The Challenge
The holy grail of quantitative information concerning exact details of an aircraft’s flight: the black box. However, the radio controlled aircraft built by students for projects and competitions are far smaller and are not so easily equipped with such a heavy and purpose-built unit for use in design evaluation, thus requiring a lighter, less expensive, and more easily adaptable module. This project fills the gap with a modular in-flight telemetry system.

System Requirements
- Display (baseline package):
  - Airspeed
  - Altitude
  - Motor RPM
  - Motor/battery pack temperature
  - Motor current draw
  - Motor power
- Measure baseline parameters to 5% of accepted value
- Operate over a 1 mile radius
- Adapt easily to different aircraft/missions
- Survive 20 m/s impact (electronics enclosure)
- Total system weight < 1.3 lbf

Structural Design Elements
- Shock Isolation
  - Insulation protects electronics during impacts and from vibration during use. Breakaway sensor connections further isolate the main circuit board from the rest of the system
- Impact Protection
  - The tubular lid distributes impact loads and shelters the electronics inside of the airborne module. Also extends beyond the module’s weaker end caps for added protection
- Interchangeable Aerodynamic Fairings
  - Nosecone-style fairings offer superior aerodynamic characteristics over lighter, smaller, ball-style foam fairings. Any combination of these fairings can be utilized
- Theoretical structural survivability to >1.5 times the stated requirement
- Impact testing verifies that the design can withstand 110% of impact energy indicated by the requirement

Electronics Design and Programming
- Adaptability
  - Baseline package: 7 parameters, 8 sensors
  - Maximum inputs: 18—with no change in the airborne module’s programming
  - The ground station program is designed in LabVIEW to be customizable to user requirements. The program also displays all data to the user in real time for use in flying the aircraft as well as for use in performance analysis
- Compact
  - Ground station components: laptop, XBee board, 9 V battery
  - Contained in a laptop bag for easy transport, setup, and self-contained operation
- Range
  - Operable for up to one mile from ground unit

System Physical Characteristics
- Total system weight: 0.671 lbf
- Length: 16.273 in
- Maximum width: 3.000 in
- Maximum height: 1.688 in

Project Summary
The Micro In-Flight Telemetry System is a compact and highly adaptable unit ready for use in flight testing, primarily on radio-controlled aircraft built by students for class assignments and extra-curricular design projects.