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**AS – 205 Instrument Unit  
Model Specification**

**("As Specified" Systems)**

**IBM No. 65-256-0005H**

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**Huntsville Facility  
Space Guidance Center**



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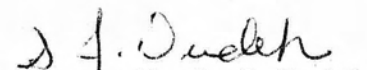
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# LIST OF ABBREVIATIONS

## - A -

AFC	Automatic Frequency Control
APC	Automatic Pulse Control
APS	Auxiliary Propulsion System
ASC	Accelerometer Signal Conditioner
AVP	Address Verification Pulse

## - B -

BTC	Begin Telemetry Cycle
-----	-----------------------

## - C -

C-EDS RG	Control -EDS Rate Gyros
CDL	Contractual Document List
CIU	Computer Interface Unit
COD	Cross-over Detector
CRP	Computer Reset Pulse
CSP	Control Signal Processor

## - D -

DCS	Digital Command System
DIM	Digital Input Multiplexer
DO	Discrete Output
DIM	Discrete Input
DOR	Discrete Output Register

## - E -

EDS	Emergency Detection System
EC	Expected Change
ESE	Environmental Support Equipment
ETC	End of Telemetry Cycle

- F -

FCC	Flight Control Computer
F/M	Thrust/Mass

- G -

GFE	Government Furnished Equipment
GLCC	Ground Launch Control Computer
GRR	Guidance Reference Release
GRRRA	Guidance Reference Release Abort

- I -

IGM	Iterative Guidance Mode
ICR	Internal Control Register
I&T	Instrumentation and Telemetry
INTR	Interrupt
IR	Interrupt Register
IU	Instrument Unit

- L -

LIRO	Load In Readout
LLS	Low Level Sense
LVDA	Launch Vehicle Data Adapter
LVDC	Launch Vehicle Digital Computer

- M -

MA	
MAP	Message Acceptance Pulse
MCC	Mission Control Center
MCP	Management Control Parameter
MF	Medium Frequency
MSFC	Marshall Space Flight Center
MSFN	Manned Space Flight Network

- O -

OECO	Outboard Engine Cutoff
OM/D	Orbit Mode Data Bits
ORBNV	Orbital Navigation Computer Program

- P -

PIO	Process Input Output
PMR	Pacific Missile Range
PSK	Phase Shift Key
PTL	Prepare To Launch

- Q -

QCI	Quality Control Instructions
-----	------------------------------

- R -

RACS	Remote Automatic Calibration System
RTC	Reasonableness Test Constant

- S -

SCO	Subcarrier Oscillator
SSCO	Switch Selector Channel Output
SSR	Switch Selector Register
STO	Stored Memory

- T -

TB0	Time Base Zero
TM1	Transfer Minus One
TMZ	Transfer (LVDC Instruction)
TMR	Triple Modular Redundant
TRA	Unconditional <u>TR</u> ansfer

4BCO	S-IVB Engine Cutoff
------	---------------------

# SECTION 1

## SCOPE

### 1.1 PURPOSE

A model specification for the Instrument Unit (IU) shall be prepared and maintained. The specification shall provide a summary description of the stage, interrelated subsystems, and major elements in detail sufficient to establish that design. Performance, human factors, and reliability are compatible with operational requirements that are established by the procuring activity.

### 1.2 OBJECTIVE

The following are the objectives for the use of the Instrument Unit model specification:

- A. The model specification shall define an IU base line capable of being assessed and evaluated against a particular set of Marshall Space Flight Center mission requirements to determine a compatible IU configuration.
- B. The model specification shall define the design configuration base lines of the IU to be delivered.
- C. The model specification shall define the plans and procedures for the implementation (manufacture, quality assurance, and support) of the IU design.
- D. The model specification shall delineate system criteria essential to generation of an IU test specification.
- E. This specification shall establish a means of IBM/MSFC configuration control (including changes) and product improvement.
- F. The model specification shall describe known configuration compliance to those factors referred to as "design considerations" in MSFC document CD-214-506, Revision A, dated: 1 October 1964.

### 1.3 AUTHORITY

The authority for this specification is as defined by the Marshall Space Flight Center (MSFC) under contract NAS8-14000. The basic requirement for a model specification is defined in MSFC-STD-263A, dated 18 December 1963, entitled "Data Submittal", Section 5.1.1.

#### 1.4 PERFORMANCE

The systems performance data generated herein is the product of studies and analyses performed by the Federal Systems Division of the International Business Machines Corporation under MSFC contract NAS8-14000. These data are based on accumulated MSFC or IBM Instrument Unit component procurement specifications and/or all other available performance information of decreasing authority transmitted under contract NAS8-14000. All data on Government Furnished Equipment (GFE) has been furnished by MSFC. At specific parametric data points, reference has been made to "systems engineering" documentation generated in the analysis of MSFC data. A complete bibliography of such supporting documents is contained in Section 9.

## SECTION 2

### APPLICABLE DOCUMENTS

#### 2.1 SPECIFICATIONS, STANDARDS, AND PROCESSES

The specifications, standards, and processes listed in the IBM Contractual Document List (CDL) are the applicable documents required to define the engineering end item requirements of the Instrument Unit.

The CDL for Instrument Unit, Apollo-Saturn 205 (AS-205) shall be IBM document number 65-237 \_\_\_\_\_H.

The CDL shall list the specification exceptions approved against the individual applicable document. These documents, of the listed revision or issue date, form a part of this specification to the extent specified in this specification. If there is conflict between reference documents and the content of this specification, the content of this specification shall take precedence.

## SECTION 3 CONFIGURATION

### 3.1 STAGE FUNCTION

The Saturn IB is a multistage booster vehicle used in performing scientific space missions. The Instrument Unit is a nonpropulsive instrumentation stage of the Saturn IB. The Instrument Unit for the AS-205 mission is herein related to the remainder of the AS-205 vehicle.

The Instrument Unit for the Saturn IB vehicle may be considered as the third stage of a four-stage vehicle consisting of the following:

- A. S-IB lower stage booster
- B. S-IVB second stage
- C. Instrument Unit
- D. Spacecraft or payload

Figure 3.1-1 shows the Saturn IB configuration with stations and dimensions indicated. Figure 3.1-2 shows the Instrument Unit's physical location in the Saturn IB vehicle.

### 3.2 GENERAL DESCRIPTION

The Instrument Unit for the Saturn IB vehicle shall be a distinct section capable of being assembled to the other sections of the vehicle at specific field splices. The Instrument Unit contains the equipment necessary to perform guidance and control of the overall boost vehicle, vehicle instrumentation necessary for performance and evaluation, radar tracking aids and command guidance functions. An Environmental Control System, an Electrical System, and a Structural System shall be provided as support equipment.

### 3.3 EXTERNAL CONFIGURATION

The Instrument Unit structure shall be capable of being mated, by field splice, to the S-IVB Stage and the Apollo adapter. Vehicle structural loads between the Apollo spacecraft and the S-IVB stage shall be transmitted by the Instrument Unit.

All external interface connections to prelaunch equipments shall be made through separable umbilical connections. All connections to the Apollo Spacecraft and the S-IVB stages shall be permanent at the Instrumental Unit interface.



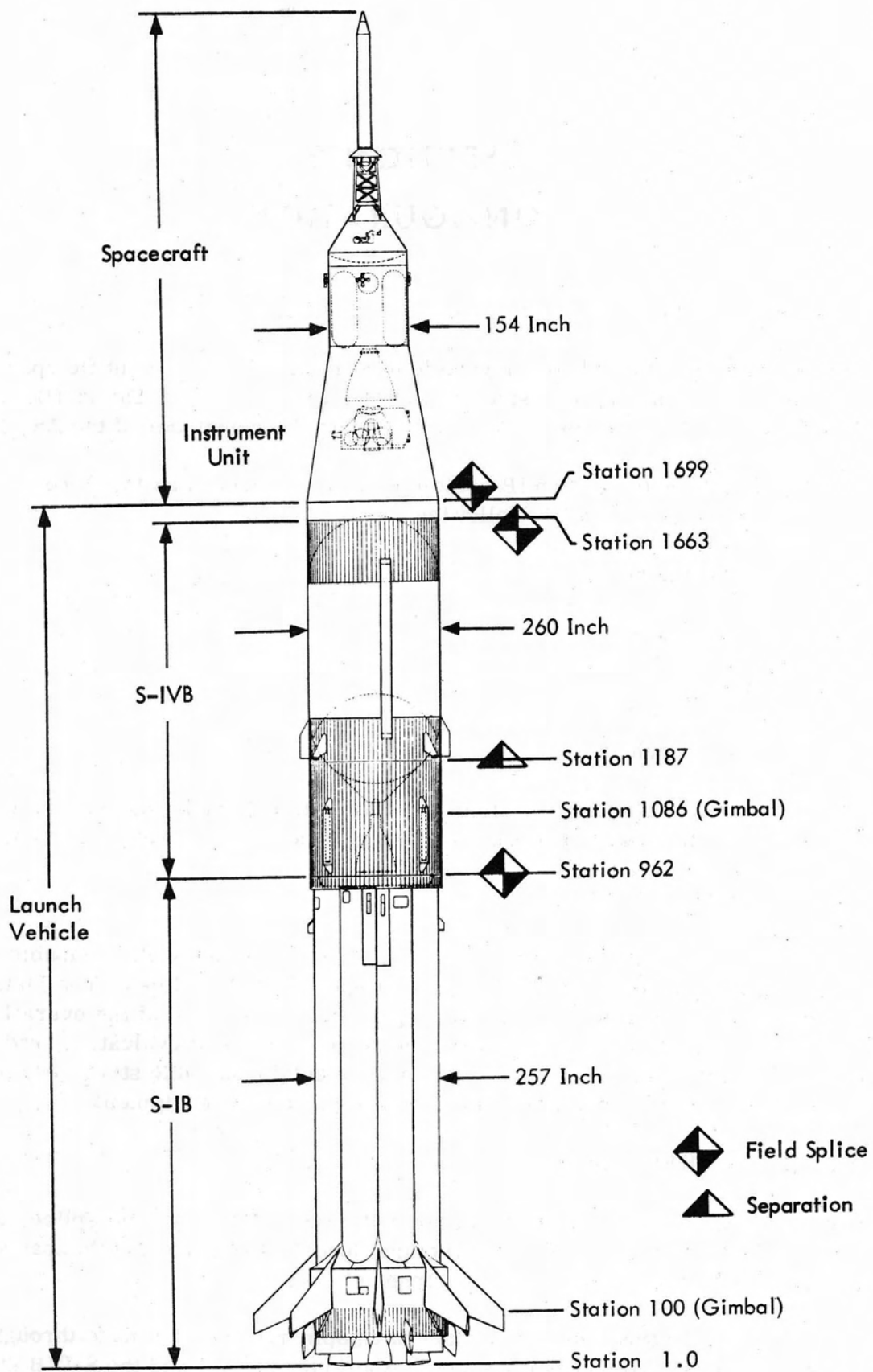


Figure 3.1-1 Saturn IB Configuration

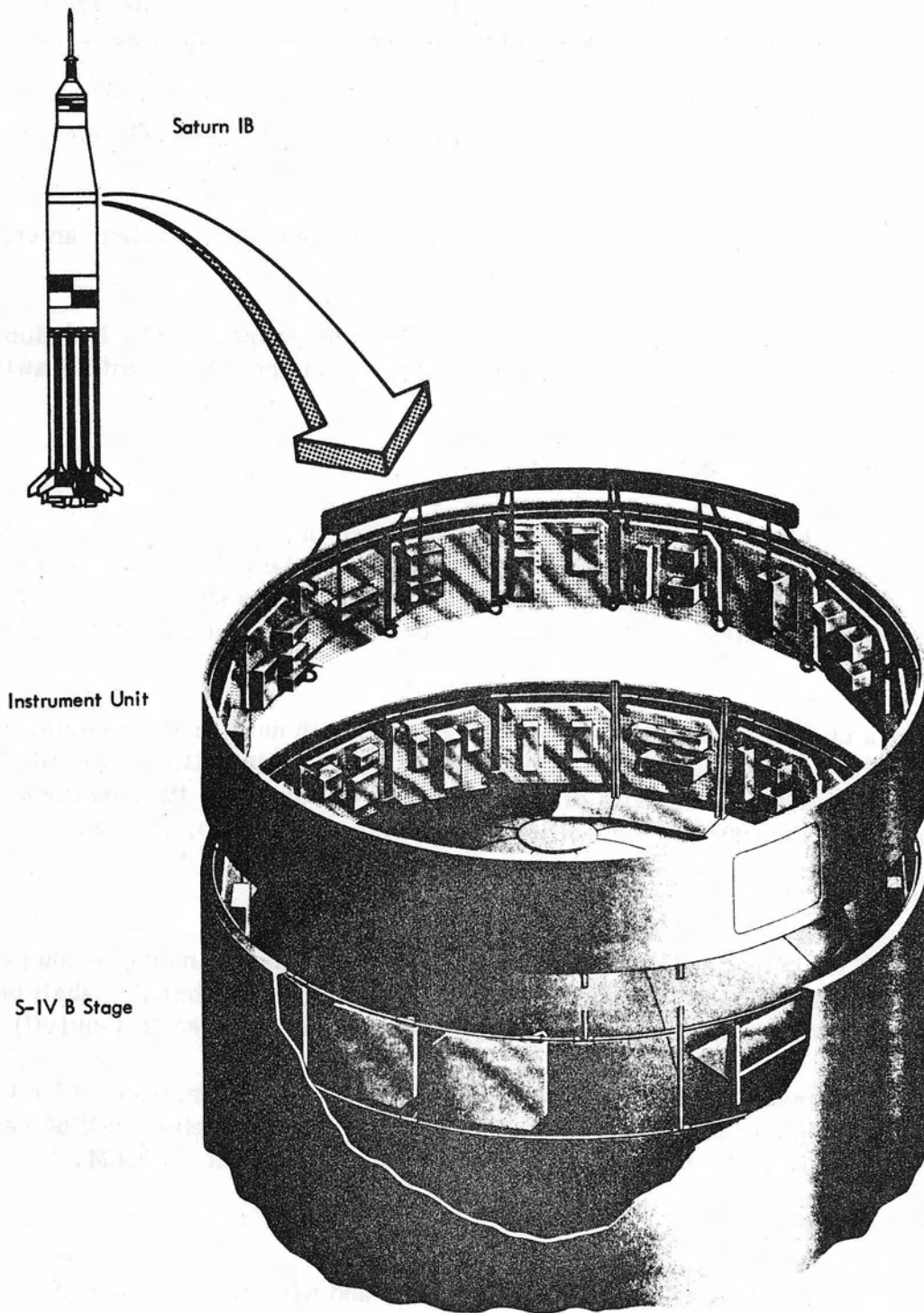


Figure 3.1-2 Instrument Units Physical Location

When the vehicle has been assembled, access to internal systems of the Instrument Unit shall be provided through a skin access door. The external profile of the Instrument Unit shall be as shown in Figures 3.3-1 and 3.3-2. The Instrument Unit shall be of cylindrical shape, 260 inches in diameter and 36 inches in mated height and will be located between stations 1663 and 1699 of the vehicle, whose overall height is approximately 2720 inches as shown in Figure 3.1-1.

The profile height of the Instrument Unit shall be increased by 12.5 inches when the cable tray assemblies are installed.

The profile diameter of the Instrument Unit shall be increased by the various antennae mounted on the exterior of the Instrument Unit.

The external surface of the AS-205 Instrument Unit shall be painted black. Position numbers, fin locations, decks, and other identification data shall be in accordance with drawing 30Z13100; Instrument Unit Assembly.

### 3.4 INTERNAL CONFIGURATION

The internal configuration of the Instrument Unit is shown in Figure 3.4-1. The figure shows the equipment shall be mounted around the inside surface of the cylinder where the arc-segments are drawn in flat projection. Orientation of equipments shall be such as to maximize function, minimize interference characteristics, and distribute weight and thermal dissipation loads.

Internal surfaces of the Instrument Unit shall be painted with number 625 aluminum (Thermocote) color in accordance with MSFC, ASTR.: Guide Lines Brief Vol. III, No. 3A, in order to reduce surface emissivity of components to 0.4 or less. Preparations and procedures for applying the finish are specified in IBM Specification No. 7907352.

### 3.5 MASS CHARACTERISTICS

The dry weight of the fully configured S-IU-205 shall be no more than  $3657 \pm 100$  pounds. Charged weight shall be  $3931 \pm 100$  pounds. The actual weights and balance shall be reported in accordance with MSFC Document No. III-4-413-13, (IBM-65-214-0010H).

Disposition of the mass of the instrumentation contained within the Instrument Unit shall be around the inner periphery of the cylinder. The open area in the center shall be capable of accommodating the top of the S-IVB hydrogen dome, and the legs of the LEM.

### 3.6 INTERFACE CONTROL

Mechanical integration of the S-IU-205 with the S-IVB and with Apollo payloads is controlled by interface control documents 13M20507 and 13M20508 for the S-IB vehicle.

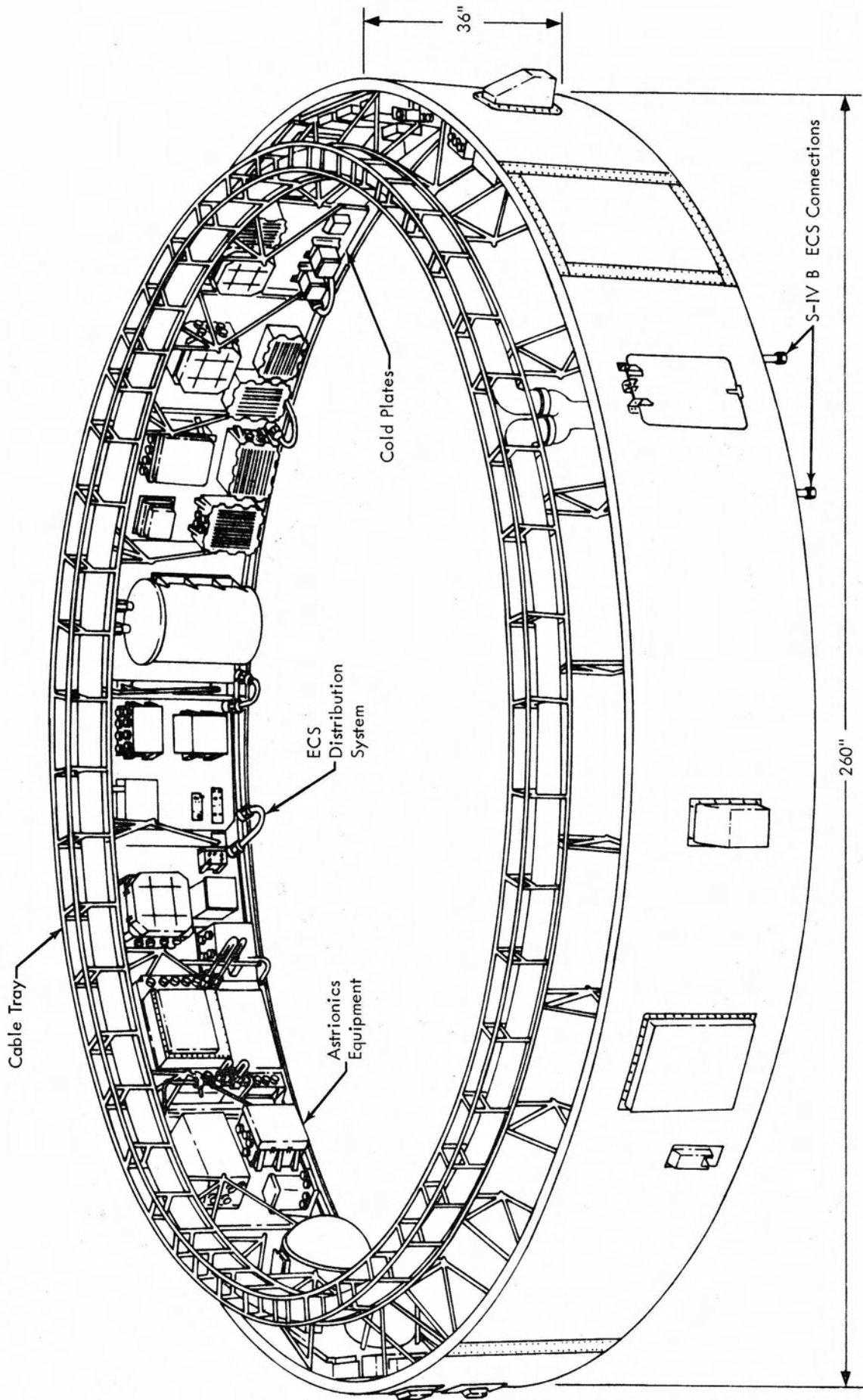
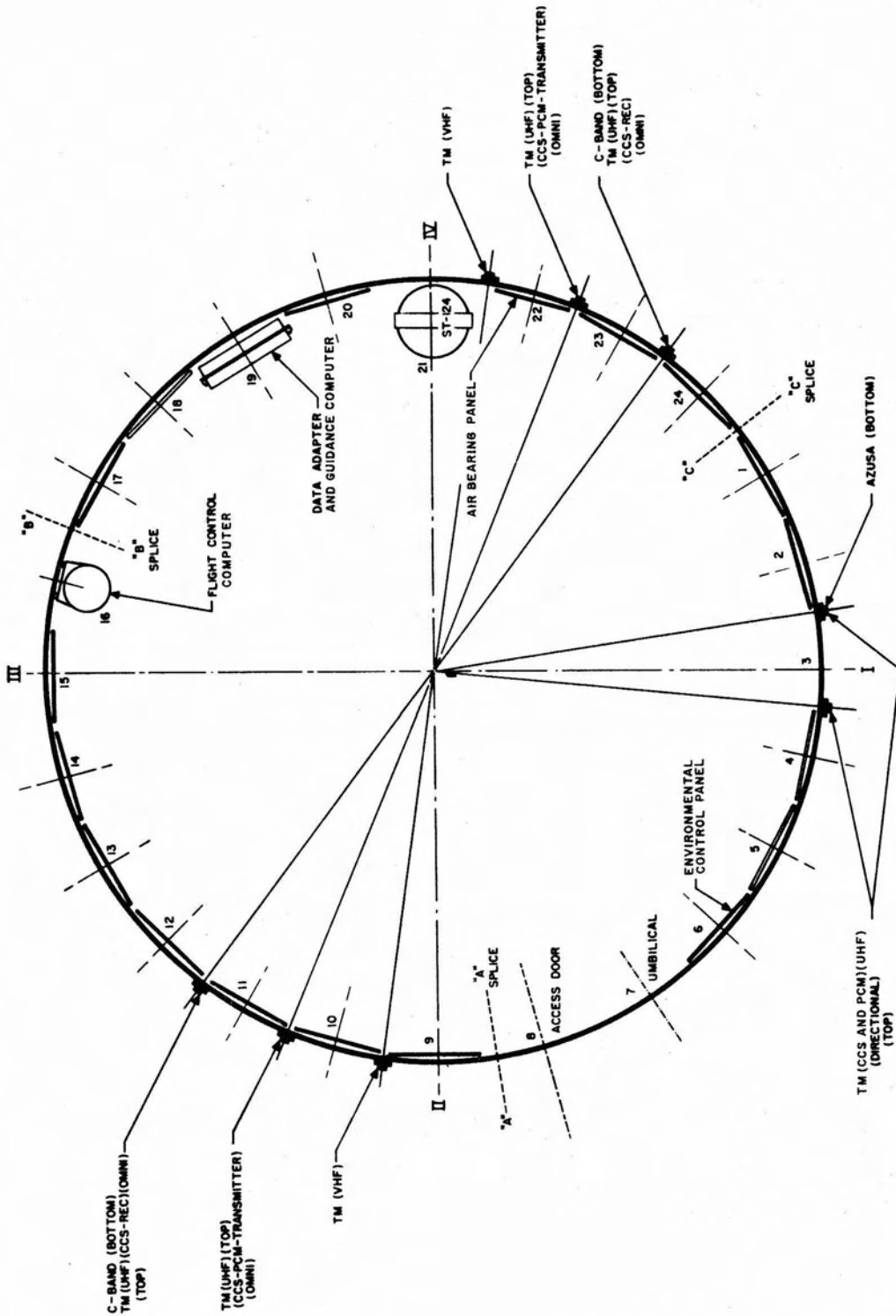


Figure 3.3-1 Saturn IB/V Instrument Unit



**NOTES:**

1. ALL ANTENNAS SUBJECT TO CHANGE IN ORIENTATION AND ANTENNA TYPES DUE TO REQUIREMENTS ESTABLISHED BY THE VEHICLE TRAJECTORIES AND MISSION REQUIREMENTS.

Figure 3.3-2 Saturn IB Instrument Unit Equipment Layout

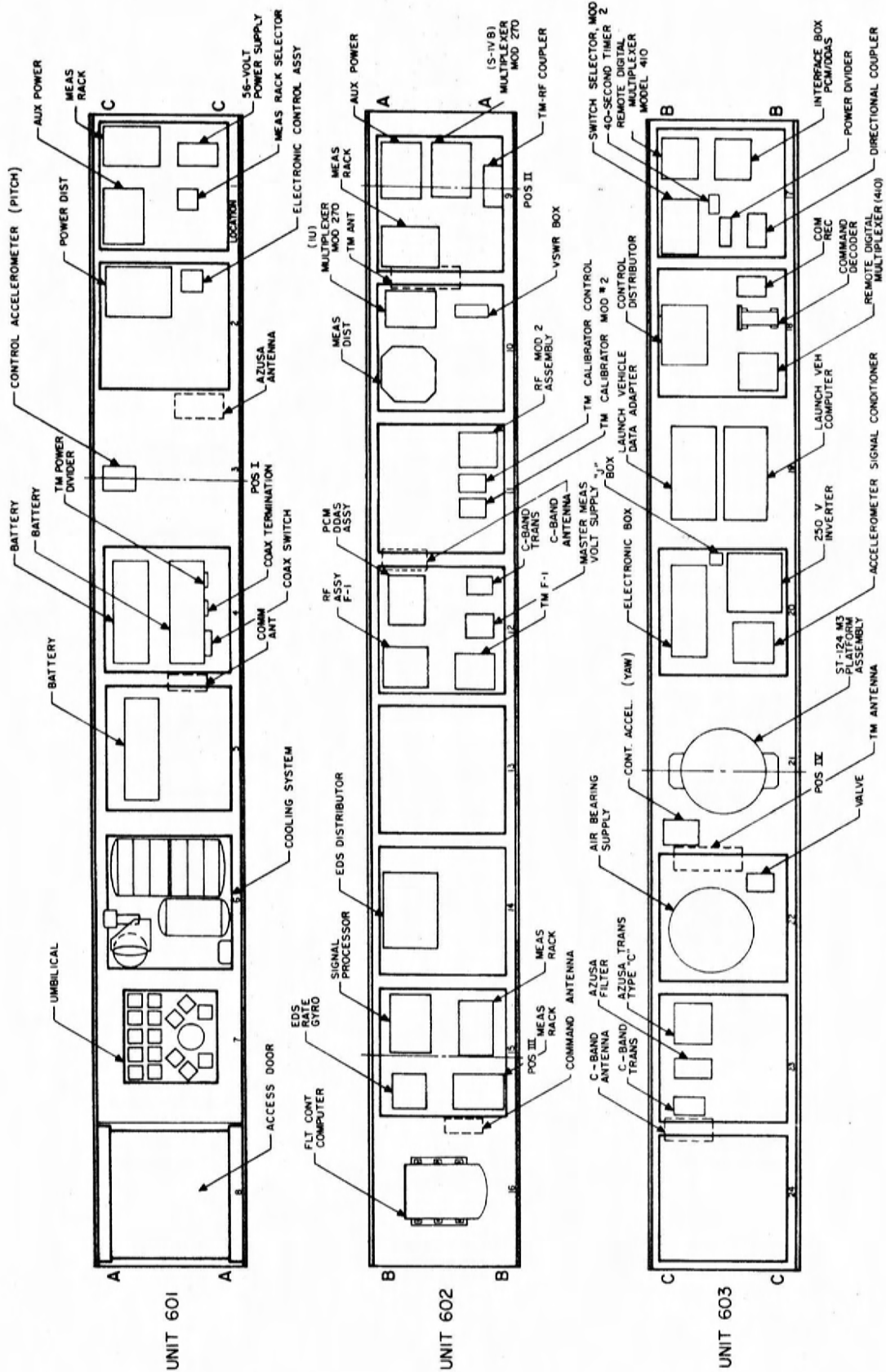


Figure 3.4-1 Saturn IB Instrument Unit Internal Configuration

Electrical interfaces are described in the sections pertaining to those specific functions. In addition, the following interface control drawings shall apply:

INTERFACE CONTROL DOCUMENTS (S-IU-205)

40M30695	Definition of Saturn IB Vehicle S-IVB/IV Electrical Interface
40M35007	Definition of Saturn IB Vehicle IV/ESE Electrical Interface

Instrument Unit to Launch GSE

13M20505	Physical Requirements
13M06465	Functional Requirements
13M04465	Environmental Requirements
13M02465	Procedural Requirements
13M00465	Human Factors Requirements

S-IVB to Instrument Unit

13M20507	Physical Requirements
13M06467	Functional Requirements
13M04467	Environmental Requirements
13M02467	Procedural Requirements
13M00467	Human Factors Requirements

Instrument Unit to Spacecraft

13M20508	Physical Requirements
13M06468	Functional Requirements
13M04468	Environmental Requirements
13M02468	Procedural Requirements
13M00468	Human Factors Requirements
13M20517	Envelope LEM/S-IVB/IV Clearance
40M37509	Definition of Saturn SA-205 and Apollo SC-014 Electrical Interface