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CLASSIFICATION CHANGE
UNCLASSIFIED
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TECHNICAL INFORMATION SUMMARY

FOR

MERCURY-ATLAS MISSION 6

(MA-6 Spacecraft 13) (U)

[redacted]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MANNED SPACECRAFT CENTER

Langley Air Force Base, Va.

December 19, 1961

[redacted]

(NASA-TM-X-72338) MERCURY-ATLAS MISSION 6 (MA-6 SPACECRAFT 13) (NASA) 15 p

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TEST OBJECTIVES

Test objectives for MA-6/13.- The MA-6/13 mission will be the sixth flight of a specification Mercury spacecraft to be powered by an Atlas booster. The spacecraft will be occupied by an astronaut. The spacecraft, after insertion, will complete three orbits before reentering the earth's atmosphere and landing in a predesignated area approximately 700 nautical miles southeast of Cape Canaveral, Florida.

First-order test objectives.-

(a) Evaluate the performance of a man-spacecraft system in a three-orbit mission

(b) Evaluate the effects of space flight on the astronaut

(c) Obtain the astronaut's opinions of the operational suitability of the spacecraft and supporting systems for manned space flight

FLIGHT ACTIVITIES

General.- One of the objectives of the first manned orbital flight will be detailed reporting of spacecraft systems operations. In addition, the astronaut will perform many flight maneuvers using the manual proportional and fly-by-wire systems to determine his ability to control the spacecraft under varying conditions of attitudes and his ability to recover from a nonstandard attitude maneuver. Additional objectives will be to make visual observations, and to report on his physical condition.

Launch phase.- During the launch phase, the astronaut will make periodic reports on spacecraft systems status and launch phase events as they occur.

Orbit phase.- All ground stations will receive telemetry from the spacecraft which will indicate the condition of both the spacecraft and astronaut. In addition, the voice sites will have talk capability to discuss operations with the astronaut and relay any pertinent information back to the Mercury Control Center.

At 30-minute intervals during the orbit phase, the astronaut will make a complete report on his physical condition and the status of

the spacecraft. Observations will be made by the astronaut of cloud formations, weather conditions, landmarks, sunrises and sunsets, visibility of stars, night visibility of cities, etc. The astronaut will eat two meals during the mission and any changes in taste and smell sensation will be noted. Three primary maneuvers are planned, (one in the second orbit and two in the third orbit), wherein rates about all axes are initiated and recovery is made using either the manual proportional or fly-by-wire control mode. A combined yaw-roll maneuver will be made to observe sunrise. Also during the orbit phase, brief maneuvers will be made using day and night horizons, landmarks, and stars as references. A period of inverted flight is planned to determine effect of replacement of earth and sky on disorientation.

Reentry phase.- At the end of the third orbit, the retrorockets will be fired by the onboard clock with the astronaut and California ground station as backup. From this point on, the sequence of events will be automatic with the astronaut observing the sequence and providing manual override if required.

TABLE I.- NORMAL FLIGHT PLAN AND MAJOR TRAJECTORY PARAMETERS

Event	Time (hr:min:sec)	Altitude (ft)	Aero-dynamic velocity (ft/sec)	Surface range from launch (n.m.)	Dynamic pressure (lb/ft^2)	Latitude (deg:min:sec)	Longitude (deg:min:sec)
Lift-off	00:00:00	112	—	—	—	28°29'28" N.	80°32'51" W.
Maximum dynamic pressure (exit)	00:01:00	33,880	1,504	*2 E.	872	28°30'11" N.	80°30'27" W.
Booster engine cutoff	00:02:11	207,358	9,155	45 E.	20	28°43'11" N.	79°43'38" W.
Booster engine separation	00:02:14	218,195	9,228	49 E.	13	28°44'18" N.	79°39'36" W.
Tower jettison	00:02:34	293,581	9,894	78 E.	—	28°52'39" N.	79°08'33" W.
Sustainer engine cutoff	00:05:04	528,497	24,379	436 E.	—	30°25'41" N.	72°31'25" W.
Spacecraft separation	00:05:05	528,513	24,379	440 E.	—	30°26'34" N.	72°27'00" W.
Maximum altitude	00:50:06	810,710	24,049	10,669 E.	—	31°07'18" S.	99°53'58" E.
Retrorocket firing initiated	04:32:26	528,854	24,397	2,544 W.	—	32°04'08" N.	129°40'21" W.
Retrograde package jettisoned	04:33:26	518,163	24,055	2,311 W.	—	32°27'16" N.	125°07'46" W.
Reentry begins	04:42:49	286,379	24,300	159 W.	3	27°13'23" N.	83°10'07" W.
Maximum heating	04:45:19	192,092	20,446	482 E.	168	23°37'03" N.	73°26'42" W.
Maximum dynamic pressure and longitudinal acceleration	04:46:23	127,299	9,744	646 E.	441	22°25'49" N.	70°42'48" W.
Drogue chute deployed	04:46:25	125,049	9,261	649 E.	440	22°24'28" N.	70°39'48" W.
Main chute deployed	04:48:49	21,000	395	689 E.	95	22°06'38" N.	70°00'33" W.
Impact	04:49:26	10,000	267	689 E.	61	22°06'38" N.	70°00'33" W.
	04:54:15	—	30	689 E.	1	22°06'38" N.	70°00'33" W.

*East of launch site

TABLE II.- NOMINAL WEIGHTS FOR THE MA-6/13 SPACECRAFT

4,257.70 pounds	Gross weight at lift-off (includes adapter and escape tower)
2,969.66 pounds	Spacecraft weight after separation from Atlas
2,681.31 pounds	Spacecraft weight at start of reentry
2,405.28 pounds	Spacecraft flotation weight

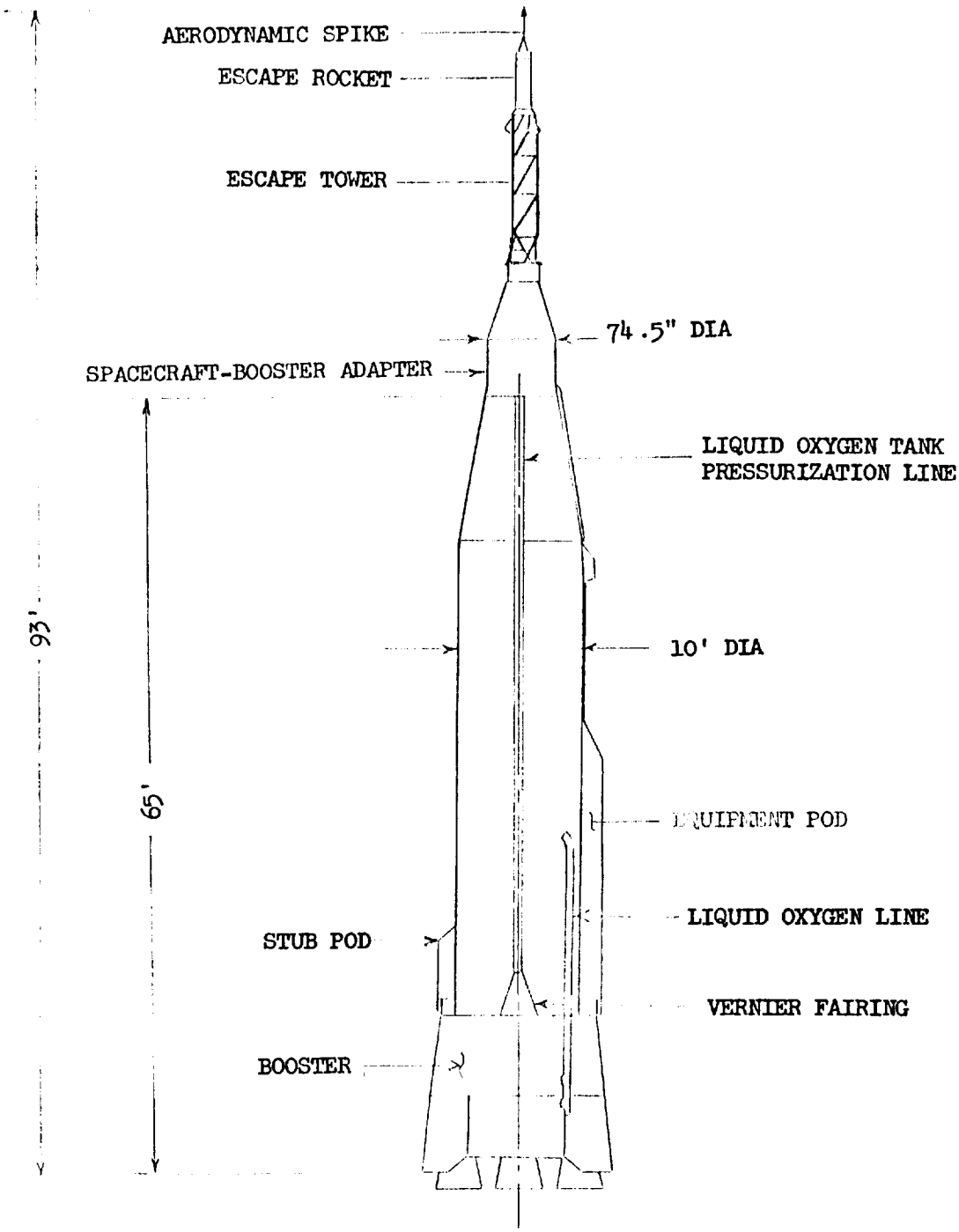


Figure 1.-
Mercury-Atlas launch vehicle configuration.

LENGTH OF OVERALL SPACECRAFT CONFIGURATION
24.5 FEET

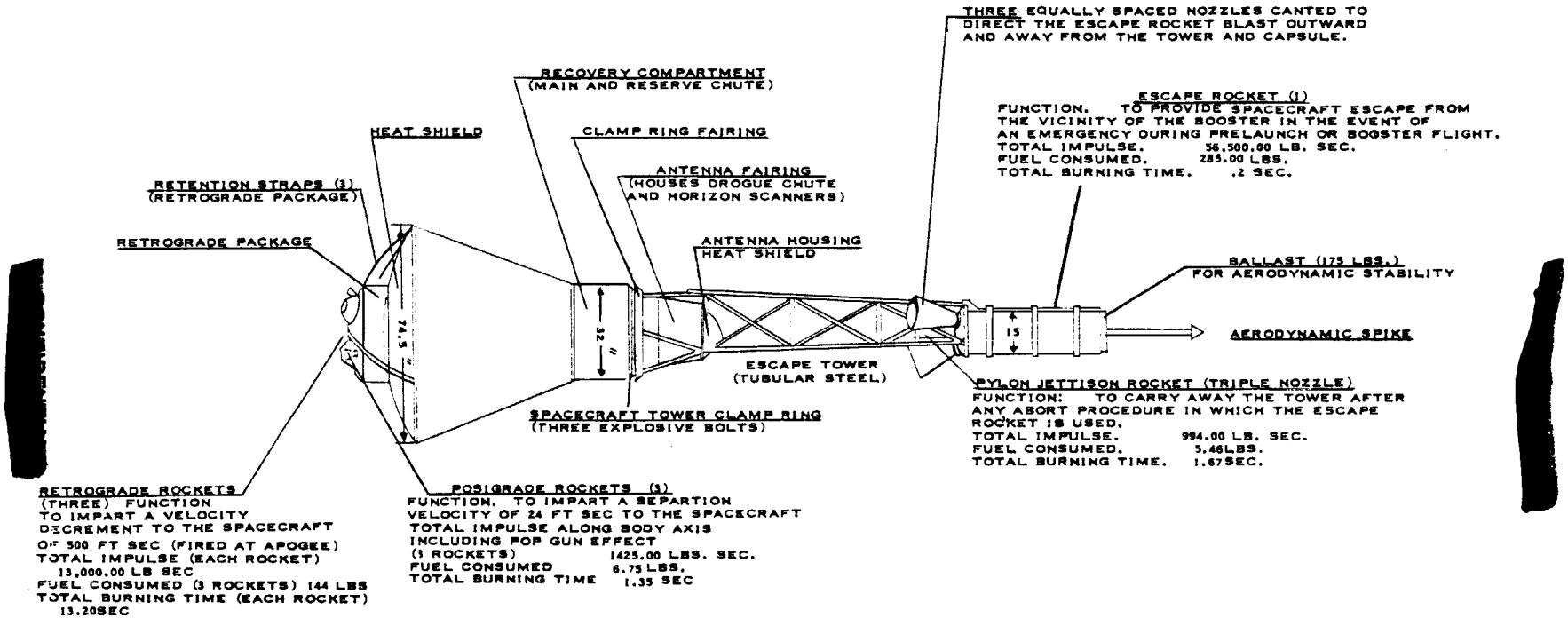


FIGURE 2.—SPACECRAFT CONFIGURATION.

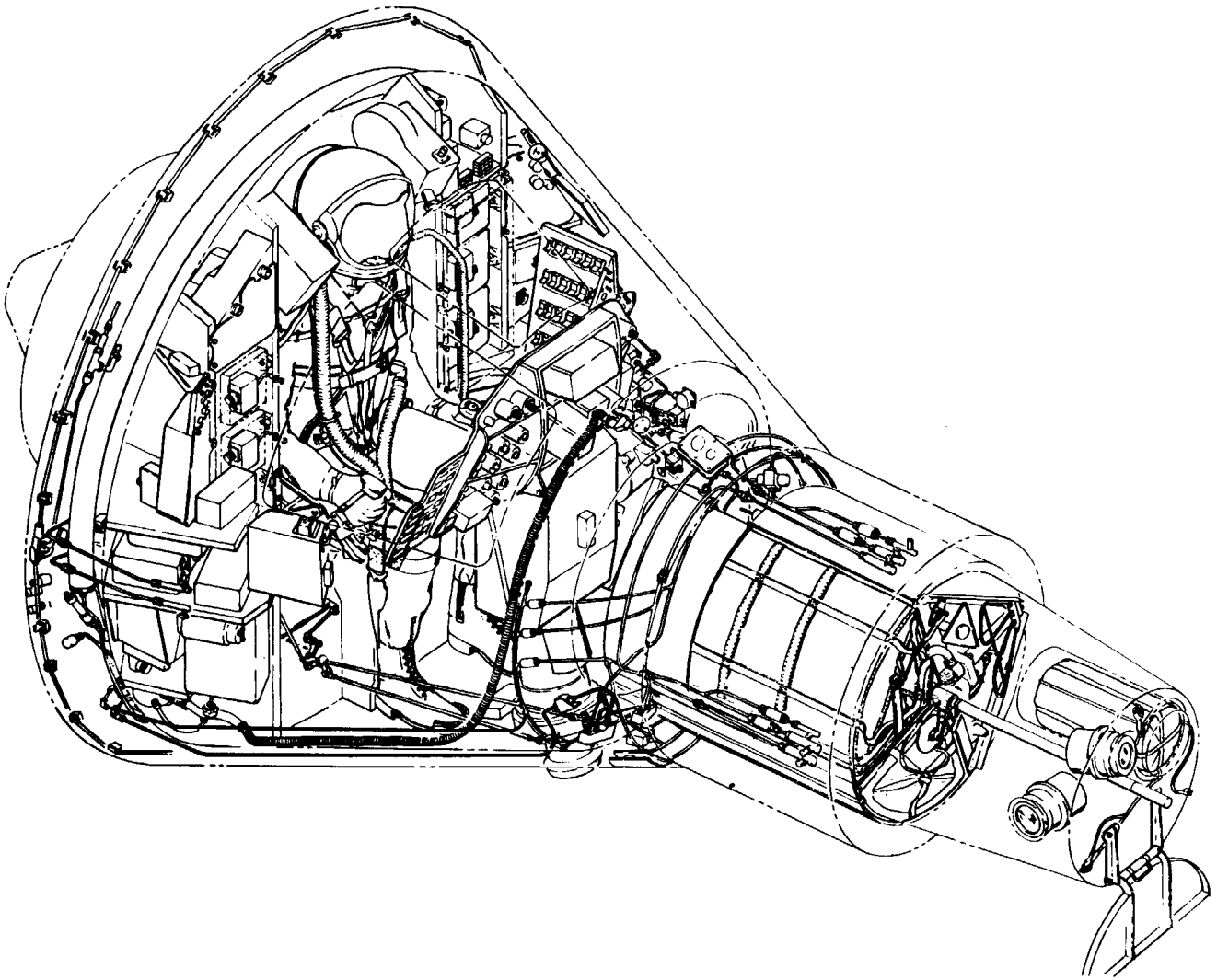
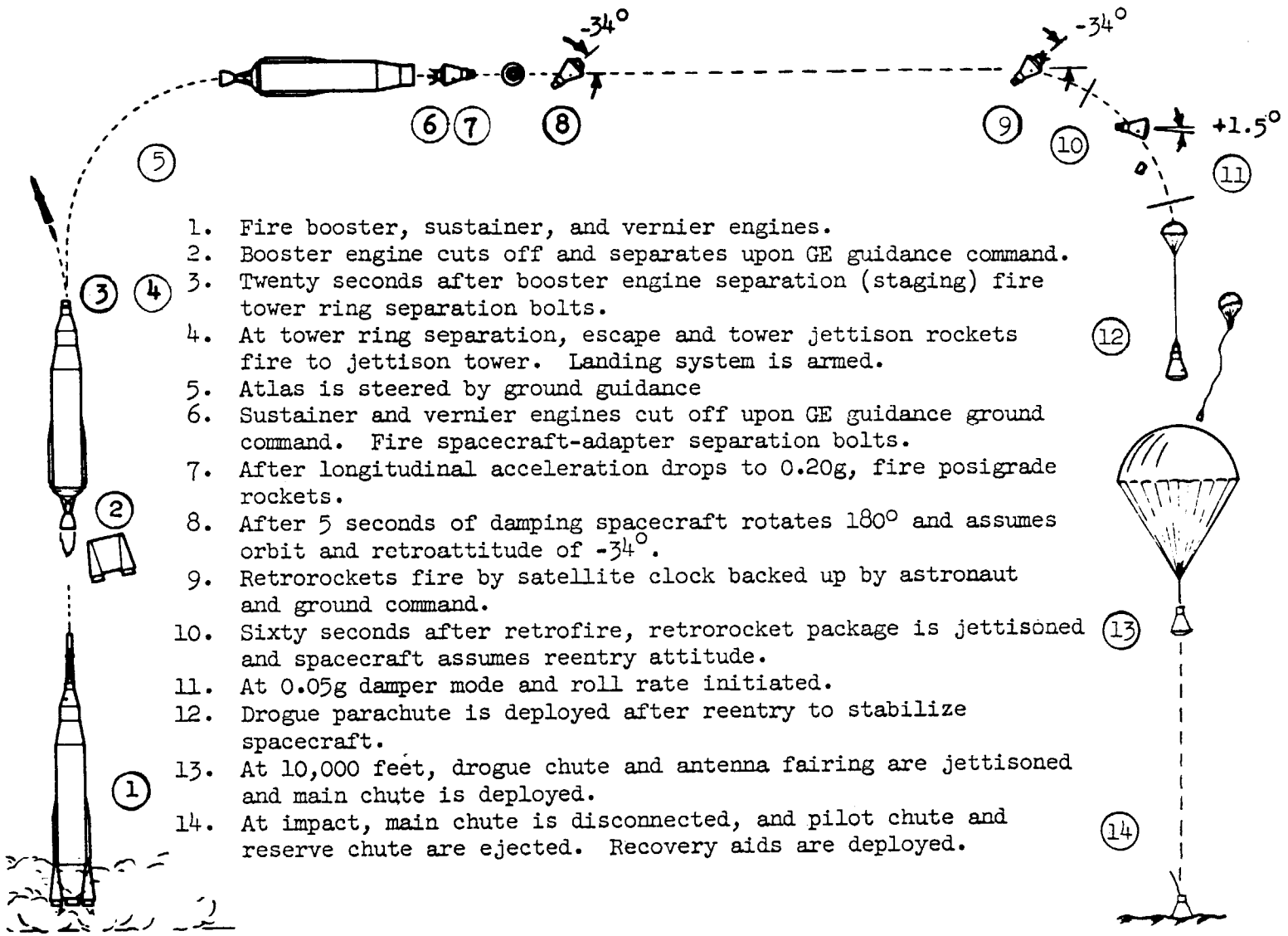
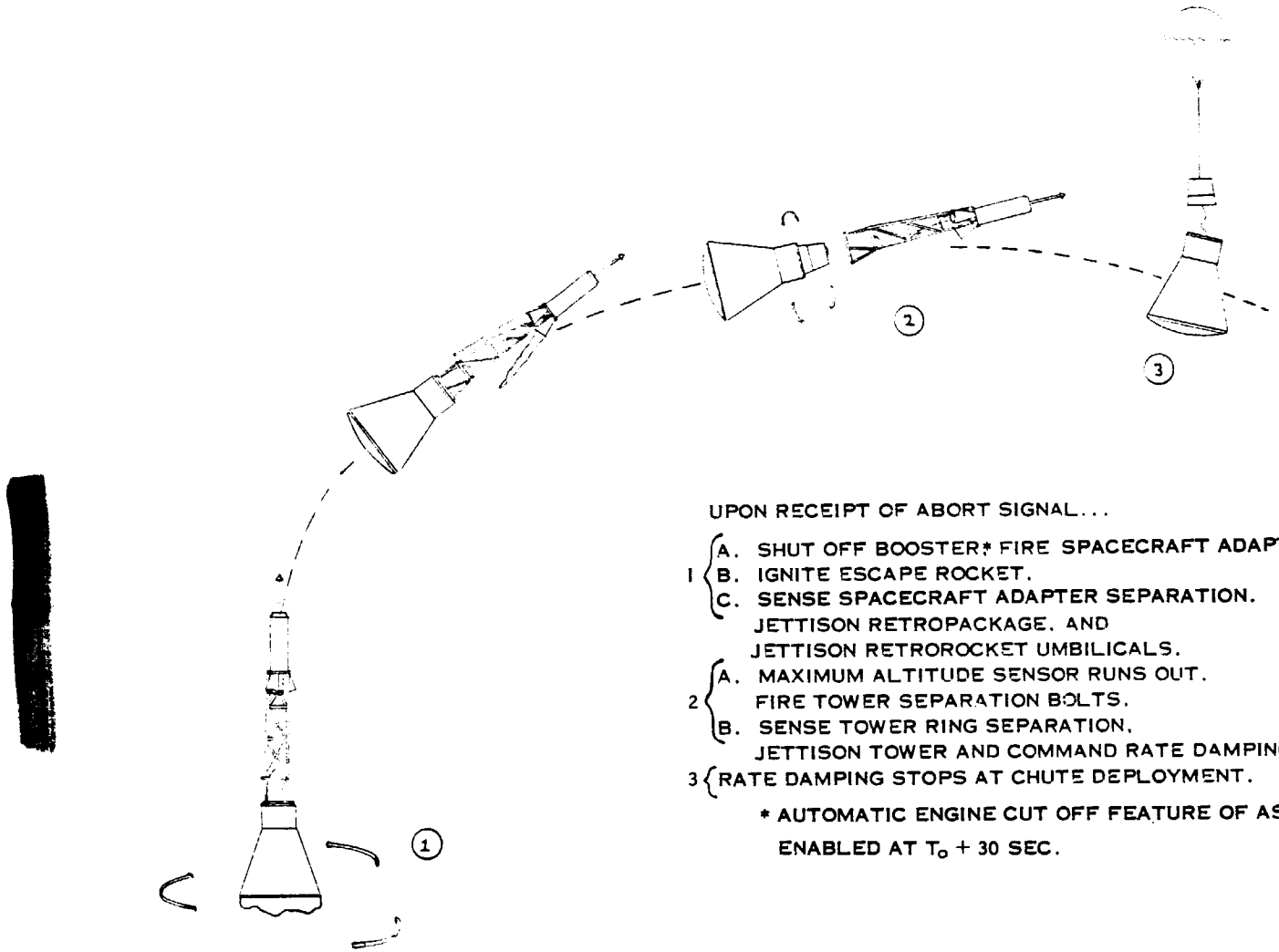


Figure 3.- General interior arrangement of capsule.



1. Fire booster, sustainer, and vernier engines.
2. Booster engine cuts off and separates upon GE guidance command.
3. Twenty seconds after booster engine separation (staging) fire tower ring separation bolts.
4. At tower ring separation, escape and tower jettison rockets fire to jettison tower. Landing system is armed.
5. Atlas is steered by ground guidance
6. Sustainer and vernier engines cut off upon GE guidance ground command. Fire spacecraft-adapter separation bolts.
7. After longitudinal acceleration drops to 0.20g, fire posigrade rockets.
8. After 5 seconds of damping spacecraft rotates 180° and assumes orbit and retroattitude of -34°.
9. Retrorockets fire by satellite clock backed up by astronaut and ground command.
10. Sixty seconds after retrofire, retrorocket package is jettisoned and spacecraft assumes reentry attitude.
11. At 0.05g damper mode and roll rate initiated.
12. Drogue parachute is deployed after reentry to stabilize spacecraft.
13. At 10,000 feet, drogue chute and antenna fairing are jettisoned and main chute is deployed.
14. At impact, main chute is disconnected, and pilot chute and reserve chute are ejected. Recovery aids are deployed.

Figure 4.- General sequence of events planned for this mission.



UPON RECEIPT OF ABORT SIGNAL...

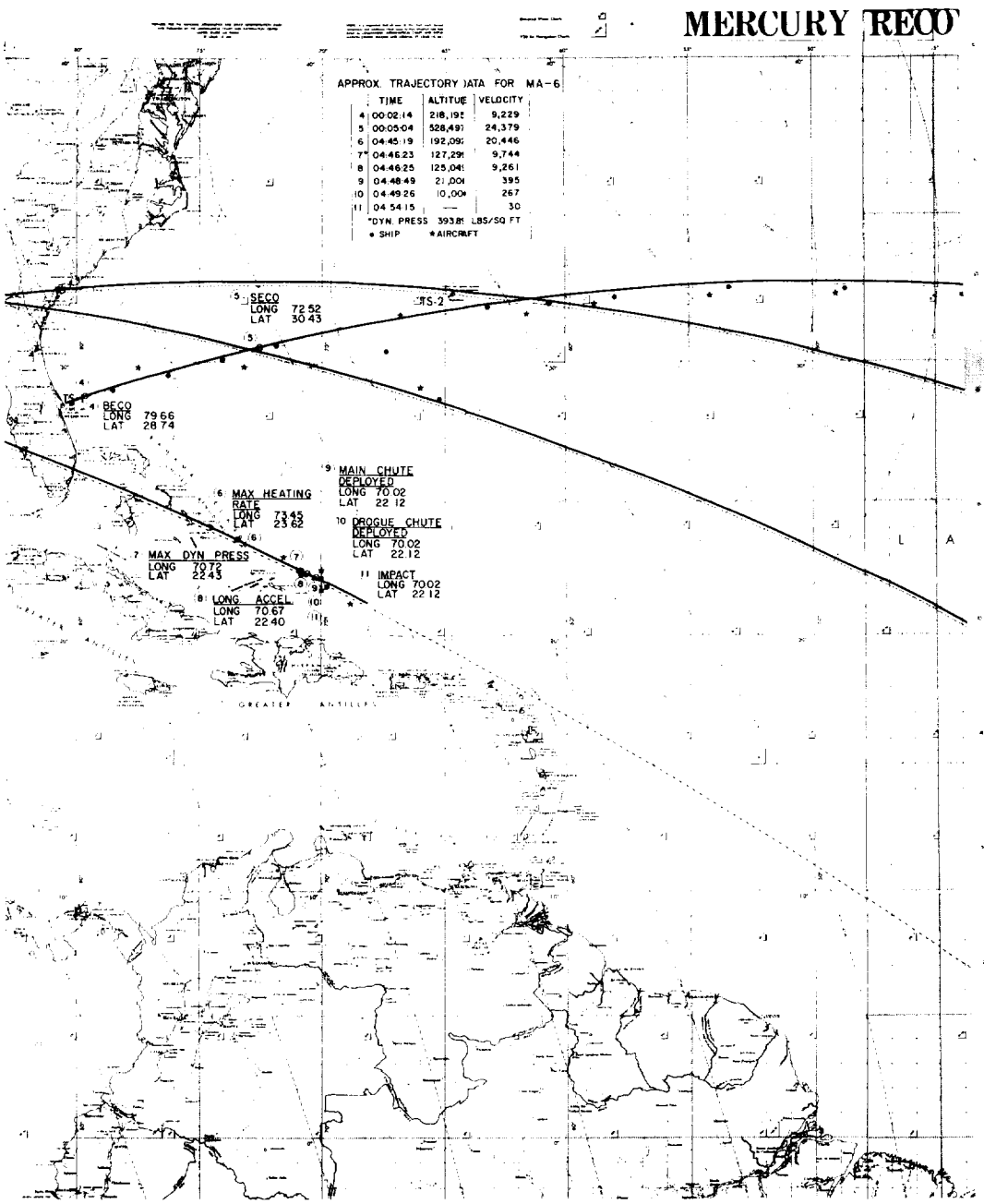
1 {
A. SHUT OFF BOOSTER* FIRE SPACECRAFT ADAPTER BOLTS
B. IGNITE ESCAPE ROCKET.
C. SENSE SPACECRAFT ADAPTER SEPARATION.
JETTISON RETROPACKAGE. AND
JETTISON RETROROCKET UMBILICALS.

2 {
A. MAXIMUM ALTITUDE SENSOR RUNS OUT.
FIRE TOWER SEPARATION BOLTS.
B. SENSE TOWER RING SEPARATION.
JETTISON TOWER AND COMMAND RATE DAMPING.

3 { RATE DAMPING STOPS AT CHUTE DEPLOYMENT.

* AUTOMATIC ENGINE CUT OFF FEATURE OF ASIS IS ENABLED AT T_o + 30 SEC.

FIGURE 5.- GENERAL SEQUENCE OF EVENTS THAT WOULD OCCUR IF FLIGHT SHOULD BE ABORTED BEFORE SPACECRAFT ESCAPE TOWER IS JETTISONED.



(a) Over Atl

Figure 6.- Earth track of Mercury-Atlas
significant events and depl

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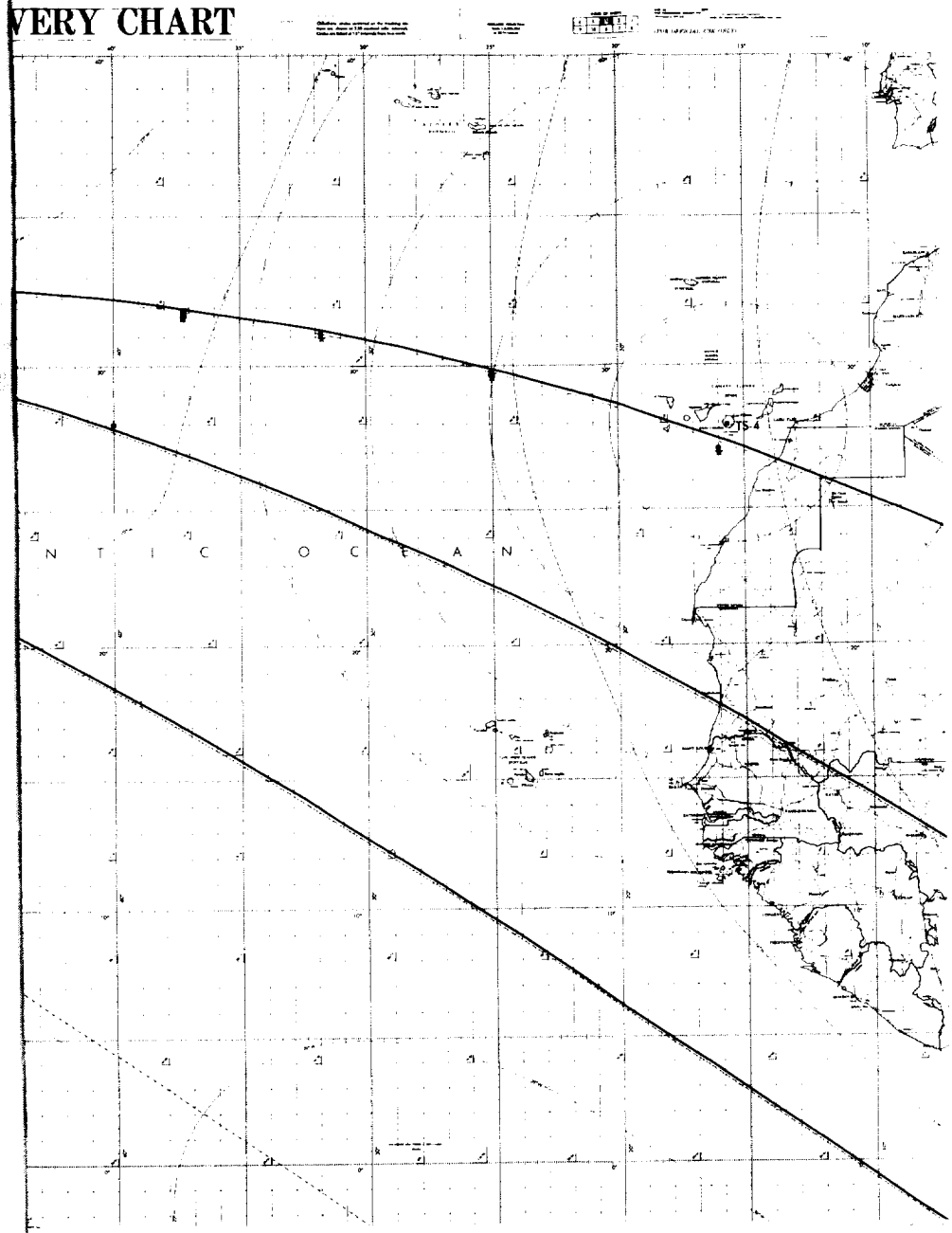

antic Ocean.

3-orbit trajectory showing locations of
oyment of recovery forces.

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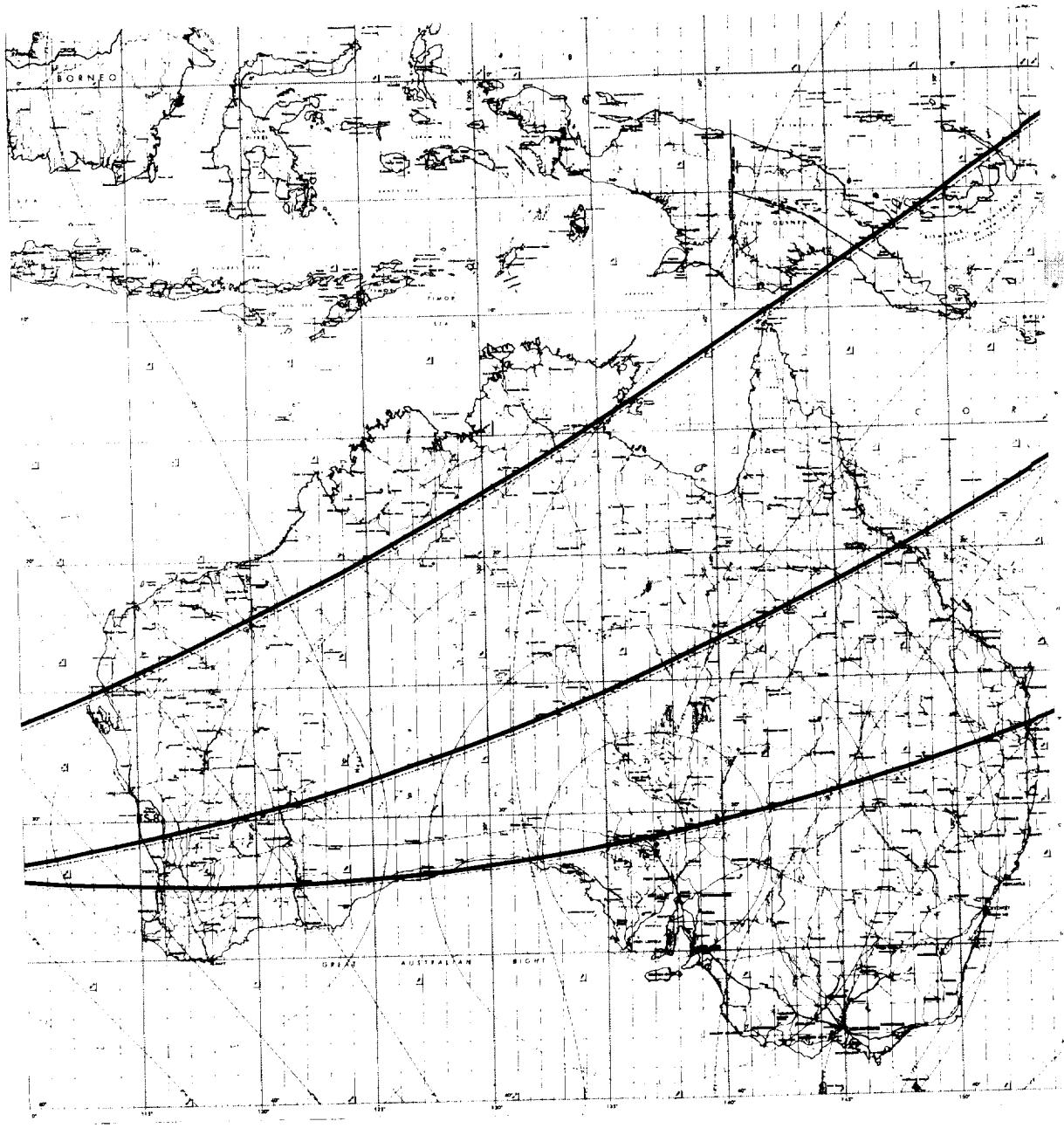

(b) Over Australia and S

Figure 6.- Conti

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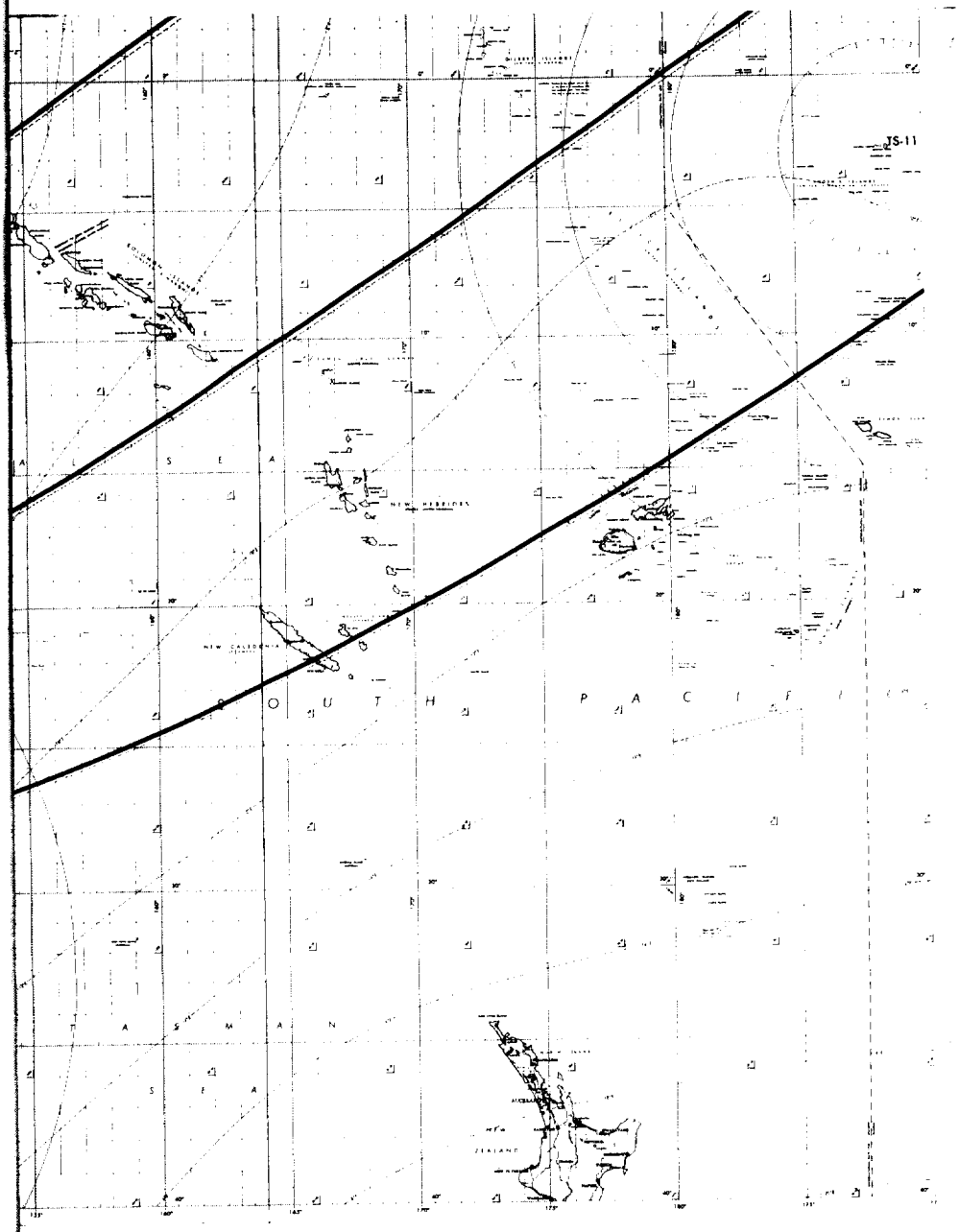

outh Pacific.

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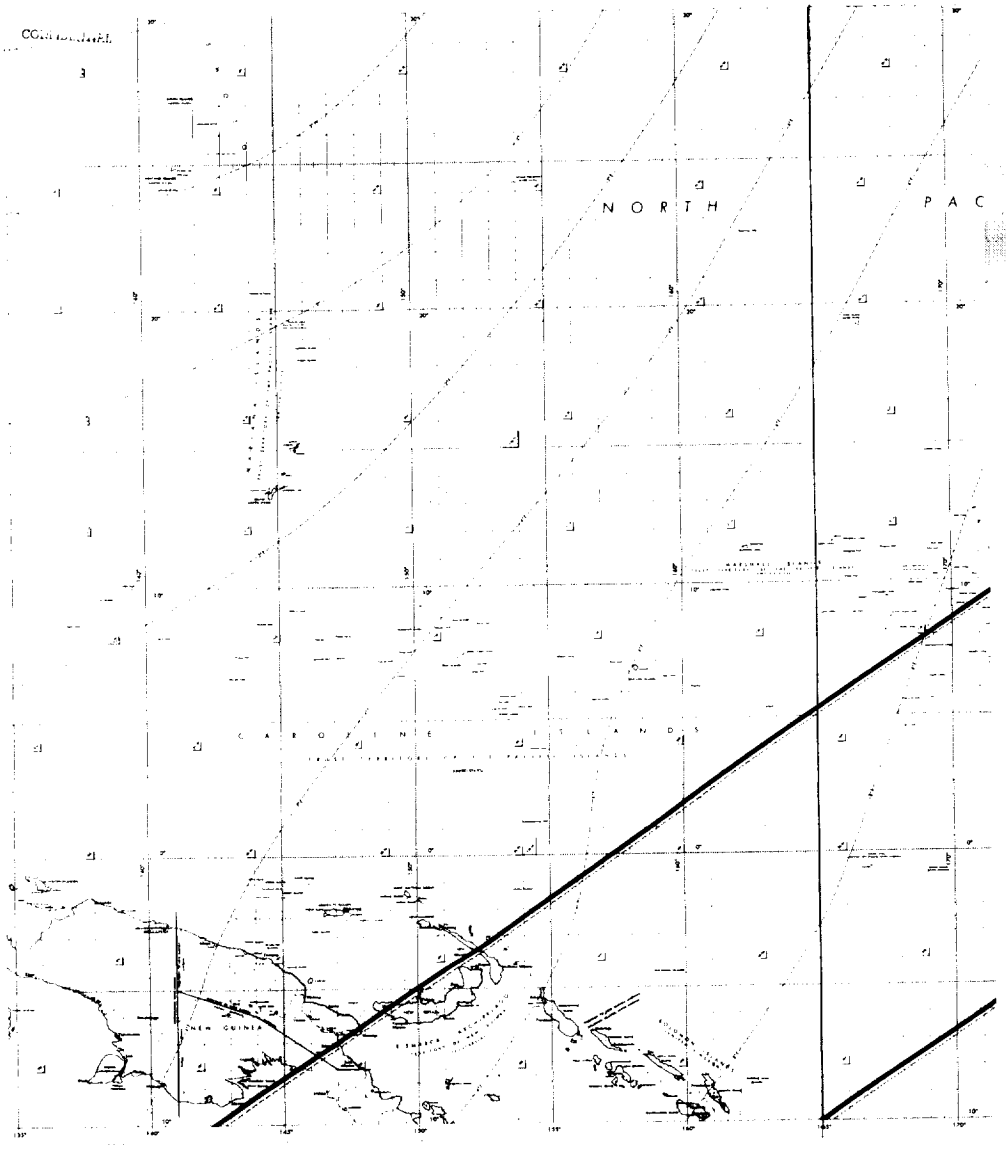

(c) Over Western I

Figure 6.

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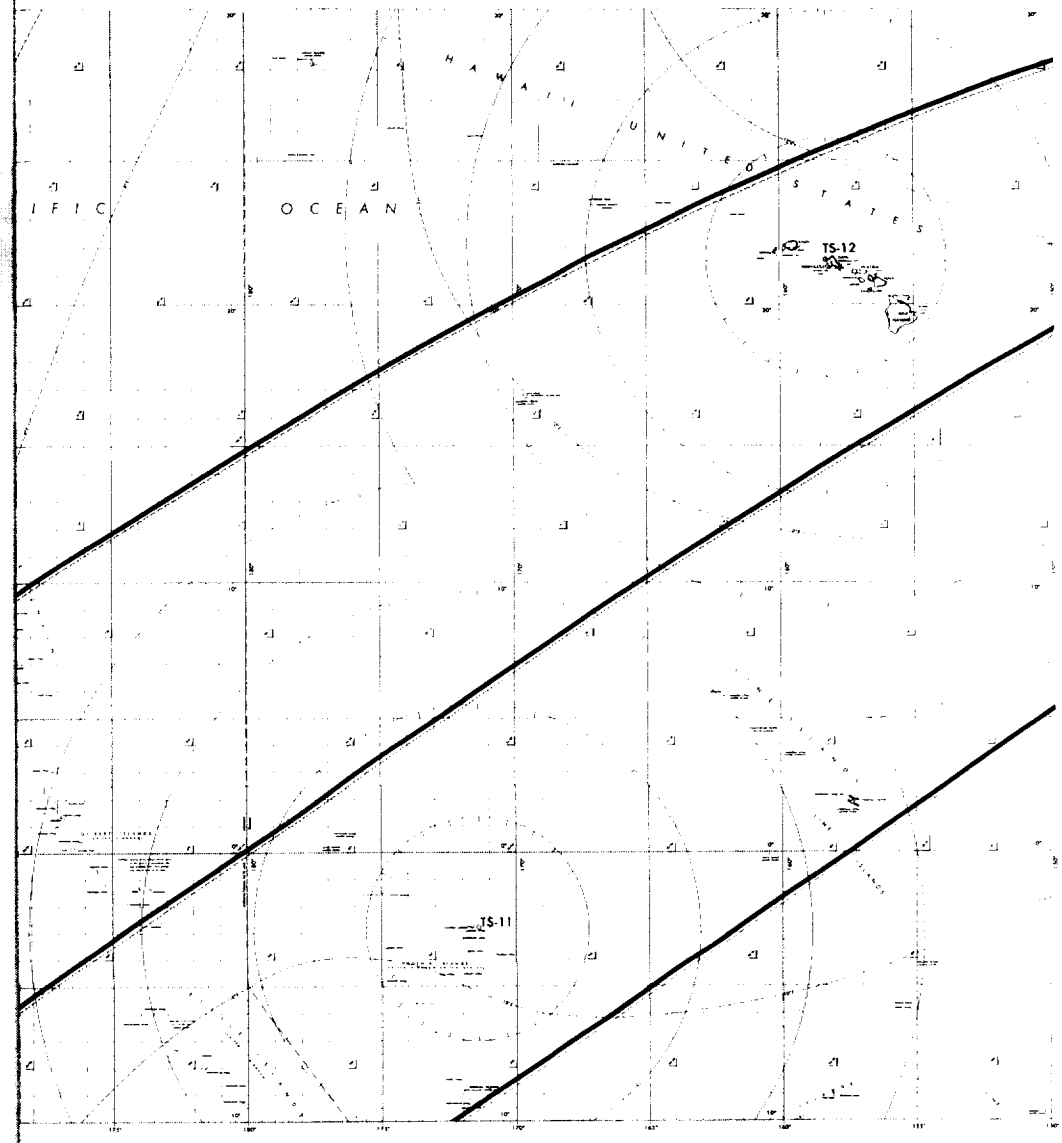

half of Pacific Ocean.

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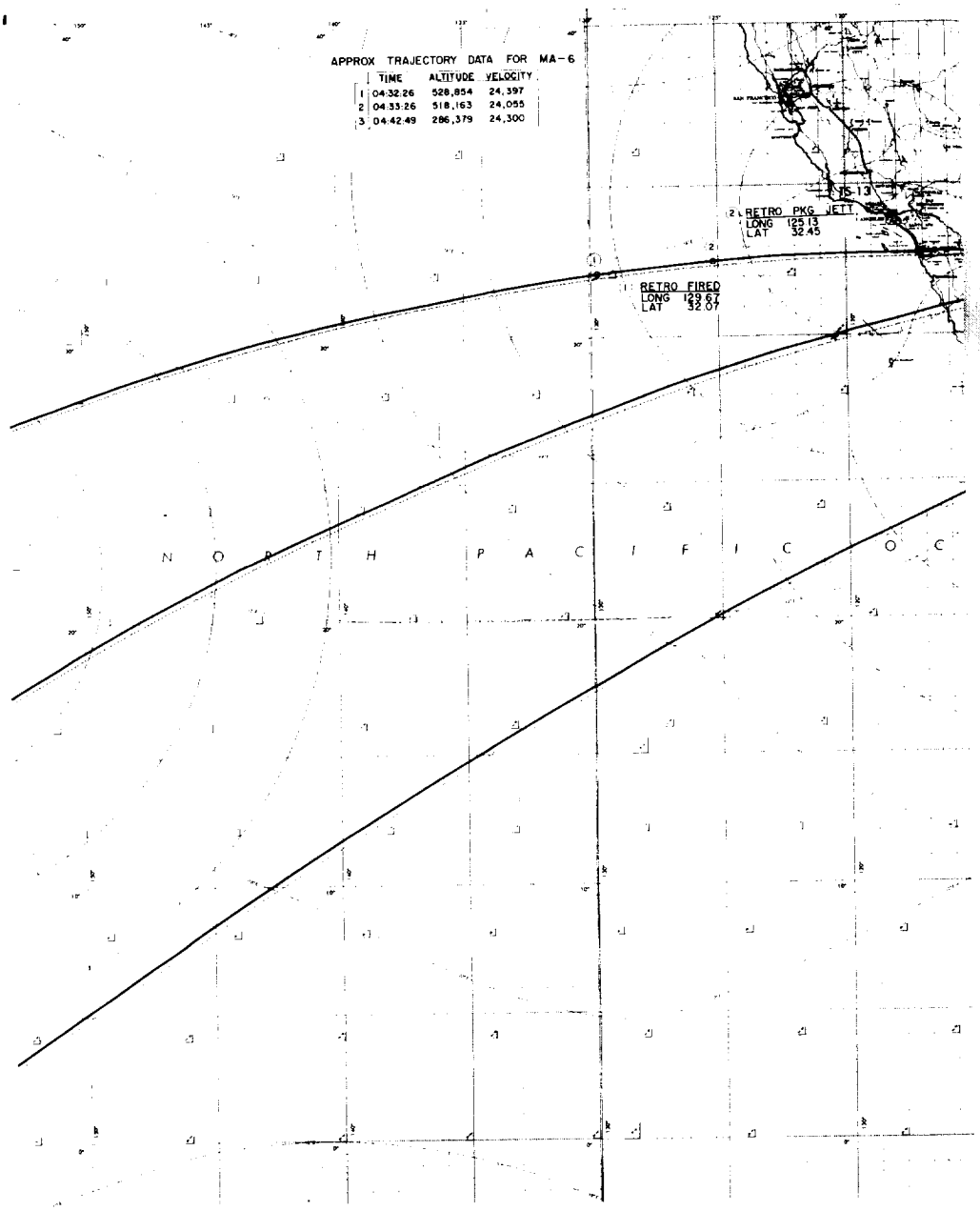

(d) Over North Paci

Figure 6.

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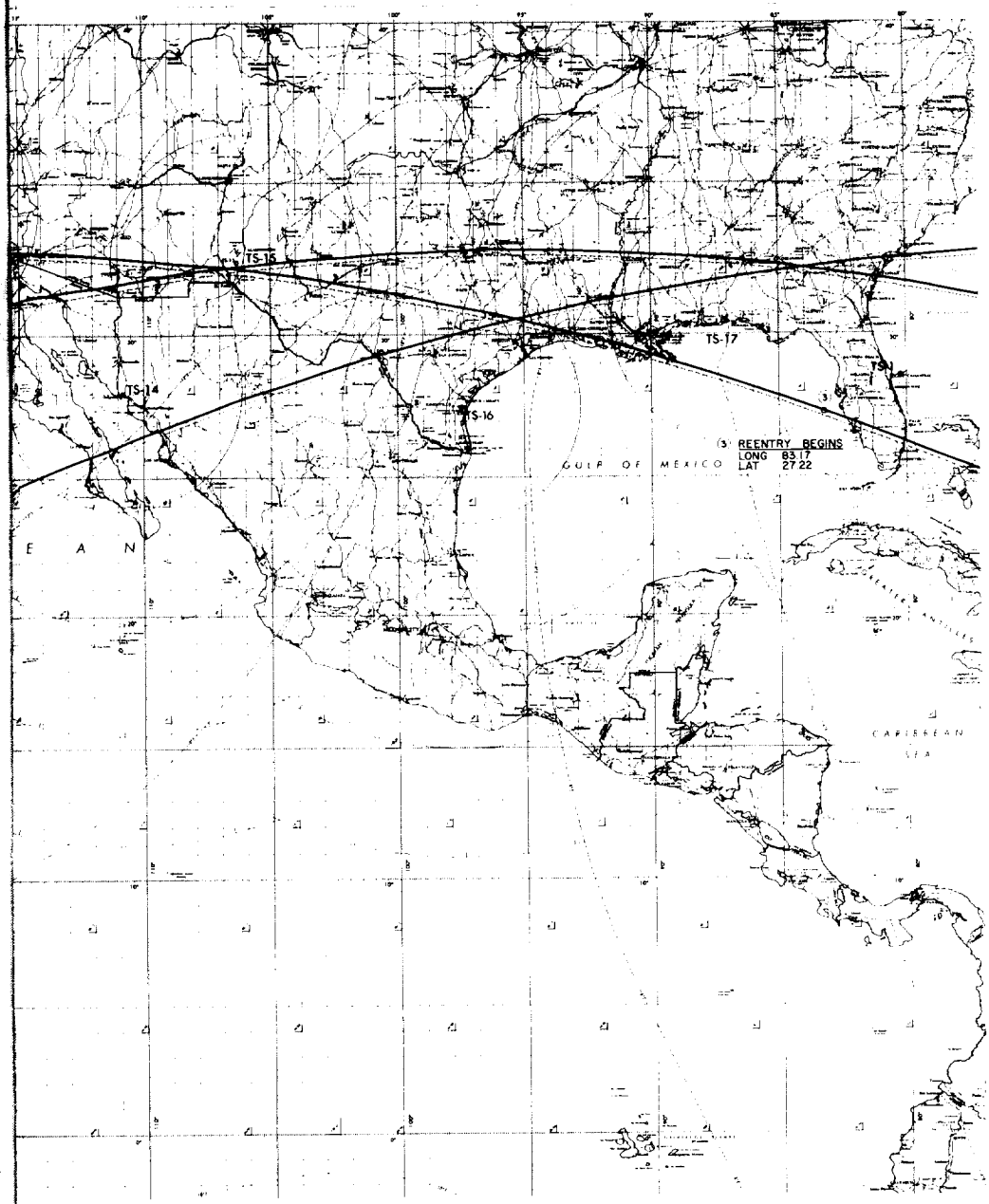

ic and United States.

Concluded.

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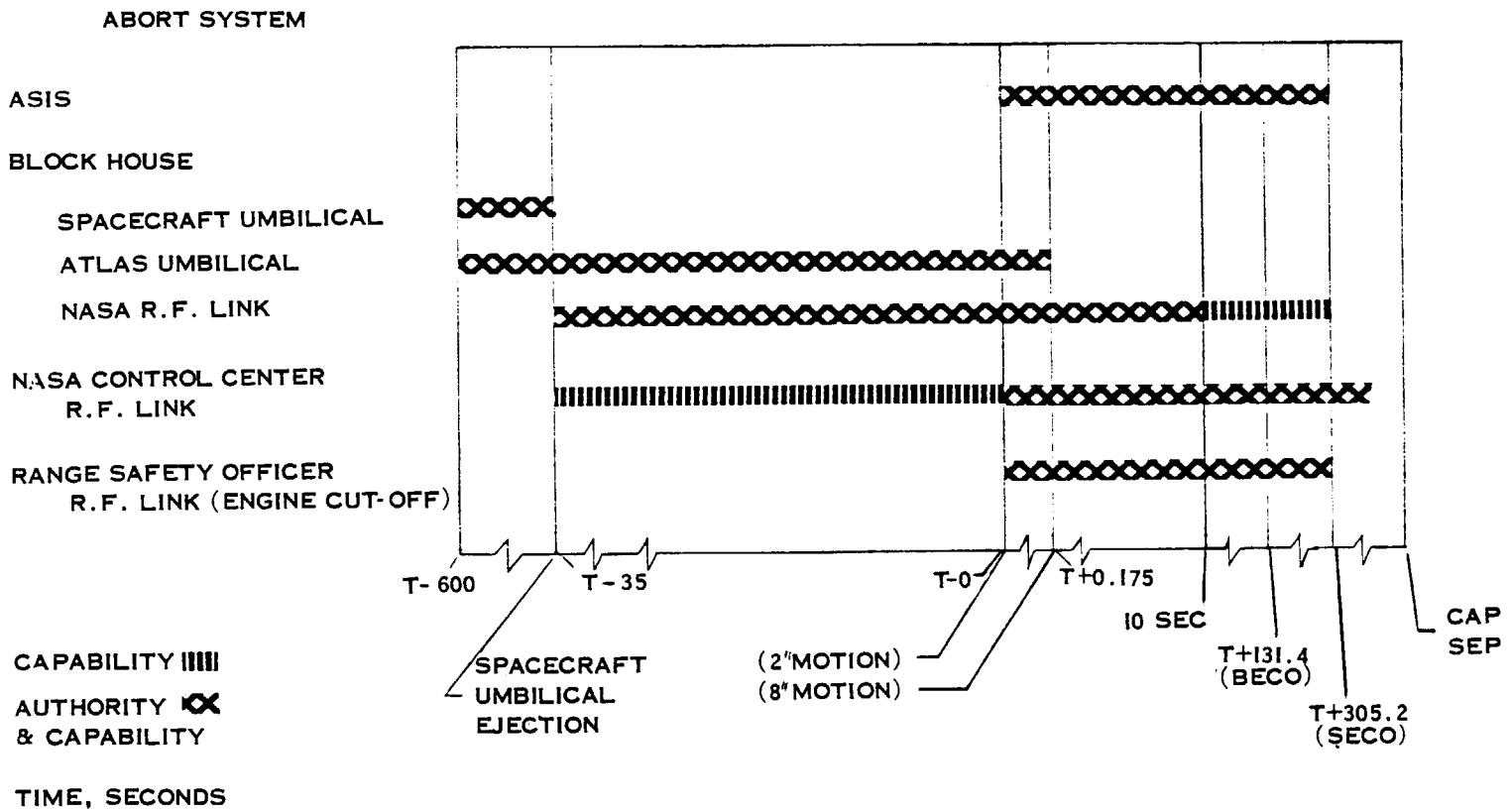

FIGURE 7.- ABORT CAPABILITY/AUTHORITY OF MERCURY-ATLAS.

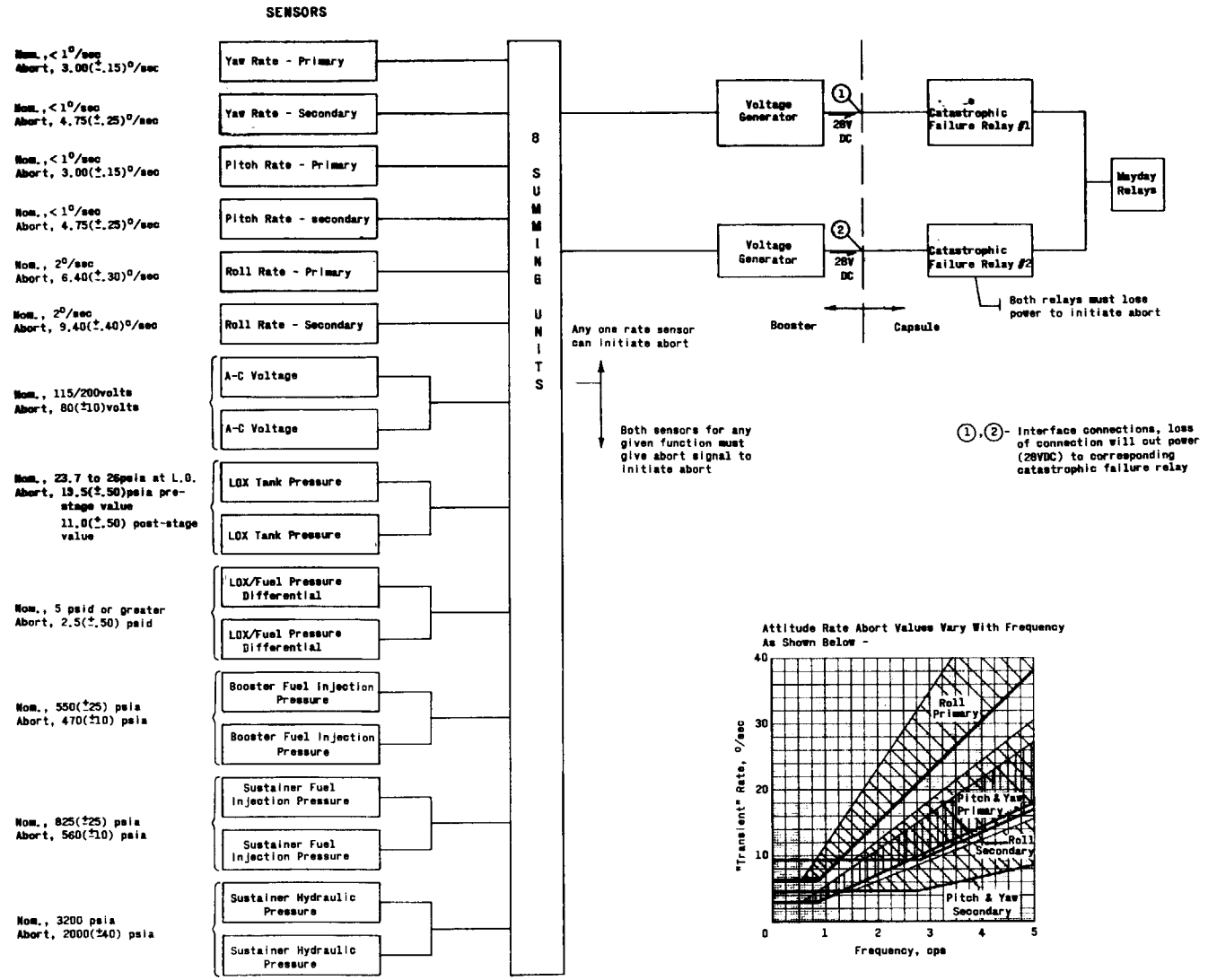

Figure 8.- BLOCK DIAGRAM OF ABORT SENSING AND IMPLEMENTATION SYSTEM.