micro fuel cell labs

Micro Fuel Cell Testbench

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Overview

- MFC Labs' Goal
- Product Overview
- System Block Diagram
- Design Solutions
- Testing Results
- Cost
- Milestones Review
- Marketing
- Future Work
- Demonstration

MFC Labs and Our Goals

***Mission statement**:*

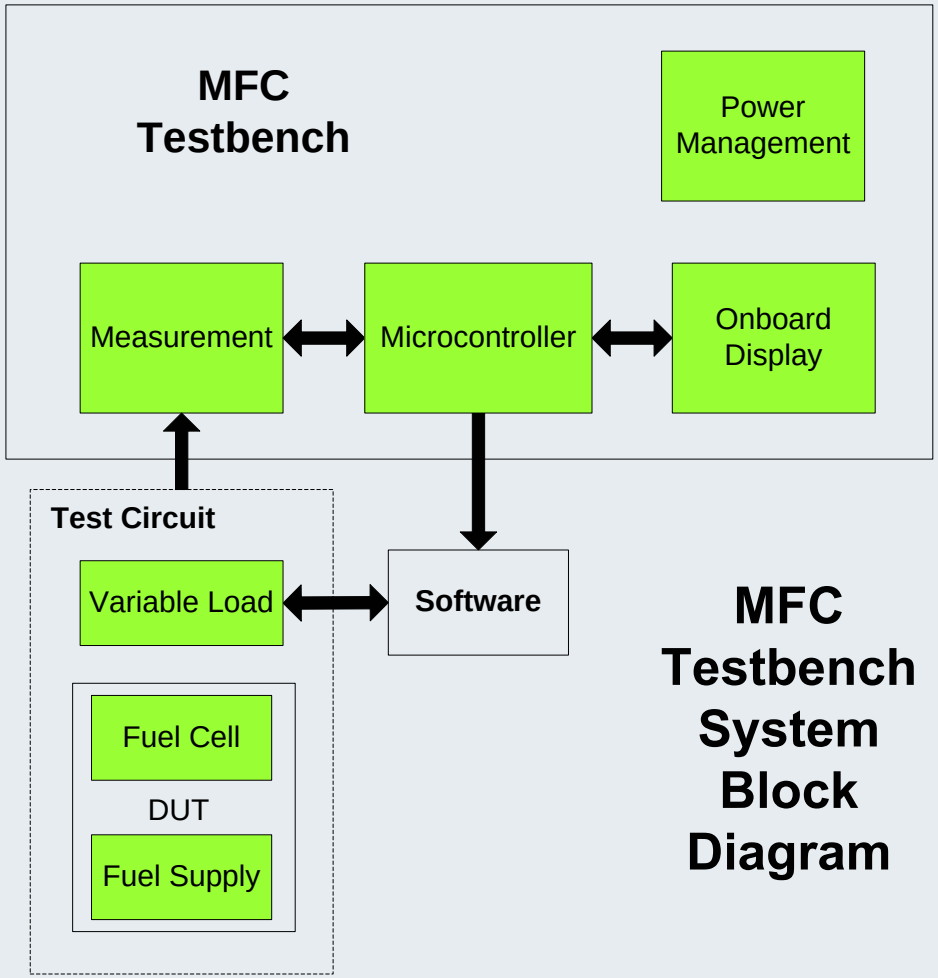
Speed up the commercialization of fuel cell technology.

Product Overview

MFC Testbench

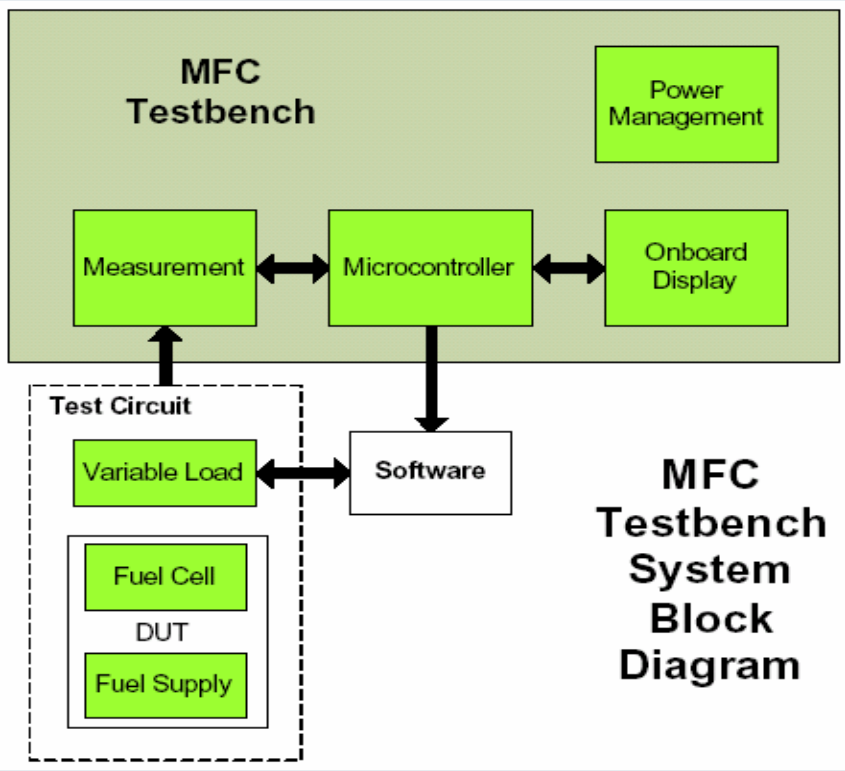
- Easy-to-use measurement
  - Voltage and Current
  - Ambient Temperature and Humidity
- Stand-alone and Portable
- Long-term Data Logging
- Durable and Accurate

System Block Diagram



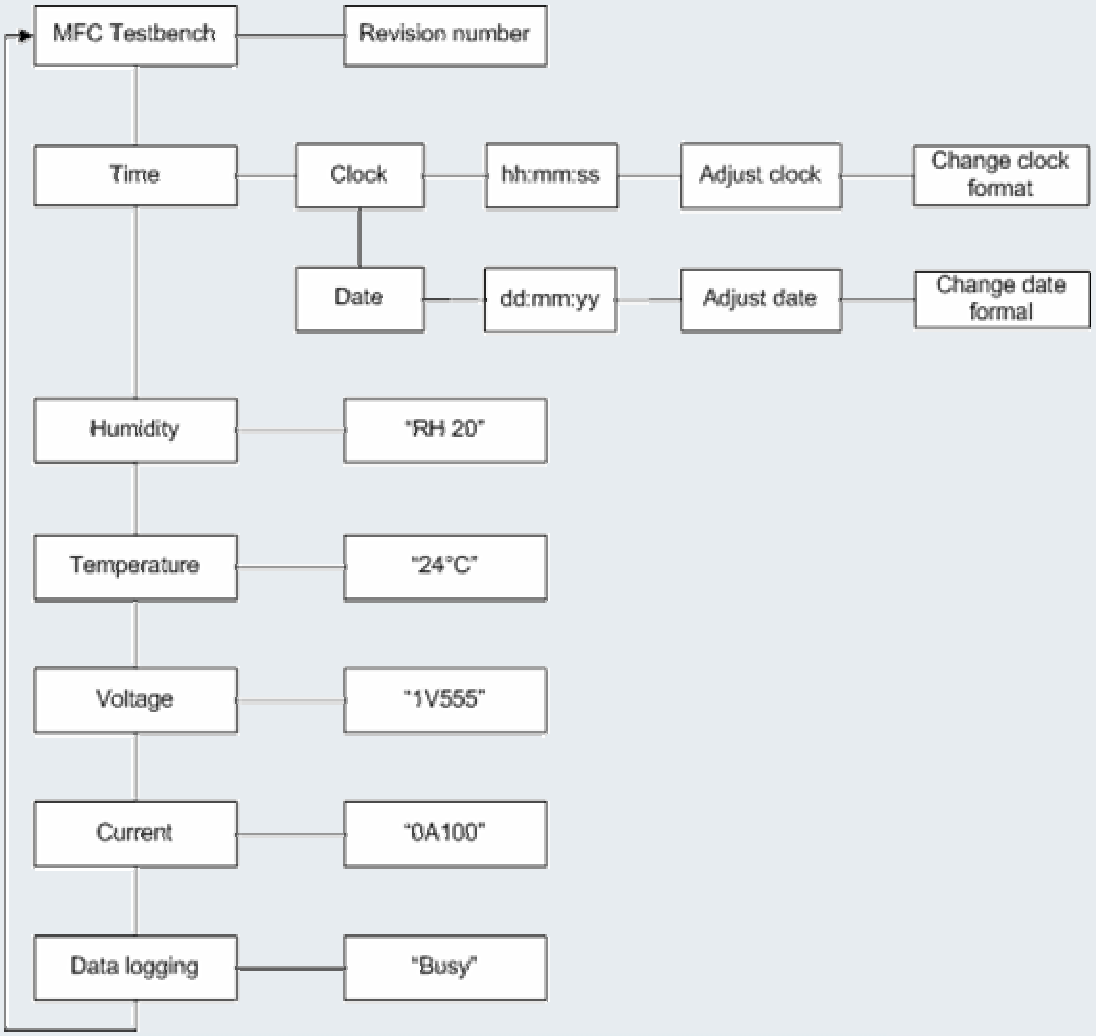
Design Solutions - Microcontroller

- ATMega169
  - Features
  - AVR Butterfly



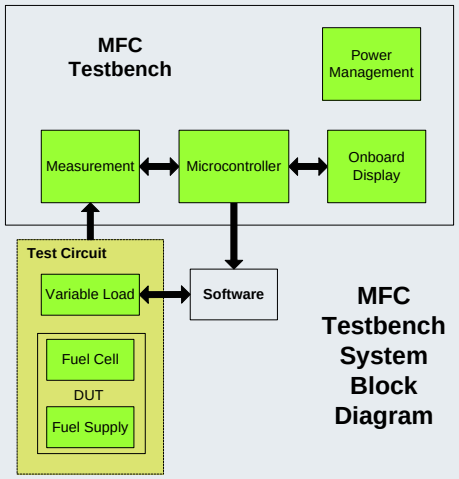
Microcontroller - Cont.

- Firmware

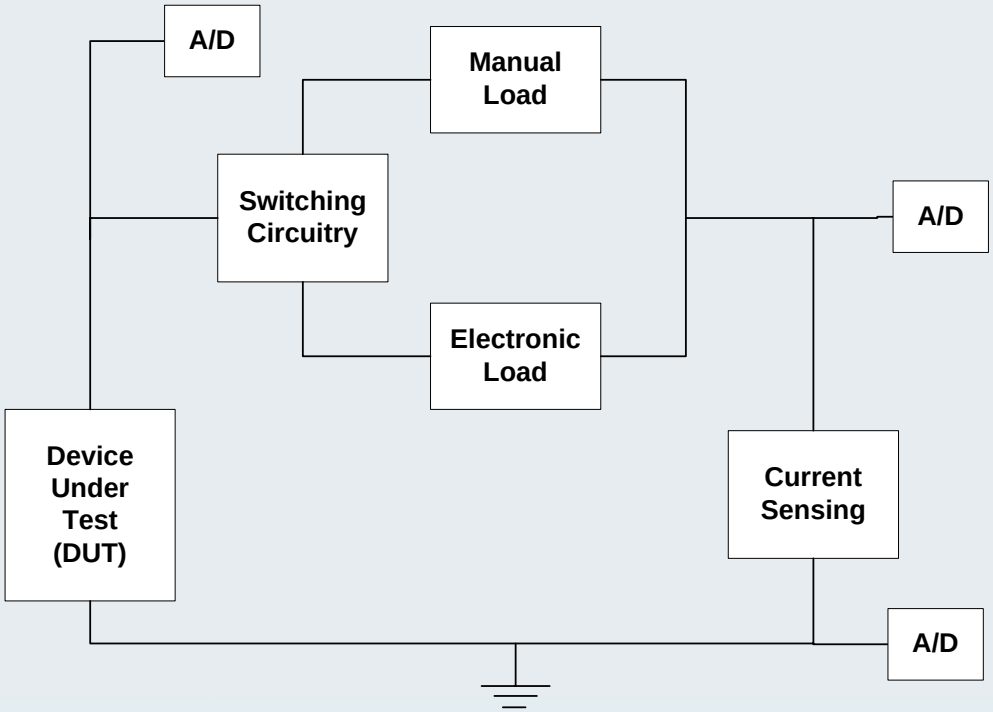


Design Solutions – Test Circuit

- Device Under Test (DMFC)
- Load Block

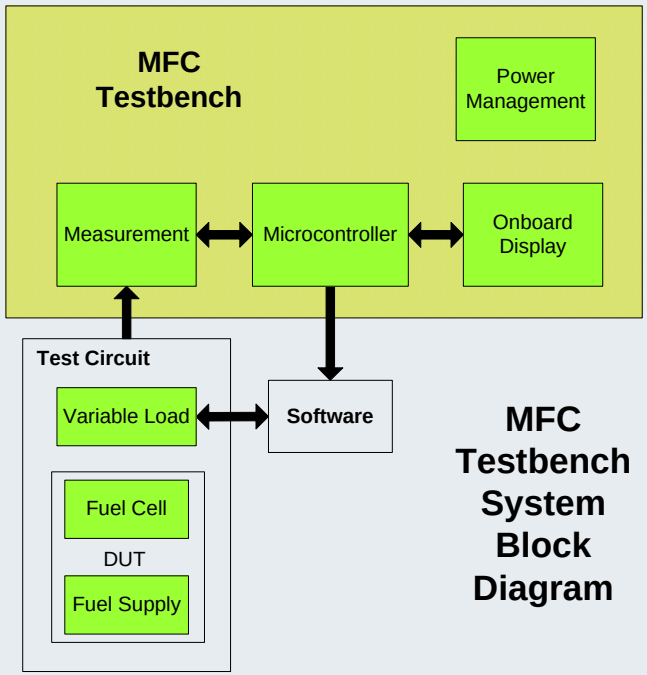


MFC Testbench System Block Diagram



Design Solutions - Measurement

- Voltage
  - A/D of ATMega169
- Current
  - Resistive Sensor to A/D
- Temperature and Humidity
  - SHT11 from Sensirion
  - Two-wire Communication



MFC Testbench System Block Diagram

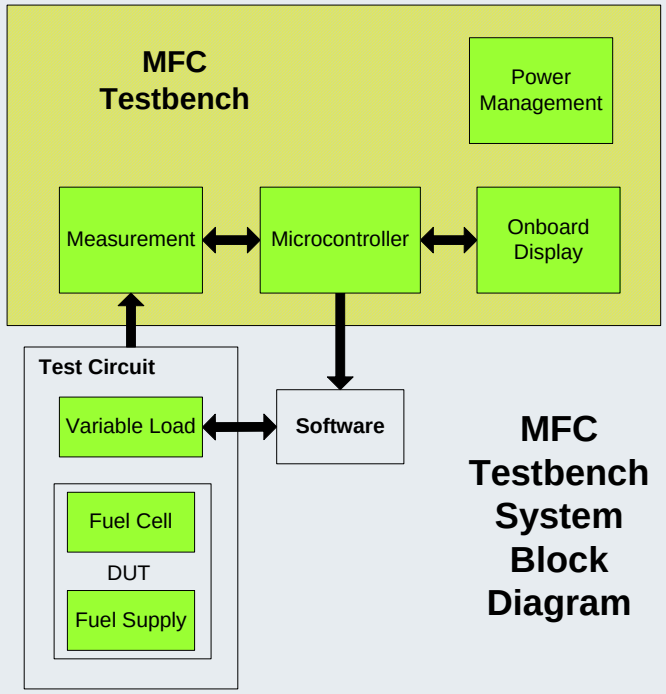
Measurement – Cont.

Measurement Ranges and Accuracies

Parameter	Range	Accuracy
Voltage	0 – 2V	± 0.05 V
Current	10 – 100 mA	± 5 mA
Temperature	0 – 50 °C	± 1 °C
Humidity	0 – 100 %RH	± 3 %RH
Fuel Flow	10 – 100 mL/min	± 10% FS

Design Solutions - Power Management

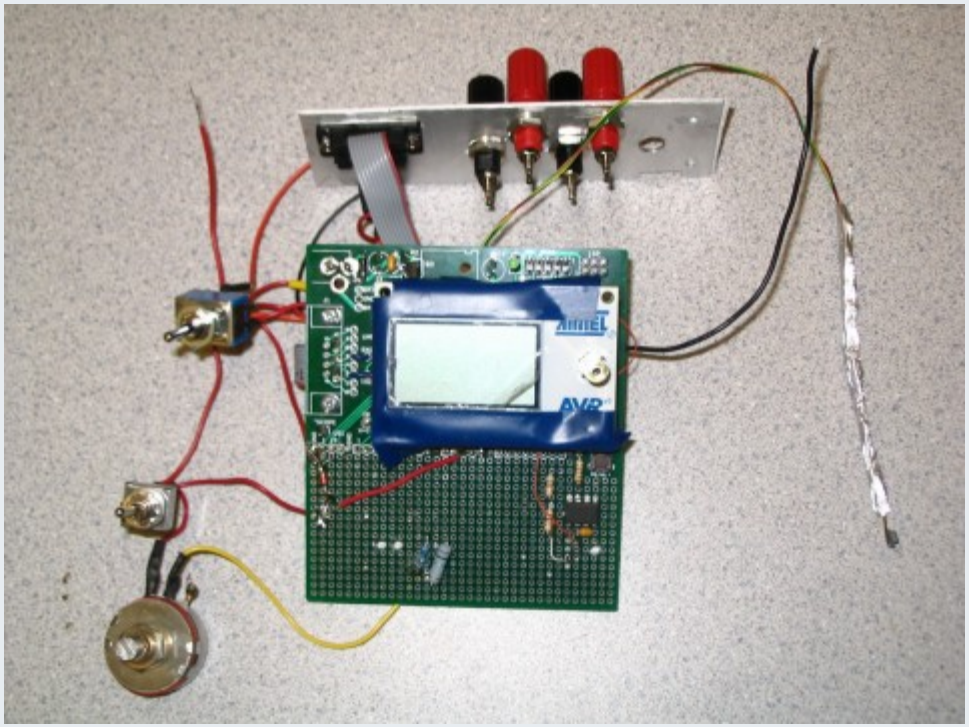
- Powering Methods
  - AC Adaptor
  - Battery
- Linear Regulation
- Voltage Reference
- Protective Circuitry



MFC Testbench System Block Diagram

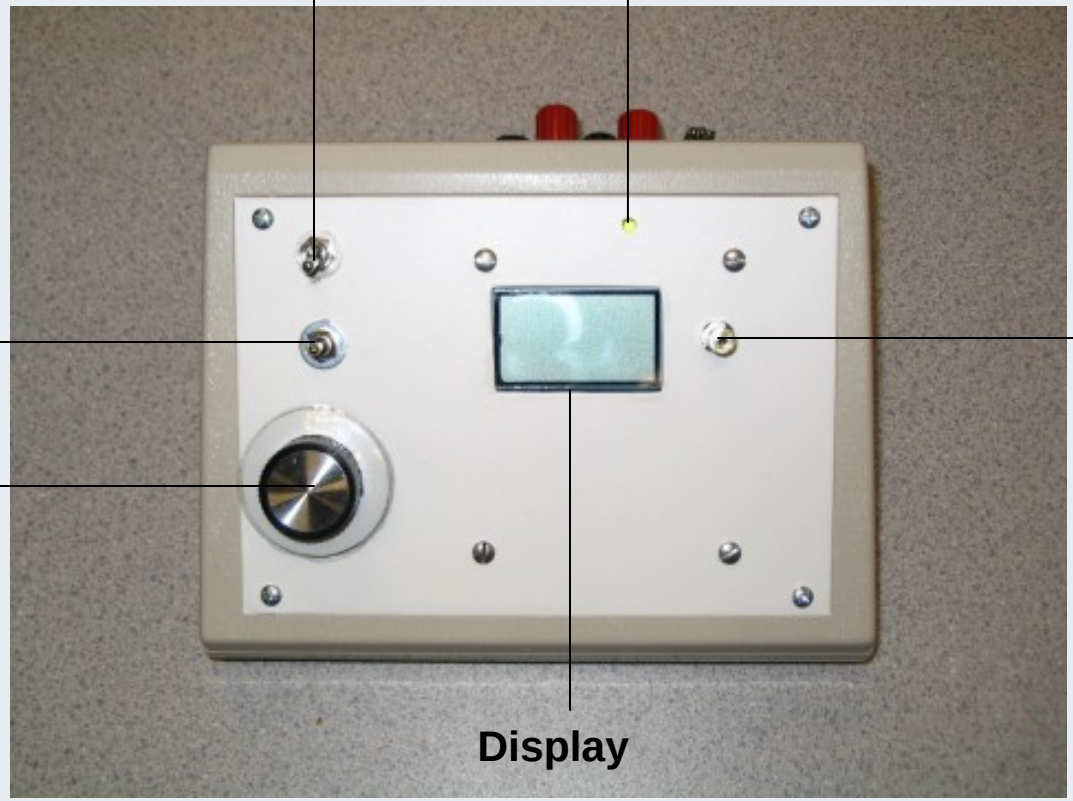
Design Solutions - Integration

- Before ...

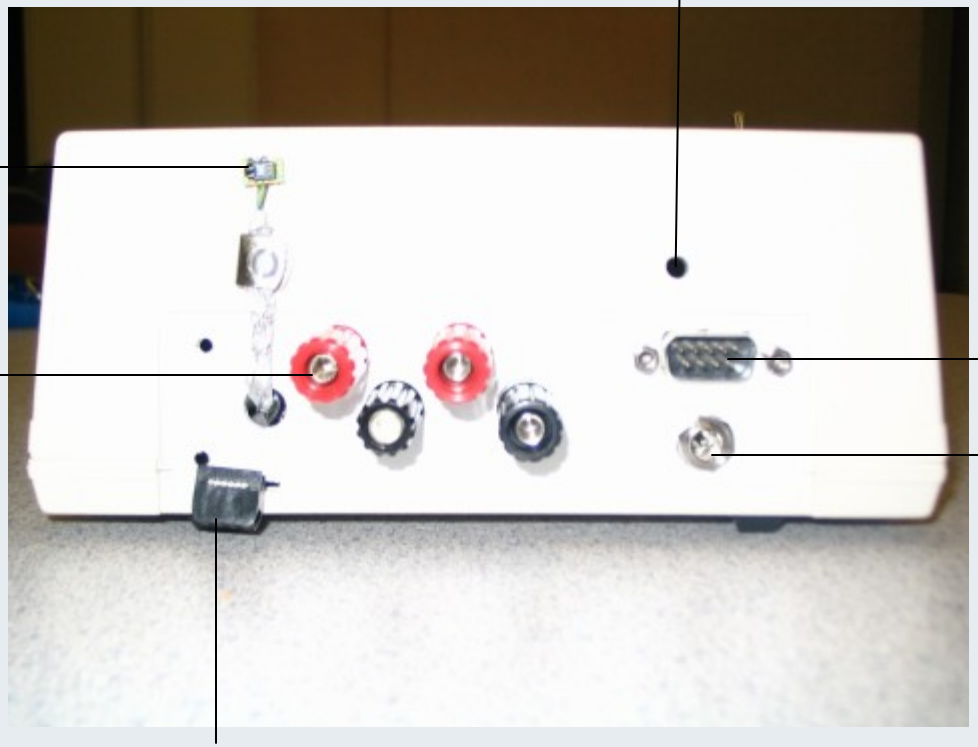


Integration – Cont.

- After …



Integration – Cont.



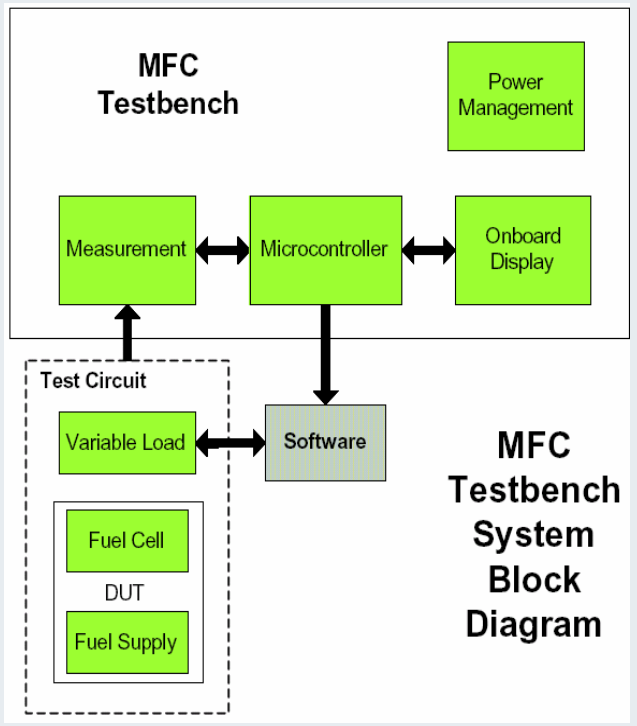
Design Solutions - Product Specifications

- Dimensions
- Operating Conditions

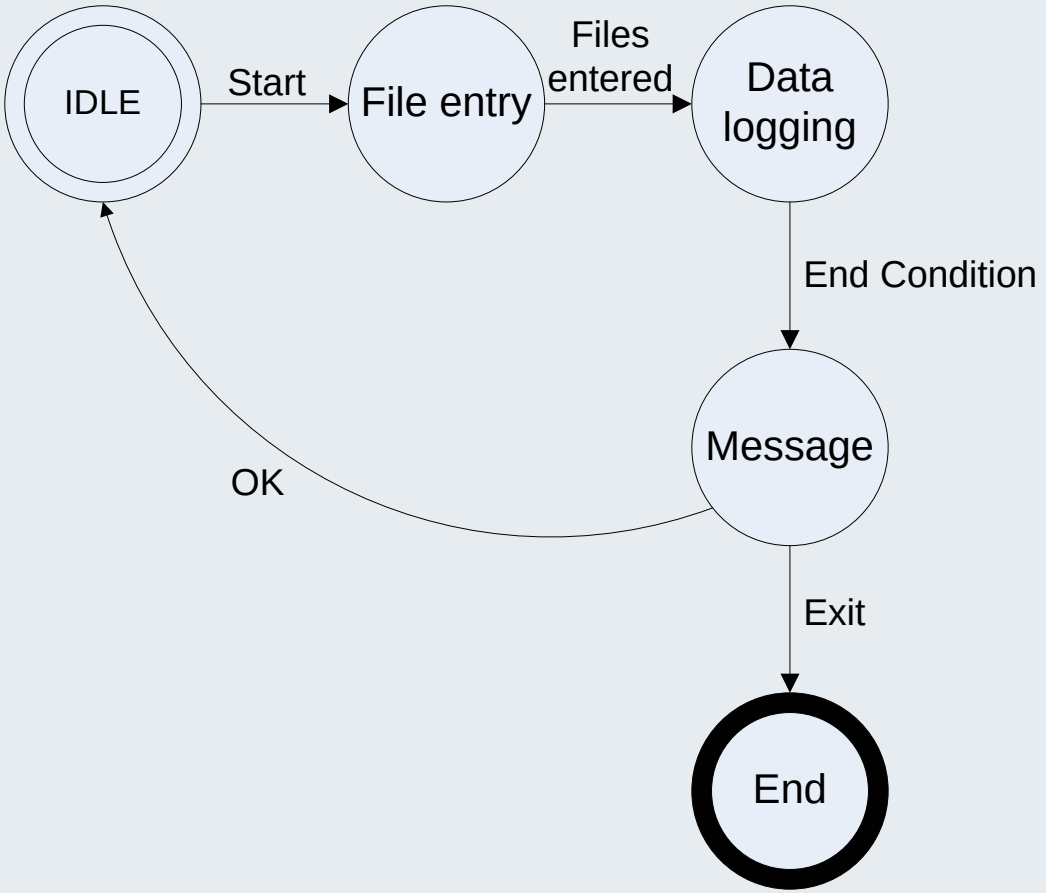
Parameter	Value
Dimensions	20 cm X 9 cm X 13 cm
Power Supply Voltage	15 V
Power	1 W
Temperature	0 - 50 °C
Water Exposure	Testbench is not waterproof

Design Solutions - Software

- Software
  - Data Logging
  - Electronic Load Control
  - RS-232 Communication



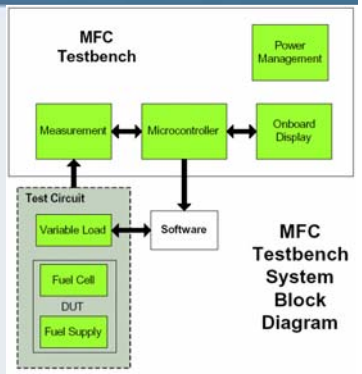
Software – Cont.



State Diagram of MFC Testbench Software

Design Solutions – Fuel Flow

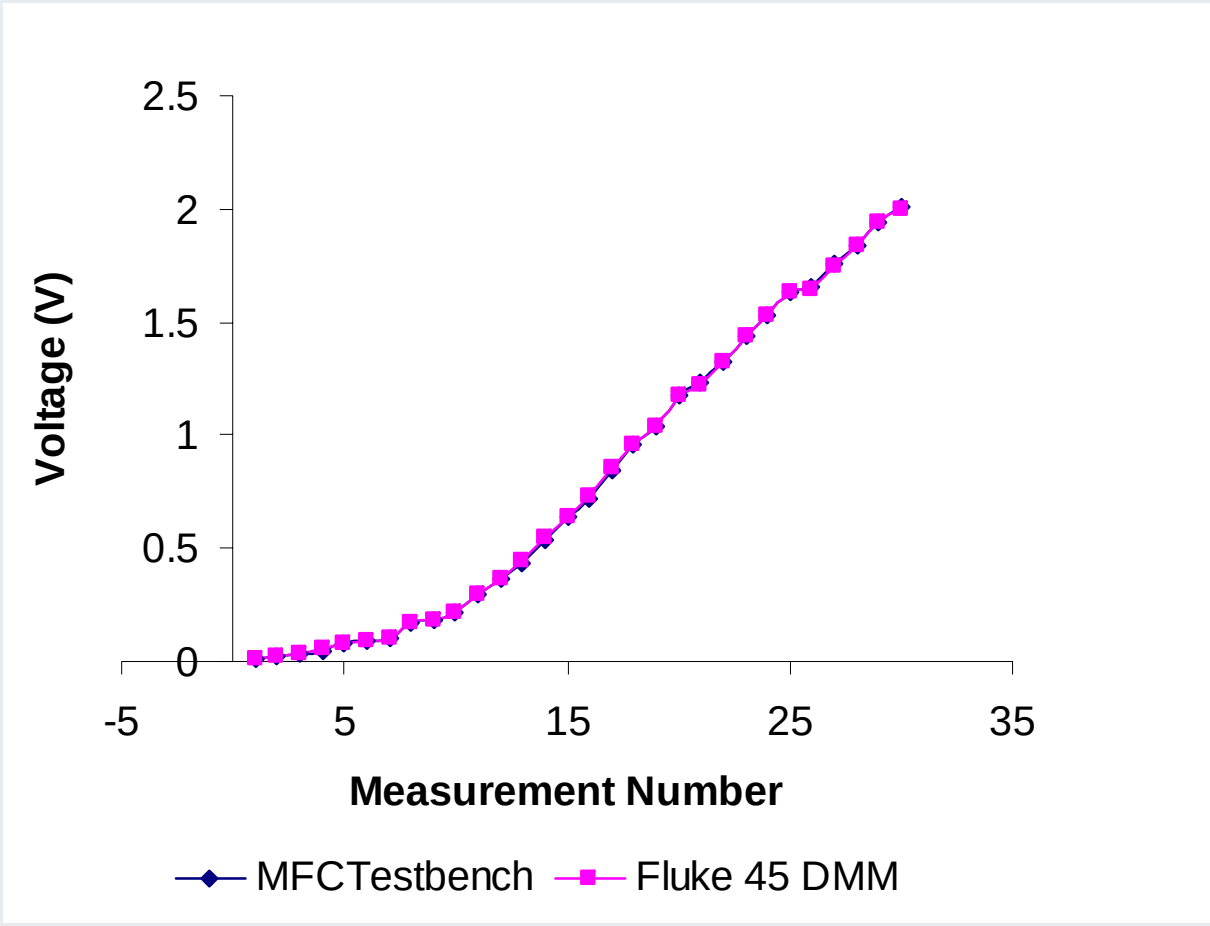
- Fuel Supply System
- Fuel Flow Monitoring



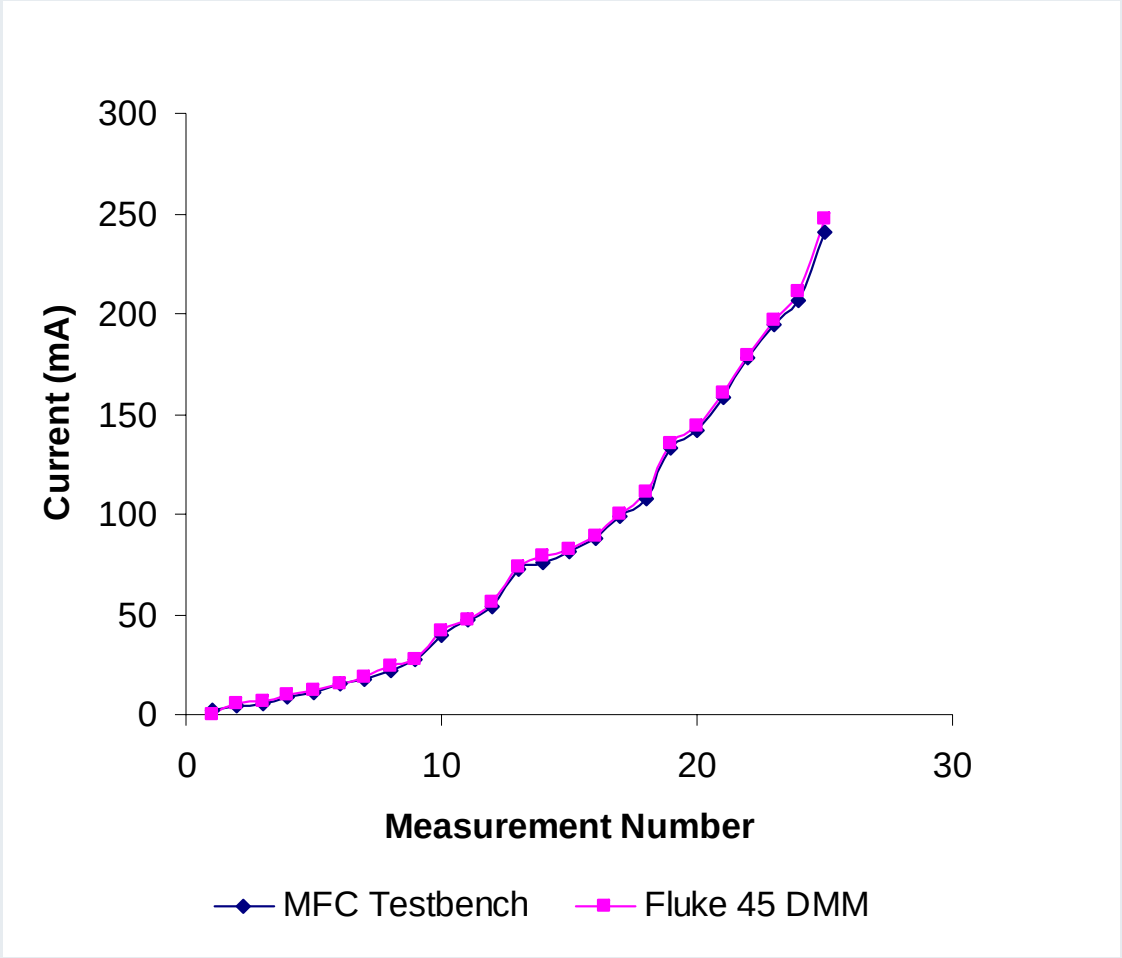
Testing Results

- Voltage
- Current
- Temperature
- Humidity
- Fuel Flow
- System Performance

Testing Results - Voltage

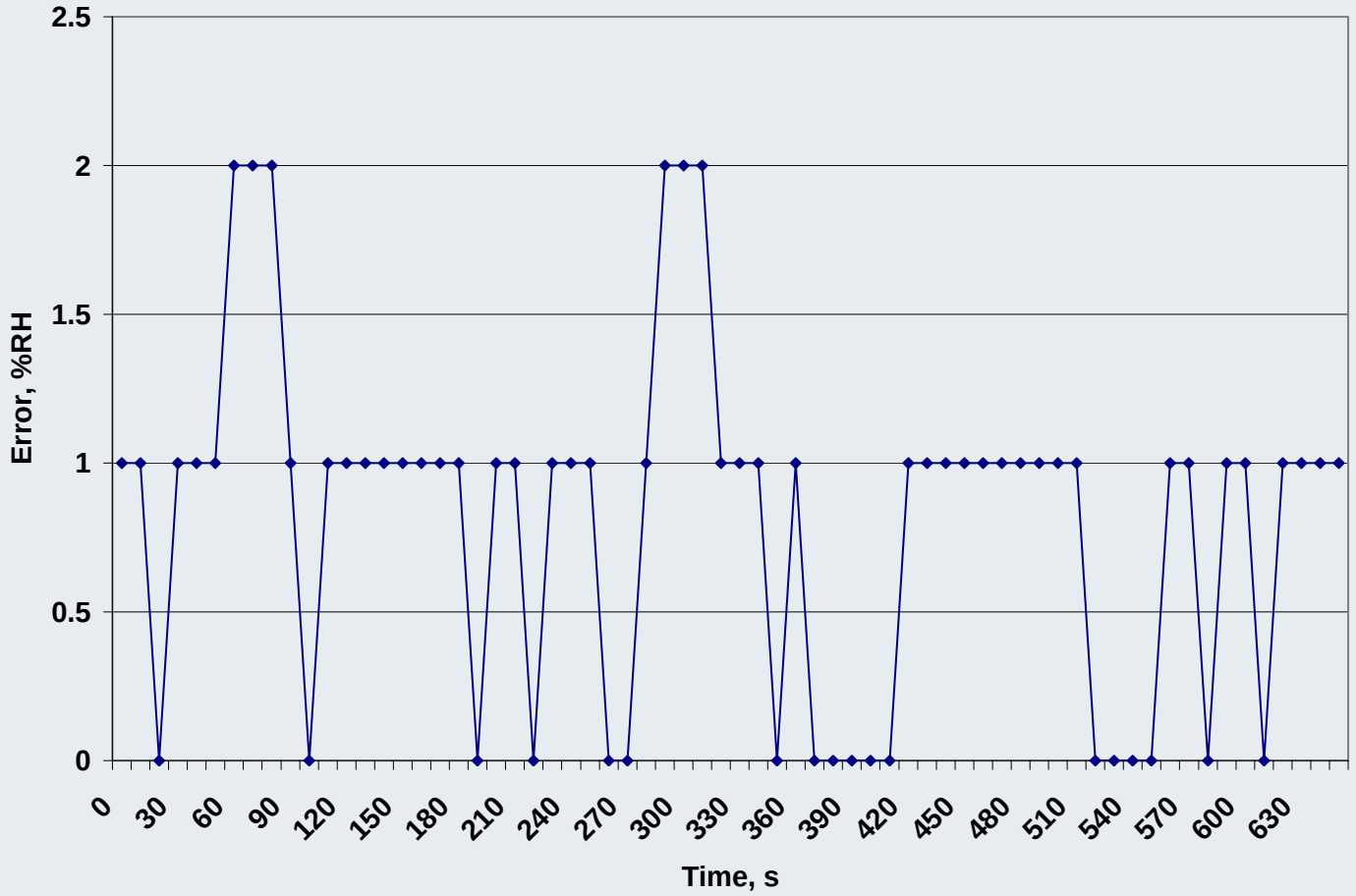


Testing Results – Current



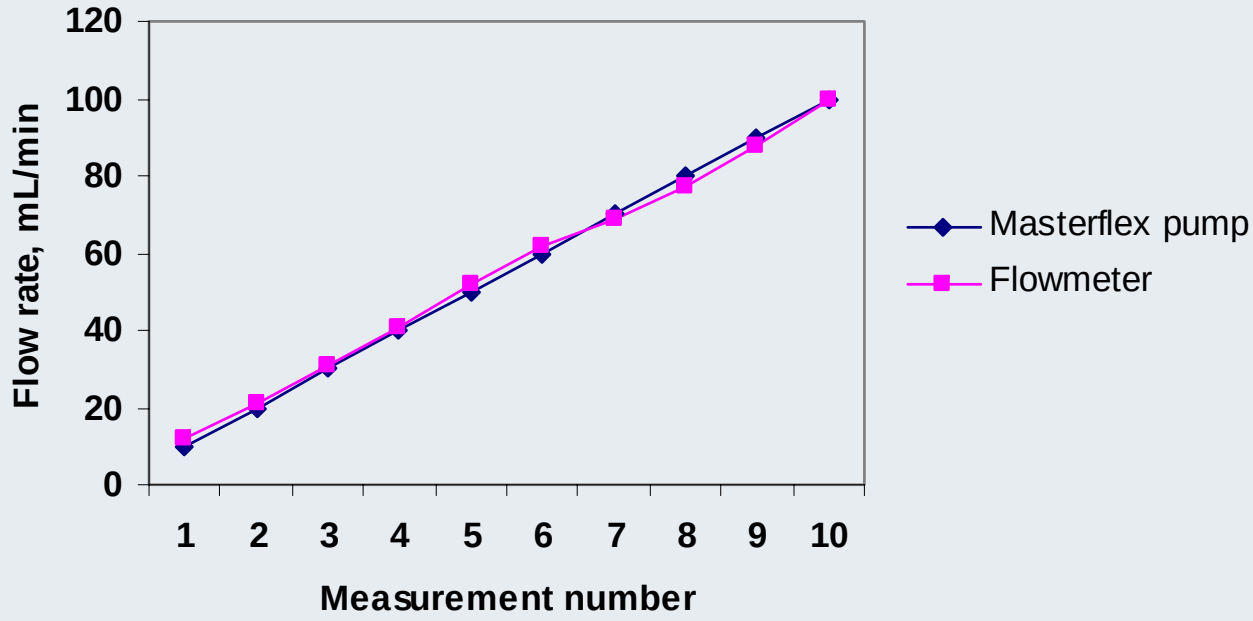
Testing Results – Temperature data

Testing Results - Humidity accuracy

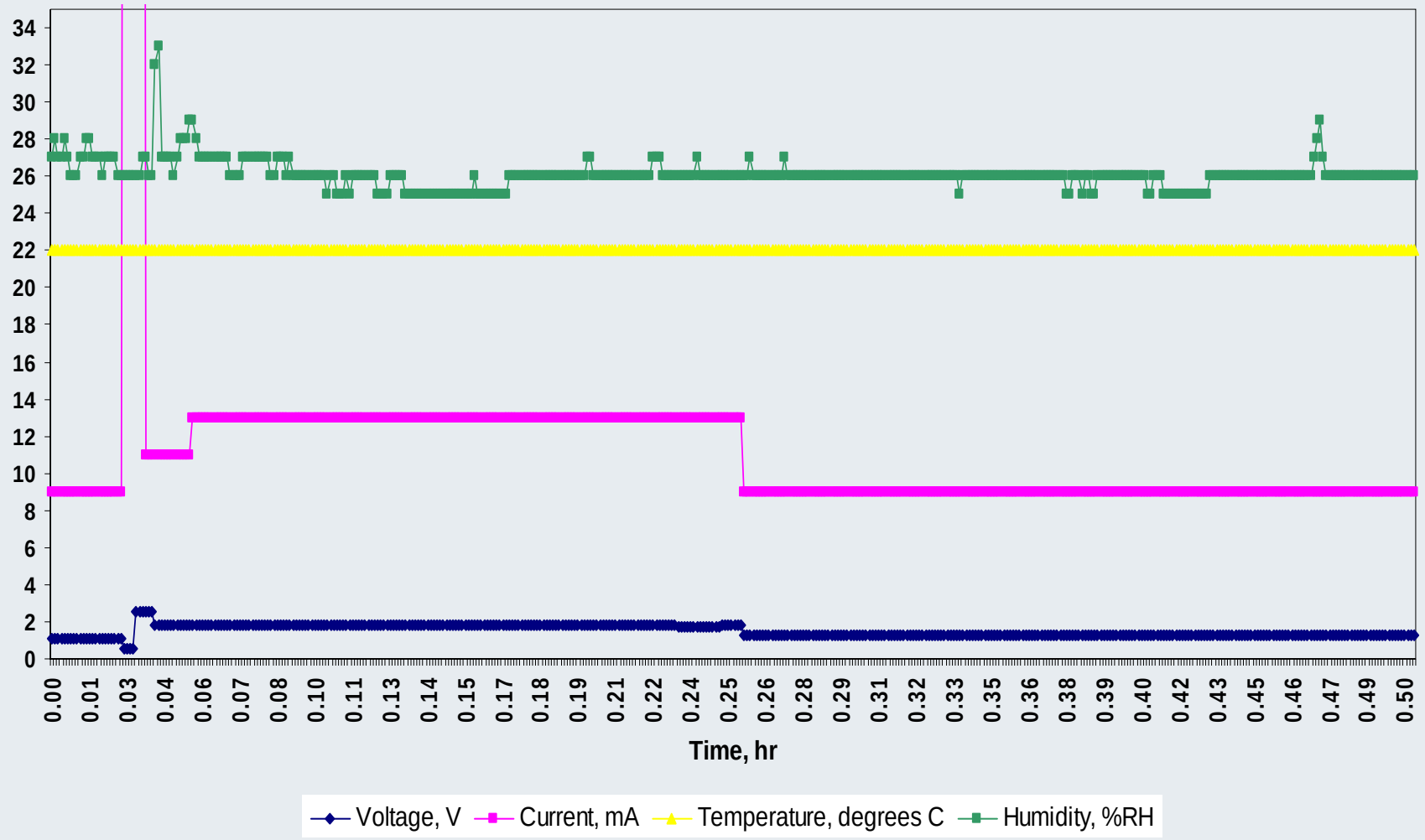


Fuel Flow – Cont.

- Two tests
  - Open circuit flow
  - Circuit with “resistive” obstruction



Testing Results – System performance



Test Results – Other Tests

- Quality Control
- Usability

Cost

	R&D	Product	External components	Total
Projected cost	**$705**	**$615**	**N/A**	**$966**
Actual Cost	**$595.78**	**<$370.67**	**$493.69**	**$1089.47**

Milestones - Review

Task Name	Original date	Actual date
Project proposal	25-Jan-05	25-Jan-05
Oral presentation/Progress report	14-Feb-05	8-Feb-05
Software	21-Feb-05	10-Mar-05
Variable Load Blocks	21-Feb-05	3-Apr-05
Functional Specs	22-Feb-05	22-Feb-05
Measurement block	28-Feb-05	24-Mar-05
Power management block	28-Feb-05	1-Mar-07
Design Specs	11-Mar-05	14-Mar-05
Preliminary demo	14-Mar-05	17-Mar-05
Methanol supply = Fuel Flow	25-Mar-05	01-Apr-05
Group Presentation	11-Apr-05	26-Apr-05

Marketing

- Customers
  - Existing
  - Future
- Website
  - www.mfclabs.com
- Competition
  - Micro Fuel Cell Testbenches
    - Heliocentris
    - Very Expensive (> $10,000 !)

Future Work

- Testing with DMFC
- Digital Flow Control
- Pressure vessel with pressure valve
- Methanol Concentration Monitor
- Temperature of the fuel cell

Summary

- MFC Testbench
- Major Components
- Significant Testing Results
- Budget and Marketing

Acknowledgments

National Research Council
- Kevin Stanley
- Lilian Fan
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SFU
- Lucky One
- Amir Niroumand
- Gary Houghton
- Deema Annyuk

Demonstration

- MFC Testbench
  - Voltage
  - Current
  - Resistive load
  - Temperature and Humidity
- MFC Testbench and Software
- Fuel Supply