

Ames Research Center

LIFE SCIENCES FLIGHT EXPERIMENTS PROJECT

SPACELAB-3 CREW TRAINING

**SL-3 ARC LSP FUNCTIONAL OBJECTIVE
TRAINING WORKBOOK**

EXPERIMENT OPERATING PROCEDURES

SL-3 WORKSHEETS

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INTRODUCTION

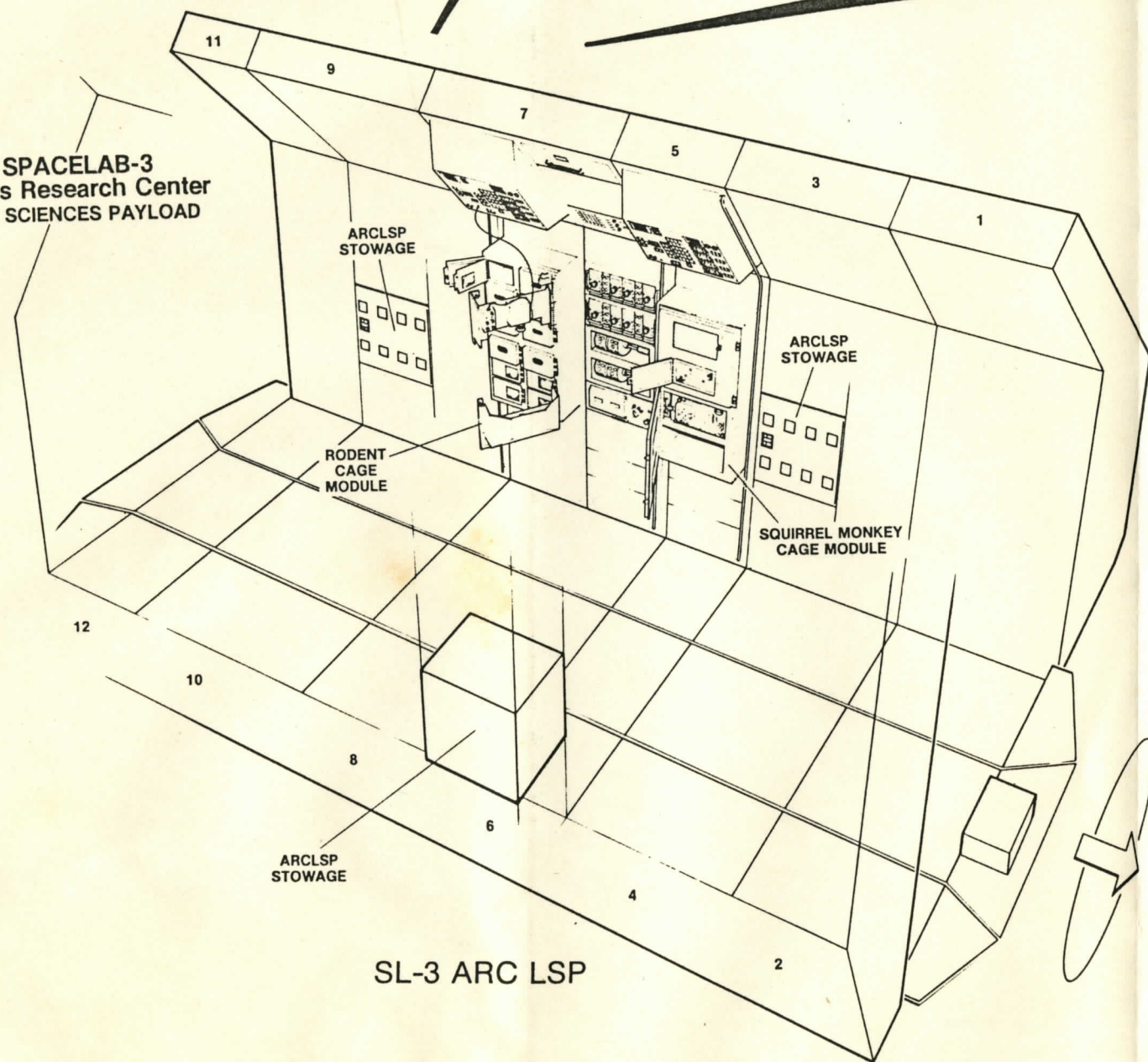
This workbook contains crew operations (Functional Objectives, FOs) for the Spacelab-3 Ames Research Center Life Sciences Payload (SL-3 ARC LSP). It is an orientation to the FOs, a reference during hands-on training, and a post-tour refresher.

The workbook contains FOs in learning statements. Before using this workbook, the reader should become familiar enough with the SL-3 ARC LSP to understand the purpose and implication of each inflight objective. Background information is contained in the Spacelab-3 Life Sciences Payload Familiarization Manual, Rev. 1 (ADP-81-50-001), and the SL-3 ARC LSP Critical Design Review presentation package (ADP-82-50-007R).

Along the right side of each learning statement are the procedures for performing each functional objective. A drawing or photograph shows the location of the indicator or control associated with the procedure. To the left of the learning statement will be found functional or descriptive information related to the procedure.

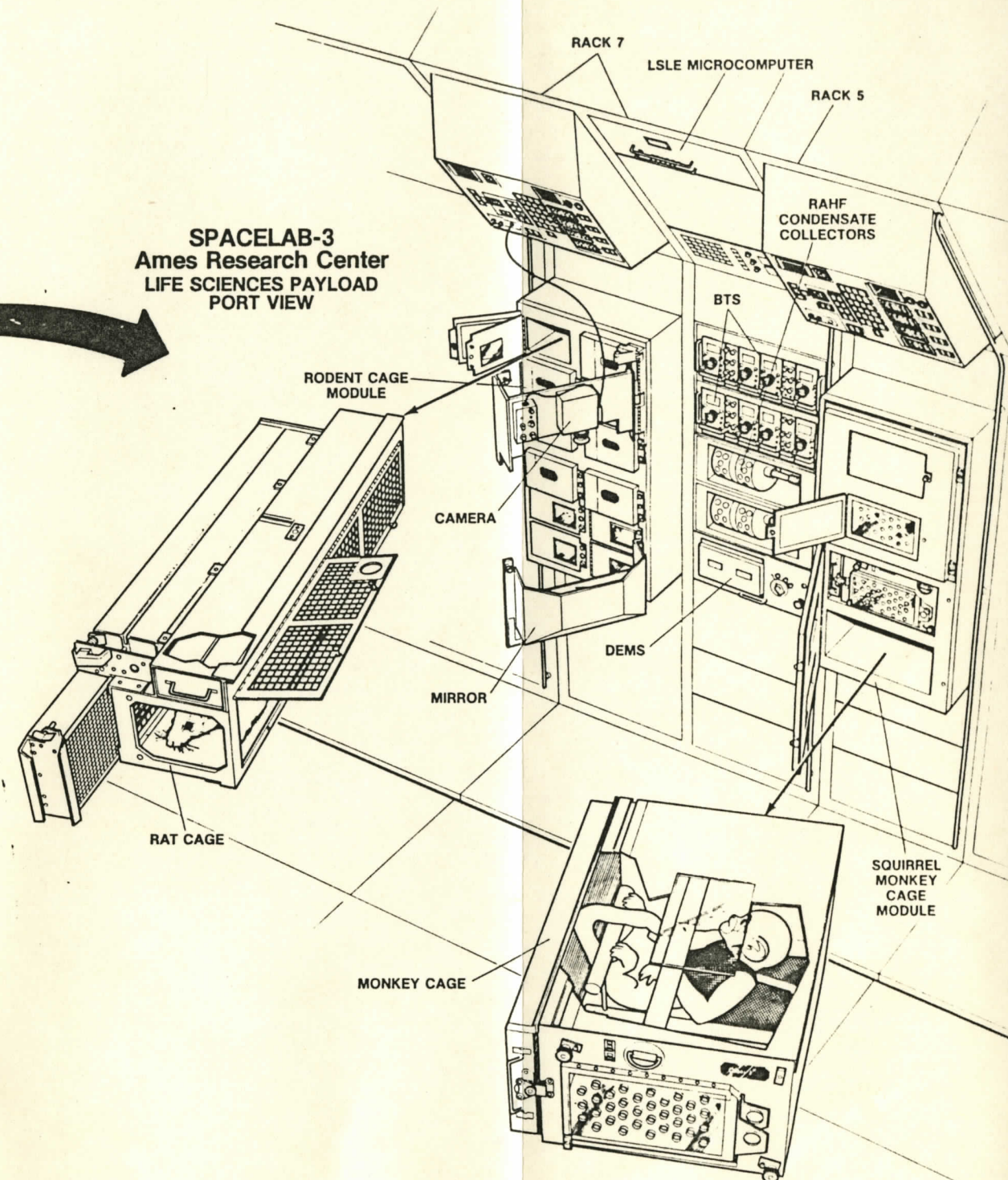
During hands-on training at Ames, this manual may be used as a reference to identify and locate the indicator or control on the hardware. This workbook may be annotated as desired.

SPACELAB-3
Ames Research Center
LIFE SCIENCES PAYLOAD



SL-3 ARC LSP

SPACELAB-3
Ames Research Center
LIFE SCIENCES PAYLOAD
PORT VIEW



LEARNING STATEMENT

FUNCTION

To ensure activation of the Dynamic Environment Measuring System.

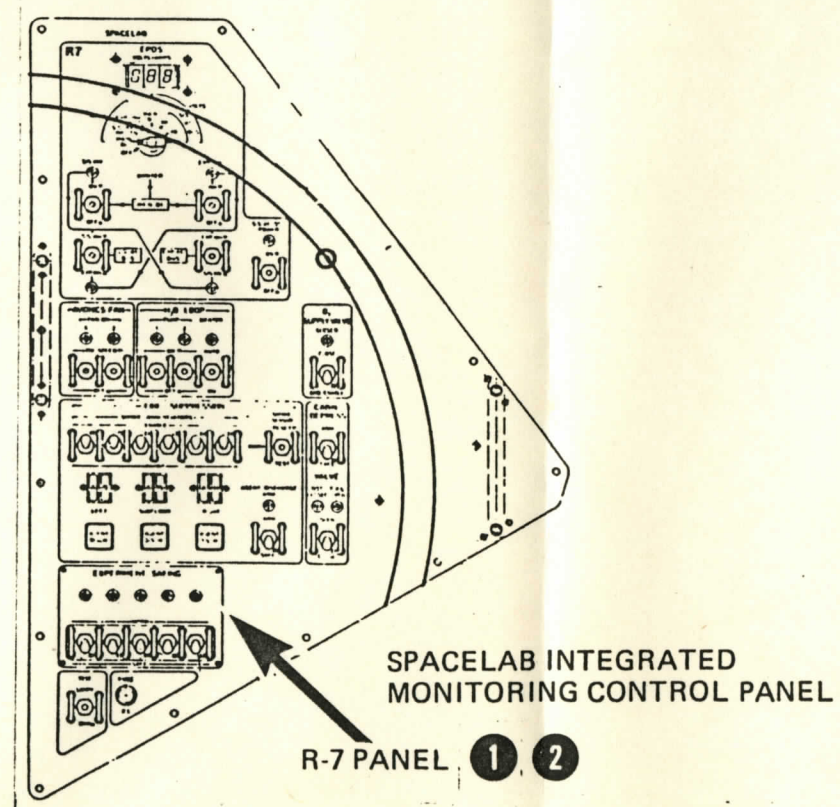
F.O.1F₂: DYNAMIC ENVIRONMENT MEASUREMENT SYSTEM SAFING SWITCH OPERATION

PROCEDURE

NOTE:

ACCOMPLISH THE FOLLOWING JUST PRIOR TO ENGINE IGNITION.

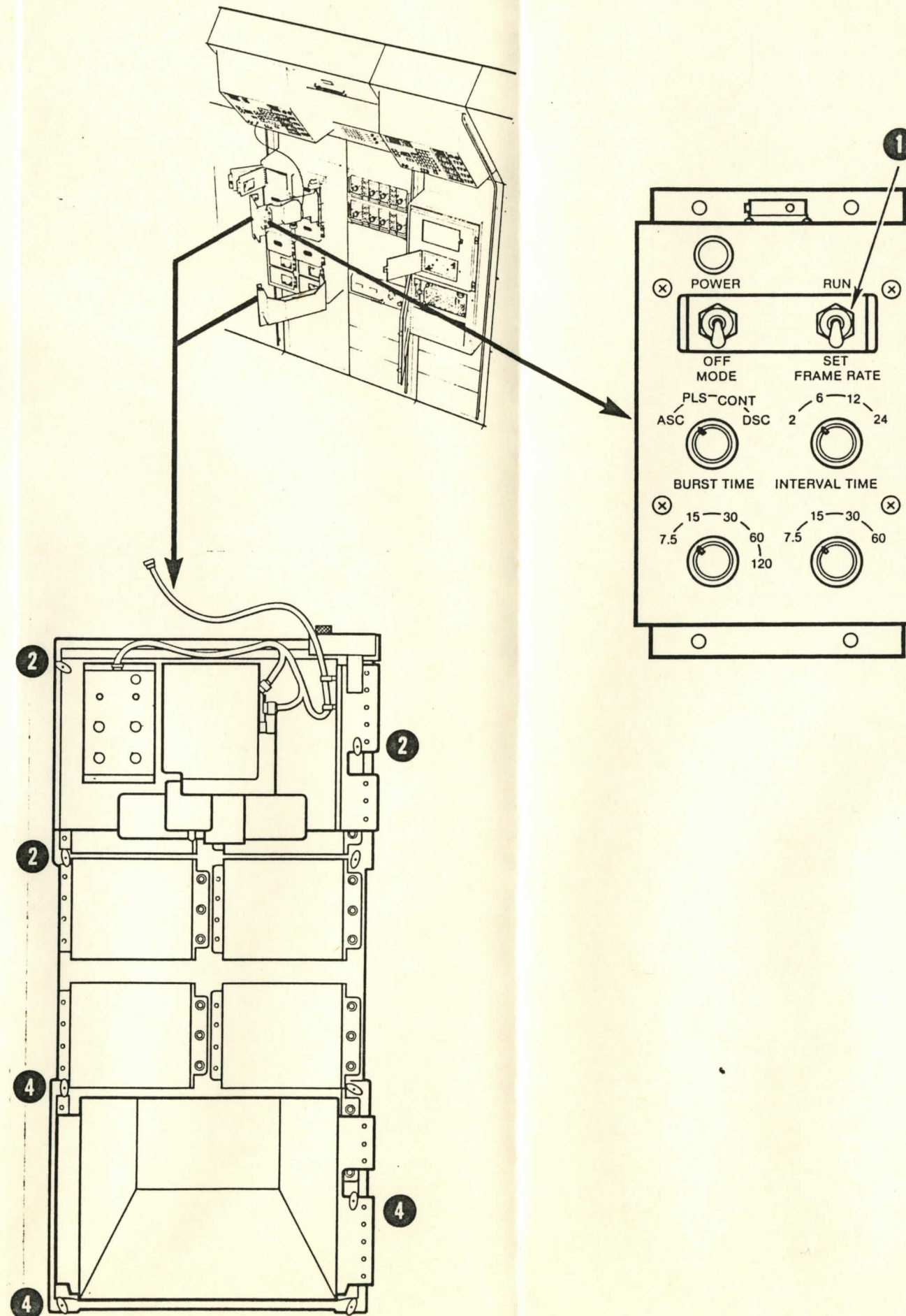
- 1 Activate experiment switch on Aft Flight Deck panel (R7).
- 2 After 3 (three) seconds reset experiment switch on Aft Flight Deck panel.



LEARNING STATEMENT

FUNCTION

To swing the camera-mirror assembly free of the rodent RAHF so animal cage doors can be opened for animal observation.



F.O.2A: RAT OBSERVATION

DAY 1, 2, 3, 4, 5, 6, 7
PROCEDURE

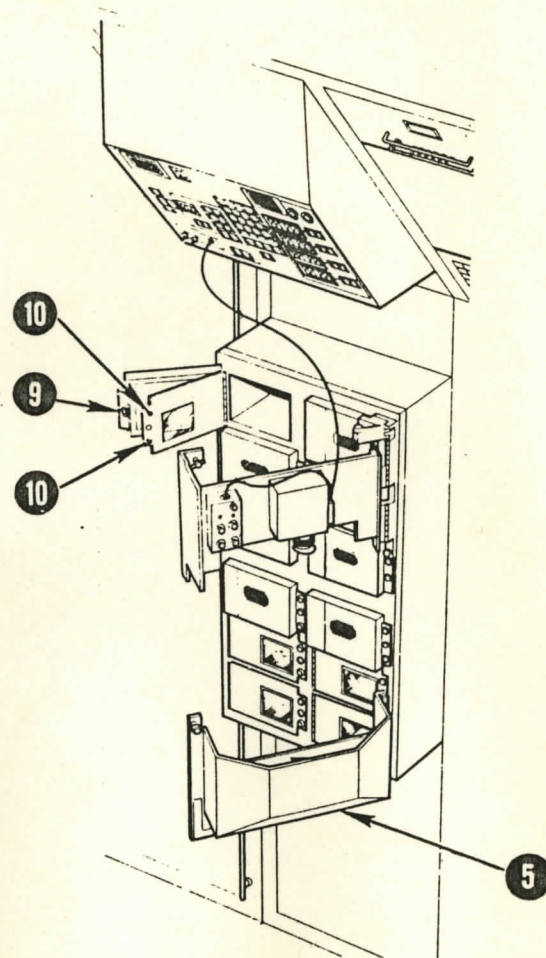
CAUTION:

BECAUSE ANIMALS' BIORHYTHM MAY BE UPSET BY RANDOM DISTURBANCES, OBSERVATIONS OF ANIMALS ARE TO OCCUR ONLY DURING SCHEDULED PERIODS.

- 1 Set camera controller RUN/SET switch - SET.
- 2 Unlatch the camera assembly by loosening the two thumbscrews on the left side of the camera bracket and by loosening the one thumbscrew on right side center of the camera bracket.
- 3 Swing the camera assembly open and lock it into the 180° open position using the right-side hinge-latch mechanism. Secure with locking pin.
- 4 Unlatch the mirror assembly by loosening the two thumbscrews on the left side and the one thumbscrew on the right side of the mirror bracket.

LEARNING STATEMENT

FUNCTION



SEGMENT 1 FUNCTIONAL OBJECTIVE 2A RAT OBSERVATION

PROCEDURE

- 5 Swing the mirror assembly open and lock it to the 180° open position using the hinge latch mechanism.

CAUTION:

DO NOT PUSH AGAINST MIRROR OR CAMERA ASSEMBLIES WHILE IN THE OPEN POSITION.

- 6 Call up DDU display RF2 Rodent Status.
- 7 Check food and water consumption for any indications that the animals are not eating or drinking properly.
- 8 Report and verify noticeable changes with POCC ground control.

NOTE:

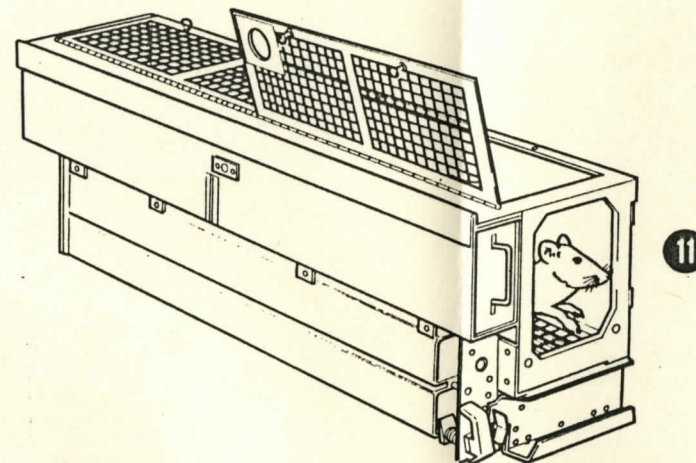
POCC/SMA WILL PROVIDE GUIDANCE SHOULD ANY ANOMALIES BE OBSERVED.

- 9 Press center button on right of cage 1 and pull open outer door 90° to left.
- 10 Press upper and lower buttons on cage 1 and open inner door.

LEARNING STATEMENT

FUNCTION

To record and to assess the effects of RAHF operation during orbit on rats' behavior and physiological status.



SEGMENT 1 FUNCTIONAL OBJECTIVE 2A RAT OBSERVATION

PROCEDURE

- 11 Observe animals for approximately 1 minute per cage, recording by exception from normal the following items:

Description of Coat: normal, roughened, ungroomed.

Behavior/Activity: inactive (asleep), floating, grasping cage, confined to specific area of cage.

Posture: inactive/active, embryonic, hunched over, back arched.

Feces: well-formed, soft or smeared, particularly around tail and anus.

Breathing Patterns: expansion/contraction of rib cage labored or smooth.

Eyes/Nose/Ears: mucous discharges or crust formations.

Distended or Swollen Abdomen: (overeating may be one cause).

Evidence of Blood: paws, nose, anus, urogenital opening.

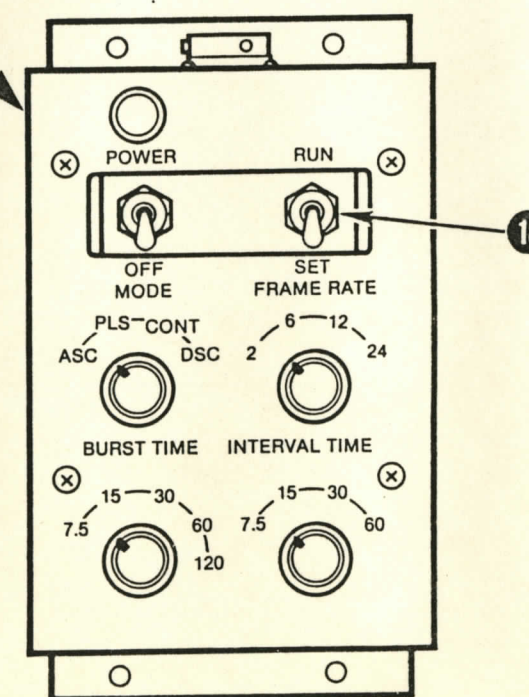
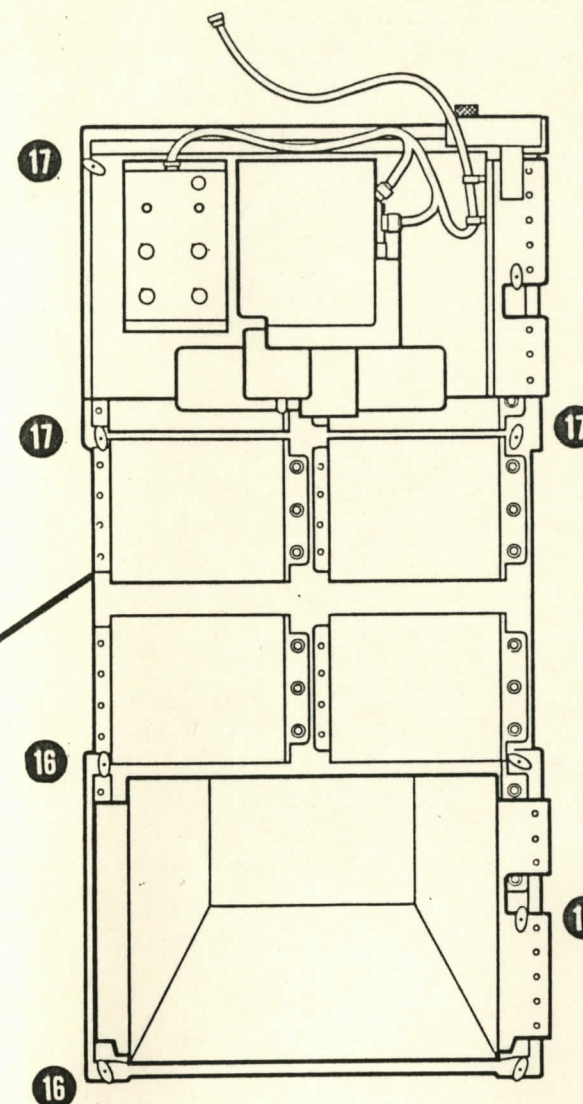
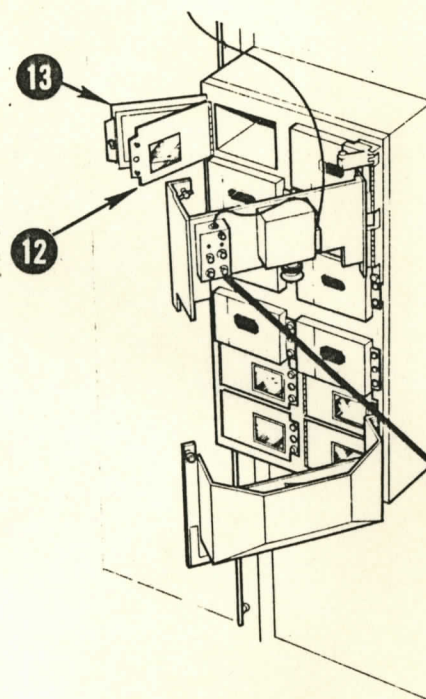
General Color of Eyes, Paws: normal pink or pale pink-white or blue.

Incision Site for BTS Transmitters (only on BTS-implanted animals): evidence of swelling, discoloration.

LEARNING STATEMENT

FUNCTION

Replace camera-mirror assembly for filming activities.



SEGMENT 1 FUNCTIONAL OBJECTIVE 2A RAT OBSERVATION

PROCEDURE

- 12 Close inner door on cage 1.
- 13 Close outer doors on cage 1.
- 14 Repeat Steps 9-13 for cages 2-8.

NOTE:

MIRROR ASSEMBLY REPLACES OUTER DOORS ON CAGES 9-12.

- 15 Repeat Steps 10-12 for cages 9-12.
- 16 Unlock and swing the mirror assembly to the closed position and tighten the two left-hand thumbscrews and right center thumbscrew.

NOTE:

WHEN OBSERVATION IS PERFORMED IMMEDIATELY PRECEDING FOOD CANISTER CHANGEOUT, STEPS 16, 17, AND 18 WILL BE DELAYED UNTIL CHANGEOUTS ARE COMPLETE.

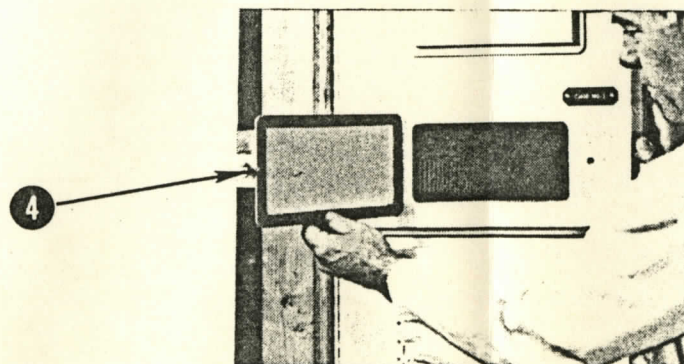
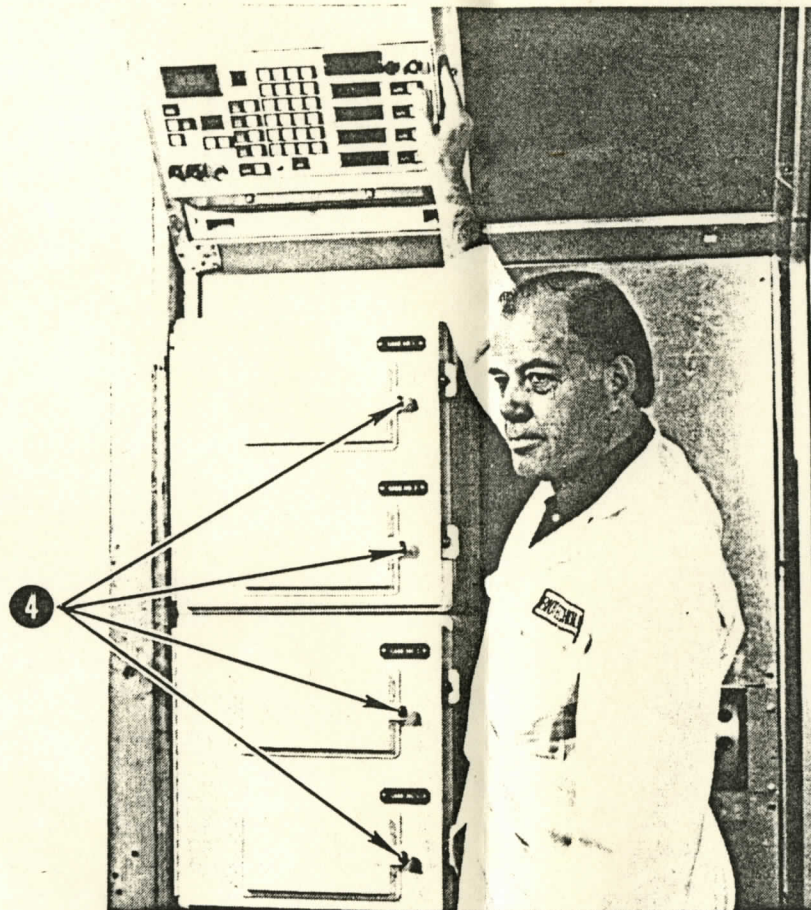
- 17 Unlock and swing the camera assembly to the closed position and tighten the two left-hand thumbscrews and right center thumbscrew.
- 18 Set camera controller RUN/SET switch - RUN.

LEARNING STATEMENT

FUNCTION

To record and assess the effects of RAHF operation on orbit on monkeys' behavior and physiological status.

During the performance of this F.O. by one crew, animals are videotaped by second crew.



F.O.2A: SQUIRREL MONKEY OBSERVATION

DAY 1, 2, 3, 4, 5, 6, 7
PROCEDURE

CAUTION:

BECAUSE ANIMALS' BIORHYTHMS CAN BE UPSET BY RANDOM DISTURBANCES, OBSERVATIONS OF ANIMALS ARE TO OCCUR ONLY DURING SCHEDULED PERIODS.

- 1 Call up DDU display RF1 Monkey Status.
- 2 Check food and water consumption for any indications that the animals are not eating or drinking properly.
- 3 Report and verify noticeable changes with POCC ground control.

NOTE:

POCC/SMA WILL PROVIDE GUIDANCE SHOULD ANY ANOMALIES BE OBSERVED.

- 4 Press center button on outer door cage 1 and swing doors 90° to left.
- 5 Observe monkeys for approximately 3 minutes per animal, noting by exception from normal the following items.

Coat:

Smooth
Dull
Rough

Eyes:

Bright and open
Dull, partially closed
Puffiness underneath eyes
Discharges

LEARNING STATEMENT



NOTE:

SQUIRREL MONKEY VIDEO OBSERVATION
(FO 2G₁) FOLLOWS THIS ACTIVITY.

Skin/Gums Color:

Pink around eyes and gums
Pale around eyes and gums
Abscess on face

Nose:

Clean
Discharge, crusting

Breathing:

Smooth, regular, unlabored
Labored, rapid, choking, sneezing

Stools:

Amount, placement in cage
(unrestrained only)
Appearance - normal soft liquid
(diarrhea)
Blood in stools

Posture and Movement (Unrestrained):

Calm, sedate, asleep
Hyperactive, jerky, rapid movements
Curious, active interest in surroundings
Inactive, no interest in surroundings
Call behavior
Huddled in corner
Self-touch - sucking on tail, fingers (tail tip may be red from self-mutilation), pulling on hair
Eating, drinking frequency
Huddling, perched on lower part of cage or lying flat on cage
Trembling in lower extremities, turning, twisting (restrained)

BTS incision (Unrestrained Monkeys):

Healed
Redness
Swelling
Discoloration

Evidence of Blood:

Arms
Legs
Head

- 6 Report any abnormal observations to ground control to define off-nominal operations.
- 7 Close door after observation is complete.
- 8 Repeat Steps 4-7 for cages 2, 3, 4.

LEARNING STATEMENT

FUNCTION

To verify normal RAHF operating conditions.

To configure the RAHFs for inflight operation.

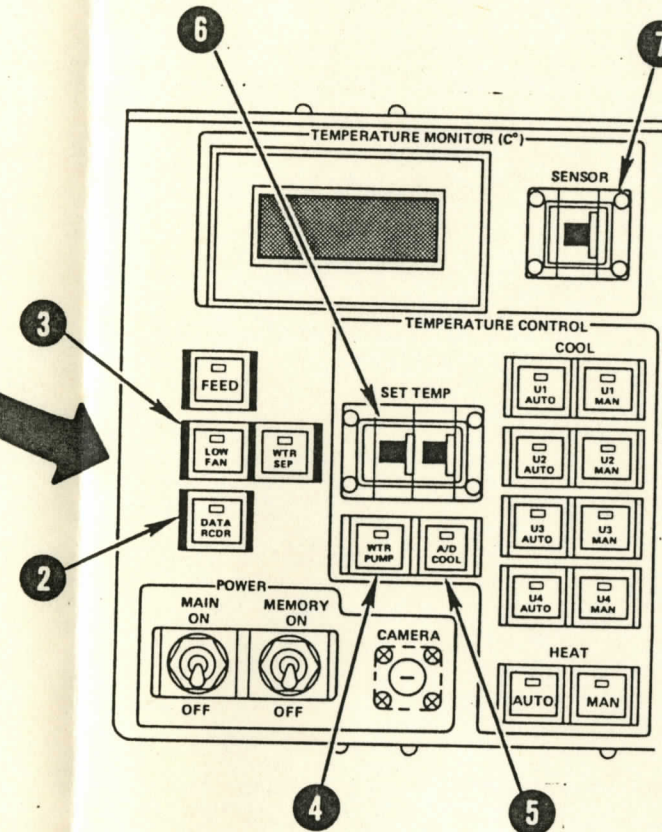
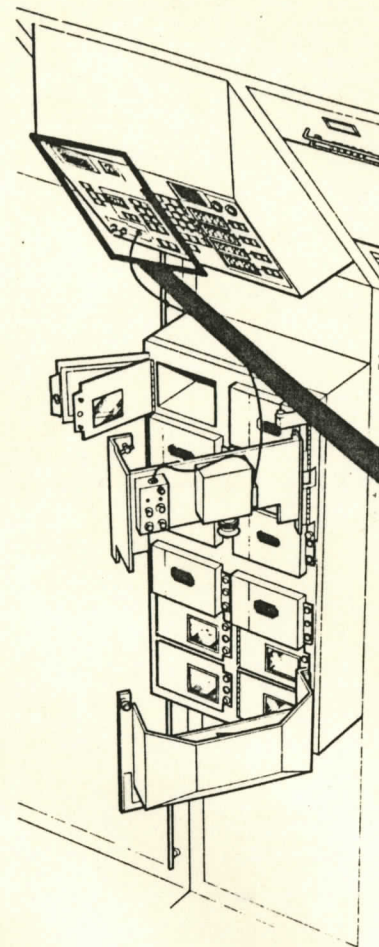
To turn off the RAHF tape recorder.

To enable all four circulation fans. (Only two fans are functional during launch).

To disengage the RAHF water pumps and switch over to MPE Spacelab pump.

To provide full power operation to the TEU cooling units. (TEU units operate at 1/4 power on ascent and descent).

To verify (or set) cage temperature.



F.O.2B: RAHF/DEMS CONFIGURATION - ACTIVATION

DAY 1 PROCEDURE

- 1 Establish A/G communications with POCC to coordinate receipt of RAHF downlink data.

NOTE:

PERFORM THE FOLLOWING SEQUENCE FOR THE ADR RACK 7 AFTER CDMS ACTIVATION.

- 2 Push data recorder (DATA RCDR) button OUT
- 3 Push low fan (LOW FAN) button OUT
- 4 Push water pump (WTR PUMP) button OUT
- 5 Push ascent/descent cooling (A/D COOL) button OUT
- 6 Check cage temperature thumbwheel (SET TEMP) as follows:

Rack 7

ADR - 24

Rack 5

ASR - 27

Set if incorrect.

- 7 Use the sensor thumbwheel (SENSOR) switch to check the following temperatures on the temperature display:

Selector Position	ADR	ASR
1-4	21-27°C	24-30°C
5	19-28°C	19-28°C
6	6-28°C	6-28°C
7	5-20°C	5-20°C
8	5-27°C	5-27°C

If temperature is out of limits, go to malfunction procedure XX, if no A/G voice with ground.

LEARNING STATEMENT

FUNCTION

To verify thermister temperature limits.

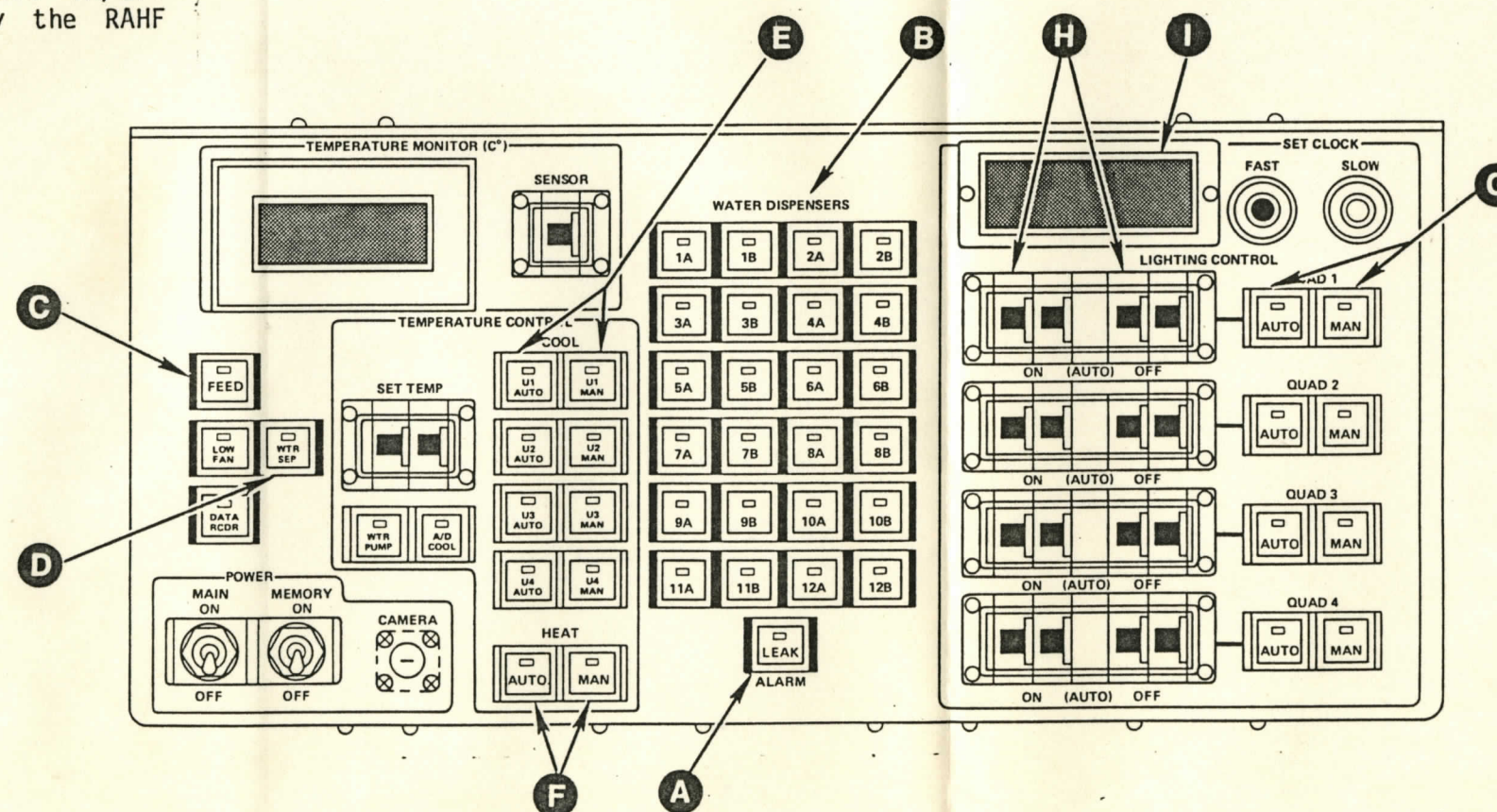
To verify panel switch positions - LEAK button on indicates drinking water leak at cage fixtures (WATER DISPENSERS).

FEED on, (rack 5), indicates power to squirrel monkey feeder circuits. NOTE: FEED button, although on, (rack 7), is not connected to the rodent feeder circuits; it does not function and remains on.

WTR SPR powers ECS water separator for condensate collection.

COOL and HEAT AUTO allows automatic control of the four TEU coolant water flow.

LIGHTS AUTO puts lights on/off cycle as determined by the RAHF clock.



- 8 Check the following RAHF control panel button/switches for the indication shown:

Panel Switch	Indication(s)
A LEAK	OUT
B WATER DISPENSERS (12)	LIT
C FEED	LIT
D WTR SPR	LIT

If leak light is lit, or any dispenser light is NOT lit, go to malfunction procedure XX, if no A/G voice with ground.

Panel Switch	Auto	Manual
E COOL (4)	LIT	OUT
F HEAT	LIT	OUT
G QUAD 1-4	LIT	OUT

Panel Switch	On	Off
H LIGHTING CONTROL (4)	02	14

If not as indicated, reset.

- I Check current time on clock.

If not within 10 seconds, reset per malfunction procedure XX.

- 9 Repeat Steps 2-8 for the ASR.

- 10 Observe DDU displays RF1-3, ensuring that all displays are nominal (no warnings/alarms). Log out-of-limit conditions. Resolve anomalies with ground.

NOTE:

ALL EXCESS WATER MONITOR DISCRETES WILL BE PROVIDED WITH AN UPWARD ARROW IN OVERBRIGHT GREEN.

FUNCTION

To disengage the DEMS tape recorder head from tapes.

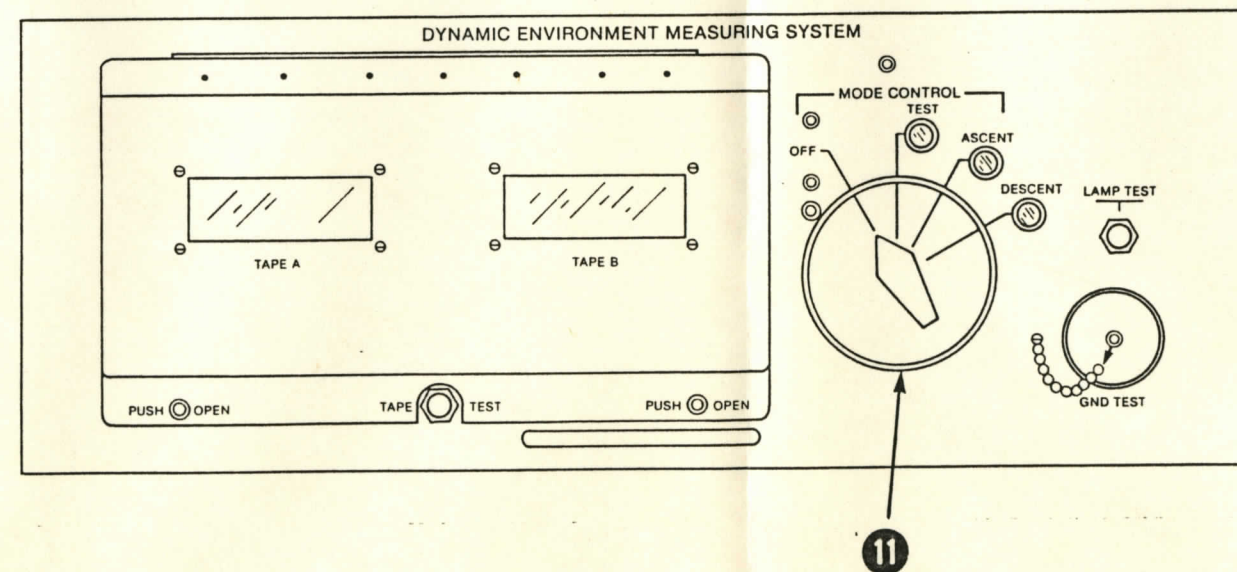
DEMS;

- 11 Turn MODE CONTROL switch - OFF.
- 12 Push left and right cassette panel button (PUSH OPEN) to open tape cover.
- 13 Press left cassette button (PRESS BUTTON); disengage head by pulling slide bar down (use cloth tab provided).
- 14 Repeat Steps 13 for right cassette.

NOTE:

TAPES WILL BE EXCHANGED FOR NEW AT RAHF RECONFIGURATION BEFORE DESCENT; SEE FO 2L DEMS CASSETTE CHANGEOUT.

- 15 Close cover. Lock by pushing two PUSH OPEN buttons partially in. Ensure two pushbuttons are locked by visual inspection.



LEARNING STATEMENT

FUNCTION

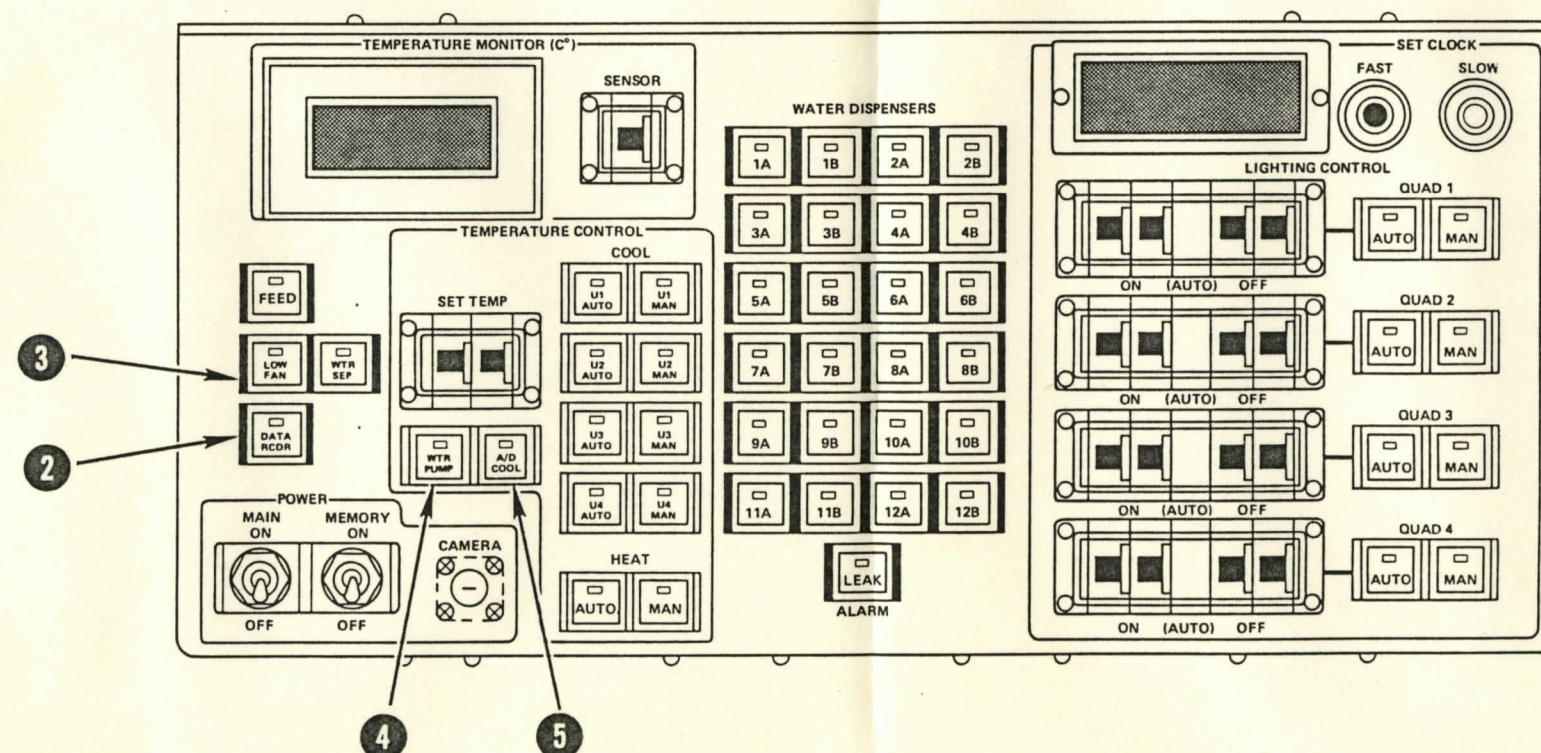
To reconfigure RAHFs for descent.

To enable RAHF tape recorders.

To change circulation fan configuration from 4 fans operating, to 2 fans operating.

To enable the RAHF pump.

To provide TEUs to operate at one-quarter power.



F.O.2B: RAHF CONFIGURATION - DE-ACTIVATION

DAY 7 PROCEDURE

NOTE:

PERFORM THE FOLLOWING SEQUENCE FOR THE ADR JUST PRIOR TO SPACELAB, CDMS DE-ACTIVATION.

- 1 Establish A/G communications with POC.
- 2 Set data recorder (DATA RCDR) button (light on) IN
- 3 Set low fan (LOW FAN) button (light on) IN
- 4 Set water pump (WTR PUMP) button (light on) IN
- 5 Set ascent/descent cooling (A/D COOL) button (light on) IN
- 6 Repeat Steps 2-5 for the ASR.

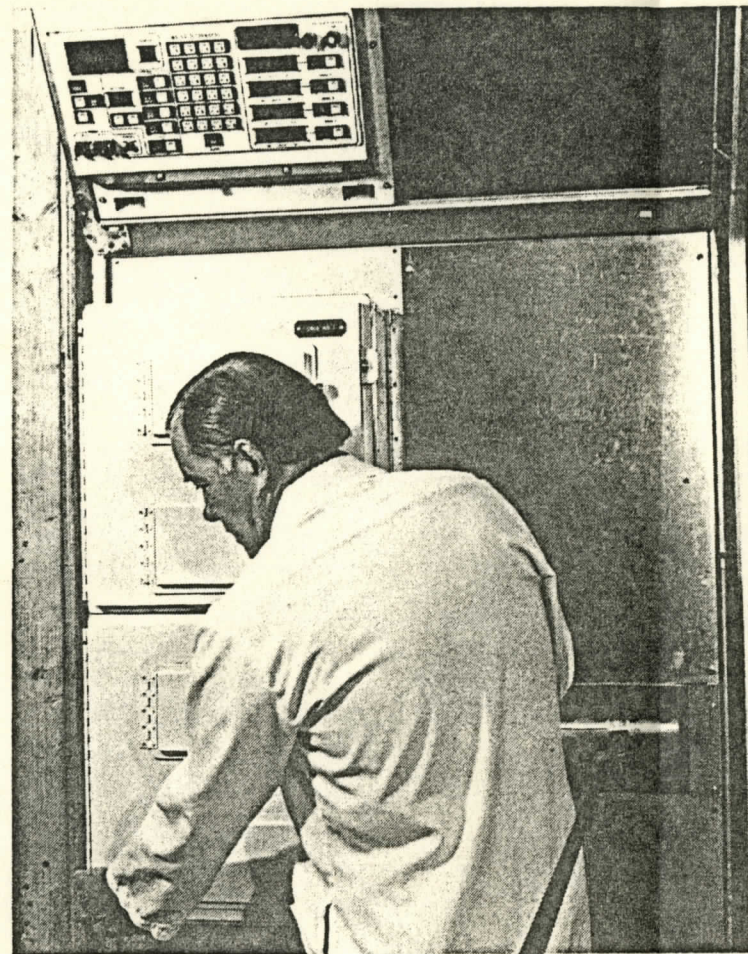
LEARNING STATEMENT

FUNCTION

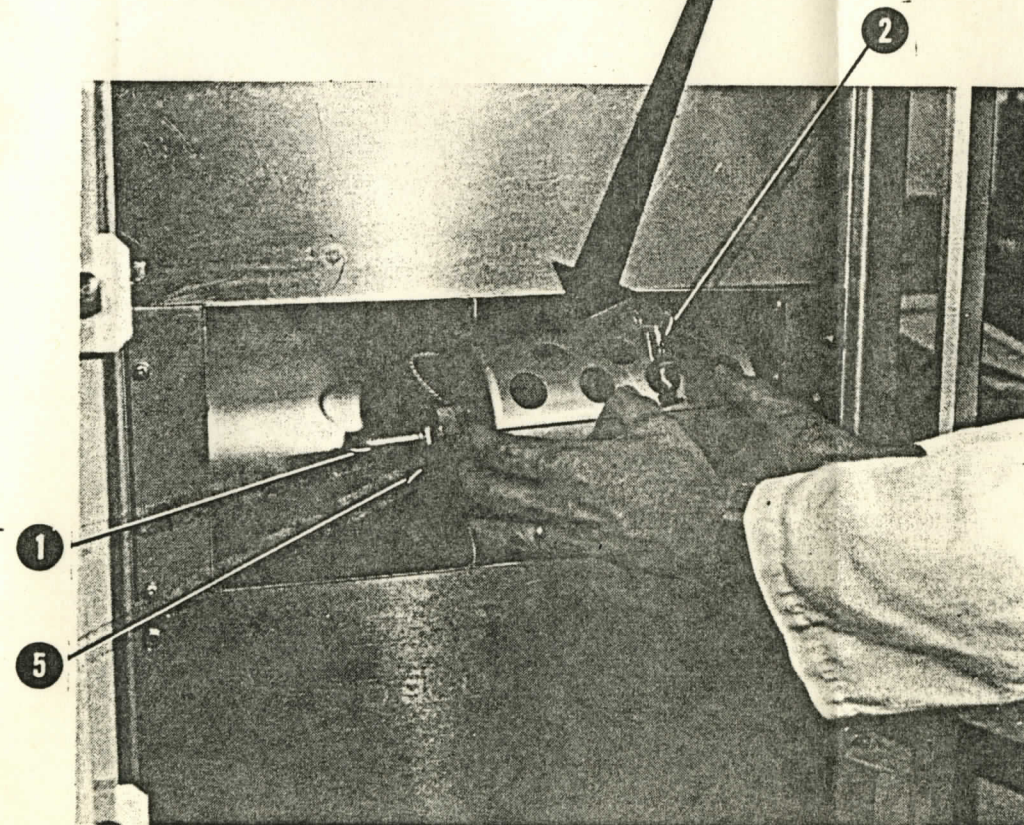
To empty water that has been removed from RAHF air through the ECS and accumulated in condensate storage bottles.

Condensate bottles must be emptied approximately every 30 hours.

Crew activity is filmed.



Clamshell protects condensate bladder.



F.O.2C: EMPTY CONDENSATE BOTTLE

DAY 1, 2, 3, 4, 5, 6, 7
PROCEDURE

NOTE:

ON MD3 ONLY, INFORM ADDITIONAL CREWPERSON TO UNSTOW VIDEO CAMERA AND BEGIN VIDEO RECORD OF THIS PROCEDURE FOR 15 MINUTES OR UNTIL COMPLETION [(FO 2G₂)].

- 1 Disengage the quick disconnect on the inlet water line flexible tube.
- 2 Release toggle latch and lift strap to permit removal of condensate collector assembly.
- 3 Remove assembly from bracket.

CAUTION:

DO NOT CONNECT NOZZLE TO CONDENSATE BOTTLE BEFORE REACHING MIDDECK FACILITY.

- 4 From Rack 3 stowage obtain the condensate bottle nozzle and transport assembly and nozzle to middeck hand wash sink.
- 5 Remove retaining ring from collar on neck of condensate assembly.
- 6 Open clamshell condensate assembly and remove bottle assembly. Secure clamshell.
- 7 Mate bottle assembly with nozzle and direct condensate into proper disposal receptacle.

LEARNING STATEMENT

FUNCTION

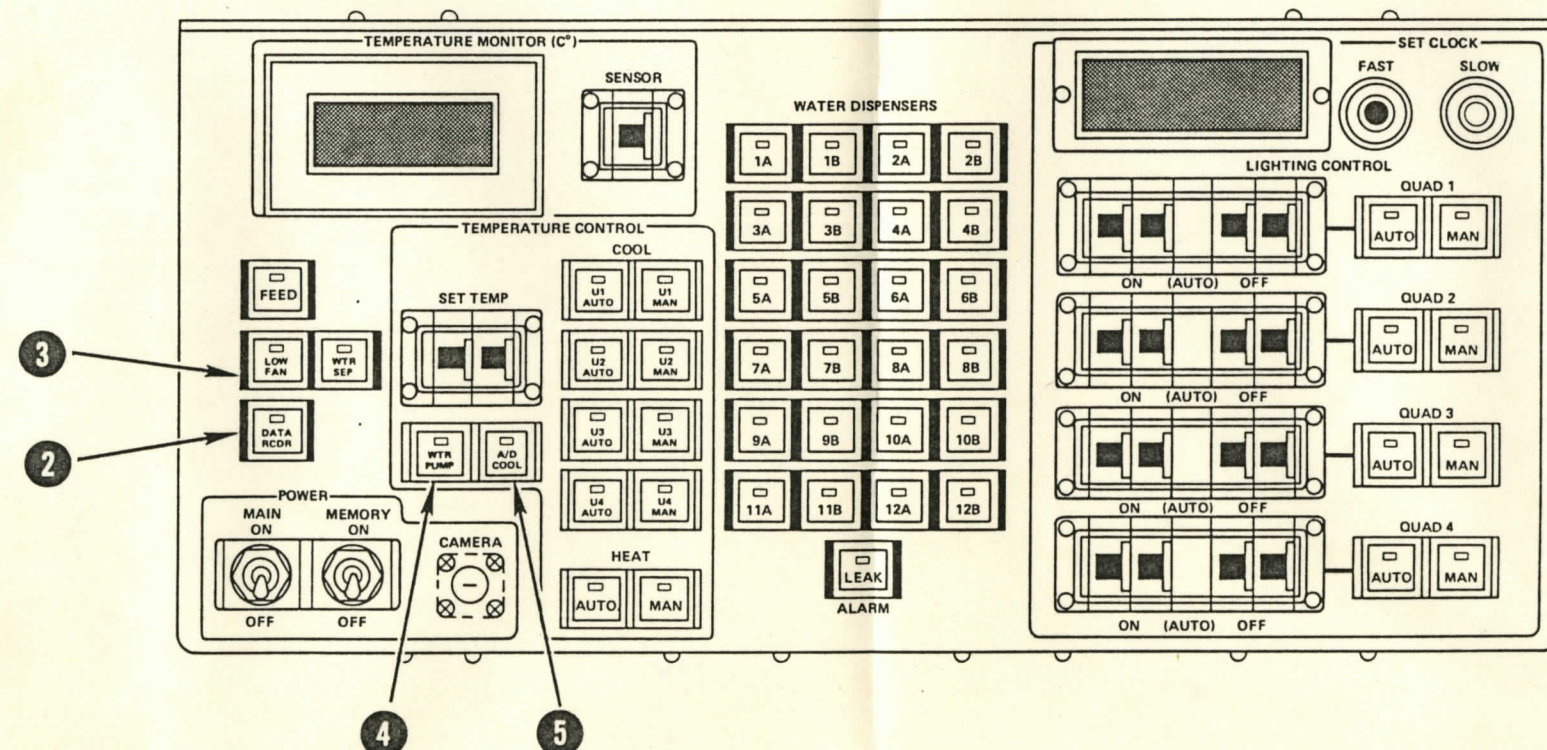
To reconfigure RAHFs for descent.

To enable RAHF tape recorders.

To change circulation fan configuration from 4 fans operating, to 2 fans operating.

To enable the RAHF pump.

To provide TEUs to operate at one-quarter power.



F.O.2B: RAHF CONFIGURATION - DE-ACTIVATION

DAY 7 PROCEDURE

NOTE:

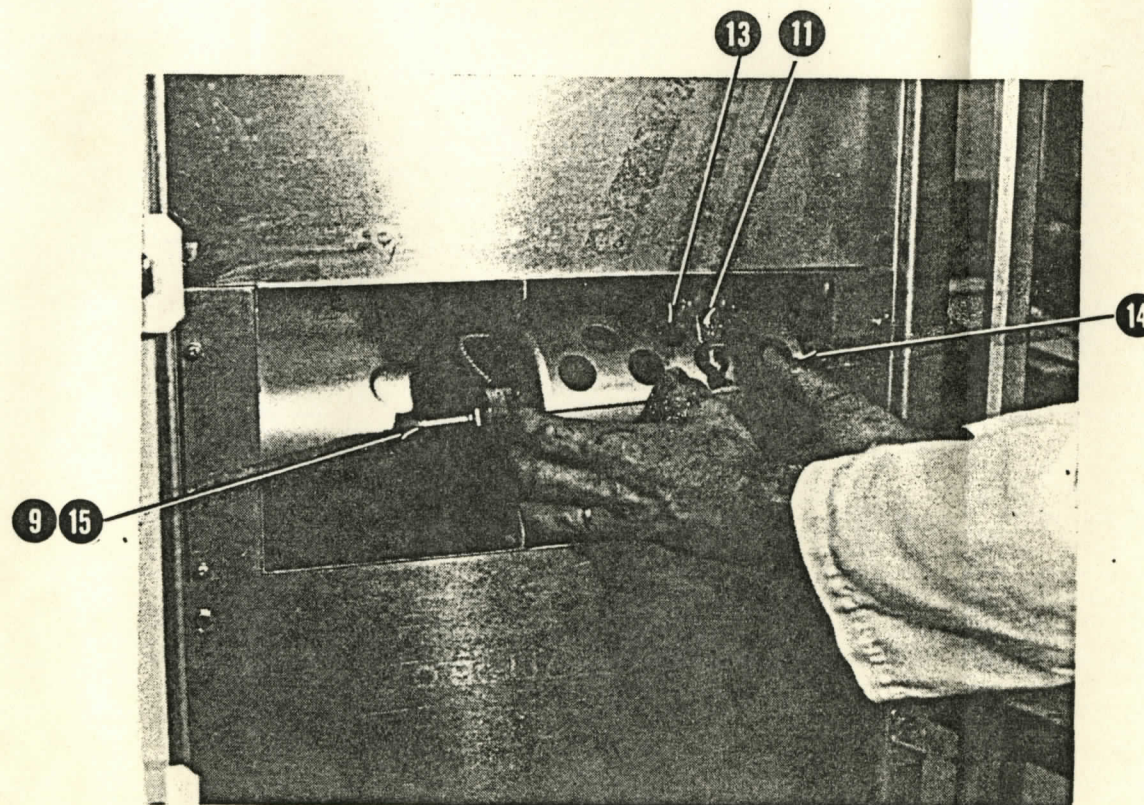
PERFORM THE FOLLOWING SEQUENCE FOR THE ADR JUST PRIOR TO SPACELAB, CDMS DE-ACTIVATION.

- 1 Establish A/G communications with POCC.
- 2 Set data recorder (DATA RCDR) button (light on) IN
- 3 Set low fan (LOW FAN) button (light on) IN
- 4 Set water pump (WTR PUMP) button (light on) IN
- 5 Set ascent/descent cooling (A/D COOL) button (light on) IN
- 6 Repeat Steps 2-5 for the ASR.

CAUTION:

BE CAREFUL NOT TO SQUEEZE BOTTLE WHILE MATING NOZZLE.

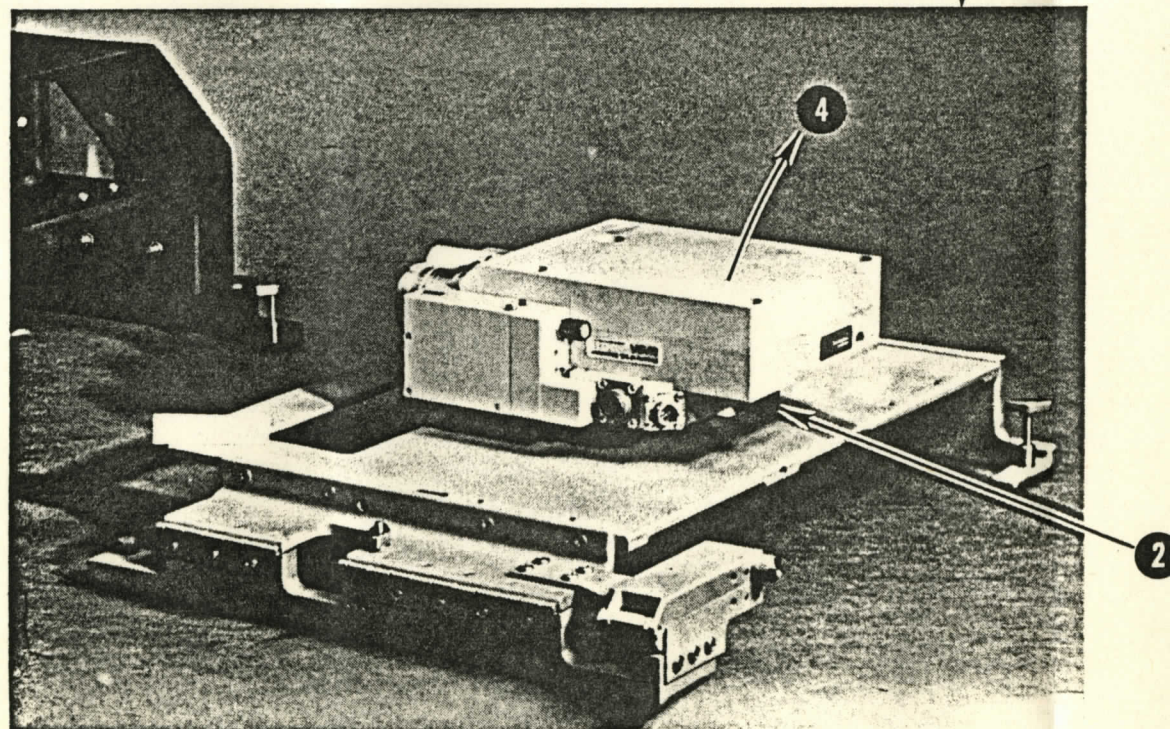
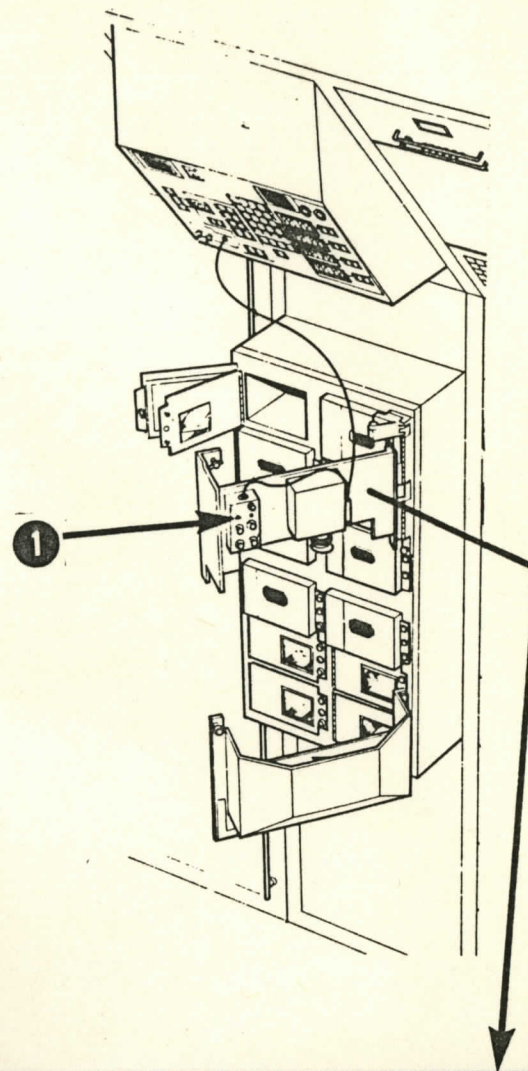
- 8 Milk bottle down by squeezing hard with hands to eject condensate until bag is completely collapsed.
- 9 While bag is compressed disengage nozzle from condensate bottle.
- 10 Assemble bottle into clamshell assembly.
- 11 Close clamshell and secure retaining ring.
- 12 Transport nozzle to stowage and clamshell assembly to RAHF.
- 13 Insert clamshell assembly into bracket.
- 14 Fasten assembly into bracket with assembly hinges facing aft.
- 15 Reconnect quick disconnect of inlet water line flexible tube.



LEARNING STATEMENT

FUNCTION

To remove and replace film magazine containing film exposed during liftoff.



F.O. 20₁: 16MM CAMERA-MIRROR OPERATIONS:
FILM MAGAZINE EXCHANGE

DAY 1, 2, 3, 4, 5, 6, 7
PROCEDURE

NOTE:

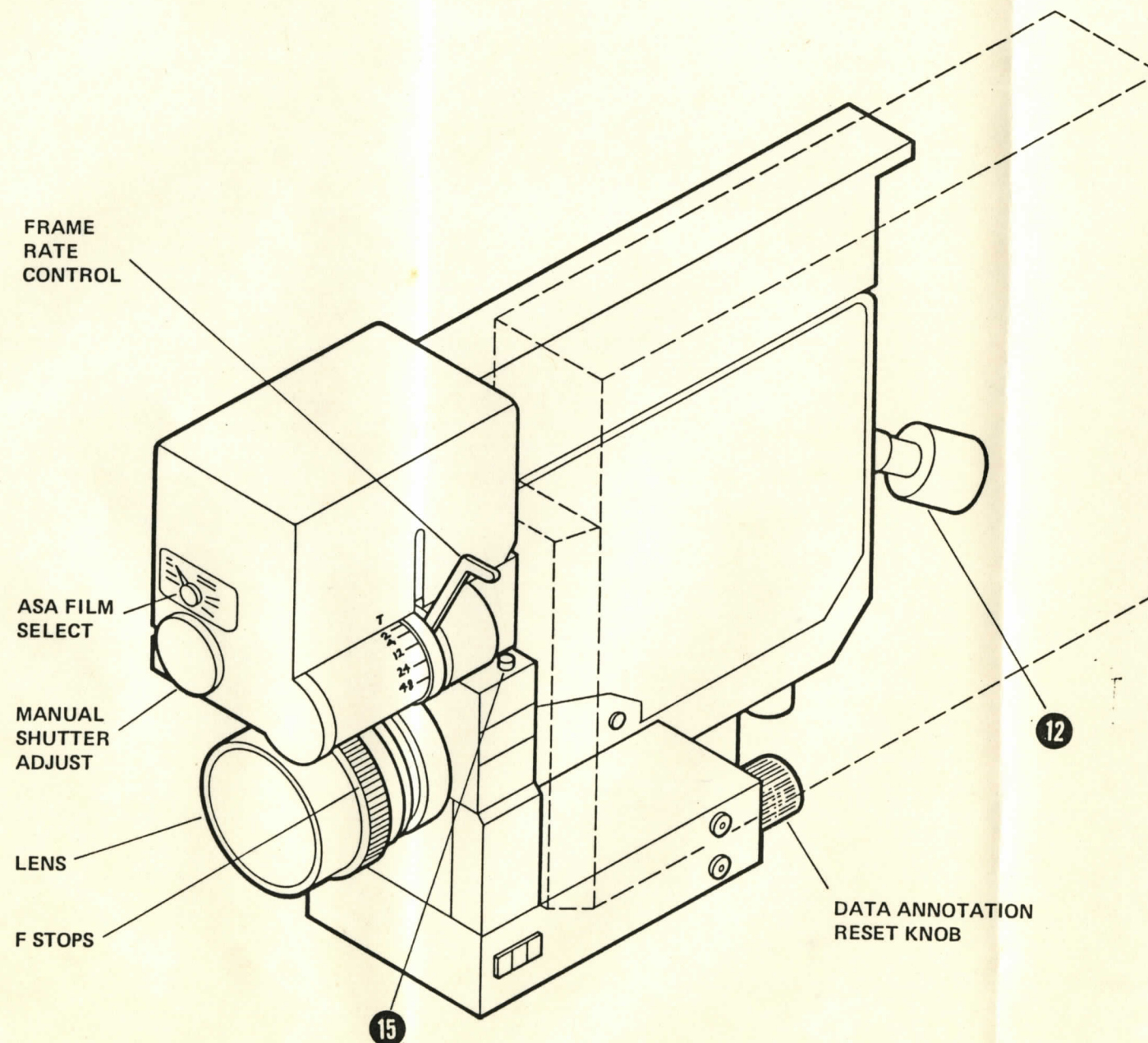
DAY 1 REQUIRES 2 PERFORMANCES - FIRST, AS SOON AS SPACELAB IS ACTIVATED DURING RODENT'S LIGHT CYCLE, SECOND DURING ANIMAL'S DARK CYCLE. | DAY 2-7 ACTIVITY TO BE PERFORMED DURING ANIMAL DARK CYCLE. |

TO UNLOAD FILM:

- ① Set camera controller RUN/SET switch - SET.
- ② Loosen locking knob.
- ③ Remove lockdown shaft from magazine slot.
- ④ Lift rear of magazine up and slide magazine aft and out.
- ⑤ Label exposed film magazine with date and time.
- ⑥ Exchange exposed film magazine with unexposed film magazine from Rack 3 stowage locker.
- ⑦ Label unexposed film magazine with date and time.

TO LOAD FILM:

- ⑧ Verify film sprocket holes in magazine window are lined up in top 1/3 of window slots.



- 9 Drop leading edge of magazine in front of camera take-up sprocket; slide forward.

NOTE:

CLAW OF THE CAMERA GUIDE BACK ASSEMBLY WILL CONNECT WITH FILM SPROCKET HOLES.

- 10 Slide the magazine dowel pins into their mating bushings and align the recessed slot in the aft part of the magazine so the lock down shaft can mate properly.
- 11 Align slot in aft part of magazine so lock down shaft can mate properly.
- 12 Turn locking knob clockwise until tight, then push down to seat knob.
- 13 To verify camera runs, set the following switches on camera controller.

Switch

POWER - ON
 RUN/SET - SET
 MODE - CONT

- 14 Set camera controller RUN/SET switch - RUN.
- 15 Verify camera runs by observing green light flashes on for several seconds.

NOTE:

IF CAMERA DOES NOT RUN AFTER ADJUSTING SPROCKET HOLES, REQUEST ASSISTANCE. FILM MAY BE EXPOSED BY OPENING MAGAZINE.

16

Verify camera settings:

Parameter control	6
ASA film select switch	TBD
F-stops	TBD
Manual shutter speed	
selection thumbwheel	IN
Data annotation reset switch	R

NOTE:

WHEN CAMERA FILM EXCHANGE OCCURS AT SPACELAB ACTIVATION, SET THE CAMERA CONTROLLER SWITCHES AS DESCRIBED FOR FO 2D₂, DAY 1.

WHEN FILM EXCHANGE OCCURS DURING LIGHTS OUT, DAYS 1-6, SET THE CAMERA CONTROLLER SWITCHES AS DESCRIBED FOR FO 2D₂, DAYS 1-6.

WHEN FILM EXCHANGE OCCURS ON DAY 7, DURING LIGHTS OUT, SET THE CAMERA CONTROLLER SWITCHES AS DESCRIBED FOR FO 2D₂, DAY 7.

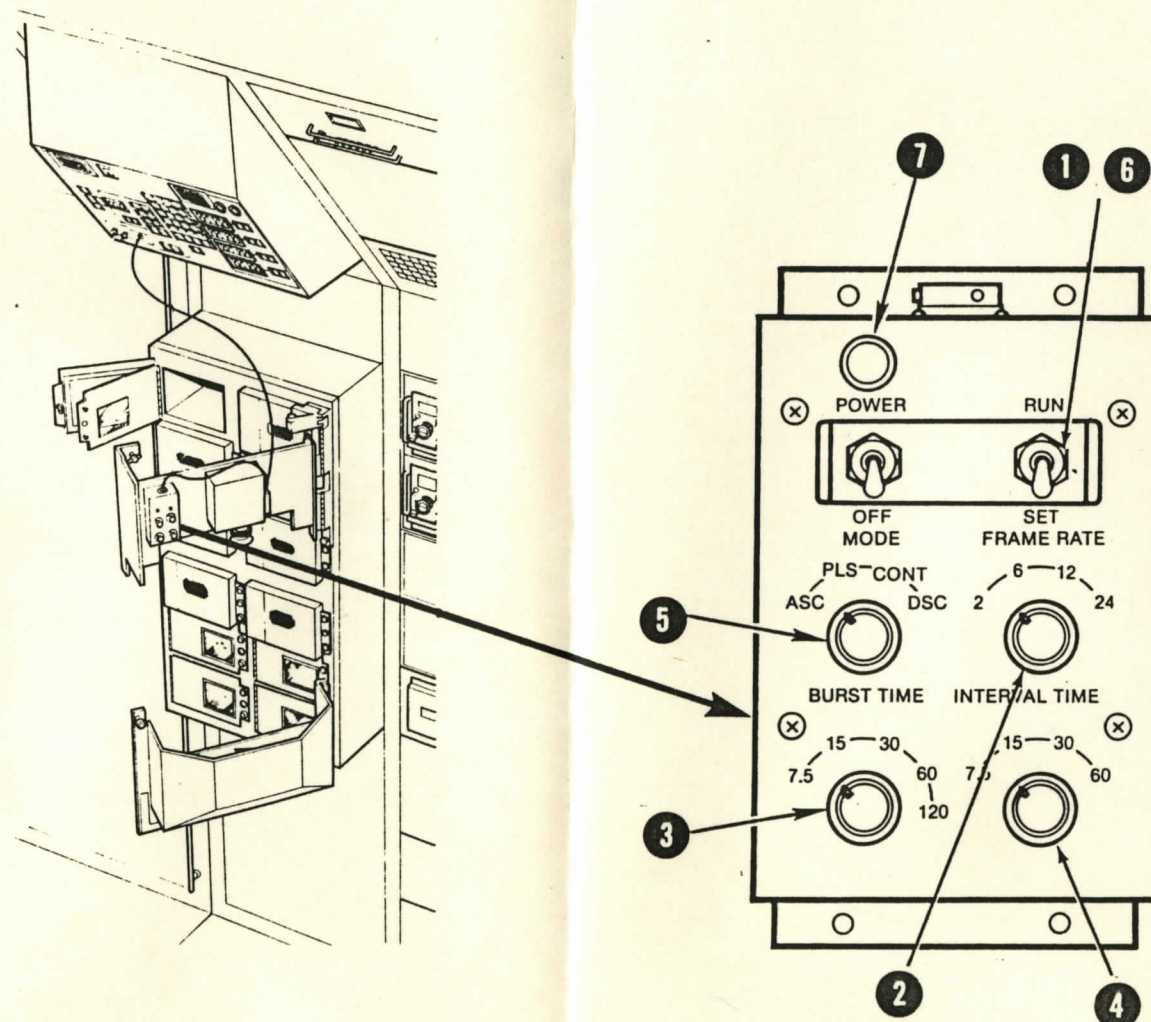
LEARNING STATEMENT

FUNCTION

To set camera for operation after reloading.

DAY 1: To set camera to run until lights out.

DAY 1-6: To set camera to run until 20 minutes until lights out. (Camera is set after lights out each day, for the FOLLOWING day.)



F.O. 2D₂: 16MM CAMERA-MIRROR OPERATIONS:
CAMERA PULSED CONTROL SETTING

DAY 1 PROCEDURE

NOTE:

AFTER SPACELAB ACTIVATION OPERATE 16MM CAMERA IN THIS CONFIGURATION UNTIL END OF FILM OR UNTIL RAHF LIGHTS OFF.

- | | | |
|---|---------------------------|-----|
| 1 | Set RUN/SET switch | SET |
| 2 | Set frame rate (T) switch | 6 |
| 3 | Set BURST TIME switch | 60 |
| 4 | Set INTERVAL TIME switch | 7.5 |
| 5 | Set MODE switch | PLS |
| 6 | Set RUN/SET switch | RUN |

DAY 1, 2, 3, 4, 5, 6 PROCEDURE

NOTE:

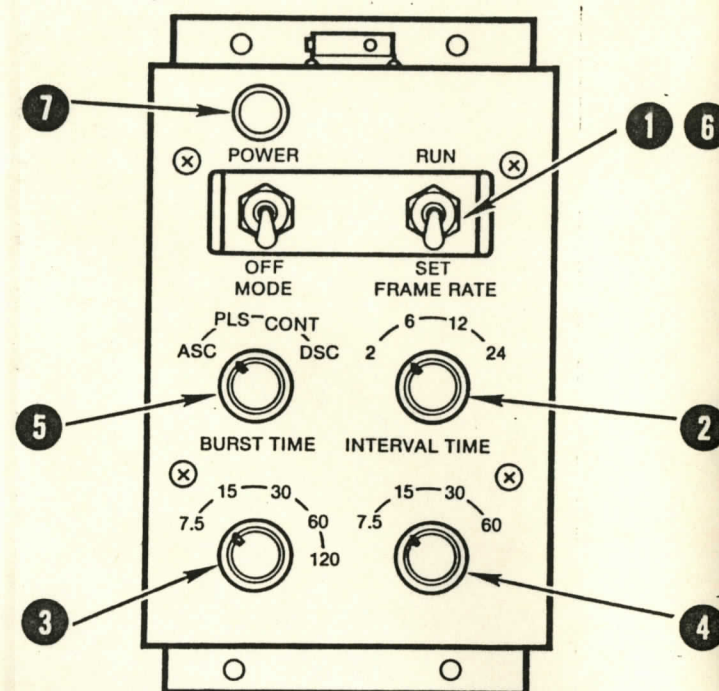
OPERATE 16MM CAMERA IN THIS CONFIGURATION UNTIL 20 MINUTES PRIOR TO RAHF LIGHTS OFF.

- | | | |
|----|--|-----|
| 1. | Set RUN/SET switch | SET |
| 2. | Set frame rate (T) switch | 6 |
| 3. | Set BURST TIME switch | 15 |
| 4. | Set INTERVAL TIME switch | 7.5 |
| 5 | Set MODE switch | PLS |
| 6 | Set RUN/SET switch | RUN |
| 7 | Ensure camera is running by observing flashing green light on left side of camera. | |
| 8 | Ensure reflecting mirrors are dust free. | |

LEARNING STATEMENT

FUNCTION

DAY 7: To set camera to descent mode.



DAY 7 PROCEDURE

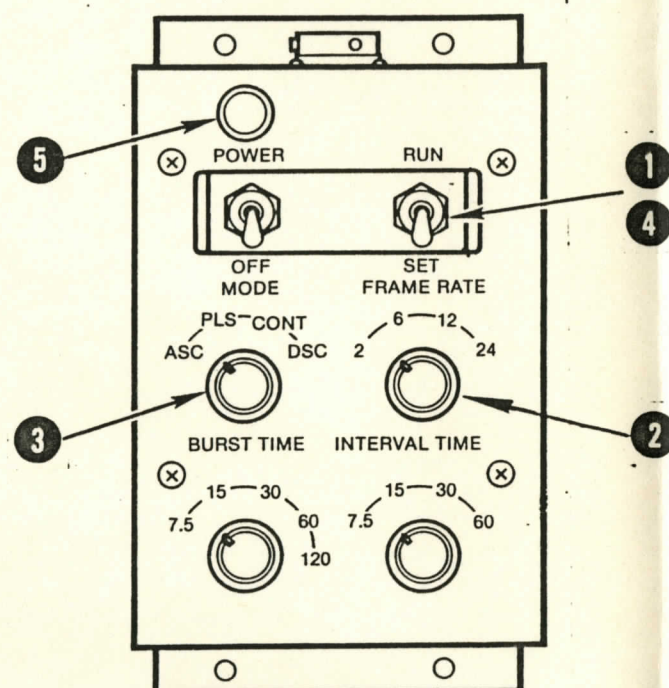
- 1 Set RUN/SET switch SET
- 2 Set frame rate (T) switch 6
- 3 Set BURST TIME switch 15
- 4 Set INTERVAL TIME switch 30
- 5 Set MODE switch DCS
- 6 Set RUN/SET switch RUN
- 7 Ensure camera is running (TBD).
- 8 Ensure reflecting mirrors are dust free.

LEARNING STATEMENT

FUNCTION

To set camera to run continuously 20 minutes prior to RAHF lights out.

Camera is run continuously during a period when the animals will likely be awake. Rats normally sleep during the day (lights on) and awaken just prior to onset of darkness.



F.O. 2D₄: 16MM CAMERA-MIRROR OPERATIONS:
CONTINUOUS MODE OPERATION

DAY 2, 3, 4, 5, 6, 7
PROCEDURE

To be accomplished at 20.0 \pm 1.0 minutes before RAHF lights out.

- | | | |
|---|---------------------------|------|
| 1 | Set RUN/SET switch | SET |
| 2 | Set frame rate (T) switch | 6 |
| 3 | Set MODE switch | CONT |
| 4 | Set RUN/SET switch | RUN |
| 5 | Ensure camera is running. | |

NOTE:

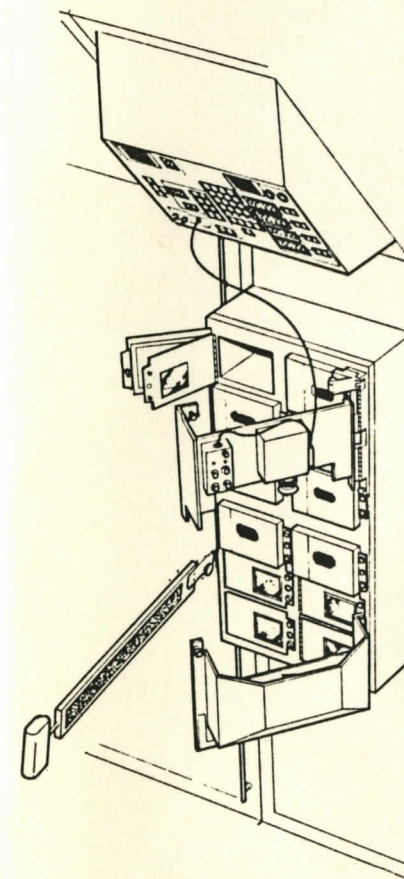
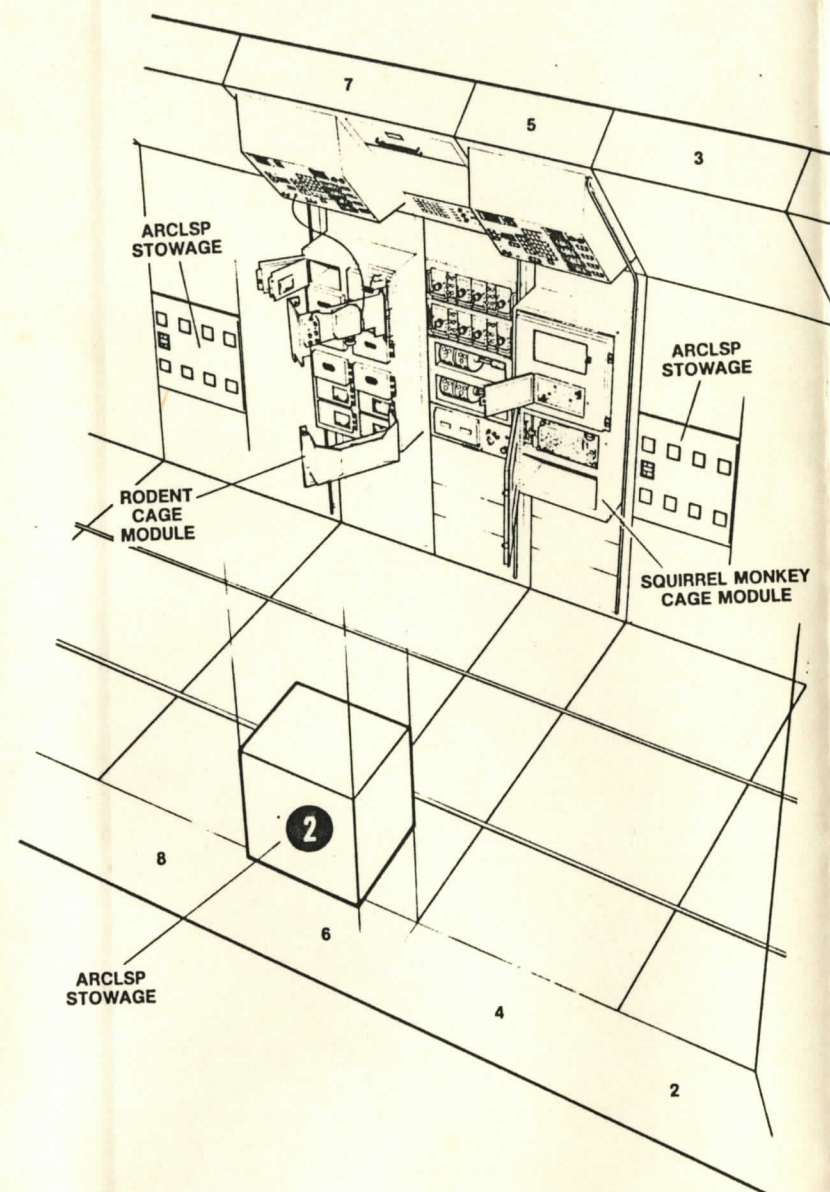
CAMERA STOPS AUTOMATICALLY WHEN IT RUNS OUT OF FILM OR AT LIGHTS OUT.

LEARNING STATEMENT

FUNCTION

To assess rodent food canister function, replenish food, and evaluate amount of food eaten or wasted.

Crew activity is filmed.



F.O.2E: RODENT FOOD CANISTER REPLACEMENT

DAY 2, 4, 6
PROCEDURE

NOTE:

FACE MASKS MAY BE REQUIRED FOR THIS ACTIVITY.

NOTE:

ON MD2 ONLY, INFORM ADDITIONAL CREWPERSON TO UNSTOW VIDEO CAMERA AND BEGIN VIDEO RECORDING FOR 7.5 MINUTES OR UNTIL PROCEDURE COMPLETED, WHICHEVER TIME IS SHORTER (FO 2G₂).

- 1 Unstow stowage transport carrier in rack 6 and clamp on rack 6 hand-rail.
- 2 Unstow rodent canisters located in rack 6 as follows:

Bag	Mission Day	Cages		
R-4FC	MD2	(1-4)	(5-8)	(9-12)
R-4FC	MD4	(1-4)	(5-8)	(9-12)
R-4FC	MD6	(1-4)	(5-8)	(9-12)

Unstow Spare bag.

- 3 Attach food canisters and bags to transport carrier, unclamp loaded transport carrier and attach to rack 7 handrail adjacent to rodent RAHF.

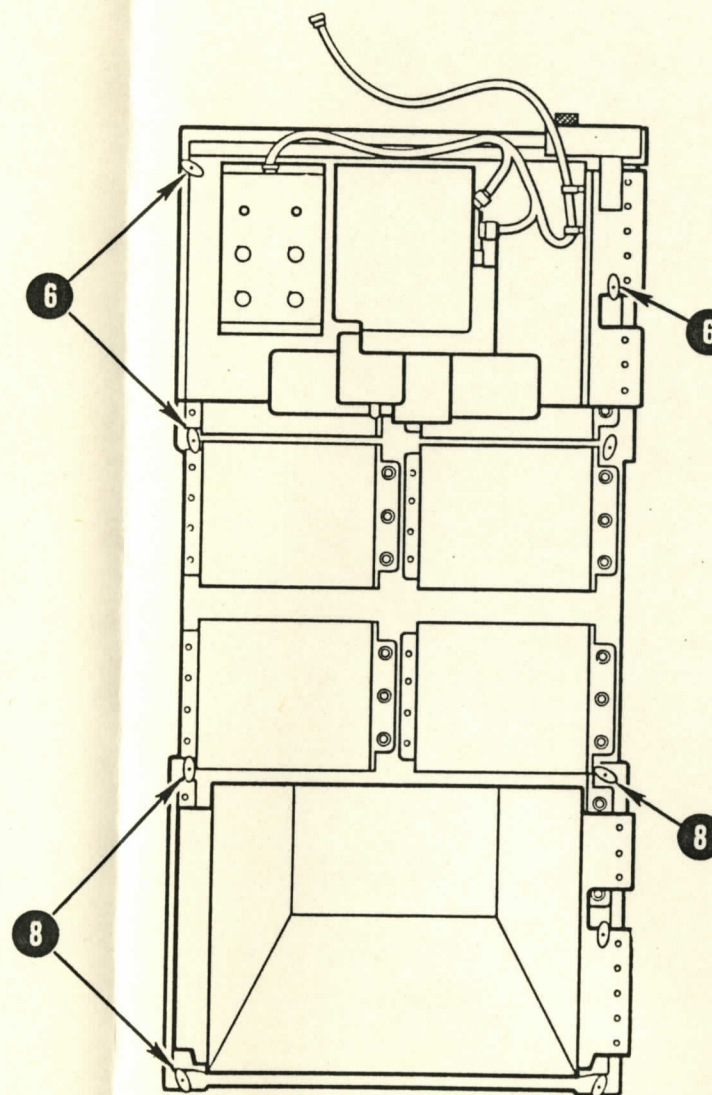
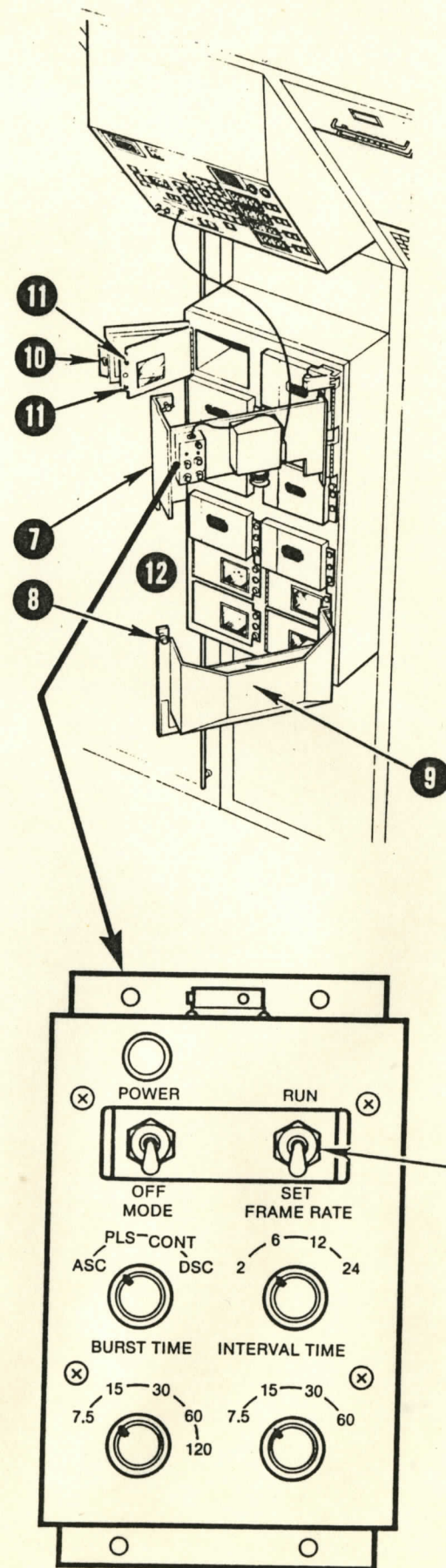
NOTE:

STEPS 4-25 MUST BE COMPLETED AS A SINGLE OPERATION.

LEARNING STATEMENT

FUNCTION

To open camera-mirror assembly for access to rodent cages.



- 4 Set camera controller RUN/SET switch - SET.
- 5 Unlatch the camera assembly by loosening the two thumbscrews on the left side of the camera bracket and by loosening the one thumbscrew on the right side center of the camera bracket.
- 6 Swing the camera assembly open and lock it into the 180° open position using the hinge latch mechanism.
- 7 Unlatch the mirror assembly by loosening the two thumbscrews on the left side of the mirror bracket and by loosening the one thumbscrew on the right side center of the mirror bracket and by removing locking pin from lower right hinge.
- 8 Swing the mirror assembly open and lock it into the 180° open position using the hinge latch mechanism; insert locking pin on lower right hinge.
- 9 Press center button on right of cage 1 and pull open outer door 90° to left.
- 10 Press upper and lower button on cage 1 and open inner door.
- 11 Open bag slot marked MD2-(1-4) for cage 1.
- 12 Remove canister from bag slot 1 and place in empty Spare bag.
- 13 Unlock used food canister from cage 1 by pulling on the handle with enough force to disengage the canister.

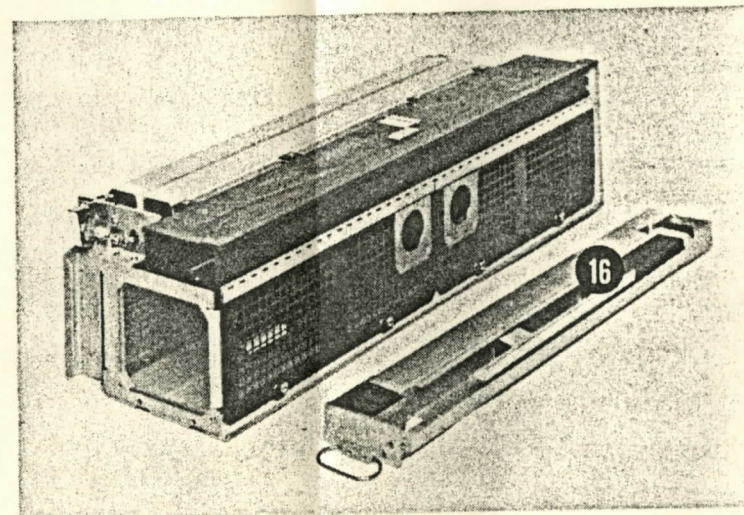
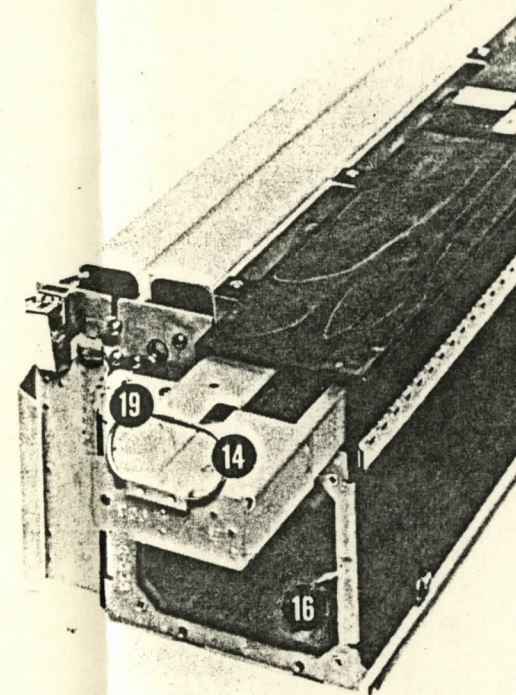
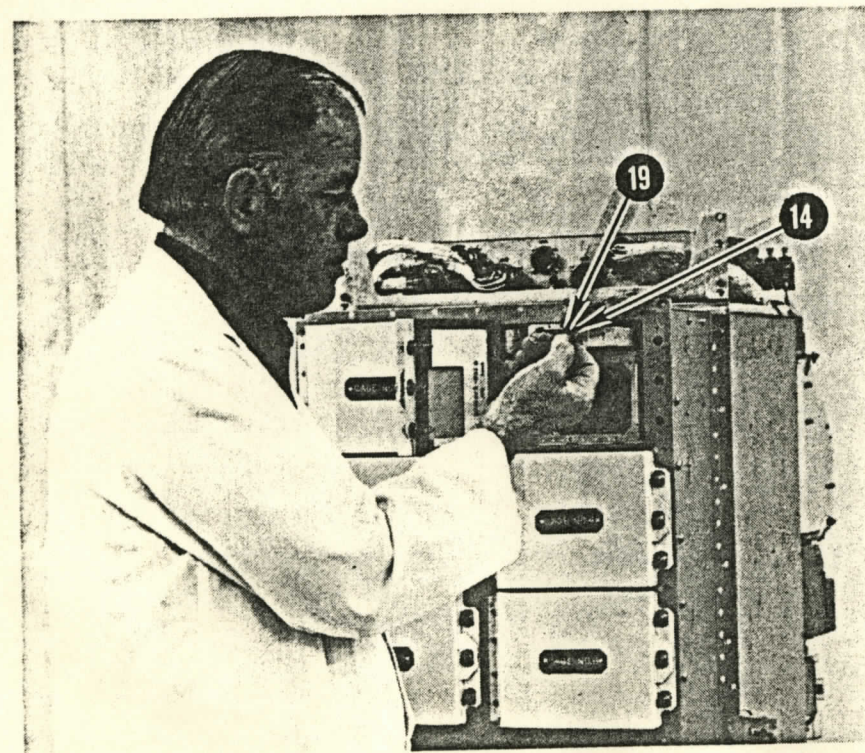
NOTE:

OBSERVE THAT RODENT IS NOT IN THE WAY.

LEARNING STATEMENT

FUNCTION

Used food canisters are stowed for postflight assessment of rat eating patterns and hardware.



CAUTION:

HAND VACUUM MAY BE REQUIRED TO CLEAN UP FLOATING CRUMBS.

- 14 Remove used canister from cage 1.

CAUTION:

TEMPORARILY CLOSE INNER CAGE DOOR WHILE CANISTER IS OUT OF CAGE.

- 15 Pull on spring latch mechanism to check that spring tension on food bar has operated properly.
- 16 Place used canister in empty bag slot (marked 1) on carrier.

NOTE:

OBSERVE THAT RODENT IS NOT IN THE WAY.

- 17 Obtain clean food canister from bag slot 2 and slide it in cage 1.
- 18 Lock the food canister by pushing in until the canister is locked into position.
- 19 Assure that canister is locked by pulling on handle.
- 20 Close cage inner and outer door; assure that latches are secure by pushing each latch and listening for click.

NOTE:

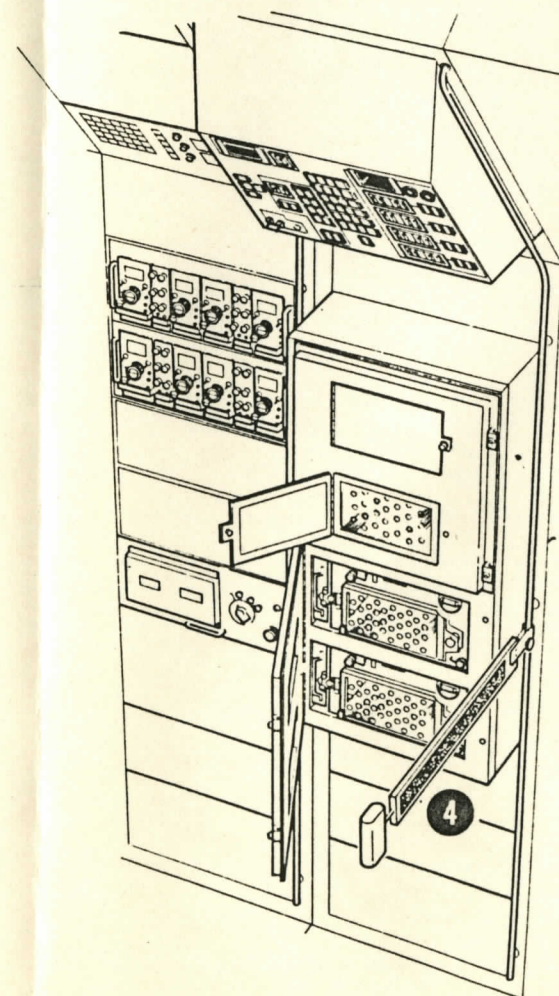
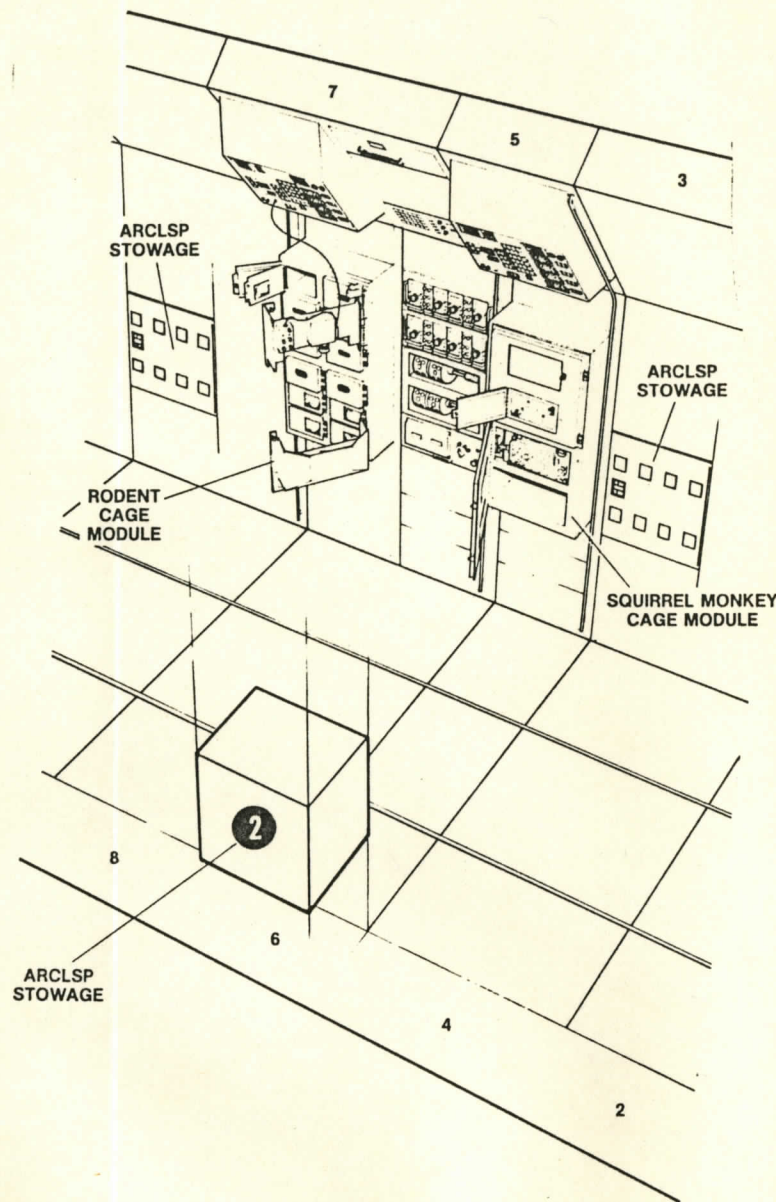
CAGES 9-12 DO NOT HAVE OUTER DOORS.

- 21 Open cage 2 inner and outer doors and repeat Steps 13-20 for cages 2-12, finally inserting new canister from Spare bag into cage 12. Seal bag.

LEARNING STATEMENT

FUNCTION

To feed squirrel monkeys and test on orbit operations with the squirrel monkey food canister and associated hardware.



F.O.2E: SQUIRREL MONKEY FOOD CANISTER REPLACEMENT

DAY 3, 5
PROCEDURE

NOTE:

FACE MASKS MAY BE REQUIRED FOR THIS ACTIVITY.

NOTE:

ON MD3 ONLY, INFORM ADDITIONAL CREWPERSON TO UNSTOW VIDEO CAMERA AND BEGIN VIDEO RECORDING FOR 7.5 MINUTES OR UNTIL PROCEDURE COMPLETED, WHICHEVER TIME IS SHORTER (FO 2G₂).

- 1 Unstow stowage transport carrier (rack 6) and clamp on rack 6 hand-rail.
- 2 Unstow Squirrel Monkey spare food canister cap; place in flight suit pocket until used during changeout.
- 3 Unstow monkey food canisters located in rack 6 as follows:

Bag	Mission Day	Cages
P-4FC	MD3	(1-4)
P-4FC	MD5	(1-4)

Unstow Spare bag.

- 4 Attach food canister bag and Spare bag to transport carrier, unclamp loaded transport carrier and attach to rack 5 handrail.

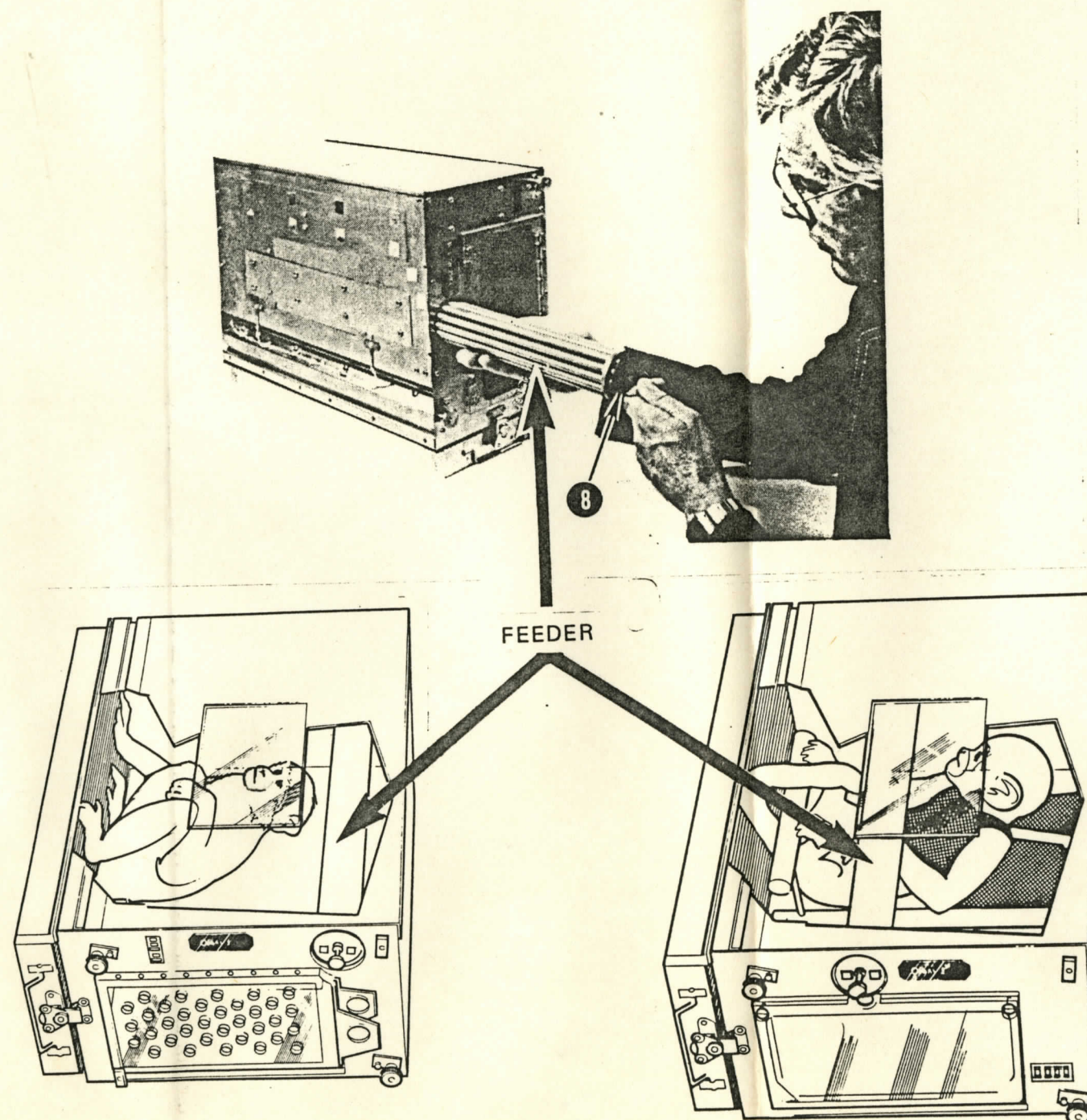
NOTE:

STEPS 5-18 MUST BE COMPLETED AS A SINGLE OPERATION.

- 5 Open bag marked MD3 for cages 1-4.
- 6 Remove canister from bag slot 1 and place in empty bag marked SPARE on carrier.

LEARNING STATEMENT

FUNCTION



PROCEDURE

- 7 Press upper and lower button and open inner door of cages 1/2.

CAUTION:

BE SURE THAT MONKEY IS NOT FEEDING WHEN FOOD CANISTER IS DISENGAGED.

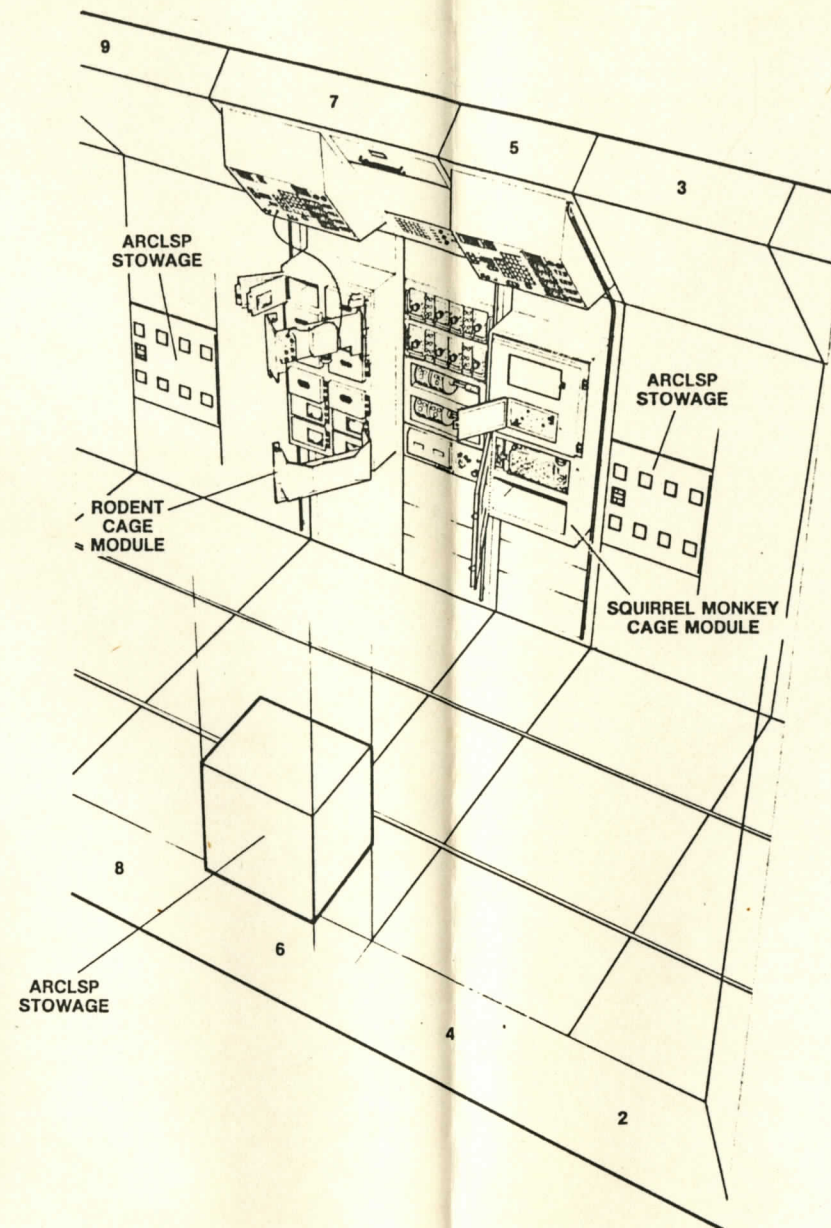
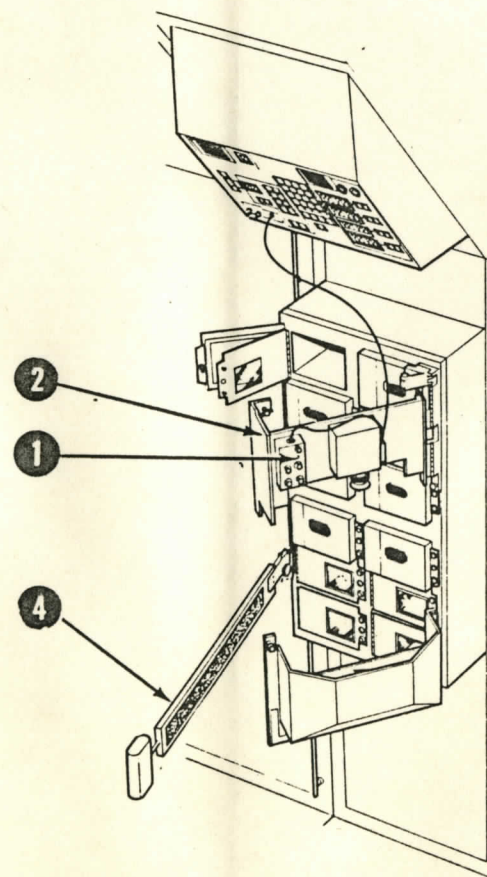
- 8 Unlock food canister from cage 1 by pulling on the handle with enough force to disengage the canister; cap canister with spare cap (from flight suit pocket).
- 9 Place in open empty bag slot marked 1 on carrier.
- 10 Obtain from transport carrier clean food canister removed from bag slot 2 for insertion into cage 1. Cap remains on.
- 11 Align the food canister by matching the feeder cam with the notch in the cage front wall; push canister in until about 80% inserted.
- 12 Remove cap and place in flight suit pocket (to be used for cage 2 changeout).
- 13 Push canister fully in, making sure that feeder cam is still aligned with cage notch. Listen for click to assure that canister is properly seated and locked into position.
- 14 Repeat Steps 8-13 for cage 2.
- 15 Assure that each canister is locked by pulling on handle.
- 16 Close cage inner door; assuring that latches are secure by pushing each latch and listening for click.
- 17 Repeat Steps 7-16 for cages 3/4. Seal bag.
- 18 Store used canisters and remaining cap in rack 6 stowage.

LEARNING STATEMENT

FUNCTION

To periodically replace selected dirty waste trays with clean ones in order to assess (1) inflight operations and (2) biocompatibility between animals and RAHF cages.

Crew activity is videotaped.



F.O. 2F: RODENT WASTE MANAGEMENT SYSTEM (WMS) REPLACEMENT

DAY 2, 4, 6
PROCEDURE

NOTE:

MASKS AND DISPOSABLE GLOVES ARE REQUIRED FOR THIS ACTIVITY.

NOTE:

ON MD2 ONLY, INFORM ADDITIONAL CREWPERSON TO UNSTOW VIDEO CAMERA AND BEGIN VIDEO RECORDING FOR 7.5 MINUTES OR UNTIL PROCEDURE COMPLETED, WHICHEVER TIME IS SHORTER (FO 2G₂).

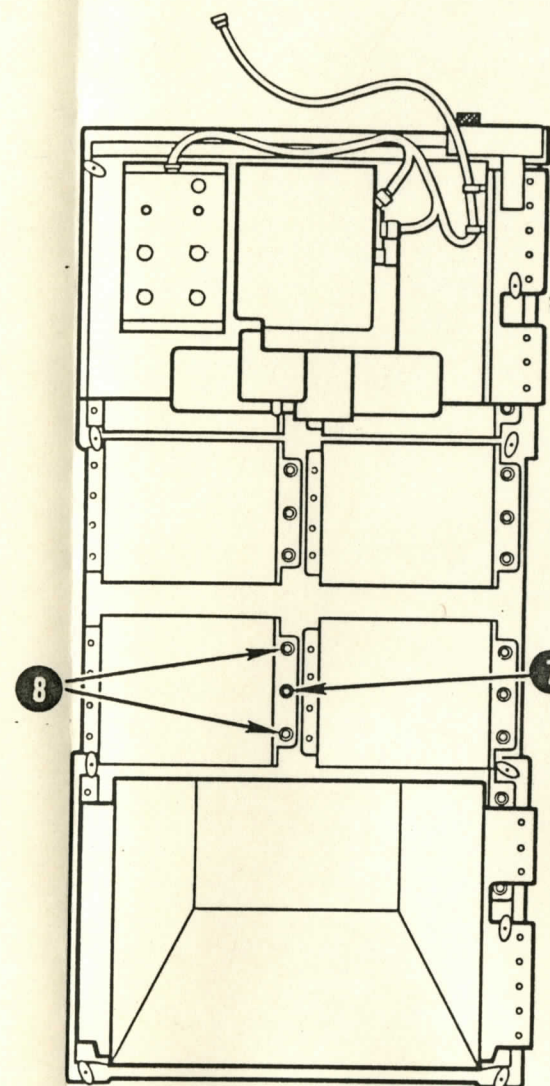
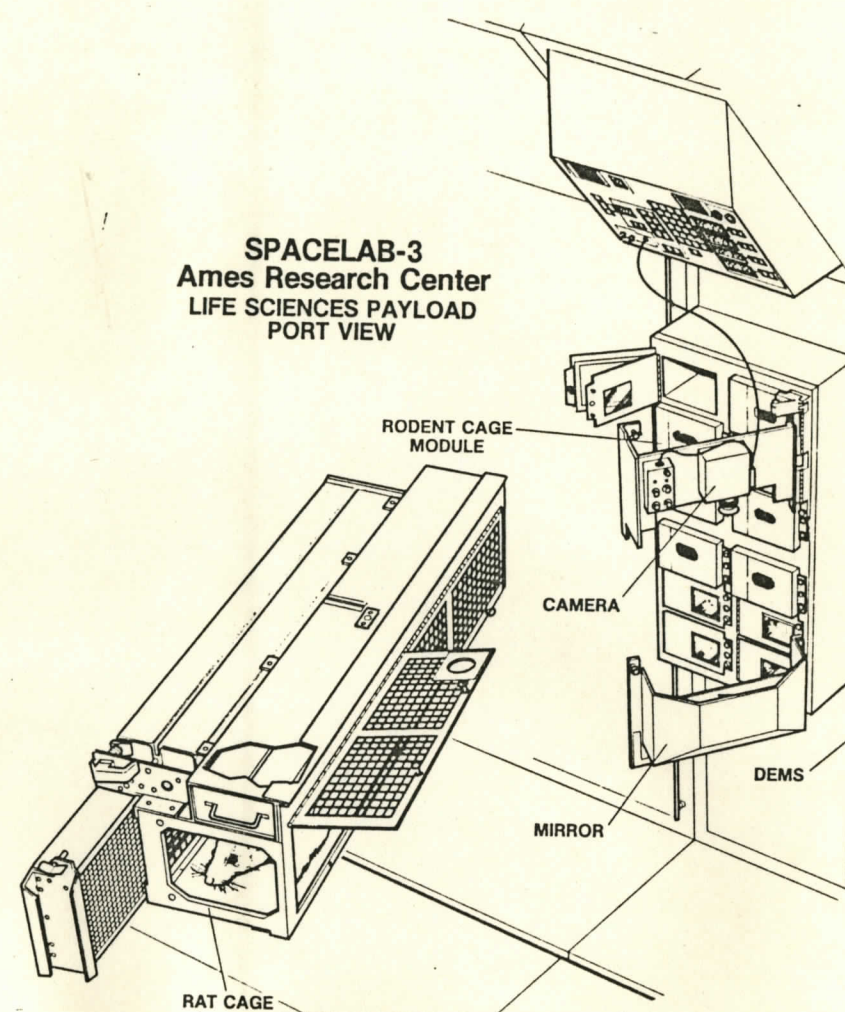
NOTE:

OMIT STEPS 1, 2, 3, 4 WHEN FO 2F ACTIVITY IS PERFORMED IMMEDIATELY AFTER FO 2E, FOOD CHANGEOUT ACTIVITY.

- 1 Put camera controller RUN/SET switch - SET.
- 2 Unlatch the camera assembly by loosening the two thumbscrews on the left side of the camera bracket and by loosening the one thumbscrew on the right side center of the camera bracket.
- 3 Swing the camera assembly open and lock it into the 180° open position using the hinge latch mechanism and locking pin.
- 4 Unstow stowage transport carrier from rack 6 stowage and clamp on rack handrail adjacent to the Rodent RAHF.

LEARNING STATEMENT

FUNCTION



- 5 Unstow covered waste trays with the cage bottom covers located in Rack 9, as follows:

Bag	Mission Day	Cages
R-WMS	MD2	1,3,5
R-WMS	MD4	1,3,5
R-WMS	MD6	1,3,5

Unstow Spare bag.

- 6 Attach WMS bags and Spare bag to transport carrier. Unclamp loaded transport carrier and attach to rack 7 handrail adjacent to rodent RAHF.

NOTE:

STEPS 7-25 MUST BE COMPLETED AS A SINGLE OPERATION.

- 7 Press center button on right of cage 1 and pull open outer door 90° to left.
- 8 Press upper and lower buttons on cage 1 and open inner door.

CAUTION:

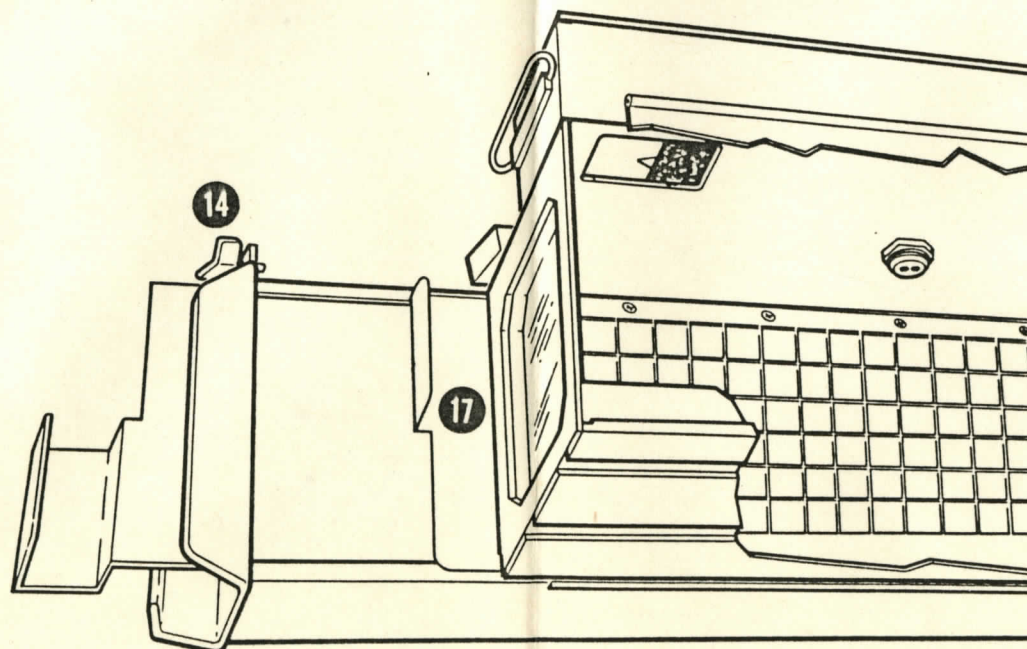
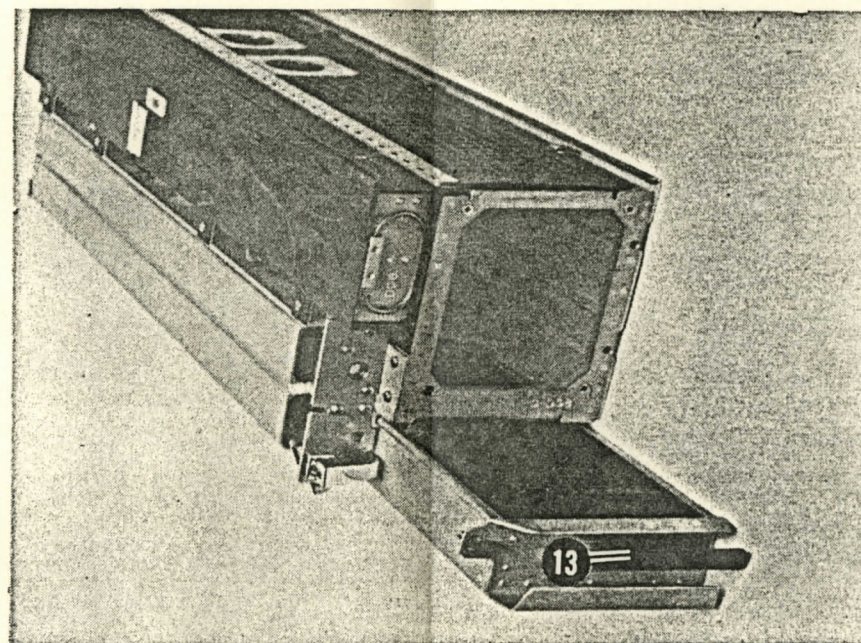
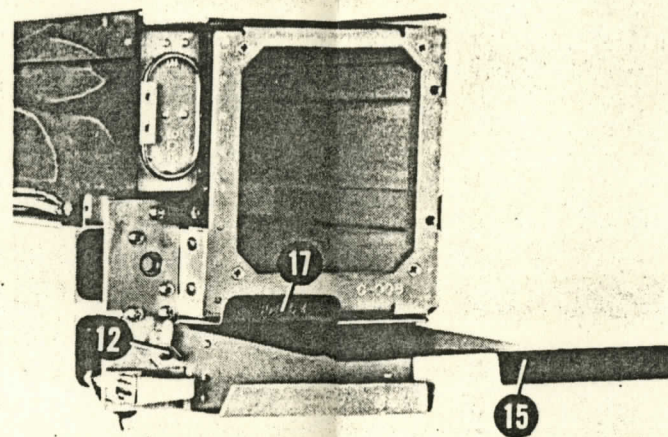
INSERT COVER SLOWLY AND CAREFULLY WHILE WATCHING RAT TO AVOID CATCHING THE ANIMAL'S APPENDAGES WHILE THE COVER IS BEING SLID INTO THE CAGE BOTTOM.

- 9 Remove cage bottom cover from MD2-1 bag and insert into cage 1.
- 10 Remove WMS tray with cover from bag MD2-1 and place in empty bag marked Spare, leaving bag MD2-1 open on carrier.
- 11 Remove tray cover from MD2-3 clean tray and slide this tray cover into the cage 1 WMS tray.

LEARNING STATEMENT

FUNCTION

As for rodent observation and waste tray changeout procedures, the camera-mirror assembly must be opened to access the WMS trays.



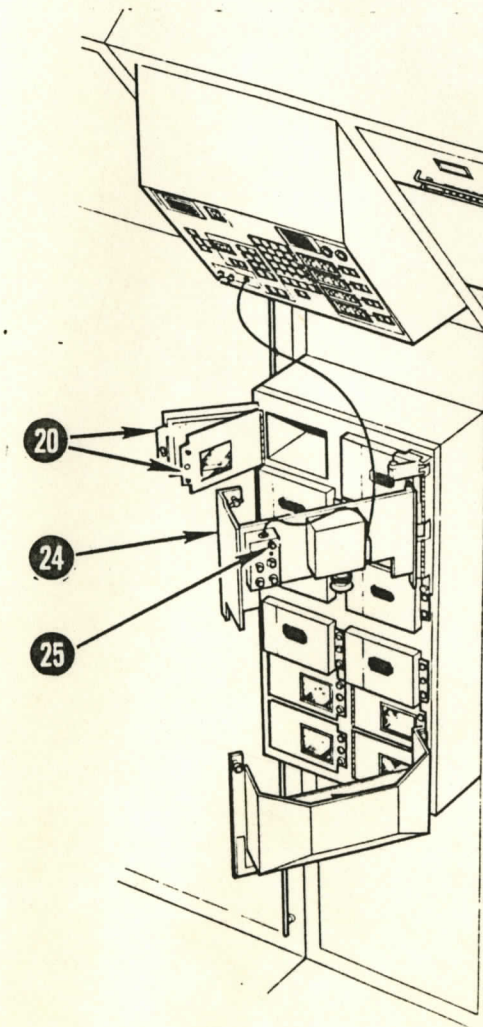
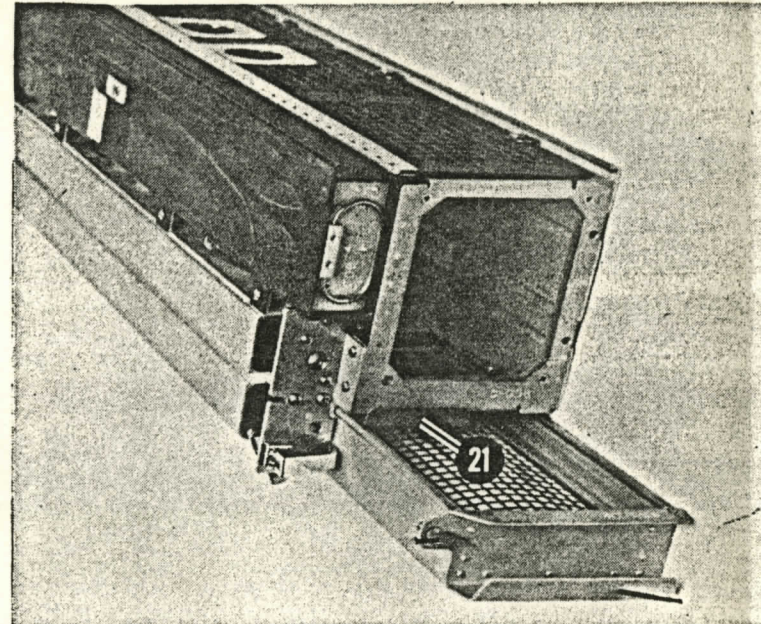
- 12 Unlock WMS tray from cage by turning latch 1/4 turn counterclockwise.
- 13 Slide out the covered waste tray.
- 14 Place soiled WMS tray with newly attached tray cover in the open empty bag (attached to carrier) marked MD2-1.
- 15 Remove clean tray from open bag MD2-3 and insert it into cage 1.
- 16 Lock WMS tray by turning latch 1/4 turn clockwise. Check to assure WMS tray is locked by pulling on tray handle.
- 17 Pull out the cage bottom cover (may or may not be soiled with waste) and place in bag MD2-1.
- 18 Seal bag (TBD).
- 19 Close cage 1 inner and outer doors; assure that latches are secure by pushing each latch and listening for click.

LEARNING STATEMENT

FUNCTION

Cage bottom prevents animal waste from moving down onto WMS tray or WMS tray cover during change operation.

Clean WMS trays can be inserted into cage without tray covers.



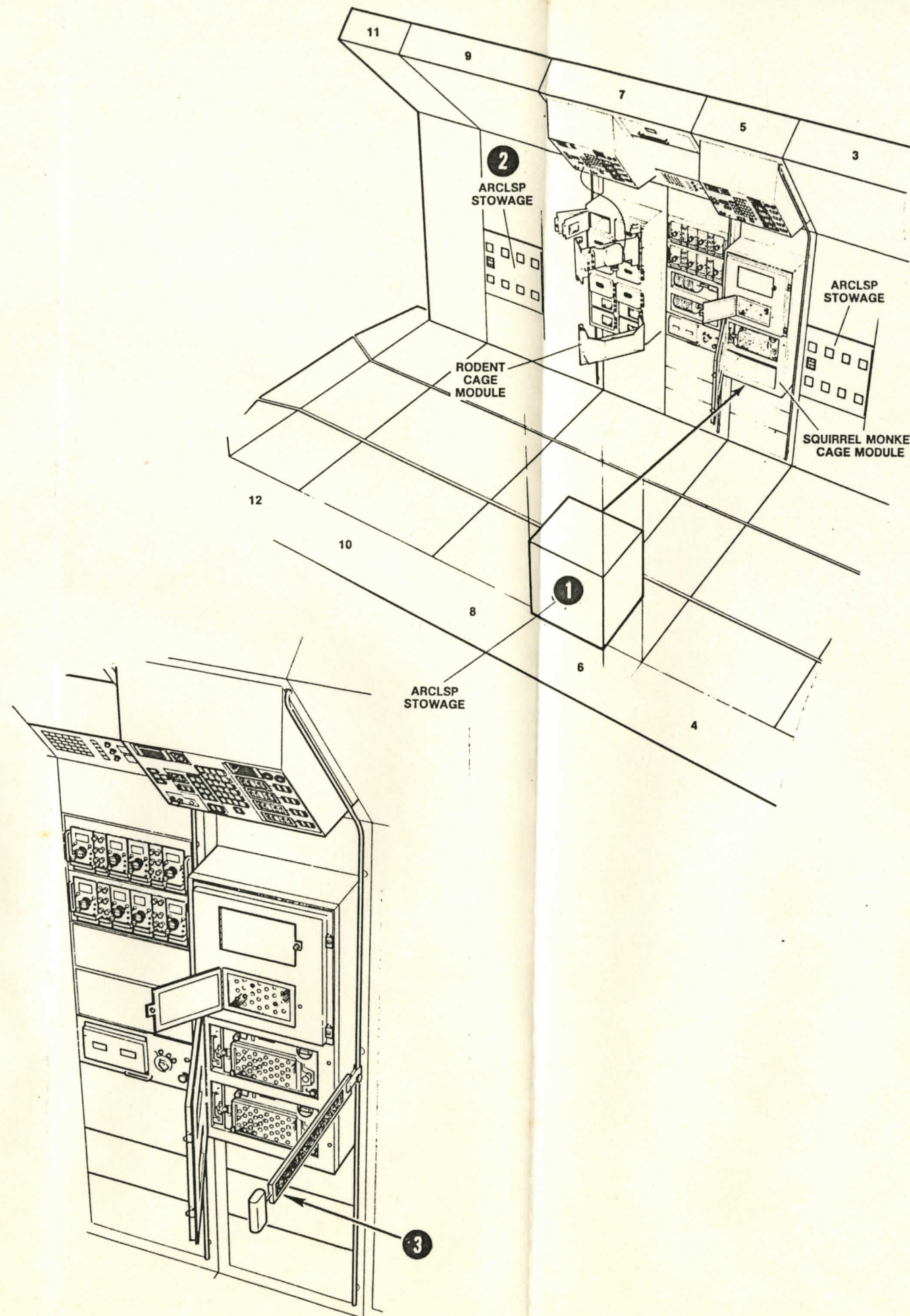
- 20 Open cage 3 inner and outer doors.
- 21 Remove cage bottom cover from MD2-3 bag and insert into cage 3.
- 22 Repeat Steps 11-19 for cages 3 and 5, finally inserting a clean tray from Spare bag into cage 5.
- 23 Assure all cage inner and outer doors are closed securely.
- 24 Unlock and swing the camera assembly to the closed position and tighten the two left-hand thumb-screws and right center thumb-screws; insert locking pin mechanism.
- 25 Put camera controller RUN/SET switch - RUN.

LEARNING STATEMENT

FUNCTION

To periodically replace selected dirty waste trays with clean ones in order to assess (1) inflight operations of WMS change and (2) biocompatibility between animal and RAHF cages.

Crew activity is filmed.



F.O.2F: SQUIRREL MONKEY WASTE MANAGEMENT SYSTEM (WMS) REPLACEMENT

DAY 3, 5
PROCEDURE

NOTE:

FACE MASKS AND DISPOSABLE GLOVES ARE REQUIRED FOR THIS ACTIVITY.

NOTE:

ON MD3 ONLY, INFORM ADDITIONAL CREWPERSOON TO UNSTOW VIDEO CAMERA AND BEGIN VIDEO RECORDING FOR 7.5 MINUTES OR UNTIL PROCEDURE COMPLETED, WHICHEVER TIME IS SHORTER (FO 2G₂).

NOTE:

OMIT STEP 1 WHEN FO 2F ACTIVITY IS PERFORMED IMMEDIATELY AFTER FOOD CHANGEOUT ACTIVITY.

- 1 Unstow stowage transport carrier in rack 6 and clamp on rack 9 handrail adjacent to the Rodent RAHF.
- 2 Unstow covered waste trays and cage bottom covers located in rack 9 as follows:

Bag	Mission Day	Cages
P-WMS	MD3	1,4
P-WMS	MD5	1,3,4

Unstow Spare bag.

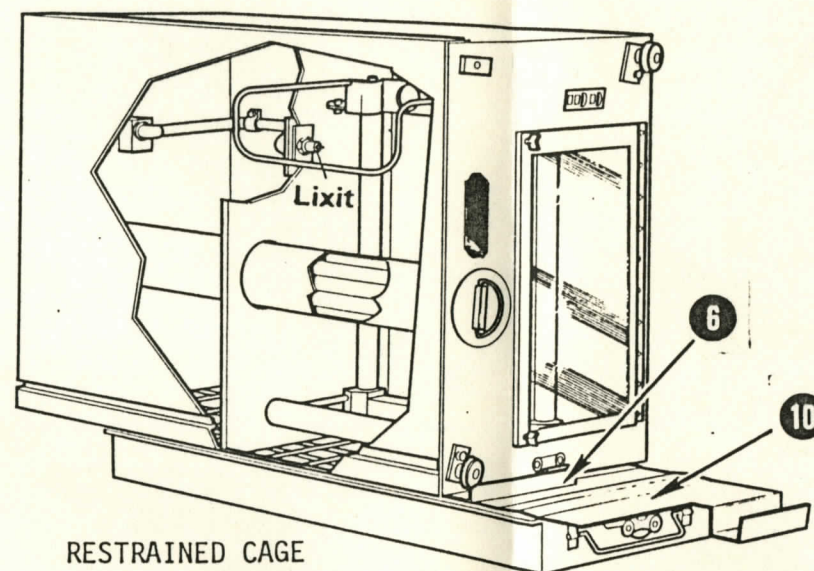
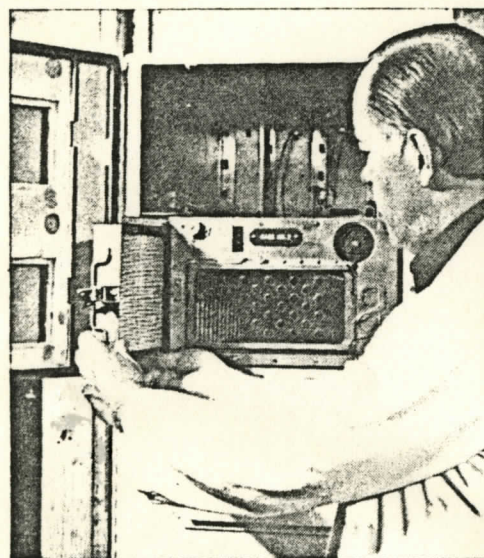
- 3 Attach WMS bags and Spare bag to transport carrier, unclamp the loaded transport carrier and attach to rack 5 handrail.

NOTE:

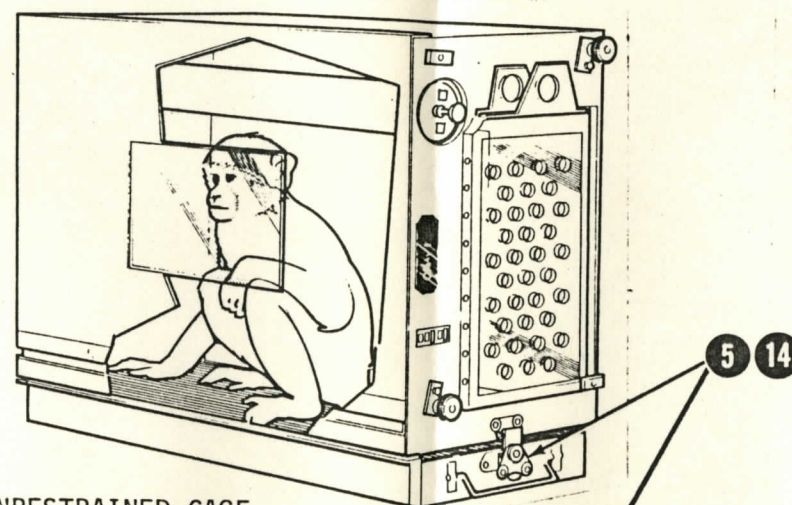
STEPS 4-21 MUST BE COMPLETED AS A SINGLE OPERATION.

LEARNING STATEMENT

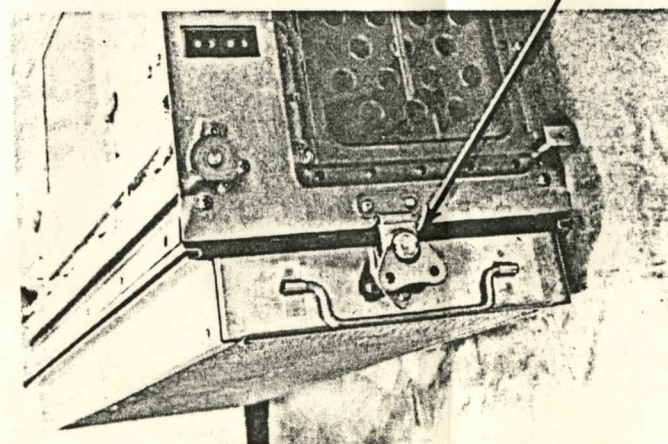
FUNCTION



RESTRAINED CAGE



UNRESTRAINED CAGE



PROCEDURE

- 4 Press upper and lower buttons and open large inner door.
- 5 Unlock WMS tray from cage by turning latch 90° counterclockwise.

CAUTION:

INSERT COVER SLOWLY WHILE WATCHING MONKEY TO AVOID CATCHING THE ANIMAL'S APPENDAGES IN THE COVER.

- 6 Remove cage bottom cover from bag MD3-1 and insert into cage 1.
- 7 Remove clean tray with cover from bag MD3-1 and place in empty bag marked Spare on carrier, leaving bag MD3-1 open and empty on carrier.
- 8 Open bag marked MD3-4.
- 9 Remove tray cover from MD3-4 tray and slide this tray cover into the cage 1 WMS tray.
- 10 Place soiled WMS tray with newly attached tray cover in the open empty bag (attached to carrier) marked MD3-1.
- 11 Obtain from transport carrier clean WMS tray with no cover from MD3-4 bag; slide it into cage 1.
- 12 Pull out the cage bottom cover (may or may not be soiled with waste) and place in bag MD3-1 containing soiled WMS tray with attached tray cover.
- 13 Seal bag.
- 14 Lock WMS tray by turning latch 90° clockwise. Check that WMS tray is locked by inspecting latch.
- 15 Close large inner door; assure that latches are secure by pushing each latch and listening for click.
- 16 Open large inner door for cages 3/4 and repeat Steps 5-6 for cage 4.

- 17 Remove clean tray cover from Spare bag and slide this cover into cage 4 WMS tray.
- 18 Place soiled tray with newly attached tray cover in open empty bag marked MD3-4.
- 19 Obtain clean WMS tray, with no cover, from Spare bag and slide it into cage 4.
- 20 Repeat Steps 12-15, ensuring that both large inner doors are latched.
- 21 Stow used WMS and Spare bag in rack 9.

NOTE:

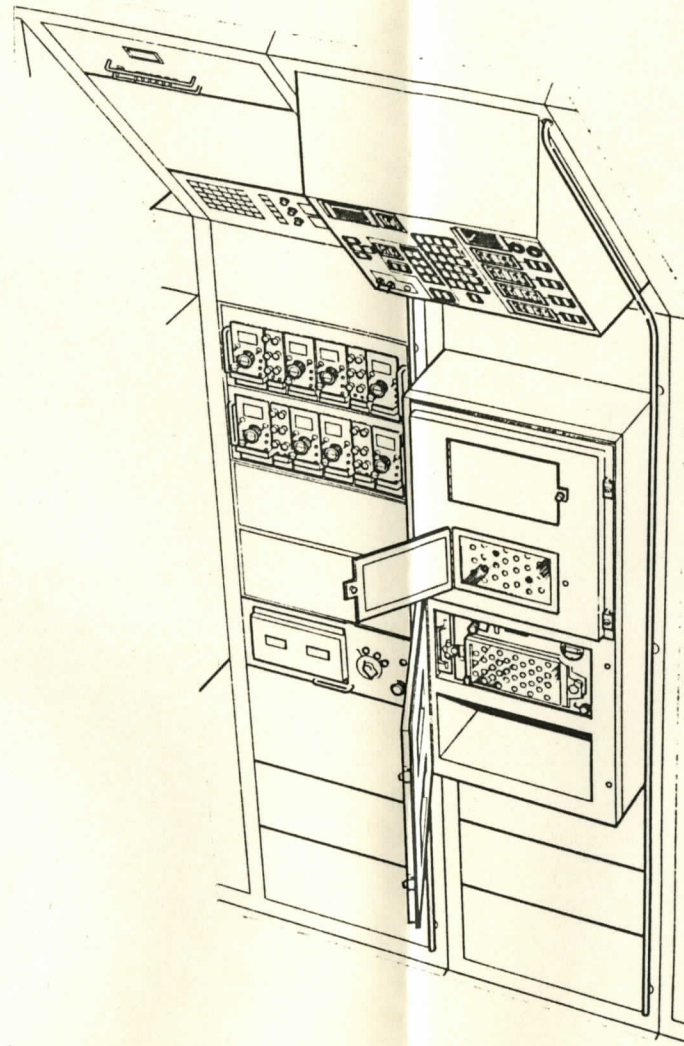
ON MISSION DAY 5, ALSO CHANGE CAGE 3 WMS.

LEARNING STATEMENT

FUNCTION

To provide video of crew activities during food canister and waste tray changeout, and emptying of condensate collector.

To record monkey observations in-flight.



F.O. 2G₁ AND 2G₂: CREW VIDEO OPERATIONS

NOTE:

FO 2G₁ APPLIES TO VIDEO OF SQUIRREL MONKEYS EACH DAY FOLLOWING ANIMAL OBSERVATION (FO 2A).

- 1 Set up and activate TV cameras per TV 10, SL-3 TV/Photo Operations Book, JA 218.
- 2 Route TV per Payload Crew Activity Plan (PCAP).
- 3 Observe monkeys in cages 1-4, 2.5 minutes per cage (10 minutes total).

NOTE:

FO 2G₂ APPLIES TO VIDEO OF CREW ACTIVITIES DURING PERFORMANCE ANY DAY AT TIME CONCURRENT WITH:

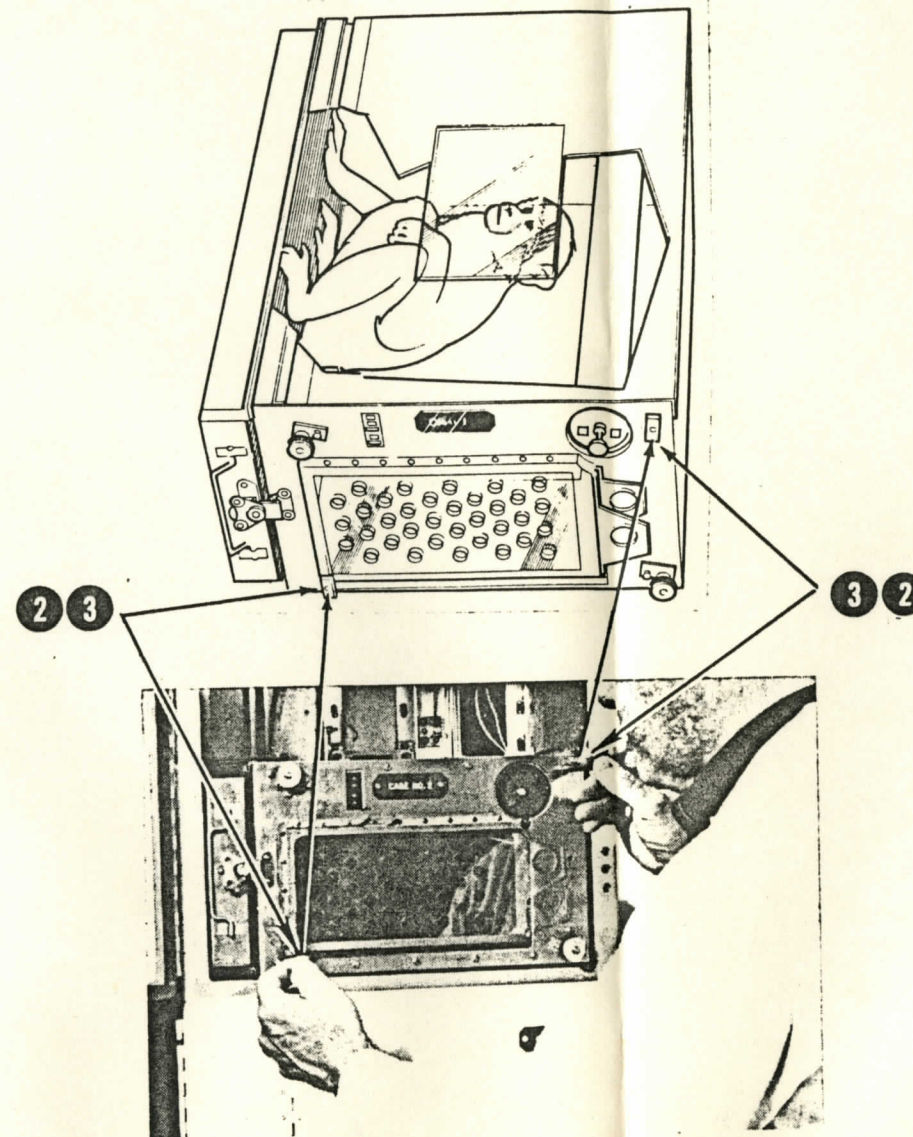
FO 2C: CONDENSATE CHANGEOUT
 FO 2E: FOOD CANISTER CHANGEOUT (R, SM)
 FO 2F: WASTE TRAY CHANGEOUT (R, SM)
 FO 2H: TEMPORARY RESTRAINT SYSTEM PROTOCOL

- 1 Set up and activate TV cameras per TV 7, 8, and 9 (SL-3 TV/Photo Operations Book, JA 218).
- 2 Route TV per Payload Crew Activity Plan (PCAP).
- 3 Observe crew activity for FO 2C, 2E, 2F (once each for rodents and squirrel monkeys), and 2H.

LEARNING STATEMENT

FUNCTION

To test the restraint wall hardware for unrestrained monkeys that could be used for contingency operations, or used on future flights for various experimental protocols.



F.O.2H: TEMPORARY RESTRAINT SYSTEM PROTOCOL

DAY 6 PROCEDURE

NOTE:

ON MD6, INSTRUCT ADDITIONAL CREW-PERSON TO UNSTOW VIDEO CAMERA, BEGIN VIDEO RECORD OF THIS PROCEDURE FOR 15 MINUTES OR UNTIL COMPLETED.

NOTE:

STEPS 1-7 MUST BE COMPLETED AS A SINGLE OPERATION.

- 1 Press upper and lower buttons and pull open inner door 90° to left.

CAUTION:

WHEN PULLING RODS AND RESTRAINT WALL FORWARD, CAREFULLY OBSERVE THAT THE ANIMAL DOES NOT GET CAUGHT BETWEEN THE WALL AND THE FEEDER SWITCH OR THE PERCH. BE ESPECIALLY AWARE OF THE HEAD.

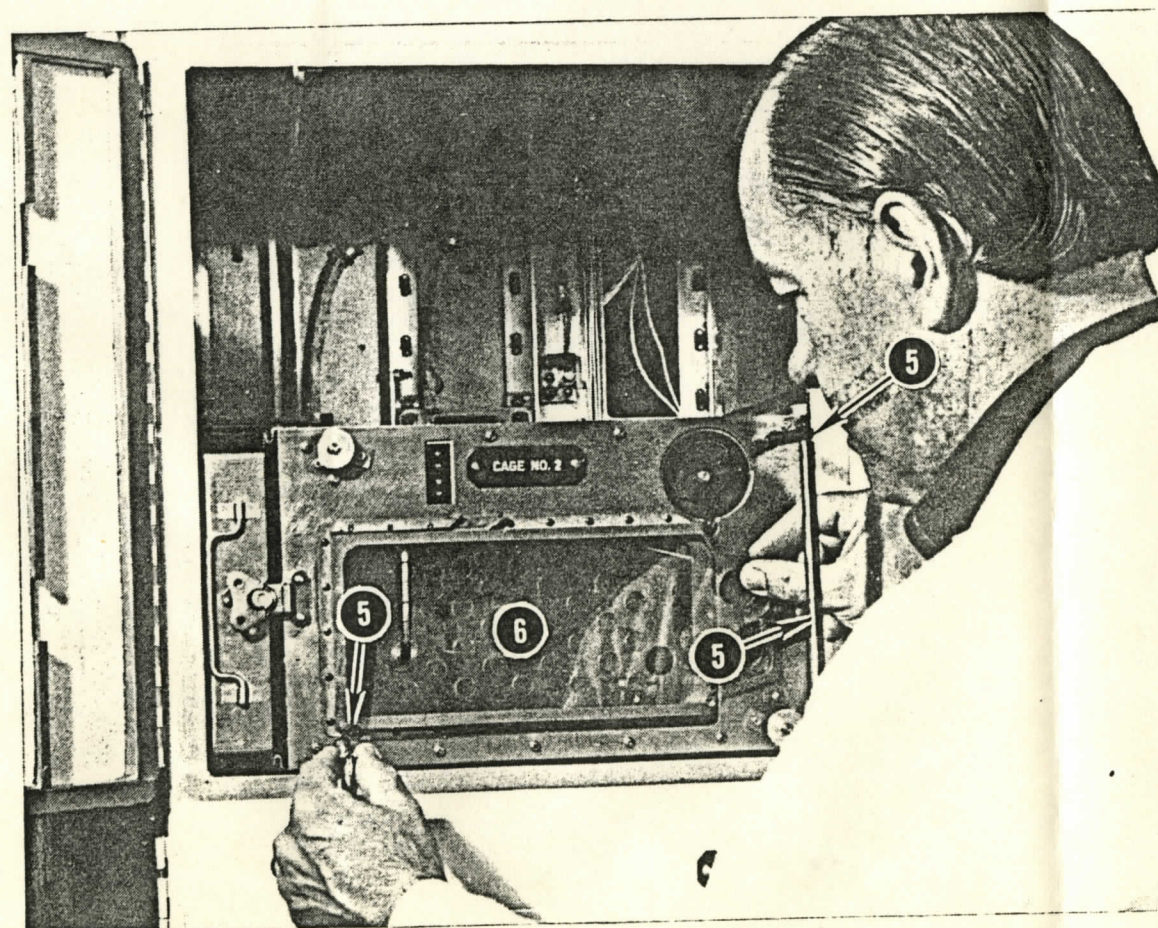
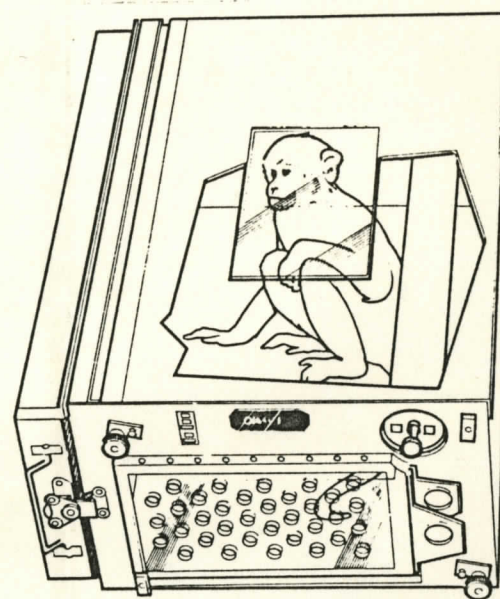
- 2 Pull both T-handles on rods outward simultaneously, slowly pulling monkey forward.

CAUTION:

DO NOT BUMP DEPLOYED RODS. RATCHETS WILL UNLOCK ALLOWING MONKEY TO FORCE CAGE WALL BACK.

- 3 Turn rods until ratchets are engaged.

EARNING STATEMENT



NOTE:

WHEN FULLY ENGAGED, RATCHETS WILL BE ROTATED TO RIGHT.

- 4 When monkey is snugly positioned against the front window, observe that the animal is in a position to be injected.

NOTE:

RODS MAY JAM IF NOT OPERATED SIMULTANEOUSLY.

- 5 Release ratchets by turning rods simultaneously.

CAUTION:

BE CAREFUL NOT TO CATCH ANIMAL IN MOVING HARDWARE.

- 6 Push temporary restraint wall to back cage wall until T-handles are flush with front wall.
- 7 Close inner cage door.

LEARNING STATEMENT

FUNCTION

DAY 1: To activate LSLE microcomputer and BTS.

DAY 7: To deactivate BTS and LSLE microcomputer prior to re-entry.

DAY 1, 7 PROCEDURE

NOTE:

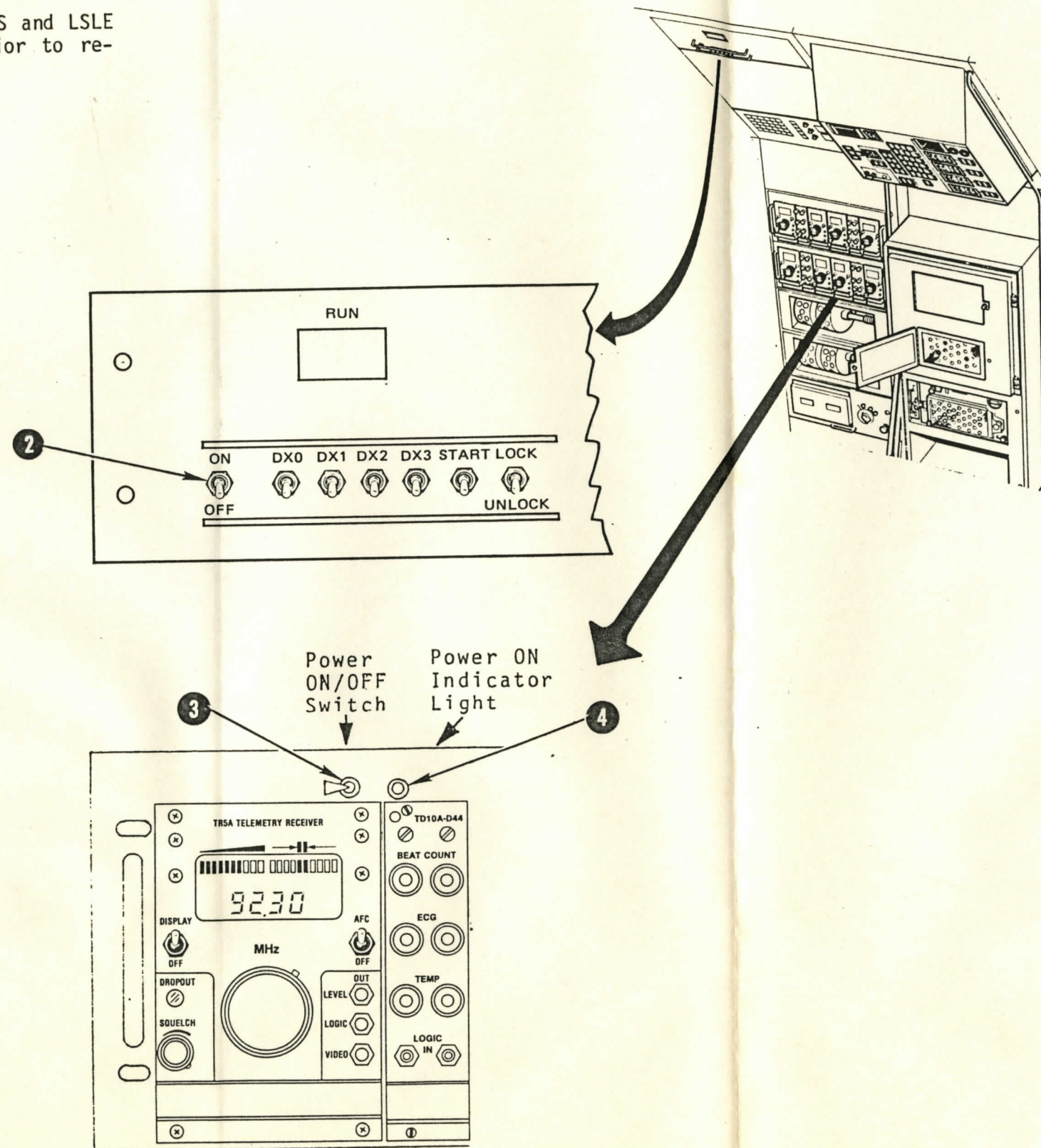
THE FOLLOWING STEPS APPLY TO THE LSLE MICROCOMPUTER:

- 1 Establish A/G voice communications with POCC.
- 2 Switch POWER switch - ON.

NOTE:

THE FOLLOWING STEPS APPLY TO THE BTS SYSTEM:

- 3 Switch POWER switch - ON.
- 4 Observe power light is lit.
- 5 Verify receipt of data with POCC.
- 6 At Spacelab deactivation, reverse procedure turning off BTS, then LSLE microcomputer.

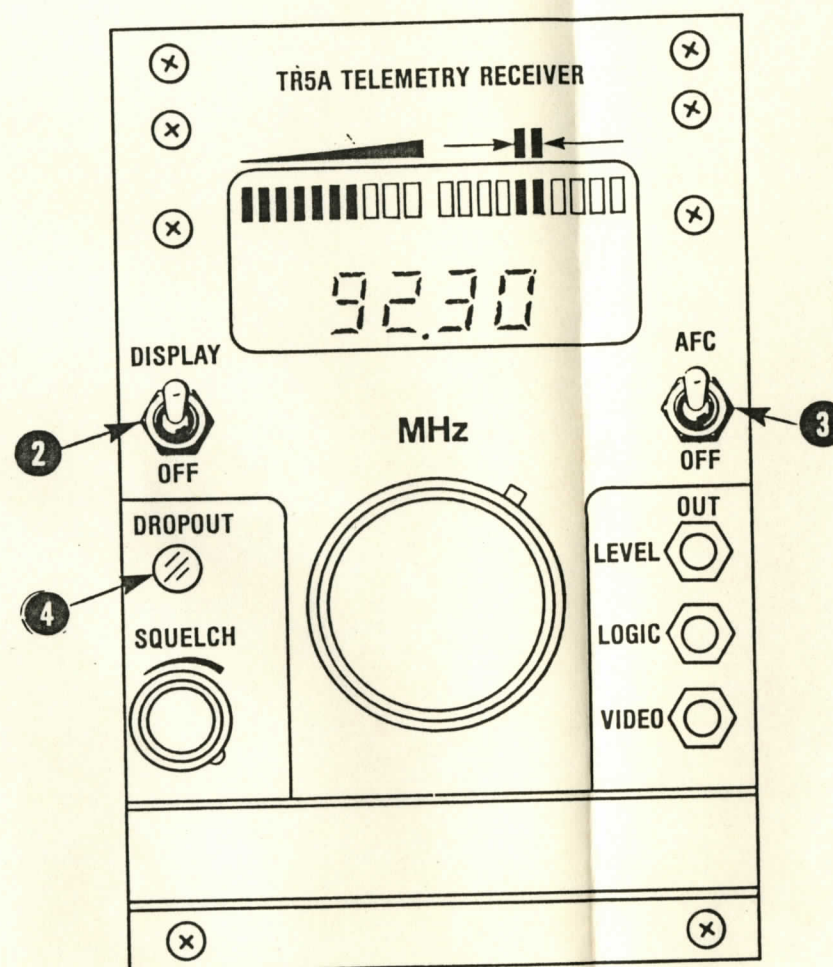


LEARNING STATEMENT

FUNCTION

To adjust BTS signal strength and center-tune the receiver.

FLIGHT RECEIVER



NOTE:

BTS receiver adjustment. Tune each receiver (8 total) 2 times per day or as required by ground personnel. Begin this procedure starting with the upper rack left-hand receiver and proceeding to the right.

This operation fine tunes the frequency from implanted transmitter to receiver.

F.O.2K: TUNING BTS

DAY 1, 2, 3, 4, 5, 6, 7
PROCEDURE

NOTE:

TUNE EACH RECEIVER (8 TOTAL) 2 TIMES PER DAY OR AS REQUIRED BY GROUND PERSONNEL.

BEGIN THIS PROCEDURE STARTING WITH THE UPPER RACK LEFT HAND RECEIVER AND PROCEEDING TO THE RIGHT. REPEAT FOR LOWER RACK.

NOTE:

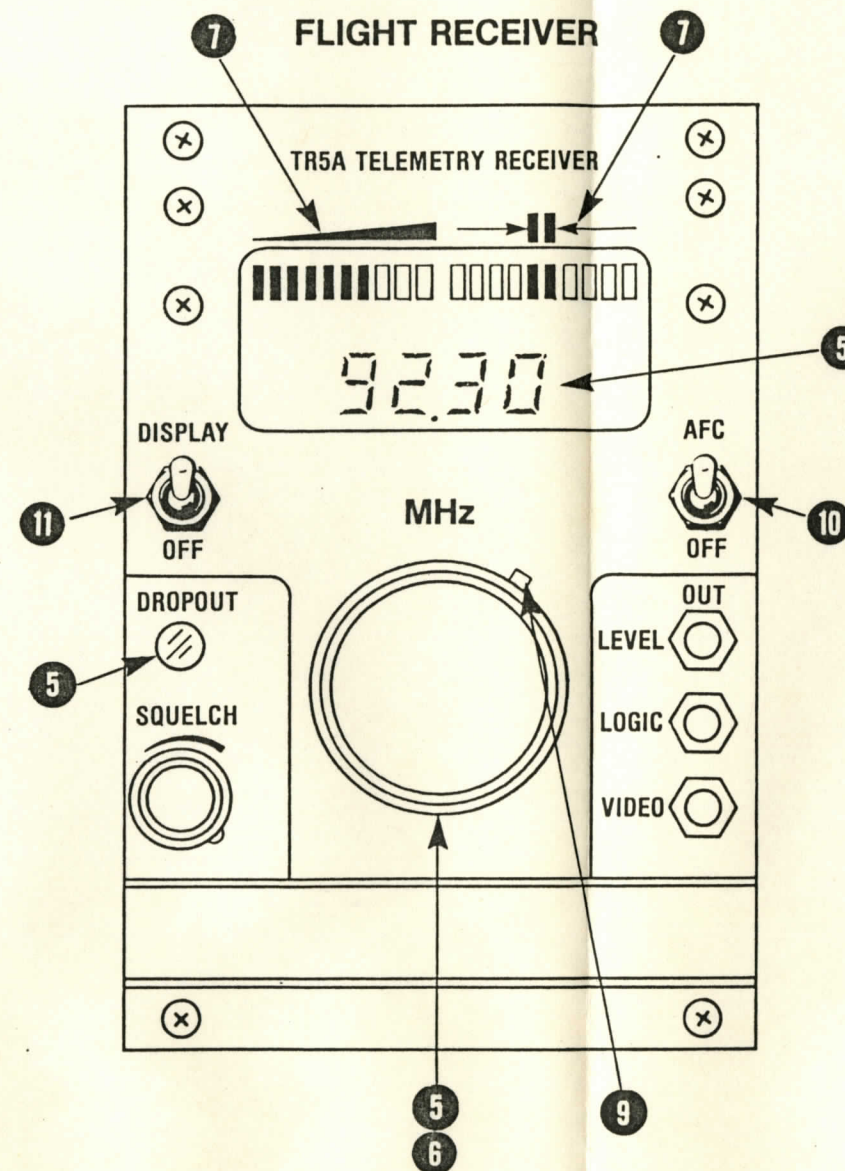
IMPLANT FREQUENCY FOR EACH ANIMAL WILL BE DIFFERENT. IMPLANT FREQUENCY WILL BE PROVIDED IN FLIGHT DATA FILE AND/OR BY VOICE COMMUNICATION. ADJUSTMENT(S) SHOULD BE MINOR. CARE MUST BE TAKEN TO KEEP SIGNAL WITHIN 0.01 MHz RANGE.

- 1 Establish A/G voice communications with POCC.
- 2 Switch DISPLAY switch - ON.
- 3 Switch AFC switch - OFF.

NOTE:

DROPOUT LIGHT MAY BE ORANGE (OUT OF TUNE), GREEN (COARSE TUNED), OR OUT (FINE TUNED).

- 4 If dropout light is out, confirm acceptable signal with POCC. Go to Step 9.



5 If dropout light is orange or green, tune receiver by turning tuner (MHz) knob on receiver front panel clockwise to unlocked position.

6 If the dropout light is orange, turn tuning (MHz) knob until dropout light is green.

NOTE:

POSITION OF CENTER FREQUENCY LIGHTS WILL BE RANDOM UNTIL DROPOUT LIGHT IS GREEN.

7 Continue to adjust tuning knob until dropout light extinguishes and center frequency displays center two lamps lit. Verify that LED digital display is within 0.01 MHz of the specified implant frequency.

8 Confirm acceptable signal with POCC.

9 Turn tuner knob level lock counter clockwise to the locked position.

10 Turn AFC toggle switch - AFC.

11 Turn DISPLAY toggle switch - OFF.

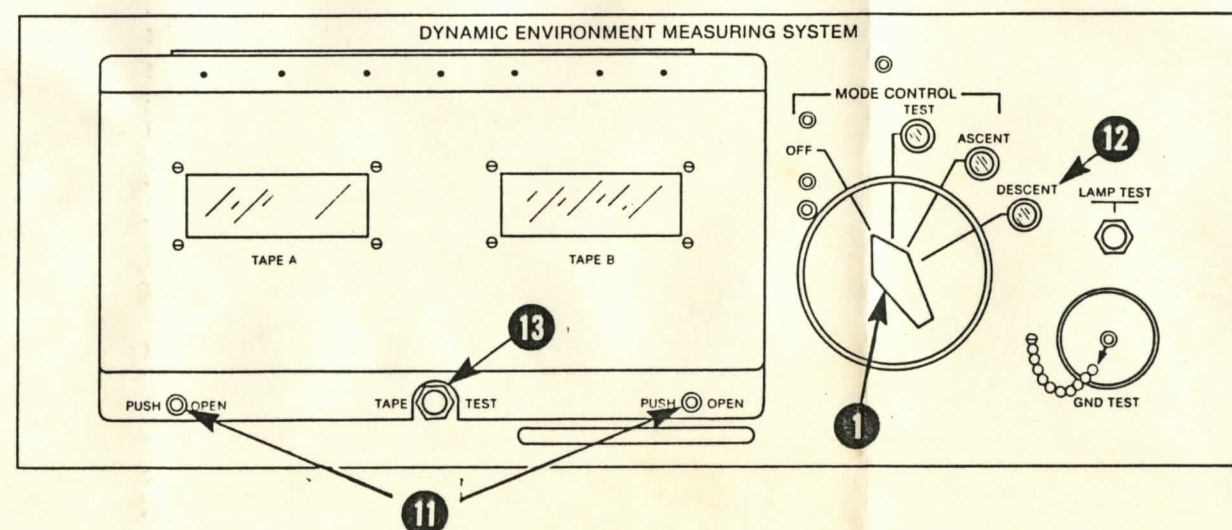
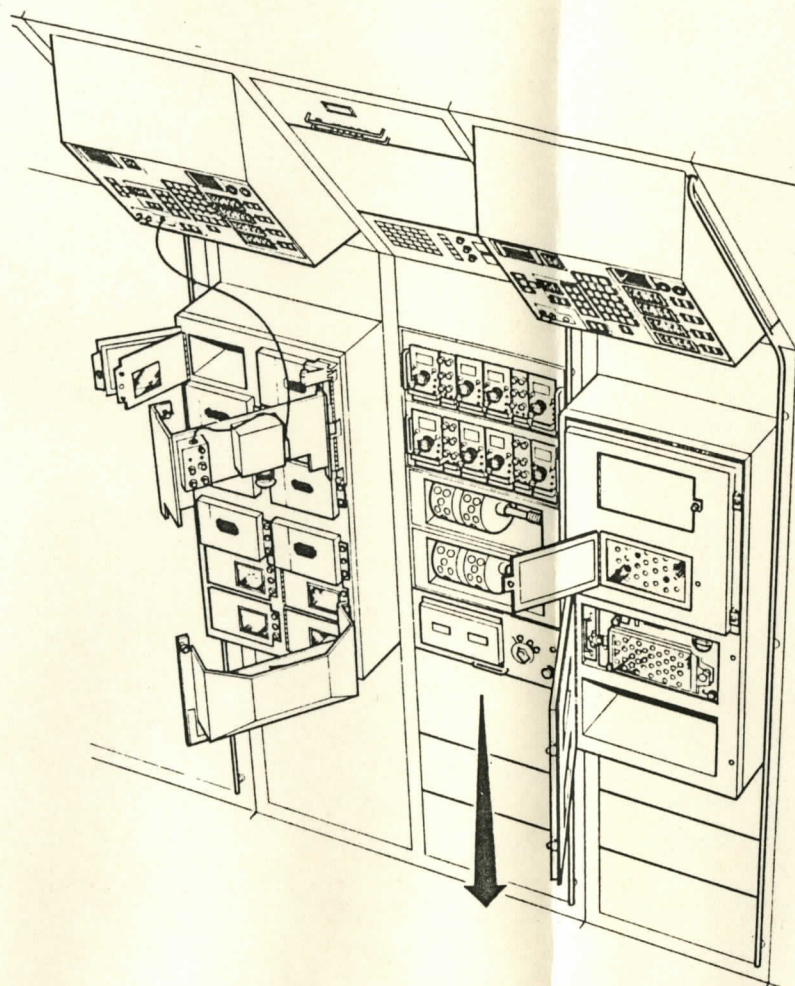
Repeat Steps 2-11 for each receiver.

LEARNING STATEMENT

FUNCTION

To replace DEMS tapes with new.

To reset DEMS to descent mode prior to re-entry.



F.O. 2L/2N: DEMS CASSETTE CHANGEOUT/
DESCENT MODE SETUP

DAY 7 PROCEDURE

- 1 Verify MODE CONTROL switch - OFF.
- 2 Push left and right cassette panel (PUSH OPEN) buttons to open tape cover.
- 3 Press left cassette (PRESS BUTTON) button; use cloth tab to disengage head; pull slide bar down; remove tape.
- 4 Place temporarily in flight suit pocket.
- 5 Repeat Step 3 for right cassette.
- 6 Label used tapes with time and date.
- 7 Exchange used tapes with new tapes from stowage rack 3.
- 8 Label new tapes with date and time.

NOTE:

TAPE MUST BE SEATED CORRECTLY TO RECORD INFORMATION.

- 9 Install new tapes. Assure that tape is laying flat against the back recorder wall and that blue spools do not touch tape. Spools should be visible evenly around the hub.
- 10 Push tape slide bar up while holding cassette flat against recorder back. Ensure BUTTONS are at full out position by inspection.
- 11 Close cover. Lock by pushing 2 (PUSH OPEN) buttons partially in. Ensure two pushbuttons are locked.
- 12 Set MODE CONTROL switch - DESCENT; descent light will illuminate.
- 13 Push TAPE TEST button and release. (DESCENT light goes off while tape test button is depressed. Verify tape movement by visual inspection.