DAILY EXERCISE ROUTINES

by

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■ <u>**OUTLINE**</u>

- **Introduction**

- **Problem Description**

- **Proposed Approaches**

- **Summary**

- **Panel Discussion**

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—— **Space Station Freedom** ——————————————————————

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(Continued)

- ■ **INTRODUCTION**

  - ● **Daily exercise and periodic stress testings are required on Space Station.**

    – **Exercise Equipment:** Treadmill, Dual Bike, Muscular Output Trainer, and portable exercise equipment.

    – **Physiological Monitors: Daily** - Heart Rate Monitor. **Periodic -** Blood Pressure Monitor, Electrocardiograph, Metabolic Gas Monitor, and Body Mass Measurement Device.

  - ● **The equipment is configured either automatically or manually.**

  - ● **Data is obtained from the physiological monitors and logged by the system.**

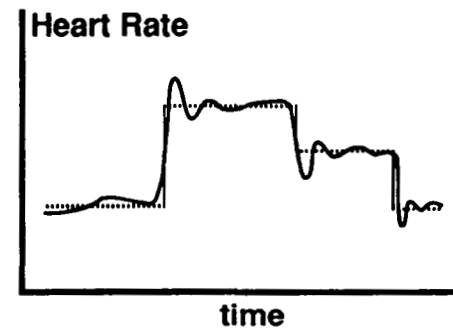 - ● **Exercise physiologist monitors data and updates the protocols.**

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■ **PROBLEM FORMULATION**

- **Exercise protocols strive to maintain cardio-vascular, and musculo-skeletal systems at levels established by doctors and/or exercise physiologists.**

- **To provide consistent data during stress testing, it is desirable to maintain physiological levels without exceeding targets.**
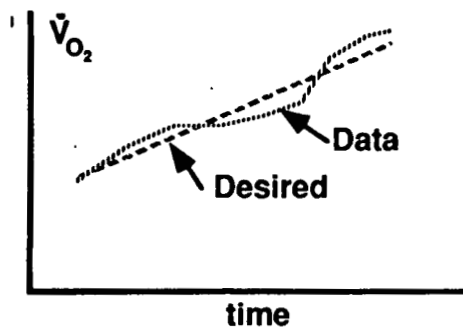
- **Metabolic Gas Monitor data, exercise workload data, and perceived exertion levels from interviews (subjective data) are used to ascertain the physical condition of crew members to determine modifications to protocols.**
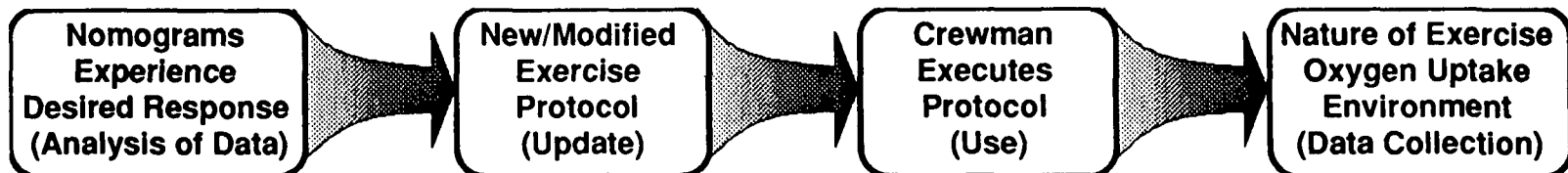
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■ **PROPOSED APPROACHES**

- **Daily exercise data and periodic stress test data is collected on-orbit and sent to the ground.**

- **Exercise protocols are modified based on the analysis of data by an exercise physiologist.**

Nomograms Experience Desired Response (Analysis of Data)	→	New/Modified Exercise Protocol (Update)	→	Crewman Executes Protocol (Use)	→	Nature of Exercise Oxygen Uptake Environment (Data Collection)

- **New exercise protocols are uploaded.**

- **Crew member executes new protocol.**

- **During stress testing, step function feedback to exercise equipment is provided to reduce overshoot of target physiological parameters.**

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■ **SUMMARY**

- **Analysis of exercise data is performed by an expert and utilizes subjective input.**

- **Equipment control is provided by step functions using time and magnitude as input parameters.**

- **(Opening question for Panel discussion)**

  Is Fuzzy Logic a viable alternative to the current approach?

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Topic: Daily Exercise Protocol
Presenter: Pat Anderson

Comment: (Berenji) Wherever there is a control problem that experts can define
                heuristics for the fuzzy rules, it makes sense to model the process using
                rules and fuzzy logic.

Comment: (Weiss) There is lots of literature available. If you treat system where
                output is heartrate, you can control heartrate by workload (i.e. adjust bungi
                cords so that the optimum heart-rate is achieved).