NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

December 16, 2010

17 - GPS Factual Report

by Joseph A. Gregor

A. EVENT

Location:	Amherst, Virginia
Date/Time:	August 22, 2010, about 1849 Eastern Daylight Time (EDT)[1]
Aircraft Type/ID:	North Wing UUM Inc. Scout X-C / N417JN
Operator:	Private
NTSB Number:	ERA10FA435

B. GROUP - No Group

C. SUMMARY

On August 22, 2010, about 1849 eastern daylight time, a special light sport aircraft, weight-shift-control, North Wing UUM Incorporated, Scout X-C, N417JN, crashed in a pasture near Amherst, Virginia.

D. DETAILS OF INVESTIGATION

On September 8, 2010, the NTSB Vehicle Recorder Laboratory received the following device(s):

GPS Manufacturer/Model:	Lowrance Airmap 2000c
Serial Number:	101490594

GPS Description: AIRMAP 2000

The Lowrance AIRMAP 2000c is a WASS-capable, battery operated hand-portable 12-channel mapping GPS unit equipped with a 320 x 240 pixel color LCD display, soft-key controls, and support for custom maps. The Lowrance AIRMAP 2000 is equipped

[1] All times are given in Eastern Daylight Time (EDT) unless otherwise noted.

with a black & white LCD display. The unit contains a slot for a multi-media card (MMC) or Secure Digital (SD) FLASH[2] memory card. This card may be used to transfer and store custom maps, waypoint, route, and trail data to and from a desktop PC. Trail data may be composed of up to 9,999 latitude/longitude points (default setting = 2,000 points). Once the trail limit has been reached, older latitude/longitude data is overwritten with new data on a first-in-first-out basis. The AIRMAP 2000c may be programmed to update trail data in one of three ways: automatically, by time, or by distance traveled. The default 'automatic' mode only updates trail data when the GPS unit senses that a change in direction has been made. Updating by time may be used to record a new latitude/longitude point every 1 to 9,999 seconds. Updating by distance may be used to record a new latitude/longitude point whenever the distance traveled from the last update exceeds a set threshold - anywhere from 0.01 miles to 9.99 miles. All recorded data is stored internally in *non-volatile* memory. Trail data is stored in a Lowrance proprietary *.usr file format. This card may be read using a standard desktop PC running the Microsoft Windows operating system.

GPS Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed that the unit had sustained major damage from impact forces (see figures 1 and 2). An internal inspection was performed and revealed numerous damaged and missing surface mounted components. It was concluded that accident damage had rendered the unit irreparable.

The Lowrance Airmap 2000c stores recorded data in *non-volatile* memory (FLASH). This particular model stores recorded data on an SST 39VF1601 FLASH memory device mounted to the main PCB. The main printed circuit board was removed and cleaned using methanol and Cirozane electronic component cleaner. The FLASH memory device was removed from the PCB using a hot air re-work station and a raw-data binary readout of the chip[3] was obtained using an EEPROM programmer.

[2] FLASH Memory is a form of re-writeable, non-volatile memory that can retain data without external power - provided that the chip is not heated beyond the data retention temperature limit as stated in the datasheet.
[3] Chip: colloquial term for an integrated circuit device.

Recorded tracklog data was identified and converted to engineering units using an in-house software program.

GPS Data Description

One (1) tracklog corresponding to the accident was downloaded from the Airmap 200c. Downloaded tracklog data included the following parameters for each recorded data point: index, latitude, and longitude position at the time of the update. Altitude information is not recorded by the Airmap 2000c. The corresponding tabular data is provided in electronic (.csv) format as Attachment 1 to this report.

Figures 3 – 5 represent Google Earth overlays illustrating the tracklog history recovered from the Airmap 2000c. Figure 3 represent the entire recorded flight. Figure 4 represents data corresponding to the departure phase of the recorded flight. Figure 5 represents data corresponding to the end of the recorded flight. The Lowrance Airmap 2000c stores data in volatile memory (SRAM) during updates, and flushes this data periodically to FLASH memory during recording, and when the device is shut down normally using the power key. Some data near the end of the flight may be lost if power to the unit is interrupted abnormally.

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Figure 1. External view of the Lowrance Airmap 2000c (s/n 101490594) showing impact damage and external fluids exposure.

Figure 2. Internal view of the Lowrance Airmap 2000c (s/n 101490594) showing impact damage, including surface-mounted electronic parts separated from the main printed circuit board.

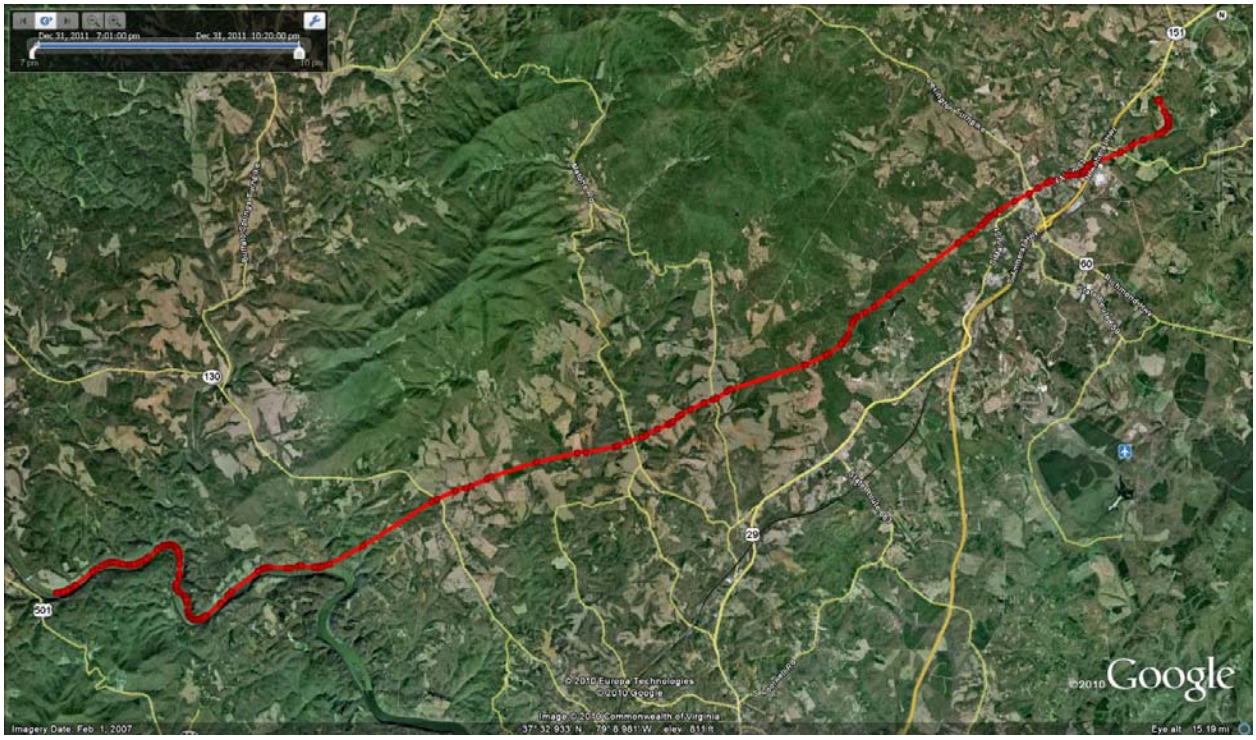

Figure 3. *Google Earth* overlay depicting aircraft position recovered from the Lowrance Airmap 2000c (s/n 101490594).

Figure 4. *Google Earth* overlay depicting the departure phase of the flight based on aircraft position recovered from the Lowrance Airmap 2000c (s/n 101490594).

Figure 5. *Google Earth* overlay depicting the end of the recorded data from the Lowrance Airmap 2000c (s/n 101490594).