ATMOSPHERIC CONTROL SYSTEMS

by
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Outline

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by
Melanie Mankamyer
(Continued)

■ INTRODUCTION

- The Space Station (and future manned space missions) require atmospheric control systems
- Spacecraft atmosphere control systems consist of:
  - Temperature control
  - Composition control
  - Pressure control
- Composition control includes controlling the major constituents, humidity, and trace contaminants
- Temperature, pressure, and composition control are all interrelated

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- **PROBLEM FORMULATION**
  - **Cabin temperature is selectable between 64.4 °F - 80.6 °F and must be maintained within 1 °F**
  - **Cabin atmospheric pressure is set at 14.7 psia and maintained within 0.2 psi**
  - **Oxygen partial pressure is set at 2 psia**
  - **Relative humidity is maintained between 25% and 70% (dew point temperature is always maintained above 59 °F)**

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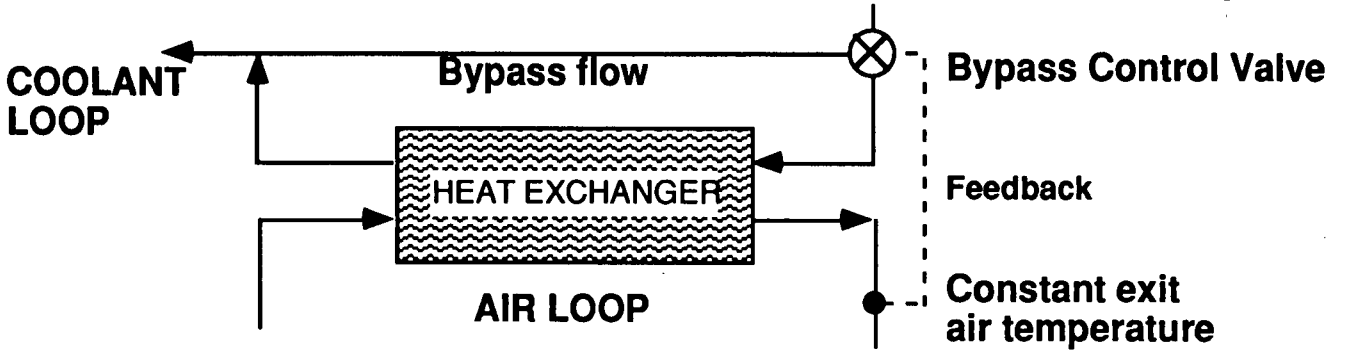
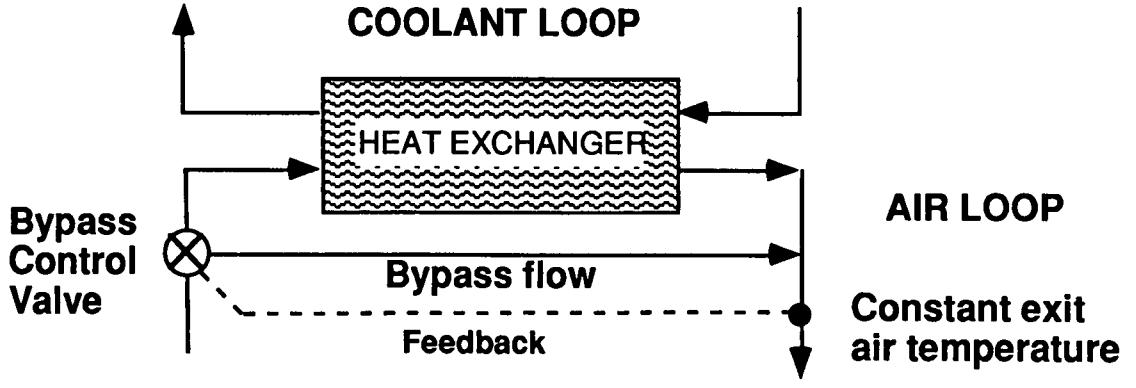
■ PROPOSED APPROACHES

- The classical approach to temperature control is to use a heat exchanger with flow bypass.
- A liquid side bypass system is smaller but slower to respond



- The air side bypass system provides a quicker response and can also maintain humidity with the use of a condensing heat exchanger



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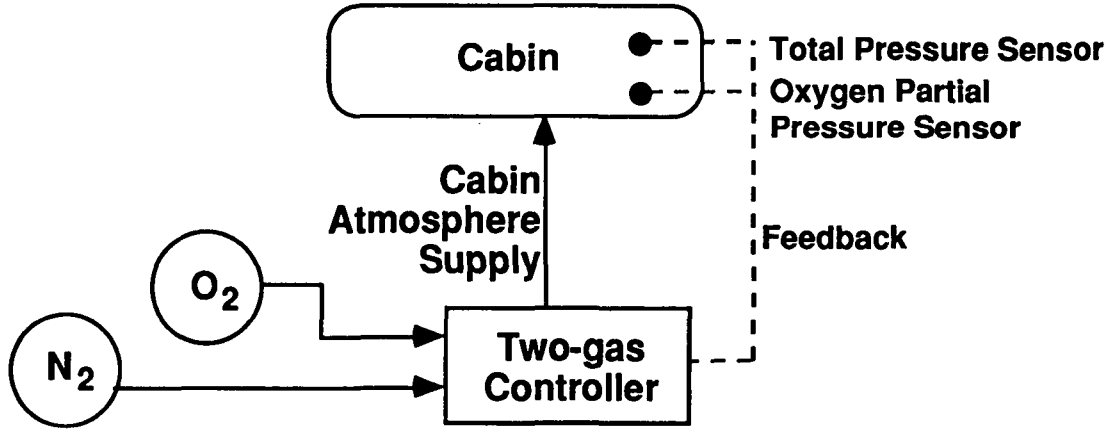
- **PROPOSED APPROACHES (cont.)**
  - **Major atmospheric constituent control is coupled with pressure control and is accomplished with a 2-gas controller**
    - **Sensor registers a drop in total cabin pressure of 0.2 psi**
    - **Controller checks the partial pressure of oxygen (sensor)**
    - **If oxygen level low, a valve is opened and oxygen added until the partial pressure is met, then nitrogen is added until total pressure is met**
    - **If oxygen level is good, then a valve is opened and nitrogen is added until total pressure is met**



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- **SUMMARY**
  - Techniques to maintain atmospheric control parameters have been identified
  - Fuzzy Logic Control Law has been mentioned for application to atmospheric control
  - (Opening question for Panel discussion)

    What advantages does fuzzy control logic offer to the rather simplistic controls of the atmospheric control systems?

Topic: Atmospheric Control
Presenter: Melanie Mankamyer

Comment: (Mankamyer) Space Station is not using automatic oxygen control due to scrub activities. Astronaut must manually check gauges and manually adjust the levels as needed. No active monitoring in the contamination system.

Comment: (Lea) Better cost and temperature control with fuzzy logic usage. Such a system keeps responding to the various changes (temerature, etc).

Commnet: (Mankamyer) Systems are mainly worked in WP-01. Temperature control is in nodes/airlock.

Q (Lawler): How much oxygen can you go without before you can detect the loss of oxygen (referring to faulty gas control).
A (Spoor): You can detect sutle symptoms; a person can possibly go to 14,000 - 14,500 feet, after that you need oxygen compensation.

Q (Brown): What if there is a valve problem?
A (Spoor): Carbon Dioxide sensors are part of ECLSS (caution & warning system)

Comment: (Berenji) Cooperating expert systems is a strong possibility (Thermal, power, etc).

Comment: (Brown) Due to scrub activities, the type of work Dr. Berenji mentioned would not be possible (no automated power).