



### Data Recovery in Light General Aviation

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### Avidyne Overview



- Company founded in 1994
- Headquarters in Lincoln, MA
- Displays, Hardware and Mechanical Engineering
- Guidance and Controls Group in Boulder, CO
- CNS Products Group in Melbourne, FL
- Safety Systems Group – Columbus, OH



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## Avidyne's Entegra Product Line



### *Entegra Integrated Flight Deck Series*

- Entegra
- Alliant
- FMS900W



### *Entegra PFD Series*

- EXP5000
- PFD4000



### *Entegra MFD Series*

- EX5000
- EX500
- MHD300



### *Entegra Traffic Series*

- TAS600
- TAS610
- TAS620



### *Entegra Wx Series*

- MLB700
- TWX670
- MLX770

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## Data Recovery as a Tool for General Aviation



- High fidelity data recording is a reality today in light general aviation.
- Accidents can be reconstructed with a level of detail that was only available in transport aircraft with flight data and cockpit voice recorders.
- The active, online pilot organizations analyze accidents and use them as training opportunities to avoid similar accidents within their community. This is happening minutes after accidents occur.

**The early dissemination of flight data will allow the pilot and training communities to quickly learn from the accident and focus their efforts on facts versus speculation.**

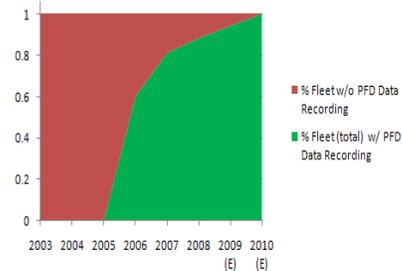
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## Avidyne Investment in Data Recording



- Avidyne has been investing in data recording capabilities on the PFD and MFD products for over eight years.
- The capability has matured over multiple product development cycles. The recent introduction of the next generation Entegra Release 9 Integrated Flight Display system improves both the data capture capabilities and probability of retrieving the data after a crash.
- We have a strong working relationship with the NTSB and assist in recovering data from Avidyne equipped aircraft.



## Avidyne Data Recording Capabilities



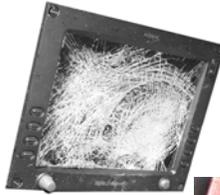
### Avidyne Primary Flight Display

- Records critical parameters used by a pilot to control and navigate aircraft
  - Stores aircraft attitude (pitch, roll, heading) five times per second
  - Stores air data (airspeed, altitude, rate of climb), autopilot modes and system health indications once per second
  - Stores navigational data (current latitude, longitude, waypoint, deviations from intended flight path) every four seconds
  - Stores pilot inputs when they are made
  - Logs cover most recent 15+ hours of flight
- In nearly every respect, NTSB says that our data are at least as good as the best available on airliners

### Avidyne Multi Function Display

- Records additional parameters used by a pilot to monitor engines and manage the flight
  - Stores engine operating parameters (RPM, manifold pressure, EGT, CHT, oil temperature, oil pressure, electrical system performance), pressure altitude and density altitude every six seconds, tagged by time and location (lat/long)
  - Stores record of datalink weather information (signal quality and message type) received by the aircraft
  - Logs cover approximately 25 flights
- Engine parameters supplement PFD data to give clear indications of pilot intent

## Avidyne Data Recovery Capabilities



- Data recording memory is not specifically designed for recovery after an accident
- We have learned how to recover data from memory devices even in cases where the leads have been ripped from the package.
- Out of 25 NTSB cases where we had data recording capabilities we recovered data in 88% of the cases.

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## Avidyne Data Recovery Case Study #1



NTSB file CHI08FA027 – Browerville, MN

- Night VFR instructional flight conducted by University of North Dakota
- Two fatalities
- From the NTSB report:

"The Avidyne avionics normally retain flight parameters in non-volatile memory within the Primary Flight Display (PFD) and Multifunction Display (MFD) units. The PFD data indicated that the airplane was in stable flight on a 320-degree magnetic heading, at 4,500 feet msl, and approximately 160 knots true airspeed prior to the accident. About 2211:46, the airplane abruptly departed from controlled flight. It rolled approximately 20 degrees left wing down, yawed to the left about 30 degrees, and simultaneously pitched nose down about 40 degrees. The airplane then reversed and immediately entered a descending, right roll for the duration of the flight. The recorded data ended about 2212:10.

"A section of upper wing skin was taken from near the left wing tip, at a point about mid-chord. The post accident examination noted the presence of material on the inside surface of the wing skin inconsistent with those used in the construction of an aircraft. The wing skin section was along a tear in the skin, adjacent to the spar. This portion of the airplane was submerged in the bog after the accident until recovery of the airplane.

"Microscopic examination and DNA testing by forensic ornithologists identified the material on the wing skin section as remains of a Canada goose. The ornithologists further noted that the natural history of this species was consistent with the location, time and date of the accident.

"The National Transportation Safety Board determines the probable cause(s) of this accident as follows: An in-flight collision with at least one Canada goose, and the resulting damage to the left stabilator that caused the airplane to become uncontrollable. Contributing to the accident was the night lighting condition, which precluded any possibility of the flight crew seeing the bird(s) prior to impact."

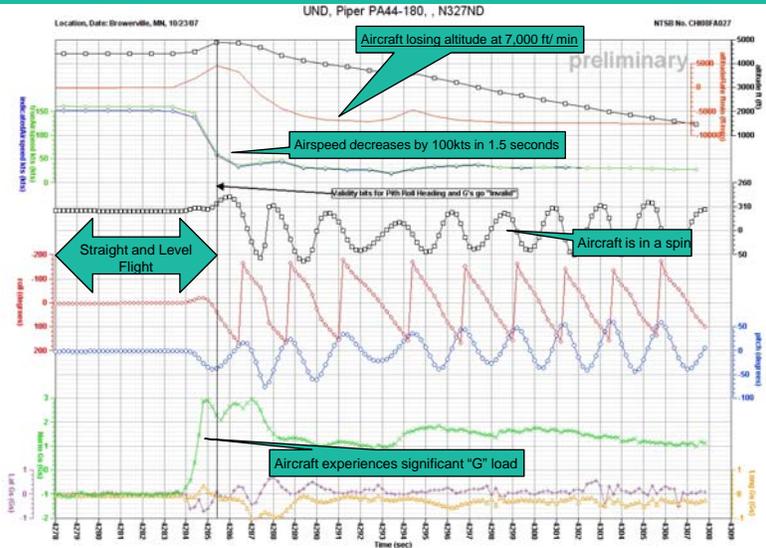
- The data from this case made it much easier to determine the exact behavior of the aircraft before and after the departure from controlled flight.

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## Avidyne Data Recovery Case Study #1

Data Provides Insight into Accident and Proof that Equipment was Operating Properly



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## Avidyne Data Recovery Case Study #2



NTSB file ATL06LA134 – McRae, GA

- VFR personal flight conducted by the owner of the airplane
- No injuries
- From the NTSB report:

"The pilot stated that 'we encountered clear air turbulence at approximately 2:00 pm. Bounced once and then after losing altitude hit a very hard bounce of severe turbulence. After stabilizing the airplane my son noticed some thin lines of paint were missing from the top of the right wing, after which I noticed thin lines of paint missing about 6 inches in from the fuel filler cap on the left wing. I slowed the plane down to about 90 knots and landed at the nearest airport', which was Telfair-Wheeler Airport, (MQW) Mc Rae, Georgia. The plane handled with no abnormalities and we landed with no issues.'

"A subsequent telephone interview with the pilot revealed that during the flight, he did not use oxygen. The pilot stated that he believed that his peak altitude was 'close to 13,000 feet.'

"Data recovered from the Primary Flight Display (PFD) and the internal compact flash memory card from the Multi-Function Display (MFD) were sent to the Safety Board's Vehicle Recorder Laboratory in Washington, D.C., for examination. The data revealed in summary the following about the flight:

"The airplane continued climbing at this rate until 1340 when the airplane leveled off at about 15,400 feet. During the climb the indicated airspeed again started to decrease from 130 knots to about 83 knots at level off. The airplane remained at this altitude but continued to lose airspeed. About 1341 at an indicated airspeed of about 72 knots the airplane pitched down and started into a steep dive. The airplane pitched down to a pitch attitude of about negative 80 degrees. During the dive the airplane rolled to the right about its longitudinal axis through two complete 360 degree revolutions and had started a third revolution, but only attained a +130 degrees of left bank prior to the recovery to straight-and-level flight. The airspeed increased from a low of 72 knots at the start of the dive to a maximum of about 336 knots indicated.

"During the recovery, the airplane sustained a positive G loading of 4.733 vertical Gs. (The PFD unit is limited to recording a vertical G-loading of 4.733 Gs even though the actual Gs loading may have been higher). After several positive and negative pitch (+50 degrees nose up to -80 degrees nose down) excursions the airplane ultimately recovered to a straight-and-level flight about 1343. After the initial recovery, the airspeed fluctuated to more than 200 knots after a low of about 120 knots. During the recovery to 2,500 feet, the airplane had lost about 13,000 feet of altitude in about 40 seconds, obtained a maximum airspeed of about 336 knots, and sustained two positive G loadings of at least 4.773 Gs. During the recovery, the recorded data averaged more than 4 Gs for a period of 21 seconds.

"The National Transportation Safety Board determines the probable cause(s) of this accident as follows: The pilot's failure to use supplemental oxygen where required, and his failure to maintain sufficient airspeed to avoid a stall."

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## Driving for the Early Release of Flight Data



- The flight data is factual and similar to the radar tracks and ATC communication transcripts that are generally made available within days or weeks of an accident.
- Release of the flight data will help reduce speculation that is generally caused by generic news reporting on general aviation accidents.
- The flight data allows the active pilot and training organizations to use high fidelity, factual data to understand the accident and improve training within the pilot community.