

# REENTRY

AN ORBITAL SIMULATOR



MERCURY CONTROL CENTER  
USER MANUAL

# REENTRY

AN ORBITAL SIMULATOR  
USER MANUAL

DRAFT

UPDATED: 11/06/2020

# TABLE OF CONTENTS

MERCURY CONTROL CENTER.....	0
I. INTRODUCTION .....	5
1. ABOUT.....	6
II. INSTALLATION.....	8
1. DOWNLOADING .....	9
2. SYSTEM REQUIREMENTS .....	9
III. ASTRONAUT.....	11
1. INFORMATION FOR THE ASTRONAUT .....	12
1.1 CONNECTION.....	12
1.2 COMMUNICATING WITH MISSION CONTROL.....	12
IV. MISSION CONTROLLER.....	15
1. INFORMATION FOR THE MISSION CONTROLLER.....	16
1.1 FINDING GAMES.....	16
1.2 CONNECTING .....	16
1.3 YOUR FIRST STEPS .....	17
2. INTERCOM AND RADIO-MESSAGES .....	20
3. Controls .....	21
4. Views.....	21
STATION VIEWS.....	21
ORBIT VIEW.....	21
FPS VIEW .....	21
THE SIMULATOR.....	22
5. MISSION PAD.....	22
V. THE FLIGHT DIRECTOR.....	23
1. GENERAL .....	24
1.1 THE DESK.....	24
1.2 OPERATION .....	25
VI. THE CAPSULE COMMUNICATOR.....	27
1. GENERAL .....	28

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

1.1 THE DESK.....	28
1.2 OPERATION.....	28
1.3 DIAGRAMS.....	29
VII. THE SPACECRAFT SYSTEMS MONITOR .....	36
1. GENERAL .....	37
1.1 THE DESK.....	37
1.2 OPERATION.....	37
1.3 DIAGRAMS AND SCHEMATICS.....	42
VIII. THE SPACECRAFT ENVIRONMENT MONITOR .....	50
1. GENERAL .....	51
1.1 THE DESK.....	51
1.2 OPERATION.....	51
1.3 DIAGRAMS AND SCHEMATICS.....	53
IX. THE FLIGHT DYNAMICS OFFICER .....	58
1. GENERAL .....	59
1.1 THE DESK.....	59
1.2 OPERATION.....	59
1.3 DIAGRAMS AND SCHEMATICS.....	60
1.4 ORBITAL ELEMENTS .....	61
X. THE RETROFIRE CONTROLLER .....	68
1. GENERAL .....	69
1.1 THE DESK.....	69
1.2 OPERATION.....	69
1.3 DIAGRAMS AND SCHEMATICS.....	70
XI. THE NETWORK STATUS MONITOR.....	73
1. GENERAL .....	74
1.1 THE DESK.....	74
1.2 OPERATION .....	74
XII. THE MISSILE TELEMETRY MONITOR .....	75
1. GENERAL .....	76
1.1 THE DESK.....	76
1.2 OPERATION .....	76
XIII. THE RECOVERY STATUS MONITOR.....	78

# MERCURY CONTROL CENTER

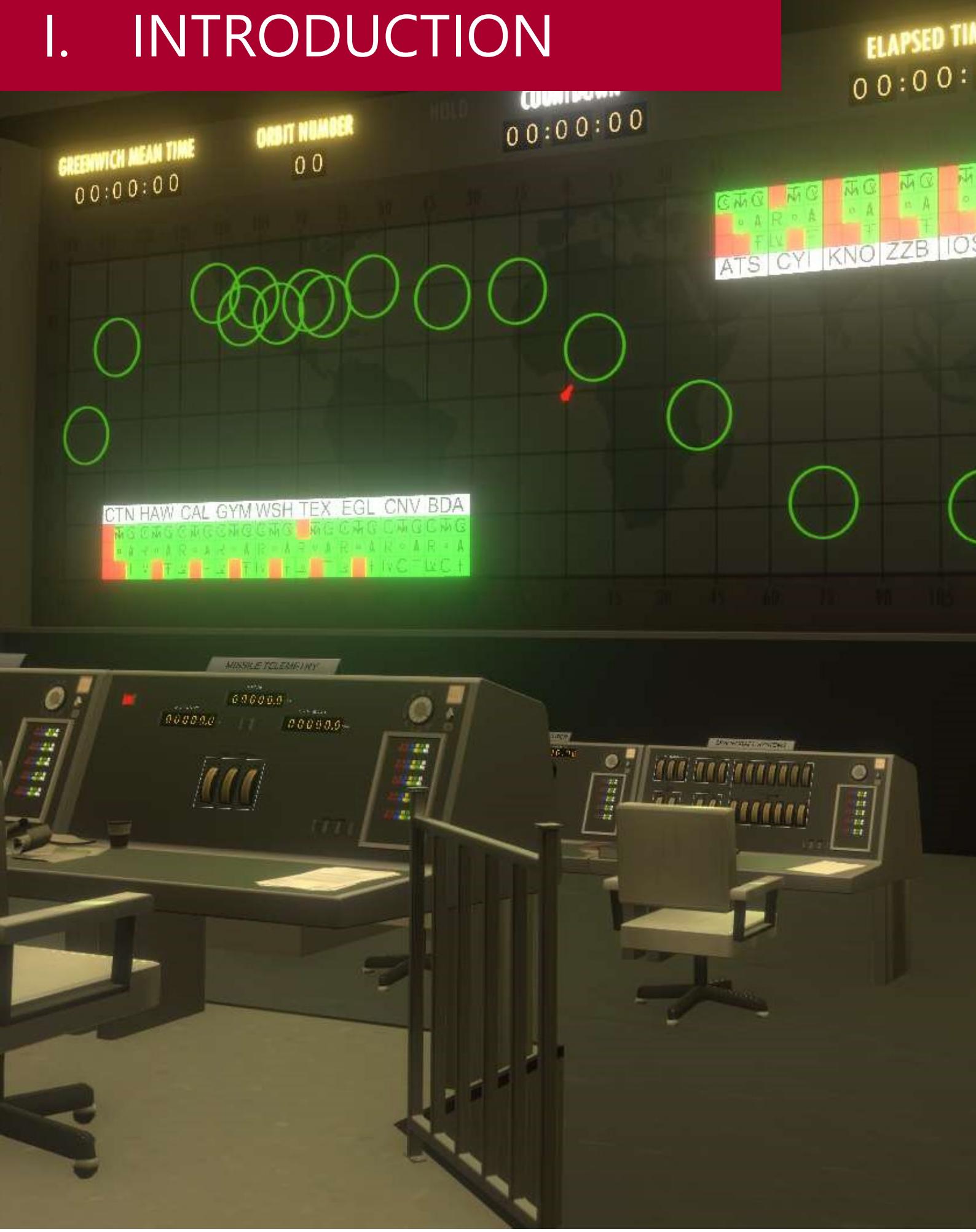
USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

1. GENERAL .....	79
1.1 THE DESK.....	79
1.2 OPERATION .....	79

# I. INTRODUCTION



## I. INTRODUCTION

### 1. ABOUT

Thank you for buying REENTRY – An Orbital Simulator!

REENTRY – An Orbital Simulator is an educational game/simulator that allows you to fly and operate spacecrafts in a realistic manner. The available spacecrafts have been programmed using the real manuals provided by NASA, with some modifications and simplifications made to allow this to be an enjoyable experience.

Please note that the game is in its early phase of development and might crash or malfunction at any time. I am working hard to fix bugs, and if you encounter an error, I highly suggest you report the bug on Steam or our Discord.

The Mercury Control Center Live is in Early Testing comes with the base installation packages and might be removed from the game at any time.

### LEGAL AND EULA

The assets in Reentry resembles properties created by NASA. By downloading and/or using Reentry – An Orbital Simulator, you agree to the EULA located here:

[https://store.steampowered.com/eula/882140\\_eula\\_0](https://store.steampowered.com/eula/882140_eula_0)

### DOWNLOAD

The game can be downloaded from <http://reentrygame.com/> - the game package comes with the Mercury, Gemini and Apollo spacecrafts.

### JOIN THE COMMUNITY – CONTRIBUTING

Use the Community Hub to discuss the game, as well as talk with the community, get help and give feedback to the developer.

The community hub for REENTRY can be found here:

<https://steamcommunity.com/app/882140/>

An official Discord server can be found here:

<https://discord.gg/reentrygame>

The reddit subreddit can be found here:

<https://www.reddit.com/r/reentrygame/>

Tools and content files can be found here:

<https://github.com/ReentryGame>

### WHAT IS THIS MANUAL?

This manual contains most of the information you need to understand how the Mercury Mission Control module for Reentry works. This manual covers the Mission Control multiplayer module for the Mercury Control Center, how you play and general tips on how you can make a session as realistic as possible.

### CREDITS

This manual is mostly written by Martin Sundhaug, with some additional content and modifications by Petri Wilhelmsen. You can find the latest iterations here:

<https://github.com/sundhaug92/mcc-manual>

## II. INSTALLATION



## II. INSTALLATION

### 1. DOWNLOADING

REENTRY is distributed through Steam on the following link:

[https://store.steampowered.com/app/882140/Reentry\\_An\\_Orbital\\_Simulator/](https://store.steampowered.com/app/882140/Reentry_An_Orbital_Simulator/)

You will need to purchase the game to start the download, and to play it.

### 2. SYSTEM REQUIREMENTS

The system requirements can be seen on the Steam page for Reentry, and will have the latest known system requirements. It is not guaranteed that the game will run on your system, even if you meet the requirements. For the latest requirements, always check the Steam page.

#### MINIMUM

Requires a 64-bit processor and operating system

OS: 64-bit Windows 7, Windows 8.1, Windows 10

Processor: Intel Core i5-4430 / AMD FX-6300

Memory: 8 GB RAM

Graphics: NVIDIA GeForce GTX 960 2GB / AMD Radeon R7 370 2GB

DirectX: Version 11

Storage: 10 GB available space

#### RECOMMENDED

Requires a 64-bit processor and operating system

OS: 64-bit Windows 7, Windows 8.1, Windows 10

Processor: Intel Core i5-6600K / AMD Ryzen 5 1600

Memory: 32 GB RAM

Graphics: NVIDIA GeForce GTX 1060 3GB / AMD Radeon RX 580 4GB

DirectX: Version 11

Storage: 10 GB available space

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

A N   O R B I T A L   S I M U L A T O R



### III. ASTRONAUT

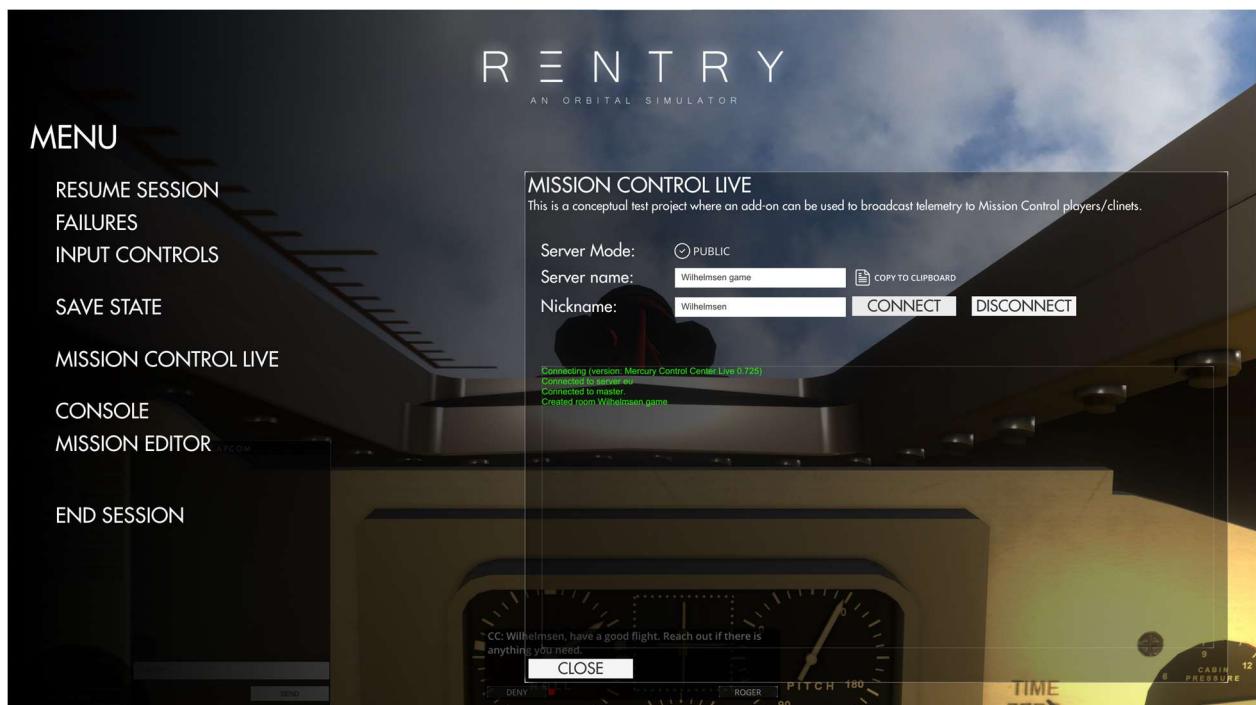
## III. ASTRONAUT

### 1. INFORMATION FOR THE ASTRONAUT

#### 1.1 CONNECTION

Upon entering the capsule, press Escape to open the in-game menu, then press Mission Control Live. This opens the server creation menu. Every Mercury Control Center live sessions needs the astronaut to be the host. If the astronaut disconnects, the session will end.

From this menu, you can set the server mode to be either public or private. Public games need a server name. Private games will generate an invite code that can be copied to the clipboard and shared with those you wish to invite to your session. You can optionally change your name. To create the server, verify the data then press CONNECT. When the log says "room created" you are good to go, and others can join your session. You can close the menu.



#### 1.2 COMMUNICATING WITH MISSION CONTROL

# MERCURY CONTROL CENTER

## USER MANUAL

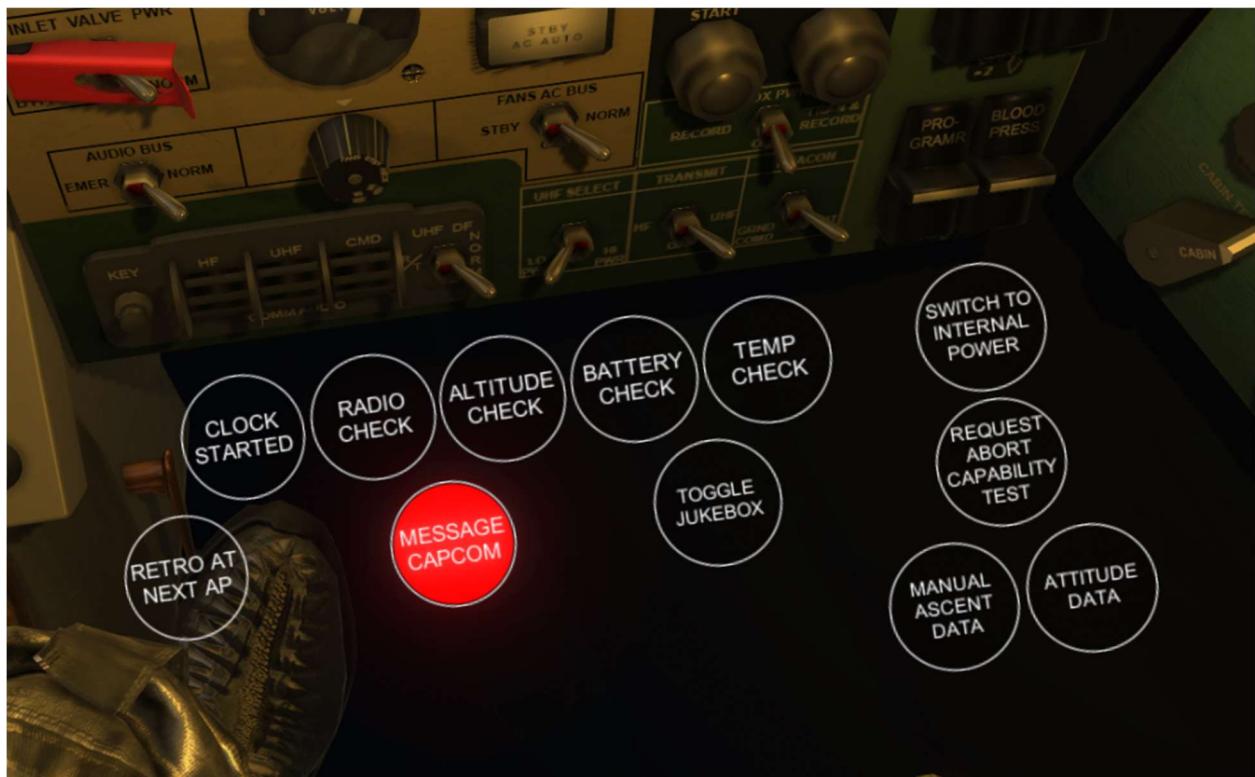
R E N T R Y

AN ORBITAL SIMULATOR

Messages from the Mission Controllers/Capsule Communicator are received in the same manner as the normal offline AI mission control messages you are used to.



A dedicated CapCom interface exists where you can see the chat history, and replay to messages from MCC using text. You can access it using the circle menu below the panel.



If you click this, the CapCom interface opens in a new window that can be moved around. This view also includes the message log. If you wish to remove the normal mission message command UI (the one with ROGER) and know you won't be needing it, feel free to move it out of the screen.

To send a message to CapCom, enter the message into the textbox and press SEND. You can optionally bind the send button in the INPUT MAPPER.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

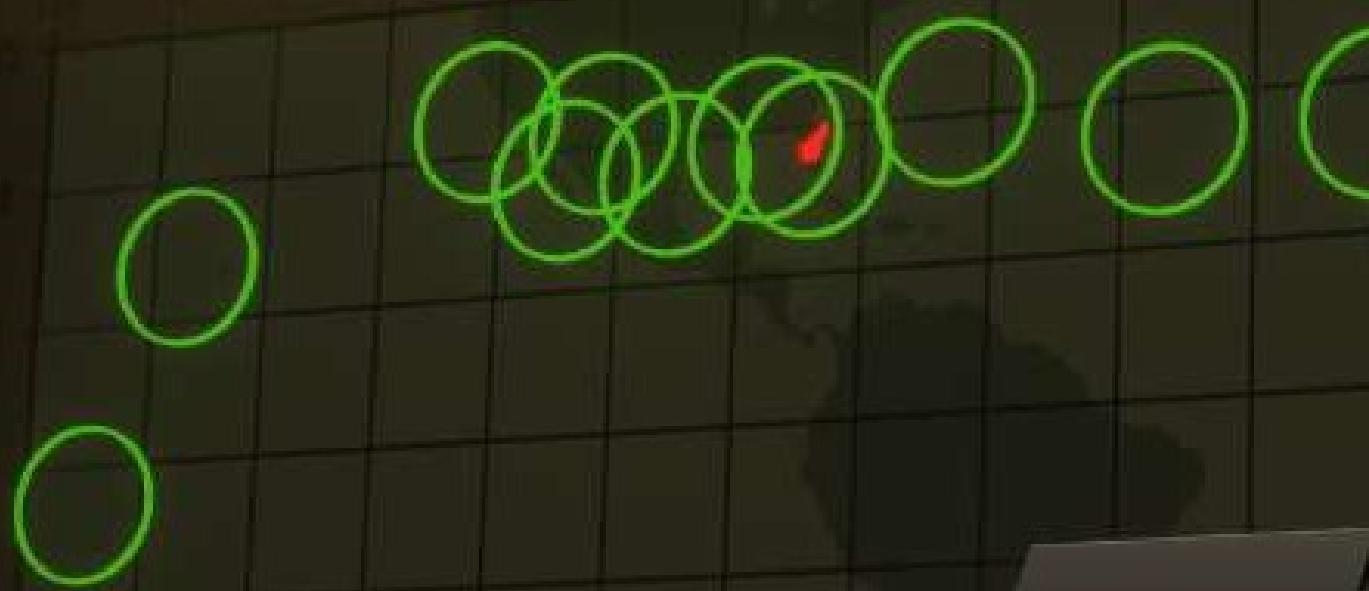
AN ORBITAL SIMULATOR



When the message is sent, it will be directed through the on-board radio system, through the antennas and reach the Mercury Control Centers CapCom Intercom. Those mission controllers who are listening to the astronaut/capcom intercom will receive your message. Because of this, you should aim to only talk directly to the CapCom mission controller and let this person deal with the teamwork down on Earth.

# IV. MISSION CONTROLLER

14:03:10



# IV. MISSION CONTROLLER

## 1. INFORMATION FOR THE MISSION CONTROLLER

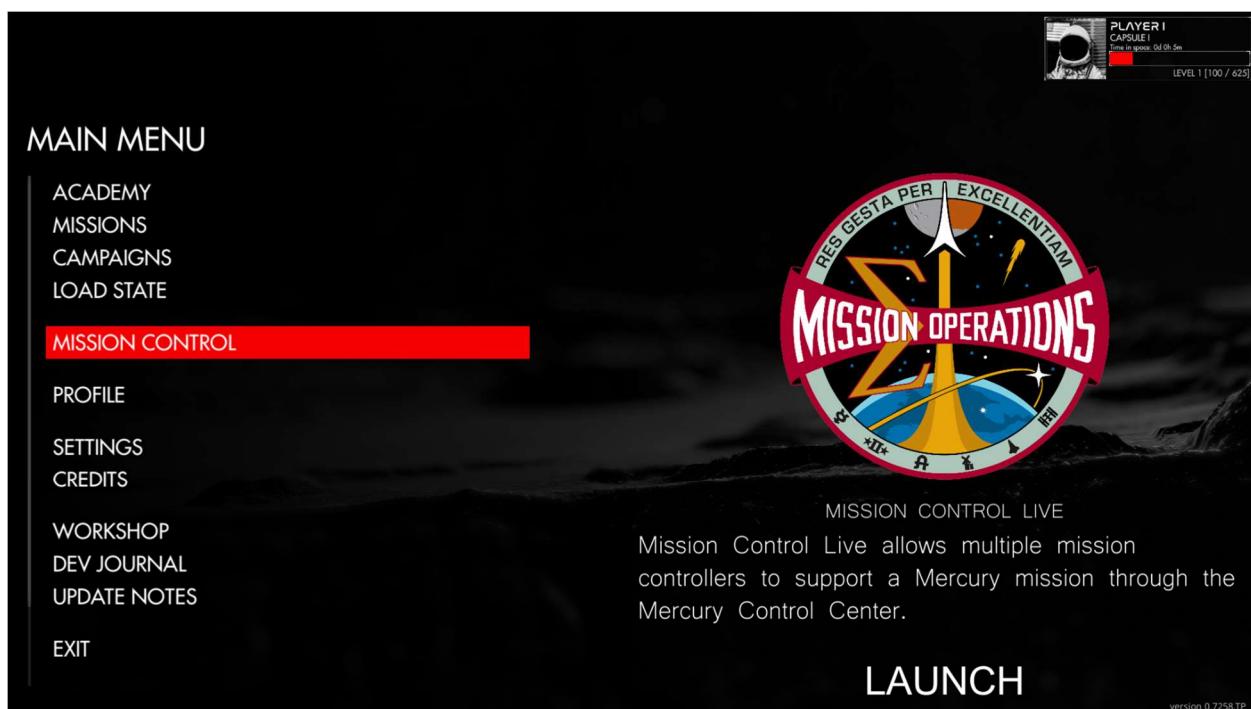
### 1.1 FINDING GAMES

Some games might be public, or you might have some friends who are hosting a session. But what if none of the above is available?

The Official Reentry Discord server ( <http://discord.gg/reentrygame> ) has both voice channels set up for this, and Ifg (looking for group) systems to aid you in setting up a session with members of the community. In addition, we host the Mission Control Academy there, where real players take you through the basics in a relaxed atmosphere.

### 1.2 CONNECTING

To join a Mission Control session, you need to select MISSION CONTROL from the Main Menu, then press LAUNCH.



The first thing you will see is a list of public games, and a way to join private games. To join a public or private game, the astronaut will need to create the server (so the telemetry gets broadcasted). It will then appear in the list of public games it the

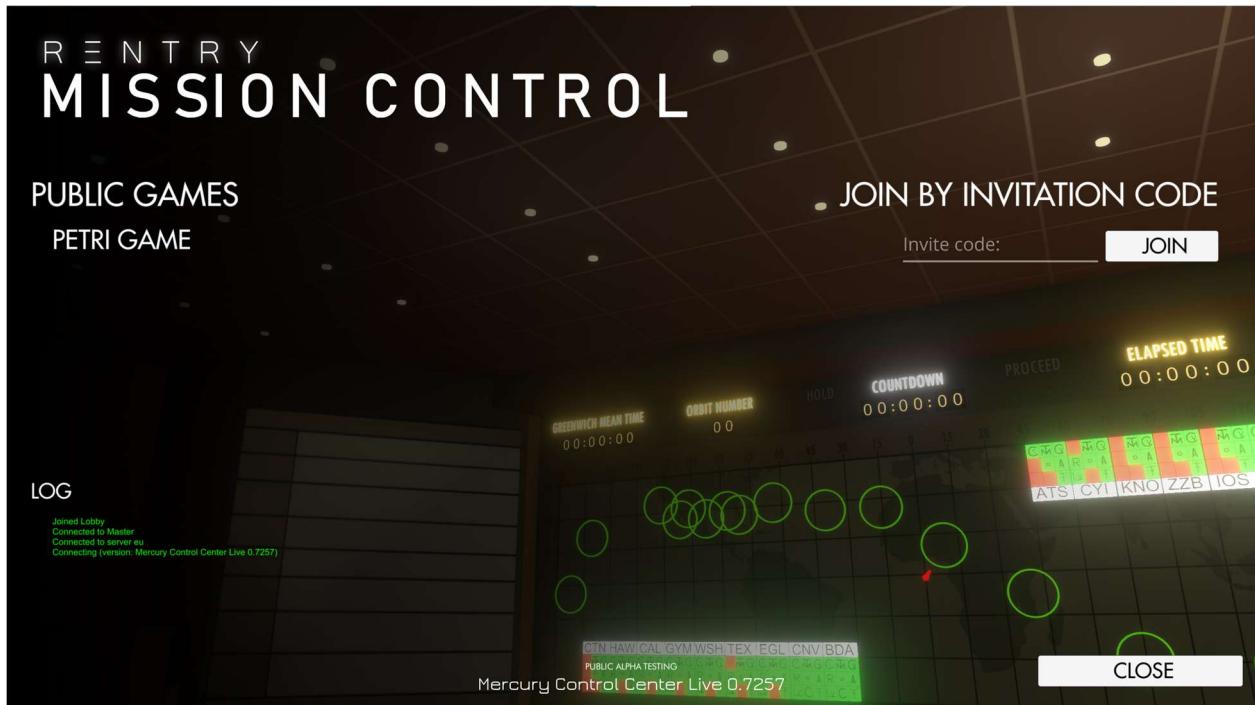
# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

server is set to public. If the game is private, the astronaut will need to share the invite code with you. The code is then used to join the private game.



## 1.3 YOUR FIRST STEPS

When you enter, you will be looking at the capsule communicator position in "walk mode". This allows you to walk around in the room using WASD and mouse input. Use the View Selector (be default bound to V) to select the CAPCOM station.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

The camera should place you in front of the CAPSULE COMMUNICATOR desk, and the view should be similar to this:



You can look and move around using the normal virtual cockpit camera controls.

First, in the seat assignment table (white rectangle in the image above), you'll see your sign. Whenever you're in a seat, the sign will tell you which seat you're in. Additionally, a UI window in the upper left corner of the screen (the seat overview) will show your position and it will show up in the chat when submitting a message to an intercom. Everyone in Mission Control can see both your seat in the seat overview and on your chat messages.

Second, in the green rectangle, you'll see your status-indicator. This is how you indicate to the flight-controller if you're ready to proceed or not. By default, none of the buttons will be lit. Pressing an unlit button changes the status of the seat. Pressing a lit button turns off the status-report, which can be used to indicate that the seat is vacant. It's recommended that a crewed station is set to amber (yellow, center) outside of GO/NOGO-calls. If you need to leave the seat, set it to none so flight can see this.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR



During critical maneuvers or mission phases, this is used during GO/GOGO calls. If something isn't GO on your station, change it to red and call out reason in chat (more on that later). These are the recommended patterns, but the rules FLIGHT set for the mission can change from one to another.

Most things are unique to each station. One of these things is the mission state indicator (red rectangle). This is the sequencer and is used to tell you where in the mission you are. This is a fully automatic device controlled by inputs from the space craft.

The purple rectangle shows you the current Mission Elapsed Time (MET) and Greenwich Mean Time (GMT). MET shows you how long it is since the launch.

The buttons in the blue rectangle is used to select camera for the screen in the yellow rectangle. This is used to watch the launch.

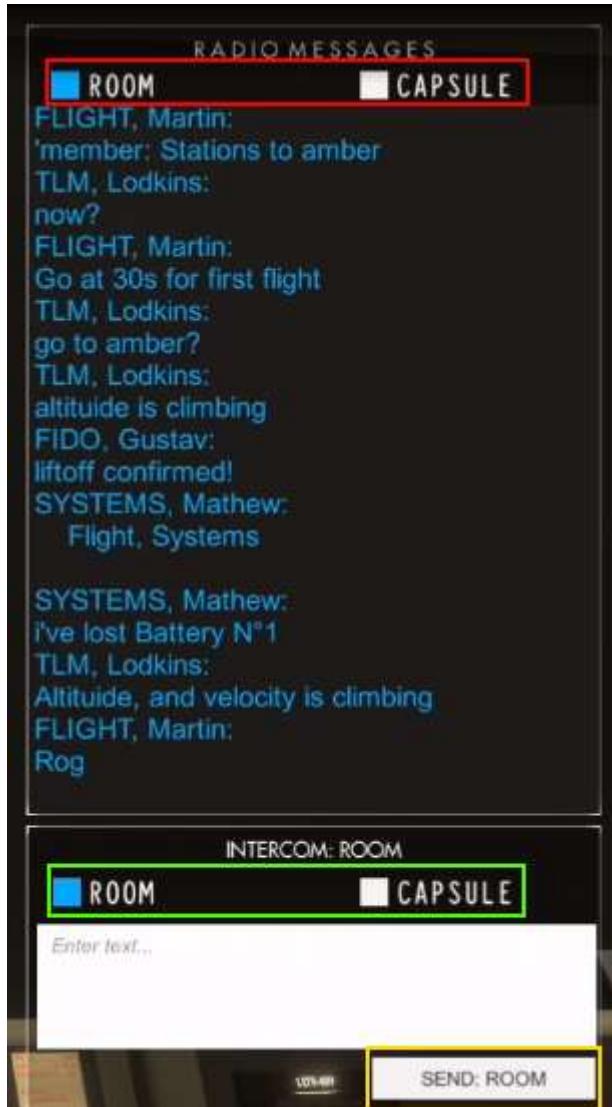
If you look around, you may see the avatars of others. Above the avatars, you'll see their usernames. If you're overlapping with someone, you'll not see them. You can customize your avatar in the profile-part of the game settings-menu.

It's recommended that the first person to enter MCC temporarily switches to the Flight Director-position to temporarily halt the countdown. See [Flight Director](#) to see how.

The seat overview shows everyone in the session, and their role. The astronaut is highlighted in red, while your team members on ground are in white.

Serpatron	ASTRO
Martin	FLIGHT
Lodkins	TLM
Jacob van Beek	CAPCOM
Gustav	FIDO
Mathew	SYSTEMS
Wilhelmsen	RETRO

## 2. INTERCOM AND RADIO-MESSAGES



If you do not have the intercom and radio-messages open, press C. The buttons in the red rectangle allow you to select which intercom you receive messages from, and you can "listen" to both intercoms at the same time if you want. In this example, the user is receiving messages from the mission control room only.

Radio-messages are color-coded so you know which intercom they're from, with blue for messages in the mission-control intercom. You'll also notice that the messages also indicate the current position of the person. The buttons in the green rectangle allows you to select which intercom you're sending a message to. Historically, you'd listen to multiple intercoms but only speak to capsule if you're CAPCOM, but in MCL that's up to you, or rather the rules FLIGHT set for the mission.



On the other hand, if "radio messages" is setup like this, with both "ROOM" and "CAPSULE" colored, you'll receive messages for both the MCC and capsule.

### 3. CONTROLS

(Assuming default controls) Arrow-keys are used to walk around without changing seat (designed to look closer at instruments and around the table, pan around). Holding the middle mouse button lets you pitch and yaw the view, scroll wheel zooms.

F1-11 lets you change to some of the views, a list of views is available if you press V, and a chat-window is viewable if you press C.

To trigger the failure-menu, press CTRL+T.

It's advised that you bind chat send to ENTER.

### 4. VIEWS

#### STATION VIEWS

Each desk is a station with a dedicated role. One player can oversee and operate them all, or multiple players can share the roles among each other. It's usual to have the responsibility of one or two desks in larger games.

#### ORBIT VIEW

This view is mostly used by mission planners, guidance and retro to plan the orbit and reentry procedures. Markers can be placed and time to these points will be given.

#### FPS VIEW

The "FPS" view is a way to walk around in the room using a traditional FPS controller. You can use this to oversee the room, check out the simulator and the map. You can not interact with stations in this mode. This is for observation only.

## THE SIMULATOR

The simulator is just a non-functional mockup of the Mercury panels. This is used to have a realistic reference to the capsule panels for verifying switch locations, procedures and checklists.

The simulator can be found in the corner of the room, but a dedicated simulation room is currently being constructed. Once it's complete, the simulator will move.

## 5. MISSION PAD

You will have access to the same checklists as the astronauts has onboard. It is a good practice to walk through each checklist with the astronaut and verify the procedures.

GREENWICH MEAN TIME  
12:43:50

ORBIT NUMBER

00

HOLD

COUNTDOWN  
01:27:28

## V. THE FLIGHT DIRECTOR



## V. THE FLIGHT DIRECTOR

## 1. GENERAL

## 1.1 THE DESK



The flight-director mission-status (green rectangle) is special. It doesn't have an amber button (because if the flight-director doesn't know if they're there you've got bigger problems), and when you press the red button pre-launch you can halt the countdown.



The halt and go indicators control the countdown timer, as well as the GO and HOLD lights above the world map.

# MERCURY CONTROL CENTER

USER MANUAL

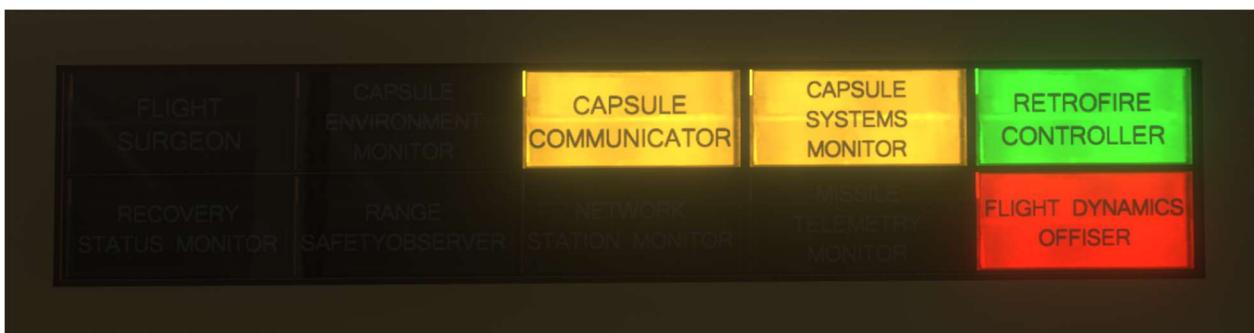
R E N T R Y

AN ORBITAL SIMULATOR



The red rectangle on the desk image marks where the flight-director sees the status of each of the seats. In this case, all the seats were unoccupied and so all the lights are unlit. Each desk has a light in this panel. It can be Amber (seat is occupied), Red (NOGO), or Green (GO).

In case of an abort, the flight-director presses the abort-button (purple rectangle), which lights the abort-light in the capsule. This is the que for the astronaut to pull the abort handle.



Above you see what the status indicators look like to the flight-director, with both CAPCOM and SYSTEMS present, retrofire has set the station to GO, and FIDO to NOGO.

## 1.2 OPERATION

The Flight Director oversees the mission. Often referred to as FLIGHT with primary role of leading the mission, the team, and have final call on decisions. The role is mainly focused on the information received over the intercom, and discussions with the other mission controllers. FLIGHT's eyes and ears are mostly focused on the room, and not in the station.

# MERCURY CONTROL CENTER

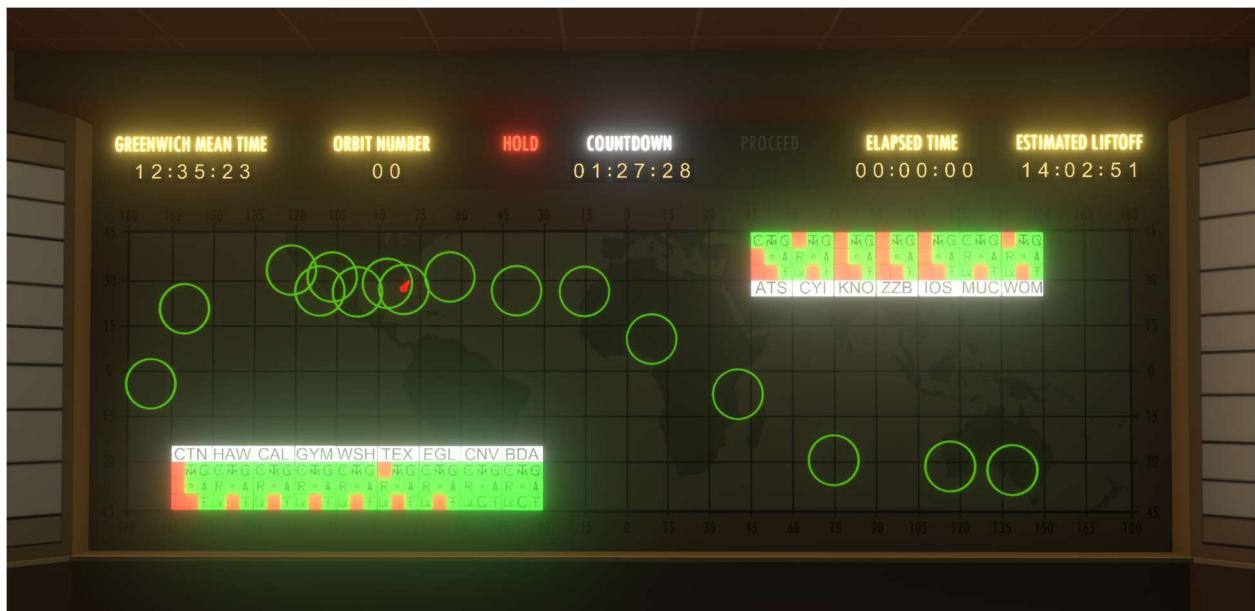
## USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

Therefore the seat is placed in the middle of the room with a good view of the map and the other stations.

Flight should have a good understanding of the flight plan (if any), knowledge of the spacecraft as a complete vehicle, and quickly be able to understand if something seems abnormal in any way.

With exception of the intercom, the station has some tools that are frequently used. The map itself is in a good distance to quickly take a glance at the information available.



A sequencer on the desk shows the status of the mission. Illuminated parts means that the action/phase is complete, and flashing means it's currently happening or needs attention.

## VI. THE CAPSULE COMMUNICATOR



# VI. THE CAPSULE COMMUNICATOR

## 1. GENERAL

### 1.1 THE DESK



The CAPCOM is in charge of communicating with the capsule. Realistically, CAPCOM is the only person directly communicating with the capsule, everyone else talks to the capsule through them. CAPCOM can see the current progress of the flight, as well as having a monitor for seeing the launch-pad.

A sequencer (red rectangle) shows the current mission phase. Two time-indicators (purple) shows current time in GMT, and the active countdown to retrograde. The retrograde time is set by the retrofire controller.

### 1.2 OPERATION

As with FLIGHT, the CapCom role is also mainly out-of-desk. Your role is to be the main (and most likely only) communication/voice link between the astronaut and the room. You will be the one talking with the astronaut, and the only one who should submit anything on the capsule intercom. You work with the room as a whole, listening in on team discussions,

# MERCURY CONTROL CENTER

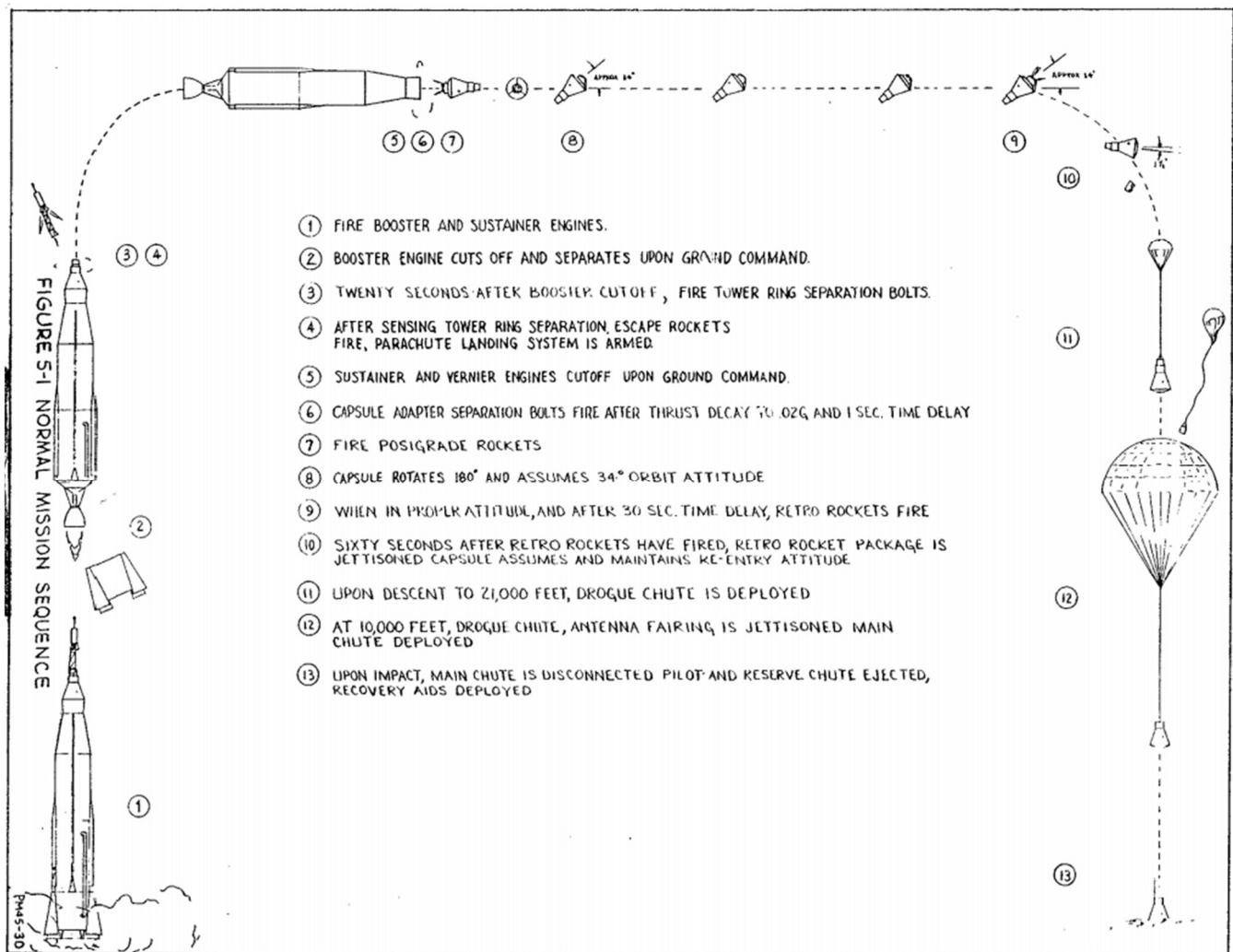
USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

talking with FLIGHT on issues, as well as the various desks needed to provide information requested by the astronaut, or report important information from the room.

The station is simple. It has the mission sequencer as with FLIGHT so you can directly verify mission phase changes and sequencer actions. During ascent, you will verify your indication with what the astronaut sees.

## 1.3 DIAGRAMS

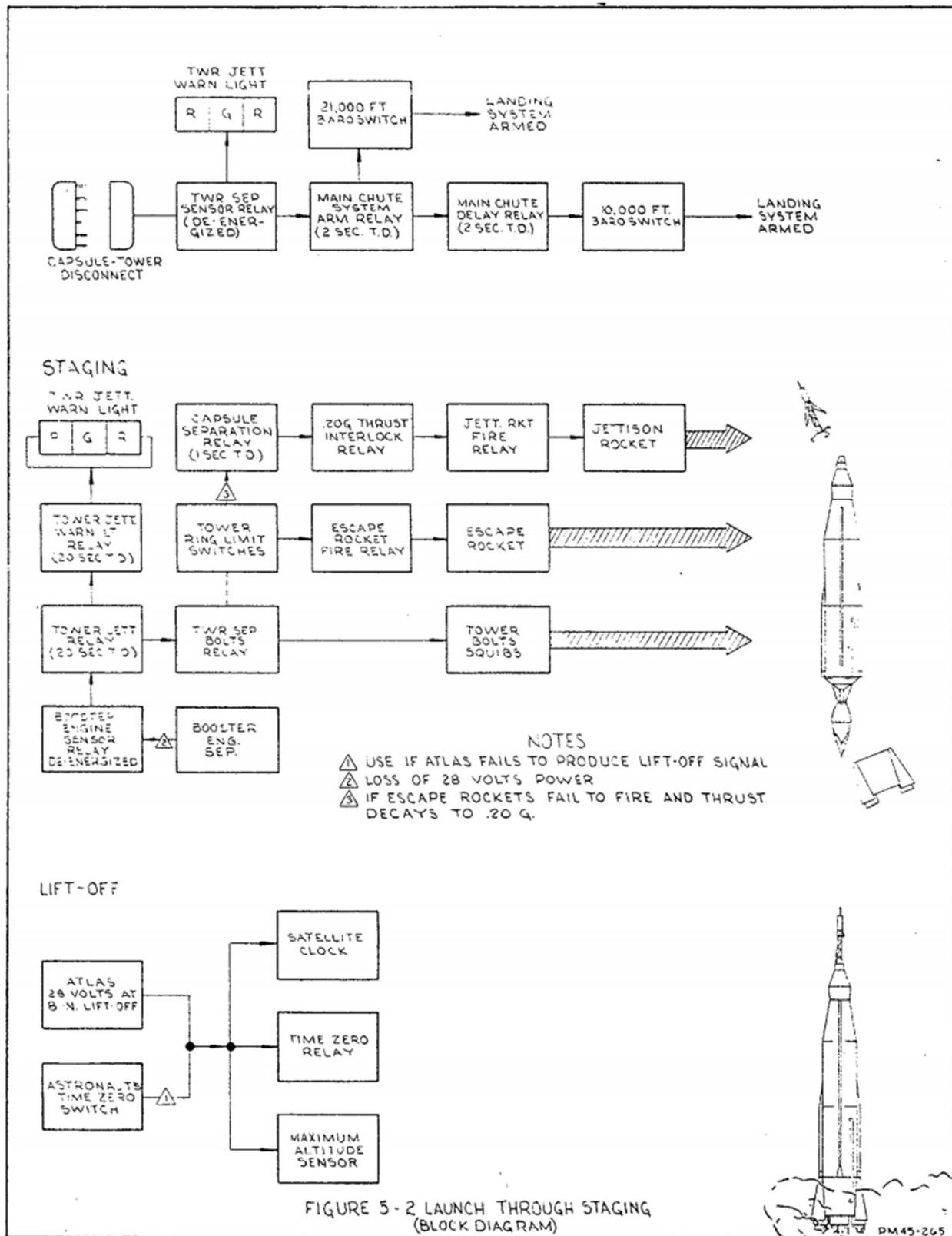


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

# USER MANUAL

# R E N T R Y

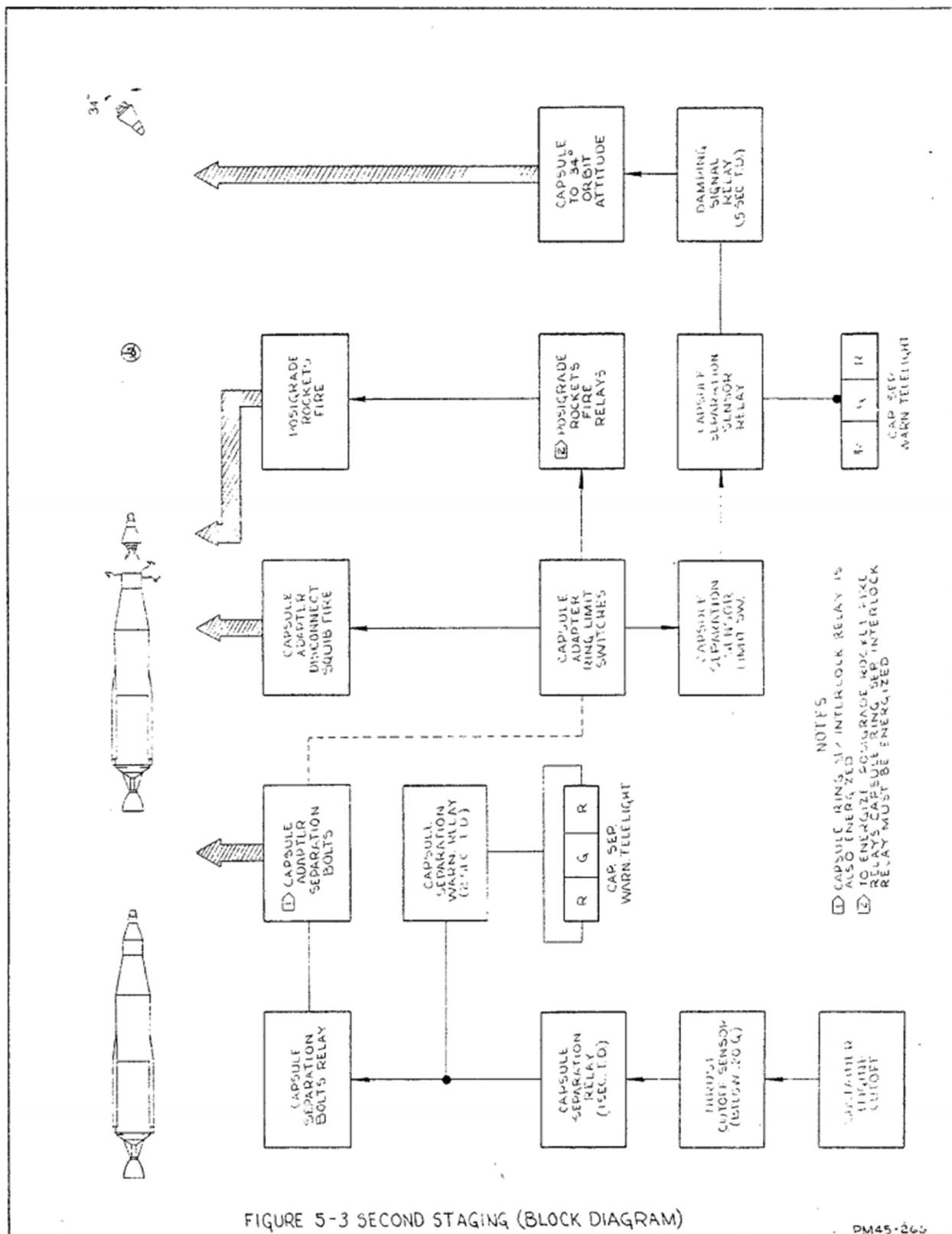


FIGURE 5-3 SECOND STAGING (BLOCK DIAGRAM)

DM45.265

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

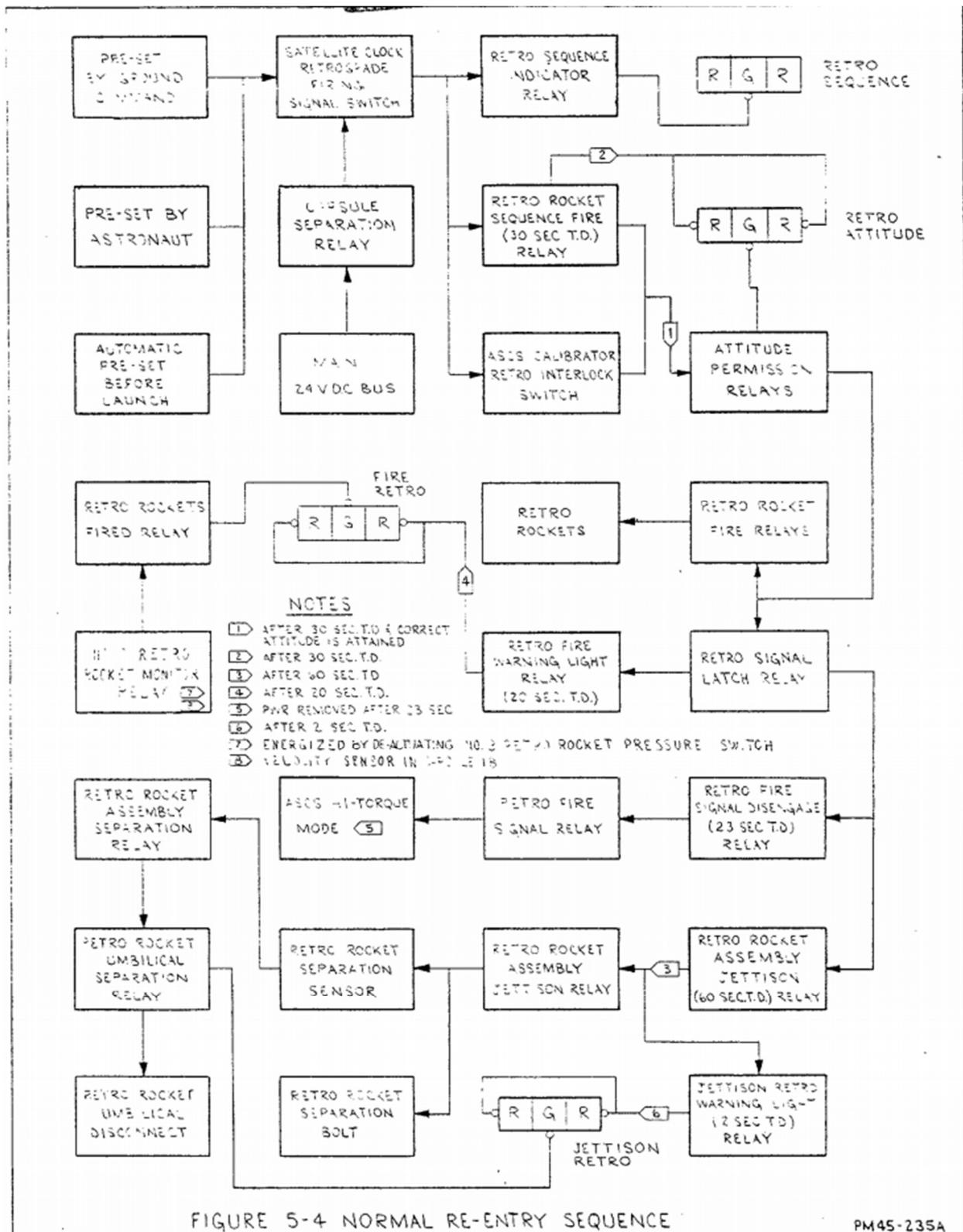


FIGURE 5-4 NORMAL RE-ENTRY SEQUENCE

PM45-235A

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

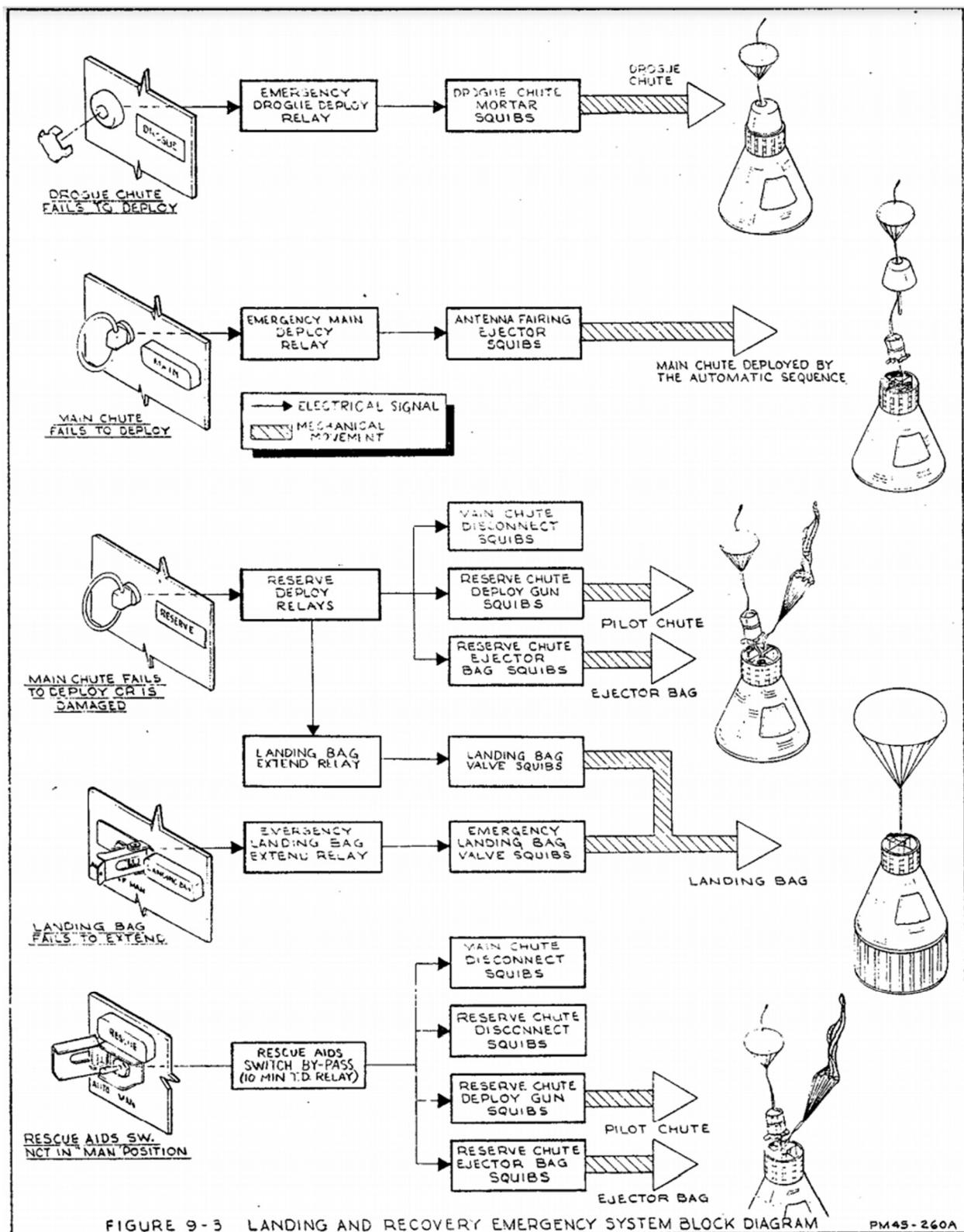


FIGURE 9-3 LANDING AND RECOVERY EMERGENCY SYSTEM BLOCK DIAGRAM

PM45-260A

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

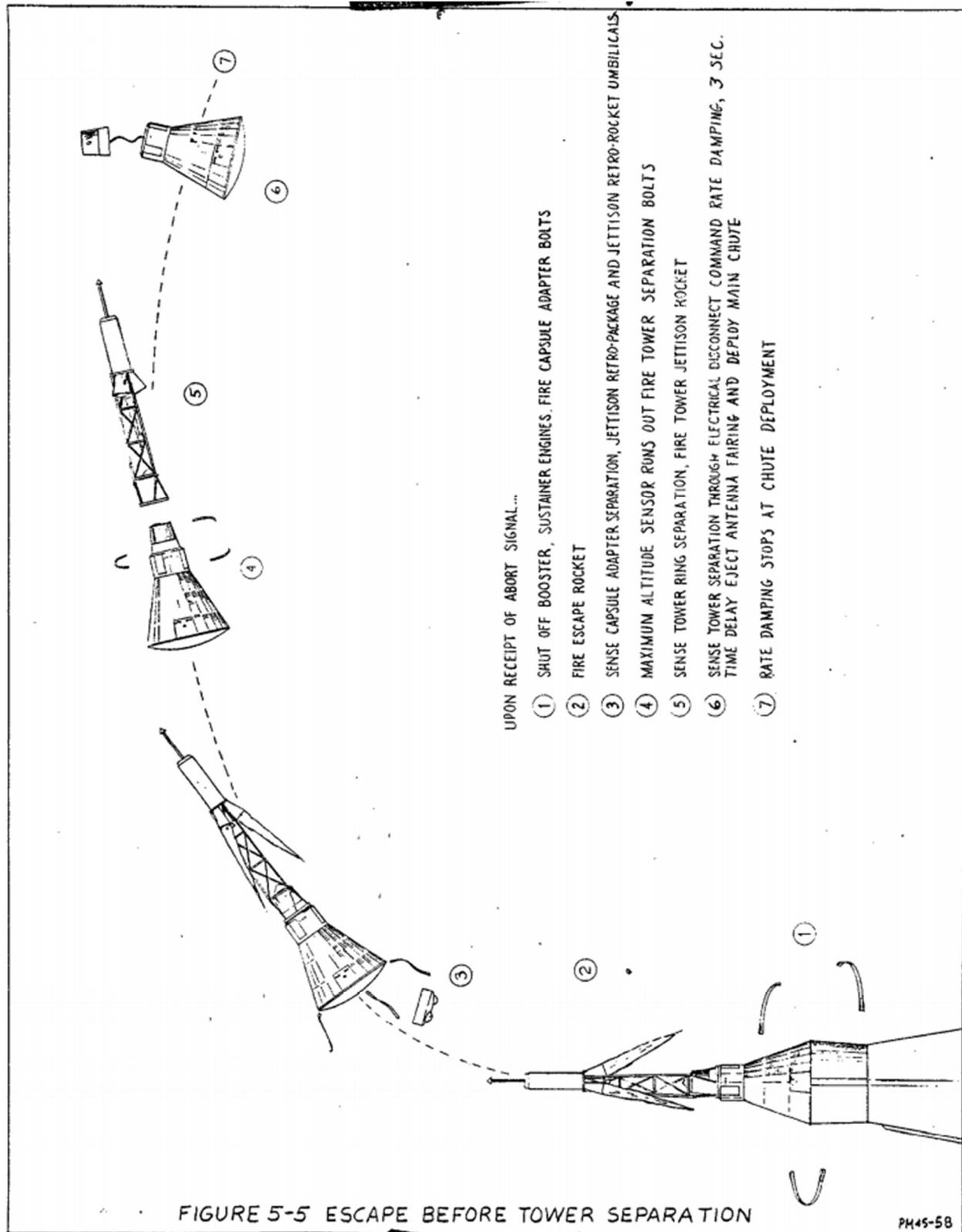


FIGURE 5-5 ESCAPE BEFORE TOWER SEPARATION

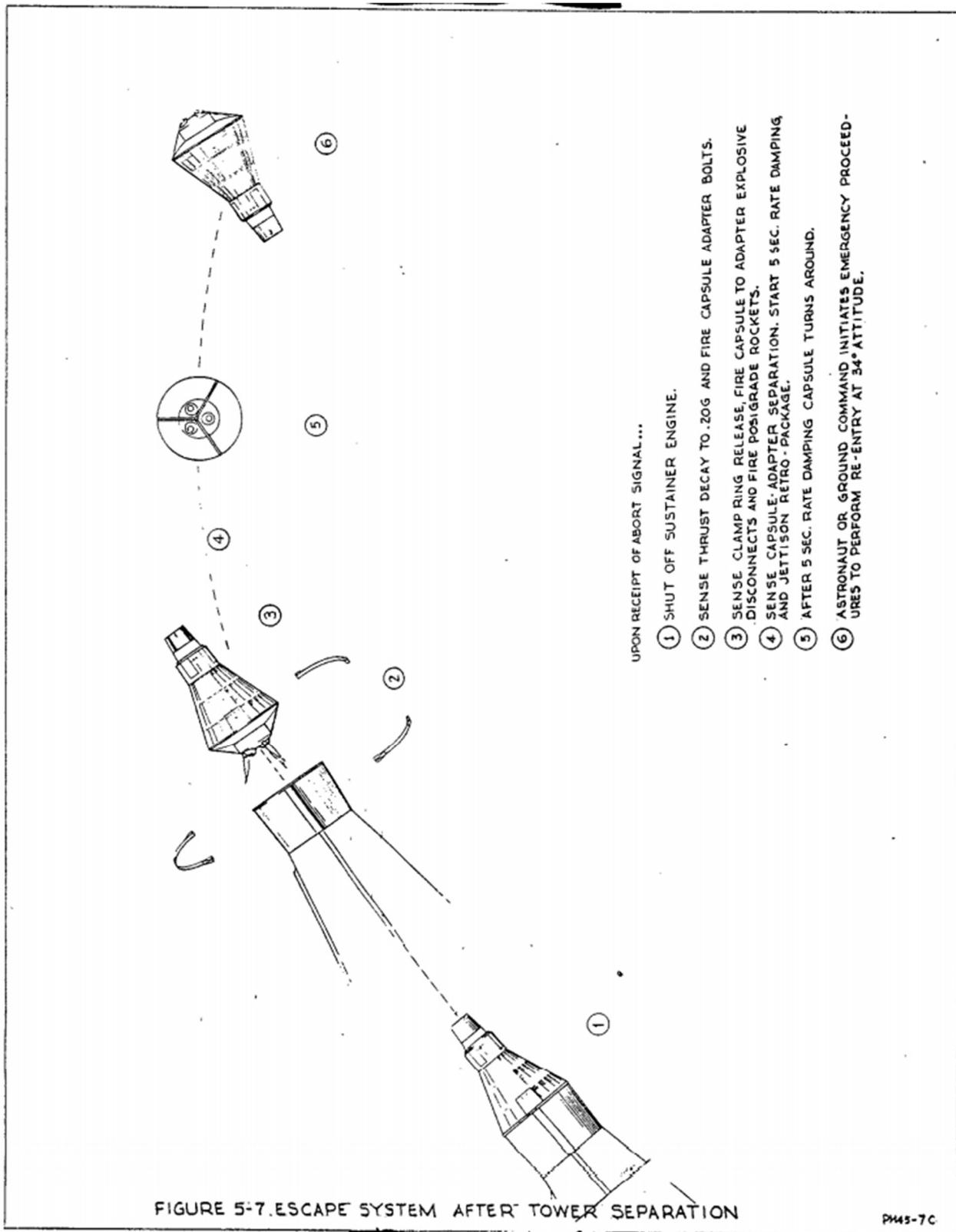
PM45-5B

# MERCURY CONTROL CENTER

USER MANUAL

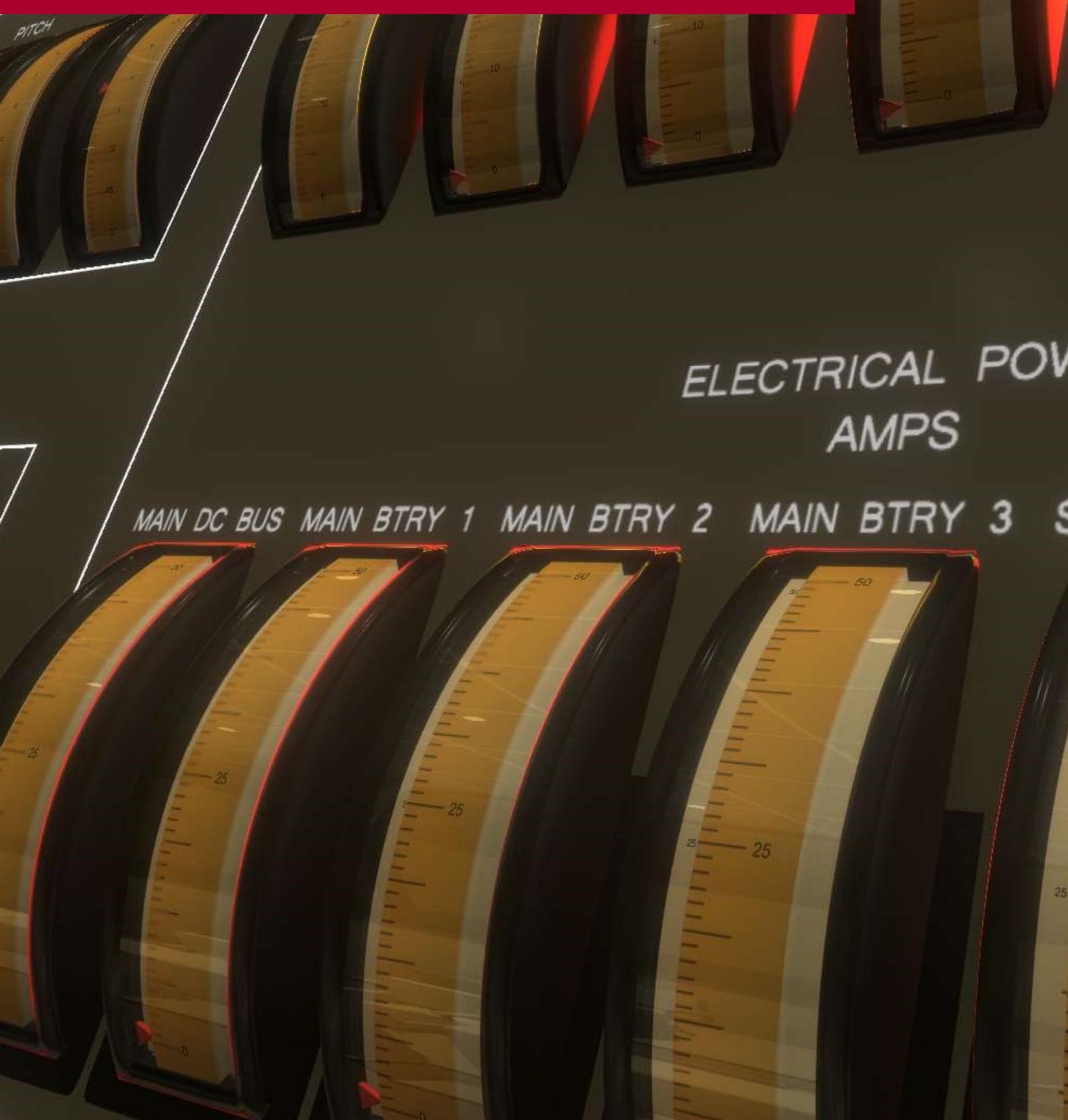
R E N T R Y

AN ORBITAL SIMULATOR





## VII. THE SPACECRAFT SYSTEMS MONITOR



# VII. THE SPACECRAFT SYSTEMS MONITOR

## 1. GENERAL

### 1.1 THE DESK



The SPACECRAFT SYSTEMS desk has vertical gauges that shows information from various systems on-board the spacecraft. Gauges (from the top left): Capsule attitude (pitch, yaw, roll), Capsule rates (pitch, yaw, roll), DC bus volts, Main battery 1 – 3 volts, Standby battery 1, 2 volts, and the isolated battery volts. The 2<sup>nd</sup> row from left shows the fuel level of the auto fuel tank, the manual fuel tank, and the amps/consumption of the DC bus, Main battery 1 – 3, Standby battery 1, 2, and the isolated battery. A light indicator shows if the squibs are armed or not.

### 1.2 OPERATION

SYSTEMS is an engineering role and is in charge of monitoring the spacecraft fuel and electrical systems, as well as the attitudes and the rate of change in the individual rotational axes. SYSTEMS is primarily working with CapCom, and can verify the information CapCom and the astronaut discuss. SYSTEMS should not talk directly with the astronaut.

In case of an indicator failure aboard the spacecraft, SYSTEMS become especially important, as the pilot has to fly partially blind otherwise. To verify indicator functionality, have both SYSTEMS and the pilot give a readout. If the values match, we are good to go.

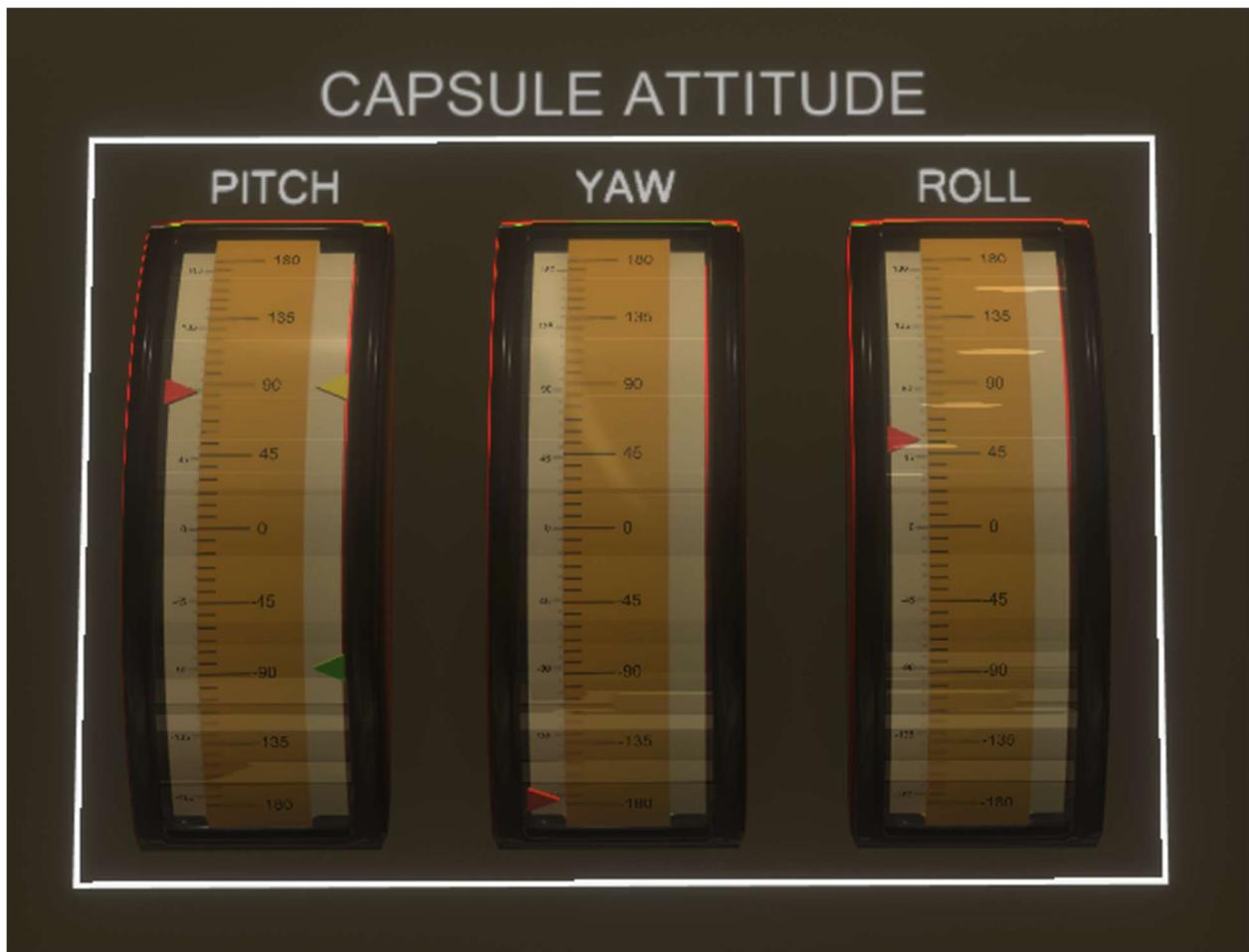
# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

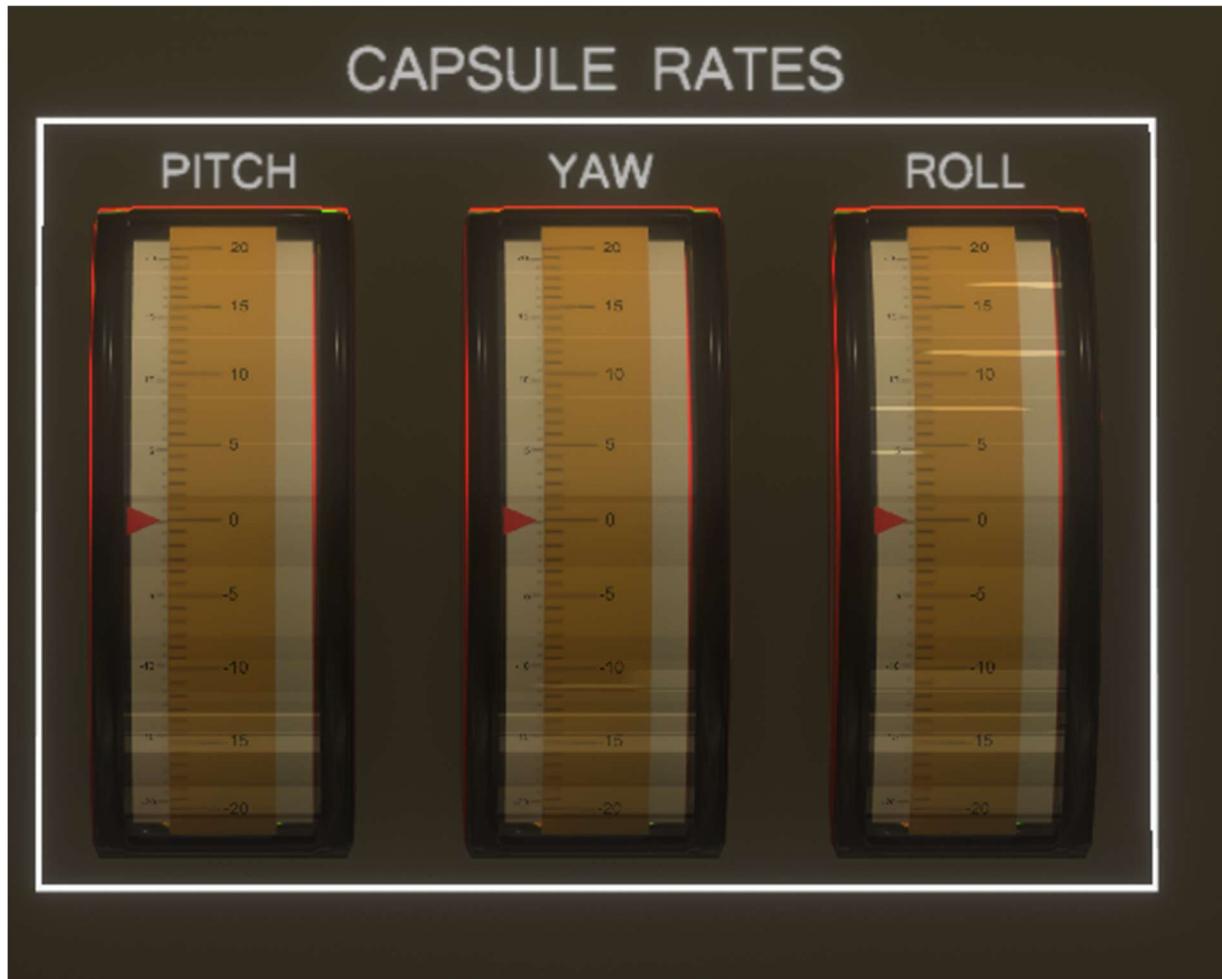
AN ORBITAL SIMULATOR

The attitude is very important during ascent, and retro fire. While the rocket stands on the pad, the pitch should be 90 degrees, and the roll should have an offset based on the launch azimuth. The roll program should move ROLL to zero, and the pitch program should reduce pitch along the horizon.



The vertical gauge has needles showing the current value, and in some cases an upper or lower limit.

The RATES gauges shows the angular momentum. If the needle is in the center, the capsule does not have any rates in that axis.



This is an important readout to understand if the capsule has a stable attitude at critical maneuvers. Each time a thruster fires, these should give you an indication of that.

You should always try to visualize the current spacecraft attitude relative to the Earth horizon and position.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR



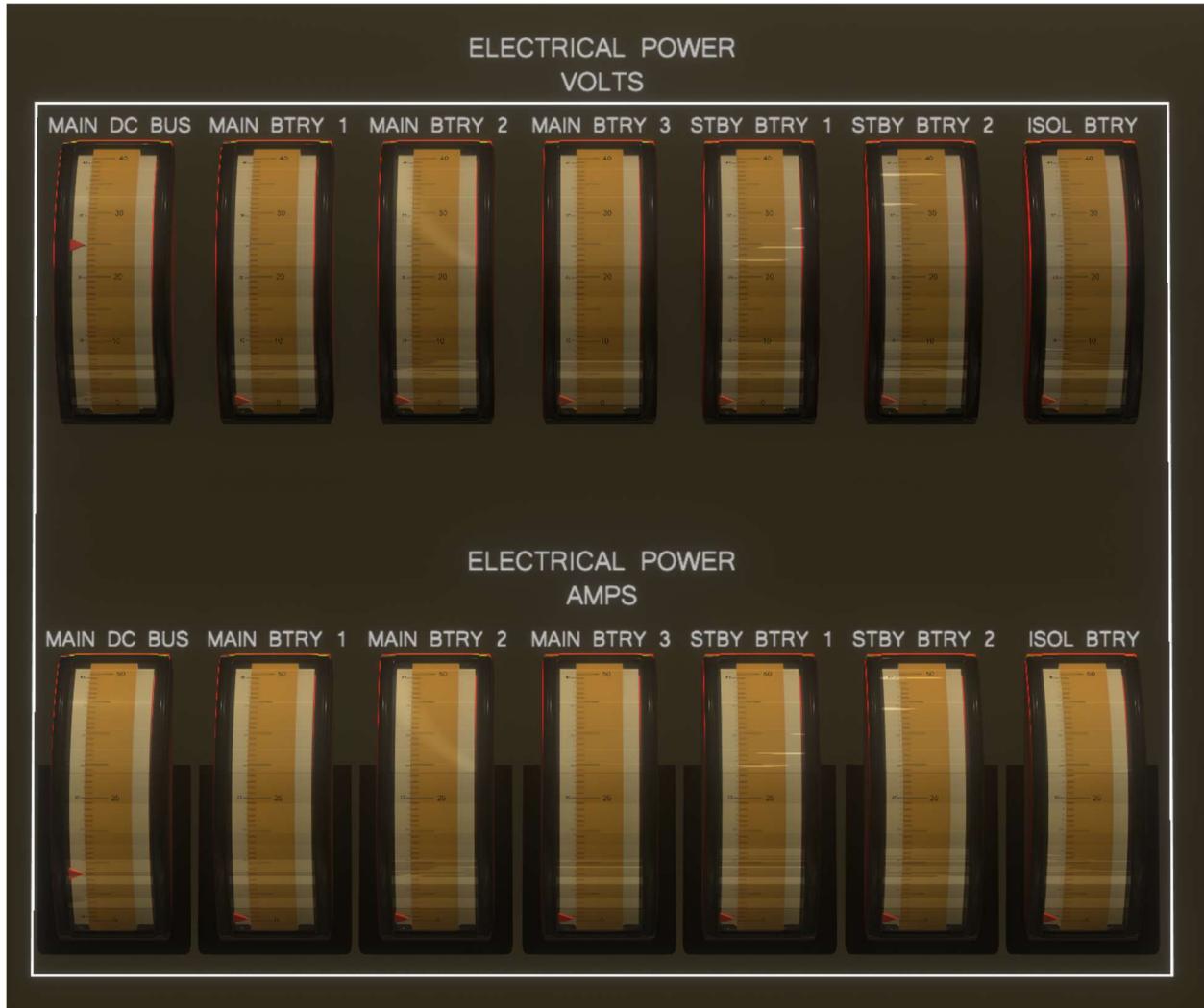
The control fuel tanks shows the status of the two fuel tanks onboard. One is used by the ASCS system (auto pilot), and the other by the manual system. Both systems supply the reaction control system with fuel for attitude changes.

The electrical power gauges shows the volts (health) and amps (consumption) of each of the onboard electrical systems.

# MERCURY CONTROL CENTER

## USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR



The squibs armed indicator illuminates red if the squibs are armed. It's good practice to keep this off unless the squibs are needed in a given mission phase.



It should be very visible when illuminated.  
You should be aware of this during the entire mission.

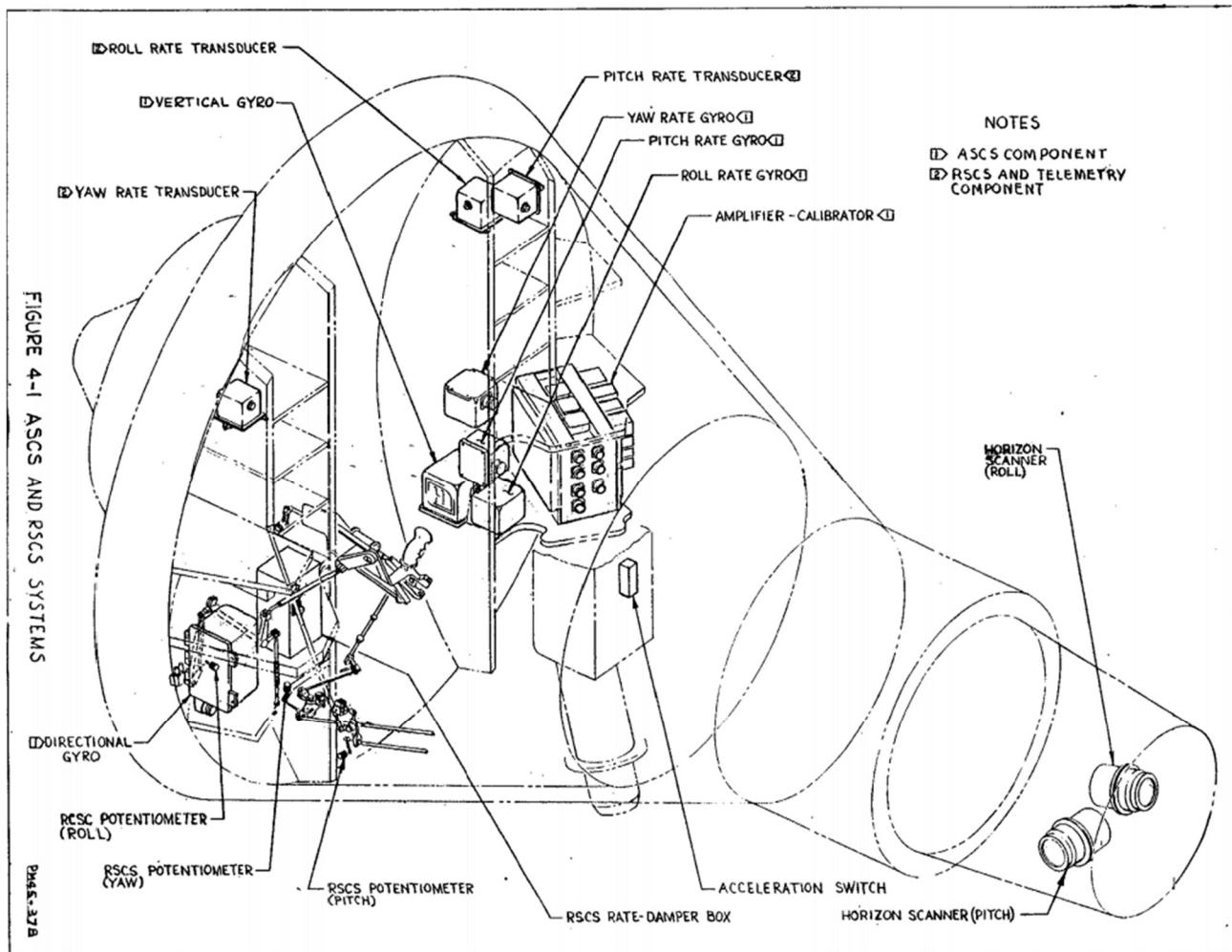
# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

## 1.3 DIAGRAMS AND SCHEMATICS



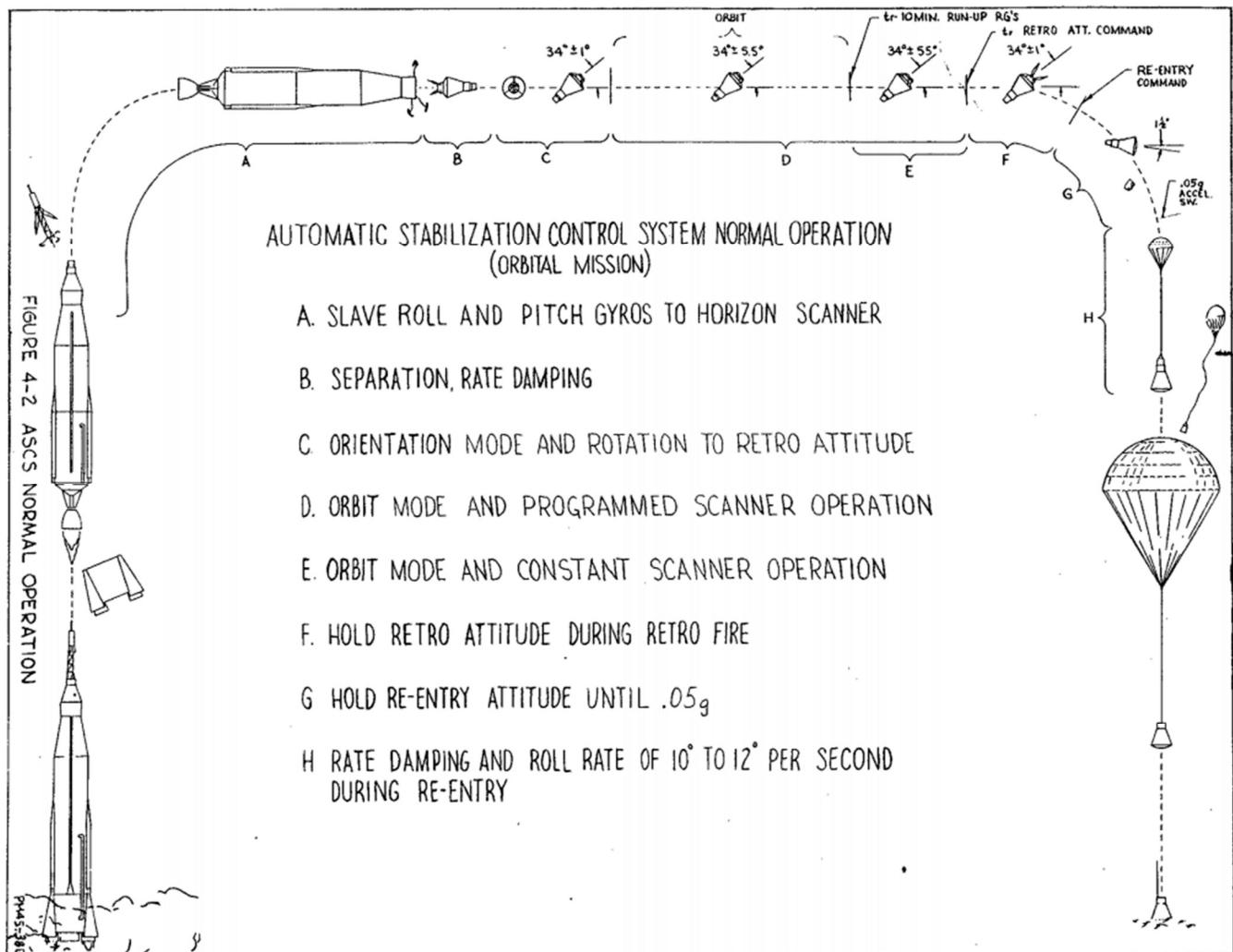
CONTROL MODE	SWITCH POSITION			RCS "T" HANDLE POSITION	
	Auto/Rate Comd	Norm-Aux	Damp-FBW	Auto Fuel Sys.	Manual Fuel Sys.
AUTOMATIC	AUTO		NORMAL	PUSH ON	RATE COMD
FLY BY WIRE	AUTO		FLY BY WIRE	PUSH ON	RATE COMD
RATE-STICK	RATE COMD		NORMAL	PULL OFF	RATE COMD
DIRECT (With Rate Damper)	AUTO		AUX. DAMP	PUSH ON	DIRECT

The above table lists the switch and control positions necessary to achieve the four basic modes of control after attaining orbit. Variations of the various modes can be obtained by further switch manipulation.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

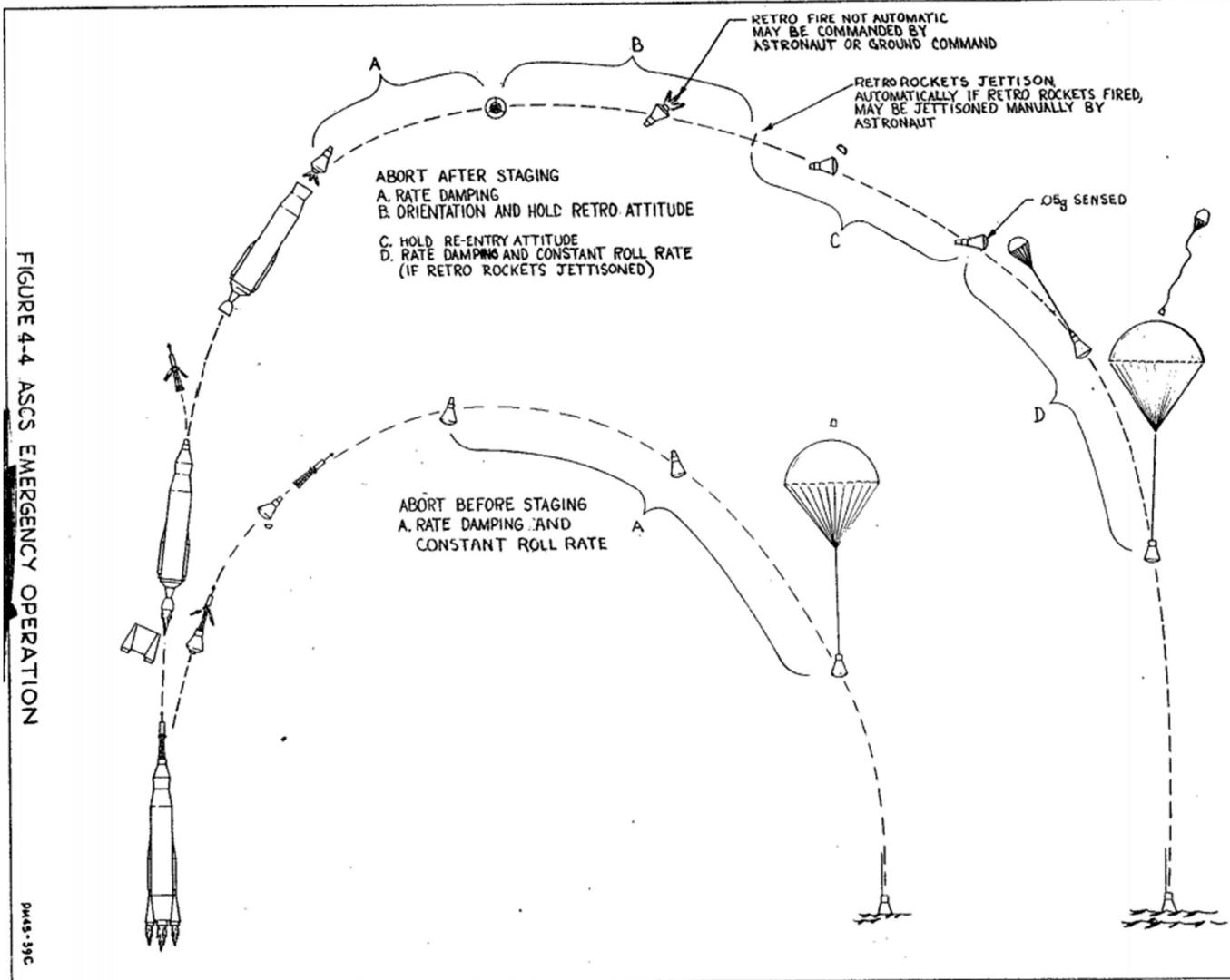


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

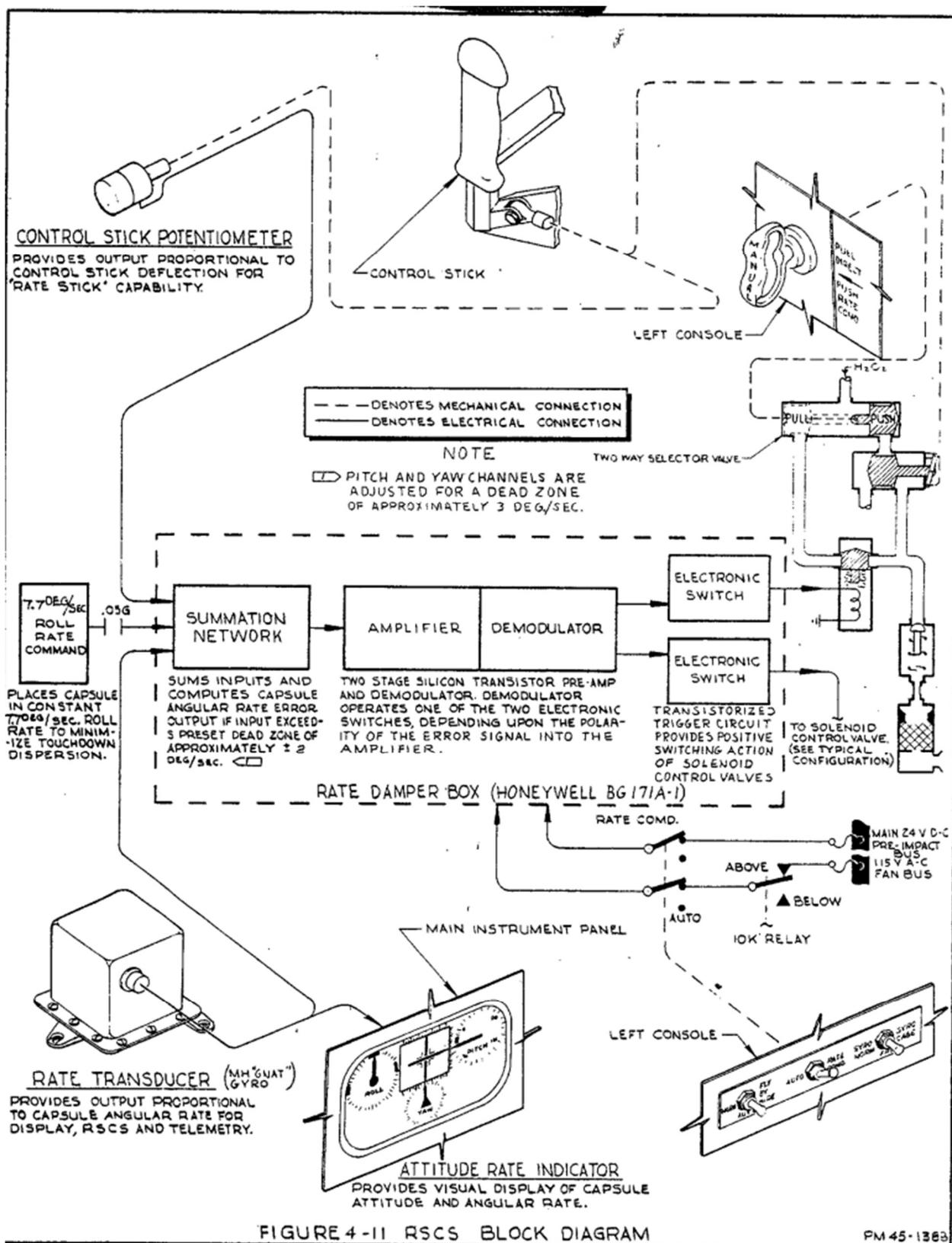
AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

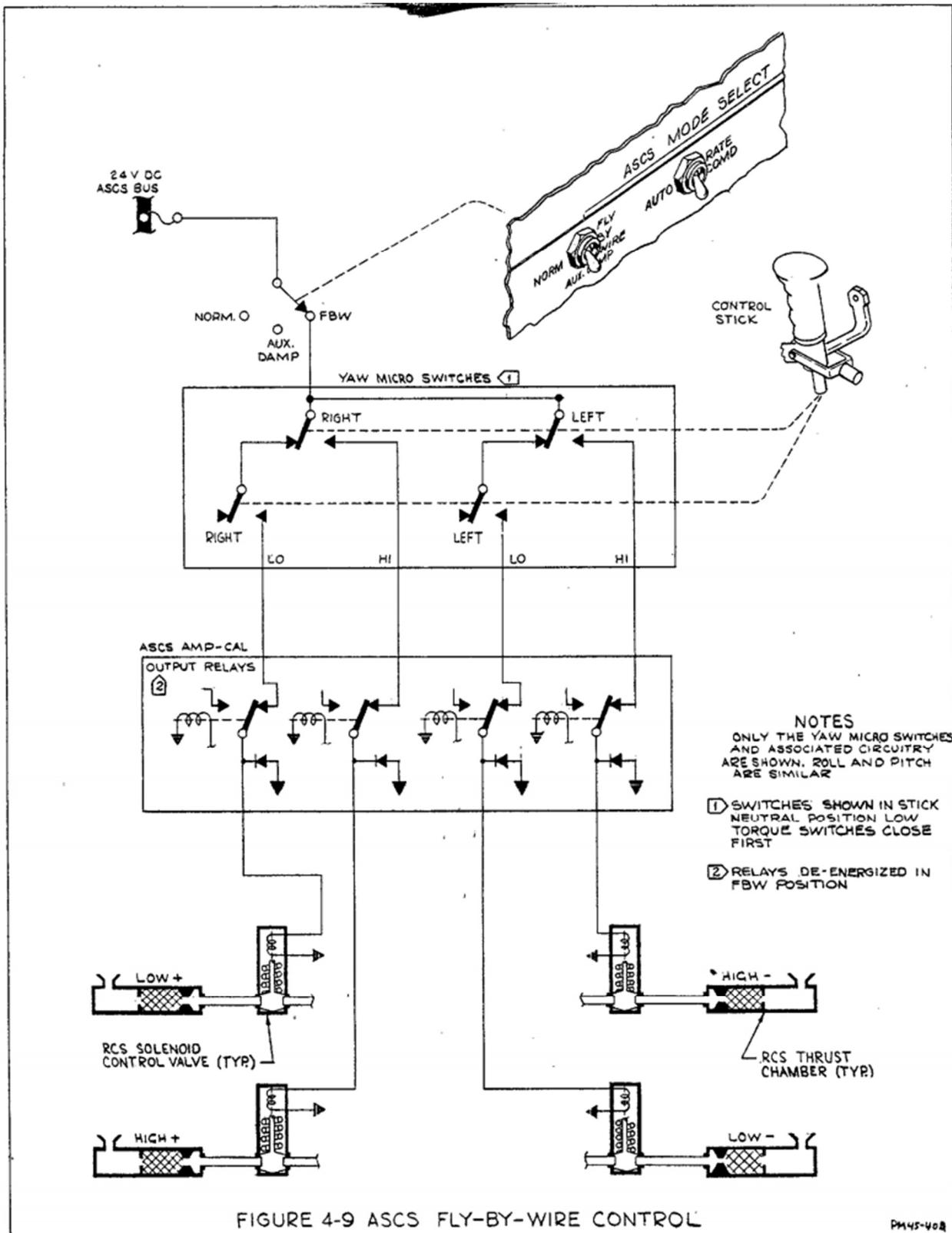


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

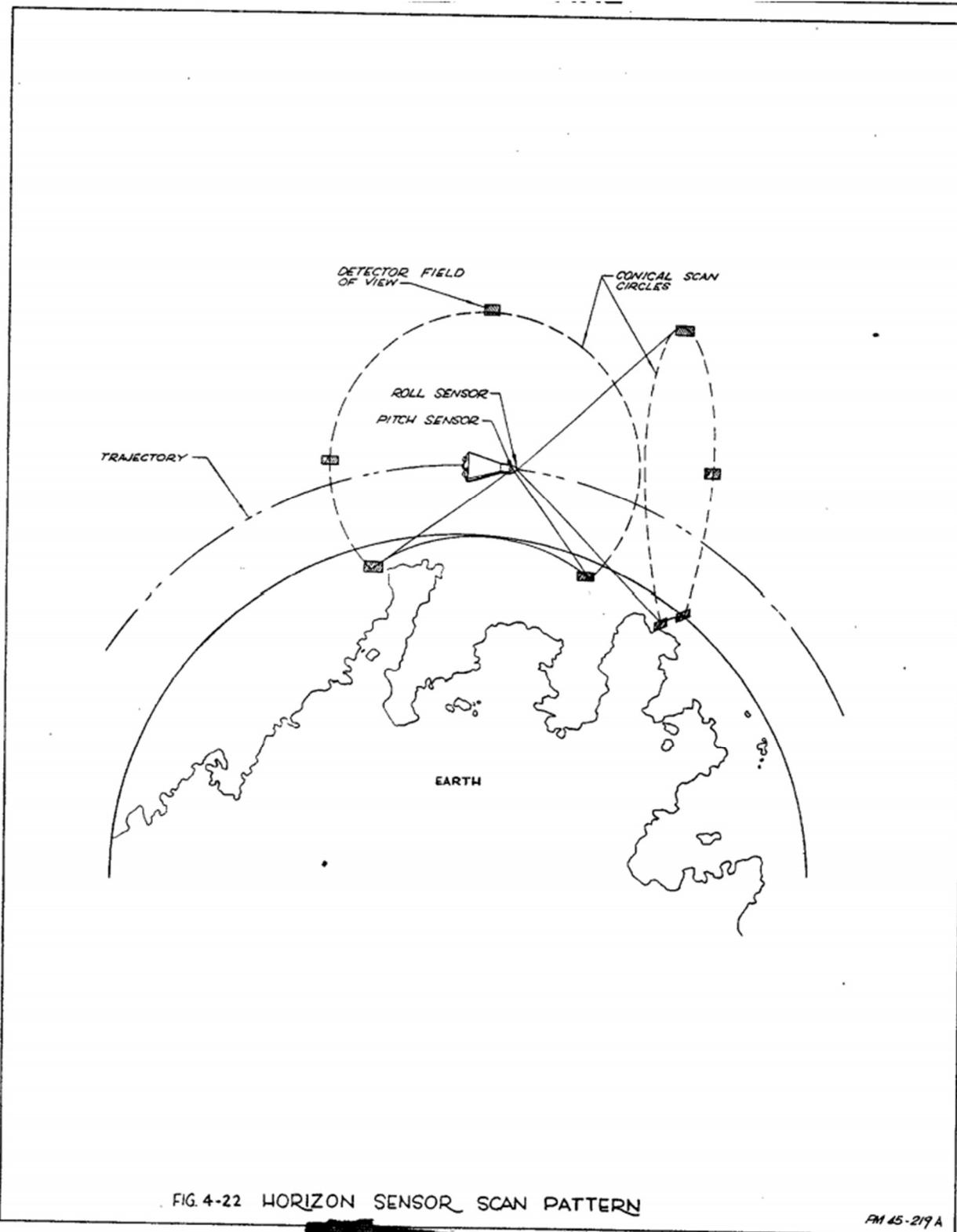


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

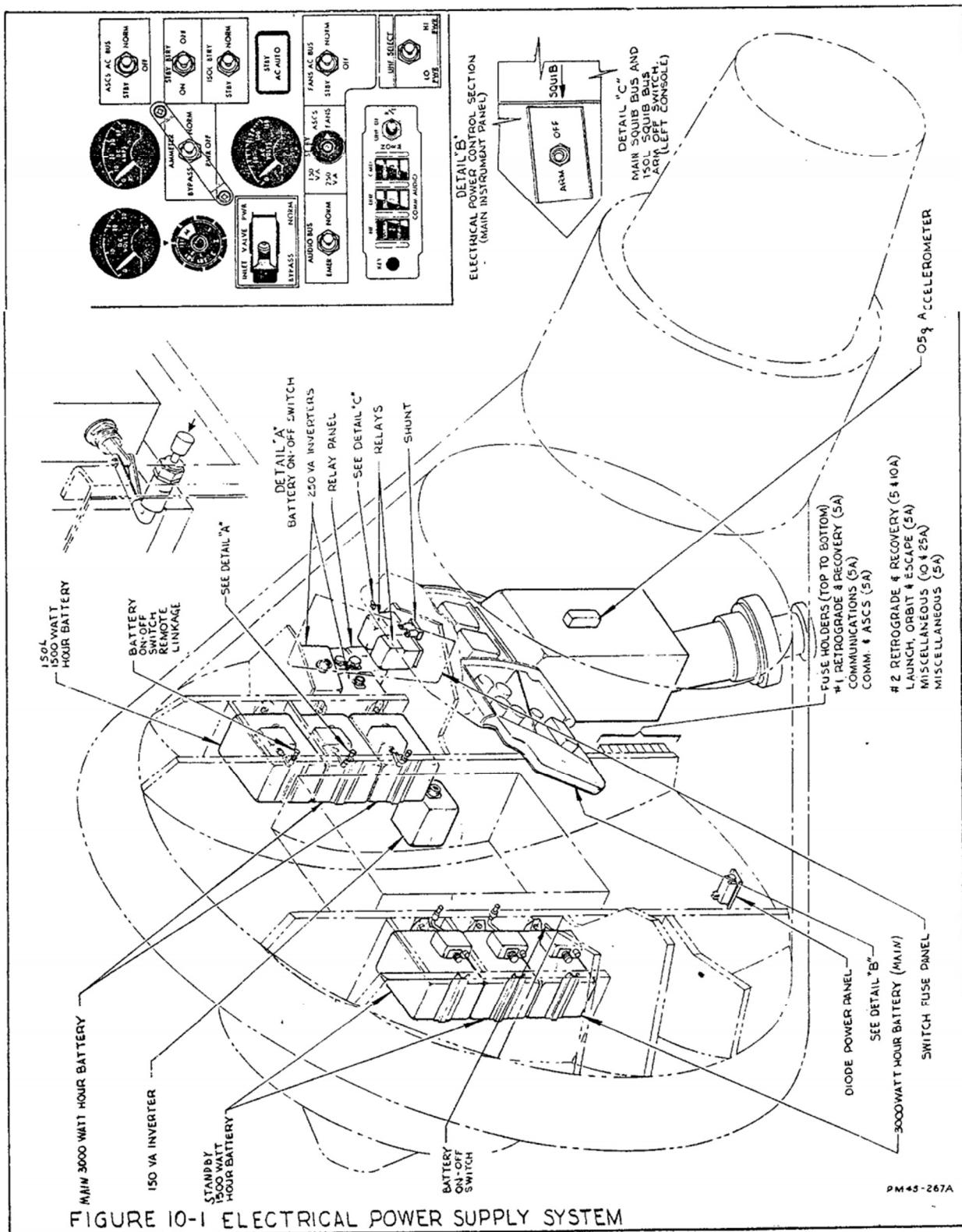


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

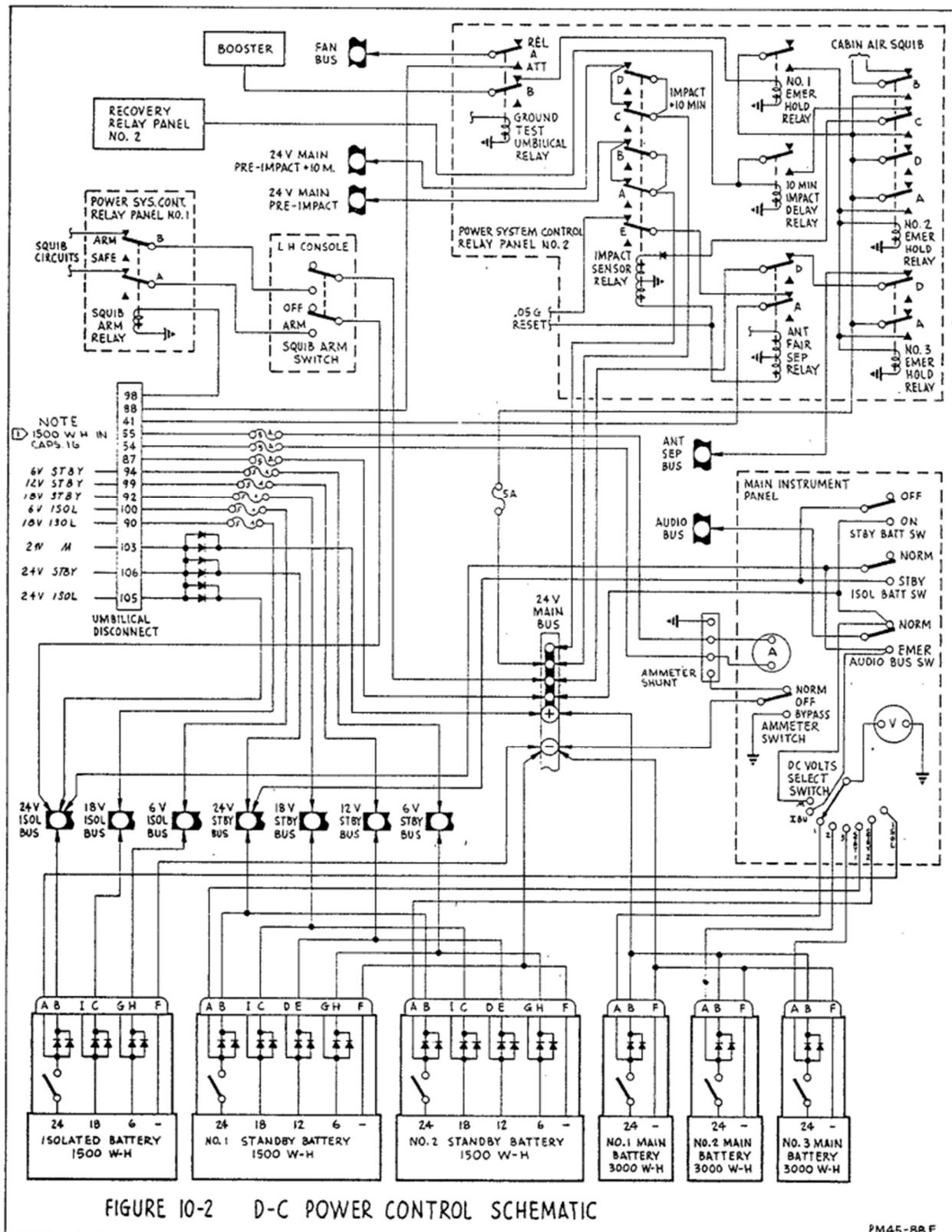


FIGURE 10-2 D-C POWER CONTROL SCHEMATIC

PM45-88 F

# VIII. THE SPACECRAFT ENVIRONMENT MONITOR



# VIII. THE SPACECRAFT ENVIRONMENT MONITOR

## 1. GENERAL

### 1.1 THE DESK



Environment has six vertical gauges and shows the life critical aspects of the spacecraft. If these are off, the mission might be at a threat. It shows the cabin pressure and temperature (outside of the suit), the suit pressure and temperature, and the reminding oxygen in the primary and secondary tanks.

### 1.2 OPERATION

ENVIRONMENT is the other half of the consumables and is in charge of monitoring the primary and secondary O<sub>2</sub> tanks, as well as the pressure and temperature of the cabin and suit. More components will soon be added here.

It's important to try and keep the temperatures within descent ranges. Keep an eye on them. In many cases, it will help to set cooling to max. The capsule only has controls to cool the capsule, not heat it. The internal systems generate so much heat that it was not needed. Before entry, the capsule should be cooled down as much as possible.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

Oxygen is important. Two tanks exists and are fully automatic. They are connected to the same system. One has slightly higher pressure and thus will be consumed first. When it's less than 10% left, the secondary tank will automatically take over the O<sub>2</sub> supply.

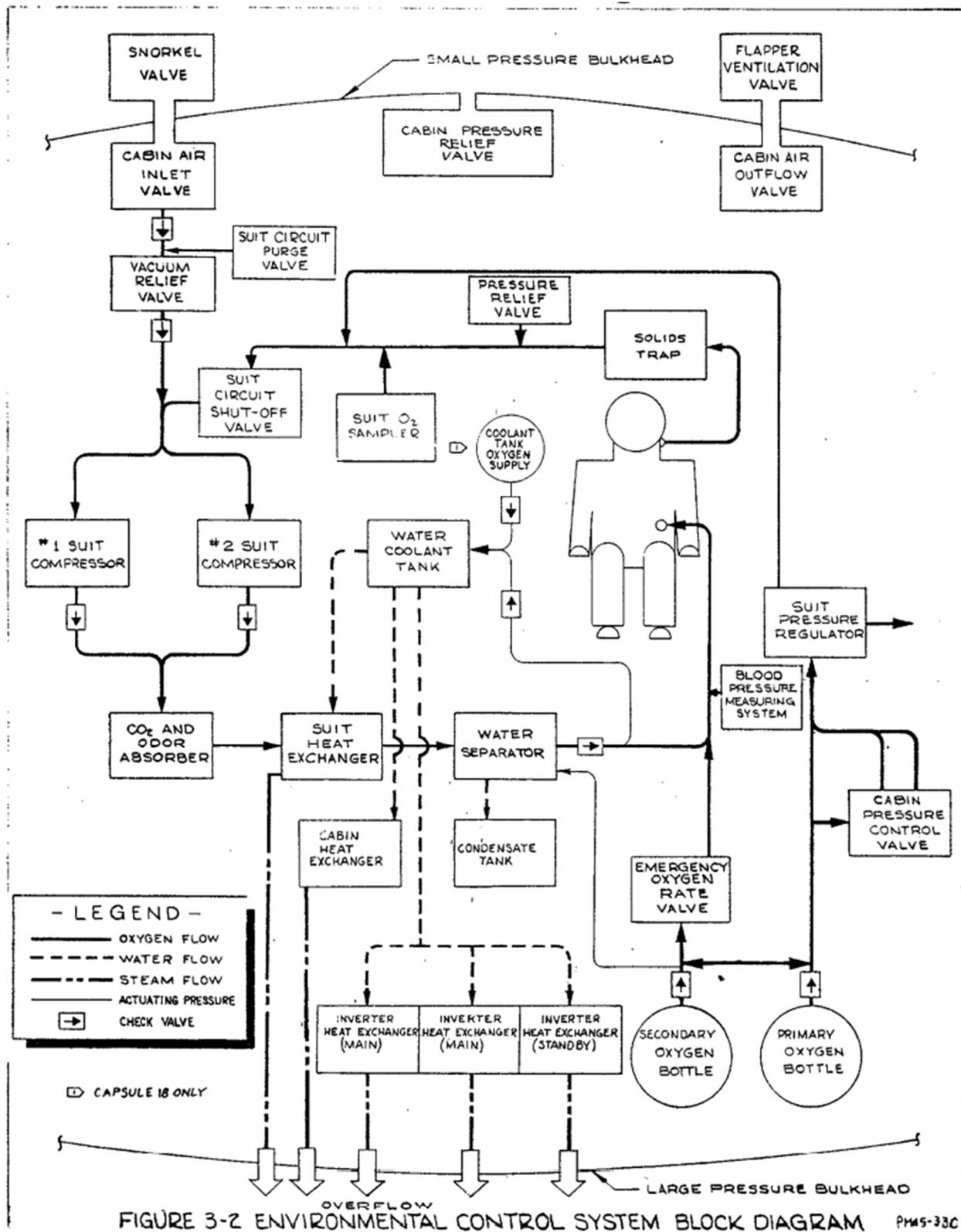
# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

## 1.3 DIAGRAMS AND SCHEMATICS



# MERCURY CONTROL CENTER

## USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

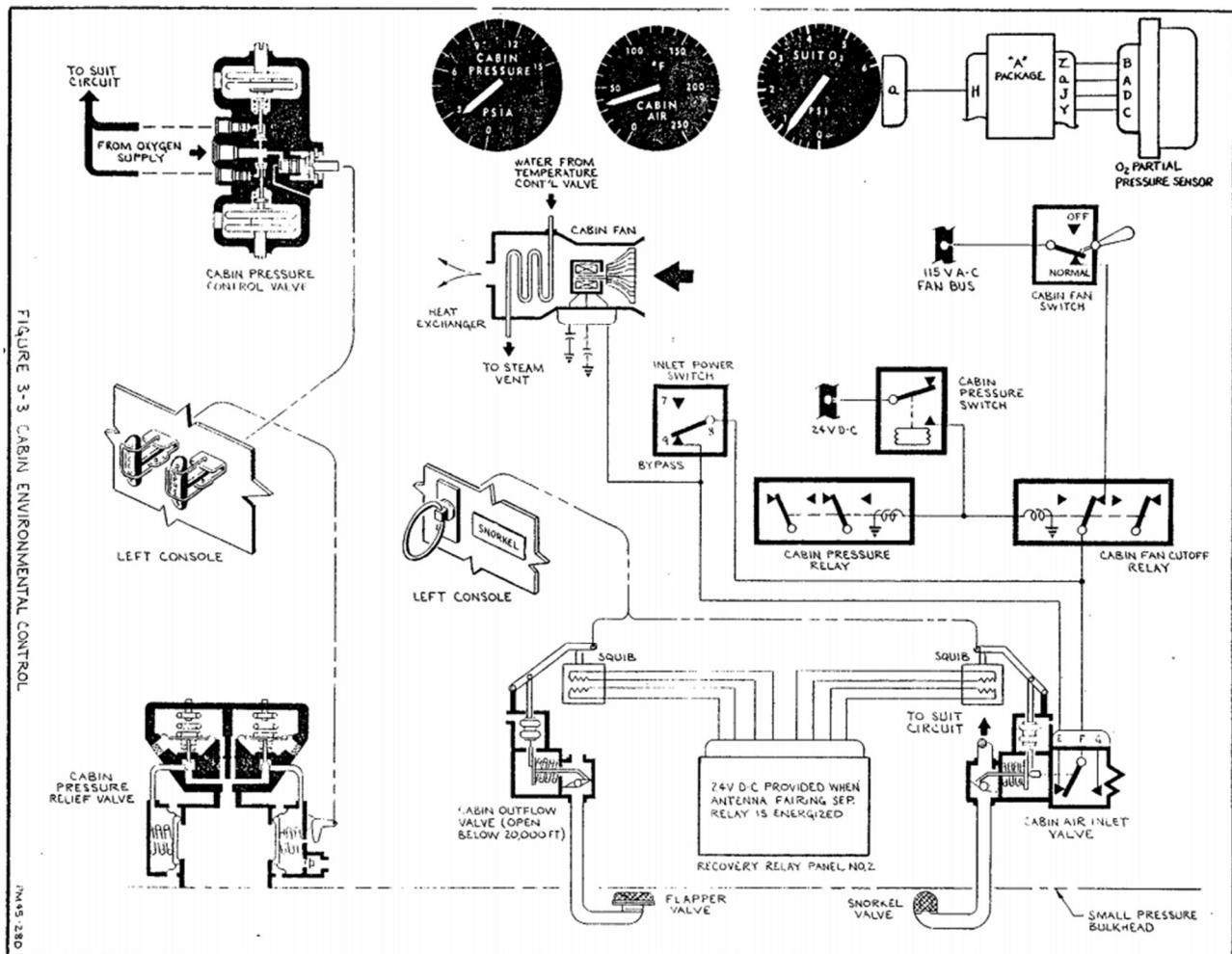


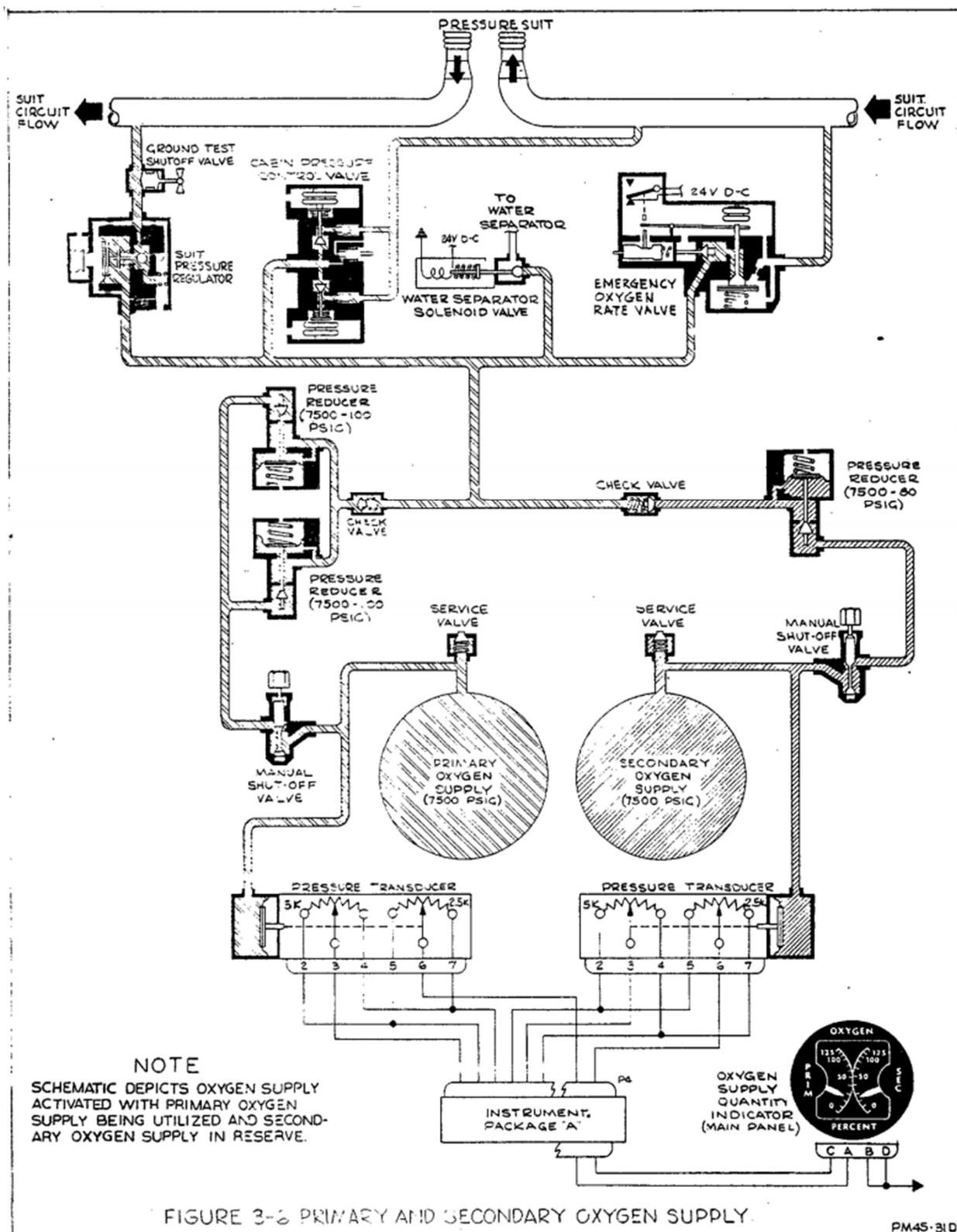
FIGURE 3-3 CABIN ENVIRONMENTAL CONTROL

PN45-280

# MERCURY CONTROL CENTER

USER MANUAL

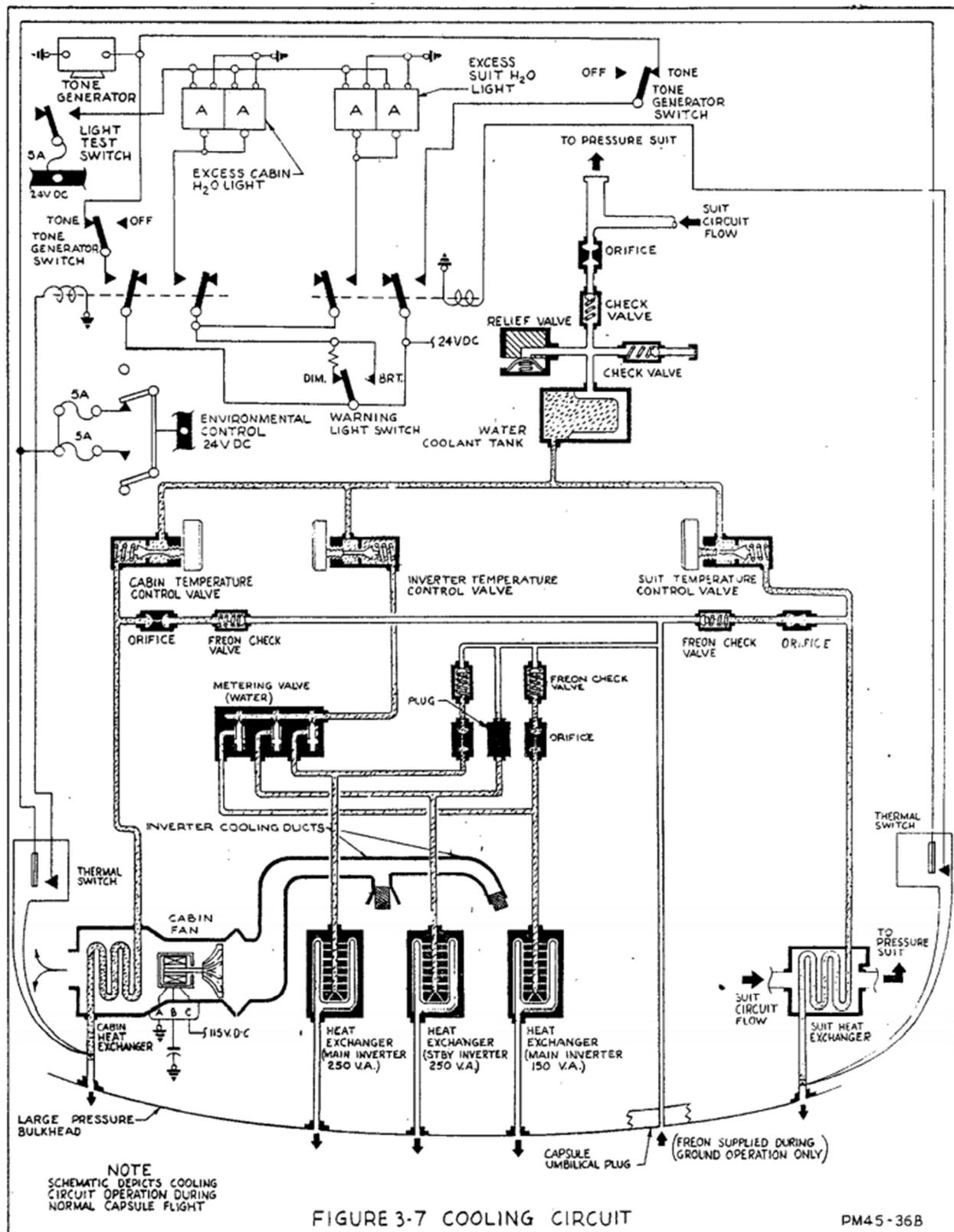
R E N T R Y  
AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

A N   O R B I T A L   S I M U L A T O R

PROCEED

ELAPSED TIME

00:00:00

ESTIMATED L

14:00

## IX. THE FLIGHT DYNAMICS OFFICER

ATS

CYI

KNO

ZZB

IOS

MOONWOMAN



# IX. THE FLIGHT DYNAMICS OFFICER

## 1. GENERAL

### 1.1 THE DESK



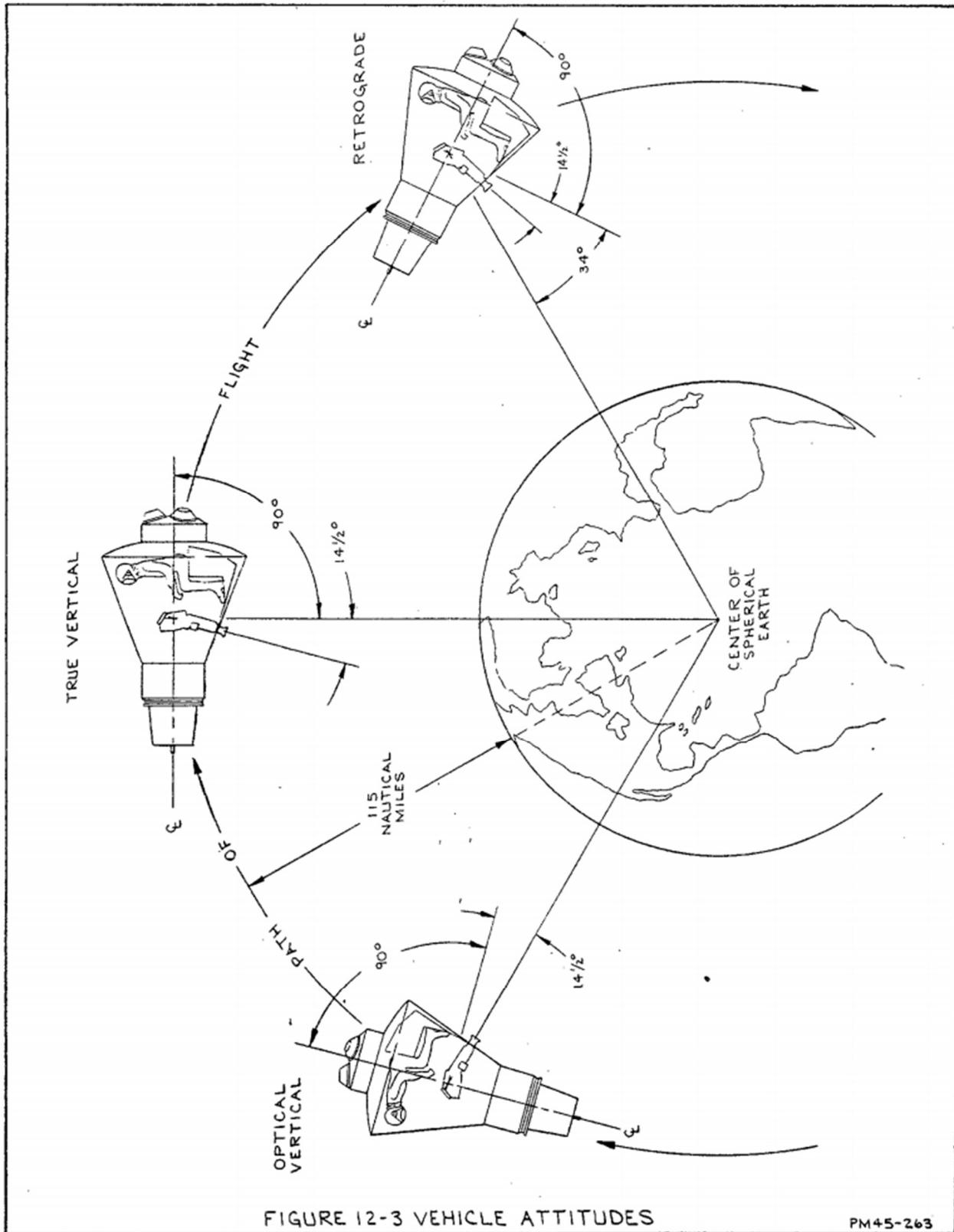
FIDO is in charge of monitoring the orbital parameters of the spacecraft. The desk has the familiar sequencer to show the state of the mission, as well as indicators for the current orbital inclination, perigee and apogee altitude, the latitude and longitude to know the current location of the spacecraft above Earth (as seen on the map), the orbital period (in seconds), current velocity and the orbit number.

### 1.2 OPERATION

The Flight Dynamics Officer needs to know where the spacecraft currently is, and where it is heading. During ascent, the parameters are monitored to verify that the spacecraft is ascending into the correct orbital plane, and into a healthy and stable orbit. The parameters (unless it's a Mercury Redstone flight) should not intersect Earth.

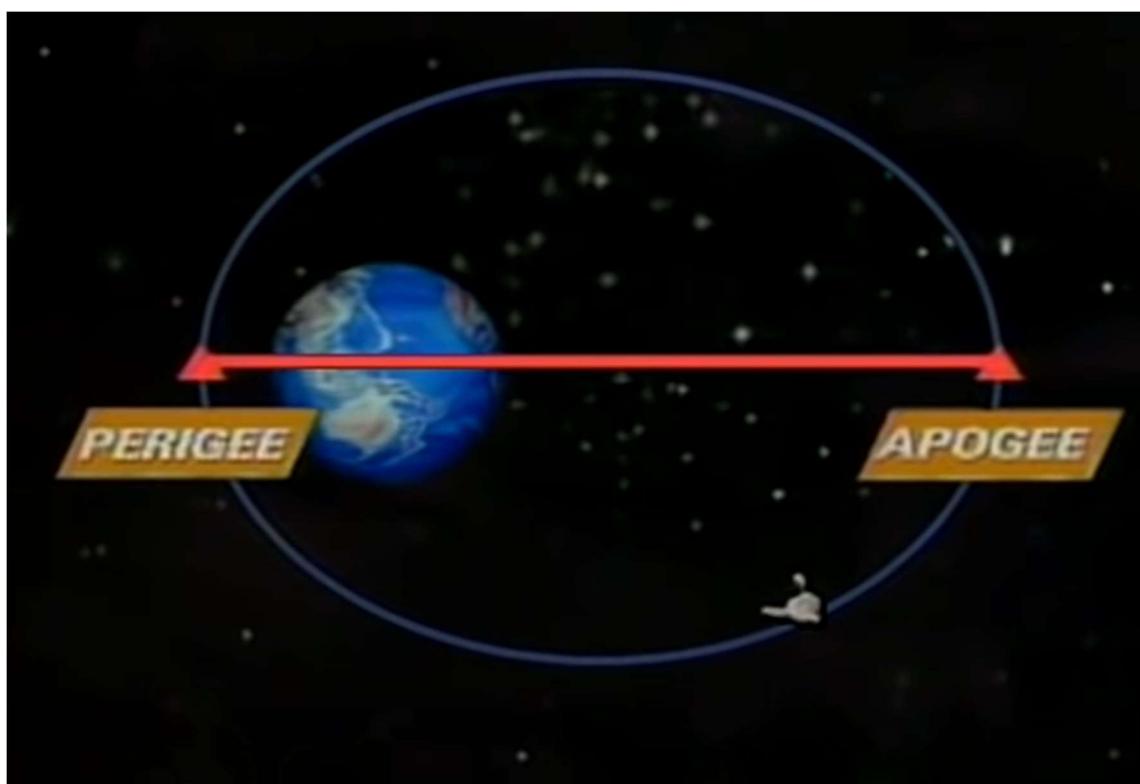
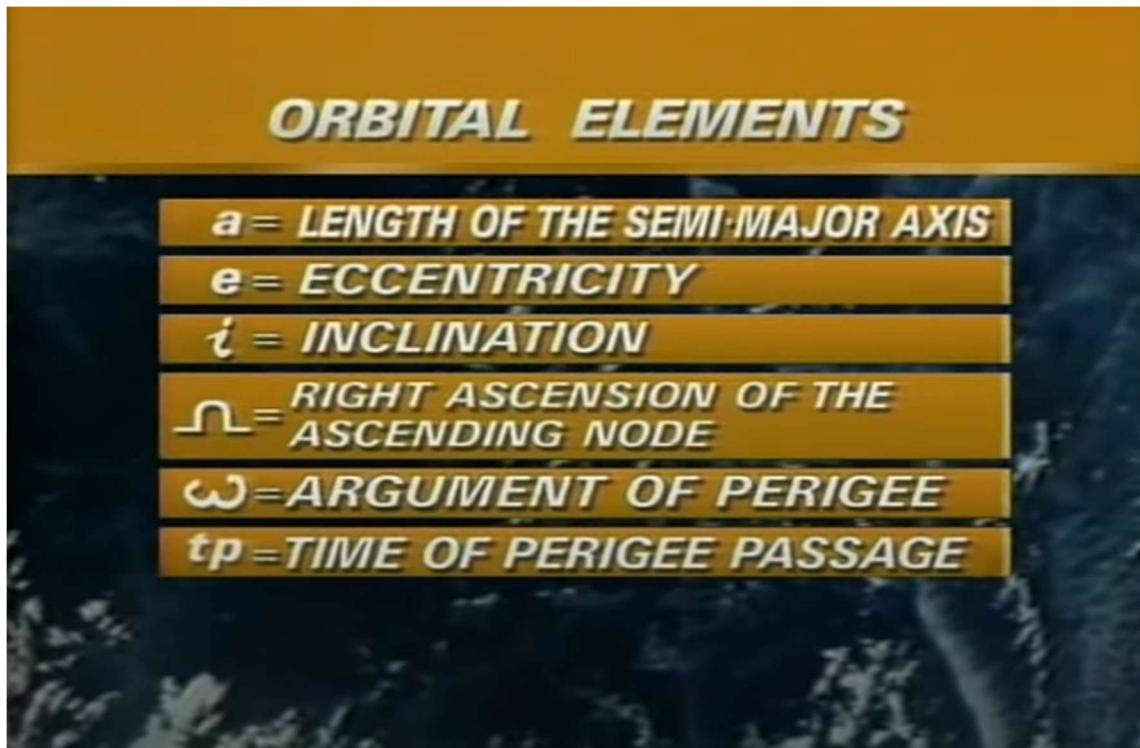
Before a planned retrograde, FIDO should work with RETRO on RETRO planning. The burn should not take place in such a position in the orbit that will fail to reduce the orbit size to intersect the atmosphere. For example, if the Apogee is very large for some reason, the retro burn should take place at the Apogee point to ensure entry. The orbital view along with these parameters are the main tools.

## 1.3 DIAGRAMS AND SCHEMATICS



### 1.4 ORBITAL ELEMENTS

Source: [https://www.youtube.com/watch?v=Am7EwmxBaw8&ab\\_channel=NASASTIProgram](https://www.youtube.com/watch?v=Am7EwmxBaw8&ab_channel=NASASTIProgram)

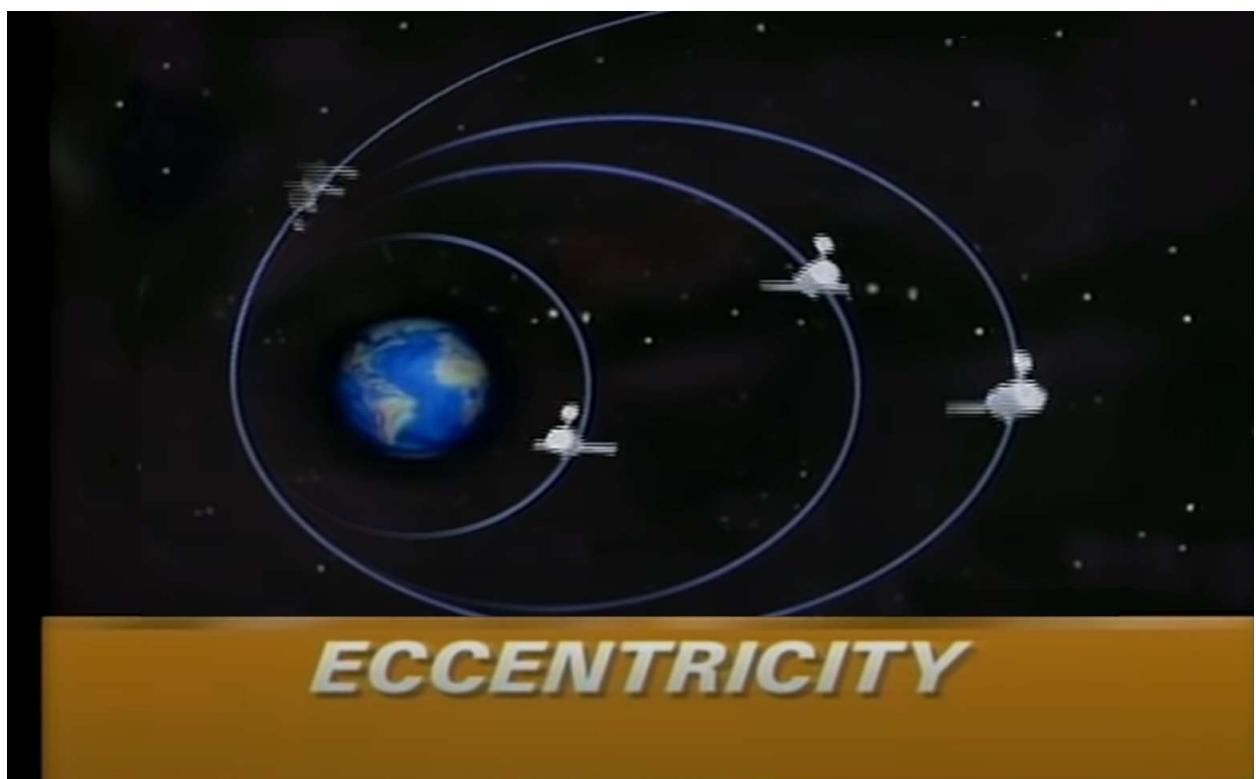


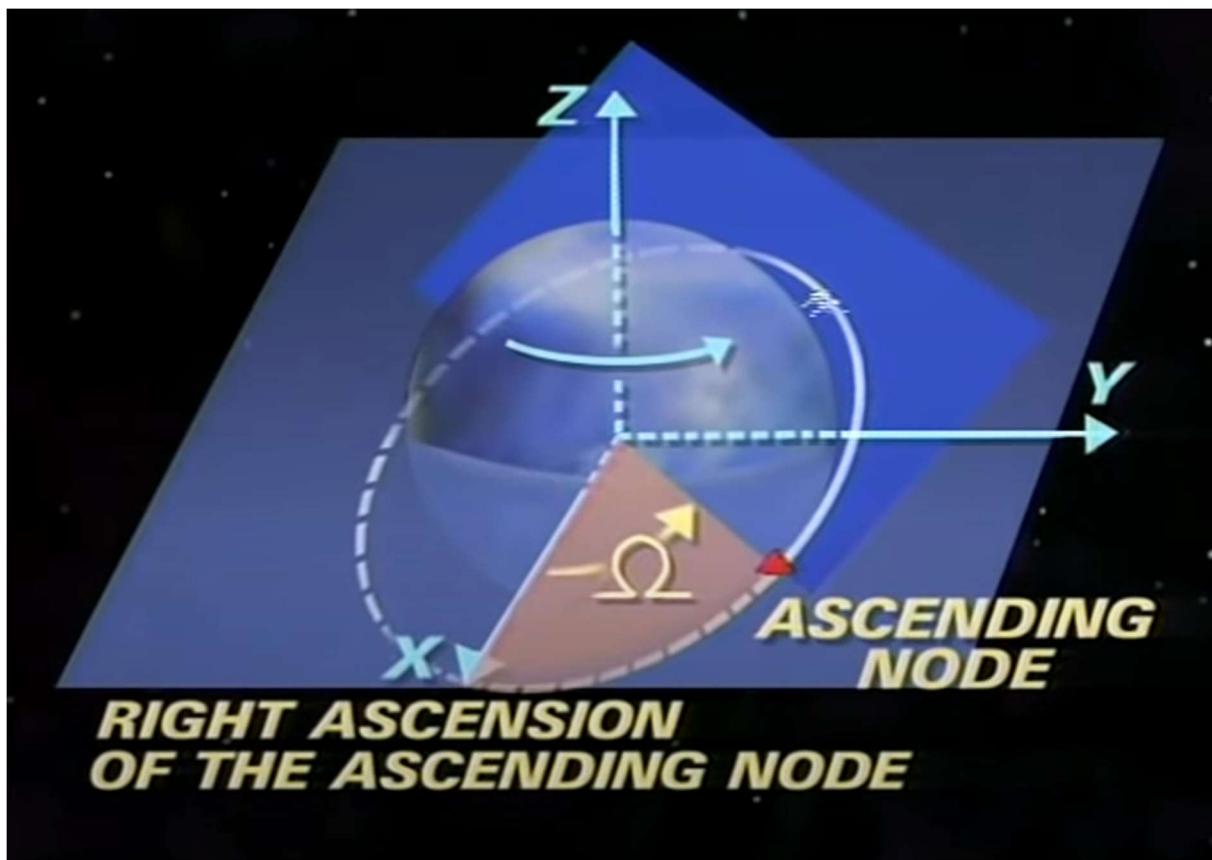
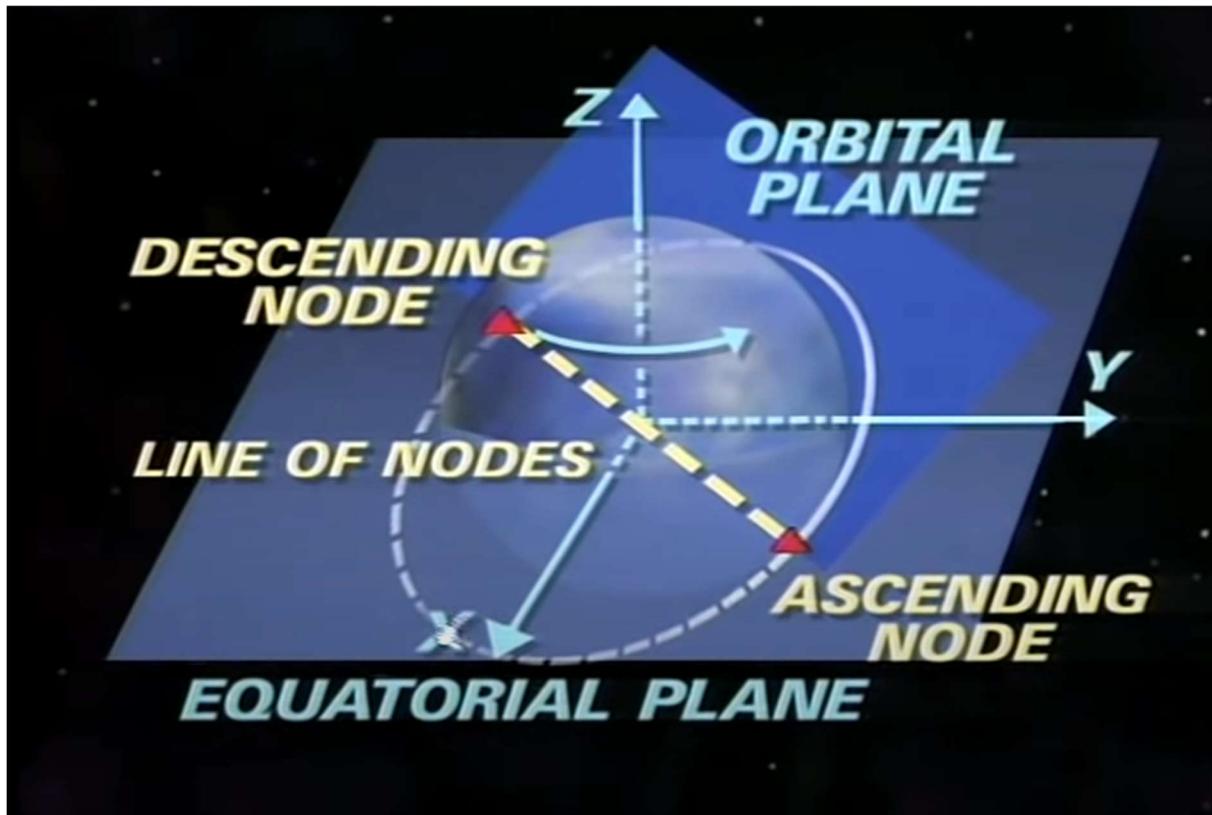
# MERCURY CONTROL CENTER

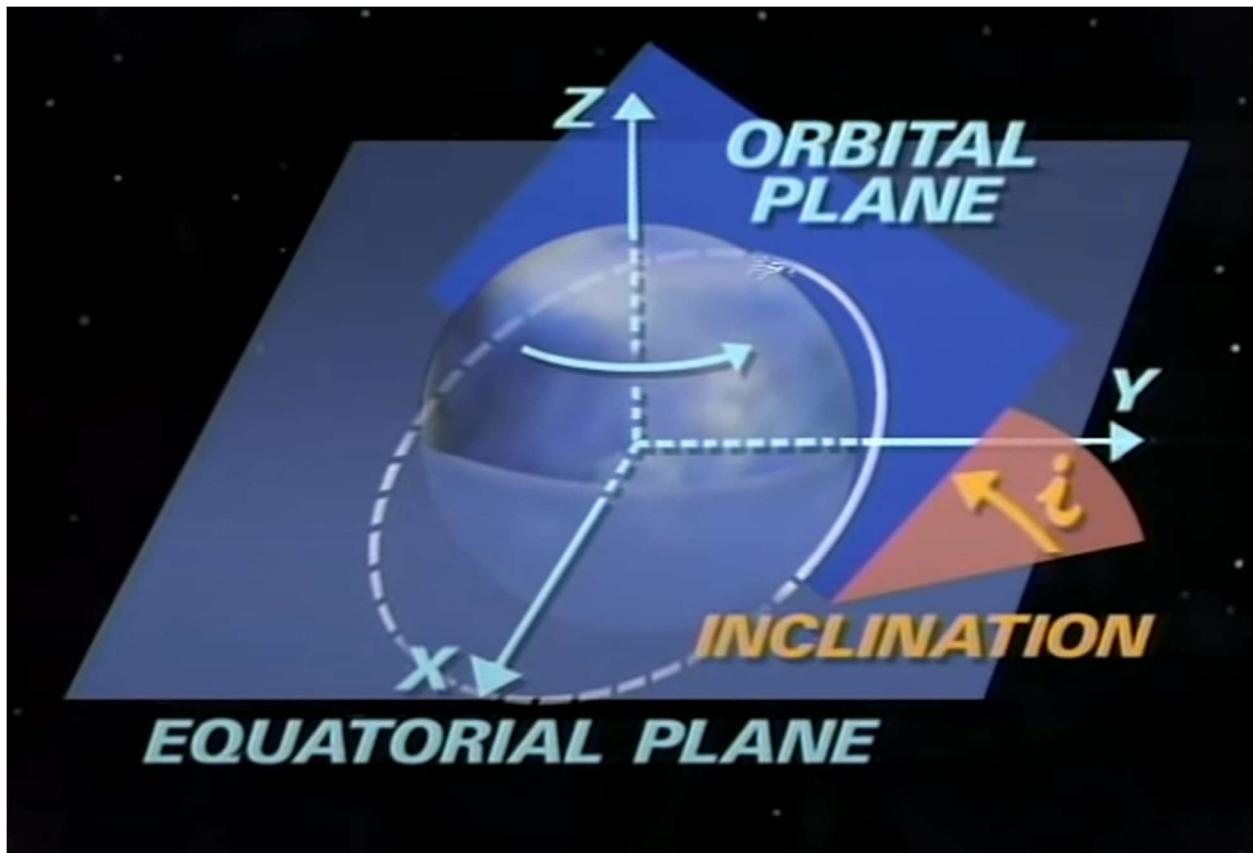
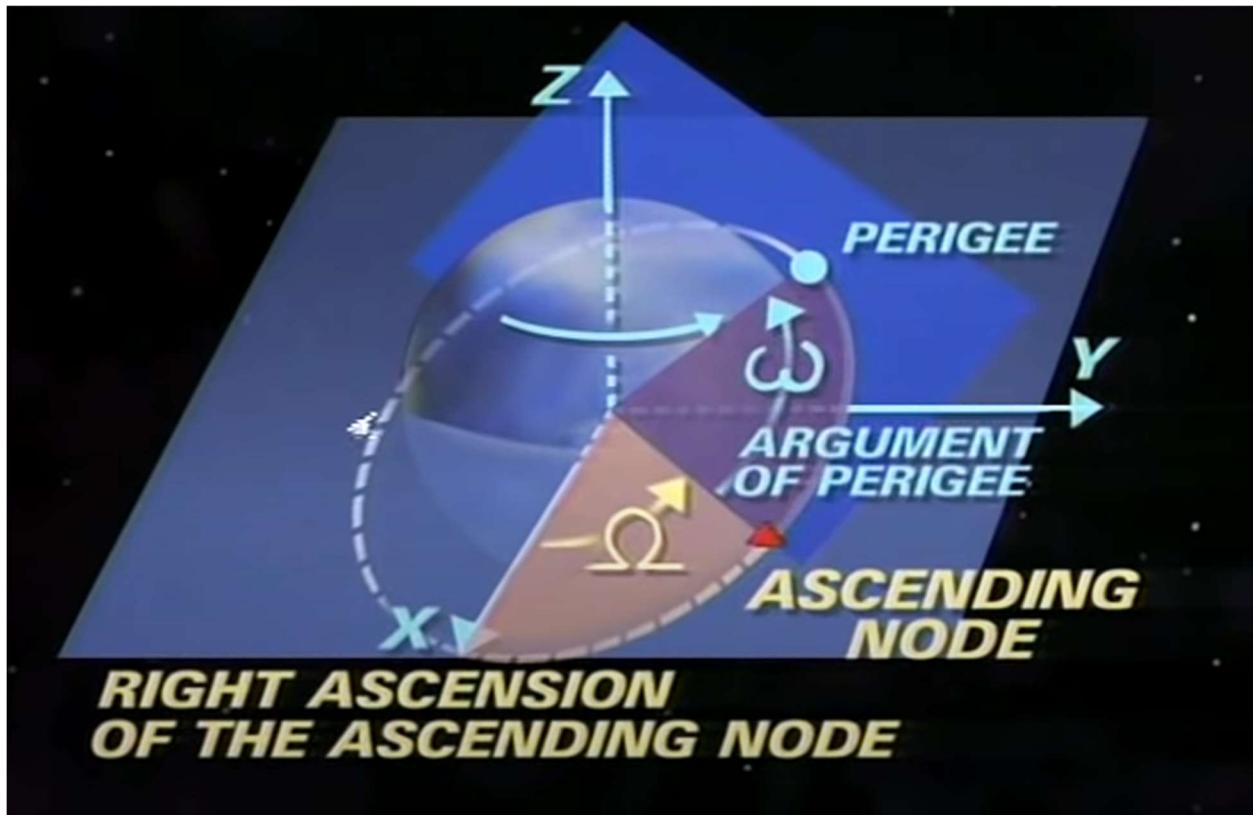
USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR





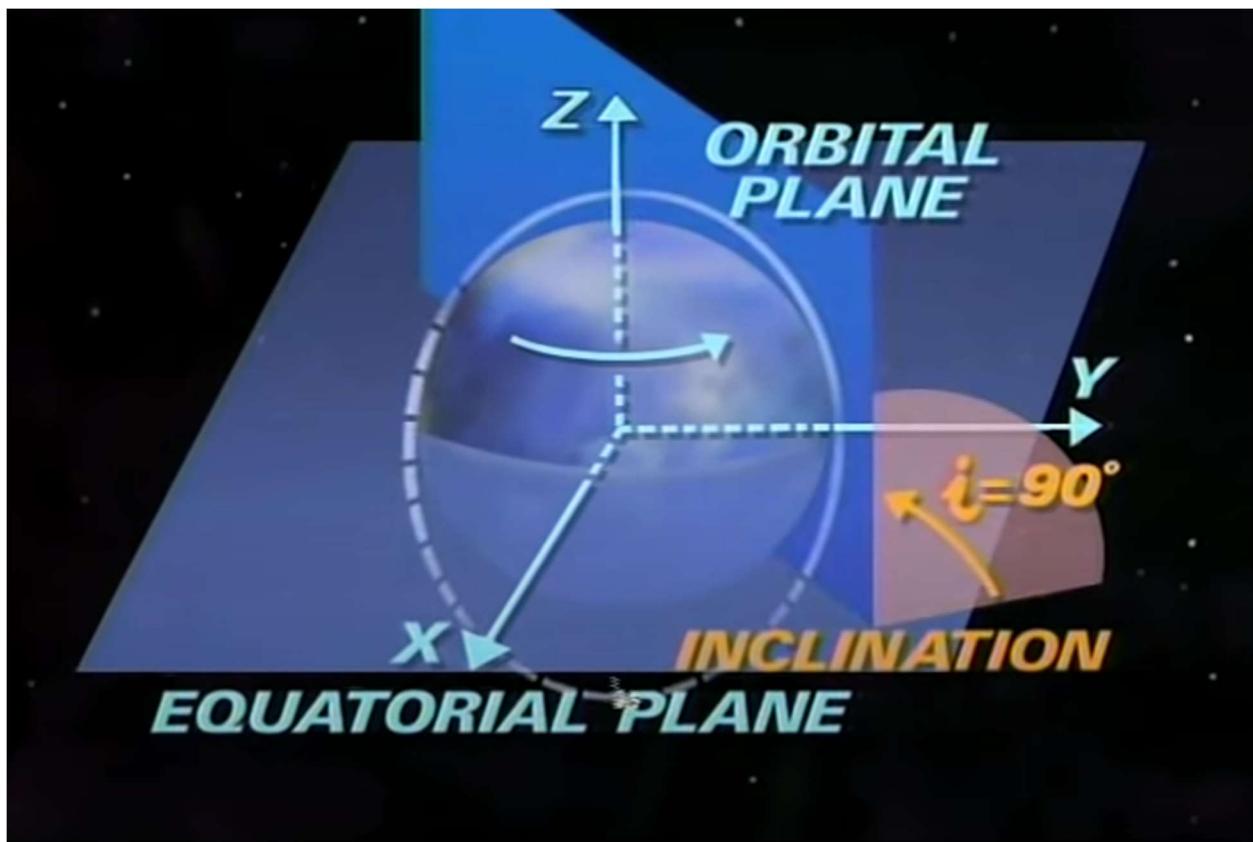
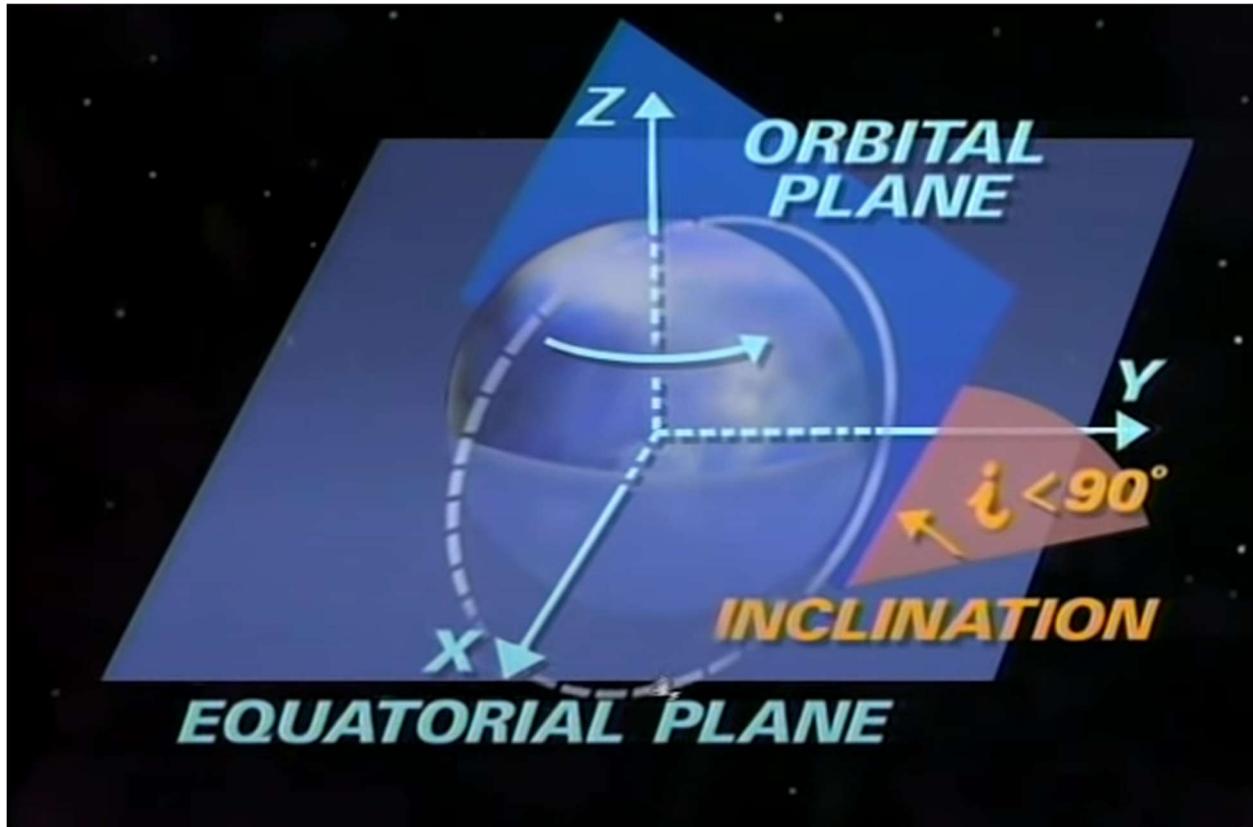


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

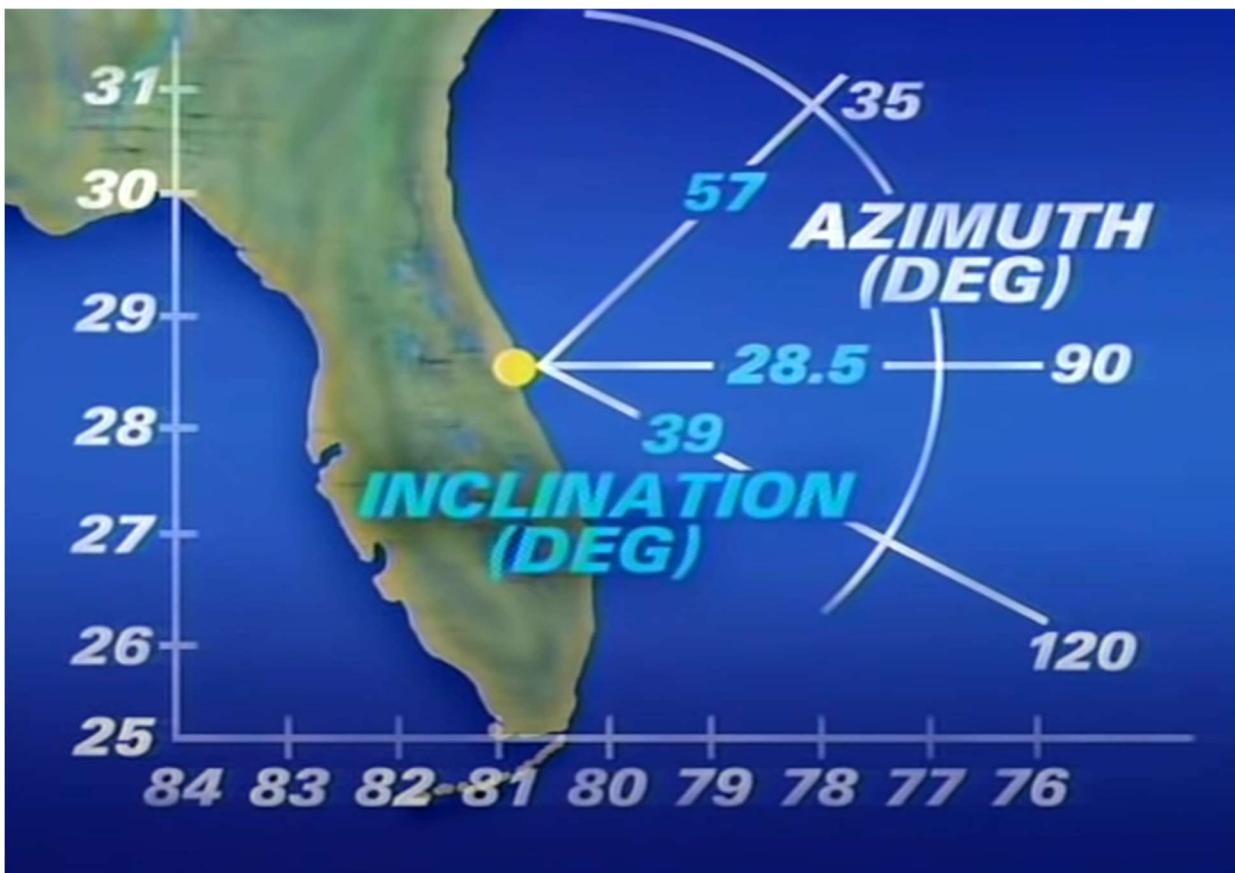
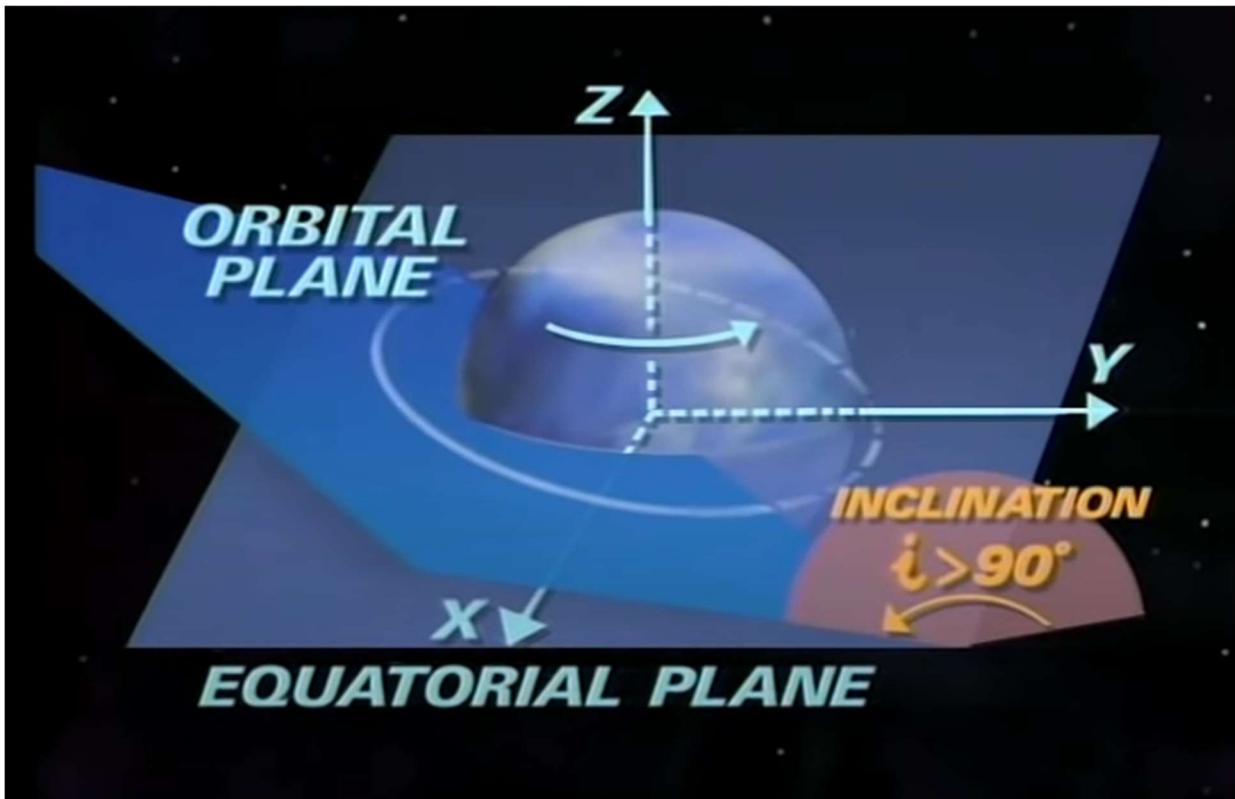
AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR



Orbit types:

Conic Section	Eccentricity, e	Semi-major axis
Circle	0	= radius
Ellipse	$0 < e < 1$	$> 0$
Parabola	1	infinity
Hyperbola	$> 1$	$< 0$

# RETROFIRE CONTROLLER

DESIRED RETROGRADE TIME

00:00

MET

SET

DESIRED RETROGRADE TIME

04:00:00

MET

RETROGRADE TIME

12:54:30

GMT

COUNTDOWN TO RETROGRADE

04:00:00

STATUS REPORT

## X. THE RETROFIRE CONTROLLER

# X. THE RETROFIRE CONTROLLER

## 1. GENERAL

### 1.1 THE DESK



The Retrofire Controller desk has indicators to set the desired retrograde time, see the currently planned time, when it will happen in GMT timezone, and a countdown to it. In addition, indicators show if the retrograde jettison squib is armed, and if each of the retrograde rockets (3x) fires.

### 1.2 OPERATION

RETRO is in charge of getting the spacecraft down. If the mission has to be aborted in orbit, it's up to RETRO to reschedule the retrofire-time. This is done by increasing or decreasing the MET timestamp (hours, minutes, and seconds). To do this, RETRO pushes the buttons above (to increase) and below (to decrease), until they reach the wanted retro-time, then press SET to set it.

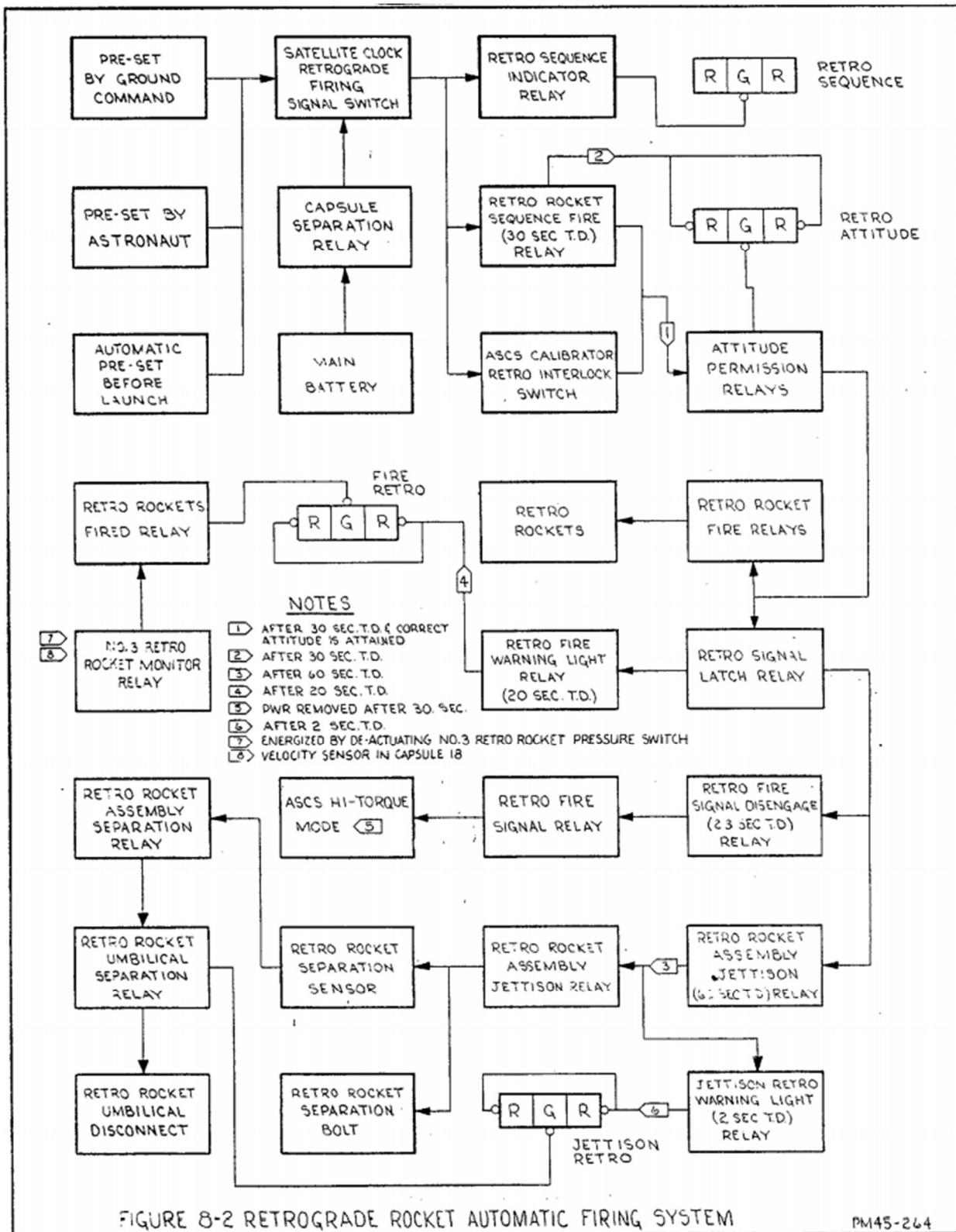
The orbital workflow of the retrograde controller is to use the orbit view (and get used to the fact that Earth rotates) to figure out where to burn, and plan backup retrograde times.

# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y  
AN ORBITAL SIMULATOR

## 1.3 DIAGRAMS AND SCHEMATICS

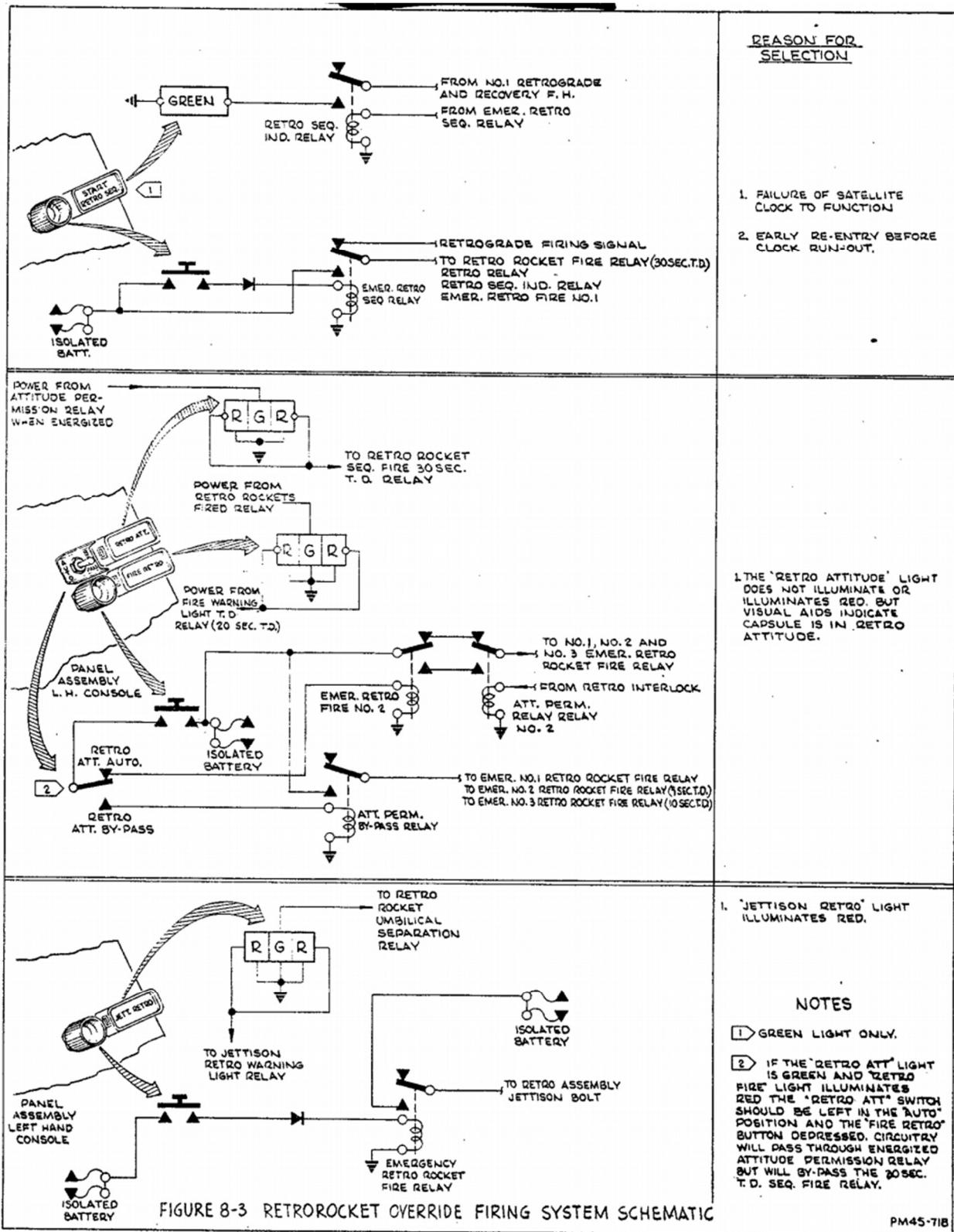


# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR



# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

AN ORBITAL SIMULATOR

## 8-5. ROCKET FIRING

All three rocket fire relays receive 24 V d-c simultaneously; however, the No. 2 and No. 3 rocket fire relays have a five- and ten-second time delay, respectively. Therefore, the following table shows when each rocket receives its fire signal and the length of burning time thereafter. Note that the asterisk indicates time of firing.

Left No. 1 RKT \* \_\_\_\_\_ +

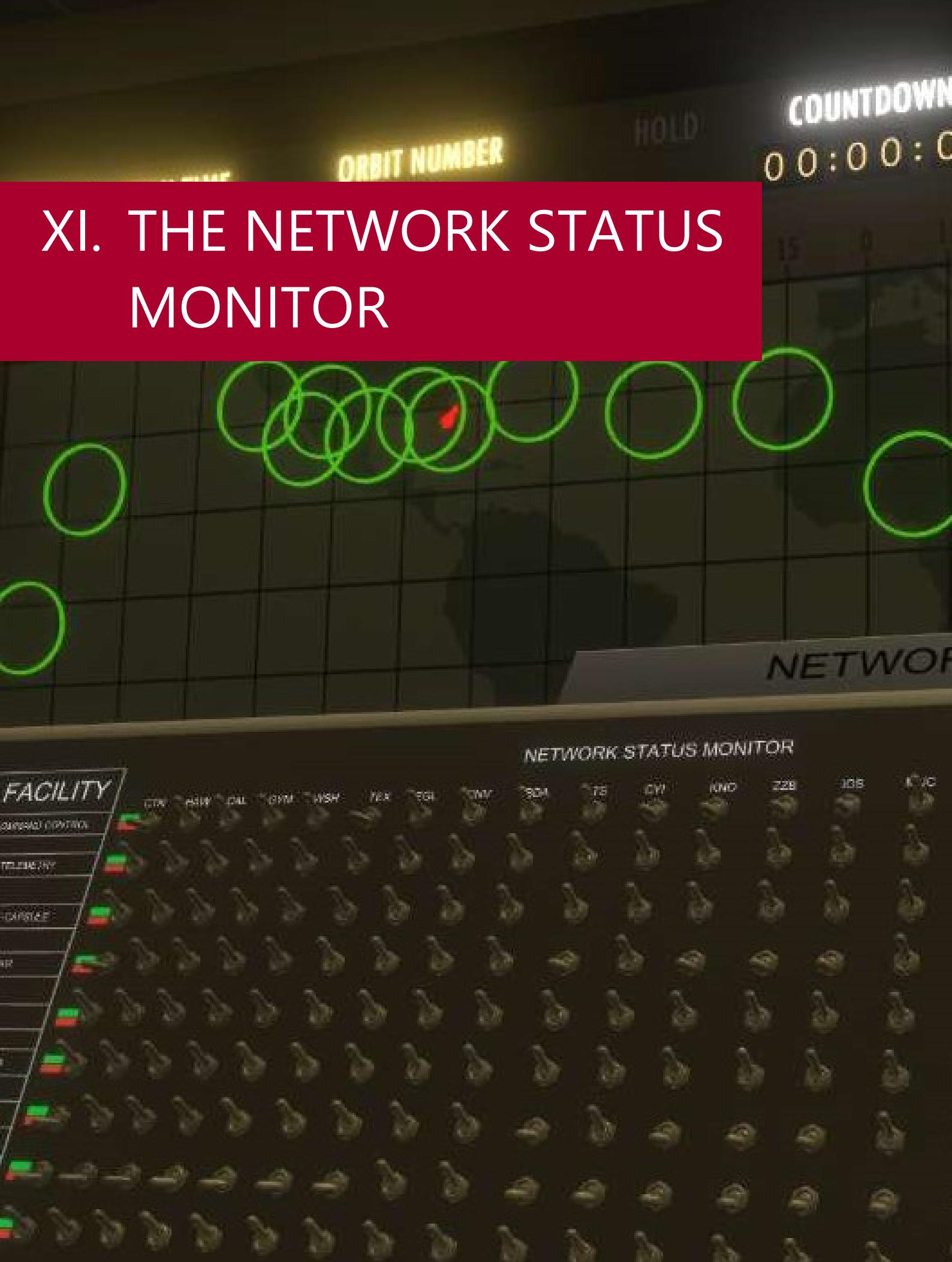
Bottom No. 2 RKT \* \_\_\_\_\_ +

Right No. 3 RKT \* \_\_\_\_\_ +

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

SECONDS

# XI. THE NETWORK STATUS MONITOR



# XI. THE NETWORK STATUS MONITOR

## 1. GENERAL

### 1.1 THE DESK



NETWORK is in charge of managing the communications-network. If Australia out lacks the paper to run their teletype, and CAL lost their radar, it's up to NETWORK to make sure that's shown on the mains. This position is sometimes used by MCC-users humorously write or draw various things on the board.

### 1.2 OPERATION

Not yet implemented.

## XII. THE MISSILE TELEMETRY MONITOR



## XII. THE MISSILE TELEMETRY MONITOR

### 1. GENERAL

#### 1.1 THE DESK



The desk shows if the launch vehicle is ready, current radial velocity (HDOT), orbital velocity, altitude, booster status (Mercury Redstone has one light, Atlas has 3 lights), and the engines thrust chamber pressure.

#### 1.2 OPERATION

TELEMETRY is in charge of monitoring the ascent and state of the booster, making sure the capsule safely gets into space (before vacating the seat). During launch, this means monitoring the pressure of the various chambers (are each of the engines thrusting), as well as the velocities and altitude of the missile.

During pre-launch operations, the astronaut sets up the cockpit, and when ready, set the LV READY switch. This is seen on the LV NOT READY light. During ignition, the chamber pressure should increase and when in operational limits, the engines are at nominal thrust. A blue light indicator shows it the engine is active and thrusting. These should illuminate and extinguish during the ascent stage.

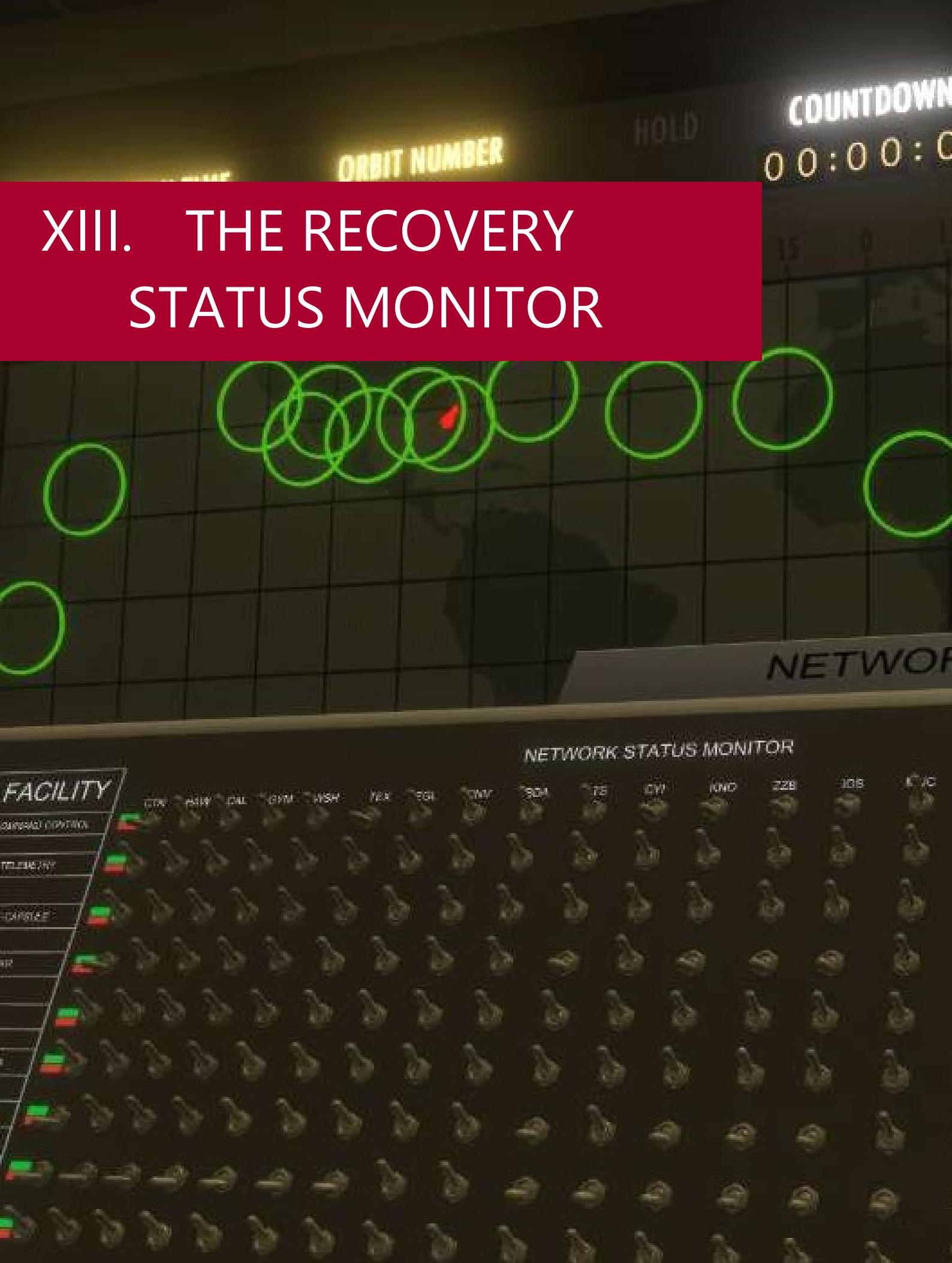
# MERCURY CONTROL CENTER

USER MANUAL

R E N T R Y

A N   O R B I T A L   S I M U L A T O R

# XIII. THE RECOVERY STATUS MONITOR



## XIII. THE RECOVERY STATUS MONITOR

### 1. GENERAL

#### 1.1 THE DESK



Monitors above height sea-level for recovery.

#### 1.2 OPERATION

N/A. This seat is still in early dev.