Slides Required for Apollo Talk

① Possibly show track and sites that were chosen.

② Word slide on basic requirements of the range
(Mathews may actually use such a slide.)
(if he does repeat use of the slide here)

③ Possibly a word slide on data and information required in MCC to make flight control decisions. Maybe consider phases of the flight.

④ Floor plan of MCC - possibly a picture of the actual cont. cent. as well.

Use MCC floor plan then picture of each console and finally an overall pic.

⑤ Picture of BOA control center. There is one around somewhere (IRD - Varra)

⑥ Picture of Remote Site Console.

⑦ Slide showing phases of computing.

⑧ Slide showing the flatboard plots as we use for launch phase.

(9) Large plot of final γ vs V_R plot which indicates go no-go line - possibly some ties indicating times of abort.

(10) Picture of F100 and Retro Consoles.

(11) Possibly a plot of what is shown while in orbit.

(12) Slide showing computer facil and data inputs

(13) Final slide showing all data inputs to MCC - this should be gross slide.

(14) Show a layout of typical remote site facilities.

(15) Use slides or revamping of slides on flight control used for Wiesner committee.

Basic Outline

Basis of MCC design - BOA design. Internal & local comm.
Computing facilities required (MCC & BOA)
Communications requirements. TTY and voice.
Remote site concepts - design basis
Then go thru flight control aspects
~~Prelaunch Period Flight~~
Prelaunch phase - countdown comp - booster - capsule
Command problems - communications
Powered flight phase
Orbital insertion - how made
Orbit phase
Reentry.
Simulation requirements
Simulation Facilities
Establishment of mission ground rules.

Concepts and requirements for the Mercury tracking sites established by Mr Mathews in opening speech.
Review these basic requirements

Put a satellite in the air in future not where

Continuous contact thru launch and initial orbit.
Continuous astro and capsule surveillance if possible
Ability to transfer info regarding emerg. condit
back from astro and grd control point of view.
Continuous updating of orbit conditions so
that accurate reentry and recovery point
could be obtained. Reentry each orbit.
Ow this and previous reasons such as the use of
available equipment the sites were chosen.
Use of Mercury control center as focal point of
info. Bda also furnished excellent site as
back-up to MCC - other locations such as those in
Australia - command - tracking etc.

Go over outline of what is to be presented in paper.

Basis of design of the MCC.
Various aspects of the mission of course considered
What data required to make flight control decis.
V/H - voice - traject - weather - booster - caps - recov.

Ideally would want all info digested and presented for decision by one human - maybe reasons why decisions not made automat unreliable data require human decis. and back-up. biggest problems is during past pt where real time and instant decis are req. - such as - - -
On this basis the number of posit. in NCC were determined. How much could be digested in real time so that proper decisions could be made.
Go over the number of positions chosen and why.
Also note that Recon Stat & RSO obs. consoles became redun and note use made of them.
Positions for Ops Direc - Navy & Det Commander
Go over various consoles - wall map - trend charts
Note Trajec displays - to be discussed with computer.
Talk about communications required locally.

BOA

Back-up control center - similar design and concepts because of real time decisions required.
Computing facil - details later.

Remote sites.

Transfer of info - reasons for positions - what duties are - describe a remote site, consoles support equipment.

Now go back and pick up additional requirements to support the flight and network in general.

What are computing requirements - actually several phases - launch - orbit insertion - orbit & reentry.

Things of concern in Mercury are - describe data that we display - how we display it plotted and digital.

What is important as flight progresses ground track - altit - flt path angle & V_I vs V_R use as to events - nominal traject.

Data use as to abort - when to abort - areas to avoid.

At orbital insertion what decisions must be made - go-no-go time - & V_I vs V_R plots - computer decisions.

Retrofire time computations - how displayed. how used - info to BOA and to remote sites.

Give all times that are computed.

Impact prediction capabilities - selection of recovery areas - to be covered in more detail.

Mayer's talk →

Having made orbit decision - computation is switched to either orbit or abort mode.

In abort mode - continuous impact prediction and real time present position are given accepts data updating from other radar when

possibles.

In orbit mode - orbit parameters updated from data obtained from remote sites. This gives continuous improvement in the time of retrofire which is updated continuously for the end of each orbit and the contingency areas which are set up.

Once ~~reset~~ reentry is started computer into reentry mode - impact predic - updating time of impact for recovery force info.

Little bit more on how this data used at MCC and remote sites to be presented subsequently.

Now go into computing facilities and data required to make the computations.

In order to make the computations just described - - - Redundant facilities provided throughout 2 7090 computers at the Goddard SFC. Data sent to GSFC on 4 hi spd lines two carrying same data Selected source returned on all 4 lines - comparisons made at both ends - Both computers used - can switch from one to the other at any time.

Discuss sources of data. - GE primary - sent to GSFC and ~~same~~ also ~~to~~ used direct out of R.E. Burroughs sys - hi accuracy.

Other sources of data include AK-T AZUSA FPS-16 out of the AMR-7090 and raw FPS-16 data. Can use multiple FPS-16 - from any one of AMR Radars. - Look angles. better from some other points of view.

B&A has 709 comp - with FPS-16 & S-band radar inputs for same type of computations.

C- & S band inputs world-wide to provide orbit updating provided by TTY and automatically fed to computer.

Other sources of information shown in slide - discuss A/C voice - T/M inputs - command capabilities - Communications nets.

Now discuss a typical remote site (pick a command site) ~~and~~ show facilities layout.

Discuss briefly the communications net used to tie all sites together. Not in detail - subject of its own.

Voice and TTY provided. Voice & TTY to all command sites - redundancy in paths - Typical times associated with messages. Experience to date. Need for voice to all sites.

Many other aspects of Mercury network its construction - tests, ~~and~~ checkout - prelaunch

countdowns etc which are too voluminous to discuss in this talk. Suffice it to say however that network and operational planning required should go hand-in-hand with the design of the space vehicle - otherwise will find that such support will tend to pace the program. Also support provided will be less than desired - consider on board instr. in lieu of ground flt cont requirs.

Having gone over the facilities provided for flight control and the design philosophy of these facil. - how do we use them to perform the flight control functions.

Think here we can use the info presented to the Wiesner committee right thru the launch-orbit insertion and orbit phases. Need to talk a little more about reentry phases and how retrofire maneuver is conducted. (Use charts from this presentation as basis for writing this part of the talk.

Dual projection

1. BASIC REQTS. — Network (5 pts.) (words)
2. control center duties & other coordination. (words)
3. <u>MCC Floor plan.</u>
   - a
   - b
   - c
   - d
   - e
   - f
   - g
   - h
   - i
   - (?)

   INDIVIDUAL CONSOLES

✓ 4. MCC picture color.

✓ 5. BDA (35) → Blown up & check if its the best one

✓ 6. Remote site (~~[illegible]~~) ← work on this. (color)

✓ 7. rough cut at CC [illegible]. — tracking & comput.

✓ 8. <u>PlotBds.</u> (?)

✓ 9. (Plots)

(over)

MERCURY NETWORK

1 DESIGN GROUND RULES

1. CONTINUOUS TRACKING, VOICE AND TELEMETRY — LIFT OFF THROUGH INSERTION.

2. PERIODIC TRACKING, VOICE AND TELEMETRY DURING EACH ORBIT

3. CONTINUOUS TRACKING DURING RE-ENTRY

4. CONTINUOUS IMPACT PREDICTIONS.

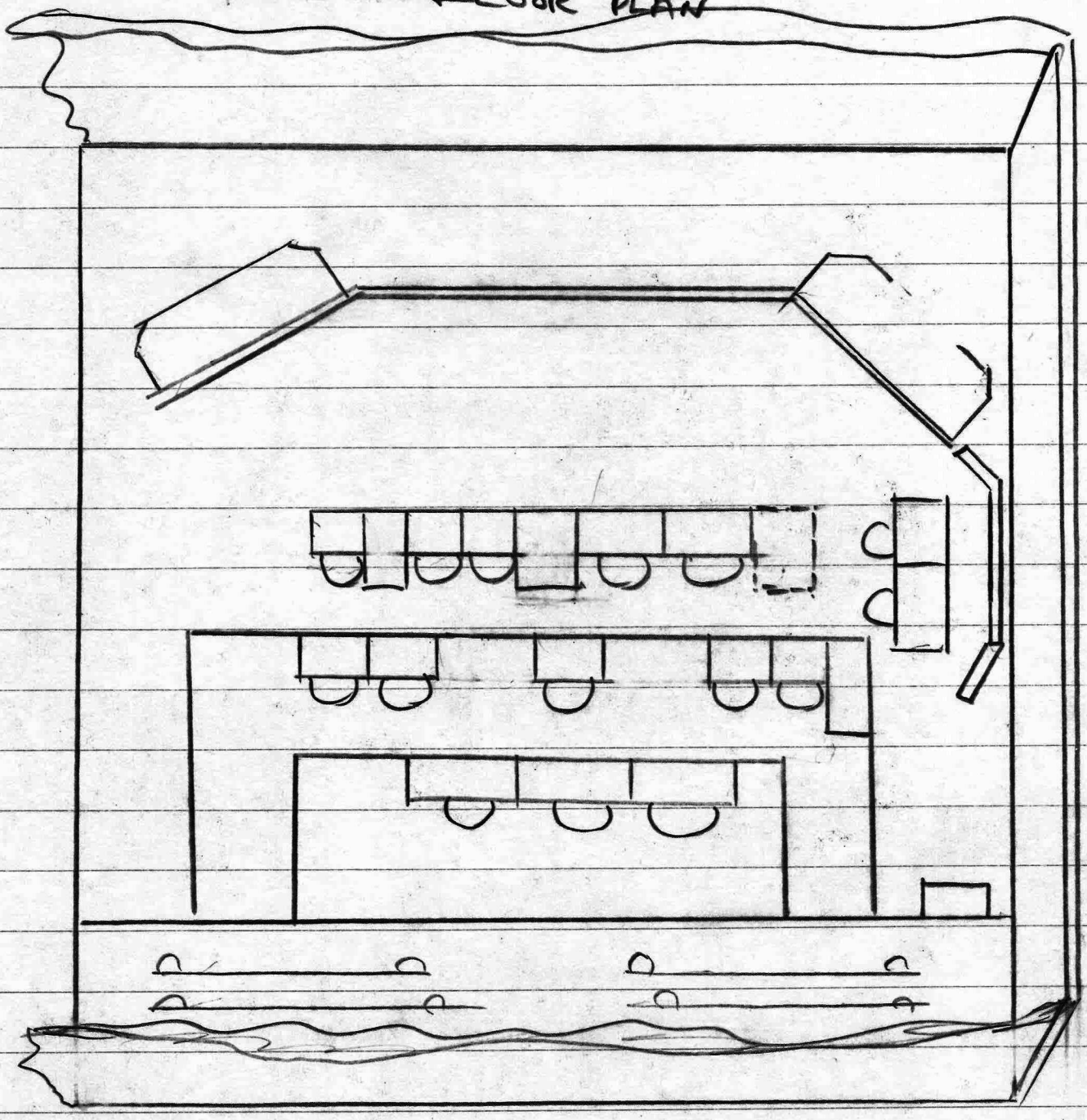
MERCURY CONTROL CENTER

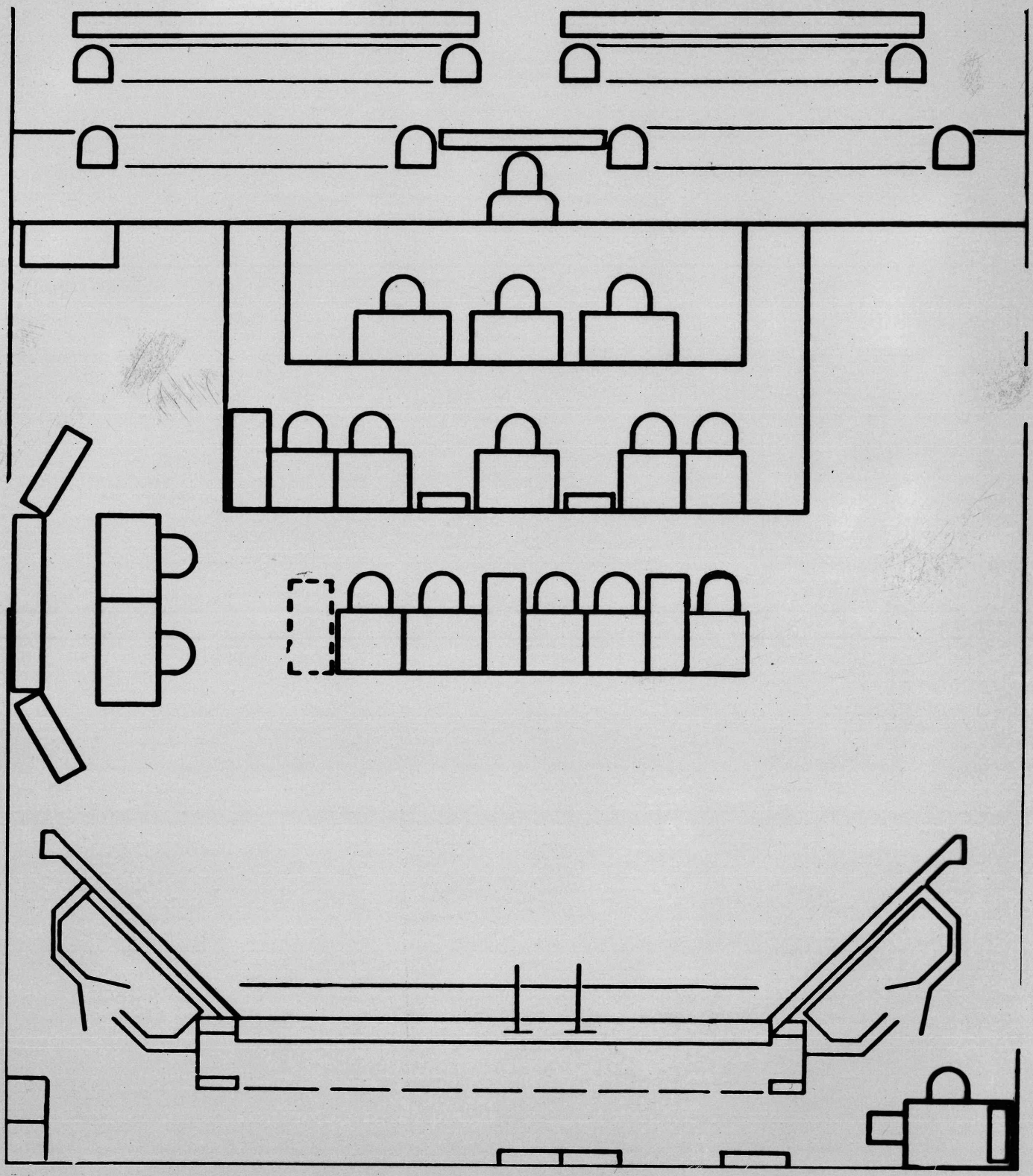
PRE-LAUNCH INPUTS AND FUNCTIONS.

1. BOOSTER READINESS
2. CAPSULE READINESS
3. ASTRONAUT READINESS
4. NETWORK COUNTDOWN AND READINESS
5. RECOVERY READINESS
6. WEATHER ASSESSMENT – LAUNCH, GROUND TRACK AND RECOVERY AREAS.
7. FLIGHT CONTROL TEAM READINESS.

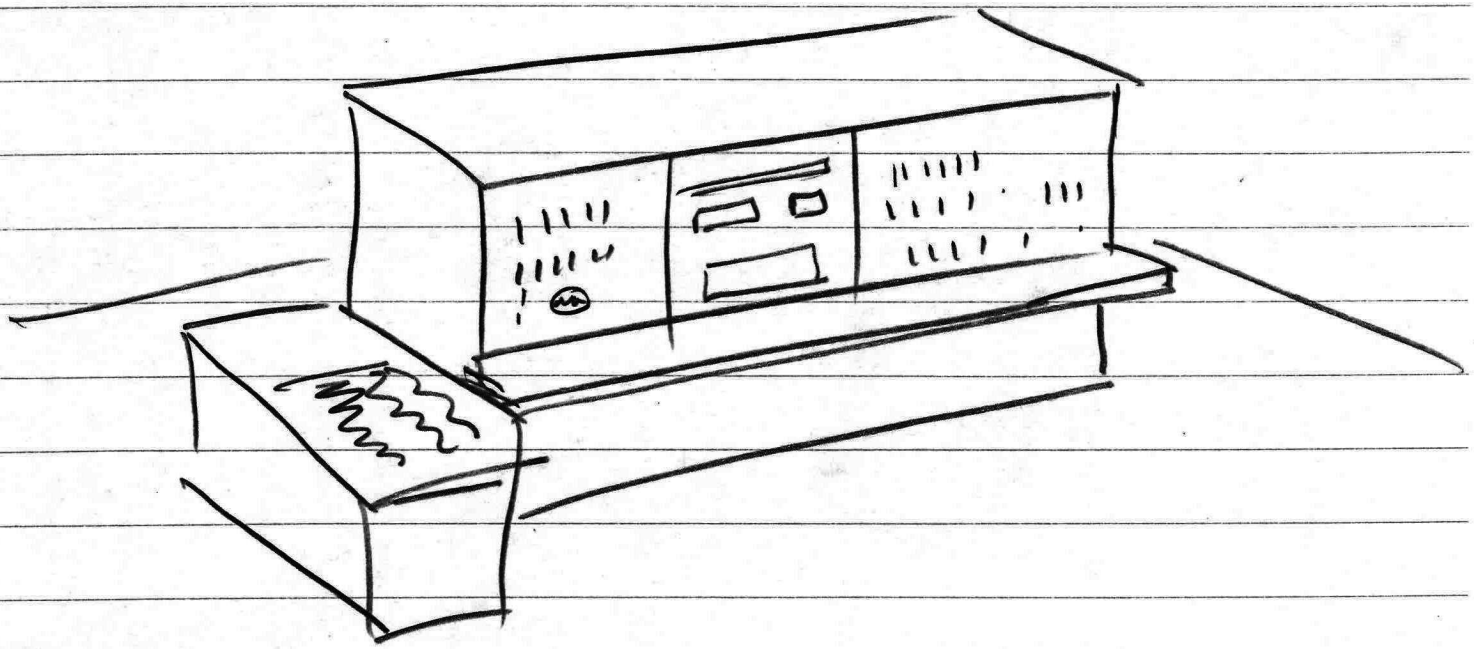
FIG. 3.

MERCURY CONTROL CENTER OPERATIONS ROOM FLOOR PLAN





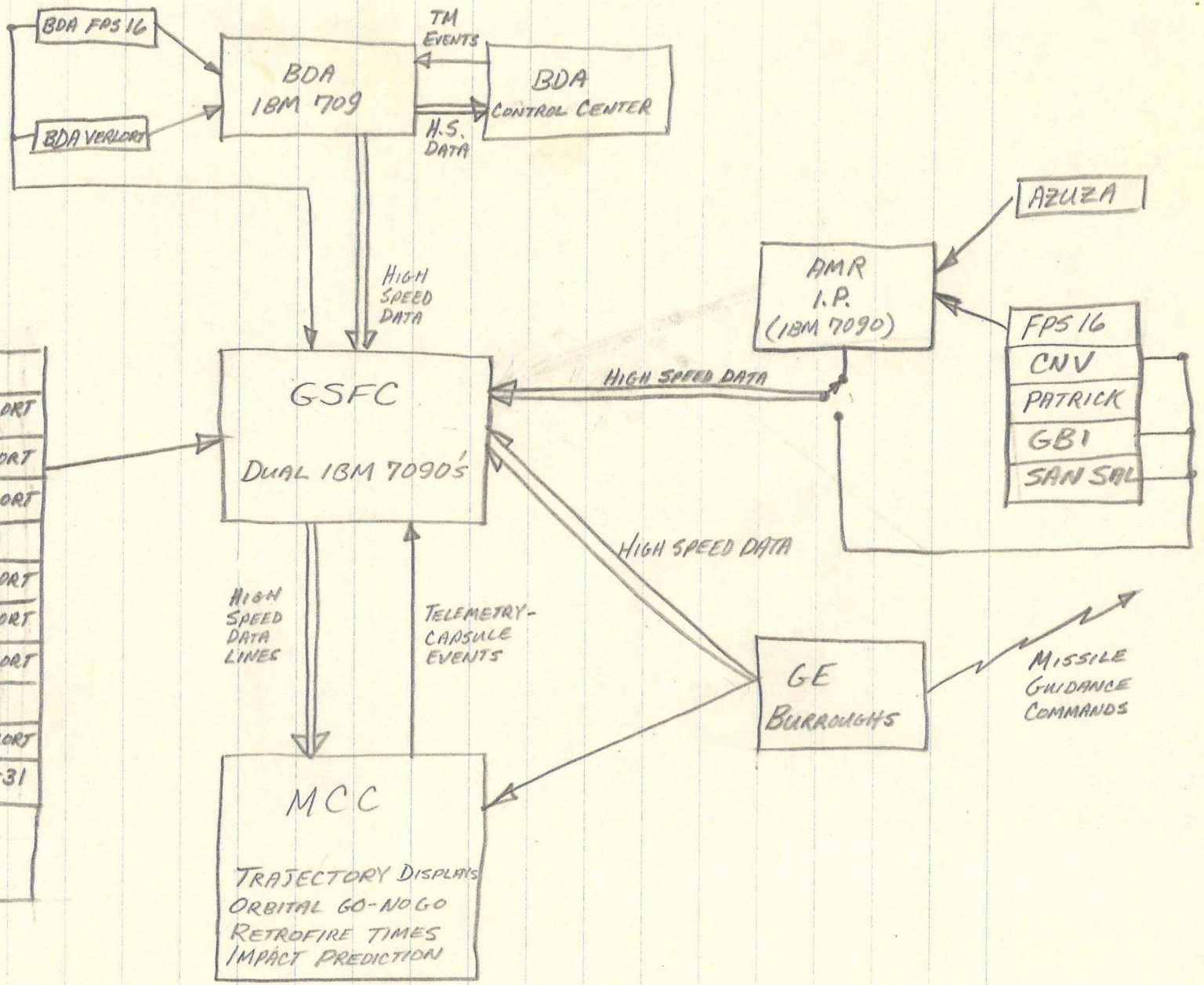
REMOTE SITE OPERATIONS ROOM



(COLOR SLIDE OF ARTIST'S SKETCH AVAILABLE).

MERCURY COMPUTING DATA FLOW

FIG-6



REMOTE SITES		
BDA	FPS-16	VERLORT
CYI		VERLORT
MUC		VERLORT
WOM	FPS-16	
HAW	FPS-16	VERLORT
CAL	FPS-16	VERLORT
GYM		VERLORT
WHS	FPS-16	
TEX		VERLORT
EGL	FPS-16	MPQ-31
CNV	FPS-16	
GBI	FPS-16	
SAN-SAL	FPS-16	

ORBIT & RE-ENTRY

LAUNCH