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HUNTSVILLE, ALABAMA

TECHNICAL INFORMATION SUMMARY
APOLLO-10 (AS-505)
APOLLO SATURN V SPACE VEHICLE

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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AS-505

TECHNICAL INFORMATION

SUMMARY

This document is prepared jointly by the Marshall Space Flight Center Laboratories S&E-ASTR-S, S&E-AERO-P, and S&E-ASTN-VN. The document presents a brief and concise description of the AS-505 Apollo Saturn Space Vehicle. Where necessary, for clarification, additional related information has been included.

It is not the intent of this document to completely define the Space Vehicle or its systems and subsystems in detail. The information presented herein, by text and sketches, describes launch preparation activities, launch facilities, and the space vehicle. This information permits the reader to follow the space vehicle sequence of events beginning a few hours prior to liftoff to its journey into space.

1. Mission Purpose:

AS-505, Apollo 10, Mission F, is described as a Lunar Mission Development Flight which has been designed to demonstrate crew/space vehicle/mission support facilities during a manned lunar mission and to evaluate lunar module performance in lunar environment.

2. Launch Vehicle Mission Objectives

The Principal Detailed Test Objective (DTO) is to demonstrate the AS-505 Launch Vehicle capability to inject the Apollo Spacecraft onto a free return, translunar trajectory.

The Secondary Detailed Test Objectives are:

- Verify J-2 engine modifications.
- Confirm J-2 engine environment in S-II and S-IVB stages.
- Confirm launch vehicle longitudinal oscillation environmental during S-IC stage burn.
- Verify that S-IC modifications will suppress low frequency longitudinal oscillations.

3. Mission Description

Mission F, AS-505, (Apollo 10), has a flight duration of approximately 10 days.

The AS-505 mission has been divided into the following phases which are described below: Launch to parking orbit, coast in parking orbit, injection into trans-lunar trajectory, lunar orbit insertion, restart and injection into transearth trajectory, reentry and splash down.

Figures 1 and 2 illustrate the boost to earth parking orbit and the balance of the mission profile to include lunar orbit and reentry.

Launch to Parking Orbit. AS-505 will be launched from Kennedy Space Center, complex 39B on a flight aximuth between 72 and 108 degrees. As the vehicle rises from the launch pad, a yaw maneuver is executed to insure that the vehicle does not collide with the tower in the event of high winds or possible engine failure. Once tower clearance has been accomplished, a pitch and roll maneuver is initiated to achieve the proper flight attitude and flight azimuth orientation.

A successful boost sequence, as illustrated in Figure 1, will insert the S-IVB/IU/SC into a 100 NMI circular earth parking orbit.

Coast in Earth Parking Orbit. Coast in earth parking orbit will consist of approximately two or three revolutions during which time the LV and SC will be checked out in preparation for translunar injection. Two injection opportunities have been programmed for AS-505.

Injection into Translunar Trajectory. This phase will begin with the S-IVB stage restart sequence which will occur midway during the second revolution (1st opportunity) or during the third revolution (2nd opportunity). This burn will inject the vehicle into a translunar, free return, trajectory. After injection, the CSM separates from the S-IVB/IU, turns around, docks with the LM/S-IVB and performs LM extraction. During translunar coast, spacecraft midcourse corrections are made as required. Following LM extraction, the S-IVB stage will undergo a residual propellant, retrograde dump and safeing sequence. Thrust from available propellants in the launch vehicle auxiliary propulsion system and from main propulsion system venting is used to "propel" the expended S-IVB/IU to pass behind the moon and into a solar orbit. (Figure 2)

Lunar Orbit Insertion. As the SC enters the lunar gravitational field, a decision will be made as to whether to remain on a "free return trajectory" which presents a path to transearth trajectory, or to brake into lunar orbit. If conditions are "go" for lunar orbit, one Astronaut will enter the lunar module and check the status of the critical systems. He will then return to the CM prior to lunar orbit insertion.

The SM propulsion system (SPS) is used to deboost the spacecraft into a circular lunar orbit. During lunar orbit, two crew members enter the LM, CSM/LM separation occurs and LM checkout proceeds.

During this activity phase, a LM excursion will simulate the descent and ascent phases of a lunar landing mission. After the simulation phase, CSM/LM final docking occurs and the astronauts will deactivate the LM and return to the CM. After the LM crew returns to the CSM, the LM will be jettisoned.

Restart and Injection to Transearth Trajectory. The SM propulsion system is used once again, to boost the CSM out of lunar orbit and onto a transearth trajectory.

Reentry and Recovery. The command and service module are separated prior to atmospheric reentry. The Service Module Reaction Control System is used to assist in separation.

A range of 2000 nautical miles approximates the distance between the point of atmospheric reentry and the point at which splash-down occurs. Recovery will take place in the Pacific Ocean.

IECO - Inboard Engine Cutoff
OECO - Outboard Engine Cutoff
LET - Launch Escape Tower
IGM - Iterative Guidance Mode

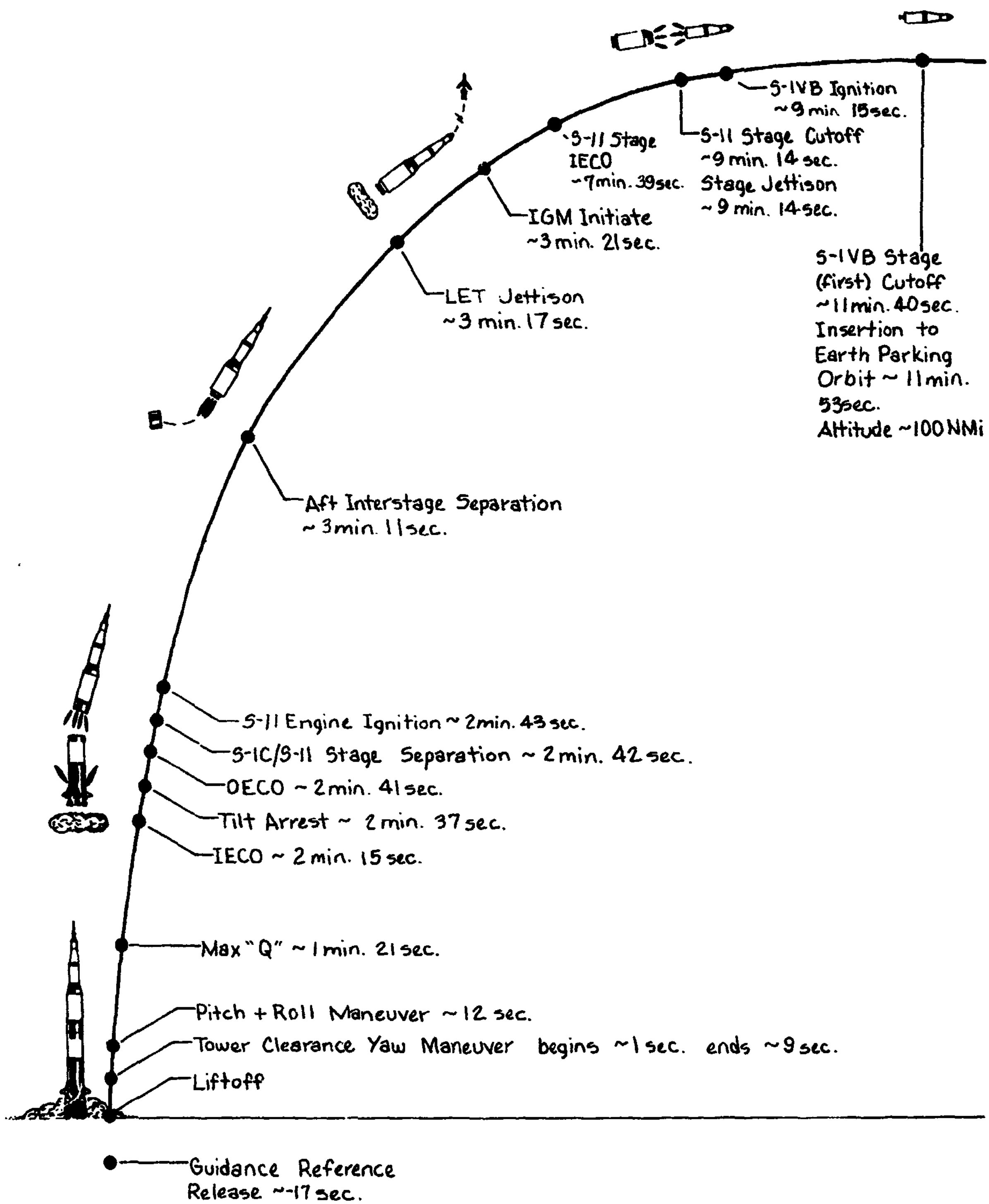

Figure 1

Mission Profile
Boost to Earth Orbit

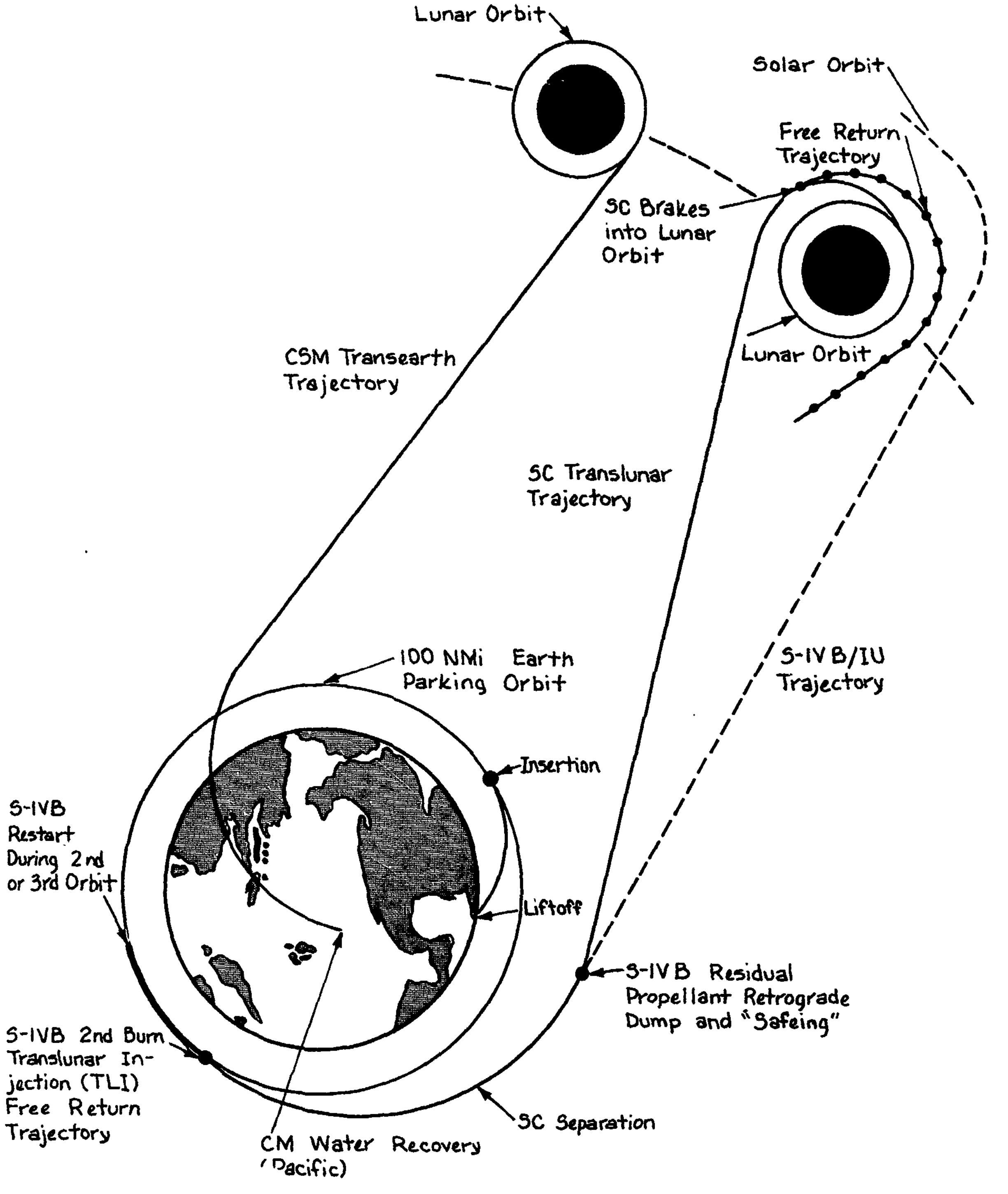

Figure 2

Trajectory Profile
Lunar Orbital Mission

LIST OF FIGURES

LIST OF FIGURES (Continued)

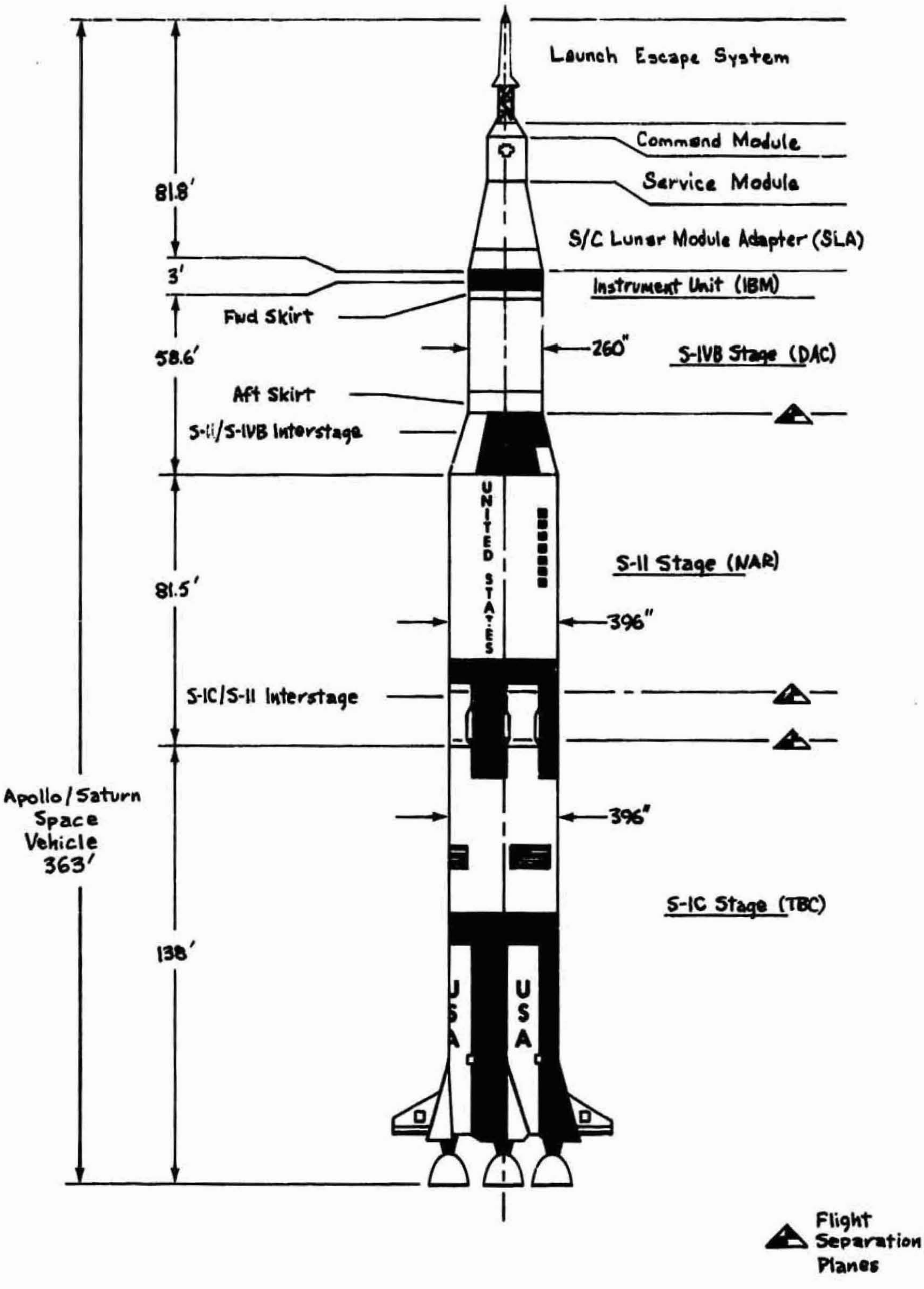

Figure 3

AS-505
Space Vehicle

- Pads "A" and "B" are located ~1500 ft. from the shoreline
- The Verticle Assembly Building (VAB) and The Launch Control Center (LCC) are ~ 3 miles from the Launch Pads

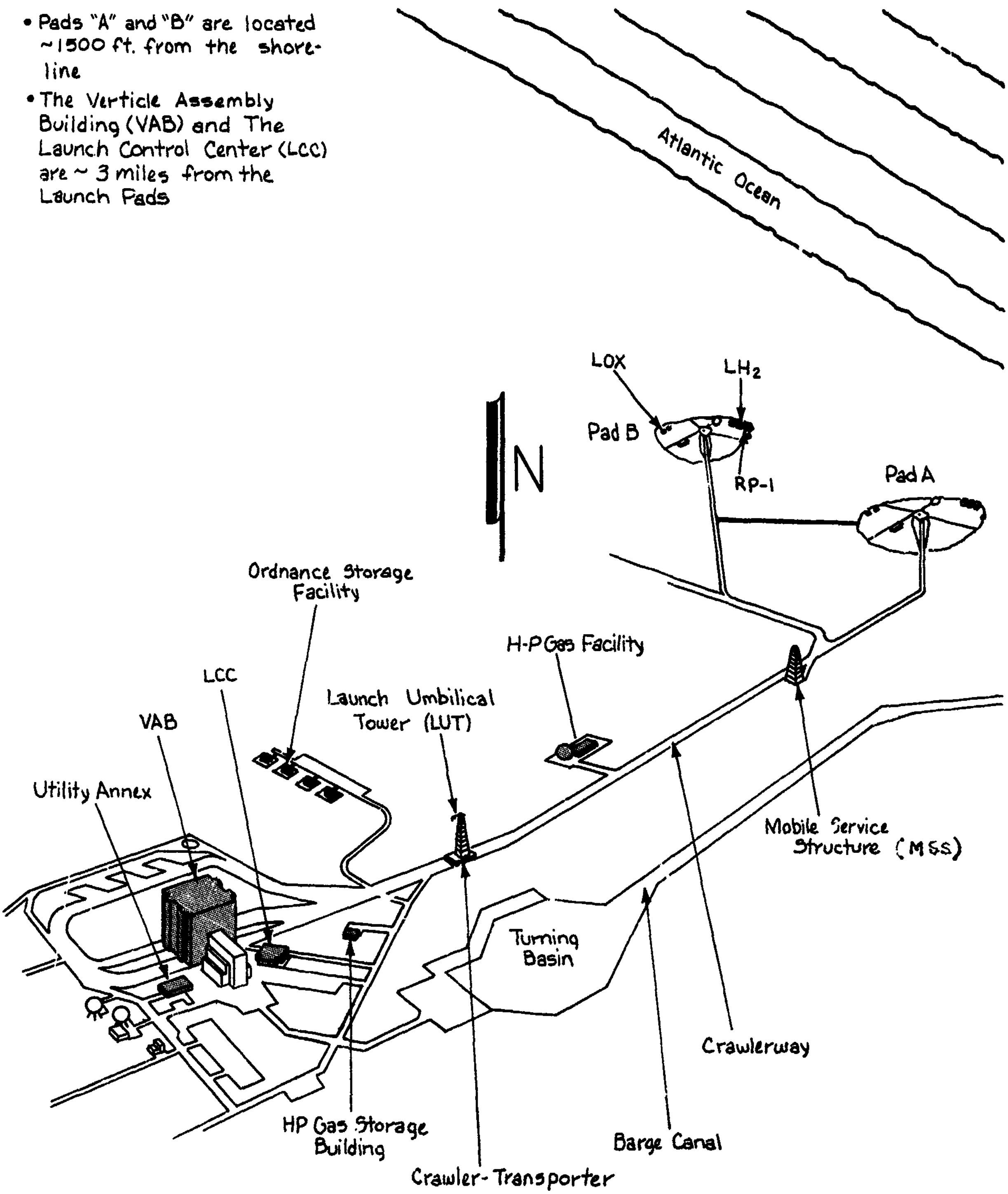

Figure 4

KSC Launch Complex 39

MOBILE LAUNCHER

The Mobile Launcher, figure 5, is a transportable steel structure which provides the capability of moving the erected vehicle to the launch pad via the crawler-transporter. The umbilical tower, permanently erected on the mobile launcher base, is a means of ready access to all important levels of the vehicle during assembly, checkout and servicing prior to launch. The intricate vehicle-to-ground interfaces are established and checked out within the protected environment of the Vertical Assembly Building (VAB) and then moved undisturbed aboard the mobile launcher to the launch pad.

(1) S-IC Intertank (preflight). Provides LOX fill and drain. Arm may be reconnected to vehicle from LCC. Retract time 8 seconds. Reconnect time ~5 minutes.

(2) S-IC Forward (preflight). Provides pneumatic, electrical, and air conditioning interfaces. Retracted at T-16.2 seconds. Retract time 8 seconds.

(3) S-II Aft (preflight). Provides access to vehicle. Retracted prior to liftoff as required.

(4) S-II Intermediate (inflight). Provides LH_2 and LOX transfer, vent line, pneumatic, instrument cooling, electrical, and air-conditioning interface. Retract time 6.4 seconds.

(5) S-II Forward (inflight). Provides GH_2 vent, electrical, and pneumatic interfaces. Retract time 7.4 seconds.

(6) S-IVB Forward (inflight). Provides LH_2 and LOX transfer, electrical, pneumatic, and air-conditioning interfaces. Retract time 7.7 seconds.

(7) S-IVB Forward (inflight). Provides fuel tank vent, electrical, pneumatic, air-conditioning, and preflight conditioning interfaces. Retract time 8.4 seconds.

(8) Service Module (inflight). Provides air-conditioning, vent line, coolant, electrical, and pneumatic interfaces. Retract time 9.0 seconds.

(9) Command Module Access Arm (preflight). Provide Access to spacecraft through environmental chamber. Arm controlled from LCC. Retracted 12° park position until T-4 minutes.

Note:

Preflight arms are retracted and locked against umbilical tower prior to launch.

Inflight arms retract at vehicle liftoff on command from service arm control switches (located in hold-down arms).