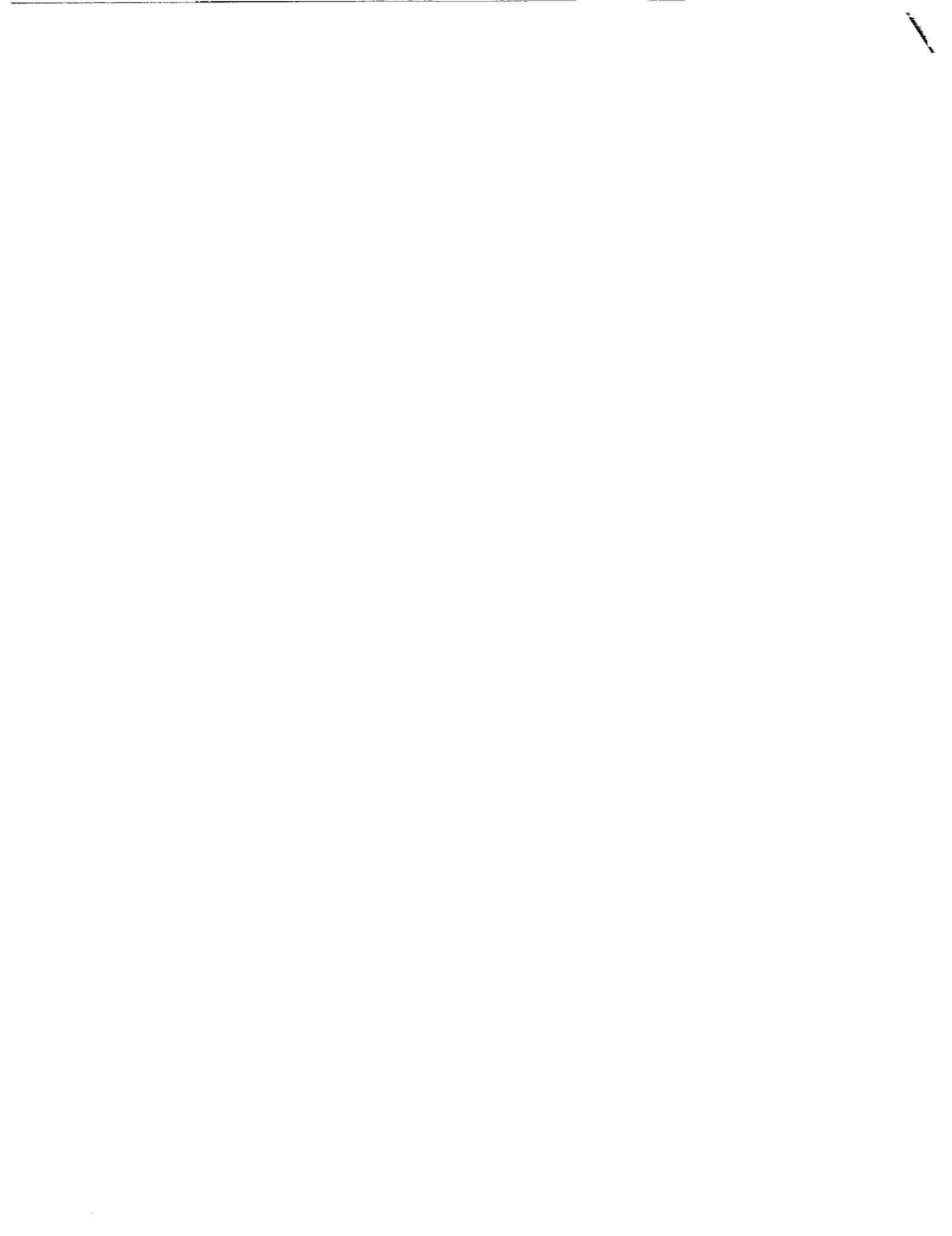


N91-10950

FAULT MONITORING

Paul Schutte
NASA Langley Research Center



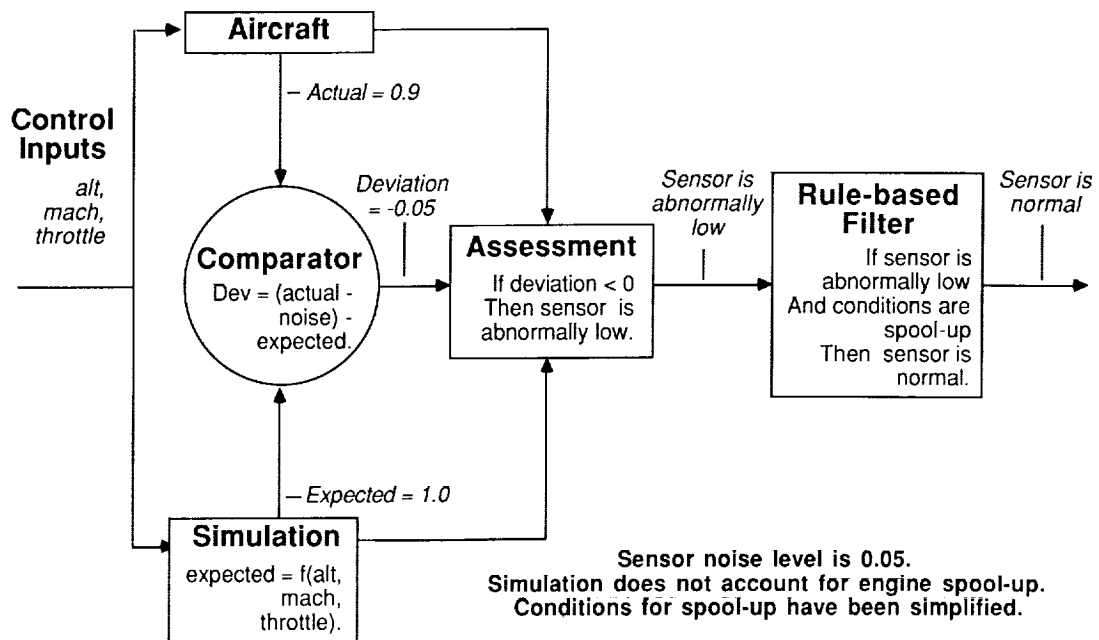
FAULT MONITORING IN THE AIRCRAFT DOMAIN

- - **Develops behavioral expectations**
 - **Collects relevant data**
 - **Makes appropriate comparisons**
 - **Interprets data into information**
- **Provides subsystem information which either directly or indirectly leads to an appropriate response.**
- **"Acts like a flight engineer"**

Information Requirements

- **Caution and warning exceedances**
- **Degradations (abnormal but within range)**
- **Data interpretation**
- **Dynamic information (derivatives)**
- **Relative parameter information**
- **Low level of false alarms**

MONITAUR ARCHITECTURE



IMPLEMENTATION

Characteristics

- **Monitors turbofan engine**
- **Separate device data base**
- **Sensor-centered object oriented design**
- **Written in Common Lisp**

Anticipated Benefits of MONITAUR Concept

- Early detection of abnormalities
- Minimal interpretation of data
- Quality system state description
- Low number of false alarms
- Relatively low implementation expense

REMAINING WORK

- **Determine false alarm rate**
 - on Symbolics using aircraft data
 - on a PC in an LaRC test aircraft
- **Implement for other subsystems**
(e.g. electrical, hydraulic)
- **Implement on other test aircraft**

REMAINING ISSUES

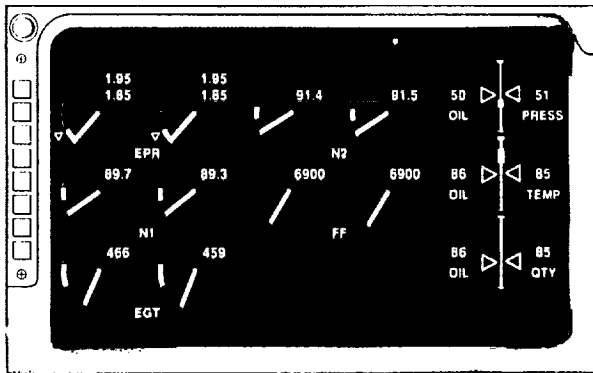
- **Prioritize monitoring tasks**
- **Develop guidelines for knowledge acquisition of rules and noise levels**
- **Evaluate effects of faulty inputs to the model**
- **Assess the risk of false alarms**

E-MACS

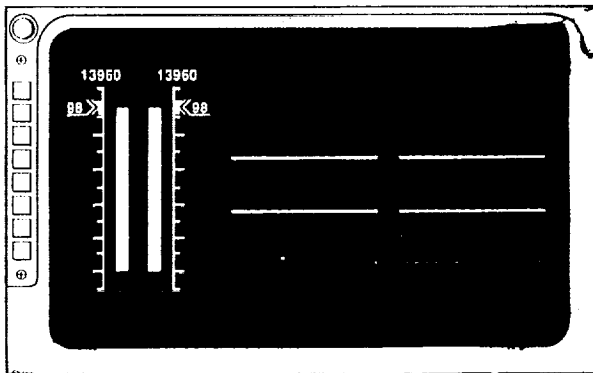
Engine Monitoring and Control System

Situation: *Normal engine power-up for takeoff.*

Traditional

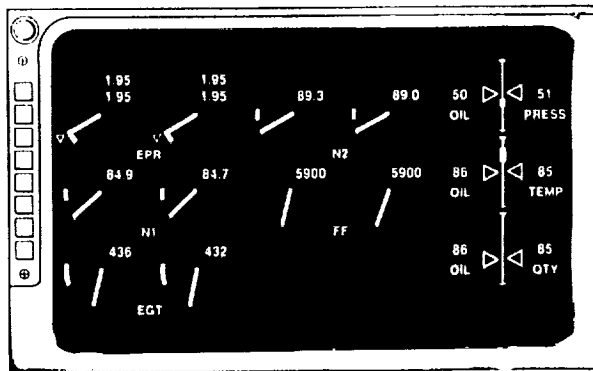


E-MACS

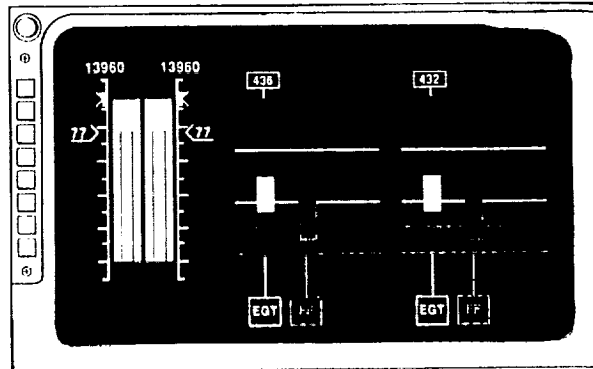


Situation: *Incorrect sensor (EPR). Similar to the 1982 Air Florida accident at Washington National Airport.*

Traditional



E-MACS



1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It includes a detailed description of the experimental procedures and the tools used for data collection.

3. The third part of the document presents the results of the study, including a comparison of the different methods and techniques used. It discusses the strengths and weaknesses of each approach and provides a summary of the findings.

4. The fourth part of the document discusses the implications of the study and provides recommendations for future research. It highlights the need for further investigation into the effectiveness of the different methods and techniques used.

5. The fifth part of the document concludes the study and provides a final summary of the findings. It reiterates the importance of maintaining accurate records and the need for transparency and accountability in financial reporting.

6. The sixth part of the document provides a detailed description of the experimental procedures and the tools used for data collection. It includes a list of the equipment and materials used and a description of the experimental setup.

7. The seventh part of the document presents the results of the study, including a comparison of the different methods and techniques used. It discusses the strengths and weaknesses of each approach and provides a summary of the findings.

8. The eighth part of the document discusses the implications of the study and provides recommendations for future research. It highlights the need for further investigation into the effectiveness of the different methods and techniques used.

9. The ninth part of the document concludes the study and provides a final summary of the findings. It reiterates the importance of maintaining accurate records and the need for transparency and accountability in financial reporting.

10. The tenth part of the document provides a detailed description of the experimental procedures and the tools used for data collection. It includes a list of the equipment and materials used and a description of the experimental setup.