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

June 19, 2012

17 - GPS Factual Report

by Bill Tuccio

A. EVENT

Location:	Pueblo, Colorado
Date:	February 2, 2012, 1915 Mountain Standard Time (MST)
Aircraft:	Lear 35
Registration:	N31WS
Operator:	Extrapoint LLC
NTSB Number:	CEN12FA151

B. GROUP - No Group

C. SUMMARY

On February 2, 2012, at 1915 mountain standard time (MST), a Gates Learjet 35, N31WS, veered off the side of the runway during takeoff from Pueblo Memorial Airport (PUB), Pueblo, Colorado. The airline transport rated captain, the first officer and the eight passengers were not injured. The airplane sustained substantial damage to the wing. The airplane was registered to and operated by Extrapoint LLC, Lewes, Delaware, under the provisions of 14 Code of Federal Regulations Part 91. Instrument meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan.

D. DETAILS OF INVESTIGATION

On March 2, 2012, the NTSB Vehicle Recorder Laboratory received the following device(s):

GPS Manufacturer/Model:	Garmin GPSMAP 496
Serial Number:	19707927

Garmin GPSMAP 496 Device Description

The Garmin GPSMAP 496 is a battery-powered portable 12-channel GPS receiver with a 256-color TFT LCD display screen. The unit includes a built-in Jeppesen database

and is capable of receiving XM satellite radio for flight information including NEXRAD radar, lightning, METARs, TAFs, and TFRs. A built-in AOPA Airport Directory and Safe Taxi Airport Diagrams are included for selected fields. The unit stores date, route-of-flight, and flight-time information for up to 50 flights. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 250 feet, and ends when groundspeed drops below 30 knots for 10 minutes or more. A detailed tracklog – including latitude, longitude, date, time, and GPS altitude information for an unspecified number of points – is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Position is updated within the tracklog as a function of time or distance moved, depending on how the unit has been configured. Once the current tracklog memory becomes full, new information either overwrites the oldest information or recording stops, depending on how the unit is configured.

Tracklog storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory[1]. The unit contains hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC via a built-in serial port using the NMEA 0183 version 2.0 protocol. The unit can also communicate with external devices such as a computer using a built in USB port. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

GPS Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior examination revealed the unit had not sustained any damage. Power was applied to the accident unit and recorded waypoint, route, and tracklog data was successfully downloaded from the unit via the USB port.

GPS Data Description

The data extracted included 76 sessions from September 2, 20112 through February 3, 2012, consisting of 10,013 total data points. The accident flight was the last session recorded. The session began on February 3, 2012 at 02:02:34 UTC and ended at 02:12:51 UTC, consisting of 35 total data points.

GPS Parameters Provided

Table 1 describes data parameters provided by the GPS device. Date, Time, Latitude, Longitude, and GPS Altitude are recorded by the device. Groundspeed and Track are derived from the recorded parameters.

[1] Non-volatile memory is semiconductor memory that does not require external power for data retention.
[2] All dates and times are referenced to Coordinated Universal Time (UTC).

Table 1: GPS Data Parameters

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded MSL[3] Altitude (feet)
Groundspeed	Average groundspeed between current and previous data point (knots)
Track	Average true course between current and previous data point (degrees)

OVERLAYS AND TABULAR DATA

The graphical overlays in figures 1 through 3 were generated using Google Earth.

Figure 1 is a graphical overlay for select recorded points of the accident flight. The first recorded point is at 02:02:34 UTC, followed about 4 minutes later at 02:06:34 by the next point. The overlay shows the aircraft taxied to runway 8L and enter the runway at about 02:10:49. The aircraft then accelerated and departed the runway. It came to a stop at about 02:12.

Figure 2 is a graphical overlay of all points for the first part of the take-off roll. The aircraft began the take-off at about 02:10:58 and achieved an average speed of 97 knots at about 02:11:21, just after crossing the intersecting runway 17/35.

Figure 3 is a graphical overlay for all points in the latter part of the take-off roll until the aircraft came to rest. The point recorded at 02:11:26, at an average speed of 120 knots, shows the aircraft first departing the centerline. The aircraft departed the south side of the runway at about 02:11:32, at an average speed of 138 knots. The aircraft came to a stop at about 02:11:59. The last point recorded was at 02:12:51.

Figure 4 is a plot of altitude, calculated average true track, and calculated ground speed for all recorded points. Figure 5 shows only those points related to the take-off roll and the aircraft coming to rest. Figure 5 includes a reference line for the runway true direction[4]. Select recorded points are annotated with captions identical to those on the Google Earth overlays in figures 1 through 3. The plot shows the aircraft achieving a maximum average speed of about 138 knots at 02:11:32 when the aircraft track had

[3] MSL means Mean Sea Level.

[4] The FAA airport diagram for PUB, dated March 8, 2012, shows a magnetic runway direction of 79.6 degrees magnetic and a variation of 8.7 degrees east. This results in a true runway direction of 88.3 degrees.

diverged from runway track; the overlay in figure 3 shows the aircraft had exited the south side of the runway by this time.

Tabular data used to generate figures 1 through 4 are included as Attachment 1. This attachment is provided in electronic comma-delimited (.CSV) format.

Figure 1. Google Earth overlay showing select points from taxi-out, take-off roll, and aircraft coming to rest.

Figure 2. Google Earth overlay showing all points, start of take-off roll.

Figure 3. Google Earth overlay showing all points, take-off roll, and aircraft coming to rest.

Figure 4. Plot of all recorded points.

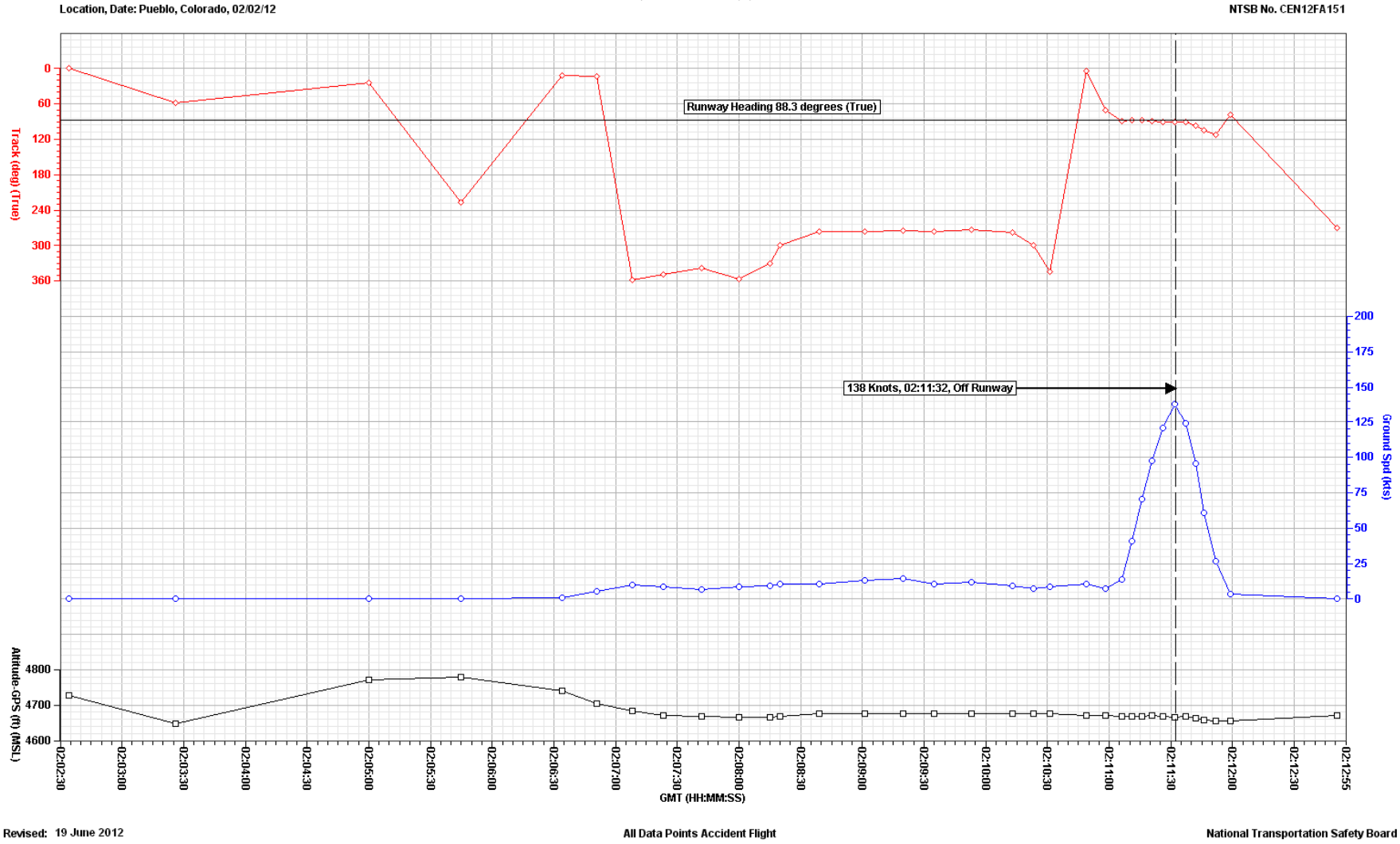

Figure 5. Plot of take-off roll and aircraft coming to rest.