

CE

- I. INTRODUCTION
- II. SKYLAB PROGRAM
- III. SKYLAB MEDICAL EXPERIMENTS PROGRAM
 - BIOMEDICAL VIEW OF SKYLAB PROGRAM IN RELATION TO MANNED SPACE FLIGHT
 - WHY THESE EXPERIMENTS SELECTED
 - MR&OD POSITIONS
- IV. MISSION OPERATIONAL ACTIVITIES
 - MSC FACILITIES
 - MCC - MOCR
 - SSR
 - MISSION MEDICAL EXPERIMENTS BOARD
- V. PRE- AND POSTMISSION ACTIVITIES
 - PREFLIGHT
 - POSTFLIGHT
- VI. DATA HANDLING
- VII. REPORTING ACTIVITIES
- VIII. ASTRONAUT BRIEFINGS BY PI'S
 - PURPOSE
 - LIMITATIONS
 - POST BRIEFING DISCUSSION WITH MR&OD

DR. HAWKINS

SKYLAB

MEDICAL EXPERIMENT
PRINCIPAL INVESTIGATOR
BRIEFING

JANUARY 21, 1971

NASA

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

NASA-S-70-1906 S

SKYLAB A



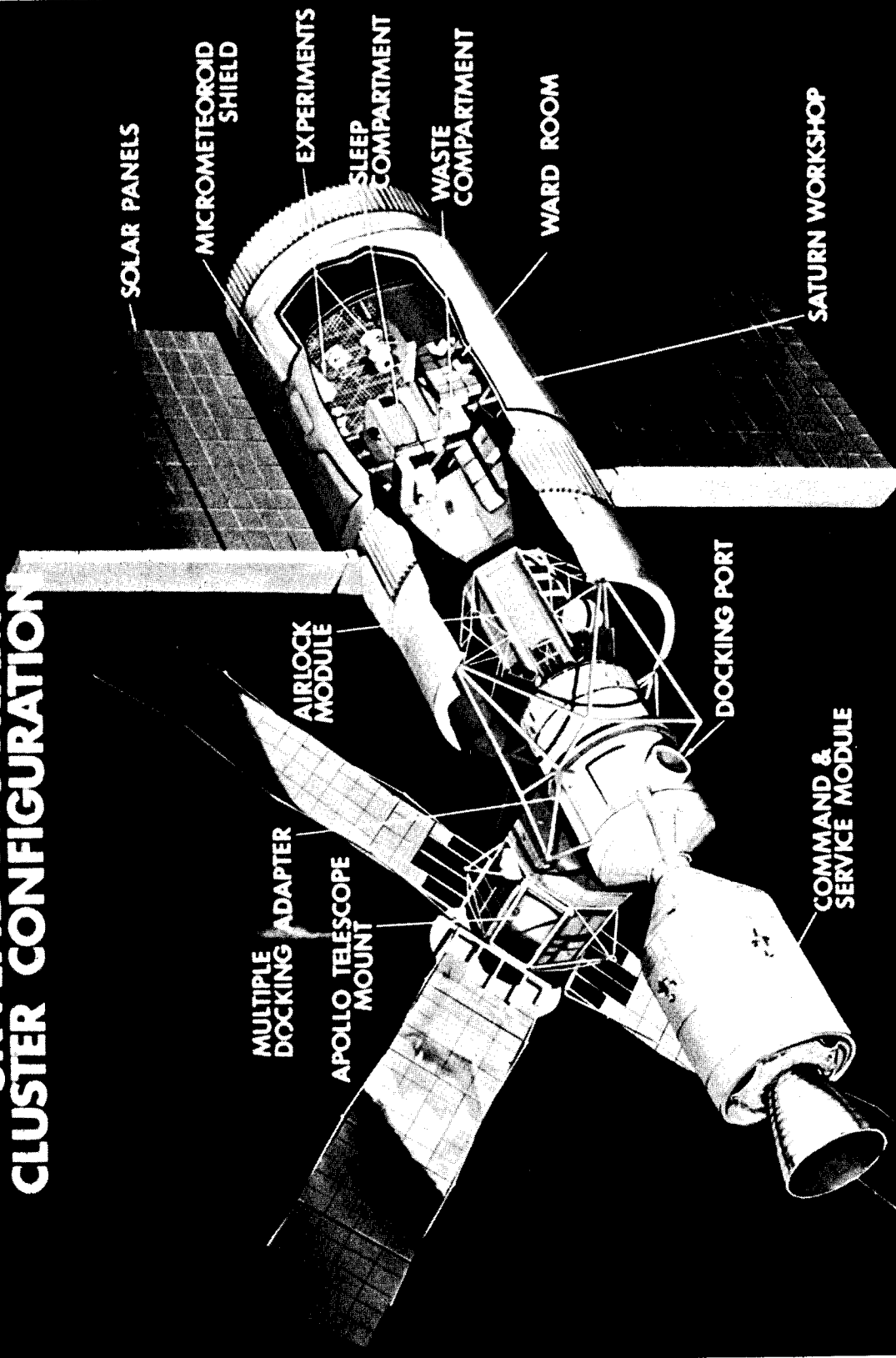
DESCRIPTION

- THE SKYLAB PROGRAM WILL ESTABLISH, EQUIP, AND MAINTAIN AN ORBITING MANNED WORKSHOP
- ALL FLIGHT ACTIVITIES WILL BE IN NEAR-EARTH ORBIT AT ALTITUDES UP TO 235 N. MI.
- THE CREW WILL PERFORM A BROAD RANGE OF SCIENTIFIC AND TECHNOLOGICAL EXPERIMENTS
- SKYLAB MISSIONS WILL EXTEND THE DURATION OF MANNED SPACE FLIGHTS
 - FIRST MISSION WILL BE FOR UP TO 28 DAYS
 - TWO SUBSEQUENT REVISIT MISSIONS WILL BE FOR UP TO 56 DAYS
- SKYLAB WILL MAKE MAXIMUM USE OF EXISTING GEMINI AND APOLLO HARDWARE

MAJOR HARDWARE ELEMENTS

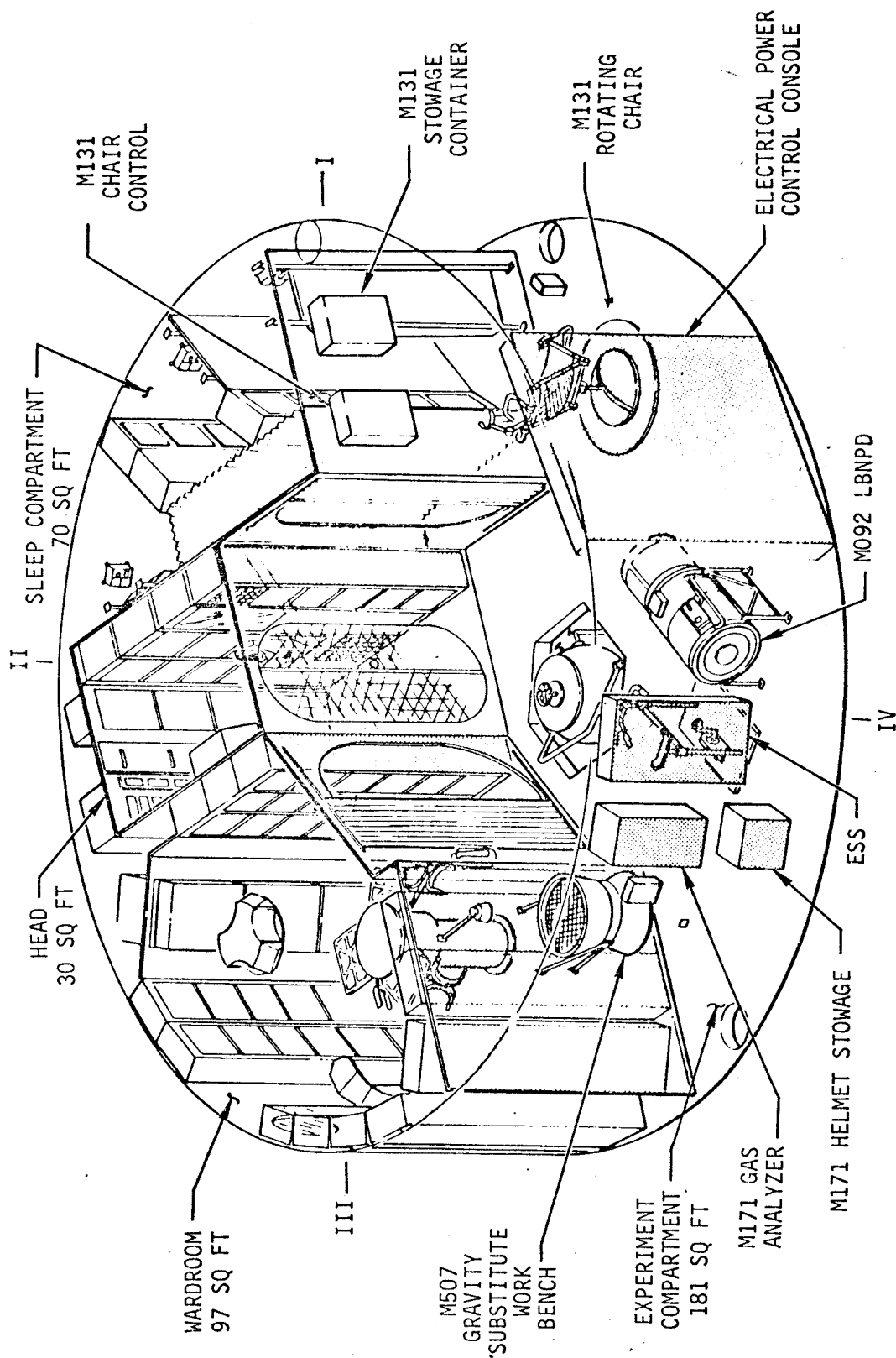
- **ORBITAL WORKSHOP (OWS)**
- **AIRLOCK MODULE (AM)**
- **MULTIPLE DOCKING ADAPTER (MDA)**
- **APOLLO TELESCOPE MOUNT (ATM)**
- **COMMAND AND SERVICE MODULES (CSM)**
- **EXPERIMENTS**

SKYLAB PROGRAM CLUSTER CONFIGURATION



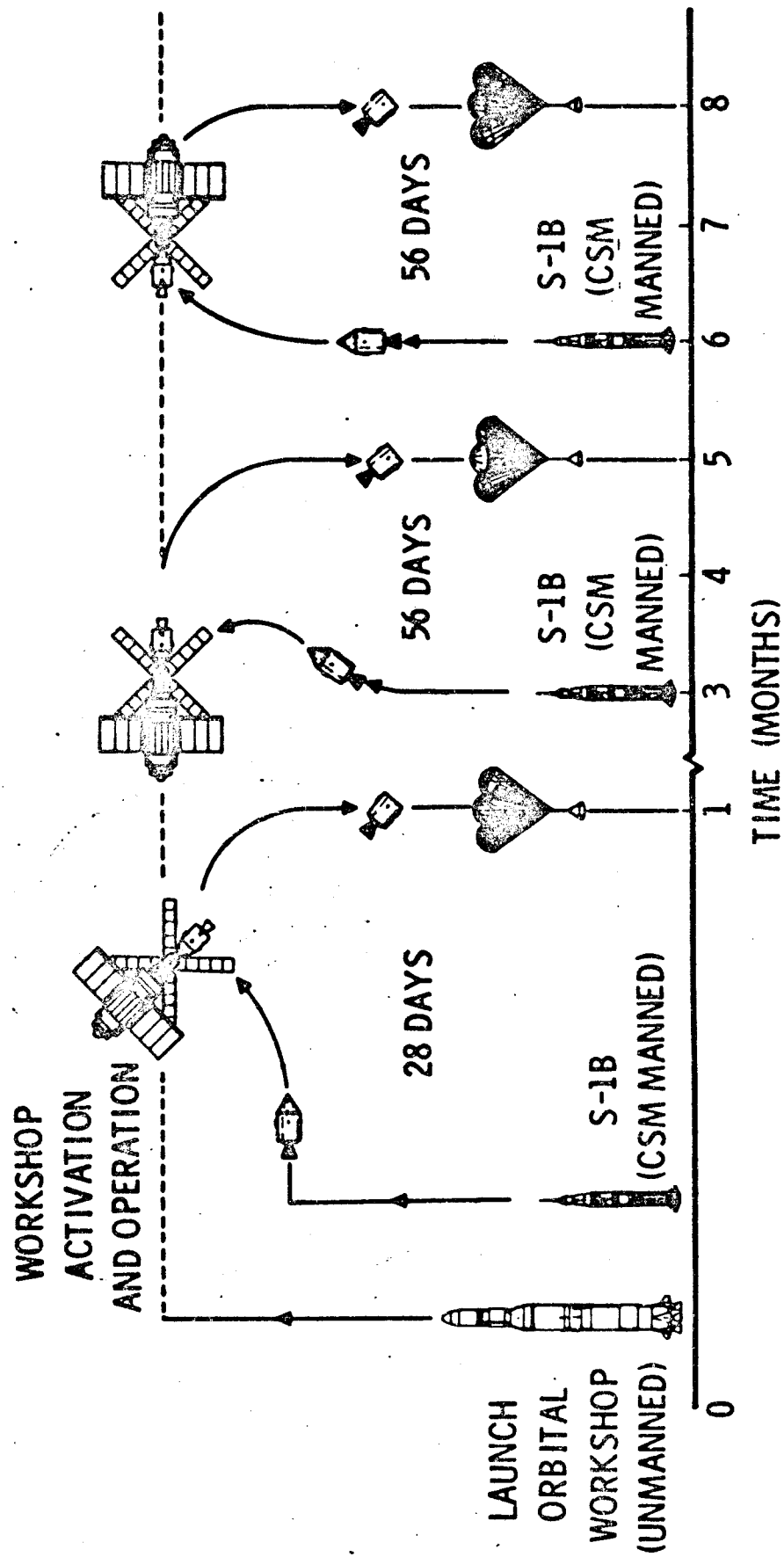
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ORBITAL WORKSHOP CREW QUARTERS INSTALLATIONS



NASA-S-70-3239-V

SKYLAB MISSION PROFILE



APOLLO/SKYLAB FLIGHT SCHEDULE

	CY 69	CY 70	CY 71	CY 72	CY 73
APOLLO MISSION G	11				
MISSION H	12	13	14		
MISSION J			15	16 17	
SKYLAB					
SATURN V WORKSHOP					
MANNED VISITS SATURN IB					

SKYLAB SCHEDULE

[illegible]

SKYLAB MEDICAL EXPERIMENTS PROGRAM

BIOMEDICAL VIEW OF SKYLAB PROGRAM IN RELATION
TO MANNED SPACE FLIGHT

① Why fly Skylab?

- FIRST MANNING (SL-2)

- MAN'S CAPABILITY FOR 28 DAYS
- COMMIT TO 56 DAYS OR DEAL WITH
DECONDITIONING

- SECOND MANNING (SL-3)

- MAN'S CAPABILITY FOR 56 DAYS
- COMMIT TO LONGER FUTURE MISSIONS

- THIRD MANNING (SL-4)

- ADDITIONAL INFORMATION TBD

② Where does Skylab fit
in Manned Spaceflight

SKYLAB MEDICAL EXPERIMENTS PROGRAM

WHY THESE EXPERIMENTS SELECTED ①

Because We Have Seen Changes In These Systems

● CARDIOVASCULAR

② Orthostatic Intolerance

● M090 SERIES

● CARDIOPULMONARY

③ ↓ O_2 Consumption ∴ ↓ Exercise Capacity

● M170 SERIES

● MUSCULOSKELETAL

④ Fluid + Electrolyte

● M070 SERIES

④ Weight Loss ∴ fluid compartment shift
∴ ↓ Bone Density

● M110 SERIES

● NEUROPHYSIOLOGICAL

● M130 SERIES

⑤ Motion Sickness? (will experiment help?)
Sleep inadequacy (Due to Schedule?)

● TIME IN MOTION

● M151

⑥ Difference in Task Performance in "OG"

SKYLAB MEDICAL EXPERIMENTS PROGRAM

MR#0D POSITIONS

- URINE COLLECTION & MEASUREMENT SYSTEM
 - COLLECT ALL URINE AT 24 HOUR INTERVALS
 - 1ST COLLECTION WITHIN 24 HOURS OF LAUNCH
 - $\pm 2\%$ SYSTEM ACCURACY
- CO₂ PARTIAL PRESSURE
 - 5 mmHg DUE TO ECS SYSTEM DESIGN

• TEMPERATURE

- OUT OF DESIRED LIMITS PART OF TIME DUE TO 50° LAUNCH AZIMUTH

• TRAINING

- MR#0D/PCS/PI TEAM IS JUDGE OF ADEQUACY
- FCOD RESPONSIBILITY TO TRAIN

• LAUNCH CENTER

- MR#0D CAN SUPPORT 60 day ~~MR#0D~~ Launch to Launch

Additions ? Humidity - may meet desires • Noise may be high - (fans)

MSC FACILITIES

- MISSION CONTROL CENTER (MCC)

- MOCR —————→ Functions at ONLY → Lunch
Docking
Activation
EVA
ReEntry
- SSR —————→ "Functional" Room During
Most of a Nominal Meeting
• Private Room: Daily Crew Talks & Private TV

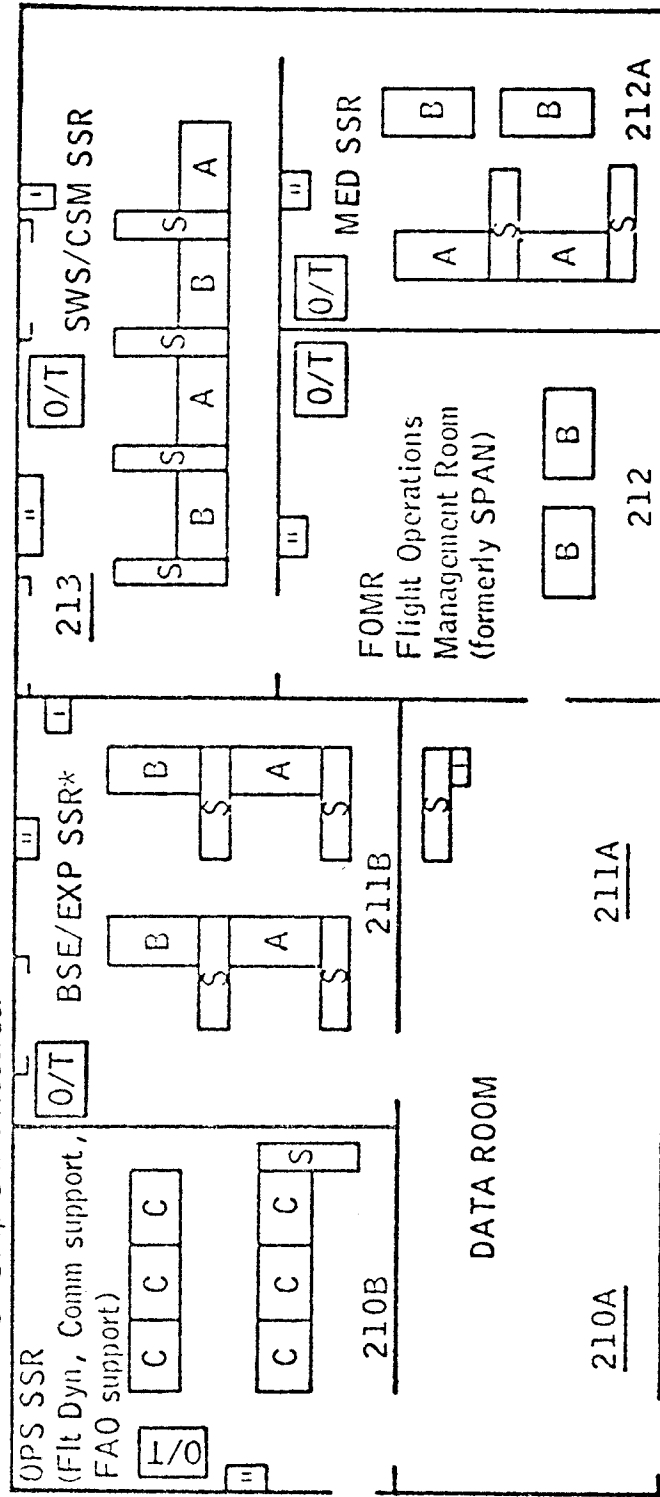
- ON-SITE OFFICES

- MISSION EVALUATION TEAM - BLDG 45
- PCS OFFICES —————→ Engineering Aspects Medical
Experiments
- LRL —————→ Desk + Radio + Phone
→ Labs: Equipment
Offices for PCS ?

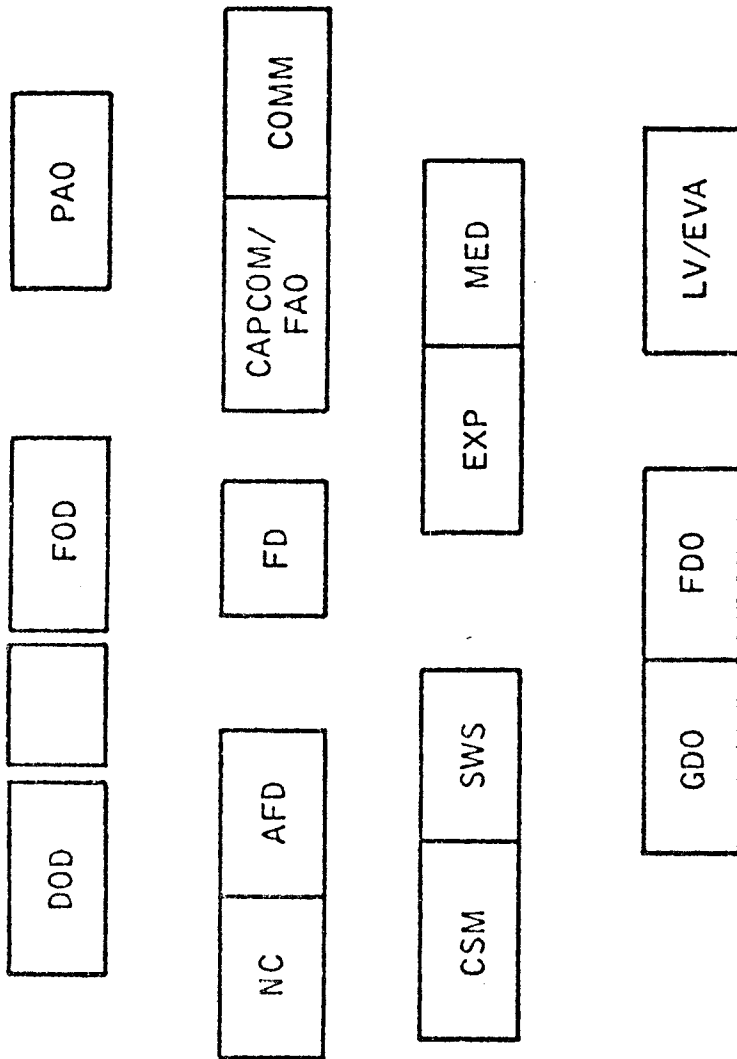
LEGEND:

- A- Standard A Console
- B- Standard B Console
- C- Standard C Console
- O/T- Opaque Televiewer
- S- Strip Chart Recorder

- "- P-Tube Station
- '- Event Recorder

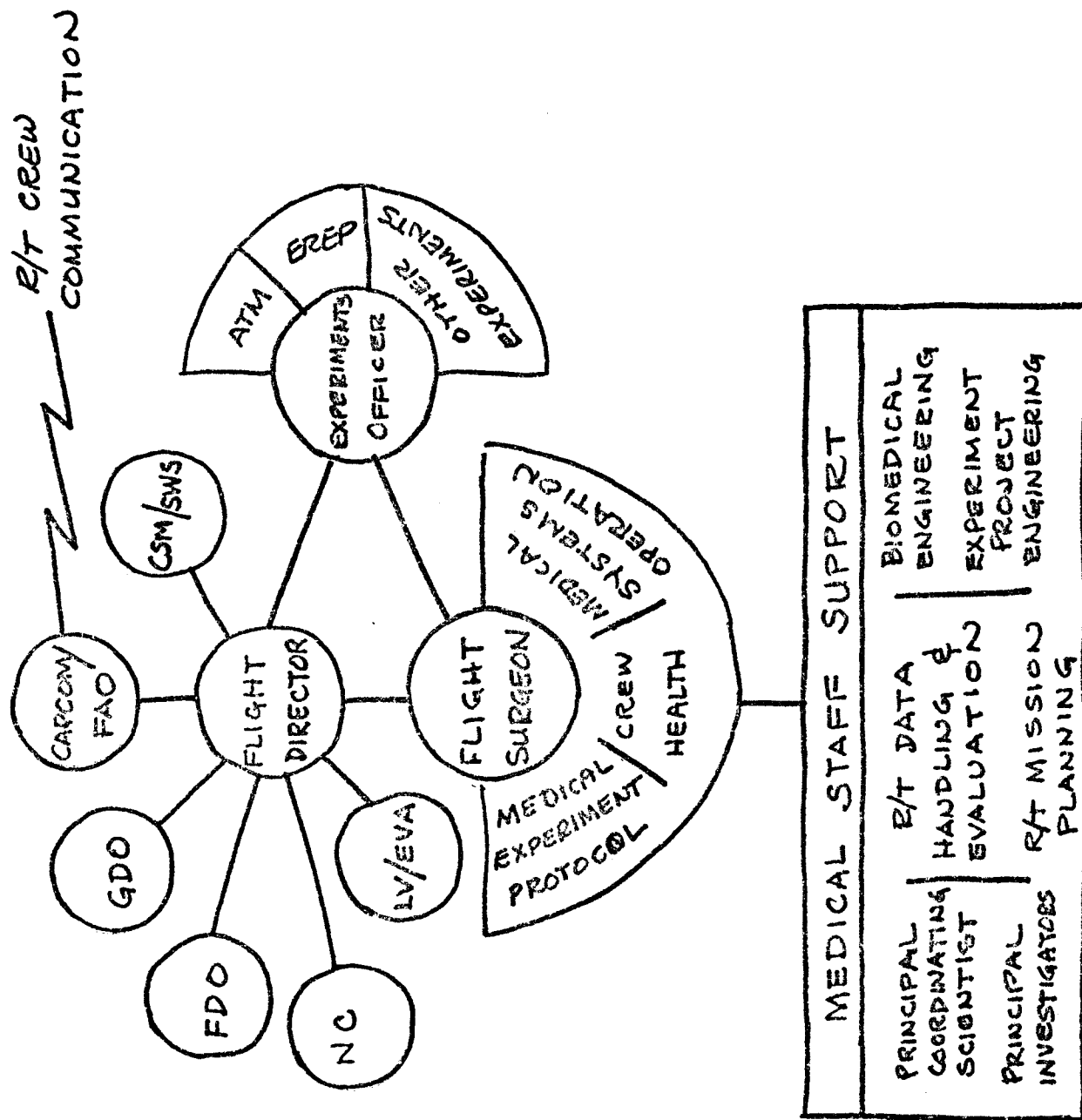


STAFF SUPPORT ROOM (SSR) LAYOUTS



MISSION OPERATIONS CONTROL ROOM (MOCR) LAYOUT

MISSION OPERATIONS FUNCTIONAL INTERFACES



MISSION MEDICAL EXPERIMENTS BOARD

When Real/Time Cuts Must Be Made — Who & How Decision Made within MRD

Priority

● PURPOSE

- REVIEW ANOMOLIES
- ESTABLISH REAL TIME CONTINGENCY PLANNING

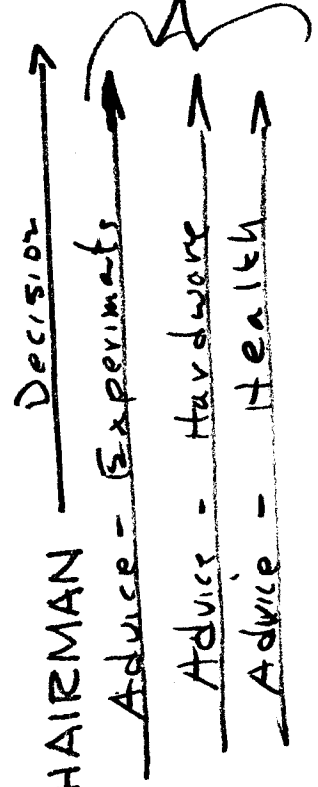
● MEMBERSHIP

DIRECTOR, MR & O — CHAIRMAN

• PCS/PI TEAMS

• PROJECT ENGINEERING

• MEDICAL OPERATIONS



Decision

Advice

IMPLEMENTATION — FLIGHT SURGEON

Implement

FD

PRE- AND POST MISSION ACTIVITIES

PREFLIGHT

- PLAN TO GET DATA FROM IG TRAINER AT MSC
- CREW WILL LEAVE AT F-7 FOR KSC
- ALL BUT M070 & M110 SERIES COMPLETED

① All PCS's
at MSC
Except
M070 & M110's

POSTFLIGHT

- ONE HOUR FROM SPLASHDOWN TO MEDICAL FACILITY ON RECOVERY SHIP
- USE MOBILE FACILITY ON RECOVERY SHIP
- RETURNED LOGS, TAPES, FILM, & SPECIMENS FLOWN IMMEDIATELY TO MSC
- CREWMEN ARRIVE AT MSC 72 HOURS AFTER SPLASHDOWN

Probably Can
Accomplish Even
If Lifted
Inside S/C

24-48 Hrs

|| Satisfies
131'
Requirement

DATA HANDLING

TABLE 1 - SKYLAB SYSTEMS SOFTWARE SUMMARY

[illegible]

TABLE 2 - SKYLAB APPLICATION SOFTWARE SUMMARY

PROGRAMS REQUIRED	BRIEF FUNCTIONAL DESCRIPTION	PROGRAM CODE NAME	PAGE # FOR MORE INFO.	TYPE INPUT	DEVELOP. RESPONS- IBILITY	SUGGESTED COMPUTER SYSTEM	CURRENT STATUS OF PROGRAM		AVERAGE RUN-TIME (BALLPARK)
							% COMPLETE	EST. IMPL. DIFFICULTY	
B. Unique Software									
1. VCG Alignment	Time correlate 3 VCG leads	ALIGN		Digital	FOD	CCATS	5	Unknown	30
2. VCG Parameters	Measure VCG para- meters from raw data (continuous and discrete)	VECTAN and VCG		Analog and Digital	MROD	CAAD	90	little	20
3. LBNP Parameters	Calculate LBNP pa- rameters (contin- uous & discrete)	PRESS 1 and PRESS 2		Analog and Digital	FOD	CAAD	5	little	10
4. Metabolic Parameters	Calculate Met. Act. parameters (cont. & discrete)	METAB 1 and METAB 2		Analog and Digital	FOD	CAAD	5	moderate	10
5. Vestibular (Illusion)	Calculate Ocular. Illusion parameter	ILLUS		Digital	FOD	CAAD	5	little	5
6. Vestibular (Sickness)	Calculate motion sickness parameter	MSICK		Digital	FOD	CAAD	5	little	5
7. Vestibular (localization)	Input spatial lo- calization para- meters from voice	LOCAL		Digital	FOD	RTCC & CAAD	5	little	5
8. Food Management	Track consumables, mineral balance, and menus	CHOW		Alpha- numeric	MROD/ FOD	RTCC	5	large	90
9. Body Fluids	Analyze a variety of body fluids	FLUIDS		Digital	MROD	MROD & CAAD	95	little	NA
10. Time & Motion	Analysis of coded motion picture elements	T & M		Digital	MROD	CAAD	70	little	20

TABLE 4

PRE-, IN-, AND POSTFLIGHT SKYLAB 2

VOLUME ESTIMATES FOR CREW DATA

I. DIGITAL TAPES (1)

<u>Experiment#</u>	<u>Name</u>	<u>#Tapes</u> <u>(Min)</u>	<u>#Tapes</u> <u>(Max)</u>
M 91-92	LBNP	15	69
M 93	VCG	13	99
M 171	Metabolic	2	60
M 131	Vestibular	8	84
		38	312

II. ANALOG TAPES (2)

<u>Experiment#</u>	<u>Name</u>	<u>#Tapes</u> <u>(Min)</u>	<u>#Tapes</u> <u>(Max)</u>
M 91-92	LBNP	8	69
M 93	VCG	8	99
M 171	Metabolic	12	60
M 131	Vestibular	11	84
		39	312

III. STRIPCHART RECORDINGS (3)

<u>Experiment#</u>	<u>Name</u>	<u># Feet</u>	<u># Rolls</u>
M 91-92	VCG	3209	7
M 93	LBNP	3584	7
M 171	Metabolic	4037	8
M 131	Vestibular	4909	10

- (1) Assumes 315×10^6 eight bit words for all experiments raw data and that one tape holds 8×10^6 eight bit words.
- (2) Assumes 14" reel (3 3/4 ipa) of 7,200 ft. or approximately 4 hours recording time.
- (3) Assumes 42.5' = 20 min. @ 10 mm/sec. and 500 ft. = 1 roll

STATISTICAL ANALYSIS GOALS

A. TO PROVIDE CLINICAL EVALUATION OF AN INDIVIDUAL CREWMAN
DURING THE FLIGHT.

- GOAL MET BY PROVIDING CONSIDERABLE DESCRIPTIVE
STATISTICS ON THE SPECIFIC INDIVIDUAL

B. TO PROVIDE A STATISTICAL BASIS FOR ANSWERING EXPERIMENTAL
QUESTIONS POSED ABOUT THE RELATIONSHIP BETWEEN INDEPENDENT
AND DEPENDENT VARIABLES.

- GOAL MUST BE MET BY PROVIDING UNIVARIATE AND/OR
INFERENTIAL STATISTICS TO ANSWER SUCH QUESTIONS

TABLE 5

I. Independent Variables

1. Mission Phase (Pre, In, Post)
2. Time in Phase (trend across days)
3. Type of Subjects (Crew, Normative Groups)
4. Variations within Types (eg. individual differences between crewmen)
5. Length of Mission (14, 28, 56 days)
6. Experimental or Stress Conditions (eg. amt. of negative pressure)

II. Dependent Variables

A. Basic Dependent Variables (Examples):

<u>LBNP</u>	<u>VCG</u>	<u>Metabolic</u>	<u>Vestibular -</u>
1. Heart Rate	Heart Rate	O ₂ Consumption	OGI Score
2. Left Leg Volume	QRS,ST,T,P Vectors	CO ₂ Production	MS Score
3. Rt. Leg Volume	Waveform Intervals	Minute Volume	Spatial
4. Systolic BP	Waveform Durations	Body Temp.	Local. Score
5. Diastolic BP	Waveform Amplitudes	Systolic BP	
6. Pulse Pressure		Diastolic BP	
7. Body Temp.		Respiration Quotient	

B. Derived Dependent Variables (Examples):

1. Rate of change during and after (recovery) stress or work
2. Mean values before, during, and after (recovery) stress or work
3. Combined Index scores

C. Extraneous Variables (eg. ambient conditions)

1. Study: (a) group and test if random
(b) adjust statistically (eg. covariance)
2. Assume Random

SPECIAL PROCESSING PROGRAMS

A. MEASUREMENTS:

1. VCG WAVEFORM ANALYSIS PROGRAM
2. M 131 OGI THRESHOLD PROGRAM
3. M 131 MOTION SICKNESS PROGRAM
4. LBNP DERIVED PARAMETERS

B. SYSTEMS:

1. TIME PLOT ROUTINES
2. CROSS PLOT ROUTINES
3. TABULAR LISTING ROUTINES

C. STATISTICAL ANALYSIS PROGRAMS

1. ANALYSIS OF VARIANCE AND COVARIANCE
2. REGRESSION ANALYSIS
3. CORRELATION ANALYSIS
4. DESCRIPTIVE - MEANS, DEVIATIONS, ETC.

DESCRIPTIVE HARD COPY OUTPUT

A. TIME PLOTS:

FOR

X AXIS

Y AXIS

1. Individual subject across single test profile

1. Single Dependent Variable

1. Test Time

2. Average for Individual across Phase (eg. Pre)

2. Two Dependent Variables

2. Averaged across blocks of time

3. Average across Individual by mission phase

ANNOTATION

ANNOTATION

ANNOTATION

Identification (Test #, etc.)

1. Workloads, Pressure, etc.

1. Test Profile Phase

2. Variable Name and Units

2. Variable Name and Unit

B. CROSS PLOTS:

AS ABOVE

1. Dependent Variable X

1. Independent Variable Y

2. Derived Variable X

2. Derived Variable Y

ANNOTATION

ANNOTATION

ANNOTATION

As Above

Variable Name and Units

Variable Name and Units
Calculation Regression Line

C. TABULAR LISTING: STANDARD RUN WITH VARIABLE TIME INCREMENTS

VOLUME ESTIMATES OF PLOTS

ASSUME:

1. EACH INVESTIGATOR ASK FOR TIME PLOT 1, 1, 1 FOR EACH OF HIS DEPENDENT VARIABLES.
2. M 91/92 HAS 12 VARIABLES
M 93 HAS 19 VARIABLES
M 171 HAS 12 VARIABLES

RESULTS:

M 91/92 GET 18 PLOTS/CREWMAN/VARIABLE OR 648 PLOTS
M 93 GETS 24 PLOTS/CREWMAN/VARIABLE OR 1,368 PLOTS
M 171 GETS 15 PLOTS/CREWMAN/VARIABLE OR 540 PLOTS

IF SAME ASSUMPTIONS BUT REQUEST IS FOR ALL TIME PLOT FORMATS:

M 91/92 GET ABOUT 6,480 PLOTS
M 93 GET ABOVE 13,680 PLOTS
M 171 GETS ABOUT 5,400 PLOTS

CONCLUSION:

THE ABOVE ARE ALL PLOTS OF PLOTS

TABLE 8 - SKYLAB 2 TIME REQUIREMENTS

I. EXPERIMENT DATA:

WHAT ITEMS	WHAT EXPERIMENTS	Pre- & Postflight Phase			Inflight Phase		
		When	Who	Why*	When	Who	Why*
STRIPCHARTS	M 91/92, 93, 171	RT	E	1	24 hrs.	E&O	2,3
ANALOG TAPES	M 91/92, 93, 171, 131	48 hrs.	E	1	24 hrs.	E	
DIGITAL TAPES	M 91/92, 93, 171, 131	24 hrs.	E	1	24 hrs.	E	2
VOICE TAPES	M 91/92, 93, 171, 131	24 hrs.	E	1	24 hrs.	E&O	2,3
EXPERIMENT LOGS	M 91/92, 93, 171, 131	RT	E	1	R+7 days	E&O	2,3
PHOTOGRAPHY	M 91/92, 93, 171, 131, 151	48 hrs.	E	1	R+7 days	E	2,3

II. EXPERIMENT SUPPORT DATA:

WHAT ITEMS	WHAT EXPERIMENTS	Preflight Phase			Inflight Phase		
		When	Who	Why*	When	Who	Why*
CALIBRATION CURVES	M 91/92, 93, 171, 131	F-5 days	O	4			
END TO END TEST	M 91/92, 93, 171, 131	RT	O	4			
SIMULATION TESTS	M 91/92, 93, 171, 131	RT	O	4			
VERIFICATION DATA	M 91/92, 93, 171, 131	RT	E	4	8 hrs.	O&E	5
ALIGNED VOG DISPLAY	M 93	RT	E	4	24 hrs.	O&E	5
STATUS & TREND REPORTS	M 91/92, 171, 131	24 hrs.	E	1	24 hrs.	O&E	6

1. Baseline reliable and valid
2. Eval. inflight, verify before next experiment
3. Operational readiness for Skylab 3.
4. Operational readiness for Skylab 2
5. Verify reasonableness before analysis
6. Monitor crew health

**RT = real time, R = recovery, F = flight, E = medical experimenter, O = medical operations

SKYLAB MISSION REPORTING SCHEDULE

- PREFLIGHT
 - STATUS & TREND REPORTS (PCS/PI)
 - F-60 DAYS
 - F-30 DAYS
 - F-15 DAYS
 - F-4 DAYS
- INFLIGHT
 - 24 HOUR POST-RUN REPORTS (PCS/PI)
- POSTFLIGHT
 - DAILY STATUS REPORTS (PCS/PI)
 - R+15 DAY SUMMARY REPORTS (PCS/PI)
 - MEDICAL EXPERIMENT PERFORMANCE REPORTS (PCS/PI/PE/MOD)

PRELIMINARY - SL-2, SL-3 R+30 DAYS

FINAL - SL-4 R+90 DAYS

- SYMPOSIUM ON PRELIMINARY EXPERIMENT RESULTS - SL-4 R+90 DAYS (PI)
- FINAL MEDICAL EXPERIMENT SCIENTIFIC REPORT - SL-4 R+180 DAYS (PI)

MRD then Reports
with summary
sum PD
to SPD
etc part of
"reporting
progress" not
to be part of
reports

Note
only PI

MRD
mod
Dir

SL-4
Dir
Xo

ASTRONAUT BRIEFING

- PURPOSE — Experimental Design
Physiology
Hardware where necessary (Project Engineer Available)

DANGERS ← ~~LIMITATIONS~~

— May get pressures to compromise experiments — TRAINING
— Will use info operationally also. — TIME LINE
— PROBLEMS are the only negotiators Experimentation's View
Not The ONLY Consideration

● POST BRIEFING STATUS REVIEW

WITH MR&OD



— Problem Discussion

With the Astro's on
any other MSC
organization

Succumb

INTRODUCTION

TURNER'S
STREET MARKET
P.O. DIST.
Glasgow

DESCRIPTION

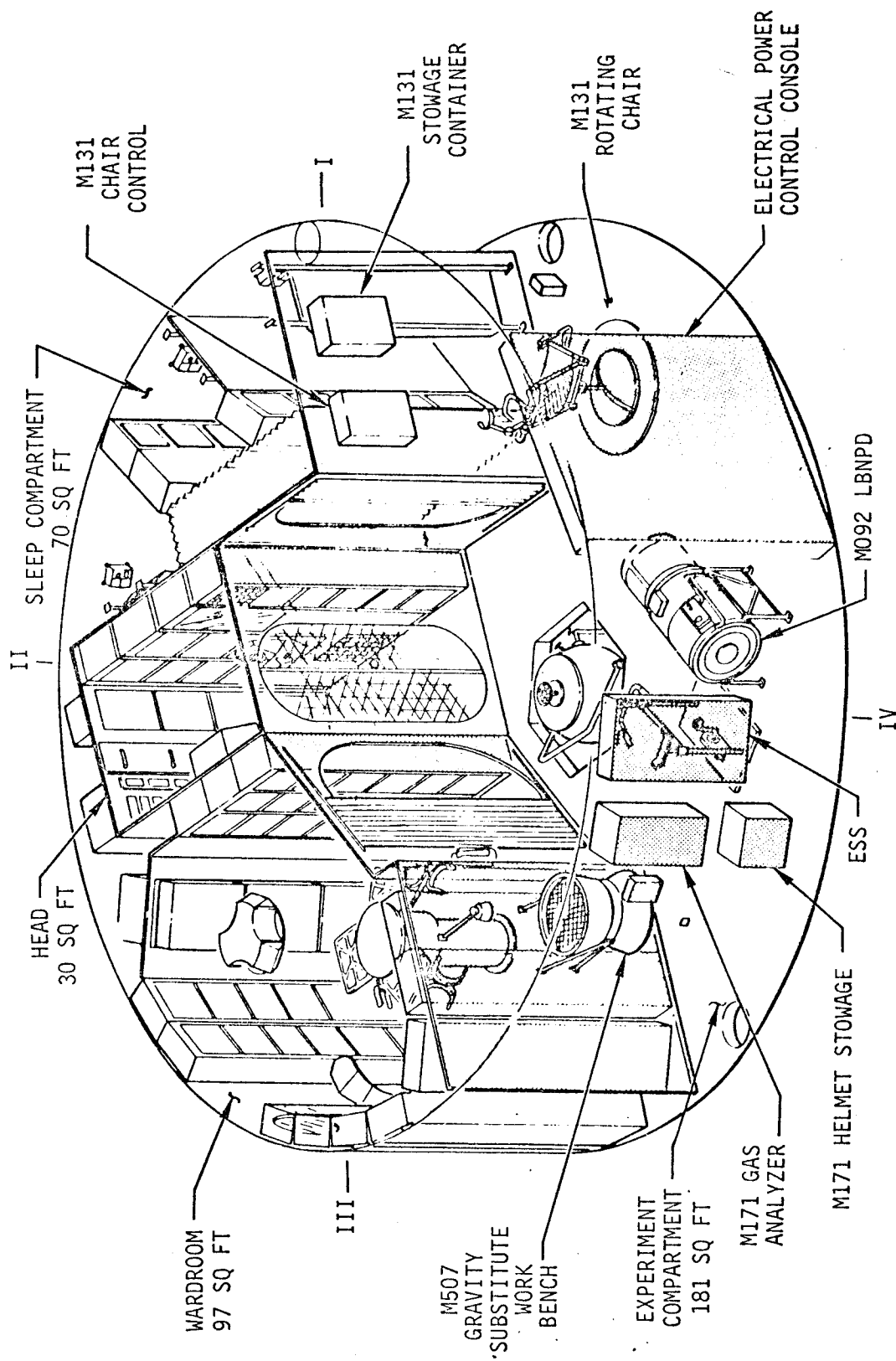
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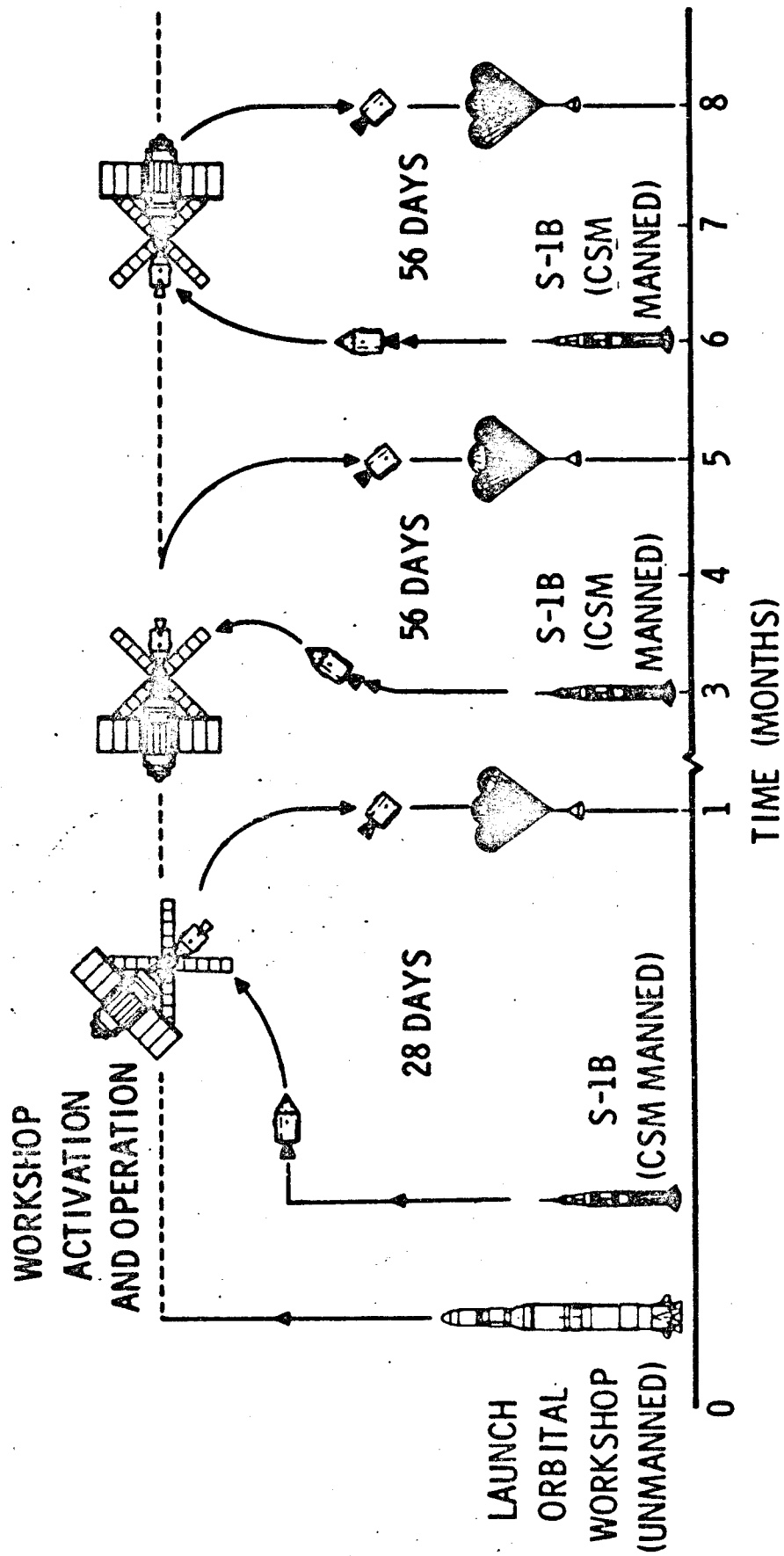
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ORBITAL WORKSHOP CREW QUARTERS INSTALLATIONS



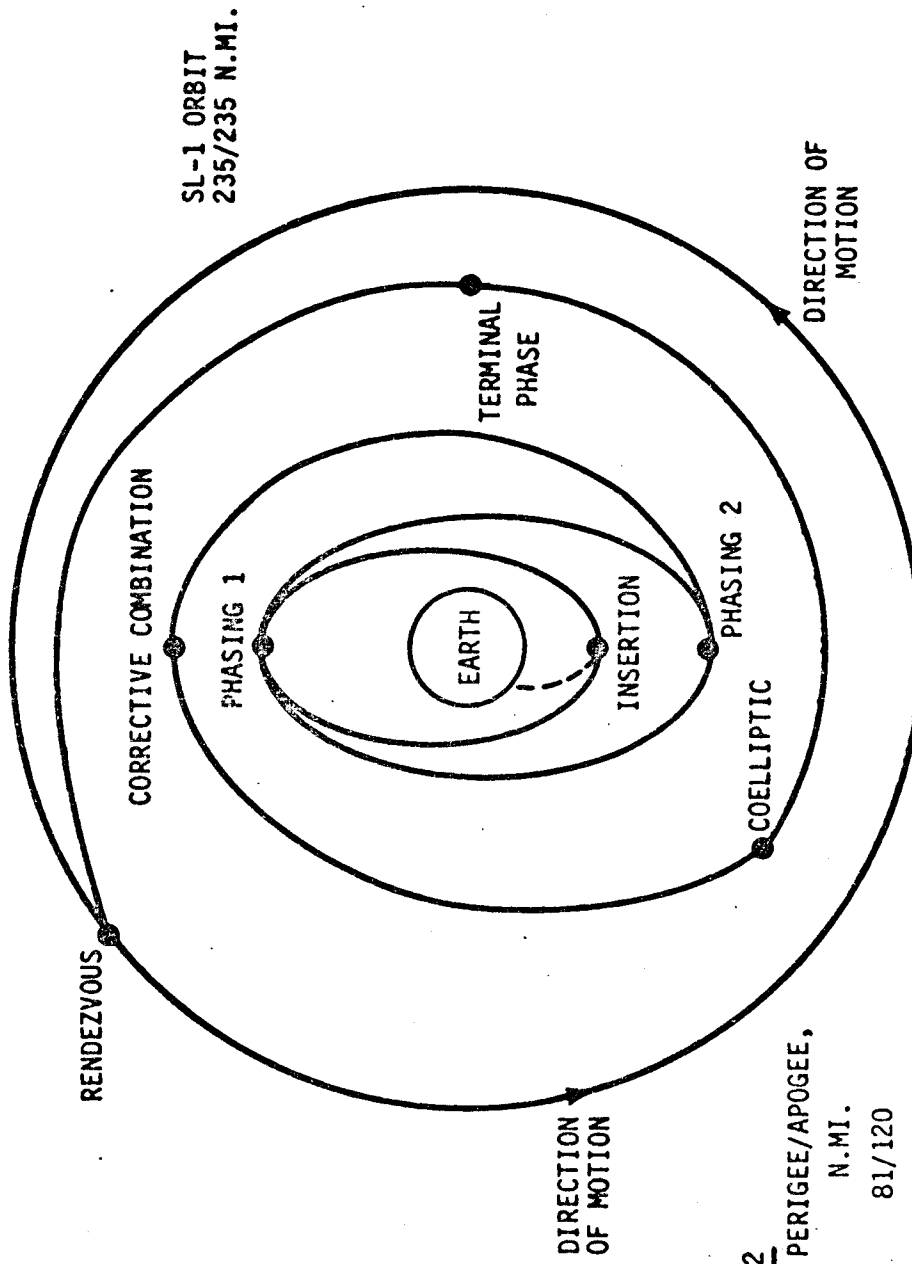
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SKYLAB MISSION PROFILE



NASA-S-70-3241-V

SKYLAB RENDEZVOUS SEQUENCE



	SL-2	
	PERIGEE/APOGEE,	N.MI.
INSERTION	81/120	
PHASING 1	120/210	
PHASING 2	210/214	
CORRECTIVE COMBINATION	214/225	
COELLIPTIC	225/225	
TERMINAL PHASE	225/235	
RENDEZVOUS	235/235	

APOLLO/SKYLAB FLIGHT SCHEDULE

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MISSION H	12	13	14		
MISSION J			15	16 17	
SKYLAB SATURN V WORKSHOP					
MANNED VISITS SATURN IB					

SKYLAB SCHEDULE

FLIGHT	MODULE	1970												1971												1972												1973											
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M																		
SL-2	CSM 116	EXP DEL V EXP DEL																																															

SKYLAB MEDICAL EXPERIMENTS PROGRAM

BIOMEDICAL VIEW OF SKYLAB PROGRAM IN RELATION TO MANNED SPACE FLIGHT

- FIRST MANNING (SL-2)
 - MAN'S CAPABILITY FOR 28 DAYS
 - COMMIT TO 56 DAYS OR DEAL WITH
DECONDITIONING
- SECOND MANNING (SL-3)
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- CARDIOVASCULAR
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 - M170 SERIES
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 - M070 SERIES
 - M110 SERIES
- NEUROPHYSIOLOGICAL
 - M130 SERIES
- TIME IN MOTION
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MR#0D POSITIONS

EXP. PRIORITY -

- URINE COLLECTION & MEASUREMENT SYSTEM
 - COLLECT ALL URINE AT 24 HOUR INTERVALS
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- TRAINING
 - MR#0D/PCS/PI TEAM IS JUDGE OF ADEQUACY
 - FCOD RESPONSIBILITY TO TRAIN
- LAUNCH CENTER
 - MR#0D CAN SUPPORT

M.D. CREWMAN.

FOOD,

HOW - OWS - TEST PHILOSOPHY (MED. HDW.

Toxical

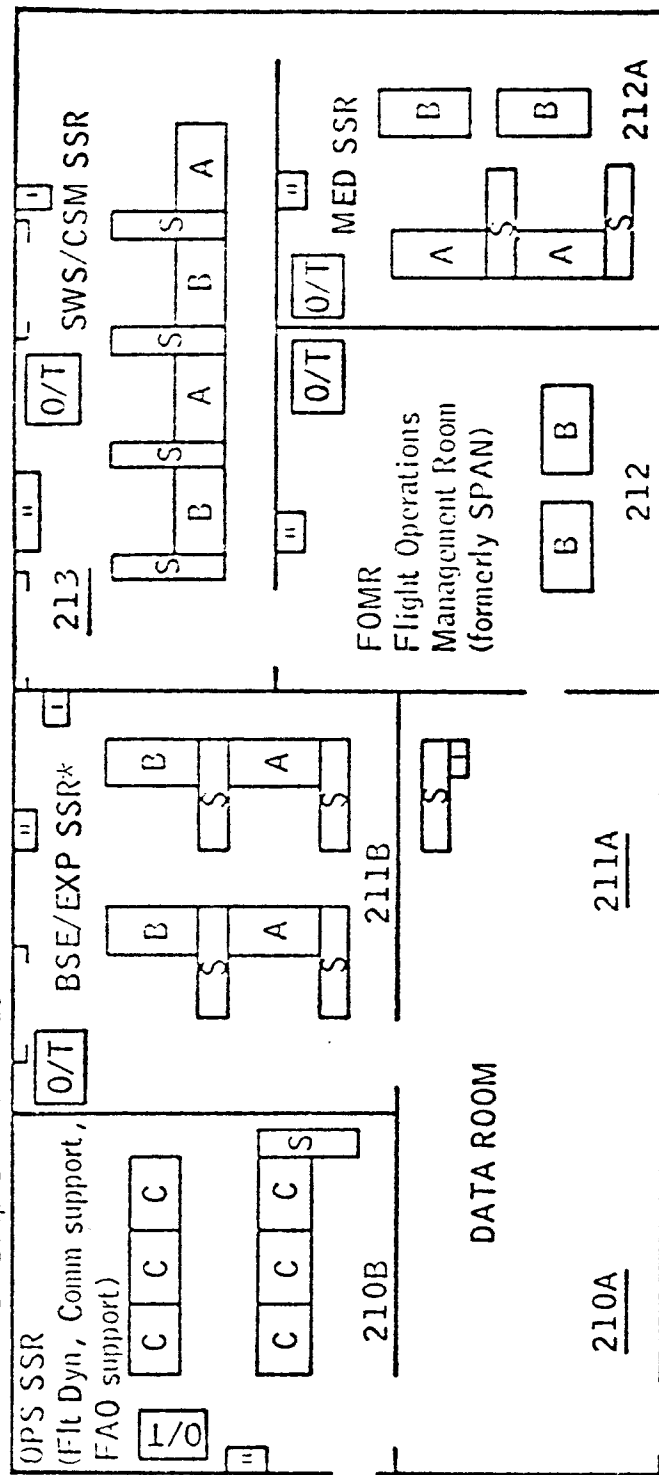
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 - PCS OFFICES
 - LRL

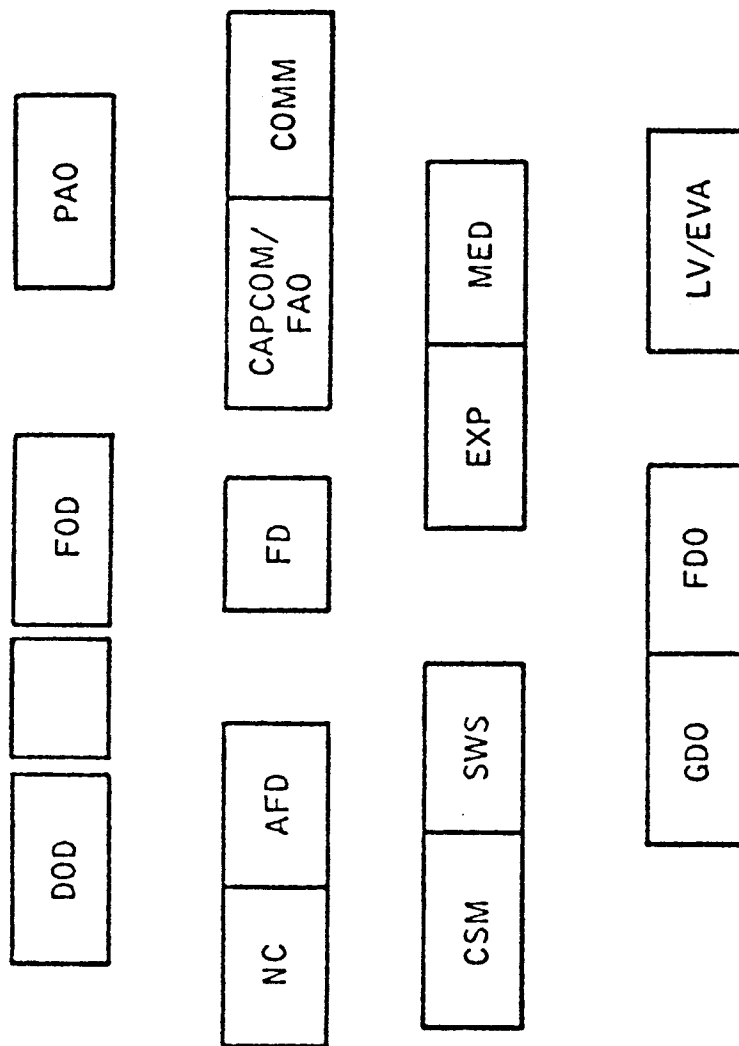
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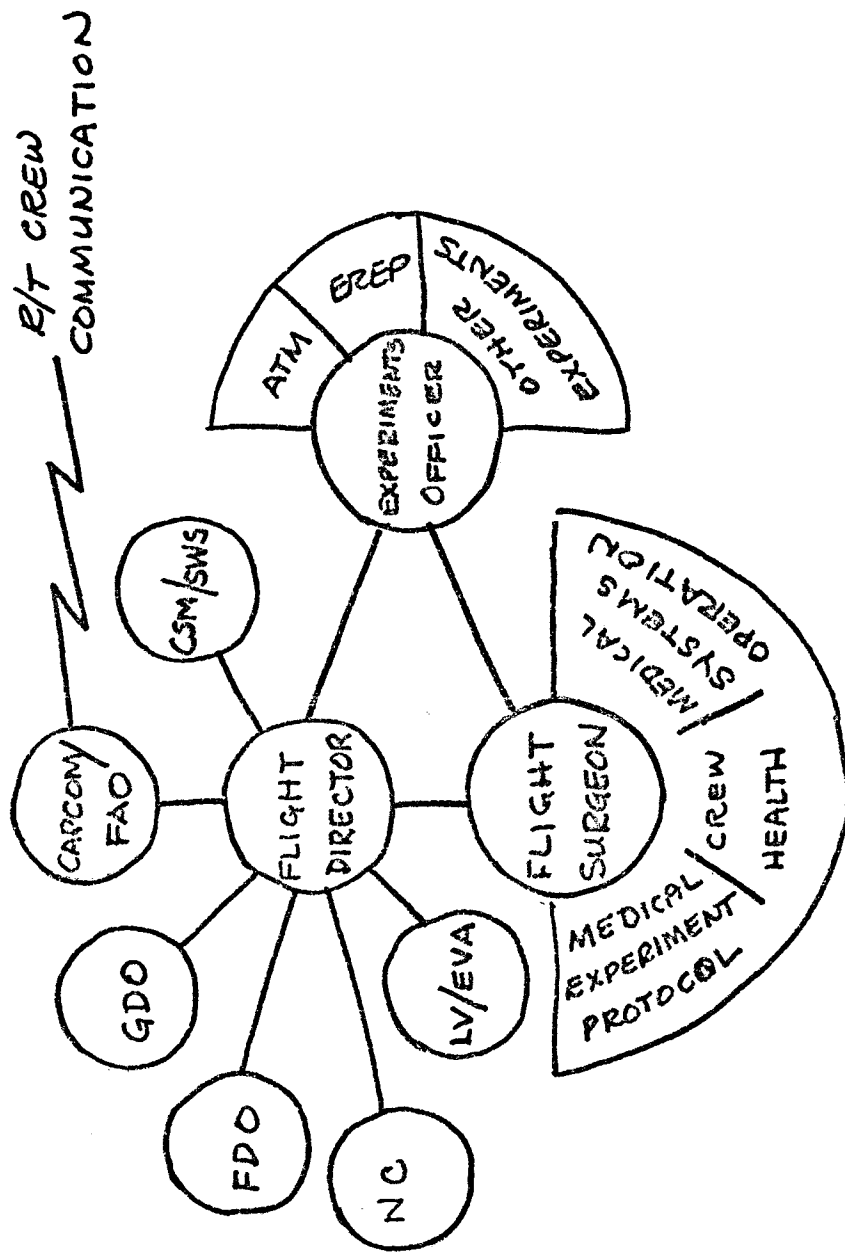


STAFF SUPPORT ROOM (SSR) LAYOUTS



MISSION OPERATIONS CONTROL ROOM (MOCR) LAYOUT

MISSION OPERATIONS FUNCTIONAL INTERFACES



MEDICAL STAFF SUPPORT			
PRINCIPAL COORDINATING SCIENTIST	R/T DATA HANDLING & EVALUATION	BIOMEDICAL ENGINEERING EXPERIMENT PROJECT ENGINEERING	
PRINCIPAL INVESTIGATORS	R/T MISSION PLANNING		

with crew in flight

MISSION MEDICAL EXPERIMENTS BOARD

- PURPOSE
 - REVIEW ANOMOLIES
 - ESTABLISH REAL TIME CONTINGENCY PLANNING
- MEMBERSHIP
 - DIRECTOR, MR & O - CHAIRMAN
 - PCS/PI TEAMS
 - PROJECT ENGINEERING
 - MEDICAL OPERATIONS
- IMPLEMENTATION - FLIGHT SURGEON

PRE- AND POST MISSION ACTIVITIES

INTERVAL

PREFLIGHT

- PLAN TO GET DATA FROM IG TRAINER AT MSC
- CREW WILL LEAVE AT F-7 FOR KSC
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- ONE HOUR FROM SPLASHDOWN TO MEDICAL FACILITY ON RECOVERY SHIP
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- RETURNED LOGS, TAPES, FILM, & SPECIMENS FLOWN IMMEDIATELY TO MSC
- CREWMEN ARRIVE AT MSC 72 HOURS AFTER SPLASHDOWN

DATA HANDLING

TABLE 1 - SKYLAB SYSTEMS SOFTWARE SUMMARY

PROGRAMS REQUIRED	BRIEF FUNCTIONAL DESCRIPTION	PROGRAM CODE NAME	PAGE # FOR MORE INFO.	TYPE INPUT	DEVELOP. RESPONS- IBILITY	SUGGESTED	CURRENT STATUS OF PROGRAM		AVERAGE RUN-TIME (BALLPARK)
							% COMPLETE	EST. IMPL. DIFFICULTY	
A. Systems Software									
1. A-D Conversion	From Analog to Digital	AD		Analog	FOD	CAAD	95	little	30
2. D-A Conversion	From Digital to Analog	DA		Telemetry	FOD	CCATS and CAAD	95	little	30
3. Plot (Time)	Variable Axis Con- tinuous time plots	T-PLOT		Analog and Digital	FOD	CCATS and CAAD	85	little	30
4. Editing Program	Variable editing	EDIT		Digital	FOD	CAAD	5	moderate	10
5. Statistical Analysis	Cumulative evalua- tion of change	STAT		Digital	FOD	CAAD	5	moderate	10
6. Statistical Output	Variable axis graphs, tab. list- ings, microfilm	OUT		Digital	FOD	CAAD and RTCC	80	moderate	10
7. Storage and Retrieval	Store, sort, merge, and retrieve data	BIOLAB		Alphanu- meric & Digital	FOD or MROD	CAAD and/or RTCC	20*	large*	
8. Real-Time Display	Display dynamic medical opera- tional data	BMDADS		Analog and Digital	FOD	CCATS and RTCC	70	moderate	1 sec.
80% complete and moderate effort if existing batch system is responsive enough.									

TABLE 2 - SKYLAB APPLICATION SOFTWARE SUMMARY

PROGRAMS REQUIRED	BRIEF FUNCTIONAL DESCRIPTION	PROGRAM CODE NAME	PAGE # FOR MORE INFO.	TYPE INPUT	DEVELOP. RESPONS- IBILITY	SUGGESTED COMPUTER SYSTEM	CURRENT STATUS OF PROGRAM		AVERAGE RUN-TIME (BALLPARK)
							% COMPLETE	EST. IMPL. DIFFICULTY	
B. Unique Software									
1. VCG Alignment	Time correlate 3 VCG leads	ALIGN		Digital	FOD	CCATS	5	Unknown	30
2. VCG Parameters	Measure VCG para- meters from raw data (continuous and discrete)	VECTAN and VCG		Analog and Digital	MROD	CAAD	90	little	20
3. LBNP Parameters	Calculate LBNP pa- rameters (contin- uous & discrete)	PRESS 1 and PRESS 2		Analog and Digital	FOD	CAAD	5	little	10
4. Metabolic Parameters	Calculate Met. Act. parameters (cont. & discrete)	METAB 1 and METAB 2		Analog and Digital	FOD	CAAD	5	moderate	10
5. Vestibular (Illusion)	Calculate Ocular. Illusion parameter	ILLUS		Digital	FOD	CAAD	5	little	5
6. Vestibular (Sickness)	Calculate motion sickness parameter	MSICK		Digital	FOD	CAAD	5	little	5
7. Vestibular (localization)	Input spatial lo- calization para- meters from voice	LOCAL		Digital	FOD	RTCC & CAAD	5	little	5
8. Food Management	Track consumables, mineral balance, and menus	CHOW		Alpha- numeric	MROD/ FOD	RTCC	5	large	90
9. Body Fluids	Analyze a variety of body fluids	FLUIDS		Digital	MROD	MROD & CAAD	95	little	NA
10. Time & Motion	Analysis of coded motion picture elements	T & M		Digital	MROD	CAAD	70	little	20

TABLE 4

PRE-, IN-, AND POSTFLIGHT SKYLAB 2

VOLUME ESTIMATES FOR CREW DATA

I. DIGITAL TAPES (1)

<u>Experiment#</u>	<u>Name</u>	<u>#Tapes</u> (Min)	<u>#Tapes</u> (Max)
M 91-92	LBNP	15	69
M 93	VCG	13	99
M 171	Metabolic	2	60
M 131	Vestibular	8	84
		38	312

II. ANALOG TAPES (2)

<u>Experiment#</u>	<u>Name</u>	<u>#Tapes</u> (Min)	<u>#Tapes</u> (Max)
M 91-92	LBNP	8	69
M 93	VCG	8	99
M 171	Metabolic	12	60
M 131	Vestibular	11	84
		39	312

III. STRIPCHART RECORDINGS (3)

<u>Experiment#</u>	<u>Name</u>	<u># Feet</u>	<u># Rolls</u>
M 91-92	VCG	3209	7
M 93	LBNP	3584	7
M 171	Metabolic	4037	8
M 131	Vestibular	4909	10

- (1) Assumes 315×10^6 eight bit words for all experiments raw data and that one tape holds 8×10^6 eight bit words.
- (2) Assumes 14" reel (3 3/4 ipa) of 7,200 ft. or approximately 4 hours recording time.
- (3) Assumes 42.5' = 20 min. @ 10 mm/sec. and 500 ft. = 1 roll

STATISTICAL ANALYSIS GOALS

A. TO PROVIDE CLINICAL EVALUATION OF AN INDIVIDUAL CREWMAN
DURING THE FLIGHT.

- GOAL MET BY PROVIDING CONSIDERABLE DESCRIPTIVE
STATISTICS ON THE SPECIFIC INDIVIDUAL

B. TO PROVIDE A STATISTICAL BASIS FOR ANSWERING EXPERIMENTAL
QUESTIONS POSED ABOUT THE RELATIONSHIP BETWEEN INDEPENDENT
AND DEPENDENT VARIABLES.

- GOAL MUST BE MET BY PROVIDING UNIVARIATE AND/OR
INFERENTIAL STATISTICS TO ANSWER SUCH QUESTIONS

TABLE 5
TYPICAL VARIABLES FOR STATISTICAL ANALYSIS

I. Independent Variables

1. Mission Phase (Pre, In, Post)
2. Time in Phase (trend across days)
3. Type of Subjects (Crew, Normative Groups)
4. Variations within Types (eg. individual differences between crewmen)
5. Length of Mission (14, 28, 56 days)
6. Experimental or Stress Conditions (eg. amt. of negative pressure)

II. Dependent Variables

A. Basic Dependent Variables (Examples):

<u>LBNP</u>	<u>VCG</u>	<u>Metabolic</u>	<u>Vestibular</u>
1. Heart Rate	Heart Rate	O ₂ Consumption	OGI Score
2. Left Leg Volume	QRS, ST, T, P Vectors	CO ₂ Production	MS Score
3. Rt. Leg Volume	Waveform Intervals	Minute Volume	Spatial
4. Systolic BP	Waveform Durations	Body Temp.	Local. Score
5. Diastolic BP	Waveform Amplitudes	Systolic BP	
6. Pulse Pressure		Diastolic BP	
7. Body Temp.		Respiration Quotient	

B. Derived Dependent Variables (Examples):

1. Rate of change during and after (recovery) stress or work
2. Mean values before, during, and after (recovery) stress or work
3. Combined Index scores

C. Extraneous Variables (eg. ambient conditions)

1. Study: (a) group and test if random
(b) adjust statistically (eg. covariance)
2. Assume Random

SPECIAL PROCESSING PROGRAMS

A. MEASUREMENTS:

1. VCG WAVEFORM ANALYSIS PROGRAM
2. M 131 OGI THRESHOLD PROGRAM
3. M 131 MOTION SICKNESS PROGRAM
4. LBNP DERIVED PARAMETERS

B. SYSTEMS:

1. TIME PLOT ROUTINES
2. CROSS PLOT ROUTINES
3. TABULAR LISTING ROUTINES

C. STATISTICAL ANALYSIS PROGRAMS

1. ANALYSIS OF VARIANCE AND COVARIANCE
2. REGRESSION ANALYSIS
3. CORRELATION ANALYSIS
4. DESCRIPTIVE - MEANS, DEVIATIONS, ETC.

DESCRIPTIVE HARD COPY OUTPUT

A. TIME PLOTS:

FOR

X AXIS

Y AXIS

1. Individual subject across single test profile

1. Single Dependent Variable

1. Test Time

2. Average for Individual across Phase (eg. Pre)

2. Two Dependent Variables

2. Averaged across blocks of time

3. Average across Individual by mission phase

3. Derived Variables

ANNOTATION

ANNOTATION

ANNOTATION

Identification (Test #, etc.)

1. Workloads, Pressure, etc.
2. Variable Name and Units

1. Test Profile Phase
2. Variable Name and Unit

B. CROSS PLOTS:

AS ABOVE

1. Dependent Variable X

1. Independent Variable Y

2. Derived Variable X

2. Derived Variable Y

ANNOTATION

ANNOTATION

ANNOTATION

As Above

Variable Name and Units

Variable Name and Units
Calculated Regression Line

C. TABULAR LISTING: STANDARD BUT WITH VARIABLE TIME INCREMENTS

VOLUME ESTIMATES OF PLOTS

ASSUME:

1. EACH INVESTIGATOR ASK FOR TIME PLOT 1, 1, 1 FOR EACH OF HIS DEPENDENT VARIABLES.
2. M 91/92 HAS 12 VARIABLES
M 93 HAS 19 VARIABLES
M 171 HAS 12 VARIABLES

RESULTS:

M 91/92 GET 18 PLOTS/CREWMAN/VARIABLE OR 648 PLOTS
M 93 GETS 24 PLOTS/CREWMAN/VARIABLE OR 1,368 PLOTS
M 171 GETS 15 PLOTS/CREWMAN/VARIABLE OR 540 PLOTS

IF SAME ASSUMPTIONS BUT REQUEST IS FOR ALL TIME PLOT FORMATS:

M 91/92 GET ABOUT 6,480 PLOTS
M 93 GET ABOVE 13,680 PLOTS
M 171 GETS ABOUT 5,400 PLOTS

CONCLUSION:

THE FBI HOLDS ON GET LOTS OF FILES

TABLE 8 - SKYLAB 2 TIME REQUIREMENTS

I. EXPERIMENT DATA:

WHAT ITEMS	WHAT EXPERIMENTS	Pre- & Postflight Phase			Inflight Phase		
		When	Who	Why*	When	Who	Why*
STRIPCHARTS	M 91/92, 93, 171	RT	E	1	24 hrs.	E&O	2,3
ANALOG TAPES	M 91/92, 93, 171, 131	48 hrs.	E	1	24 hrs.	E	
DIGITAL TAPES	M 91/92, 93, 171, 131	24 hrs.	E	1	24 hrs.	E	2
VOICE TAPES	M 91/92, 93, 171, 131	24 hrs.	E	1	24 hrs.	E&O	2,3
EXPERIMENT LOGS	M 91/92, 93, 171, 131	RT	E	1	R+7 days	E&O	2,3
PHOTOGRAPHY	M 91/92, 93, 171, 131, 151	48 hrs.	E	1	R+7 days	E	2,3

II. EXPERIMENT SUPPORT DATA:

WHAT ITEMS	WHAT EXPERIMENTS	Preflight Phase			Inflight Phase		
		When	Who	Why*	When	Who	Why*
CALIBRATION CURVES	M 91/92, 93, 171, 131	F-5 days	O	4			
END TO END TEST	M 91/92, 93, 171, 131	RT	O	4			
SIMULATION TESTS	M 91/92, 93, 171, 131	RT	O	4			
VERIFICATION DATA	M 91/92, 93, 171, 131	RT	E	4	8 hrs.	O&E	5
ALIGNED VCG DISPLAY	M 93	RT	E	4	24 hrs.	O&E	5
STATUS & TREND REPORTS	M 91/92, 171, 131	24 hrs.	E	1	24 hrs.	O&E	6

1. Baseline reliable and valid

2. Eval. inflight, verify before next experiment

3. Operational readiness for Skylab 3.

4. Operational readiness for Skylab 2

5. Verify reasonableness before analysis

6. Monitor crew health

**RT = real time, R = recovery, F = flight, E = medical experimenter, O = medical operations

SKYLAB MISSION REPORTING SCHEDULE

- PREFLIGHT
 - STATUS & TREND REPORTS (PCS/PI)
 - F-60 DAYS
 - F-30 DAYS
 - F-15 DAYS
 - F-4 DAYS
- INFLIGHT
 - 24 HOUR POST-RUN REPORTS (PCS/PI)
- POSTFLIGHT
 - DAILY STATUS REPORTS (PCS/PI)
 - R+15 DAY SUMMARY REPORTS (PCS/PI)
 - MEDICAL EXPERIMENT PERFORMANCE REPORTS (PCS/PI/PE/MOD)
 - PRELIMINARY - SL-2, SL-3 R+30 DAYS
 - FINAL - SL-4 R+90 DAYS
 - SYMPOSIUM ON PRELIMINARY EXPERIMENT RESULTS - SL-4 R+90 DAYS (PI)
 - FINAL MEDICAL EXPERIMENT SCIENTIFIC REPORT - SL-4 R+180 DAYS (PI)

ASTRONAUT BRIEFING

- PURPOSE
- LIMITATIONS
- POST BRIEFING STATUS REVIEW
WITH MR & OD

Director