Status Update on UAV Sensors

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Progress Since 2015

- iMet-XQ completes beta testing and moves into commercial production
- XQ XDATA interfaced with 3DR Solo for real-time data transfer on low-cost platform
- Enhanced temperature sensor + redundancy for iMet-XF
- MiniGAS project started in conjunction with Gaslab
- Early stage work on new five-hole pressure sensor
iMet-XQ Beta Testing

Cooperative effort
- NOAA / ATDD
- NOAA / GMD
- University of Oklahoma
- University of Virginia

Initial Problems
- GPS Faults
- T sensor self-heating
- Software lock-ups
- User interface

Positive Feedback
- Humidity and pressure sensors OK
- Consensus that it is a promising tool for atmospheric research

Photo courtesy of NOAA / ATDD
• Initial tests of temperature sensor in still air showed significant heating relative to reference sensors
• Problem isolated to the copper ground-plane extending up the length of the sensor PCB
• Resolution required re-designing the PCB, shortening the ground plane and moving the thermistor higher on the probe
• Final step aluminized the sensor to eliminate any solar radiation effects
T Sensor Self-Heating

- PCB redesign reduced self-heating from 2.7° to 0.11°
Growing Interest

U.S. Universities
- Kentucky
- Maryland
- South Alabama
- Colorado State
- Bridgewater State
- East Carolina
- Oregon State
- Louisiana / Monroe

International Universities
- Canterbury (NZ)
- Birmingham (UK)
- Reading (UK)
- Cologne (Aus)

Other Institutions
- U.S. Navy / SPAWAR
- Australia BOM
- Oak Ridge Nat’l Lab

Inexpensive, Intuitive, Simple to Use
3DR Solo Integration

USB input to UAV processor allows for real-time data over Wi-Fi channel - transparent user interface

– XDATA compatible
Gather feedback from initial users and make improvements

Consider integration with additional platforms

What will be the platform of choice for research users?

- DJI Matrice – 100?

Development to Production
iMet-XQ: Next Steps

XDATA format

Standardization of Data formats

Reduce development time and efforts

Your sensors available for others

Configurable Protocol

Data sampling and output rates

Plug and go sensor modules (up load calibration coefficients)

Hardware available for I²C, SPI, UART, ADC
NOAA Coyote

- Primary user of the XF
- Enhanced temperature sensor
- Redundant temperature sensor
- User defined sensors
- Custom board layout
- Custom sensor configuration
- Low volume at low Cost
Product Continues to Evolve

Requires greater sophistication and user content than XQ
- but offers greater potential

- Re-package with self-contained power and data handling?
- Add more sensors
- Many options – I/O, power
- Open source the hardware and software to act as a replacement for Arduino / Raspberri-Pi boards?
User Defined Specifications or DIY

SENATORS
TEMPERATURE AND HUMIDITY
PRESSURE
CARBON DIOXIDE
PARTICULATE MATTER (PM 10 - PM 2.5)
BLACK CARBON
OZONE
RADIATION
SOIL MOISTURE

IMET-XF CONTROL BOARD
COMM'S METHOD
I'C
SP1
3.3V UART
ADC

USER DEFINED INTERFACE
USB
RS-232
3.3V UART - SP1 - I'C

INPUT POWER + 5 VDC 0.200 TO 1.5 AMP
User Support

Ground Testing and Sensor Performance

[Image of a computer interface showing data on temperature and pressure graphs with coordinates and additional details.]
iMet-MiniGAS

Joint development with New Technology Costa Rica (Dr. Jorge A. Dias)
High precision gas sensor for flux measurement

- Pump-controlled air flow
- Combines high-resolution infra-red sensor with electrochemical devices
- CO2, SO2, H2S, CH4
- Additional species possible
- Flux vs. gross identification
- Cost / benefit tradeoffs
5-Hole Pressure Transducer

- Working with BlackSwift on new design for pressure based sensor
- Will be integrated with iMet-XF control board
- Goal is a sturdy design that is resistant to damage, with high performance at a lower cost than currently available COTS options