CONTROL STATION: Rover UAS

Specifications: The Rover UAS described here may use for aircraft control the CloudCap Technologies "Piccolo II" autopilot and ground control station (GCS) with hand-held control console.

How the Control Station Operates: The Piccolo 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:	Cloud Cap Technologies, Hood River, OR 97031
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

Size: 5.6 inches x 3.0 inches x 2.4 inches Weight: 212 grams (7.5 oz)

Environmental

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

Radio Modem in Piccolo Autopilot:

The "Rover" UAS will use the 2.4 GHz 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 Piccolo autopilot, which is installed inside the UAS, is shown in Figure 1. The input and output connections are identified.

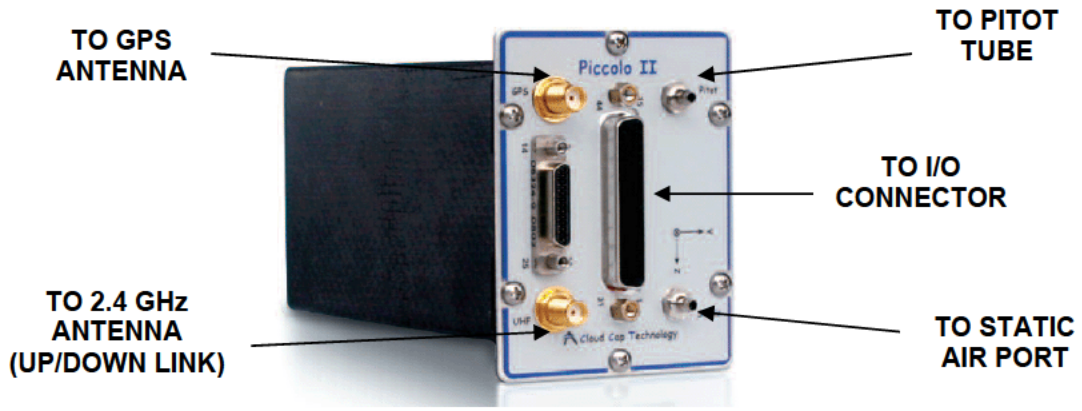

Figure 1. Piccolo Autopilot with I/O connectors

Ground Control Station (GCS): The GCS consists of the other RF modem, used to communicate with the aircraft autopilot, a laptop computer, running the Piccolo flight control software and mapping program, and the Pilot's console (controller with two joysticks). The ground station includes the RF modem and other support capabilities for the laptop computer. The GCS uses a directional antenna for additional radio signal gain between GCS and UAS. The GCS is shown in Figure 4 which follows. It is shown in Figure 2 below, with its control console and laptop computer connection.

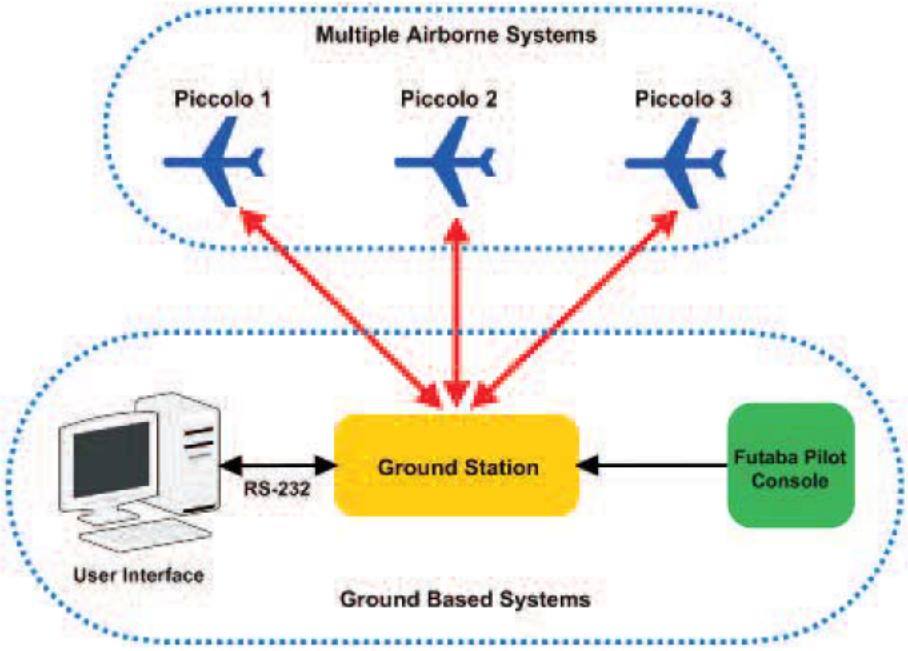

Figure 2. Block Diagram for Piccolo Autopilot and Ground Station

UAS Location/Heading and Situational Display: The Piccolo GCS uses a laptop computer, running their 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. One type of display, using 2D and 3D maps, is shown in Figure 3 below.

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. Engine power, 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.

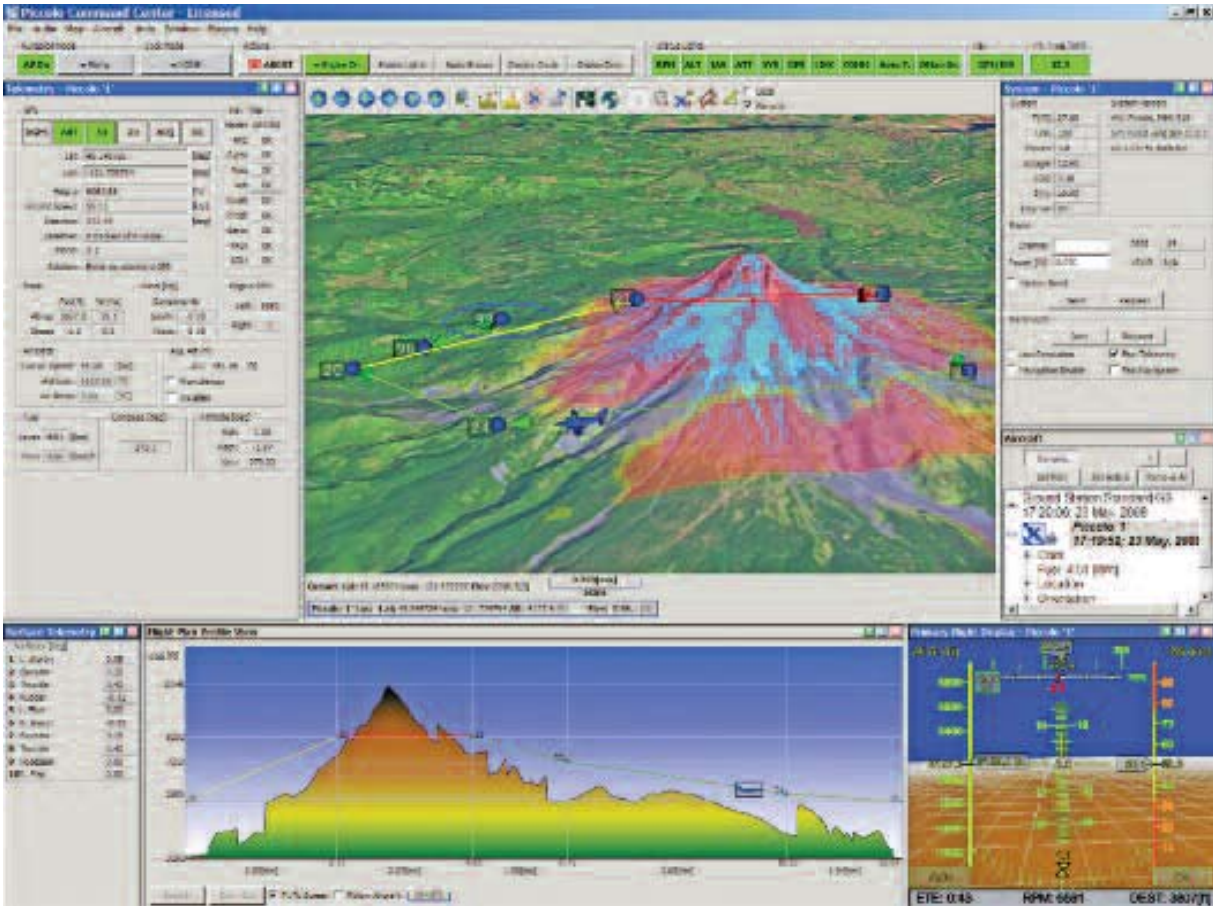

Figure 3. Piccolo Ground Station Laptop Computer Display (typical)

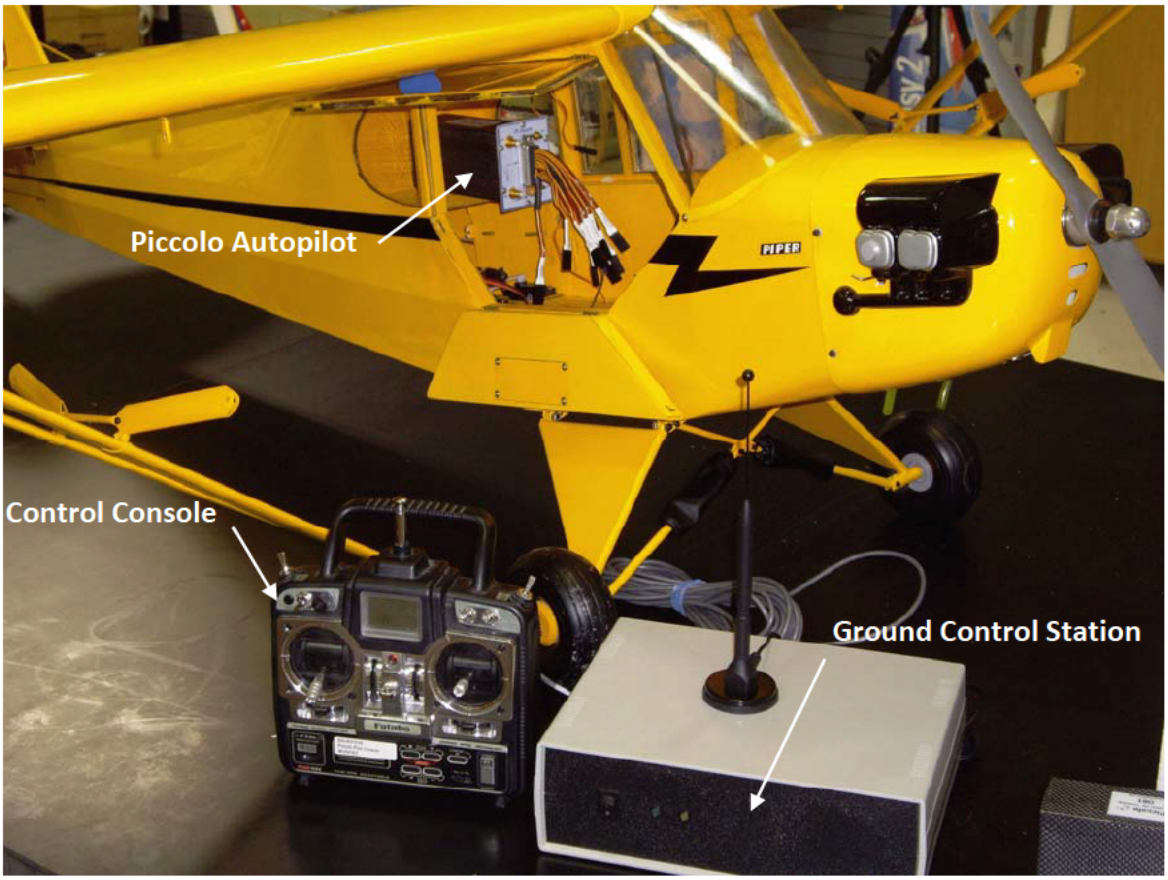

Figure 4. Piccolo Autopilot inside UAS with Control Console and Ground Station

The Cloud Cap Technologies "Piccolo" autopilot is a proven system and is in use worldwide. Numerous commercial and military UAS have made Piccolo their choice of autopilot, including "BroadSword" by Griffon Aerospace, Advanced Ceramics "Silver Fox" and "Manta," "Aerosonde," "Viking" by BAI Aerospace, including the "Quarter-scale Piper Cub" (seen above) used by GTRI. GTRI has extensive experience in using the Piccolo and keeps in communication with Cloud Cap in order to keep their Piccolo equipment up to date. All of these factors provide confidence in the use of the Piccolo in the Rover UAS.