

## Autogenic Feedback System-2 (AFS-2)

### Hardware Description

The Autogenic Feedback System-2 (AFS-2) is a light-weight, battery-operated, fully ambulatory physiological monitoring system that allows complete freedom of motion for users. It is designed to allow astronauts to monitor their own physiological data so they can consciously alter their physiological responses to help counteract the effects of space motion sickness. It can continuously monitor, display, and record nine channels of physiological data for up to 12 hours on a single set of alkaline batteries. The AFS-2 offers both a Treatment Mode and a Control Mode. In Treatment Mode, physiological data can be viewed on the Wrist Display Unit, while in Control Mode only system status and malfunction indications are displayed. Data are stored on a standard audiocassette using special instrumentation tape.

### Subsystems

**Sensors:** The AFS-2 sensors include a ring transducer to monitor skin temperature and blood volume pulse, a respiration transducer, electrodes for electrocardiography (ECG) and skin conductance, and a triaxial accelerometer for head movement. The Belt Electronics package conditions these signals prior to recording.

**Garment Assembly:** The Garment Assembly consists of a Garment, a Cable Harness, and a Wrist Display Unit. The Garment is a cotton jumpsuit with Velcro attachment points to secure the Cable Harness and serves as a support structure for the various system sensors and transducers. The Wrist Display Unit displays physiological data, indicates system malfunctions, and notifies the user of a low battery condition.

**Belt Assembly:** The Belt Assembly consists of a Belt Electronics Package, a Battery Pack, and a TEAC Data Recorder. The Battery Pack provides power for the entire system. The TEAC Data Recorder records analog signals from the Belt Assembly. Data and power for the Data Recorder are provided by the Belt Electronics via the TEAC Interface Cable.

### Specifications

**Dimensions:** N/A

**Weight:** 2 kg

**Power:** 4 batteries, 9 V each

**Sensors:** blood volume pulse (1–200±0.5) skin temperature (70–99.9±1°F), skin conductance level (0.5–50 µMHOs ±2%), respiration (40–60 breaths/min), electrocardiography (40–180 beats/min) and acceleration (±0.25 G±5%)

### Data Acquisition

Skin temperature, electrocardiography, respiration, skin conductance level, blood volume pulse/photoplethysmography, xyz-axis acceleration

### Related Ground-Based Hardware

**TEAC MR-40 Playback Unit:** The unit replays AFS-2 tapes. It reproduces original analog data by demodulating the recorded FM signals.

**Data Analysis System:** The system digitizes and processes MR-40 analog data.

### Hardware Publications

- Cowings, P.S. and W.B. Toscano: *Autogenic-Feedback Training (AFT) As a Preventative Method for Space Motion Sickness: Background and Experimental Design*. NASA TM-108780, 1993, pp. ill.
- Fukushima, A., D. Bergner, and M.T. Eodice: *Autogenic Feedback System-2 (AFS-2) User Manual*. NASA UM-21350, 1995.
- *Life Sciences Laboratory Equipment (LSLE) On-line Catalog*. NASA, 1998. <http://lifesci.arc.nasa.gov:100/lisle/>.

### Missions Flown 1991-1995

SL-J/STS-47

