N94-33654

La Chalupa-30: Lessons Learned from a 30-day Subsea Mission Analogue

Steve Vander Ark, MS
JoAnna Wood, Ph.D.
KRUG Life Sciences
Houston, TX

Albert W. Holland, Ph.D.
NASA Johnson Space Center
Houston, TX

The Behavior and Performance Laboratory (BPL) utilizes space mission analogues to study issues such as the psychological health and wellbeing, team characteristics, and task performance of crew members on long-duration missions. The analogue used in this investigation was an underwater habitat named *La Chalupa*, which was selected for its similar features to a space station environment. The primary objectives of the *La Chalupa*-30 investigation were to (1) evaluate the efficiency of several methods for collecting data in remote environments, and (2) assess aspects of living and working under isolated and confined conditions.

A primary data collection technique tested was the Individualized Field Recording System (IFRS) software installed on a portable computer. This customized, Microsoft Windows-based software permits questionnaires to be administered to crew members and stores responses in individual, confidential databases. Other methods of data collection tested included Question Cards and microcassette recorders, two-way video and audio link, and actigraphy. The BPL evaluated the quality of information obtained with each method and assessed crew member's preference for the methods.

Evaluation of data collection procedures and equipment indicated: (1) the IFRS software proved effective for collecting self-report, repeated-measures data; (2) since each crew member may prefer to respond in different ways (e.g., spoken versus typed responses), multiple methods of data collection are helpful for eliciting pertinent information; and (3) two-way audio and video link was perceived as a significant means of promoting the sense of tight coordination between crew and controllers.

Preliminary analysis of the data collected indicates: (1) overall, the crew experienced very little difficulty in the areas measured during the 30-day mission and felt that a 60-day mission would be no different. However, the crew members felt that significant countermeasures would be necessary for a 90-day + mission: (2) crew members reported that it was critical to have personal space to express individuality in the isolated and confined environment: and, (3) two 30-minute opportunities per week provided for communication with family members was perceived as too frequent.

La Chalupa-30: Lessons Learned from a 30-day Subsea Mission Analogue

Stephen T. Vander Ark, MS*
Albert W. Holland, Ph.D.**
JoAnna Wood, Ph.D.*

*KRUG Life Sciences, Houston, TX 77058
**NASA Johnson Space Center, Houston, TX 77058

1

Background

Behavior and Performance Lab investigates issues related to individual and team psychological health, wellbeing, and performance as crews live and work in isolated and confined environments for extended periods.

Analogues provide the platform to collect this information.

Must be able to remotely track these variables during L/D missions:

- Collecting repeated measures data from remote crews has been problematic: compliance, storage
- Methods study was necessary

2

Objectives

- Assess equipment for improving data collection in remote environments:
  - Repeated Measures
  - Maximum storage/security
- Evaluate software, hardware, and procedures for collecting data in L/D analogues and space flights.
- Evaluate the subsea environment as a platform for future L/D space analogue investigations.
- Gather information for establishing guidelines for 30-day space missions.

3

Approach

Marine Resources Development Foundation (MRDF)

- "Piggyback" onto their planned 30-day mission.

Crew Composition:

- 4 Males: Marine Biologist (CDR), Diver (Deputy), Hyperbaric EMT (CMO), Cell Biologist.
- One crew member exited mission day 3 due to flu-like symptoms.

30-day mission preceded by 2-day "Sea Trial."

4

Facilities

La Chalupa (Habitat):

- Lagoon depth 9 m, hatch depth 7 m, pressure 1.69 atm.
- Habitable Volume = 55.63 cubic meters.
  - 3 main chambers: Wetroom, Commons, and Sleeping Quarters (2 suites / 4 bunks)
  - Head and shower facilities.
- Life Support Systems from topside (umbilicals):
  - Habitat/diving air supply, potable water, waste water disposal, electrical.

Control Van: Comm. and system monitoring/control.

5

Study Components

Data Collection Methods

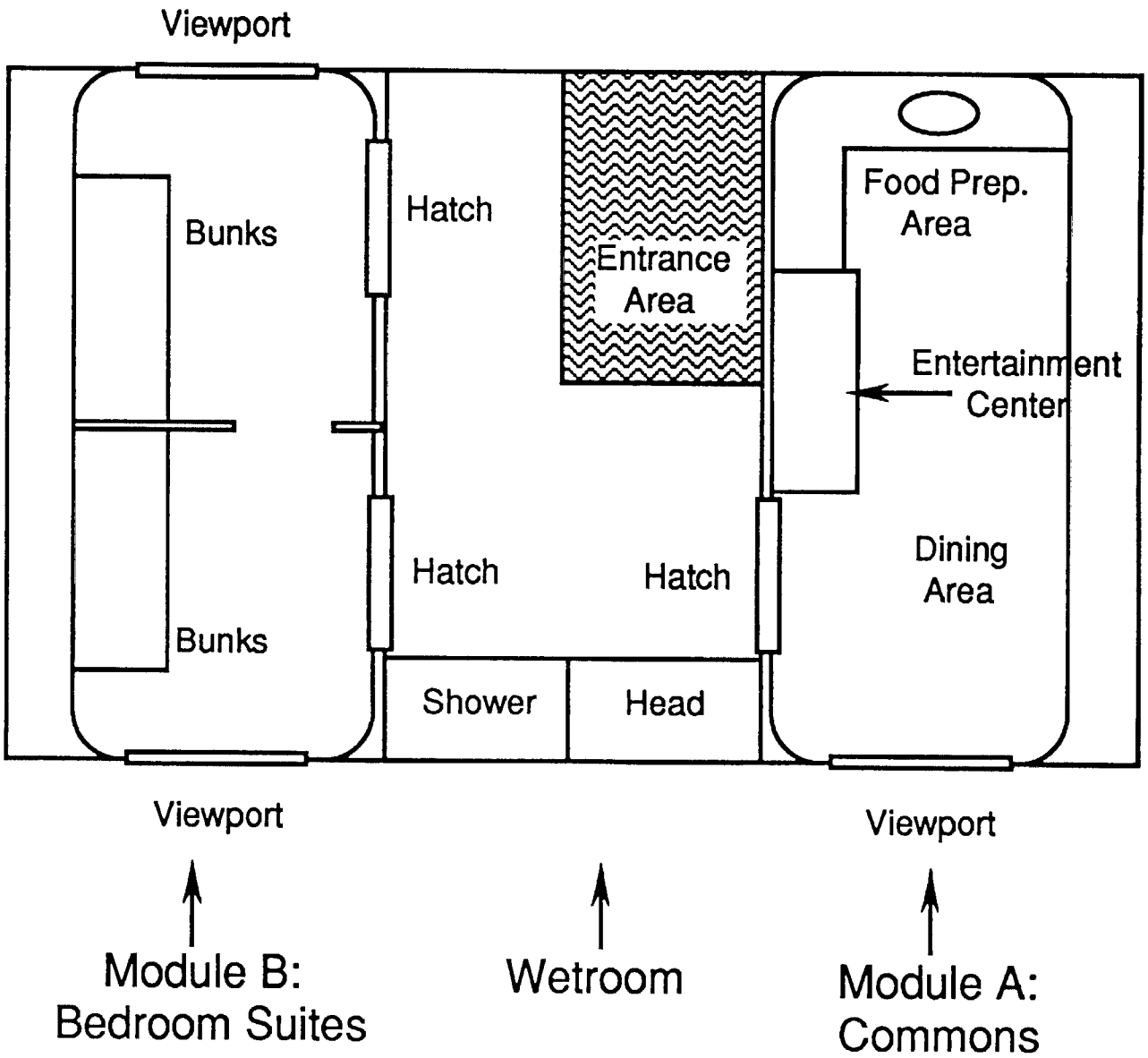
Pre-mission: abbreviated version of battery used in astronaut selection research, including psychological tests and interview.

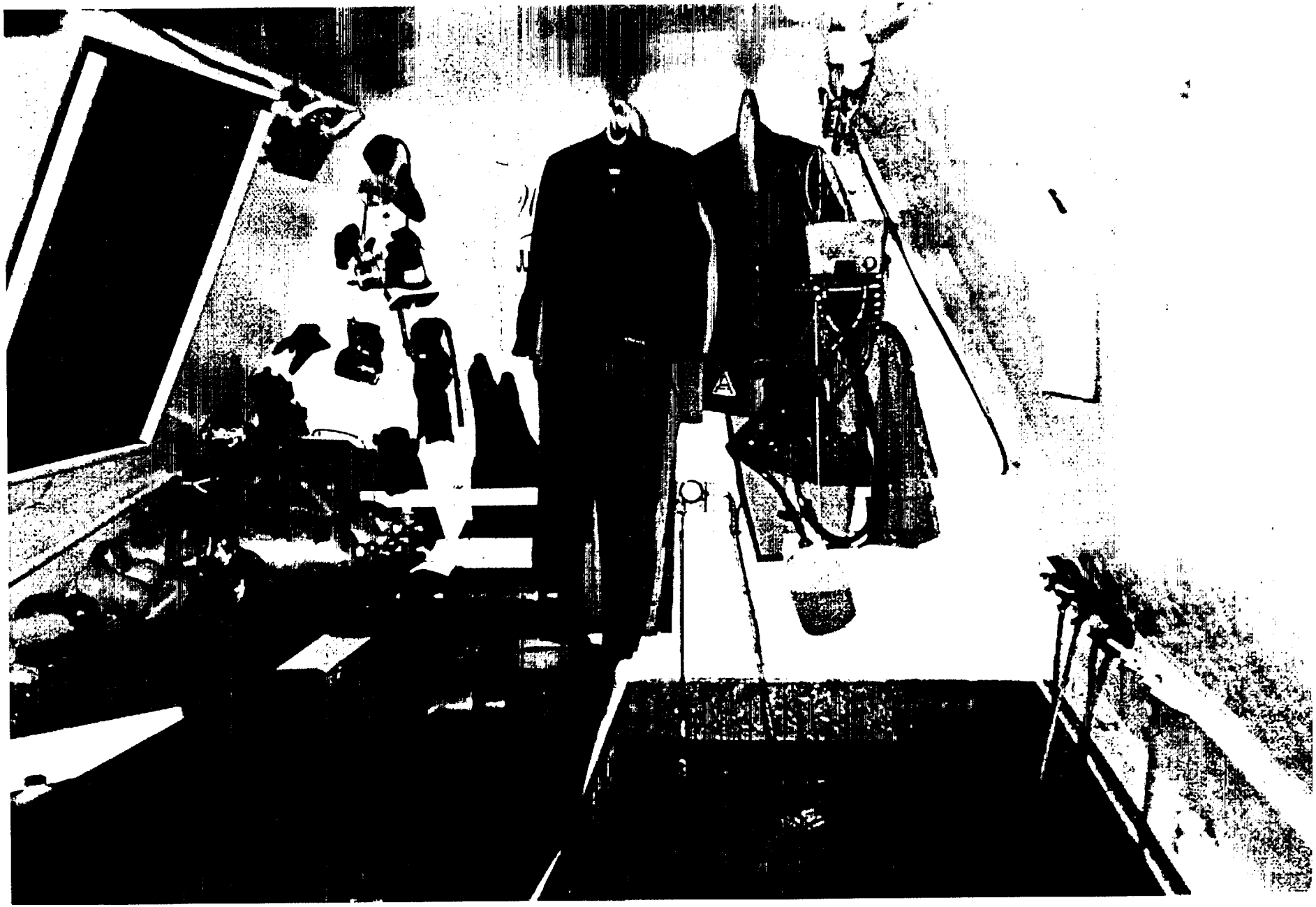
During mission:

- Individualized Field Recording System (IFRS)
  - Computer-based questionnaire pres. system.
  - Incorporates A/V "postcards."
- Automated Neurological Assessment Metrics (ANAM)
  - Computer-based cognitive assessment.

6

Schematic of Underwater Habitat used in *La Chalupa-30*





Wetroom

590

Bedroom Suite

Crewmember Completing IFRS in Commons

Study Components (cont'd)

Data Collection Methods, continued

- Micro-recorders and Question Cards
  - Oral responses given to questions.
- Audio/Video
  - 2-way A/V team debriefs.
  - Taped meal prep. and schedule planning (evenings).
- Sleep Quality/Quantity
  - Sleep diaries.
  - Actigraph Activity Monitors.

Post-mission: conducted 1-hour debriefs.

7

Lessons Learned

Crew members completed all IFRS questionnaires and judged it to be effective for collecting self-report, repeated measures data.

Field environment taught important lessons for software upgrades to IFRS system and procedures:

- Lengthen narrative response buffer.
- Make s/w operation as simple as possible.
- Training to observe and report psych. events.

Extremely positive response to the A/V "postcards" and gaming that was incorporated. Generated ideas for future field investigations.

8

Lessons Learned (cont'd)

Multi-method approach is desirable to obtain data:

- Information from one source helped to explain the information collected from another source.
- Each crew member had a preferred method for reporting.
- Some methods could be combined (Q-card narratives with IFRS).

Over time, bright people will tinker with equipment:

- Perusing our computer files.

Remote up- and downloading of data was touchy but workable. Will improve with better software.

9

Lessons Learned (cont'd)

Actigraphs were reliable, but limited battery and storage would be problematic in field settings.

Significant changes in the data occurred during specific mission events, such as:

- 4th crew member exiting mission.
- Press-day.
- Personal experiments going well.
- End-of-mission activity scheduling.

Crew desired more space to store personal effects and a place to "get away" from rest of crew (used bottom time).

10

Lessons Learned (cont'd)

Certain food/snack items took on great importance:

- Disappointment when resupply excluded M&M's.
- Crew members began hoarding Kudos.

Family communication 2x/week was too frequency:

- Interfered with crew's focus on mission and work.
- Suggested 1x/week.

11

Lessons Learned (cont'd)

Moral/Cohesion:

- Removal of 4th crew member had significant effect on remaining crew members' morale:
  - Bounced back within 3 days
  - A focal point for generating cohesiveness.
- High morale and cohesion were maintained – Affected positively by off-time projects (e.g., spa construction).
- Relationship with topside was good – Occasional conflicts with topside, generally over schedule constraints and coordination of resupply.

12

Lessons Learned (cont'd)

2-way video team debriefs were well received:

- Simple but powerful means of creating greater level of cohesion between controllers and crew.

Overall no mission-stopping psychological issues over the 30 days.

Subsea habitat proved to be useful analogue for on-orbit space operations.

13