Psychosocial Issues in Space Flight

- Group organization
- Isolation and community
- Case studies from Earth analogues
- Leadership structures

So You Want to Be an Astronaut?

"You're sleep-deprived, and you have to perform perfectly or else you don't fly anymore. As soon as you're done with something, ground control is telling you something else to do. The bathroom stinks, and you have noise all the time. You can't open a window. You can't go home, you can't be with your family, you can't relax. And you're not well paid. Can you get a worse job than that?"

- Norbert Kraft

Psychosocial Issues in Space Flight

- Physical environment
  - Inhospitable environment - “death outside the porthole”
  - Limited supplies for extended missions
  - Unchanging perceptual field - sight, auditory
- Social environment
  - Withdrawal from home community
  - Challenges of microsociety
    - Limited variety in social relationships
    - Forced intense relationships - life-critical

Potential Stressors in Space Flight

- Separation/remoteness from Earth
- Confinement
- Potential interpersonal conflicts
- Medical risks including trauma

Mission Parameters Affecting Stress

- Mission duration
- Architectural layout
- Crew size and composition
- Leadership structures
- Degree of isolation and social monotony
- Crew autonomy
- Emergency evacuation options
- Support measures - e.g., communications, entertainment
- Amount of meaningful work

Cultural Issues Affecting Stress

- Language
- Cultural norms
- Alienation - “odd man out”
- Food
- Mission phase
  - Initial anxiety
  - Mid-mission depression - “third quarter effect”
  - Terminal euphoria
- “Host”-”guest” relationships

Potential Responses to Social Stresses

- Impaired intellectual functioning
- Motivational decline
- Somatic complaints
- Psychological changes
- Social tensions
- Temporal fluctuations

Critical Aspects of Ground Simulations

- Isolation
  - Physical
  - Virtual (communications)
- Hazardous/Stressful
- Appropriate time scales
- Small interdependent group

Case Study: Huautla Cave Expedition (1994)

- Explore Huautla cave system outside Oaxaca, Mexico - more than 1 mile in depth
- Most of cave volume is underwater - need lightweight, long-range diving equipment
- 15 divers, support crew, film crew from National Geographic
- 2.5 months on site with 44 days inside cave

Huautla Environment

- Total darkness inside cave system
- Water temperature 64°F
- Working/sleeping on suspended platform over water-filled tunnel
- Proximity to water fall at 100dB
- Absence of normal sensory cues
- Difficulty of descent/ascent

Huautla Data Collection (planned)

- Psychiatric assessments (NEO Personality Inventory)
- Daily Stress Inventory
- Daily Sleep Log
- Wahler Physical Symptoms Inventory
- Weekly Group Performance tests
- Testing continued post-test by mail

NEO Personality Inventory

- NEO=”Neuroticism-Extroversion-Openness”
- Tests “big five” personality traits
  - Neuroticism
  - Extroversion
  - Openness to experience
  - Agreeableness
  - Conscientiousness
- Intended for adults without psychopathology

"Big Five" Personality Traits

Neuroticism	Extraversion	Openness to Experience	Agreeableness	Conscientious
Anxiety Hostility Depression Self-consciousness Impulsiveness Vulnerability to stress	Warmth Gregarious Assertiveness Activity Excitement seeking Positive emotions	Fantasy Asthetics Feelings Actions Ideas Values	Trust Straightforward Altruism Compliance Modesty Tenderminded	Competence Order Dutifulness Achievement striving Self-discipline Deliberation

Pre-Mission Crew Evaluations

- 12 divers and 2 support crew examined for physical and psychological health
- Evaluated in top or bottom decile or "average" (central 80%) in physical and psychological health
- 4 divers top 10% physically
- 1 diver bottom 10% physically
- 3 divers, 1 crew top 10% psychologically
- 1 diver, 1 support in bottom 10% psychologically

Personality Profile Data

- 8 personnel with personality profile data
- 4 highly suited to mission
  - Low Neuroticism (anxiety, hostility, impulsiveness)
  - High Extraversion (warmth, gregariousness, assertive)
  - High Openness to Experience
  - Average on Agreeableness
- 4 unfavorable profiles
  - Elevated Neuroticism
  - Low Agreeableness
  - Low Conscientiousness

Huautla Experiences

- One death in pre-mission dive training
- Several in-cave medical emergencies, including one death
- Team dissolved over time
- Final team composed of three divers and one support crew member

Case Study: Australian Outback

- Survival course in Western Australian Desert
- Two 6-person teams: 1 all-male, 1 all-female
- Six days to walk 90 km to water hole for pickup
- After reaching water hole, had to hike 30 km overnight for pickup
- Each team had (same gender) reporter and cameraperson
- One woman had no night vision

Australian Outback Subject Profiles

- Subjects were tested with NEO-PI
- Several males low-very low on Agreeableness and Conscientiousness and high on Neuroticism
- One woman very low on extraversion and openness
- Men's group predominantly task focused, but still high in interpersonal concerns
- Women's group highest on interpersonal concerns

Australian Outback Stress Indicators

- Stress data collected by subjective evaluations and cheek swabs to measure cortisol levels
- Men reported reduced stresses as time went by
- Women reported elevated stresses with time
- Both men and women cortisol levels showed elevated stress with time

Leadership Styles

- Men adopted rotational leadership strategy
- Different men specialized in different tasks - “fishing”, “firestarters”, “cooks” - and took lead in their areas
- Women adopted consensus leadership approach
- Also had rotational leadership, but preceded rotation with discussion of who “wanted” to lead in each phase
- Discussions were instigated by several members and slowed progress down substantially

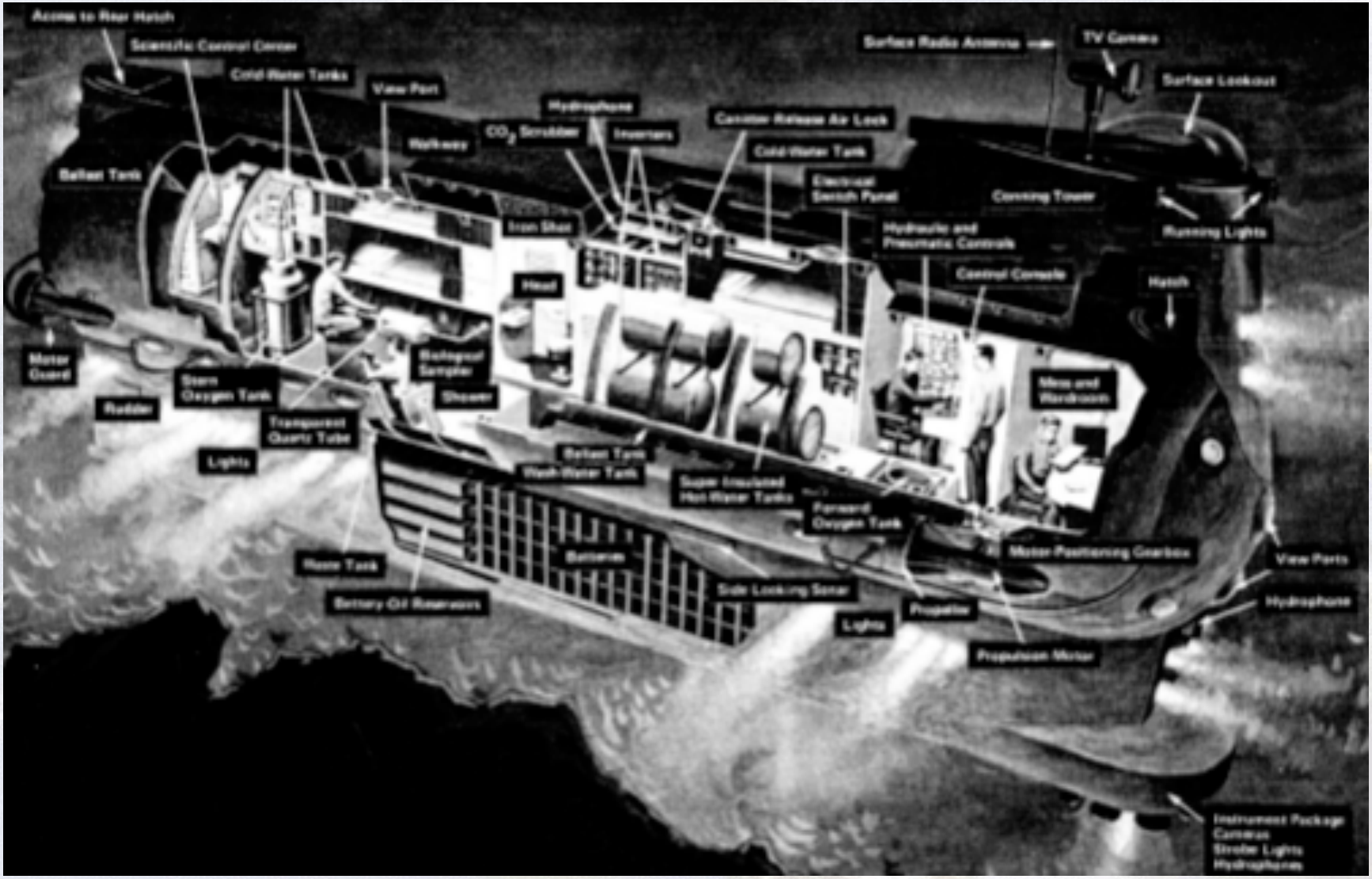
Australian Results

- Women's group was slower with lower physical fitness at start and had more false turns, but made the goal within time
- By end of exercise, men's group scored higher in enthusiasm, participation, leadership, group cohesion, and group involvement
- Women's group scored higher on group morale
- "Take-away" conclusion was gender-based differentiation between task orientation and interpersonal relation orientation

Case Study: Ben Franklin Gulf Drift Mission

- Ben Franklin submersible
- 6-man crew for 30 days (1969)
- Used as analogue test of long-duration mission
- Psychosocial data collected via pre-planned logs, time-lapse photography, and audio recordings
- Motor skills testing to measure physiological responses
- Two months of crew training prior to mission, but full crew only came together at mission start

Internal Cutaway of Ben Franklin



Results of Ben Franklin GSDM

- Negativity towards partners was constant throughout mission but increased post-mission
- Negativity about environment grew with time
- Positive feelings were higher post-mission than at any time during the mission
- Annoyance with partners increased with time
- Emotional control increased with time
- Compatibility increased through third week, was lower at end of mission than at beginning

Results of Ben Franklin GSDM

- Morale remained high and constant
- Motivation reached nadir around day 21 but returned to original level at end of mission
- Privacy seeking increased with time
- Boredom with environment increased with time
- Social interaction was high but dropped slightly with time
- Proportion of solo meals increased with time

Privacy

- Functional definitions
  - "Aloneness"
  - "Controlling access to space"
  - "No one bothering me"
  - "Controlling access to information" [about me]
- Control of transactions between individual and others to enhance autonomy or minimize vulnerability

Work Capacity and Performance Issues

- Gravitational changes
- Biomedical changes
- Altered wake-sleep cycles
- Altered work-rest cycles
- Stress
- Fatigue
- Boredom/monotony
- Variety of work/control of work

Optimal Crew Work Scheduling

- 2 hrs - passive task(s) without active task(s)
- 4 hrs - passive task(s) mixed with active task(s), workload is not too great, high level of performance required
- ≤10 hrs - considerable variety of tasks, active role in major tasks, detectable events with response(s) in passive tasks

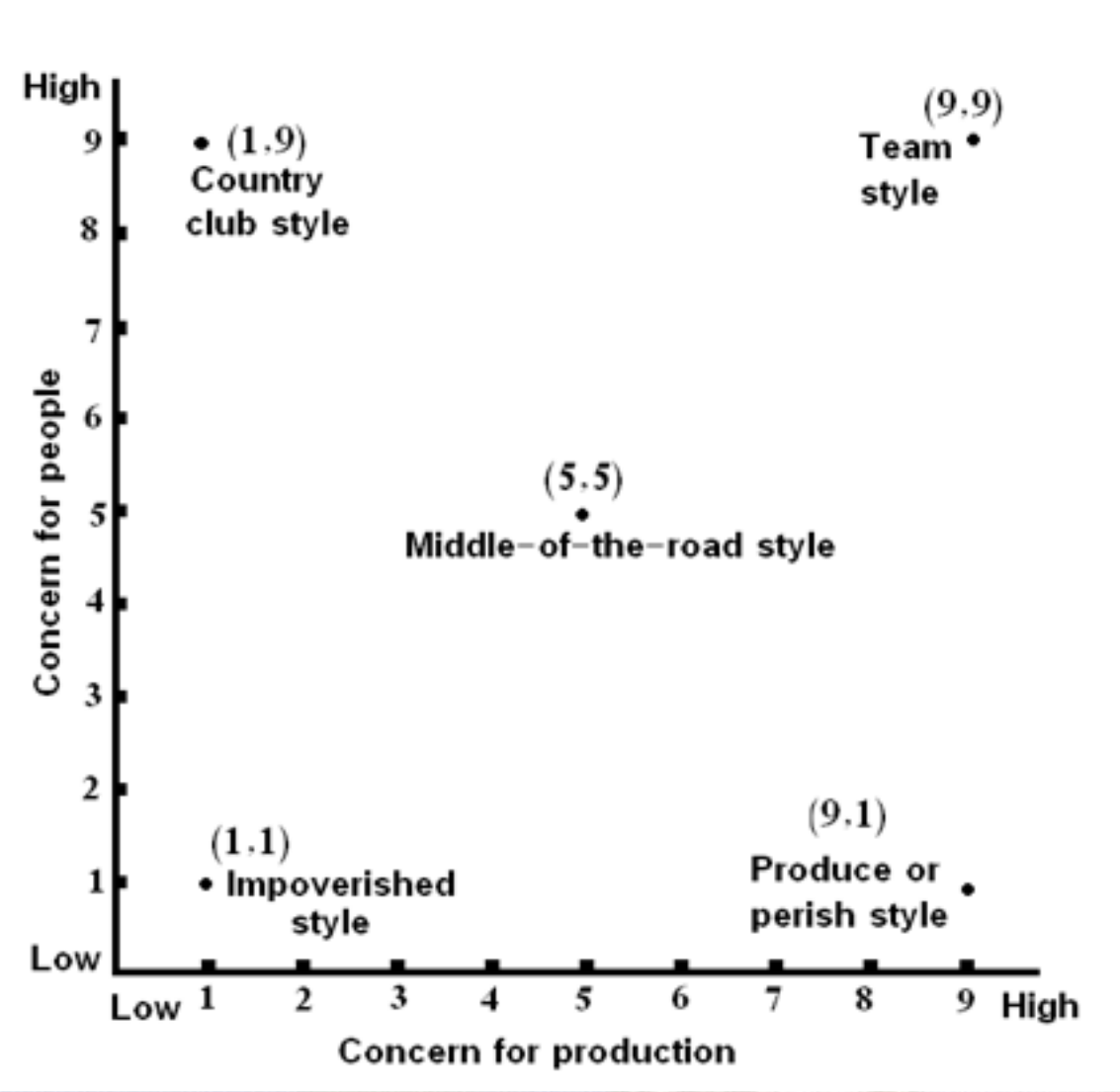
Small Groups

- Selection
- Make-up
  - Gender
  - Backgrounds
  - Age
  - Background cultures
  - Personal attractiveness
  - Competence
  - Cooperativeness
  - Size

Leadership Structures

- Lewin et. al. (1939)
  - Authoritarian
  - Democratic
  - Laissez-faire
- Path-Goal Theory (House 1971)
  - Achievement-oriented
  - Directive
  - Participative
  - Supportive

Management Grid Model (Blake 1964)



Leadership vs. Management (Zaleznik 1977)

- Managers administer; leaders innovate.
- Managers ask how and when; leaders ask what and why.
- Managers focus on systems; leaders focus on people.
- Managers do things right; leaders do the right things.
- Managers maintain; leaders develop.
- Managers rely on control; leaders inspire trust.
- Managers have short-term perspective; leaders have long-term perspective.
- Managers accept the status-quo; leaders challenge the status-quo.
- Managers have an eye on the bottom line; leaders have an eye on the horizon.
- Managers imitate; leaders originate.
- Managers emulate the classic good soldier; leaders are their own person.
- Managers copy; leaders show originality.