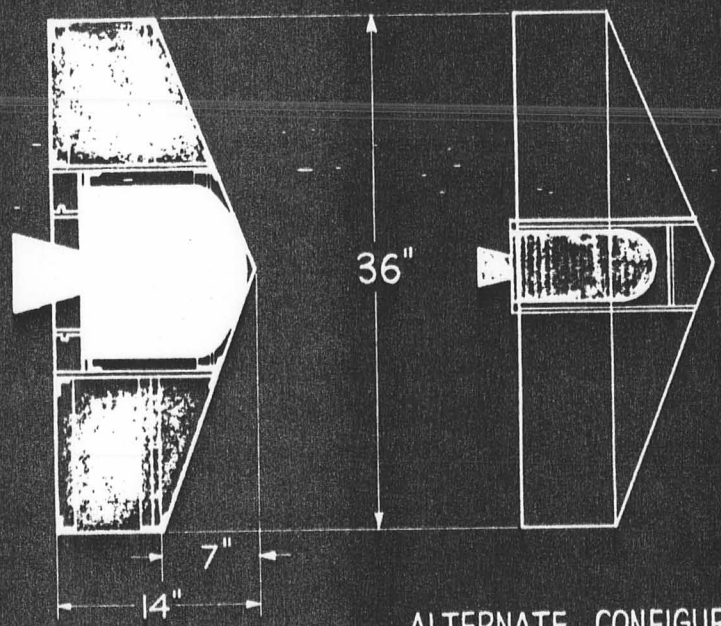
UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE DETAILS





- ● TE 316 ROCKET
- ○ 2000 NM APOGEE (FOR 225 LBS.)
- ○ PAYLOAD SENSOR VOLUME = 3000 CU. IN.

ALTERNATE CONFIGURATION

- ● TE 344 ROCKET
- ○ 200 NM CIRCULARIZED ORBIT
- ○ PAYLOAD SENSOR VOLUME = 3750 CU. IN.

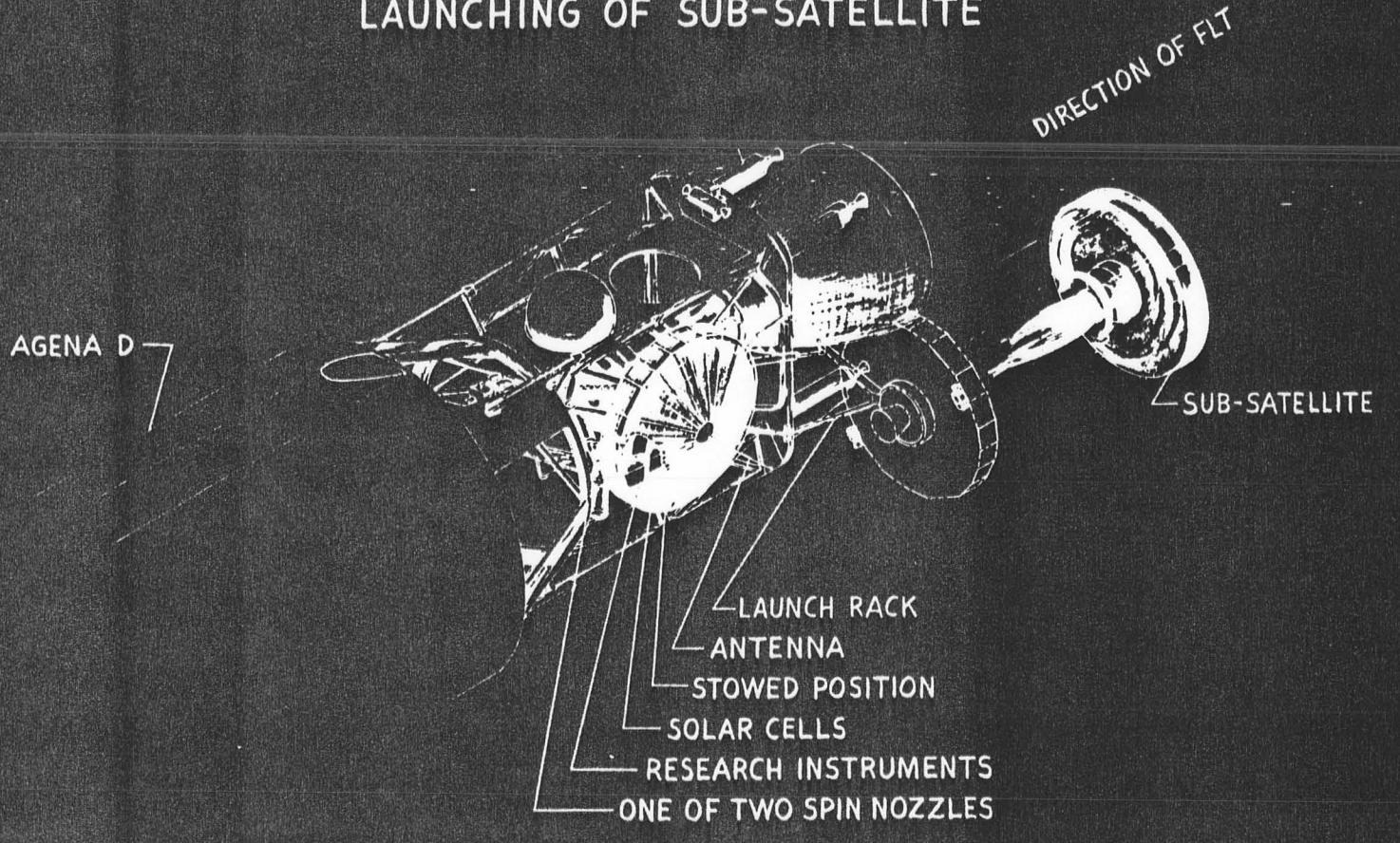
P-6947 "DISC" 4-30-62 CY-5-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

LAUNCHING OF SUB-SATELLITE



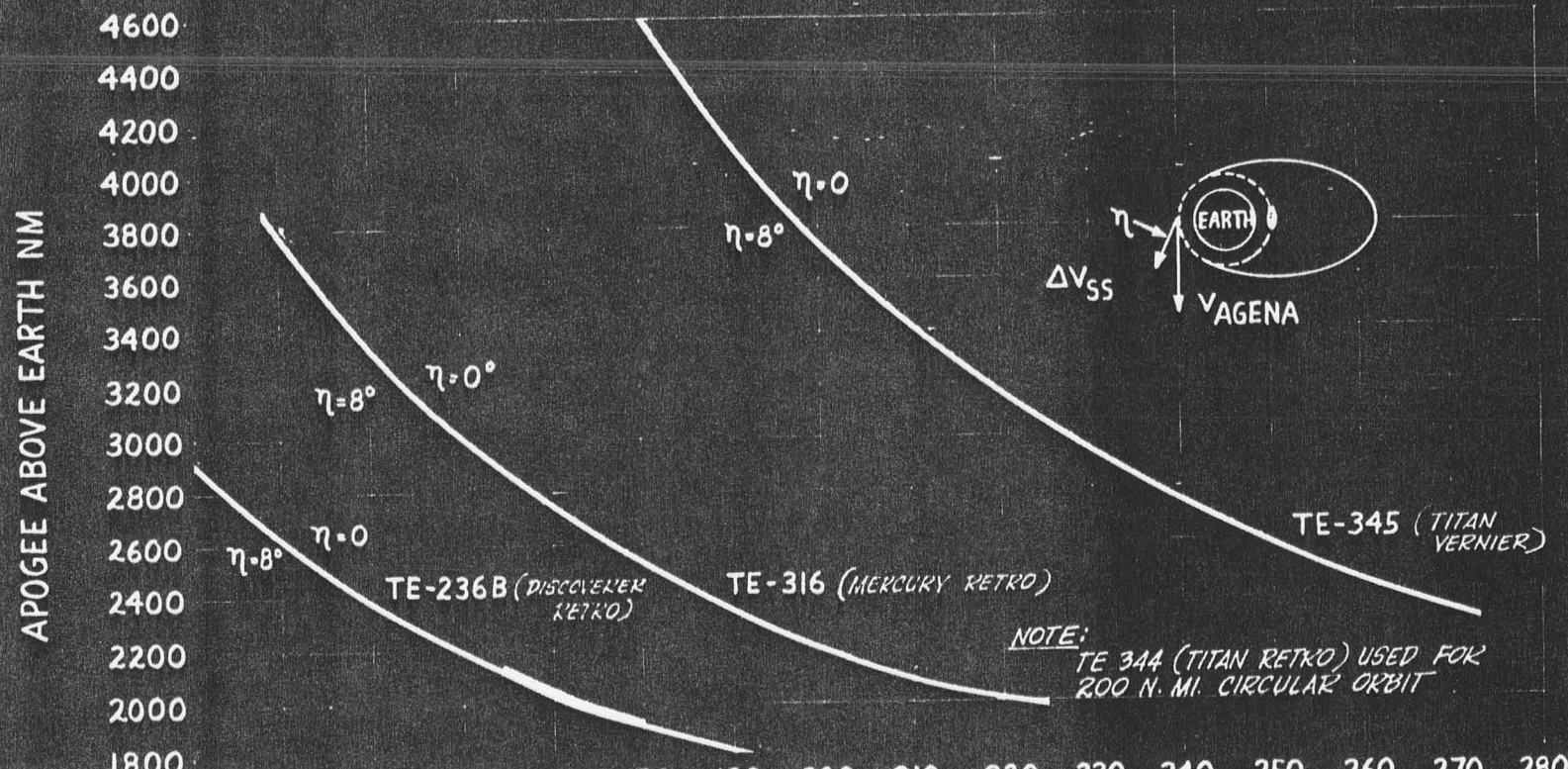
T-0595(1) DISC 4-30-62
CK-5-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE WT. VS APOGEE



P-6645(1) "DISC" 4-30-62
CV-S-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE EQUIPMENT & WEIGHT SUMMARY

DESCRIPTION		WEIGHT, LBS				
		TE 344	TE 236B	TE-316	TE-345	
BASIC VEHICLE						
STRUCTURE	12.0					
SPIN SYSTEM	3.0					
BATTERY & CHARGER	19.0					
SOLAR CELL ASSEMBLY	5.0					
ANTENNA & COUPLER	4.5					
TIMER	1.2					
COMMAND & SQUIB PROGRAMMERS	3.0					
COMMUTATORS (2 REQUIRED)	3.2					
TRANSMITTERS (2)	2.0					
• MOD AMPLIFIER	.1					
• VCO (4 REQUIRED)	1.2					
• TRAY ASSEMBLY	.4					
• DC-DC CONVERTER	1.0					
COMMAND RECEIVER / DECODER	4.0					
TAPE RECORDERS (2)	13.0					
ACCELEROMETER	.6					
CONNECTORS & WIRING	7.0					
SUBTOTAL	78.2					
BOOST ROCKET (INCL. HEATER BLANKET)		8.0	60.0	68.8	86.0	
EXPERIMENT PAYLOAD		127.8	75.8	67.0	49.8	
SUBSATELLITE						214.0
AGENA EQUIPMENT & STRUCTURE (LAUNCHER, UMBILICAL, BAROMETRIC SWITCH)						11.0
TOTAL SYSTEM WEIGHT						225.0

P-6944 DISC 4-30-62
CY-S-1

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

2500 N.M. ~ SUBSATELLITE POWER SUMMARY

DESCRIPTION	POWER (WATT)	DUTY CYCLE* (PERCENT)	W-HR ORBIT*
COMMAND RECEIVER	0.35	100	0.81
TAPE RECORDER	4.0	100	9.20
T/M TRANSMITTER DC-DC CONVERTER MOD AMPLIFIER	18.0	10	4.14
VCO (4 UNITS) @ 30 MA	3.36	10	.77
COMMUTATOR (2 UNITS) @ 1.6 W	3.6	100	8.26
TIME REFERENCE GENERATOR	0.5	100	1.15
COMMAND & SQUIB PROGRAMMER	1.5	10	0.35
RESEARCH INST.	13.0	100	29.90
TIMER	1.5	10	.35
TOTAL	≈ 46		≈ 55

* OPERATIONAL DUTY CYCLE BASED ON 2.3 HRS. PER ORBIT, AVERAGE POWER OF 15 WATTS FOR SOLAR CELLS, AND A 1.75 AMP-HR NI-CAD BATTERY IS AS FOLLOWS:
2.3 HRS/ORBIT - ON
FOUR ORBITS - OFF

* ORBIT - 137 MIN. = 2.3 HRS

2-66460(1) "DISC" 4-30-62
CV-5-1

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUB-SATELLITE COMMAND LINK CALCULATION

	GAINS	LOSSES
TRANSMISSION SYSTEM		
R.F. POWER 1000 WATTS	+30 db	
ANTENNA GAIN	+10 db	
RANGE 5000 N.M. (SLANT RANGE)		-154 db
RECEIVING SYSTEM		
RECEIVER SENSITIVITY	+132 db	
ANTENNA GAIN		-3 db
FADE LOSS		-3 db
POLARIZATION LOSS		-3 db
TOTALS	+172 db	-163 db

P-66 39(1) DISC 4-30-62
CY-5-1

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUB SATELLITE TELEMETRY LINK CALCULATION

	GAINS	LOSSES
TRANSMISSION SYSTEM:		
R.F. POWER 2 WATTS	+3 db	
ANTENNA GAIN		-3 db
RANGE 5000 NM (SLANT RANGE)		-157 db
RECEIVING SYSTEM:		
RECEIVER SENSITIVITY	+139 db	
ANTENNA GAIN TLM-18	+28 db	
FADE LOSS		-3 db
POLARIZATION LOSS		-3 db
TOTALS	+170 db	-166 db

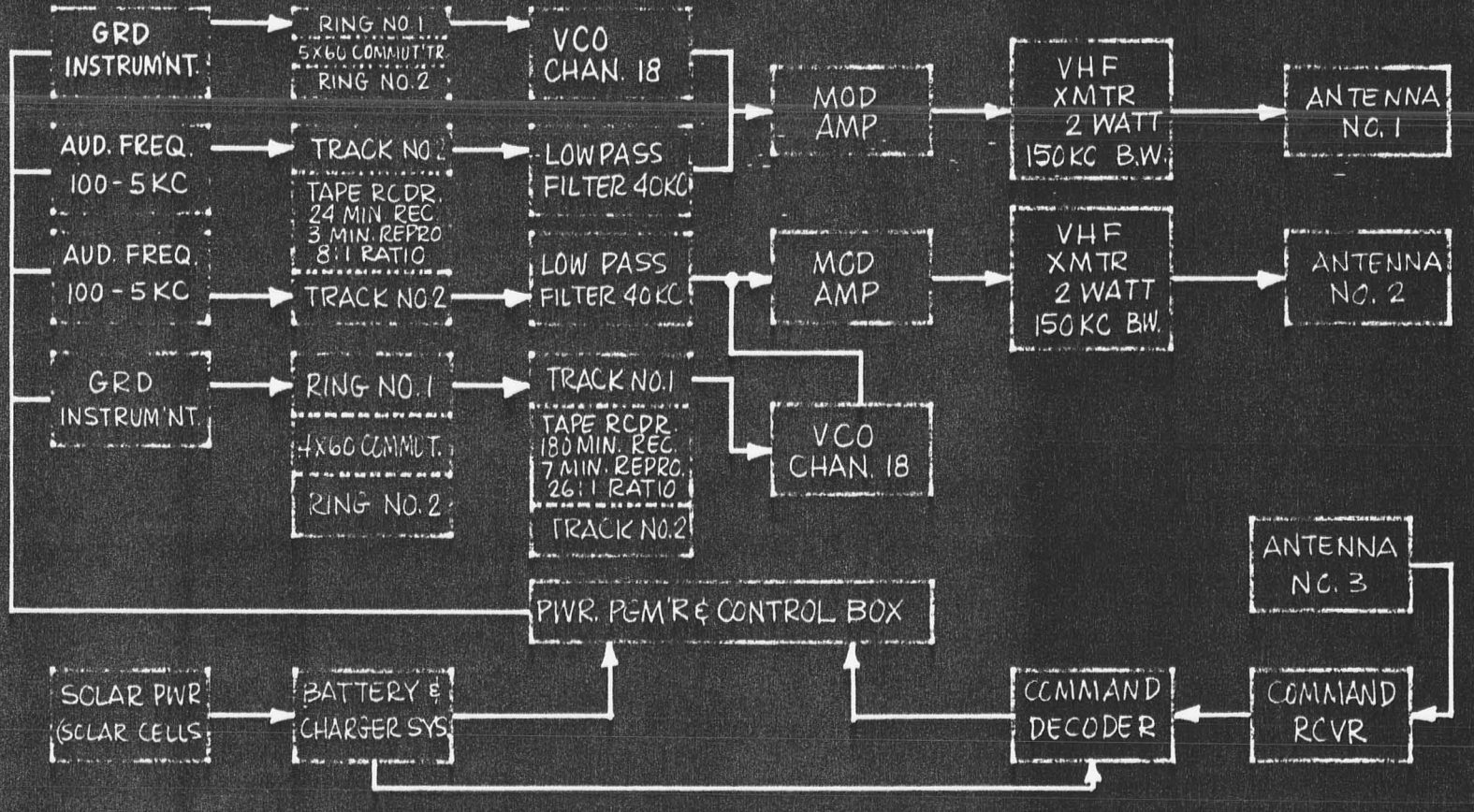
+4

P-6638(1) "DISC" 4·30·62
CV-3-1

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

200 N. MI ~ SUBSATELLITE TELEMETER SYSTEM

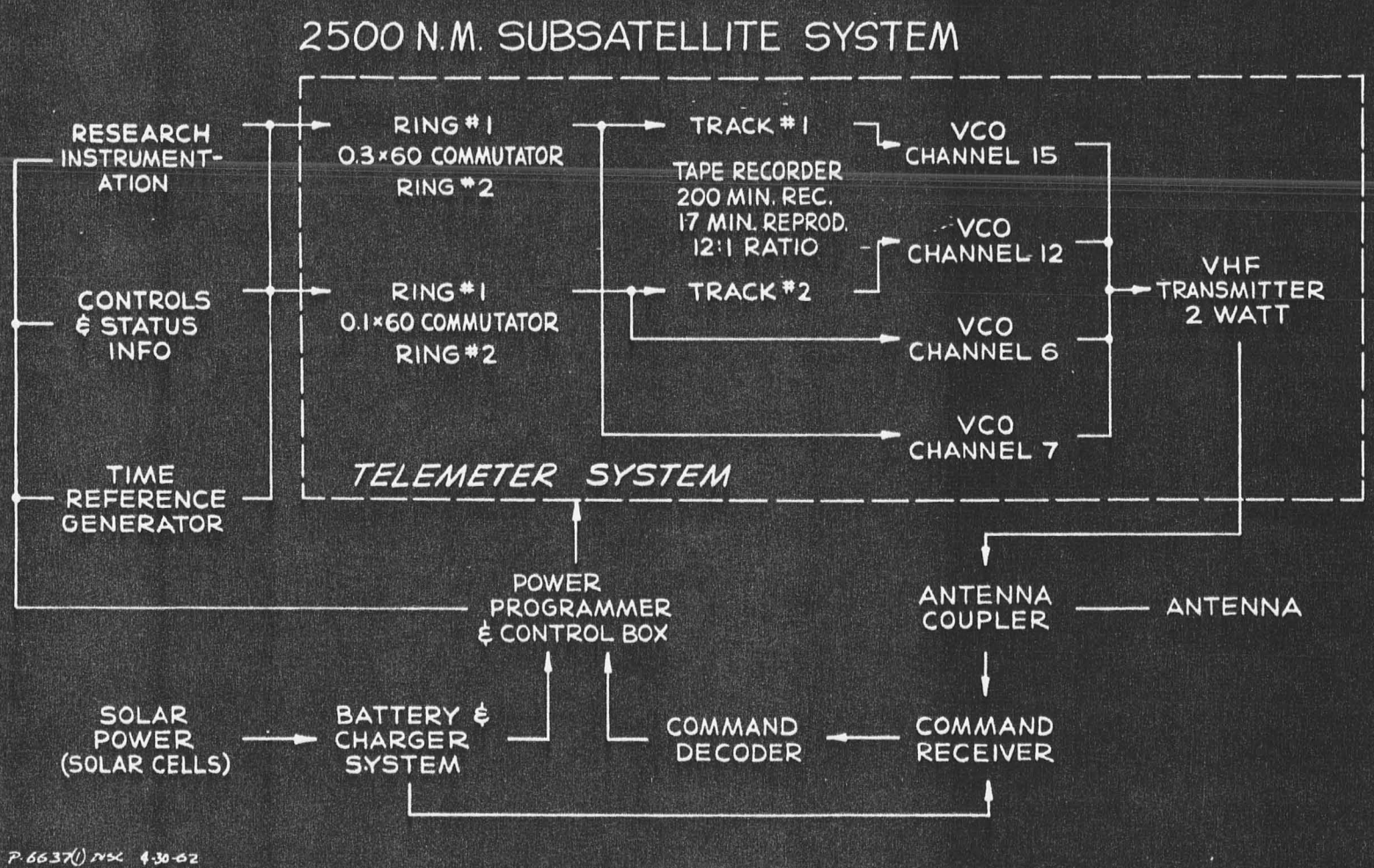


P-6985 DISC 5-1-62
C4-S-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM



P-6637(1) NSC 4-30-62
C-4-5-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE TRACKING

- "SPADATS" FOR PRIMARY EPHEMERIS DATA
  - DELETES NEED FOR TRACKING BEACON
  - MUCH MORE ACCURATE & RELIABLE THAN ANGLES ONLY

- SATELLITE TEST CENTER GENERATES ACQUISITION MESSAGES
  - ACQUISITION MESSAGES TO HAWAII & VANDENBERG, NTS TRACKING STATIONS

- HAWAII & VANDENBERG FOR COMMAND & TELEMETRY DATA READOUT
  - NO ADDITIONAL MAJOR C & C EQUIPMENTS REQUIRED
  - NO ADDITIONAL COMMAND OR READOUT STATIONS REQUIRED

- NEW BOSTON TRACKING STATION USED IN SUPPORT OF ABOVE FOR 200 N. MI. CIRCULAR ORBIT

P-6943 'DISC 4-30-62
CY-5-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE COST & PERFORMANCE COMPARISON

DESCRIPTION	BLUE SCOUT	DISCOVERER RESEARCH SUBSATELLITE
• COST		
○ BOOSTER & GUIDANCE	$ 855,000	$ 0
○ SATELLITE VEHICLE (INCL. PAYLOAD INTEGRATION, TELEMETRY, BATTERIES)	310,000	310,000
○ LAUNCH	GFE	0
○ TRACKING	GFE	GFE
○ TOTAL COST EACH FLIGHT	$ 1,165,000	$ 310,000
• PERFORMANCE (300 N M CIRCULAR ORBIT)		
○ INCLINATION ANGLE	70°-105°	70°-105°
○ ORBITING WEIGHT	160 LBS	225 LBS
○ VEHICLE ACTIVE LIFE	1 MONTH	2 - 6 MONTHS
• COST PER LB IN ORBIT	$7,300	$ 1,380

P-6972 "DISC" 4-30-62
CV-S-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

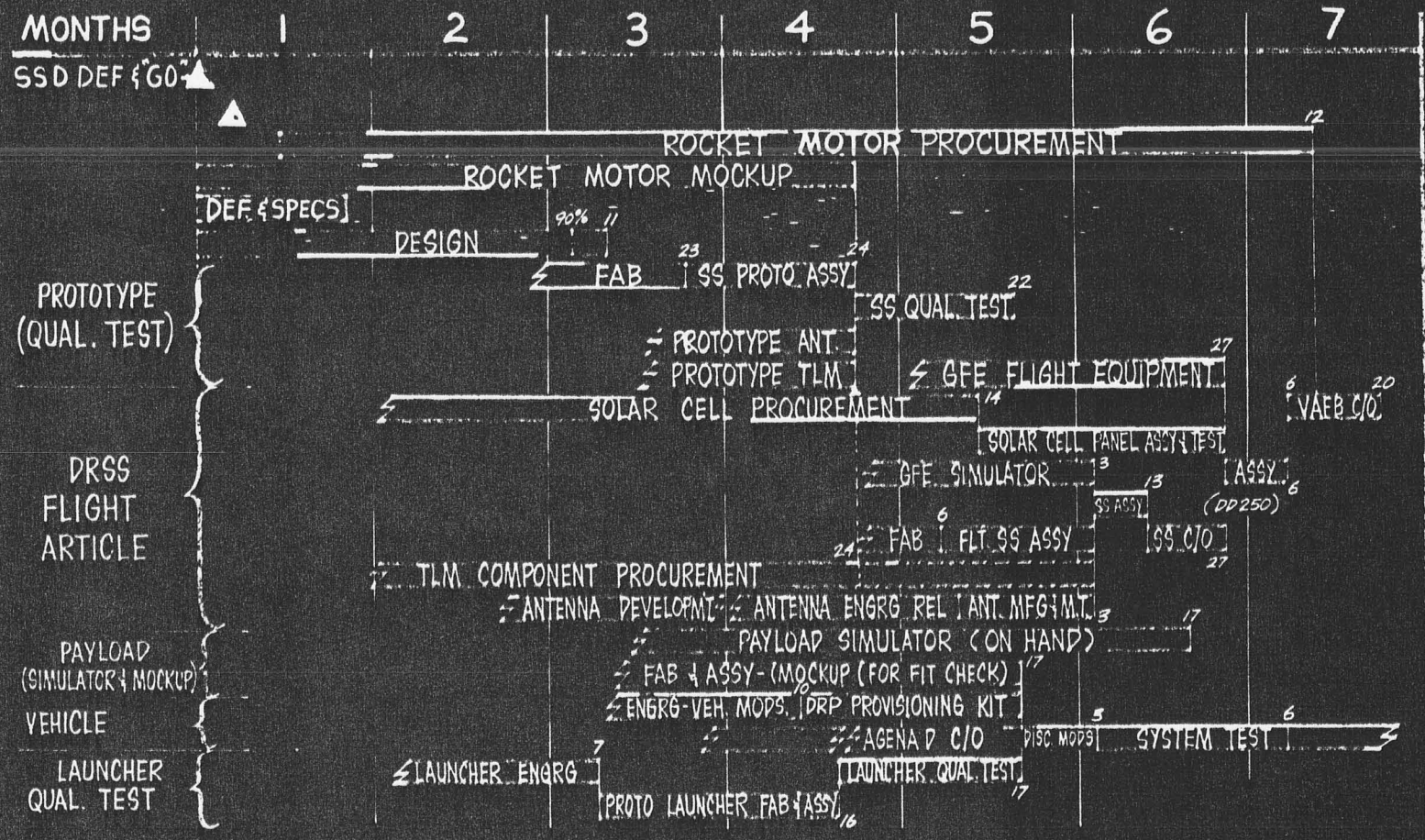
SUBSATELLITE SYSTEM RELIABILITY

ROCKET MOTOR & SPIN SYSTEM	0.990
LAUNCHER MECHANISM	0.999
COMMAND SYSTEM	0.971
TELEMETRY SYSTEM	0.940
POWER SYSTEM	0.942
OVERALL SYSTEM	0.850

P-6945 "DISC" 4-30-62
CY-S-1

UNCLASSIFIED

DRP SUBSATELLITE PROGRAM SCHEDULE

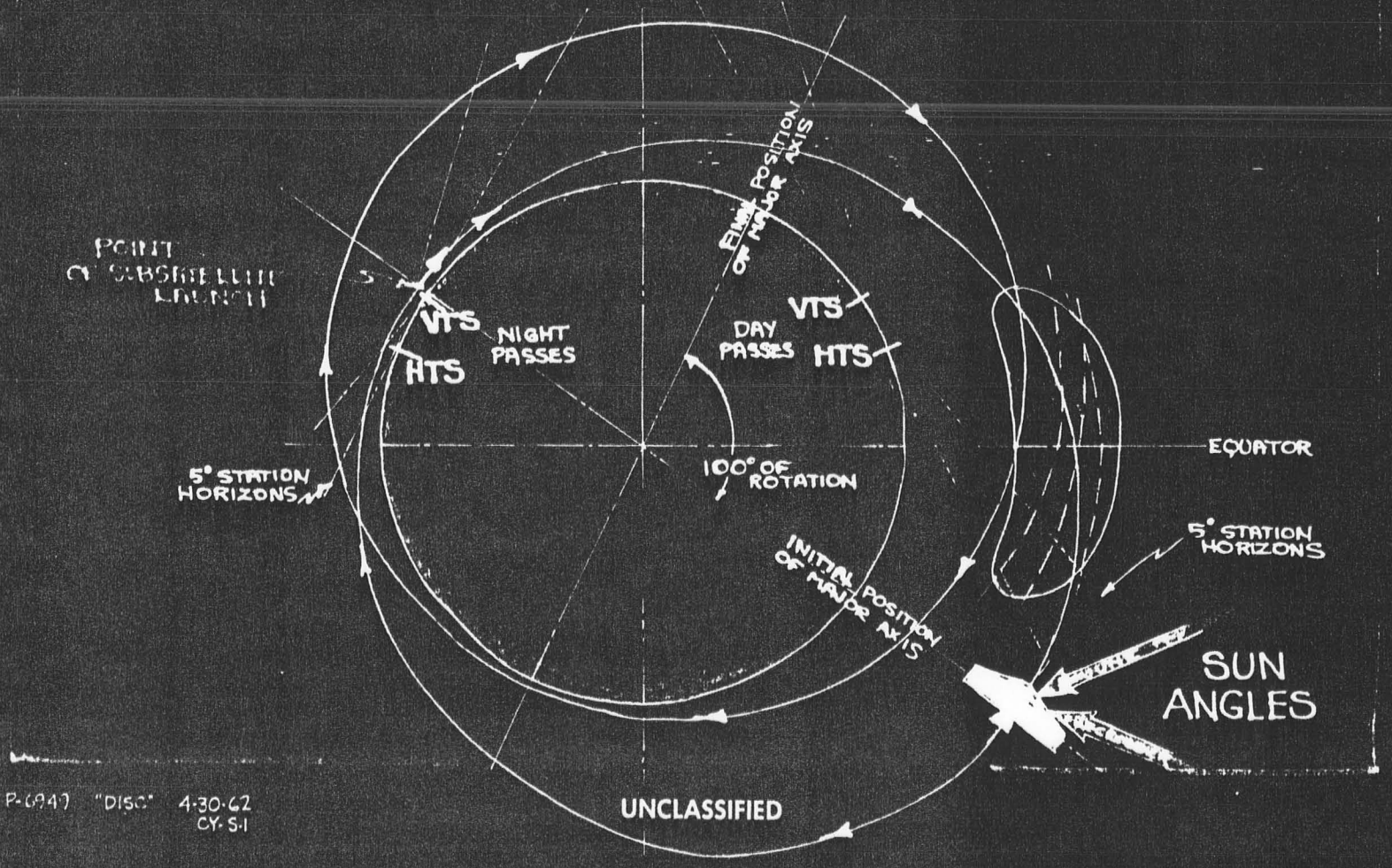


P. 6615(1) "DISC" 4-30-62.
CY-5-1

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE APOGEE ROTATION



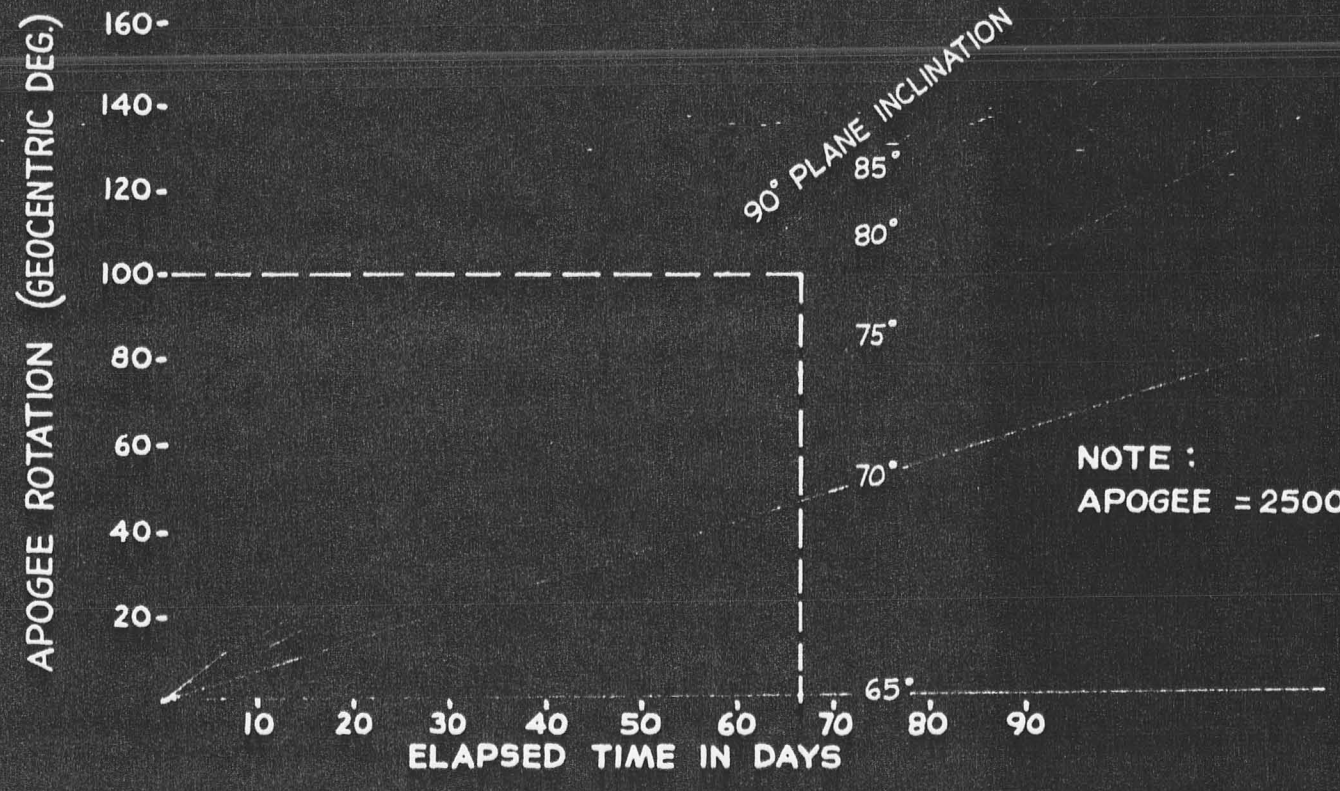
P-0947 "DISC" 4-30-62
CY-S-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH PROGRAM

SUBSATELLITE APOGEE ROTATION VS ELAPSED TIME



P-69-48 "DISC" 4-30-62
CY-S-1

UNCLASSIFIED

UNCLASSIFIED

DISCOVERER RESEARCH SUBSATELLITE

SYSTEM RELIABILITY

DESCRIPTION	(4) DUTY CYCLE (PERCENT)	LIFE (PERCENT PROBABILITY OF SURVIVAL	(2) MEANTIME TO FAILURE (θ-HOUR)	COMPONENT RELIABILITY (R)
COMMAND SYSTEM				
RECEIVER	100	99.9 % FOR 100 HOURS	10^5	0.985 (3)
DECODER	100	99.9 % FOR 100 HOURS	10^5	0.985 (3)
			COMMAND SYSTEM RELIABILITY	0.971
TELEMETRY SYSTEM				
TRANSMITTER	10		2.0×10^4	0.999
DC-DC CONVERTER	10	MINIMUM OF 10,000 HOURS (95 % FOR 10,000 HOURS)	1.92×10^5	0.999
VCO	10	95 % FOR 2,000 HOURS	3.84×10^4	0.999
COMMUTATOR (SWITCH TYPE)	100	95 % FOR 1,000 HOURS	1.92×10^4	0.990
TAPE RECORDER	100	95 % FOR 200 HOURS	3.84×10^3	0.954
TIME REF. GEN.	100	98 % FOR 2,000 HOURS	9.90×10^4	0.998
			TELEMETRY SYSTEM RELIABILITY	0.940
POWER SYSTEM				
SOLAR CELLS	100	95 % FOR 1440 HOURS (ESTIMATED)	2.81×10^4	0.950
BATTERY	100	95 % FOR 115,000 HOURS	2.25×10^5	0.994
POWER PROGRAMMER & CONTROL	100	95 % FOR 20,000 HOURS	3.84×10^5	0.999
			POWER SYSTEM RELIABILITY	0.942

OVERALL SYSTEM RELIABILITY = 0.860

NOTE: 1 PER INDIVIDUAL SPECIFICATIONS
2 ASSUME EXPONENTIAL DENSITY FUNCTION $R = e^{-t/\theta}$
3 LIFE TEST ON SIMILAR EQUIPMENT CONDUCTED AT GEORGE C. MARSHALL SPACE FLIGHT CENTER - TOTAL NUMBER OF INTERROGATION CYCLES COMPLETED CORRESPONDS TO MAXIMUM INTERROGATION FOR 25 YEARS
4 ASSUMED - ACTIVE LIFE OF SUBSATELLITE OF 60 DAYS (3 HOURS OF OPERATION PER DAY)

P-6718 DISC 3-13-62
CY-S-1

UNCLASSIFIED