[redacted]

GP-4

[redacted] *

180p.

CODE-2C
NASA CR-52645

(Title Unclassified)

MERCURY - ATLAS NO. 5 (MA-5)

SPACECRAFT NO. 9

DATA ANALYSIS REPORT (U)

(REPORT 8633) SERIAL NO. 9

CLASSIFICATION CHANGE

TO = UNCLASSIFIED ~~CONFIDENTIAL~~

By authority of E.O. 11652

Changed by L. Shirley Date 10-30-73

AVAILABLE TO U.S. GOVERNMENT AGENCIES ONLY

(NASA-CR-52645) MERCURY ATLAS NO. 5 (MA-5) SPACECRAFT NO. 9 DATA ANALYSIS REPORT (McDonnell Aircraft Co.) 13 p

N73-71[illegible]

Unclas
00/99 21515

McDONNELL Aircraft Corporation
ST. LOUIS, MO.

[redacted] (3)

CONTROL NO. C-64275 DATE 6 March 1962 180p

REVISED

(Title Unclassified)

MERCURY - ATLAS NO. 5 (MA-5)

SPACECRAFT NO. 9

DATA ANALYSIS REPORT (U)

(NASA CR-52645; t.)

REPORT 8633 SERIAL NO. 9

[redacted] U.S. GOVERNMENT AGENCIES ONLY

McDONNELL Aircraft Corp.,
ST. LOUIS, ~~MISSOURI~~ Mo. 5605308

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAW, TITLE 18 U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

[redacted]

[6]

SUBMITTED UNDER (NASA Contract NAS 5-59)

PREPARED BY D. W. Bean
Flight Test Data Engr.

APPROVED BY H. V. Walden
Sr. Flight Test Engr.

APPROVED BY R. Roths
Flight Test Data Senior Engr.

APPROVED BY J. C. Waldner
Project Flight Test Engr.

APPROVED BY R. J. McGroarty
Flight Test Data Group Engr.

APPROVED BY C. E. Matheny
Chief, Data Analysis

[redacted]

SUB-TITLE PAGE

In addition to the personnel whose signatures appear on the title page, concurrence with the contents of this report is also acknowledged by the following.

E. A. Rood
Senior Group Engineer, Thermodynamics

T. P. Brooks
Project Strength Engineer

F. J. Smith
Project Test Coordinator

P. J. Werdes
Project Structural Dynamics Engineer

T. R. Stalzer
Senior Controls Dynamics Engineer

R. B. Mick
Project Propulsion Engineer

D. R. Casper
Sr. Grp. Aerodynamics Engineer

Edited By
L. A. Beal
Flight Test Div. Reports

MCDONNELL

ST. LOUIS, MISSOURI

DATE 6 March 1962

REVISED

REVISED

REPORT 8633

MODEL 133

INDEX OF REVISIONS

DATE	PAGES AFFECTED.			REMARKS	REVISED BY	APPROVED
	REVISED	ADDED	REMOVED			
				None		

LIST OF PAGES

This report contains the following 180 pages.

Title	4.0
i	↓
ii	↓
iii	4.5
iv	
v	
vi	5.0
vii	↓
viii	↓
	5.16
1.0	
	6.0
	↓
2.0	↓
2.1	6.4
3.0	7.0
↓	↓
↓	↓
3.16	7.122

CONTENTS

		Page Number
INDEX OF REVISIONS		ii
LIST OF PAGES		iii
PREFACE		viii
1.0	FLIGHT SUMMARY	1.0
2.0	INTRODUCTION	2.0 - 2.1
3.0	DATA ACQUISITION	3.0 - 3.16
4.0	DATA PROCESSING	4.0 - 4.5
	4.1 General	4.0
	4.2 PAM Telemetry Data	4.0
	4.3 PDM On-Board Data	4.0 - 4.2
	4.4 Camera Data	4.2 - 4.3
	4.5 Sunrise and Sunset at Spacecraft	4.3 - 4.4
	4.6 Temperatures	4.4 - 4.5
	4.7 Orientation of Sun to Spacecraft and Thermocouples	4.5
5.0	SYSTEMS OPERATION	5.0 - 5.16
	5.1 Atlas Booster Performance	5.0
	5.2 Sequential System	5.0 - 5.1
	5.3 Accelerometer Data	5.1 - 5.2
	5.3.1 Z Axis	5.1 - 5.2
	5.3.2 X and Y Axis	5.2

CONTENTS (Cont'd.)

		Page Number
5.4	Specification Temperatures	5.2 - 5.4
5.4.1	RCS Low Roll H_2O_2 Lines	5.2 - 5.3
5.4.2	RCS Yaw H_2O_2 Line	5.3
5.4.3	Retro-Rocket	5.3
5.4.4	Transmitter	5.4
5.4.5	150 VA Main Inverter	5.4
5.4.6	250 VA Main Inverter	5.4
5.5	Attitude and Reaction Control Systems	5.4 - 5.8
5.5.1	Attitude Control	5.5 - 5.8
5.5.2	Reaction Control	5.8
5.6	Electrical System	5.9 - 5.12
5.6.1	DC Voltage Monitor	5.9
5.6.2	DC Current Monitor	5.9 - 5.10
5.6.3	7-Volt AC Monitor	5.10
5.6.4	115-Volt AC Monitor	5.10
5.6.5	18-Volt DC Isolated Bus Monitor	5.10
5.6.6	18-Volt DC Standby Bus Monitor	5.11
5.6.7	ASCS AC Voltage Monitor	5.11
5.6.8	Blood Pressure Pump Voltage Monitor	5.11
5.6.9	Command Receiver Monitor	5.11
5.6.10	Command Receiver Signal Strength	5.11 - 5.12

CONTENTS (Cont'd.)

		Page Number
5.7	Environmental Control System and Static Pressure	5.12 - 5.15
5.7.1	Static Pressure	5.12 - 5.13
5.7.2	Cabin Pressure	5.13
5.7.3	Cabin Temperature	5.13 - 5.14
5.7.4	Primate's Cabin Pressure	5.14
5.7.5	Primate's Cabin Temperature	5.14
5 7.6	O_2 Primary Supply Pressure	5.14 - 5.15
5.7.7	O_2 Secondary Supply Pressure	5.15
5.7.8	Coolant Pressure	5.15
5.7.9	O_2 Partial Pressure	5.15
5.8	Primate Data	5.16
5.8.1	Body Temperature	5.16
5.8.2	Pulse Rate	5.16
5.8.3	Respiration Rate and Depth	5.16
6.0	SPECIAL TEMPERATURE INSTRUMENTATION	6.0 - 6.4
6.1	General	6.0
6.2	Aerodynamic Heating	6.0 - 6.3
6.2.1	Conical Section Sides	6.0 - 6.1
6.2.2	Hat Section	6.1 - 6.2
6.2.3	Ablation Shield	6.2
6.2.4	Tower-To-Spacecraft Retaining Ring	6.2 - 6.3

CONTENTS (Cont'd.)

			Page Number
		6.2.5 Pylon Explosive Bolt Cover	6.3
		6.2.6 Adapter Sides Outer Skin	6.3
	6.3	Sun Radiation	6.3 - 6.4
7.0	DATA		7.0 - 7.122

PREFACE

This report documents the results from processing and analysis of data recorded by the basic instrumentation during the orbital flight of the Mercury - Atlas No. 5 (MA-5) vehicle which was launched at Cape Canaveral on 29 November 1961. A primate named Enos was aboard the spacecraft.

1.0 FLIGHT SUMMARY

10570

The MA-5 vehicle was launched from Cape Canaveral at 1007:57 EST, 29 November 1961. Booster engine cut-off occurred two minutes and ten seconds after launch at an altitude of 203,000 feet. The escape tower was jettisoned from the spacecraft approximately 25 seconds later at an altitude of 295,000 feet. The sustainer engine continued the flight profile until it cut off five minutes after launch at an altitude of 527,000 feet. The spacecraft was rate-damped approximately five seconds prior to initiation of spacecraft turn-around, which was accomplished satisfactorily within 32 seconds.

The orbital flight was controlled by the automatic stabilization and control system (ASCS). The retro-command sequence and the left retro-rocket ignition occurred simultaneously at three hours and 15 seconds after launch. The retro-rockets on the bottom and right each followed at five-second intervals. The retro-assembly was jettisoned approximately 60 seconds after retro-command. The spacecraft re-entered the earth's atmosphere with a peak deceleration of 7.6 g's. Drogue chute and main chute deployment occurred at indicated altitudes of 20,500 and 9,700 feet respectively.

The spacecraft landed in the water down-range from Cape Canaveral after two orbits. The duration of the flight was three hours, 20 minutes, and 59 seconds. Conf.

Author

2.0 INTRODUCTION

2.1 Purpose of Flight - MA-5, the fifth flight of the Mercury spacecraft utilizing the Atlas booster, was an orbital mission with Enos, a primate, in the vehicle. The Atlas booster was intended to provide an altitude of 87 nautical miles at an earth-fixed velocity of 24,300 feet per second, with an inertial flight path angle of zero degrees. The test objectives involved the qualification of the following:

(a) the spacecraft/booster combination,

(b) the posigrade rockets,

(c) the recovery system,

(d) the Automatic Stabilization and Control Systems (ASCS) including the Reaction Control System (RCS),

(e) the spacecraft for orbital flight, and

(f) the environmental system.

2.2 Flight Profile - The MA-5 vehicle was launched from a 90-degree attitude, and a load factor of 6.8 g's was reached at booster engine cut-off. The sustainer engine then continued the flight path until a load factor of 7.4 g's was reached at sustainer engine cut-off. The posigrade rockets ignited at five minutes and four seconds after launch, separating the spacecraft from the booster.

The Automatic Stabilization and Control System controlled the spacecraft turn-around and establishment of orbit attitude five seconds after spacecraft separation. The spacecraft was controlled in orbit attitude with the impulse from

the low-thrusters until the spacecraft drifted out of its permissible attitude, and at two hours, 22 minutes and 49 seconds after launch, the ASCS changed to the orientation mode of operation which utilizes the high-thrusters in addition to the low thrusters.

Re-entry of the spacecraft from orbit was initiated automatically with the firing of the retro-rockets. The actuation of the .05-g relay indicated the start of re-entry at three hours, nine minutes and 41 seconds after launch. A peak deceleration of 7.6 g's occurred during re-entry. The spacecraft instrumentation remained on for ten minutes after landing, and data were recorded during this interval.

3.0 DATA ACQUISITION

Parameters recorded by the basic instrumentation in Spacecraft No. 9 during the MA-5 mission are tabulated on Pages 3.2 through 3.8, along with their respective high-level commutator segments or subcarrier frequencies, ranges calibrated, slopes of tape setup, and pickup serial numbers. Temperatures recorded via the special low-level commutator are identified on Pages 3.9 through 3.14, together with their respective thermocouple locations, thermocouple types, and ranges. The primate's activity, instrument panel, periscope view, and earth-sky view were monitored individually by four cameras. A block diagram of the on-board recording system, cameras and one of the two tape recorders excluded, appears on Page 3.15. The locations of thermocouple used in the special temperature survey are illustrated on Page 3.16.

The majority of the basic on-board parameter signals were commutated and recorded by the PDM method on one of two on-board tape recorders and also transmitted to the ground stations by PAM-FM/FM telemetry. The special low-level temperature commutator data were tape recorded by the on-board PDM system only. Parameters recorded continuously via the FM/FM mode on the on-board tape recorders and transmitted to the ground stations via FM/FM telemetry were (a) rates (pitch, roll and yaw) and RCS low solenoid signals mixed; (b) vernier clock; (c) respiration rate and depth; (d) EKG; (e) adapter strain gauge No. 1; (f) adapter strain gauge No. 2; (g) DC voltage; (h) DC current; (i) the reference frequency; and (j) the psychomotor functions.

The second on-board tape recorder was used to continuously record the

horizon scanner pitch and roll outputs via the FM/FM mode, and also some of the same high-link FM/FM parameters that were recorded on the first on-board recorder.

In the "On-Board Parameter Log" which follows, the "Slope of the Tape Setup" reflects the general accuracy which can be expected during the parameter playback, but does not reflect the accuracy of the pickup and the instrumentation installation. A comparison of the range of data values obtained (data plots), "Range Calibrated", and "Slope of the Tape Setup" suggests that the calibration slopes and ranges calibrated could be improved upon for future shots, thus improving at least one portion of the data acquisition cycle.

MAC 2310 (REV 1 AUG 61)

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
0.40 kc(HF)	Continuous	Roll Rate and Low Solenoids	-10 to +10°/sec. -30 to +30°/sec.	26.36°/sec. ⚠1 57.6°/sec. ⚠2	J-3 J-3
0.40 kc(LF)		Pitch Rate and Low Solenoids	-10 to +10°/sec.	21.8°/sec.	J-10
0.56 kc(HF)		Vernier Clock	-	-	-
0.56 kc(LF)		Yaw Rate and Low Solenoids	-10 to +10°/sec.	22.4°/sec.	J-9
0.73 kc(HF)		DC Voltage Monitor	18 to 28 volts	16.7 volts	0443
0.73 kc(LF)		DC Current Monitor	5 to 34 amps.	58.4 amps.	157
1.30 kcs		Respiration Rate and Depth	-	-	-
1.70 kcs		Electrocardiogram No. 1	-	-	-
2.30 kcs		Electrocardiogram No. 2	-	-	-
3.00 kcs(HF)		Reference Oscillator	-	-	-
3.90 kcs(HF)		Periscope Housing Accelerometer	-4 to +4 g's	8.89 g's	965F
3.90 kcs(LF)		Psychomotor No. 1(L/H Lever,Shock,Drink)	-	-	-
5.40 kcs(LF)		Psychomotor No. 2(L/H Lever, Center Lever, Blue Light)	-	-	-
22.00kcs(HF)		Adapter Strain Gauge No. 2	41 to 405μin/in	1046 μin/in	2
30.00kcs(HF)		Adapter Strain Gauge No. 1	82 to 2671μin/in	3220 μin/in	1

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
	1	3-Volt DC Reference	-	-	-
	2	0-Volt DC Reference	-	-	-
	3	7-Volt AC Monitor	-	-	-
	4	High Link Transmitter Temperature	71 to 160°F	107.3°F	11
	HF -- 5, 27, 49, 71	Command Receiver "B" Signal Strength	5 to 100 μ volts	(3)	-
	LF -- 5, 27, 49, 71	Command Receiver "A" Signal Strength	5 to 100 μ volts	(3)	-
	6	O_2 Partial Pressure	.94 to 15 psia	18.22 psia (3)	218991
	7	ASCS AC Voltage Monitor	80 to 125 volts	115.9 volts	1
	8	Primate Capsule Pressure	.46 to 14.74 psia	29.4 psia	30°
	9	Oxygen Supply Pressure, Primary	1000 to 7500 psig	7510 psig	OC-1005
	10 HF	Cabin Temp. No. 1 (Left Probe)	0 to 197°F	203.7°F (3)	25061
	10 LF	Cabin Temp. No. 2 (Right Probe)	1 to 200°F	212.0°F (3)	22467
	11 HF	Suit Temperature No. 1	40 to 100°F	78.3°F (3)	214
	11 LF	Suit Temperature No. 2	40 to 100°F	76.7°F	233
	12	Oxygen Supply Pressure, Secondary	1000 to 7500 psig	7610 psig	OC-1002

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
	13, 43, 73	Y-Axis Acceleration	-3.9 to +4.0 g's -.5 to +.5 g's	8.48 g's (4) 1.068 g's (5)	962F 962F
	14, 44, 74	X-Axis Acceleration	-3.95 to +3.9 g's -.5 to +.5 g's	8.94 g's (4) 1.128 g's (5)	967F 967F
	15, 45, 75	Z-Axis Acceleration	-19.0 to +24.0g's	63.6 g's	1804F
	16	Pitch Gyro Output	-140 to 160°	123.9° - 470° (3)	J23
	17	Roll Gyro Output	-116 to 160°	116.5° - 603° (3)	J23
	18	Yaw Gyro Output	-70 to 160°	125° - 496°	J23
	19 HF	Low Roll - CW Fuel Line Temperature	-20 to 160°F	178.8°F (3)	2
	19 LF	Low Roll - CCW Fuel Line Temperature	-20 to 160°F	178.9°F (3)	3
	20 HF	Retro-Rocket Temperature-Bottom Case	0 to 300°F	289.0°F (3)	167
	20 LF	Low Yaw - Left Fuel Line Temperature	0 to 160°F	174°F (3)	8
	21	150 VA Inverter Temperature	-9 to +310°F	351.4°F (3)	61
	22	250 VA Inverter Temperature	-13 to 242°F	336.5°F (3)	37
	23	Primate Body Temperature	95 to 108°F	12.70°F (3)	20
	24	Low Link Transmitter Temperature	82 to 160°F	105.7°F (3)	12
	25	Blood Pressure Pump Voltage Monitor	0 to 10 volts	10.8 volts	2

MAC 231U (REV 1 AUG 61)

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
	26	Oxygen Mode Switching	ON - OFF	-	-
	28	Elapsed Time	0 to 1 Minute	-	-
	29	Elapsed Time	0 to 10 Minutes	-	-
	30	Elapsed Time	0 to 1 Hour	-	-
	31	Elapsed Time	0 to 10 Hours	-	-
	32	Elapsed Time	0 to 10 Seconds	-	-
	33	Time of Retrograde	0 to 10 Seconds	-	-
	34	Time of Retrograde	0 to 1 Minute	-	-
	35	Time of Retrograde	0 to 10 Minutes	-	-
	36	Time of Retrograde	0 to 1 Hour	-	-
	37	Time of Retrograde	0 to 10 Hours	-	-
	38	Horizon Scanner Pitch Ignore	ON - OFF	-	-
	39	RCS H_2O_2 Supply Pressure, Automatic	100 - 2305 psig	3970 psig (3)	20947
	40	Horizon Scanner Output, Roll	-30 to +30°	70.8°	129
	41	115-Volt AC Monitor	80 to 125 volts	119.8 volts	0317

MAC 231U (REV 1 AUG 61)

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
	42	DC Current Monitor	0 to 30 amps.	51.2 amps.	
	46	Tower Jettison	ON - OFF	-	-
	47	Spacecraft Separation	ON - OFF	-	-
	48	Retro-Attitude Command	ON - OFF	-	-
	50	Retro-Rocket No. 2 Fire, (Bottom)	ON - OFF	-	-
	51	Retro-Rocket No. 1 Fire, (Left)	ON - OFF	-	-
	52	Retro-Rocket No. 3 Fire, (Right)	ON - OFF	-	-
	53	Retro-Assembly Jettison	ON - OFF	-	-
	54	Drogue Chute Deploy	ON - OFF	-	-
	55	Antenna Fairing Release	ON - OFF	-	-
	56	Main Chute Deploy	ON - OFF	-	-
	57	Escape Hatch Off	ON - OFF	-	-
	58	RCS H_2O_2 Supply Pressure, Manual	30 to 2285 psig	4980 psig (3)	20955
	59	18-Volt DC Isolated Bus Monitor	16 to 22 volts	10.12 volts (3)	-
	60	Mayday	ON - OFF	-	-

MAC 2310 (REV 1 AUG 61)

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
	61	Tower Escape Rockets Fire	ON - OFF	-	-
	62	Standby Inverter ON	ON - OFF	-	-
	63 HF	ASCS Slaving Signal	ON - OFF	-	-
	63 LF	Center Lever (Psychomotor)	ON - OFF	-	-
	64	Calibrate	ON - OFF	-	-
	65	RCS Pitch Solenoid, High (UP)	ON - OFF	-	-
	66	RCS Pitch Solenoid, High (DOWN)	ON - OFF	-	-
	67 HF	Roll to Yaw Voltage, (Lo Sensitivity)	15.6 out to 15.3 volts in phase	48.5 volts	-
	67 LF	Static Pressure	.46 to 14.74psia	15.95 psia	5974
	68	Left Hand Lever (Psychomotor)	ON - OFF	-	-
	69	RCS Roll Solenoid, High (CW)	ON - OFF	-	-
	70	RCS Roll Solenoid, High (CCW)	ON - OFF	-	-
	72	Periscope Retract	ON - OFF	-	-
	76	Roll to Yaw Voltage, (Hi Sensitivity)	2 out to 2 volts in phase	4.79 volts	-
	77	Yaw Torquer Voltage	16 out to 16 volts in phase	43.8 volts	-

MAC 231U (REV 1 AUG 61)

ON-BOARD PARAMETER LOG

Subcarrier Frequency	Commutator Segment	Measurement	Range Calibrated	Slope of Tape Setup (0-100%)	Pickup Ser. No.
	78	RCS Yaw Solenoid, High (Left)	ON - OFF	-	-
	79	RCS Yaw Solenoid, High (Right)	ON - OFF	-	-
	80	Right Hand Lever (Psychomotor)	ON - OFF	-	-
	81	Program Identification (Psychomotor)	ON - OFF	-	-
	82	Cabin Pressure	.46 to 14.74psia	25.6 psia	3093
	83	DC Voltage Monitor	18 to 28 volts	16.65 volts	0443
	84	Coolant Pressure	0 to 400 psig	515 psig	9M4775
	85	Horizon Scanner Roll Ignore	ON - OFF	-	-
	86	18-Volt DC Standby Bus Monitor	16 to 22 volts	10.68 volts ③	-
	87	.05-G Relay Actuation	ON - OFF	-	-
	88	Horizon Scanner Output, Pitch	-30 to +30°	70.6°	128
①	Before .05-G Relay.				
②	After .05-G Relay.				
③	A non-linear calibration. The slope of the tape setup reflects the most-used or main portion of the calibration curve.				
④	All except sp'crft separation +60 seconds to .05-G Relay.				
⑤	Sp'crft separation +60 seconds to .05-G Relay.				

MAC 231U (REV 1 AUG 61)

LOW LEVEL TEMPERATURE COMMUTATOR

Commutator Segment	Measurement	Thermocouple Location			Thermocouple Type	Range
1	Zero Reference (-3 mv)	-	-	-	-	-
2	Full Scale Reference (+13 mv)	-	-	-	-	-
3	Reference Junction (60 to 135°F)	-	-	-	-	60 to 135°F
4	Reference Junction (70 to 90°F)	-	-	-	-	70 to 90°F
5	UHF Power Amplifier	Z106.5	-	-	CR-CN	-70 to 390°F
6	S-Band Beacon	Z107.5	-	-	CR-CN	
7	Cabin Temperature	Z101.5	LX12	YO	CR-CN	
8	Cabin Temperature	Z151.5	XO	BY4	CR-CN	
9	Heat Exchanger (Outlet)	-	-	-	CR-CN	
10	Heat Exchanger (Inlet)	-	-	-	CR-CN	
11	H_2O_2 Line Conical Section, Automatic	Z126.5	-	-	CR-CN	
12	H_2O_2 Line Conical Section, Manual	Z126.5	-	-	CR-CN	
13	Low Pitch Down (Fuel Line)	-	-	-	CR-CN	
14	H_2O_2 Line to No. 24 Chamber (Top)	Z168.5	-	-	CR-CN	
15	H_2O_2 Tank, Manual	-	XO.0	-	CR-CN	

MAC 231U (REV 1 AUG 61)

LOW LEVEL TEMPERATURE COMMUTATOR

Commutator Setment	Measurement	Thermocouple Location			Thermocouple Type	Range
16	H_2O_2 Tank, Automatic	Z104.5	X0.0	Y0	CR-CN	-70 to 390°F
17	Heat Shield (Bulkhead Cap)	Z109.5	-	-	CR-CN	
18	Low Roll CCW (Thrust Chamber)	-	-	-	CR-CN	
19	Low Yaw Right (Fuel Line)	-	-	-	CR-CN	
20	Low Pitch Up (Fuel Line)	-	-	-	CR-CN	
21	Clamp to Low Pitch Up Fuel Line	-	-	-	CR-CN	
22	Recovery Compartment (Internal Structure)	Z184.6	LX6	BY12	CR-CN	
23	Recovery Compartment (Inner Skin)	Z179	LX6.4	TY11.4	CR-CN	-70 to 390°F
24	Ablation Shield (Shield Inboard Surface)	-	RX33	TY1	CR-CN	-100 to 480°F
25	Ablation Shield (Shield Inboard Surface)	-	LX1	Y0	CR-CN	-100 to 480°F
26	Low Pitch Up (Thrust Chamber) (Attenuated)	-	-	-	CR-AL	-310 to 1480°F
27	Low Pitch Up (Thrust Chamber)	-	-	-	CR-AL	-120 to 610°F
28	Recovery Compartment (Shingle)	Z176.1	X0	TY	CR-AL	-310 to 1480°F
29	Emergency Egress Hatch (Outer Skin, Bottom)	Z123	-	-	CR-CN	-70 to 390°F
30	Low Yaw Right (Thrust Chamber) (Attenuated)	-	-	-	CR-AL	-310 to 1480°F

MAC 231U (REV 1 AUG 61)

LOW LEVEL TEMPERATURE COMMUTATOR

Commutator Segment	Measurement	Thermocouple Location			Thermocouple Type	Range
31	Emergency Egress Hatch (Outer Skin, Top)	Z146	-	-	CR-CN	-70 to 390°F
32	Conical Section Sides (Outer Skin)	Z154.5	RX2	TY	CR-AL	-310 to 1760°F
33	Conical Section Sides (Outer Skin)	Z154.5	LX2	BY	CR-AL	-310 to 1760°F
34	Conical Section Sides (Outer Skin)	Z154.5	LX	TY2	CR-AL	-310 to 1760°F
35	Conical Section Sides (Outer Skin)	Z126.5	RX3	TY	CR-AL	-310 to 1760°F
36	Emergency Egress Hatch (Percussion Igniter)	Z126.5	-	-	CR-CN	-70 to 390°F
37	Conical Section Sides (Outer Skin) (Attenuated)	Z126.5	LX3	BY	CR-AL	-310 to 1760°F
38	Conical Section Sides (Outer Skin)	Z126.5	LX3	BY	CR-AL	-120 to 610°F
39	Conical Section Sides (Outer Skin)	Z110.2	LX3	TY	CR-AL	-310 to 1760°F
40	Conical Section Sides (Outer Skin)	Z112	LX3	BY	CR-AL	-310 to 1760°F
41	Conical Section Sides (Outer Skin) (Attenuated)	Z112	LX	BY3	CR-AL	-310 to 1760°F
42	Conical Section Sides (Outer Skin)	Z112	LX	BY3	CR-AL	-120 to 610°F
43	Tower to Spacecraft Retaining Ring (Top)	Z184.5	RX6	TY12	CR-AL	-120 to 610°F
44	Tower to Spacecraft Retaining Ring (Bottom)	Z184.5	LX7.6	BH11.2	CR-AL	-120 to 610°F
45	Tower to Spacecraft Retaining Ring (Bottom)	Z184.5	LX5	BY	CR-AL	-120 to 610°F

MAC 231U (REV 1 AUG 61)

LOW LEVEL TEMPERATURE COMMUTATOR

Commutator Segment	Measurement	Thermocouple Location			Thermocouple Type	Range
46	Not Used					
47	Ablation Shield	-	LX1	BY1	CR-AL	-210 to 860°F
48	Ablation Shield	-	RX33	TY3	CR-AL	-210 to 860°F
49	Ablation Shield	-	LX1	TY1	CR-AL	-210 to 860°F
50	Ablation Shield	-	RX33	TY2	CR-AL	-210 to 860°F
51	Not Used					
52	Hat Section (No. 12 Stringer, Bottom)	Z127	-	-	CR-CN	-70 to 390°F
53	Low Yaw Left (Thrust Chamber)	-	-	-	CR-CN	-70 to 390°F
54	Hat Section (No. 12 Stringer, Top)	Z127	-	-	CR-CN	-100 to 480°F
55	Inside Skin Midway Between Stringers 1 and 24	Z121	-	-	CR-CN	-70 to 390°F
56	Hat Section (No. 24 Stringer, Bottom)	Z117	-	-	CR-CN	-70 to 390°F
57	Hat Section (No. 24 Stringer, Side)	Z117	-	-	CR-CN	-240 to 800°F
58	Hat Section (No. 24 Stringer, Top)	Z117	-	-	CR-CN	-100 to 480°F
59	Left Side Window (Bolt)	Z128	-	-	CR-AL	-250 to 970°F
60	Left Side Window (Inner Pane)	Z127	LX1.4	-	CR-AL	-250 to 970°F

MAC 231U (REV 1 AUG 61)

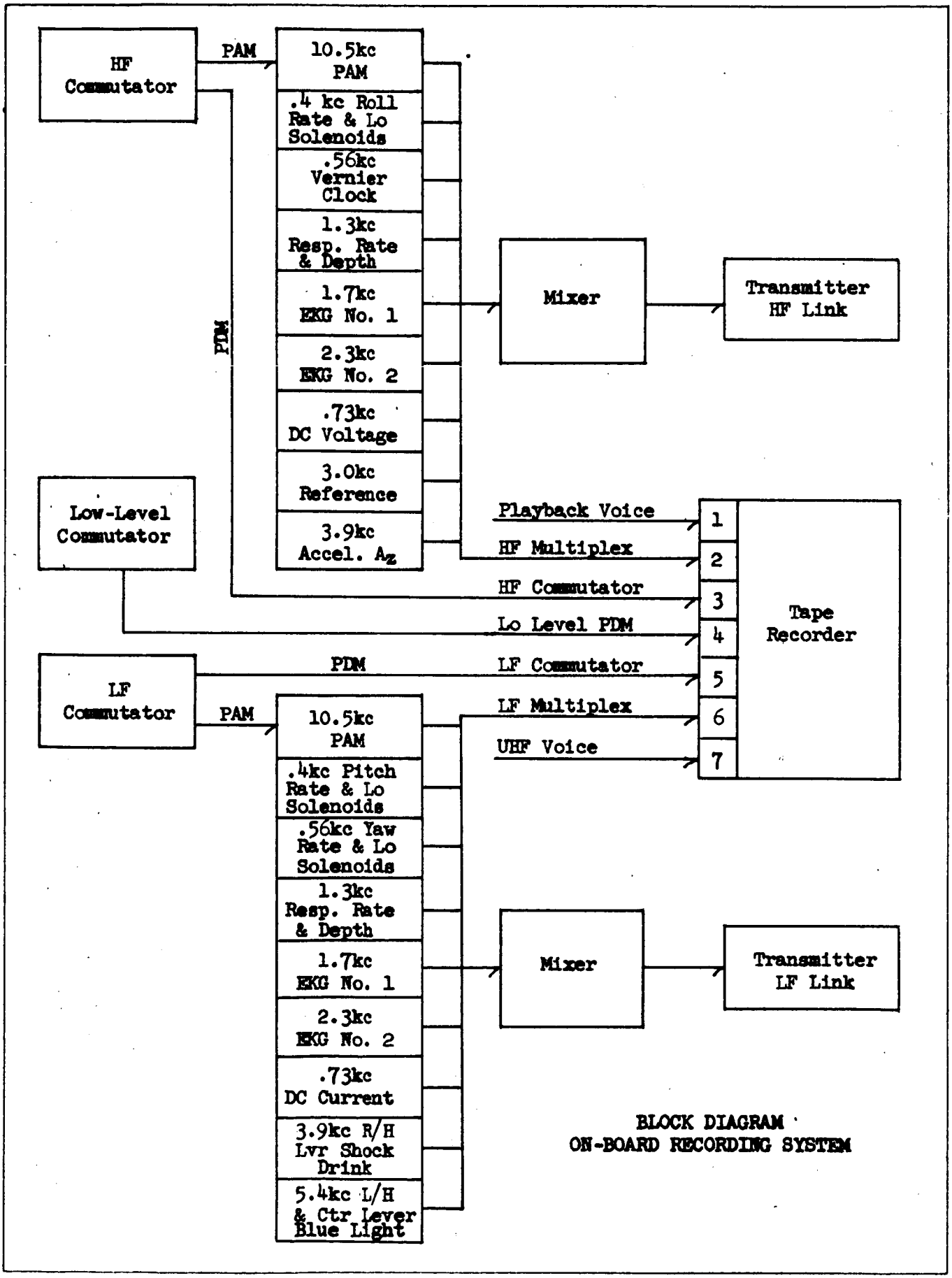
LOW LEVEL TEMPERATURE COMMUTATOR

Commutator Segment	Measurement	Thermocouple Location			Thermocouple Type	Range
61	High Pitch Down (Thrust Chamber)	-	-	-	CR-AL	-310 to 1480°F
62	Low Pitch Down (Thrust Chamber)	-	-	-	CR-AL	-310 to 1480°F
63	Manual Pitch Down (Thrust Chamber)	-	-	-	CR-AL	-310 to 1480°F
64	Low Roll CW (Thrust Chamber) (Attenuated)	-	-	-	CR-AL	-310 to 1480°F
65	Low Roll CW (Thrust Chamber)	-	-	-	CR-AL	-120 to 610°F
66	Ablation Shield (Attaching Point)	Z104.5	XO	TY	CR-AL	-120 to 610°F
67	Horizon Scanner (Roll)	-	-	-	CR-CN	-120 to 610°F
68	Not Used					
69	Not Used					
70	Not Used					
71	Not Used					
72	Antenna Compartment (Fiberglass Outer Surface)	Z191	XO	TY	CR-CN	-150 to 600°F
73	Retro-Rocket Package	Z88	LX1.5	TY	CR-CN	-70 to 390°F
74	Retro-Rocket Package	Z88	RX15	BY6.5	CR-CN	-70 to 390°F
75	Retro-Rocket Package	Z88	LX13	BY9.5	CR-CN	-70 to 390°F

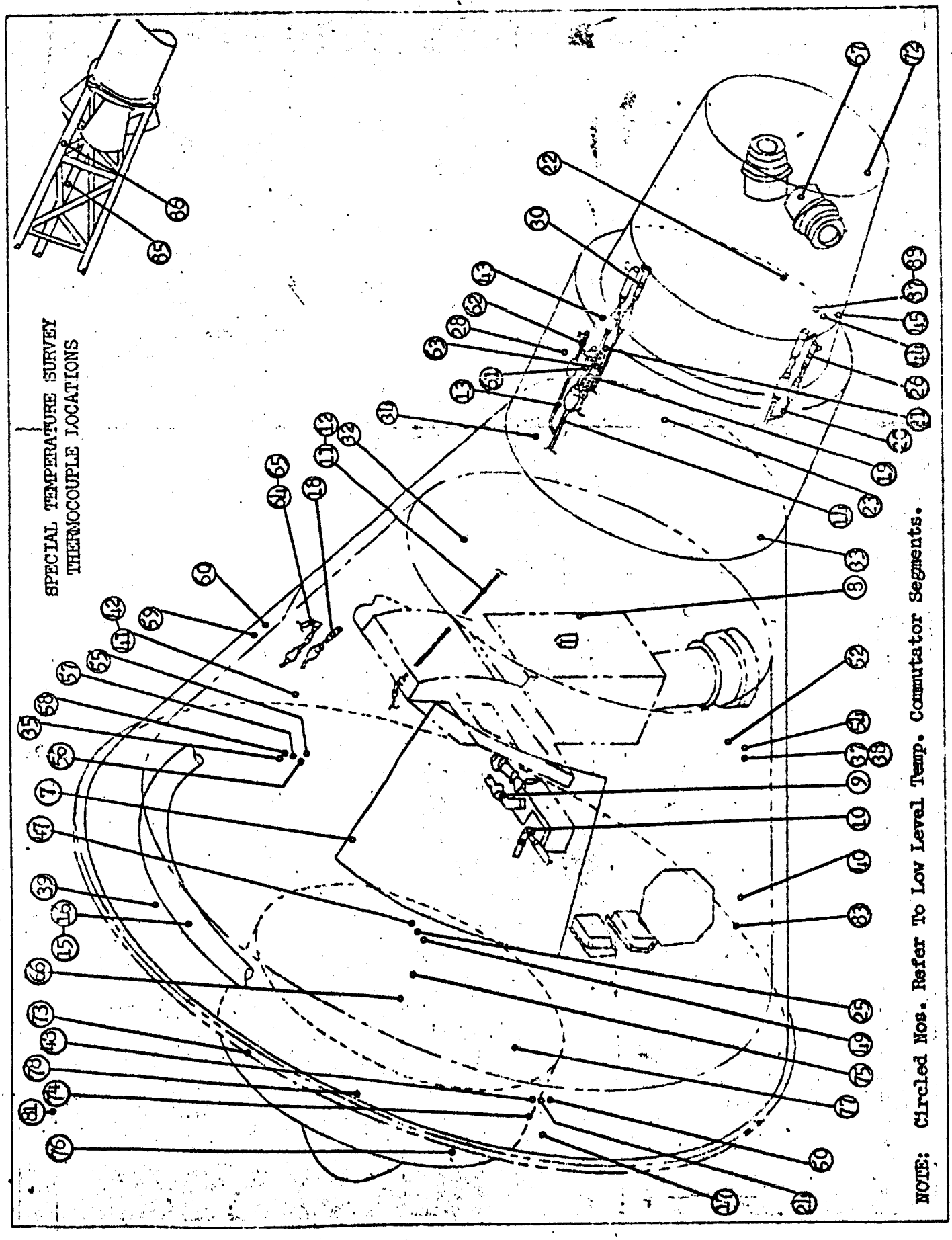
MAC 231U (REV 1 AUG 61)

LOW LEVEL TEMPERATURE COMMUTATOR

Commutator Segment	Measurement	Thermocouple Location			Thermocouple Type	Range
76	Retro-Rocket Package (Retro-Rocket-Nozzle-Bottom)	-	-	-	CR-CN	-70 to 390°F
77	Retro-Rocket Package (Retro-Rocket-Bottom)	-	-	-	CR-CN	-70 to 390°F
78	Retro-Rocket Package (Explosive Bolt)	Z81.6	XO	YO	CR-CN	-70 to 390°F
79	Deep Ablation Shield	-	LX2.4	BY1.5	CR-CN	-400 to 1370°F
80	Not Used					
81	Adapter Sides (Outer Skin)	Z79.5	XO	TY	CR-CN	-100 to 480°F
82	Not Used					
83	Adapter Retaining Ring (Cover)	Z104.5	XO	BY	CR-AL	-310 to 1270°F
84	Not Used					
85	Escape Tower	Z257.0	XO	TY	CR-AL	-310 to 1130°F
86	Not Used					
87	Pylon Explosive Bolt (Cover)	Z184.6	-	-	CR-CN	-260 to 850°F
88	Stability Wedge	Z187	RX.85	BY	CR-AL	-310 to 1370°F



BLOCK DIAGRAM
ON-BOARD RECORDING SYSTEM


SPECIAL TEMPERATURE SURVEY
THERMOCOUPLE LOCATIONS
NOTE: Circled Nos. Refer To Low Level Temp. Commutator Segments.

4.0 DATA PROCESSING

4.1 General - Data-gathering sources for the MA-5 mission consisted of two on-board tape recorders, four on-board cameras, ground telemetry station tape recorders and ground support equipment. The methods of analyzing and evaluating the information obtained are discussed in this section.

The NASA Space Task Group supplied MAC with the following data records:

(a) duplicates of 3 "Tele. 2" telemetry magnetic tapes,

(b) duplicates of the two on-board tapes,

(c) 16-mm primate observer camera film,

(d) 16-mm instrument panel camera film,

(e) 16-mm periscope camera film,

(f) 70-mm earth-sky camera film, and

(g) trajectory data.

4.2 PAM Telemetry Data - Three "Tele. 2" telemetry tapes were received at approximately 1000 hours on 1 December 1961. One of these had fairly good PAM and FM/FM data out to time T + 6 minutes on the high frequency commutator, but there was some signal loss on the low frequency commutator. This tape was used mainly to obtain the time increment between range-zero and the start of the satellite clock. No data were processed from any of the PAM "Tele. 2" telemetry tapes.

4.3 PDM On-Board Data - The PDM on-board data were recorded using a 90 x 1-1/4 format. The duplicate on-board PDM tape, which was used as the final or prime data source, was received in St. Louis at approximately 1500 hours on

2 December 1961. A preliminary inspection of the tape revealed that recording quality of the signals was good. No difficulty was experienced in reducing either the PDM or FM/FM data.

Some difficulty was experienced in time correlation of the tape, because during the duplication of the master tape at Cape Canaveral, the recorders were stopped at approximately 02:57:00 flight time and the master tape was backed up a short distance, and then both recorders were restarted. This operation caused a time discontinuity in the duplicate tape. Time correlation was accomplished, however, by recording an 800-cps signal on an unused track of the tape while the tape was run at an 8-time speed-up, and utilizing it as the time base for the Millisadic data system. Then a correlation of this time base was made with the satellite clock time. By utilizing the 800-cps signal, an electronic counter, and the correlation between the 800-cps signal and the satellite clock time, it was possible to accurately record DC level shifts on another unused track of the tape for analog plotting purposes.

The majority of the PDM data was converted from analog to digital values by means of the Millisadic data system using a standard IRIG format of 90 x 10. The digital values from the Millisadic were converted to parameter values by means of the Datatron computer. The digital data were first punched in cards as plotting counts and then tabbed out as actual values. The card-plotted data were faired and then checked against the tabbed data. During the exit, retro-fire, and .05-g relay-to-main chute deployment phases, every block of data was computed. During the orbit phase, three block averages were computed every 20 seconds.

Three block averages were computed every 10 seconds for data recorded from main chute deploy to landing.

All the continuously recorded FM/FM data and the DC level shifts were re-recorded on another tape at an 8-time speed-up to allow better utilization of available equipment for analog plotting.

Pitch, roll, and yaw rates and RCS low solenoid signals mixed, which were recorded continuously via the FM/FM mode, were plotted directly from the re-recorded FM/FM tape by using a Pace analog plotter.

The PDM ASCS horizon scanner and gyro outputs and the RCS high solenoid signals were plotted directly from the tape by means of an ASCOP decommutator which gated out the desired segments and fed them into a Mosely analog plotter.

A time history of the primate's pulse rate was obtained from the re-recorded FM/FM tape by using a rate meter to differentiate the number of pulses per minute on the electrocardiograph (EKG) signal. The resulting rate signal was filtered to remove excessive noise and plotted directly by means of a Pace analog plotter.

4.4 Camera Data - Pitch and roll attitudes that were recorded by the earth-sky camera during daylight hours of the orbital phase were processed using procedures established by the Contractor's Data Analysis Department (Reference: Report ONOO.7A, Dept. 289). These are presented together with the ASCS and horizon scanner attitudes. Correlation, facilitated by a real-time clock included in the camera's field of view, was referenced to elapsed time by synchronizing the photographically recorded attitude transitions with those derived from the on-board

tape recorded data. The only deviation from the previously mentioned procedures was the use of the lens data from the MA-4 mission. Lens data for the MA-5 mission were not available because of the relocation of the earth-sky camera and because they could not be obtained from prelaunch camera coverage.

Periscope photographic coverage was used for verification of the sunrises and sunsets at the spacecraft. Since the periscope camera lacked positive correlation, data from it were correlated during the orbital phase from periscope "out" to periscope "in" by time-of-transit of known points along the ground track. Camera operation was constant at 30 frames per minute.

Lack of an optical system calibration precluded the processing of the periscope camera coverage for yaw attitudes, and the earth-sky camera coverage is not compatible with any yaw data processing procedures currently in use.

4.5 Sunrise and Sunset at Spacecraft - Elapsed times for occurrences of sunrises and sunsets at the spacecraft were calculated from analytic expressions developed by the Contractor's Data Analysis Department (Reference: Report DM00.9, Dept. 289). These times were verified within $\pm$ 0.4 minutes from observations taken by the periscope camera, and were in agreement with elapsed time calculated by relating spacecraft geodetic locations, relative velocities and the 1961 ephemeris. These times are noted on the presentation of parameters relating to the sun.

All calculations were based on launch at 10:08 EST. The sunrises and sunsets presented are defined as the elapsed time when a line-of-sight from the spacecraft to the sun's center transits the earth's horizon. In the analytical development of expressions relating sun rays to the spacecraft, all factors were

considered except atmospheric bending effects on the light rays, which are insignificant in terms of spacecraft elapsed time. Assumptions made were that the earth's surface is spherical with a mean radius of 3,438 nautical miles, the sun's rays are parallel, and the spacecraft traveled the predicted trajectory. Actual altitudes were used.

4.6 Temperatures - Thermocouple temperatures recorded on Track 4 of the on-board tape recorder via the special low-level commutator were correlated and digitized using established procedures for processing PDM commutated data. Prior to performing the temperature calculations on a Datatron digital computer, a 2.25 percent upscale correction factor was applied to compensate for a shift of the zero (-3 millivolts) and full-scale (+13 millivolts) references. This correction factor was obtained from thermocouples that were deactivated at spacecraft separation. Its validity was confirmed by the agreement of temperature values that were recorded from the same thermocouple in duplicate with different sensitivities.

The millivolt thermocouple signals were converted to temperature values using the calibrated reference junction temperatures and thermocouple conversion tables per procedures set forth by NASA, except for a minor deviation to eliminate any error resulting from the non-linearity of the conversion tables. This deviation involved the changing of the reference junction temperature to a millivolt equivalent of the particular thermocouple and summing it with the millivolt output of the thermocouple. This summation was then converted to temperature in degrees Fahrenheit.

The temperatures tape-recorded on Tracks 3 and 5 via the two high-level commutators were processed using standard procedures for calibrated parameters.

4.7 Orientation of Sun to Spacecraft and Thermocouples - The position of the sun relative to the spacecraft is presented in angles $\alpha 6$ and $\beta 6$. These angles were calculated using the procedures discussed in Section 4.5 for determining sunrises and sunsets, and other expressions to account for the attitudes of the spacecraft. The flight time investigated was from time 00:06:00 to .05-g relay actuation since the heating effects from the sun are insignificant during exit and re-entry.

External thermocouples not receiving direct radiation from the sun are noted by shading on applicable time histories of thermocouple temperatures. The transition from sun radiation to darkness is defined as that time when the sun rays are tangential to the instrumented external surface of the spacecraft. The elapsed time for the occurrence of this transition was determined by relating the orientation angles of the sun to their tangential limits defined by the spacecraft geometry.

5.0 SYSTEMS OPERATION

5.1 Atlas Booster Performance - Data showing the characteristics of the trajectory developed by the launch vehicle are presented on Pages 7.1 through 7.6, and those concerning load factors appear on Page 7.7. The actual performance of the launch vehicle was in good agreement with pre-launch estimates as stated in NASA Post-launch Memorandum Report for Mercury - Atlas No. 5 (MA-5), dated 6 December 1961. At the time of booster engine separation, approximately two minutes and ten seconds after launch, a load factor of 6.8 g's along the Z axis, a velocity of 9,000 feet per second, and an altitude of 203,000 feet had been attained. The sustainer engine continued to accelerate the spacecraft until it cut off at approximately five minutes after launch, with a load factor of 7.4 g's along the Z axis, a velocity of 23,900 feet per second, and an altitude of 527,000 feet. The launch vehicle reached its maximum dynamic pressure of 1,004 pounds per square foot one minute and five seconds after launch.

5.2 Sequential System - A tabulation of the major sequences and the time (referenced to range-zero time) of their first indication on the commutator follows:

Sequence of Events	Time (Hr:Min:Sec)
Tower Jettison	00:02:33.8
Periscope Extension	00:05:02.9
Spacecraft Separation	00:05:02.9
Retro-Attitude Command	03:00:15

Sequence of Events	Time (Hr:Min:Sec)
Retro-Rocket Ignition, Left	03:00:15
Retro-Rocket Ignition, Bottom	03:00:20
Retro-Rocket Ignition, Right	03:00:25
Retro-Assembly Jettison	03:01:14
Periscope Retraction	03:01:47
.05-G Relay Actuation	03:09:41
Drogue Chute Deployment	03:15:36
Antenna Fairing Release	03:16:09
Periscope Extension	03:16:09
Main Chute Deployment	03:16:09
Landing	03:20:59

5.3 Accelerometer Data - Accelerations along the X, Y and Z axes of the spacecraft were measured in the PDM mode. A time history appears on Page 7.7 and a diagram of the sign convention appears on Page 7.8.

5.3.1 Z Axis - Three significant load factor points were recorded along the Z axis during the flight. The first, associated with the booster phase, peaked at approximately 6.8 g's at time T plus two minutes and ten seconds. The second load factor build-up occurred during the sustainer engine portion of the flight, where the acceleration peaked at approximately 7.4 g's at time T plus five minutes. The third significant load factor occurred during the re-entry portion of the mission when a peak deceleration of approximately 7.6 g's

was reached at time T plus three hours, 13 minutes and six seconds. Impulse of the retrograde rockets and the opening of the drogue and main chutes each caused a deceleration of the spacecraft.

5.3.2 X and Y Axes - The outputs of the X and Y axes accelerometers did not vary more than 0.15 g during the entire flight. The acceleration measured in the Y axis prior to spacecraft separation probably resulted from changes in the pitch attitude of the launch vehicle during the boost phase, since no misalignment of the accelerometer was evidenced. The acceleration measured in the X axis during exit and re-entry could have been caused by a slight misalignment (within the installation tolerances) of the accelerometer.

5.4 Specification Temperatures - Temperatures were measured by the basic instrumentation system at the following locations on the spacecraft: low roll clockwise H_2O_2 line, low roll counterclockwise H_2O_2 line, low yaw left H_2O_2 line, bottom retro-rocket case, HF and LF transmitters, and the 150 and 250 volt-ampere main inverters. A time history appears on Pages 7.9 and 7.10.

5.4.1 RCS Low Roll H_2O_2 Lines - These temperatures were measured by resistance elements located on both the clockwise and counterclockwise low roll H_2O_2 lines. The recorded temperature on each line was 76°F at launch. At spacecraft separation, the temperatures had increased to 94°F and 100°F respectively on the clockwise and counterclockwise low roll lines. Both temperatures then increased rapidly, reaching a general plateau of approximately 120°F at time T plus 35 minutes. At one hour and 20 minutes after launch, both temperatures

began to increase again, until about 140°F was reached 20 minutes later. They began to increase again at one hour and 55 minutes after launch, with clockwise roll and counterclockwise roll peaking at 164°F and 150°F respectively and then leveling off at about 153°F and 148°F. Both temperatures decreased very rapidly at two hours, 22 minutes and 50 seconds after launch, when the high thrusters were actuated to correct for spacecraft drift, and an increase in H_2O_2 flow probably cooled the lines. The temperature of both roll lines increased and decreased in a cyclic manner that corresponded with the actuation of the high thrusters until .05-g relay actuation, when they began to rise until the instrument limit of 168°F was reached.

5.4.2 RCS Yaw H_2O_2 Line - This temperature was measured by a resistance element located on the low yaw left H_2O_2 line. The measured temperature was 78°F at launch and remained constant until after spacecraft separation, where it began to increase until a general plateau of approximately 95°F was reached at time T plus 50 minutes. A maximum temperature of 98°F was reached at two hours and five minutes after launch before it began to decrease gradually, reaching a minimum plateau of approximately 84°F. It started increasing at .05-g relay actuation, indicating 118°F at landing.

5.4.3 Retro-Rocket - The temperature of the retro-rocket was measured by a resistance element attached to the retro-rocket heater blanket. The temperature, which was 80°F at launch, was maintained between 70° and 80°F until retro-rocket firings.

5.4.4 Transmitter - The temperatures of the HF and LF transmitters were measured by a resistance element attached to the housing of each transmitter. Both temperatures indicated 90°F at launch. The HF transmitter exhibited a steady temperature rise, reaching 130°F at two hours and 20 minutes after launch and remained at this level until landing. The LF transmitter temperature increased steadily until 125°F was reached two hours and 27 minutes after launch, where it remained for five minutes. It then decreased and remained at an average level of about 120°F until landing.

5.4.5 150 VA Main Inverter - The main 150 volt-ampere inverter temperature was measured by a resistance element attached to its housing. The temperature, which was 98°F prior to launch, increased slowly until a maximum of 195°F was measured during re-entry.

5.4.6 250 VA Main Inverter - This temperature was measured by a resistance element attached to the inverter housing. It was 120°F prior to launch, and increased slowly until a maximum of 200°F was measured during re-entry.

5.5 Attitude and Reaction Control Systems - The recorded parameters which relate to the operation of the spacecraft's control system (i.e.: attitudes; rates; reaction jets; horizon scanner roll, pitch and ignore signal outputs; attitudes calculated from the earth-sky camera; H_2O_2 supply; yaw torquer voltage; and roll to yaw voltage, high and low sensitivity) are presented in time history form on Pages 7.11 through 7.59.

5.5.1 Attitude Control - The operation of the attitude control system was monitored by instrumentation which included rate gyros, attitude gyro repeater outputs, horizon scanner roll and pitch outputs, horizon scanner ignore signals, and reaction jet solenoid outputs. Time histories appear on Pages 7.11 through 7.54.

5.5.1.1 Spacecraft Turn-Around - The command for spacecraft turn-around and orbit attitude was given five seconds after spacecraft separation. Approximately 32 seconds were required to accomplish spacecraft turn-around and complete damping to the orbit attitude. The spacecraft yaw and pitch attitudes were damped to orbit attitude within 15 seconds.

5.5.1.2 Horizon Scanner - The roll and pitch scanner ignore signals were lost during a portion of the boost phase at times T plus 44 seconds and 46 seconds respectively.

The maximum output of the pitch scanner occurred at time T plus one minute and 22 seconds where it remained for 69 seconds. The pitch scanner corrected for this erroneous output very rapidly after tower jettison, and at spacecraft separation, the pitch gyro output agreed with the earth-sky camera data. The earth-sky camera is believed to be the most reliable instrumentation for determining true roll and pitch attitudes of the spacecraft since the accuracy of its data is approximately 1.5 degrees.

Loss of the roll scanner ignore signal also occurred occasionally between times T plus 21 minutes and 54 seconds, and 37 minutes and

14 seconds, with transients in the scanner roll output occurring each time. The roll scanner ignore was "on" occasionally, however, during the orbital portion of the flight except when the spacecraft was in darkness.

The scanner outputs indicated excursions that could not be correlated with spacecraft motion. Examples of this, other than noted in the preceding paragraphs, can be seen at one hour and 6 minutes, one hour and 19 minutes, one hour and 50 minutes, and two hours and ten minutes after launch. The pitch and roll scanner outputs both indicated excursions after two hours and 37 minutes of the flight when the spacecraft drifted out of orbit attitude and returned to the orientation mode. Since the gyros were continuously slaved to the scanners on this mission, the transients caused incorrect gyro torquing which resulted in gyro output errors as large as 12 degrees in roll and 8 degrees in pitch.

5.5.1.3 Orbit Control - The low thrusters were utilized to maintain the orbit attitude. The spacecraft was controlled to zero $\pm$ 6 degrees roll and yaw attitudes, with corrective thruster firings occurring at the prescribed indicated attitudes. The roll gyro output agreed with the roll attitude from the earth-sky camera except in the areas of incorrect torquing due to erroneous scanner outputs. The pitch attitude was controlled to an average indicated gyro output of -32 degrees instead of the prescribed -34 degrees. Deviations from the mean attitude were approximately $\pm$ 5 degrees. A comparison of gyro output to earth-sky camera coverage, however, indicates the data agree with the exception of the areas of incorrect torquing caused by erroneous pitch scanner outputs.

The spacecraft was in the orbital control mode as stated

in the preceding paragraph until two hours, 21 minutes and 20 seconds after launch. From this point on, the positive low roll thruster seemed to have little or no effect on spacecraft motion. This allowed the spacecraft to drift continually until it exceeded the attitude limits of the orbit mode and returned to the orientation mode at time T plus two hours, 22 minutes and 49 seconds. At this time, the roll attitude was approximately -28 degrees. The spacecraft drifted out to approximately -28 degrees nine times prior to retro-attitude command, and the high thrusters were required to correct for this attitude drift each time. The low solenoid firings were also indicated, but no corresponding rate change resulted.

5.5.1.4 Retro-Fire and Re-Entry - The spacecraft retro-attitude command and firing of the left retro-rocket were initiated by the preset timer at three hours and 15 seconds after launch. The indicated outputs of the roll and yaw gyros were zero and +4 degrees respectively. The pitch gyro output indicated -34 degrees and remained at this attitude throughout rocket firings.

The retro-assembly jettison initiated the change from orbit to re-entry attitude at three hours, one minute and 14 seconds after launch. The spacecraft returned to the orientation mode at three hours, five minutes and 36 seconds after launch, when the roll attitude drifted to -28 degrees.

The .05-g relay was actuated at time T plus three hours, 9 minutes and 41 seconds, changing the control to the programmed 10-degree-per-second roll rate with rate damping in the pitch and yaw axes. The scanners and attitude gyros were turned "off" at .05-g relay actuation, and the complete ASCS system was turned "off" at antenna fairing release and main chute deployment. The

high pitch and yaw thrusters were held open electrically 60 seconds to allow jettison of the remaining H_2O_2 before landing.

5.5.2 Reaction Control - The automatic and manual reaction H_2O_2 systems were interlinked to increase the H_2O_2 supply available for the automatic system on this mission. Data concerning the reaction control system H_2O_2 supply pressures and the resultant quantity appear on Pages 7.55 and 7.56. The approximate quantity of H_2O_2 aboard at the time of launch was 61.5 pounds.

The programmed five seconds of rate damping and turn-around of the spacecraft utilized approximately 5 pounds of H_2O_2. The RCS operated satisfactorily until time T plus two hours, 22 minutes and 49 seconds when the positive roll thrusters were inoperative. This malfunction was undoubtedly caused by the small wire found stuck in the inlet jet to the thrust chamber. The H_2O_2 utilized by the RCS during the orbital phase was not indicated by supply pressure changes until the high thrusters were actuated to compensate for the drift out of orbit attitude, and 10 pounds of H_2O_2 were used to correct and maintain the attitude until retro-attitude command. The spacecraft used 3 pounds of H_2O_2 to maintain the correct attitude during the retro-rocket firing sequence and subsequent control until .05-g relay actuation. Following the actuation of the .05-g relay, the spacecraft control mode with the programmed roll rate and rate damping in the pitch and yaw axes required 10 pounds of H_2O_2 until drogue chute deployment, and an additional 8 pounds of H_2O_2 were used while the spacecraft was descending with drogue chute deployed. The remaining 25.5 pounds of H_2O_2 were jettisoned following antenna fairing release and main chute deployment.

5.6 Electrical System - Satisfactory performance of the electrical system was experienced throughout the flight. The electrical parameters are presented in time history form with an expanded time scale during spacecraft exit, retro-rocket firings, and re-entry. The orbital area of flight is plotted at a condensed time scale from spacecraft separation to .05-g relay actuation.

A .67 cycle-per-minute fluctuation was measured on DC current and DC voltage during orbit. This was probably caused by the intermittent switching "on" and "off" of the playback tape recorder.

Time histories of the following parameters appear on Pages 7.60 through 7.66: DC voltage, DC current, 7-volt AC, 115-volt AC, 18-volt DC isolated bus, 18-volt DC standby bus, ASCS AC voltage, blood pressure pump voltage, command receiver all-channel signal and command receivers "A" and "B" signal strength.

5.6.1 DC Voltage Monitor - The 24-volt DC monitor indicated 24.7 volts at launch. The voltage decreased throughout the flight until 22 volts was measured at landing. Momentary voltage drops occurred at tower escape rocket fire, spacecraft separation, and antenna fairing release and main chute deploy.

5.6.2 DC Current Monitor - Direct current indicated 24.5 amperes at launch and 28 amperes at landing. The average current level increased to approximately 28 amperes upon tower escape rocket fire and tower jettison, then increased again at spacecraft separation to approximately 30 amperes. It dropped to an average level of approximately 25.5 amperes five minutes after spacecraft separation, then gradually increased to approximately 30 amperes at .05-g relay

[redacted]

actuation. The DC current increased to approximately 33 amperes during the jettison of H_2O_2, then decreased to 28 amperes, where it remained until landing. It increased to 40 amperes upon landing and remained at this level for 26 seconds. Momentary current surges occurred at spacecraft separation, retrograde rocket firing, retro-assembly jettison, antenna fairing release and main chute deploy, and landing bag deploy.

5.6.3 7-Volt AC Monitor - The 7-volt AC monitor, presented in percent-of-full scale value, indicated 76.5 percent at launch. The variation throughout the flight was no greater than + 1 percent and - 2 percent.

5.6.4 115-Volt AC Monitor - The 115-volt AC monitor measured 113 volts at launch, and held between 112 and 116 volts throughout the flight, with no large transients.

5.6.5 18-Volt DC Isolated Bus Monitor - The isolated battery bus indicated approximately 21.8 volts until tower escape rocket fire and tower jettison, where the voltage indicated approximately 20.2 volts until five minutes after spacecraft separation. Then it increased to approximately 21.8 volts until retro-attitude command, where it decreased to about 21.2 volts. It remained at this level until antenna fairing release, where it dropped to 20.6 volts and held until landing. The voltage dropped to approximately 17.3 volts for a period of 26 seconds upon landing. Momentary voltage drops occurred at spacecraft separation, retrograde rocket firings, antenna fairing release, and landing bag deploy.

[redacted]

5.6.6 18-Volt DC Standby Bus Monitor - The standby battery bus indicated approximately 20.6 volts at launch, and decreased to 20 volts prior to spacecraft separation. It continued to decrease slowly until it stabilized at 18.4 volts one hour and 20 minutes after launch. It remained at this level within ± .2 volt throughout the remainder of the flight.

5.6.7 ASCS AC Voltage Monitor - The ASCS AC voltage monitor indicated 116 volts at launch and gradually increased until a maximum of 120 volts was reached by drogue chute deploy. The voltage was maintained within ± 1 volt of this value throughout the remainder of the flight.

5.6.8 Blood Pressure Pump Voltage Monitor - The blood pressure pump voltage monitor indicated 6.5 volts at launch and was maintained at this level throughout the flight.

5.6.9 Command Receiver Monitor - The command receiver monitor was an ON - OFF signal which gave indications of ground commands at spacecraft separation, retro-attitude command, .05-g relay actuation, drogue chute deploy, and main chute deploy. The signals sent to the spacecraft were employed as backup to the spacecraft programmer and normal sequencing of events.

5.6.10 Command Receiver Signal Strength - The signal strengths of the "A" and "B" command receivers were measured in microvolts. Since the calibrations were complex and the slopes non-linear, nominal values are presented and only the trends are meaningful.

The outputs in microvolts coincide with the spacecraft passing over ground stations having sufficient power to be monitored. These outputs paralleled each other in their transient and mean values during the following time intervals: launch to ten minutes and 30 seconds, 49 minutes to 57 minutes, one hour and 26 minutes to one hour and 43 minutes, two hours and 22 minutes to two hours and 31 minutes, two hours and 48 minutes to two hours and 54 minutes, and intermittently from two hours and 58 minutes until three hours and 16 minutes.

5.7 Environmental Control System and Static Pressure - Static pressure was measured by means of a 4-teed, flush-mounted source located at Spacecraft Station Z-158, at angular intervals of 90 degrees. Cabin pressure was recorded from a transducer located inside the spacecraft and positioned near the left side of the primate's cabin. Cabin temperature was recorded from two probes mounted behind and near the top of the instrument panel. Primate's cabin pressure was recorded from a transducer in the inlet line,and the primate's cabin temperature was monitored by two sensors on the inlet line. The O_2 primary and secondary supplies and coolant quantity were measured by means of pressure transducers located in the respective supply tanks. The O_2 partial pressure was monitored by a transducer in the primate's cabin inlet line. Time histories of these parameters appear on Pages 7.67 through 7.70.

5.7.1 Static Pressure - Ambient indicated static pressure, which was 14.8 psi at launch, decreased until zero static pressure was recorded at time T plus one minute and 56 seconds. The static pressure remained at zero

throughout orbit, but started increasing three minutes and 10 seconds after .05-g relay actuation until it was 14.7 psi at landing.

5.7.2 Cabin Pressure - The cabin pressure, which indicated 14.8 psia at launch, lagged the static pressure by approximately 6 psi during ascent until a pressure of 5.7 psia was reached at spacecraft separation. The cabin pressure decreased gradually throughout the orbit phase until a minimum of 4.8 psia was reached at .05-g relay actuation. The increase in cabin pressure followed static pressure with an approximate one psi lag throughout spacecraft descent and read 13.9 psia at landing, after which it gradually increased toward ambient static pressure.

5.7.3 Cabin Temperature - Cabin temperature was measured by two pickups, both of which indicated 82°F at launch. The transient measurements of both pickups followed the same trends with a difference in magnitude. Pickup No. 1 increased steadily until a maximum of 105°F was reached approximately 45 minutes after launch, while pickup No. 2 reached a peak of 100°F approximately 50 minutes after launch. Both pickups then began to decrease gradually until they indicated approximately 95°F one hour and 40 minutes after launch. The temperatures then began to increase again until pickup No. 1 indicated 104°F two hours, 15 minutes and 30 seconds after launch, and pickup No. 2 indicated 101°F two minutes later. Then both pickups began to decrease until a minimum of 96°F was reached on each two hours and 53 minutes after launch. Both remained at this level until .05-g relay actuation. The temperatures began to increase during re-entry and

continued to rise for a short period of time after landing until a maximum of 118°F and 113°F were measured by Pickups No. 1 and No. 2 respectively.

5.7.4 Primate's Cabin Pressure - The primate's cabin pressure, which indicated 14.8 psia at launch, decreased to approximately 6.0 psia by spacecraft separation. The pressure gradually decreased until 5.1 psia was reached at .05-g relay actuation and was maintained at this level until the static pressure increased to approximately 5.6 psia. It lagged the static pressure by approximately .5 psia during the rapid descent until main chute deploy, where the differential pressure increased to approximately 1.0 psia and remained until after landing. The pressure gradually increased toward indicated static pressure after landing.

5.7.5 Primate's Cabin Temperature - This temperature was measured by two pickups whose transient measurements paralleled each other by approximately 3°F throughout the flight. Pickup No. 1, which consistently registered the lower temperature, indicated 61°F at launch. It increased to 64°F by spacecraft separation, then gradually decreased to a low of 59°F approximately one hour and two minutes after launch. The temperature then began a gradual rise throughout the remainder of flight, measuring 86°F at landing and 90°F four minutes thereafter.

5.7.6 O_2 Primary Supply Pressure - The primary oxygen supply pressure, which measured approximately 6,000 psi prior to launch, indicated no pressure decrease until after drogue chute deploy, where the pressure began to

decrease until 5,700 psi was reached at landing. The lack of a pressure drop during orbit probably resulted from the increase in cabin temperature, which kept the pressure from being a true indication of oxygen usage.

5.7.7 O_2 Secondary Supply Pressure - The secondary oxygen supply pressure, which measured approximately 7,000 psi prior to launch, indicated an increase in pressure to 7,200 psi upon landing. This increase in pressure resulted from an increase in cabin temperature without a corresponding usage of oxygen.

5.7.8 Coolant Pressure - The coolant pressure, which indicated 350 psi prior to launch, indicated an increase in pressure to 380 psi upon landing. This increase in pressure made it impossible to determine the quantity of coolant used to maintain the primate's cabin temperature throughout the flight.

5.7.9 O_2 Partial Pressure - The absolute values of the O_2 partial pressure data are considered questionable throughout the mission; however, the transient indications are considered correct. The data followed the same transients as the primate's cabin pressure until the inflow snorkel valve opened prior to main chute deploy. The opening of the inflow snorkel valve vented the primate's cabin to the ambient air, and a period of unstable O_2 partial pressure resulted when the incoming ambient air mixed with the oxygen in the primate's cabin circuit. The O_2 partial pressure experienced two other periods of instability: at landing and two minutes and 40 seconds after landing, both of which probably resulted from the opening of the snorkel valves and cabin venting to ambient air.

5.8 Primate Data - The primate was instrumented with an internal probe to monitor body temperature, EKG sensors to measure heart action, and a harness to indicate the depth and rate of respiration. Instrumentation was also available to monitor electrical shocks applied to the primate. The body temperature data are presented on Pages 7.69 and 7.70 and pulse rate and shock occurrences are presented on Pages 7.71 and 7.72.

5.8.1 Body Temperature - The body temperature of the primate indicated 97.3°F prior to launch and increased slowly throughout the flight until it reached 101°F four minutes after landing.

5.8.2 Pulse Rate - The pulse rate of the primate was monitored by EKG sensors that gave indications of each beat. The beats were converted into pulse rates by a rate meter. The indicated pulse rate was approximately 100 pulses per minute at launch, increased to a maximum of 150 pulses per minute prior to tower jettison, where it dropped to 122 pulses per minute. It sharply increased to 150 pulses per minute shortly after spacecraft separation, then decreased rapidly during orbit. Throughout orbit, the pulse rate followed a rhythmic pattern, with the maximum and minimum pulse rate being 166 and 94 pulses per minute. The data were unreadable during the following two portions of the flight where repeated shocks also occurred: one hour and 59 minutes, and three hours and three minutes after launch.

5.8.3 Respiration Rate and Depth - The respiration rate and depth are not presented in this report.

6.0 SPECIAL TEMPERATURE INSTRUMENTATION

6.1 General - For the MA-5 mission, thermocouples were installed at several locations on the spacecraft to monitor the following temperatures: structural, heat shield, spacecraft skin, RCS system, and environmental. The identification and location of the thermocouples used for this special temperature survey are detailed in Section 3.0. Time histories of the thermocouple data are presented on Pages 7.73 through 7.116.

6.2 Aerodynamic Heating - The thermocouples that measured an increase in temperature during the exit and re-entry phases were mounted on the conical section and hat section of the spacecraft. The thermocouples mounted on the ablation heat shield measured an increase in temperature during the re-entry phase of the flight only. Those mounted on the tower-to-spacecraft retaining ring, pylon explosive-bolt cover, and the adapter sides outer skin indicated an increase in temperature during the exit phase of flight only, since they were jettisoned either prior to or at spacecraft separation.

6.2.1 Conical Section Sides - The thermocouples located on the conical section sides at Spacecraft "Z" Stations 154.5, 126.7, and 107 along the LX, TY, and BY axes indicated an uneven temperature distribution on the sides of the spacecraft during the exit. This uneven temperature condition indirectly resulted from the angle-of-attack introduced by the booster to pitch the spacecraft into a horizontal flight path. The negative angle-of-attack allowed the top side of the spacecraft to heat more than the bottom side, and the thermocouple at

Z-107 and TY measured a peak temperature of 1,160° during the exit.

The temperature of the conical section sides was evenly distributed during the re-entry with the lower side of the spacecraft heating more rapidly then the upper side. The temperature at Z-112 and Z-126.5 peaked at about two minutes and 30 seconds after .05-g relay actuation, and that at Z-154.5 peaked one minute later.

The exit and re-entry temperature data are presented on Page 7.117 in the form of a color photograph that illustrates the temperature gradient over the conical surface of the spacecraft. For comparison purposes, exit and re-entry data from MA-2 (Spacecraft No. 6) are presented in color on Page 7.118.

Noteworthy observations about the MA-2 data are:

(a) the exit temperature data show the effect of some spacecraft yaw along with the expected angle-of-attack; and

(b) the re-entry temperature data indicate an angle-of-attack effect.

6.2.2 Hat Section - The thermocouples located on the top, bottom, and side of Stringer Nos. 12 (Z-127) and 24 (Z-117) lagged the conical section in temperature transients. This temperature peaked approximately four minutes and 30 seconds after .05-g relay actuation, with the top of Stringer Nos. 12 and 24 reaching 343°F and 308°F respectively. Two minutes later, the side of Stringer No. 24 peaked at approximately 230°F, while the bottom peaked at 200°F.

6.2.3 Ablation Shield - The thermocouples mounted in the

ablation shield were located as follows:

(a) between .05 and .3 Fiberglass (LX1, BY1, .130 deep),

(b) between .05 and .3 Fiberglass (RX33, TY3, .133 deep),

(c) bond line (LX1, TY1, .204 deep),

(d) bond line (RX33, TY2, .309 deep),

(e) inboard surface (RX33, TY1, on back surface),

(f) inboard surface (LX1, Y0, on back surface), and

(g) deep heat shield (LX2.4, TY1.5, .97 deep).

These temperatures did not indicate any major transients during exit, but did increase during re-entry. The deep heat shield indicated a maximum of approximately 1,260°F during re-entry, three minutes and 30 seconds after .05-g relay actuation. The indicated temperature of the remaining thermocouples increased more slowly due to the location of the thermocouples within the shield.

6.2.4 Tower-to-Spacecraft Retaining Ring - The thermocouples located on the top and bottom of the tower-to-spacecraft retaining ring indicated approximately 70°F and 77°F respectively at launch. The transients were very mild with the bottom increasing to 120°F within the first three minutes after launch. The top increased until a maximum of 115°F was measured at escape tower jettison.

6.2.5 Pylon Explosive Bolt Cover - The thermocouple located on the pylon explosive-bolt cover indicated approximately 110°F prior to launch and increased rapidly during exit until a peak of 660°F was measured approximately

two minutes after launch.

6.2.6 Adapter Sides Outer Skin - The thermocouple located on the adapter sides outer skin indicated approximately 80°F at launch, increased to maximum of 200°F within two minutes, then slowly decreased to 95°F by spacecraft separation.

6.3 Sun Radiation - The solar radiation was in a conical pattern about the spacecraft's LX axis, having an apex angle of 80 degrees as illustrated on Page 7.119. The thermocouples that were located in areas significantly affected by the sun's radiation include the following:

(a) parachute compartment - outer skin,

(b) conical section sides - outer skin,

(c) retro-rocket package, and

(d) hat sections.

The sun's radiation was tangential to the upper and lower surfaces of the spacecraft, while the right side was shaded. The sun orientation during orbit is presented as a time history on Pages 7.120 through 7.122. These data are presented as the angles between the Z axis and the sun vector, and Y axis and the projections of the sun vector as illustrated on Page 7.120.

The parachute compartment outer skin indicated only a slight increase and decrease in temperature from sun radiation and darkness. The conical section sides outer skin at Z-154.5, Z-126.7 and Z-107 indicated a transient rise and cooling in temperature of approximately 200°F within about 15 minutes after the

[redacted]

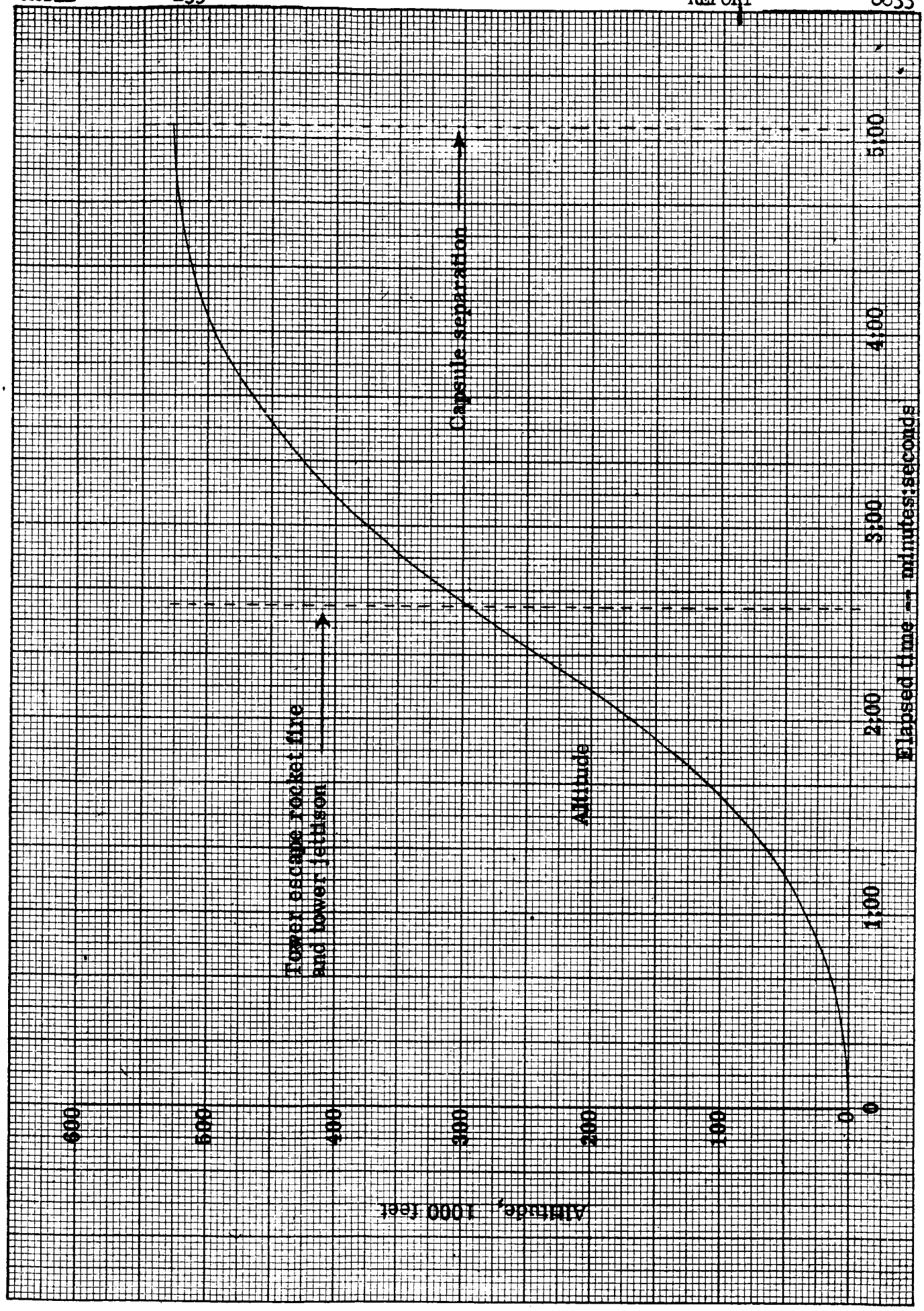
transition from sun radiation to darkness or vice versa. The retro-rocket package thermocouple at Z-88 indicated a transient of approximately 100°F during the transition. Stringer Nos. 12 and 24 of the hat section indicated a lower transient temperature rise and cooling effect from sun radiation and darkness since the thermocouples were mounted on the internal structure. These nominal temperature transients of the hat section indicated approximately 50°F during each transition from sun radiation to darkness and vice versa, and were of a relative long duration because of the low heat conduction rate.

[redacted]

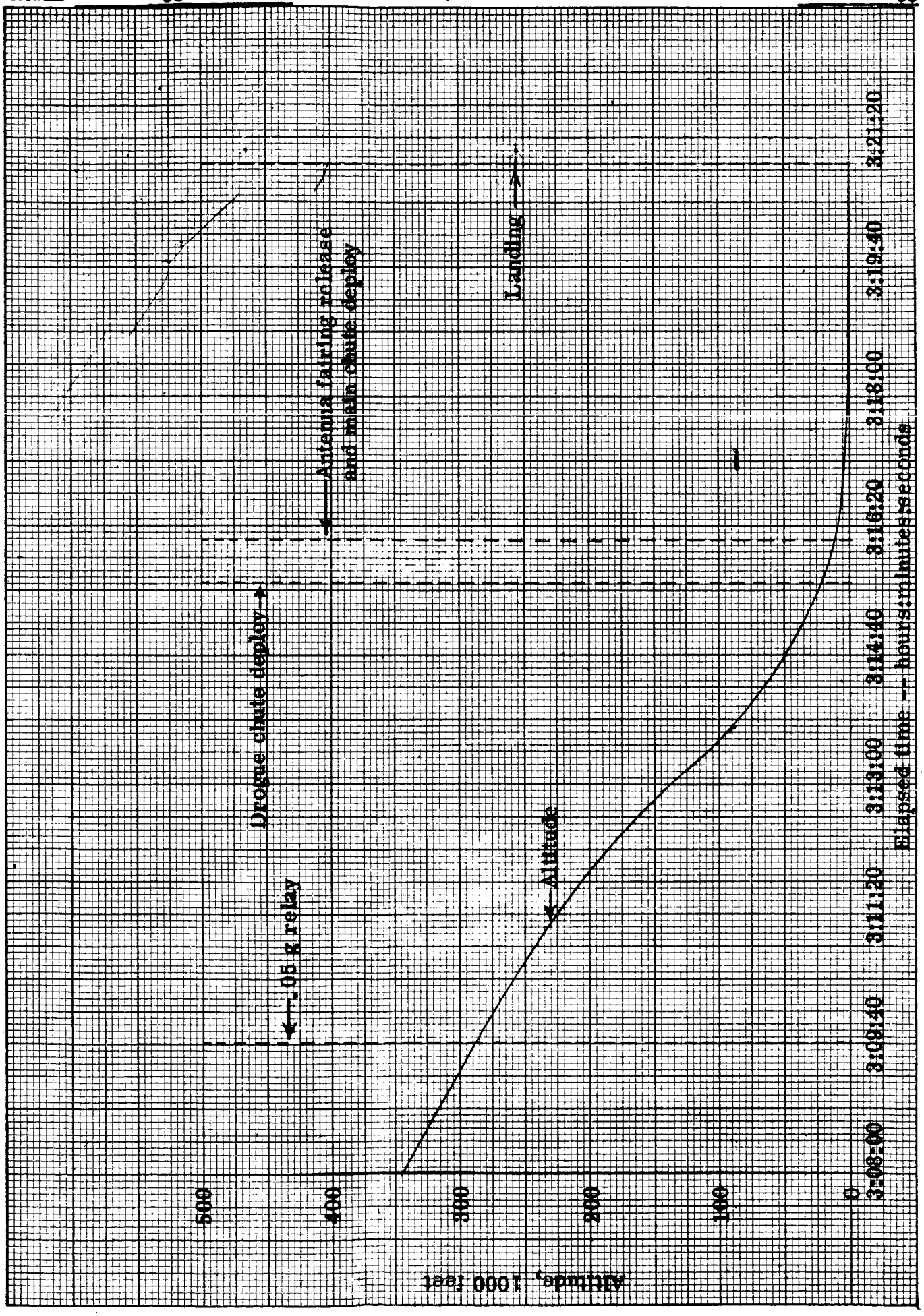
7.0 DATA

INDEX

	Page Number
Trajectory Information	
Altitude	7.1 - 7.2
Mach No. and Dynamic Pressure	7.3 - 7.4
Earth Fixed Flight Path Angle and Velocity	7.5 - 7.6
Accelerometer Data	
X, Y, and Z Axes Accelerations	7.7
Sign Convention	7.8
Specification Temperatures	7.9 - 7.10
Attitude and Reaction Control	
Attitude Control	7.11 - 7.54
H_2O_2 Supply	7.55 - 7.56
Yaw Torquer and Roll-to-Yaw Voltages	7.57 - 7.59
Electrical System	7.60 - 7.66
Environmental Control System and Static Pressure	7.67 - 7.70
Primate Data	
Body Temperature	7.69 - 7.70
Pulse Rate	7.71 - 7.72
Special Thermocouple Data	
Time Histories	7.73 - 7.116
Color Photographs	7.117 - 7.118
Orientation of Sun During Orbit	7.119 - 7.122



KEUFFEL & ESSER CO.
10 X 10 TO THE ½ INCH
ALBANENE
MADE IN U.S.A.
359T-11G



KEUFFEL & ESSER CO. ALBUQUERQUE
10 X 10 TO THE INCH
359-112

Tower escape rocket fire and tower jettison
Capsule separation
Mach
Dynamic pressure
Elapsed time -- minutes:seconds
0:00
1:00
2:00
3:00
4:00
5:00
Dynamic pressure, 100 pounds per square foot
Mach number, M
0
2
4
6
8
10
12
14
16

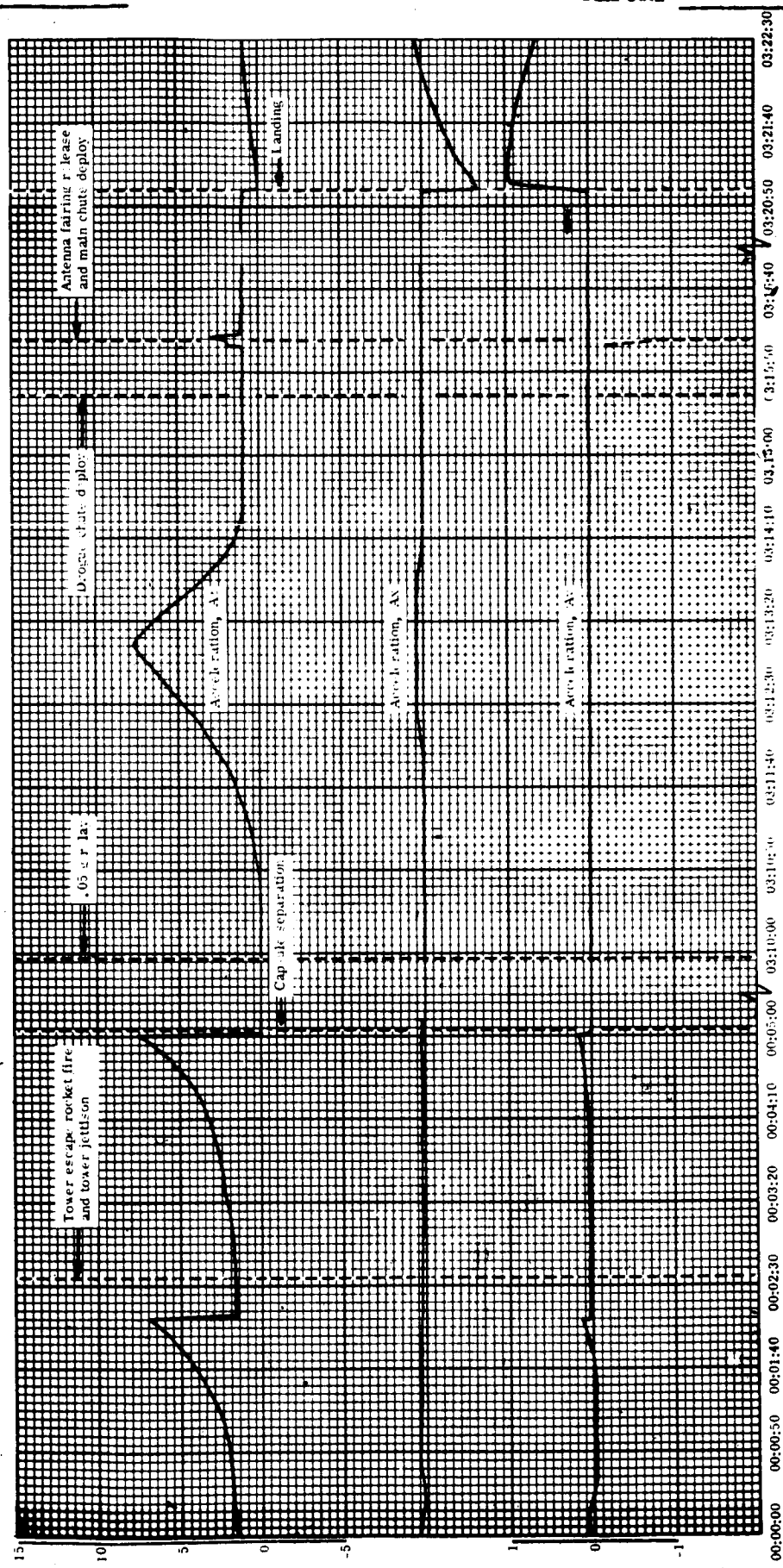
DATE 6 March 1962 PAGE 7.4

MODEL 133 REPORT 8633

Earth fixed flight path angle, degrees
-100
-80
-60
-40
-20
0
Earth fixed velocity, 1000 feet per second
24
20
16
12
8
4
0
0
1:00
2:00
3:00
4:00
5:00
Elapsed time -- Minutes:seconds
Capsule ejection
Tower escape rocket fire
and tower jettison
Earth fixed flight path angle
Earth fixed velocity

Earth fixed flight path angle, degrees
20
0
20
40
60
80
100
Earth fixed velocity, 1000 feet/second
24
20
16
12
8
4
0
Drogue Chute Deploy
.05 g Relay
Earth fixed flight path angle
Antenna Fairing Release
And Main Chute Deploy
Earth fixed velocity
Landing
5:08:00
5:09:40
8:11:20
8:13:00
8:14:40
8:16:20
8:18:00
8:19:40
8:21:20
Elapsed time--hours:minutes:seconds

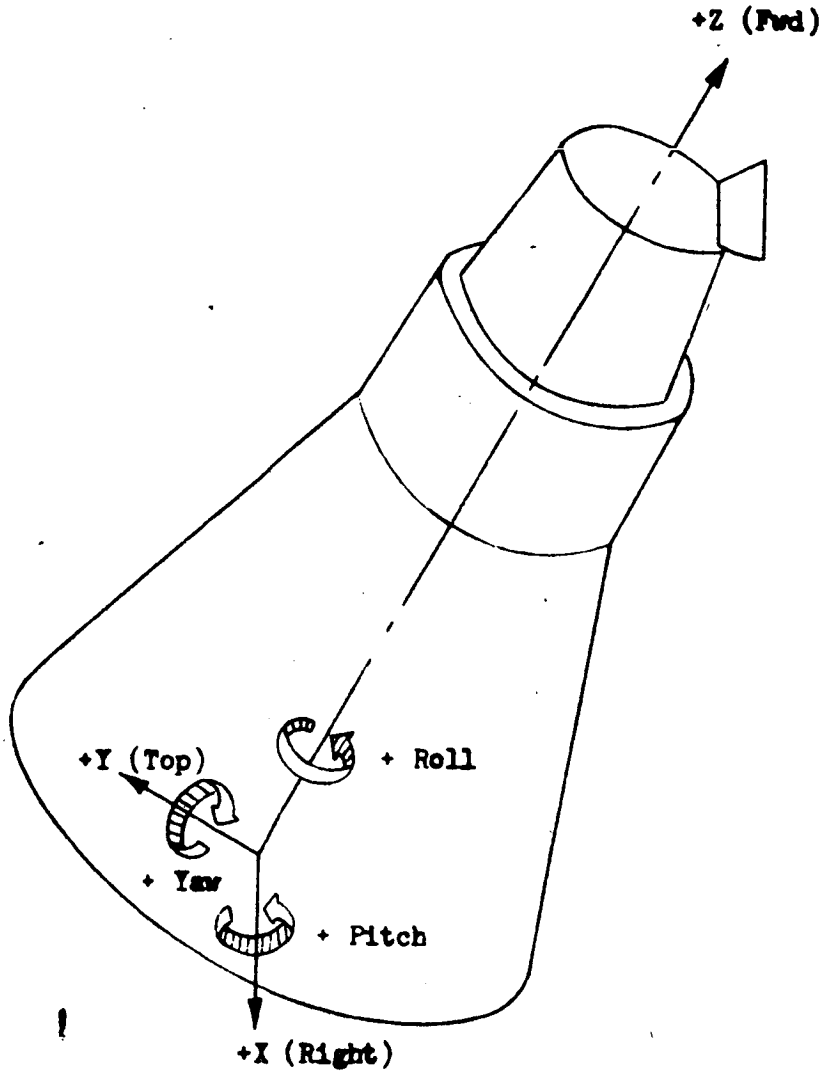
MA-5-M-2301



CONFIDENTIAL

CONFIDENTIAL

RATE AND ACCELERATION ORIENTATION



CONFIDENTIAL

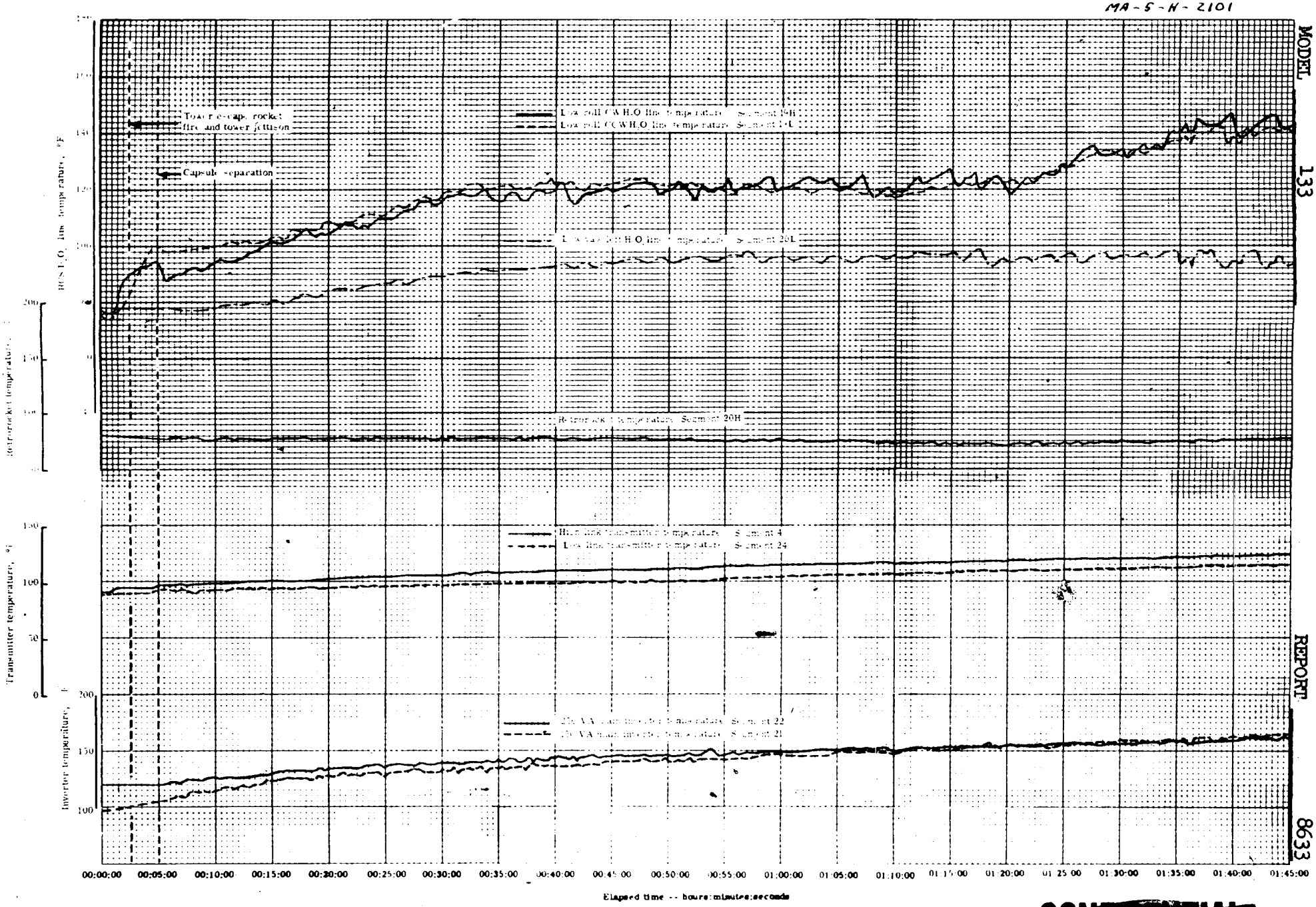
MA-5-H-2101

DATE 6 March 1962

MODEL 133

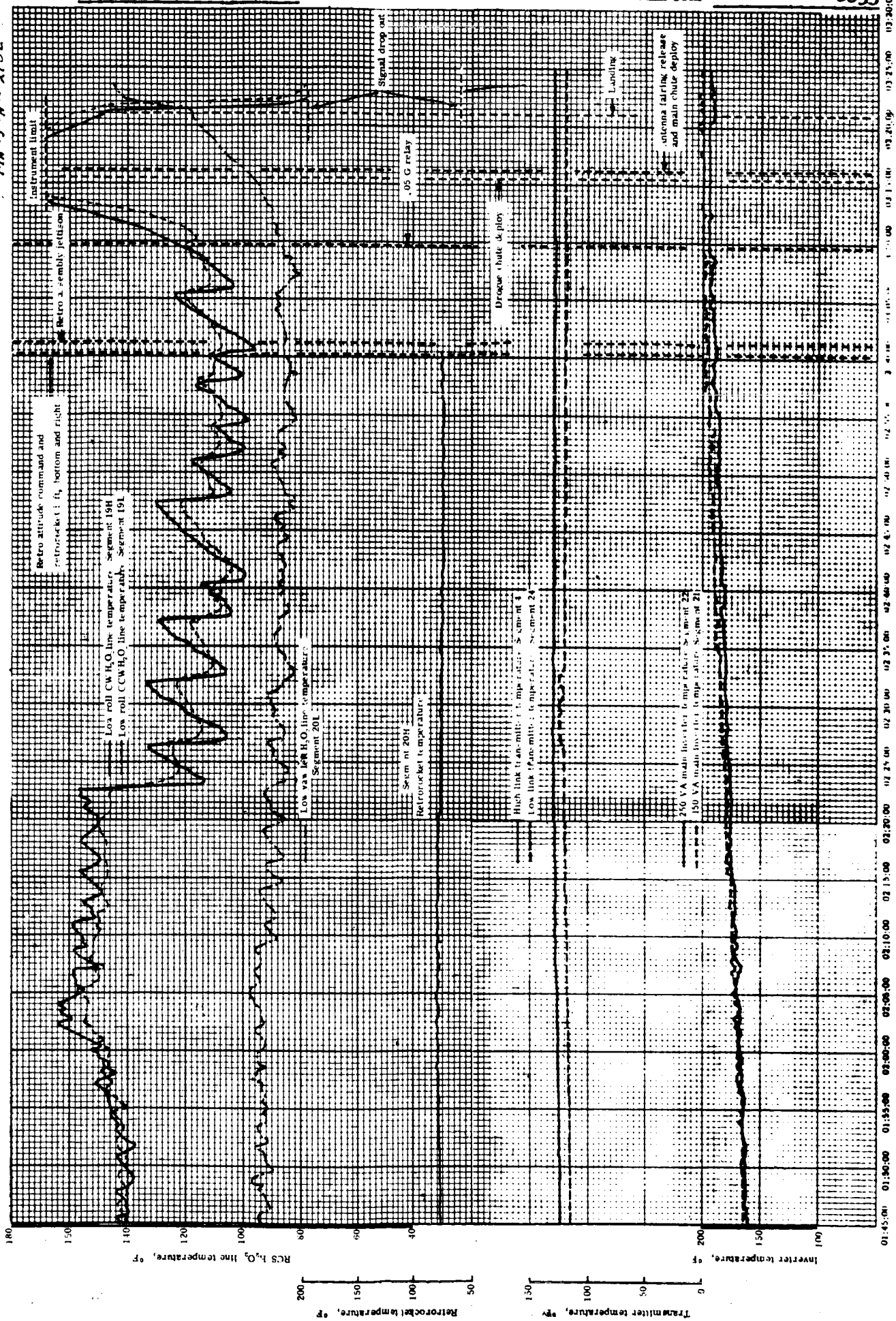
PAGE 7-9

REPORT 8633



[redacted]

MA-5-M-A102



CONFIDENTIAL

CONFIDENTIAL

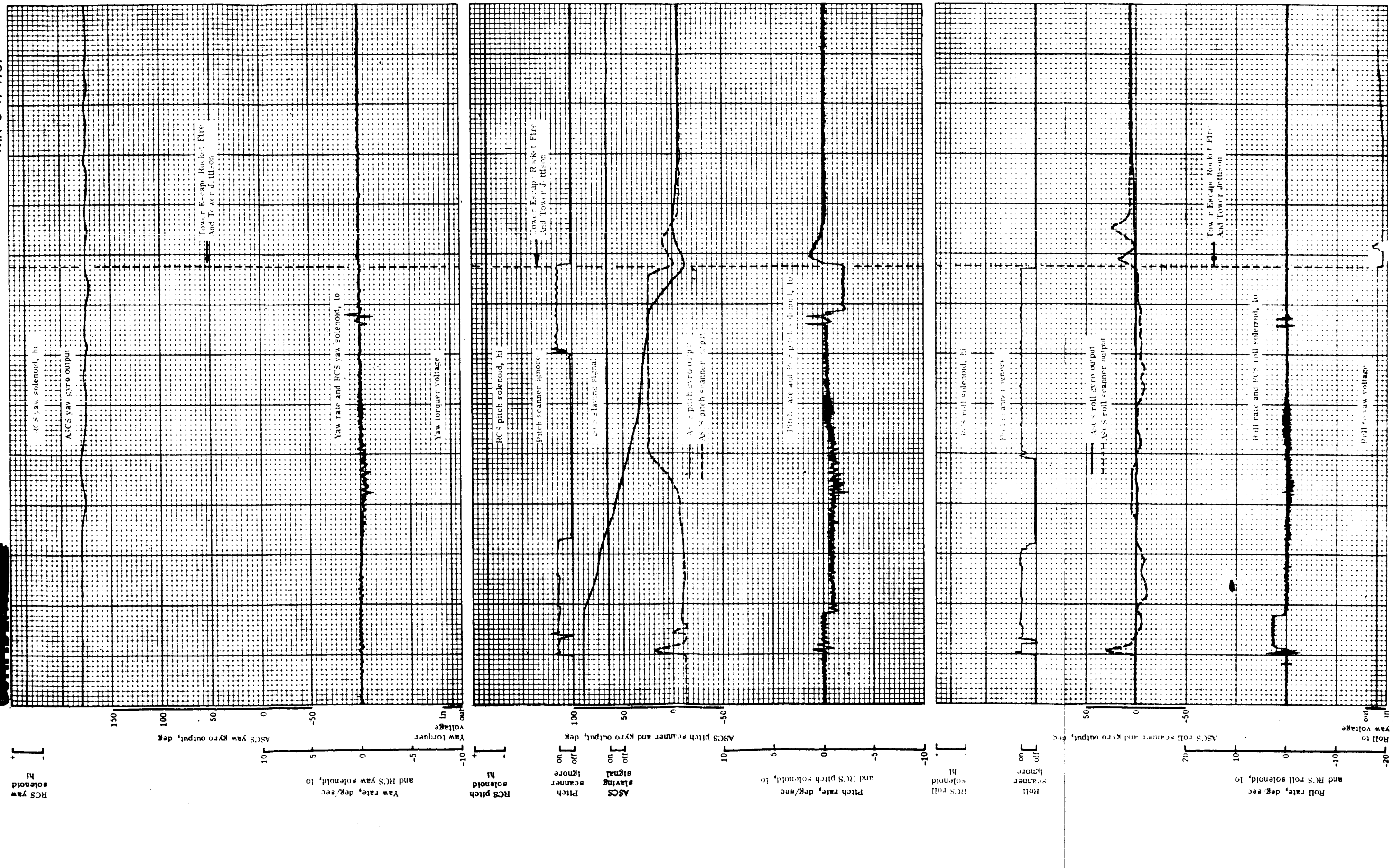
DATE 6 March 1962

MODEL 133

PAGE 7.11

REPORT 8633

MA-5-H-1701

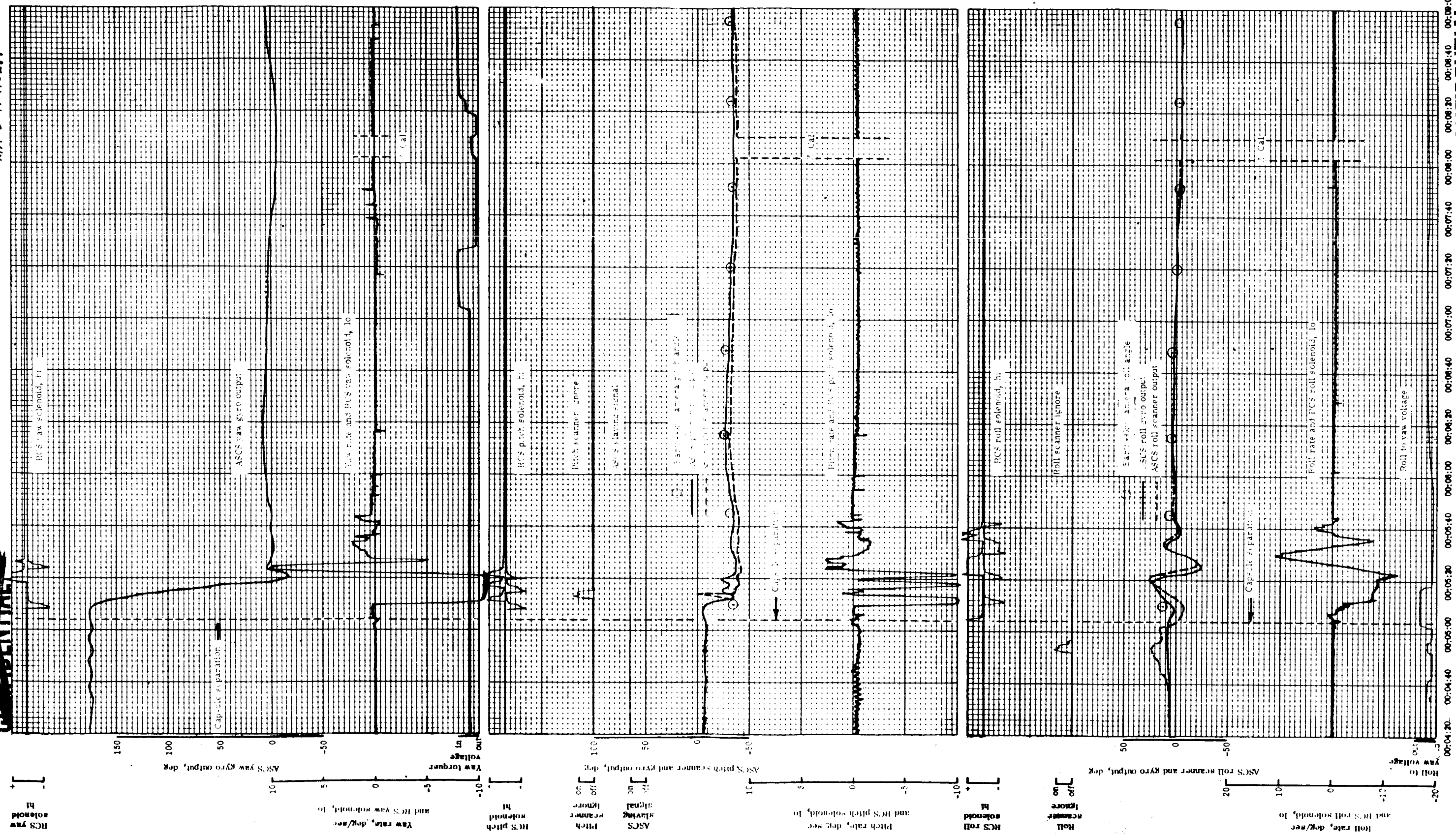


DATE 6 March 1962

MODEL 133

MA-5-H-1702A

CONFIDENTIAL

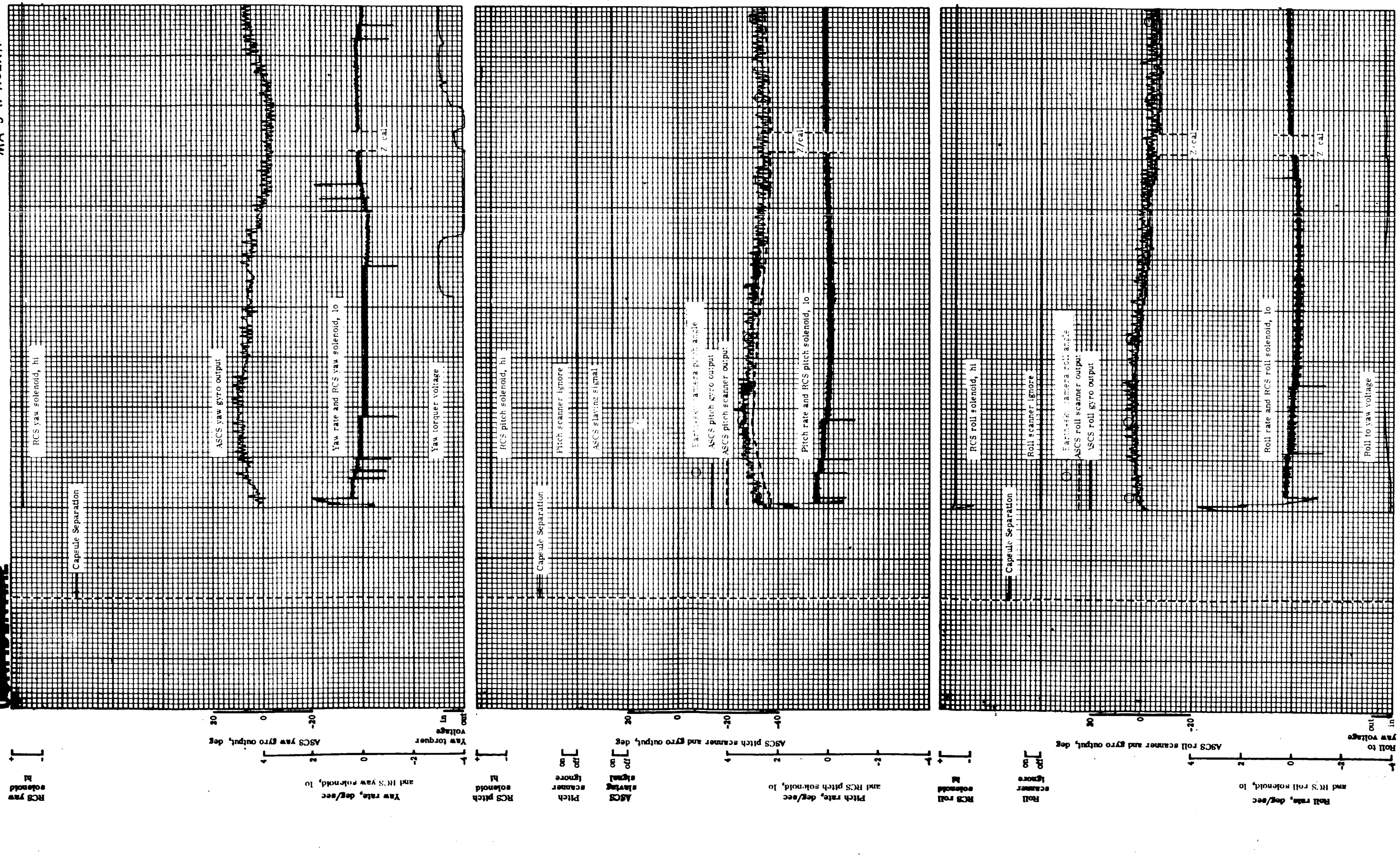


DATE 6 March 1962

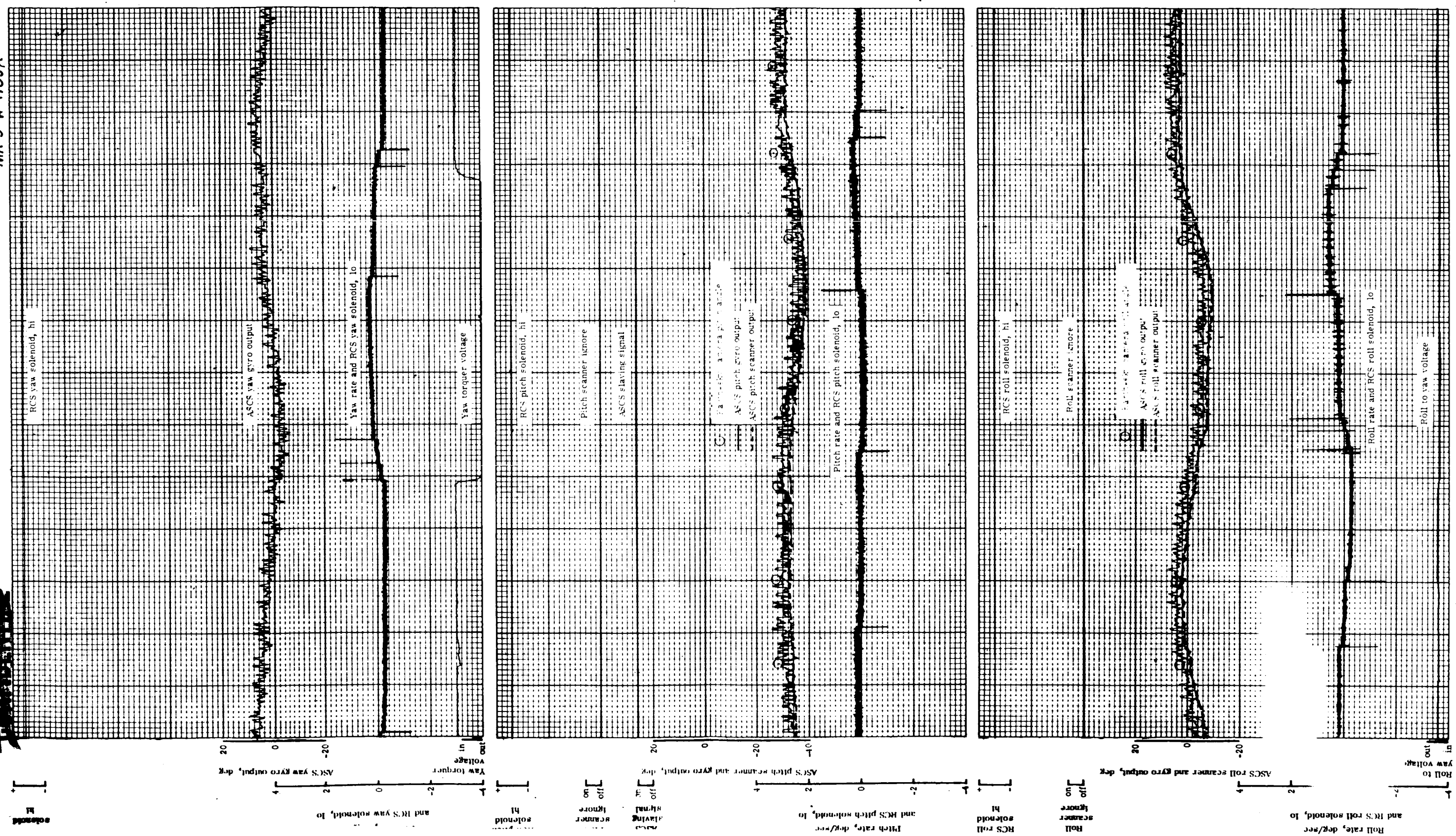
MODEL 133

REPORT 7633

MA-5-H-1702A

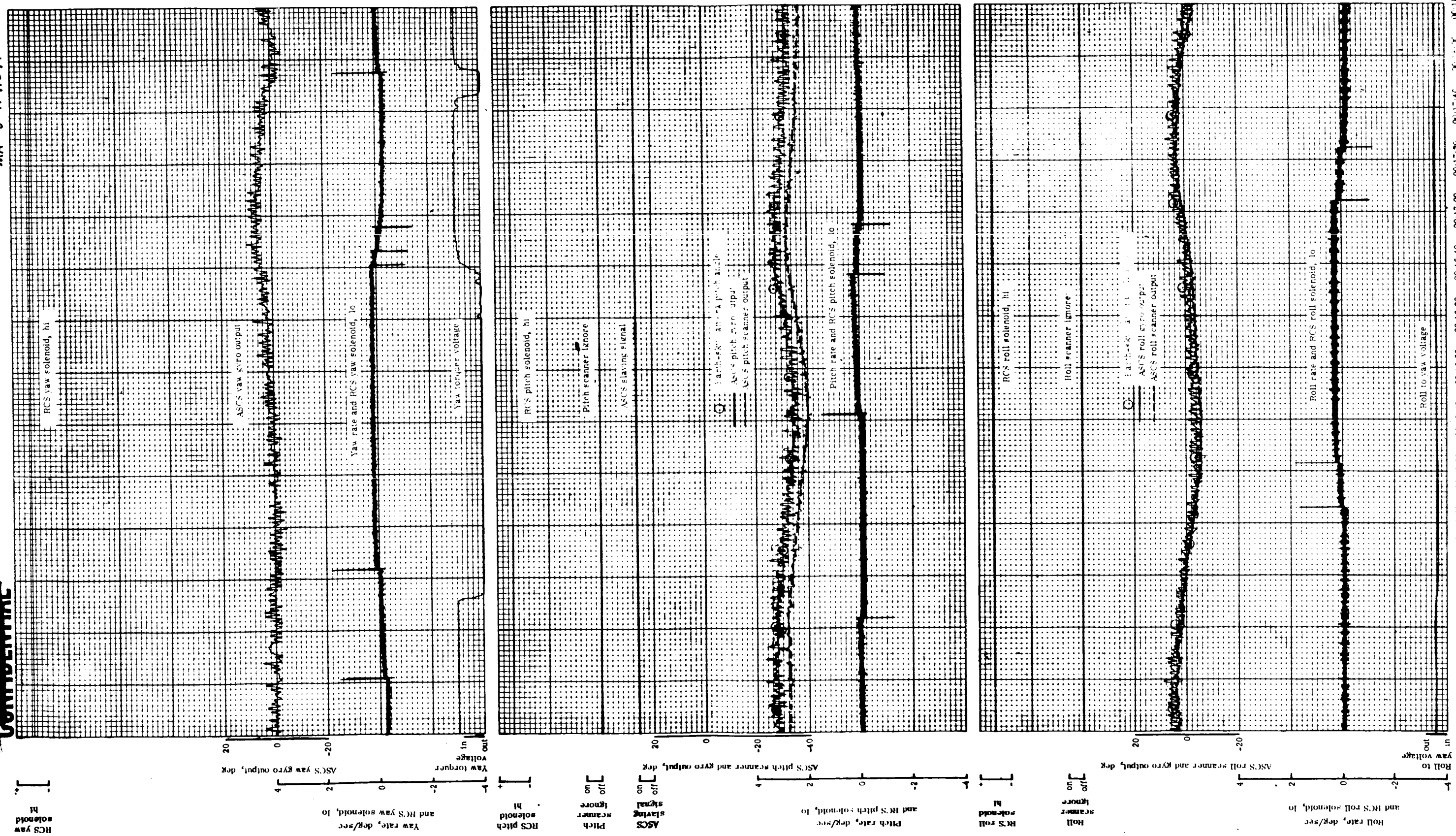


MA-5-W-1703A



CONFIDENTIAL

MA-5-H-1704A



RCS yaw solenoid hi

Yaw rate, deg/sec and RCS yaw solenoid, lo

RCS pitch solenoid hi

ASCS slaving signal: on / off

Pitch scanner ignore: on / off

Pitch rate, deg/sec and RCS pitch solenoid, lo

RCS roll solenoid hi

Roll scanner ignore: on / off

Roll rate, deg/sec and RCS roll solenoid, lo

ASCS yaw gyro output, deg

Yaw torquer voltage: in / out

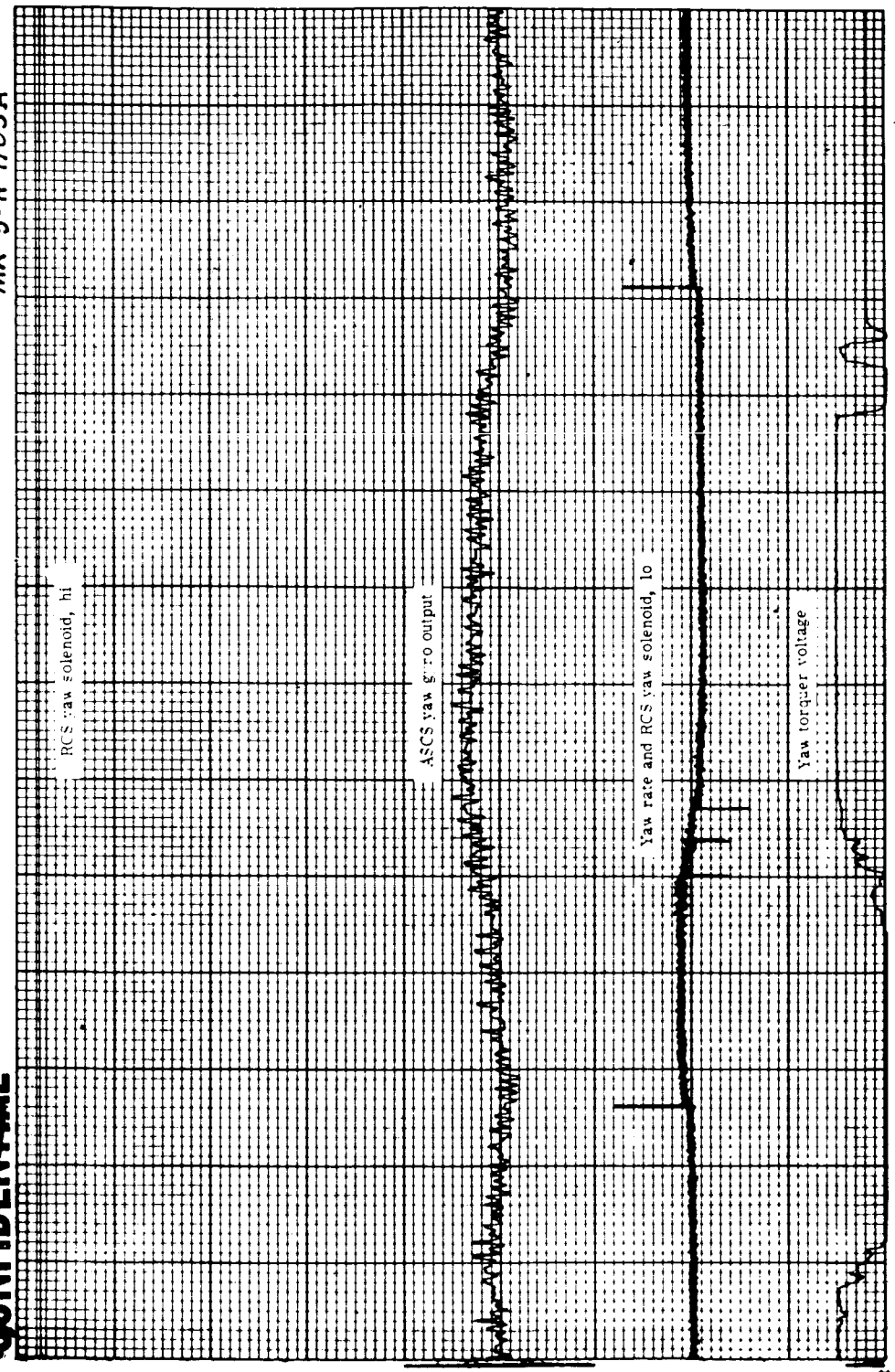
ASCS pitch scanner and gyro output, deg

ASCS roll scanner and gyro output, deg

Roll to yaw voltage: out / in

CONFIDENTIAL

MA-5-H-1705A



CONFIDENTIAL

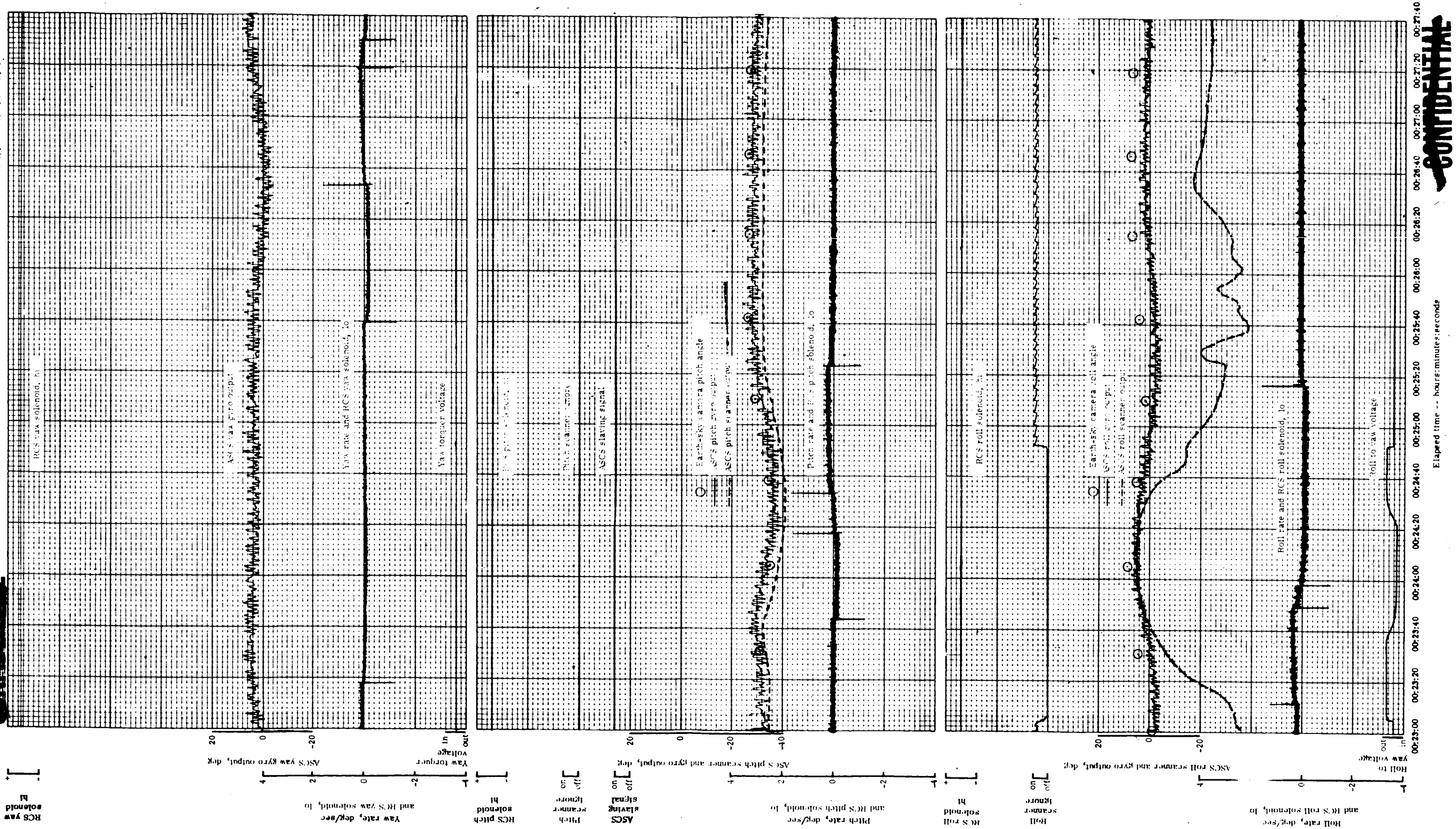
DATE 6 March 1962

MODEL 133

PAGE 7.17

REPORT 8633

MA-5-H-1706A



Yaw torquer voltage

ASCS yaw gyro output, deg

Yaw rate, deg/sec and RCS yaw solenoid, lo

RCS pitch solenoid hi

Pitch scanner ignore

ASCS slaving signal

ASCS pitch scanner and gyro output, deg

Pitch rate, deg/sec and RCS pitch solenoid, lo

RCS roll solenoid hi

Roll scanner ignore

ASCS roll scanner and gyro output, deg

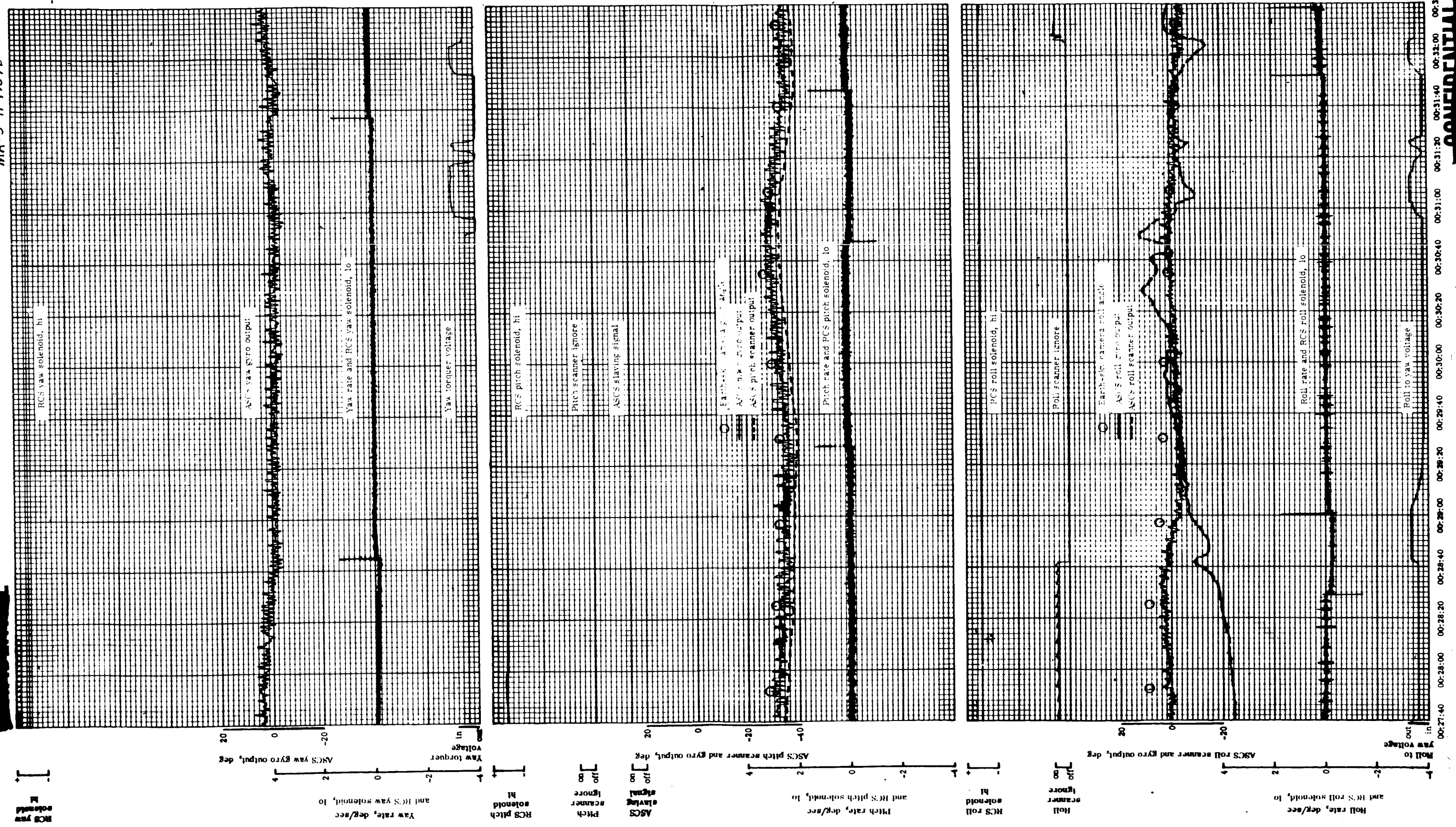
Roll rate, deg/sec and RCS roll solenoid, lo

Roll to tau voltage

RCS yaw solenoid hi

CONFIDENTIAL

MA-5-H-170TB



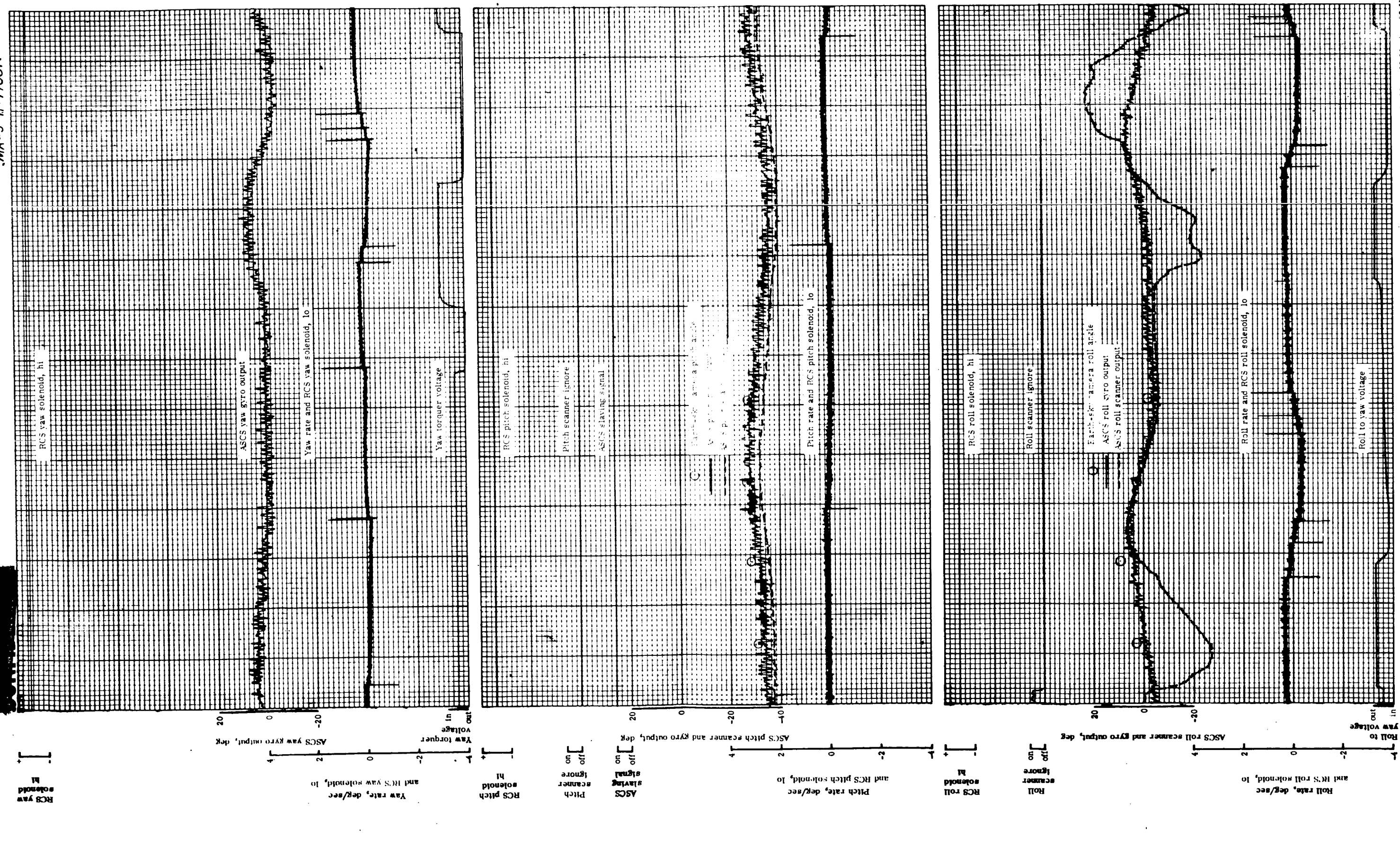
CONFIDENTIAL

DATE 6 March 1962

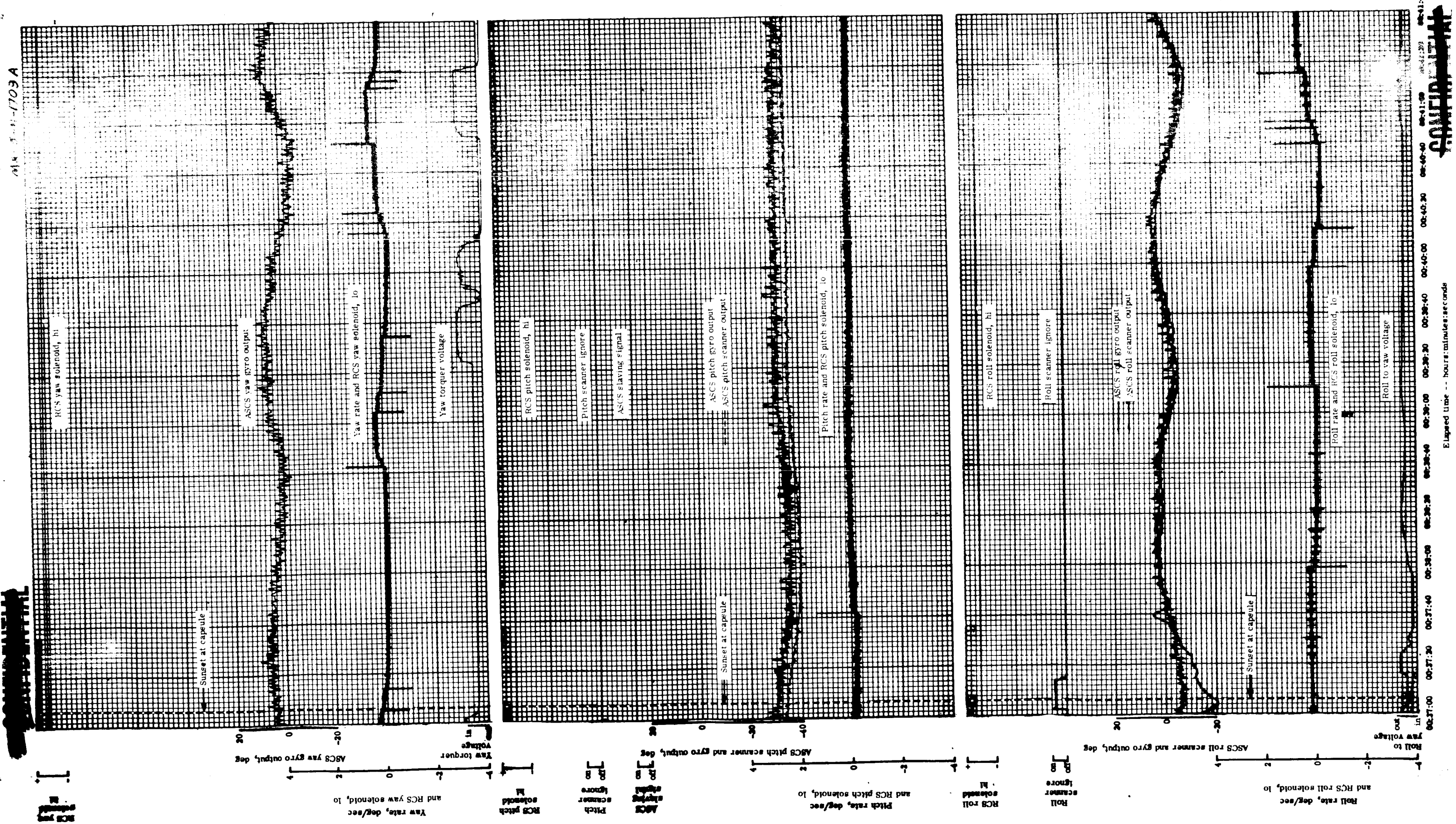
MODEL 133

REPORT 8633

MA-5-H-1708A



CONFIDENTIAL

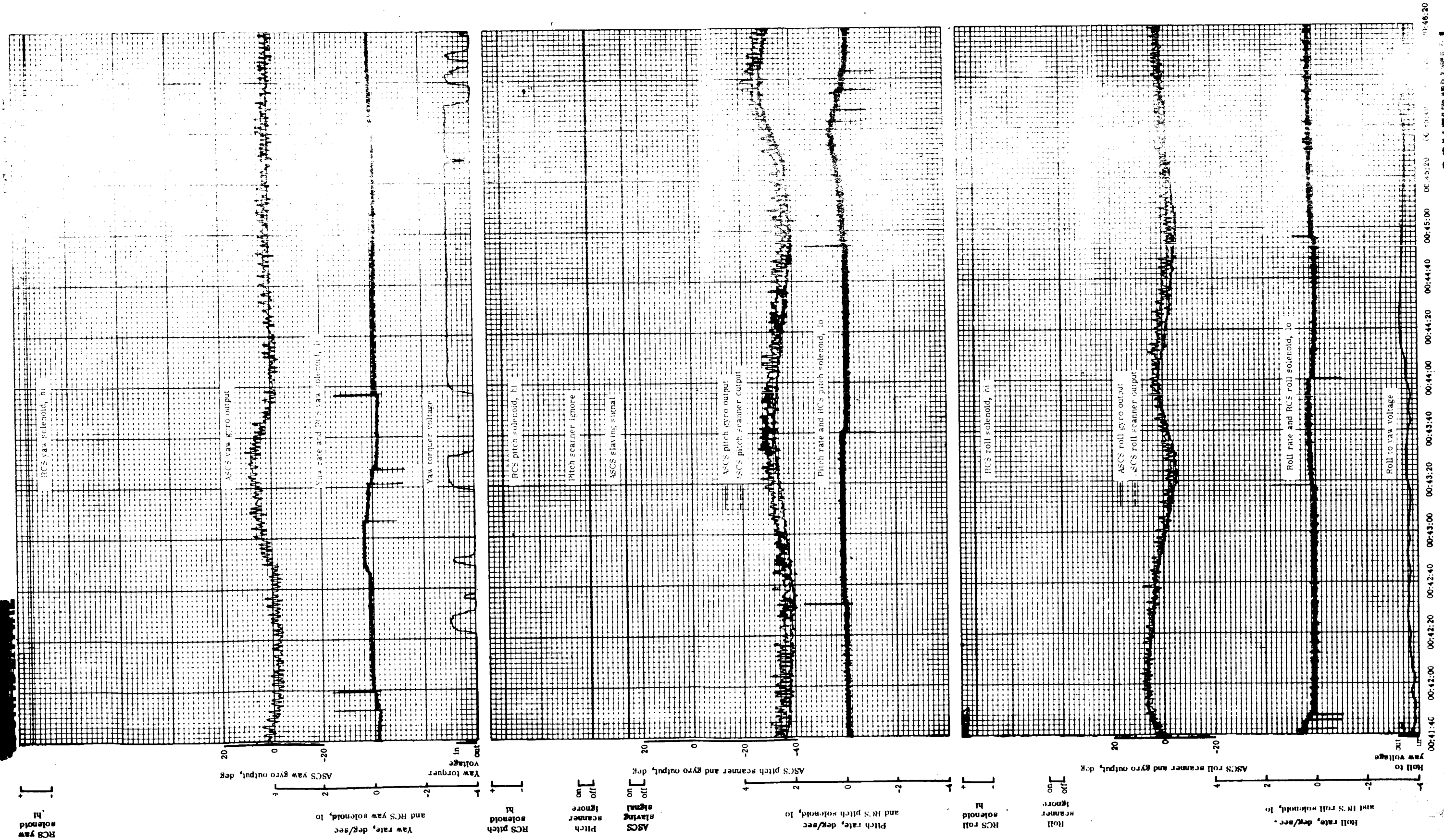

Yaw rate, deg/sec and RCS yaw solenoid, lo
RCS yaw solenoid, hi
ASCS yaw gyro output
Yaw rate and RCS yaw solenoid, lo
Yaw torquer voltage
Sunset at capsule
ASCS yaw gyro output, deg
Yaw torquer voltage
Pitch rate, deg/sec and RCS pitch solenoid, lo
RCS pitch solenoid, hi
Pitch scanner ignore
ASCS slaving signal
ASCS pitch gyro output
ASCS pitch scanner output
Pitch rate and RCS pitch solenoid, lo
Sunset at capsule
ASCS pitch scanner and gyro output, deg
Roll rate, deg/sec and RCS roll solenoid, lo
RCS roll solenoid, hi
Roll scanner ignore
ASCS roll gyro output
ASCS roll scanner output
Roll rate and RCS roll solenoid, lo
Roll torquer voltage
Sunset at capsule
ASCS roll scanner and gyro output, deg
Roll torquer voltage
Elapsed time -- hours:minutes:seconds
00:37:00
00:37:20
00:37:40
00:38:00
00:38:20
00:38:40
00:39:00
00:39:20
00:39:40
00:40:00
00:40:20
00:40:40
00:41:00
00:41:20
RCS yaw solenoid, hi
Yaw rate, deg/sec and RCS yaw solenoid, lo
RCS pitch solenoid, hi
Pitch scanner ignore
ASCS slaving signal
ASCS pitch scanner output
Pitch rate, deg/sec and RCS pitch solenoid, lo
RCS roll solenoid, hi
Roll scanner ignore
ASCS roll scanner output
Roll rate, deg/sec and RCS roll solenoid, lo

DATE 6 March 1962

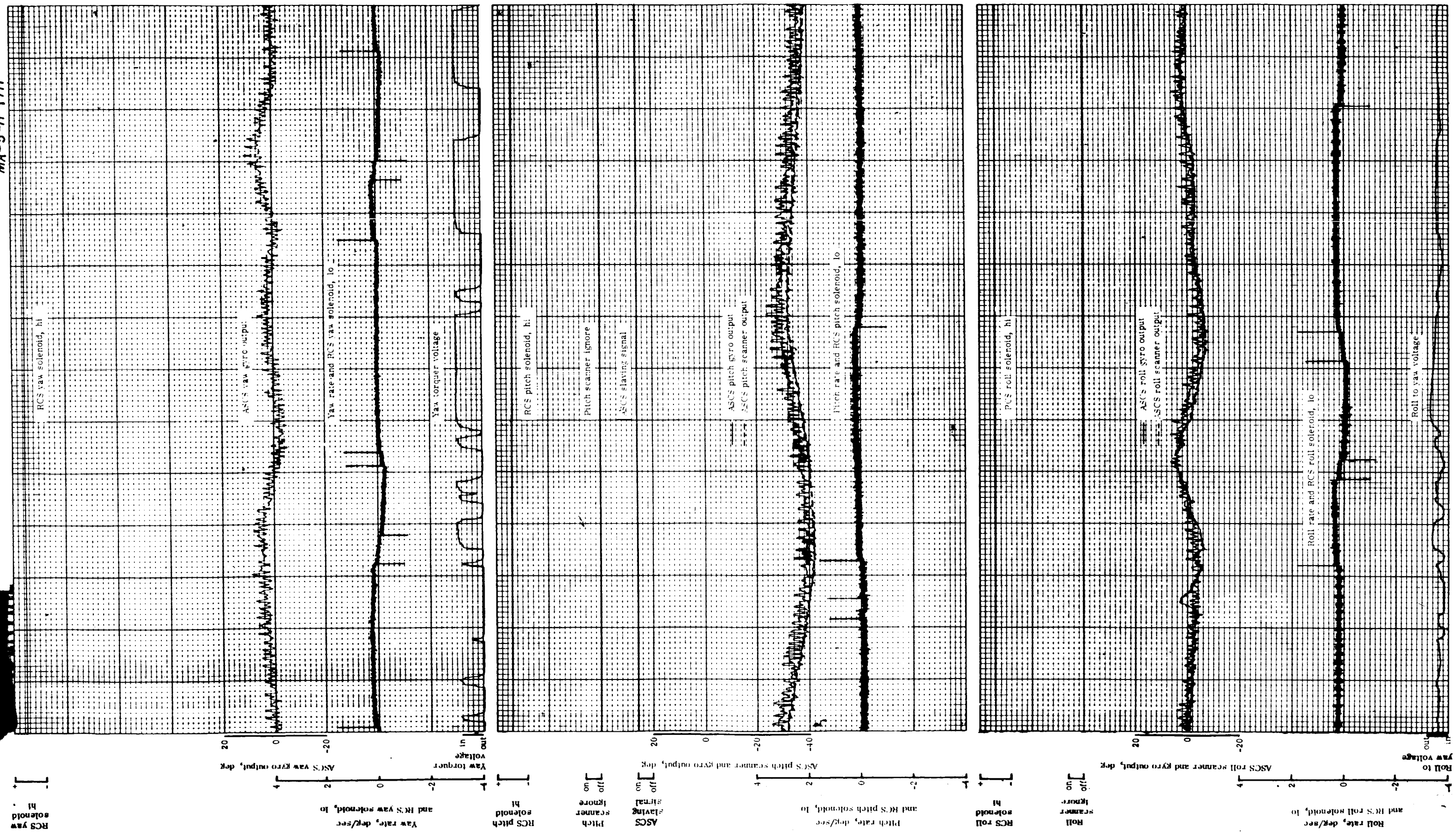
MODEL 133

PAGE 7.21

REPORT 8633



MA-5-H-1711


RCS yaw solenoid, hi
ASCS yaw gyro output
Yaw rate and RCS yaw solenoid, lo
Yaw torquer voltage
RCS pitch solenoid, hi
Pitch scanner ignore
ASCS slaving signal
ASCS pitch gyro output
ASCS pitch scanner output
Pitch rate and RCS pitch solenoid, lo
RCS roll solenoid, hi
ASCS roll gyro output
ASCS roll scanner output
Roll rate and RCS roll solenoid, lo
Roll to yaw voltage
00:46:20
00:46:40
00:47:00
00:47:20
00:47:40
00:48:00
00:48:20
00:48:40
00:49:00
00:49:20
00:49:40
00:50:00
00:50:20
00:50:40
00:51:00
Elapsed time -- hour:minute:seconds
RCS yaw solenoid hi
Yaw rate, deg/sec and RCS yaw solenoid, lo
ASCS yaw gyro output, deg
Yaw torquer voltage
RCS pitch solenoid hi
Pitch scanner ignore
ASCS slaving signal
Pitch rate, deg/sec and RCS pitch solenoid, lo
ASCS pitch scanner and gyro output, deg
RCS roll solenoid hi
Roll scanner ignore
Roll rate, deg/sec and RCS roll solenoid, lo
ASCS roll scanner and gyro output, deg
Roll to yaw voltage

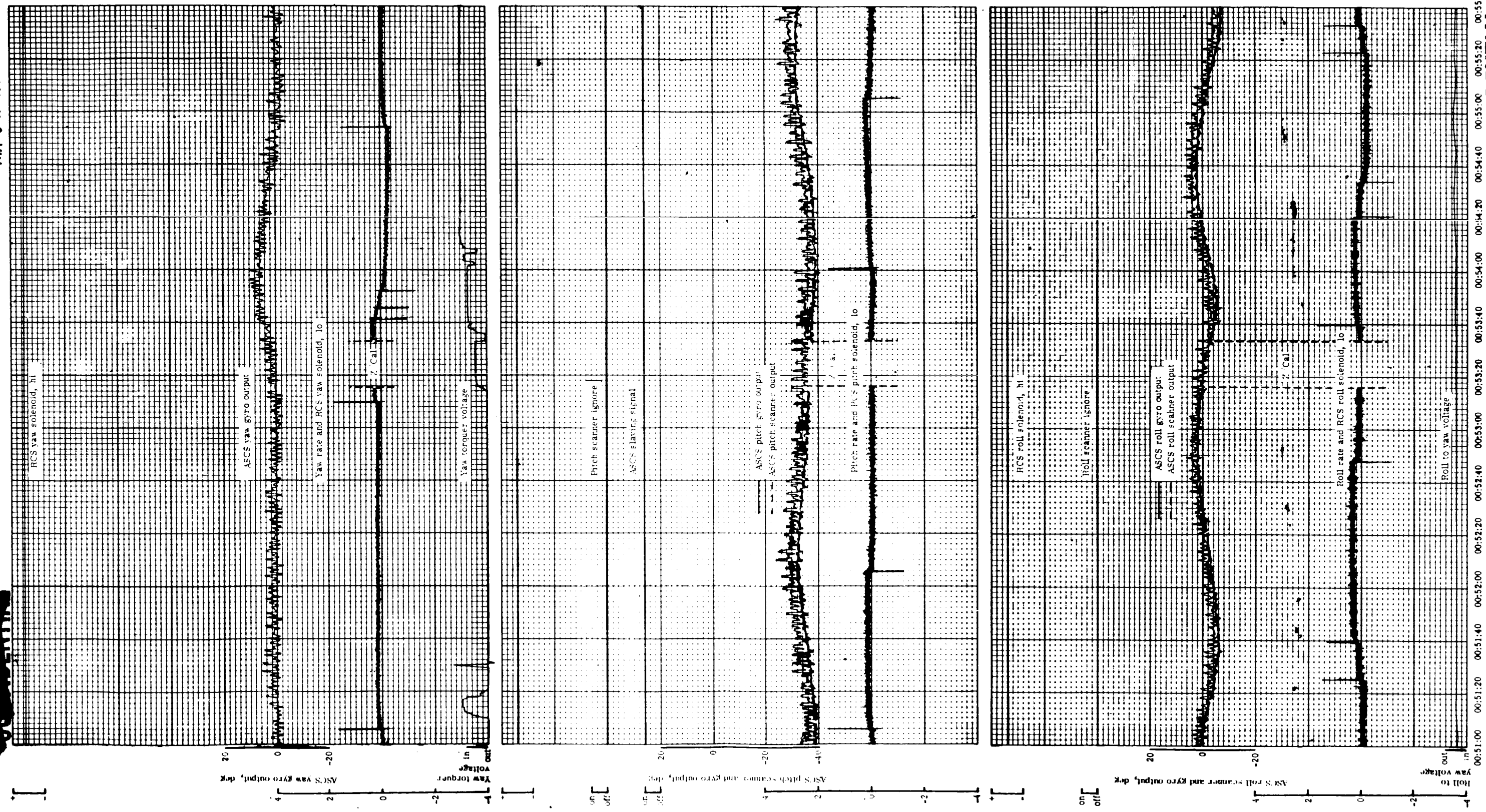
DATE 6 March 1962

MODEL 133

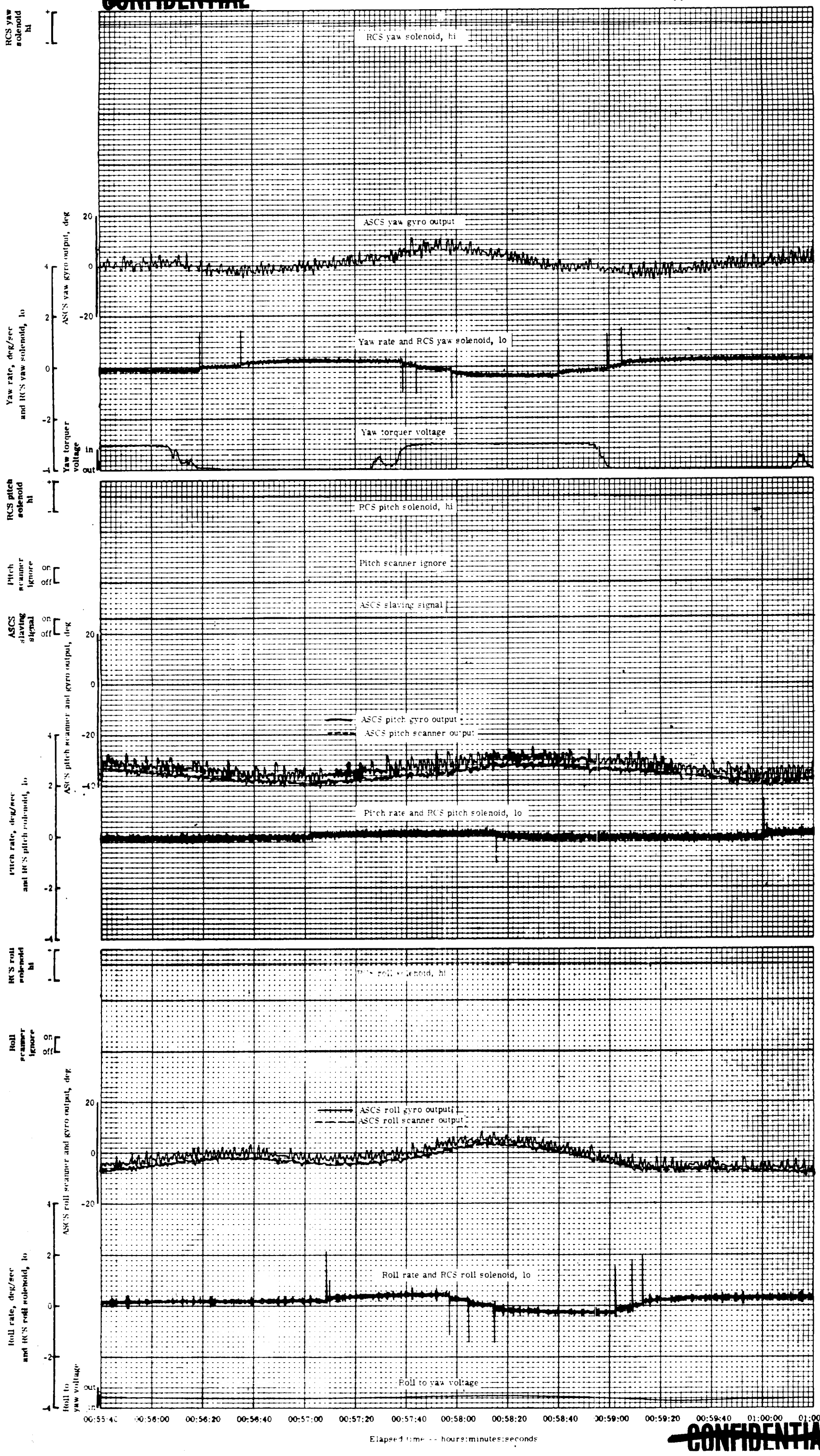
PAGE 7.23

REPORT 8633

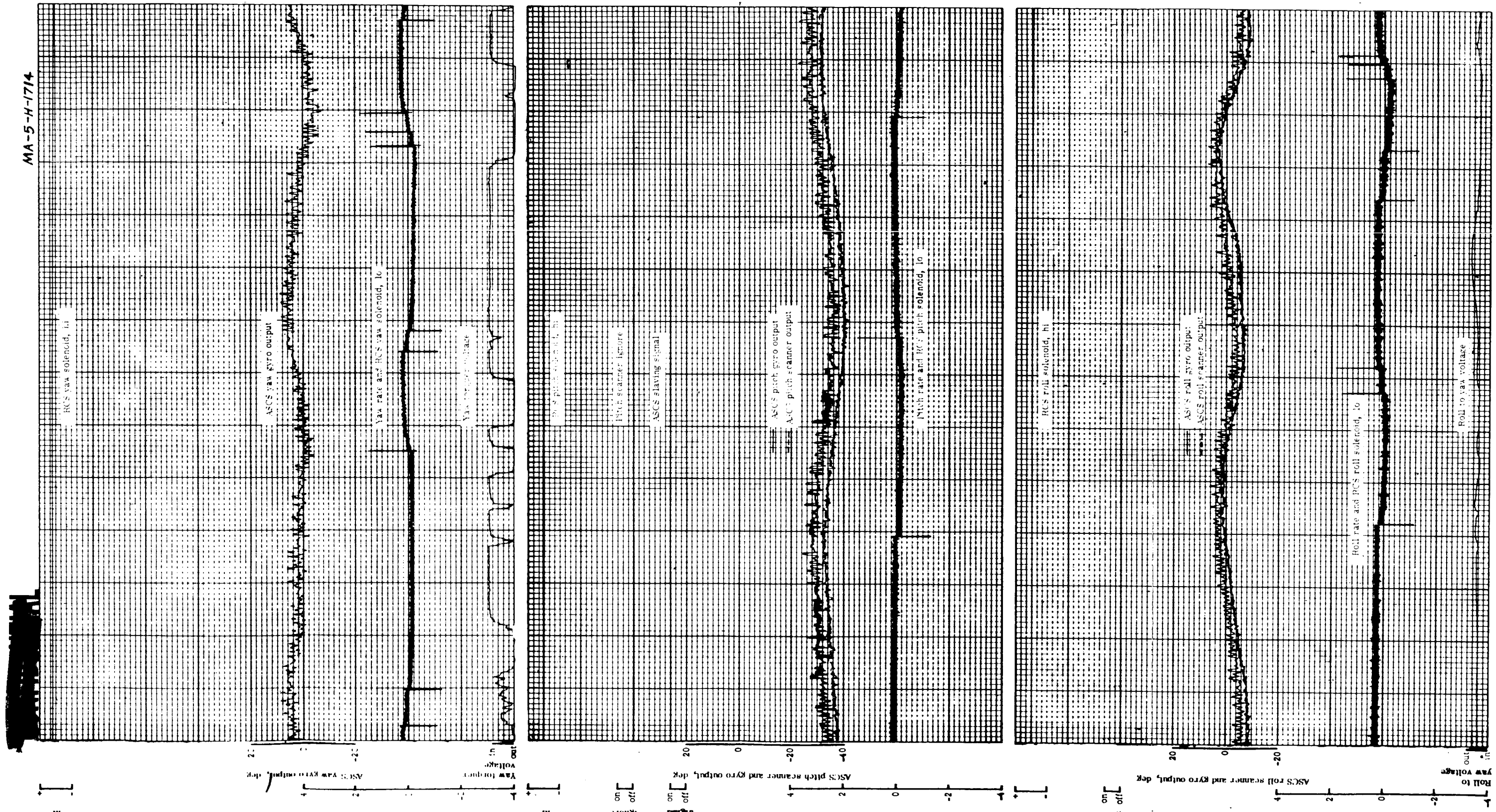
MA-5-H-1712



CONFIDENTIAL


RCS yaw solenoid hi
RCS yaw solenoid, hi
ASCS yaw gyro output, deg
ASCS yaw gyro output
Yaw rate, deg/sec and RCS yaw solenoid, lo
Yaw rate and RCS yaw solenoid, lo
Yaw torquer voltage
in
out
RCS pitch solenoid hi
RCS pitch solenoid, hi
Pitch scanner ignore
on
off
ASCS slaving signal
ASCS pitch scanner and gyro output, deg
ASCS pitch gyro output
ASCS pitch scanner output
Pitch rate and RCS pitch solenoid, lo
RCS roll solenoid hi
RCS roll solenoid, hi
Roll scanner ignore
ASCS roll scanner and gyro output, deg
ASCS roll gyro output
ASCS roll scanner output
Roll rate, deg/sec and RCS roll solenoid, lo
Roll rate and RCS roll solenoid, lo
Roll to yaw voltage
00:55:40
00:56:00
00:56:20
00:56:40
00:57:00
00:57:20
00:57:40
00:58:00
00:58:20
00:58:40
00:59:00
00:59:20
00:59:40
01:00:00
01:00:20
Elapsed time -- hours:minutes:seconds

MA-5-H-1714



CONFIDENTIAL

DATE 6 March 1962

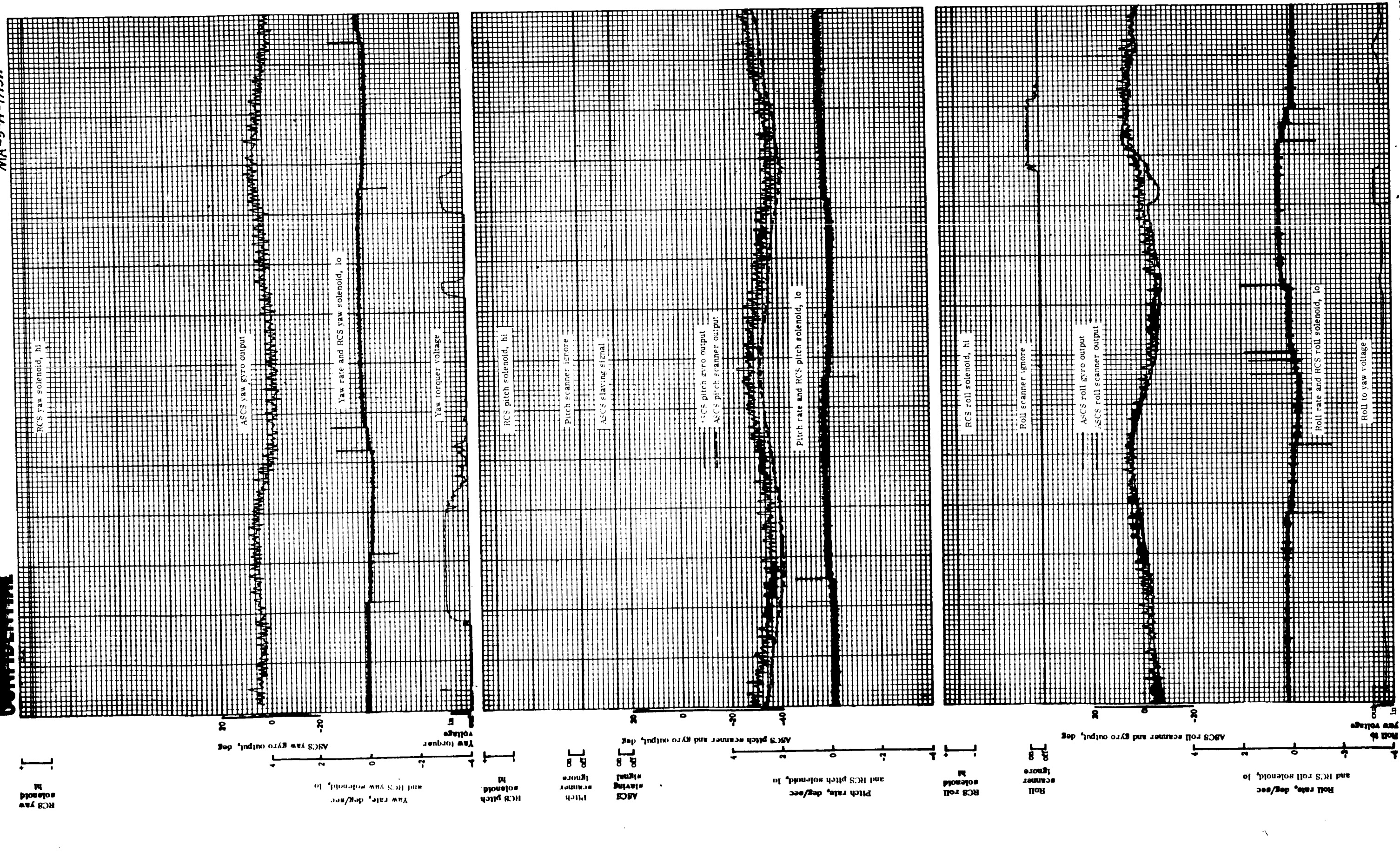
MODEL 133

PAGE 7.26

REPORT 8633

MA-5-H-1715A

CONFIDENTIAL



RCS yaw solenoid, hi

Yaw torquer voltage

ASCS yaw gyro output, deg

Yaw rate, deg/sec and RCS yaw solenoid, lo

RCS pitch solenoid, hi

Pitch scanner ignore

ASCS slaving signal

ASCS pitch scanner output

ASCS pitch gyro output

Pitch rate and RCS pitch solenoid, lo

RCS roll solenoid, hi

Roll scanner ignore

ASCS roll scanner output

ASCS roll gyro output

Roll rate and RCS roll solenoid, lo

Roll to yaw voltage

ASCS pitch scanner and gyro output, deg

Pitch rate, deg/sec and RCS pitch solenoid, lo

ASCS roll scanner and gyro output, deg

Roll rate, deg/sec and RCS roll solenoid, lo

RCS yaw solenoid hi

RCS pitch solenoid hi

RCS roll solenoid hi

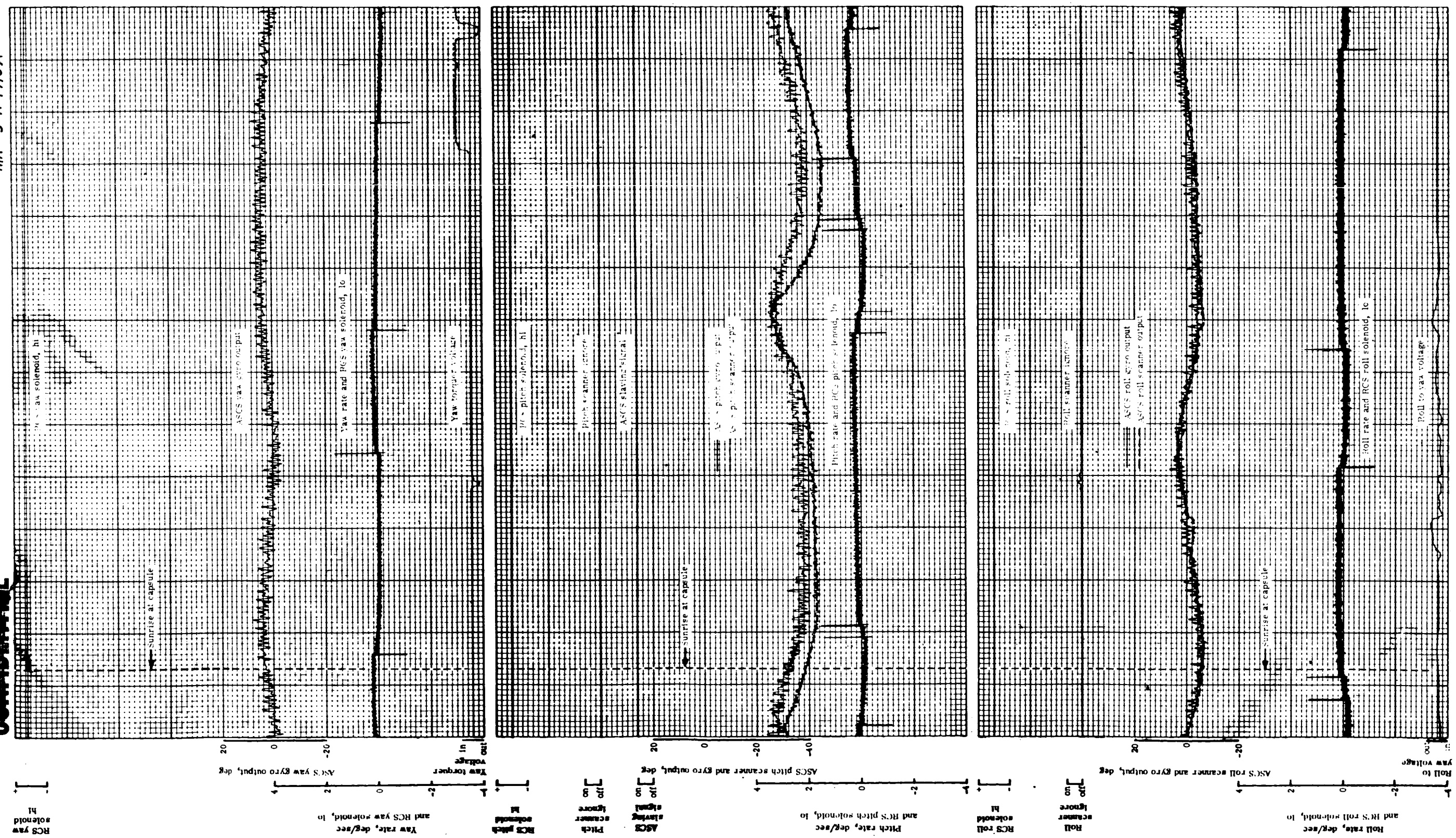
Pitch scanner ignore

Roll scanner ignore

ASCS slaving signal

CONFIDENTIAL

MA -5-H-17/6A


CONFIDENTIAL
Roll to yaw voltage
Roll rate and RCS roll solenoid, lc
ASCS roll scanner and gyro output
Roll scanner lamps
ASCS roll sub-mode, hi
Sunrise at capsule
ASCS roll scanner and gyro output, deg
Roll rate, deg/sec and RCS roll solenoid, lo
RCS roll solenoid hi
Roll scanner ignore
Pitch rate and RCS pitch solenoid, lc
ASCS pitch scanner and gyro output
ASCS slaving signal
Pitch scanner lamps
Pitch sub-mode, hi
Pitch rate, deg/sec and RCS pitch solenoid, lo
RCS pitch solenoid hi
Pitch scanner ignore
Yaw rate and RCS yaw solenoid, lc
ASCS yaw scanner and gyro output
Yaw scanner lamps
Yaw sub-mode, hi
Yaw rate, deg/sec and RCS yaw solenoid, lo
Yaw torquer voltage
RCS yaw solenoid hi
01:09:40
01:10:00
01:10:20
01:10:40
01:11:00
01:11:20
01:11:40
01:12:00
01:12:20
01:12:40
01:13:00
01:13:20
01:13:40
01:14:00
01:14:20
Elapsed time -- hours:minutes:seconds

DATE 6 March 1962

MODEL 133

REPORT 8633

MA-5-H-1717A

CONFIDENTIAL

Elapsed time -- hours:minutes:seconds

01:14:20 01:14:40 01:15:00 01:15:20 01:15:40 01:16:00 01:16:20 01:16:40 01:17:00 01:17:20 01:17:40 01:18:00 01:18:20 01:18:40 01:19:00

Roll to yaw voltage

ASCS roll scanner and RCS roll solenoid, hi

Roll rate and RCS roll solenoid, lo

ASCS roll gyro output

Pitch scanner ignore

Pitch rate and RCS pitch solenoid, lo

ASCS pitch scanner and gyro output, deg

ASCS pitch scanning signal

RCS pitch solenoid, hi

Yaw torquer voltage

Yaw rate and RCS yaw solenoid, lo

ASCS yaw gyro output

RCS yaw solenoid, hi

ASCS yaw scanner and gyro output, deg

Roll to yaw voltage

Roll rate, deg/sec and RCS roll solenoid, lo

Roll scanner ignore

RCS roll solenoid hi

Pitch rate, deg/sec and RCS pitch solenoid, lo

ASCS scanning signal

Pitch scanner ignore

RCS pitch solenoid hi

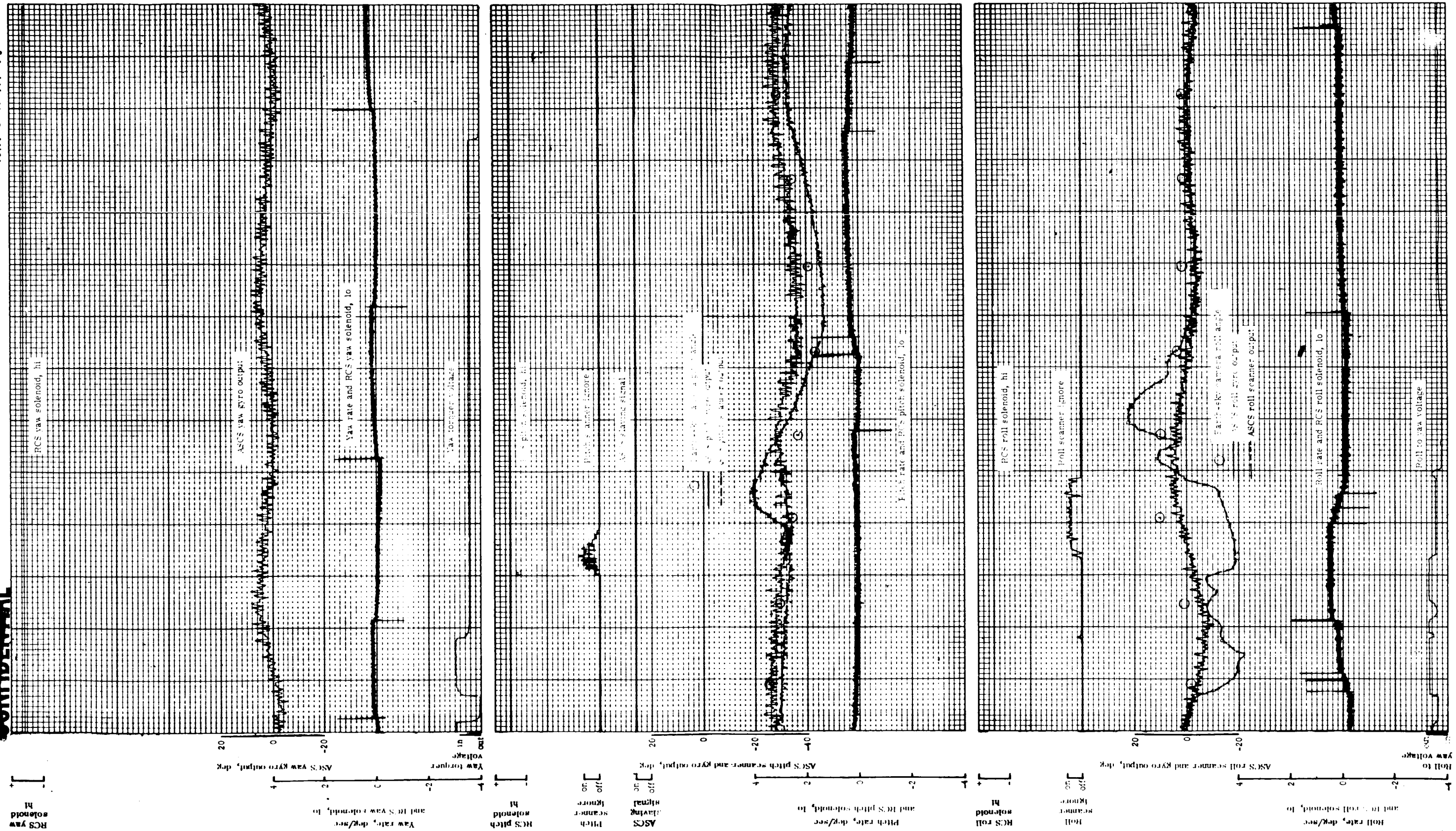
Yaw rate, deg/sec and RCS yaw solenoid, lo

ASCS yaw scanner and gyro output, deg

Yaw torquer voltage

RCS yaw solenoid hi

MA-5-H-1718A


CONFIDENTIAL
RCS yaw solenoid, hi
ASCS yaw gyro output
RCS yaw solenoid, lo
Yaw rate and RCS yaw solenoid, lo
Yaw torquer voltage
ASCS yaw gyro output, deg
20
0
-20
+
-
Yaw rate, deg/sec and lo S yaw solenoid, lo
+
-
RCS pitch solenoid hi
off
Pitch scanner ignore
on
ASCS aligning signal
+
-
Pitch rate, deg/sec and lo S pitch solenoid, lo
+
-
RCS roll solenoid hi
off
Roll scanner ignore
on
RCS roll solenoid, hi
Roll scanner ignore
ASCS roll scanner output
Roll rate and RCS roll solenoid, lo
Roll to yaw voltage
ASCS roll scanner and gyro output, deg
Roll to yaw voltage
Roll rate, deg/sec and lo S roll solenoid, lo
01:19:00
01:19:20
01:19:40
01:20:00
01:20:20
01:20:40
01:21:00
01:21:20
01:21:40
01:22:00
01:22:20
01:22:40
01:23:00
01:23:20
01:23:40
Elapsed time -- hours:minutes:seconds
CONFIDENTIAL

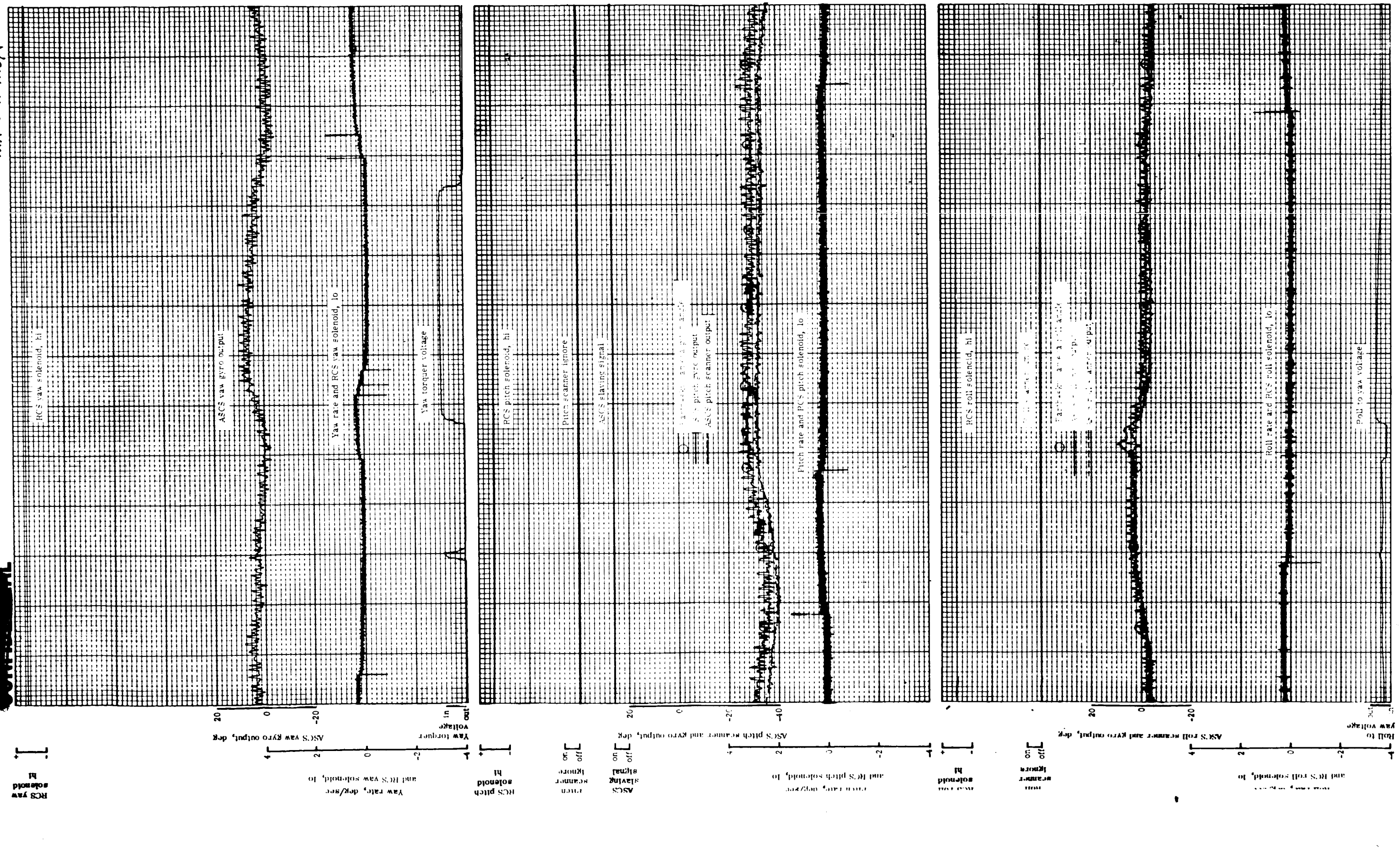
DATE 6 March 1962

MODEL 133

PAGE 7.30

REPORT 8633

MA-5-H-1719A



CONFIDENTIAL

DATE 6 March 1962

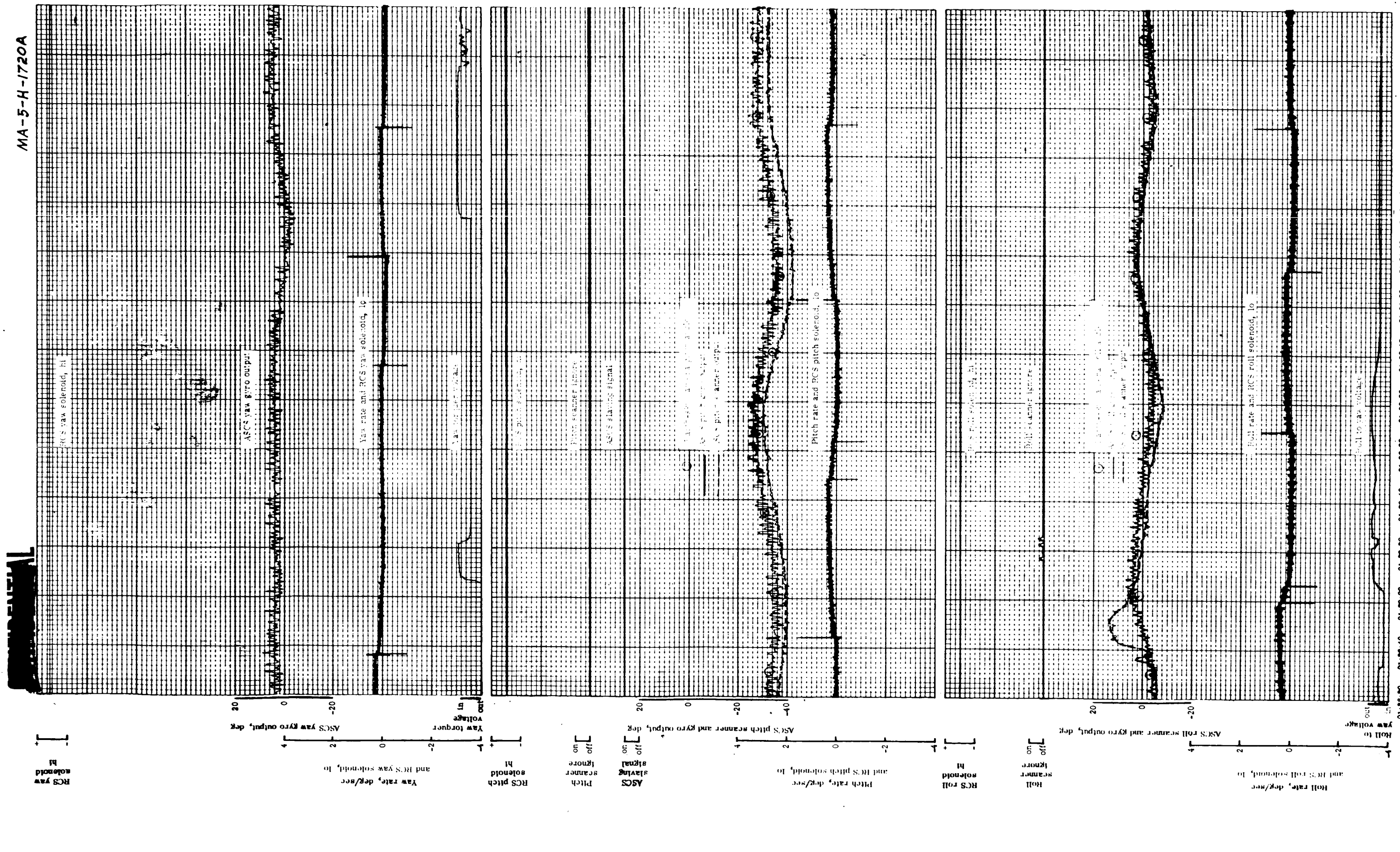
MODEL 133

PAGE 7.31

REPORT 8633

MA-5-H-1720A

CONFIDENTIAL



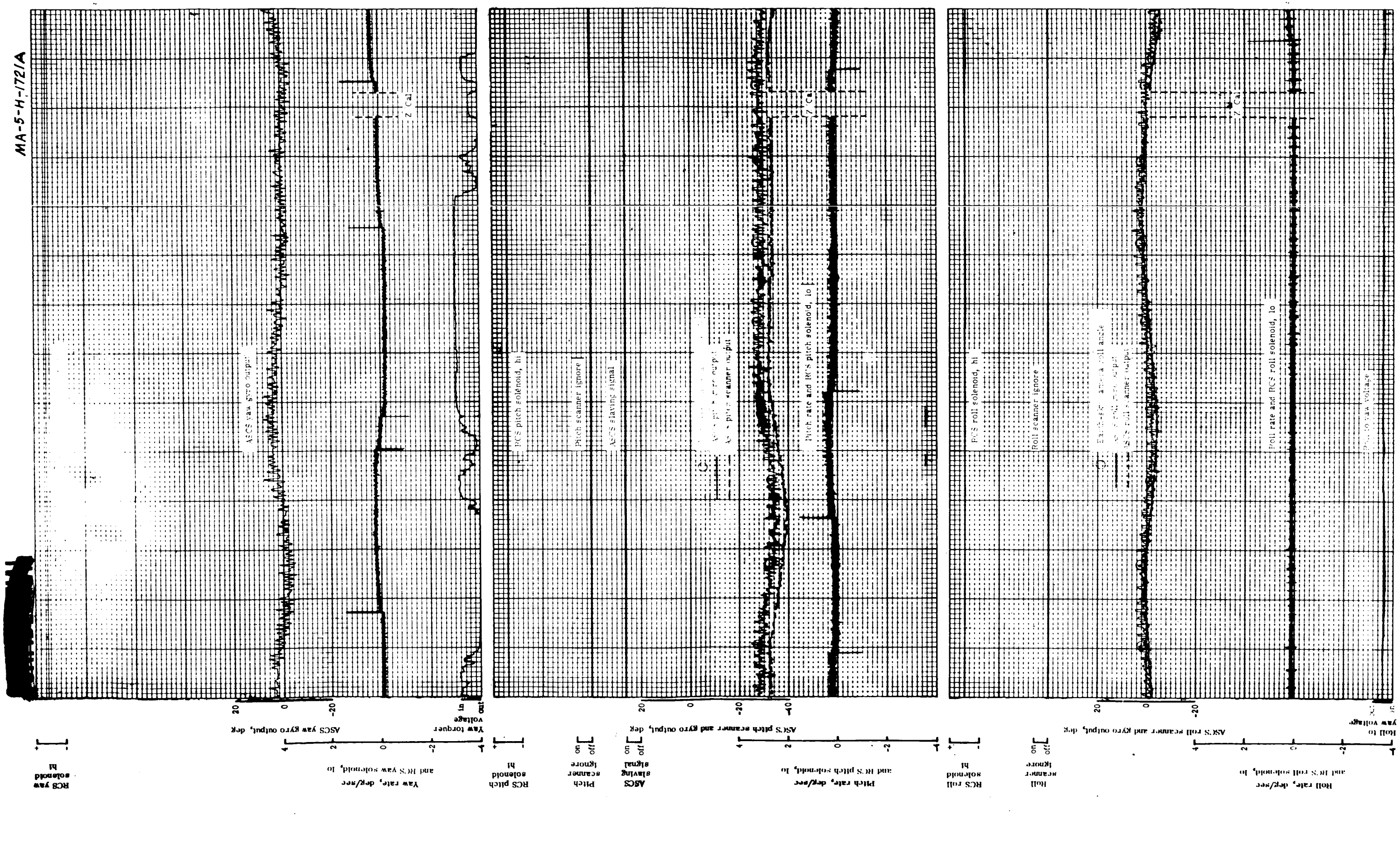
DATE 6 March 1962

MODEL 133

PAGE 7.32

REPORT 8633

MA-5-H-172A



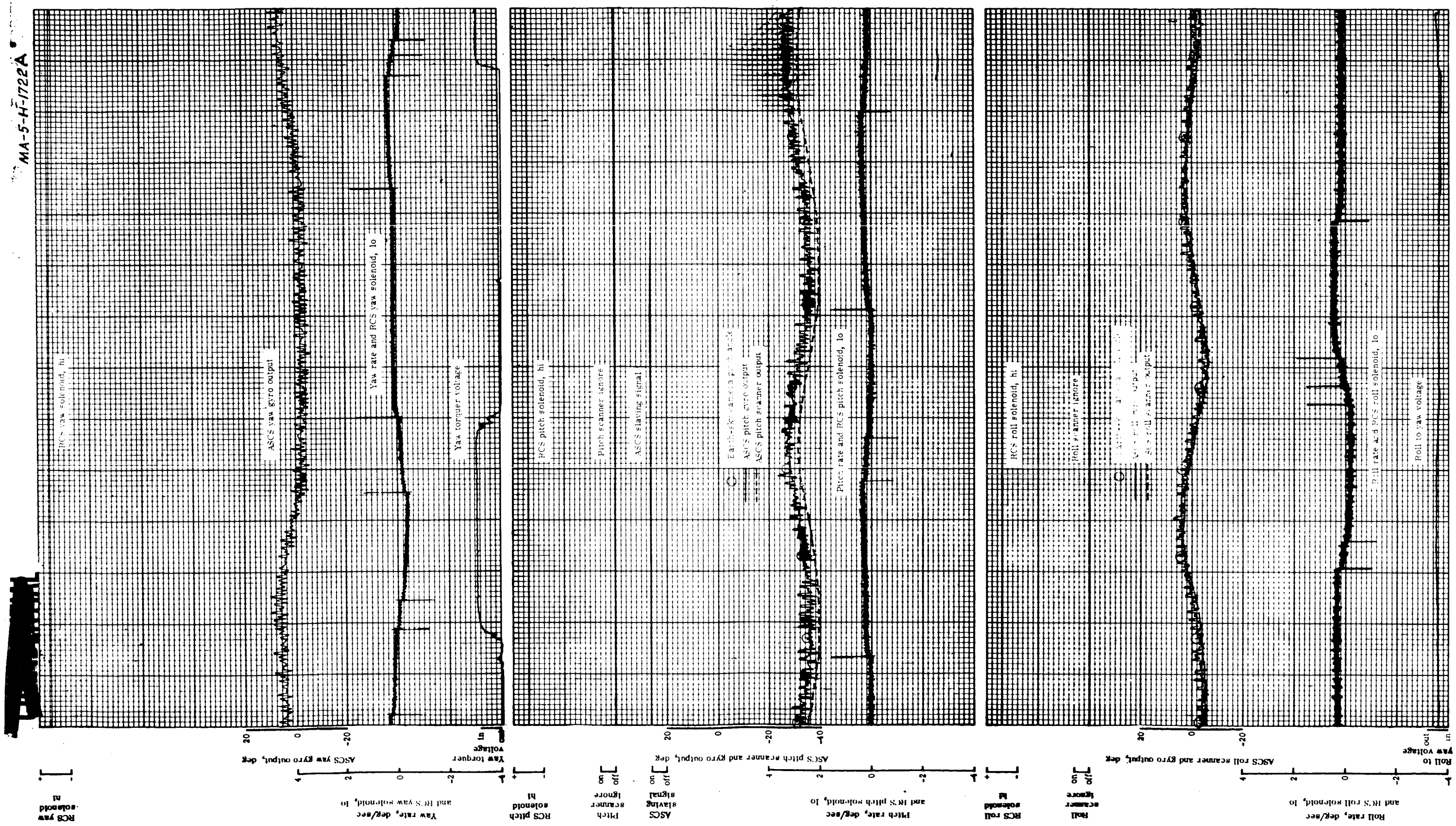
DATE 6 March 1962

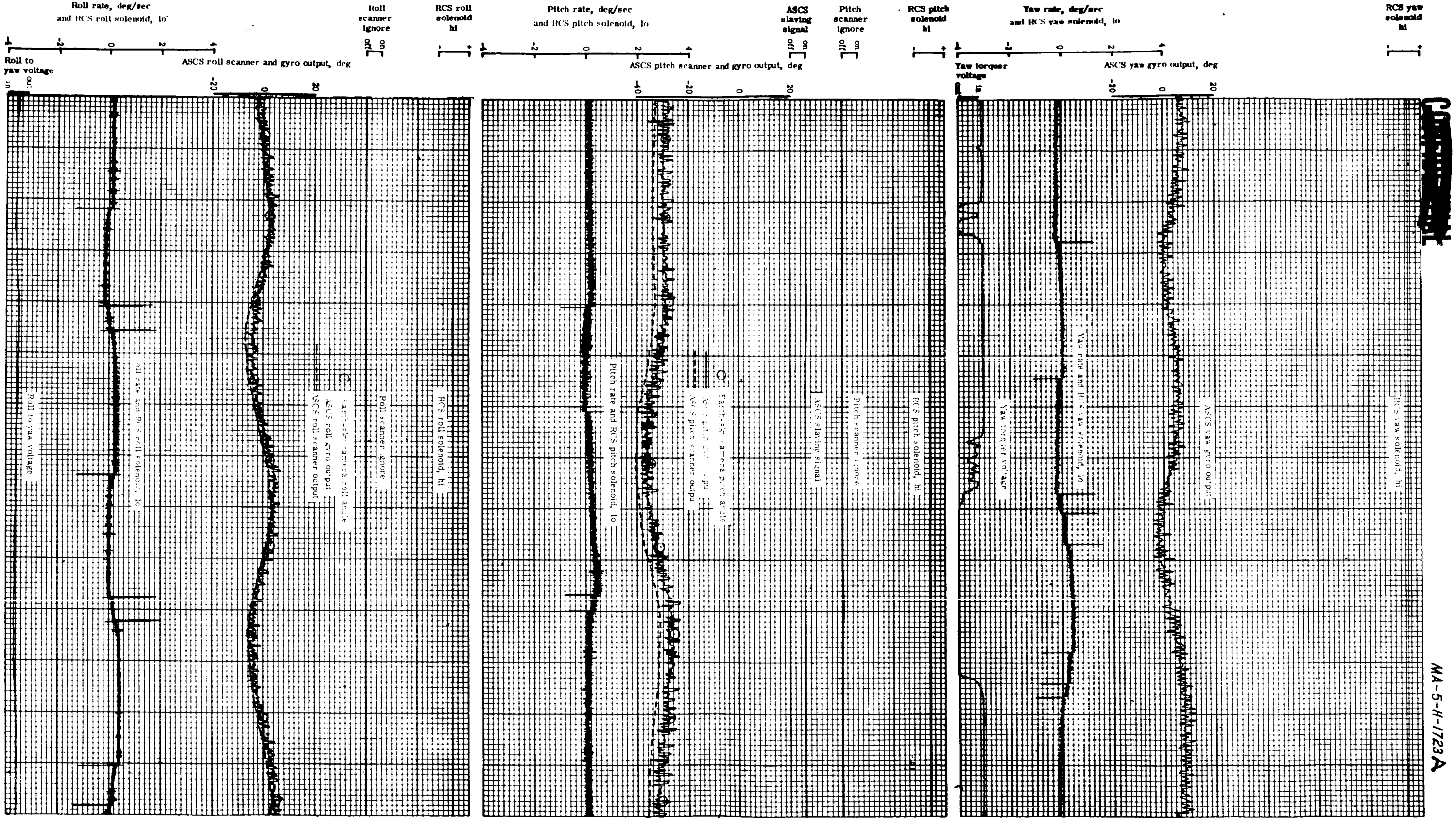
MODEL 133

PAGE 7.33

REPORT 8633

MA-5-H-1722A





DATE 6 MARCH 1965
MODEL 133
PAGE 7.34
REPORT 8633

CONFIDENTIAL

MA-5-H-1724A

DATE 6 March 1962

MODEL 133

RCS yaw solenoid, hi

ASCS yaw gyro output

Yaw rate and RCS yaw solenoid, lo

Yaw torquer voltage

RCS yaw solenoid hi

ASCS yaw gyro output, deg

Yaw rate, deg/sec and RCS yaw solenoid, lo

Yaw torquer voltage

RCS pitch solenoid, hi

Pitch scanner ignore

ASCS slaving signal

Earth-sky camera pitch angle

ASCS pitch gyro output

ASCS pitch scanner output

Pitch rate and RCS pitch solenoid, lo

RCS pitch solenoid hi

Pitch scanner ignore

ASCS slaving signal

ASCS pitch scanner and gyro output, deg

Pitch rate, deg/sec and RCS pitch solenoid, lo

RCS roll solenoid, hi

Earth-sky camera roll angle

ASCS roll gyro output

ASCS roll scanner output

Roll rate and RCS roll solenoid, lo

Roll to yaw voltage

RCS roll solenoid hi

Roll scanner ignore

ASCS roll scanner and gyro output, deg

Roll rate, deg/sec and RCS roll solenoid, lo

Roll to yaw voltage

01:47:00 01:47:20 01:47:40 01:48:00 01:48:20 01:48:40 01:49:00 01:49:20 01:49:40 01:50:00 01:50:20 01:50:40 01:51:00 01:51:20 01:51:40

Elapsed time -- hours:minutes:seconds

PAGE 7.35

REPORT 8633

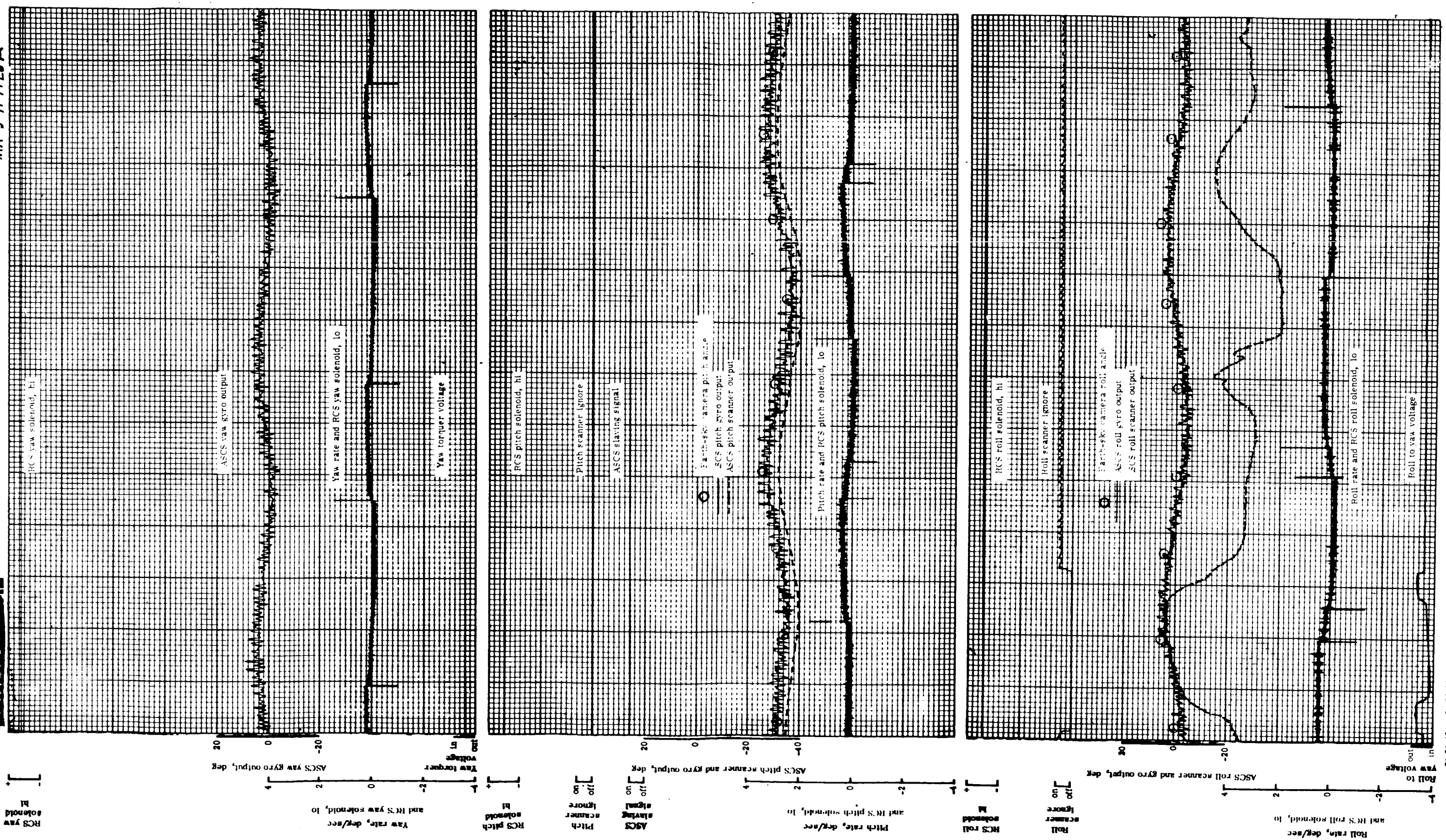
DATE 6 March 1962

MODEL 133

PAGE 7.36

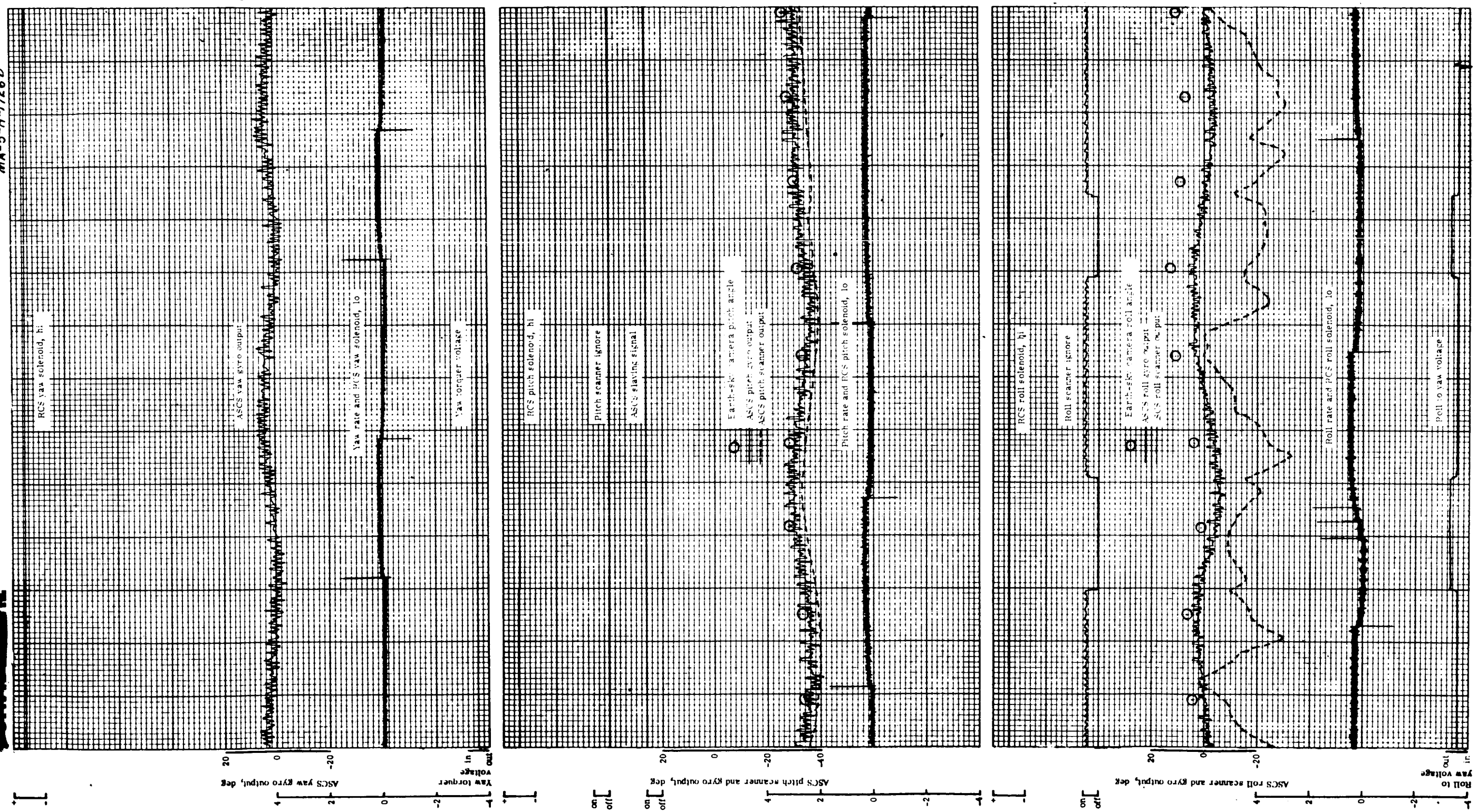
REPORT 8633

MA-5-H-1726 A



CONFIDENTIAL

MA-5-H-1726 B

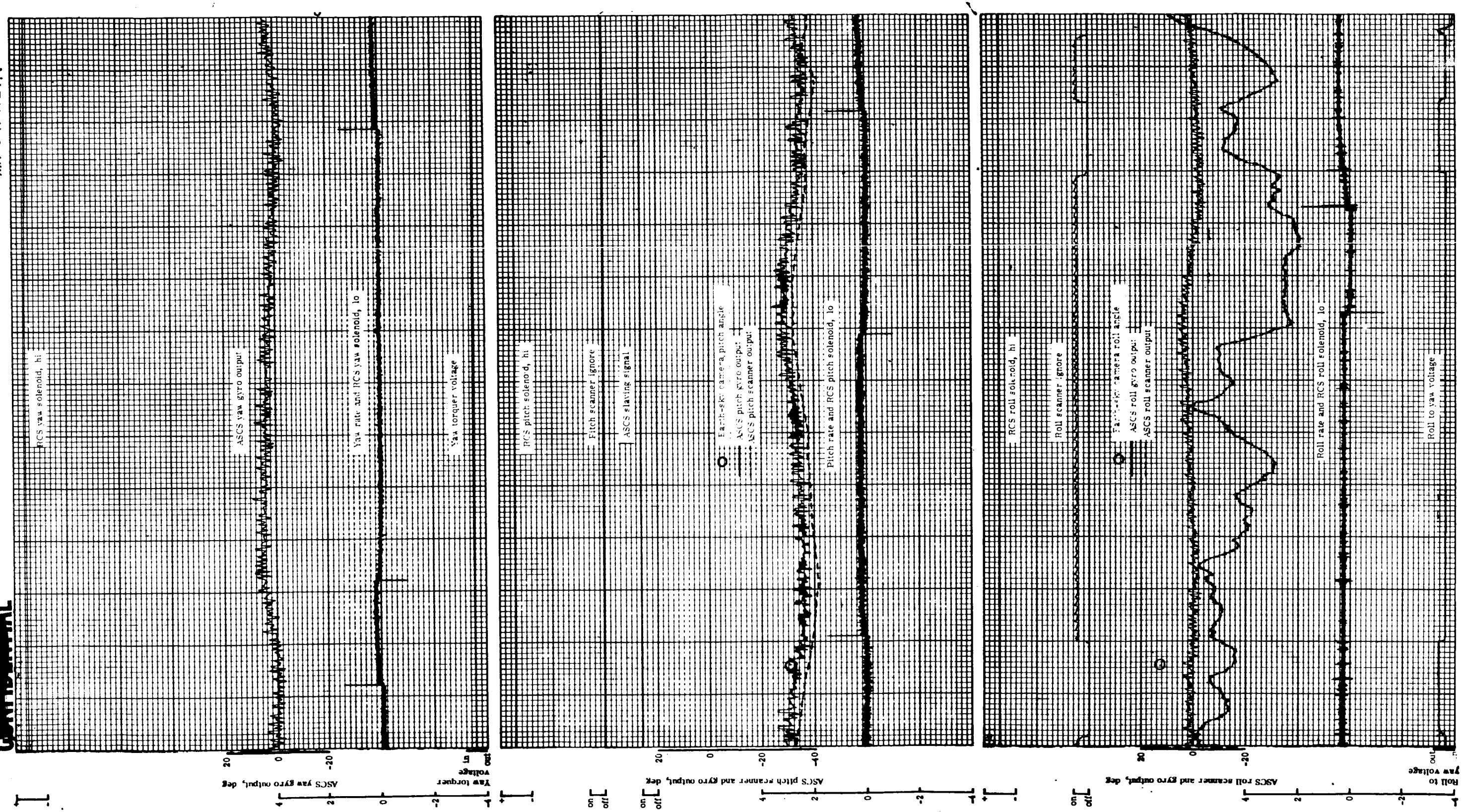


CONFIDENTIAL

DATE 6 March 1962

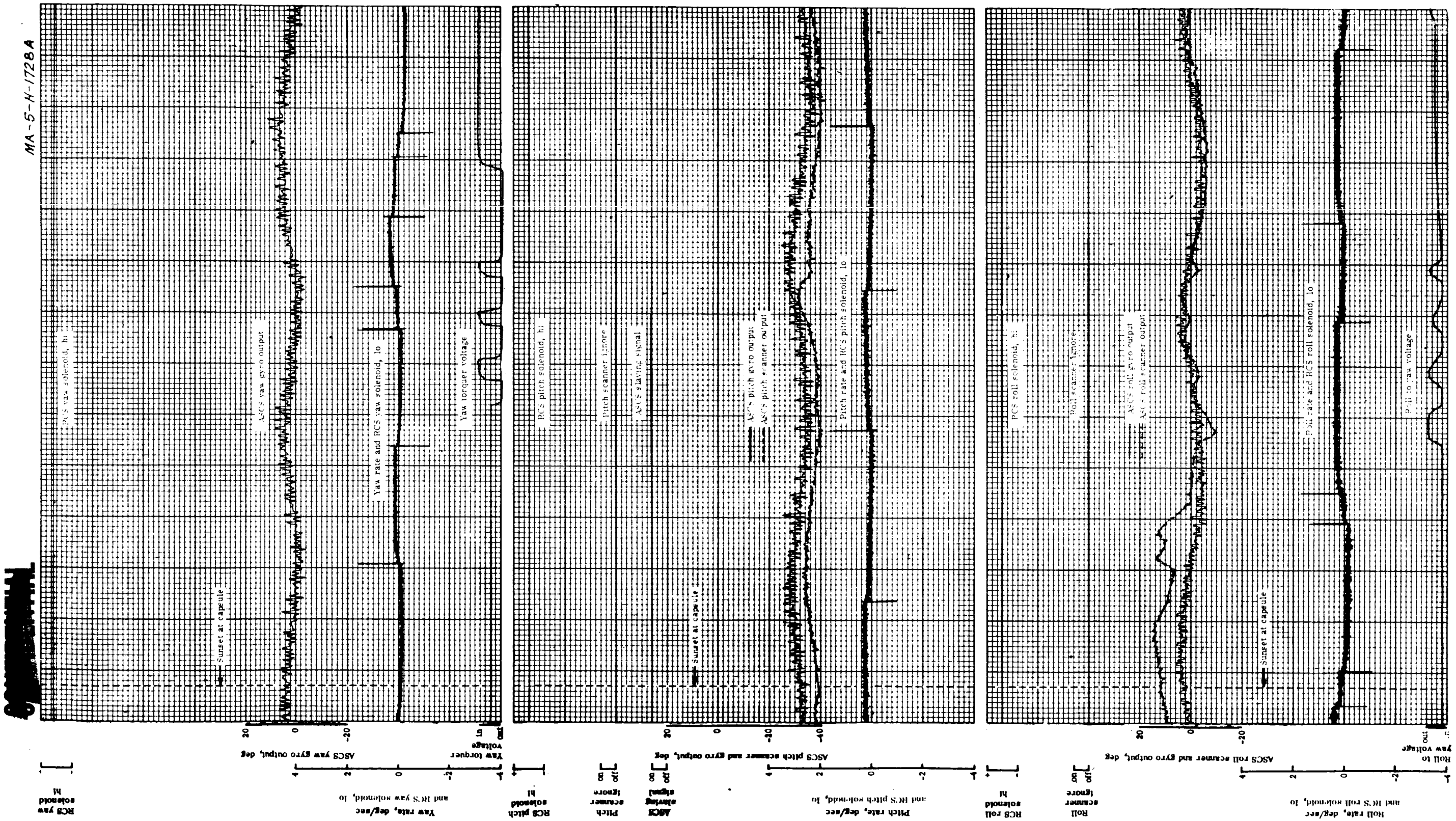
MODEL 133

MA-5-H-1721A



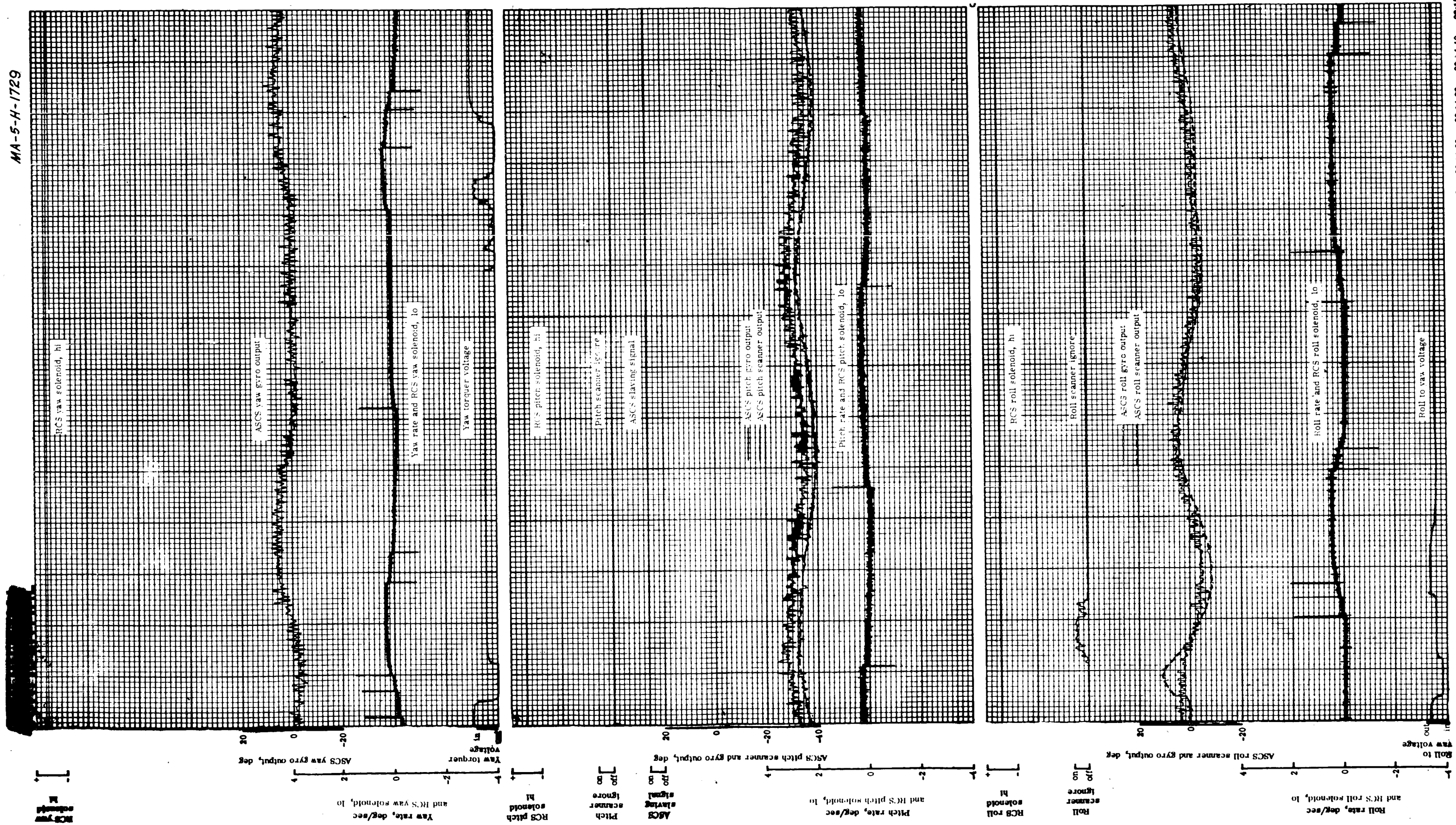
CONFIDENTIAL

MA-5-H-1728A



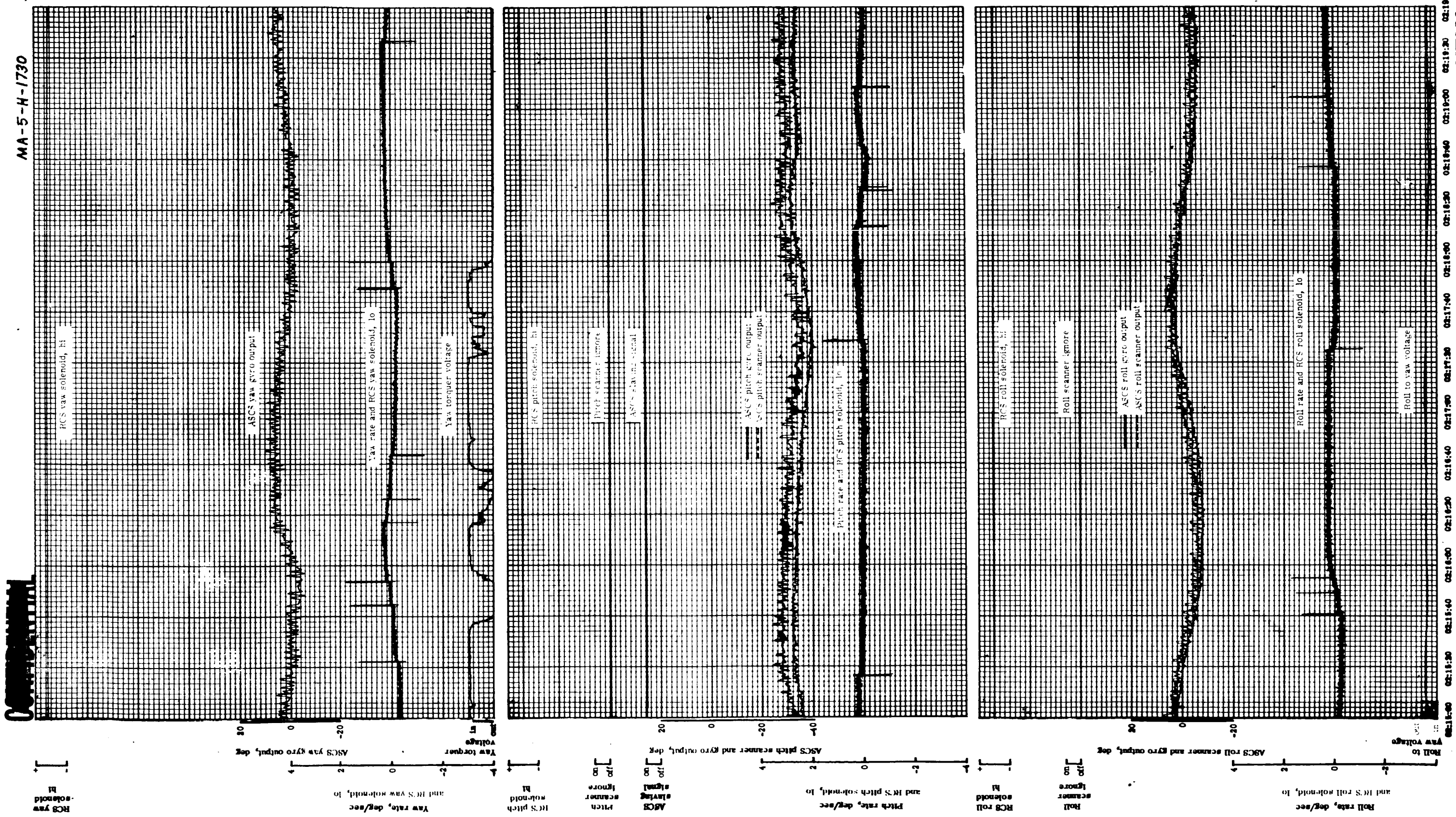
CONFIDENTIAL

MA-5-H-1729



CONFIDENTIAL

MA-5-H-1730



CONFIDENTIAL

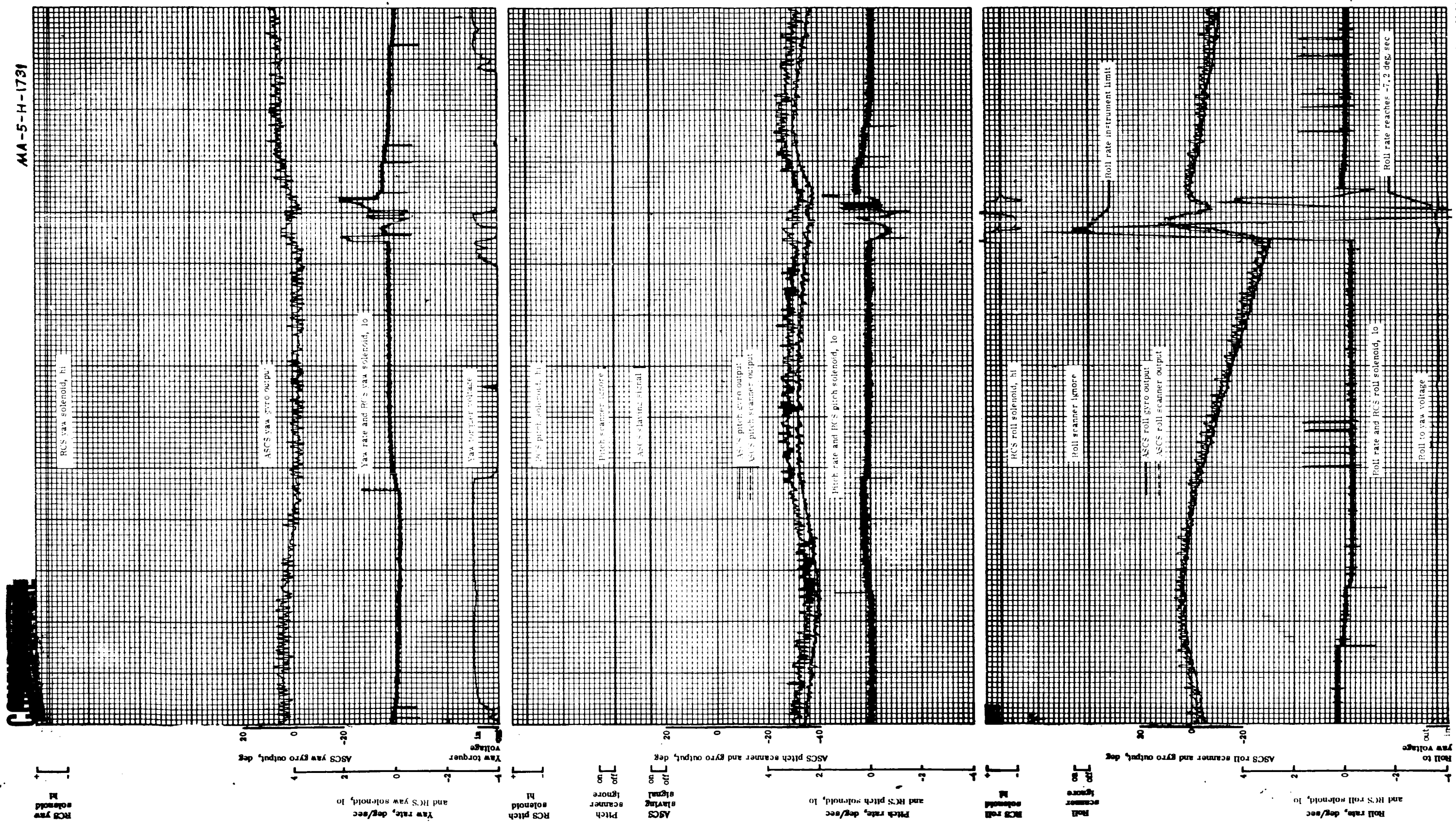
DATE 6 March 1962

MODEL 133

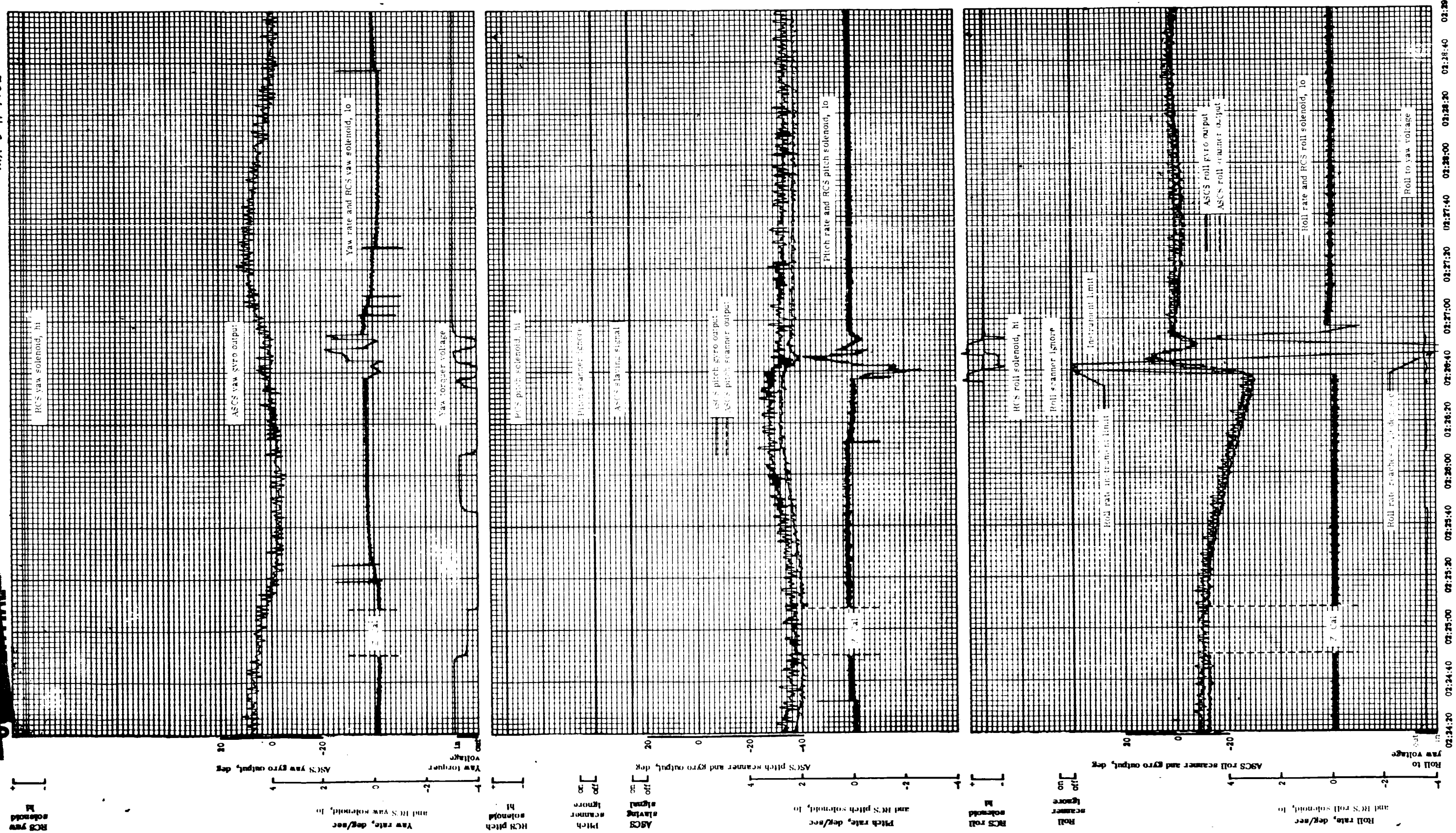
PAGE 7.42

REPORT 86-5

MA-5-H-1731

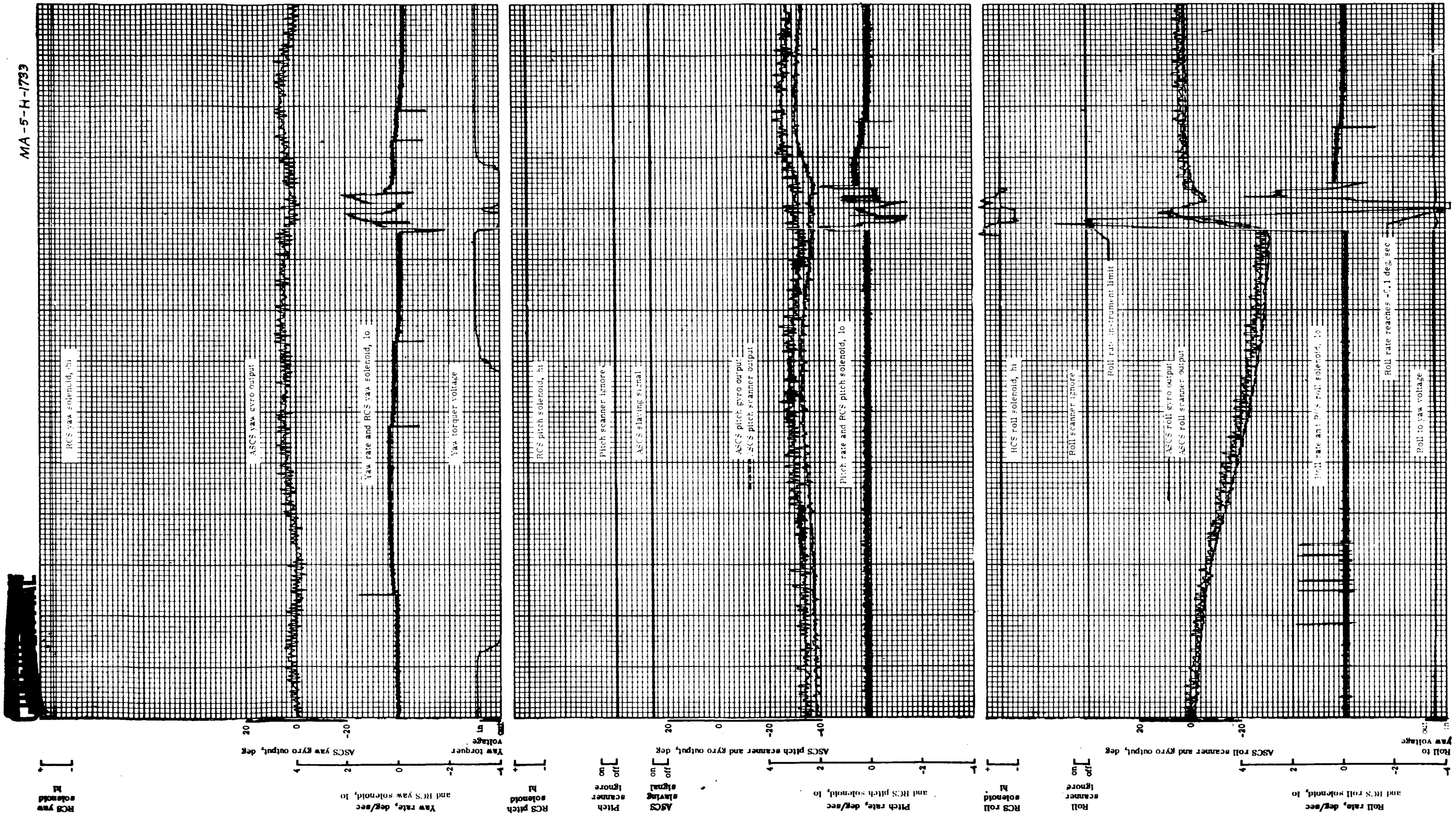


MA-5-H-1732



CONFIDENTIAL

MA-5-H-1733



CONFIDENTIAL

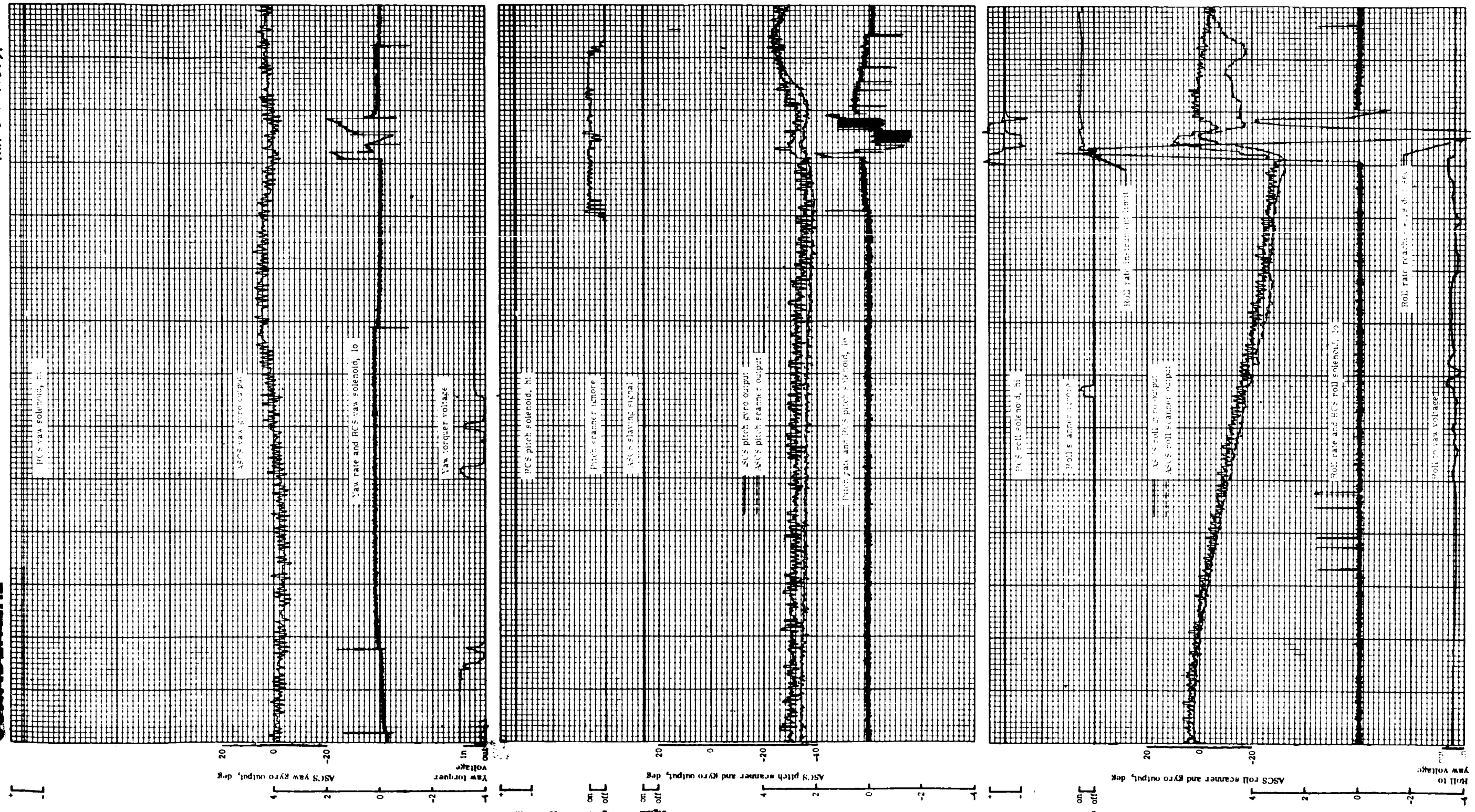
DATE 6 March 1962

MODEL 133

PAGE 7.45

REPORT 8633

MA-5-H-1734-A

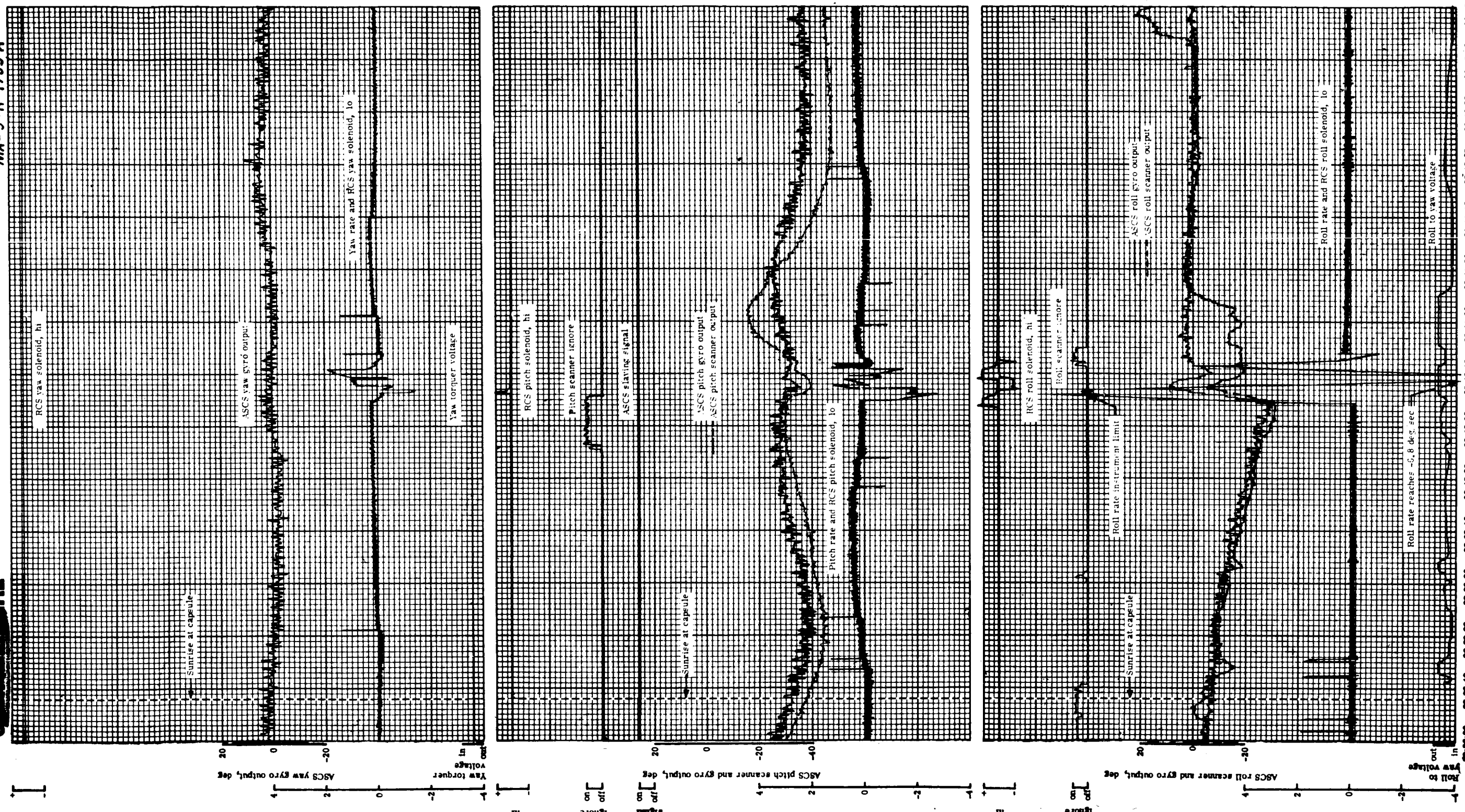


DATE 6 March 1962

MODEL 133

MA-5-H-1735 A

CONFIDENTIAL

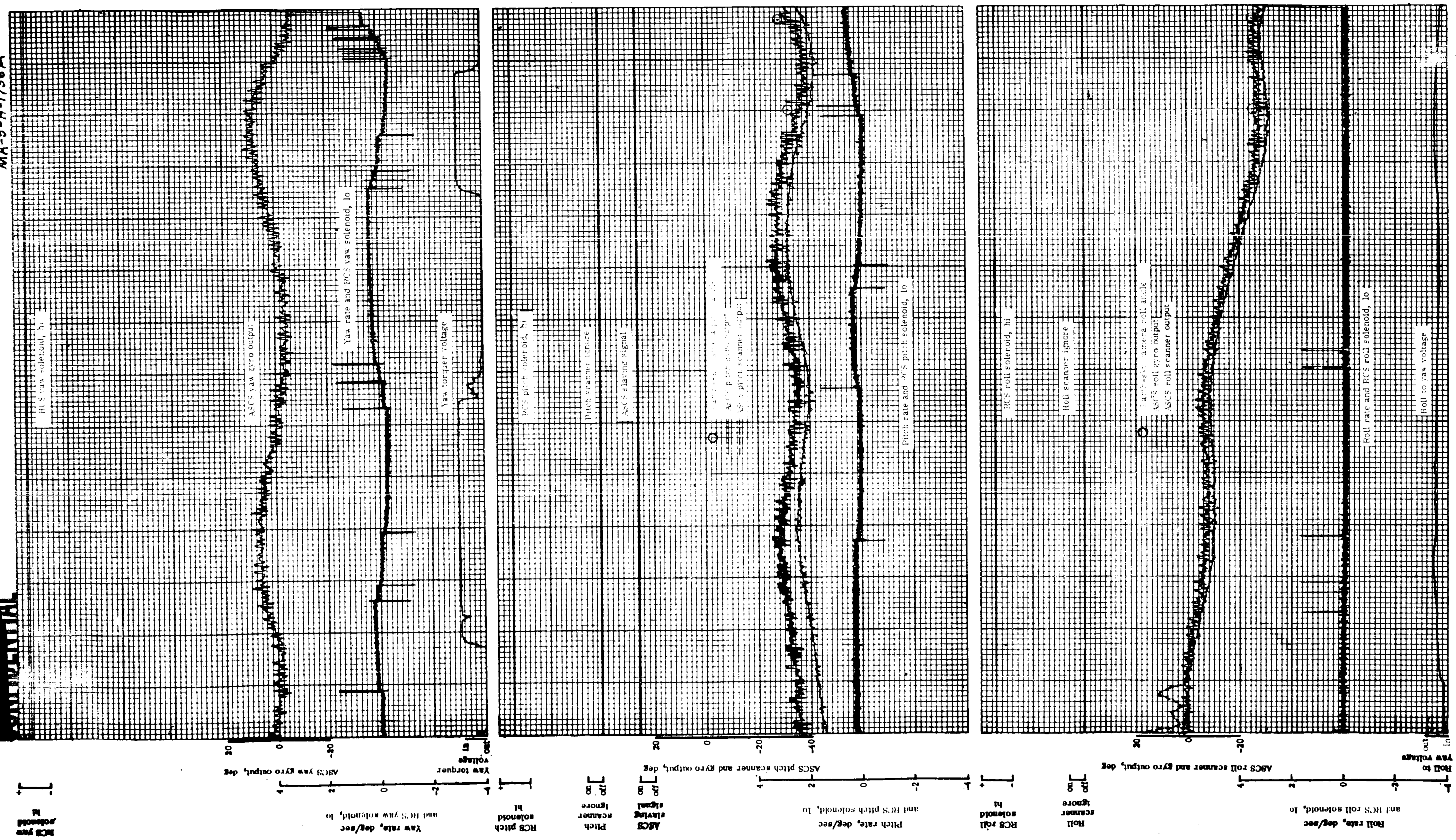


DATE 6 March 1962

MODEL 133

REPORT 8633

MA-5-H-1736A



CONFIDENTIAL

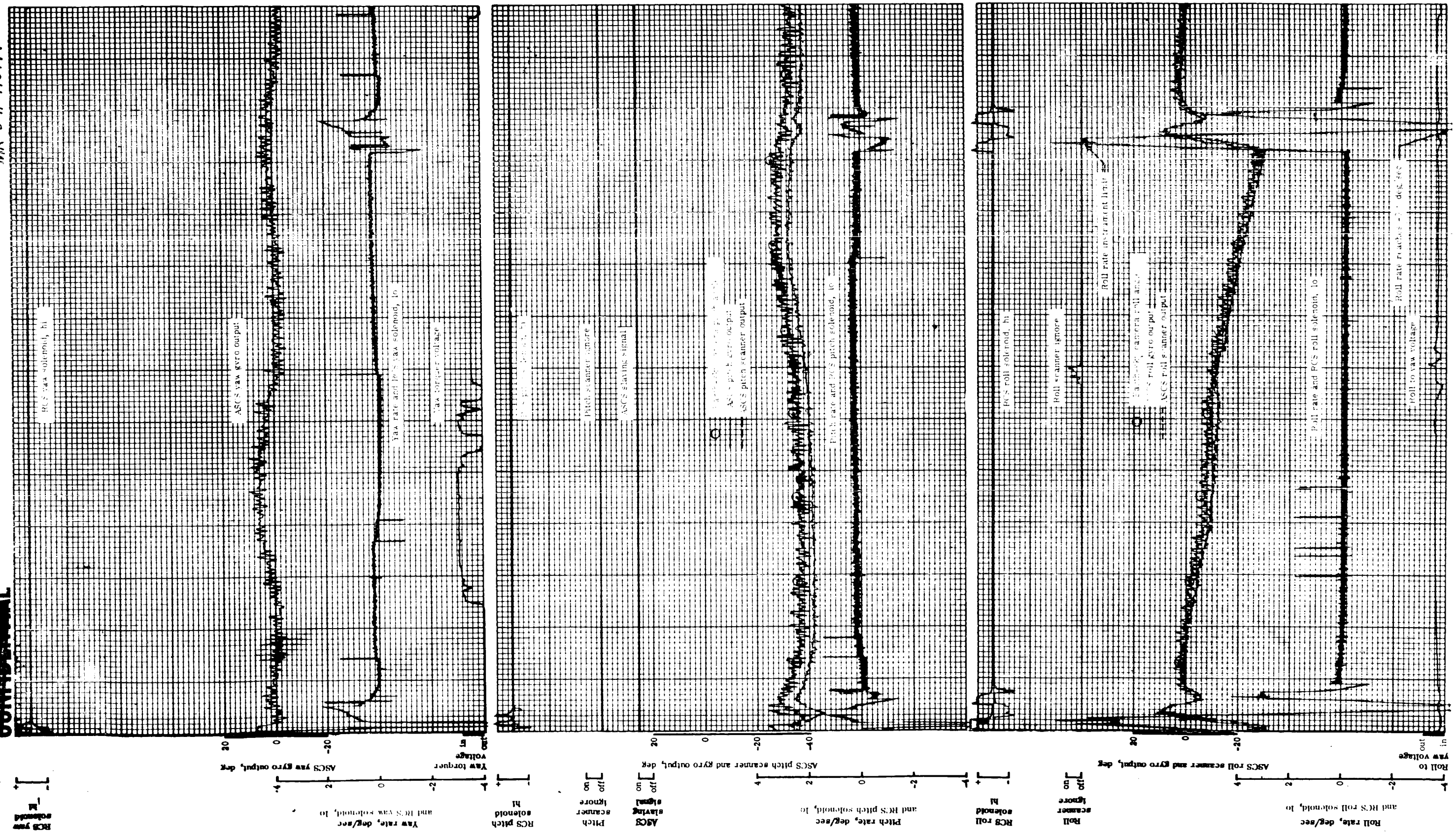
DATE 6 March 1962

MODEL 133

PAGE 7.48

REPORT 8633

MA-5-H-1737A



CONFIDENTIAL

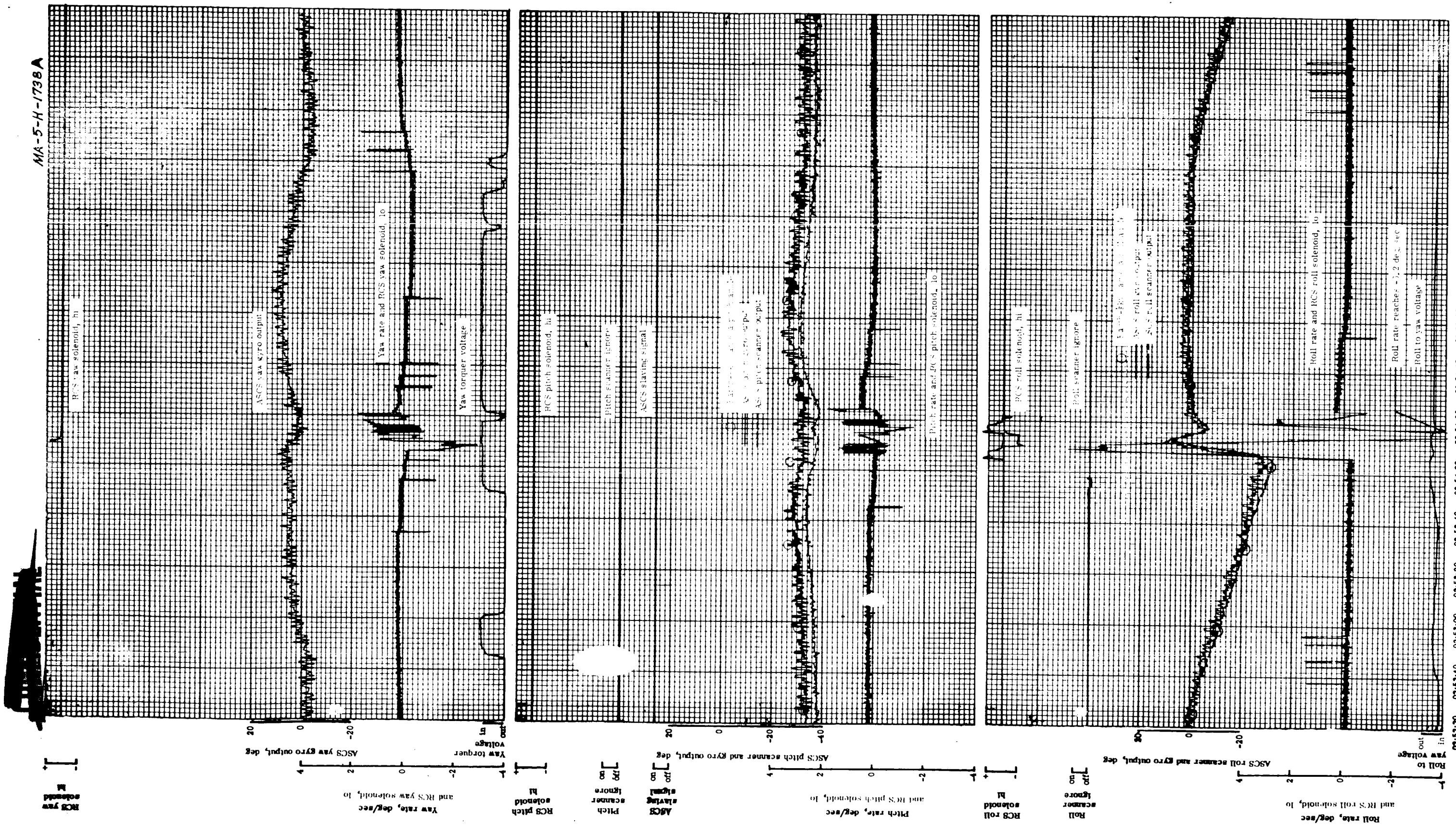
DATE 6 March 1962

MODEL 133

PAGE 7.49

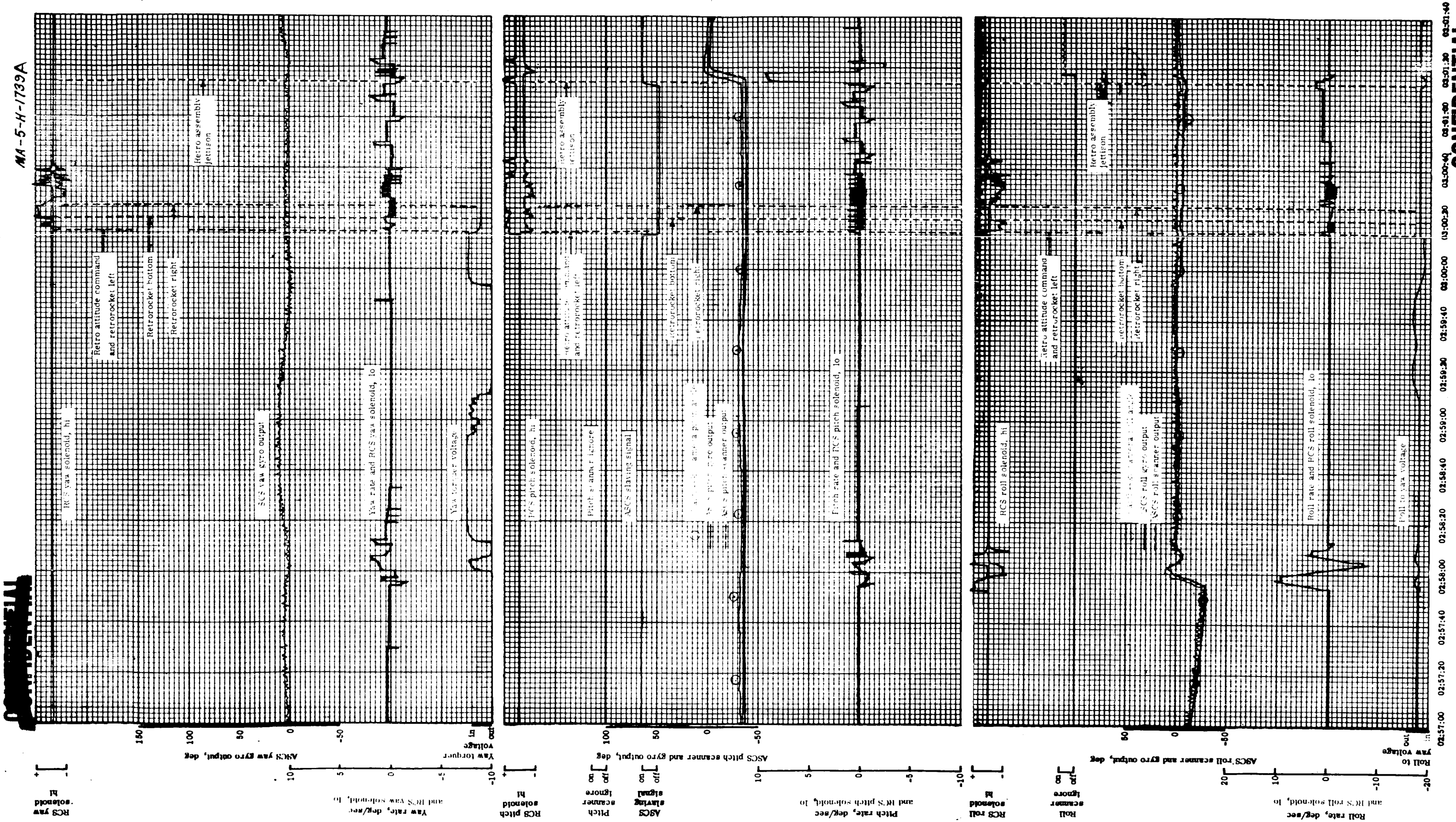
REPORT 8633

MA-5-H-1738A



CONFIDENTIAL

MA-5-H-1739A



CONFIDENTIAL

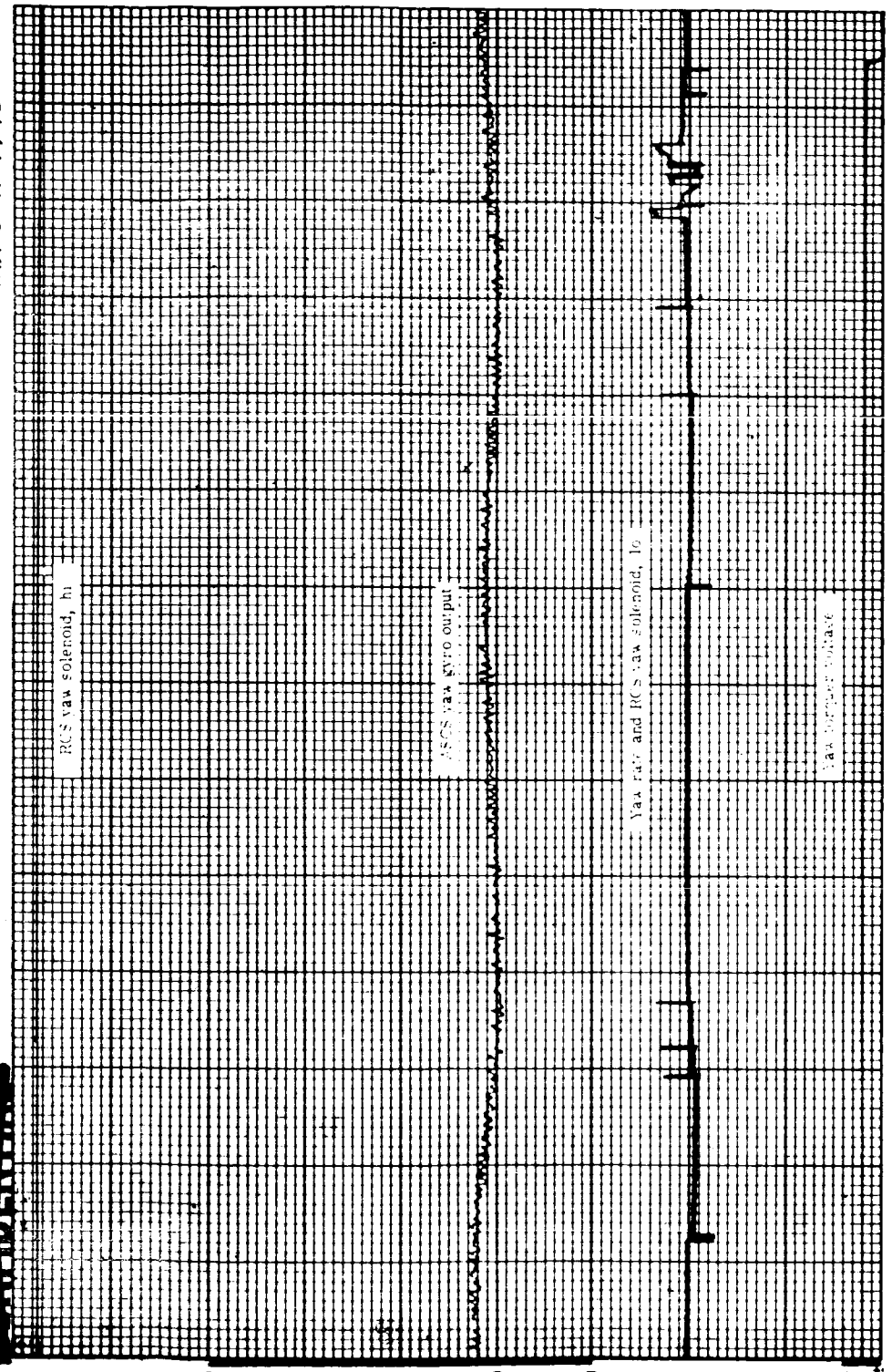
DATE 6 March 1962

MODEL 133

PAGE 7.51

REPORT 8633

MA-5-H-1740



CONFIDENTIAL

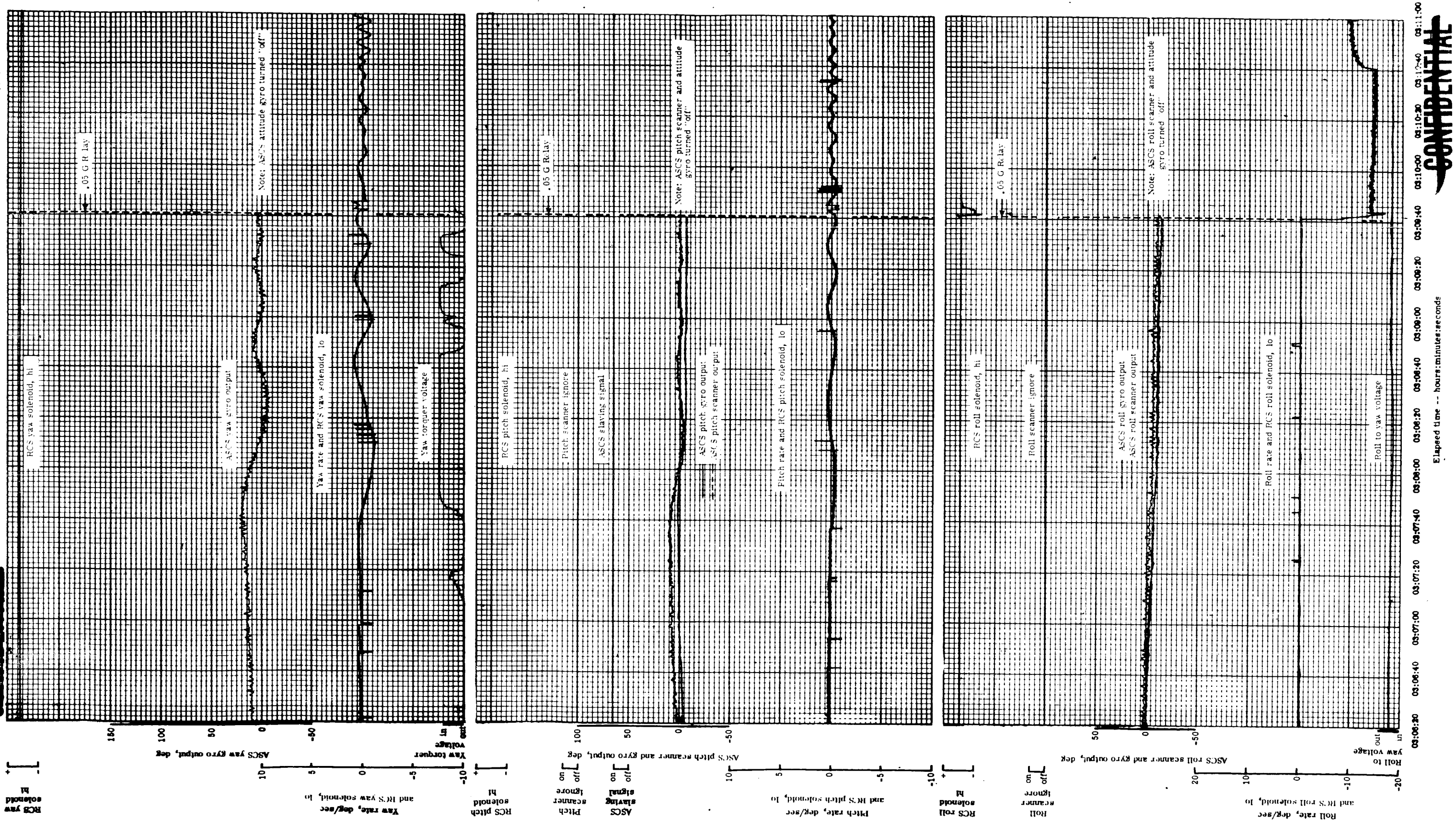
DATE 6 March 1962

MODEL 133

PAGE 7.52

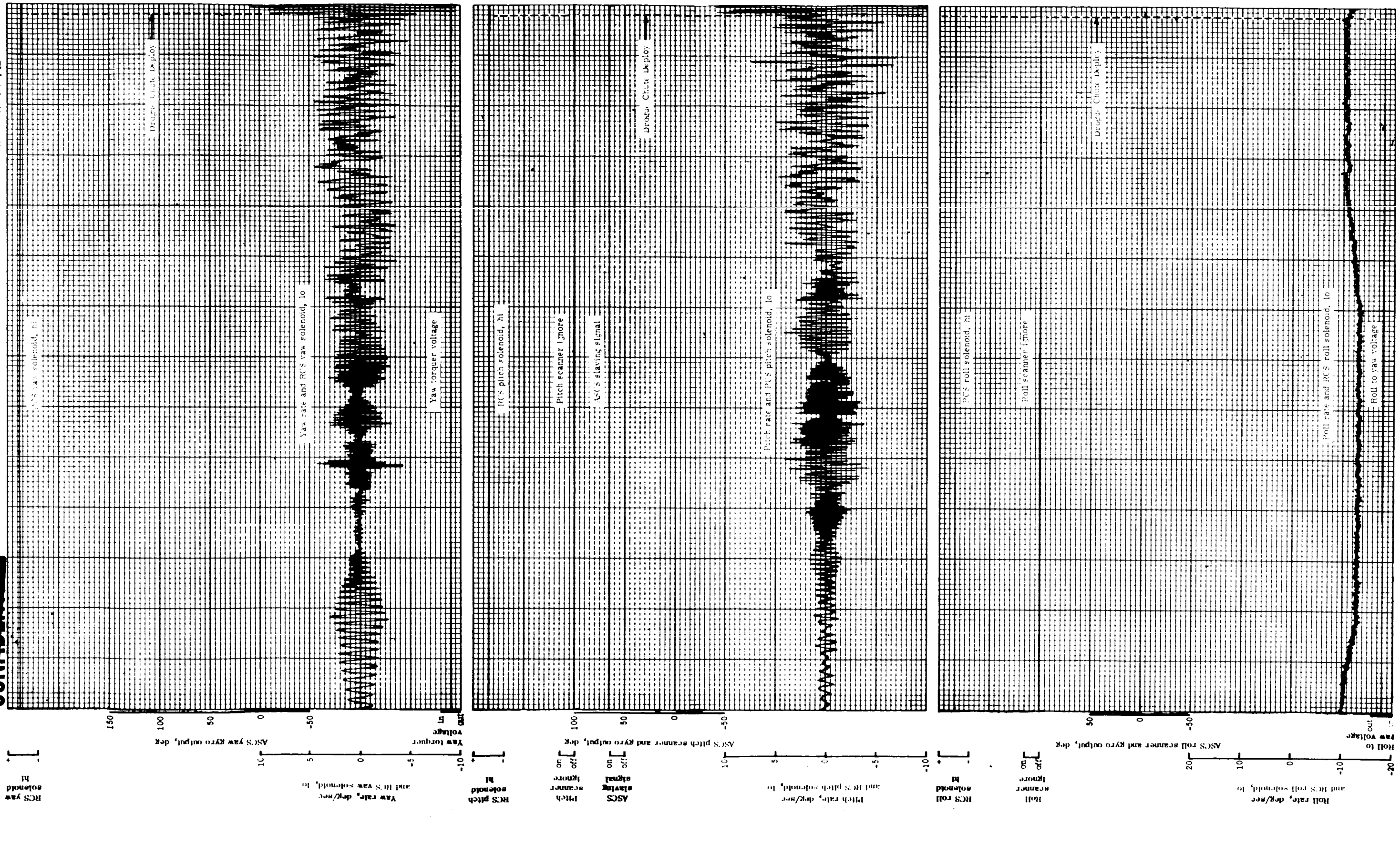
REPORT 8633

MA-5-H-1741



CONFIDENTIAL

MA-5-H-1742



CONFIDENTIAL

DATE 6 March 1962

MODEL 133

PAGE 7.54

REPORT 8633

MA-5-H-1743

CONFIDENTIAL

Elapsed time -- hours:minutes:seconds

03:15:40 03:16:00 03:16:20 03:16:40 03:17:00 03:17:20 03:17:40 03:18:00 03:18:20 03:18:40 03:19:00 03:19:20 03:19:40 03:20:00 03:20:20

Yaw voltage

ASC'S yaw gyro output, deg

Yaw torquer voltage

Yaw rate, deg/sec and ACS yaw solenoid, hi

ACS pitch solenoid, hi

Pitch scanner ignore

Pitch rate, deg/sec and ACS pitch solenoid, hi

Pitch scanner and gyro output, deg

Antenna Fairing Release And Main Chute Deploy

Note: Yaw rate gyro tumbled after

Yaw torquer voltage

ACS roll solenoid, hi

Roll scanner ignore

Roll rate, deg/sec and ACS roll solenoid, hi

ASC'S roll scanner and gyro output, deg

Roll voltage

Note: Roll rate gyro tumbled after

RCS yaw solenoid hi

ACS yaw solenoid, hi

Yaw rate, deg/sec

ACS pitch solenoid hi

Pitch scanner ignore

ACS pitch signal

Pitch rate, deg/sec

ACS pitch solenoid, hi

RCS roll solenoid hi

Roll scanner ignore

Roll rate, deg/sec

ACS roll solenoid, hi

CONFIDENTIAL

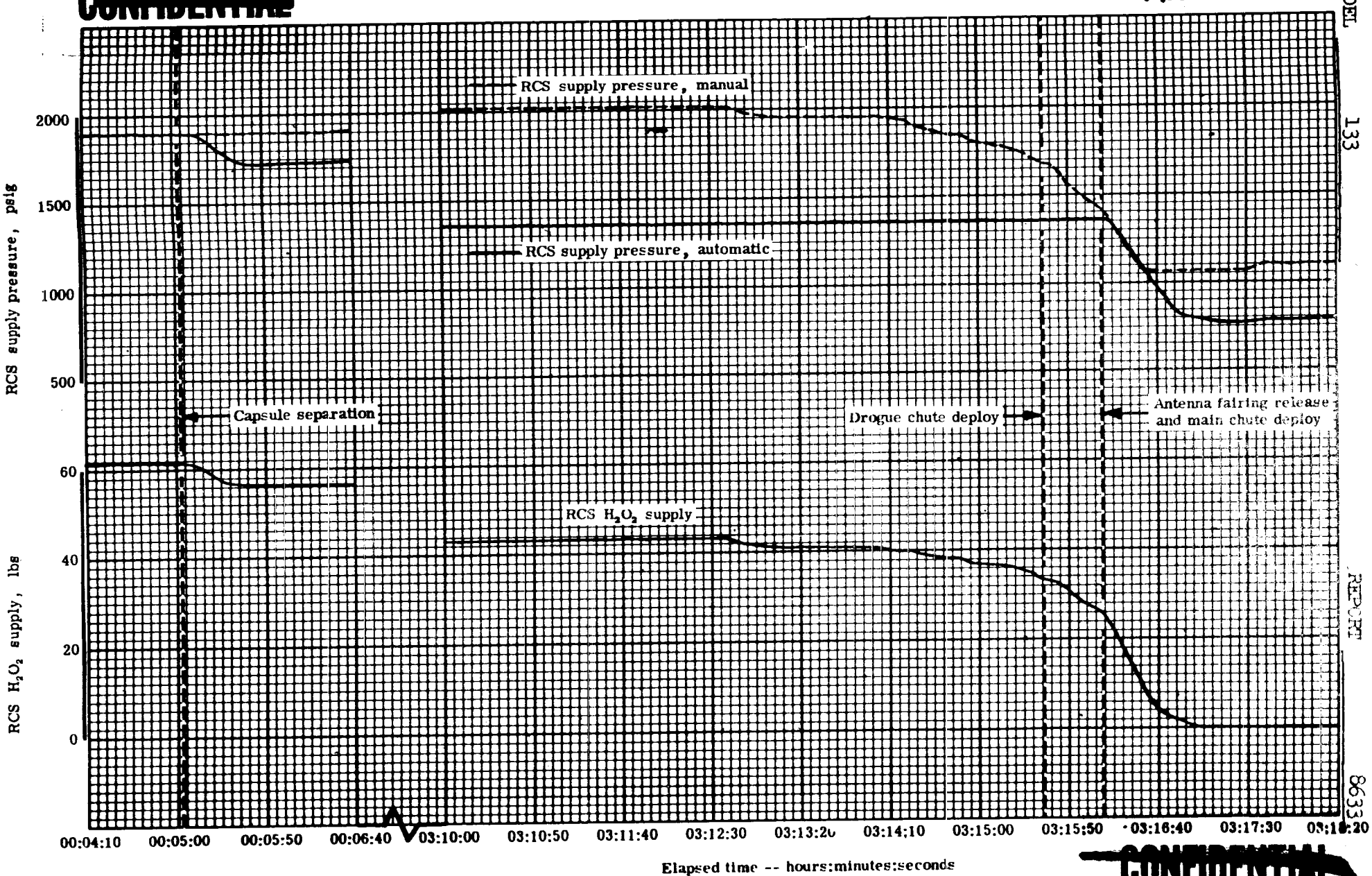
MA-5-H-2501

DATE 6 March 1962

MODEL 133

PAGE 7-55

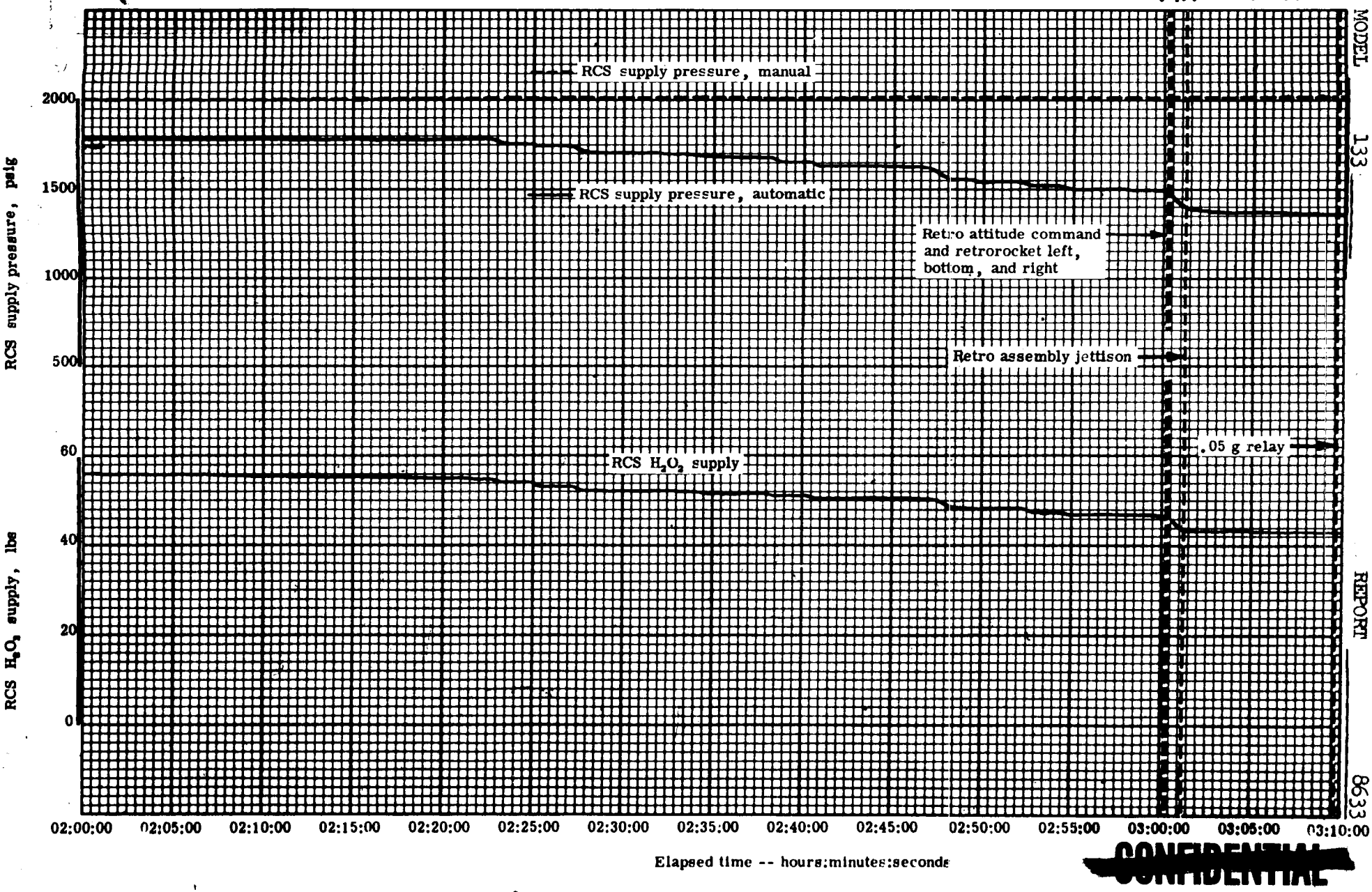
REPORT 8633



CONFIDENTIAL

CONFIDENTIAL

MA-5-H-2502



DATE 6 March 1962

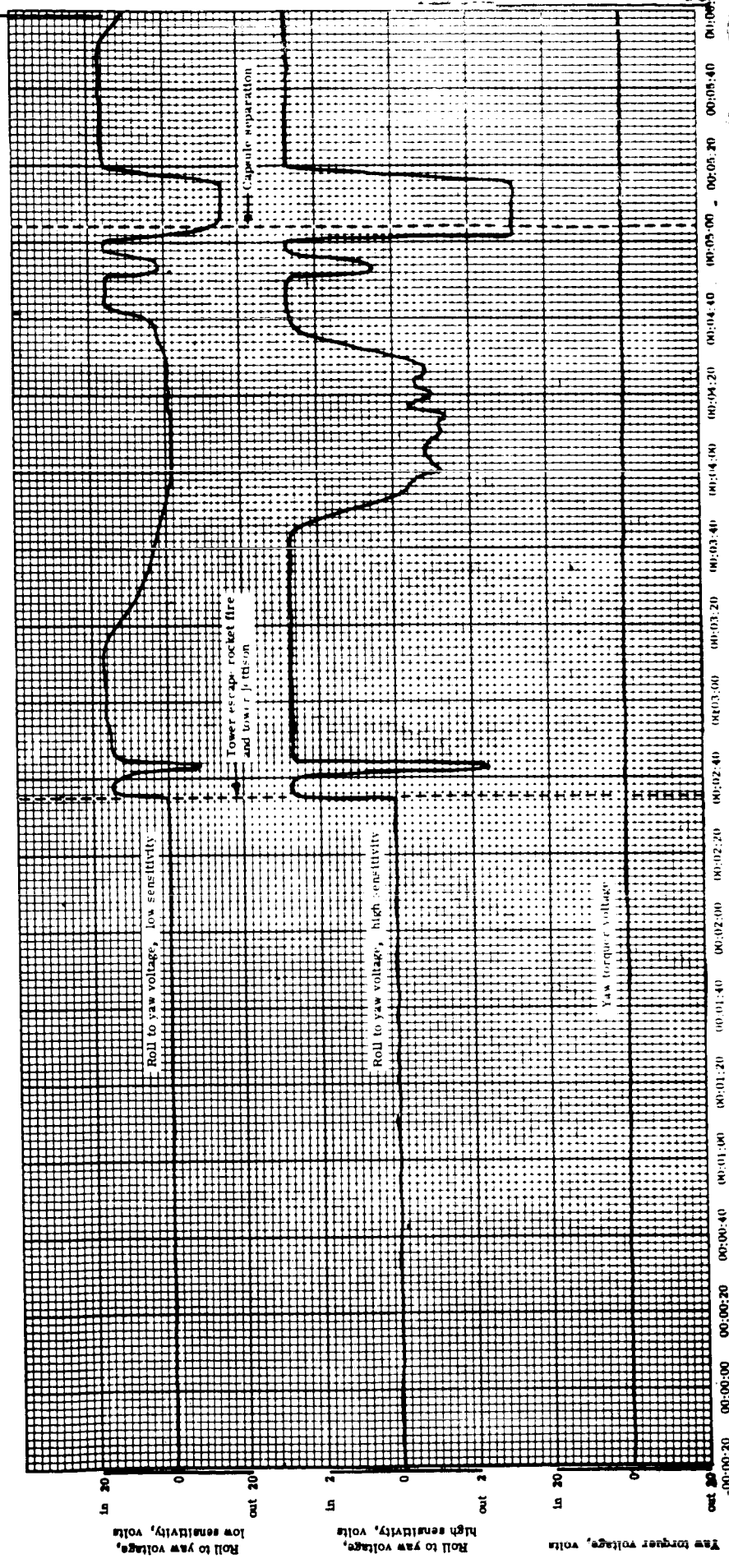
MODEL 133

REPORT 8633

PAGE 7-56

CONFIDENTIAL

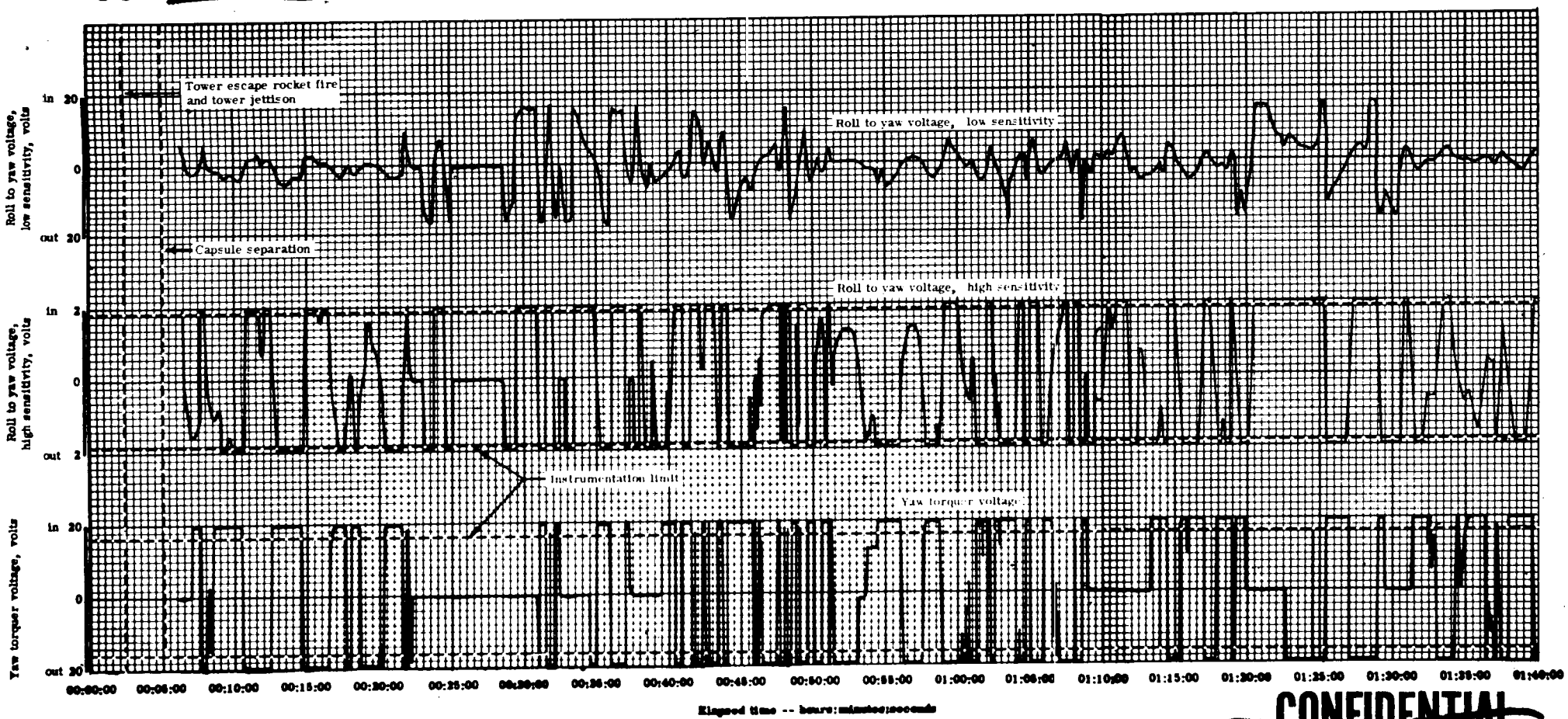
MR-5-H-2601



CONFIDENTIAL

CONFIDENTIAL

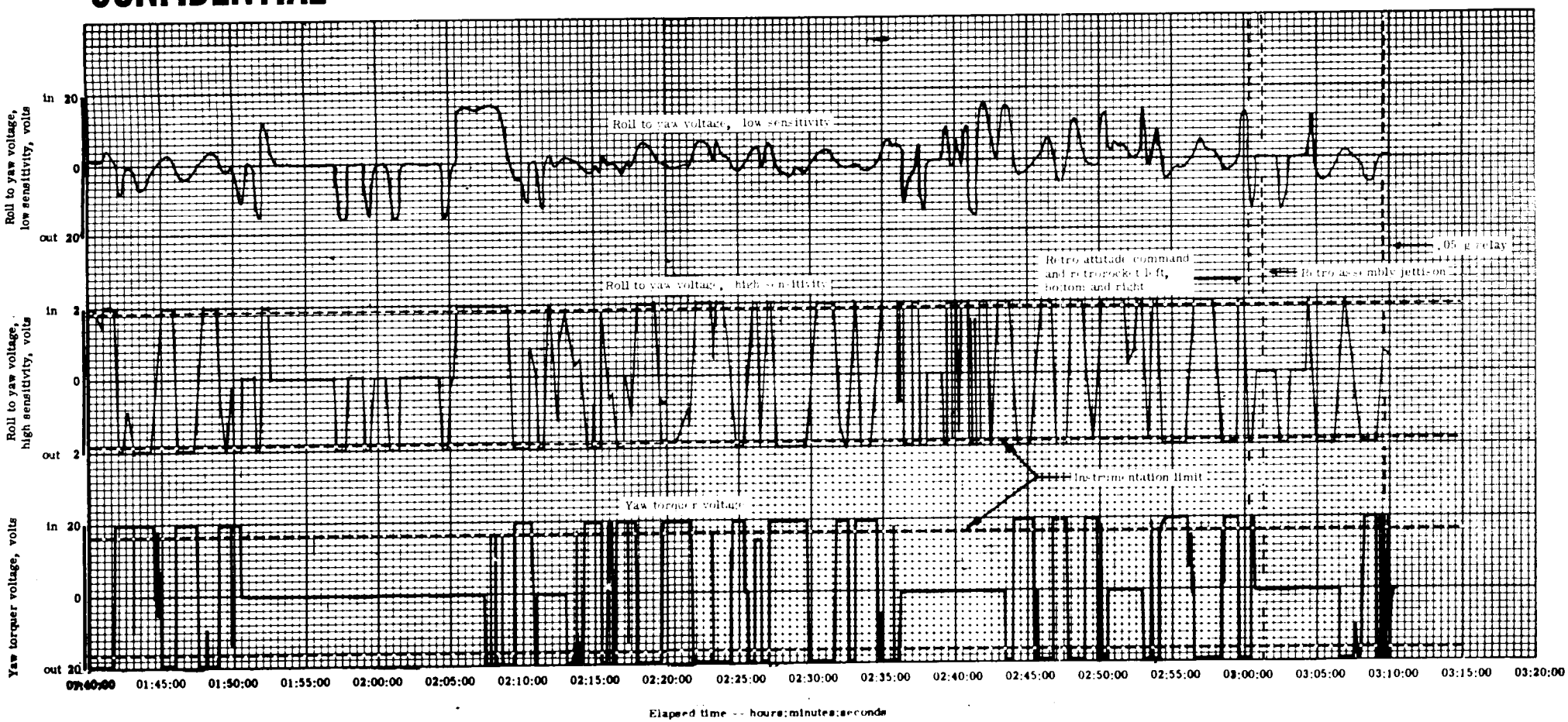
MA-5-H-2602



DATE 6 March 1961

MODEL 133

MA-5-H-2603

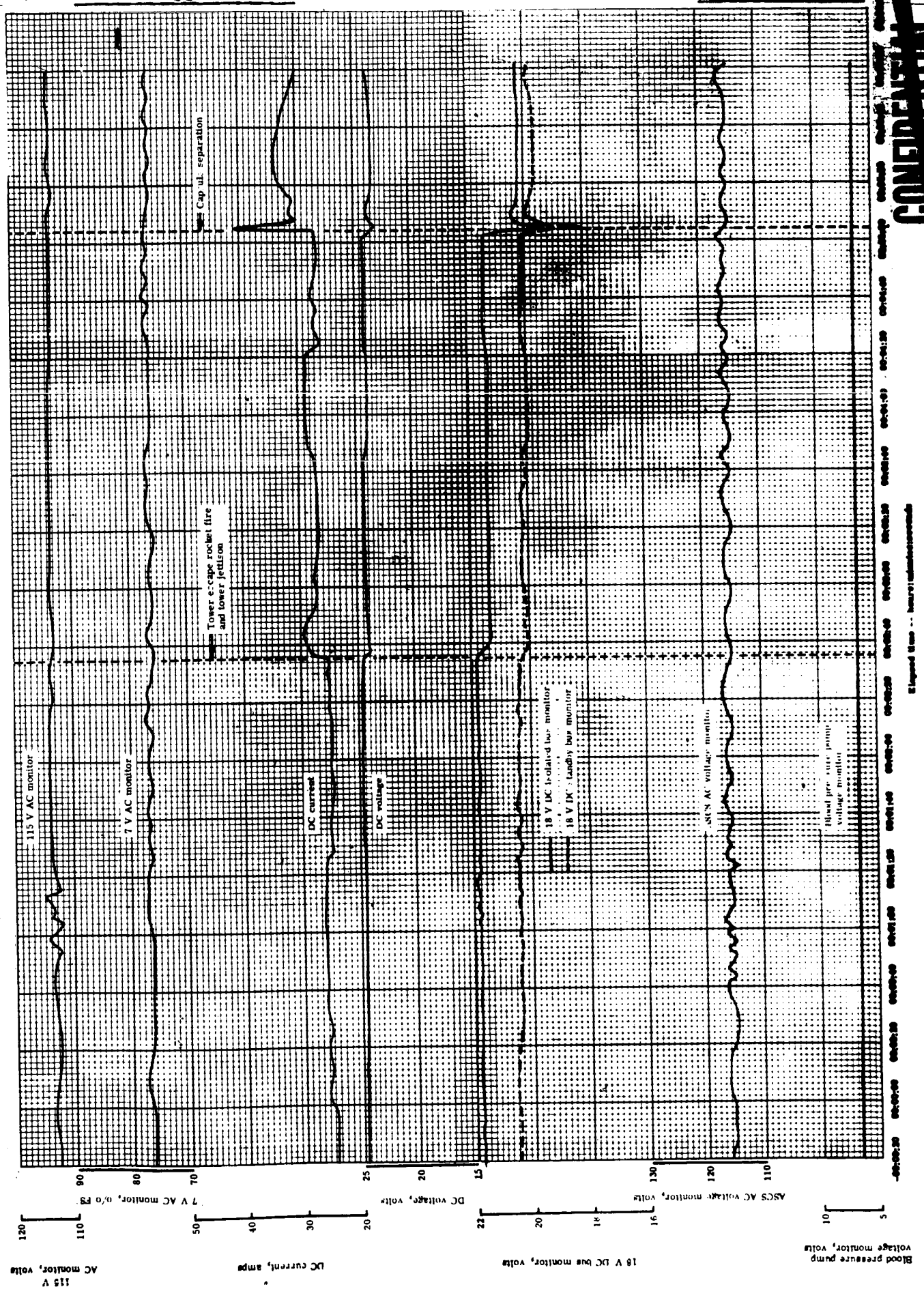

Roll to yaw voltage, low sensitivity, volts
in 20
0
out 20
Roll to yaw voltage, low sensitivity
Roll to yaw voltage, high sensitivity, volts
in 2
0
out 2
Roll to yaw voltage, high sensitivity
Retro attitude command and retrorocket left, bottom and right
.05 g relay
Retro assembly jettison
Instrumentation limit
Yaw torquer voltage, volts
in 20
0
out 20
Yaw torquer voltage
07:40:00
01:45:00
01:50:00
01:55:00
02:00:00
02:05:00
02:10:00
02:15:00
02:20:00
02:25:00
02:30:00
02:35:00
02:40:00
02:45:00
02:50:00
02:55:00
03:00:00
03:05:00
03:10:00
03:15:00
03:20:00
Elapsed time -- hours:minutes:seconds

DATE 6 March 1962 PAGE 7-60

MODEL 133 REPORT 8633

MA-5-H-1801

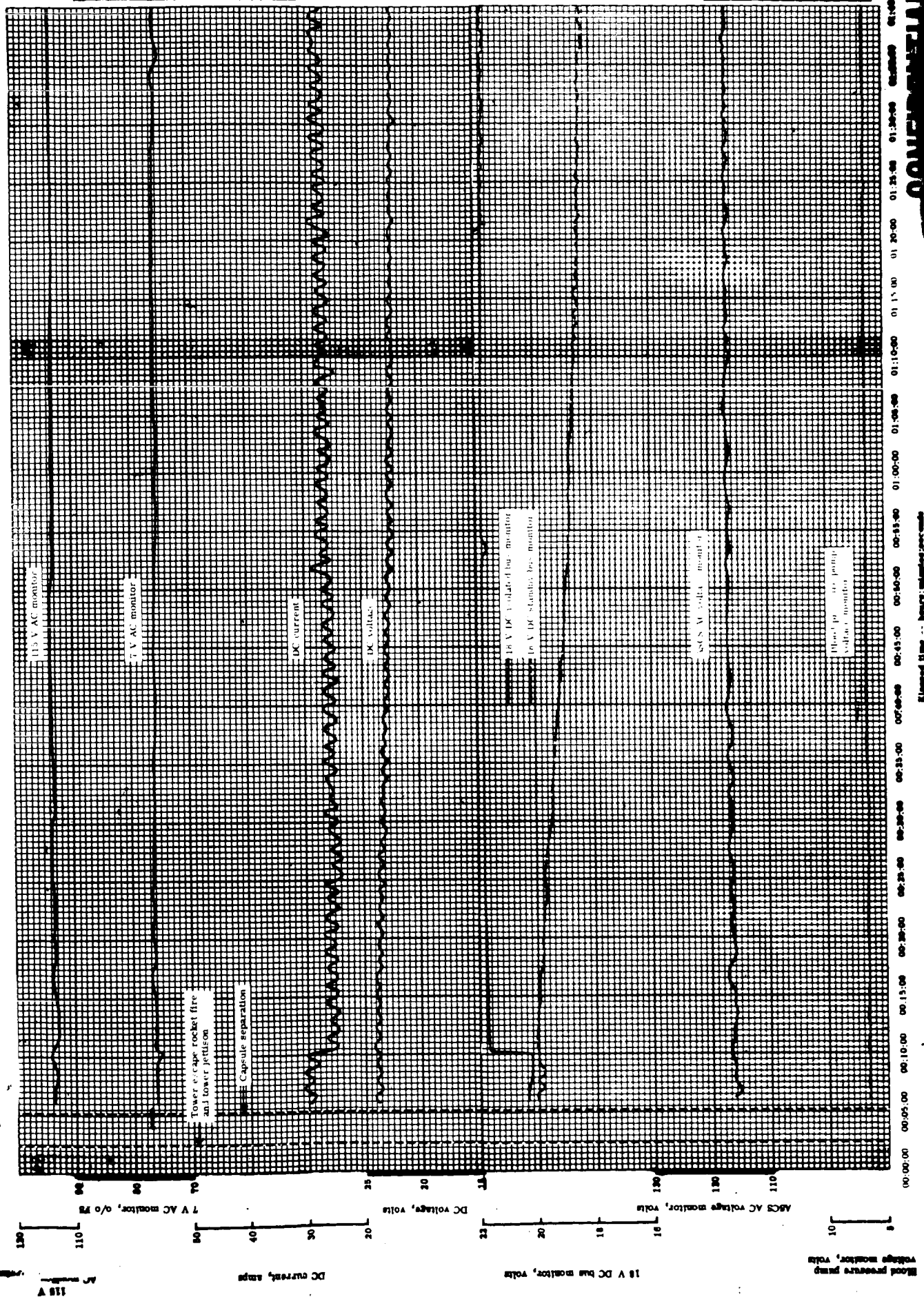
CONFIDENTIAL



CONFIDENTIAL

MA-5-H-1802

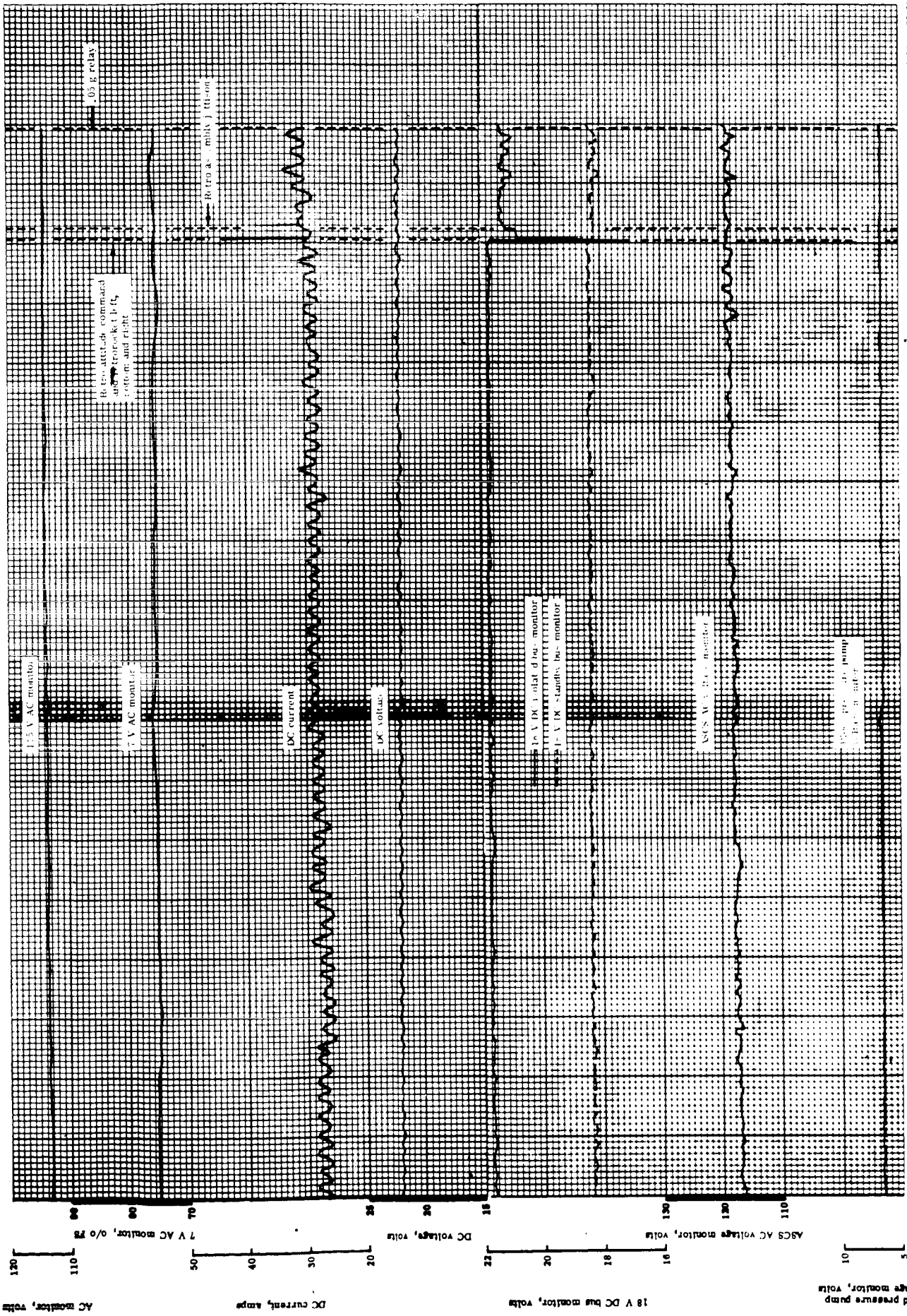
CONFIDENTIAL



CONFIDENTIAL

MA-5-M-1803

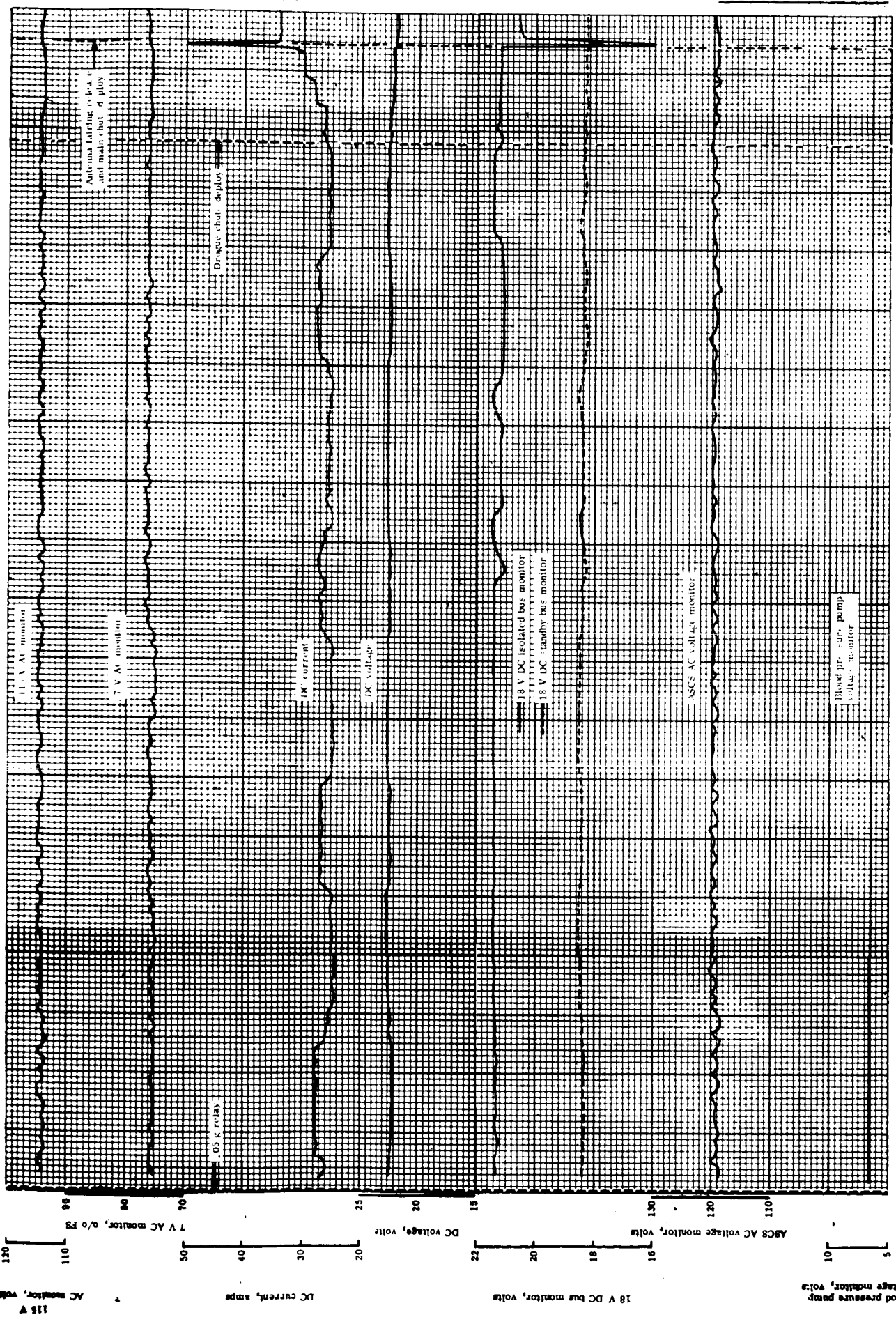
CONFIDENTIAL



CONFIDENTIAL

MA-5-4-1804

CONFIDENTIAL

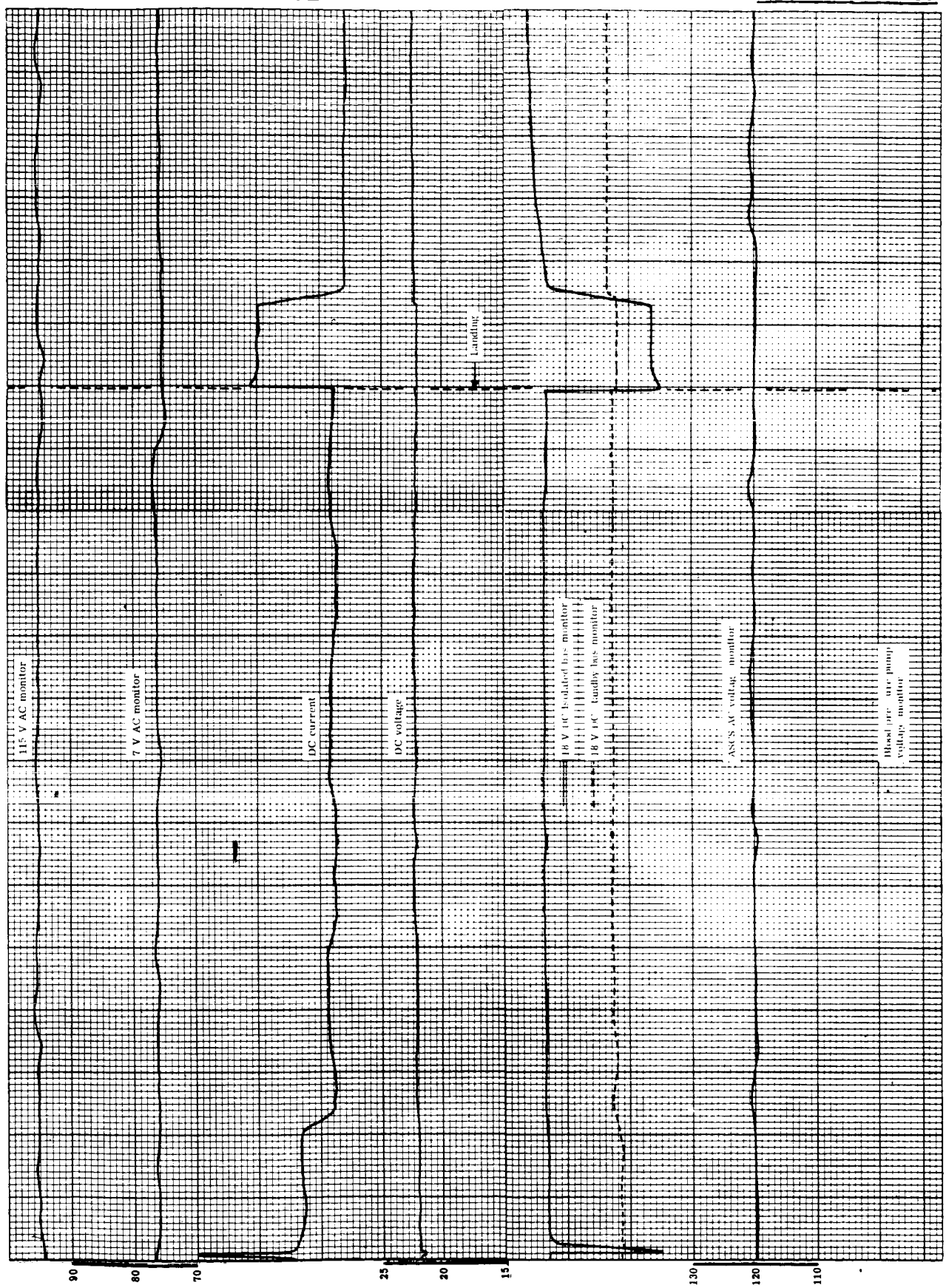


CONFIDENTIAL

DATE 6 March 1962 PAGE 7.64

MODEL 133 REPORT 8633

MA-5-H-1805



CONFIDENTIAL

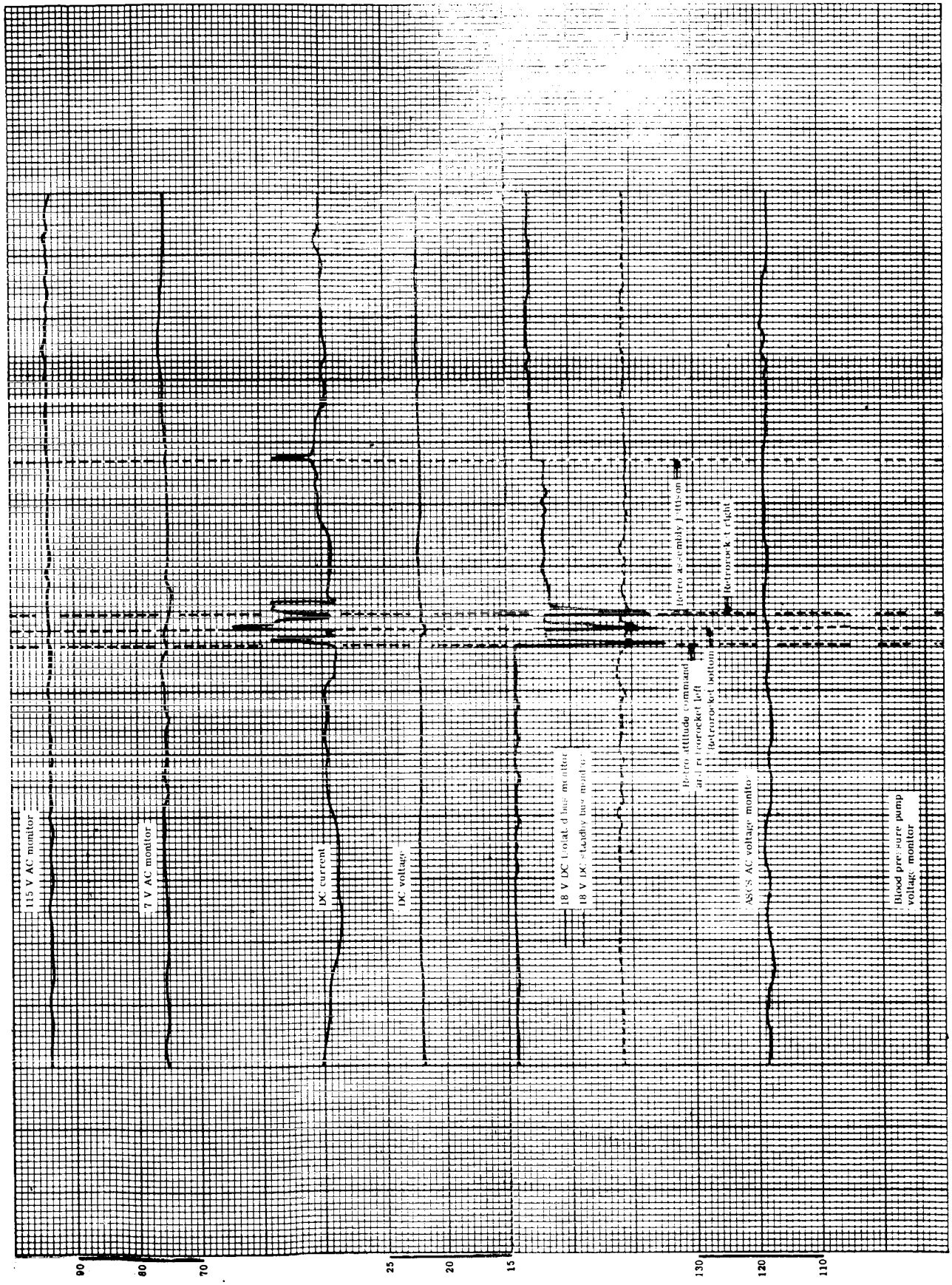
CONFIDENTIAL

DATE 6 March 1962 PAGE 7.65

MODEL 133 REPORT 8633

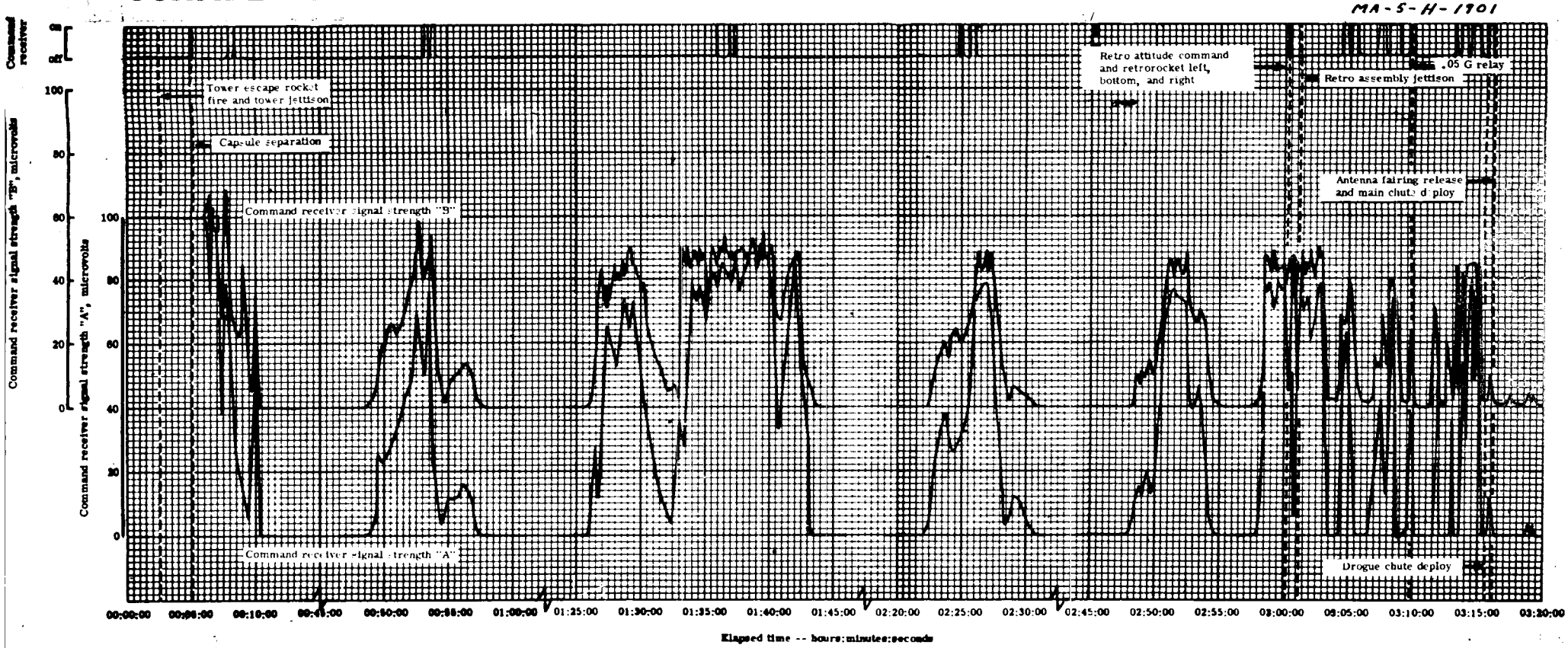
MA-5-H-1806

CONFIDENTIAL



CONFIDENTIAL

MA-5-H-1901



DATE 6 March 1962

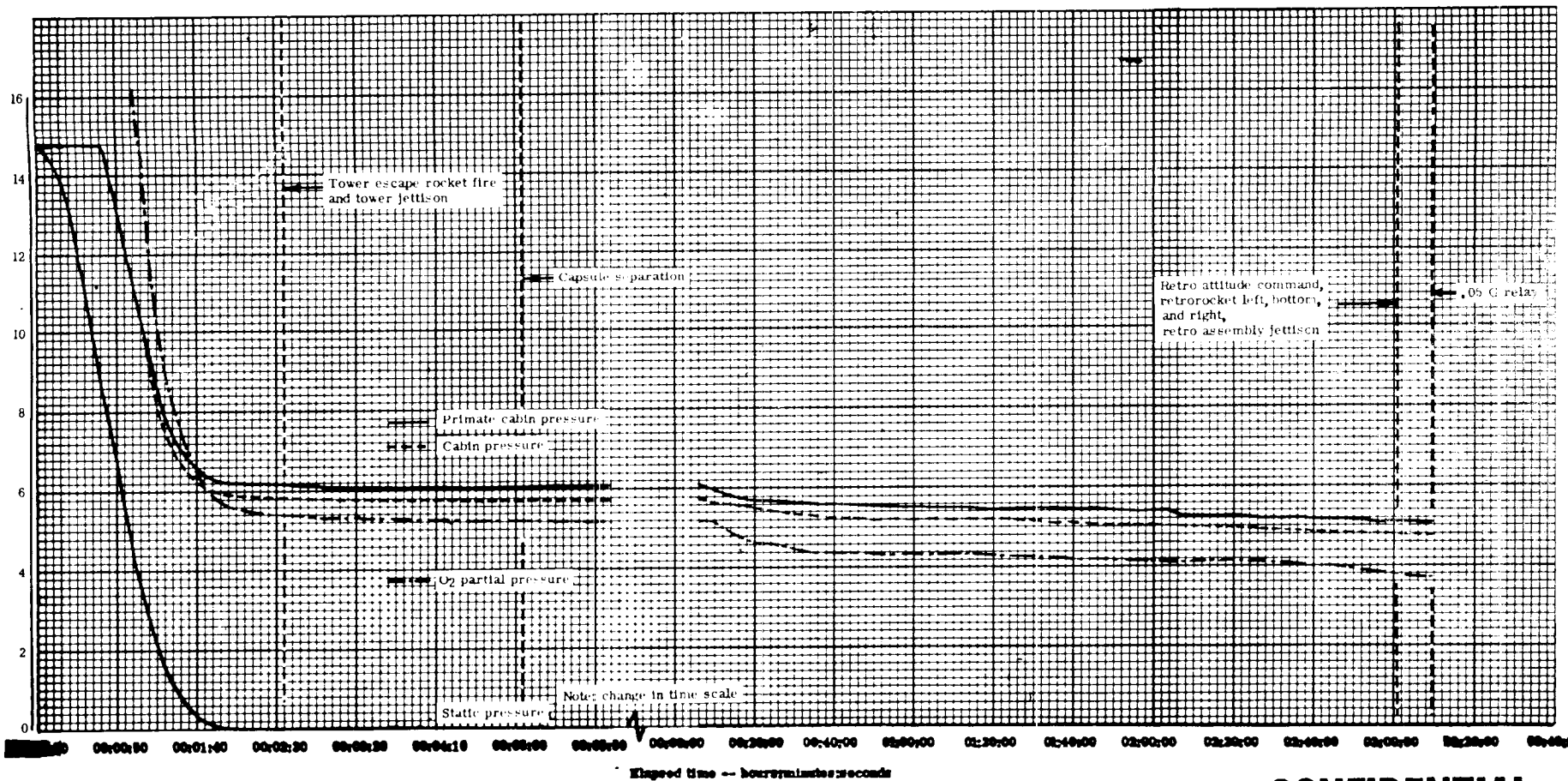
MODEL 133

PAGE 7.66

REPORT 8633

CONFIDENTIAL

MA-5-H-2201



CONFIDENTIAL

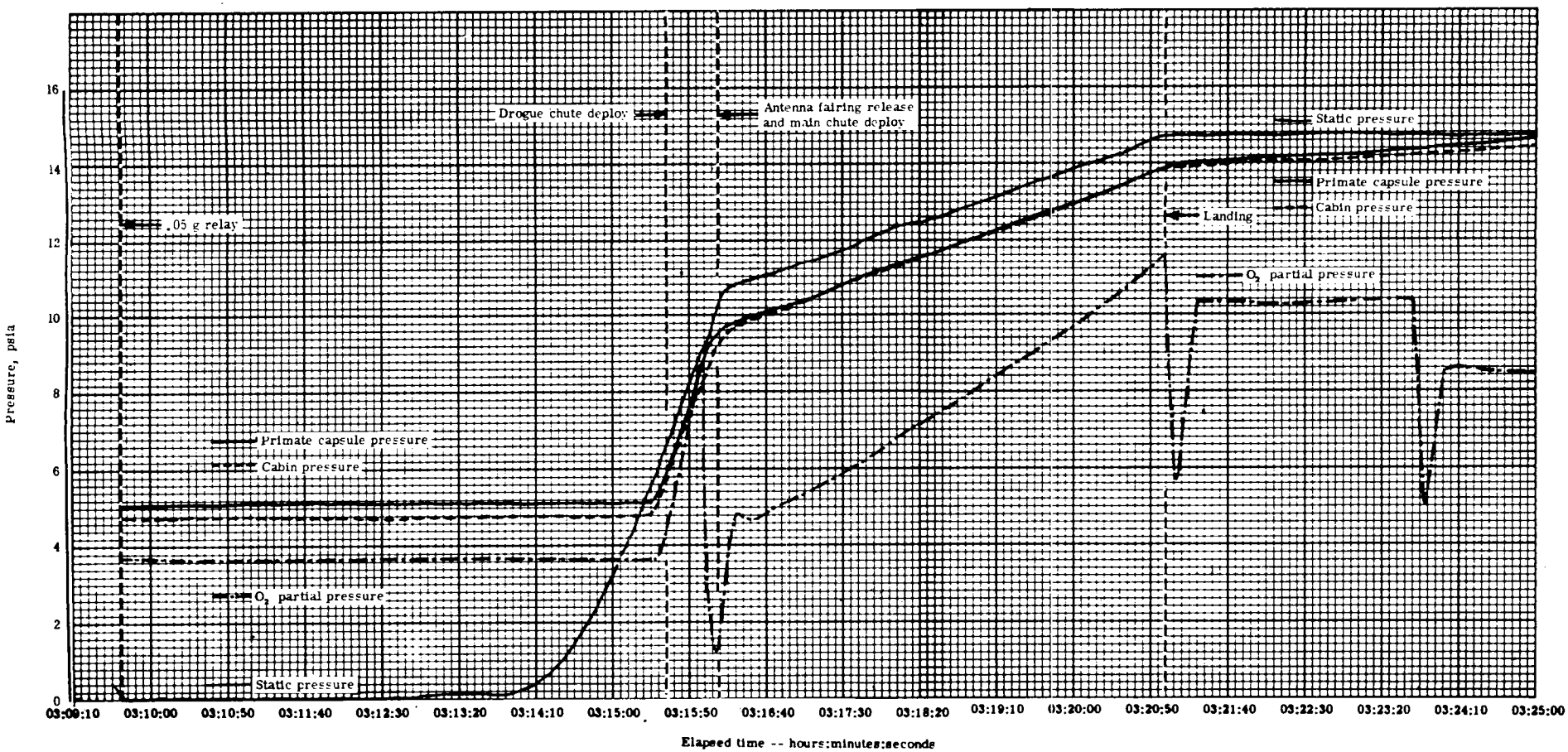
DATE 6 March 1962

MODEL 133

PAGE 7.67

REPORT 8633

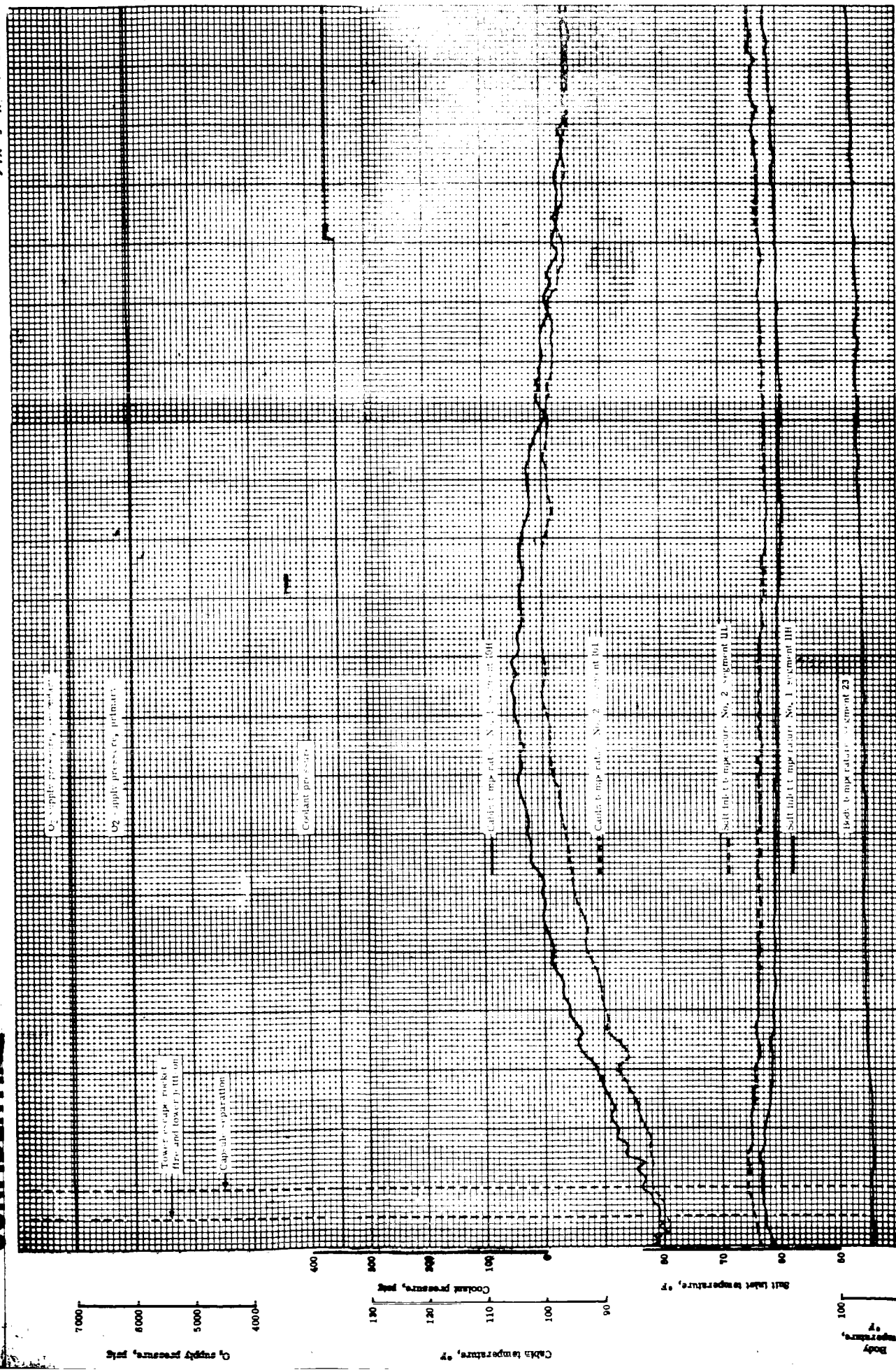
MA-5-H-2202


Pressure, psia
16
14
12
10
8
6
4
2
0
Drogue chute deploy
Antenna fairing release and main chute deploy
Static pressure
Primate capsule pressure
Cabin pressure
.05 g relay
Landing
O_2 partial pressure
Primate capsule pressure
Cabin pressure
O_2 partial pressure
Static pressure
03:09:10
03:10:00
03:10:50
03:11:40
03:12:30
03:13:20
03:14:10
03:15:00
03:15:50
03:16:40
03:17:30
03:18:20
03:19:10
03:20:00
03:20:50
03:21:40
03:22:30
03:23:20
03:24:10
03:25:00
Elapsed time -- hours:minutes:seconds

DATE 6 March 1962 PAGE 7.69

MODEL REPORT 8633

MA-5-N-2001



CONFIDENTIAL

CONFIDENTIAL

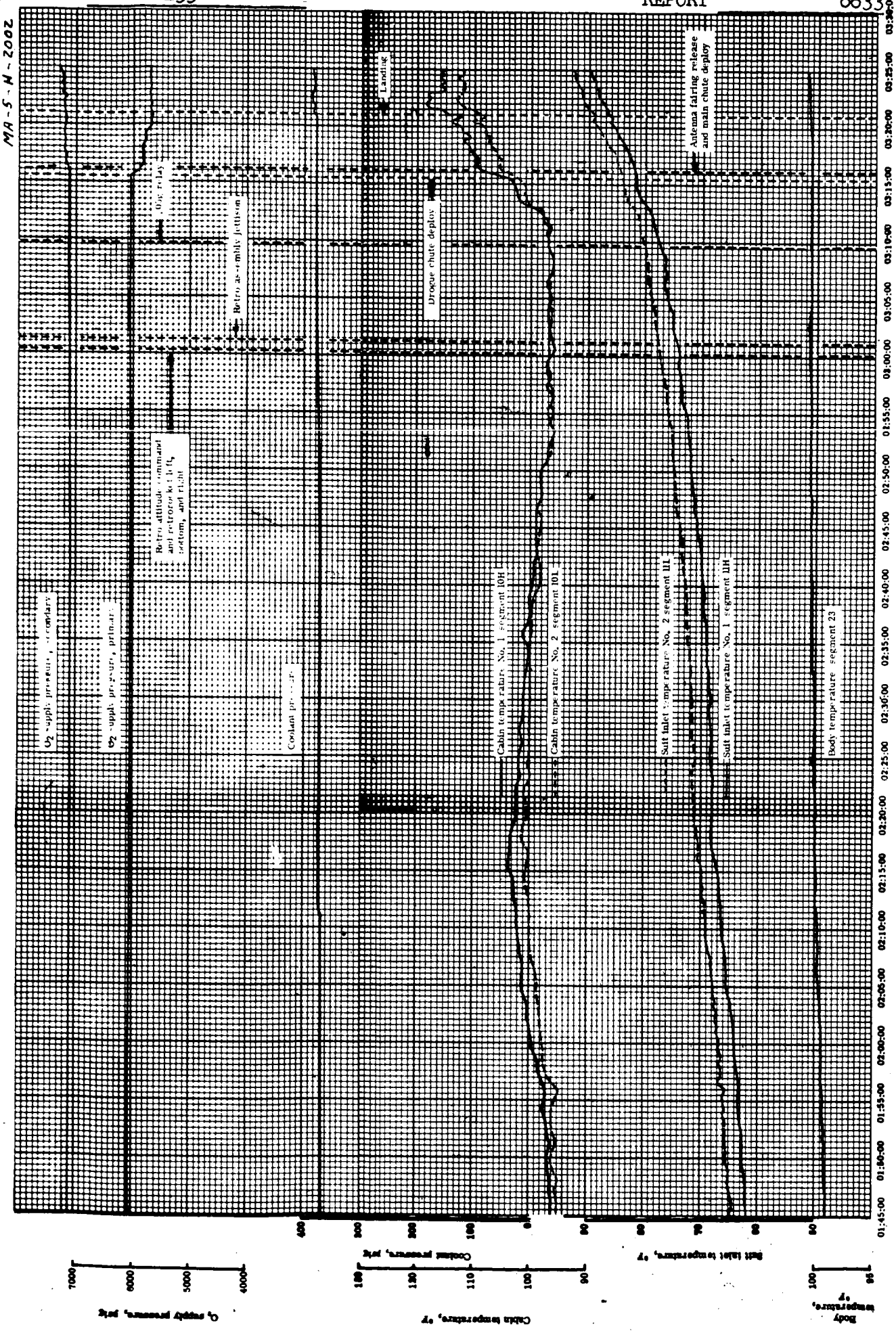
DATE 6 March 1962

MODEL 133

PAGE 7.70

REPORT 8633

MA-5-M-2002



CONFIDENTIAL

DATE 6 March 1962

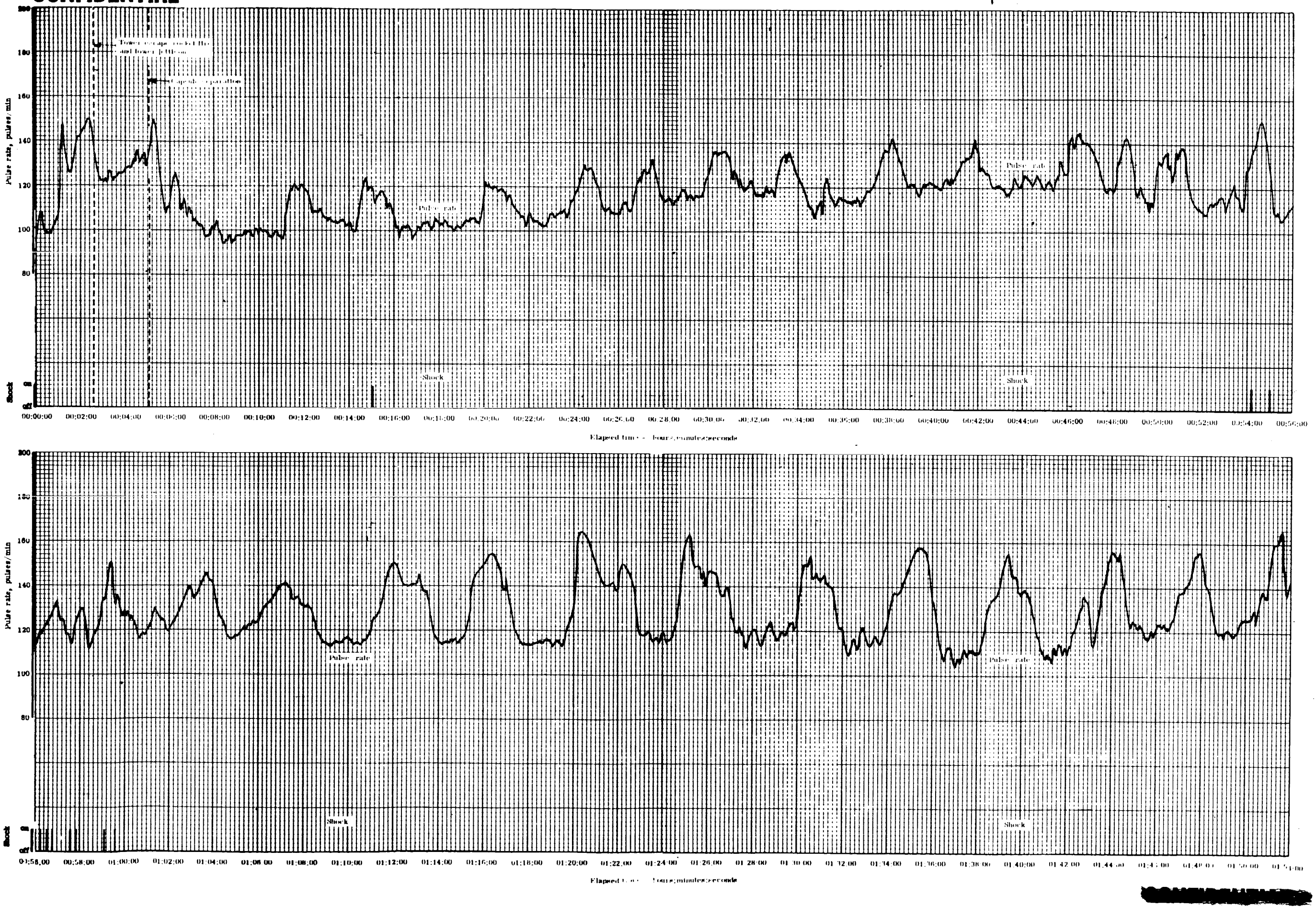
MODEL 133

CONFIDENTIAL

PAGE 7-71

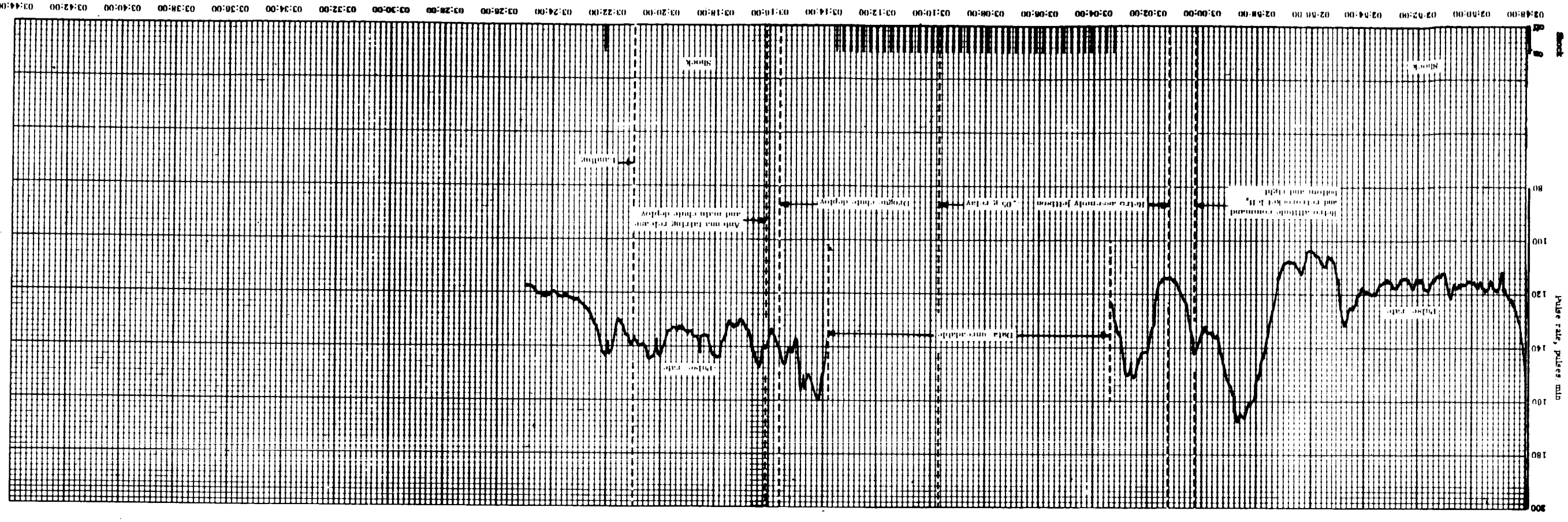
REPORT 8633

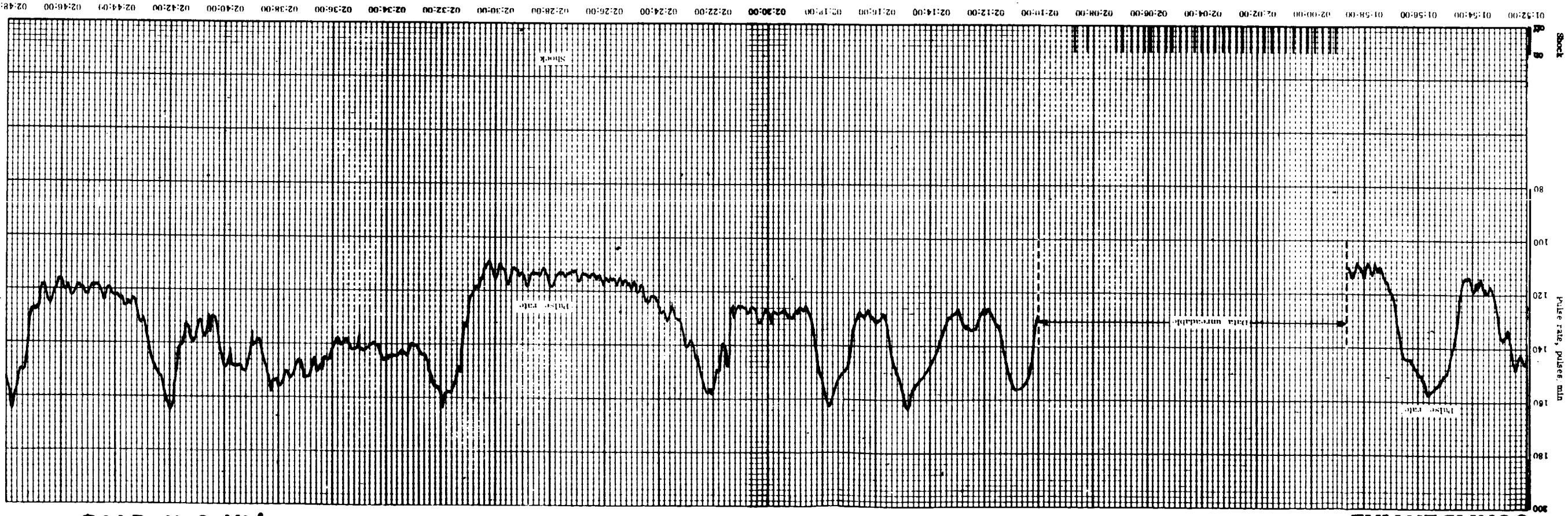
MA-5-H-2401



[redacted]

CONFIDENTIAL





CONFIDENTIAL

MODEL 133

DATE 6 March 1962

PAGE 7.72

REPORT 8631

NA-S-H-2402

~~CONFIDENTIAL~~

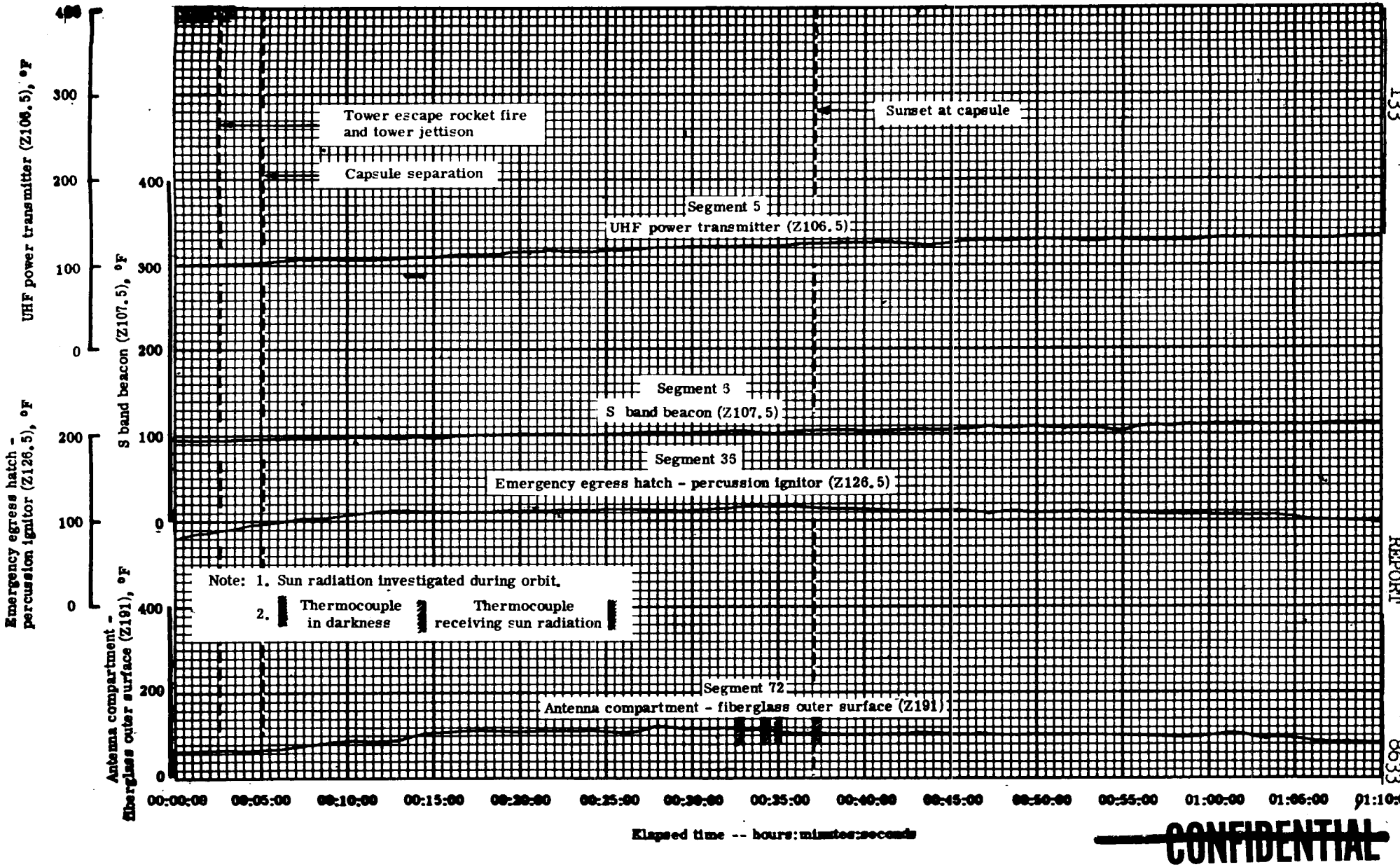
MA-5-T-101 REV B

DATE 6 March 1962

MODEL 133

REPORT 8633

PAGE 7-73



~~CONFIDENTIAL~~

CONFIDENTIAL

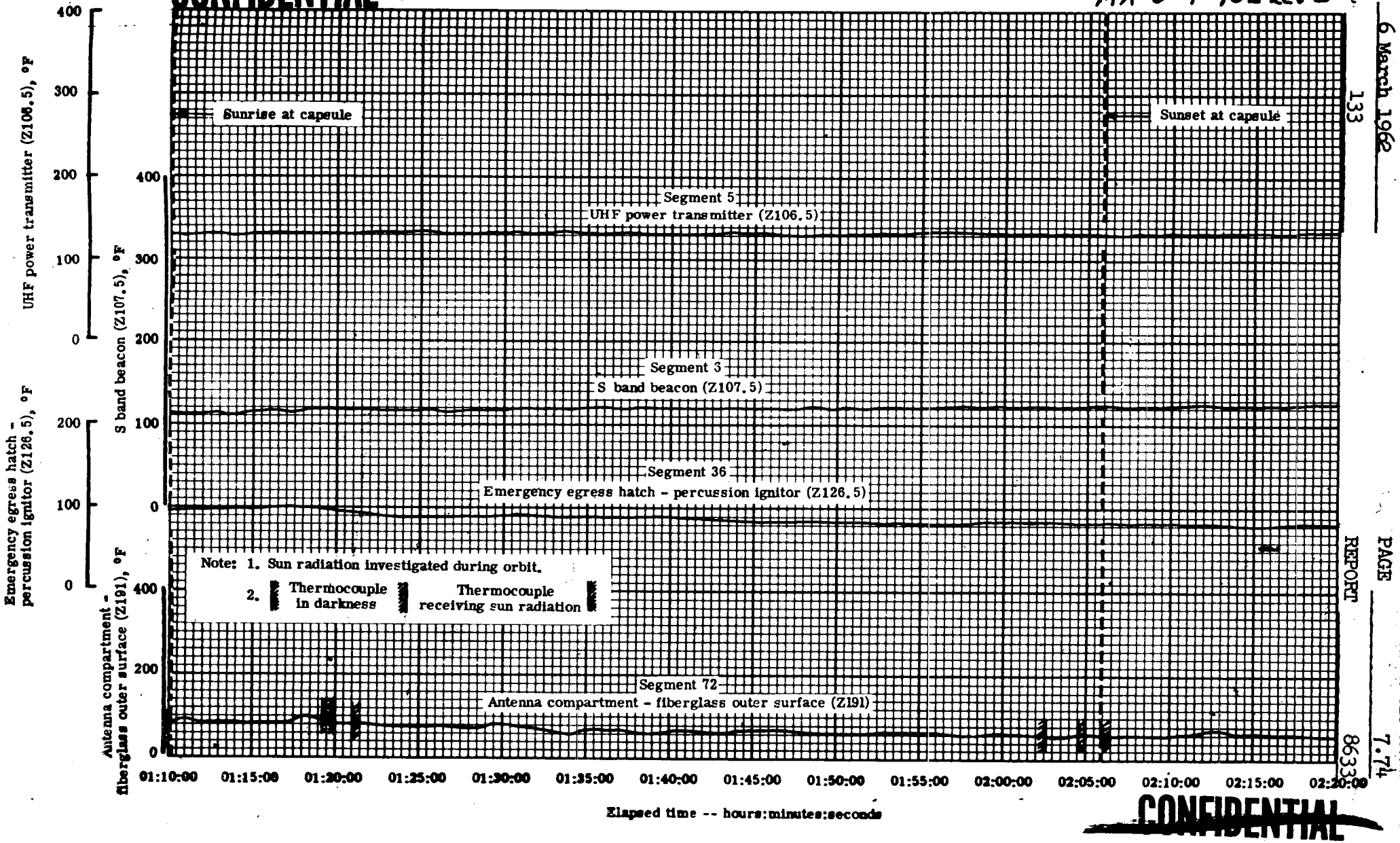
MA-5-T-102 Rev B

DATE 6 March 1962

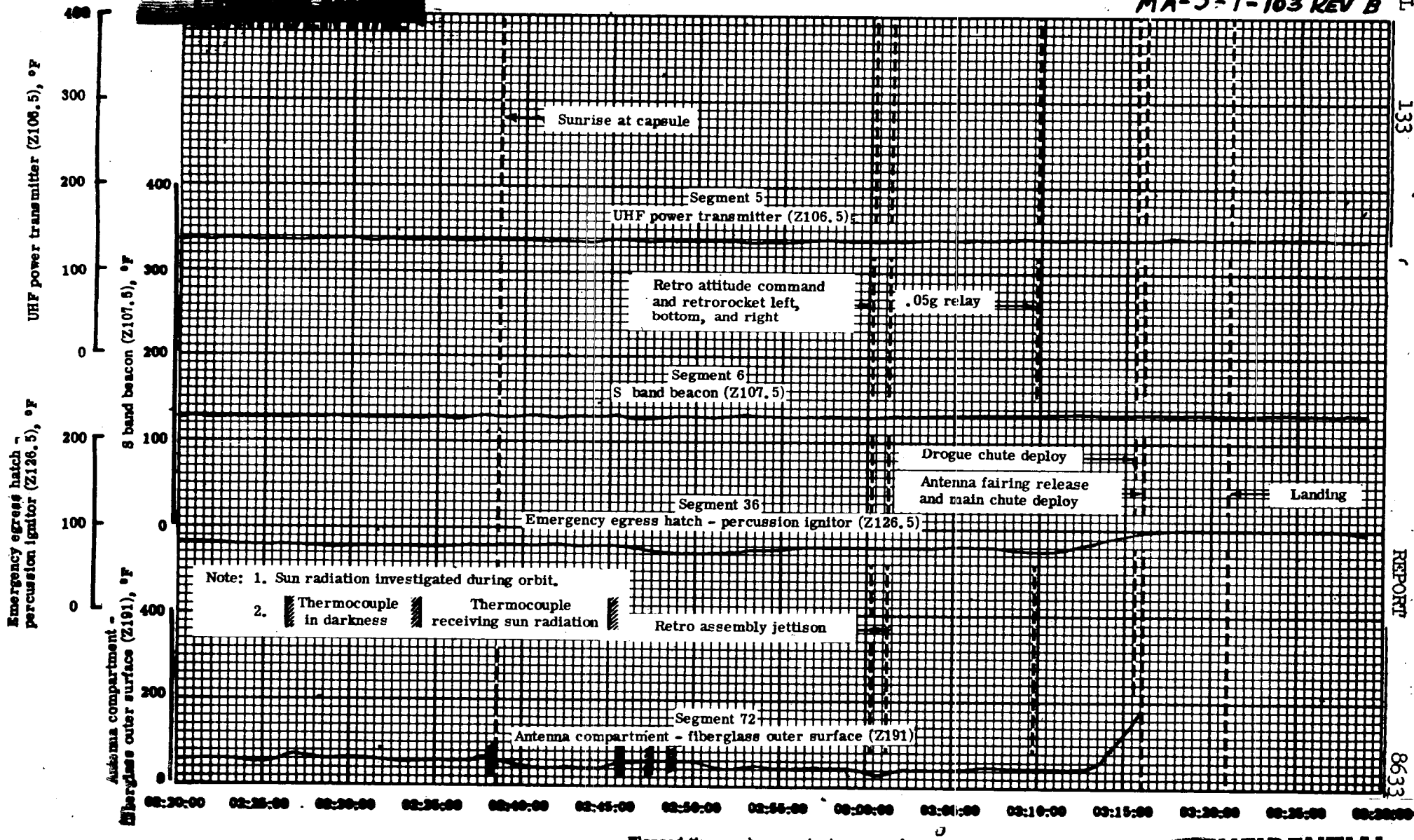
MODEL 133

REPORT 863374

PAGE 7.74



CONFIDENTIAL


UHF power transmitter (Z106.5), °F
400
300
200
100
0
S band beacon (Z107.5), °F
400
300
200
100
0
Emergency egress hatch - percussion ignitor (Z126.5), °F
200
100
0
Antenna compartment - fiberglass outer surface (Z191), °F
400
200
0
Sunrise at capsule
Segment 5
UHF power transmitter (Z106.5)
Retro attitude command and retrorocket left, bottom, and right
.05g relay
Segment 6
S band beacon (Z107.5)
Drogue chute deploy
Antenna fairing release and main chute deploy
Landing
Segment 36
Emergency egress hatch - percussion ignitor (Z126.5)
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
Retro assembly jettison
Segment 72
Antenna compartment - fiberglass outer surface (Z191)
02:20:00
02:25:00
02:30:00
02:35:00
02:40:00
02:45:00
02:50:00
02:55:00
03:00:00
03:05:00
03:10:00
03:15:00
03:20:00
03:25:00
03:30:00
Elapsed time -- hours:minutes:seconds

CONFIDENTIAL

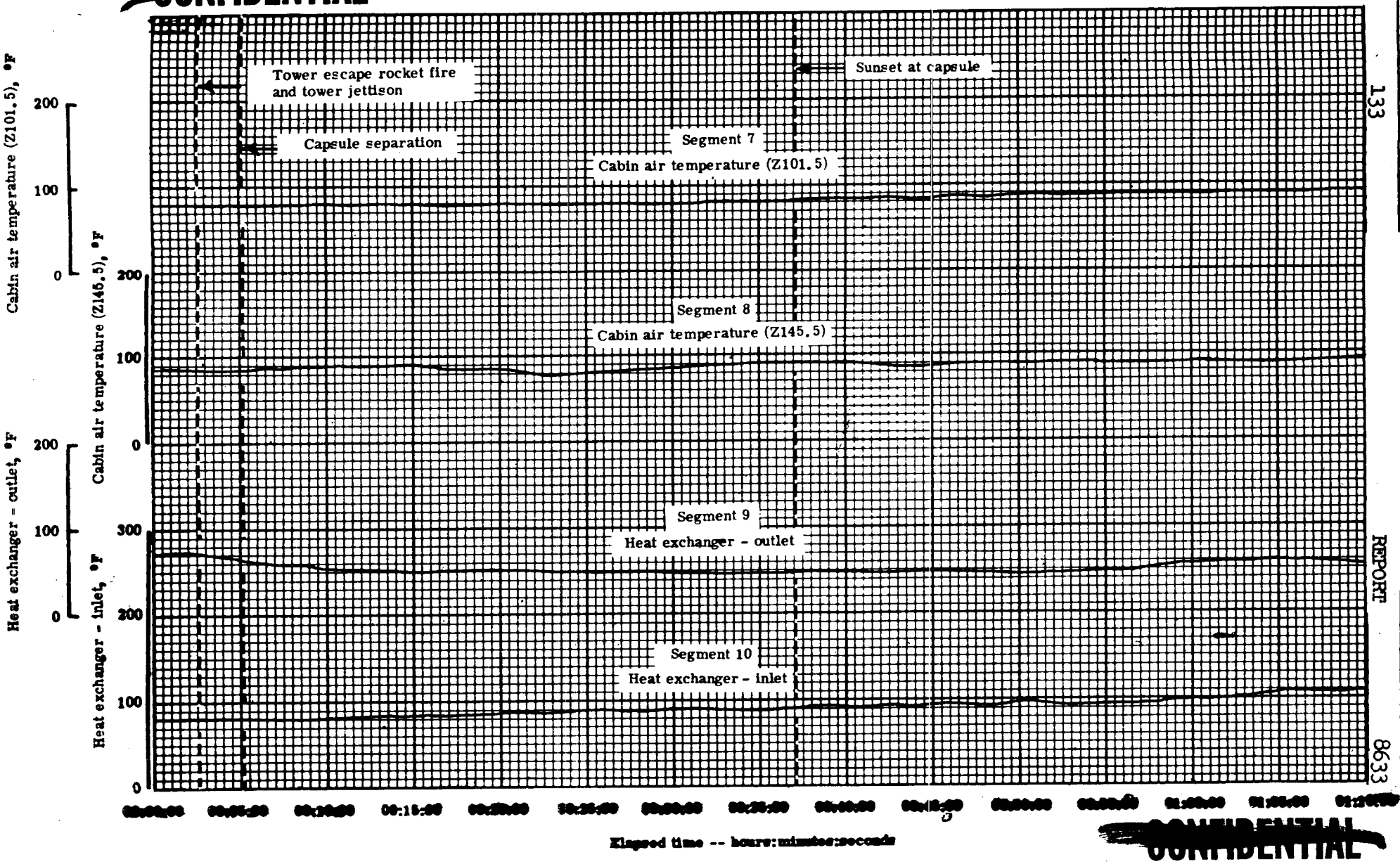
MA-5-T-201 REV B

DATE 6 March 1962

MODEL 133

PAGE 7-76

REPORT 8633

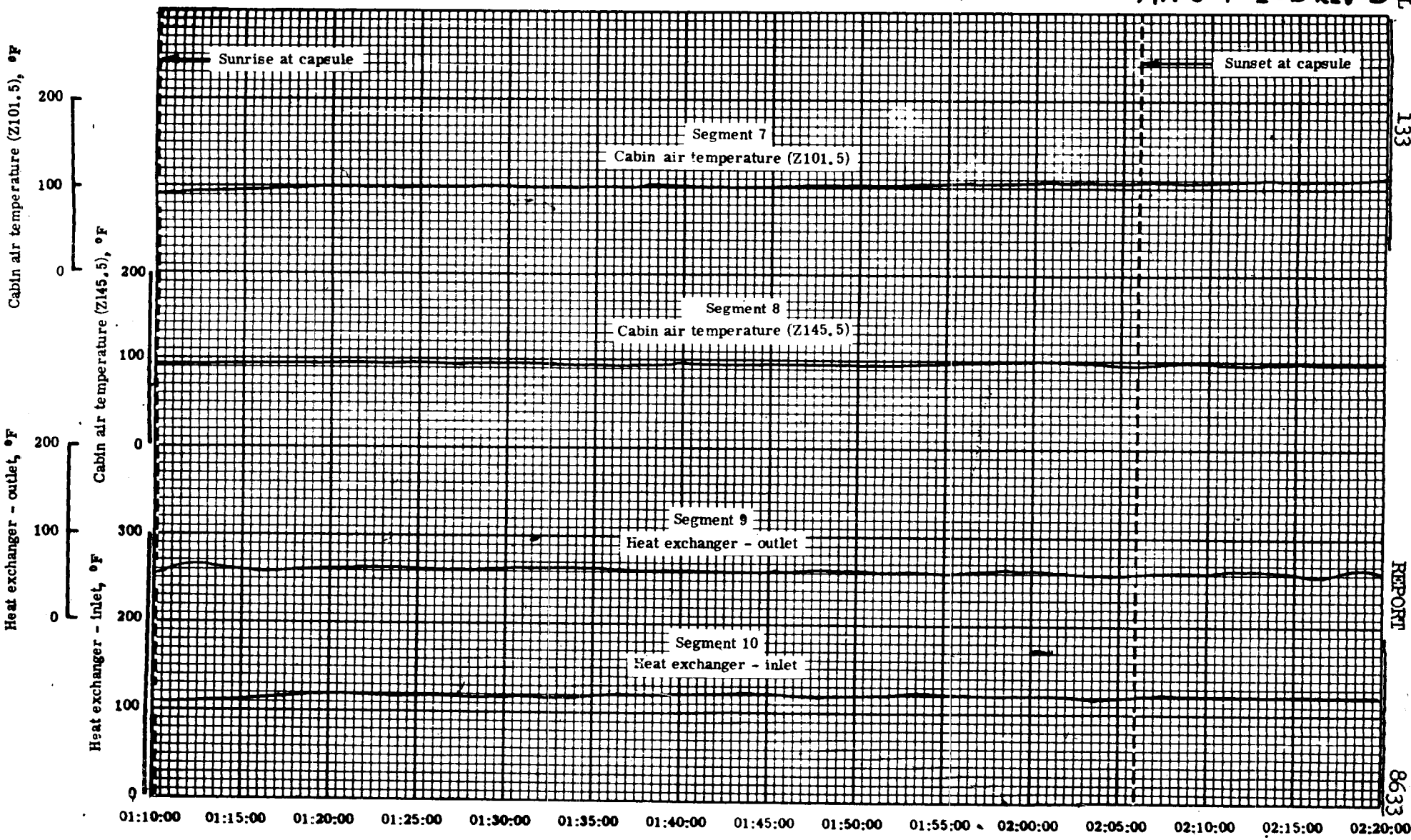


CONFIDENTIAL

~~CONFIDENTIAL~~

MA-5-T-202 REV B

DATE 6 March 1962 MODEL 133 PAGE 7-77 REPORT 8633

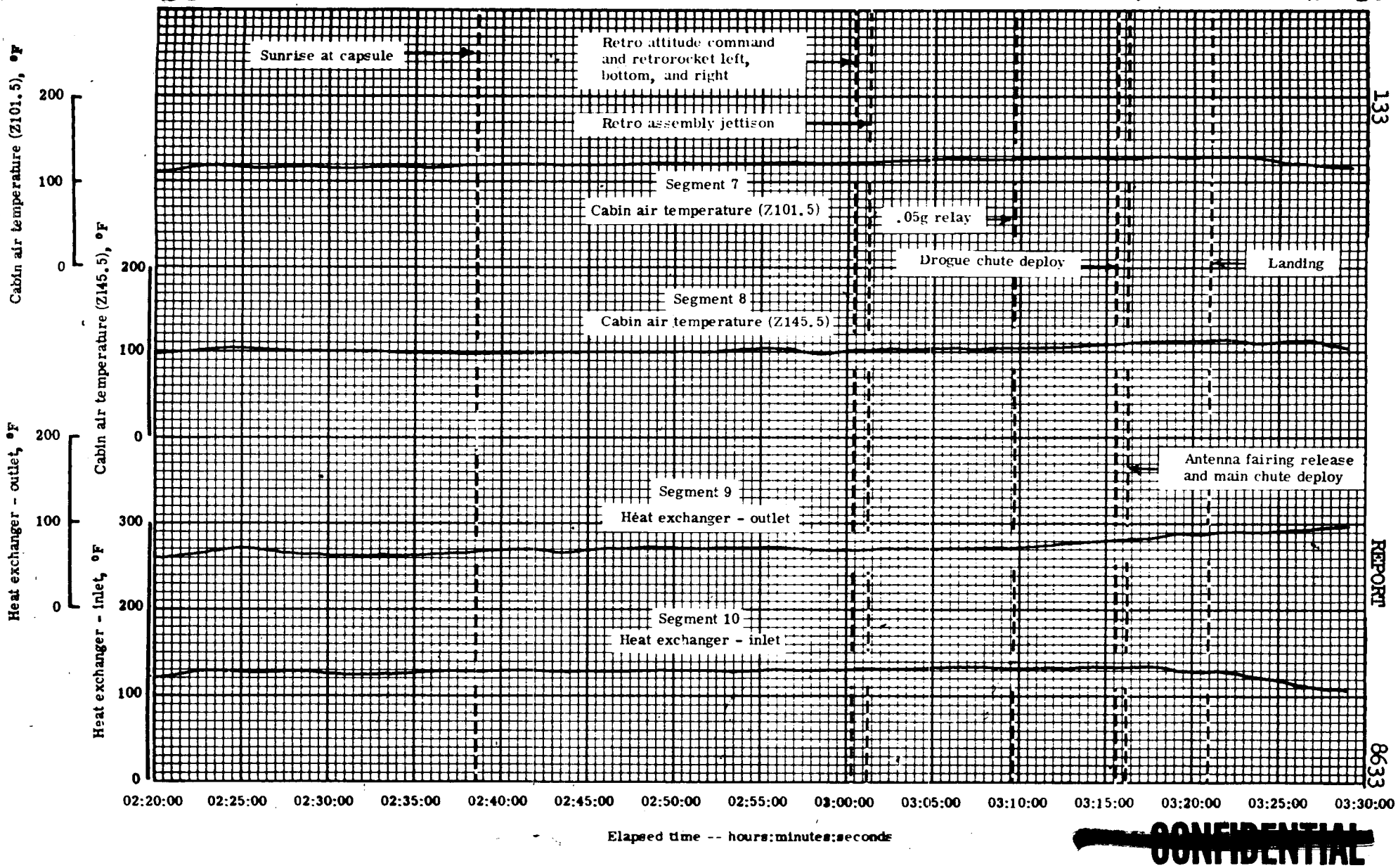


~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

MA-5-T-203 REV B

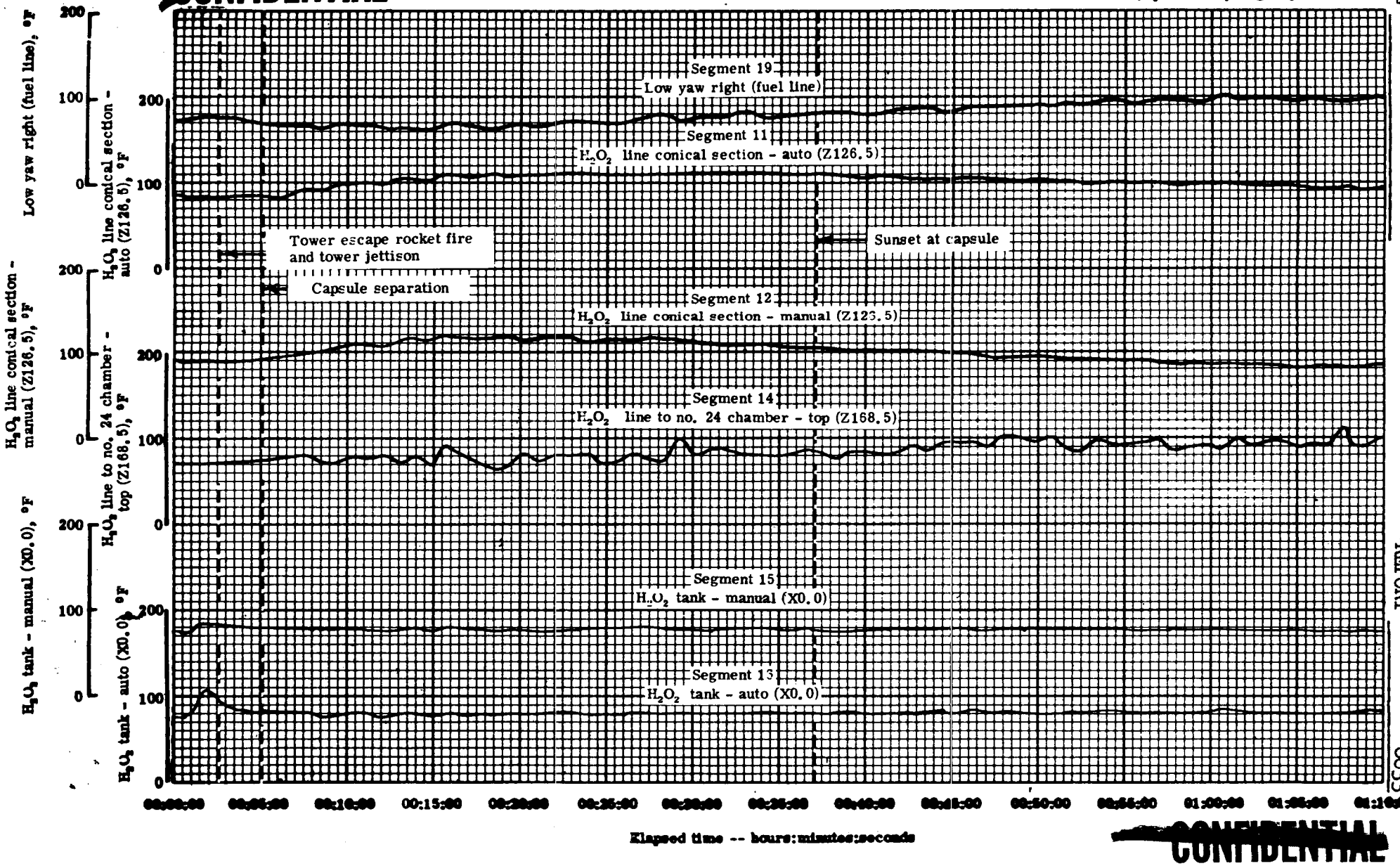
DATE 6 March 1962 MODEL 133 REPORT 8633 PAGE 7-78



~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

MA-5-T-301 Rev B



~~CONFIDENTIAL~~

DATE 6 March 1962

MODEL

REPORT 8633

PAGE 7.79

CONFIDENTIAL

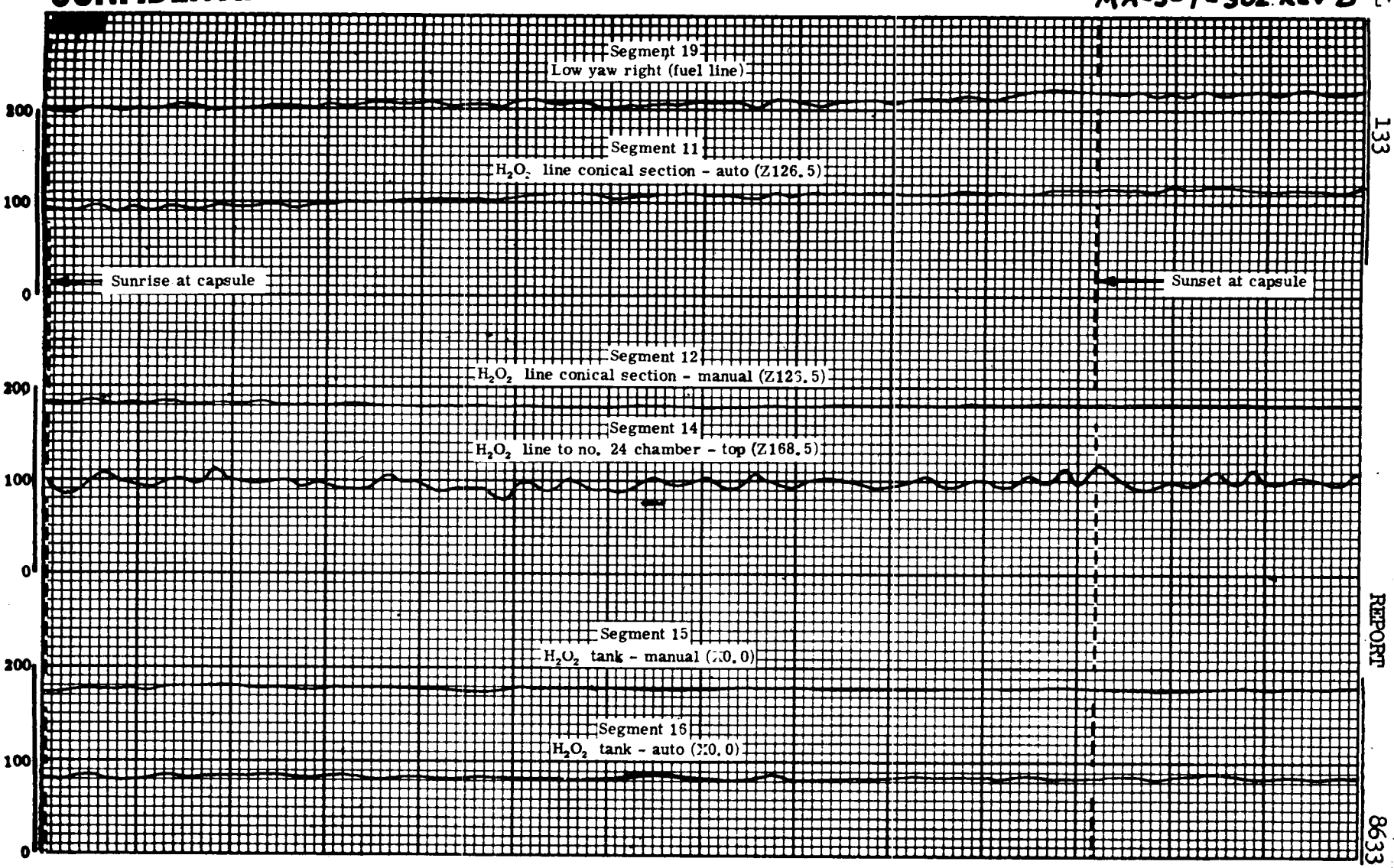
MA-5-T-302 Rev B

DATE 6 March 1962

MODEL 133

REPORT 8633

PAGE 7.80



CONFIDENTIAL

CONFIDENTIAL

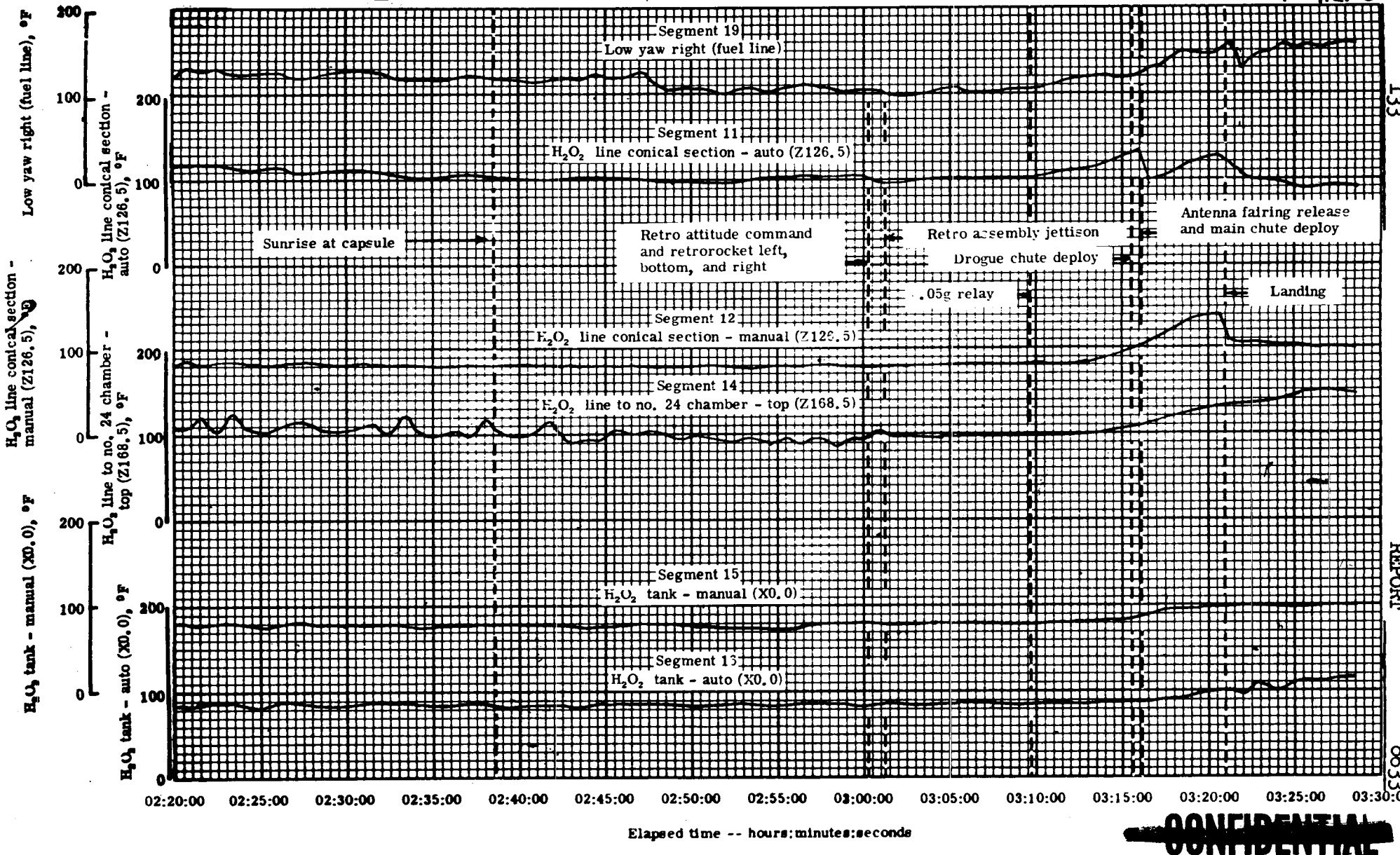
MA-5-T-303 REV B

DATE 6 March 1962

MODEL 133

PAGE 7-81

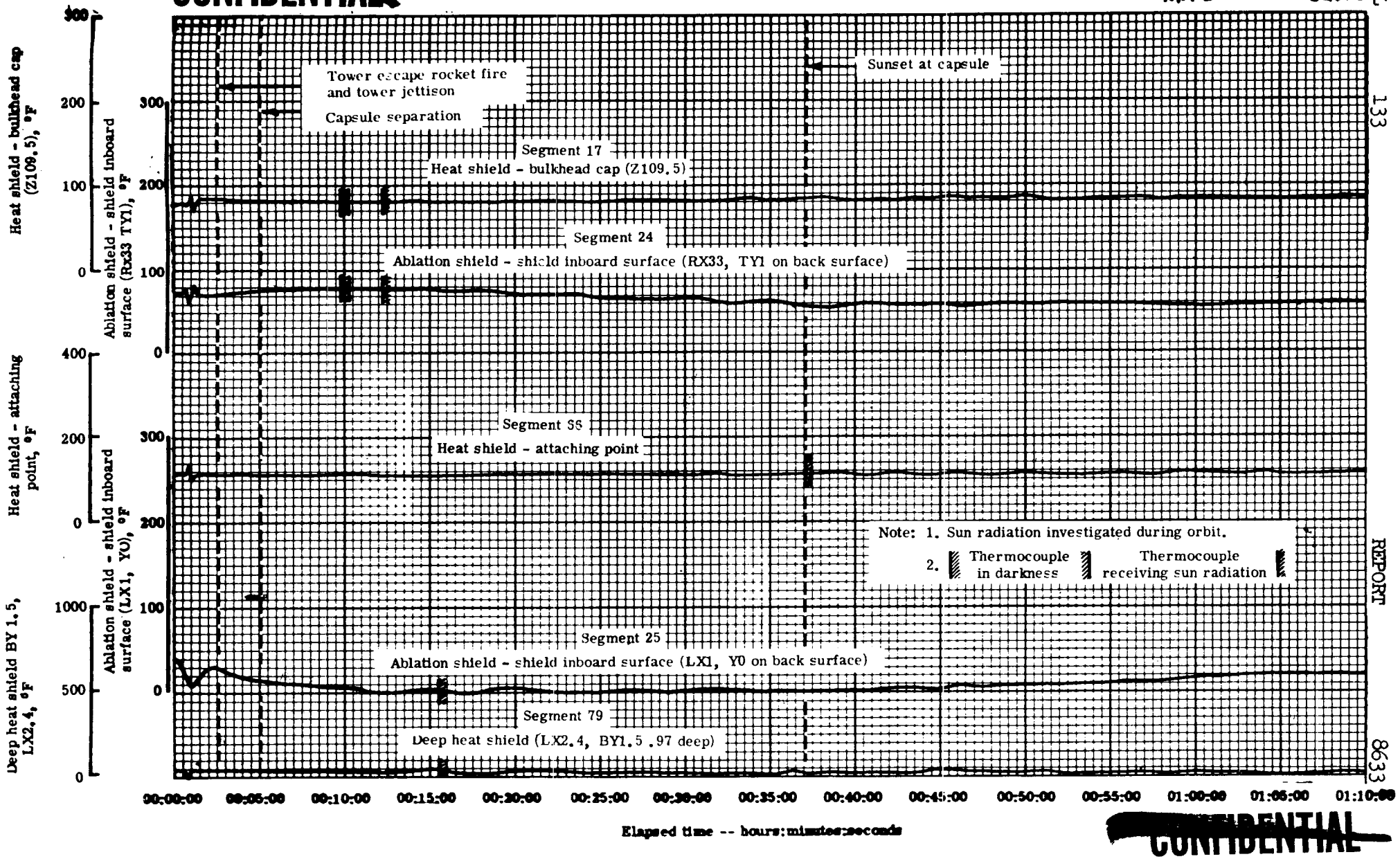
REPORT 86333



CONFIDENTIAL

CONFIDENTIAL

MA-5-T-401 REV C



CONFIDENTIAL

MODEL 133 REPORT 8633

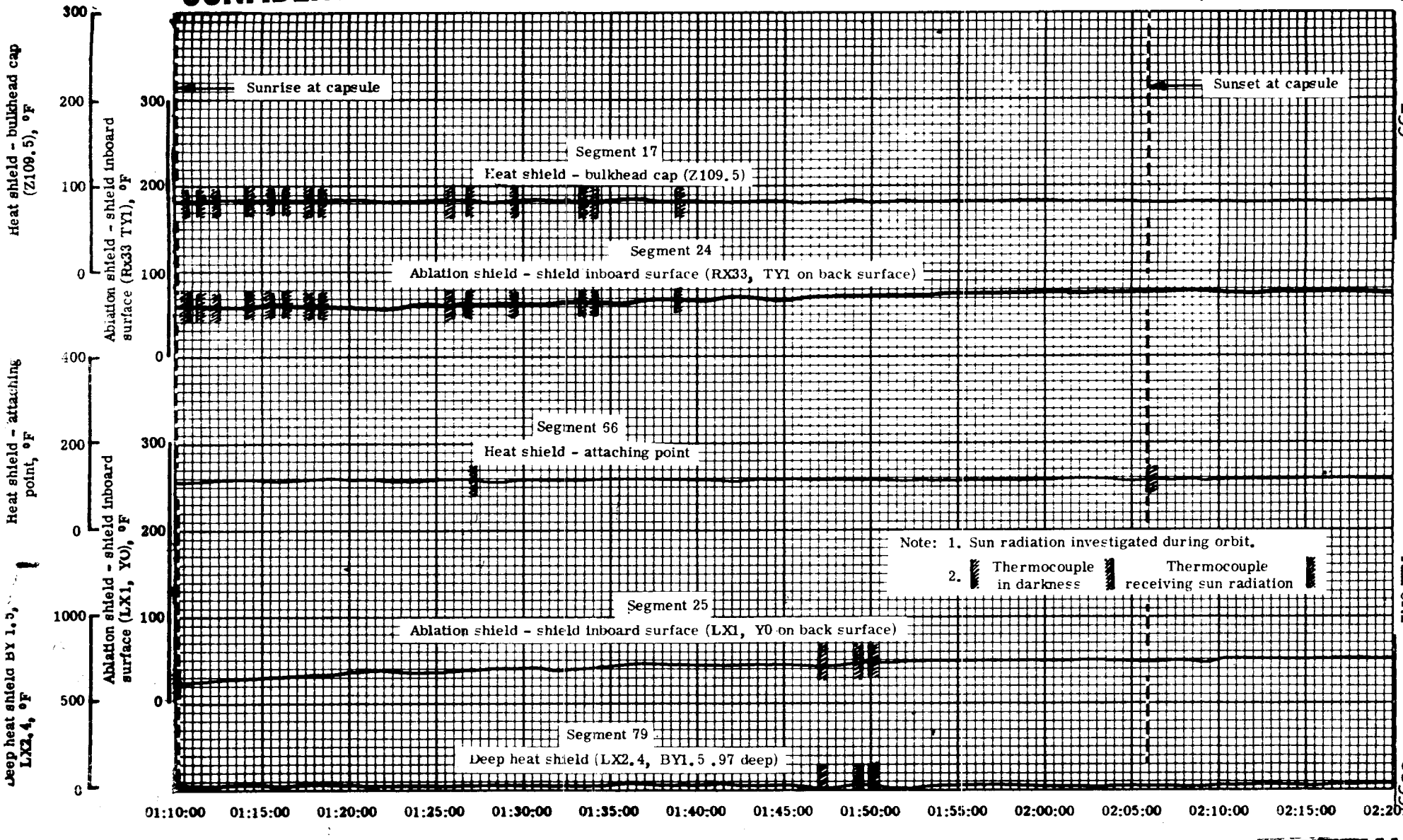
DATE 6 March 1962 PAGE 7.82

CONFIDENTIAL

MA-5-T-402 REV C

DATE 6 March 1962

MODEL 133

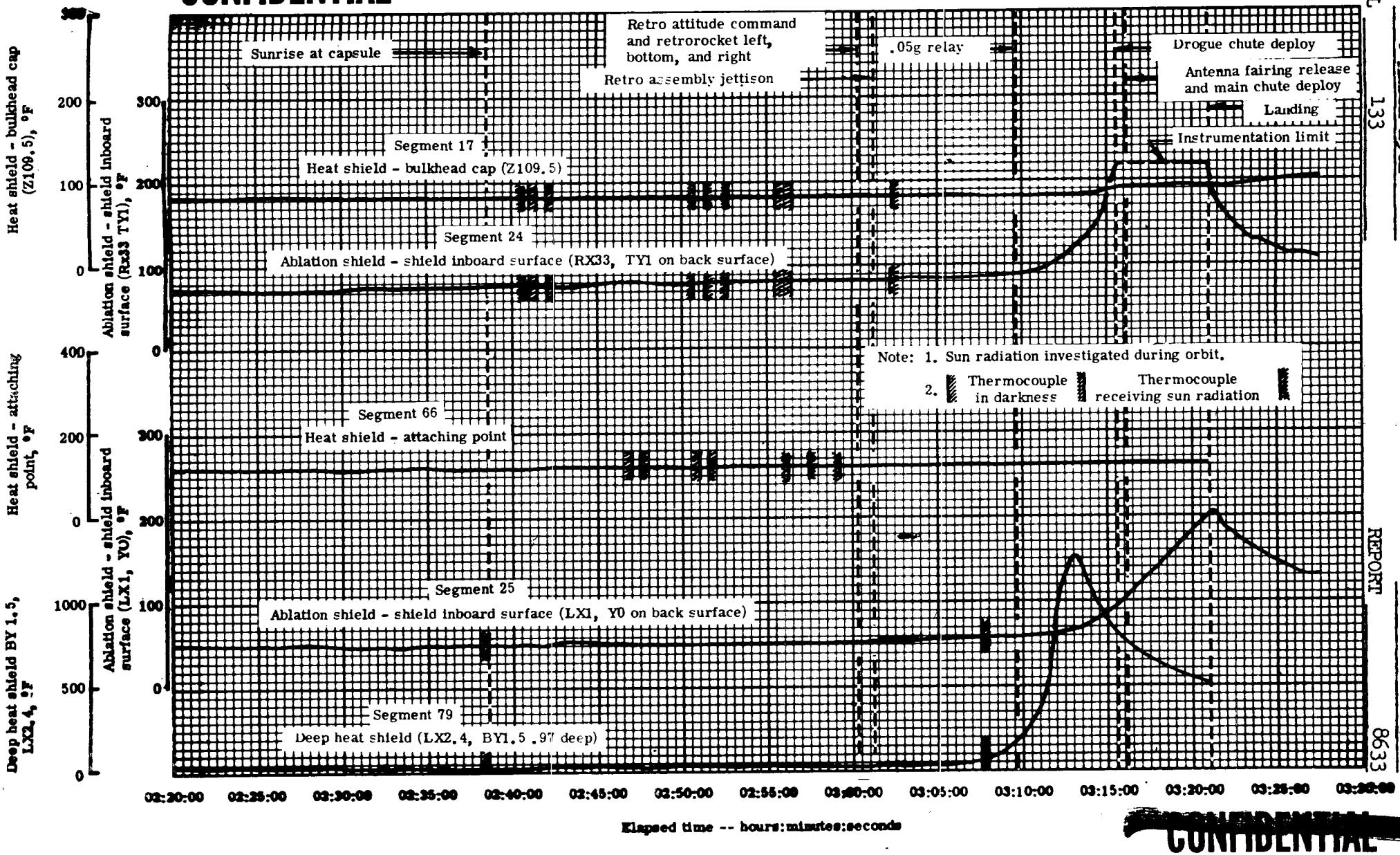


PAGE 7.83

REPORT 86333

CONFIDENTIAL

CONFIDENTIAL

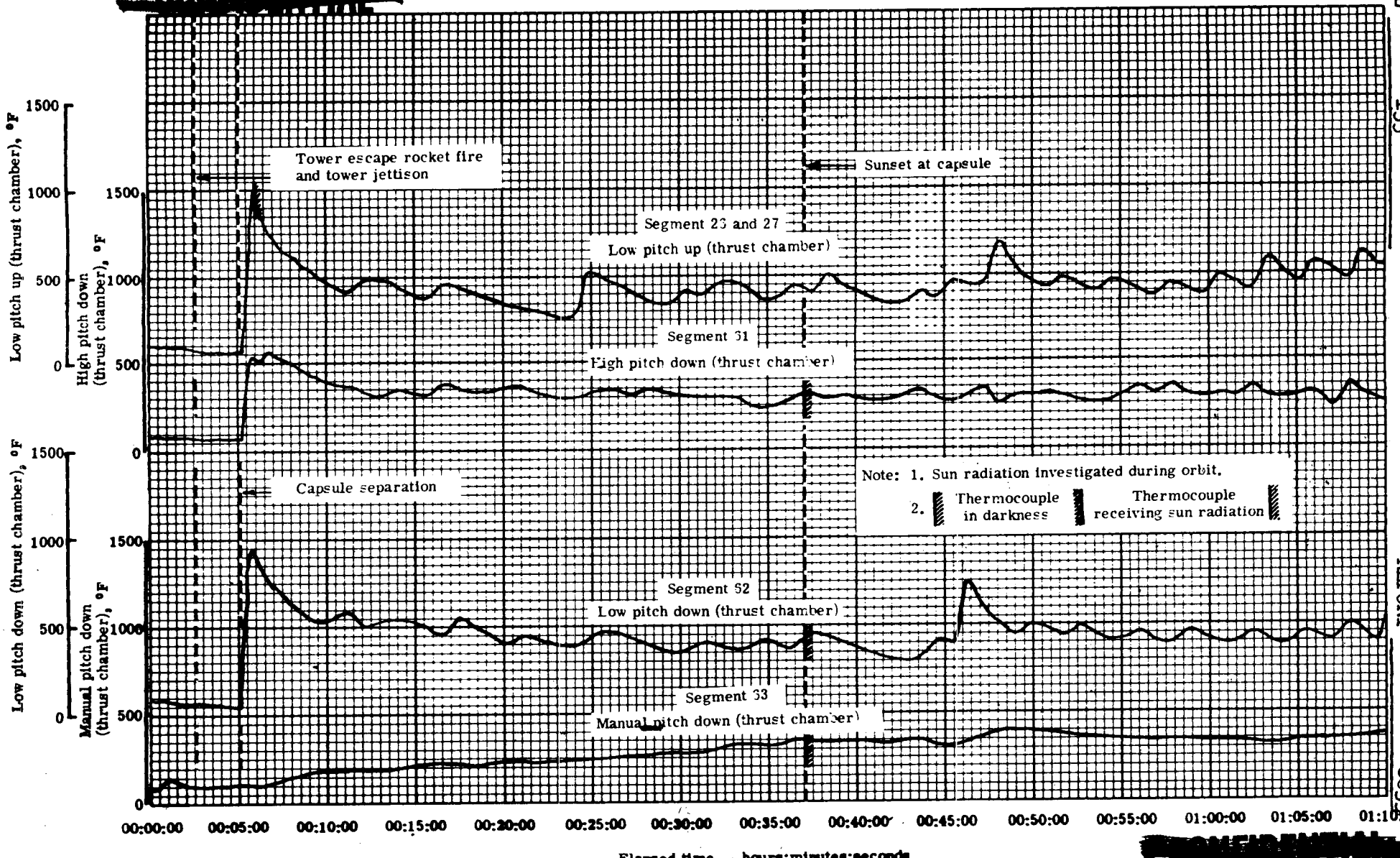


DATE 6 March 1962
MODEL 133
REPORT 7.84
PAGE 8633

CONFIDENTIAL

MA-5-T-501 REV B

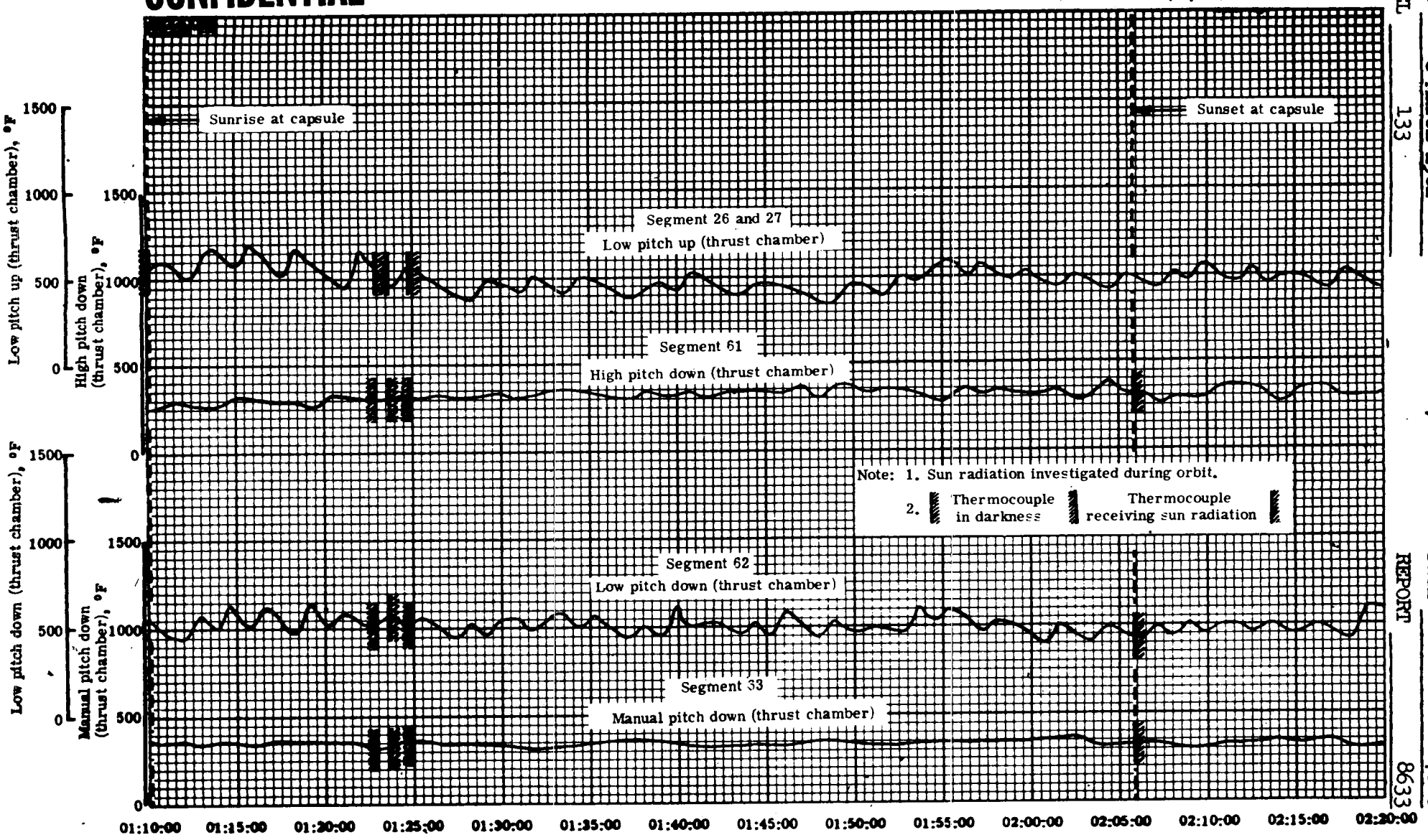
MODEL 133 DATE 6 March 1962



PAGE 7-85 REPORT 8633

CONFIDENTIAL

MA-5-T- 502 REV A

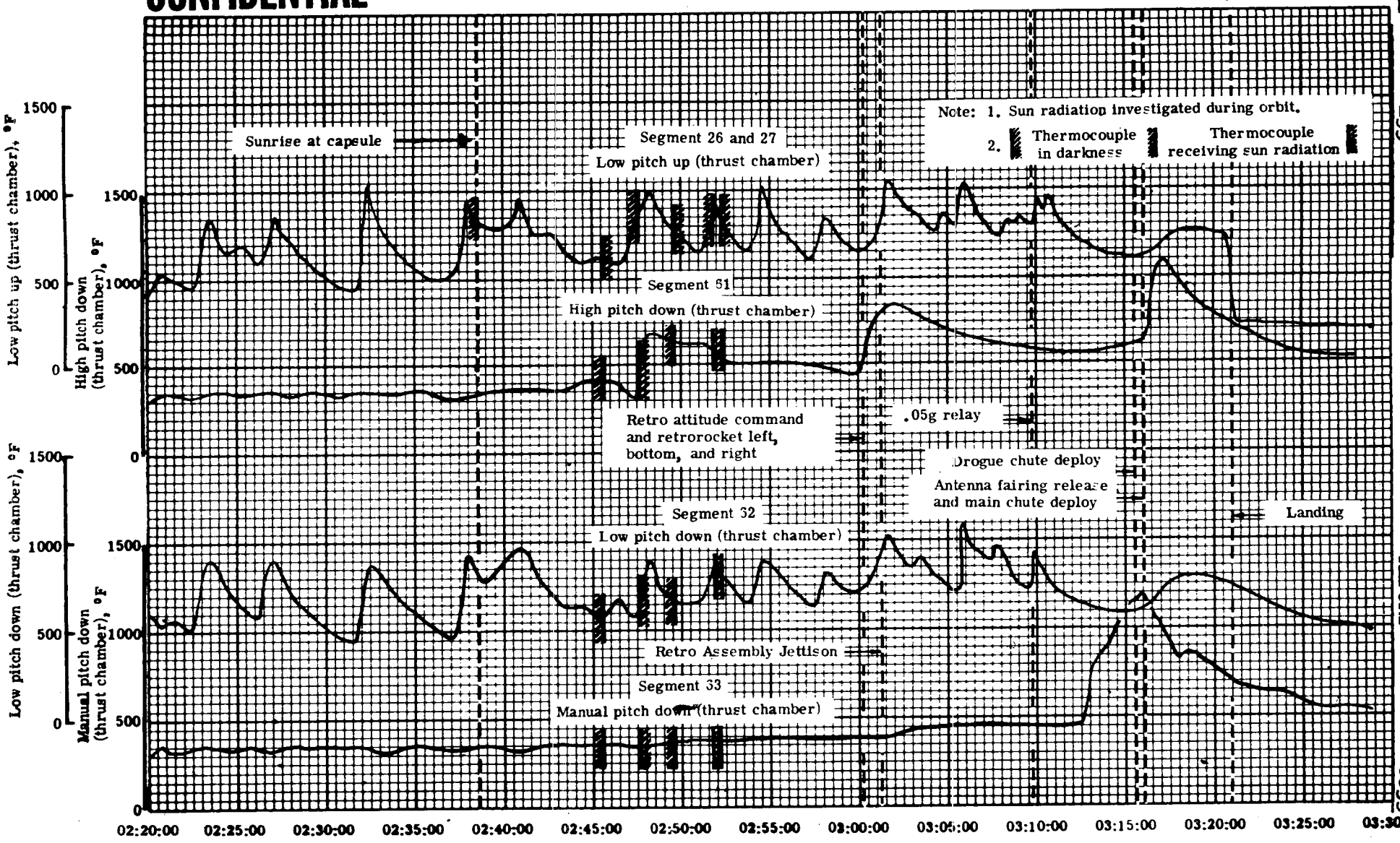


CONFIDENTIAL

CONFIDENTIAL

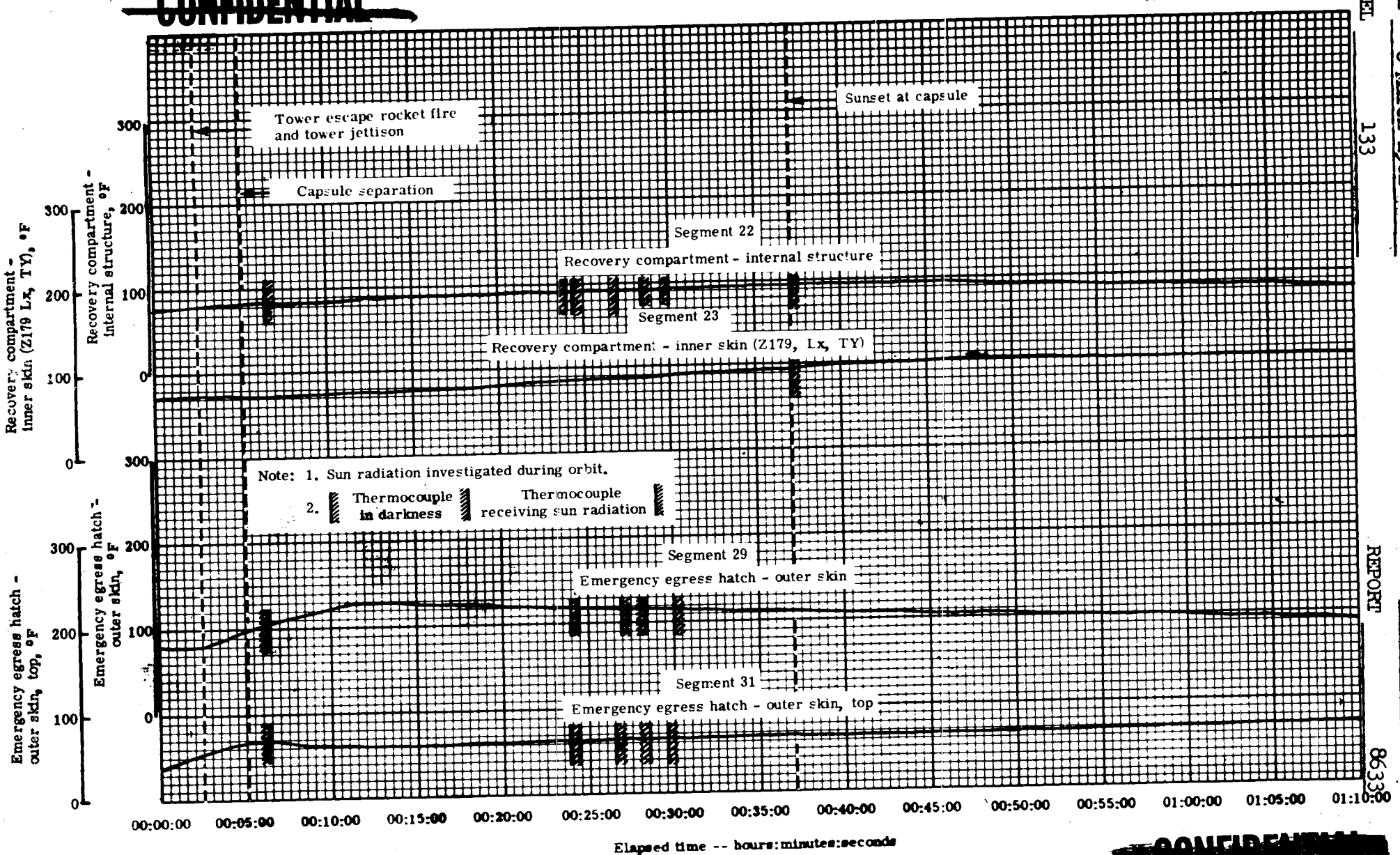
MA-5-T-503 REV B

DATE 6 March 1962 MODEL 133



PAGE REPORT 7.87 8633

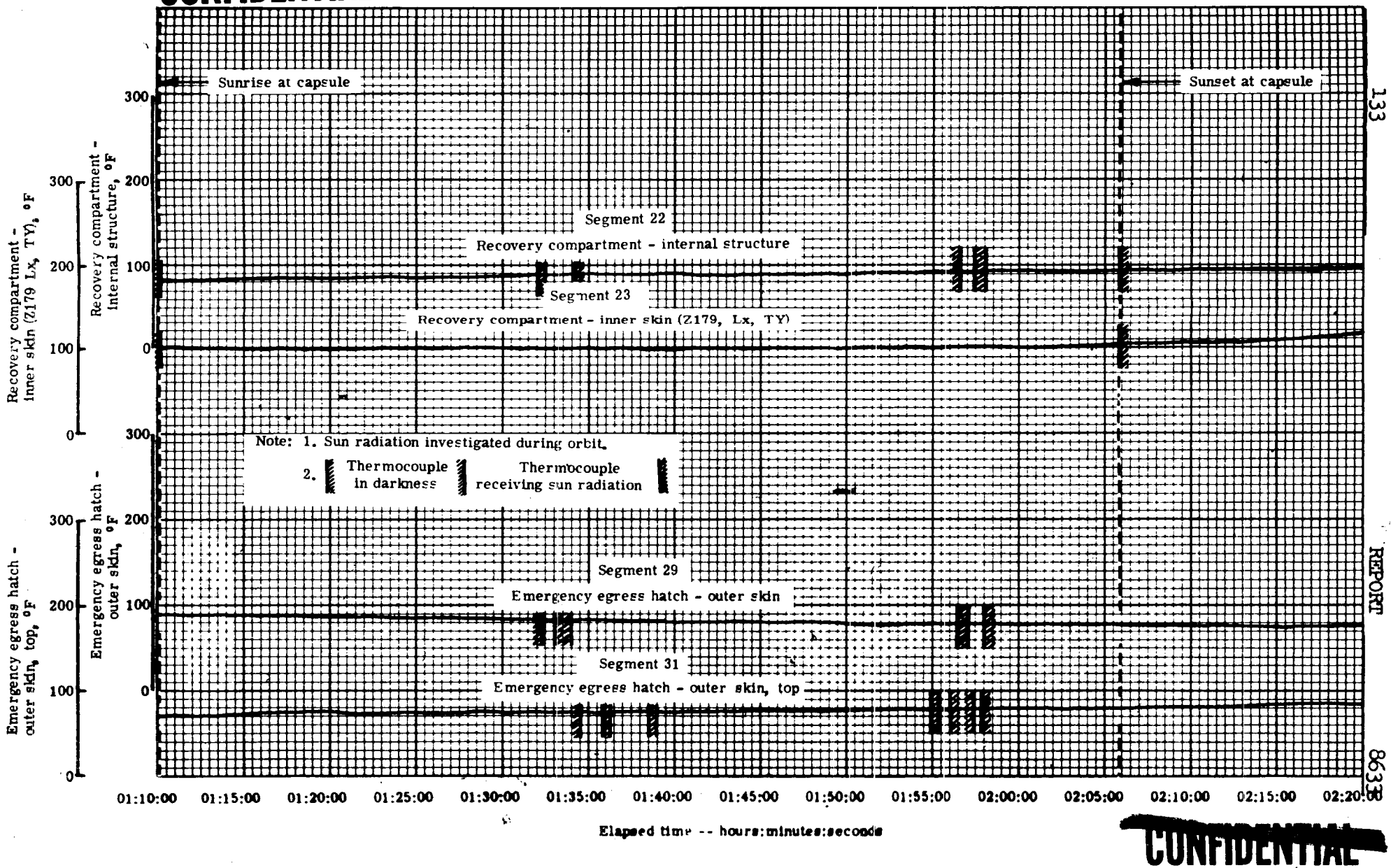
CONFIDENTIAL


Tower escape rocket fire and tower jettison
Capsule separation
Sunset at capsule
Segment 22
Recovery compartment - internal structure
Segment 23
Recovery compartment - inner skin (Z179, Lx, TY)
Recovery compartment - inner skin (Z179 Lx, TY), °F
Recovery compartment - internal structure, °F
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
Segment 29
Emergency egress hatch - outer skin
Segment 31
Emergency egress hatch - outer skin, top
Emergency egress hatch - outer skin, top, °F
Emergency egress hatch - outer skin, °F
300
200
100
0
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
00:30:00
00:35:00
00:40:00
00:45:00
00:50:00
00:55:00
01:00:00
01:05:00
01:10:00
Elapsed time -- hours:minutes:seconds

CONFIDENTIAL

MA-5-T-602 REV B

DATE 6 March 1962 MODEL 133



REPORT 8633 PAGE 7-89

CONFIDENTIAL

CONFIDENTIAL

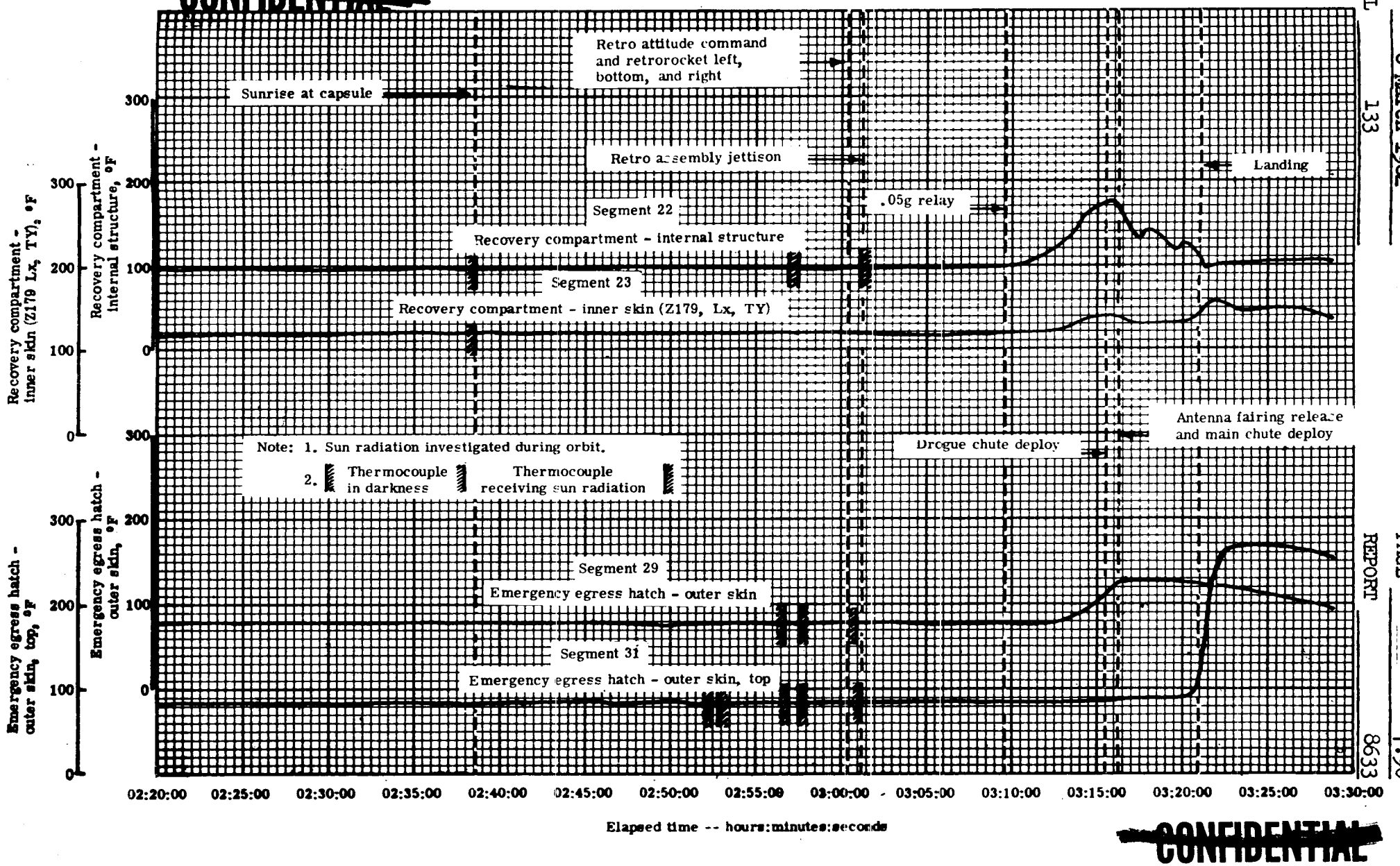
MA-5-T-603 Rev B

DATE 6 March 1962

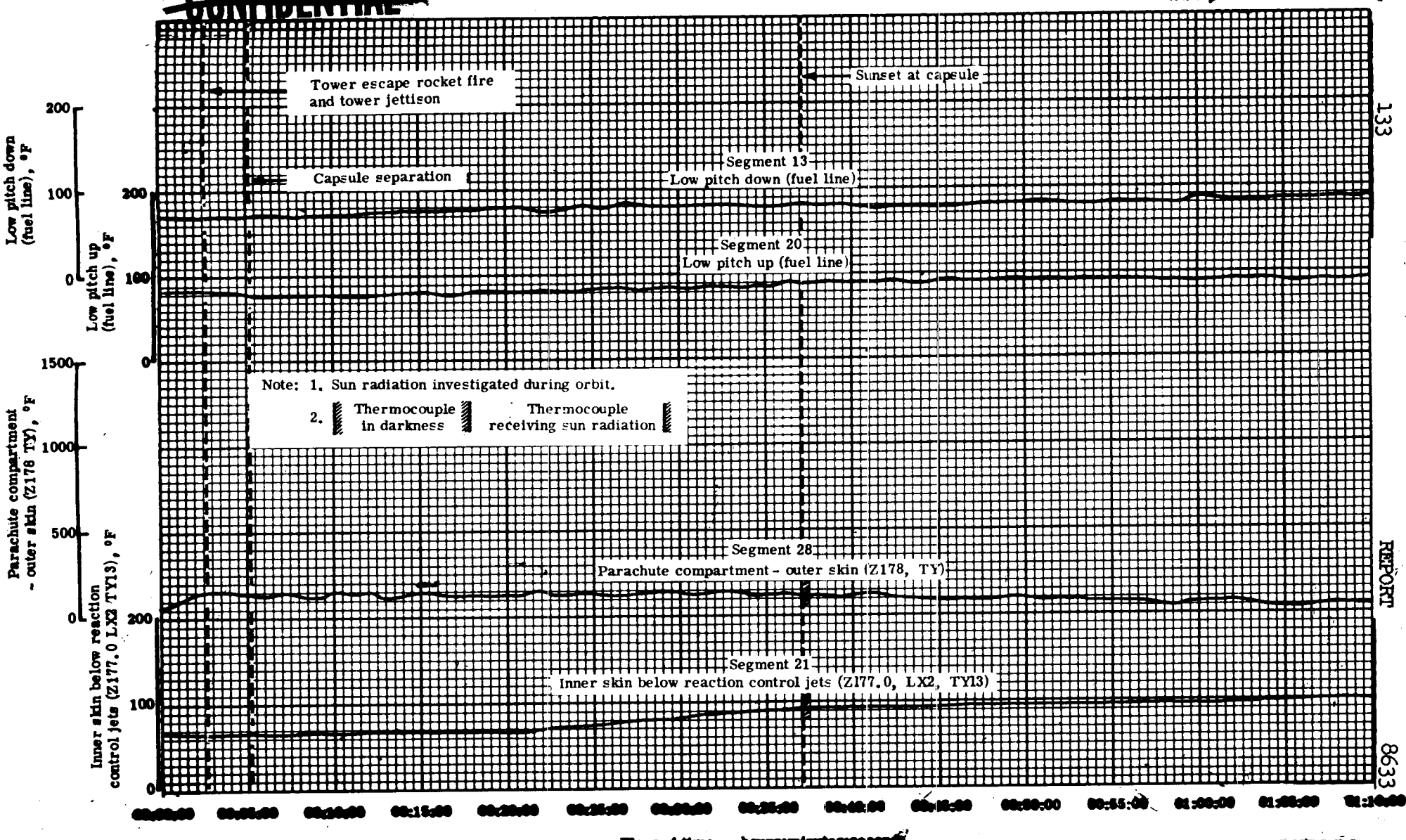
MODEL 133

PAGE 7-90

REPORT 8633



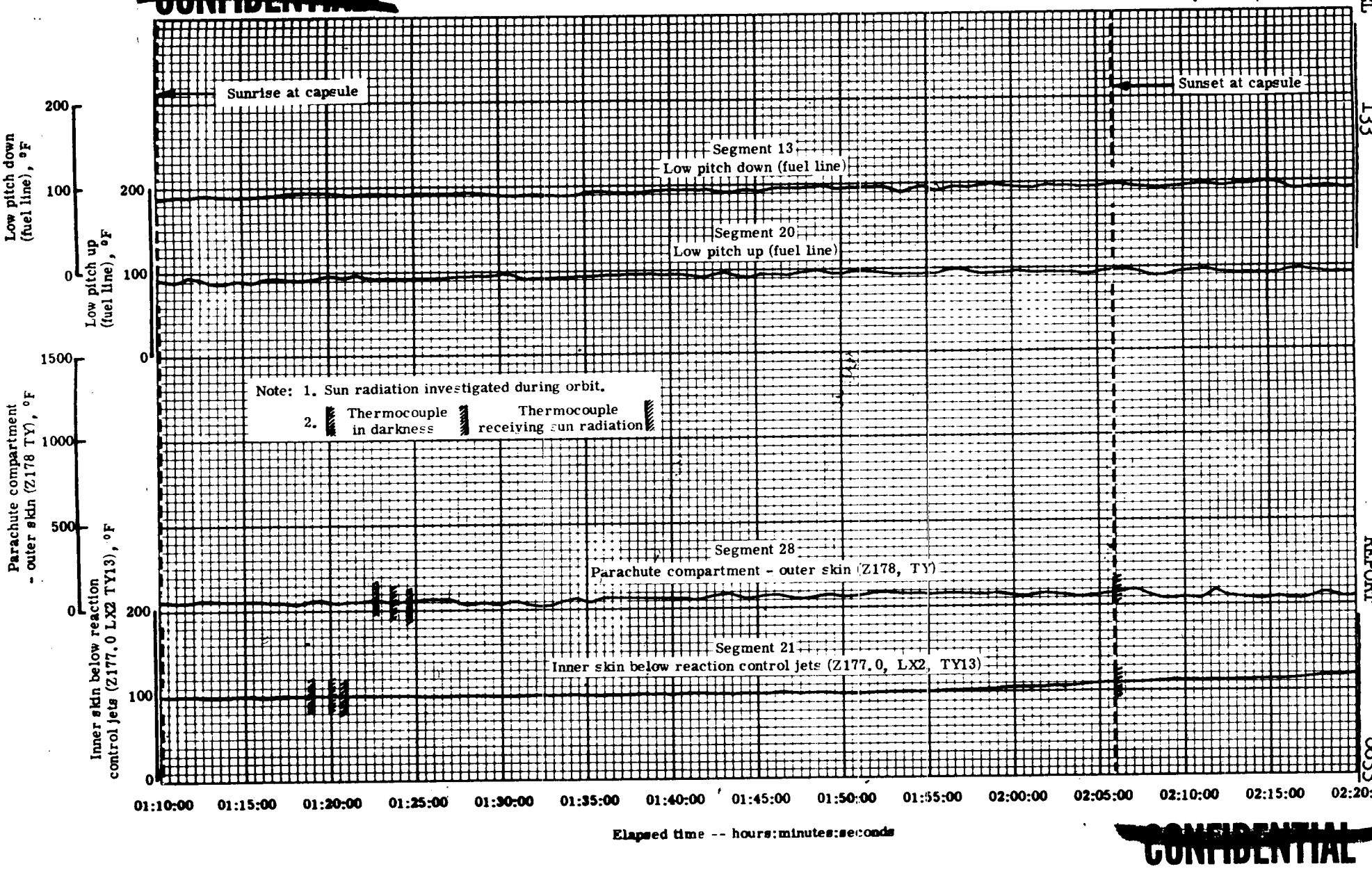
CONFIDENTIAL


Tower escape rocket fire and tower jettison
Sunset at capsule
Capsule separation
Segment 13
Low pitch down (fuel line)
Segment 20
Low pitch up (fuel line)
Segment 28
Parachute compartment - outer skin (Z178, TY)
Segment 21
Inner skin below reaction control jets (Z177.0, LX2, TY13)
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
Low pitch down (fuel line), °F
Low pitch up (fuel line), °F
Parachute compartment - outer skin (Z178 TY), °F
Inner skin below reaction control jets (Z177.0 LX2 TY13), °F
Elapsed time -- hours:minutes:seconds

CONFIDENTIAL

MA-5-T-702 REV B

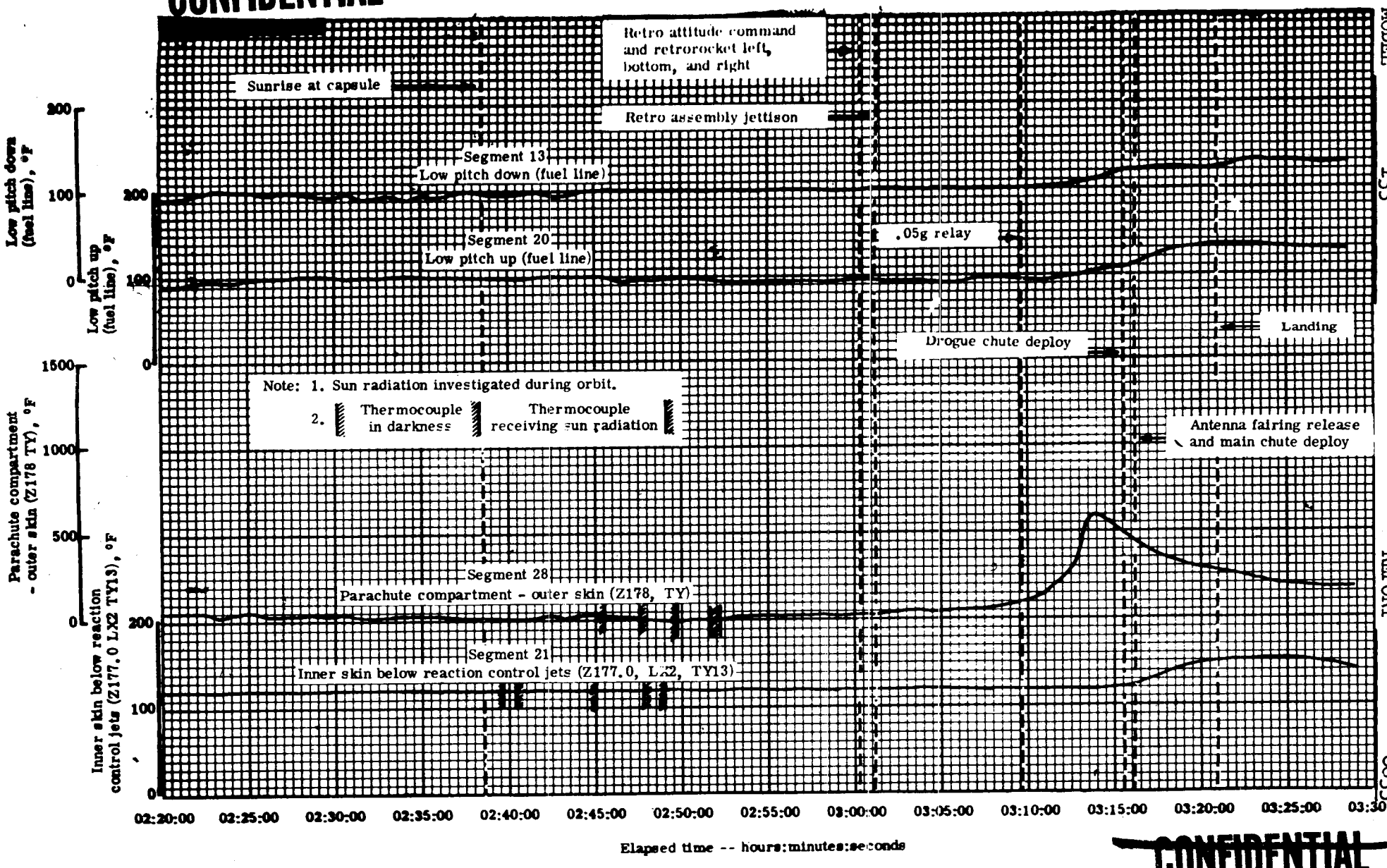
DATE 6 March 1962 MODEL 133 REPORT 8633 PAGE 7-92



CONFIDENTIAL

CONFIDENTIAL

MA-5-T-703 REV B



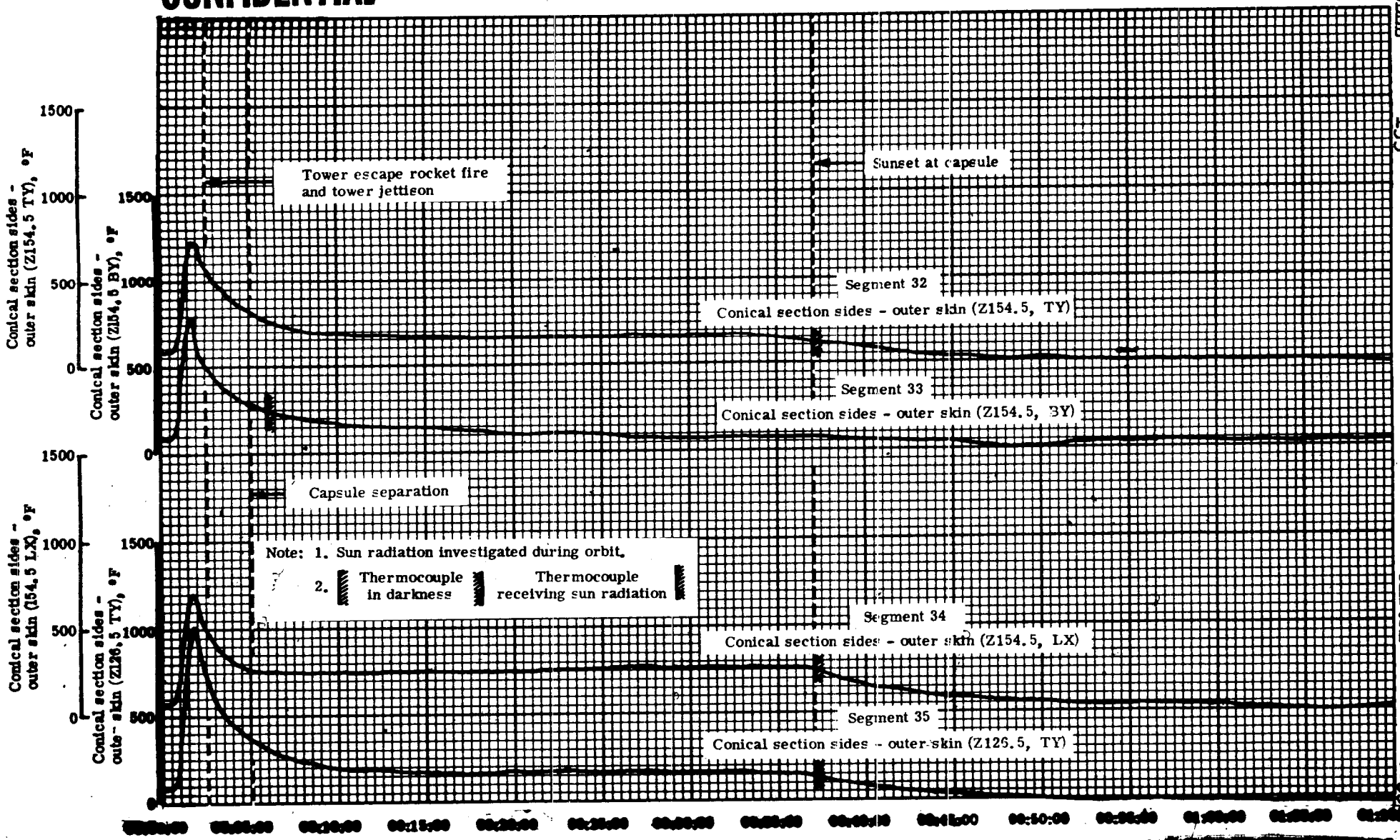
DATE 6 March 1962

MODEL 133

REPORT 8633

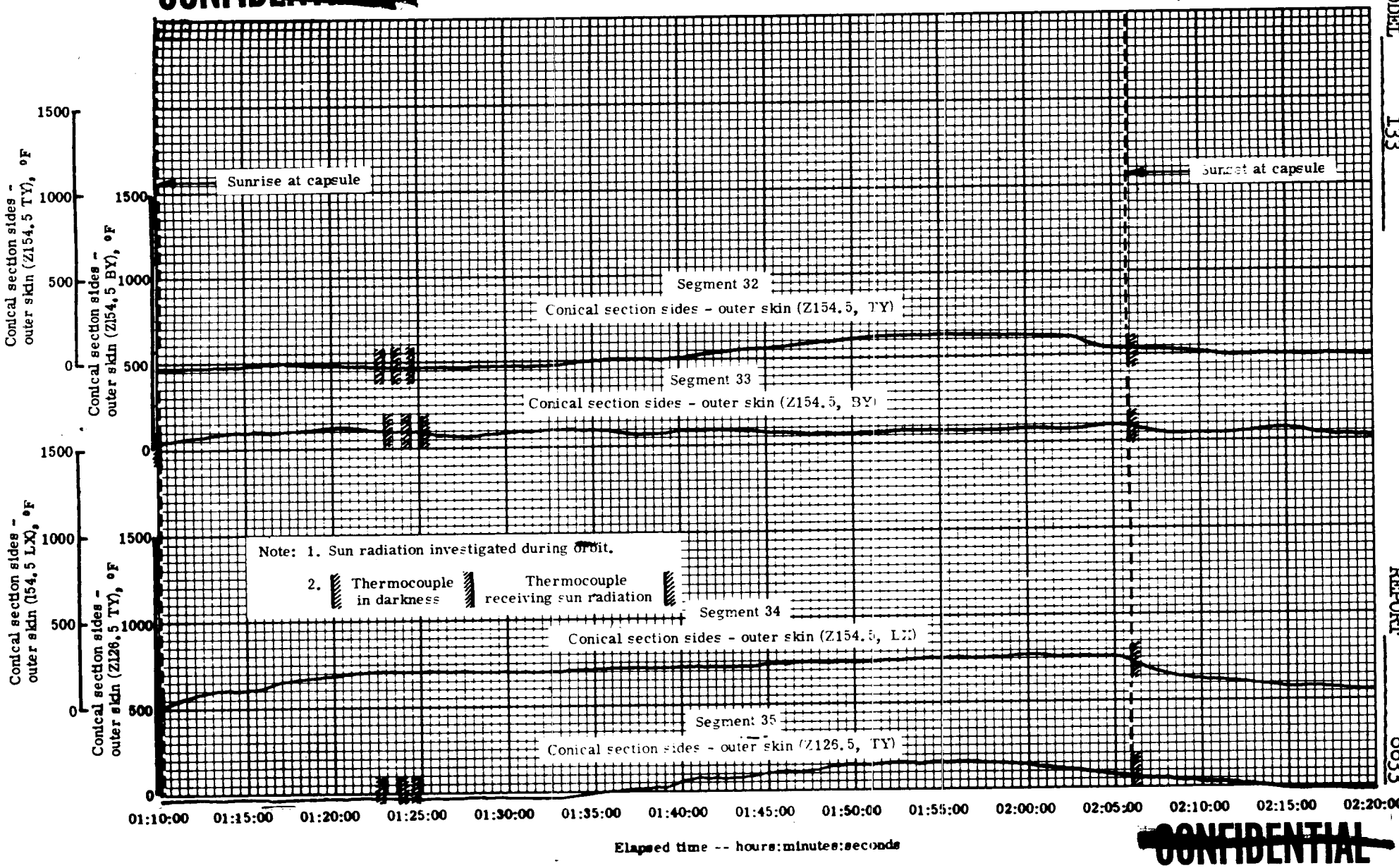
PAGE 7-93

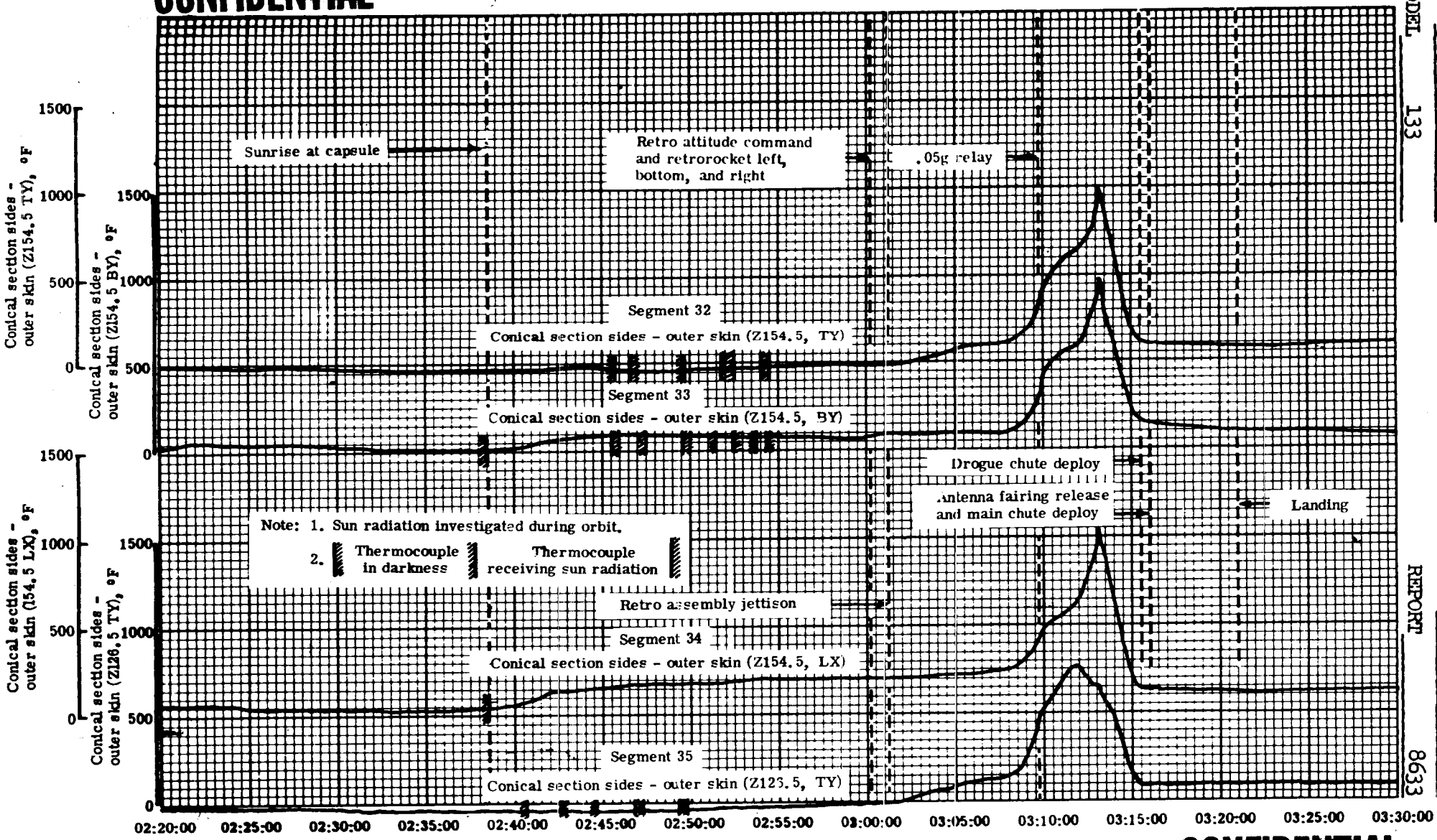
CONFIDENTIAL

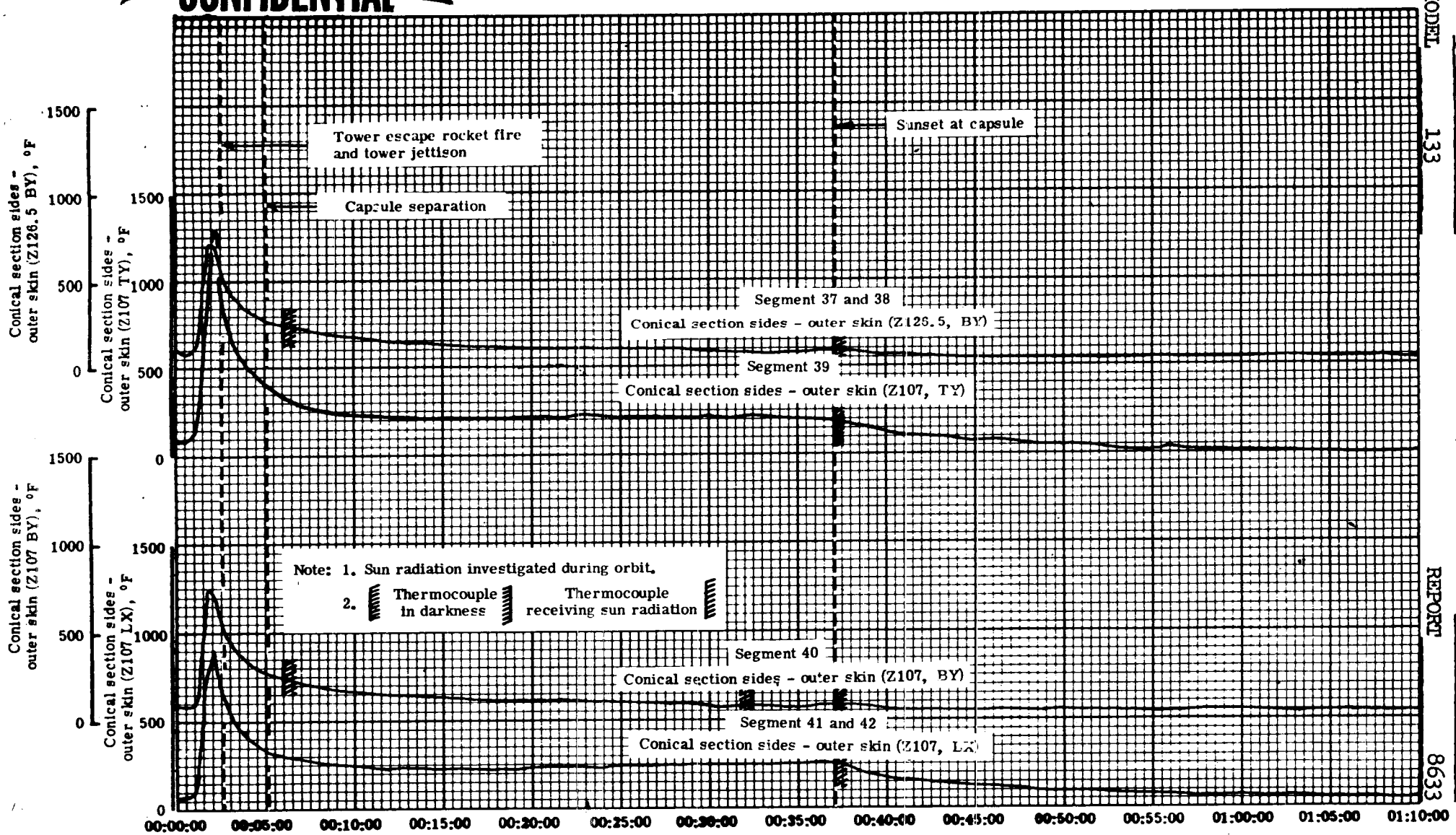

Conical section sides - outer skin (Z154.5 TY), °F
Conical section sides - outer skin (Z154.5 BY), °F
Conical section sides - outer skin (154.5 LX), °F
Conical section sides - outer skin (Z126.5 TY), °F
1500
1000
500
0
Tower escape rocket fire and tower jettison
Capsule separation
Sunset at capsule
Segment 32
Conical section sides - outer skin (Z154.5, TY)
Segment 33
Conical section sides - outer skin (Z154.5, BY)
Segment 34
Conical section sides - outer skin (Z154.5, LX)
Segment 35
Conical section sides - outer skin (Z126.5, TY)
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
00:10:00
00:15:00
00:40:00
00:45:00
00:50:00
Elapsed time -- hours:minutes:seconds

MA-5-T-802REV B

DATE 6 March 1962
MODEL 133
PAGE 7-95
REPORT 8633




Conical section sides - outer skin (Z154.5 TY), °F
Conical section sides - outer skin (Z154.5 BY), °F
Conical section sides - outer skin (154.5 LX), °F
Conical section sides - outer skin (Z126.5 TY), °F
1500
1000
500
0
Sunrise at capsule
Retro attitude command and retrorocket left, bottom, and right
.05g relay
Segment 32
Conical section sides - outer skin (Z154.5, TY)
Segment 33
Conical section sides - outer skin (Z154.5, BY)
Drogue chute deploy
Antenna fairing release and main chute deploy
Landing
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
Retro assembly jettison
Segment 34
Conical section sides - outer skin (Z154.5, LX)
Segment 35
Conical section sides - outer skin (Z126.5, TY)
02:20:00
02:25:00
02:30:00
02:35:00
02:40:00
02:45:00
02:50:00
02:55:00
03:00:00
03:05:00
03:10:00
03:15:00
03:20:00
03:25:00
03:30:00
Elapsed time -- hours:minutes:seconds

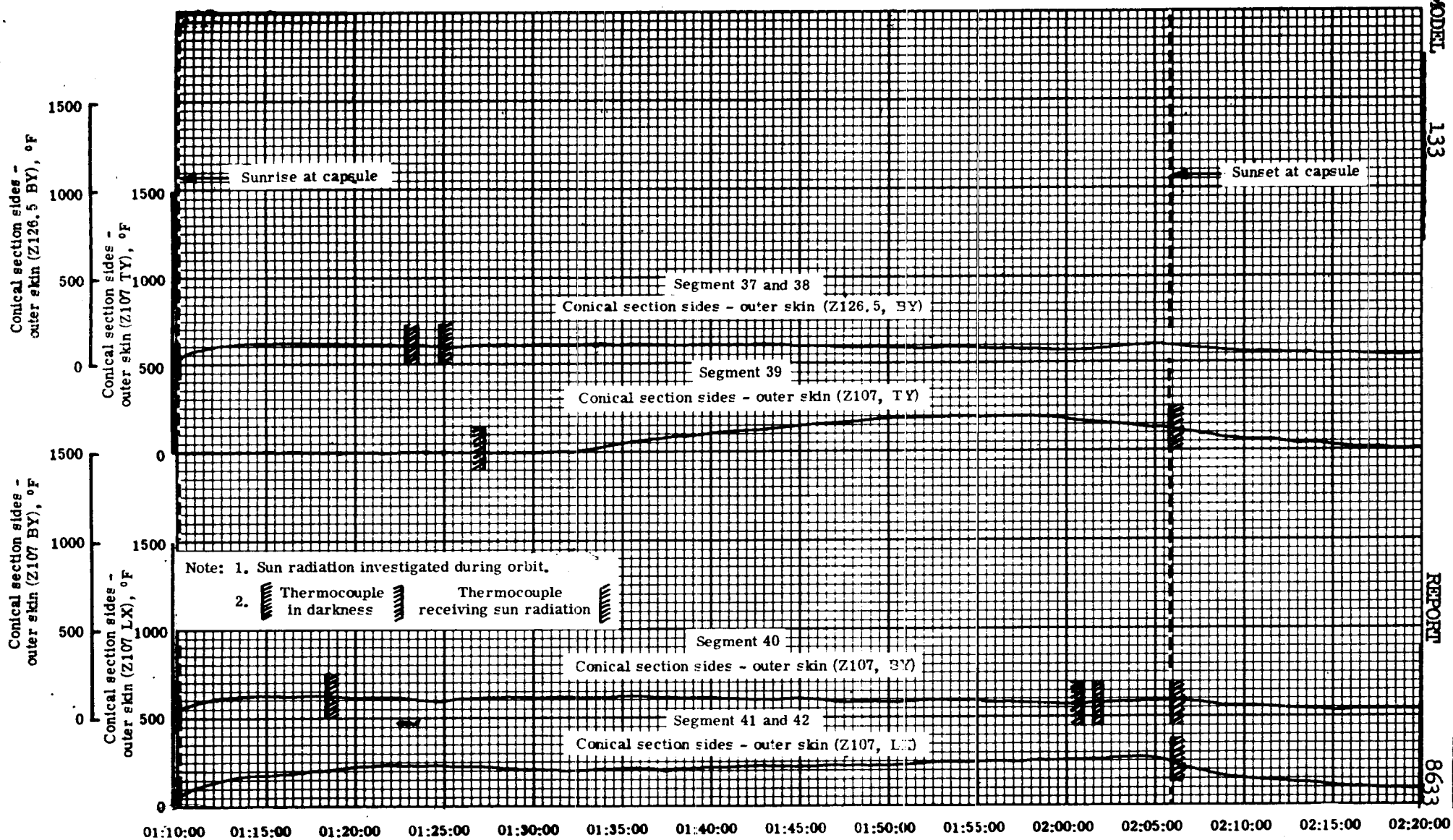

Conical section sides - outer skin (Z126.5 BY), °F
Conical section sides - outer skin (Z107 TY), °F
Conical section sides - outer skin (Z107 BY), °F
Conical section sides - outer skin (Z107 LX), °F
1500
1000
500
0
Tower escape rocket fire and tower jettison
Capsule separation
Sunset at capsule
Segment 37 and 38
Conical section sides - outer skin (Z126.5, BY)
Segment 39
Conical section sides - outer skin (Z107, TY)
Segment 40
Conical section sides - outer skin (Z107, BY)
Segment 41 and 42
Conical section sides - outer skin (Z107, LX)
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
00:30:00
00:35:00
00:40:00
00:45:00
00:50:00
00:55:00
01:00:00
01:05:00
01:10:00
Elapsed time -- hours:minutes:seconds

CONFIDENTIAL

MA-5-T- 902 Rev B

DATE 6 March 1962

MODEL 133



REPORT 7.98-8633

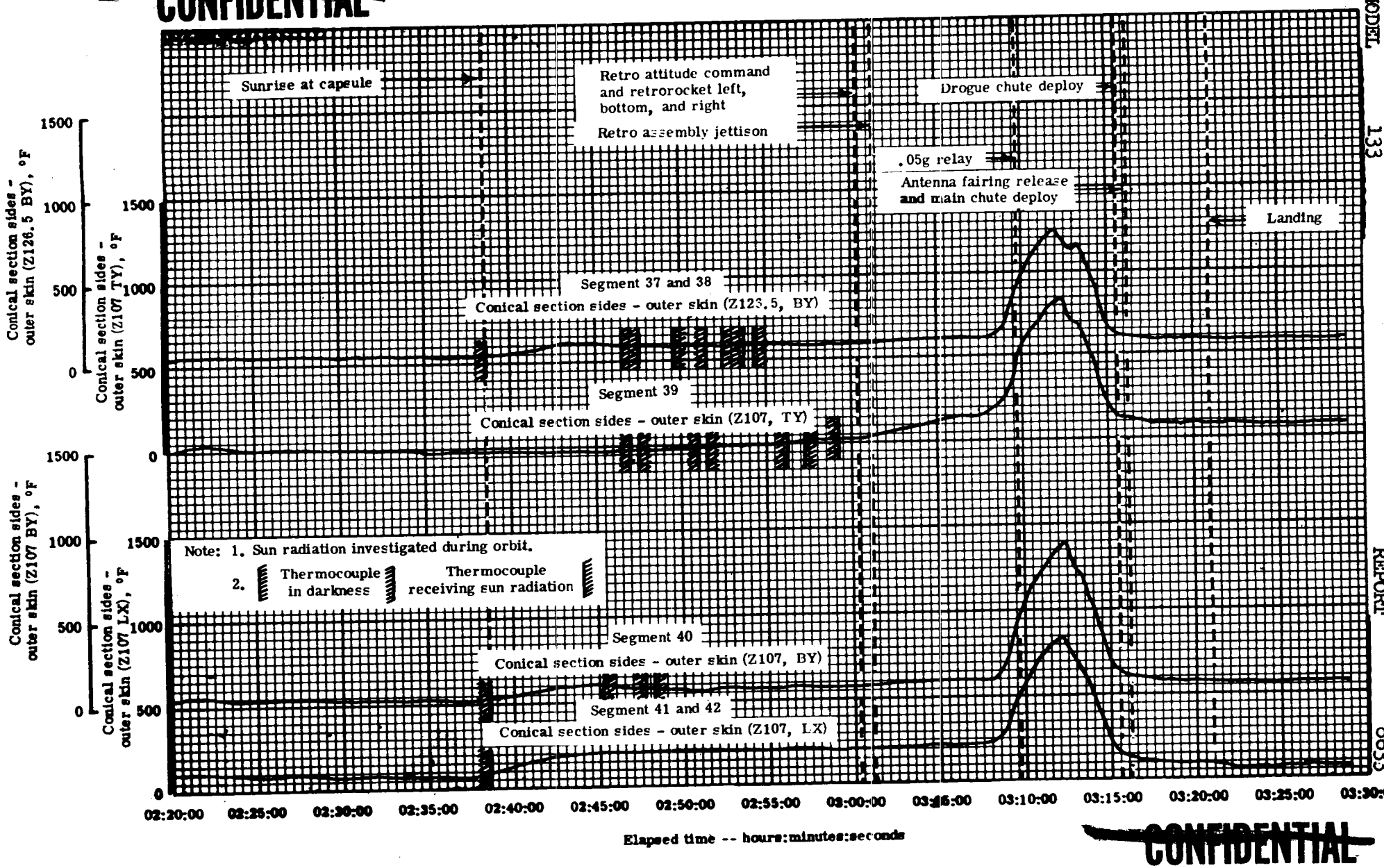
PAGE

CONFIDENTIAL

CONFIDENTIAL

MA-5-T-903 REV A

DATE 6 March 1962 MODEL 133



REPORT 8633 PAGE 7-92

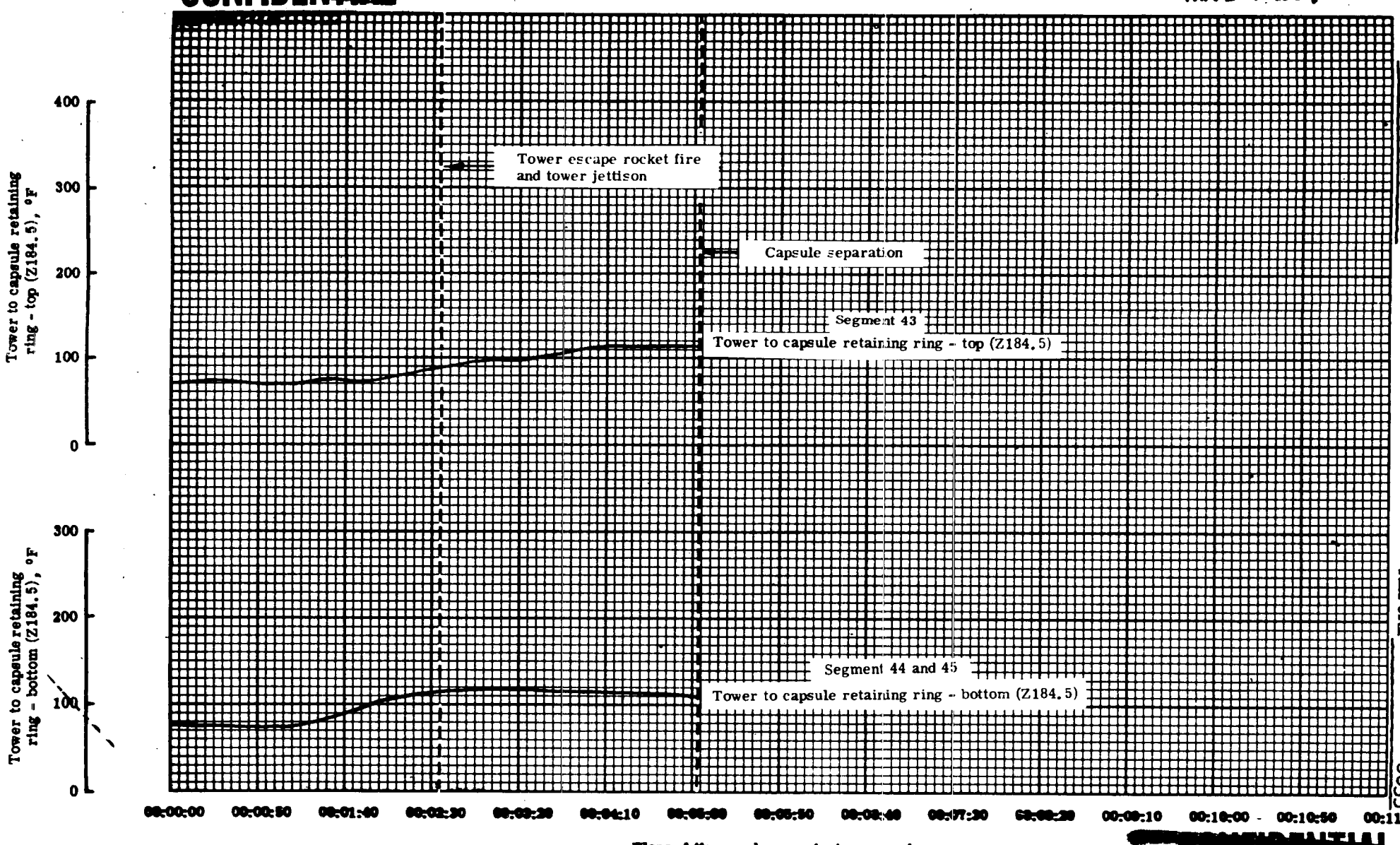
CONFIDENTIAL

~~CONFIDENTIAL~~

MA-9-T-180

DATE 6 March 1962

MODEL 133



PAGE 7.100

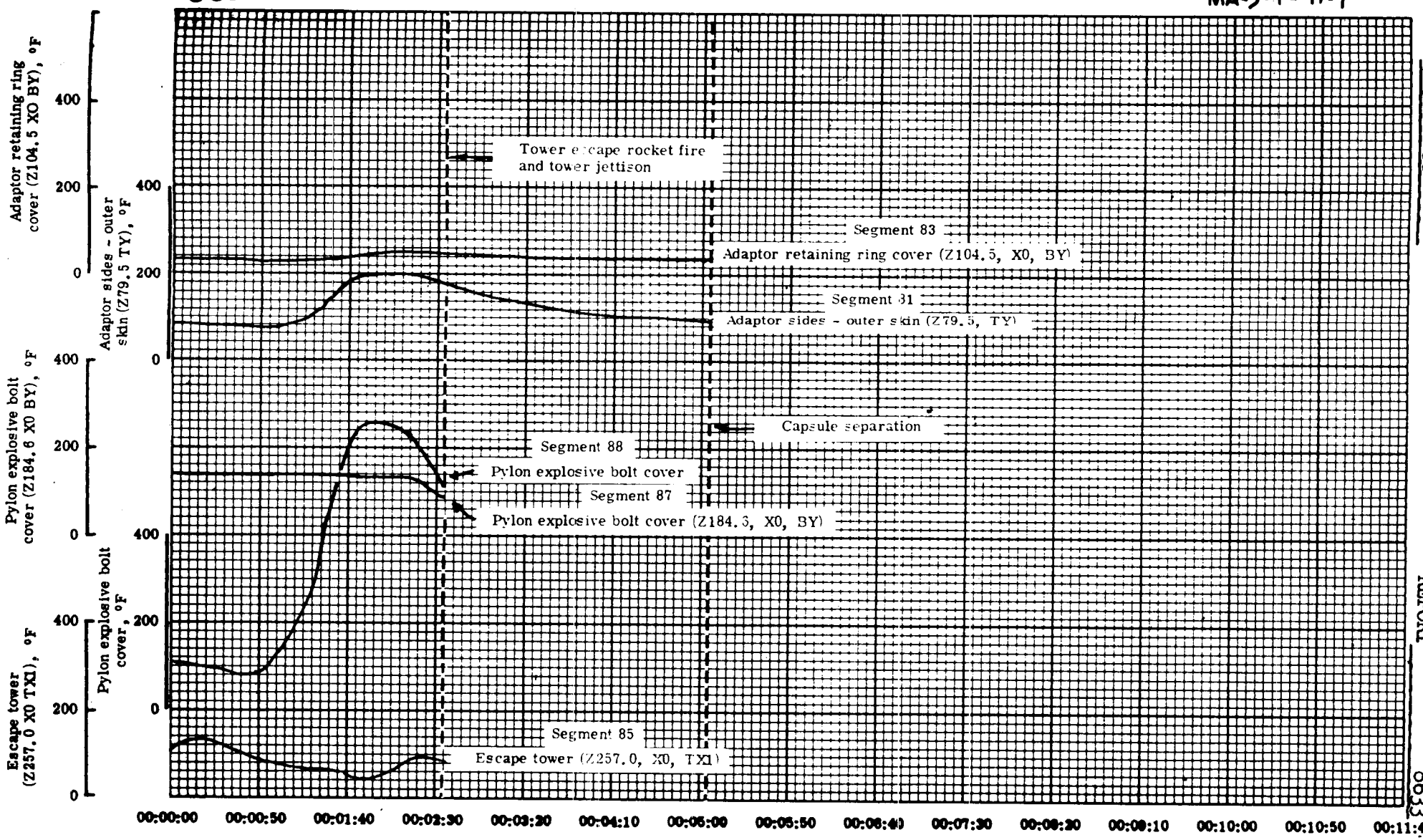
REPORT 8633

~~CONFIDENTIAL~~

CONFIDENTIAL

MA-5-T- 1101

DATE 6 March 1962
MODEL 133
PAGE 7.101
REPORT 8633

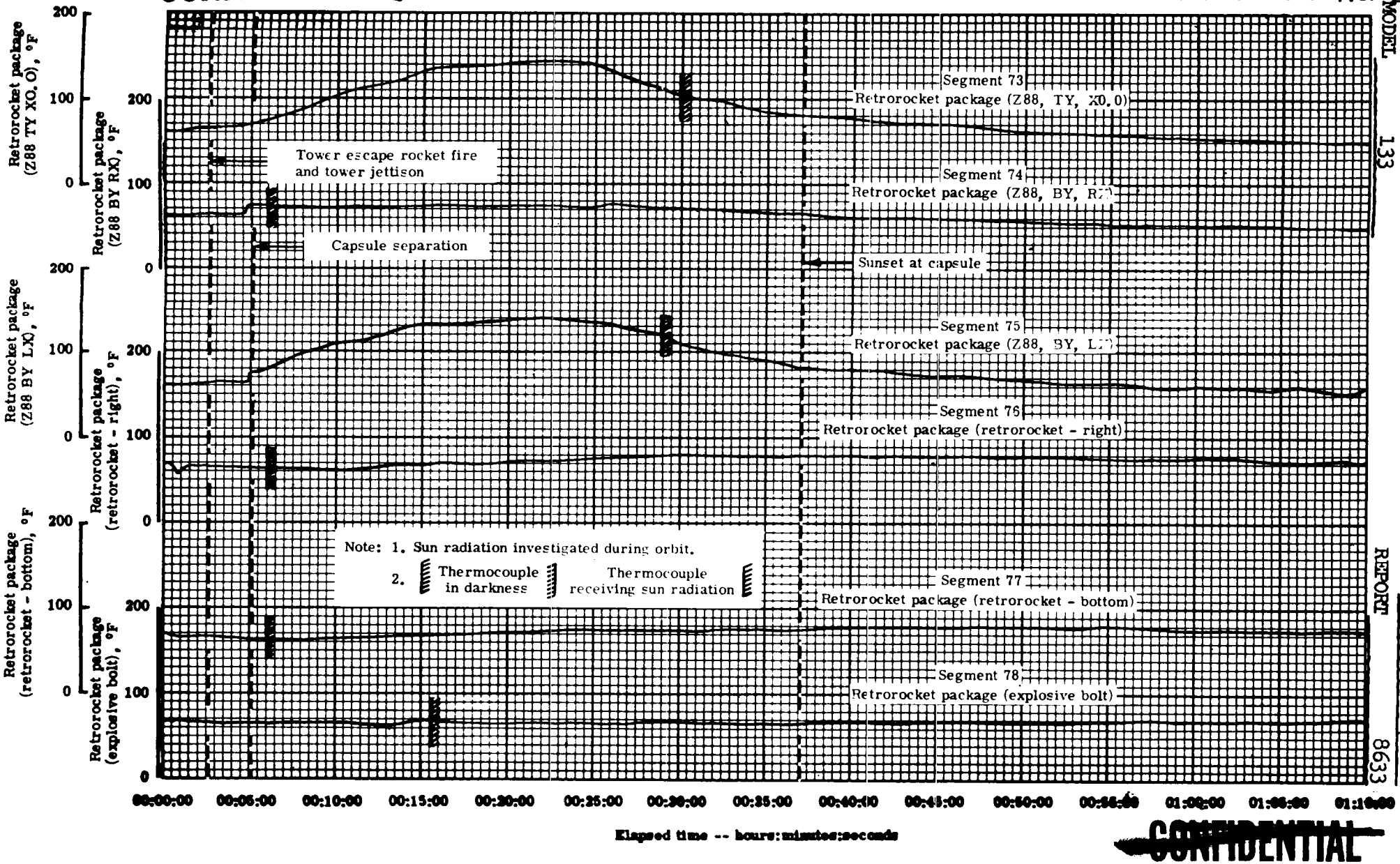


CONFIDENTIAL

CONFIDENTIAL

MA-5-T-1201 REV B

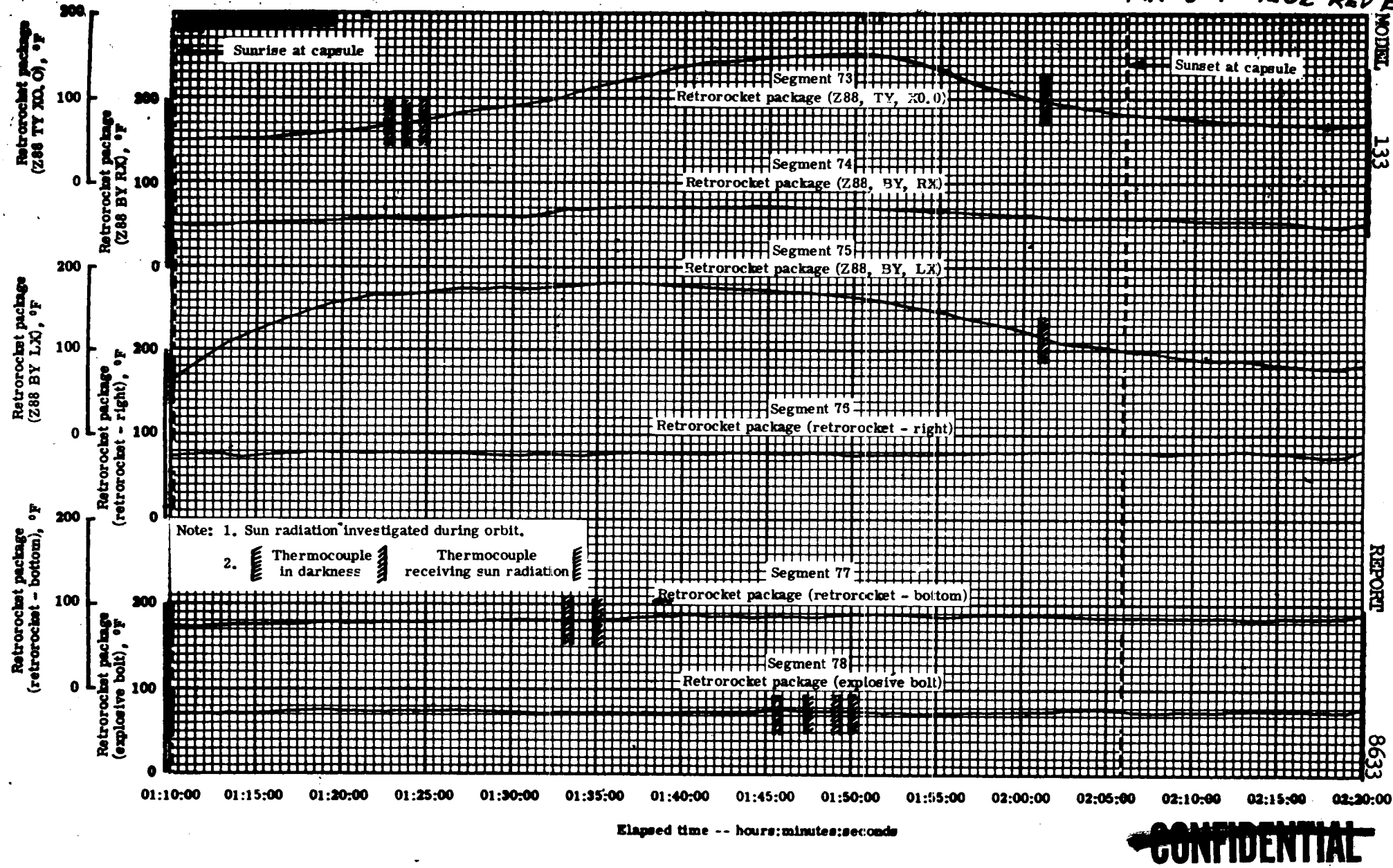
DATE 6 March 1962
MODEL 133
PAGE 7-102
REPORT 8633



CONFIDENTIAL

CONFIDENTIAL

MA-5-T-1202 REV B



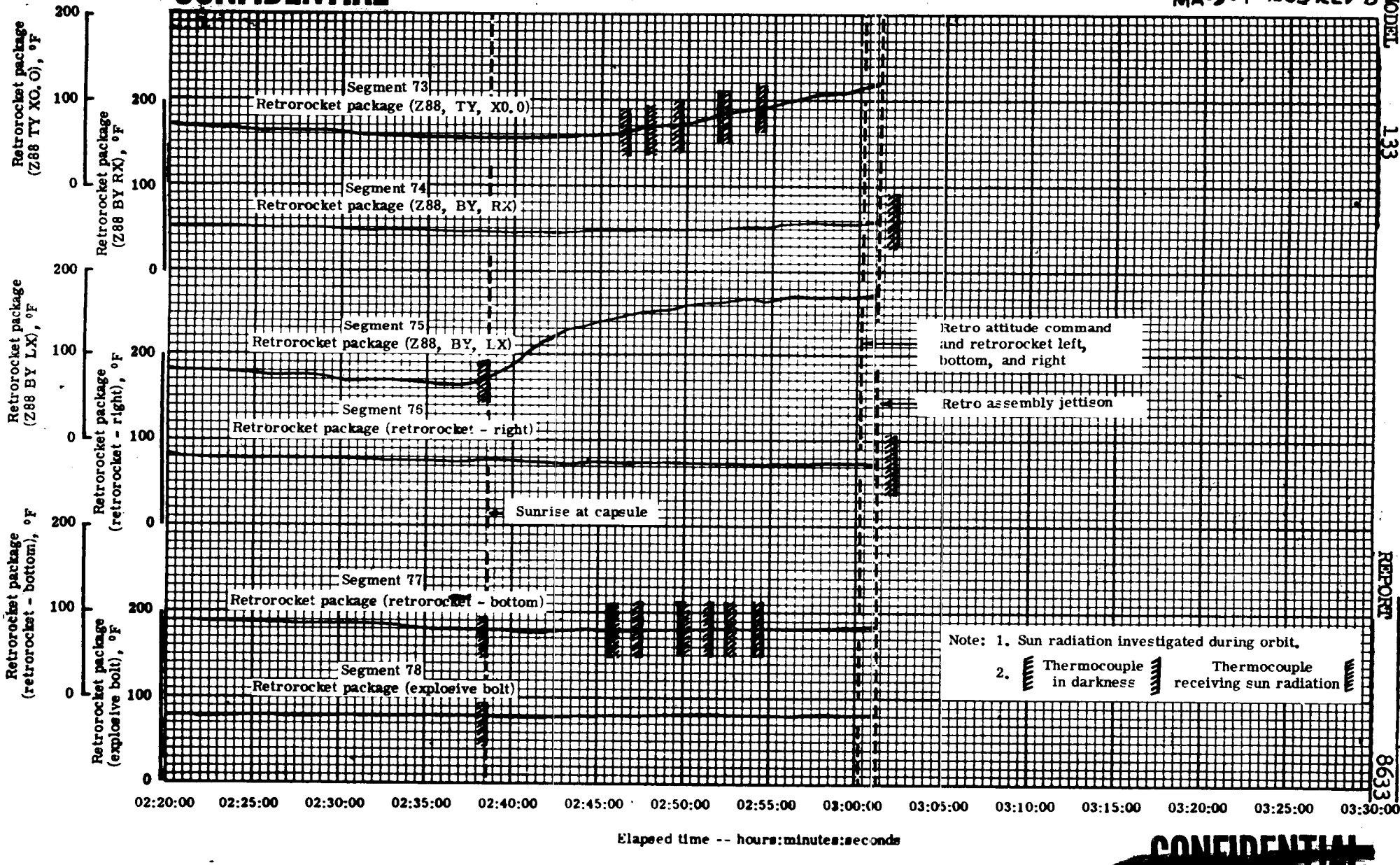
CONFIDENTIAL

DATE 6 March 1962
MODEL 133
REPORT 7.103
PAGE 8633

~~CONFIDENTIAL~~

MA-5-T-1203 REV B

DATE 6 March 1962
MODEL 133
REPORT 7-104
PAGE 8633

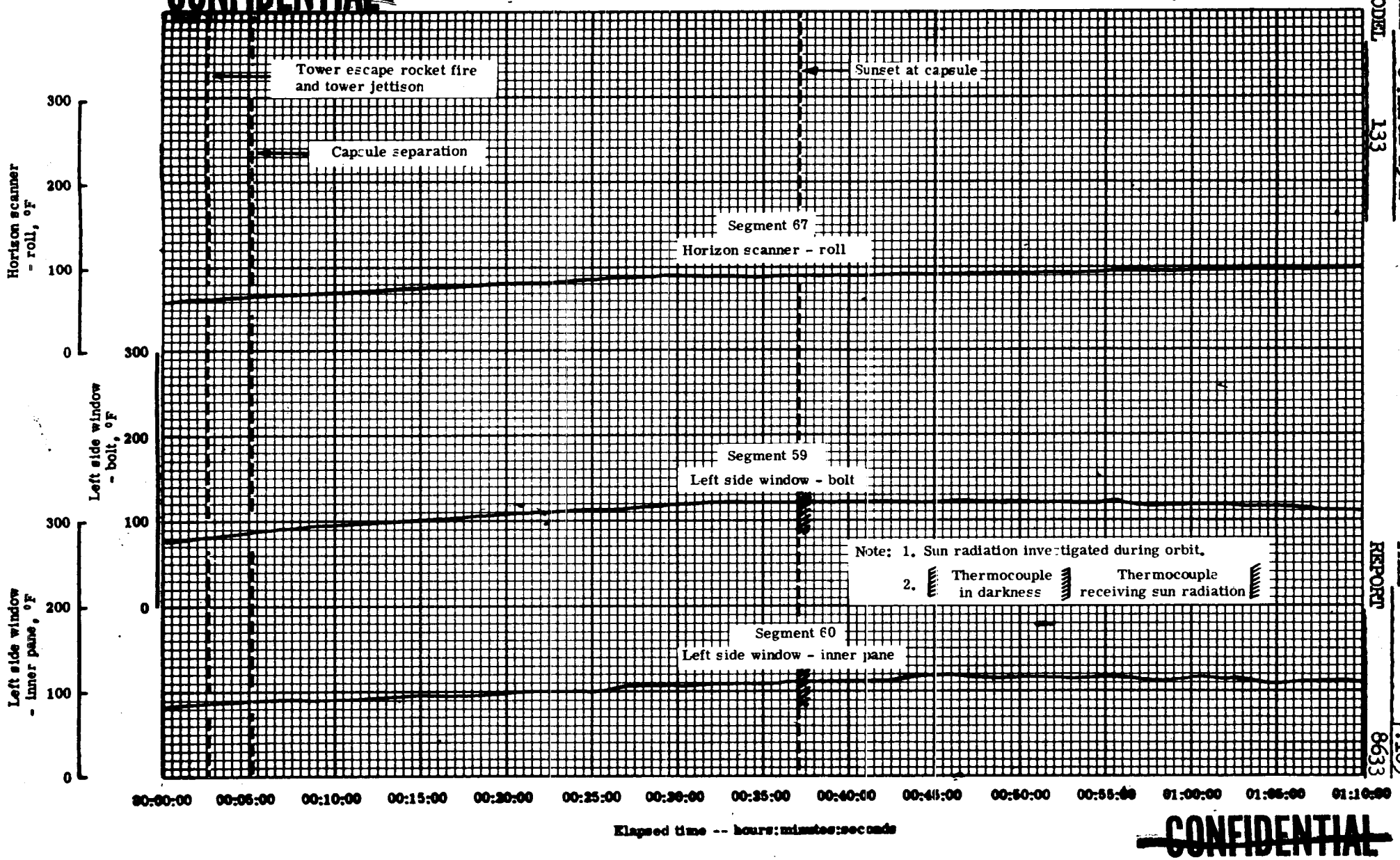


~~CONFIDENTIAL~~

CONFIDENTIAL

MA-S-T-101 Rev B

DATE 6 March 1962
MODEL 133
PAGE 7.105
REPORT 8633



CONFIDENTIAL

~~CONFIDENTIAL~~

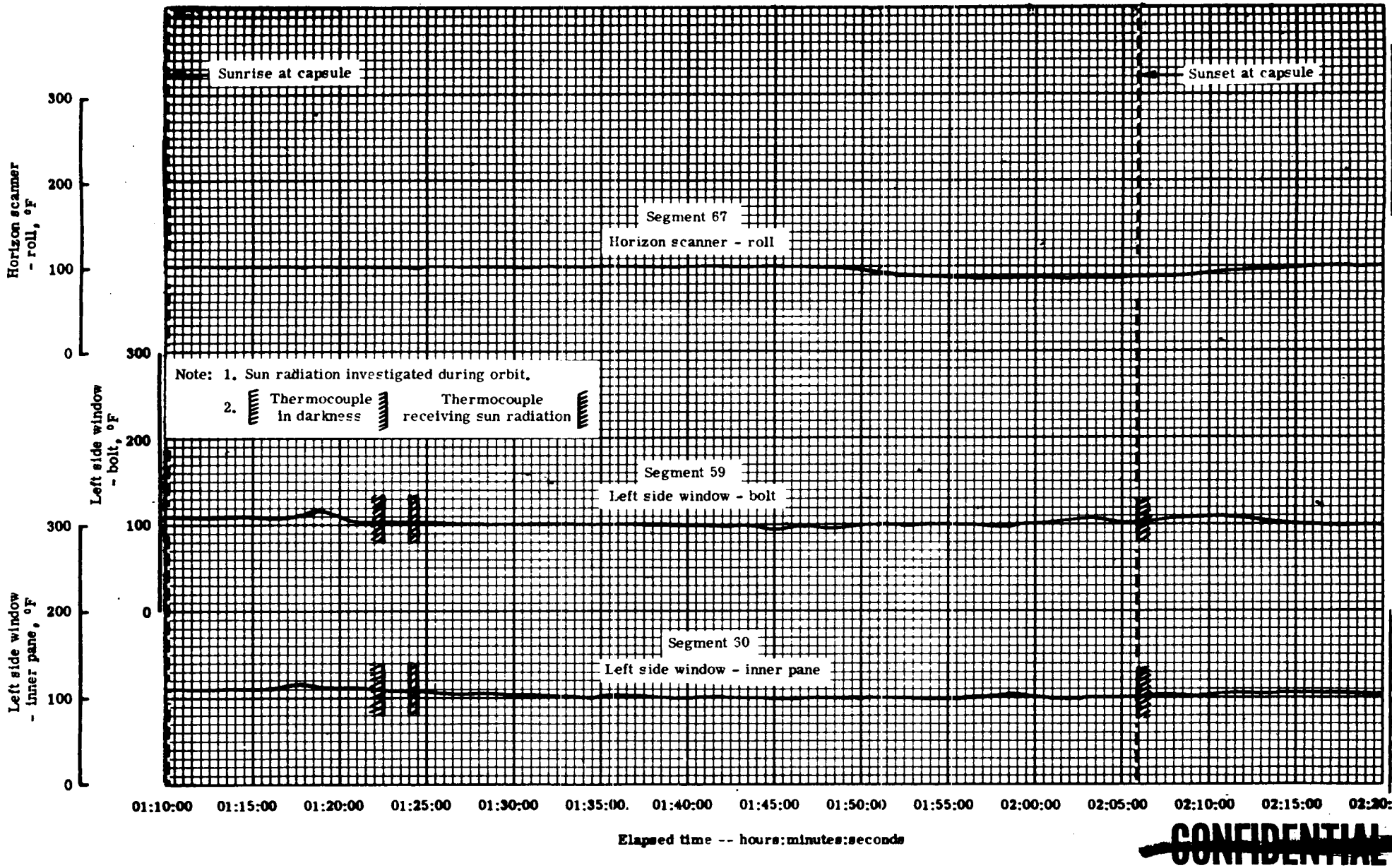
MA-8-T-802 REV B

DATE 6 March 1962

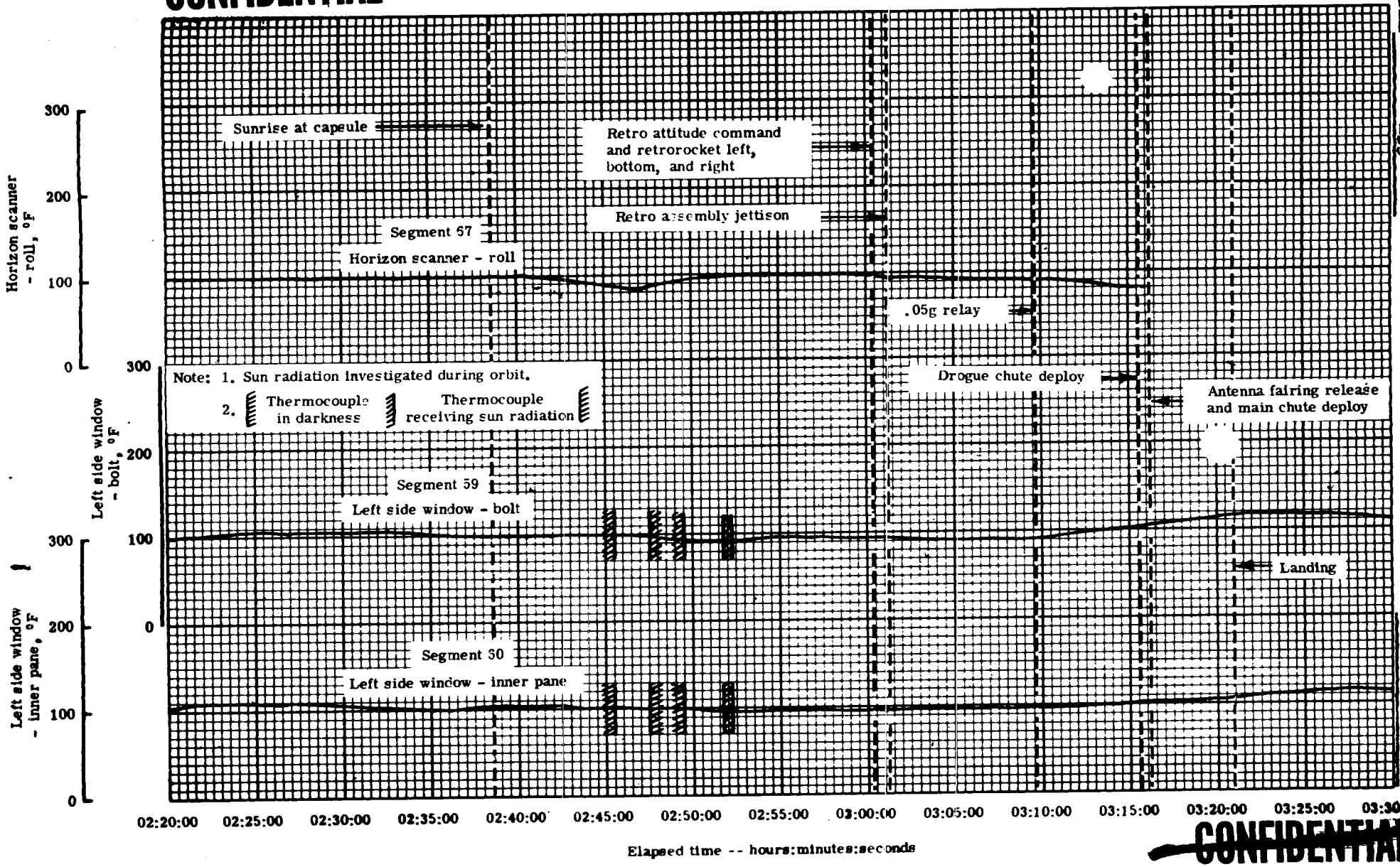
MODEL 133

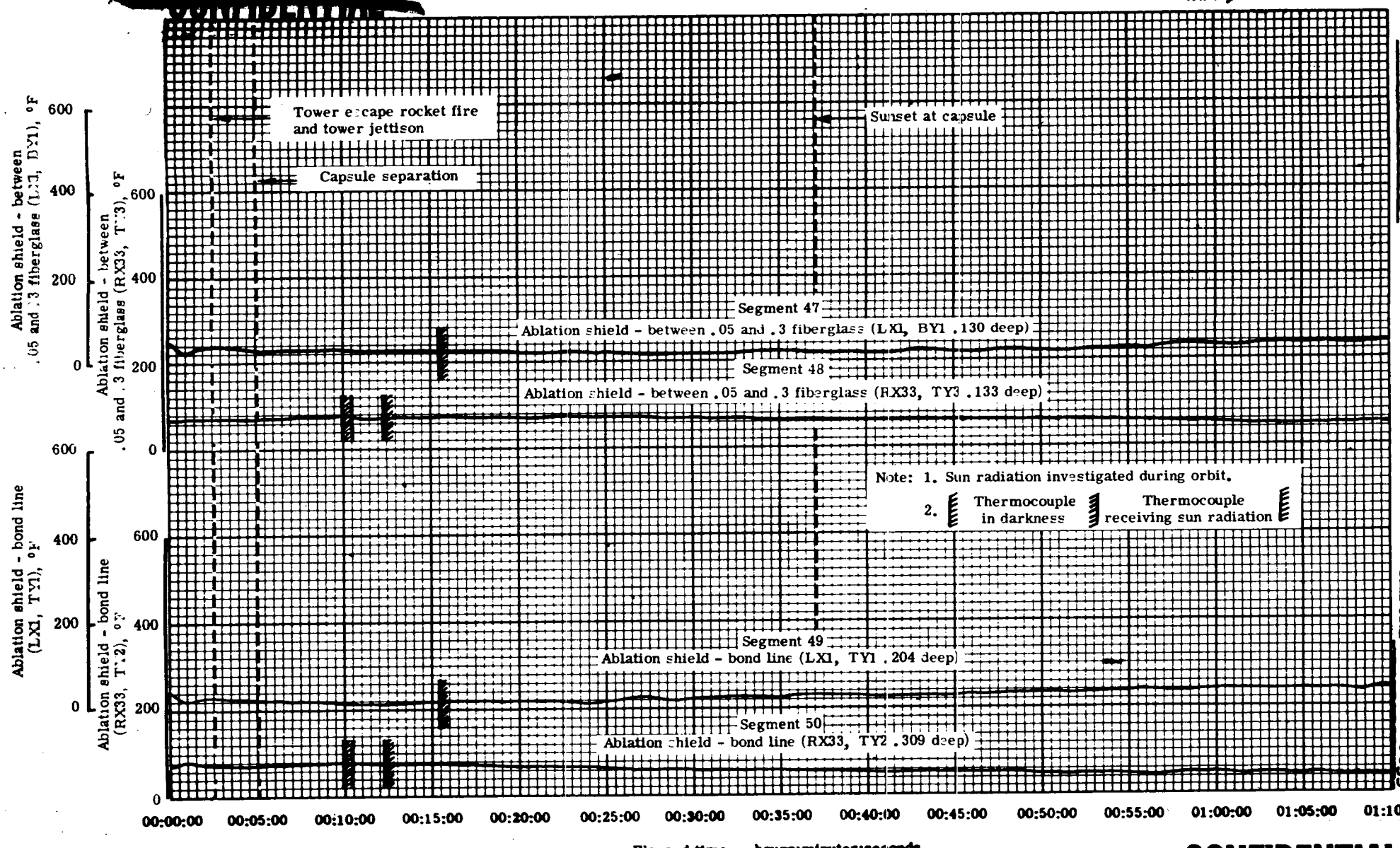
PAGE 7.106

REPORT 8633



~~CONFIDENTIAL~~

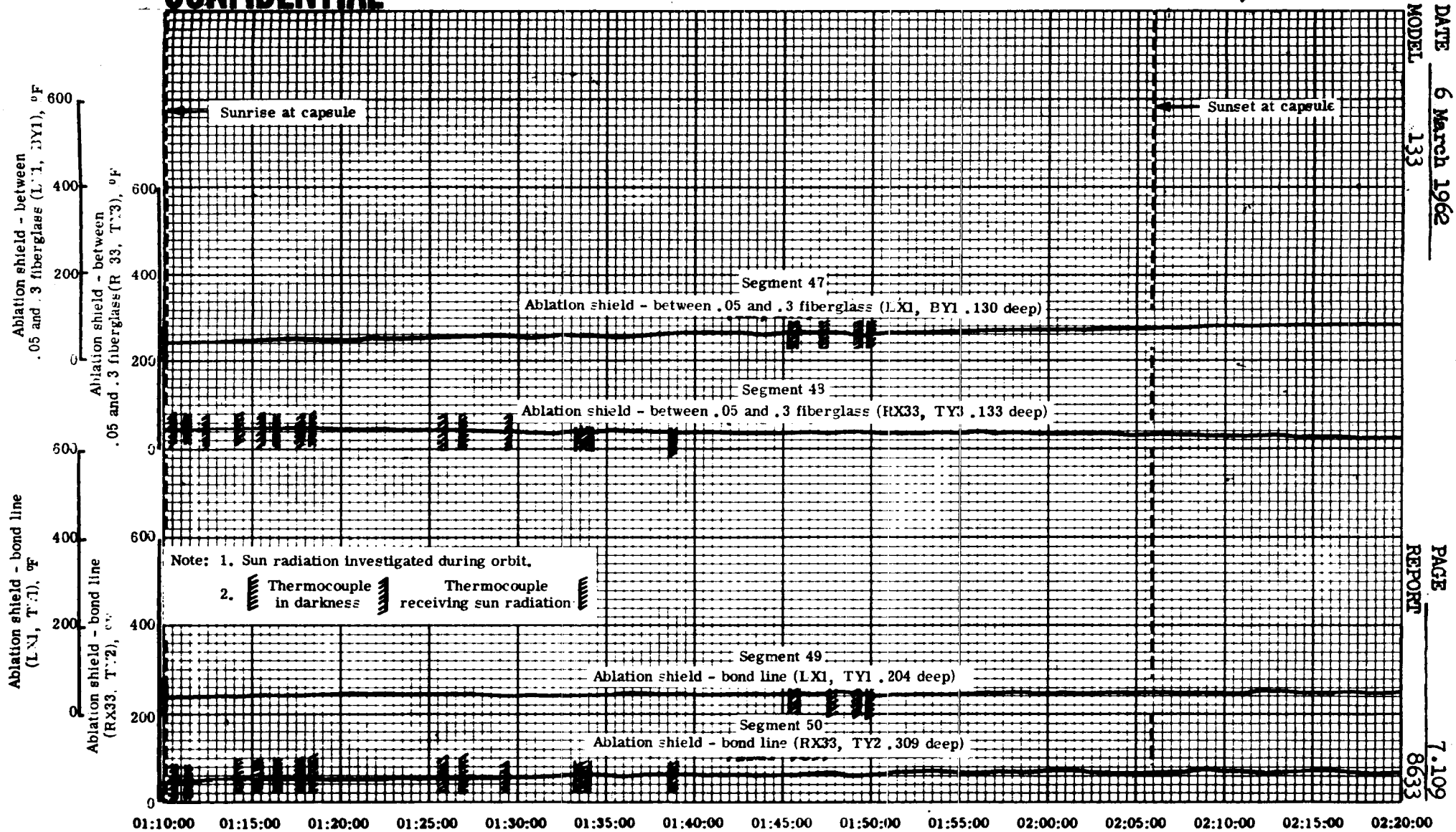

Horizon scanner - roll, °F
300
200
100
0
Left side window - bolt, °F
300
200
100
0
Left side window - inner pane, °F
300
200
100
0
Sunrise at capeule
Retro attitude command and retrorocket left, bottom, and right
Retro assembly jettison
Segment 57
Horizon scanner - roll
.05g relay
Drogue chute deploy
Antenna fairing release and main chute deploy
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
Segment 59
Left side window - bolt
Landing
Segment 60
Left side window - inner pane
02:20:00
02:25:00
02:30:00
02:35:00
02:40:00
02:45:00
02:50:00
02:55:00
03:00:00
03:05:00
03:10:00
03:15:00
03:20:00
03:25:00
03:30:00
Elapsed time -- hours:minutes:seconds


Tower escape rocket fire and tower jettison
Capsule separation
Sunset at capsule
Segment 47
Ablation shield - between .05 and .3 fiberglass (LX1, BY1 .130 deep)
Segment 48
Ablation shield - between .05 and .3 fiberglass (RX33, TY3 .133 deep)
Segment 49
Ablation shield - bond line (LX1, TY1 .204 deep)
Segment 50
Ablation shield - bond line (RX33, TY2 .309 deep)
Note: 1. Sun radiation investigated during orbit.
2. Thermocouple in darkness
Thermocouple receiving sun radiation
Ablation shield - between .05 and .3 fiberglass (LX1, BY1), °F
Ablation shield - between .05 and .3 fiberglass (RX33, TY3), °F
Ablation shield - bond line (LX1, TY1), °F
Ablation shield - bond line (RX33, TY2), °F
0
200
400
600
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
00:30:00
00:35:00
00:40:00
00:45:00
00:50:00
00:55:00
01:00:00
01:05:00
01:10:00
Elapsed time -- hours:minutes:seconds

CONFIDENTIAL

MA-5-T-1402 Rev C

DATE 6 March 1962
MODEL 133
PAGE 7-109
REPORT 8633

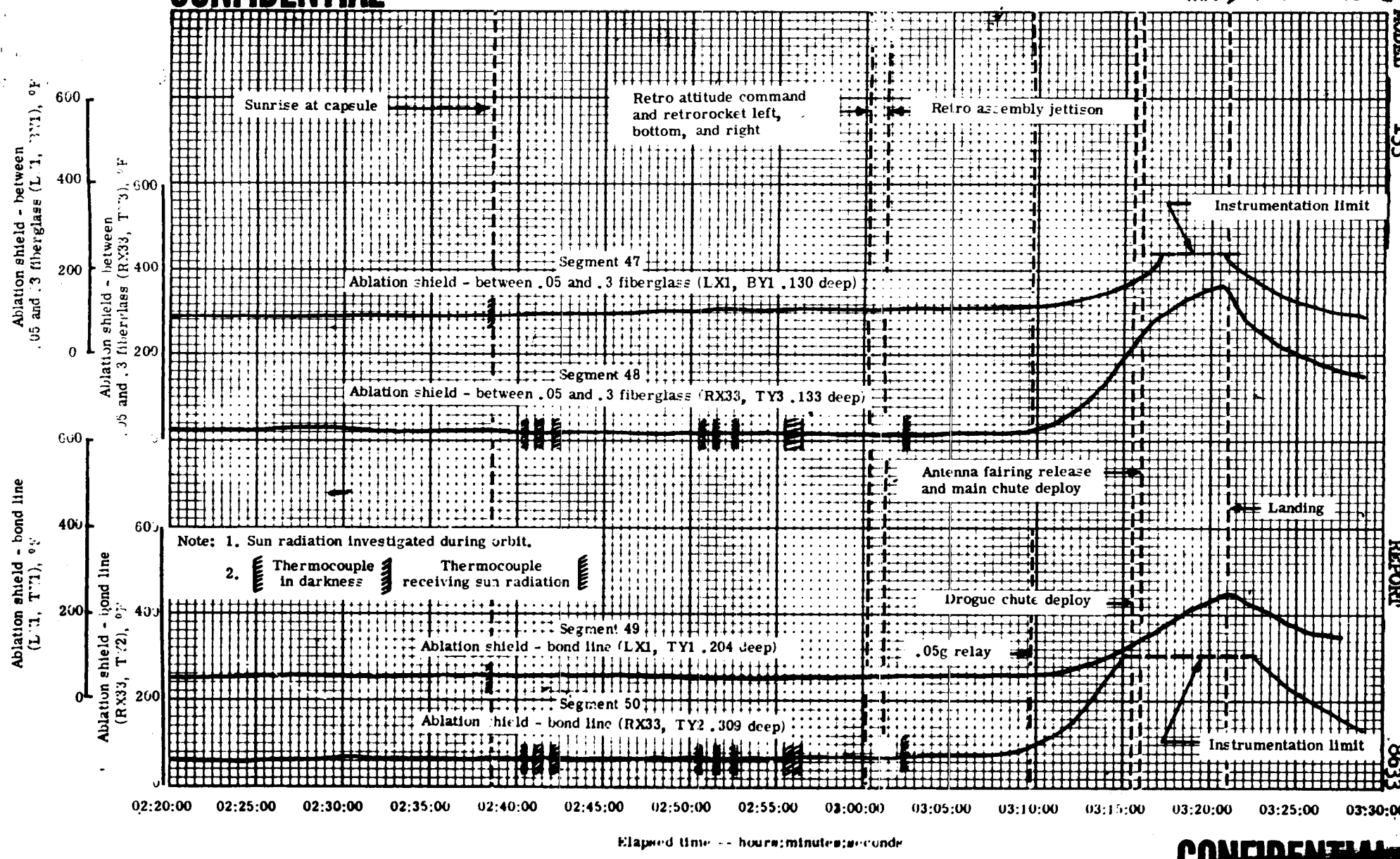


CONFIDENTIAL

CONFIDENTIAL

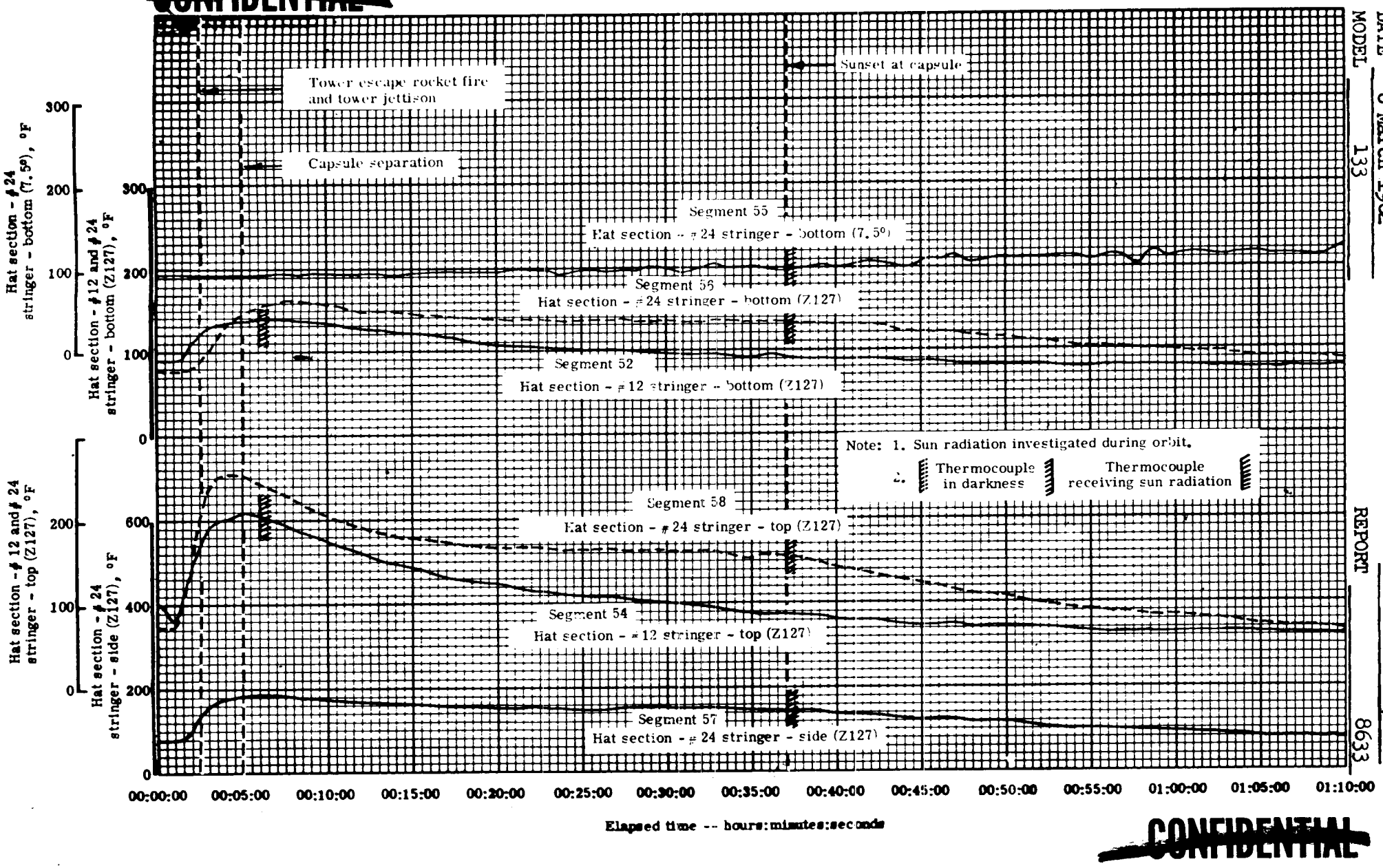
MA-5-T-1403 Rev C

MODEL 133 DATE 6 March 1962



REPORT 7.110 PAGE 8633

CONFIDENTIAL



DATE 6 March 1962
MODEL 133
PAGE 7-111
REPORT 8633

CONFIDENTIAL

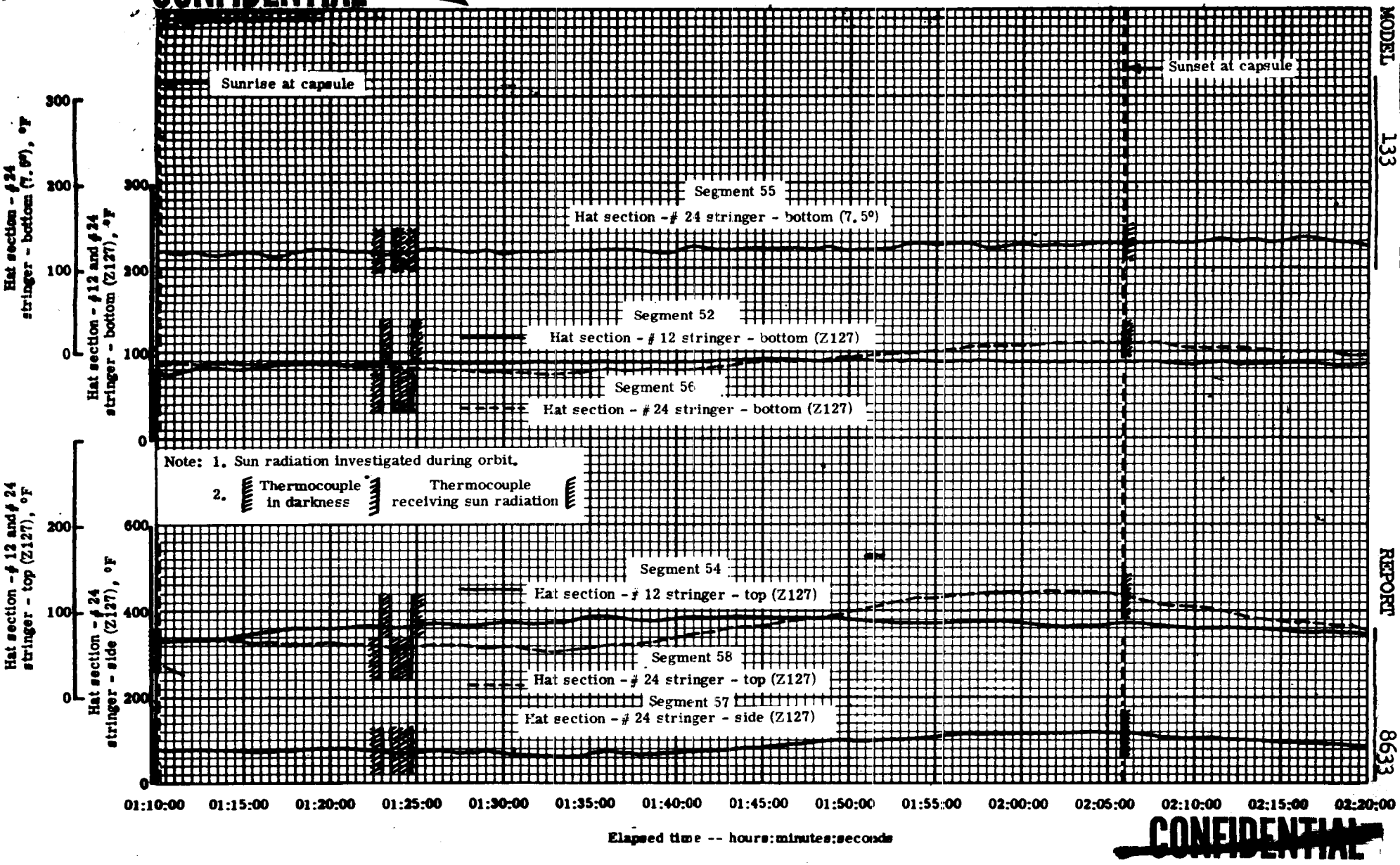
MA-5-T-1502 REV B

DATE 6 March 1962

MODEL 133

PAGE 7.116

REPORT 8633

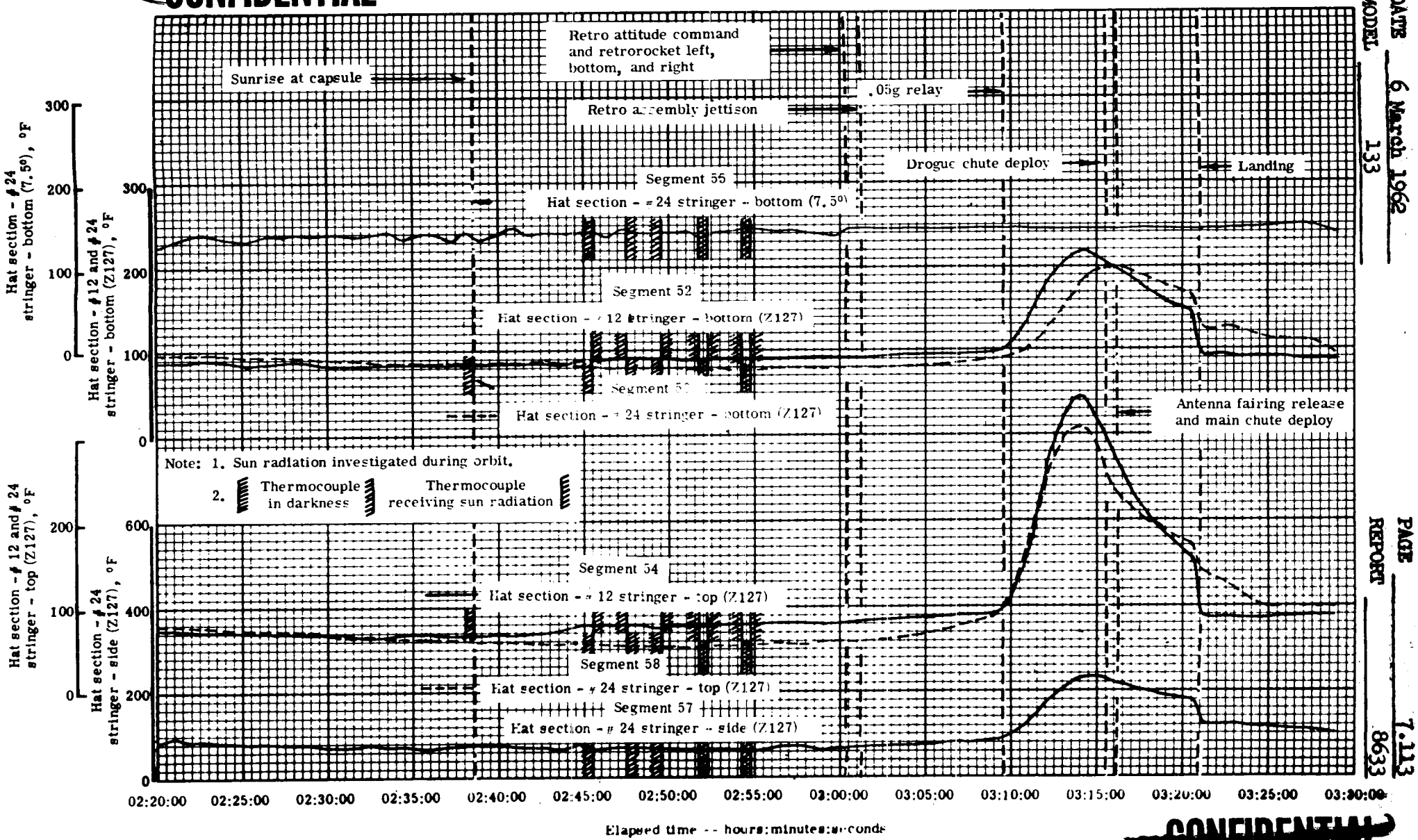


CONFIDENTIAL

~~CONFIDENTIAL~~

MA-5-T-1503 REV B

DATE 6 March 1962
MODEL 133
PAGE 7.113
REPORT 8633

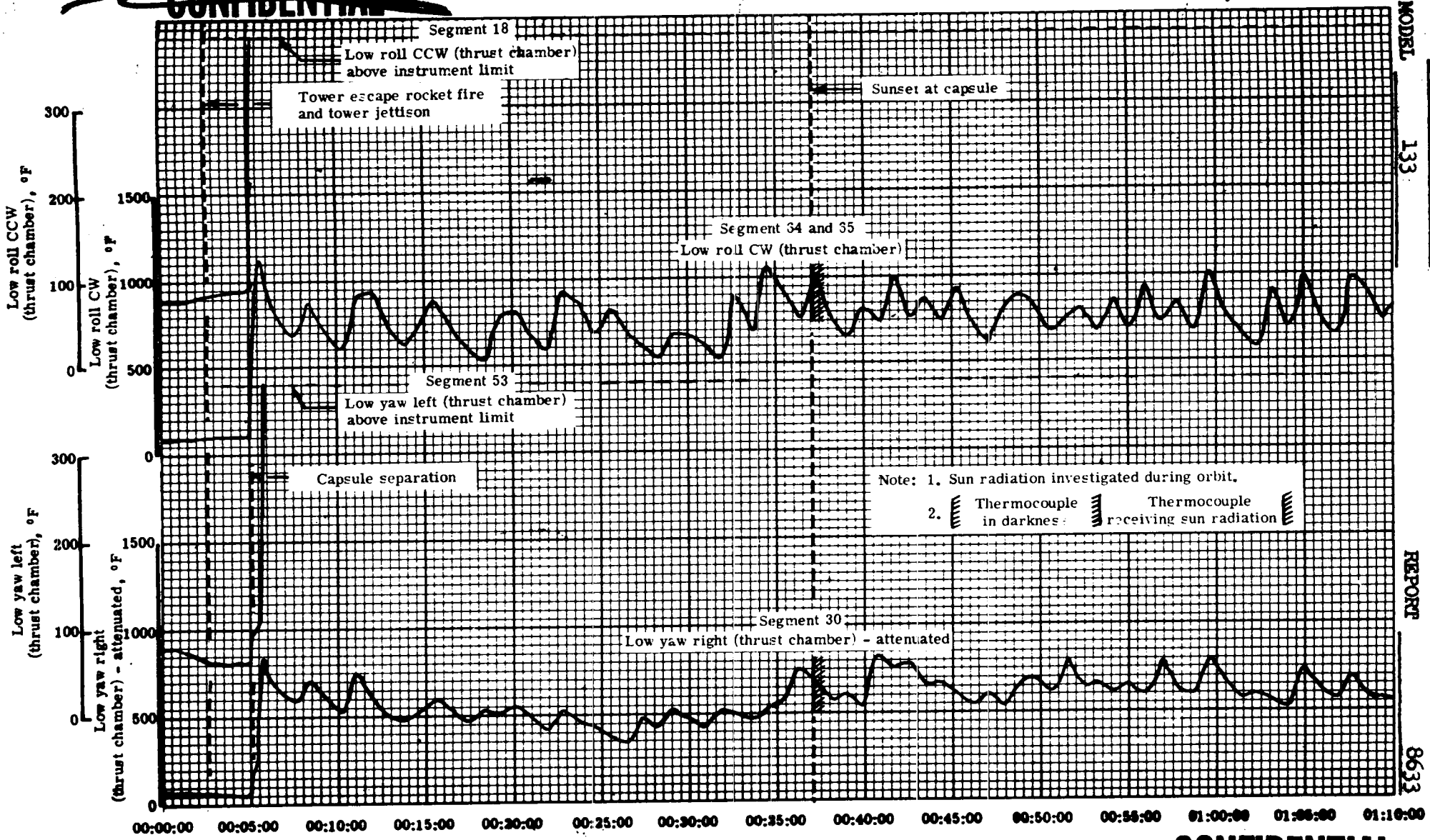


~~CONFIDENTIAL~~

CONFIDENTIAL

MA-5-T-1601 REV B

MODEL 133 - DATE 6 March 1962



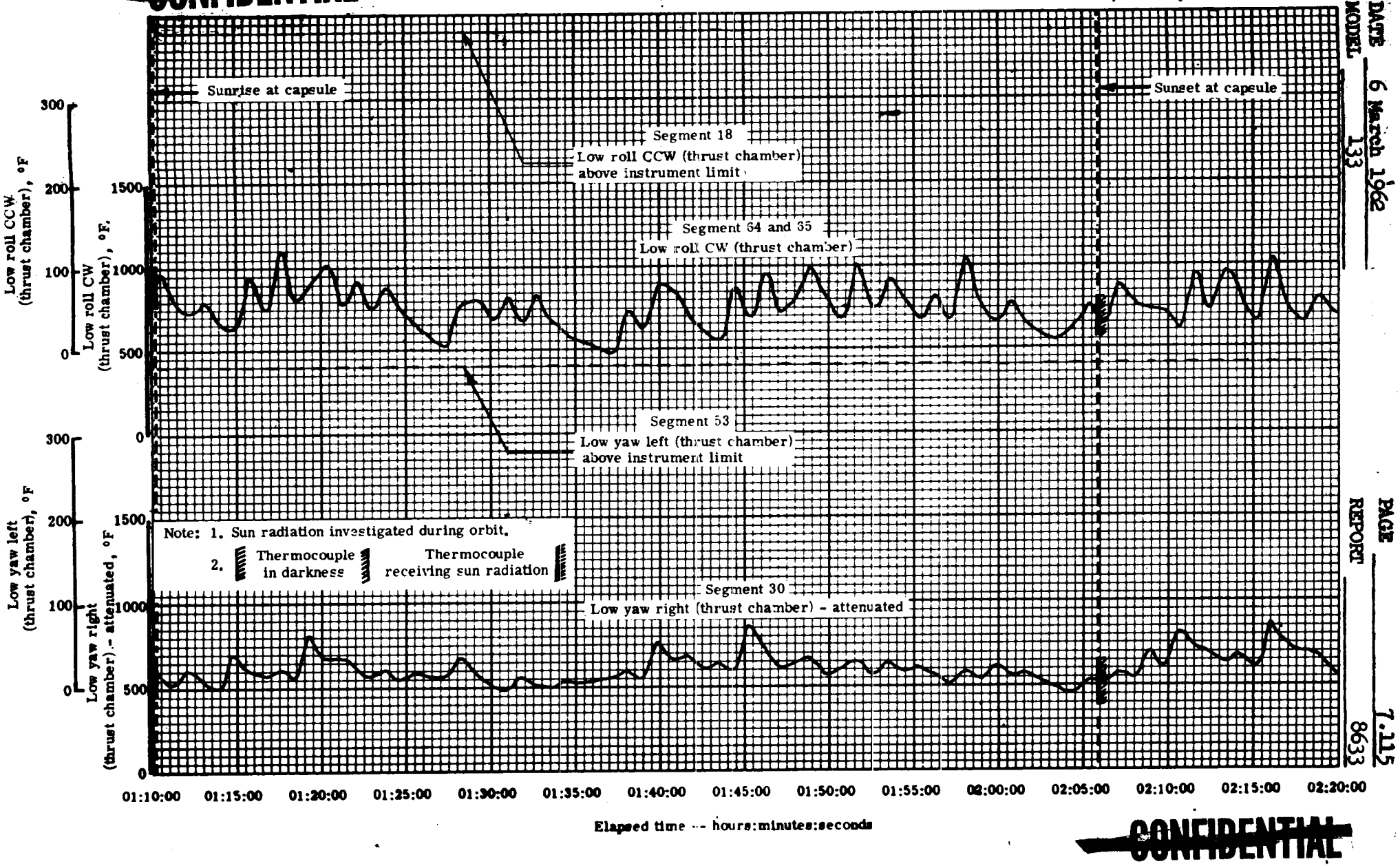
PAGE 7.114 REPORT 8633

CONFIDENTIAL

~~CONFIDENTIAL~~

MA-5-T-1002 REV B

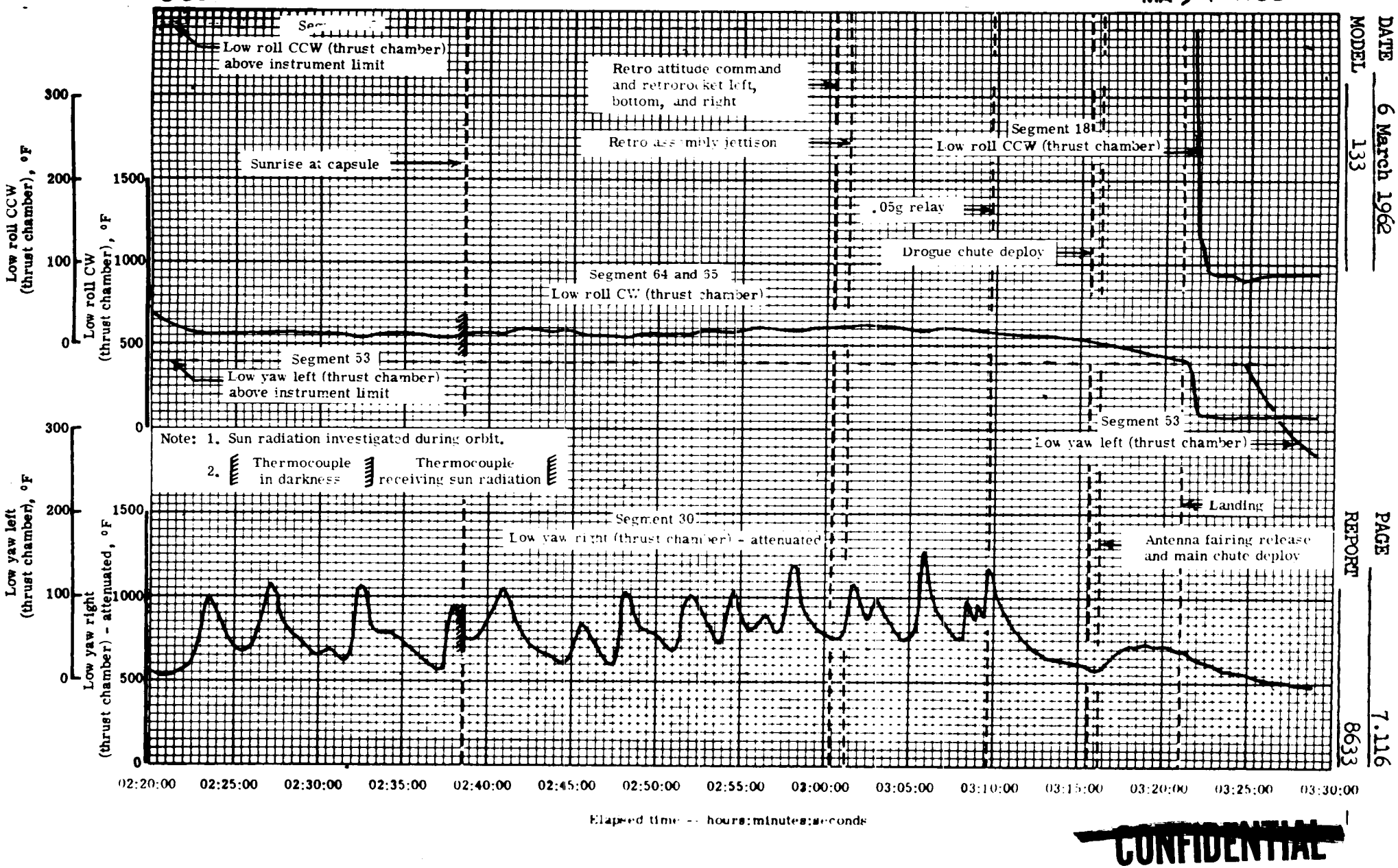
DATE 6 March 1962
MODEL 133

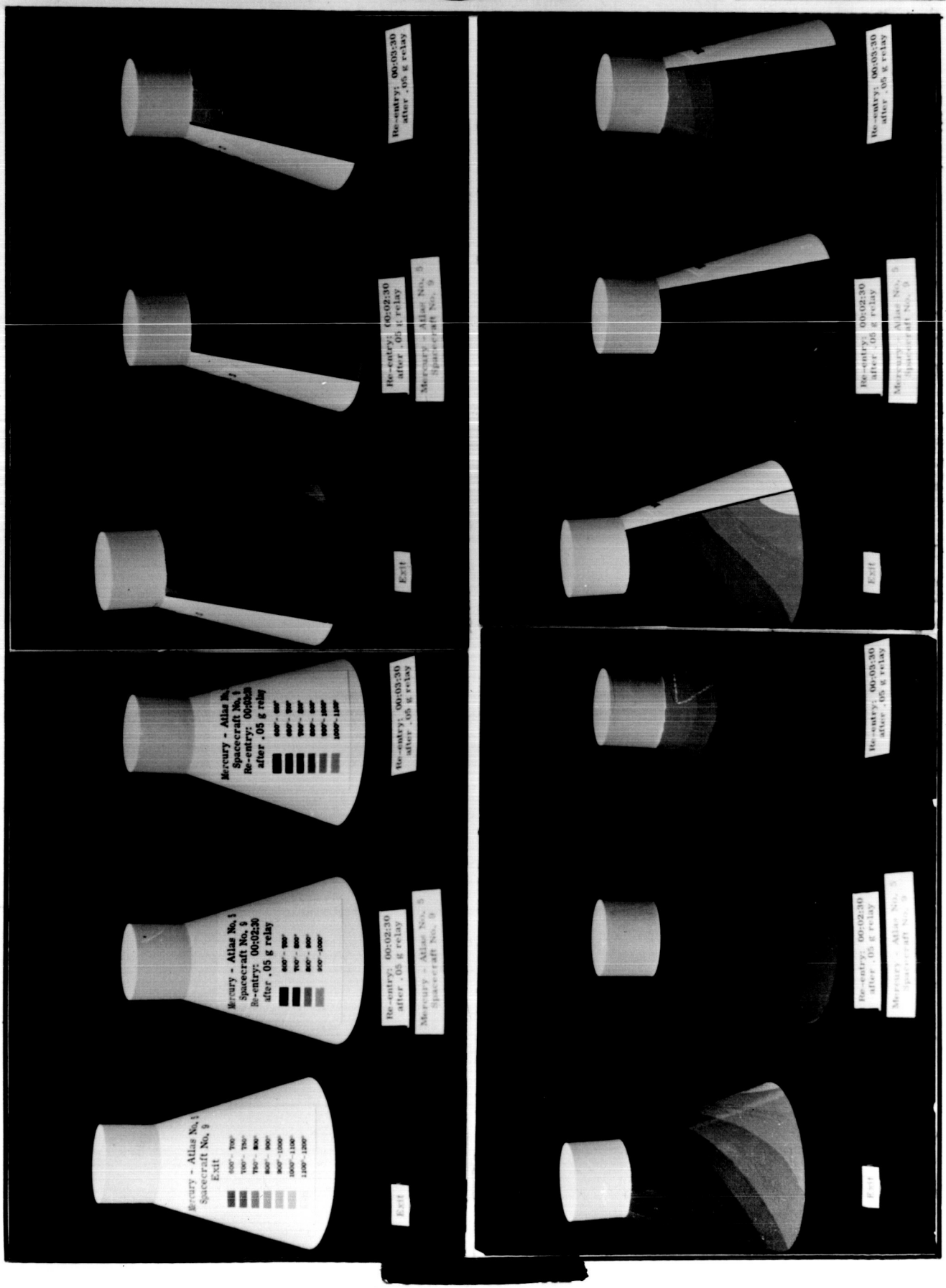


PAGE 7-115
REPORT 8633

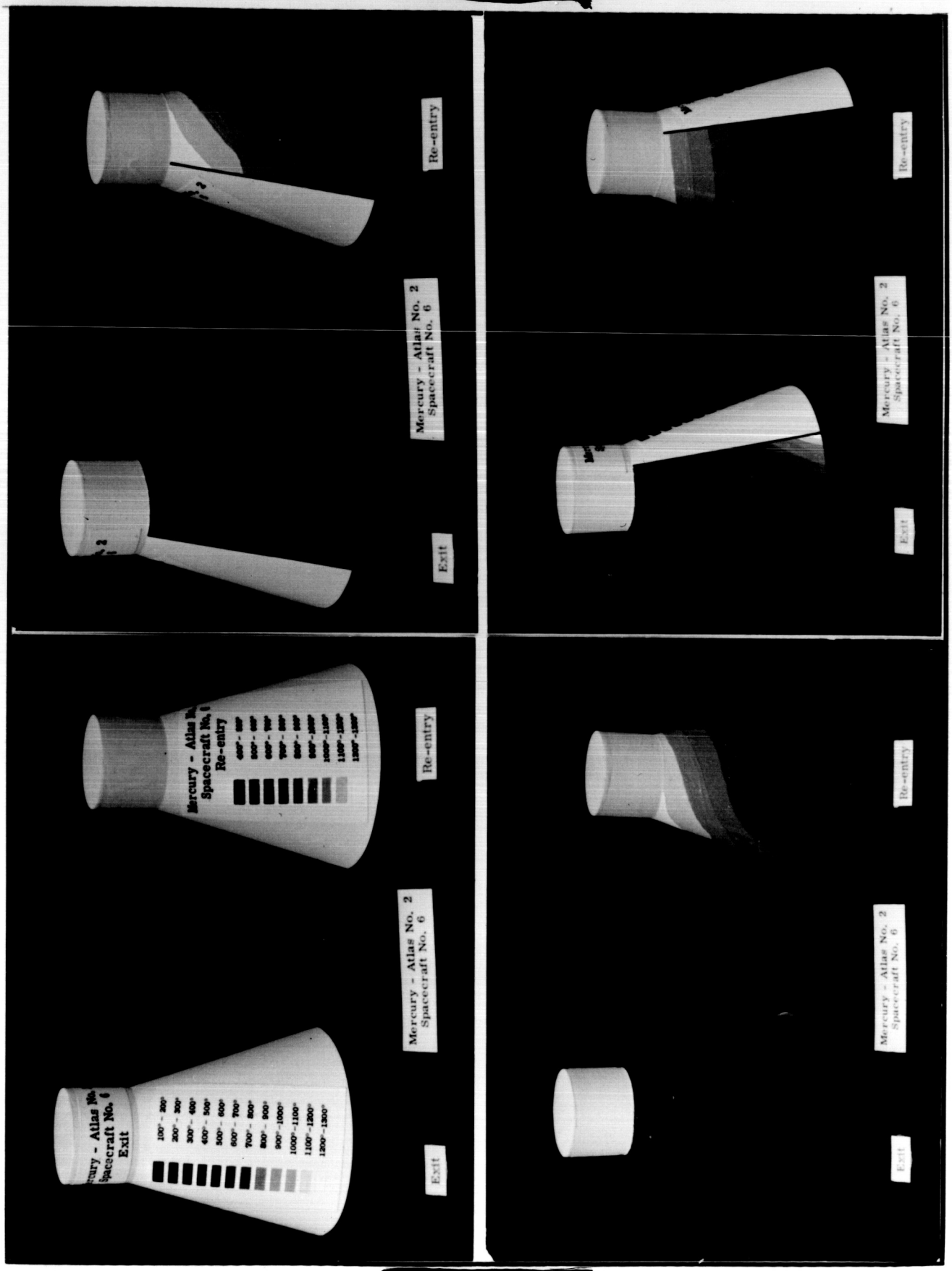
~~CONFIDENTIAL~~

MA-5-T-1603 REV B



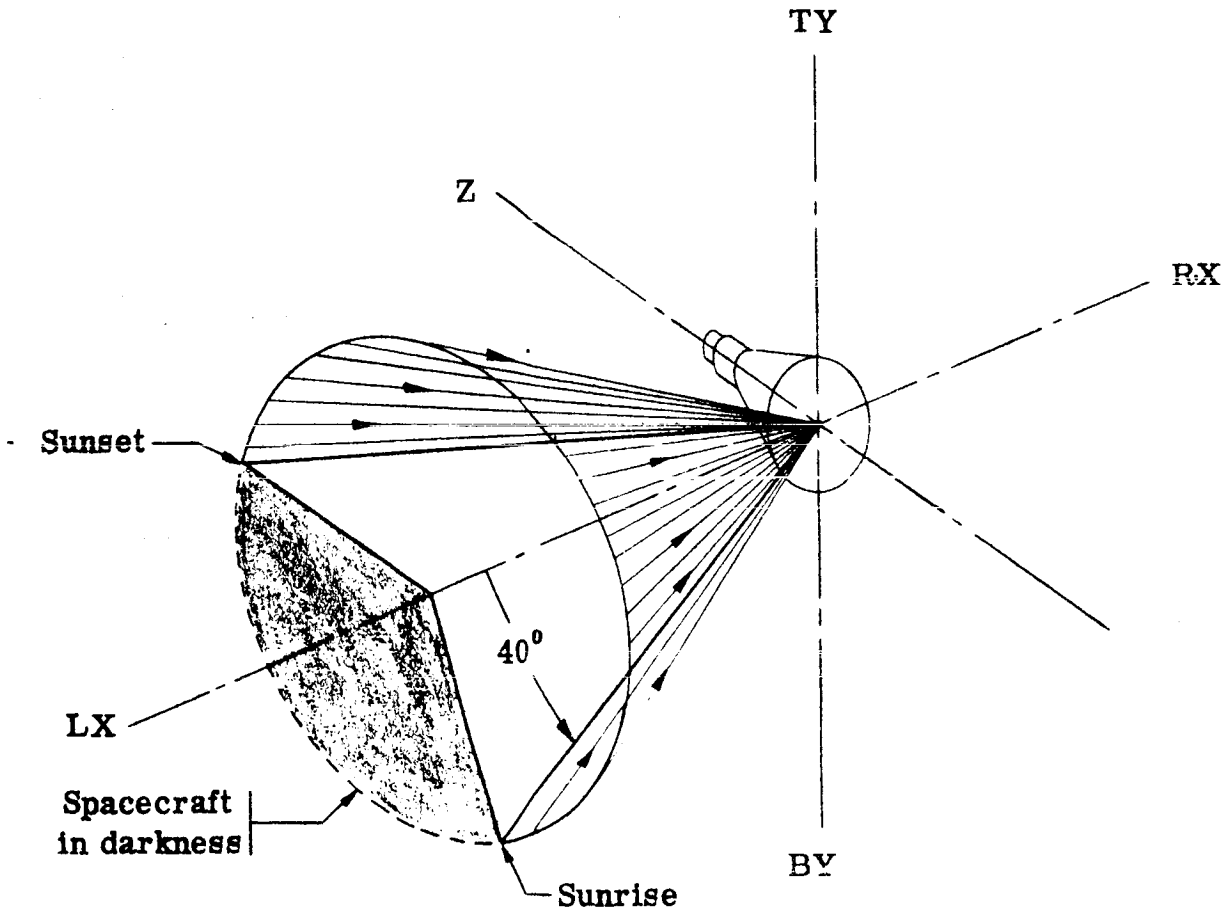

Re-entry: 00:03:30 after .05 g relay
Re-entry: 00:02:30 after .05 g relay
Mercury - Atlas No. 5 Spacecraft No. 9
Exit
Mercury - Atlas No. 1 Spacecraft No. 9 Re-entry: 00:03:30 after .05 g relay
Mercury - Atlas No. 1 Spacecraft No. 9 Re-entry: 00:02:30 after .05 g relay
Mercury - Atlas No. 1 Spacecraft No. 9 Exit

[redacted]


Re-entry
Mercury - Atlas No. 2
Spacecraft No. 6
Exit
Re-entry
Mercury - Atlas No. 2
Spacecraft No. 6
Exit
Re-entry
Mercury - Atlas No. 2
Spacecraft No. 6
Re-entry
Exit
Re-entry
Mercury - Atlas No. 2
Spacecraft No. 6
Exit

MAC 9311 (Rev 11 Sep. 59)

ORIENTATION OF SUN DURING ORBIT
MERCURY-ATLAS NO. 5
SPACECRAFT NO. 9

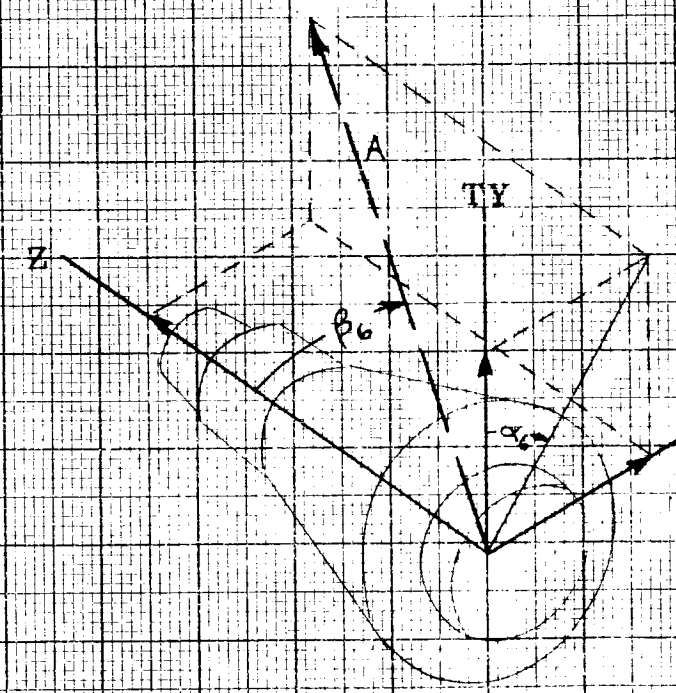


McDONNELL Aircraft Corporation
ST. LOUIS 3, MISSOURI

CONFIDENTIAL

MERCURY SPACECRAFT
SUN ORIENTATION DURING ORBIT
MA-5 Capsule No. 9 29 Nov. 1961

Sunset at capsule



A - Sun vector
β_6 - Angle between Z axis and sun vector
α_6 - Angle between Y axis and projection of sun vector on X, Y plane

α_6 Degrees: 400, 300, 200, 100, 0

β_6 Degrees: 200, 100, 0

0 00:05:00 00:10:00 00:15:00 00:20:00 00:25:00 00:30:00 00:35:00 00:40:00 00:45:00 00:50:00 00:55:00 01:00:00 01:05:00

Elapsed time - hours:minutes:seconds

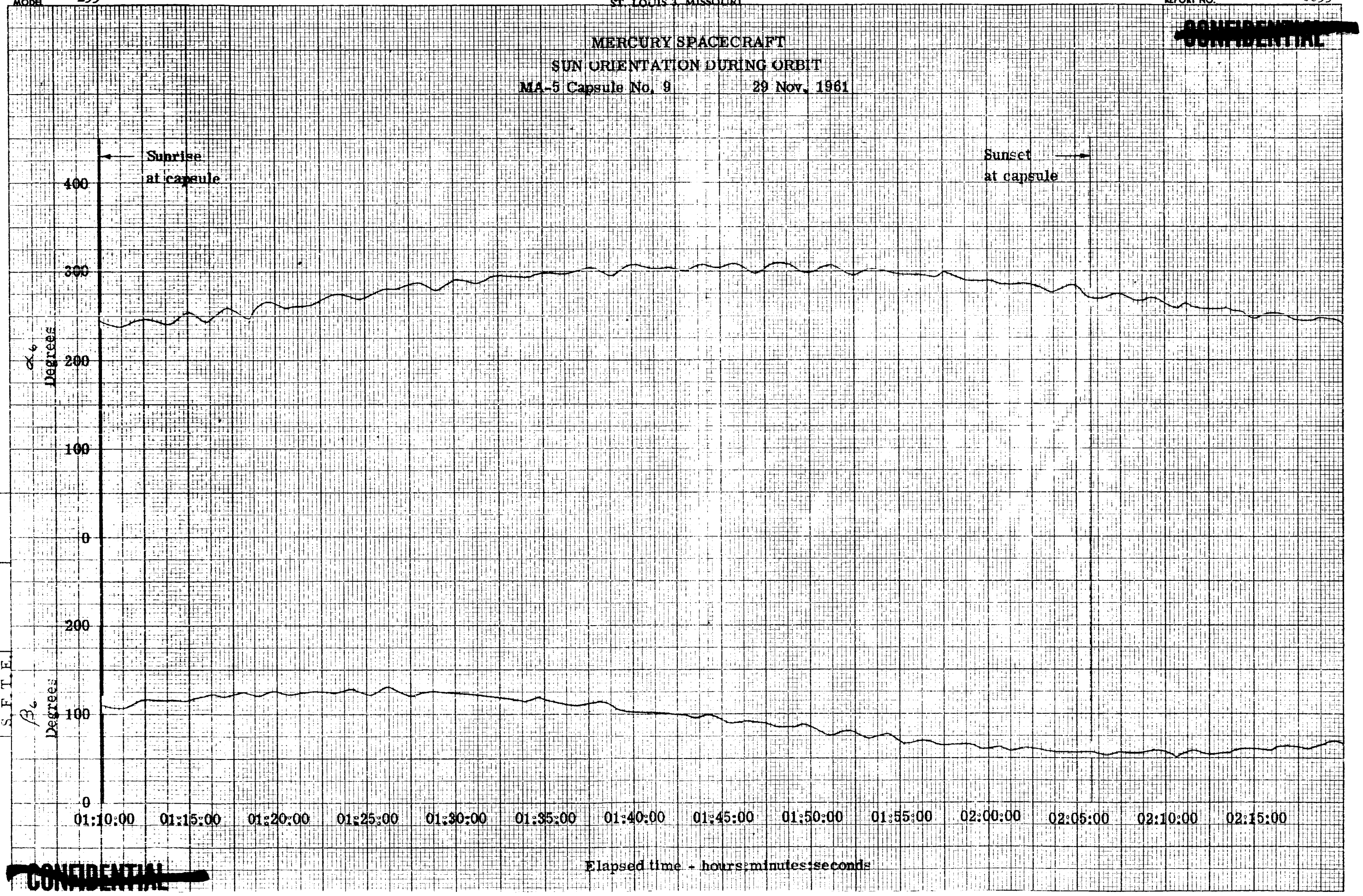
	Approved	Date
D.E.		
S.D.E.		
S.F.T.E.		

CONFIDENTIAL

McDONNELL Aircraft Corporation
ST. LOUIS 3, MISSOURI

CONFIDENTIAL

MERCURY SPACECRAFT
SUN ORIENTATION DURING ORBIT
MA-5 Capsule No. 9 29 Nov. 1961



	Approved	Date
D. E.		
S. D. E.		
S. F. T. E.		

KEUFFEL & ESSER CO. MADE IN U.S.A.

CONFIDENTIAL

DATE 6 March 1962
MODEL 133

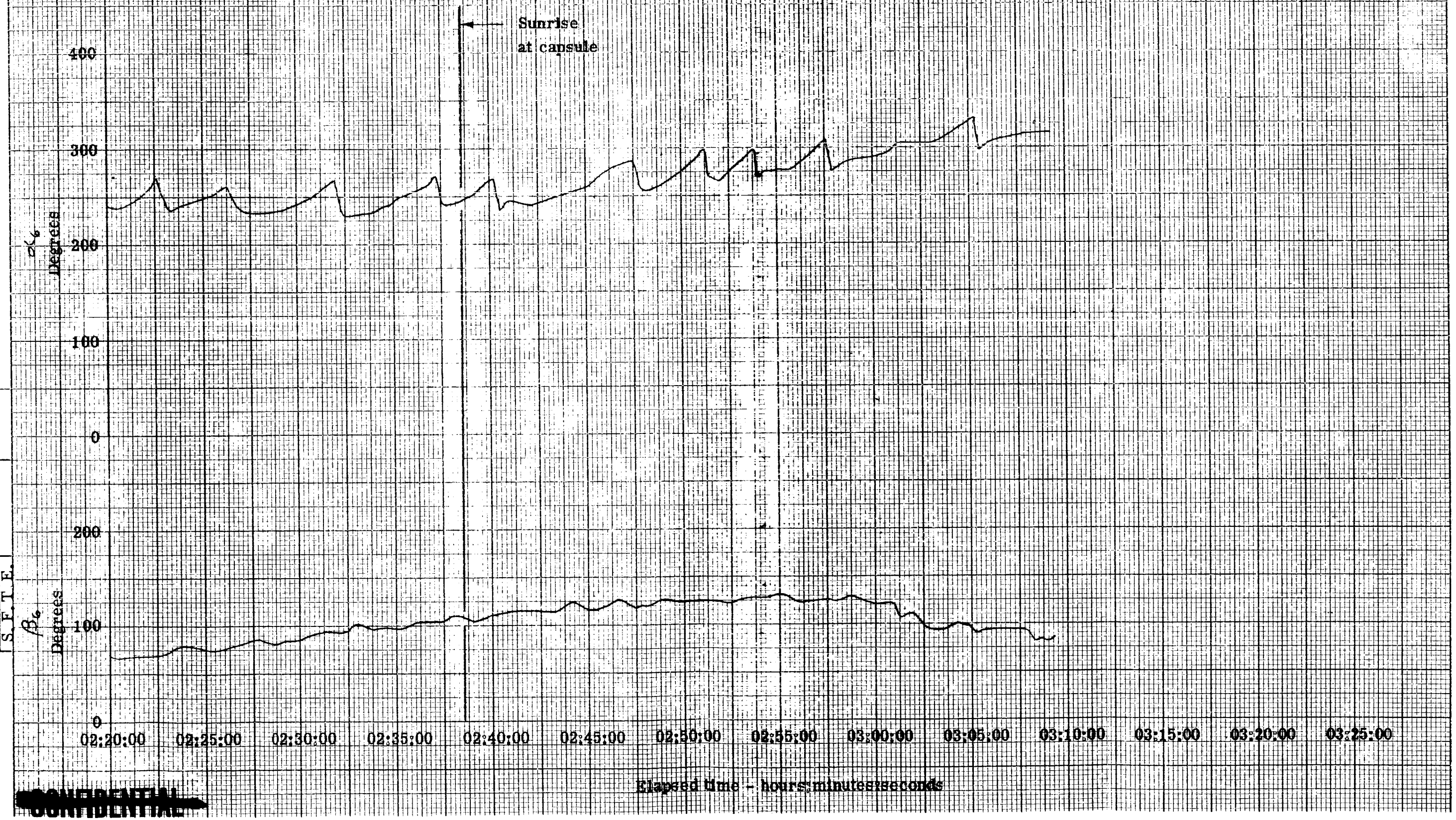
McDONNELL Aircraft Corporation
ST. LOUIS 3, MISSOURI

PAGE NO. 7.122
REPORT NO. 8633

CONFIDENTIAL

	Approved	Date
D.E.		
S.D.E.		
S.F.T.E.		

MERCURY SPACECRAFT
SUN ORIENTATION DURING ORBIT
MA-5 Capsule No. 9 29 Nov. 1961



CONFIDENTIAL