

Space 2012



Living in Space

Monsi Roman

Environmental Control and Life Support Group—NASA/MSFC

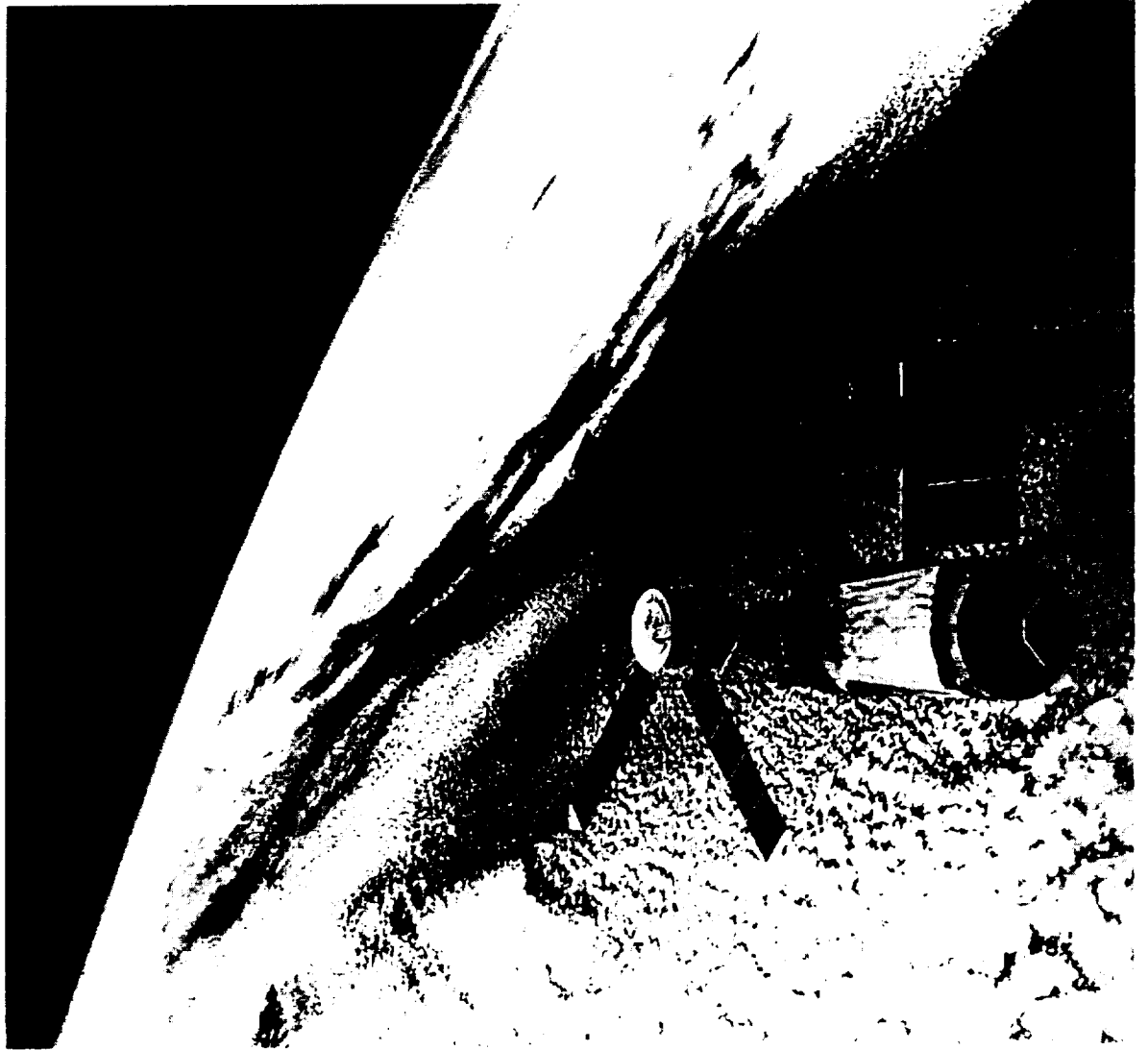


Apollo 11 Lift-Off



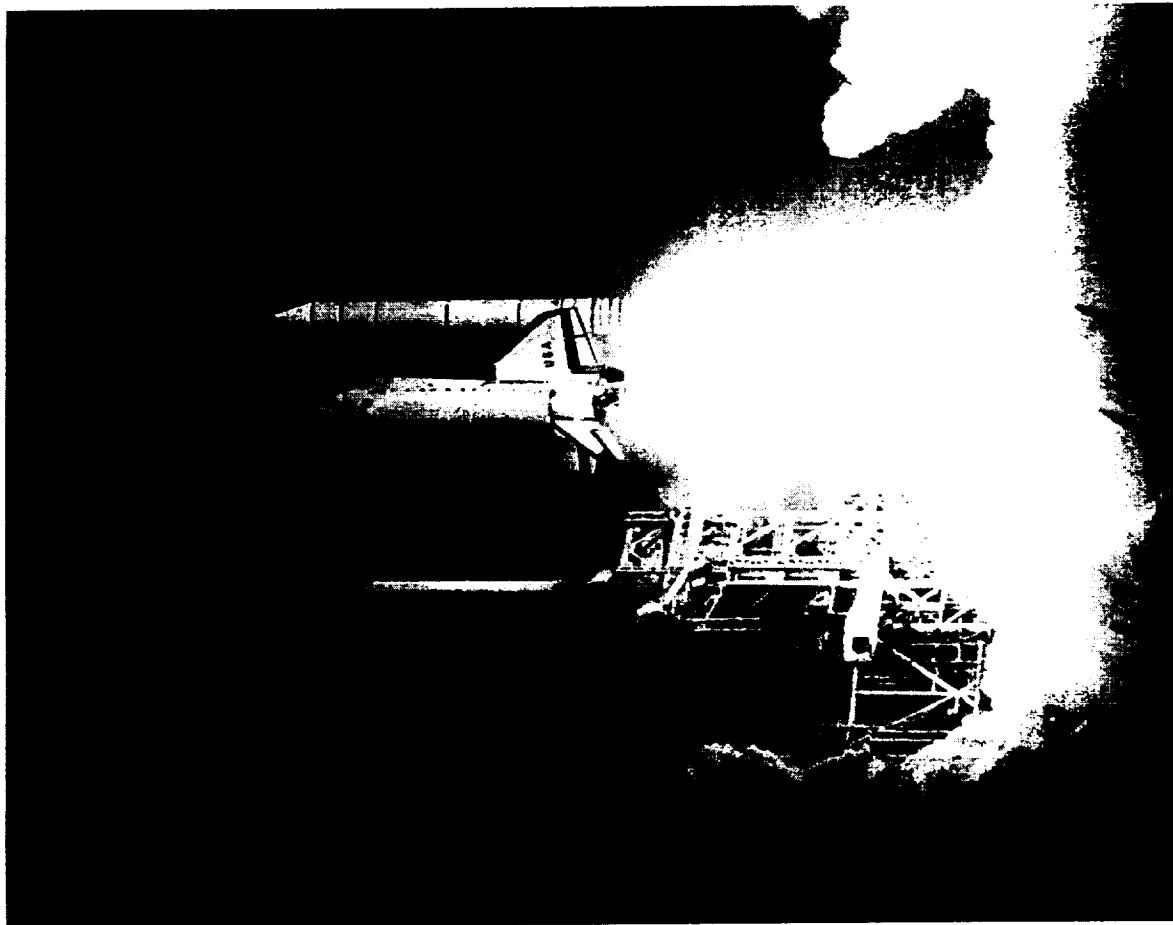
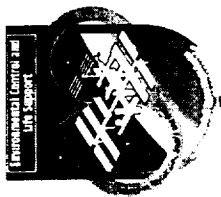


Skylab





Space Shuttle





International Space Station

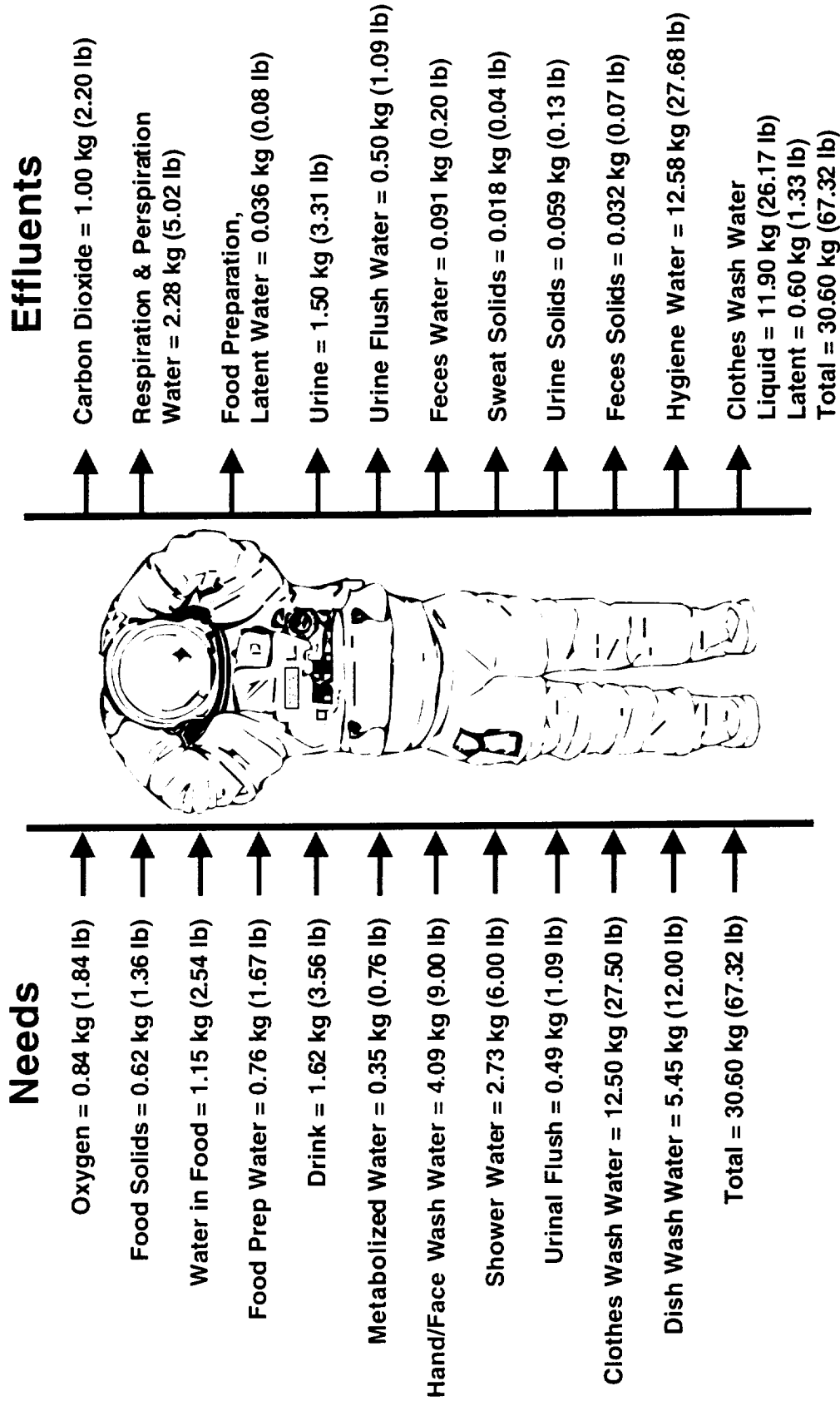




MSFC Environmental Control and Life Support Group



Human Needs and Effluents Mass Balance (per person per day)



Note: These values are based on an average metabolic rate of 136.7 W/person (11,200 BTU/person/day) and a respiration quotient of 0.87.

The values will be higher when activity levels are greater and for larger than average people. The respiration



MSFC Environmental Control and Life Support Group

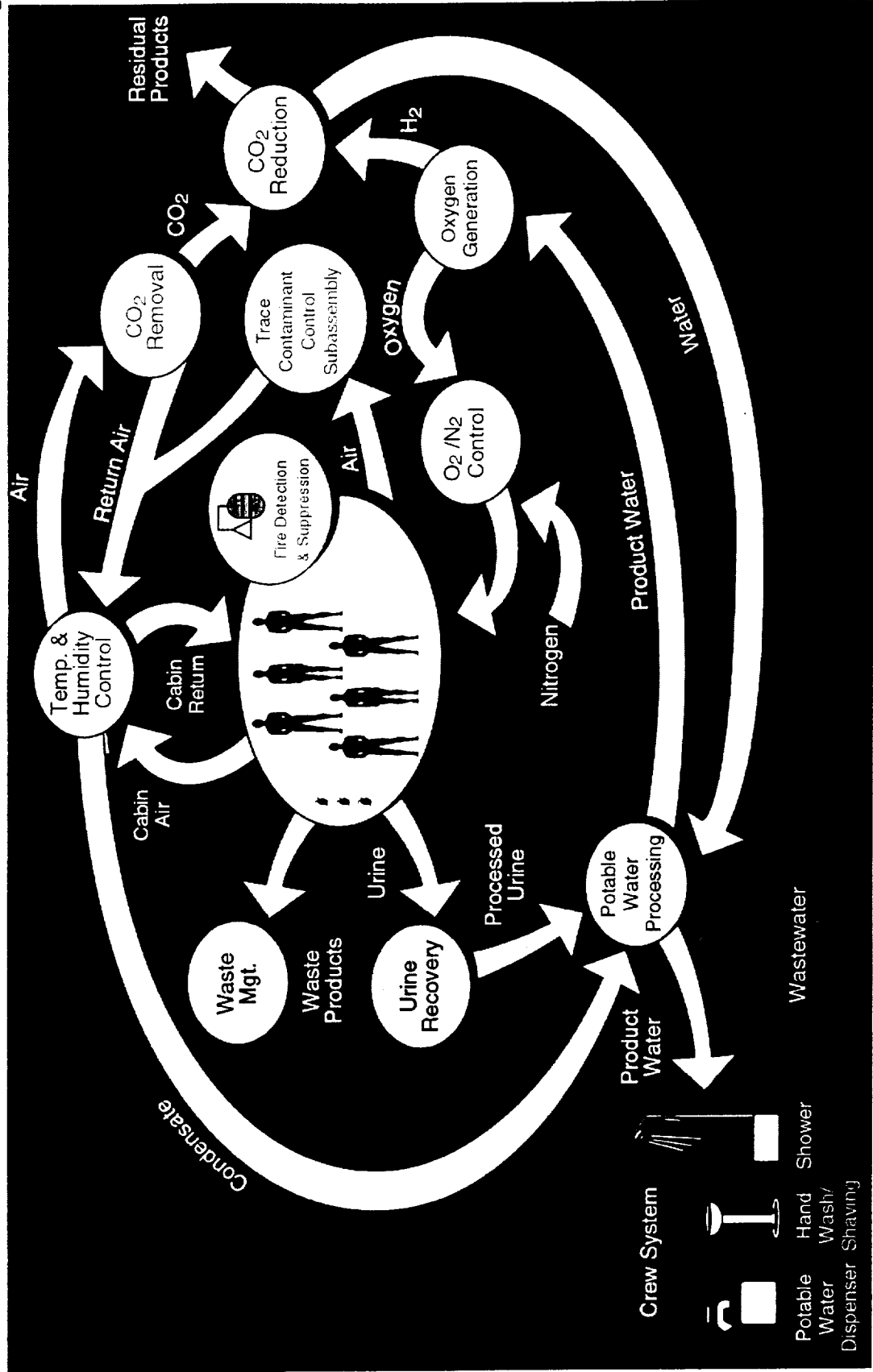


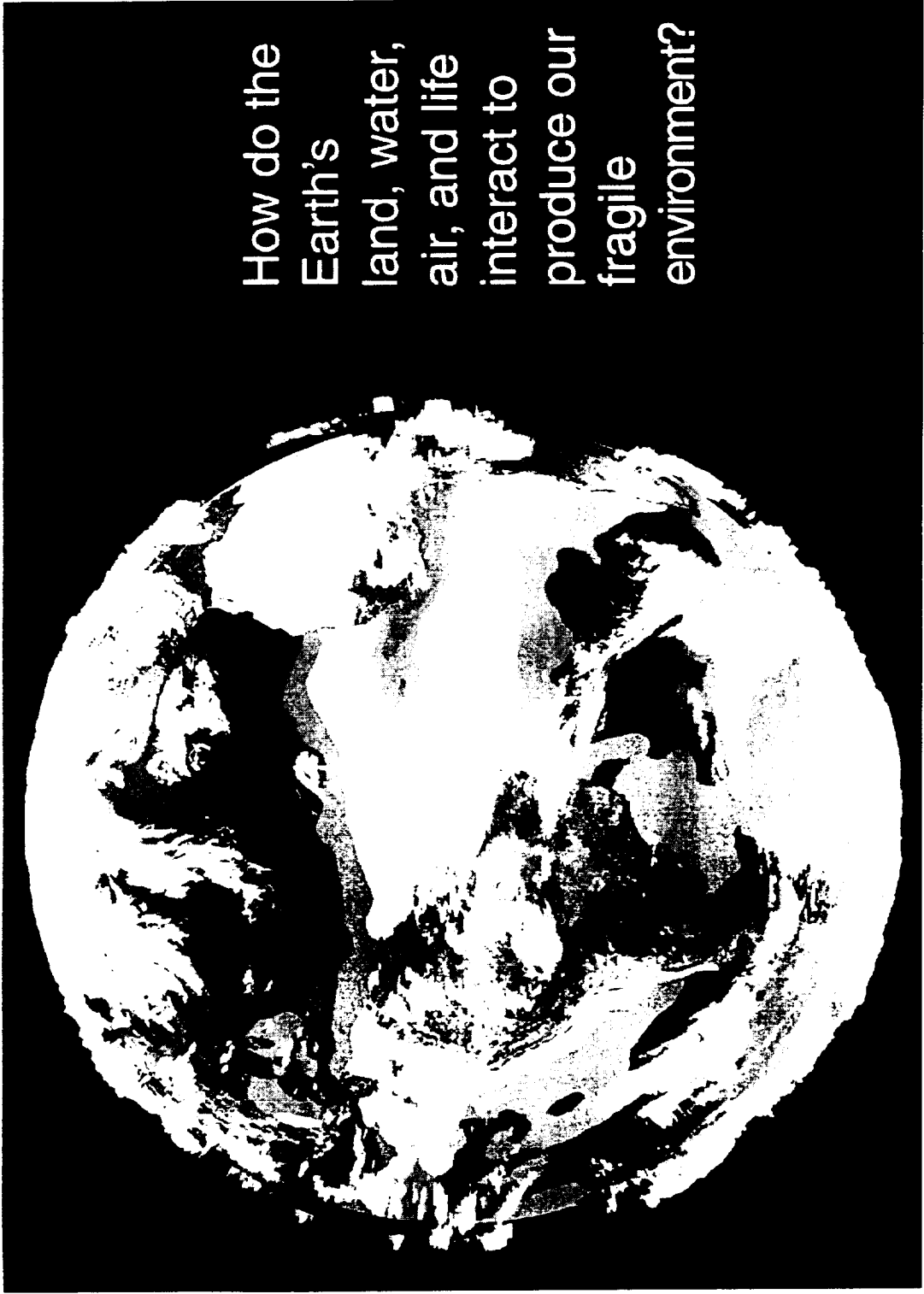
ECLS System Capabilities to Hardware Implementation

Control Atmosphere Pressure	Condition Atmosphere	Respond to Emergency Conditions	Control Internal CO ₂ & Contaminants	Provide Water	Prepare for EVA Operations
<ul style="list-style-type: none"> • O₂/N₂ Pressure Control Assemblies (USO/RS) • Positive & Negative Pressure Relief (USOS-Transport) • O₂/N₂ Storage (USOS, RS, Progress) • O₂ Generation Assembly, O₂ Solid Chemicals (RS) • Major Constituent Analyzer (USOS) (Share) • Gas Analyzer (RS) (Shared) 	<ul style="list-style-type: none"> • Cabin Air Temperature & Humidity Control Assemblies (All) • Ventilation Fans (USOS, RS, MPLM) • Air Particulate Filters (All) • Intermodule Ventilation Fans & Valves (All) • Ducting (All) 	<ul style="list-style-type: none"> • Smoke Detectors (All) • Portable Fire Extinguishers (All) • Fire Indicators and Fire Suppression Ports (All) • Portable Breathing Apparatus and Masks (All) • O₂/N₂ Pressure Control Assemblies (USOS) (Shared) 	<ul style="list-style-type: none"> • CO₂ Removal Assembly (USOS/RS) • CO₂ Vent (USOS/RS) • Trace Contaminant Control Assembly (USOS/RS) • Major Constituent Analyzer (USOS) • CO₂ Reduction Assembly (RS) • CO₂ LiOH Removal (RS) • Manual Sampling Equipment (USOS) • Gas Analyzer (RS) 	<ul style="list-style-type: none"> • Potable Water Processor (USOS/RS) • Urine Processor (USOS/RS) • Process Control Water Quality Monitor (USOS) • Condensate Storage (USOS/RS) • Fuel Cell Water Storage (USOS) • Waste Water Distribution (USOS) • Hygiene Water Processor (RS) 	<ul style="list-style-type: none"> • O₂/N₂ Pressure Control Assemblies (USOS) • O₂/N₂ Distribution (USOS) • O₂/N₂ Storage (USOS) • Major Constituent Analyzer (USOS) (Shared)
Atmosphere Control & Supply (ACS) & AR	Temperature Humidity Control	Fire Detection	Atmosphere Revitalization (AR)	Water Recovery & Mgmt/ Waste Mgmt	ACS & AR



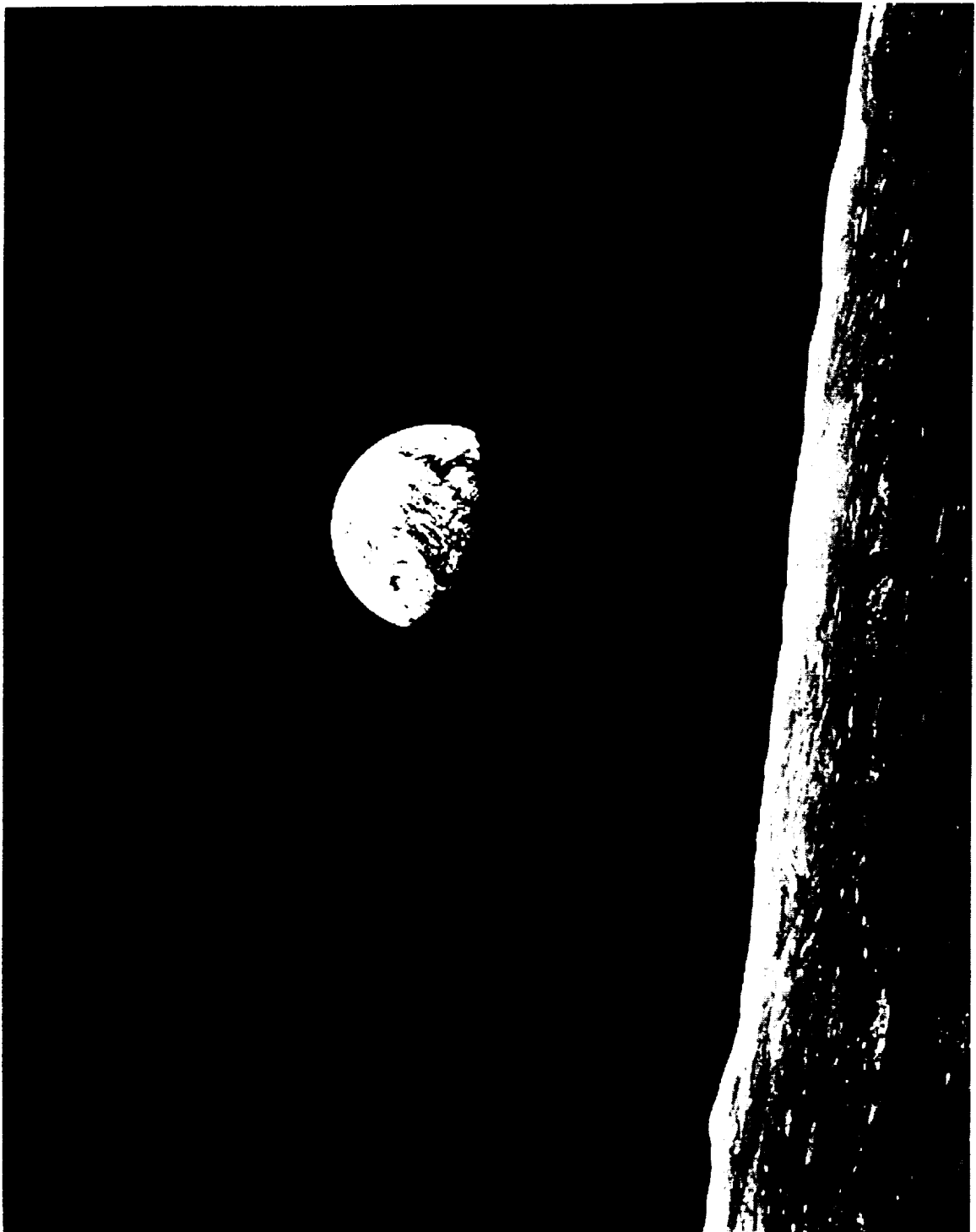
Space Station Regenerative ECLSS Flow Diagram (Baseline and Scarring)





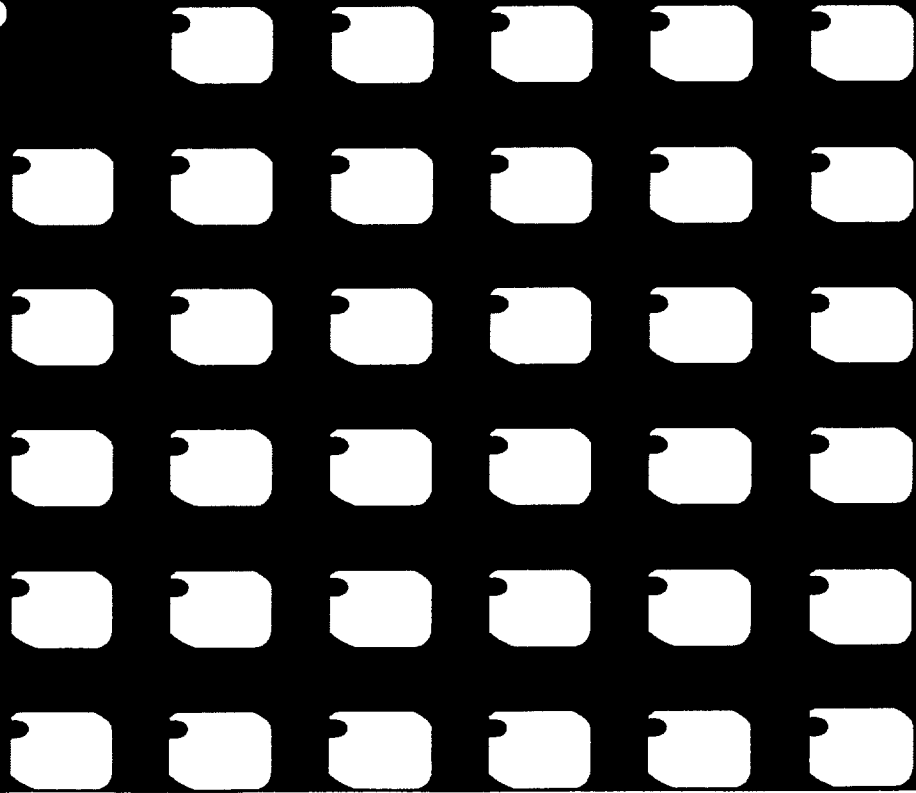
How do the
Earth's
land, water,
air, and life
interact to
produce our
fragile
environment?

This earth image is a compilation of data from several different satellites that remotely sense vegetation, clouds, fires over land, and aerosols over the ocean.





An Average American Uses Almost 35 Gallons of Water Each Day





**An Astronaut on Space Station Needs Only
About 3 Gallons of Water Each Day**

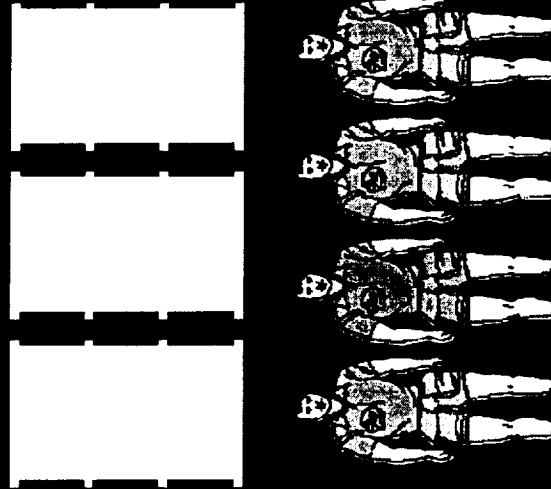
A high-contrast, black and white illustration of an astronaut in a full space suit, standing next to three water jugs. The astronaut is positioned on the left, and the three jugs are arranged on the right. The background is solid black, making the white figures stand out.



International Space Station

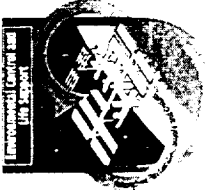


**Four Astronauts On Space Station
Will Need Over 1,000 Gallons of Water Every 90 Days**





International Space Station



**A Water Recycling System Allows the Same Water
to be Used Over and Over Again**



Clean
Water



Dirty
Water



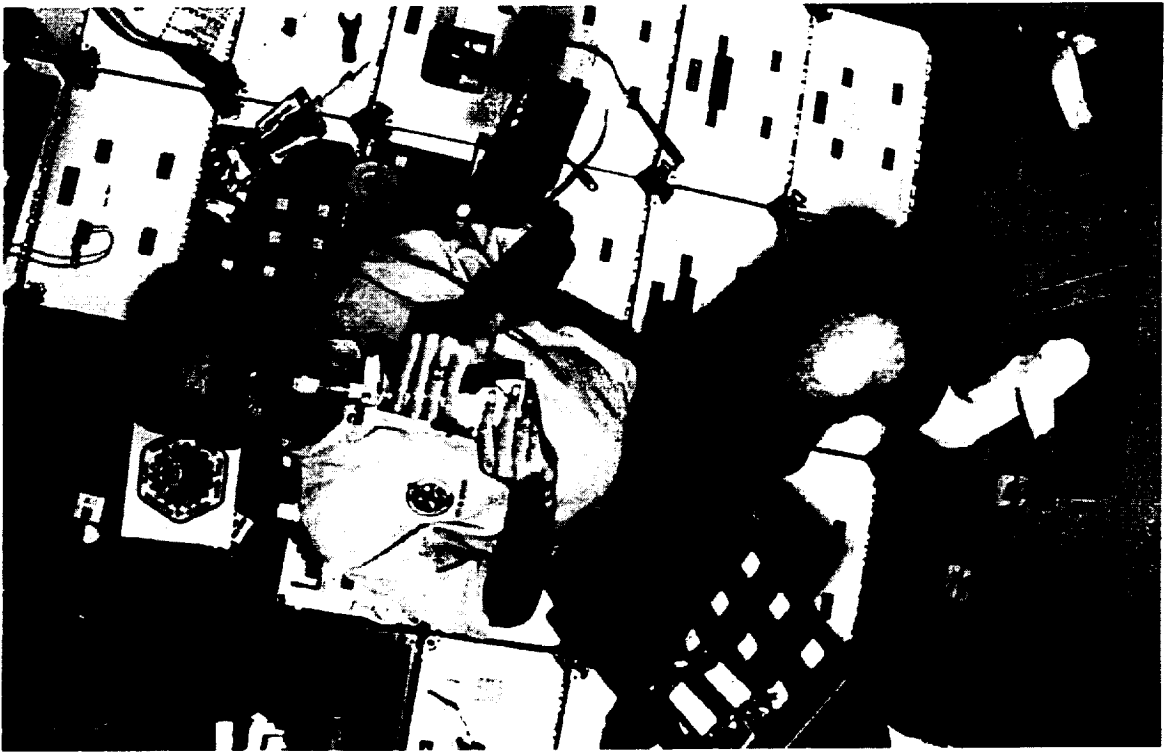
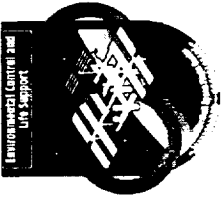
**Water Recycling
System**



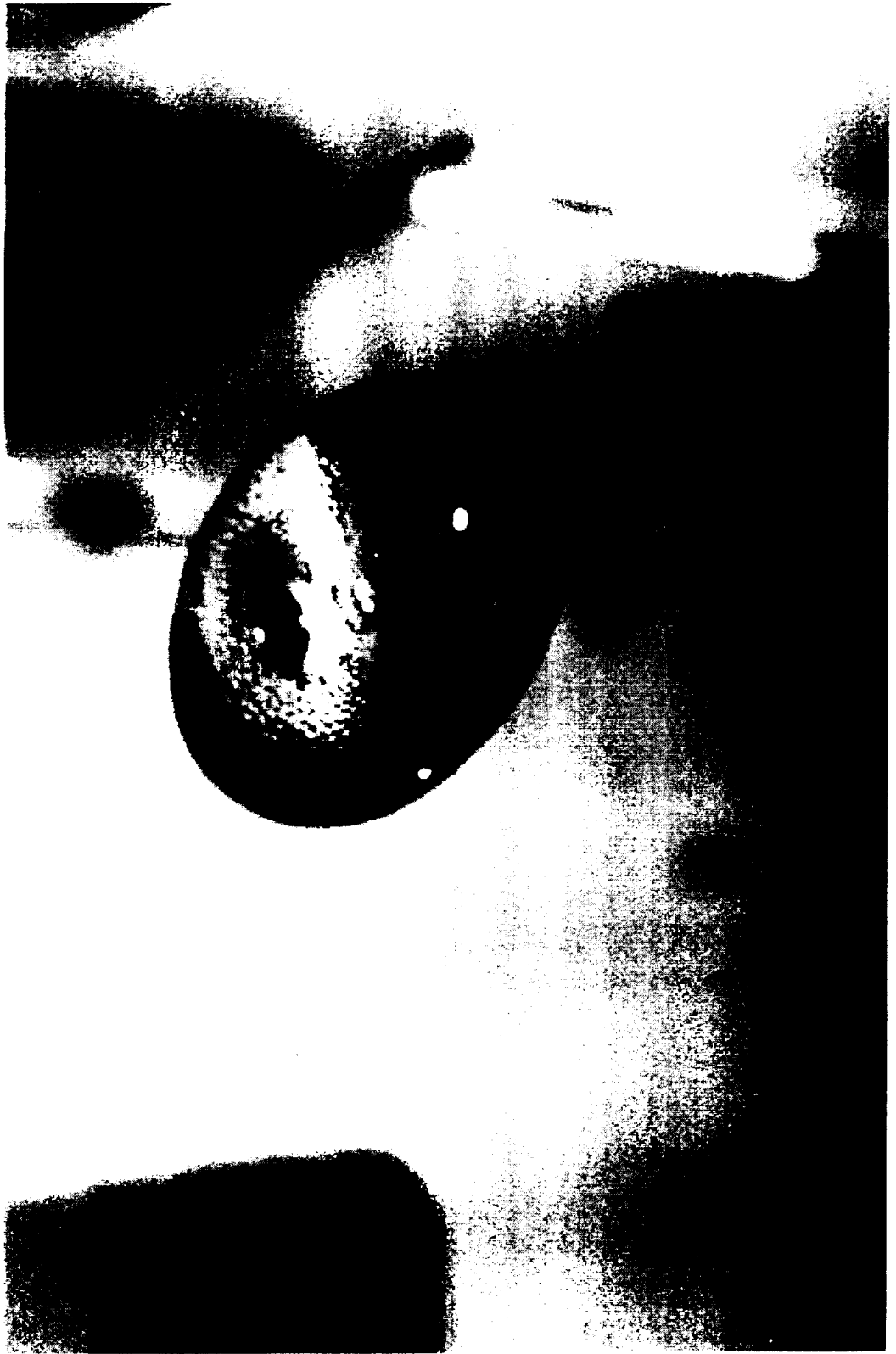








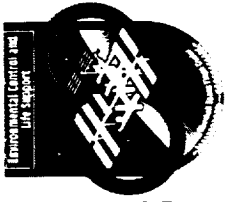




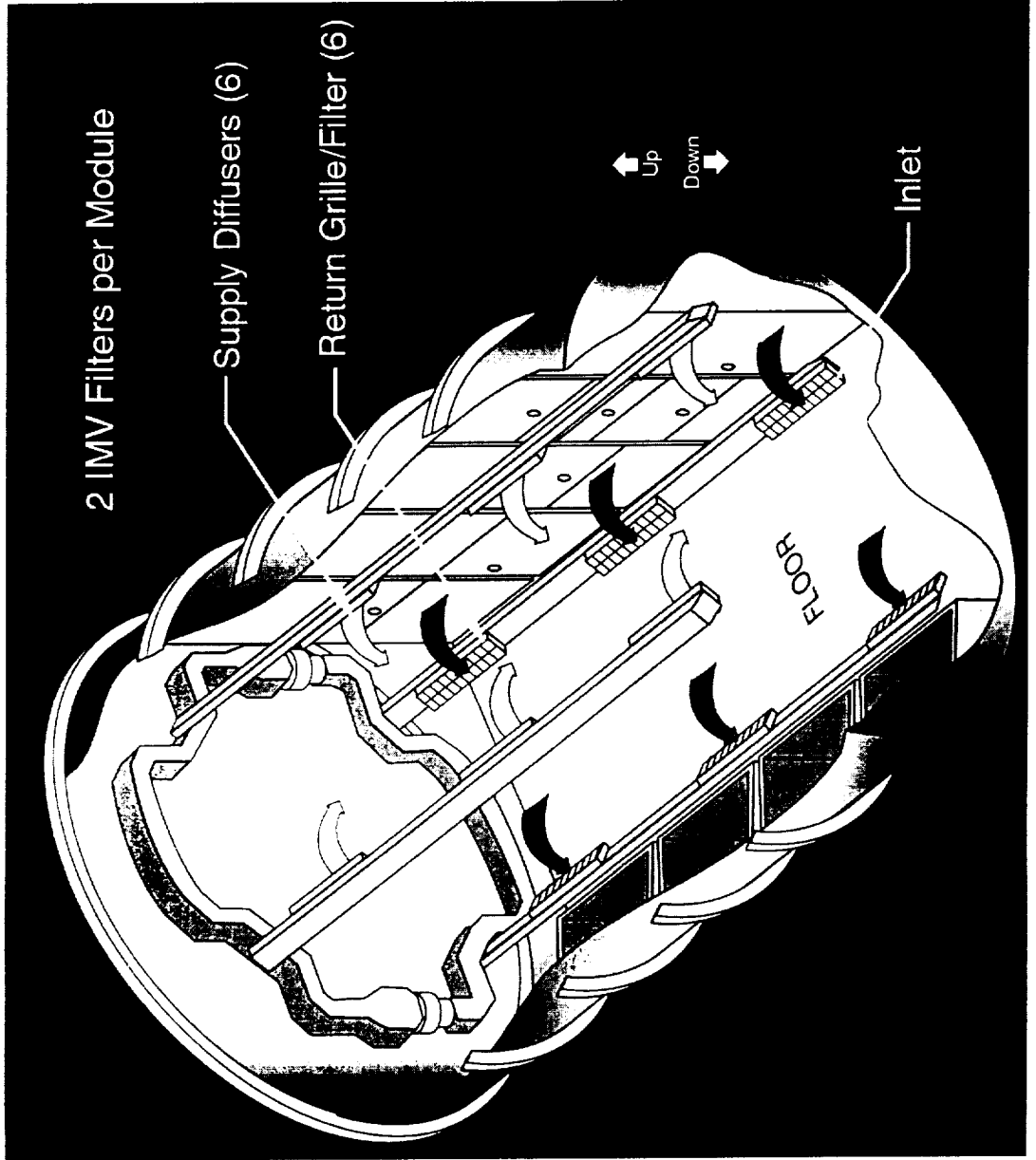




Temperature and Humidity Control



Baseline Cabin Air System

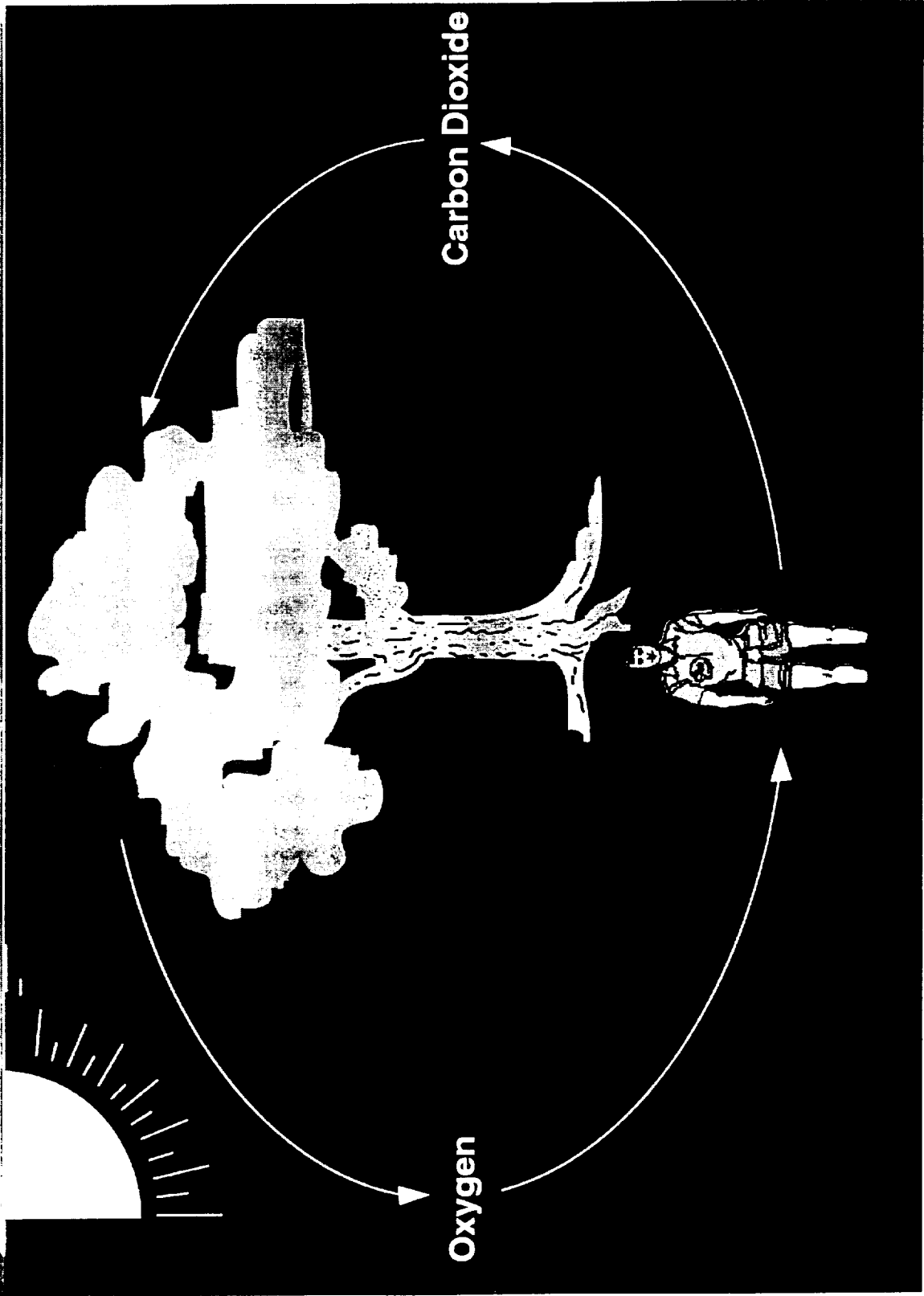






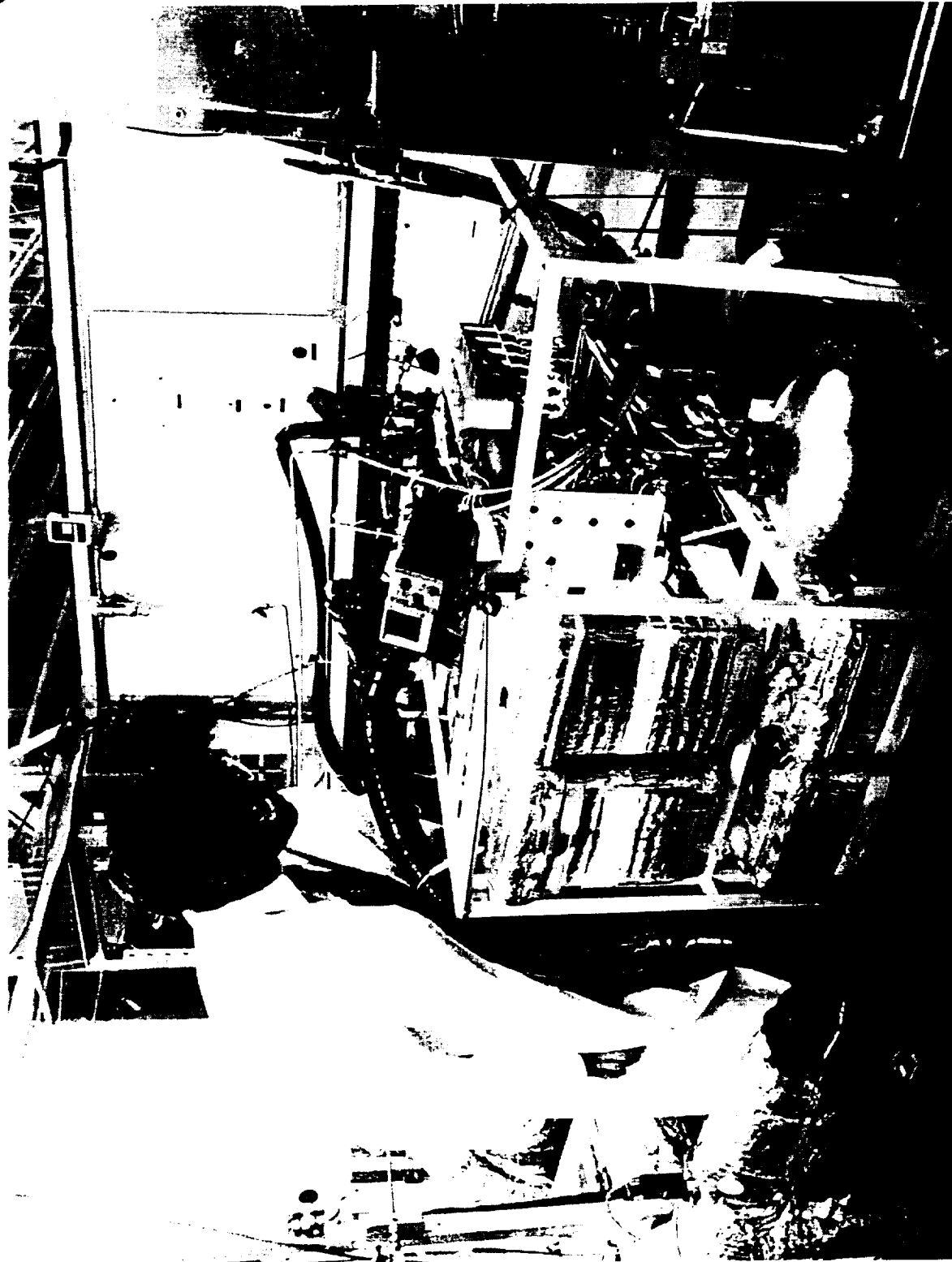
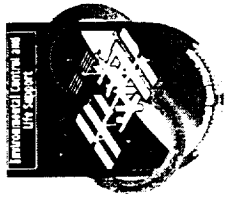


Earth's Air Cycle





Carbon Dioxide Removal Assembly Life Test





Carbon Dioxide Removal Assembly and Metabolic Simulator





ISS U.S. Laboratory 4BMS

