Integrated Avionics Systems for Small Scale Remotely Operated Vehicles

Lead Center: LaRC

Participating Center(s): AFRC, ARC

Small scale remotely operated vehicles are becoming an increasingly attractive option for experimental research in flight dynamics, vehicle state assessment, and automatic flight control as well as a growing number of commercial applications. Small scale vehicles (nominally 20 lbs to 80 lbs total weight) place constraints on the amount of on-board avionics that can be accommodated and these systems can benefit from integration of components. For flight research activities key avionic systems are:

- Inertial navigation units which combine gyroscopic measurements with GPS position data;
- The capabilities to implement an autopilot fail-safe should RF uplink be lost;
- The ability to log instrumentation data from analog, pulse-width and serial stream inputs;
- The ability to read and generate serial-port data streams for RF communication systems;
- Telemetry systems to provide for both ground-based piloting and real-time data downlink.

When used as experimental research test beds the requirements for data quality (resolution, bandwidth, linearity, etc.) are often higher than would be derived just for automated flight operations on the vehicle itself. Although existing commercial technology can individually address each of these areas, an integrated high-fidelity system that is commensurate with the low-power, low-weight, and EMI sensitive environment of subscale remotely piloted vehicles is not available. For safety of flight a fail-safe autopilot should be able to recover vehicle stability from a range of entry conditions and also have GPS waypoint return-and-hold or full auto landing capability. Programmability of the avionics unit is important to allow the system to be extended to a wide range of platforms, application environments, and experimental requirements. Telemetry systems are flight critical for remotely piloted vehicles and therefore must have high reliability in addition to meeting bandwidth requirements imposed by the data downlink from a fully instrumented vehicle.

Innovative system concepts are sought which can address some or all of the areas above and provide substantial improvements, in capability and range of applicability, over existing commercial technology.