

NATIONAL ACADEMY OF SCIENCES

SPACE SCIENCE BOARD

INTERIM REPORT

SKYLAB-2 MEDICAL STATUS

JULY 24, 1973

DR. CHARLES A. BERRY

NASA DIRECTOR FOR LIFE SCIENCES

LONG DURATION MANNED MISSIONS

UNITED STATES

GEMINI 5	8 DAYS
GEMINI 7	14 DAYS
APOLLO 7-17	8-12.5 DAYS
SKYLAB 2	28 DAYS

SOVIET

SOYUZ 9	18 DAYS
SOYUZ 11/SALYUT	24 DAYS

MANHOURS OF MANNED SPACE FLIGHT

UNITED STATES

APOLLO 7 - 17

7508

SKYLAB 2

2016

TOTAL U.S. (ALL MISSIONS) *

11524

SOVIET

SOYUZ 9

850

SOYUZ 11/SALYUT

1686.2

TOTAL SOVIET (ALL MISSIONS) **

4377.2

* INCLUDES MERCURY, GEMINI, APOLLO AND SKYLAB

** INCLUDES VOSTOK, VOSKHOD, SOYUZ/SALYUT

MM7/10/73

CENTRAL NERVOUS SYSTEM

	<u>UNITED STATES</u> <u>(THROUGH APOLLO)</u>	<u>SOVIET UNION</u>	<u>SKYLAB-I</u>
<u>SLEEP</u>	<u>INFLIGHT</u> VARIABLE QUALITY AND DURATION <u>POSTFLIGHT</u> NORMAL <u>RECOVERY</u> IMMEDIATE	<u>INFLIGHT</u> NORMAL REPORTS OF SLEEP <u>POSTFLIGHT</u> NORMAL <u>RECOVERY</u> NO CHANGE FROM PRE- FLIGHT	<u>INFLIGHT</u> GOOD QUALITY - DECREASED DURATION <u>POSTFLIGHT</u> NORMAL <u>RECOVERY</u> NOT APPLICABLE
<u>VESTIBULAR</u>	<u>INFLIGHT</u> VARIABLE SYMPTOMS ONSET IN APOLLO. STABILIZED IN 5 DAYS <u>POSTFLIGHT</u> GRADUAL DIMINISHING SYMPTOMS <u>RECOVERY</u> 3 TO 4 DAYS	<u>INFLIGHT</u> FREQUENT REPORT OF SYMPTOMS ? STABILIZED IN 3 - 5 DAYS <u>POSTFLIGHT</u> GRADUAL DIMINISHING SYMPTOMS <u>RECOVERY</u> 3 TO 4 DAYS	<u>INFLIGHT</u> HEAD FULLNESS - ADAPTA- TION TO ZERO G - MARKED INCREASE IN TOLERANCE TO MOTION SENSITIVITY <u>POSTFLIGHT</u> READAPTATION TO ONE G <u>RECOVERY</u> PERSISTENCE OF INCREASED TOLERANCE TO MOTION SENSITIVITY THROUGH R + 8

FLUID & ELECTROLYTE BALANCE

UNITED STATES
(THROUGH APOLLO)

INFLIGHT

DATA NOT AVAILABLE

POSTFLIGHT

DECREASE IN TOTAL BODY
WATER. DECREASE IN
INTRACELLULAR FLUID.
DECREASE IN EXCHANGE-
ABLE POTASSIUM.
RETENTION OF FLUIDS
AND ELECTROLYTE

RECOVERY

FLUID REPLACEMENT AVERAGE
50-72% IN 24 HOURS.
GRADUAL REPLACEMENT,
REMAINING FLUID AND
BODY TISSUES

SOVIET UNION

INFLIGHT

DATA NOT AVAILABLE

POSTFLIGHT

NO INDICATION OF THESE
MEASUREMENTS BEING MADE.
RETENTION OF FLUIDS &
ELECTROLYTES

RECOVERY

RAPID RECOVERY

SKYLAB-I

INFLIGHT

INTAKE & OUTPUT ADEQUATE.
ELECTROLYTE INTAKE NEAR NORMAL.
INCREASED K, Na, N, Ca LOSS.
BODY RESPONDING TO STRESSES
THROUGH MISSION. HEAT STRESS
COMPLICATES ASSESSMENT.

POSTFLIGHT

TOTAL BODY EXCHANGEABLE
POTASSIUM REDUCED BY 6-8%.
RENAL FUNCTION MAINTAINED.
BODY SYSTEMS & PROTECTIVE
MECHANISMS WERE ACTIVE
THROUGHOUT MISSION (ALDOSTERONE,
EPINEPHRINE, NOREPINEPHRINE,
CORTISOL, ANTIDIURETIC HORMONE)

RECOVERY

POSTFLIGHT SAMPLE EXAMINATION
CONTINUING.
RECOVERY TO PREFLIGHT LEVELS
PROLONGED BUT CONTINUING

CARDIOVASCULAR SYSTEM

	<u>UNITED STATES</u> <u>(THROUGH APOLLO)</u>	<u>SOVIET UNION</u>	<u>SKYLAB-I</u>
<u>1. ORTHOSTATIC TOLERANCE</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>
(HEART RATE, BLOOD PRESSURE, TILT TABLE &/OR LOWER BODY NEGATIVE PRESSURE TOLERANCE, TENDENCY TOWARD SYNCOPE)	NOT AVAILABLE	DECREASED TOLERANCE IN SALYUT (13 DAYS)	INDIVIDUAL VARIABILITY - DECREASED TOLERANCE
	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>
	ROUTINELY DECREASED	ROUTINELY DECREASED	ROUTINELY DECREASED
	<u>RECOVERY</u>	<u>RECOVERY</u>	<u>RECOVERY</u>
	VARIABLE DURATION MOST RECOVERED WITHIN 72 HOURS. MAXIMUM 5-10 DAYS	RETURN TO NORMAL ON 11TH DAY (SOYUZ 9)	EXTENDED PERIOD OF RECOVERY ESSENTIALLY RETURN TO PREFLIGHT BY 20-24 DAYS
<u>2. BLOOD VOLUME</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>
	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>
	REDUCED IN MOST CREW- MEN. VARIABLE FIND- INGS AS TO WHETHER LOSS IN PLASMA OR CELL MASS OR BOTH	BY CALCULATION - GENERALLY REDUCED OR UNCHANGED	RED CELL MASS REDUCED IN 3. PLASMA VOLUME UNCHANGED
	<u>RECOVERY</u>	<u>RECOVERY</u>	<u>RECOVERY</u>
	7-14 DAYS	<u>RAPID RECOVERY</u>	RECOVERY INCOMPLETE AFTER 14 DAYS

NEUROMUSCULAR SYSTEM

	<u>UNITED STATES</u> <u>(THROUGH APOLLO)</u>	<u>SOVIET UNION</u>	<u>SKYLAB-I</u>
<u>WORK CAPACITY</u>	<u>INFLIGHT</u> MAINTAINED <u>POSTFLIGHT</u> REDUCED <u>RECOVERY</u> USUALLY 3 - 4 DAYS APOLLO 15 - UP TO 13 DAYS	<u>INFLIGHT</u> MAINTAINED <u>POSTFLIGHT</u> REDUCED <u>RECOVERY</u> RETURN TO NORMAL IN 3 - 8 DAYS	<u>INFLIGHT</u> MAINTAINED <u>POSTFLIGHT</u> REDUCED <u>RECOVERY</u> RETURN TO PREFLIGHT IN 20 - 24 DAYS
<u>MUSCLE ACHES & PAIN</u>	<u>INFLIGHT</u> INFREQUENT BACKACHE <u>POSTFLIGHT</u> NO SYMPTOMS <u>RECOVERY</u> NOT APPLICABLE	<u>INFLIGHT</u> NONE REPORTED <u>POSTFLIGHT</u> MUSCLE SORENESS & ACHES R + L. MUSCLE ATROPHY - FEELING OF LIMB HEAVINESS <u>RECOVERY</u> INCREASED PAIN UNTIL R + 5 DAY THEN IMPROVED - HEAVINESS 5 - 10 DAYS	<u>INFLIGHT</u> NONE REPORTED <u>POSTFLIGHT</u> MUSCLE SORENESS (CALF, BACK & BUTTOCKS). KNEE JOINT PAIN - FEELING OF HEAVINESS <u>RECOVERY</u> VARIABLE - SOME SYMPTOMS FOR 7 DAYS (CALF SORE- NESS) - HEAVINESS DISAPPEARED 2-3 DAYS

NEUROMUSCULAR SYSTEM (CONT'D)

	<u>UNITED STATES</u> <u>(THROUGH APOLLO)</u>	<u>SOVIET UNION</u>	<u>SKYLAB-I</u>
<u>MUSCLE STRENGTH & SIZE</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>
	NOT DONE	DECREASED	CALF SIZE DECREASED
	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>
	CALF SIZE REDUCED	MUSCLE ATROPHY REPORTED	CALF SIZE DECREASED
	<u>RECOVERY</u>	<u>RECOVERY</u>	<u>RECOVERY</u>
	BEYOND 2 WEEKS	NOT REPORTED	20 - 24 DAYS
<u>REFLEXES</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>	<u>INFLIGHT</u>
	NOT DONE	NOT REPORTED	NORMAL
	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>	<u>POSTFLIGHT</u>
	NORMAL	DECREASED REFLEXES	NORMAL
	<u>RECOVERY</u>	<u>RECOVERY</u>	<u>RECOVERY</u>
	NOT APPLICABLE	RECOVERED IN 2 DAYS	NOT APPLICABLE

OVERALL ASSESSMENT

- PRIME RESPONSE IS IN CARDIOVASCULAR AREA. REDUCED TOLERANCE INFLIGHT TO LBNP
AND HEIGHTENED CVS RESPONSE TO LBNP POSTFLIGHT
- FLUID, ELECTROLYTE AND HORMONAL DATA ANALYSIS PRELIMINARY.
INITIAL DATA INDICATES COMPENSATORY RESPONSE WITH DESIRE TO
MAINTAIN SODIUM, LOSS OF CALCIUM, NITROGEN AND POTASSIUM.
HEIGHTENED STRESS RESPONSE WITH ADEQUATE RESERVE. FINDINGS
CONSISTENT WITH CARDIOVASCULAR ADAPTATION RESPONSE
- LOSS OF RED CELL MASS
- BODY WEIGHT LOSS
- RETURN TO ESSENTIALLY PREFLIGHT LEVEL IN ABOUT THREE WEEKS
- INFLIGHT AND POSTFLIGHT CHANGES NOTED
 - DEGREE NOT EXCESSIVE
 - RETURN TO PREFLIGHT STATUS CONTINUAL

FOR 56-DAY MISSION

- CONTINUE REGULAR INFLIGHT OBSERVATIONS
- ORGANIZE POSTFLIGHT ACTIVITIES TO ACHIEVE A MORE ORDERED COMBINATION OF
MEDICAL, OPERATIONAL AND REHABILITATIVE ACTIVITIES

LOGIC FOR 56 DAY MEDICAL GO DECISION

COMMIT

- o MEDICAL JUDGMENT BASED ON ALL SPACE FLIGHT MEDICAL DATA BASE
- o REVIEW SL-2 PRE-, IN-, POSTFLIGHT DATA
- o R + 21 DATA REVIEW WITH P.I.'S AT JSC JULY 17, 1973
- o MANAGEMENT REVIEWS AND DECISION

CONTINUE

- o CONTINUOUS SURVEY SL-3 INFLIGHT DATA
- o MID-MISSION DATA REVIEW WITH P.I.'S WEEK OF AUGUST 20, 1973
- o WEEKLY REVIEWS FOR SEVEN DAY CONTINUATION
- o COUNTERMEASURE: ANTIHYPOTENSIVE COUNTER PRESSURE GARMENT
- o POSTFLIGHT: MORE ORDERED COMBINATION OF MEDICAL, OPERATIONAL AND
REHABILITATIVE ACTIVITIES