0G Human Factors and Habitability

- Overview
- Required Crew Volumes
- Human Physiological Adaptation to 0G
- Workstation Design
- Restraint Design
- Ideal Cabin Layout
- Stowage
Mercury Spacecraft Interior Layout

- Fuel Supply
- Batteries
- .05G Accelerometer
- Antenna
- Reserve Parachute
- Auto Pitch Thrusters
- Manual Pitch Thrusters
- Drogue Parachute
- Roll Horizon Sensor
- Pitch Horizon Sensor
- De-stabilizing Flap
- Periscope
- Main Parachute
- Auto Pitch Thrusters
- Manual Pitch Thrusters

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Human Factors and Habitability
Space Life Support and Human Factors
Gemini 4 Crew Cabin
Apollo Spacecraft (Rescue Configuration)
Required Habitable Volume

From Nicogossian et. al., *Space Biology and Medicine, Vol. II: Life Support and Habitability*, AIAA, 1994
OG Neutral Body Posture

OG Restrained Reach Envelope

From Nicogossian et. al., *Space Biology and Medicine, Vol. II: Life Support and Habitability*, AIAA, 1994

Human Factors and Habitability
Space Life Support and Human Factors
Minimum Translation Paths (IVA)

Pass-through

81 cm
(32 in.)

183 cm
(72 in.)

Standard Passageway

81 cm
(32 in.)
OG Workstation Layout

95 PERCENTILE MALE, 20 INCH EYEPONINT

5 PERCENTILE FEMALE, 16 INCH EYEPONINT

From Nicogossian et. al., *Space Biology and Medicine, Vol. II: Life Support and Habitability*, AIAA, 1994
ISS Robotic Work Station
ISS TORU Work Station
Skylab Chair Restraint

Skylab Table Restraints

Isogrid Flooring Design

0.435 INCH DIA. HOLE AT EACH INTERSECTION

0.444 INCH

0.250 INCH RADIUS (TYPICAL)

0.080 ± 0.015 INCH (TYPICAL)

4,200 INCHES (TYPICAL)

60° (TYPICAL)

MADE FROM HALF-INCH ALUMINUM PLATE, MACHINED TO 0.400 INCH THICKNESS

Cleat Restraint System

Skylab Triangle Cleat
EVA Foot Restraints

Skylab Exterior Configuration

General characteristics
- Conditioned work volume: 12,700 ft³
- Overall length: 117 ft
- Weight (including CSM): 199,750 lb
- Width (of orbital workshop including solar array): 90 ft

- Solar panels
- Experiments
- Micrometeoroid shield
- Ward room
- Waste compartment
- Sleep compartment
- Workshop
- Command and service module
- Docking adapter
- Solar observatory
- Airlock module
Skylab Orbital Work Shop Interior

SKYLAB ORBITAL WORKSHOP

ENTRY HATCH A
AIRLOCK INTERFACE

LOCKER STOWAGE

RADIANT HEATER

FILM VAULTS

ASTRONAUT MANEUVERING UNITS

M600 RACK PACK
HANG OPERATED

TOW-HOOK MOUNTED

CONTROL & DISPLAY PANEL

LOWER BODY NEGATIVE PRESSURE MU-91

LFPM 171 METABOLIC ANALYZER

HUMAN VESTIBULAR FUNCTION M131

GENERAL UTILITY LIGHTS

WATER SUPPLY

URINE RETURN CONTAINERS

ULTRA-VIOLET AIRGLOW HORIZON PHOTOGRAPHY EXP.

NITROGEN STORAGE FOR ASTRONAUT MANEUVERING UNITS

EXPERIMENT SUPPORT SYSTEM

FORWARD COMPARTMENT ACCESS HATCH

SHOWER

WASTE TANK
Looking Down into Orbital Work Shop
Skylab Living Quarters Layout

ORBITAL WORKSHOP
CREW QUARTERS INSTALLATIONS

WASTE MANAGEMENT
COMPARTMENT 30 SQ FT

WARDROOM
100 SQ FT

EXPERIMENT
COMPARTMENT
180 SQ FT

M171 GAS
ANALYZER

II

III

M131 CHAIR
CONTROL

M131 STOWAGE
CONTAINER

M131 ROTATING
CHAIR

ELECTRICAL POWER
CONTROL CONSOLE

I

II

III

IV

SLEEP COMPARTMENT
70 SQ FT

MO92 LBNPD

NASA-S-73-1066
Skylab Wardroom Layout


University of Maryland

Human Factors and Habitability
Space Life Support and Human Factors
Dinner on ISS
Thanksgiving Dinner on ISS
Skylab Waste Management Compartment
Skylab Shower
Skylab Sleep Restraints
Stowage

- Number of items stowed proportional to volume, crew size, duration, complexity of mission
  - Mercury: 48 items
  - Gemini: 196
  - Apollo: 1727
  - Shuttle: 2600
  - Skylab: 10,160
  - ISS: >20,000

- After you stow it, how do you find it?
Stowage on ISS

Human Factors and Habitability
Space Life Support and Human Factors
Space Shuttle Stowage for Entry
Space Shuttle Stowage for Entry
Psychosocial Issues

• Scheduling and planning
• Recreation
• Command structure
• Issues affecting crew morale
  - Environment
  - Food and drink
  - Exercise
  - Hygiene
  - Noise
  - Lighting
Exercise (and Stowage) on ISS
International Space Station
A Tour of ISS