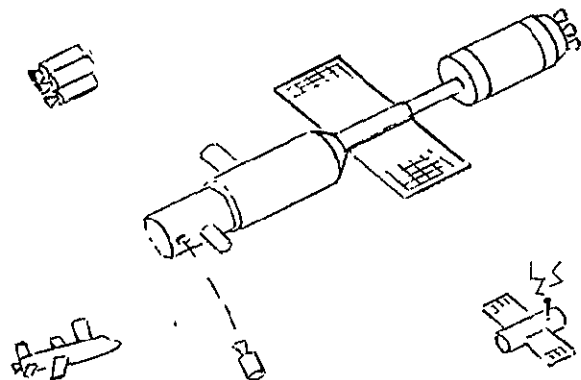


2-P
mix

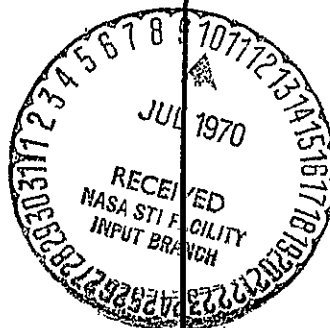
MID-TERM REPORT PRESENTATION -- 26 JUNE 1970



HOUSEKEEPING CONCEPTS FOR MANNED SPACE SYSTEMS

HABITABILITY

Architecture
Environment
Mobility and Restraint
Garments and Personal Items
Food and Water
Personal Hygiene
HOUSEKEEPING
Off-Duty Activities



Prepared For

NASA/MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

Contract NAS 9-10662

Doc. No. MS124Y0001
DRL Line Item No. 8


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REPUBLIC AVIATION DIVISION
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OUTLINE

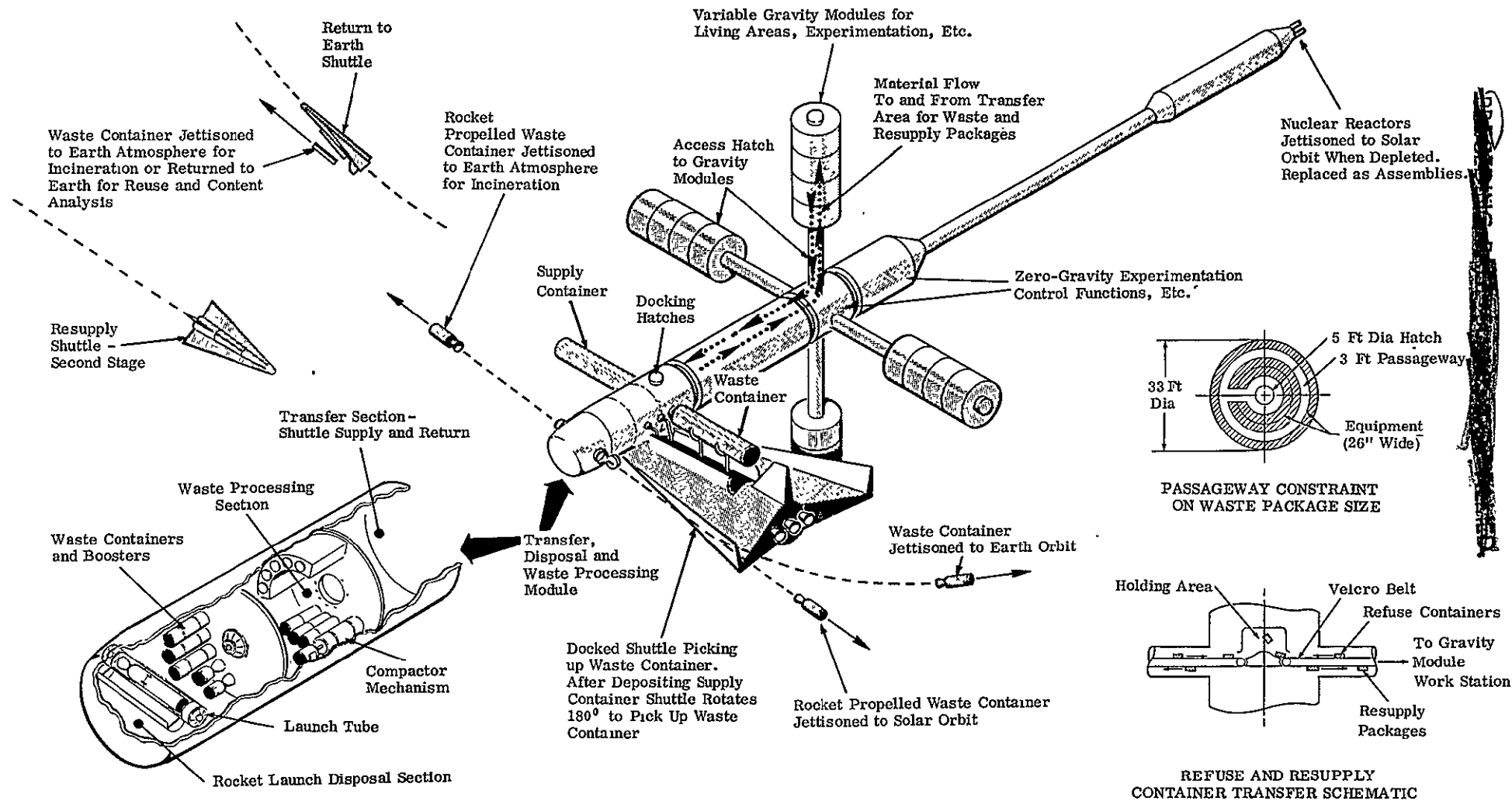
STUDY TASKS
SURVEYS
WASTE DEFINITION
WASTE UTILIZATION
WASTE DISPOSAL PRETREATMENT
WASTE DISPOSAL
WASTE HANDLING AND HOUSEKEEPING
COMPUTER DATA
USS GATO HABITABILITY
HANDBOOK
RECOMMENDATIONS

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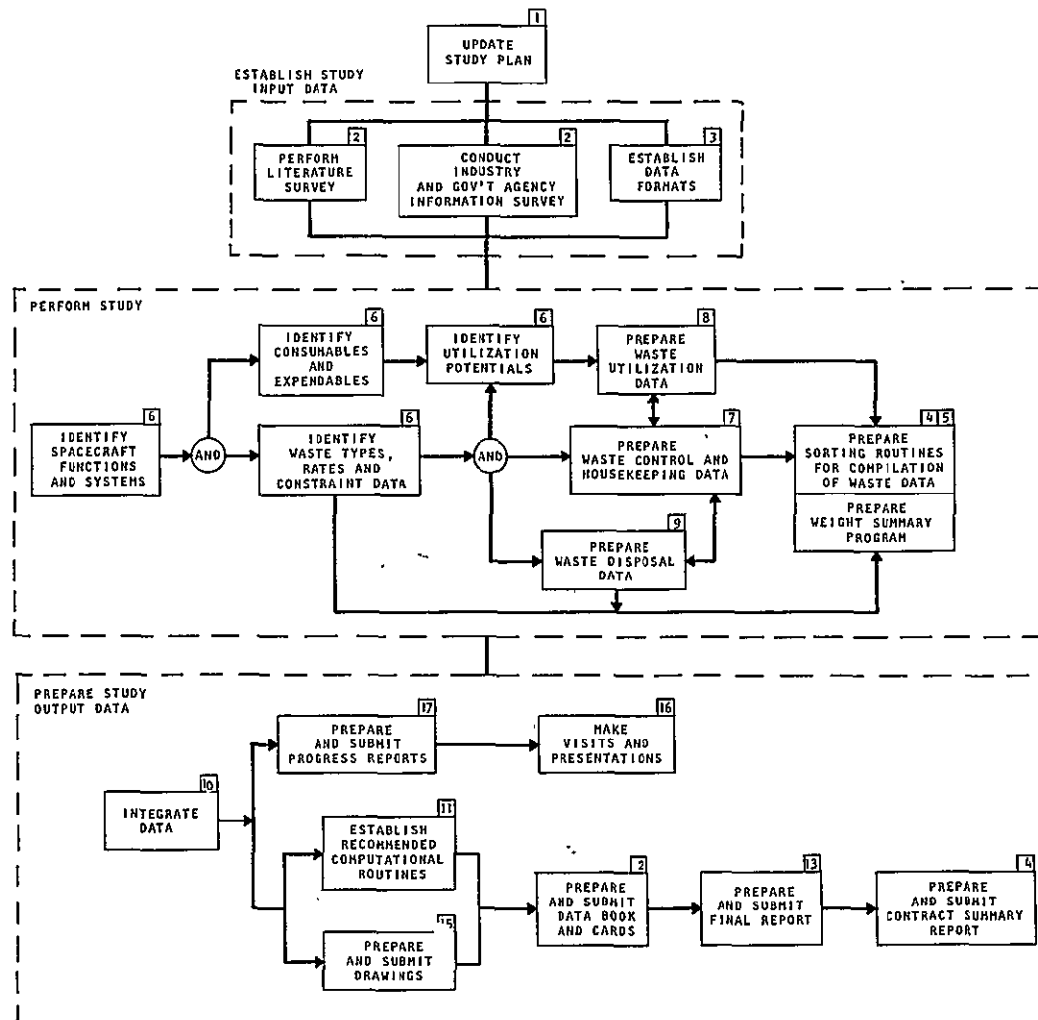


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WASTE DISPOSAL CONCEPTS



STUDY TASKS



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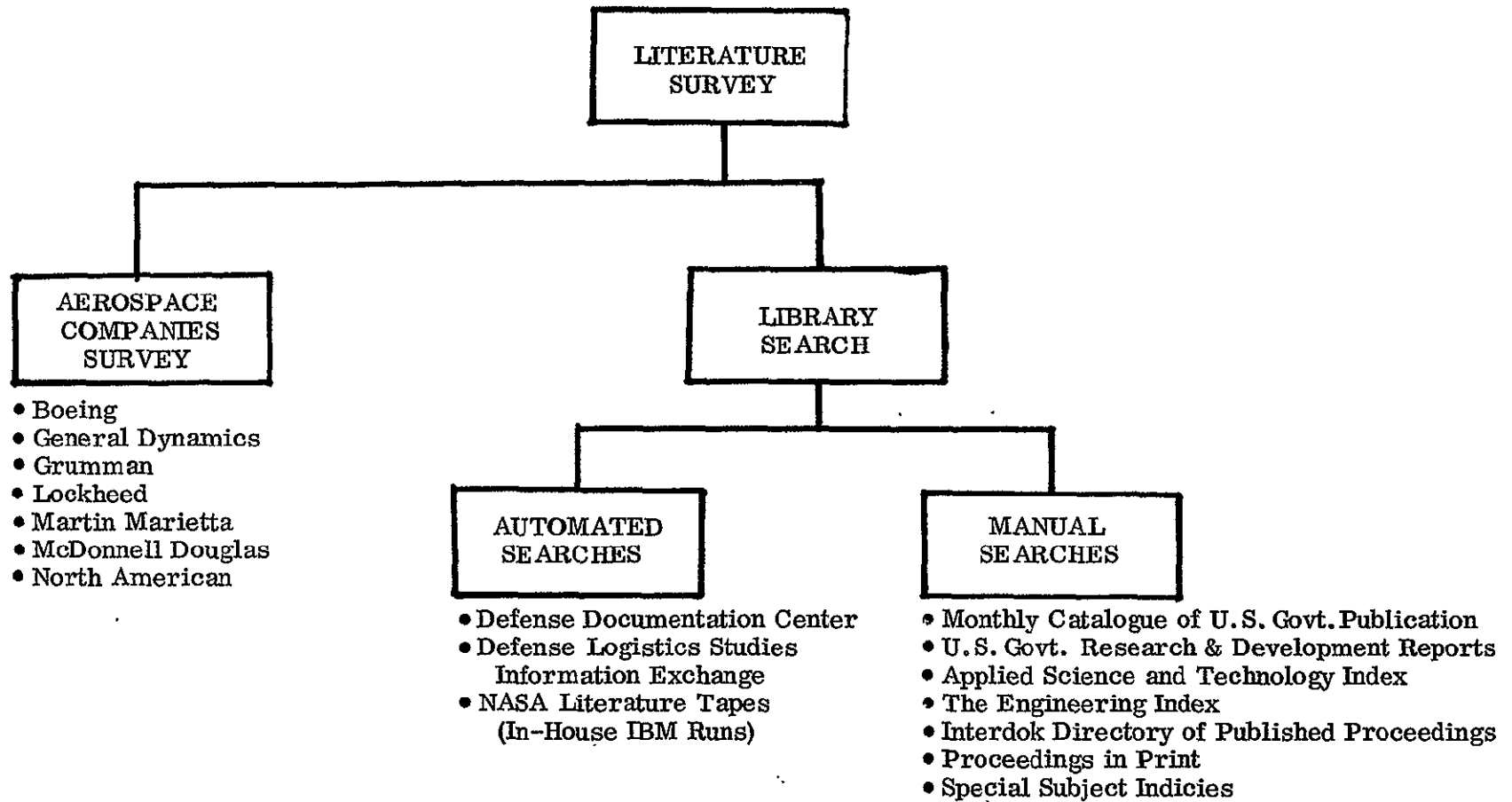
SCHEDULE

Month	M	April	May	June	July	August	September	October
MSC REVIEW		▼	▼	▼	▼	▼	▼	
SURVEY								
Literature								
Industry/Government								
DATA PROCESSING								
Input Set-Up								
Input Data								
Print Out Data								
WASTE DEFINITION								
Oper. Descriptions								
Cons./Expendables								
Wastes								
WASTE UTILIZATION								
WASTE DISPOSAL								
WASTE HOUSEKEEPING								
DATA								
Study Plan	▼	▼						
Progress Reports		▼	▼	▼	▼	▼	▼	▼
Data Book								
Final Report								
Summary Report								



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LITERATURE SURVEY



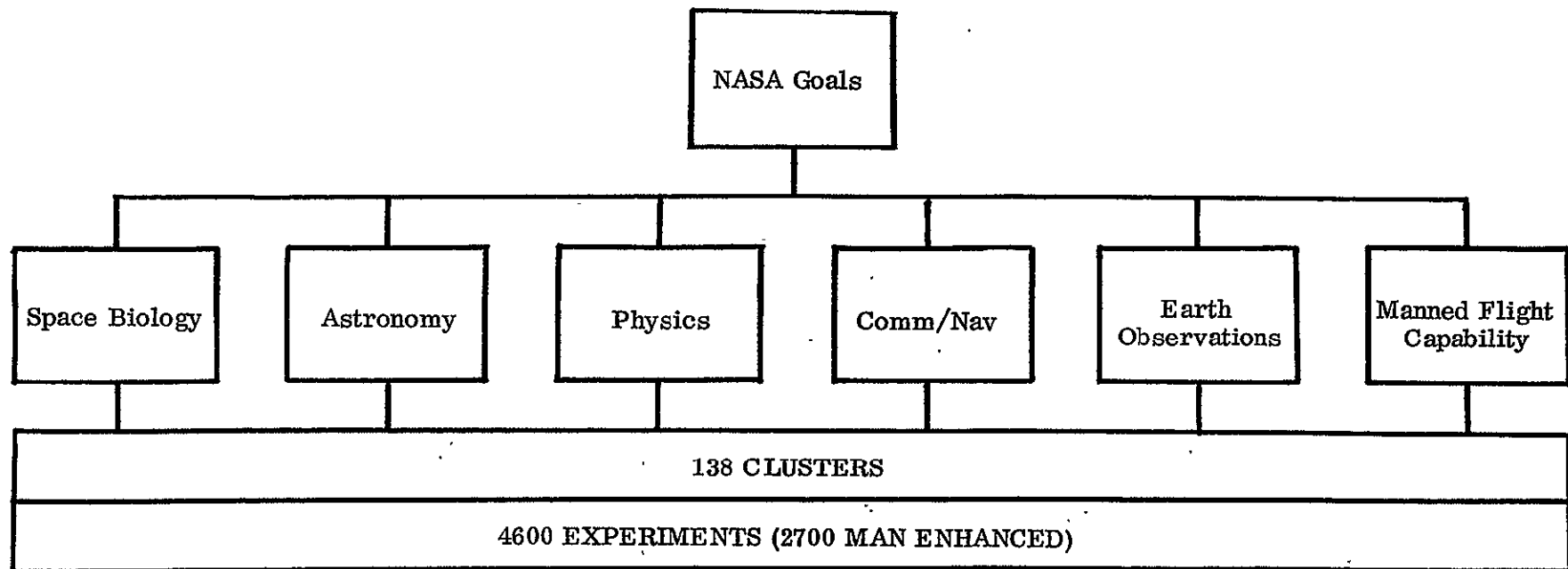
INDUSTRY/GOVERNMENT SURVEY

	RESPONSE		
	IN PREPARATION	PARTIAL	COMPLETE
BOEING			X
GENERAL DYNAMICS			X
GRUMMAN			X
LOCKHEED	X		
MARTIN			
McDONNELL DOUGLAS		X	
NORTH AMERICAN ROCKWELL	X		
MSC		X	
MSFC			X
LaRC			X
OMSF		X	

WASTE SOURCE FUNCTIONAL AREAS AND WASTE DEFINITION % COMPLETION

	<u>Completion</u>
1.0 SUPPORT LIFE	
1.1 Monitor and Maintain Crew Health and Safety	25%
1.2 Provide Crew Quarters	25%
1.3 Provide Crew Food and Drink	25%
1.4 Provide for Crew Hygiene	25%
1.5 Provide and Control Atmospheric Environment	0%
2.0 MAINTAIN SPACECRAFT FUNCTIONS	
2.1 Control Spacecraft Orbit Position and Attitude	80%
2.2 Provide for Electric and Thermal Power	40%
2.3 Provide for System Maintenance and Repair	0%
2.4 Provide Communication and Navigation	40%
2.5 Provide Station Data Collection and Storage	25%
2.6 Provide for Spacecraft Logistics	0%
2.7 Provide for Experiment Support	0%
3.0 PERFORM MISSION TASKS	
3.1 Astronomy, Astrophysics, and Celestial Mechanics Studies/Tasks	0%
3.2 Physics and Chemistry Studies/Tasks	0%
3.3 Agriculture and Animal Housing Studies/Tasks	75%
3.4 Biology Studies/Tasks	30%
3.5 Medical Studies/Tasks	80%
3.6 Space Manufacturing Studies/Tasks	20%
3.7 Earth Resources and Oceanography Studies/Tasks	0%
3.8 Military Sciences Studies/Tasks	0%
3.9 Advanced Technology and Engineering	0%
3.10 Lunar and Interplanetary Mission Support	0%

OART EXPERIMENT DEFINITION
(MDAC/IBM/TRW)



EXPERIMENT PROGRAM DOCUMENTS

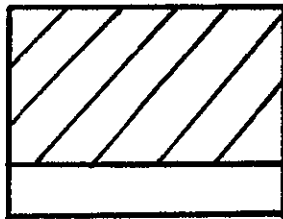
EXPERIMENTS



DETAIL PER EXPERIMENT

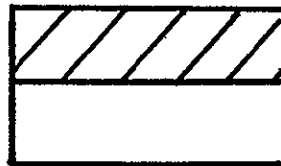


YELLOW BOOK



PLANNING CATALOG OF ALL
PROPOSED SPACE STATION
EXPERIMENTS

BLUE BOOK



DESIGN REFERENCE DATA
FOR SPACE STATION
AND SUPPORTING STUDIES

GREEN BOOK

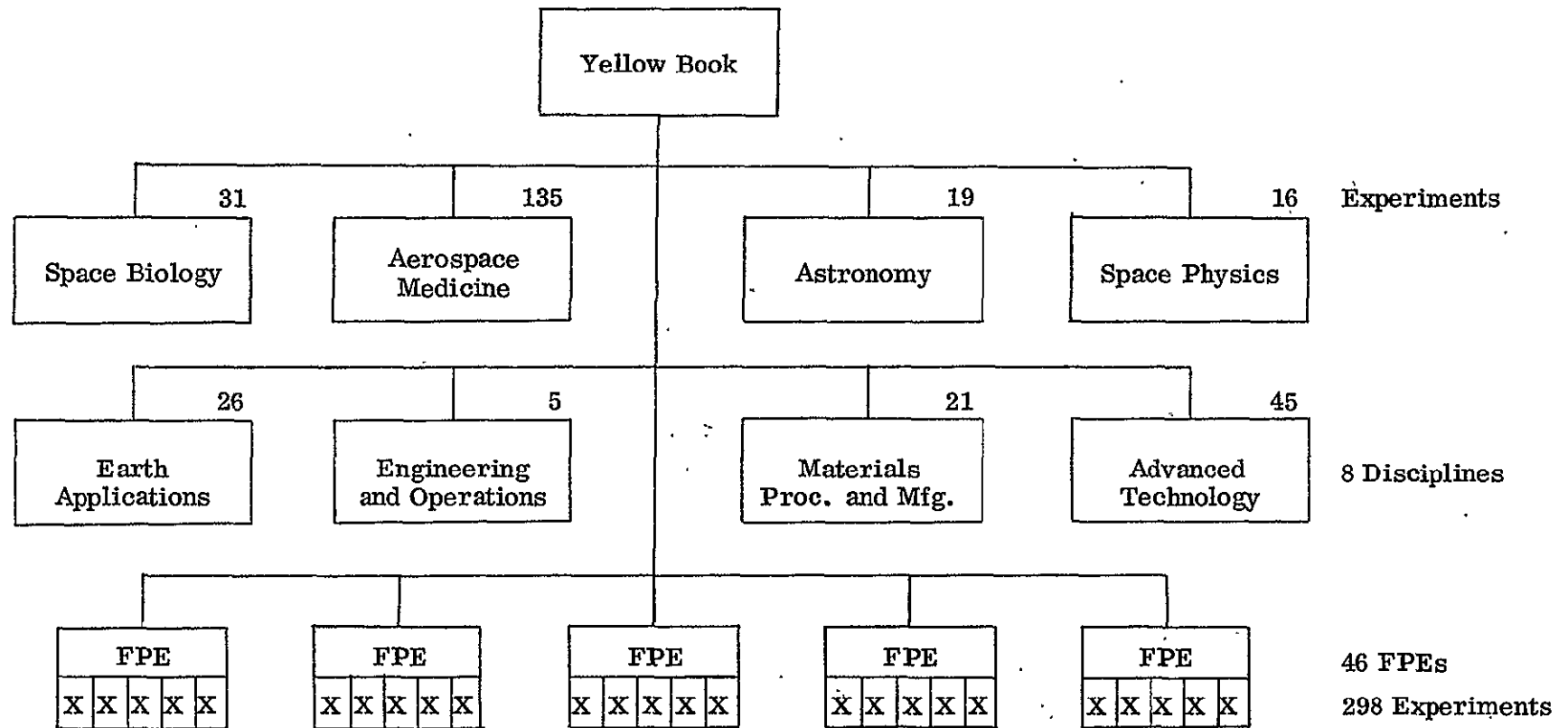


PROPOSED FLIGHT RESEARCH
AND EXPERIMENT PLAN

OMSF/MSFC/GD BLUE BOOK FPE'S

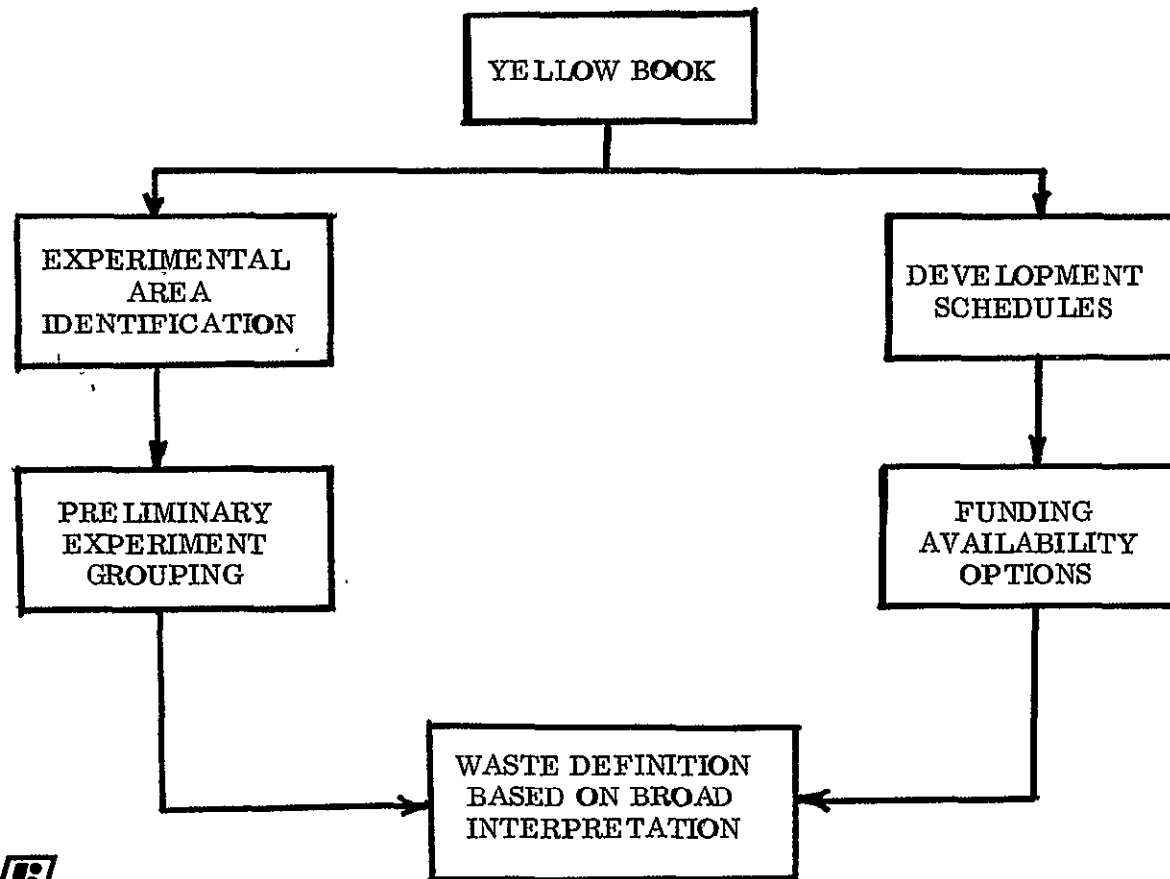
- | | |
|--|---|
| 1. GRAZING INCIDENCE X-RAY TELESCOPE | 14. MAN SYSTEM INTEGRATION |
| 2. ADVANCED STELLAR ASTRONOMY | 15. LIFE SUPPORT AND PROTECTIVE SYSTEMS |
| 3. ADVANCED SOLAR ASTRONOMY | 16. MATERIALS SCIENCE AND PROCESSING |
| 4. UV STELLAR SURVEY | 17. CONTAMINATION MEASUREMENTS |
| 5. HIGH ENERGY STELLAR SURVEY | 18. EXPOSURE EXPERIMENTS |
| 6. SPACE PHYSICS AIRLOCK | 19. EXTENDED SPACE STRUCTURE DEVELOPMENT |
| 7. PLASMA PHYSICS AND ENV. PERTURBATIONS | 20. FLUID PHYSICS IN MICROGRAPHY |
| 8. COSMIC RAY PHYSICS LAB | 21. INFRARED STELLAR SURVEY |
| 9. SMALL VERTEBRATES (BIO D) | 22. COMPONENT TEST AND SENSOR CALIBRATION |
| 10. PLANT SPECIMENS (BIO E) | 23. ADVANCED SPACECRAFT SYSTEM TESTS |
| 11. EARTH SURVEYS | 24. MSF ENGINEERING AND OPERATIONS |
| 12. REMOTE MANEUVERING SUBSATELLITE | 25. MICROBIOLOGY (BIO C) |
| 13. BIOMEDICAL AND BEHAVIORAL RESEARCH | 26. INVERTEBRATES (BIO F) |

ORGANIZATION OF OMSF YELLOW BOOK (REV. 1, SEPT. 1, 1969) EXPERIMENT PROGRAM

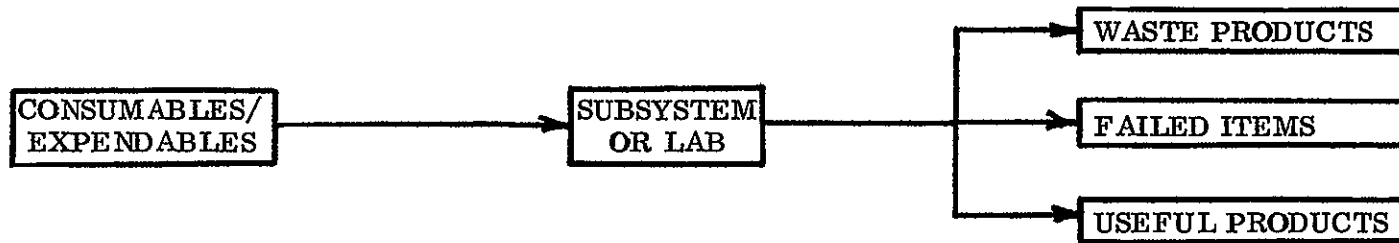


FPE = Functional Program Element

WASTE DEFINITION DATA RELATIONSHIP TO YELLOW BOOK



MATERIAL FLOW RELATIONSHIP TO WASTE DEFINITION

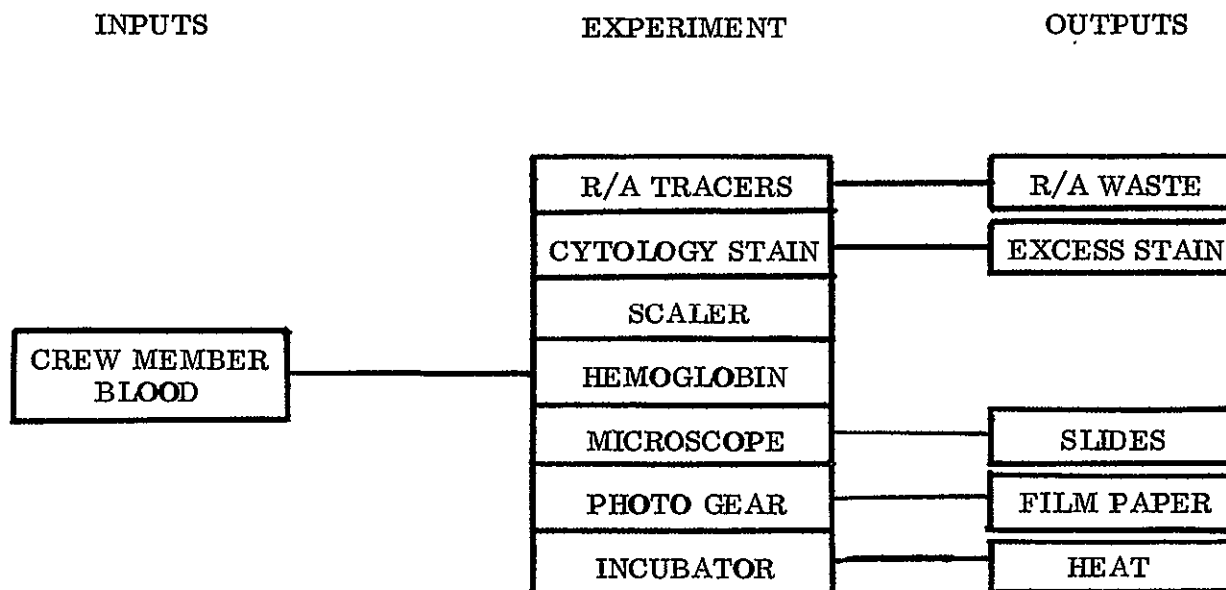


WASTE PRODUCTS FROM SYSTEMS RESULT FROM SCHEDULED MAINTENANCE/CONSUMED AND CLEANABLE ITEMS ARE WASTES.

FAILED ITEMS RESULT FROM UNSCHEDULED MAINTENANCE/FAILURE RATES BASED ON λT WHERE $T = 10$ YEARS/MAINTENANCE PERFORMED ON LINE REPLACEABLE UNIT BASIS/PACKAGING FOR REPLACEMENTS PARTS USED FOR RETURN OF FAILED ITEMS.

USEFUL PRODUCTS SUCH AS DATA ITEMS MAY BE RETURNED TO EARTH.

OPERATIONAL DESCRIPTION (SCHEMATIC DIAGRAM)
HEMATOLOGY - BLOOD CELL DYNAMICS



R/A = Radioactive

OPERATIONAL DESCRIPTION (RATIONALE AND REFERENCES)
HEMATOLOGY - BLOOD CELL DYNAMICS

RATIONALE

Specific tests are employed in this series to determine the effect of space flight on various blood cells (erythrocyte, leukocyte, and platelet dynamics). A sample of 5 ml of blood is required from each crewmember for each of 28 test periods. The grand total of the blood and reagents would be 500 ml. Film paper would contribute about 3 pounds of waste overall. The discarded glass slides should approach about 1/2 pound total for the three experiments. The radioactive (R/A) waste would be primarily in the discarded blood. Expected radioactivity would never exceed 1-2 uc of activity due to the quantities required.

REFERENCES

1. National Multipurpose Space Station, NASA MSC December 1964.
2. Medical Aspects of an Orbiting Research Laboratory, NASA Space Medicine Advisory Group, NASA Report No. SP-86, 1966.
3. Experiment Program For Extended Earth Orbital Missions, Revision No. 1, NASA OMSF, September 1, 1969.

CONSUMABLES/EXPENDABLES
HEMATOLOGY - BLOOD CELL DYNAMICS

Consumable/Expendable ITEM	How Consumed	Basic Constituents Consumed	Expt. Total Lbs.	Max. Rate Lbs./Day	Single Load Rate Lbs/Unit	Average Density Lbs/Cu.Ft.	Remarks
Film	Exposed	Silver Emulsion	10.0	.3	.3	43	
Cytology Stain	Chemical Reaction	Dyes	3.0	.1	.1	62	
Glass Slides	Contamination-R/A	Glass	.5	.02	.02	150-175	
Container	Contamination-R/A	Glass	2.0	.06	.06	150-175	
Radioactive Isotopes	Chemical Reaction	NaI ¹³¹ Na ₂ Cr ⁵¹ O ₄	0.1	.003	.003	62	Must be shielded by lead

WASTES
HEMATOLOGY - BLOOD CELL DYNAMICS

WASTE ITEM	Characteristics State And Condition	Chemical Composition	Action Required To Reclaim	Expt. Total lbs.	Max. Rate lbs/day	Single Load Rate lbs/unit	Average Density lbs/cu.ft.	Index Of Utilization Potential And Remarks
Microscope Slides Glass	Solid Non R/A	Si O ₂	Wash	5	.2	.2	150-175	Protect against R/A contact
Microscope Slides Glass	Solid R/A	Si O ₂	N/R	.5	.02	.02	150-175	
Cytology Stain	Liquid	H ₂ O + Stain	N/R	5	.2	.2	62	
Film Paper	Solid	C - H - O	N/R	3	.1	.1	44-72	
Container	Glass R/A	Si O ₂	R/A Decay	2	.06	.06	150-175	
Radioactive Isotopes	Liquid	Na I ¹³¹ - Na ₂ Cr ⁵¹	None	0.1	.003	.003	62	Must be constant- ly shielded

SUBSYSTEM INFORMATION SOURCES

INDUSTRY

McDONNELL DOUGLAS

NORTH AMERICAN ROCKWELL

COLLINS

GRUMMAN

FAIRCHILD HILLER

AIRCRAFT PROGRAMS

POWER CONVERSION PROGRAMS

APPLICATIONS TECHNOLOGY SATELLITE PROGRAM

SKYLAB WASTE MANAGEMENT

HABITABILITY DEFINITION

PERSONAL HYGIENE

FOOD MANAGEMENT

CREW QUARTERS

LITERATURE SEARCHES

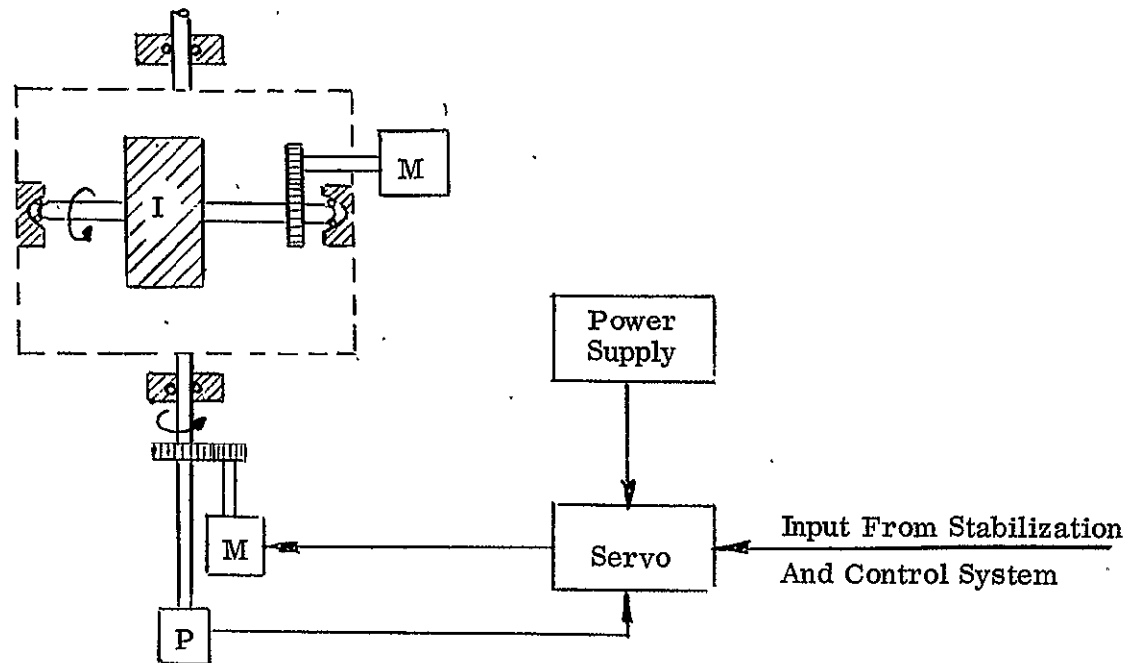
DEFENSE DOCUMENTATION CENTER

DEFENSE LOGISTICS STUDIES INFORMATION EXCHANGE

NASA LITERATURE TAPES

FH/RAD LIBRARY

OPERATIONAL DESCRIPTION (SCHEMATIC DIAGRAM)
STABILIZATION AND CONTROL SUBSYSTEM



Control Moment Gyro System

OPERATIONAL DESCRIPTION (RATIONALE AND REFERENCES) STABILIZATION AND CONTROL SYSTEM

RATIONALE

Control Moment Gyros (CMG's) will be used for attitude stabilization of both the space station and space base (Ref. 1). The system comprises three CMG's, oriented in the x, y, and z directions, with associated spin drive motors, gimbals, gimbal angle drive motor and gimbal angle pick-offs. In operation, the gimbal angle is driven off by a servo under control of signals from the stabilization and control system until the disturbance moments are compensated.

The analyses given herewith is based on an assumed gyro wheel weight of 240 pounds. The estimated bearing and motor weights have been sized accordingly and are given in the analysis Table I. If a different size gyro wheel is employed, the weights of bearings and motors may be scaled linearly as a first approximation.

The failure rates employed were obtained from Ref. 2, modified by engineering judgment and combined other sources.

REFERENCES

1. NASA, Space Station RFP
2. MIL-HDBK-217A (1 December 1965) Reliability Stress and Failure Rate Data for Electronic Equipment

**OPERATIONAL DESCRIPTION (TABLE I WASTE ANALYSIS)
STABILIZATION AND CONTROL SUBSYSTEM**

LRU Part Type	Number of Items	Weight Per Item	Total Weight Pounds	Failure Rate Fails/10 ⁶ Hrs	Number of Failures Per Year	Total Weight Per 10 Yrs	Single Load Rate Lbs/Unit
CMG Gyro Bearing	6	6	36	5.2	0.274	16.4	6
CMG Gimbal Bearing	6	6	36	2.6	0.137	8.2	6
CMG Drive Motor	3	50	150	7.5	0.187	93.5	50
CMG Gimbal Angle Pick-Off	3	1	3	7.0	0.184	1.8	1
CMG Servo Electronics	3	15	45	11.0	0.289	43.4	15
CMG Gimbal Angle Servo Motor	3	25	75	7.5	0.187	46.8	25
CMG Power Supply	1	15	15	14.0	0.123	18.5	15

CONSUMABLES/EXPENDABLES
STABILIZATION AND CONTROL SUBSYSTEM

Consumable/Expendable Item	How Consumed	Basic Constituents Consumed	Ten Year Total Lbs.	Max. Rate Lbs/Day	Single Load Rate Lbs/Unit	Average Density Lbs/Cu. Ft.	Remarks
Spare CMG Gyro Bearing	Part Failure	Component Part	16.4	-	6	250	RTE
Spare CMG Gimbal Bearing	Part Failure	Component Part	18.2	-	6	250	RTE
Spare CMG Drive Motor	Part Failure	Component Part	93.5	-	50	200	RTE
Spare CMG Gimbal Angle	Part Failure	Component Part	1.8	-	1	200	RTE
Spare CMG Servo Electronics	Part Failure	Component Part	43.4	-	15	52	RTE
Spare CMG Gimbal Angle Servo Motor	Part Failure	Component Part	46.8	-	25	200	RTE
Spare CMG Power Supply	Part Failure	Component Part	18.5	-	15	77	RTE
Packaging For Replacement Parts	Environmental Integrity Destroyed	Internal Environment Changed	-	-	-	5	Reuse for Returning Failed Items

RTE - Return to Earth

WASTES
STABILIZATION AND CONTROL SUBSYSTEM

WASTE ITEM	Characteristics State And Condition	Chemical Composition	Action Required To Reclaim	Ten Year Total lbs.	Max. Rate lbs/day	Single Load Rate lbs/unit	Average Density lbs/cu.ft.	Index Of Utilization Potential And Remarks
1. Failed CMG Gyro Bearing	Solid Metal RTE	Fe	Repair	16.4	-	6	250	
2. Failed CMG Gimbal Bearing	Solid Metal RTE	Fe	Repair	8.2	-	6	250	
3. Failed CMG Drive Motor	Solid Metal RTE	Cu, Fe	Repair	93.5	-	50	200	.2 Repair on board
4. Failed CMG Gimbal Angle Pick-Off	Solid Metal RTE	Cu, Fe	Repair	1.8	-	1	200	.2 Repair on board
5. Failed CMG Servo Electronics	Solid Metal RTE	Al, Cu, Fe, Si	Repair	43.4	-	15	52	.2 Repair on board
6. Failed CMG Gimbal Angle Servo Motor	Solid Metal RTE	Cu, Fe	Repair	46.8	-	25	200	.2 Repair on board
7. Failed CMG Power Supply	Solid Metal RTE	Al, Cu, Fe, Si	Repair	18.5	-	15	77	.2 Repair on board
8. Packaging for Replacement Parts	Solid Plastic RTE	Plastic Sponge and Sheeting	Reuse As Is	-	-	-	5	

WASTE UTILIZATION/RECOVERY PROCESS CATEGORIES

PHYSICAL SEPARATION

Filtration
Centrifugation
Thermal
Vacuum
Distillation
Absorption (Molecular Sieve)

ELECTROLYSIS (Water)

OXIDATION

Incineration
Wet (Zimmerman Process)

FUNCTIONS:

- 1) Regenerate original material
- 2) Produce useful intermediate (consumable)
- 3) Provide useful spacecraft functions by ejection or storage.

DECOMPOSITION

Thermal (Pyrolysis)
Bacterial (Aerobic/Anaerobic)

REDUCTION (CO₂)

Bosch Process
Sabatier Process
Solid Electrolyte Process

COMPACTION

PROPULSION

FOOD PREPARATION

SAMPLE WASTE UTILIZATION/RECOVERY PROCESS DATA SUMMARY

PROCESS NAME - Wet Oxidation

PROCESS BASIS/PRINCIPAL - Elevated temperature and pressure oxidation of aqueous slurries or solutions of organic materials.

MATERIALS TREATED - 1) Raw urine and/or feces
2) Urine distillation residue
3) Cellulose, sucrose, etc.
4) Proteins, amino acids

CONSUMABLES REQUIRED - O₂

PRODUCTS - CO₂, H₂O, N₂, NH₄ salts, CH₃COOH, White ppt. in aqueous phase

PROCESS DATA - 1) Nominal T, P: 500°F, 2300 psi
2) Thermal requirements - ca. 250 BTU/lb.
3) Conversion efficiency - 95% (organic)

UTILITY - 1) Deactivation of complex organic wastes (including biological)
2) Closure of carbon balance (in conjunction with CO₂ reduction)
3) Generation of plant nutrition media through lower level (partial) oxidation

REFERENCES - 1) "Investigation of the Feasibility of Wet Oxidation For Spacecraft Waste Treatment" - R.B. Wheaton et al. NASA CR66450, 1967.
2) "Wet Oxidation For Space Waste Management" - J. Konikoff and T. Slaweki, SAE Paper 680714, October 1968.
3) "The Problems of the Possibility of the Mineralization of Water - Fecal Mixtures by the Method of Wet Burning" - A. L. Agre et al. NASA TT 66-34698, October 1966.

WASTE DISPOSAL PRETREATMENT CONCEPTS

MICROBIAL CONTROL

INCINERATION

HOT AIR STERILIZATION

DESICCATION (DEHYDRATION)

GAMMA RAY IRRADIATION

MOIST HEAT STERILIZATION (AUTOCLAVE)

COMPACTION

BAG TYPE DRYER/COMPACTOR

CENTRIFUGAL DRYER/COMPACTOR

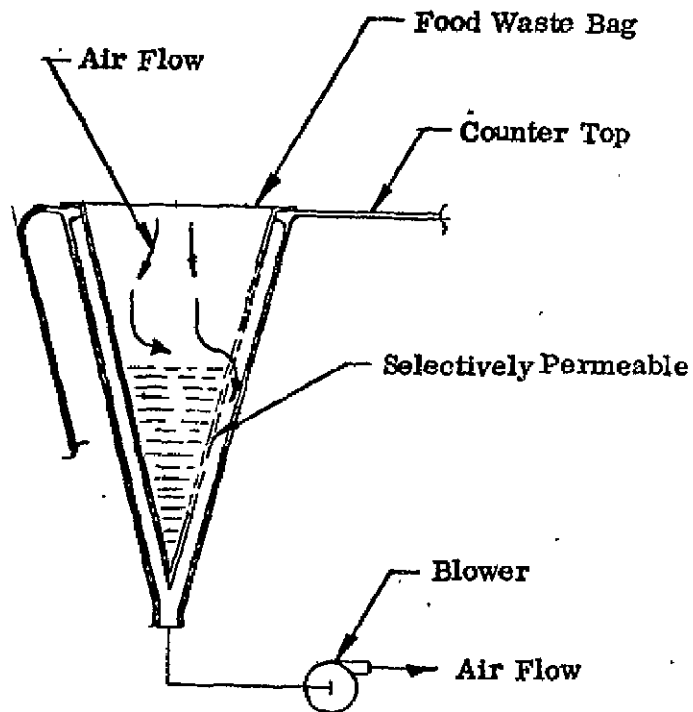
CENTRIFUGAL SHREDDER

BELLOUED COMPACTOR/CONTAINER

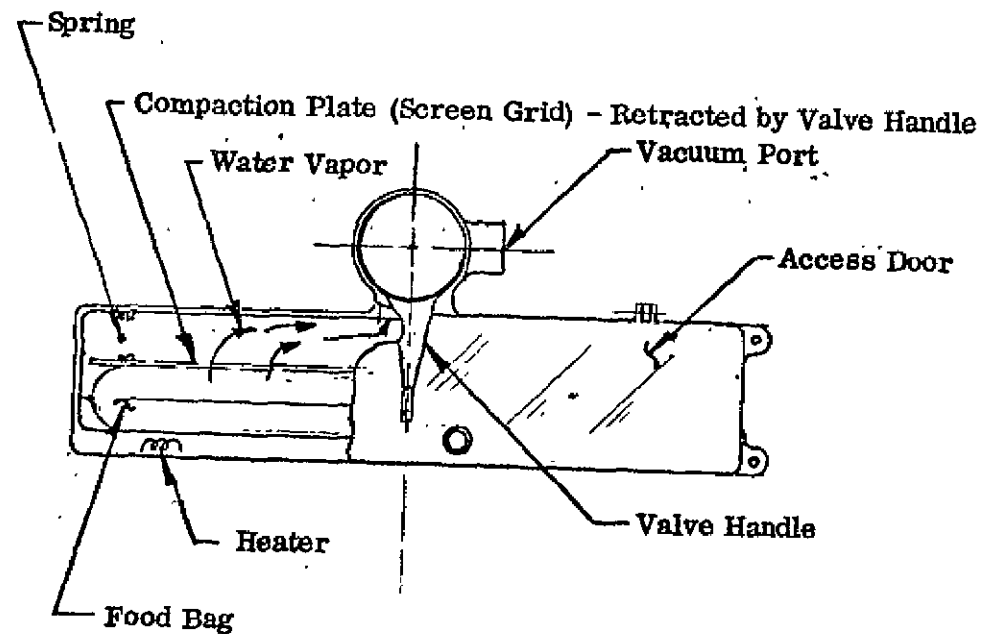


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BAG TYPE FOOD WASTE DRYER/COMPACTOR



COLLECTION

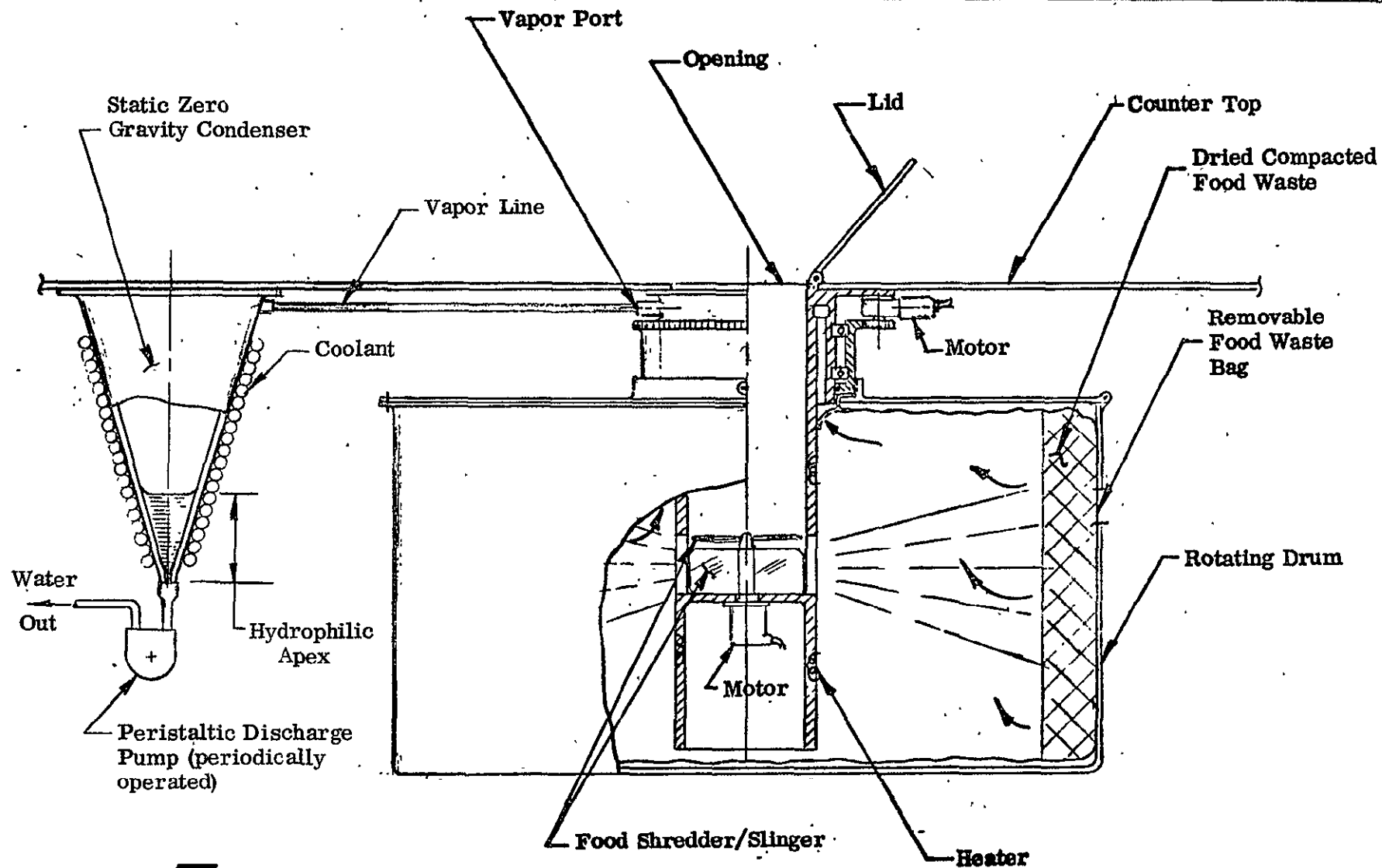


DRYING AND COMPACTING

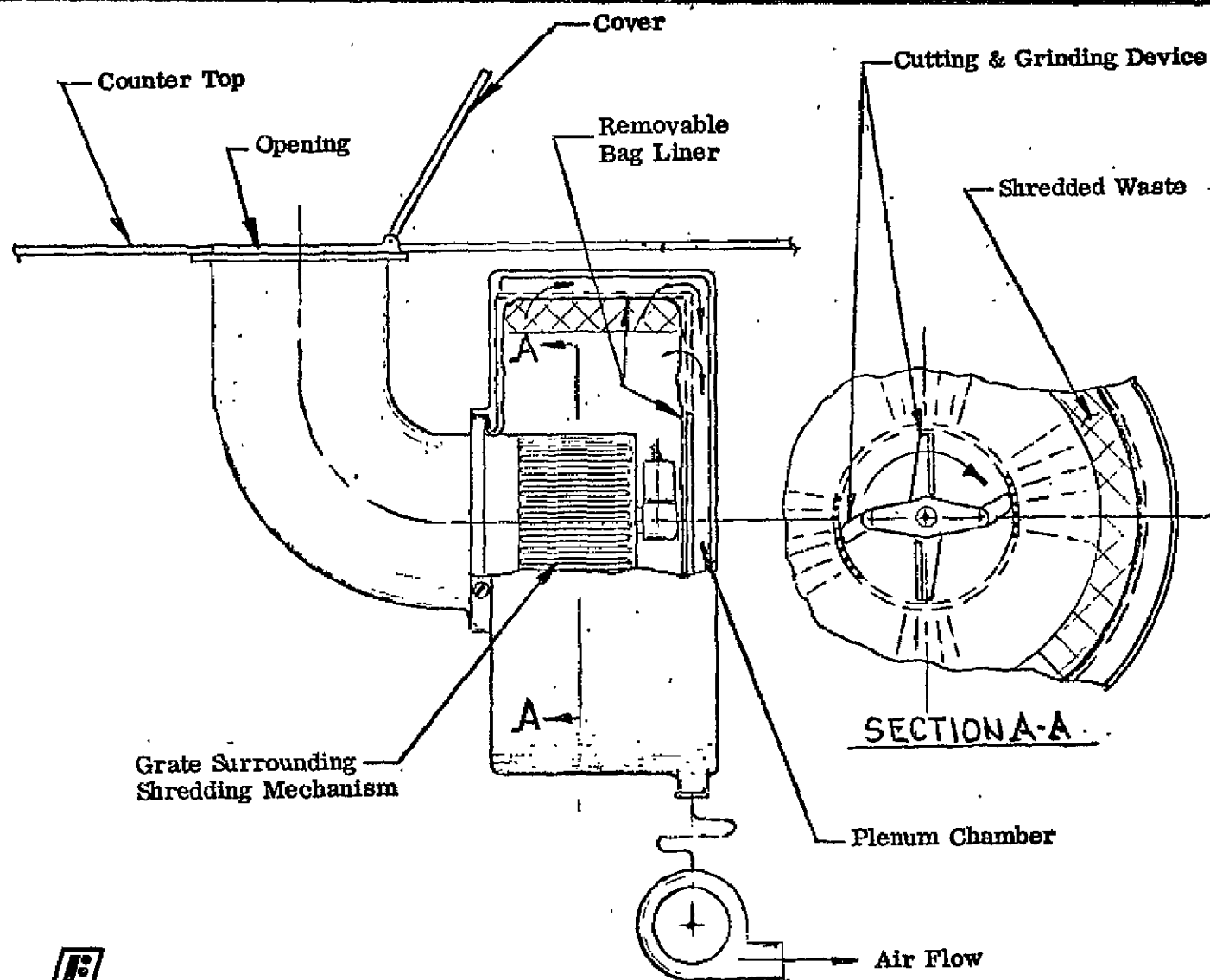


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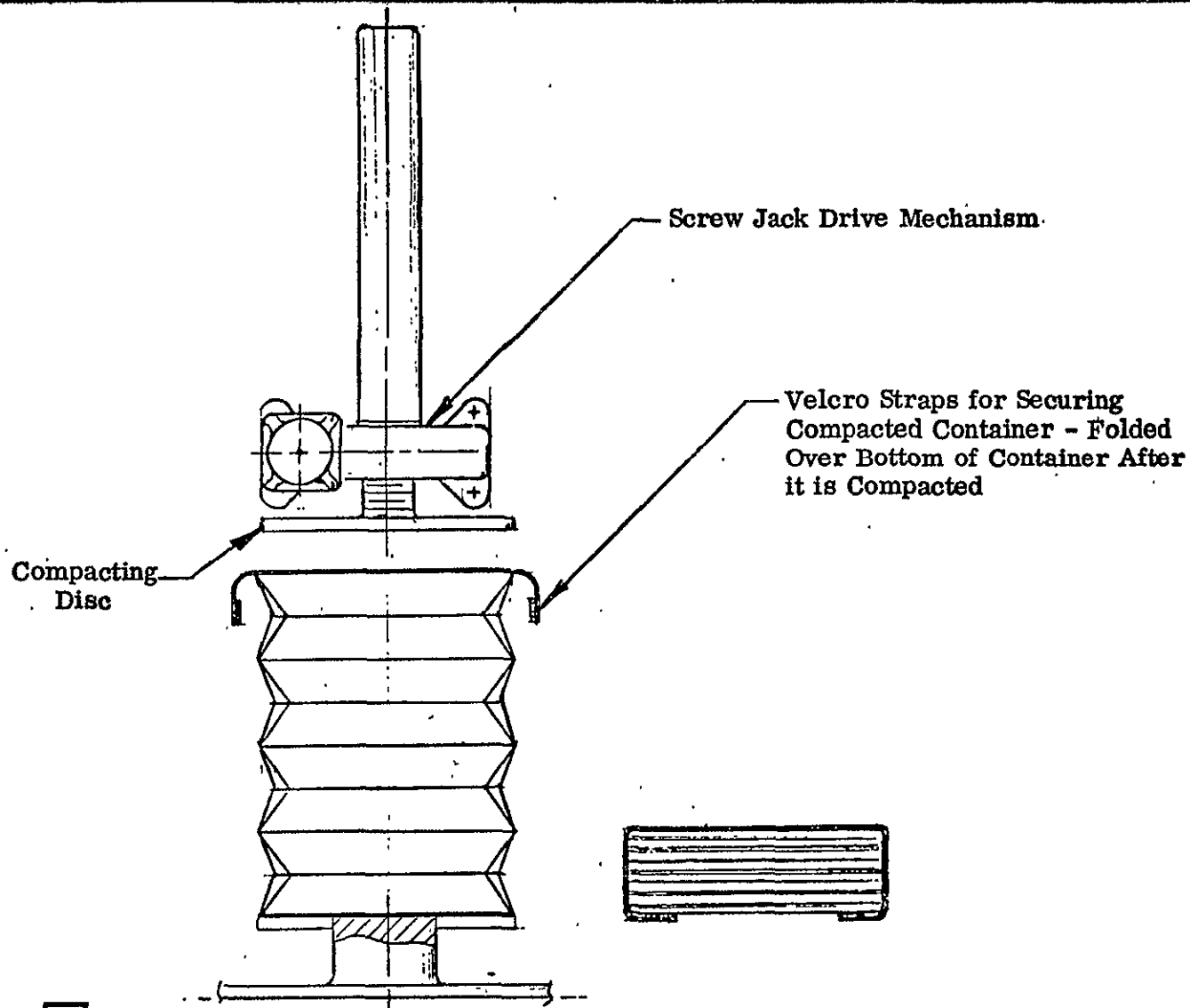
CENTRIFUGAL FOOD WASTE DRYER/COMPACTOR



CENTRIFUGAL SOLID WASTE SHREDDER



BELLOWED COMPACTOR/CONTAINER

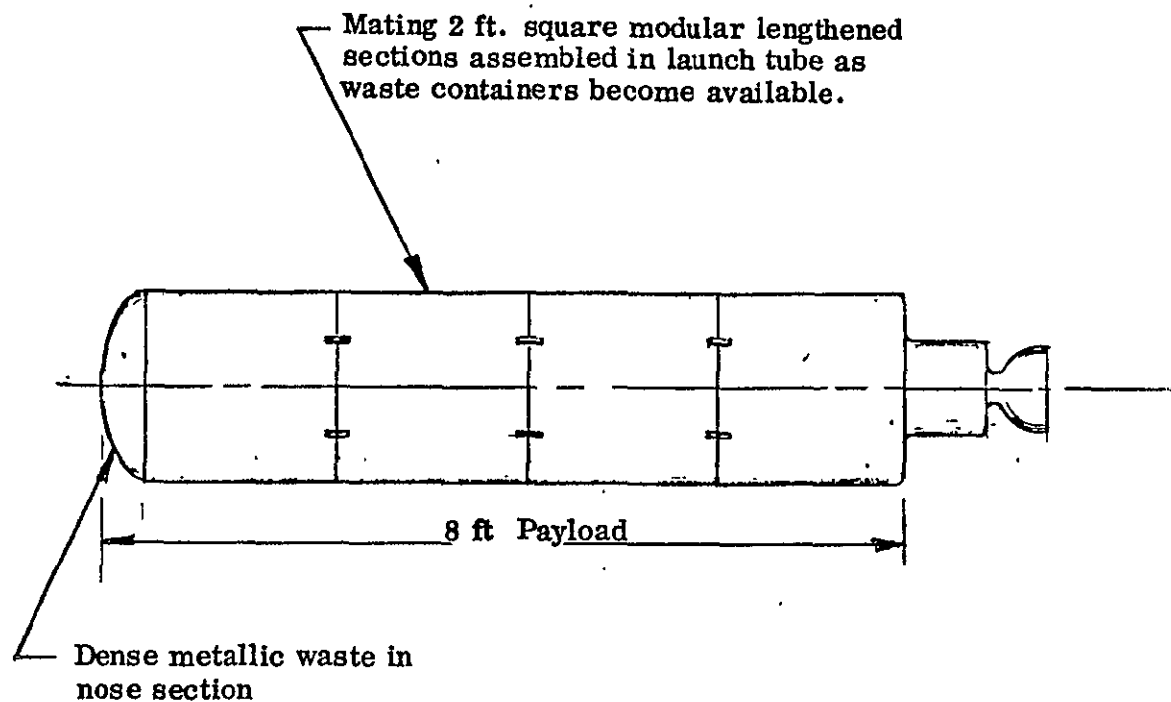


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FARMINGDALE, NEW YORK 11735

WASTE DISPOSAL CONCEPTS

- A. JETTISON TO EARTH ATMOSPHERE FOR AERODYNAMIC INCINERATION AND DISPERSION
 - 1. VIA ROCKET PROPULSION
 - 2. VIA SHUTTLE
- B. JETTISON TO PARKING ORBIT
 - 1. VIA ROCKET PROPULSION
 - 2. VIA SHUTTLE
- C. JETTISON TO SOLAR ORBIT VIA ROCKET PROPULSION
- D. RETURN TO EARTH VIA SHUTTLE
- E. ON BOARD STORAGE
- F. JETTISON TO REMOTE MODULE
 - 1. VIA AUTOMATIC MANEUVERING UNIT
 - 2. VIA MANNED MANEUVERING UNIT

ROCKET FOR JETTISON TO EARTH ATMOSPHERE OF
1250 LBS. COMPACTED WASTE FROM 300 N.M. ORBIT



Fuel required: $W_p = .052 W_w = .052 (1250\#) = 65\#$

Rocket Struct: $W_s = .0071 W_w = .0071 (1250) = 9\#$

Propulsion system $W_t = 74\#$

Total required impulse = $I W_p = 260 \frac{\# \text{ sec}}{\#} (65\#) = 16,900\# \text{ sec.}$

Fuel Vol = $65 \# \div 107 \frac{\#}{\text{ft}^3} = .61 \text{ ft}^3$

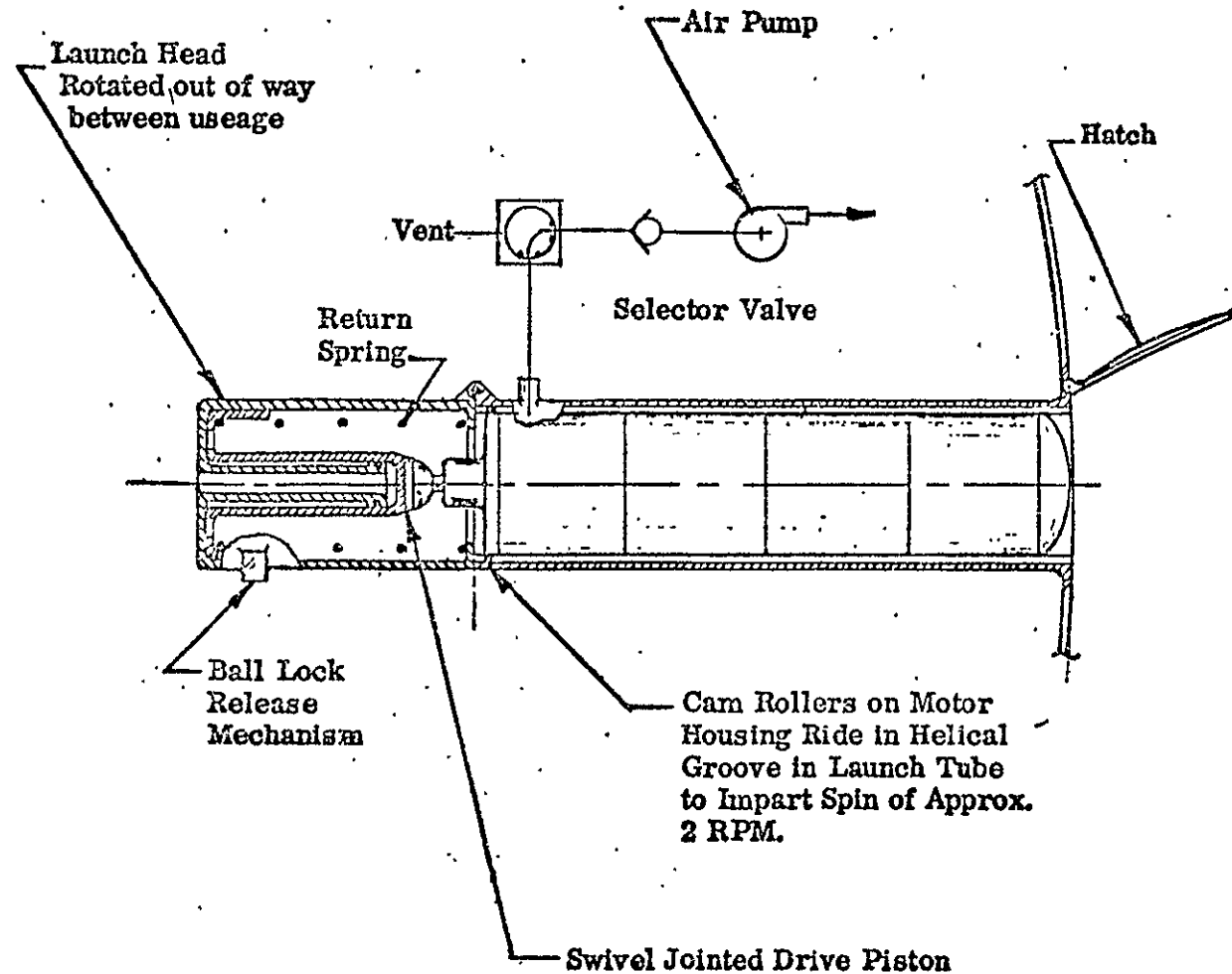


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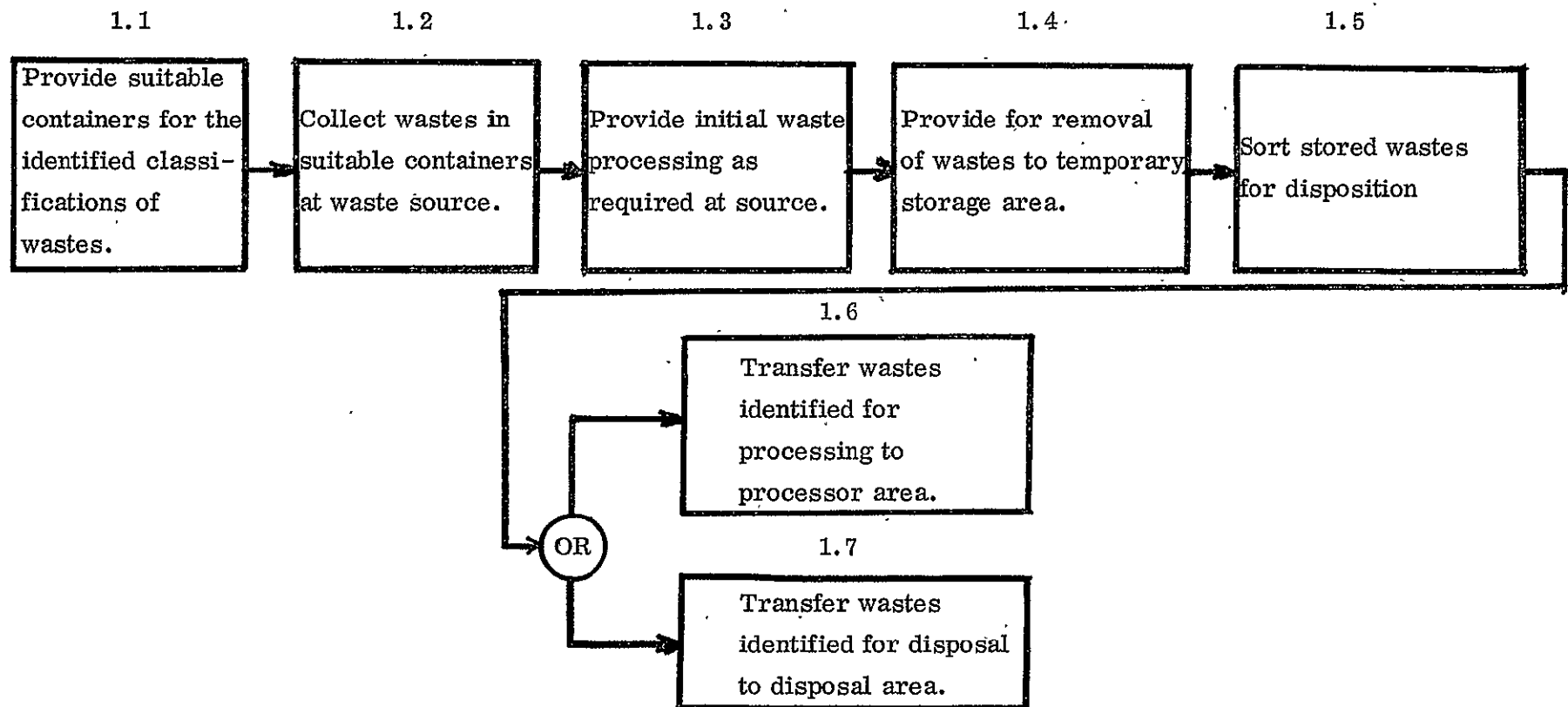
CONFIGURATION FOR SPIN EJECTING WASTE ROCKET

OPERATION:

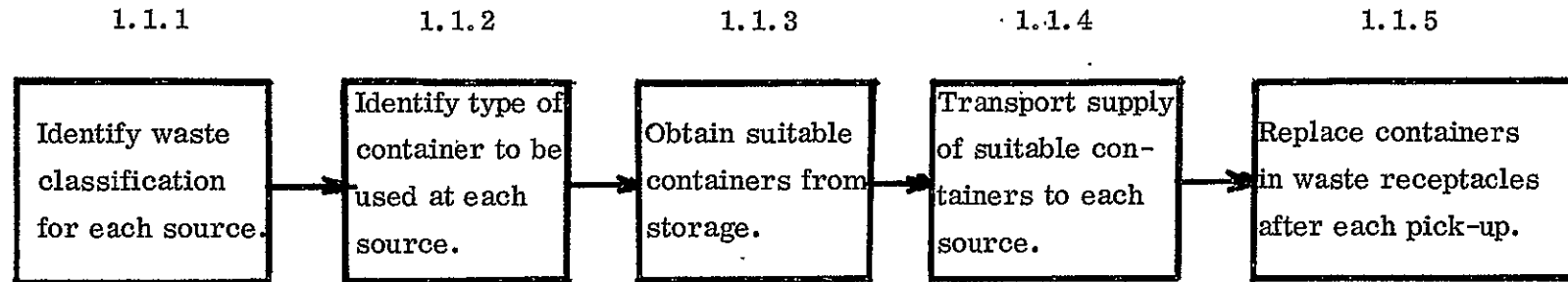
1. Pump down launch tube to conserve air and open hatch.
2. Release ball-lock mechanism; atmospheric pressure acting on launch piston ejects rocket.
3. Close hatch.
4. Vent launch tube—spring in launch mechanism retracts launch piston.



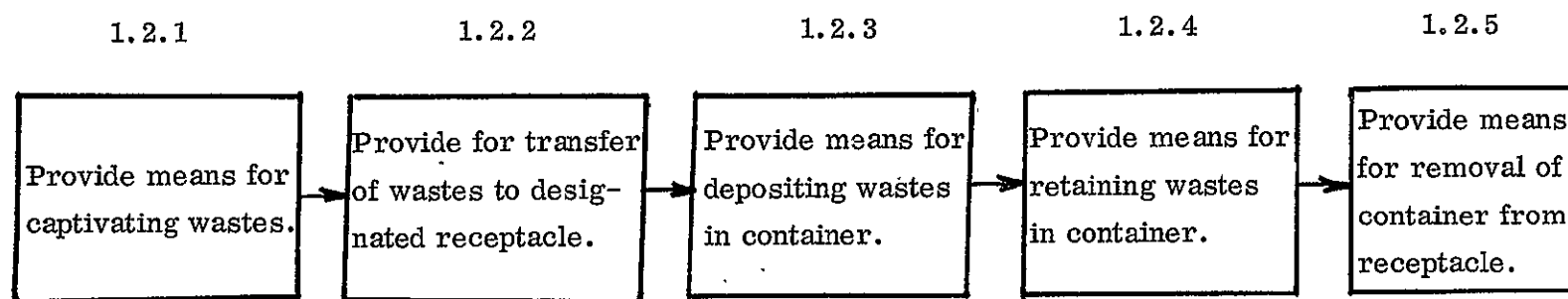
FUNCTION 1.0 -- PROVIDE FOR WASTE HANDLING



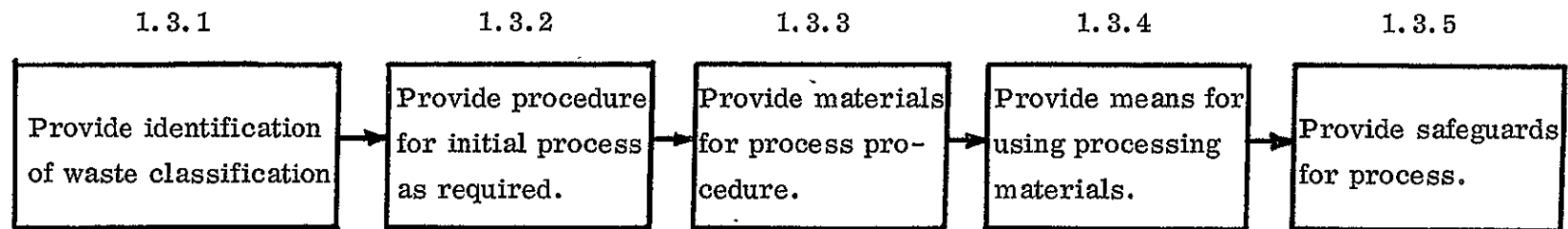
FUNCTION 1.1 -- PROVIDE CONTAINERS FOR WASTE COLLECTION



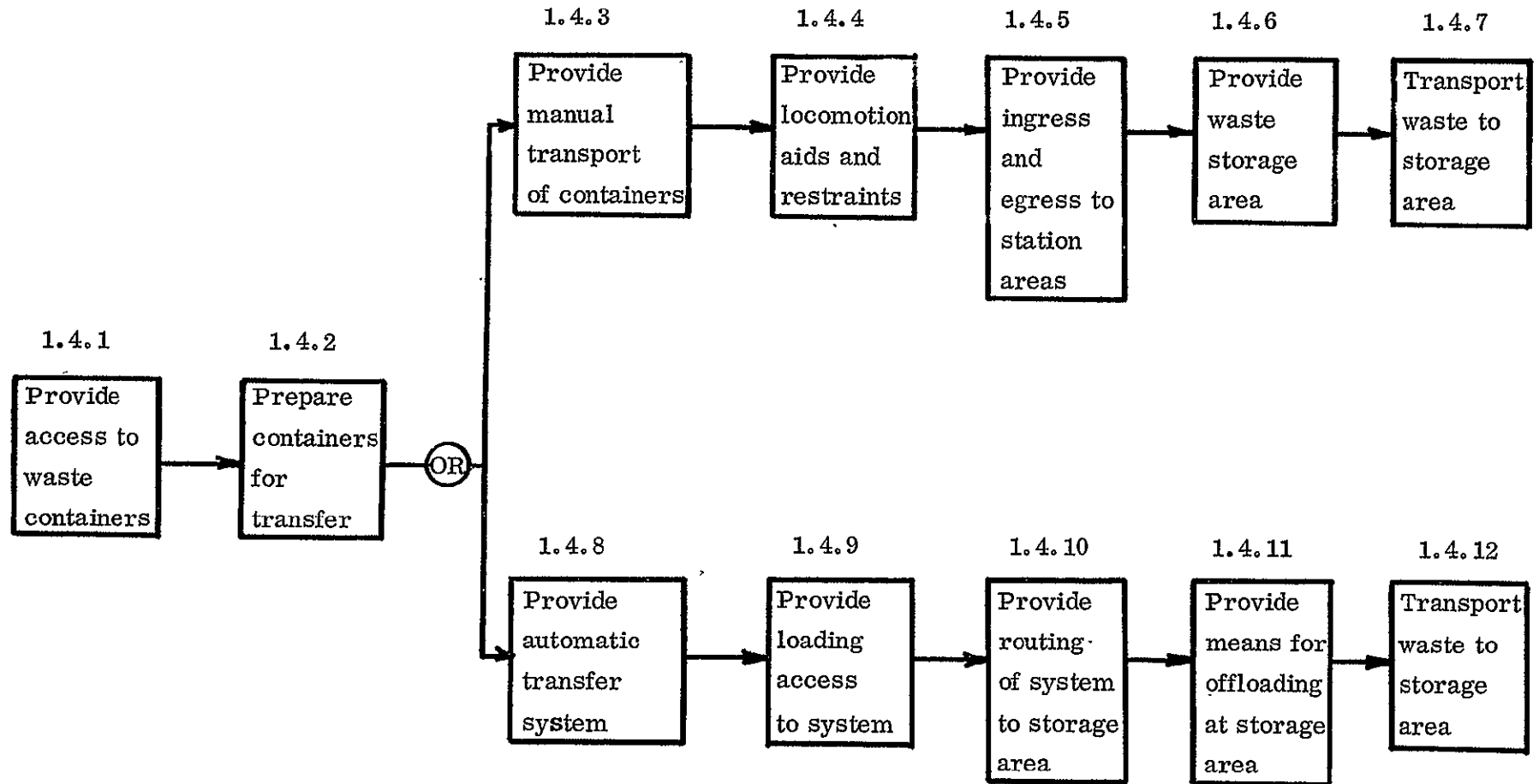
FUNCTION 1.2 -- COLLECT WASTES AT SOURCE



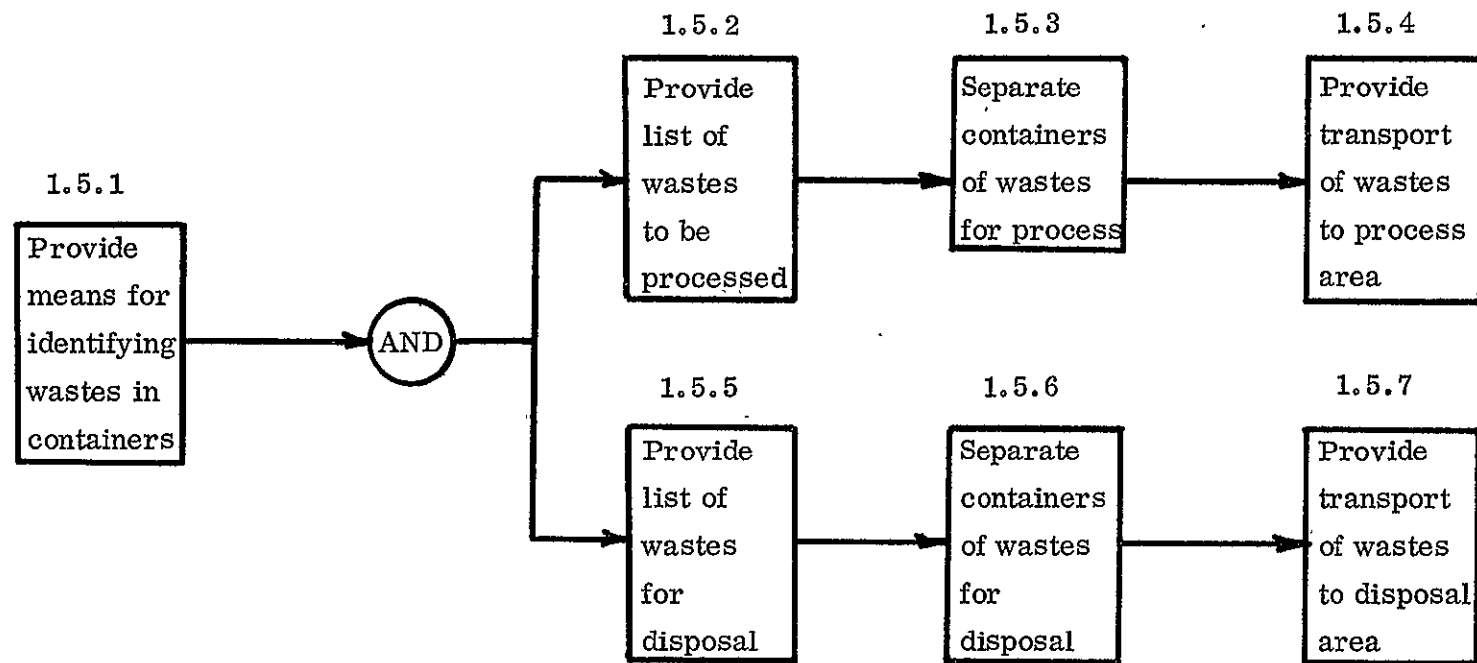
FUNCTION 1.3 -- PROVIDE INITIAL WASTE PROCESSING



FUNCTION 1.4 PROVIDE FOR TRANSFER OF WASTES



FUNCTION 1.5 PROVIDE SORTING OF WASTES FOR DISPOSITION



AUTOMATIC TRANSFER CONCEPTS AND CONSIDERATIONS

<u>CONCEPT</u>	<u>DESIGN CONSIDERATIONS</u>
1. CENTRAL VACUUM	OUTLETS AT EACH AREA/CLOSURES/CONDUITS/CENTRAL COLLECTION/ CENTRAL VACUUM POWER SOURCE
2. PNEUMATIC TUBE	INDIVIDUAL TUBES TO EACH AREA/WASTE CONTAINER SHUTTLES/ PREPARATION/MAINTENANCE ACCESS/PNEUMATIC POWER SOURCE/ OPENING SEALS
3. LIQUID	PLUMBING/PUMPS/TANKS/LIMITED UTILITY
4. CABLE RUNS	BULKHEAD PENETRATION/MAINTENANCE ACCESS/LOADING/MANUAL POWER/MOTIVE POWER
5. VELCRO BELTS	BULKHEAD PENETRATION/POWER DRIVES/MAINTENANCE ACCESS/ MANUAL LOADING/CONTAINER ADAPTATION FOR VELCRO PADS

TRANSFER CONTAINER CONCEPTS

WASTE CONDITION WASTE STATE	NON-TOXIC, STERILE, OR INERT	TOXIC, PATHOGENIC, OR ACTIVE	HOT (ABOVE SAFE SKIN CONTACT TEMPERATURE)	COLD (BELOW SAFE SKIN CONTACT TEMPERATURE)	RADIOACTIVE
A. SOLID	SOFT BAG	SEALED IMPERMEABLE BAG	INSULATED CONTAINER	INSULATED CONTAINER	SHIELDED CONTAINER
B. LIQUID	SOFT BAG	SEALED IMPERMEABLE BAG	INSULATED CONTAINER	INSULATED CONTAINER	SHIELDED CONTAINER
C. GAS	FLASK	FLASK	FLASK IN INSULATED CONTAINER	FLASK IN INSULATED CONTAINER	FLASK IN SHIELDED CONTAINER
D. MIXTURE - Solid and Liquid	SOFT BAG	SEALED IMPERMEABLE BAG	INSULATED CONTAINER	INSULATED CONTAINER	SHIELDED CONTAINER
E. MIXTURE - Liquid and Gas	FLASK	FLASK	FLASK IN INSULATED CONTAINER	FLASK IN INSULATED CONTAINER	FLASK IN SHIELDED CONTAINER

TRANSFER CONTAINER DATA

CANDIDATE CONTAINERS	CONTAINER LIMITATIONS		
	VOLUME (CU. FT.)	DIAMETER (INCHES)	GROSS WEIGHT (LOADED - LBS)
BAG	5.3	18	35
SEALED BAG	5.3	18	35
INSULATED CONTAINER	1.5	12	35
SHIELDED CONTAINER	1.0	12	35
FLASK	0.5	12	35

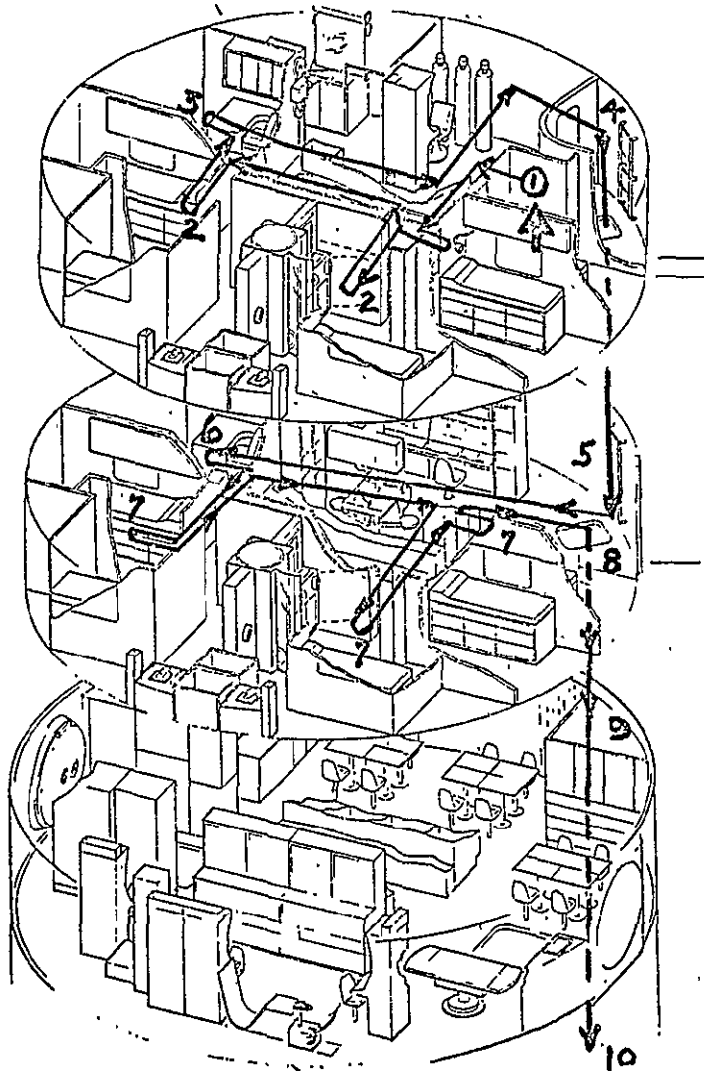
MANUAL TRANSFER DATA

CONTAINER	HORIZONTAL HRS/FT $\times 10^{-3}$	VERTICAL HRS/FT $\times 10^{-3}$	TURN HRS/TURN $\times 10^{-3}$	AIRLOCK HRS/PASSAGE $\times 10^{-3}$	HATCH HRS/PASSAGE $\times 10^{-3}$
BAG	0.092	0.139	1.11	35.0	12.5
SEALED BAG	0.092	0.139	1.11	35.0	12.5
INSULATED CONTAINER	0.139	0.185	0.84	32.5	11.2
SHIELDED CONTAINER	0.139	0.185	0.84	32.5	11.2
FLASK	0.139	0.185	0.84	32.5	11.2



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TYPICAL WASTE HANDLING ROUTING AND TASKS



1. Start at Deck 3 crew quarters.
2. Remove soiled clothing in crew quarters.
3. Remove soiled clothing from Chief Investigator's Stateroom.
4. Enter inter-volume airlock.
5. Pass through airlock to Deck 2.
6. Remove soiled clothing from Commander's stateroom.
7. Remove soiled clothing from crew quarters.
8. Leave Deck 2 by auxiliary hatch.
9. Pass through Deck 1 and enter storage area in torus.
10. Store soiled clothing for laundering.



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DATA PROCESSING PROGRAM - OBJECTIVES

- COLLECT CONDENSED DATA AND STORE IN PERMANENT DISC STORAGE FILES.

Waste Material Generation

Properties/Attributes

Associated Handling Equipment And Procedures

Utilization And Disposal Processes

- PERMIT KEYWORD ORIENTED SEARCHES OF DATA.
- PROVIDE CAPABILITY OF UPDATING OF FILES.
- PREPARE REPORT MATERIAL FROM DATA FILES.

DATA PROCESSING PROGRAM - DATA CATEGORIES

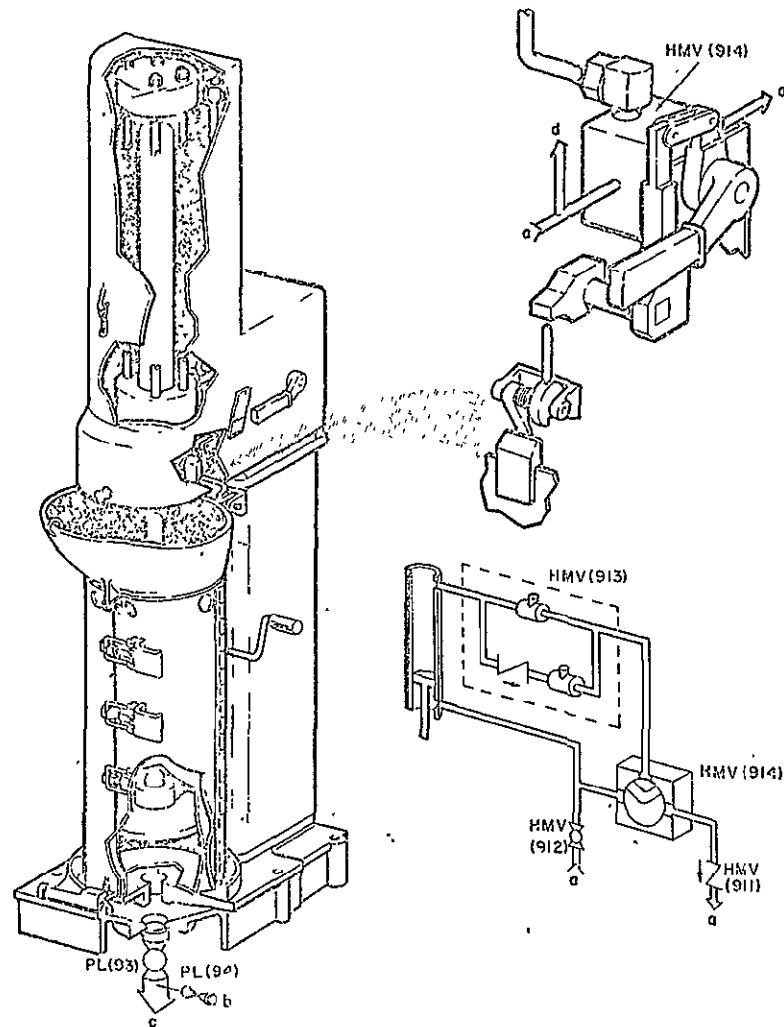
<u>WASTE GENERATION/PROPERTIES</u>	<u>HANDLING</u>	<u>PROCESSES</u>	<u>DISPOSAL</u>
* Waste Name	Containers	* Name	* Name
* S/C Origin	* Type	* Input Material	* Waste Attributes
Generation Rates	* Waste Attributes Required	* Output Material	* Processes Required
* State	Design Criteria	* Consumables	* Consumables
* Attributes	Collection Procedures	Process Variables	Manpower/Handling
* Composition	* Name	Electrical	Design Constraints
Density	* Waste Attributes Required	Thermal	
Unit Weight	Containers Required	Manpower	
References	Manpower	Equipment	
	Transfer Method	References	
	* Name		
	* Waste Attributes		
	Containers		
	Manpower		

* Items containing search keywords

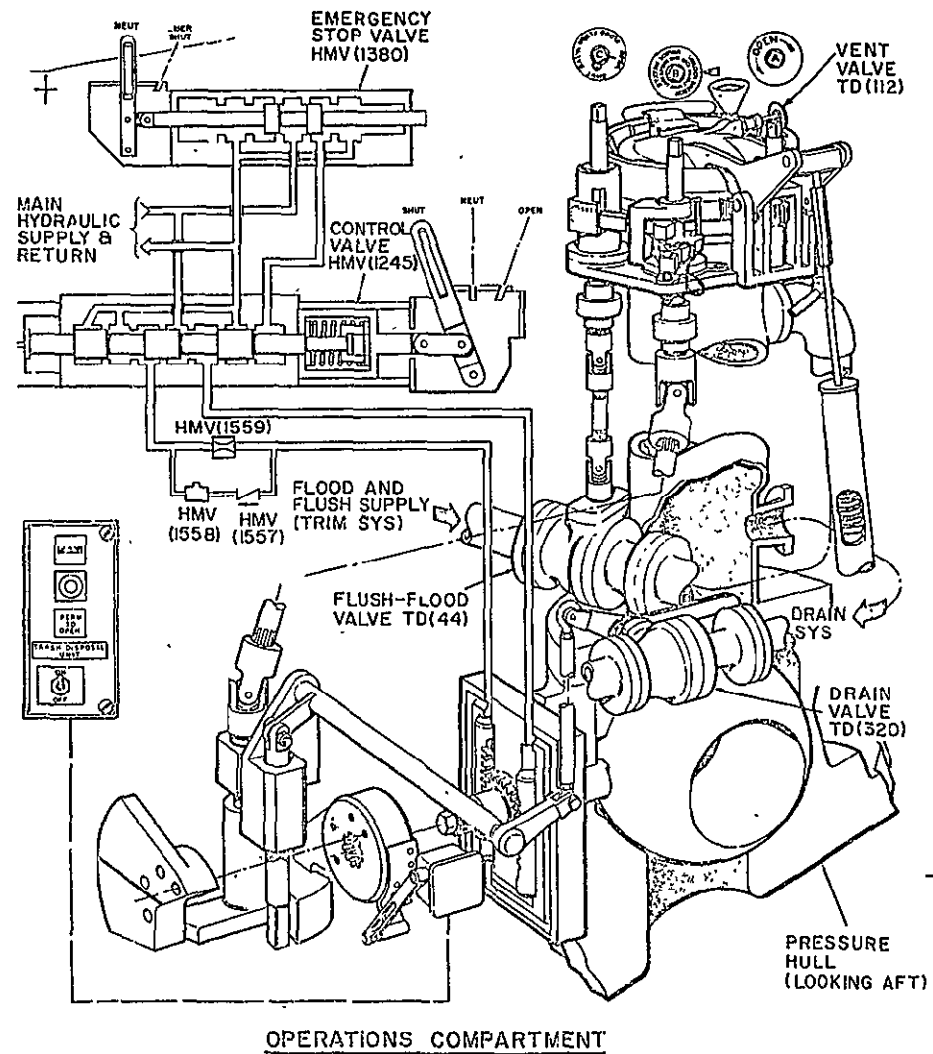
SUBMARINE USS GATO (SSN 615) RELATIONSHIPS TO MANNED SPACE HABITABILITY

USS GATO TYPE	-	SMALL/NUCLEAR POWERED/100 MAN/ADVANCED GEAR/ANTISUB
UPKEEP CONDITION	-	MINIMUM HOUSEKEEPING
OPERATING CONDITION	-	SKILL AND DISCIPLINE PARAMOUNT/HOUSEKEEPING WHEN CONVENIENT
RANK	-	VERY IMPORTANT
CREW AREAS	-	NUCS CRAMMED/CHIEFS SPACIOUS/OFFICERS TIDY
WORK AREAS	-	HIGHLY ENGINEERED
AIR REGEN SYSTEM	-	CRITICAL
GALLEY	-	SMALL/RUGGED/BULK BINS/ELECTRIC MIXERS, OVENS, AND RANGES
PANTRY/FREEZER	-	LARGE/ADJACENT TO RADIATION AREA
MESS	-	DINER BOOTH ARRANGEMENT
WARD ROOM	-	IMPECCABLE/PANELED/RED LEATHER/FINEST LINEN AND SILVER
HEADS	-	RUGGED GEAR/WASTE HOLDING TANKS
WASTE CONTAINERS	-	METAL CANS/PLASTIC NET BAGS
COMPACTORS	-	ON FBM SUBS
TRASH DISPOSAL UNIT	-	IN GALLEY/COMPLEX PROCEDURE AND EQUIPMENT

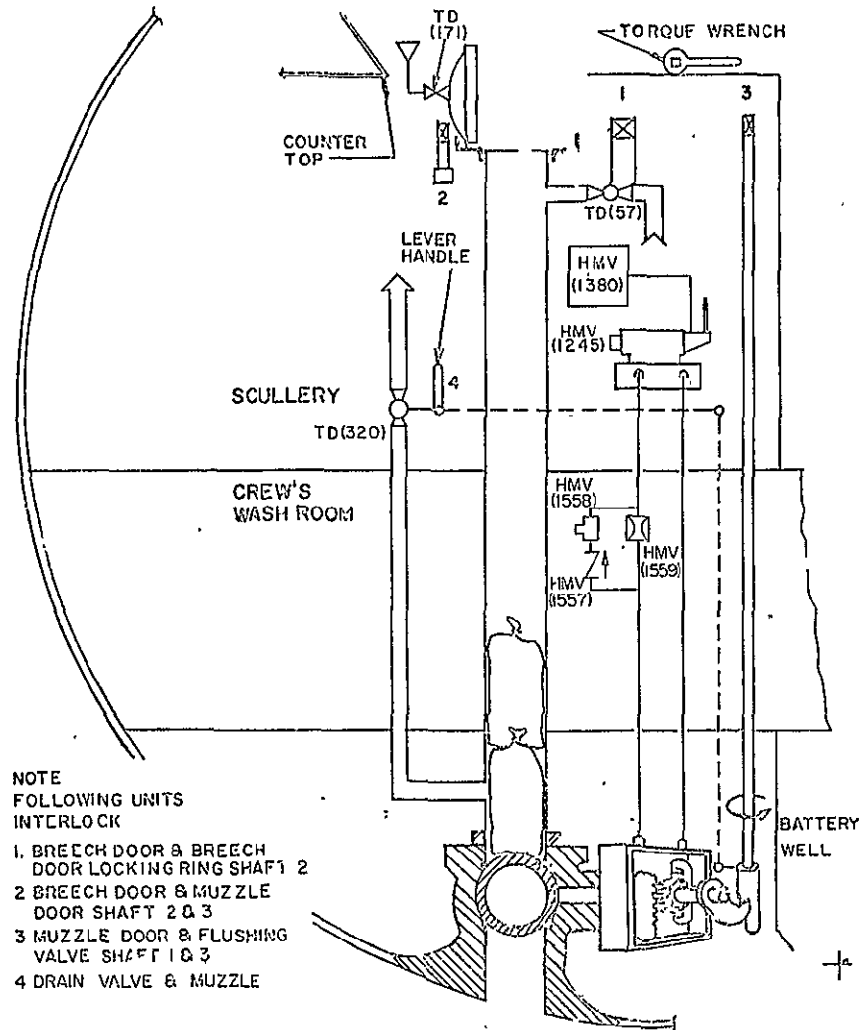
SUBMARINE TRASH COMPACTOR



SUBMARINE TRASH DISPOSAL UNIT ARRANGEMENT



SUBMARINE TRASH DISPOSAL UNIT LOADING



SUBMARINE TRASH DISPOSAL UNIT OPERATING PROCEDURE (ITEM A)

A. LOADING THE TDU

1. MAN THE PHONES TO DRAIN MANIFOLD, AIR REGEN, GALLEY, AND CONTROL
2. REQUEST PERMISSION TO LOAD
3. CHECK TDU LINE-UP
4. WHEN ORDERED "LOAD THE TDU"
 - a. HOLD A COFFEE MUG OVER VENT
 - b. OPEN TDU VENT
 - c. UNLOCK BREECH
 - d. OPEN BREECH
 - e. ADD WATER
 - f. LOAD
 - g. SHUT BREECH
 - h. LOCK BREECH
5. REPORT "TDU LOADED"



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SUBMARINE TRASH DISPOSAL UNIT OPERATING PROCEDURE (ITEM B)

B. FLUSHING THE TDU

1. WHEN ORDERED "MAKE THE TDU READY FOR FLUSHING"
 - a. OPEN FLUSH VALVE
 - b. SHUT TDU VENT
 - c. OPEN MUZZLE DOOR
 - d. REPORT "MUZZLE DOOR IS OPEN"
 - e. DIRECT AIR REGEN TO SHUT ECS ASW DISCHARGE VALVE
 - f. FLUSH FOR 3 MINUTES
 - g. DIRECT AIR REGEN TO OPEN ECS ASW DISCHARGE VALVE
 - h. SHUT FLUSH VALVE
 - i. SHUT MUZZLE DOOR
 - j. REPORT "THE MUZZLE DOOR IS SHUT"



SUBMARINE TRASH DISPOSAL UNIT OPERATING PROCEDURE (ITEMS C AND D)

C. DRAINING THE TDU

1. WHEN MUZZLE DOOR HAS BEEN SHUT
 - a. OPEN TDU DRAIN
 - b. REQUEST CONTROL TO INFORM DRAIN MANIFOLD OPERATOR "PUMP DOWN THE TDU"
 - c. WHEN RECEIVING THE WORD "THE DRAIN PUMP IS RUNNING" OPEN THE TDU VENT
 - d. CONTINUE PUMPING UNTIL SUCTION IS LOST
 - e. SHUT THE DRAIN PUMP VALVE AND SECURE THE DRAIN PUMP
 - f. SHUT THE TDU VENT
 - g. REPORT "TDU SECURED, RIGGED FOR DIVE"
2. WHEN NOTIFIED BY CONTROL, SECURE THE PHONES

D. ABNORMAL OPERATIONS

1. IF MUZZLE DOOR FAILS TO SHUT
 - a. REPEAT FLUSH
 - b. TRY 700 PSIG AIR
 - c. PUT DIVER OVERBOARD TO CLEAR MUZZLE
2. IN EVENT OF FLOODING CASUALTY CLOSE MUZZLE DOOR FROM TORPEDO ROOM FLOOD CONTROL STATION OUTSIDE LAUNDRY ROOM



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HANDBOOK OUTLINE

VOLUME VIII - HOUSEKEEPING HANDBOOK

(WASTE DEFINITION AND CONTROL SECTION IN LIEU OF DATA BOOK, DRL LINE ITEM 4)

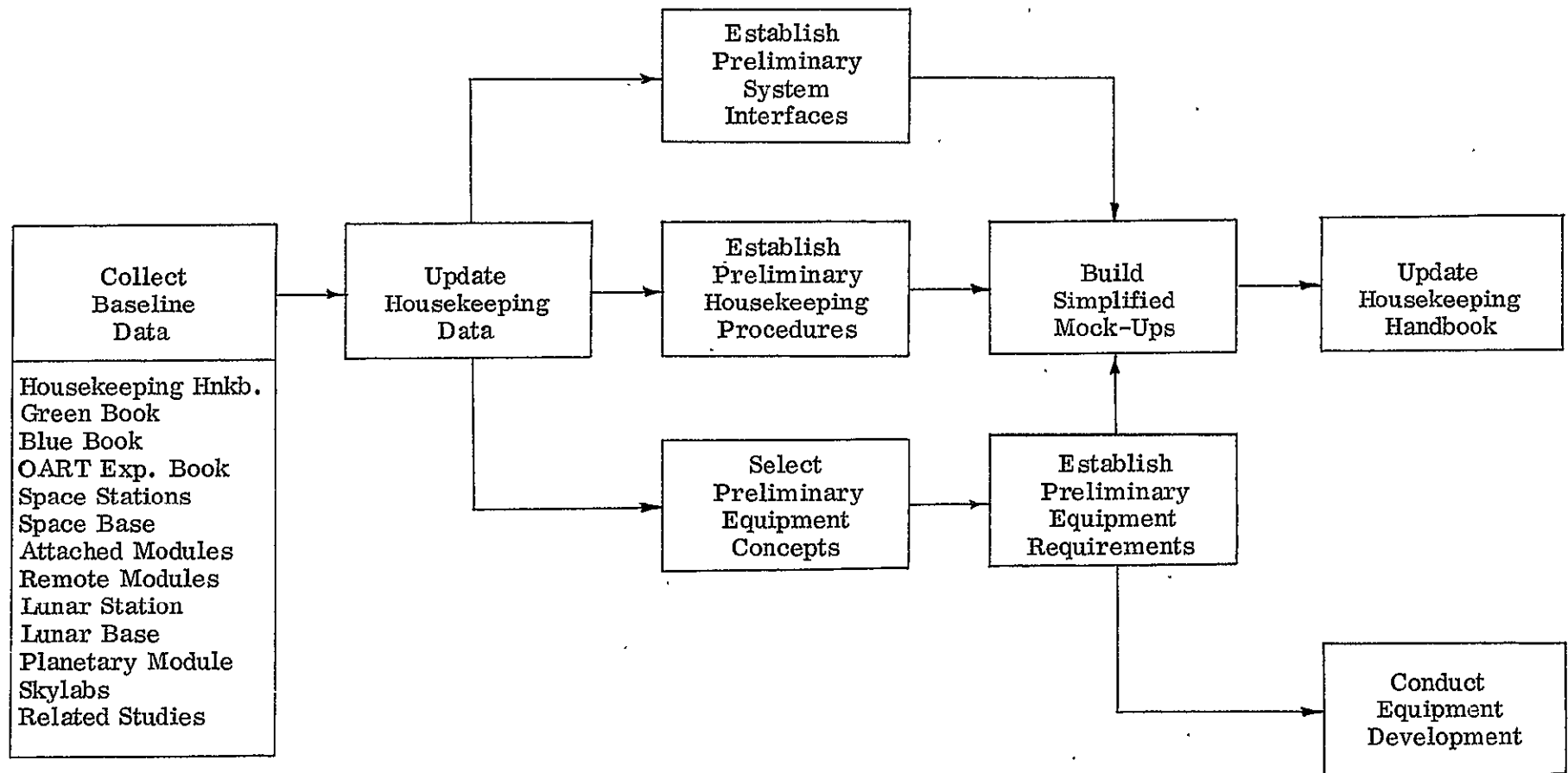
- A. TITLE SHEET
- B. FORWARD
- C. TABLE OF CONTENTS
- D. INTRODUCTION AND SUMMARY
- E. CONDUCT OF STUDY
- F. STUDY DATA
(Basic Content of Section - See Page 56)
- G. DEFINITIONS
- H. ABSTRACT

HANDBOOK OUTLINE - SECTION F

F. STUDY DATA

1. Waste Definition
 - a. Discussion (Summary and Organization of Section)
 - b. Spacecraft Functions and Systems (Tables of Functional Analyses)
 - c. Data Tables (Contains Operational Descriptions and Tables of Consumables/Expendables and Wastes)
 - d. Utilization Potential Analysis (Rationale and Results of Analyses)
 - e. Waste Lists (IBM Printout of Waste Lists and Data by Subsystem/Experiment)
2. Utilization Processes
 - a. Discussion (Summary and Organization of Section)
 - b. Processing Data (Data and Trade-Off Information on Each Process)
3. Predisposal Processes
 - a. Discussion (Summary and Organization of Section)
 - b. Processing Data (Data and Trade-Off Information on Each Process)
4. Disposal Techniques
 - a. Discussion (Summary and Organization of Section)
 - b. Disposal Data (Data and Trade-Off Information on Each Disposal Technique)
5. Waste Control and Housekeeping
 - a. Discussion (Summary and Organization of Section)
 - b. Collection and Sorting (Temporary Containerization; Automated versus Manual)
 - c. Transfer (Transfer Equipment; Automated versus Manual)
 - d. Task and Time Line Analysis Data (Man-Machine Interface)
 - e. Crew Support of Utilization Processors (Task and Time Line Data)
 - f. Crew Support of Disposal and Predisposal Processors (Task and Time Line Data)
6. Search/Report Computer Program
(Discussion of Capabilities of Program and Detail Instructions For Use)

RECOMMENDED REQUIREMENTS STUDY



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RECOMMENDED PROCEDURES STUDY

