

RD93 GPS Dropwindsonde and Aircraft Data System

The RD93 is a general-purpose dropwindsonde for aircraft use. It is designed for high-altitude drops, and the Data System architecture supports four simultaneous dropsonde soundings. NCAR has developed this GPS dropsonde system in cooperation with German Aerospace Research Establishment, DLR, and with National Oceanic and Atmospheric Administration, NOAA. The production of the RD93 GPS Dropsonde and Aircraft Data System is licensed to Vaisala Inc.

STRUCTURE

The GPS dropwindsonde RD93 incorporates a Vaisala RSS903 sensor module and a Vaisala GPS121 codeless GPS receiver module.



In addition to the RSS903 sensor module and the GPS121 receiver module, the dropsonde electronics board includes a microprocessor for interfacing the sensor module and forming the digital data transmission sequence.

The sonde can be connected to the Aircraft Data System via an RS-232 link for test and checkout and for setting the telemetry transmitter frequency. The transmitter can be set anywhere in the 400 MHz meteorological band in 20 kHz steps.

A unique square-cone parachute is used to reduce the initial shock load and to slow and stabilize the sonde. The parachute is immediately deployed on exit from the launch chute and streamers for about five seconds until filled by ram-air. The square cone parachute is very stable during the sonde's descent and reduces or eliminates any pendulum motions of the sonde.

AIRCRAFT DATA SYSTEM

Reception of the signal transmitted from the sonde begins at a 400 MHz Telemetry Antenna mounted on the underside of the aircraft fuselage. The output signal from the preamplifier is connected to a 400 MHz Power Divider which feeds the amplified signal to all telemetry receivers. Similarly, a GPS antenna mounted on the topside of the fuselage receives the local GPS signals which are then amplified and distributed to a MWG201 GPS Processor.

The signal from the telemetry receiver is a stream of Manchester-encoded binary data containing both PTU and GPS data. This signal is fed to the input of a microprocessor-based PTU and GPS Frame Buffer board where it is decoded back into the two separate data sources and processed to a single ASCII message that is asynchronously transmitted via RS-232 to a serial port of the system PC.

The PC runs a high-level language application program that ingests the raw PTU and GPS data and computes the final data products.

SONDE

Chassis interface	TTL Level
GPS Receiver Channel	track up to 8 satellites simultaneously
Transmitter	
Frequency range	400 MHz to 406 MHz
Frequency stability	±3 kHz
RF Power output	100 mW
Harmonic & spurious output	>50 dB below the carrier level
DC input current	~225 mA at +15 V DC
Digital deviation	>2 kHz, <2.5 kHz
GPS deviation	>2 kHz, <2.5 kHz
Total modulation	>2.5 kHz, <3.5 kHz
Battery	
Type	Lithium, six CR-2 cells
Voltage	+15 hours
Life	2 hours (operating), 3 years (shelf)
Pressure sensor	
Range	1080 hPa to 100 hPa
Resolution	0.1 hPa
Accuracy	
Repeatability (*)	0.4 hPa
Uncertainty in soundings (**)	1.5 hPa
Temperature sensor	
Range	+60 °C to -90 °C
Resolution	0.1 °C
Accuracy	0.1 °C
Repeatability (*)	0.1 °C
Uncertainty in soundings (**)	0.5 °C

Relative humidity sensors

Range	0 % to 100 % RH
Resolution	1 %
Accuracy	
Repeatability (*)	2% RH
Uncertainty in soundings (**)	5% RH
Horizontal winds	
Range	0 m/s to 200 m/s
Resolution	0.1 m/s
Accuracy	±0.5 m/s
Antenna	
400 MHz impedance	50 Ω
Wavelength	1/4
Polarization	Vertical
Data rate	
PTU	over 0.5 second
Wind	over 0.5 second
Descent speed	~ 11 m/s at sea level



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