

## **CONTROL STATION: CropCam UAS**

**Specifications:** The CropCam UAS described here uses for aircraft control the MicroPilot, Inc. “MP2028g” autopilot and ground control station (GCS) with hand-held control console.

**How the Control Station Operates:** The MP2028g controls the UAS in either of two modes, PIC (pilot in command) and CIC (computer in command).

- **PIC Mode**—The PIC takes off and lands by conventional radio control. The PIC uses a hand-held console, which is basically a conventional radio control transmitter (in fact, it is made by Futaba, a leading R/C company). The Pilot-in-Command flies the aircraft by moving the two control sticks on the console, controlling throttle and rudder, elevator and aileron. The Channel 5 switch is flipped to the rear, selecting “PIC” mode.
- **CIC Mode**—After the PIC takes off the a/c, he may pass control to the autopilot by flipping the Channel 5 switch forward, selecting “CIC” mode. The autopilot now flies the aircraft autonomously over a pre-programmed flight path, using GPS for navigation. The onboard autopilot computer controls throttle and rudder, elevator and aileron. The radio link from aircraft to GCS is used to pass position and flight situational data from a/c to GCS. This data is displayed on the GCS laptop computer map display for the pilot and/or assistant to view.

### **Manufacturer:**

MicroPilot, Inc.  
P.O. Box 720, 72067 Road 8E, Sturgeon Rd.  
Stony Mountain, Manitoba, Canada  
R0C 3A0

### **Interface**

- |                      |                          |
|----------------------|--------------------------|
| •Serial interface:   | Two RS-232 payload ports |
| •Servo PWM:          | Up to 10 servos          |
| •CAN:                | Simulation Interface     |
| •General Purpose:    | 2 GP I/O lines           |
| •Flight Termination: | Programmable response    |

### **Electrical**

- |         |                        |
|---------|------------------------|
| •Power: | 8 V to 20 VDC, 5 W max |
|---------|------------------------|

### **Mechanical**

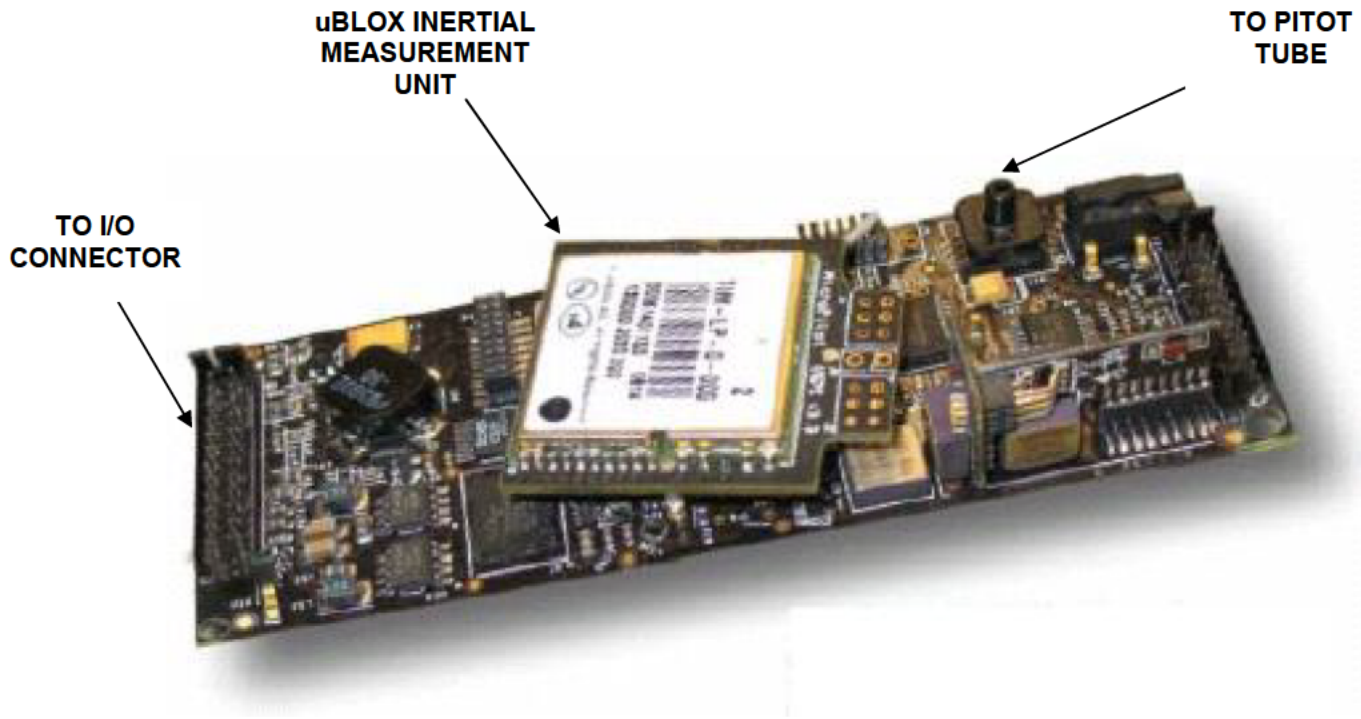
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|---------------------|----------------------------------|
| •Size: 10 cm x 4 cm | •Weight: 28 grams w/GPS receiver |
|---------------------|----------------------------------|

### **Environmental**

- Operating Temperature: -40C to +80C (Calibrated Range)

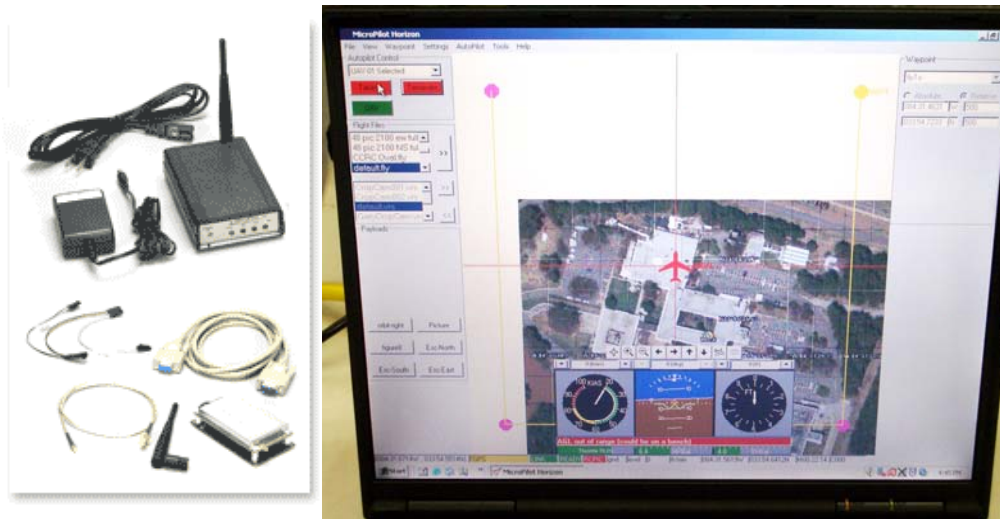
### **Radio Modem in MP2028g Autopilot:**

The “CropCam” UAS will use the MaxStream 900 MHz radio link. This is a frequency-hopping spread spectrum system that provides more than sufficient range for this limited flight area, and offers immunity from possible interference from narrow band sources, RFI and EMI. The MP2028g autopilot, which is installed inside the UAS, is shown in Figure 1. The input/output and pitot tube connections are shown. Also shown is the uBLOX inertial measurement unit.



**Figure 1. MP2028g Autopilot showing I/O & pitot tube connections**

**Ground Control Station (GCS):** The GCS consists of the other RF modem, used to communicate with the aircraft autopilot, a laptop computer, running the MP2028g “Horizon” flight control software and mapping program. The Pilot’s radio control controller has two joysticks and toggle switches. The ground control station includes the RF modem and other support capabilities for the laptop computer. The GCS uses an omni-directional antenna for radio communication between GCS and UAS. The GCS is shown in Figure 2 below, with its RF modem equipment and a screen capture image of laptop computer operating the Horizon software.



**Figure 2. Ground Control Station equipment for MP2028g Autopilot—shown are GCS, radio modems, antennas and view of GCS laptop display of Horizon software**

**UAS Location/Heading and Situational Display:** The MicroPilot MP2028g GCS uses a laptop computer, running their Horizon flight control software, to monitor the position, altitude, heading, and situational data (air speed, GPS ground speed, rate of climb, battery voltage/current, internal temperature, and many other data). This is configurable in several forms including a dashboard view with round (analog) instruments like a manned aircraft.

Using the situational display, the Pilot-in-Command and spotters can keep close track of the UAS in flight. In addition, telemetry from the UAS will alert the Pilot and spotters to potential problems before they become safety or operational concerns. Battery voltage, temperature, RPM, and various airframe data are available at a glance on the display. These provide constant updates on the UAS condition while in flight and during pre- and post-mission checks.

The MicroPilot MP2028g autopilot is a proven system and is in use worldwide. GTRI has extensive experience in using the MP2028g in multiple fixed-wing UAS. All of these factors provide confidence in the use of the MP2028g in the CropCam UAS.

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