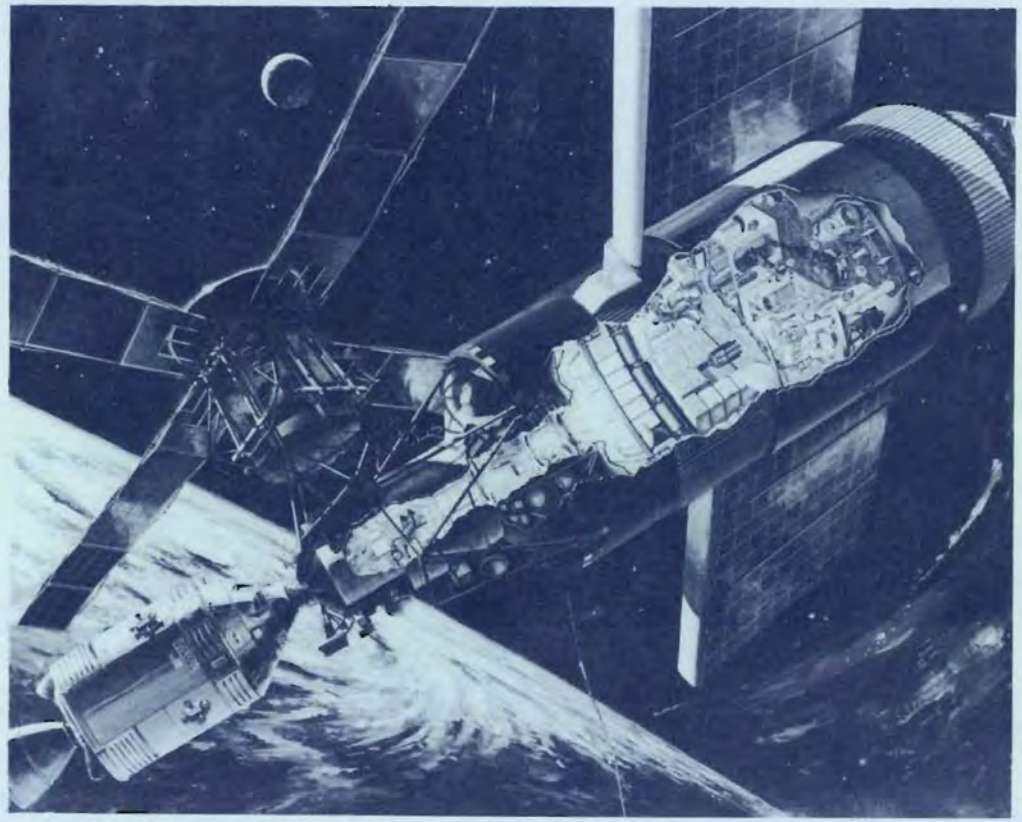
MSFC- SL-73-3

skylab
student project
summary description
march, 1973



GEORGE C. MARSHALL SPACE FLIGHT CENTER

MSFC - One-Time Form 31 (March 1973)

SKYLAB STUDENT PROJECT

SUMMARY DESCRIPTION

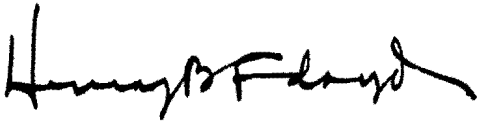
MARCH 1973

GEORGE C. MARSHALL SPACE FLIGHT CENTER

FOREWORD

THIS BROCHURE OFFERS A BRIEF LOOK AT THE SKYLAB STUDENT PROJECT; ..... WHAT IT IS, WHY AND HOW IT ORIGINATED, HOW IT WAS DEVELOPED, AND WHAT IT ATTEMPTS TO ACCOMPLISH.

THIS DOCUMENT IS ISSUED IN ACCORDANCE WITH THE REQUIREMENTS OF SKYLAB PROGRAM DIRECTIVE NUMBER 60 DATED DECEMBER 26, 1972.



HENRY B. FLOYD
PROJECT MANAGER

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INTRODUCTION

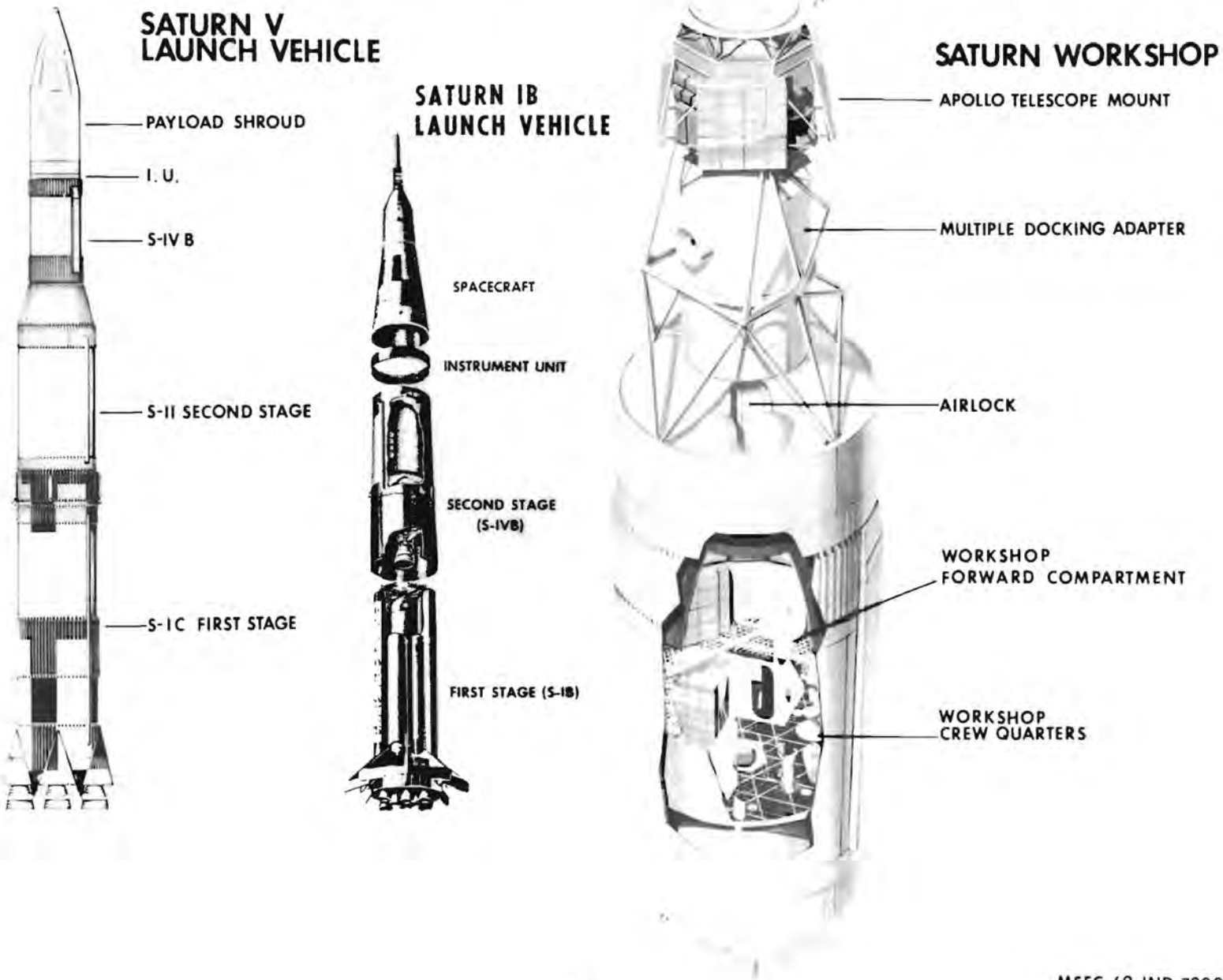
THE SKYLAB STUDENT PROJECT, AS THE NAME IMPLIES, IS A PART OF THE NASA SKYLAB MANNED RESEARCH PROGRAM. THIS PROJECT REPRESENTS AN EFFORT TO PROMOTE THE INTEREST AND INVOLVEMENT OF THE PUBLIC, ESPECIALLY YOUTH IN THE EXPANSION OF SCIENTIFIC RESEARCH AND THE DEVELOPMENT AND UTILIZATION OF THE RESOURCES AND UNIQUE ADVANTAGES OF SPACE, FOR THE BENEFIT OF THE NATION AND THE WORLD.

IN THE FOLLOWING PAGES, THE STUDENT PROJECT IS DESCRIBED FROM ITS ORIGIN WITH NASA AND THE NATIONAL SCIENCE TEACHERS ASSOCIATION (NSTA) THROUGH THE INTRICATE TASKS OF DEVELOPMENT AND INTEGRATION INTO SKYLAB RESEARCH FACILITIES.

INCLUDED IS A COMPREHENSIVE OVERVIEW OF THE TWENTY-FIVE EXPERIMENTS SELECTED BY THE NSTA FROM THE MANY EXCELLENT ENTRIES IN THE STUDENT PROJECT COMPETITION, A DESCRIPTION OF NASA'S EFFORTS TO INCORPORATE ALL OF THE STUDENT EXPERIMENTS WITHIN THE MISSION SCOPE AND CONSTRAINTS OF SKYLAB, AND A BRIEF LOOK AT THE ORGANIZATION MECHANISM THROUGH WHICH THE PROGRAM WAS DEVELOPED.

BUT FIRST, A BRIEF LOOK AT SKYLAB .....

WORKSHOP LAUNCH CONFIGURATION



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SKYLAB ..... WHAT IS IT?

THE SKYLAB, AN OUTGROWTH OF THE APOLLO LUNAR EXPLORATION PROGRAM, REPRESENTS A MAJOR STEP IN THE UTILIZATION OF SPACE FOR THE BENEFIT OF MANKIND. WHEREAS APOLLO MADE THE REALM OF SPACE AVAILABLE TO MAN ..... SKYLAB WILL DETERMINE HOW ITS MANY ADVANTAGEOUS ASPECTS MAY BE USED, BENEFICIALLY, FOR MAN.

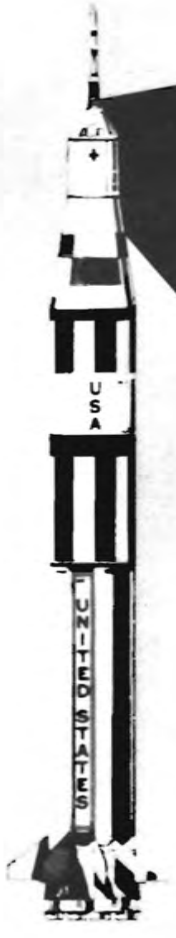
SKYLAB IS A HIGHLY DIVERSIFIED RESEARCH STATION, INCORPORATING FACILITIES FOR RESEARCH IN SOLAR AND STELLAR ASTRONOMY, ASTROPHYSICS, AGRICULATURE, CARTOGRAPHY, FORESTRY, GEOLOGY, WATER RESOURCES MANAGEMENT, MATERIALS TECHNOLOGY AND THE LIFE SCIENCES, AMONG OTHERS.

THE ORBITAL CLUSTER CONSISTS OF THE COMMAND AND SERVICE MODULE (CSM), MULTIPLE DOCKING ADAPTOR (MDA), APOLLO TELESCOPE MOUNT (ATM), AIRLOCK MODULE (AM), INSTRUMENT UNIT (IU), AND THE ORBITAL WORKSHOP (OWS), CONFIGURES AS SHOWN ON PAGE 5.

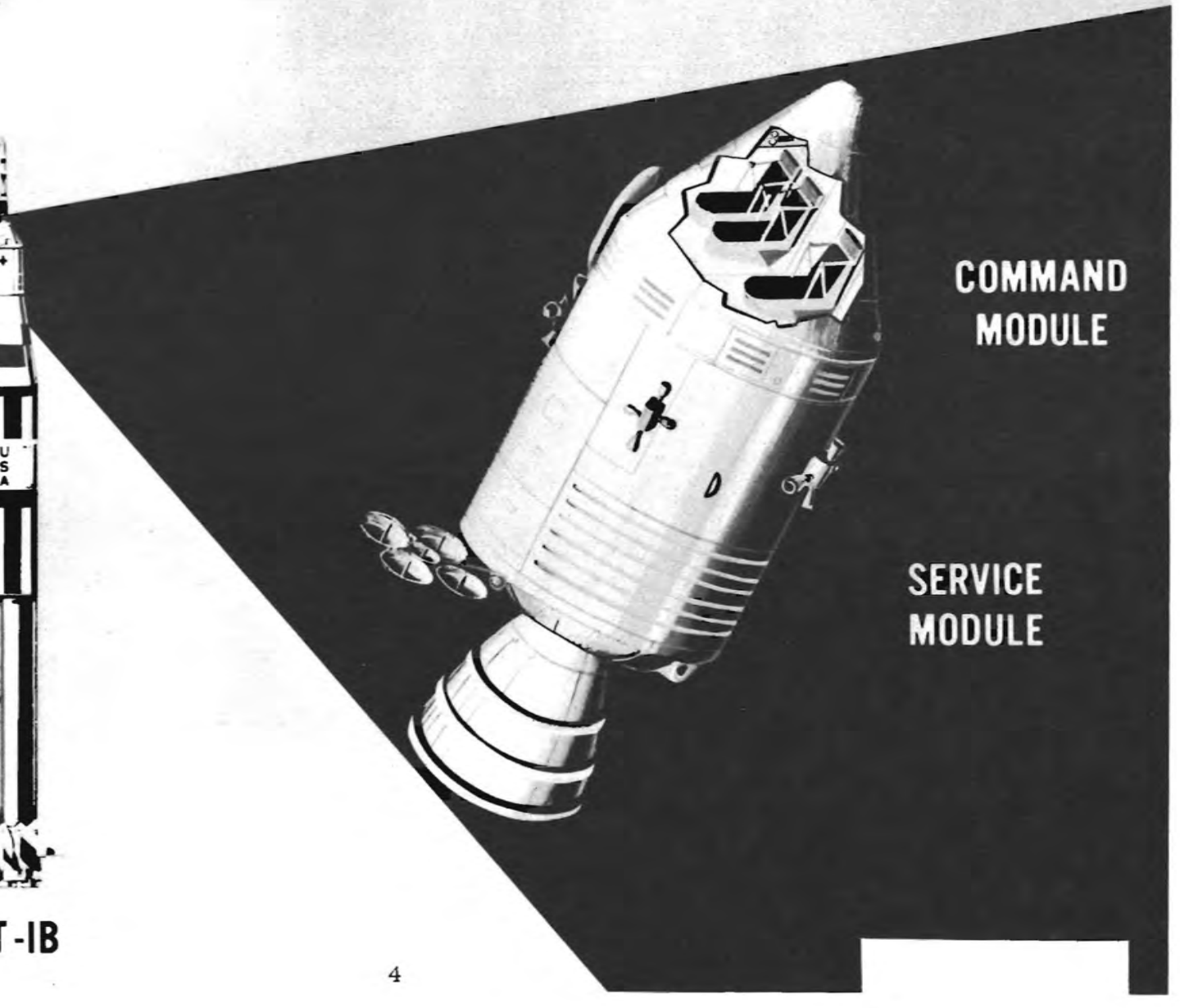
THE SKYLAB PROGRAM REQUIRES FOUR SEPARATE LAUNCHES.

THE FIRST LAUNCH, DESIGNATED SL-1, IS THAT OF THE UNMANNED WORKSHOP. THE BOOSTER UTILIZED IS THE SATURN V, THE SAME VEHICLE WHICH SUCCESSFULLY LAUNCHED THE APOLLO ASTRONAUTS ON THEIR TRIPS TO THE MOON.

SKYLAB 2, 3 & 4 LAUNCH CONFIGURATION



SAT-IB



EACH OF THE THREE SUBSEQUENT LAUNCHES, SL-2, SL-3, AND SL-4, UTILIZES A SATURN IB CONFIGURATION TO PLACE THE COMMAND/SERVICE MODULES, WITH THEIR THREE-MAN CREWS, INTO ORBIT.

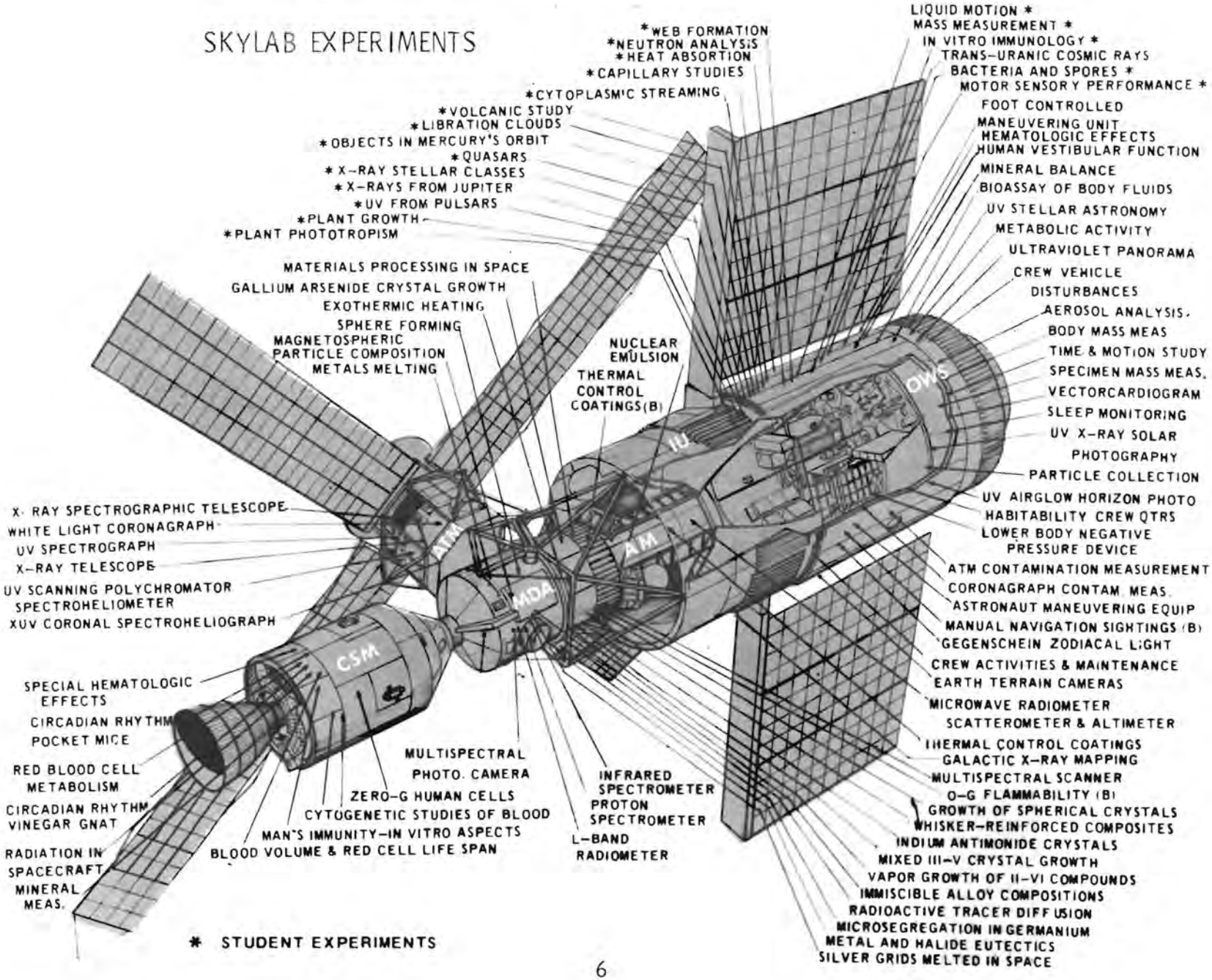
THE FIRST OF THESE, SL-2, FOLLOWS THE SL-1 BY ONE DAY, AND ITS CREW PERFORMS EXPERIMENTATION IN ORBIT FOR TWENTY-EIGHT DAYS BEFORE RETURNING TO EARTH.

AFTER AN APPROXIMATE SIXTY-DAY LAPSE, DURING WHICH MEDICAL DATA IS ANALYZED, SL-3 IS LAUNCHED. ITS CREW WILL REMAIN ON STATION FOR FIFTY-SIX DAYS AND, SUBSEQUENT TO DE-ORBIT, WILL UNDERGO AN EVALUATION PERIOD OF THIRTY DAYS.

FOLLOWING THE SL-3 CREW EVALUATION, THE FINAL (SL-4) CREW WILL BE BOOSTED INTO SPACE AND WILL REMAIN IN ORBIT FOR ANOTHER FIFTY-SIX-DAY TOUR.

RESCUE CAPABILITY IS PROVIDED FOR SL-2 BY SL-3, FOR SL-3 BY SL-4, AND FOR SL-4 BY THE BACKUP FLIGHT.

SKYLAB EXPERIMENTS



* STUDENT EXPERIMENTS

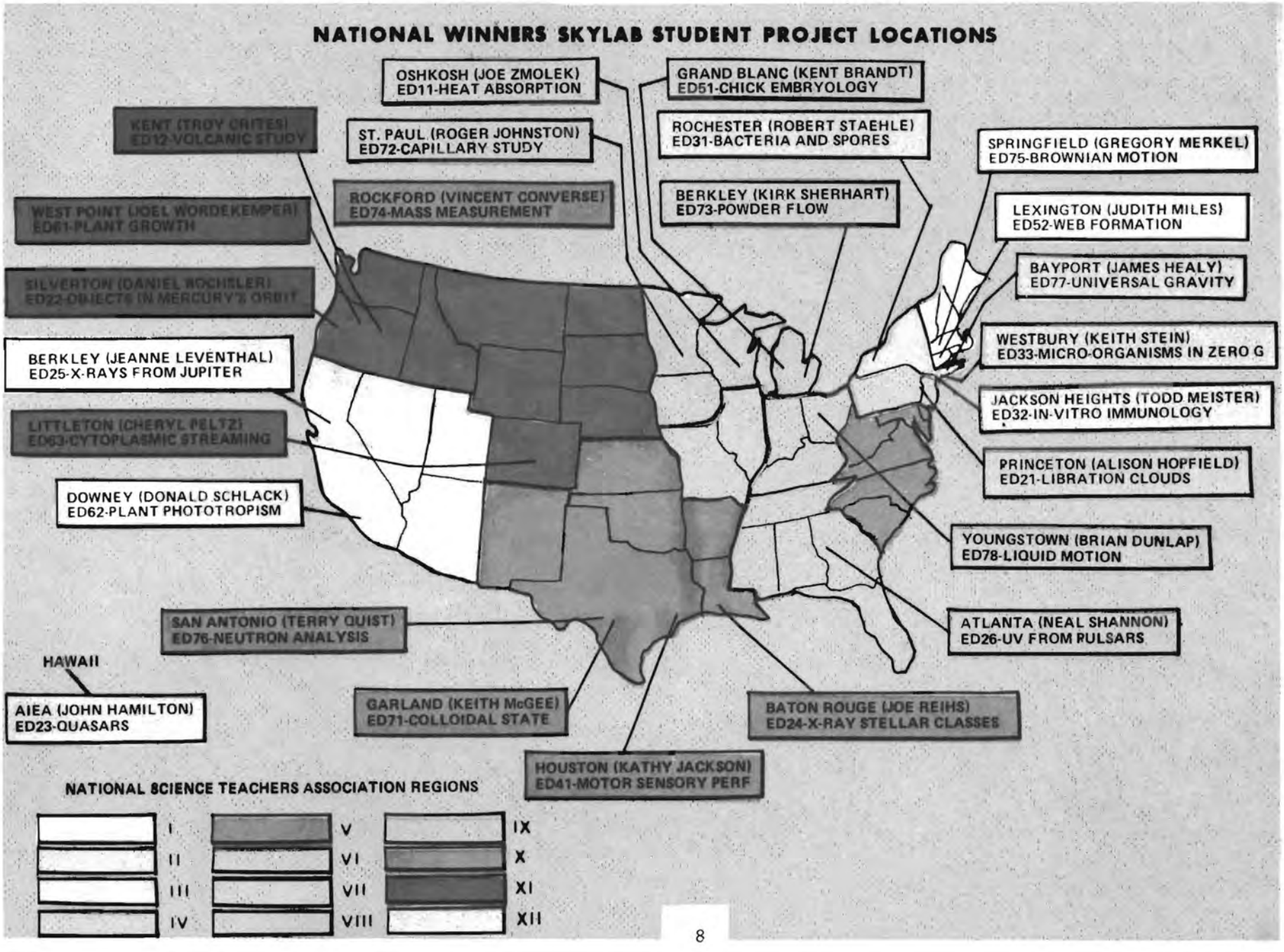
WHAT ARE ITS OBJECTIVES?

IF SPACE IS TO BE UTILIZED FOR MAN'S BENEFIT, HE MUST FIRST LEARN THE EXTENT OF HIS PHYSICAL AND EMOTIONAL CAPACITY TO FUNCTION FOR EXTENDED PERIODS THERE. A PRIMARY OBJECTIVE OF SKYLAB IS THEREFORE, TO PROVIDE A BIOMEDICAL LABORATORY FOR THE EVALUATION OF THE PHYSIOLOGICAL ADAPTABILITY OF THE HUMAN TO THAT ENVIRONMENT.

IF THE EARTH'S RESOURCES ARE TO BE UTILIZED EFFICIENTLY AND EFFECTIVELY, IT IS NECESSARY TO FULLY UNDERSTAND AND UTILIZE THE COMPLEX ECOLOGICAL INTER-RELATIONSHIPS SUCH AS WEATHER, AVAILABILITY OF WATER, ENVIRONMENTAL POLLUTION, THE SPREADING OF CROP DISEASES, TO NAME JUST A FEW, WHICH BEAR UPON THE AVAILABILITY OF ADEQUATE RESOURCES. A SECOND PRIMARY OBJECTIVE, THEN, IS TO PROVIDE A CAPABILITY TO SURVEY LARGE AREAS OF THE EARTH'S SURFACE, AS WELL AS ITS ATMOSPHERE, ON A CONTINUOUS SHORT INTERVAL BASIS TO DETERMINE GLOBAL INTERRELATIONSHIPS AND OPTIMIZE THE PRODUCTION AND MANAGEMENT OF RESOURCES AND THE MAINTENANCE OF A SOUND ECOLOGICAL BALANCE.

IF MAN IS TO LEARN MORE ABOUT THE EFFECTS, BOTH BENEFICIAL AND DETRIMENTAL, OF EXTRATERRESTRIAL INFLUENCES, AND THE METHODS FOR MAXIMIZING THEIR BENEFITS, HE MUST HAVE AN OBSERVATION PLATFORM FREE FROM THE LIMITING OR DISTORTING ASPECTS OF EARTH'S ATMOSPHERE. A THIRD PRIMARY OBJECTIVE OF SKYLAB, THEREFORE, IS TO PROVIDE A CAPABILITY FOR SOLAR AND STELLAR ASTRONOMICAL OBSERVATION EXPERIMENTATION, IN ORBIT.

NOT ONLY ARE OBJECTIVES OF THIS SCOPE MORE READILY ACCOMPLISHED FROM SPACE, BUT IN FACT, MANY CAN BE ACCOMPLISHED ONLY WITH GREAT DIFFICULTY, IF AT ALL, WITHOUT THE BENEFIT OF AN ORBITING OBSERVATORY.


NATIONAL WINNERS SKYLAB STUDENT PROJECT LOCATIONS
OSHKOSH (JOE ZMOLEK)
ED11-HEAT ABSORPTION
GRAND BLANC (KENT BRANDT)
ED51-CHICK EMBRYOLOGY
KENT (TROY CRITES)
ED12-VOLCANIC STUDY
ST. PAUL (ROGER JOHNSTON)
ED72-CAPILLARY STUDY
ROCHESTER (ROBERT STAEHLE)
ED31-BACTERIA AND SPORES
SPRINGFIELD (GREGORY MERKEL)
ED75-BROWNIAN MOTION
ROCKFORD (VINCENT CONVERSE)
ED74-MASS MEASUREMENT
BERKLEY (KIRK SHERHART)
ED73-POWDER FLOW
LEXINGTON (JUDITH MILES)
ED52-WEB FORMATION
WEST POINT (JOEL WORDEKEMPER)
ED61-PLANT GROWTH
BAYPORT (JAMES HEALY)
ED77-UNIVERSAL GRAVITY
SILVERTON (DANIEL ROCHELER)
ED22-OBJECTS IN MERCURY'S ORBIT
WESTBURY (KEITH STEIN)
ED33-MICRO-ORGANISMS IN ZERO G
BERKLEY (JEANNE LEVENTHAL)
ED25-X-RAYS FROM JUPITER
JACKSON HEIGHTS (TODD MEISTER)
ED32-IN-VITRO IMMUNOLOGY
LITTLETON (CHERYL PELTZ)
ED63-CYTOPLASMIC STREAMING
PRINCETON (ALISON HOPFIELD)
ED21-LIBRATION CLOUDS
DOWNEY (DONALD SCHLACK)
ED62-PLANT PHOTOTROPISM
YOUNGSTOWN (BRIAN DUNLAP)
ED78-LIQUID MOTION
SAN ANTONIO (TERRY QUIST)
ED76-NEUTRON ANALYSIS
ATLANTA (NEAL SHANNON)
ED26-UV FROM PULSARS
HAWAII
AIEA (JOHN HAMILTON)
ED23-QUASARS
GARLAND (KEITH McGEE)
ED71-COLLOIDAL STATE
BATON ROUGE (JOE REIHS)
ED24-X-RAY STELLAR CLASSES
HOUSTON (KATHY JACKSON)
ED41-MOTOR SENSORY PERF
NATIONAL SCIENCE TEACHERS ASSOCIATION REGIONS
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII

THE SKYLAB STUDENT PROJECT

IN 1971 THE NASA CONCEIVED THE SKYLAB STUDENT PROJECT IN AN EFFORT TO INVOLVE THE GENERAL PUBLIC IN THE SKYLAB PROGRAM. THE PRIMARY AIM OF THIS PROJECT WAS TO STIMULATE NATIONAL INTEREST IN SCIENCE AND TECHNOLOGY.

NASA DECIDED TO DIRECT THE SKYLAB STUDENT PROJECT TO THOSE YOUNG PEOPLE WHO HAVE INDICATED AN INTEREST IN SCIENCE AND TECHNOLOGY AND TO FOSTER THIS INTEREST THROUGH DIRECT PARTICIPATION IN AN ONGOING PROGRAM EMPHASIZING AS WIDE A SPECTRUM OF SCIENCE AND TECHNOLOGY AS POSSIBLE. SKYLAB, WITH THE OPPORTUNITY IT GIVES TO PROVIDE EXPERIMENTS IN AREAS OF SCIENCE AND TECHNOLOGY PROVIDED THE IDEAL OPPORTUNITY FOR SUCH PARTICIPATION.

IN IMPLEMENTING THIS PROJECT, THE NATIONAL SCIENCE TEACHERS ASSOCIATION (NSTA) HAVING AN EXISTING, CLOSELY ASSOCIATED CONTACT WITH STUDENTS, GRADES 9 THROUGH 12, IN UNITED STATES SCHOOLS, WAS ASKED TO SPONSOR, ORGANIZE, AND ADMINISTER A NATIONAL COMPETITION FOR HIGH SCHOOL STUDENTS. THIS COMPETITION CALLED FOR INDIVIDUAL STUDENTS (OR GROUPS OF STUDENTS) TO DEVELOP MEANINGFUL

STUDENTS GETTING ACQUAINTED WITH MSFC

Skylab Student Investigator, Roger G. Johnston and Dr. Raymond Gause, Advisor

Skylab Student Investigator, Gregory A. Merkel and Harry Coons, Advisor

Skylab Student Investigator, Kirk M. Sherhart and Dr. Robert Head, Advisor

John Humphreys, Advisor, and Skylab Student Investigator, Neal W. Shannon

EXPERIMENTS TO BE FLOWN ON SKYLAB. TO FACILITATE THE ORGANIZATION AND ADMINISTRATION OF THIS PROGRAM, THE NSTA DIVIDED THE PARTICIPATING STUDENTS INTO THEIR 12 GEOGRAPHICAL REGIONS WITH A REGIONAL CHAIRMEN APPOINTED TO RECEIVE ALL PROPOSALS FOR HIS REGION. THE REGIONAL CHAIRMEN THEN APPOINTED A COMMITTEE OR EMINENT SCIENTISTS, ENGINEERS, AND SCIENCE EDUCATORS TO EVALUATE EACH PROPOSAL. SOME 80,000 APPLICATIONS WERE REQUESTED BY TEACHERS AND 3409 PROPOSALS WERE SUBMITTED. MOREOVER, BECAUSE OF TEAM PROPOSALS, OVER 4000 STUDENTS PARTICIPATED AND APPROXIMATELY 300 REGIONAL WINNERS SELECTED. EACH PARTICIPANT RECEIVED A CERTIFICATION OF MERIT. THE 300 WINNING REGIONAL PROPOSALS WERE TRANSMITTED TO THE NSTA HEADQUARTERS WHERE THEY WERE FURTHER SCREENED. IN MARCH OF 1972 TWENTY-FIVE NATIONAL WINNERS AND 22 SPECIAL MENTIONS WERE ANNOUNCED. THE 25 WINNING STUDENTS WERE THEN ASSIGNED SCIENCE ADVISERS AT THE GEORGE C. MARSHALL SPACE FLIGHT CENTER (MSFC), THE CENTER SELECTED BY NASA TO BE RESPONSIBLE FOR DEVELOPMENT OF THE STUDENT PROJECT. THE JOHNSON SPACE CENTER (JSC) ALSO PROVIDED SCIENCE ADVISORS AND VALUABLE SUPPORT.

STUDENTS WORKING WITH THEIR ADVISORS

Skylab Student Cheryl A. Peltz with
Science Advisor Charles Cothran

Skylab Student Todd A. Meister with
Science Advisor Dr. Robert Allen

Skylab Student Brian W. Dunlap with
Science Advisor Dr. Robert Head

Skylab Student Robert L. Staehle with
Science Advisor Steve Hall

WORKING CLOSELY WITH THESE ADVISERS, THE STUDENTS PREPARED AN EVALUATION OF THEIR EXPERIMENTS, IN TERMS OF COMPATIBILITY WITH THE SKYLAB PROGRAM AND ITS NECESSARY CONSTRAINTS, WHICH WERE SUBSEQUENTLY PRESENTED AT A PRELIMINARY DESIGN REVIEW (PDR) HELD IN MAY 1972 AT MSFC. THE REVIEW BOARD, MADE UP OF NASA OFFICIALS FROM MSFC, JSC, KENNEDY SPACE CENTER (KSC) AT CAPE KENNEDY, FLORIDA, AND NASA HEADQUARTERS AT WASHINGTON D.C., EXAMINED THESE PRESENTATIONS CAREFULLY. THIS REVIEW RESULTED IN THE DETERMINATION THAT 19 OF THE 25 PROPOSED EXPERIMENTS FELL WITHIN MISSION CAPABILITIES AND COULD BE FLOWN ON SKYLAB. ARRANGEMENTS WERE MADE FOR THE REMAINING SIX STUDENTS TO BE ASSOCIATED WITH NASA SCIENTISTS IN COROLLARY RESEARCH IN ORDER TO KEEP THEM INVOLVED IN SKYLAB ACTIVITIES.

STUDENTS GIVING PRESENTATIONS AT DESIGN REVIEWS

Left to Right: Henry Floyd (Manager)
Judith Miles (Skylab Student) and
Keith Demorest (Advisor)

Left to Right: Henry Floyd (Manager)
Brian Dunlap (Skylab Student) and
Dr. Head (Advisor)

Left to Right: Art White (MSC)
Kathy Jackson (Skylab Student)
Dr. Allen (Advisor)

Left to Right: Henry Floyd (Manager)
Terry Quist (Skylab Student) and
Dr. Gause (Advisor)

AN INTENSIVE DEVELOPMENT EFFORT DIRECTED TOWARD REDUCING THE STUDENT EXPERIMENTS TO SPACE QUALIFIED HARDWARE, OR THE USE OF EXISTING SKYLAB EXPERIMENT HARDWARE UNDER THE SUPERVISION OF RECOGNIZED PRINCIPAL INVESTIGATORS, FOLLOWED. THE RESULTS OF THIS EFFORT WERE PRESENTED IN A CRITICAL DESIGN REVIEW (CDR) HELD AT MSFC EARLY IN JULY 1972, DURING WHICH EACH STUDENT DISCUSSED HIS EFFORTS IN FURTHERING THE DEVELOPMENT OF HIS OR HER EXPERIMENT. PROGRAMMATIC ASPECTS, HARDWARE DETAILS, MISSION REQUIREMENTS AND OTHER ELEMENTS WERE CONSIDERED. A FINAL PROJECT GO-AHEAD WAS GIVEN AT THAT TIME.

FOR THOSE EXPERIMENTS REQUIRING HARDWARE DEVELOPMENT, AN ACCEPTANCE REVIEW WAS HELD AT MSFC IN JANUARY 1973. AT THIS TIME ALL TEST RESULTS WERE REVIEWED AND THE HARDWARE WAS DECLARED FLIGHT WORTHY AND DELIVERED TO KSC FOR INSTALLATION IN THE SKYLAB.

SKYLAB STUDENT PROJECT EXPERIMENTS

Skylab No.	Skylab Title	Student Investigator
Earth Observations		
ED-11	Atmospheric Attenuation of Energy	Joe B. Zmolek, 1914 Hazel Street Oshkosh, Wisconsin
ED-12	Volcanic Study	Troy A. Crites, 736 Wynwood Drive Kent, Washington 98031
Astronomy		
ED-21	Libration Clouds	Alison Hopfield, 183 Hartley Avenue Princeton, New Jersey 08540
ED-22	Objects Within Mercury's Orbit	Daniel C. Bochsler, Route 2, Box 75 Silverton, Oregon 97381
ED-23	Quasars	John C. Hamilton, 98-1054 Palula Way Aiea, Hawaii 96701
ED-24	X-Ray Stellar Classes	Joe W. Reihs, 12824 Wallis Street Baton Rouge, Louisiana 70815
ED-25	X-Rays From Jupiter	Jeanne L. Leventhal, 1511 Arch Street Berkeley, California 94708
ED-26	UV From Pulsars	Neal W. Shannon, 2849 Foster Ridge Road Atlanta, Georgia 30345
Bacteriology		
ED-31	Bacteria and Spores	Robert L. Staehle, Huntington Hills-North Rochester, New York 14172
ED-32	In Vitro Immunology	Todd A. Meister, 33-04 93 Street Jackson Heights, New York 11372
ED-33*	Micro-Organisms in Varying G	Keith L. Stein, 2167 Regent Court South Westbury, New York 11590

SKYLAB STUDENT PROJECT EXPERIMENTS

Skylab No.	Skylab Title	Student Investigator
Physiology		
ED-41	Motor Sensory Performance	Kathy L. Jackson, 18618 Capetown Drive Houston, Texas 77058
Zoology		
ED-51*	Chick Embryology	Kent M. Brandt, 11380 Grand Oak Drive Grand Blanc, Michigan 48439
ED-52	Web Formation	Judith S. Miles, 3 Dewey Road Lexington, Massachusetts 02173
Botany		
ED-61	Plant Growth	Joel G. Wordekemper, 810 East Sherman Street West Point, Nebraska 68782
ED-62	Plant Phototropism	Donald W. Schlack, 9217 Appleby Street Downey, California 90240
ED-63	Cytoplasmic Streaming	Cheryl A. Peltz, 7117 S. Windermere Littleton, Colorado 80120
Physics		
ED-71*	Colloidal State	Keith D. McGee, 122 Sunflower Street Garland, Texas 75041
ED-72	Capillary Study	Roger G. Johnston, 1833 Draper Drive St. Paul, Minnesota 55113
ED-73*	Powder Flow	Kirk M. Sherhart, 2144 Earlmont Road Berkley, Michigan 48072

SKYLAB STUDENT PROJECT EXPERIMENTS

Skylab No.	Skylab Title	Student Investigator
Physics (Continued		
ED-74	Mass Measurement	Vincent W. Converse, 1704 Roosevelt Road Rockford, Illinois 61111
ED-75*	Brownian Motion	Gregory A. Merkel, 153 Ashland Avenue Springfield, Massachusetts 01119
ED-76	Neutron Analysis	Terry C. Quist, 3818 Longridge Drive San Antonio, Texas 90228
ED-77*	Universal Gravity	James E. Healy, 84 S. Gillette Avenue Bayport, New York 11705
ED-78	Liquid Motion	W. Brian Dunlap, 6695 Abbot Avenue Youngstown, Ohio 44515

* Affiliated Research

STUDENT EXPERIMENT

DESCRIPTIONS

IN CARRYING OUT THE DELEGATED RESPONSIBILITIES NASA ELECTED TO DIVIDE THE STUDENT EXPERIMENTS INTO FOUR CATEGORIES. THESE CATEGORIES EVOLVED AS A RESULT OF EFFORTS TO ACCOMMODATE AS MANY OF THE TWENTY-FIVE NATIONAL SELECTEES AS POSSIBLE ON SKYLAB AND TO KEEP ALL OF THEM INVOLVED IN SPACE RESEARCH.

SKYLAB STUDENT PROJECT

DEFINITION OF EXPERIMENT CATEGORIES

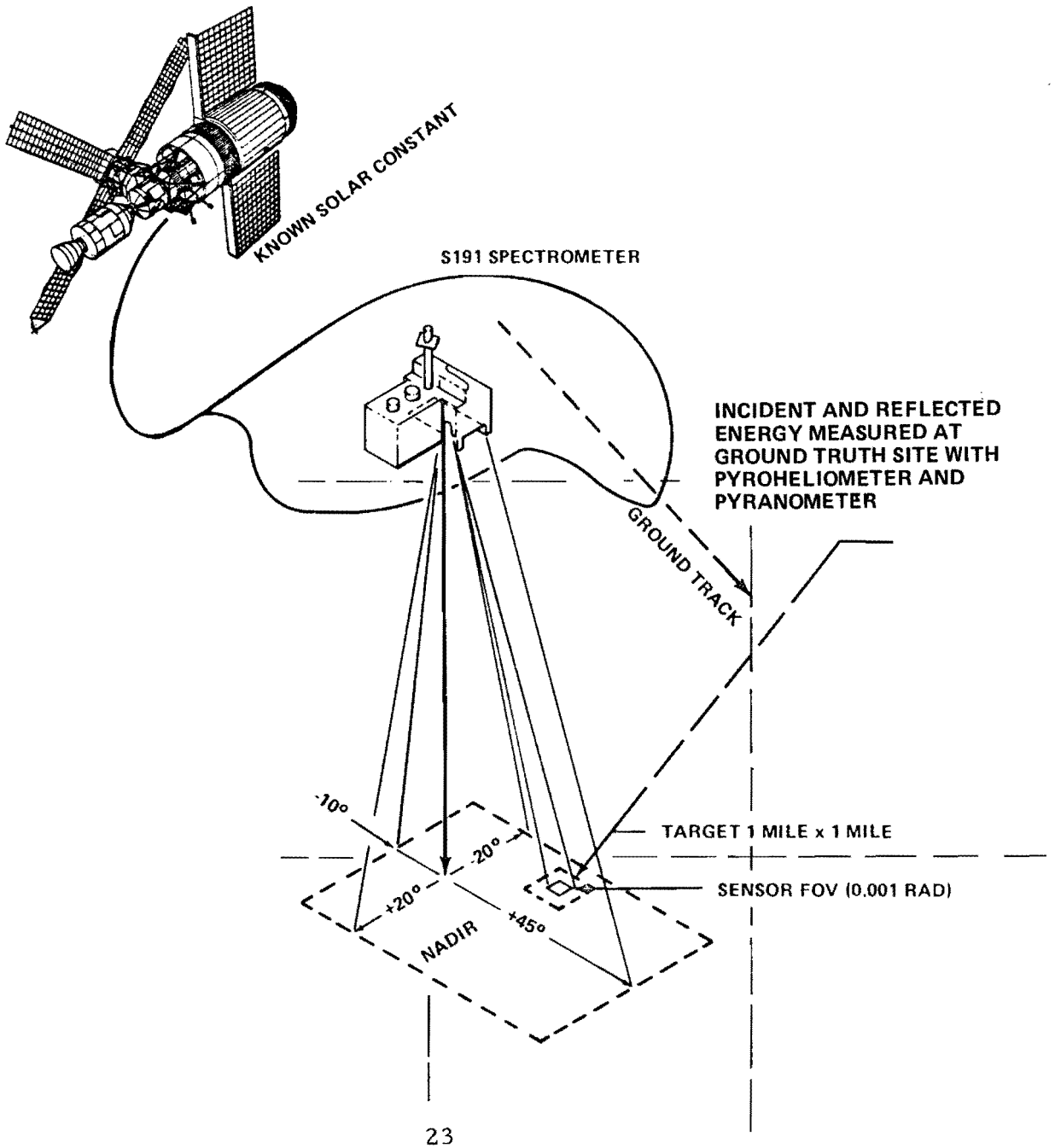
CATEGORY I	-	WILL PROVIDE STUDENT WITH DATA ALREADY PLANNED TO BE OBTAINED ON SKYLAB (6 EXPERIMENTS)
CATEGORY II	-	WILL USE EXISTING HARDWARE, BUT WILL HAVE FLIGHT PLAN, CREW PROCEDURES AND/OR RESOURCES IMPACT (2 EXPERIMENTS)
CATEGORY III	-	HARDWARE EXPERIMENTS (11 EXPERIMENTS)
CATEGORY IV	-	EXPERIMENTS REQUIRING OTHER DISPOSITION/AFFILIATION (6 EXPERIMENTS)
CATEGORY V	-	SPECIAL MENTION (RUNNERS UP TO 25 NATIONAL WINNERS) (22 EXPERIMENTS)

EXPERIMENTS REQUIRING DATA FROM SKYLAB HARDWARE

(CATEGORY I/II)

SKYLAB STUDENT PROJECT

ED 11 - ATMOSPHERIC ATTENUATION OF ENERGY



ED-11 - ATMOSPHERIC ATTENUATION OF ENERGY

STUDENT:
MR. JOE B. ZMOLEK
1914 HAZEL STREET
OSHKOSH, WISCONSIN 54901

TEACHER/SPONSOR:
MR. WILLIAM L. BEHRING
LOURDES HIGH SCHOOL

SCIENCE ADVISORS:
MR. GENE COMER, MSFC/SL-DP
DR. DEAN NORRIS, JSC/TF2

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. THOMAS BARNETT, JSC/TF3

OBJECTIVE:

- DETERMINE ATTENUATION OF VISIBLE AND NEAR IR ENERGY THROUGH THE ATMOSPHERE AT VARIOUS LOCATIONS AND ATMOSPHERIC CONDITIONS
- COMPARE ENERGY REFLECTED TO SKYLAB SENSORS FROM EARTH'S SURFACE WITH MEASUREMENTS MADE AT "GROUND TRUTH SITE"

IMPLEMENTATION:

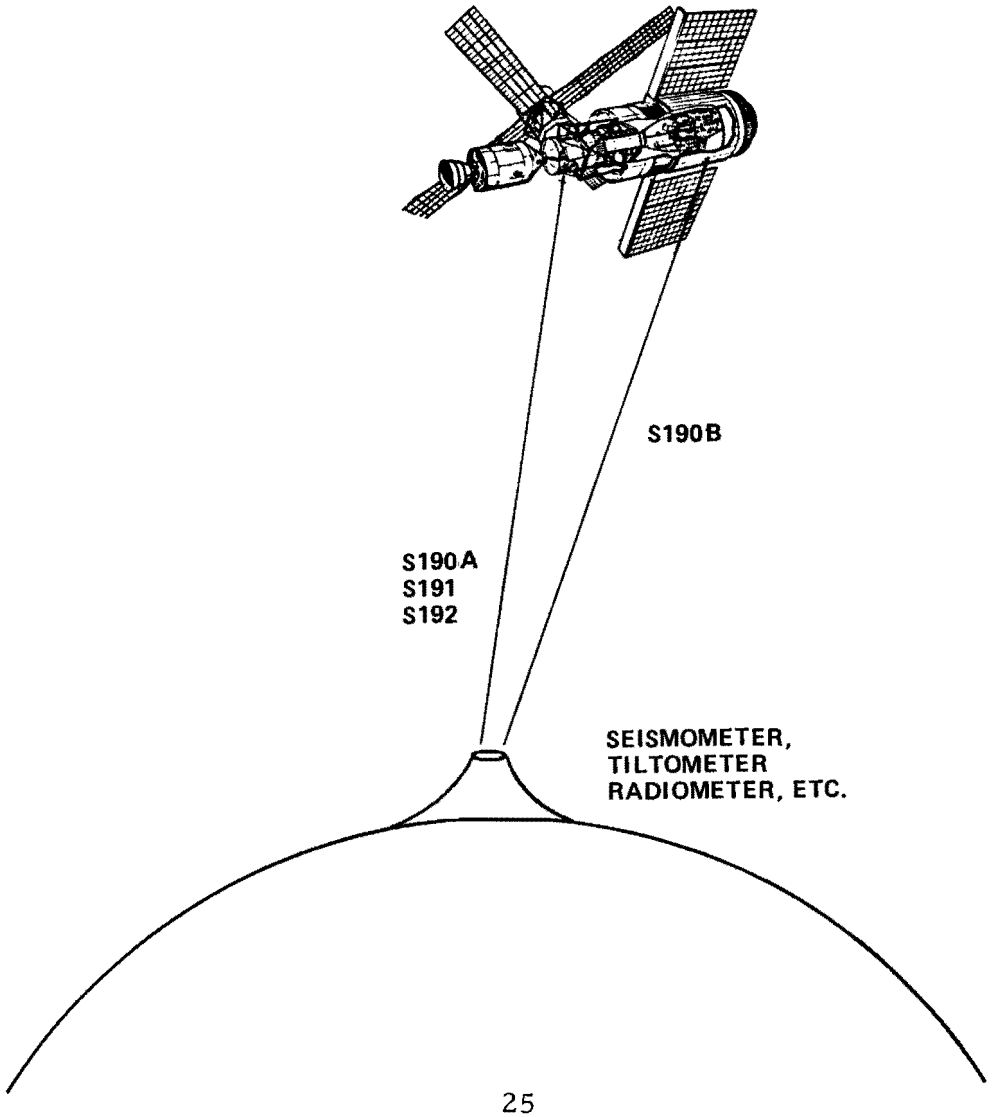
- S191 INFRARED SPECTROMETER WILL MEASURE RADIATION FROM EARTH'S SURFACE
- SIMULTANEOUS GROUND DATA AVAILABLE WHEN SPECTROMETER IS VIEWING "GROUND TRUTH SITE"

DATA AND ANALYSIS:

- PERTINENT S191, S190A AND S190B DATA AND EREP GROUND TRUTH DATA WILL BE PROVIDED TO STUDENT
- ASSISTANCE WILL BE GIVEN STUDENT IN DATA INTERPRETATION AND PREPARING REPORT

SKYLAB STUDENT PROJECT

ED 12 VOLCANIC STUDY



ED-12 - VOLCANIC STUDY

STUDENT:
MR. TROY A. CRITES
736 WYNWOOD DRIVE
KENT, WASHINGTON 98031

TEACHER/SPONSOR:
MR. RICHARD C. PUTNAM
KENT JUNIOR HIGH SCHOOL

SCIENCE ADVISORS:
MR. GENE COMER, MSFC/SL-DP
DR. DAVID AMSBURY, JSC/TF2

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. THOMAS BARNETT, JSC/TF3

OBJECTIVE:

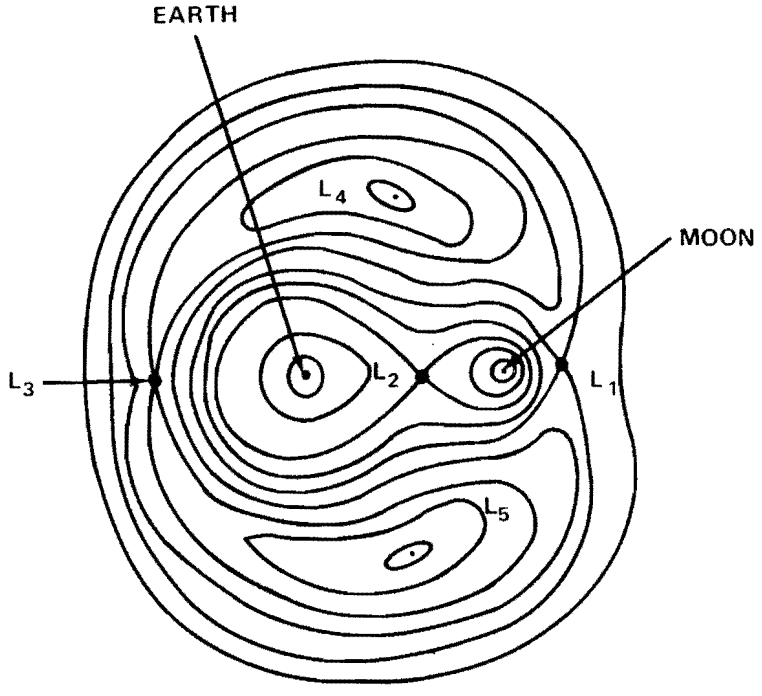
- PERFORM INFRARED SURVEYS FROM SKYLAB OF VOLCANOES WITHIN THE FIELD OF VIEW OF SKYLAB SENSORS
- CORRELATE WITH DATA FROM GROUND INSTRUMENTATION
- ESTABLISH A METHODOLOGY FOR PREDICTION OF VOLCANIC ACTIVITY

IMPLEMENTATION:

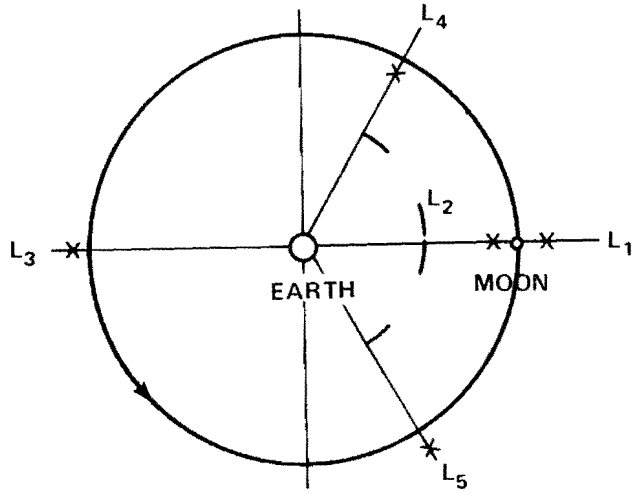
- ON A TARGET OF OPPORTUNITY BASIS ALL NON-DORMANT VOLCANOES AVAILABLE WILL BE SURVEYED BY THE S191 INFRARED SPECTROMETER AND THE S192 MULTISPECTRAL SCANNER WITH SUPPORTING TARGETING DATA PROVIDED BY S190A AND S190B PHOTOGRAPHS

DATA AND ANALYSIS:

- S191 AND S192 DATA TOGETHER WITH SUPPORTING PHOTOGRAPHY (S190A AND S190B) PROVIDED TO STUDENT
- ASSISTANCE WILL BE GIVEN STUDENT IN DATA INTERPRETATION AND REPORT WRITING



GRAVITY CONTOURS
EARTH-MOON SYSTEM



LAGRANGIAN POINTS

ED-21 - LIBRATION CLOUDS

STUDENT:
MISS ALISON HOPFIELD
183 HARTLEY AVENUE
PRINCETON, NEW JERSEY 08540

TEACHER/SPONSOR:
MR. NORMAN SPERLING
DIRECTOR, DUNCAN PLANETARIUM

SCIENCE ADVISOR:
JOHN HUMPHREYS, MSFC/SL-ATM

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. ROBERT MACQUEEN
HIGH ALTITUDE OBSERVATORY
BOULDER, COLORADO

OBJECTIVE:

- PHOTOGRAPH LUNAR LIBRATION CLOUDS AT THE LAGRANGIAN POINTS L_4 AND L_5 AT WHICH PARTICLES EXPERIENCE ZERO FORCE

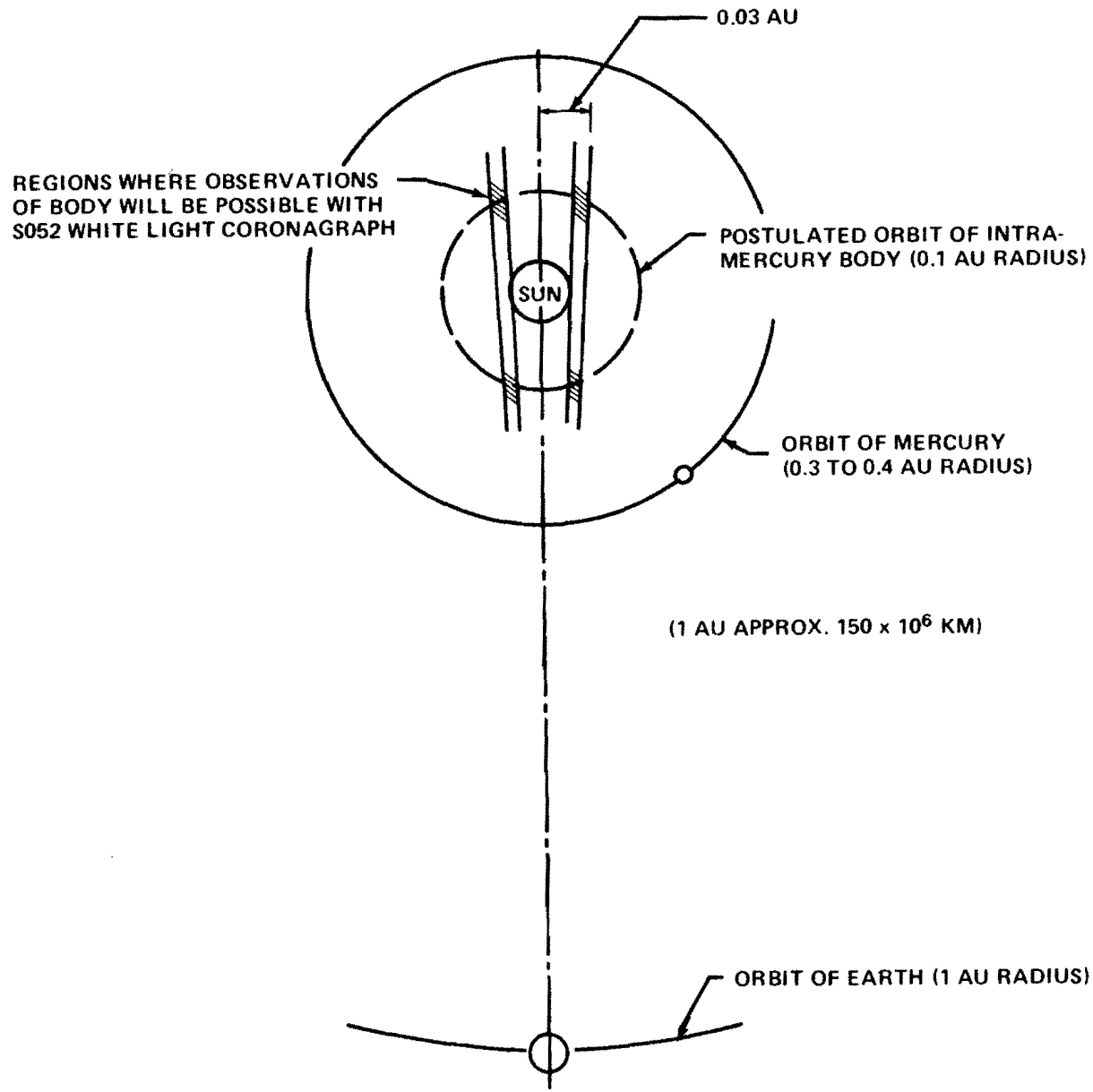
IMPLEMENTATION:

- ATM JOINT OBSERVING PROGRAM 10 UTILIZING THE S052 WHITE LIGHT CORONAGRAPH, CURRENTLY WILL PHOTOGRAPH THE REGIONS OF THE LAGRANGIAN POINTS L_4 AND L_5

DATA ANALYSIS:

- EXPERIMENT DATA BOOK AND PHOTOGRAPHS TO BE SUPPLIED STUDENT
- STUDENT INVITED TO PARTICIPATE IN DATA REDUCTION AND ANALYSIS AT HIGH ALTITUDE OBSERVATORY

SKYLAB STUDENT PROJECT
ED 22 - OBJECTS IN MERCURY'S ORBIT



ED-22 - OBJECTS WITHIN MERCURY'S ORBIT

STUDENT:
MR. DANIEL C. BOCHSLER
ROUTE 2, BOX 75
SILVERTON, OREGON 97381

TEACHER/SPONSOR:
MR. JOHN P. DALY
TEACHER, SILVERTON UNION
HIGH SCHOOL

SCIENCE ADVISOR:
MR. JOHN HUMPHREYS, MSFC/SL-ATM

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. ROBERT MACQUEEN
HIGH ALTITUDE OBSERVATORY
BOULDER, COLORADO

OBJECTIVE:

- PHOTOGRAPH POSSIBLE OBJECTS IN ORBIT BETWEEN MERCURY AND THE SUN

IMPLEMENTATION:

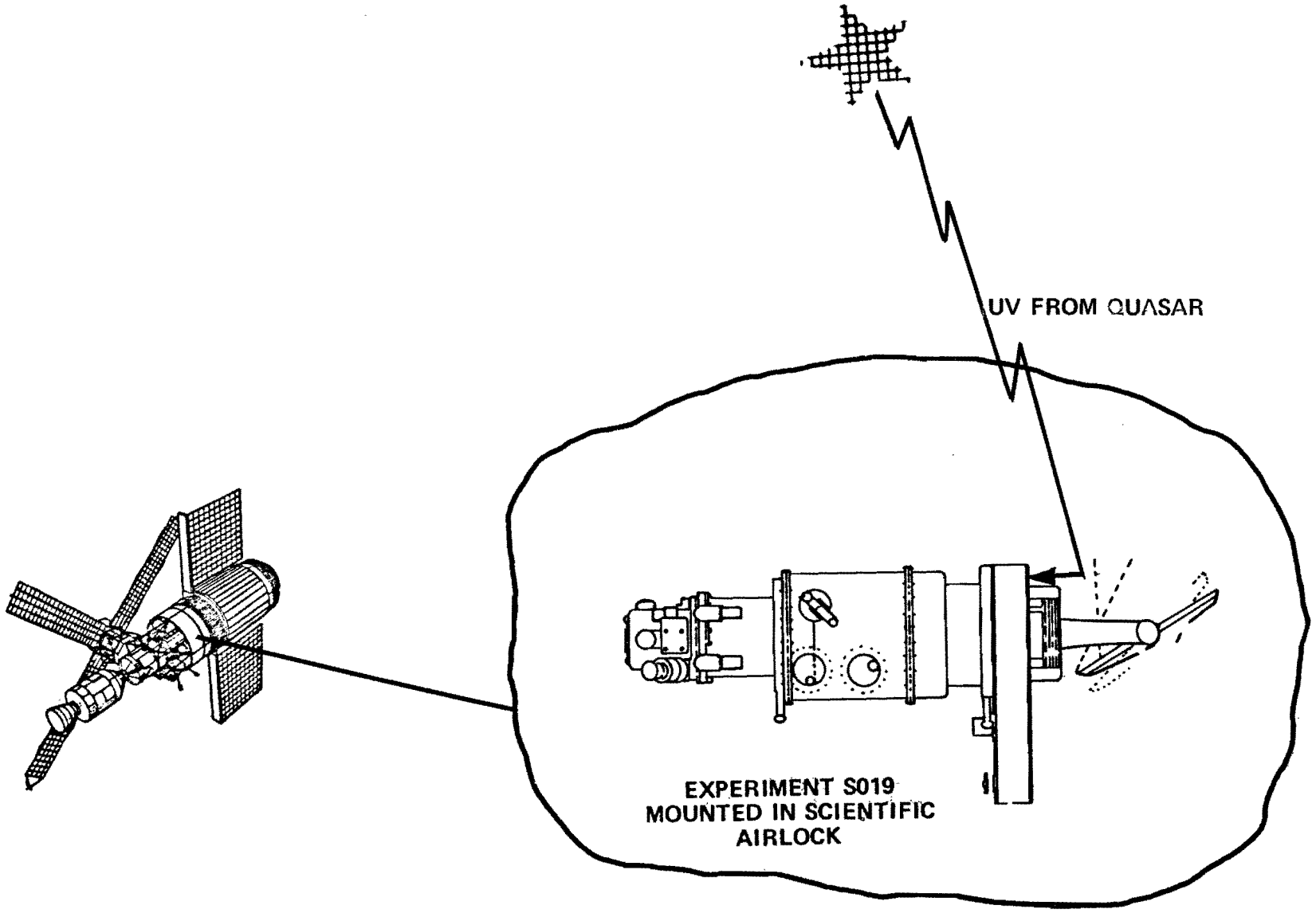
- ATM JOINT OBSERVING PROGRAM 6 UTILIZING THE S052 WHITE LIGHT CORONAGRAPH
- SYNOPTIC OBSERVATIONS OF THE SUN TWICE DAILY THROUGHOUT THE SKYLAB MISSION

DATA AND ANALYSIS:

- STUDENT WILL PARTICIPATE IN S052 JOP-6 DATA ANALYSIS AND EVALUATION OF PHOTOGRAPHS AT THE HIGH ALTITUDE OBSERVATORY
- ASSISTANCE WILL BE GIVEN STUDENT IN DATA INTERPRETATION AND REPORT WRITING

SKYLAB STUDENT PROJECT

ED 23 - UV FROM QUASARS



ED-23 - QUASARS

STUDENT:
MR. JOHN C. HAMILTON
12 HONU STREET
AIEA, HAWAII 96701

TEACHER/SPONSOR:
MR. JAMES A FUNCHIGAMI
AIEA HIGH SCHOOL

SCIENCE ADVISOR:
MR. JOHN HUMPHREYS, MSFC/SL-ATM

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. KARL HENIZE, JSC/CB

OBJECTIVE:

- OBTAIN QUASAR SPECTRA IN THE ULTRAVIOLET SPECTRAL REGION

CONCEPT:

- OBSERVE QUASARS PREVIOUSLY IDENTIFIED WITH RADIO AND OPTICAL TELESCOPES
- OBSERVATION ABOVE EARTH'S ATMOSPHERE ALLOWS STUDY OF QUASAR SPECTRA

IMPLEMENTATION:

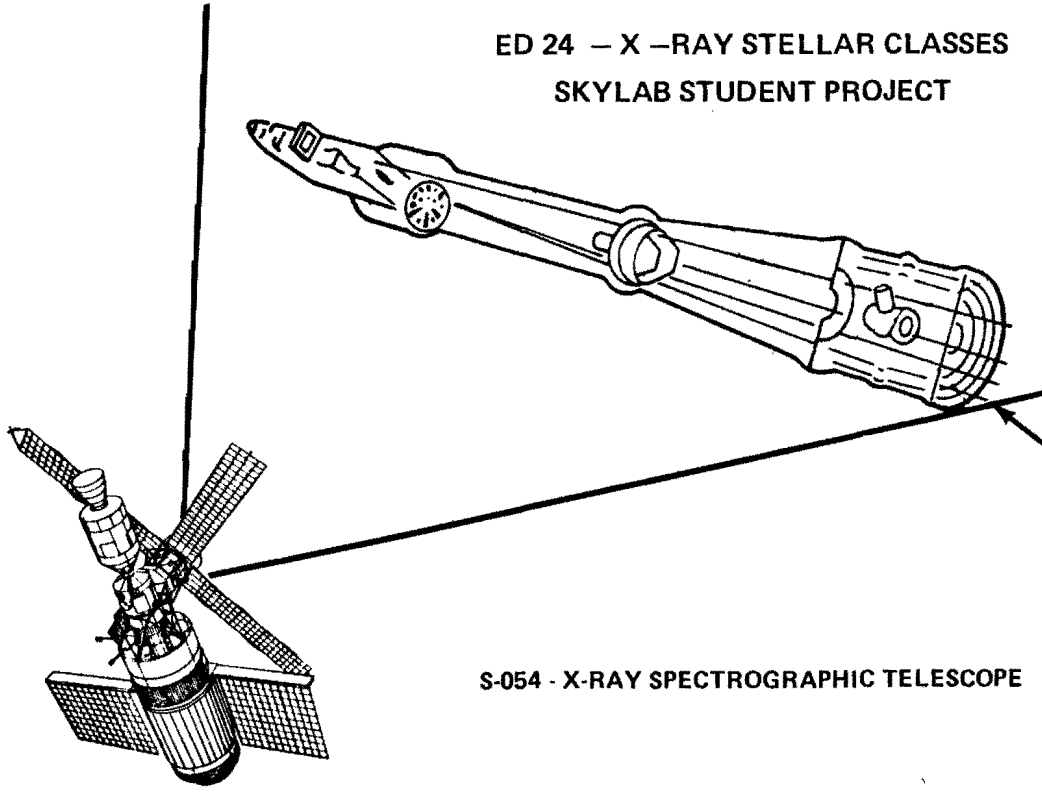
- DETECTION OF QUASAR ULTRAVIOLET WILL BE ATTEMPTED WITH THE S019 ULTRAVIOLET STELLAR ASTRONOMY FACILITY
- RESULTS MAY BE MARGINAL DUE TO LOW UV RADIATION AND SENSOR SENSITIVITY

DATA AND ANALYSIS:

- STUDENT WILL PARTICIPATE IN ANALYSIS OF DATA WITH DR. HENIZE OF JSC
- ASSISTANCE WILL BE PROVIDED IN PREPARATION OF STUDENT'S REPORT TO BE CO-AUTHORED BY DR. HENIZE

ED 24 – X –RAY STELLAR CLASSES

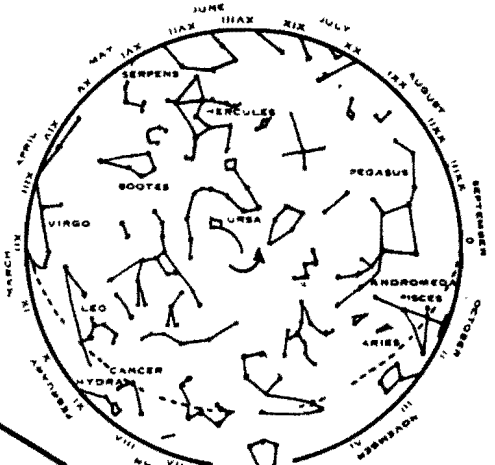
SKYLAB STUDENT PROJECT

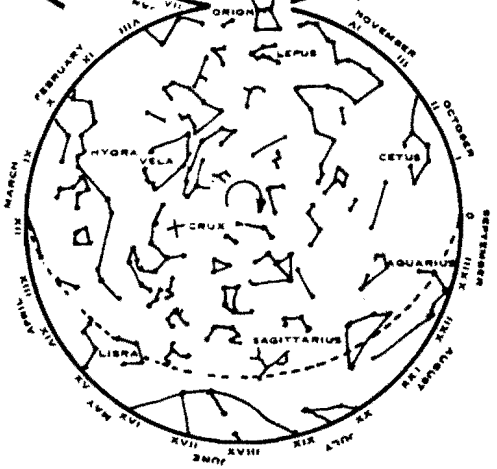


S-054 - X-RAY SPECTROGRAPHIC TELESCOPE

TARGET STAR FIELDS

THE NORTHERN SKY





THE SOUTHERN SKY

ED-24 - X-RAY STELLAR CLASSES

STUDENT:
MR. JOE W. REIHS
12824 WALLIS STREET
BATON ROUGE, LOUISIANA 70815

TEACHER/SPONSOR:
MRS. HELEN W. BOYD
TARA HIGH SCHOOL

SCIENCE ADVISOR:
MR. JOHN HUMPHREYS, MSFC/SL-ATM

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. VIANA/DR. KAHLER
AMERICAN SCIENCE & ENGINEERING
CAMBRIDGE, MASSACHUSETTS

OBJECTIVE:

- DETERMINE THE GENERAL CHARACTERISTICS AND LOCATION OF CELESTIAL X-RAY SOURCES

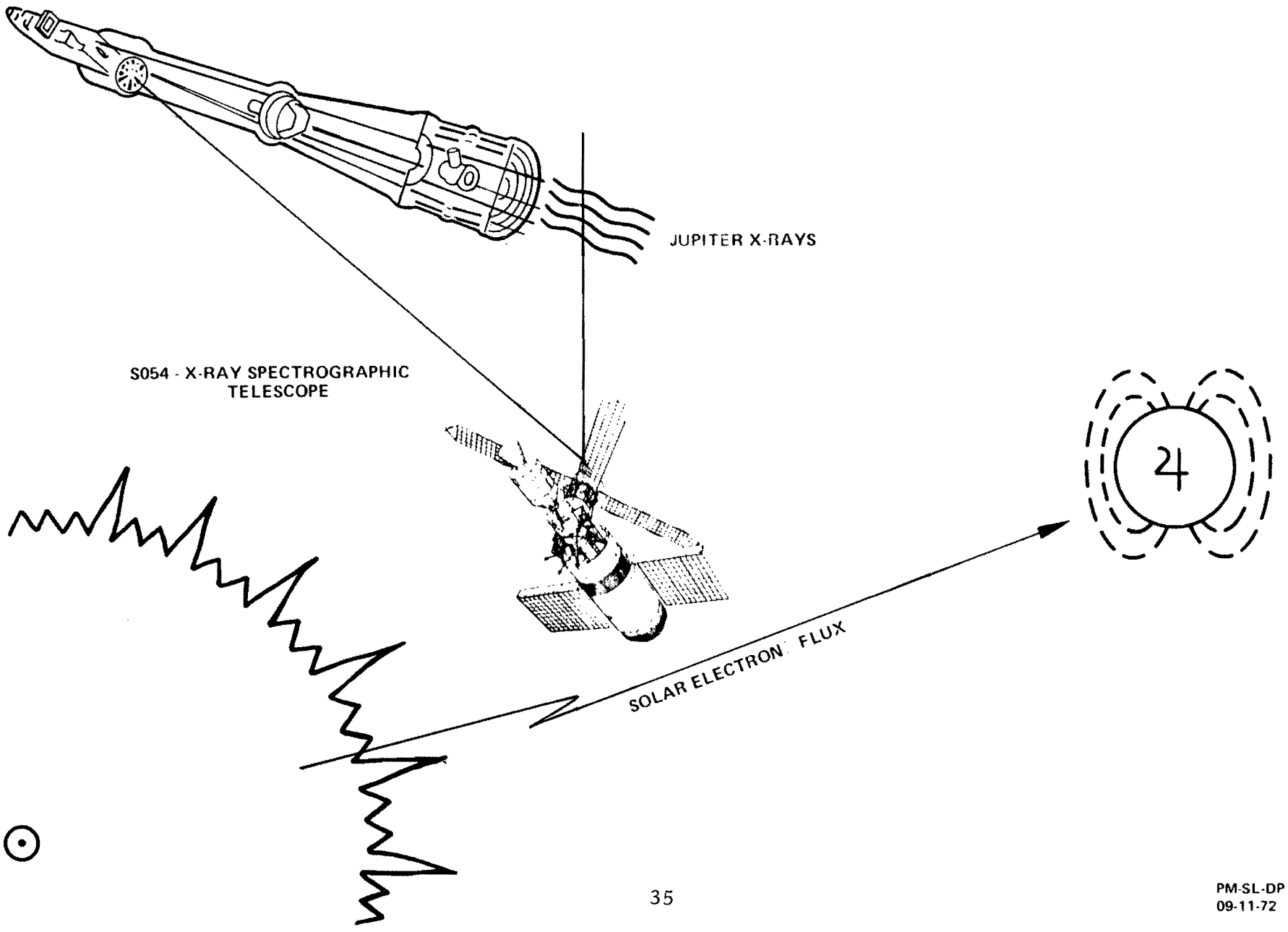
IMPLEMENTATION:

- EXPERIMENT S054, X-RAY TELESCOPE WILL SUPPLY THE NECESSARY DATA

DATA AND ANALYSIS:

- SUPPORT PROVIDED STUDENT IN DATA ANALYSIS AND REPORTING

SKYLAB STUDENT PROJECT
ED 25 - X-RAYS FROM JUPITER



PM-SL-DP
09-11-72

ED-25 - X-RAYS FROM JUPITER

STUDENT:
MISS JEANNE L. LEVENTHAL
1511 ARCH STREET
BERKELEY, CALIFORNIA 94708

TEACHER/SPONSOR:
MR. HARRY E. CHOULETT
BERKELEY HIGH SCHOOL

SCIENCE ADVISOR:
MR. JOHN HUMPHREYS, MSFC/SL-ATM

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. VIANA/DR. KAHLER
AMERICAN SCIENCE & ENGINEERING
CAMBRIDGE, MASSACHUSETTS

OBJECTIVE:

- DETECT X-RAYS FROM JUPITER
- SEARCH FOR CORRELATION OF X-RAY EMISSION WITH BOTH SOLAR ACTIVITY AND JOVIAN DECAMETRIC RADIO EMISSION
- ANALYZE SOLAR WINDS AT JUPITER RADIUS

IMPLEMENTATION:

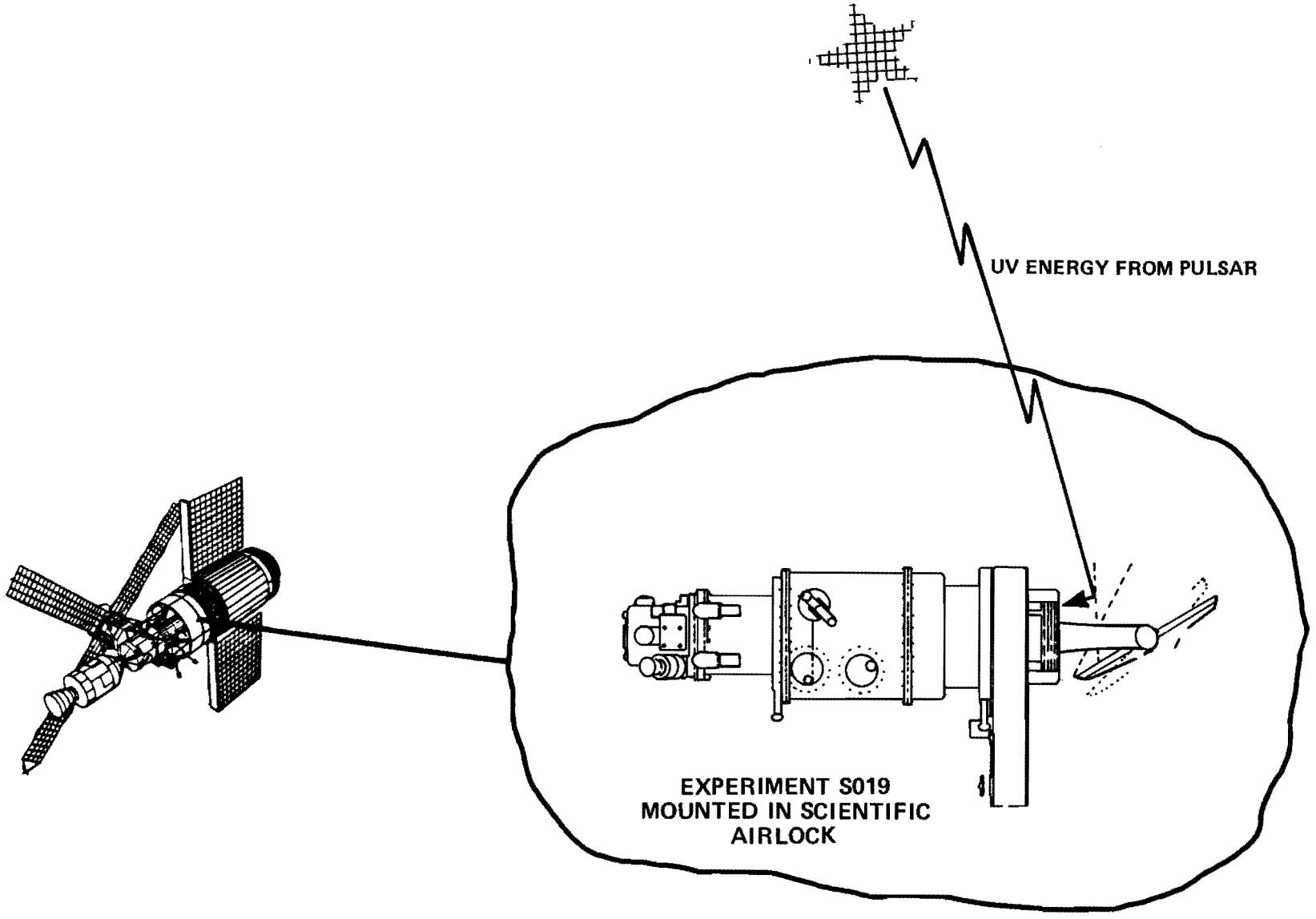
- EXPERIMENT S054, X-RAY TELESCOPE WILL SUPPLY THE NECESSARY DATA

DATA AND ANALYSIS:

- SUPPORT PROVIDED STUDENT IN DATA INTERPRETATION AND REPORTING

SKYLAB STUDENT PROJECT

ED 26 - UV FROM PULSARS



ED-26 - UV FROM PULSARS

STUDENT:
MR. NEAL W. SHANNON
3849 FOSTER RIDGE ROAD
ATLANTA, GEORGIA 30345

TEACHER/SPONSOR:
DR. PAUL H. KNAPPENBERGER
THE SCIENCE MUSEUM OF VIRGINIA
ROOM 1215, STATE OFFICE BUILDING
RICHMOND, VIRGINIA 23219

SCIENCE ADVISOR:
MR. JOHN HUMPHREYS, MSFC/SL-ATM

AFFILIATE PRINCIPAL INVESTIGATOR:
DR. KARL HENIZE, JSC/CB

OBJECTIVE:

- STUDY AND PHOTOGRAPH PULSARS IN THE ULTRAVIOLET REGION
- VERIFY CHARACTERISTIC SPECTRA IN THE ULTRAVIOLET FROM CRAB NEBULA PULSAR

IMPLEMENTATION:

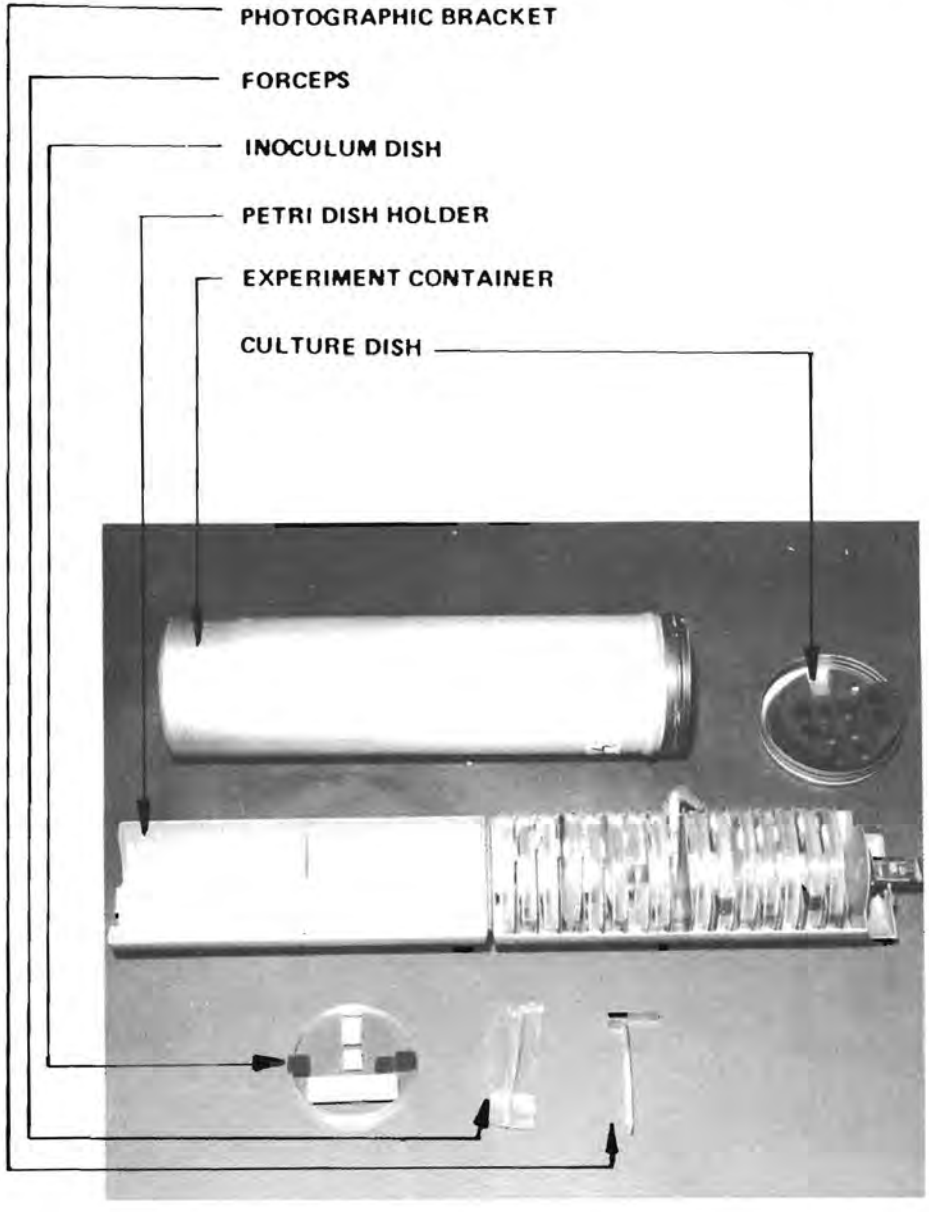
- S019 - ULTRAVIOLET STELLAR ASTRONOMY WILL PHOTOGRAPH SEVERAL TARGETS TO BE SELECTED BY THE PRINCIPAL INVESTIGATOR OF S019 AND THE STUDENT INVESTIGATOR

DATA AND ANALYSIS:

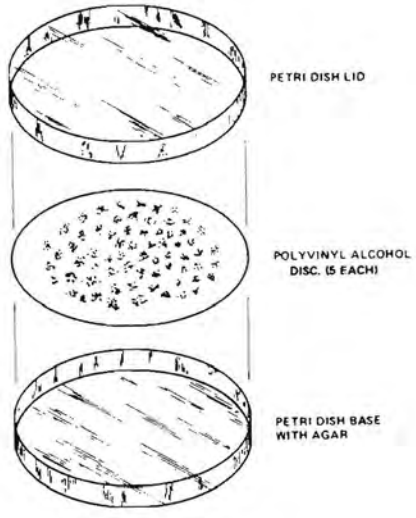
- ASSISTANCE WILL BE PROVIDED STUDENT IN DATA INTERPRETATION AND REPORT WRITING

EXPERIMENTS REQUIRING HARDWARE

(CATEGORY III)



VIEW OF HARDWARE



PETRI DISH DETAILS

EXPERIMENT PERFORMANCE SIMULATION

ED-31 - BACTERIA AND SPORES

STUDENT:
MR. ROBERT L. STAEHLE
HUNTINGTON HILLS-NORTH
ROCHESTER, NEW YORK 14622

TEACHER/SPONSOR:
MR. ALAN H. SOANES
HARLEY SCHOOL

SCIENCE ADVISORS:
MR. STEVE HALL, MSFC/S&E-ASTN-SM
DR. GERRY R. TAYLOR, JSC/DD52

OBJECTIVE:

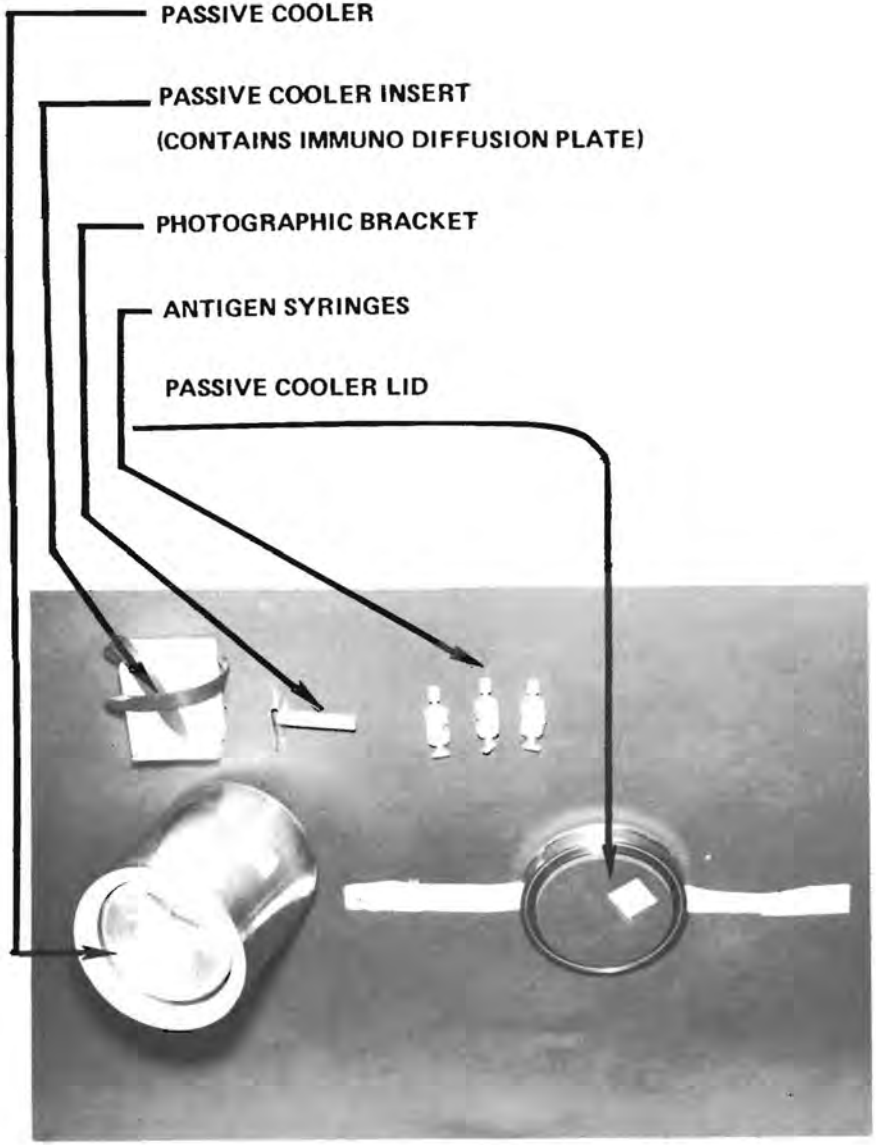
- TO DETERMINE, UNDER CONTROLLED CONDITIONS, THE SURVIVAL, GROWTH AND MUTATIONS OF SELECTED BACTERIA IN THE SKYLAB ENVIRONMENT

IMPLEMENTATION:

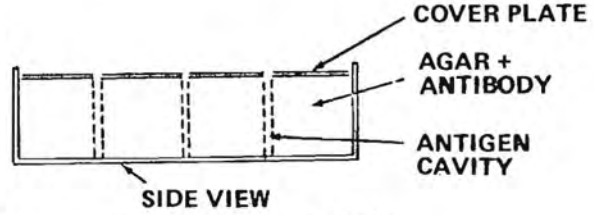
- AGAR FILLED PETRI DISHES INOCULATED IN SPACE
- CULTURES INCUBATED IN IMSS INCUBATOR AT 35°C AND AT OWS AMBIENT
- PERIODIC OBSERVATION AND PHOTOGRAPHY
- COLONY GROWTH ATTENUATED AT SPECIFIED TIME BY COOLING
- CULTURES RETURNED FOR LABORATORY STUDY

DATA AND ANALYSIS:

- RETURNED PETRI DISHES (GROWTH RATE, MORPHOLOGY, PIGMENTATION AND TEXTURE)
- PHOTOGRAPHS
- STUDENT PROVIDED ASSISTANCE IN DATA ANALYSIS, INTERPRETATION AND REPORTING



View of Hardware



Immuno Diffusion Plate Details

View of Reacted Immuno Diffusion Plate

Simulating Data Acquisition

ED-32 - IN VITRO IMMUNOLOGY

STUDENT:
MR. TODD A. MEISTER
33-04 93 STREET
JACKSON HEIGHTS, NEW YORK 11372

TEACHER/SPONSOR:
MR. VINCENT G. GALASSO
BRONX HIGH SCHOOL OF SCIENCE

SCIENCE ADVISORS:
DR. ROBERT ALLEND, MSFC/S&E-ASTN-M
DR. S. KIMZEY, JSC/DC72

OBJECTIVE:

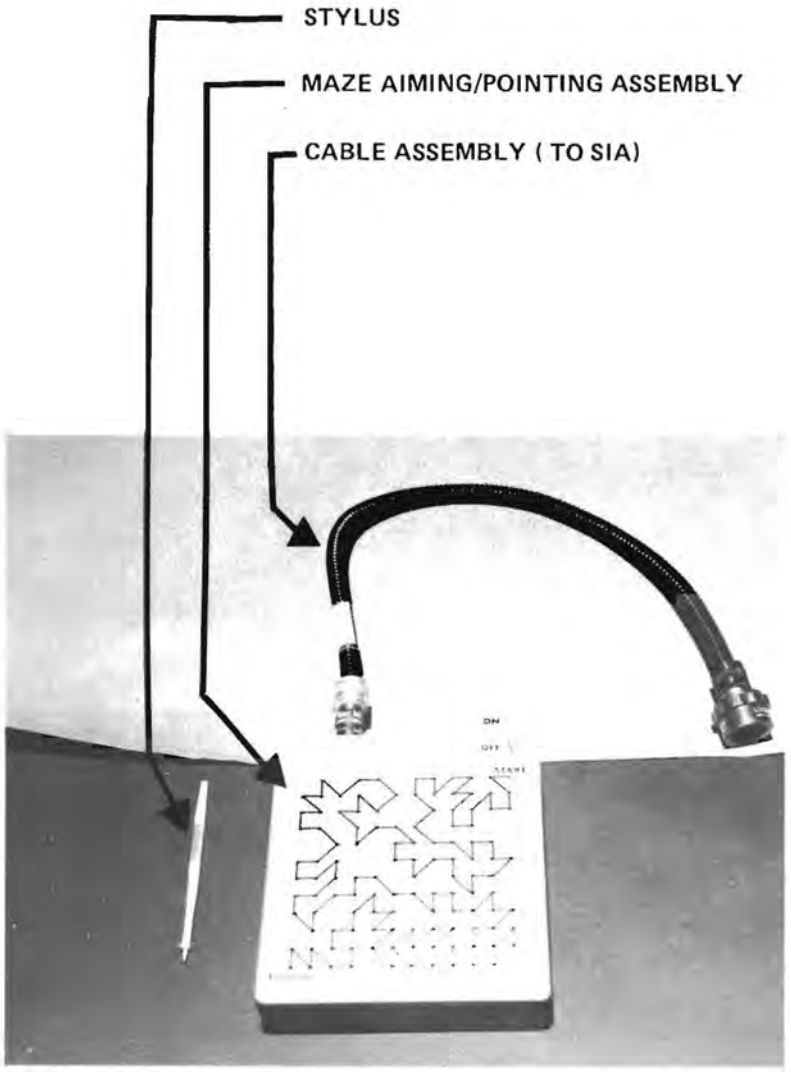
- THE DETERMINATION OF THE EFFECTS OF ZERO-GRAVITY ON ANTIGENIC CHANGES IN SURFACE MEMBRANES

IMPLEMENTATION:

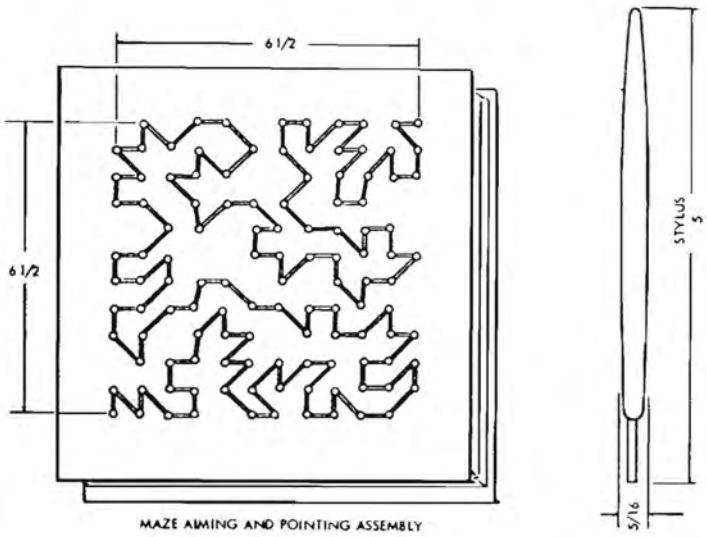
- EXPOSURE TO ZERO GRAVITY, OF A KNOWN EXPERIMENTAL SYSTEM FOR THE STUDY OF THE ANTIGEN/ANTIBODY REACTION WHICH FORMS A PRECIPITIN RING

DATA AND ANALYSIS:

- CLOSEUP PHOTOGRAPHY OF THE REACTION PLATES
- SUPPORT PROVIDED STUDENT IN DATA ANALYSIS, DATA INTERPRETATION AND REPORTING IN CLOSE COORDINATION WITH LIFE SCIENCES DIRECTORATE OF JOHNSON SPACE CENTER



ED 41 Motor Sensory Performance



Experiment System Details

Simulation Experiment Performance

ED-41 - MOTOR SENSORY PERFORMANCE

STUDENT:
MISS KATHY L. JACKSON
18618 CAPETOWN DRIVE
HOUSTON, TEXAS 77058

TEACHER/SPONSOR:
MRS. MARY K. KIMZEY
CLEAR CREEK HIGH SCHOOL

SCIENCE ADVISORS:
DR. ROBERT ALLEN, MSFC/S&E-ASTN-SM
DR. WILLIAM FEDDERSEN, JSC/DC72

OBJECTIVE:

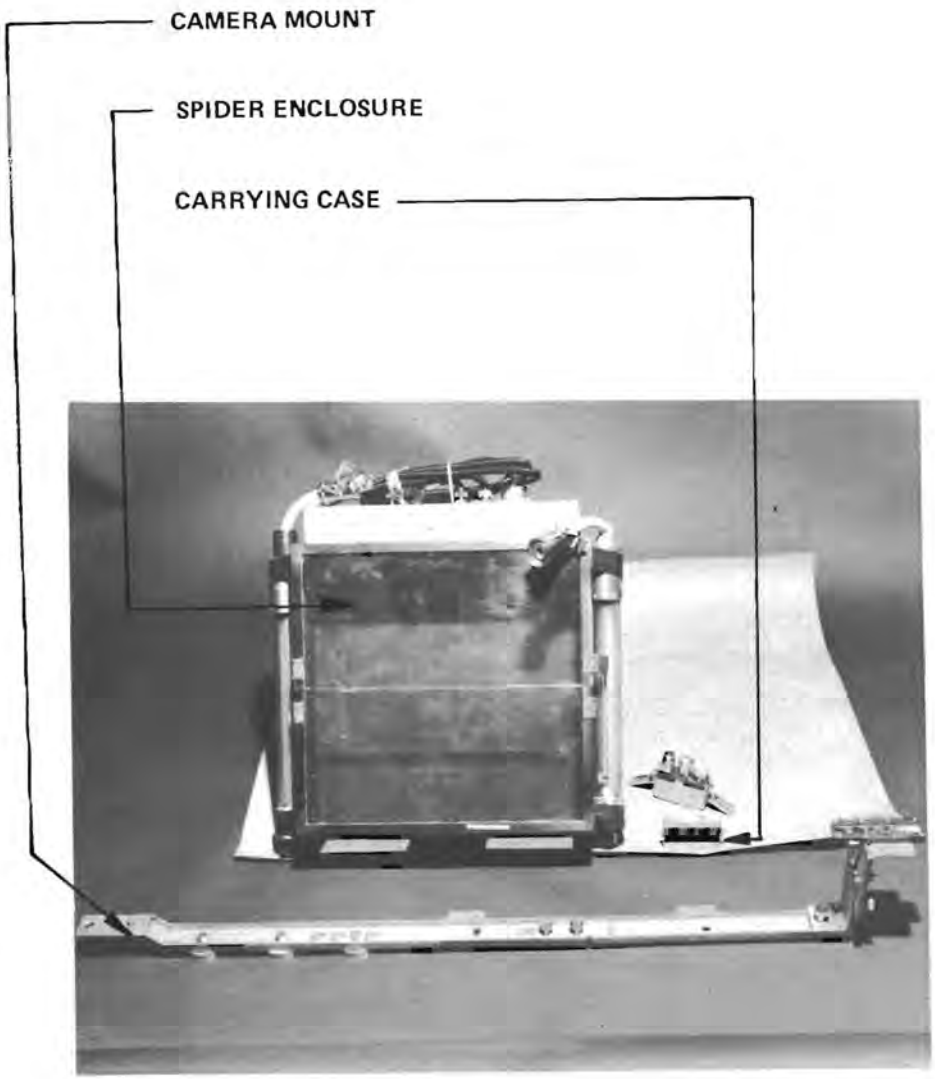
- MEASURE CHANGES IN MOTOR SENSORY PERFORMANCE RESULTING FROM PROLONGED SPACE FLIGHT
- COMPARE SKYLAB PERFORMANCE DATA WITH EXISTINB ASELINE DATA AND THAT OBTAINED DURING PRE- AND POST-FLIGHT ANALYSIS.

CONCEPT:

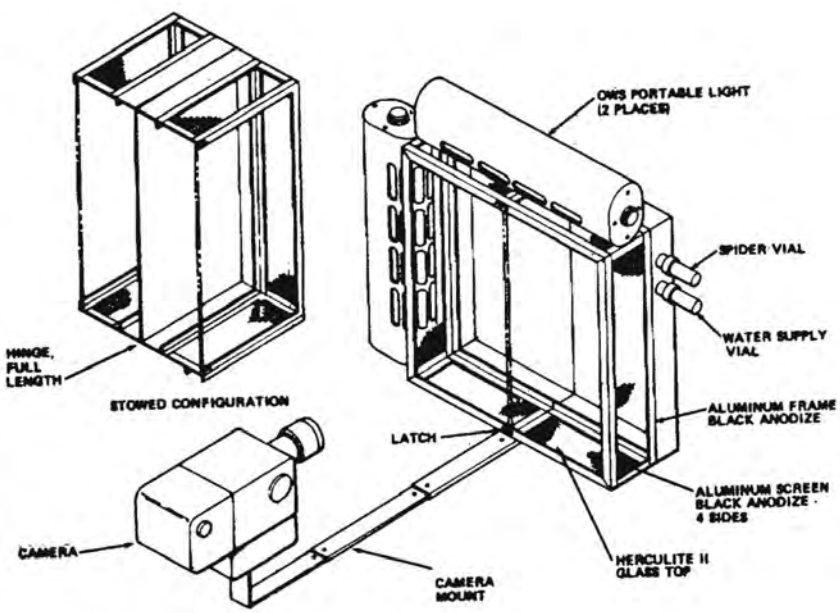
- AN ESTABLISHED SENSORY PERFORMANCE MAZE WILL BE UTILIZED TO ASSESS A CREW MEMBER'S MOTOR SENSORY SKILLS

IMPLEMENTATION:

- THE STANDARD EYE-HAND COORDINATION TEST APPARATUS DEVELOPED BY THE HUMAN PERFORMANCE GROUP OF THE DEPARTMENT OF INDUSTRIAL ENGINEERS, UNIVERSITY OF MICHIGAN, HAS BEEN MODIFIED FOR USE ON SKYLAB
- DATA WILL BE RECORDED ON THE SKYLAB AUDIO TAPE RECORDER TOGETHER WITH MILLISECOND TIME MARKS



View of Hardware



Hardware Details

ED-52 - WEB FORMATION

STUDENT:
MISS JUDITH S. MILES
3 DEWEY ROAD
LEXINGTON, MASSACHUSETTS 02173

TEACHER/SPONSOR:
MR. J. MICHAEL CONLEY
LEXINGTON HIGH SCHOOL

SCIENCE ADVISORS:
DR. RAYMOND GAUSE, MSFC/S&E-ASTN-ME
JOHN MACLEOD, JSC /KM

OBJECTIVE:

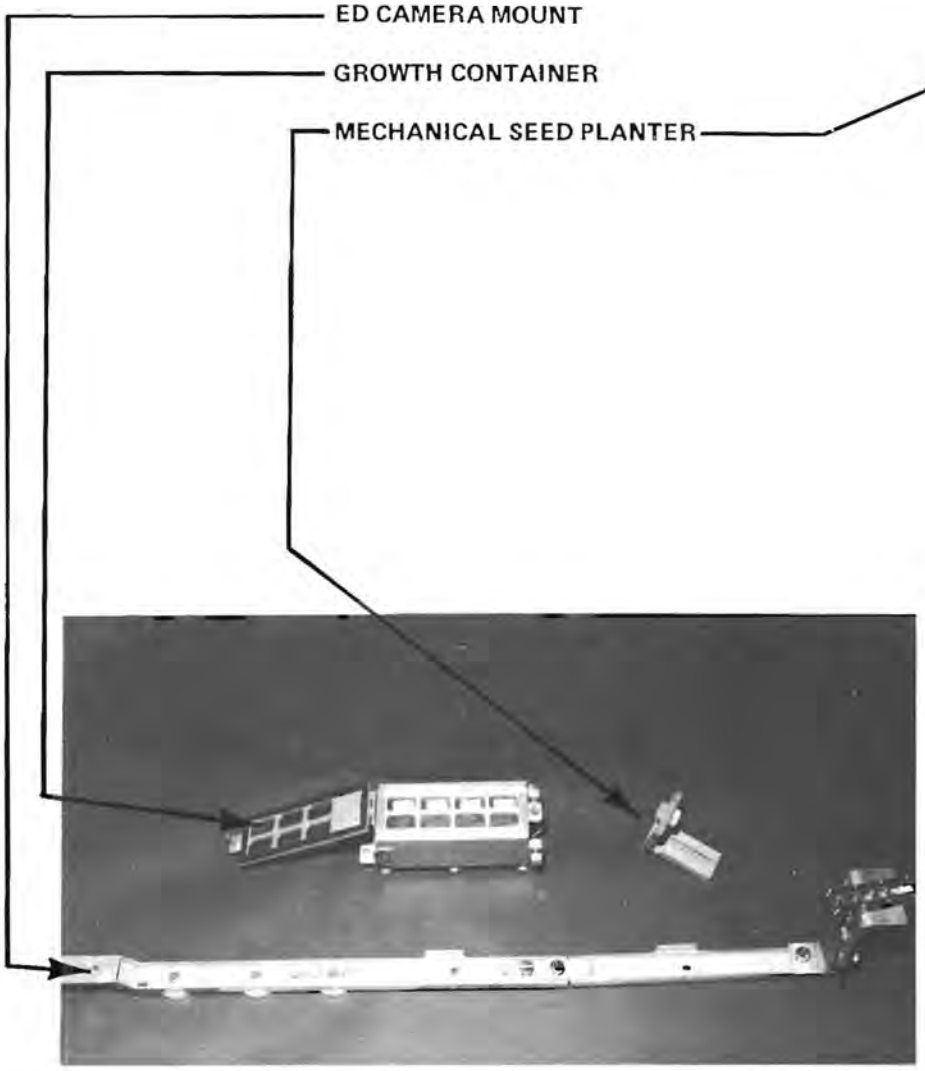
- OBSERVE THE WEB BUILDING PROCESS AND DETAILED STRUCTURE OF THE WEB OF THE COMMON CROSS SPIDER (ARANEUS DIADEMATUS) IN BOTH A NORMAL ENVIRONMENT AND THE SKYLAB ENVIRONMENT

IMPLEMENTATION:

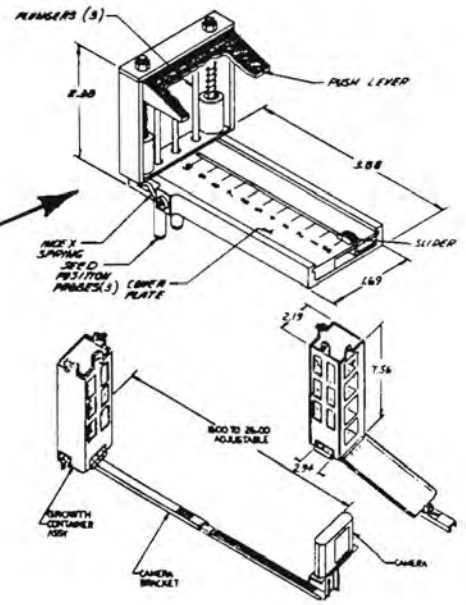
- SPIDERS, ACCLIMATED TO THE SKYLAB AMBIENT ENVIRONMENT IN AN EARTH GRAVITATIONAL FIELD, ARE LAUNCHED IN THE COMMAND MODULE AND DEPLOYED TO A CAGE LAUNCHED IN THE ORBITAL WORKSHOP
- AUTOMATED MOTION PICTURES ARE TAKEN DURING THE ATTEMPTS TO BUILD A WEB
- STILL PHOTOGRAPHS MADE OF COMPLETED WEB EARLY, MIDWAY AND LATE IN MISSION

DATA AND ANALYSIS:

- PHOTOGRAPHS ANALYZED FOR WEB SIZE, TOTAL THREAD LENGTH, NUMBER OF RADII, ETC.
- SUPPORT PROVIDED STUDENT IN DATA ANALYSIS, INTERPRETATION AND REPORTING



View of Hardware



Hardware Details

Simulating Experiment Deployment

ED-61/62 - PLANT GROWTH/PLANT PHOTOTROPISM

STUDENT:
MR. JOEL G. WORDEKEMPER
810 EAST SHERMAN STREET
WEST POINT, NEBRASKA 68788

TEACHER/SPONSOR:
MRS. LOIS M. SCHAFF
CENTRAL CATHOLIC HIGH SCHOOL

SCIENCE ADVISORS:
MR. LOREN GROSS, MSFC/S&E-ASTN-PPM - DR. CHARLES WALKINSHAW, JSC/DD52
MR. CHARLES MILLER, MSFC/S&E-ASTN-PPM

OBJECTIVE:

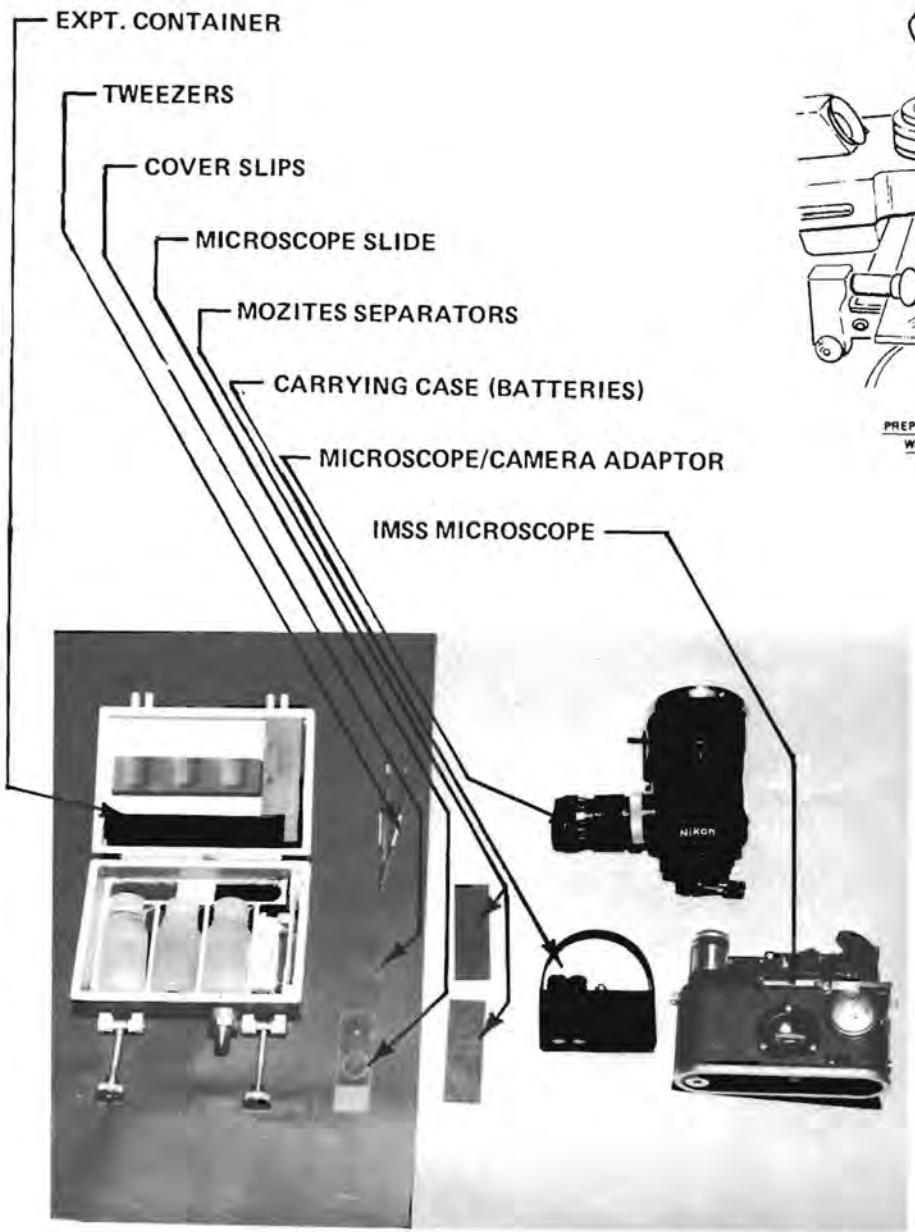
- OBSERVATION AND RECORDING OF DIFFERENCES IN ROOT AND STEM GROWTH AND ORIENTATION OF RICE SEEDS GERMINATED IN THE SKYLAB ENVIRONMENT
- ASSESSMENT OF WHETHER OR NOT PHOTOTROPISM CAN SERVE AS A SUBSTITUTE FOR GEOTROPISM FOR RICE SEEDS GERMINATED AND DEVELOPED IN THE SKYLAB ENVIRONMENT

IMPLEMENTATION:

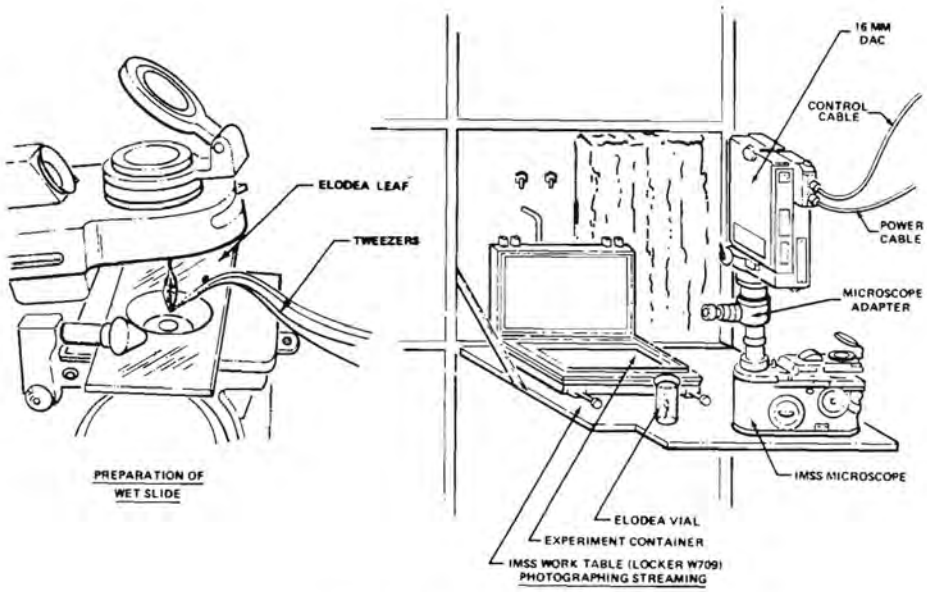
- EIGHT SEED GROUPS (24 SEEDS) ARE IMPLANTED IN A COMPARTMENTAL CONTAINER FILLED WITH CLEAR AGAR
- NEUTRAL DENSITY FILTERS ENABLE VARIATION IN LIGHT IMPINGING ON EACH COMPARTMENT
- PHOTOGRAPHIC RECORDS ARE MADE OVER A PERIOD OF 14 DAYS

DATA AND ANALYSIS:

- COPIES OF PHOTOGRAPHY PROVIDED STUDENT
- SUPPORT PROVIDED STUDENT IN DATA ANALYSIS AND REPORTING



View of Hardware



Hardware Description

Simulating Wet Slide Preparation

ED-63 - CYTOPLASMIC STREAMING

STUDENT:
MISS CHERYL A. PELTZ
7117 S. WINDERMERE
LITTLETON, COLORADO 80120

TEACHER/SPONSOR:
MR. GORDON B. SCHEELE
ARAPAHOE HIGH SCHOOL

SCIENCE ADVISORS:
CHARLES COTHRAN, MSFC/S&E-ASTN-PTC
DR. CHARLES WALKINSHAW, JSC/DD52

OBJECTIVE:

- OBSERVATION OF THE EFFECTS OF ZERO GRAVITY ON CYTOPLASMIC STREAMING IN PLANTS

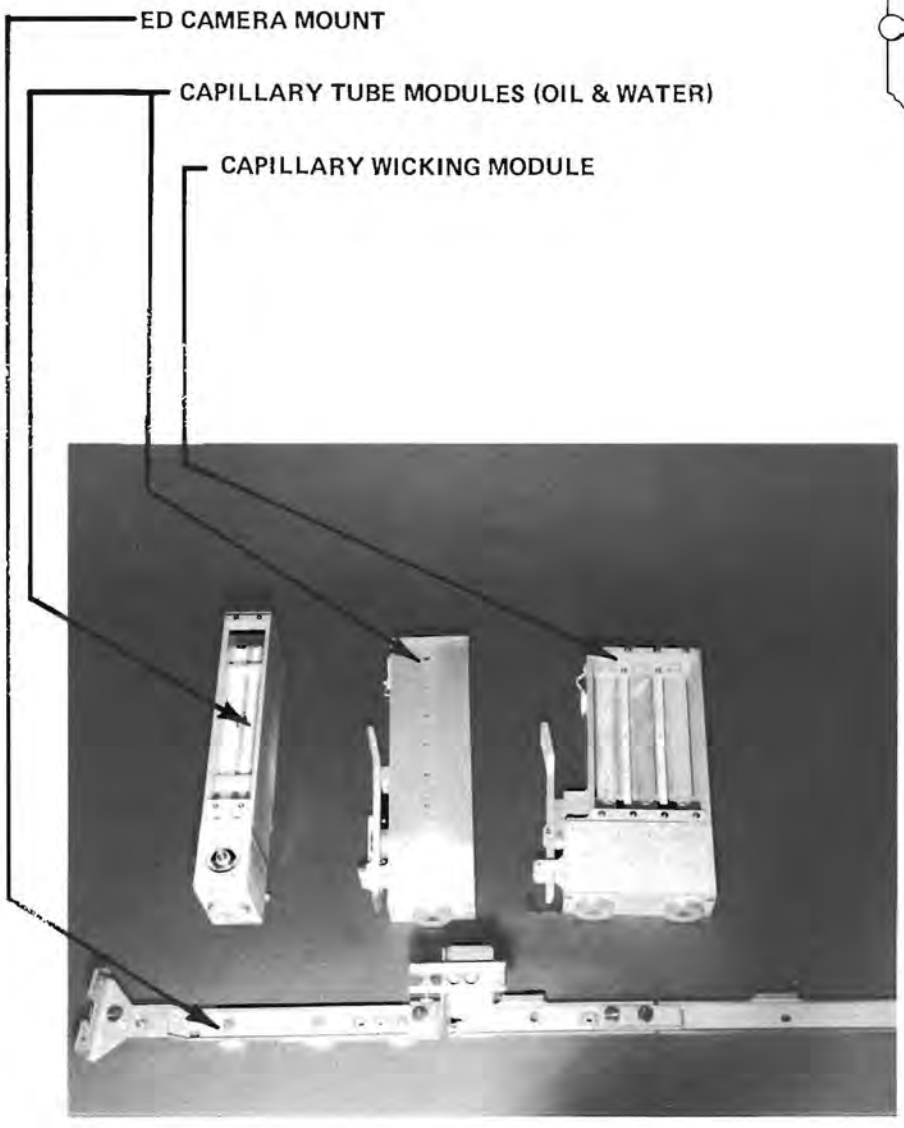
IMPLEMENTATION:

- A SPRIG OF THE WATER PLANT, ELODEA, WILL BE PLACED IN A TRANSPARENT CONTAINER, TOGETHER WITH ADEQUATE NUTRIENT
- EXISTING LIGHT SOURCE WILL MAINTAIN PHOTOSYNTHESIS THROUGHOUT SKYLAB MISSION
- AS CONVENIENT, ONCE EARLY IN THE MISSION AND ONCE LATE IN THE MISSION, A LEAF OF THE PLANT WILL BE PLACED UNDER A MICROSCOPE AND EXAMINED FOR THE PRESENCE OF STREAMING
- 16MM MOVIES OF THE STREAMING PROCESS WILL BE MADE THROUGH THE MICROSCOPE TO ENABLE ASSESSMENT OF THE QUALITY OF THE STREAMING

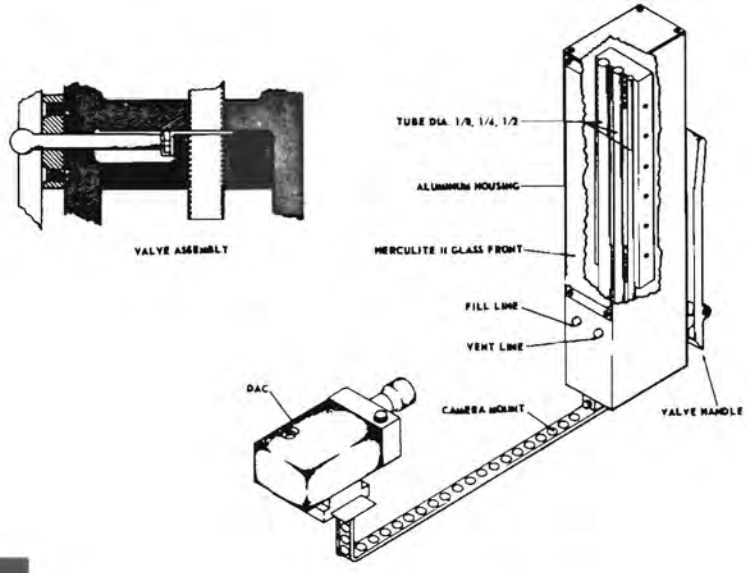
DATA AND ANALYSIS:

- DUPLICATES OF FILM WILL BE PROVIDED STUDENT
- SUPPORT PROVIDED STUDENT IN DATA ANALYSIS AND REPORTING

ED 72 CAPILLARY STUDY



View of Hardware



Capillary Tube System

Simulating Deployment of Experiment

ED-72 - CAPILLARY STUDIES

STUDENT:
MR. ROGER G. JOHNSTON
1833 DRAPER DRIVE
ST. PAUL, MINNESOTA 55113

TEACHER/SPONSOR:
MR. THEODORE B. MOLITOR
ALEXANDER RAMSEY HIGH SCHOOL

SCIENCE ADVISORS:
DR. RAYMOND GAUSE, MSFC/S&E-ASTN-ME
JOHN MACLEOD, JSC/KM

OBJECTIVE:

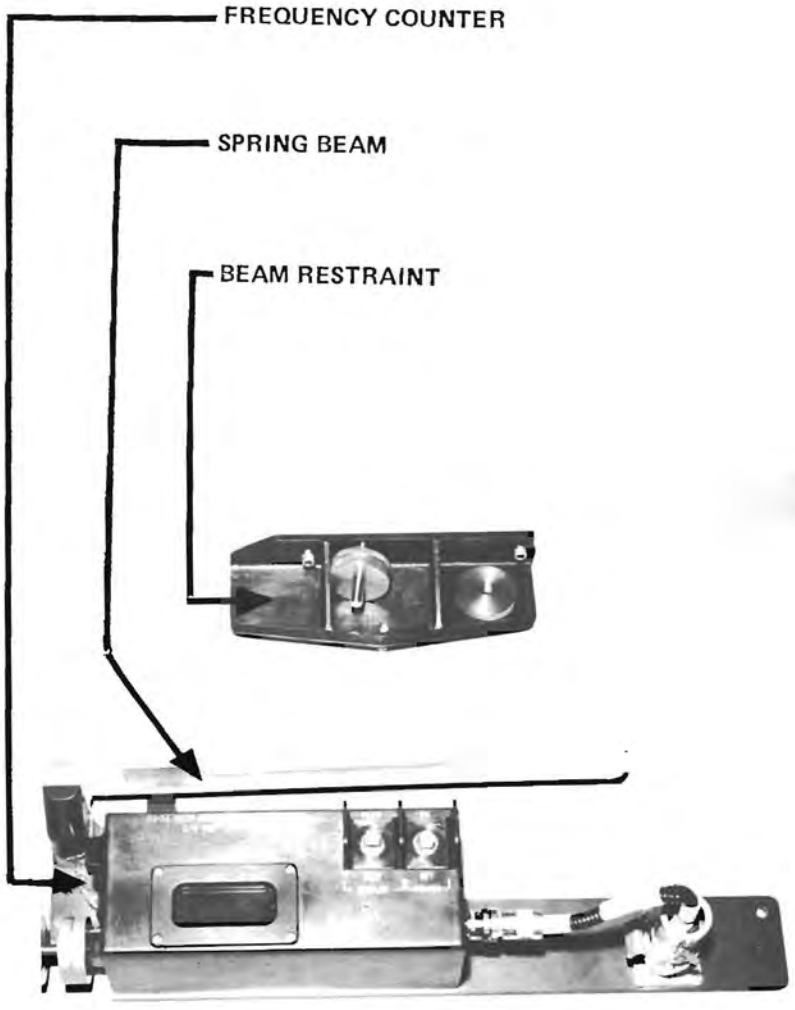
- DEMONSTRATION OF CAPILLARY TUBES AND CAPILLARY WICKS IN THE SKYLAB ENVIRONMENT

IMPLEMENTATION:

- TWO CAPILLARY TUBE MODULES PROVIDED WITH "ZERO FORCE" BLADDERS AND DIFFERENT VISCOSITY LIQUIDS
- ONE SIMILAR CAPILLARY WICK MODULE
- MOTION PICTURE PHOTOGRAPHY

DATA AND ANALYSIS:

- PHOTOGRAPHS PROVIDED STUDENT
- CONTACT ANGLE, SHAPE OF MENISCUS AND FLOW RATE AS A FUNCTION OF TUBE DIAMETER, SCREEN WEAVE AND FLUID VELOCITY
- ASSISTANCE PROVIDED STUDENT IN DATA INTERPRETATION AND REPORT WRITING



View of Hardware

Simulating Deployment of Experiment

ED-74 - MASS MEASUREMENT

STUDENT:

MR. VINCENT W. CONVERSE
1704 ROOSEVELT ROAD
ROCKFORD, ILLINOIS 61111

TEACHER/SPONSOR:

MISS MARY J. TRUMBAUER
HARLEM HIGH SCHOOL

SCIENCE ADVISORS:

DR. ROBERT HEAD, MSFC/S&E-ASTN-DIR
MR. JOHN MACLEOD, JSC/KM

OBJECTIVE:

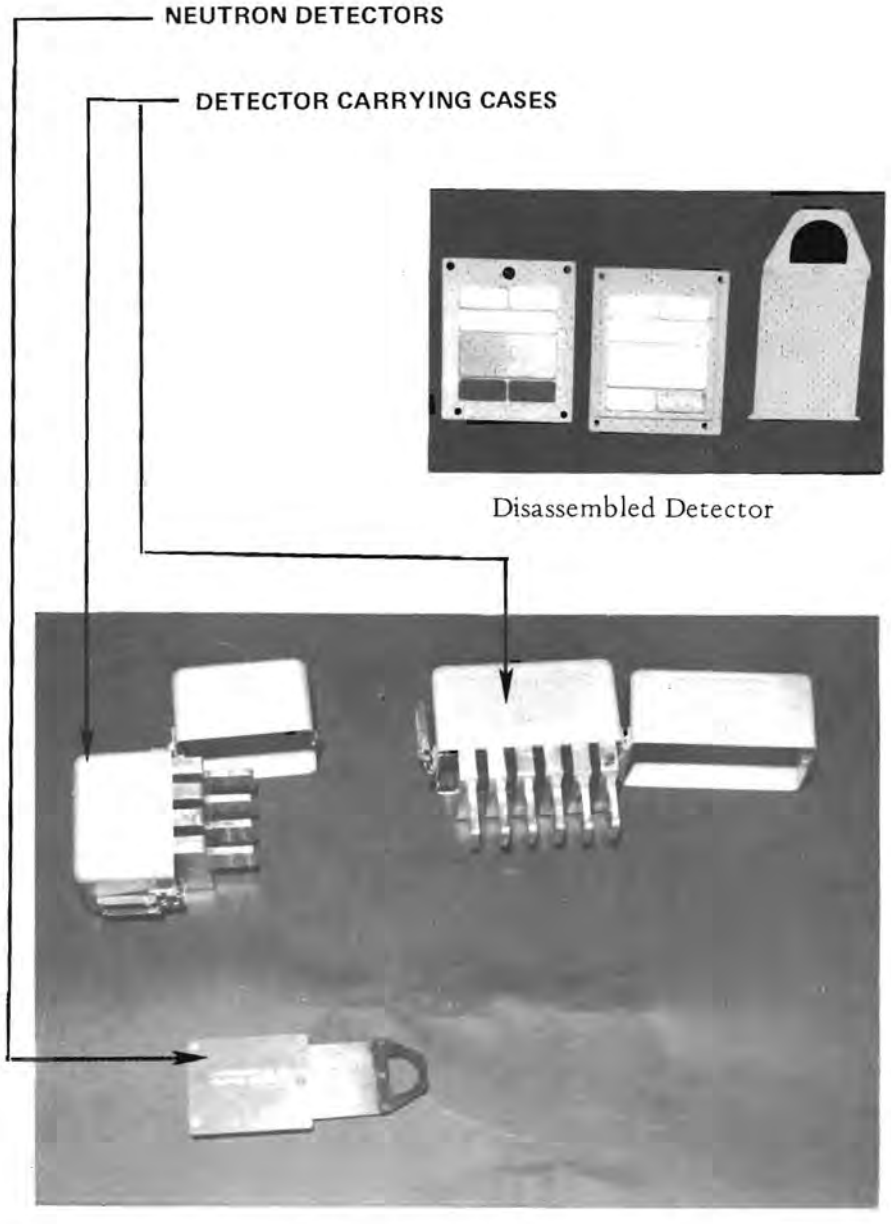
- DEMONSTRATION OF THE METHODS OF MASS MEASUREMENT UTILIZED ON BASELINE SKYLAB SYSTEMS

IMPLEMENTATION:

- A SIMPLE CNTILEVERED BEAM SUPPORTING A LUMPED MASS AT ONE END IS SET INTO OSCILLATION
- THE FREQUENCY OF OSCILLATION IS A FUNCTION OF THE BASIC BEAM PROPERTIES AND THE LUMPED MASS
- CALIBRATION WILL BE DONE IN ORBIT USING 16MM MOVIE FILM FOR ANALYSIS AND DEMONSTRATION WITH A NEAR-REAL-TIME TV RECORD AS A BACKUP

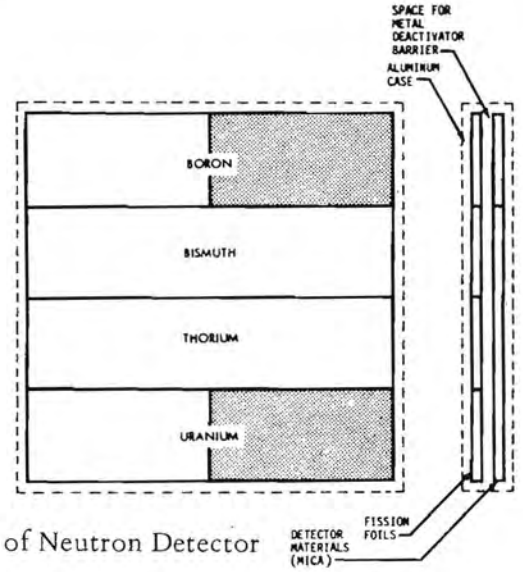
DATA AND ANALYSIS:

- STUDENT PROVIDED PHOTOGRAPHS
- STUDENT PROVIDED ASSISTANCE IN DATA ANALYSIS AND REPORTING
- CAPABILITY FOR CLASSROOM DUPLICATION USING READILY AVAILABLE MATERIALS



View of Hardware

Disassembled Detector



Sketch of Neutron Detector

Simulating Deployment of Detectors

ED-76 - NEUTRON ANALYSIS

STUDENT:
MR. TERRY C. QUIST
3818 LONGRIDGE DRIVE
SAN ANTONIO, TEXAS 78228

TEACHER/SPONSOR:
MR. MICHAEL STEWART
THOMAS JEFFERSON HIGH SCHOOL

SCIENCE ADVISORS:
MR. CHARLES PEACOCK, MSFC/S&E-ASTN-ME
DR. DON ROBBINS, JSC/TN22

OBJECTIVE:

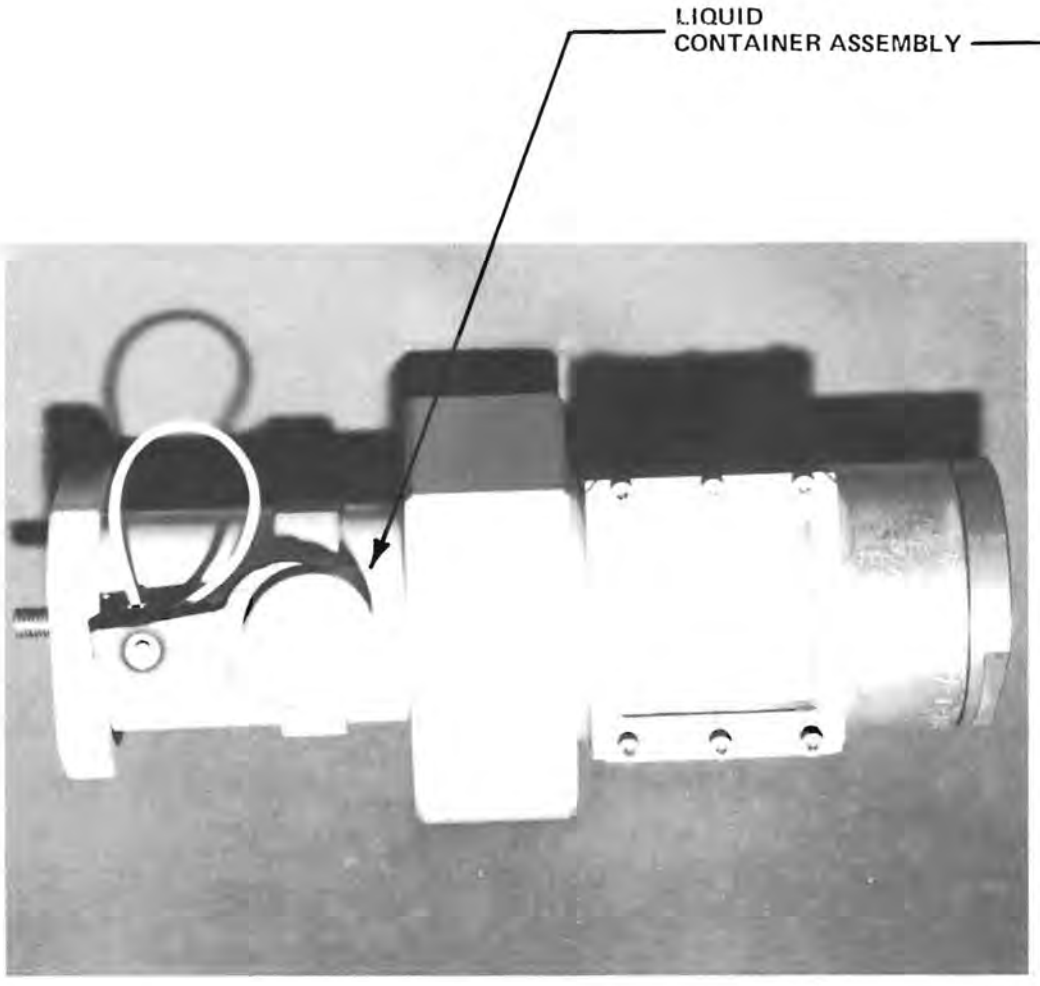
- MEASUREMENT OF THE AMBIENT NEUTRON FLUX EXISTENT IN THE ORBITAL WORKSHOP
- ATTEMPT IDENTIFICATION OF THE CONTRIBUTION FROM EACH OF THREE SOURCES: 1) EARTH ALBEDO NEUTRONS; 2) SOLAR NEUTRONS; 3) COSMIC RAY SECONDARY NEUTRONS

IMPLEMENTATION:

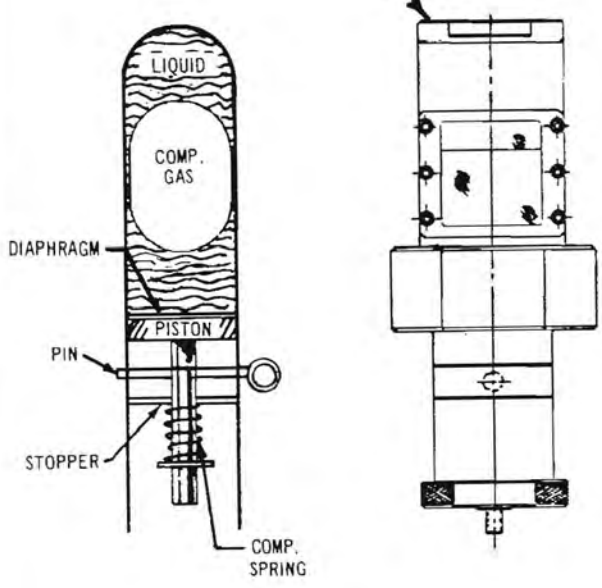
- TEN SANDWICH DETECTORS CONSISTING OF SUITABLE FILM WITH A FOUR-PART GRID/FOIL ARRANGEMENT USING 10_B, THORIUM, 235_U AND CADMIUM COVERED 235_U FOIL ARE DEPLOYED ON THE INBOARD SURFACE OF THE OWS AND OWS WATER STORAGE TANKS
- AT STATED TIMES DURING THE SKYLAB PROGRAM CERTAIN OF THE DETECTORS WILL BE DEACTIVATED AND PLACED IN STOWAGE FOR ULTIMATE RETURN FOR ANALYSIS ON THE GROUND

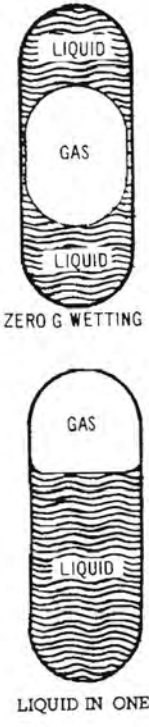
DATA AND ANALYSIS:

- SUPPORT WILL BE PROVIDED STUDENT IN DATA ANALYSIS AND INTERPRETATION IN SPECIALIZED FACILITY



View of Hardware





Hardware Details

ED-78 - LIQUID MOTION

STUDENT:
MR. W. BRIAN DUNLAP
6695 ABBOT AVENUE
YOUNGSTOWN, OHIO 44515

TEACHER/SPONSOR:
MR. PAUL J. PALLANTE
AUSTINTOWN FITCH HIGH SCHOOL

SCIENCE ADVISORS:
DR. ROBERT HEAD, MSFC/S&E-ASTN-DIR
MR. JOHN MACLEOD, JSC/KM

OBJECTIVE:

- OBSERVATION OF THE MOTION OF A GAS BUBBLE SURROUNDED BY A FLUID EXCITED BY A SIMPLE MECHANICAL SYSTEM OF CALIBRATED DRIVING FORCE OF SIMPLE FREQUENCY

IMPLEMENTATION:

- LIQUID WILL FORM AN ENVELOPE AROUND AN AIR POCKET
- SIZE OF THE AIR POCKET WILL DEPEND ON THE AMOUNT OF EARTH ATMOSPHERE ENCLOSED WITH THE LIQUID

DATA AND ANALYSIS:

- PHOTOGRAPHS PROVIDED STUDENT
- SUPPORT PROVIDED STUDENT IN DATA INTERPRETATION AND REPORTING

STUDENT EXPERIMENTS
AFFILIATED WITH OTHER RESEARCH

(CATEGORY IV)

ED-33 - MICROORGANISMS IN VARYING G

STUDENT:
MR. KEITH L. STEIN
2167 REGENT COURT SOUTH
WESTBURY, NEW YORK

TEACHER/SPONSOR:
MR. DENNIS UNGER
W. TRESPER CLARKE HIGH SCHOOL

NASA ADVISOR:
MR. STEPHEN HALL, MSFC/
S&E-ASTN-SMH

AFFILIATED RESEARCHER:
DR. GERRY TAYLOR, JSC/DD52

OBJECTIVE:

- DETERMINATION OF THE EFFECTS OF VARYING "G" LEVEL UPON GROWTH RATE, DEVELOPMENT PROCESS AND SURVIVABILITY OF SELECTED ORGANISMS

CONCEPT:

- COUNTER ROTATING CENTRIFUGE MOUNTED SPECIMENS SUBJECTED TO CAREFULLY CONTROLLED REGIME OF ACCELERATION-TIME PROFILES

PROGRAM INCOMPATIBILITY RATIONALE:

- VOLUME REQUIRED FOR STATISTICALLY USEFUL DATA CANNOT BE LAUNCHED IN CM
- EXCESSIVE POWER REQUIREMENT FOR DURATION OF SL-2, 3, 4
- HARDWARE COMPLEXITY PRECLUDES DEVELOPMENT IN ALLOTED TIME
- EXCESSIVE CREW TIME REQUIRED

AFFILIATION:

- DATA FROM MICROBIOLOGY DTO WILL BE STUDIED BY THE STUDENT

ED-51 - CHICK EMBRYOLOGY

STUDENT:
MR. KENT M. BRANDT
11380 GRAND OAK DRIVE
GRAND BLANC, MICHIGAN

TEACHER/SPONSOR:
MR. CHARLES E. MARTELL III
GRAND BLANC SENIOR HIGH SCHOOL

NASA ADVISOR:
DR. ROBERT ALLEN, MSFC/S&E-ASTN-M

AFFILIATED RESEARCHER:
DR. ROBERT LINDBERG
NORTHROP CORPORATE LAB.
HAWTHORNE, CALIFORNIA

OBJECTIVE:

- STUDY OF THE EMBRYOLOGICAL DEVELOPMENT OF CHICK EGGS INCUBATED IN ZERO GRAVITY
- COMPARISION OF MOTOR COORDINATION AND VESTIBULAR FUNCTION OF SPACE CHICK WITH NORMAL CHICK

CONCEPT:

- FERTILE EGGS LAUNCHED IN CM, INCUBATED IN OWS. DEVELOPMENT TERMINATED AT SPECIFIC TIMES AND EGGS RETURNED IN CM
- HATCH CHICK, OBSERVE AND PHOTOGRAPH BEHAVIOR, RETURN IN CM

PROGRAM INCOMPATIBILITY RATIONALE:

- EXCESSIVE CM LAUNCH VOLUME
- HARDWARE COMPLEXITY PRECLUDES DEVELOPMENT IN ALLOTTED TIME
- LOW PROBABILITY OF SUCCESS WITHOUT EXTENSIVE DEVELOPMENT PROGRAM

AFFILIATION:

- STUDENT WILL STUDY DATA GENERATED BY EXPERIMENT S071 (CIRCADIAN THYTHM POCKET MICE)

ED-71 - COLLOIDAL STATE

STUDENT:
MR. KEITH D. MCGEE
122 SUNFLOWER STREET
GARLAND, TEXAS

TEACHER/SPONSOR:
MRS. ANN B. PATTERSON
SOUTH GARLAND HIGH SCHOOL

NASA ADVISOR:
MR. HARRY COONS, MSFC/SL-DP

AFFILIATED RESEARCHER:
DR. ROBERT SNYDER, MSFC/
S&E-ASTN-MX

OBJECTIVE:

- TO INVESTIGATE THE EFFECT OF A ZERO GRAVITY ENVIRONMENT ON THE COLLOIDAL STATE OF MATTER, AS OPPOSED TO THE KNOWN CHARACTERISTIC OF THIS STATE IN A ONE-G ENVIRONMENT

CONCEPT:

- MOTION PICTURE PHOTOGRAPHY OF THE FORMATION OF A SOL (COLLOIDAL SOLUTION) UNDER CONTROLLED CONDITIONS.
- MOTION PICTURE PHOTOGRAPHY OF FORMATION OF A SUSPENSION BY ADDITION OF AN ELECTROLYTE TO A SOLUTION
- MOTION PICTURE PHOTOGRAPHY OF AN ELECTROPHORETIC REACTION

PROGRAM INCOMPATIBILITY RATIONALE:

- IMPLEMENTATION OF FIRST THREE OBJECTIVES REQUIRES LONG DURATION, EXTREMELY STABLE OPERATING SITE NOT OBTAINABLE ON SKYLAB
- ELECTROPHORESIS HARDWARE UNDULY COMPLEX

AFFILIATION:

- STUDENT PERFORMING A STUDY OF APOLLO 14/16 ELECTROPHORESIS DATA

ED-73 - POWDER FLOW

STUDENT:
MR. KIRK M. SHERHART
2144 EARLMONT ROAD
BERKLEY, MICHIGAN

TEACHER/SPONSOR:
MRS. HELEN POLITZER
BERKLEY HIGH SCHOOL

NASA ADVISOR:
DR. ROBERT HEAD, MSFC/S&E-ASTN-DIR

AFFILIATED RESEARCHER:
WILLIAM MASICA
LEWIS RESEARCH CENTER

OBJECTIVE:

- TEST FLOW PROPERTIES ON POWDERED SOLIDS AND EXAMINE POTENTIAL FOR USE OF POWDERED SOLIDS IN PLACE OF LIQUIDS IN A ZERO GRAVITY ENVIRONMENT

CONCEPT:

- A TWO CHAMBER CONTAINER WITH AN APPROPRIATE VALVE AND NOZZLE JOINING THEM IS PROVIDED WITH A MECHANICAL PLUNGER IN EACH CHAMBER TO FORCE POWDER BACK AND FORTH BETWEEN THE TWO CHAMBERS

PROGRAM INCOMPATIBILITY RATIONALE:

- DEVELOPMENT TESTS INDICATE FLOW WOULD NOT OCCUR DUE TO PARTICLE BRIDGING PHENOMENON

AFFILIATION:

- STUDENT PERFORMING A STUDY OF FLUID FLOW IN ZERO "G"

ED-75 - BROWNIAN MOTION

STUDENT:
MR. GREGORY A. MERKEL
WILBRAHAM AND MONSON ACADEMY
SPRINGFIELD, MASSACHUSETTS

TEACHER/SPONSOR:
MR. SOLON S. ECONOMOU
WILBRAHAM AND MONSON ACADEMY

NASA ADVISOR:
MR. HARRY COONS, MSFC/SL-DP

AFFILIATED RESEARCHER:
DR. KARL HENIZE, JSC/CB

OBJECTIVE:

- A QUALITATIVE EVALUATION OF THE EFFECTS OF A ZERO GRAVITY ENVIRONMENT ON BROWNIAN MOTION

CONCEPT:

- A CRYSTAL OF COPPER SULFATE IS SLOWLY IMMERSED IN A CONSTANT TEMPERATURE LIQUID, HELD IN PLACE, AND ALLOWED TO DISSOLVE
- PERIODIC PHOTOGRAPHS WILL BE MADE OF THE DISSOLVING SALT CRYSTAL

PROGRAM INCOMPATIBILITY RATIONALE:

- REQUIRED AN ABSOLUTELY STABLE OPERATING SITE FOR TIME PERIODS UP TO ONE MONTH WHICH IS UNOBTAINABLE ON SKYLAB

AFFILIATION:

- STUDENT WILL STUDY DATA GENERATED BY THE STELLAR ASTRONOMY EXPERIMENT, S019. (AN ALTERNATE SCIENTIFIC INTEREST OF THE STUDENT)

ED-77 - UNIVERSAL GRAVITY

STUDENT:
MR. JAMES E. HEALY
84 S. GILLETTE AVENUE
BAYPORT, NEW YORK

TEACHER/SPONSOR:
DR. PAUL MOTTL
ST. ANTHONY'S HIGH SCHOOL

NASA ADVISOR:
MR. HARRY COONS, MSFC/SL-DP

AFFILIATED RESEARCHER:
MR. BRUCE CONWAY, CODE 217A
LANGLEY RESEARCH CENTER

OBJECTIVE:

- DETERMINATION OF THE UNIVERSAL GRAVITATION CONSTANT IN A NULL-G ENVIRONMENT

CONCEPT:

- INSTALL A PORTABLE CAVENDISH BALANCE IN SKYLAB AND MEASURE THE MOTION OF THE CALIBRATED SPHERES AS A FUNCTION OF TIME

PROGRAM INCOMPATIBILITY RATIONALE:

- THE ACCELERATION OF THE SPHERES IN THE PROPOSED CAVENDISH BALANCE WITH 1 Kg MASSES HAS BEEN CALCULATED TO BE OF THE ORDER OF 10^{-9} G
- ACCELERATIONS ASSOCIATED WITH VARIOUS SL CONTROL MODE OPERATIONS ARE OF THE ORDER OF 10^{-3} G

AFFILIATION:

- STUDENT WILL STUDY DATA GENERATED BY THE T013-CREW VEHICLE DISTURBANCE EXPERIMENT

EXPERIMENT ANALYSIS AND REPORTING

GENERAL

CATEGORY I, II AND IV EXPERIMENTS ARE IMPLEMENTED BY AFFILIATING THE STUDENT INVESTIGATOR (S.I.) WITH A SKYLAB PRINCIPAL INVESTIGATOR (P.I.) OR OTHER NASA RESEARCHER. THE S.I.'S REQUIREMENTS ARE THEN SUPPORTED BY THE P.I. IN SUBSTANTIALLY THE SAME MANNER AS THE P.I. WOULD SUPPORT A CHANGE TO HIS OWN EXPERIMENT AS WITH OTHER SKYLAB EXPERIMENTS. THE S.I.'S REQUIREMENTS ARE DEFINED IN EXPERIMENT REQUIREMENTS DOCUMENTS (ERD'S) WHICH REFLECT RECONCILIATION OF S.I.'S PROPOSAL WITH PROGRAM CONSTRAINTS. MSFC'S SKYLAB PROGRAM OFFICE ASSIGNS PERSONNEL FOR OVERVIEW AND CONTROL, BUT IMPLEMENTATION DETAILS ARE HANDLED PRIMARILY BY THE AFFILIATED SKYLAB P.I. OR OTHER RESEARCHER. CATEGORY III EXPERIMENTS ARE IMPLEMENTED BY DEVELOPMENT OF HARDWARE INHOUSE AT MSFC. THE SCIENCE ADVISOR COORDINATES TECHNICAL ACTIVITIES WITHIN MSFC AND WITH OTHER CENTERS WHEN APPROPRIATE.

PRE-FLIGHT PHASE

DATA AND FLIGHT HARDWARE SELECTEES EXCHANGE LETTERS AND ATTEND WORKING SESSIONS WITH THEIR P.I. OR SCIENCE ADVISORS THROUGH VISITS AND TELEPHONE CONFERENCES TO DEVELOP TECHNICAL DATA TO SUPPORT THE EXPERIMENT. DURING THIS PHASE THE STUDENT ALSO ATTENDS PRESENTATIONS AND REVIEWS (PDR, CDR, ETC.) AT THE CENTERS AS APPROPRIATE.

OPERATIONAL PHASE

DURING THE MISSION, THE STUDENTS WILL BE ACTIVELY INVOLVED IN FOLLOWING THE CONDUCT OF THEIR EXPERIMENTS OR RELATED EXPERIMENTS BY PROVIDING

RECOMMENDATIONS TO NASA CONCERNING THE OPERATION OF THEIR EXPERIMENTS. THE STUDENTS AND THE ADVISOR OR APPROPRIATE P.I. HAVE THE RESPONSIBILITY TO PROVIDE THE "QUICK LOOK" OR DAILY MISSION REPORTS TO THE MISSION CONTROLLER THROUGH NORMAL SKYLAB CHANNELS.

POST-FLIGHT PHASE

ACTIVITIES DURING THE POST-FLIGHT PHASE OF THE PROGRAM WILL BE DIRECTED TOWARD THE PREPARATION OF REPORTS AND PRESENTATIONS, BY THE STUDENTS, OF EXPERIMENT RESULTS. NASA WILL NOT BE INVOLVED IN STYLE AND PRESENTATION FORM, BUT WILL USE THE ADVISORS TO ASSURE CORRECTNESS AND APPROPRIATENESS. IT IS THE RESPONSIBILITY OF THE S.I. TO SUBMIT A FORMAL REPORT OF HIS EXPERIMENT COVERING BOTH GROUND BASED AND IN-ORBIT OPERATIONAL ASPECTS AS WELL AS ANALYTICAL DATA. THE REPORT MUST REFLECT AN INDEPENDENT ANALYSIS OF ALL EXPERIMENT DATA BY THE STUDENT.

APPENDIX

DIVISION OF RESPONSIBILITIES WITHIN NASA

THE ORGANIZATIONAL DIVISION OF NASA RESPONSIBILITY FOR THE VARIOUS ELEMENTS OF THE SKYLAB EDUCATION PROGRAM IS AS FOLLOWS:

HEADQUARTERS

THE OFFICE OF MANNED SPACE FLIGHT - SKYLAB PROGRAM OFFICE (ML) IS RESPONSIBLE FOR OVERALL PLANNING, DIRECTION, AND COORDINATION OF ALL SKYLAB EDUCATION PROGRAM ACTIVITIES, INCLUDING THE DEFINITION OF GOALS, OBJECTIVES AND MISSION ASSIGNMENTS FOR THE STUDENT PROJECT; ESTABLISHMENT OF LIMITS FOR THE STUDENT PROJECT IMPACT ON THE SKYLAB PROGRAM; AND PREPARATION OF THE SKYLAB EDUCATION PROGRAM REPORT. IN CONJUNCTION WITH THESE RESPONSIBILITIES, THE PROGRAM OFFICE ASSISTS THE EDUCATIONAL PROGRAMS DIVISION OF THE OFFICE OF PUBLIC AFFAIRS IN PROMOTING PUBLIC INVOLVEMENT IN SKYLAB, AND IN COORDINATION OF STUDENT PROJECT INFORMATION BETWEEN NASA AND THE EDUCATIONAL COMMUNITY THROUGH THE NATIONAL SCIENCE TEACHERS ASSOCIATION (NSTA).

MARSHALL SPACE FLIGHT CENTER

THE MSFC SKYLAB PROGRAM OFFICE OCCUPIES THE LEAD ROLE IN THE SKYLAB STUDENT PROJECT, HAVING PRIME RESPONSIBILITY FOR DEVELOPMENT OF DETAILED REQUIREMENTS FOR CONDUCTING THE STUDENT PROJECT, AND FOR INTEGRATION OF

THE ACTIVITIES OF THE OTHER MANNED SPACE FLIGHT CENTERS IN THE DEVELOPMENT, CERTIFICATION AND INTEGRATION OF STUDENT PROJECT EXPERIMENTS INTO THE SKYLAB PROGRAM.

KENNEDY SPACE CENTER (KSC)

KSC HAS PRIME RESPONSIBILITY FOR INSTALLATION AND CHECKOUT OF THE EQUIPMENT DEVELOPED, BY MSFC, FOR THE SKYLAB STUDENT PROJECT.

IN ADDITION, THIS CENTER WILL SERVE, IN CONJUNCTION WITH EDUCATION PROGRAMS OFFICERS, AS HOST TO THE SKYLAB STUDENT EDUCATION CONFERENCE DURING THE INITIAL SKYLAB LAUNCH.

JOHNSON SPACE CENTER

THE JSC SKYLAB PROGRAM OFFICE HAS PRIME RESPONSIBILITY FOR INTEGRATING SKYLAB STUDENT PROJECT ORBITAL ACTIVITIES INTO THE OPERATIONAL FLIGHT PLANNING AND CREW ACTIVITY ASPECTS OF THE SKYLAB PROGRAM, AND PROVIDES SUPPORT TO THE DEVELOPMENT INTEGRATION CENTER, MSFC, IN COMPATIBILITY ANALYSES, HARDWARE CONCEPT DEVELOPMENT AND DESIGN REVIEW ACTIVITIES.

OTHER NASA CENTERS

OTHER NASA CENTERS SUCH AS AMES RESEARCH CENTER, LANGLEY RESEARCH CENTER, AND LEWIS RESEARCH CENTER, PROVIDE TECHNICAL SUPPORT TO THE SKYLAB EDUCATION PROGRAM AS REQUIRED. MOREOVER, LANGLEY RESEARCH CENTER AND LEWIS RESEARCH CENTER HAVE RESPONSIBILITY FOR THE AFFILIATION OF ED 73 AND ED 77.

STUDENT PROJECT DEVELOPMENT PHILOSOPHY

THE STUDENT PROJECT WAS ESTABLISHED LATE IN THE SKYLAB DEVELOPMENT PROGRAM. IT WAS NECESSARY, THEREFORE, TO IMPOSE CERTAIN CONSTRAINTS WITHIN WHICH ITS OWN DEVELOPMENT WOULD OCCUR. THESE CONSTRAINTS INCLUDED:

- COMPLETION OF EXPERIMENT PROTOCOLS AND HARDWARE FABRICATION WITHIN A SEVERELY CURTAILED TIME PERIOD
- USE OF EXISTING SKYLAB HARDWARE WHEREVER FEASIBLE
- MINIMUM IMPACT ON SKYLAB SYSTEMS (ESPECIALLY POWER, SIZE AND WEIGHT)
- MINIMUM IMPACT ON CREW TIME
- NO INTERFERENCE WITH PRIMARY MISSION OBJECTIVES
- NO ADVERSE AFFECTS ON CREW OR SPACECRAFT SAFETY OR MISSION INTEGRITY

IN ORDER TO DEVELOP THE STUDENT PROJECT WITHIN THESE CONSTRAINTS, YET WITH MAXIMUM BENEFIT TO THE STUDENT, THE TASK WAS ACCOMPLISHED THROUGH THE COMBINED TECHNICAL, SCIENTIFIC AND MANAGERIAL EFFORTS OF THE SEVERAL ORGANIZATIONAL ELEMENTS OF NASA. PROVISION WAS MADE FOR MAXIMUM CONTRIBUTION FROM THE STUDENT, CONSISTANT WITH HIS OR HER ACADEMIC SCHEDULE, DURING ALL PHASES OF THE PROJECT, BUT ESPECIALLY IN ANALYSIS

TEAM COMPOSITION FOR FORMAL REVIEWS

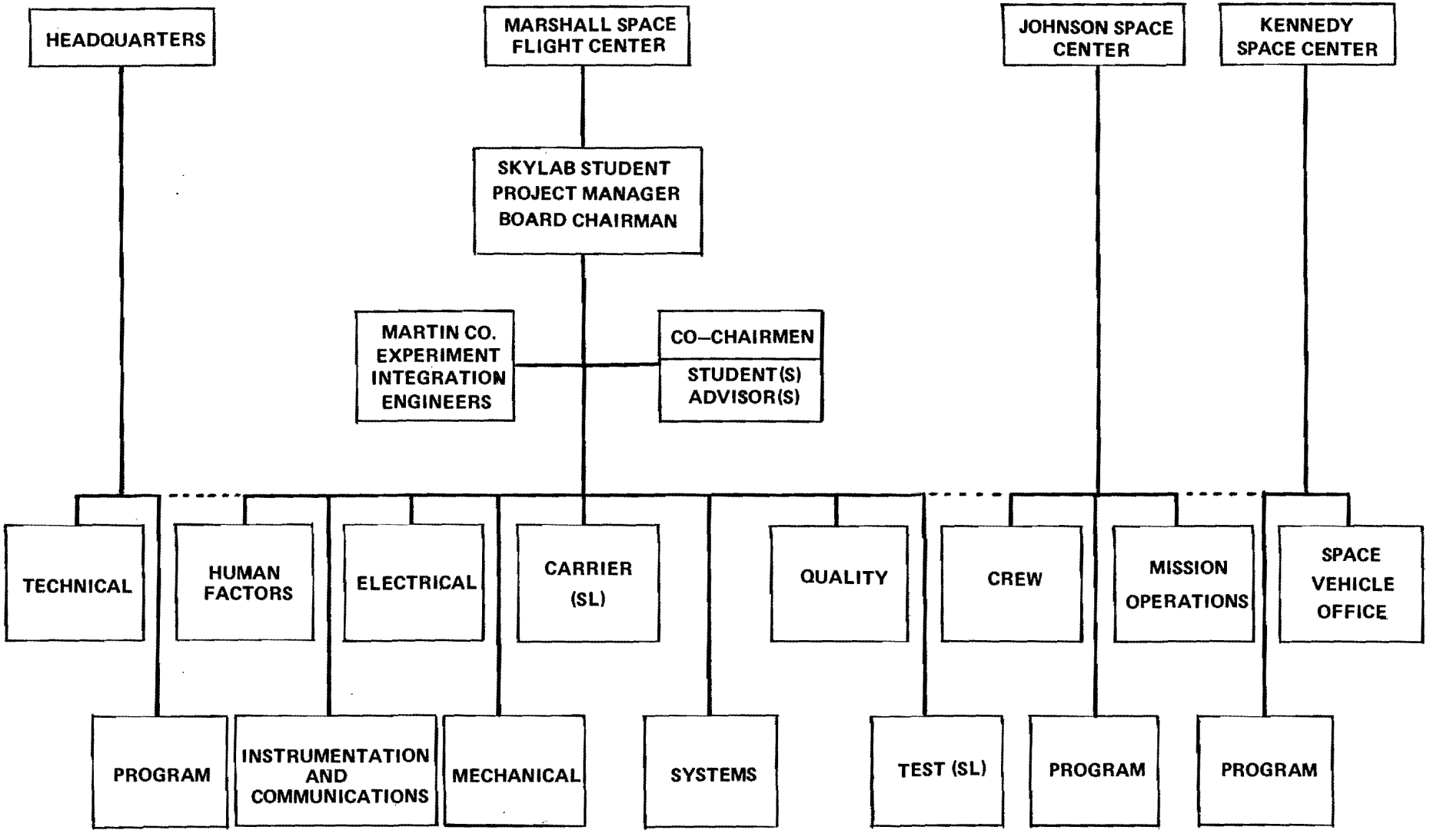


FIGURE 1

AND REPORTING OF RESULTING EXPERIMENTAL DATA. THIS METHOD PROVIDED THE STUDENTS WITH EXCELLENT OPPORTUNITIES FOR ASSOCIATION WITH RECOGNIZED AUTHORITIES IN THEIR RESPECTIVE FIELDS OF INTEREST, AS WELL AS SOME VALUABLE PRACTICAL EXPERIENCE IN THE METHODS NECESSARY TO DESIGN, FABRICATE AND TEST EQUIPMENT FOR SCIENTIFIC RESEARCH.

DIVERSIFICATION IN THIS MANNER NECESSARILY REQUIRES A GREAT AMOUNT OF COORDINATION. THIS WAS ACCOMPLISHED THROUGH A STAFF OF SCIENCE ADVISORS, PERFORMING THE TECHNICAL INTERFACES.

PROGRESS OF THE STUDENT DEVELOPMENT PROGRAM WAS MONITORED THROUGH A SERIES OF FORMAL TECHNICAL REVIEWS, BY TEAMS OF DIVERSE DISCIPLINARY COMPOSITION, AS SHOWN IN FIGURE I. OF THESE, THE FIRST WAS THE PRELIMINARY DESIGN REVIEW (PDR), HELD DURING THE WEEK OF MAY 8-12, 1972, DURING WHICH EACH STUDENT CONCEPT WAS SUBJECTED TO REVIEW AND DISCUSSION AND DECISIONS WERE MADE ESTABLISHING WHICH STUDENT EXPERIMENTS WOULD BE: INCORPORATED AS SPEARATE HARDWARE ENTITIES (CATEGORY III); ASSOCIATED WITH EXISTING SKYLAB EXPERIMENTS (CATEGORIES I AND II); AND ACCOMMODATED BY AFFILIATION WITH OTHER RESEARCH (CATEGORY IV). SIMULTANEOUSLY, EFFORTS WERE INITIATED TO ASSOCIATE THE CARETORY IV STUDENTS WITH EXISTING SKYLAB EXPERIMENTERS SO THAT THEY MIGHT AT LEAST PARTICIPATE THROUGH RECEIPT AND ANALYSIS OF DATA. AT THIS TIME STUDENT EXPERIMENT SIZE, WEIGHT AND POWER CONSTRAINTS WERE DEFINED. AMONG THESE WERE THE FOLLOWING:

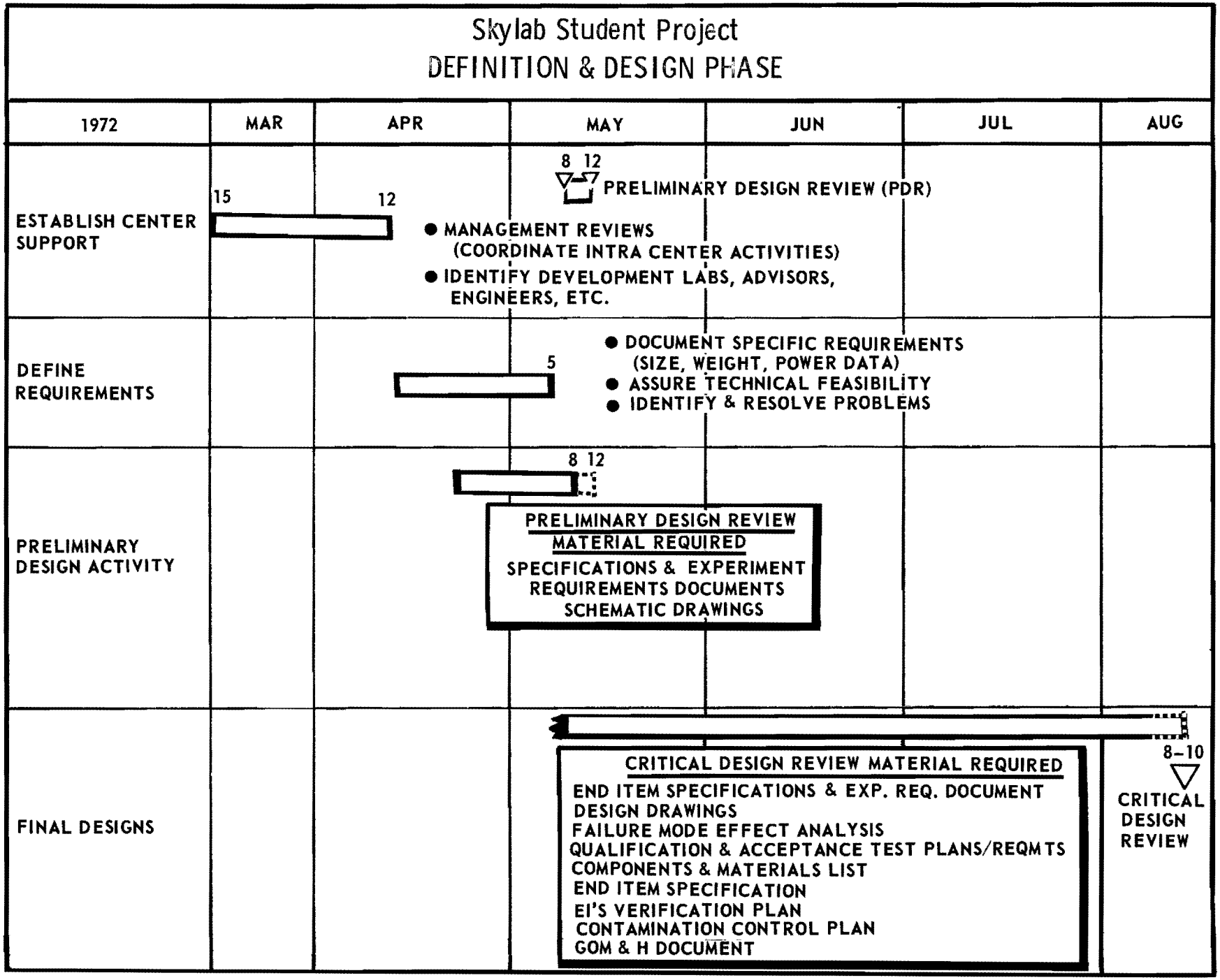


FIGURE II

SL-DP 609, 3-20-73

- ALL STUDENT HARDWARE MUST BE CONTAINED WITHIN A MAXIMUM OF TWO (2) WARDROOM STOWAGE LOCKERS
- MAXIMUM WEIGHTS MUST BE WITHIN LOCKER CAPACITIES
- TOTAL CREW TIME ALLOCATED TO STUDENT EXPERIMENTS MUST NOT EXCEED 1.5 HRS/WEEK OF FLIGHT TIME

THE SECOND, OR CRITICAL DESIGN REVIEW (CDR) WAS HELD ON AUGUST 8-10, 1972, AND INVOLVED ONLY THE CATEGORY III EXPERIMENTS WHEREIN HARDWARE DEVELOPMENT WAS REQUIRED. DURING THIS REVIEW, DESIGN CONCEPTS WERE FINALIZED AND THEIR COMPATIBILITY WITH SKYLAB VERIFIED, AS WERE LAUNCH AND DEPLOYMENT LOCATIONS AND MODES.

IN THE INTEREST OF SIMPLICITY, AS WELL AS TIME, THE USUAL REVIEW ITEM DISCREPANCY (RID) SYSTEM WAS DISCARDED IN FAVOR OF THE MORE EXPEDIENT AND LESS FORMAL ACTION ITEM LOG WITH ACTION ITEM DISPOSITION NOTICE AND CONCURRENCE FORMS.

DOCUMENTATION PREPARED IN SUPPORT OF THIS REVIEW INCLUDED EXPERIMENT REQUIREMENTS DOCUMENTS (ERD'S), END ITEM SPECIFICATIONS (EIS'S), EXPERIMENT DESIGNS, FAILURE MODE AND EFFECTS ANALYSES (FMEA'S), QUALIFICATION AND ACCEPTANCE TEST PROCEDURE/RECORD, COMPONENT AND MATERIAL LISTS, AND THE CONTAMINATION CONTROL PLAN. THE DEFINITION AND DESIGN PHASE, OF WHICH THE FOREGOING COMPRISE THE MAJOR PART, IS SHOWN IN FIGURE II.

DESIGN, FABRICATION & TEST ORGANIZATIONS

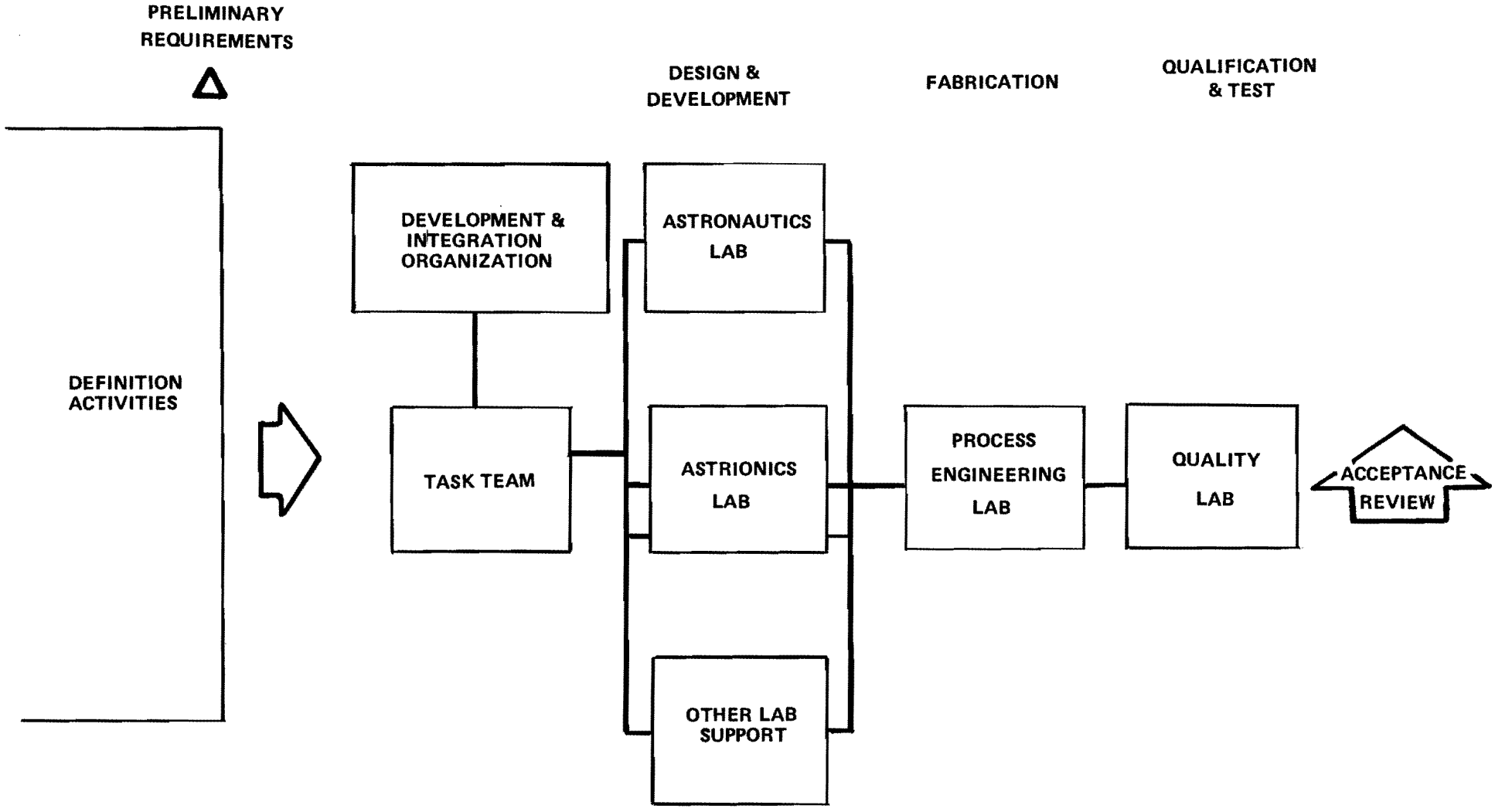


FIGURE III

HAVING COMPLETED THIS INITIAL PHASE, THE PROCUREMENT, FABRICATION AND TESTING FUNCTIONS WERE BEGUN AT THE VARIOUS MSFC FACILITIES, WHICH ARE SUMMARIZED IN FIGURE III, AND PROCEEDED TO COMPLETION ACCORDING TO THE SCHEDULE GIVEN IN FIGURE V . HARDWARE DELIVERY TO KSC OCCURRED IN LATE JANUARY 1973.

INTEGRATION OF THE STUDENT EXPERIMENTS TECHNOLOGY AND PHYSICAL HARDWARE INTO SKYLAB WAS ACCOMPLISHED, UNDER MSFC DIRECTION, THROUGHOUT THE DEFINITION, DEVELOPMENT AND FABRICATION FUNCTIONS, IN A MANNER CONSISTANT WITH THE MINIMAL IMPACT PHILOSOPHY OF THE SKYLAB PROGRAM, WITH EVERY EFFORT MADE TO MAXIMIZE THE VALUE OF THE PROJECT TO THE STUDENT. PHYSICAL INTEGRATION OF HARDWARE WAS VERIFIED AT KSC THROUGH CHECKOUT OF EQUIPMENT FIT AND FUNCTION.

THE MISSION OPERATIONS ASPECTS OF THE STUDENT EXPERIMENTS, THOSE FUNCTIONS DIRECTLY AFFECTING THE FLIGHT OF SKYLAB, ARE THE RESPONSIBILITY OF THE JOHNSON SPACE CENTER (JSC) AND TOWARD THIS END, A CONTINUOUS INTERFACE IS MAINTAINED THROUGH THE JSC PROGRAM OFFICE WITH TECHNICAL SUPPORT SUPPLIED TO MSFC BY THE VARIOUS JSC TECHNICAL DIRECTORATES DURING THE DEVELOPMENT PHASE TO ASSURE COMPATIBILITY WITH THE SKYLAB SPACECRAFT.

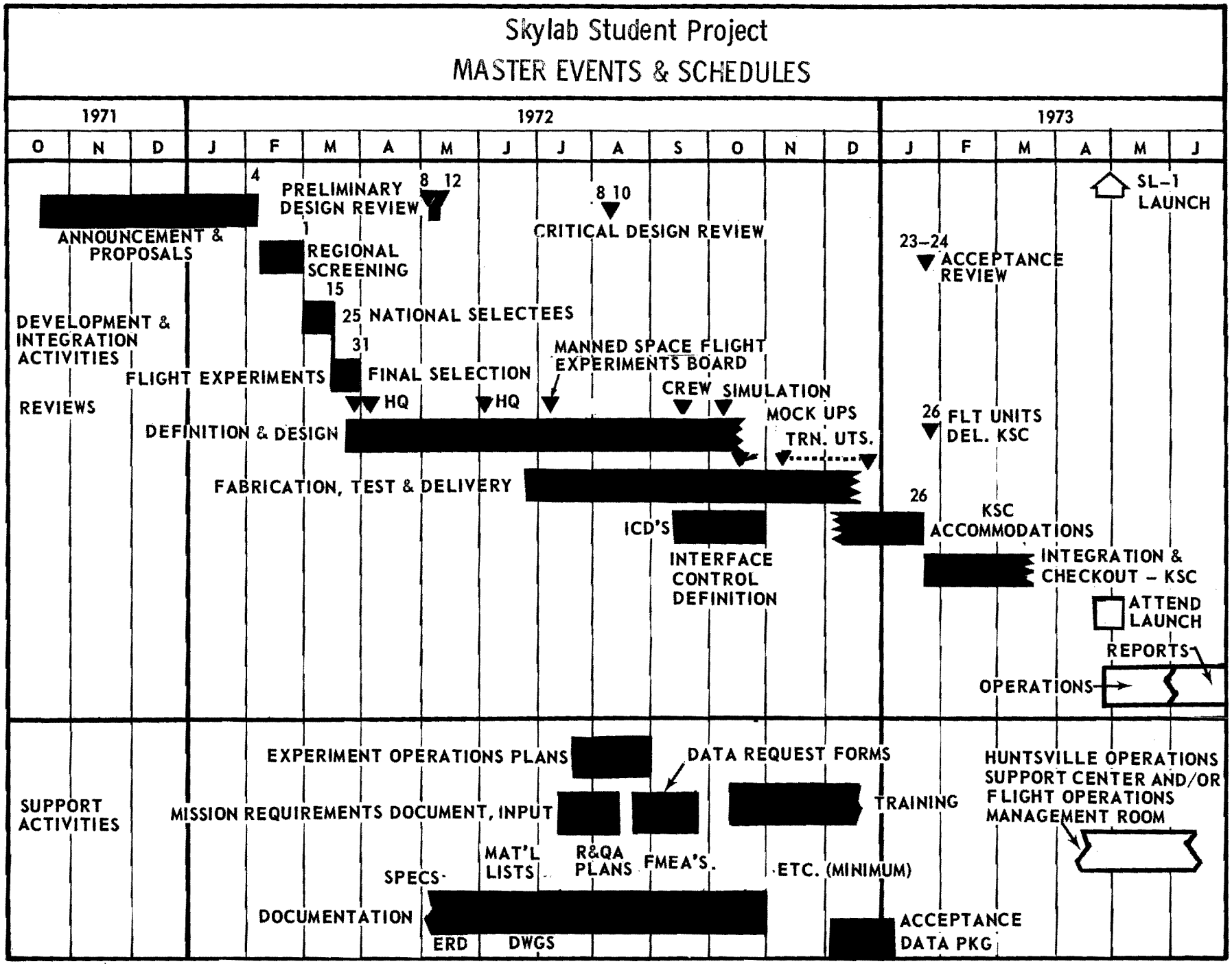


FIGURE IV

SL-DP 612, 3-20-73

MASTER SCHEDULE

THE SKYLAB STUDENT PROJECT IS SEVERELY TIME CONSTRAINED SO THAT MONITORING OF ITS DEVELOPMENT, FROM RECEIPT OF STUDENT PROPOSALS TO FINAL INSTALLATION OF HARDWARE IS NECESSARILY ACCOMPLISHED AT CERTAIN PRINCIPAL REVIEW POINTS (PDR, CDR, ETC.) WITH SPECIAL EFFORT DIRECTED TOWARD THE FINAL PHASE OF FABRICATION FOR FLIGHT UNIT DEVELOPMENT.

TO ASSURE THAT DEVELOPMENT PROCEEDS IN A TIMELY MANNER, THE FOLLOWING MAJOR MILESTONES WERE ESTABLISHED:

GO-AHEAD	STARTED
MOCKUP DELIVERY	AT PDR (OPTIONAL)
PDR PRELIMINARY DESIGN DATA	28 APRIL 1972
PRELIMINARY DESIGN REVIEW	8-12 MAY 1972
CRITICAL DESIGN REVIEW	8-10 AUGUST 1972
HIGH FIDELITY MOCKUP DELIVERY	15 OCTOBER 1972
TRAINING UNIT DELIVERY	15 DECEMBER 1972
MAJOR QUAL TESTING COMPLETE	19 DECEMBER 1972
ACCEPTANCE REVIEW (FLIGHT)	23-24 JANUARY 1973
FLIGHT UNIT DELIVERED	26 JANUARY 1973

FIGURE IV OUTLINES MASTER EVENTS AND SCHEDULES FOR THE PROJECT.

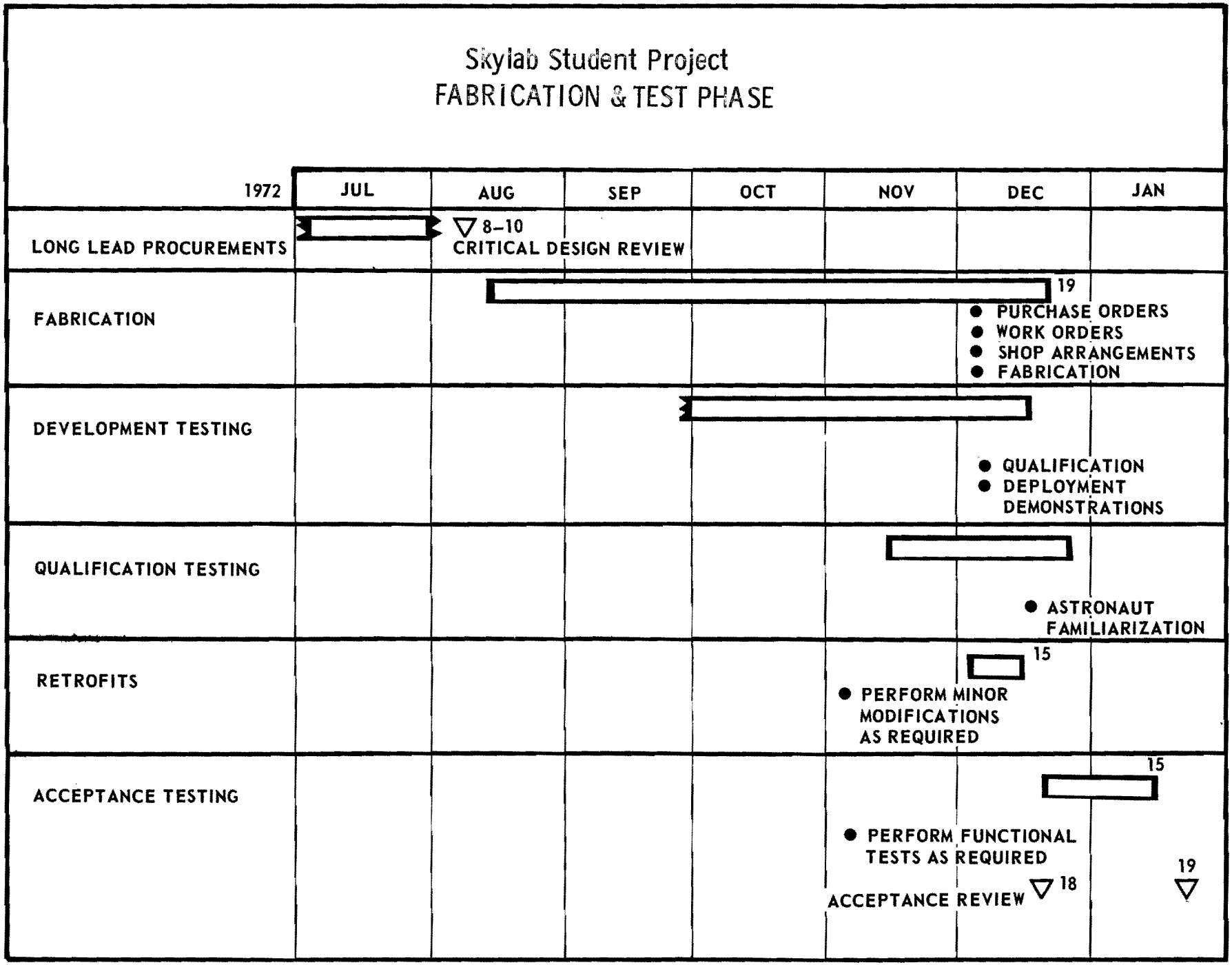


FIGURE V

SL-DP 611, 3-20-73

RESOURCES MANAGEMENT

THE GENERAL RESOURCES MANAGEMENT PHILOSOPHY OF THE STUDENT EXPERIMENTS DEVELOPMENT PROGRAM CONSISTS OF ALLOCATING ONLY ESSENTIAL RESOURCES TO THIS EFFORT AND TO CONSERVE WHEREVER POSSIBLE. INHOUSE CAPABILITIES WHERE, THEREFORE, UTILIZED TO THE FULLEST IN THE FABRICATION OF HARDWARE ITEMS AND EXISTING AND APPROVED MATERIALS WERE UTILIZED WHERE POSSIBLE. THE SAME ECONOMY MEASURES DICTATED SIMPLICITY AND EXPEDIENCE IN THE REVIEW SYSTEM, AS WELL. FOR EXAMPLE, THE FORMAL REVIEW ITEM DISCREPANCY (RID) SYSTEM WAS REPLACED BY AN ACTION ITEM LOG AND ACTION ITEM DISPOSITION NOTICE AND CONCURRENCE FORM. MAJOR REVIEWS WERE LIMITED TO THE PRELIMINARY DESIGN REVIEW, THE CRITICAL DESIGN REVIEW AND ACCEPTANCE REVIEW. THESE REVIEWS INVOLVED A MINIMUM OF ESSENTIAL DETAILS AND WERE SUPPORTED ONLY BY MINIMUM ACCEPTABLE DOCUMENTATION.