SPACE STATION
HUMAN PRODUCTIVITY WORKING GROUP
February 27 - March 2, 1984
Ames Research Center
Building 239 Room B39

HUMAN PRODUCTIVITY EXPERIENCE AND UNDERSEA HABITAT DESIGN

BY

Thomas C. Taylor

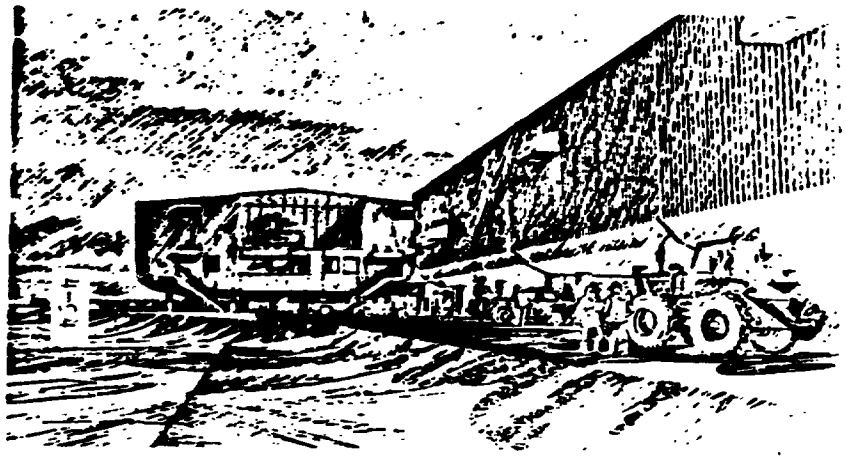
John S. Spencer

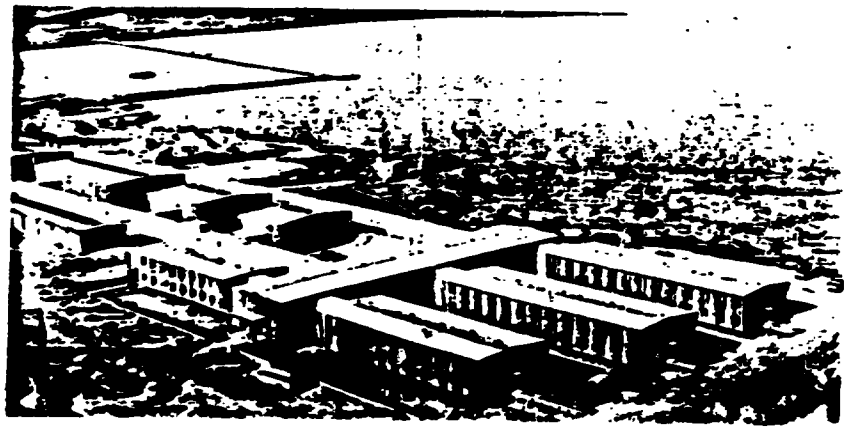
Prudhoe Bay Operations

LESSONS LEARNED

- FINANCIAL DRIVER
- HABITATION
- RISK REDUCTION
- TRANSPORTATION
- EQUIPMENT
- MARKET DEVELOPMENT
- OTHER ELEMENTS

North
Slope
Alaska:





HABITATION LESSONS LEARNED

- GOOD DESIGN PAYS DIVIDENDS
- DESIGN MUST GO BEYOND HUMAN FACTORS CONSIDERATION
- FOOD IS IMPORTANT MORALE FACTOR
- PRIVACY IMPORTANT
- HUMAN PRODUCTIVITY SUCCESS CAN BE MEASURED BY CONSTRUCTION OPERATIONS
- NEGATIVE SOCIAL INDICATORS ALSO VISIBLE

INTERIOR DESIGN COMPARISON - ALASKA CONSTRUCTION CAMPS

Actual Observed Experience
1975 - 1978

WELL DESIGNED INTERIOR

- Good lighting
- Acoustical provisions
- Group gathering locations
- Exercise and recreation Facilities provided

EFFECTS

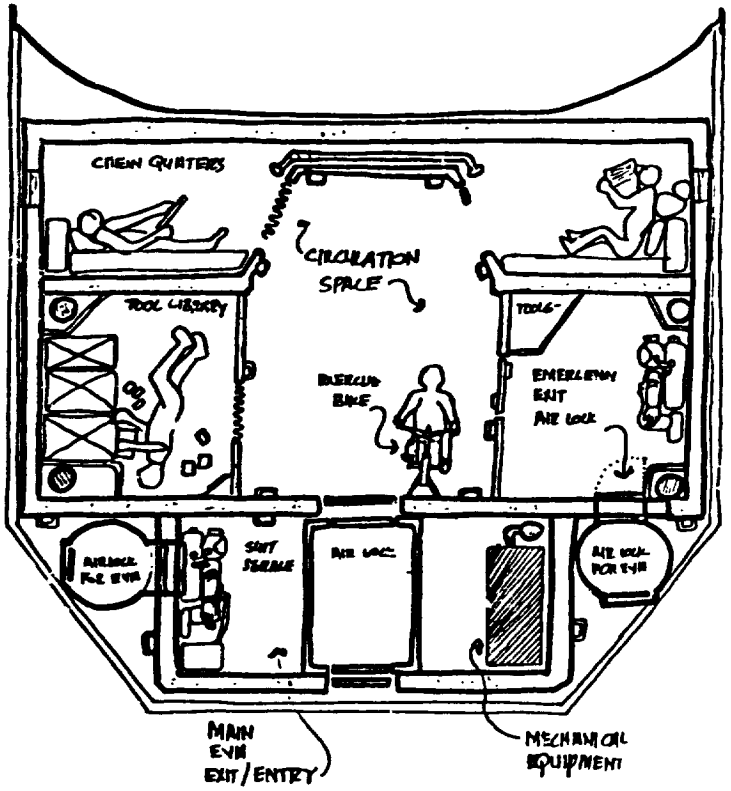
- Pleasant and positive overall Feeling from surroundings
- Inhabitants changed work Clothes before dinner
- Several security staff For 600 inhabitants
- Room doors without locks
- Interior sprinkler system added
- Food served cafeteria style

MARGINAL HUMAN FACTORS DESIGN

- Poor lighting
- No acoustical provisions
- Group meetings in rooms
- Exercise and recreation Facilities limited

EFFECTS

- Cramped feeling
- Inhabitants usually ate In work clothes
- Approximately 1 uniformed Security staff for each 30 inhabitants
- Room doors with locks
- Inhabitants slept with Arctic Parka over feet and near boots
- Food with portions served by staff
- Noticeably more drugs, gambling, Alcohol, and camp damage problems
- Some cases of arson

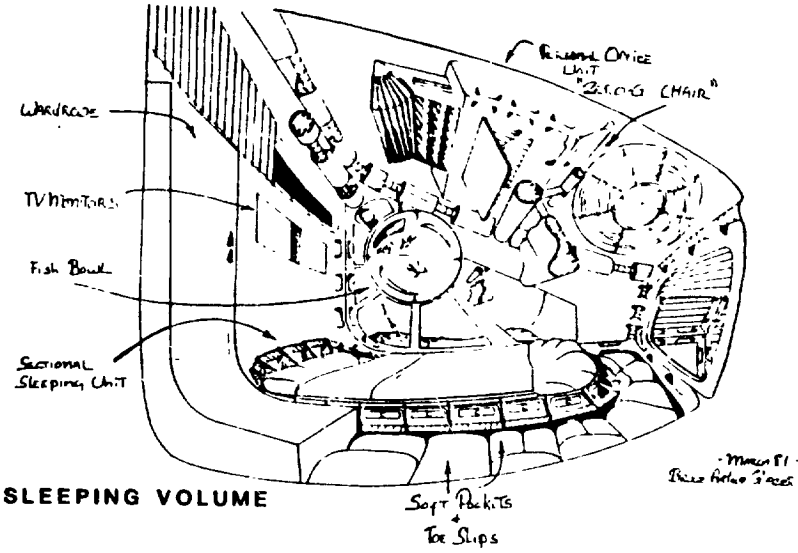


HABITATION MODULE

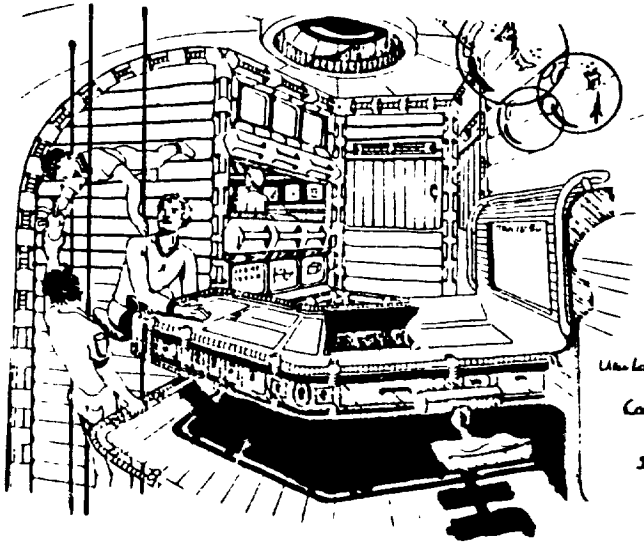
SECTION A-A
1/4"-1'-0"

1981 SHDA

HABITATION SPACE FOR SIX ASTRONAUTS FROM 3 TO 6 MONTHS - SHUTTLE CREW LAY-OVER OR EMERGENCY HABITATION.



SLEEPING VOLUME



View Looking Across Galley Towards Command Center
1981

DESIGN STUDY

HABITABILITY CRITERIA

by Carol J. Amato

	PSYCHOLOGICAL/ BIOLOGICAL	CULTURAL	SOCIAL	GENERAL PHYSICAL
Single Nationality Crews	Nature of Mission Duration Motivation Mobility Sense of Orientation Adaptability Flexibility Sensory Stimulation Variability Personal Identification Personal Turf Change and Surprise Environmental Enhancement Growth and Change Sense of Security Work/Free Schedules Presence of Family View of Outside Escape Procedures Known Need to "Get Away" Living Things (pets, etc) Room for Job Advancement Solipsism Effect Shimanigasi Syndrome	Crew Characteristics Which Language Dominates? Holistic Medicine Approach Cultural Self-Evolution Colonist Superiority Complex Toward Terrans Hierarchical vs. Egalitarian Pacifism vs. Militarism	Social Areas Activity Arrangement Loner vs. Social Personalities Male/Female Roles Required Social Interaction Sports (Individual and Group) Arts Entertainment Age Distribution a Must	Safety Ease of Movement Comfort Volume/ Person/ Activity Gravity Situation Life Support Ease of Maintenance Exercise
Multi-National Crews	Architectural Preferences Aesthetic Values and Choice of Surroundings Living Things (Pets, Plants) Variation of Routine	Basic Anthropological Knowledge of Other Cultures as a Requirement Decision-making Process		

h-97

CULTURAL REFERENCES

World View — Ethnic Cooking — Religious Practices
Sex Practices — Family Structure — Marriage Practices
Political Orientation — Hygiene Habits — Male/Female Roles
Economic Orientation — Kinship and Descent Patterns
Pacifism Vs. Militarism — Concept of Private Ownership
Child-Raising Practices — Attitudes on Sickness and Death

MILITARY PERSONNEL (ADDITIONAL CONSIDERATIONS)

Officers vs. Enlisted (No hierarchy?)
Violence as Good
Military Wife Syndrome

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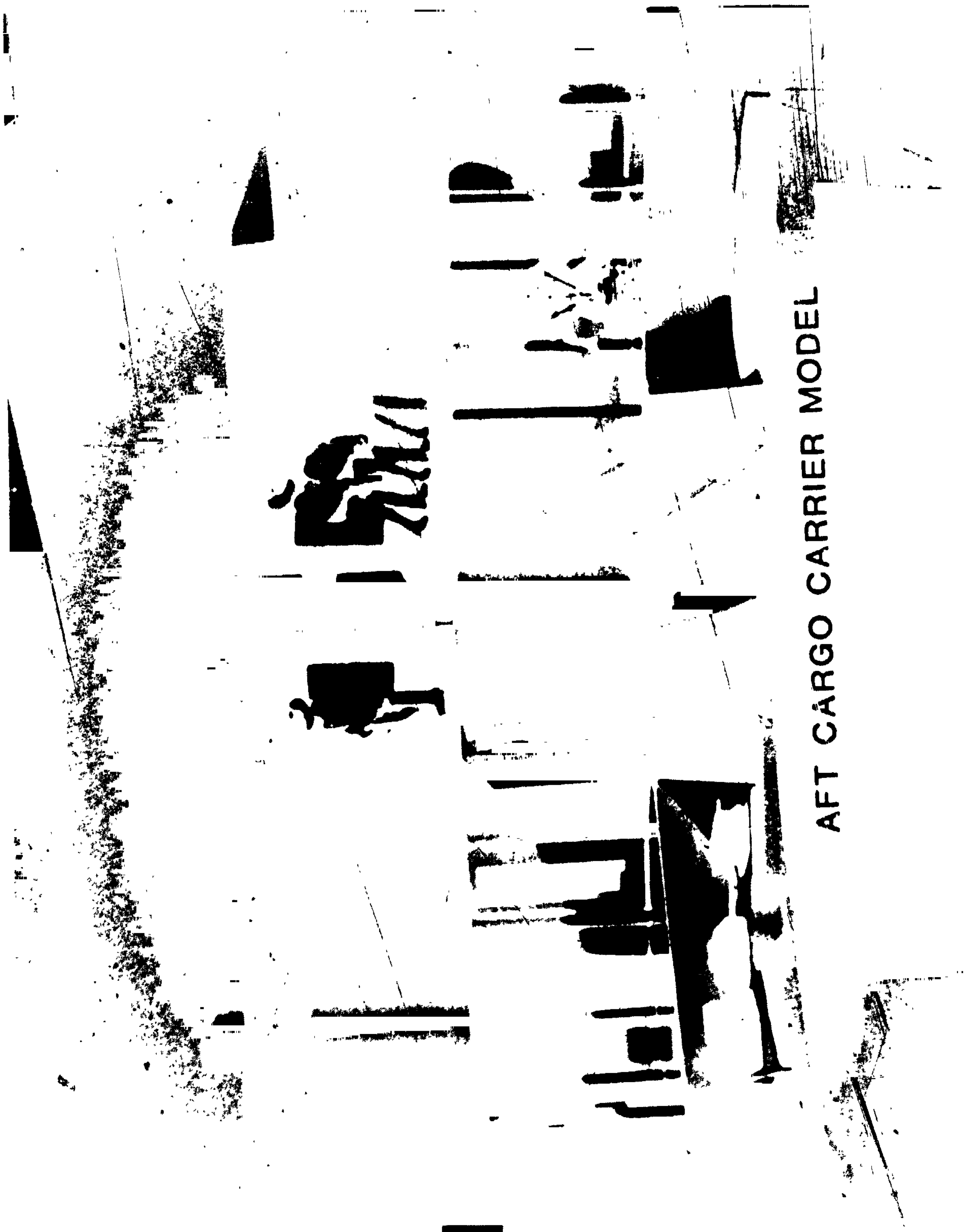
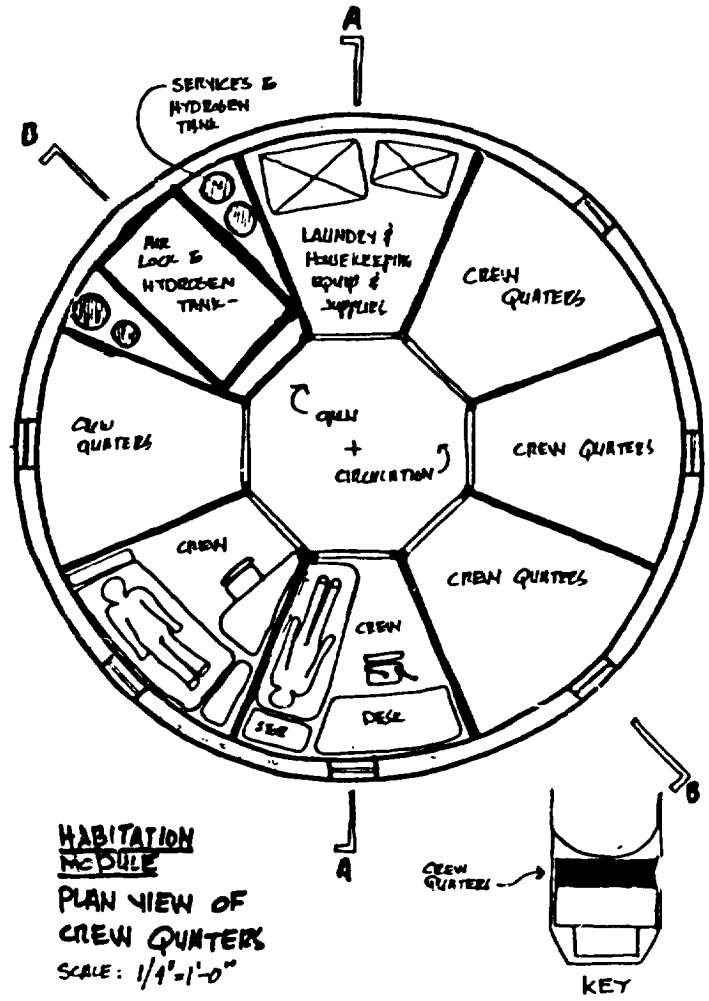


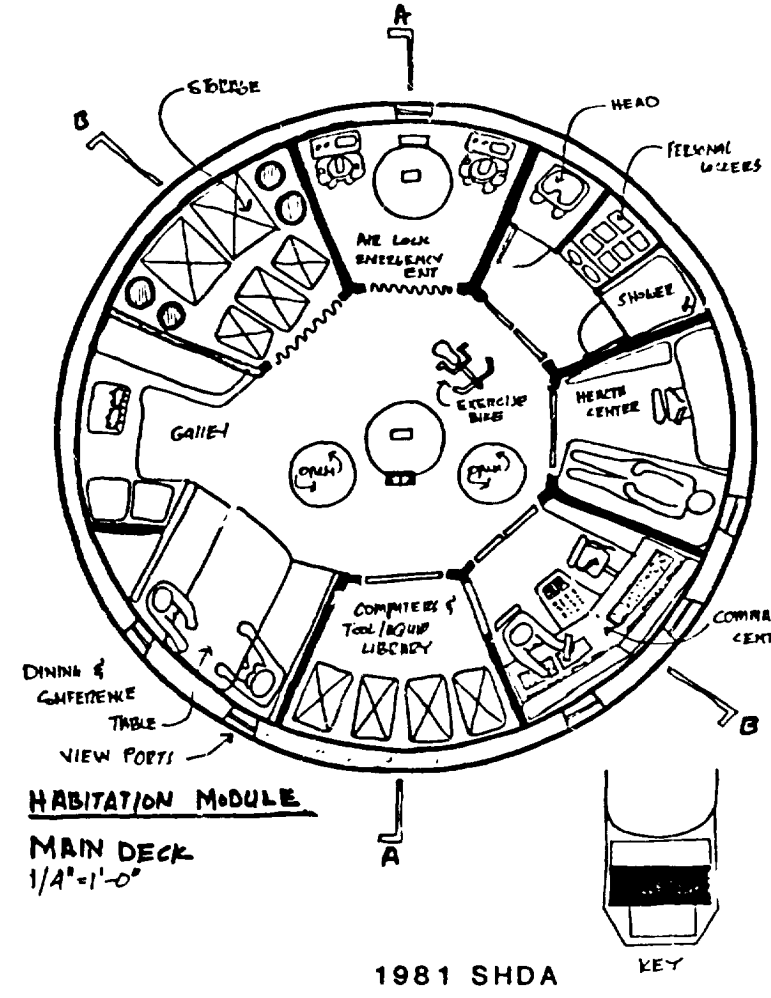
AFT CARGO CARRIER MODEL



HABITATION MODULE

PLAN VIEW OF CREW QUARTERS

SCALE: 1/4"=1'-0"

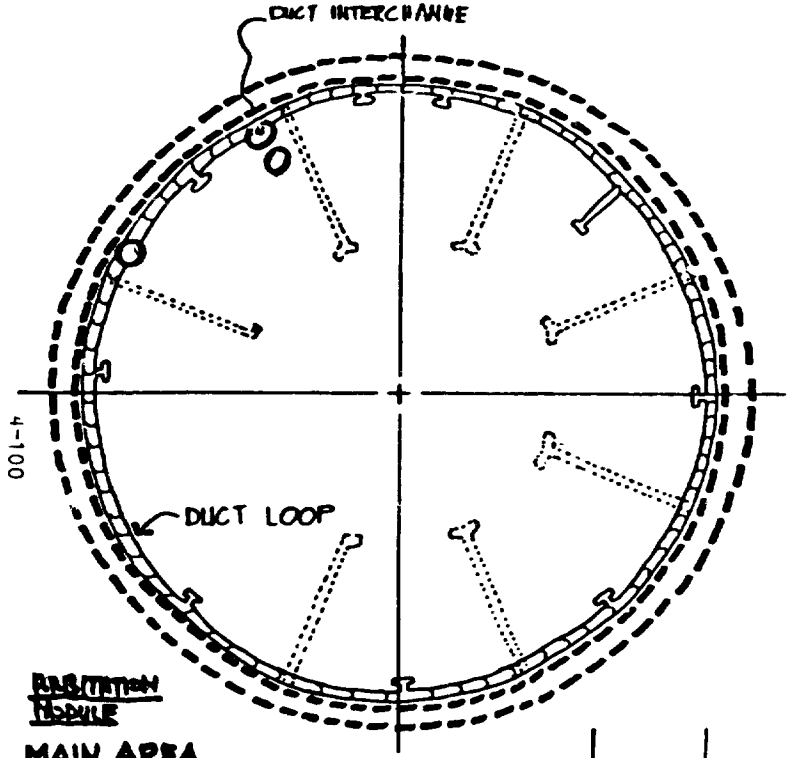


HABITATION MODULE

MAIN DECK

1/4"=1'-0"

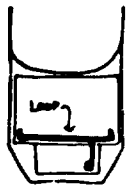
UTILITY CONSIDERATIONS



MAIN AREA

MECHANICAL DUCT DISTRIBUTION PATTERN

SCALE: 1/4"=1'-0"



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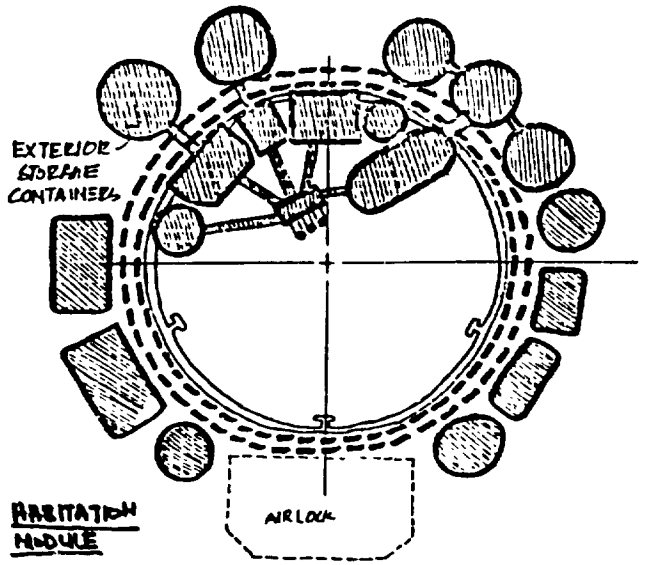
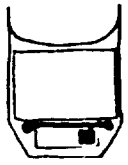


SERVICE/MECHANICAL AREA EQUIPMENT-DUCT DISTRIBUTION

SCALE: 1/4"=1'-0"



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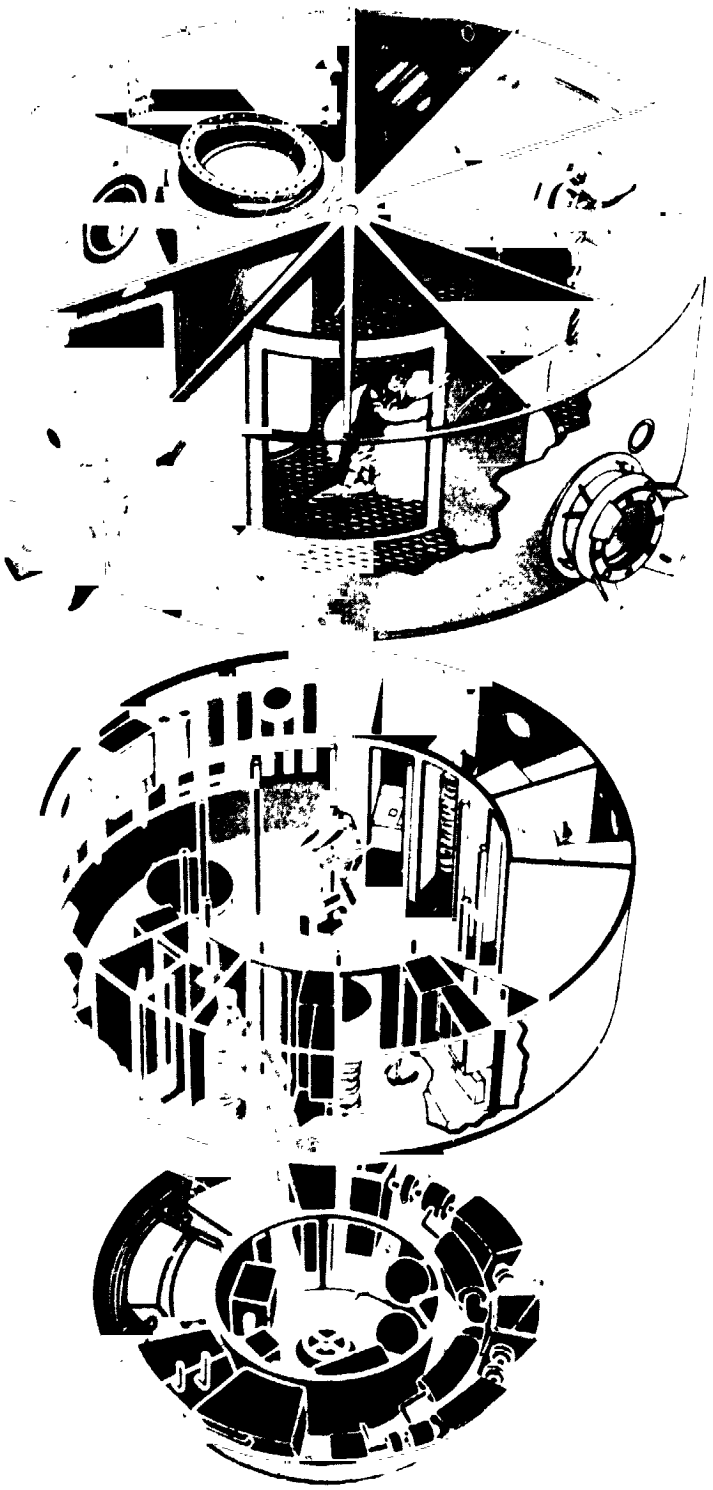


Western Regional Undersea Laboratory

Announcement of the initiation of a University of Southern California (USC)/National Oceanic and Atmospheric Administration (NOAA) cooperative undersea research program at the USC Catalina Marine Science Center (CMSC).

• the program

On July 1, 1980, the Institute for Marine and Coastal Studies at USC signed a cooperative agreement with the National Underseas Research Project Office of NOAA for funding to initiate a long-term underwater scientific research program at Santa Catalina Island, California, utilizing saturation diving and an underwater habitat.

• saturation diving

Saturation diving allows extended periods at the work site without intermediate decompression times. Non-work periods are spent in an underwater structure anchored on the bottom near the work site, which serves as both home and laboratory. The WRUL program is designed to give mission [illegible] to 14 days. Missions will commence and end on dry land beside an on-site fully [illegible] hyperbaric chamber.

• time frame

The first operational mission is expected to start in late 1982. It is anticipated there will be [illegible] missions per year. Interested investigators should [illegible]

• objectives

The primary goal of the WRUL Program is to expand marine research in the Pacific region of the U.S. The program will support basic and applied marine science by making available a saturation diving facility in temperate waters. Additionally, the location of the habitat within a preserve under the control of the university administration allows, indeed promotes, long term studies. The WRUL staff and facilities will be made available to those research projects that qualify through the peer review process.

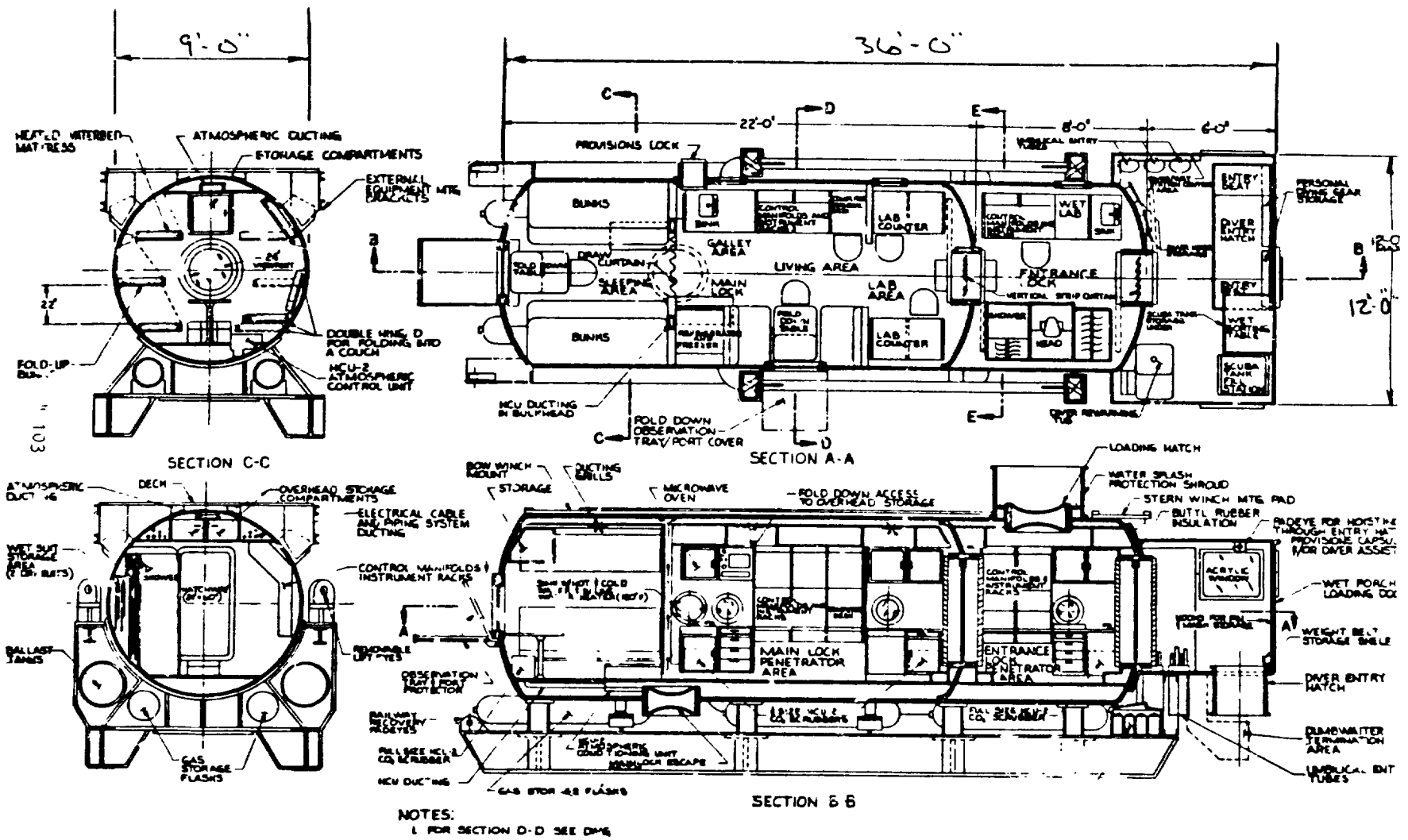
Possible areas of investigation include

- Marine fisheries
- Marine ecology
- Oceanography
- Marine pollution
- Sea floor properties and processes
- Human physiology
- Nautical archaeology
- Marine geology
- Energy resources

The proposed WRUL system will be guided in its design and operation by a philosophy of safety (with ABS certification), simplicity of operation, and utilization of existing facilities, all within a modest operating budget.

the habitat

- Size - 8 meters long by 3 meters diameter
- Depth range - 16 to 50 meters sea water
- Mission crew - 4
- Support via shore umbilical
- Excursion range:
  Horizontal - 100 m untethered, 300 m tethered
  Vertical - 8 to 80 meters sea water
- One large observation port
- Breathing gas - air or nitrox (reduced O2 percentage)
- Mission duration - 5 to 14 days
- Contains wet and dry laboratory space
- Flexible configuration to meet investigator requirements



UNDERSEA HABITAT

UNDERSEA HABITAT STUDY

Crew Size: 4-5
Mission Length: 2 weeks

HABITABILITY CRITERIA
USC UNDERSEA LABORATORY

by Carol J. Amato

PSYCHOLOGIAL/BIOLOGICAL

Nature of Mission
Duration
Motivation
Mobility
Sense of Orientation
Adaptability

Flexibility
Sensory Stimulation
Variability
Personal Identification
Personal Turf
Change & Surprise
Environmental Enhancement
Sense of Security
Work/Free Schedules
View of Outside
Escape Procedures Known
Need to "Get Away"
Living Things (fish tank)
Aesthetic Values
Variation of Routine

CULTURAL

Crew Characteristics
Basic Knowledge of
Cultural Habits of
Other Crew Members

CULTURAL DIFFERENCES

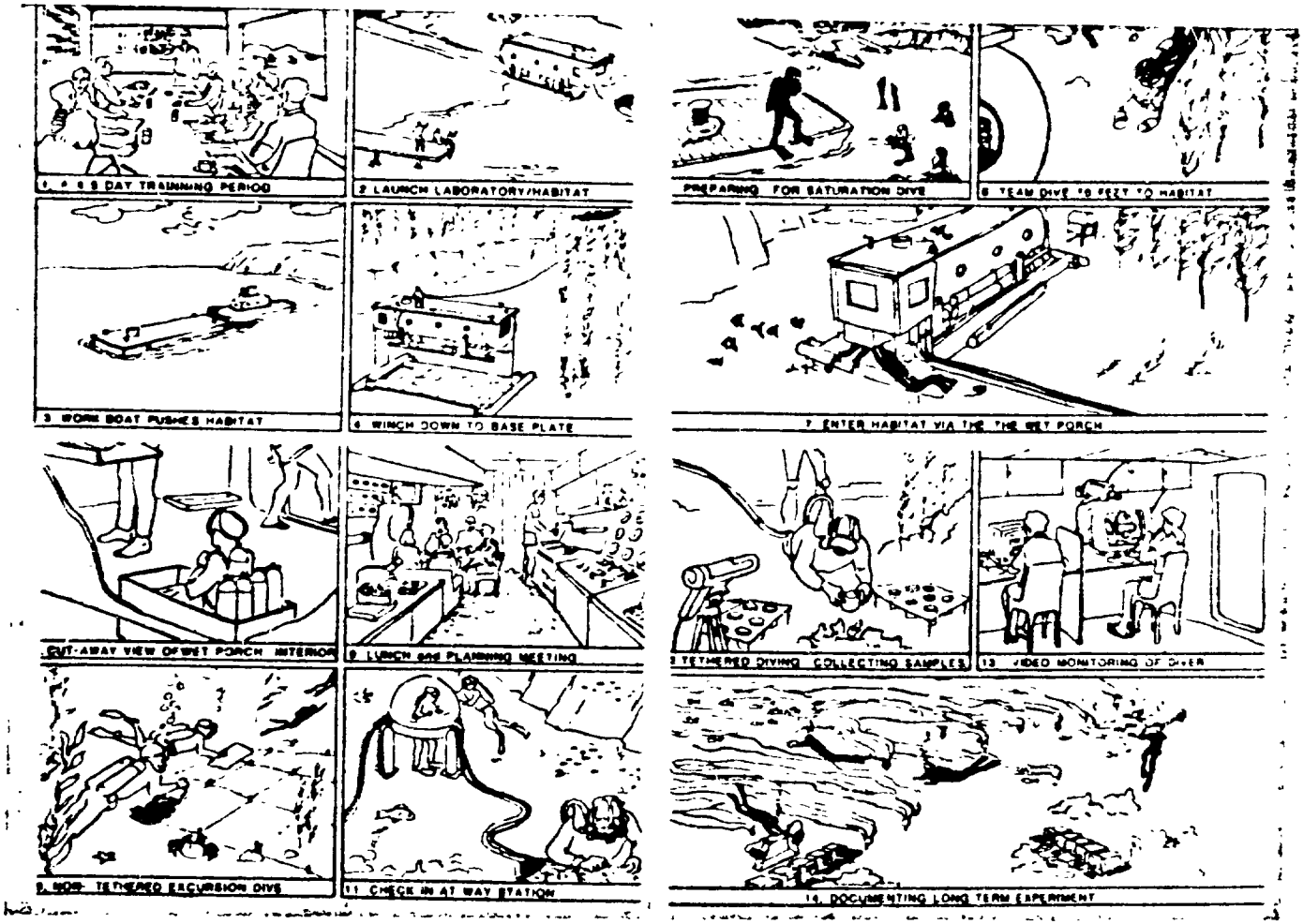
World View
Dietary Habits
Hygiene Habits
Political Orientation
Religious Practices

SOCIAL

Social Areas
Activity Arrangement
Loner Vs. Social Personalities
Male/Female Roles
Required Social Interaction
Entertainment

GENERAL PHYSICAL

Safety
Ease of Movement
Comfort
Volume/Person/Activity
Life Support
Ease of Maintenance



STORY BOARD OF SEA HABITAT EXPERIENCE

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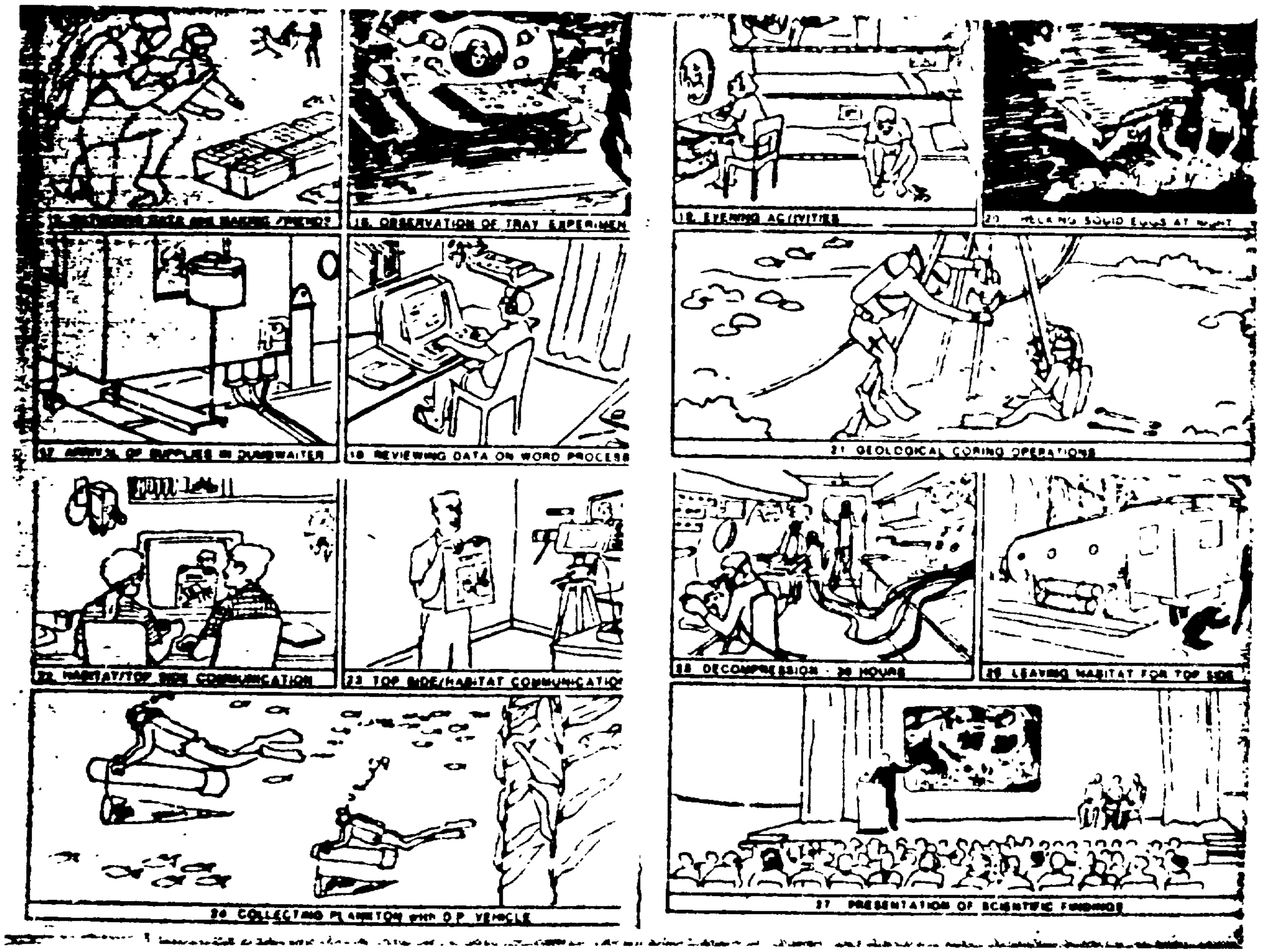

STORY BOARD OF SEA HABITAT EXPERIENCE

PUBLICATIONS

List of Publications - The following publications are available upon request from the author, Thomas C. Taylor, Taylor & Associates, Inc., P.O. Box 1547, Wrightwood, CA 92397, (619-249-6882).

*1. Taylor, T.C. (1980), "Commercial Operations for the External Tank in Orbit," Eighteenth Goddard Memorial Symposium, Washington, D.C., AAS 80-89, March 1980.

2. Taylor, T.C. (1980), "SPS Primary Structure by Another Method," Presentation at the D.O.E. SPS Conference in Lincoln, NE, 17 April 1980.

3. Witek, N.J. and Taylor, T.C. (1980), "Global Benefits of the Space Enterprise Facility Using the External Tank," IAF Tokyo, Paper 80-IAA-46.

4. Witek, N.J. and Taylor, T.C. (1980), "The External Tank as a Large Space Structure Construction Base," IAF Tokyo, Paper IAF-80-A-41.

*5. Taylor, T.C.(1981), "A Commercial Construction Base using the External Tank," 2nd AIAA Conf. on Large Space Platforms, Feb. 2-4, 1981, AIAA-81-0460.

*6. Tewell, J.F., Anderson, J.W. and Taylor, T.C. (1981), "Platform Operations Using the External Tank," 2nd Conf. on Large Space Platforms, San Diego, CA, Feb. 2-4, 1981, AIAA-81-0461.

*7. Taylor, T.C. (1981), "A Modest Habitation Facility in Low Earth Orbit," Fifth Princeton/AIAA/SSI Conf. on Space Manufacturing, May 18-21, 1981, Paper No. 53.

*8. Taylor, T.C. (1981), "A Modest Habitation Facility in Low Earth Orbit," Rome IAF, IAF-81-40.

9. Taylor, T.C. (1981), "Future Potential Uses of Spacelab for Manned Orbital Facilities," Rome IAF, IAA-81-227.

10. Taylor, T.C. (1982), "Orbital Facility Operations Through an Assured Market Sceanrio," Paris IAF, IAF-82-33.

11. Mobley, T.B. and Taylor, T.C. (1982), "The ET in Orbit as a Space System Material Resource," Paris IAF, IAF-82-392.

12. Mitchell, P.M. and Taylor, T.C. (1984), "Low Cost Science and Astronomy Platforms in Orbit," AIAA 22nd Aerospace Sciences Meeting, Reno, NV, Jan. 9-12, 1984.

* COMMERCIAL HUMAN PRODUCTIVITY RELATED