



NATIONAL TRANSPORTATION SAFETY BOARD

**Office of Aviation Safety
Western Pacific Region**

AIRFRAME AND ENGINE EXAMINATION

**NTSB Accident: WPR16LA071
Accident Date: February 16, 2016**

Examination Date: March 9, 2016

This document contains 25 embedded images

A. ACCIDENT

Location: Buckeye Airport, Buckeye AZ
Date: February 16, 2016
Aircraft: Evolution Aircraft Revo, N107SB, Serial # 000608
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
National Transportation Safety Board
Western Pacific Region

Jacob Hansen
Operations Inspector
Federal Aviation Administration
Scottsdale, AZ

C. SUMMARY

Examination of the recovered airframe and engine was conducted on March 9, 2016 at the facilities of Air Transport in Phoenix Arizona. The owner (Mr. Steven Bohus) and his girlfriend (Ms. Nicole DeLuca) were in attendance for a portion of the period to provide additional information as requested.

No evidence of preimpact mechanical malfunction was noted during the examination of the recovered airframe and engine.

D. WITNESS-PROVIDED INFORMATION

The owner and his girlfriend were witnesses to the accident. They provided their verbal recounts of the accident sequence, and used a model airplane to demonstrate some of the vehicle dynamics.

1.0 Owner-Provided Information

The owner had previously provided his observations to the NTSB on the day of the accident. His recount this time was essentially the same as his previous recount, but added some details by way of the model airplane. His observations (some prompted by investigator questions) included:

- The pilot and owner did not know one another until introduced by a third party a few weeks prior to the accident
- The pilot was reportedly interested in purchasing a Revo
- The owner and Ms. DeLuca watched the takeoff from the ramp; they were standing next to one another outside the owner's truck
- They estimated that they were about 1/2 mile away from the start of the takeoff roll position
- The aircraft broke ground at a speed that seemed too slow

- Just after breaking ground, the left wing dipped to the point that it might have struck the runway, but their view of that was obscured by distance and vegetation
- He estimated that the bank angle was about 45 degrees
- After liftoff the airplane climbed essentially straight up
- When asked to elaborate and also differentiate between body angle and flight track, he indicated that both the body angle and the flight track were essentially vertical
- The aircraft then turned to its right until its nose was pointed approximately straight down (in a maneuver he depicted with the model as a hammerhead stall)
- At some point during that maneuver the aircraft left side was visible in profile to the owner
- The aircraft then rolled somewhat and appeared to be oriented, and on a track, that would result in it striking the ground inverted
- During that maneuver the aircraft headed toward the right side of the runway
- He did not witness ground impact due to distance and obscuring vegetation, but knew it had crashed since the engine noise had ceased and the aircraft did not re emerge
- The sound of the engine power seemed to decrease during the right wing down/right turn, and did not increase again
- The maximum altitude was estimated to be about 75' to 100'
- He estimated that the flight from liftoff to impact lasted about 5 seconds
- After the accident, the owner notified the airport manager and then they went to the accident site
- The aircraft carriage was lying on its left side, and the wing was detached from the carriage
- The owner had accrued about 40 hours in the aircraft
- The owner repeated that he had taken the pilot for a ride the evening before
 - o The owner sat in the front (primary control/flight position)
 - o The pilot sat in the back
 - o They flew for about 45 minutes
- The pilot wanted to try flying the aircraft from the rear seat, & the owner allowed him to do so
- The owner cautioned the pilot not to conduct any extreme control inputs
- The pilot was granted the controls and immediately executed a few dramatic maneuvers, which the owner was very uncomfortable with
- The owner took back control within about 5 -10 seconds, and did not let the pilot have the controls again
- The pilot inquired about the 'dead stick' (very low engine power) capabilities of the aircraft, and convinced the owner to demonstrate a dead stick landing from the traffic pattern.
- The owner reluctantly agreed but conducted a satisfactory landing
- The owner stated that full control bar fore-aft (pitch) range was about 12 inches, 6 inches each way of neutral/cruise/normal position
- Pitch control forces are very light, independent of pitch trim position
- Pitch trim is actuated/controlled by a momentary switch in the center lower instrument panel
- It is impossible on the ground to determine what the current trim setting is
- There is no takeoff trim setting, and the aircraft is easily taken off and flown independent of the trim setting
- Yaw/roll trim is accomplished with another momentary switch; it controls the rudder-like surfaces on the aft ends of the MLG fairings

- Front seat throttle control is accomplished via a right-foot pedal similar to an automotive 'gas pedal'
- Prior to both flights, the owner and pilot watched some REVO training videos
- Prior to the flights the pilot did look in the POH, but the owner did not know for how long or on what topics
- The pilot did not ask what the appropriate "rollout speed" was
 - o After questioning by NTSB & FAA, it became clear that the owner's (and apparently industry) term "rollout speed" was akin to takeoff rotation speed; the speed where the pilot would input control movement to initiate liftoff
- The owner made it clear that after the forward push on the control bar to initiate liftoff, the pilot should reverse that input to allow a normal climb attitude and track
- The owner stated that in flight, and even just after liftoff, a pilot could release the control bar and the aircraft was stable enough to fly 'hands off'
- The pilot was seated in the front seat (as appropriate) for the accident flight

2.0 Other Witness-Provided Information

The owner's girlfriend, Ms. DeLuca, had not previously provided any observations to the NTSB. Her observations (some prompted by investigator questions) included:

- Her basic version of events was similar to that of the owner
- The biggest differences included:
 - o The maximum altitude reached was not significantly more than a wingspan above the ground (approx 30 – 50 feet)
 - o The climb attitude and track were not vertical- they were closer to about 45 degrees, but still far too steep for a normal profile
 - o The aircraft did not roll inverted; She thought the aircraft would strike the ground with its right wing first
 - o She did not recall hearing any engine noise. She made it clear that she wasn't stating that the engine wasn't running; she just didn't recall being aware of engine noise
 - o She estimated that the flight from liftoff to impact lasted about 15 – 20 seconds
 - o It was obvious to her from the start of the flight that the aircraft was likely going to crash
- She had accrued about 20 hours flying the Revo

E. EXAMINATION INFORMATION

1.0 Airframe

- The aircraft was in two major pieces (wing assembly and carriage) with an accompanying bag of fracture- separated parts (windscreen, carriage fairings, propeller fragments, foot pedal, etc)
- There was no evidence of fire, either pre- or post-impact
- The carriage damage was consistent with a front and left-side ground impact, with fore-aft scraping also

- The instrument panel was dislodged from its carriage mounts, and severely deformed
- All 3 instruments were present and affixed in the panel. They included
 - o MGL Stratomaster Xtreme EFIS
 - o f.u.n.k.e. communications radio (PN TRT800H, SN 30761514)
 - o Hour meter/clock
- Given the exposure of the switch panel, the level of damage, and the fact that the wreckage was transported from the accident site to the salvage facility, and then from its storage location to the exam location, the switch positions were deemed to be unreliable.
- Fuel was observed in the fuel tank
- The rocket powered ballistic parachute was still in its case, and the extraction rocket had not been fired
- The aircraft was not equipped with any placards advising or warning first responders or any other personnel of the presence of the rocket
- The front restraint harness belts had been cut to extract the pilot



Figure 1 - Carriage Right Side



Figure 2 - Carriage Aft Left Side



Figure 3 - Carriage Left Side



Figure 4 - Instrument Panel



Figure 5 - Switch Panel



Figure 6 - Parachute and Rocket



Figure 7 - Parachute Deployment Handle



Figure 8 - Forward Seat (note cut belt)

2.0 Engine and Propeller

- The engine (Rotax 912 IS) did not exhibit any signs of any pre-impact failures
- Engine damage appeared to be limited to some minor muffler crush and displacement from impact
- The four top spark plugs were pulled and the engine rotated freely by hand; thumb compressions were observed on all four cylinders
- The bodies and electrodes of the four top spark plugs (NGK- DCPR8E) all were unremarkable
- The engine control unit (ECU) was removed and retained for data download
 - o ECU Rockwell Collins PN ECU-204-102 B SN 12.0412
 - o Rotax PN 665566 00 then (per software update) 665568
- Both composite propeller blades were fracture-separated at their approximate 18 inch span locations
- Propeller blade damage was consistent with power at impact



Figure 9 - Propeller and Engine Aft left



Figure 10 - Engine and Propeller Forward Left

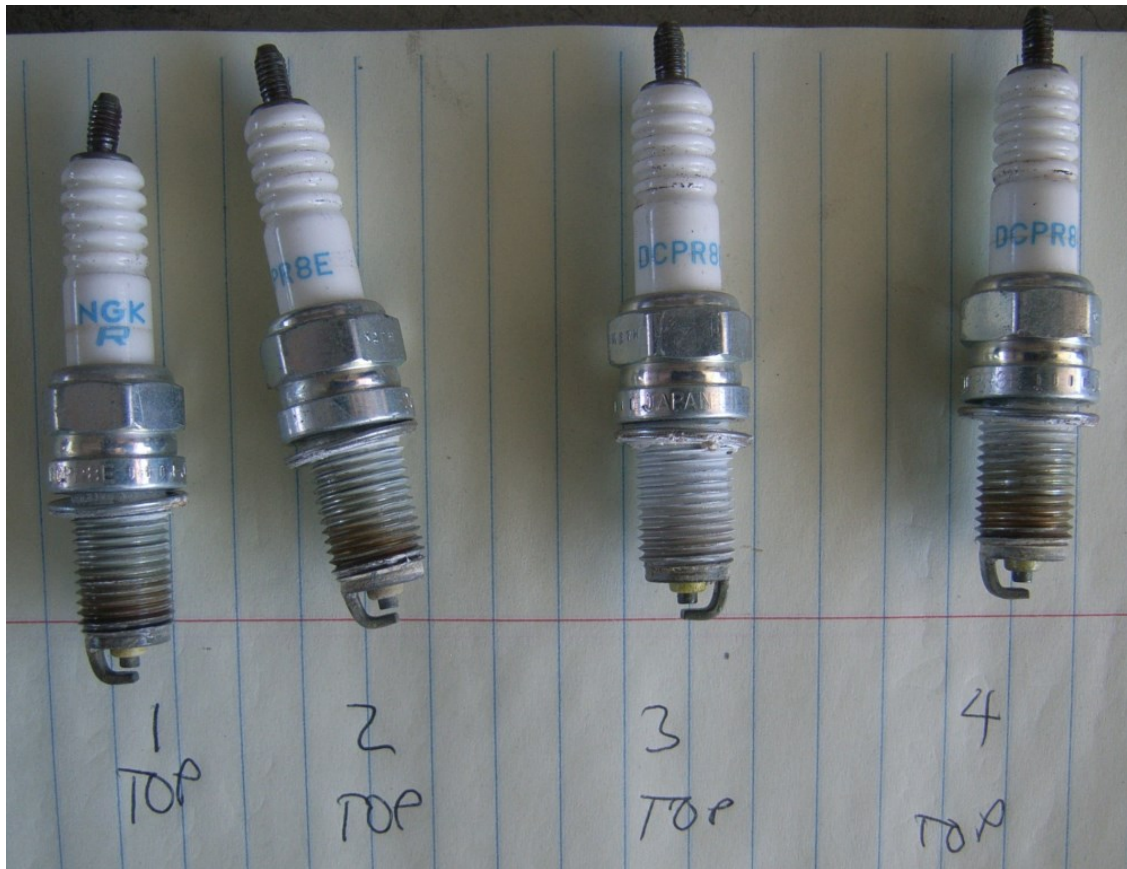


Figure 11 - Top Spark Plugs



Figure 12 - Engine ECU (in situ)

3.0 Wing

- The main mast tube of the wing assembly had fracture-separated from the carriage at its attach point to the mast mount block
- The aluminum tube front spars formed the wing leading edges
 - o The left front spar was fracture-separated at about its 2 foot span location
 - o The right front spar was fracture-separated about 5 feet inboard of the tip
- The auxiliary/jury spar aft of the main spar was also fracture separated
- The wing cloth was intact excluding impact damage
- An unidentified/unassigned quick-release pin was found inside the left wing
 - o The pin bore the following markings
Jergens
800603
C3B1.25S
-PUSH-
J 15960
 - o No vacant holes for the pin were located
 - o Discussions with the aircraft manufacturer did not enable determination of the pin's origin
- A small attached but unused pulley was found inside the center wing
 - o The aircraft manufacturer advised that the pulley was used to provide mechanical advantage for initial wing setup, and that once the wing was set up, the pulley was no longer needed, but remained attached to the wing structure.
- The aft actuating tube assembly of the pitch trim mechanism was fracture-separated from the travel block of the main housing jackscrew
 - o On disassembly and inspection, it was revealed that the threads of the aluminum actuating tube had pulled aft over the jackscrew nylon travel block threads
 - o Fore-aft elongation of quick release pin hole in the aluminum tube was also consistent with a significant fore-aft separation load of the trim mechanism; this was not consistent with normal system capability, and was attributed to impact loads and structural deformation
- The aircraft manufacturer stated that based on the position of the jackscrew travel block, the trim was set close to the slowest speed of the aircraft. He also stated that that trim setting was acceptable for takeoff.



Figure 13 - Wing and Control Bar



Figure 14 - Fractured Left Spars



Figure 15 - Fractured Right Spar



Figure 16 - Quick Release Pin in As-Found Location



Figure 17 - Unassociated Quick Release Pin



Figure 18 - Unused Pulley



Figure 19 - Unused Pulley



Figure 20 - Pitch Trim Assembly (Pin removed by investigators)



Figure 21 - Elongated Hole in Pitch Trim Actuator



Figure 22 - Pitch Trim Motor and Servo



Figure 23 - Separated Actuator Tube (pitch trim)



Figure 24 - Pitch Trim Jackscrew Assembly

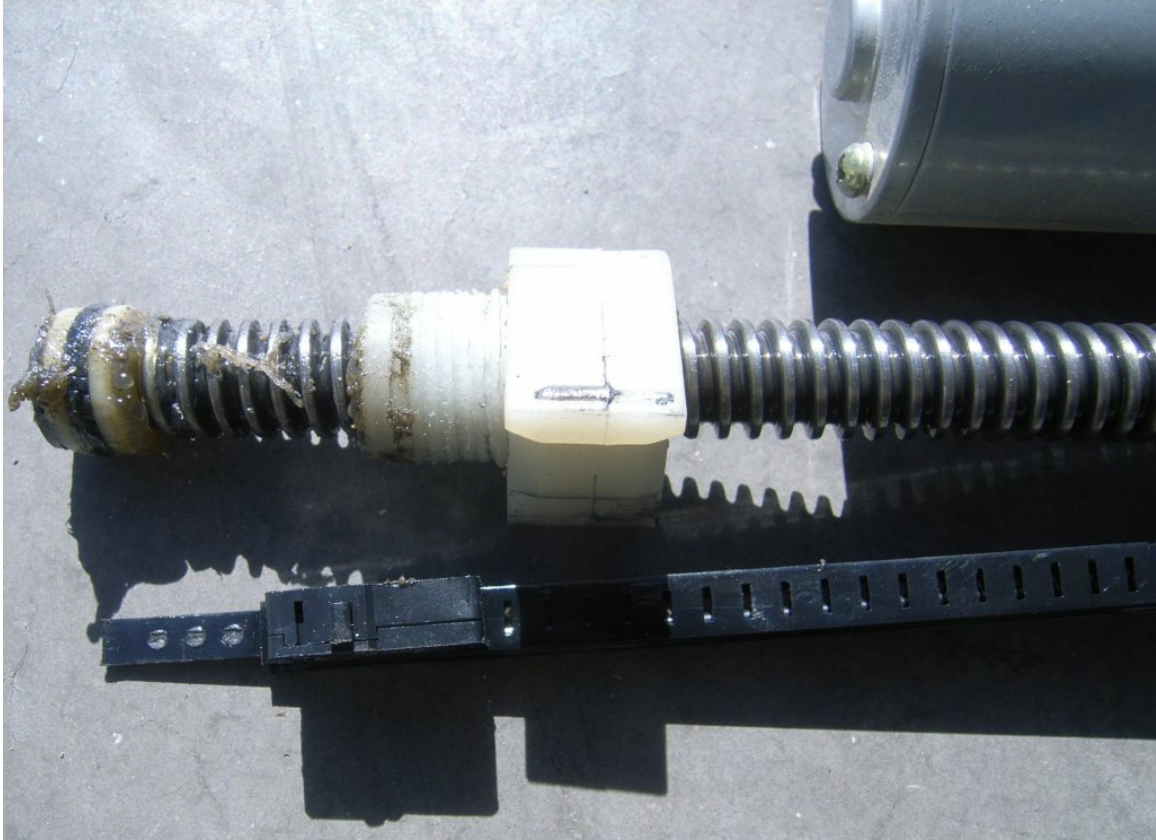


Figure 25 - Nylon Travel Block of Pitch Trim (note stripped threads)