# Table of Contents

1.0 Experiment Background
2.0 Experiment Description
3.0 Equipment Description
   3.1 Full Assembly
      3.1.1 Equipment Layout and Flyer Positions
      3.1.2 General Apparatus Hazards
   3.2 Structure
      3.2.1 Design Constraints
      3.2.2 Footprint Limitation
      3.2.3 Ergonomics
      3.2.4 Lean Flammability Ratio
         3.2.5 Schlieren System Accommodation
         3.2.6 G-Load Specifications
         3.2.7 Structural Analysis
         3.2.8 Component Attachments
         3.2.9 Floor Attachment
   3.3 Electrical System
      3.3.1 Electrical Analysis
      3.3.2 Load Table
      3.3.3 Automation
      3.3.4 Safety
   3.4 Pressure/Vacuum System Documentation
      3.4.1 System Description and Fluid Quantities
      3.4.2 Lean Flammability Limit of Methane Fuel
      3.4.3 Operating Procedures
      3.4.4 Pulsed Flame Apparatus
      3.4.5 Flame Ignition System
   3.5 Schlieren Flow Imaging System
      3.5.1 How schlieren works
      3.5.2 Fabricated Schlieren Components
   4.0 Flight Week Operations
      4.1 Ground Support Requirements
      4.2 Equipment Shipment to Ellington Field
      4.3 Test Readiness Review (TRR)
      4.4 Pre-Flight
      4.5 In-Flight
      4.6 Post-Flight
      4.7 Experiment Limitations
   5.0 Results
   6.0 Recommended Design Modifications
      6.1 Structural System
      6.2 Schlieren System
      6.3 Electrical
      6.4 Pressure
   7.0 Outreach
8.0 Conclusions
9.0 Acknowledgements
10.0 References

List of Tables

Table 1 - Internal Components
Table 2 - G Load Specifications
Table 3 - Stress Analysis
Table 4 - Wire Specifications
Table 5 - Load Tables
Table 6 - Pressure System Design Specifications

List of Figures

Figure 1 - Normal Gravity vs. Microgravity flame luminosity with 40 Hz pulse
Figure 2 - Normal Gravity vs. Microgravity flame schlieren flow density data with 40 Hz pulse
Figure 3 - Setup of schlieren flow imaging system inside structure
Figure 4 - Experiment Test Apparatus
Figure 5 - Experiment layout and flyer positions
Figure 6 - Aircraft Floor Schematic
Figure 7 - Structure Orientation
Figure 8 - Forward Stress Analysis (N/mm²)
Figure 9 - Aft Stress Analysis (N/mm²)
Figure 10 - Down Stress Analysis (N/mm²)
Figure 11 - Lateral Stress Analysis (N/mm²)
Figure 12 - Up Load (N/mm²)
Figure 13 - Component-mounting straps
Figure 14 - Schematic of Electrical System
Figure 15 - LabVIEW interface
Figure 16 - LabVIEW interface during experiment operation
Figure 17 - Master kill switch on top of structure
Figure 18 - LED states during experiment operation (fuel flow on)
Figure 19 - Pressure System AutoCAD Design
Figure 20 - Photograph showing actual pressure system
Figure 21 - Schematic of Pressure System
Figure 22 - Pulsed Flame Apparatus
Figure 23 - Schlieren Imaging System Schematic
Figure 24 – Schlieren Schematic
Figure 25 - Mirror Mounts
Figure 26 - Handles on the side of the structure
Figure 27 - Normal Gravity and Microgravity examples of diffusion vs. convection
Figure 28 - Normal Gravity vs. Microgravity flame luminosity with 40 Hz pulse
Figure 29 - Normal Gravity vs. Microgravity flame schlieren flow density data with 40 Hz pulse
Figure 30 - Team presenting at COE Homecoming
Figure 31 - Team members describing experiment to COE alumni
Figure 32 - Group demonstrating experiment during SEEK presentation