# Aviation Investigation Final Report

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| **Location:** | Roche Harbor, Washington | **Accident Number:** | LAX07LA215 |
| **Date & Time:** | July 11, 2007, 18:30 Local | **Registration:** | N9551B |
| **Aircraft:** | Cessna 172RG | **Aircraft Damage:** | Substantial |
| **Defining Event:** | | **Injuries:** | 3 None |
| **Flight Conducted Under:** | Part 91: General aviation - Personal | | |

## Analysis

As the airplane approached the destination airport, it had an electrical failure. The pilot stated he was concerned about the potential for an electrical fire, and elected not to attempt to troubleshoot the malfunction. He extended the landing gear by placing the gear lever in the "DOWN" position, and said he visually confirmed that they were down by the mirrors affixed to the wings, as the landing gear indicator lights in the cockpit were not illuminated due to the loss of electrical power. The pilot did not use the emergency gear extension system. With the landing gear appearing to be extended, the airplane touched down on the runway and the main landing gear collapsed. The airplane's loss of electrical power rendered the landing gear warning system inoperative; the warning system is designed to help prevent the pilot from inadvertently making a landing with the landing gear retracted. No evidence of any mechanical malfunction was found during the postimpact examination of the landing gear and alternator/battery electrical system. If the pilot had used the emergency gear extension system per the procedures prescribed in the pilot's operating handbook, it is probable that the landing gear would have extended and locked. The underlying cause of the electrical system failure could not be determined.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to perform the emergency landing gear extension procedure prior to landing. A contributing factor in the accident was the failure of the electrical system.

## Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE

Findings
1. (F) ELECTRICAL SYSTEM - FAILURE
2. ELECTRICAL SYSTEM,BATTERY - DISCHARGED
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Occurrence #2: GEAR COLLAPSED
Phase of Operation: LANDING - ROLL

Findings
3. TERRAIN CONDITION - RUNWAY
4. (C) EMERGENCY PROCEDURE - NOT PERFORMED - PILOT IN COMMAND

## Factual Information

HISTORY OF FLIGHT

On July 11, 2007, about 1830 Pacific daylight time, a Cessna 172RG, N9551B, experienced a landing gear collapse while on the landing roll at Roche Harbor Airport, Roche Harbor, Washington. Avian Flight Center was operating the airplane under the provisions of 14 Code of Federal Regulations Part 91. The commercial pilot and two passengers were not injured. The airplane sustained substantial damage. The personal cross-country flight departed from Bremerton National Airport, Bremerton, Washington, about 1750, with a planned destination of Roche Harbor. Visual meteorological conditions prevailed, and a flight plan had not been filed.

In an interview with a National Transportation Safety Board investigator and a following written statement, the pilot reported that as he approached the vicinity of Roche Harbor the airplane experienced a partial electrical failure with a radio and transponder failure. He continued to the airport and, unwilling to risk the chance of an electrical fire, elected to not attempt to troubleshoot the malfunction. He extended the landing gear by placing the gear lever in the "DOWN" position and visually confirmed that they were down by utilizing mirrors affixed to the wings; the landing gear indicator lights in the cockpit were not illuminated due to the now total loss of electrical power. He did not use the emergency landing gear extension procedure. With the landing gear appearing to be extended, the airplane touched down on runway 25. The main landing gear collapsed as the airplane rolled down the runway.

According to a Federal Aviation Administration (FAA) inspector who examined the wreckage, the airplane incurred structural damage during the accident sequence to the underside of the fuselage and the cabin area was twisted. The airplane came to rest with the nose landing gear bent aft. He opined to the Safety Board investigator that during the flight the pilot had failed to properly perform procedures relating to an electrical failure. Additionally, he thought the pilot failed to ensure that the landing gear was fully extended by using the emergency gear extension system.

AIRPLANE INFORMATION

The single-engine, high wing airplane was a Cessna 172RG, serial number 172RG0873, manufactured in 1981. The landing gear was designed to be manipulated by the pilot via a gear lever in the cockpit that has the selection of "UP" and "DOWN". After the lever is positioned, the power pack will create pressure in the hydraulic system and actuate the landing gear to the selected position. During a normal cycle, the landing gear is designed to completely retract or extend and lock while the limit switches close (only during the landing gear extended cycle), and the indicator light illuminates an amber for a retracted indication and green for down indication. After indicator light illumination, during the extension cycle, the power pack

will continue to run until the fluid pressure reaches 1500 PSI and the pressure switch is activated, turning the power pack off.

A hand-operated hydraulic pump, located between the front seats, is provided for manual extension of the landing gear in the event of a hydraulic or electrical system failure. The utilization of the pump is accomplished by the extension of the handle forward and a pumping action vertically.

The airplane is equipped with a landing gear warning system designed to help prevent the pilot from inadvertently making a landing with the landing gear retracted. The system consists of a throttle actuated switch which is electrically connected to a dual warning unit. An electronic interconnect switch in the wing flap system additionally warns the pilot when the wing flaps are extended beyond 20 degrees with the landing gear retracted.

In the event of a failed landing gear extension, the Cessna Pilot's Operating Handbook (POH) advises the pilot to utilize the emergency hand-pump. It instructs that the handle should be extended and pumped "until resistance becomes heavy," which is acquired after "about 35 cycles." Verification of the landing gear position is obtained after receiving the green illumination of the landing gear indication light.

According to a representative from the Cessna Pilot's Association, when extending the landing gear on the 172RG airplanes the nose gear will free-fall down to the locked position first. The main landing gear hydraulically extend, locking several seconds thereafter. He further stated that if the main landing gear are partially extended (visible from the cockpit via the wing mirror) during touch down the airplane's weight will prevent the landing gear from collapsing. He additionally noted that an electrical surge can occur under high power demands such as the landing gear being cycled simultaneously with the wing flaps, which would result in the disengagement of the alternator.

TESTS AND RESEARCH

Following the accident, Safety Board investigators examined the wreckage at the facilities of Avtech Services, Maple Valley, Washington. Examination of the airframe revealed the nose gear was crushed aft and upwards into the cabin area. Both the left and right main landing gear were not locked. A portion of the rudder trim control system was pushed aft into the hydraulic lines to the hydraulic power pack. The hydraulic line from the hydraulic power pack to the emergency hand pump was severed, consistent with impact damage.

The emergency hand pump handle was found in the stowed position and the gear selector handle was observed in the "DOWN" position. The master switch was placed into the "ON" position and no electrical power was observed. The 24-Volt Gill battery was inspected and found to have little to no charge. Upon replacement of the battery, the master switch was activated and the sound of instruments spooling was heard. The landing gear selector switch was then placed in the retracted position and hydraulic fluid was observed expelling from the

separated hydraulic line from the hydraulic power pack; the hydraulic pump sounded consistent with normal actuation. The gear selector handle was placed in the extended position and again the sound of the hydraulic pump actuating was heard. The emergency hand pump handle was extended and manually actuated by hand. Continuity was established from the emergency hand pump to the separated line.

Both the left and right main landing gear were moved manually by hand and locked in the down position with no anomalies noted. Due to the damage sustained to the nose gear, the nose gear was not actuated manually by hand.

The alternator, voltage regulator, and battery were removed and delivered to Valley Automotive Repair and Electric, Maple Valley, for further examination and testing. The alternator was placed on a test bench and functioned normally producing an average load of 50 amps with no anomalies noted. The battery was intact and contained a minimal charge. It could not be determined if the solid-state Zeftronics voltage regulator was functional.

## Pilot Information

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| **Certificate:** | Commercial; Flight instructor | **Age:** | 27,Male |
| **Airplane Rating(s):** | Single-engine land; Multi-engine land | **Seat Occupied:** | Left |
| **Other Aircraft Rating(s):** | None | **Restraint Used:** | |
| **Instrument Rating(s):** | None | **Second Pilot Present:** | No |
| **Instructor Rating(s):** | Airplane multi-engine; Airplane single-engine | **Toxicology Performed:** | No |
| **Medical Certification:** | Class 2 Without waivers/limitations | **Last FAA Medical Exam:** | July 1, 2007 |
| **Occupational Pilot:** | No | **Last Flight Review or Equivalent:** | May 1, 2007 |
| **Flight Time:** | 1400 hours (Total, all aircraft), 10 hours (Total, this make and model), 4 hours (Last 90 days, all aircraft) | | |

## Aircraft and Owner/Operator Information

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| **Aircraft Make:** | Cessna | **Registration:** | N9551B |
| **Model/Series:** | 172RG | **Aircraft Category:** | Airplane |
| **Year of Manufacture:** | | **Amateur Built:** | |
| **Airworthiness Certificate:** | Normal | **Serial Number:** | 172RG0873 |
| **Landing Gear Type:** | Retractable - Tricycle | **Seats:** | 4 |
| **Date/Type of Last Inspection:** | Unknown | **Certified Max Gross Wt.:** | 2650 lbs |
| **Time Since Last Inspection:** | | **Engines:** | 1 Reciprocating |
| **Airframe Total Time:** | 7531 Hrs at time of accident | **Engine Manufacturer:** | Lycoming |
| **ELT:** | Installed, not activated | **Engine Model/Series:** | O-360-F1A6 |
| **Registered Owner:** | Northwest Zephyr Aviation LTD | **Rated Power:** | 180 Horsepower |
| **Operator:** | Avian Flight Center | **Operating Certificate(s) Held:** | None |

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | FHR,113 ft msl | **Distance from Accident Site:** | 7 Nautical Miles |
| **Observation Time:** | 18:53 Local | **Direction from Accident Site:** | 140° |
| **Lowest Cloud Condition:** | Clear | **Visibility** | 10 miles |
| **Lowest Ceiling:** | None | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 3 knots / None | **Turbulence Type Forecast/Actual:** | / |
| **Wind Direction:** | 350° | **Turbulence Severity Forecast/Actual:** | / |
| **Altimeter Setting:** | 29.94 inches Hg | **Temperature/Dew Point:** | 31°C / 10°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | Bremerton, WA (KPWT) | **Type of Flight Plan Filed:** | None |
| **Destination:** | Roche Harbor, WA (WA09) | **Type of Clearance:** | VFR;Traffic advisory;VFR flight following |
| **Departure Time:** | 17:50 Local | **Type of Airspace:** | |

## Airport Information

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| **Airport:** | Roche Harbor Airport WA09 | **Runway Surface Type:** | Asphalt |
| **Airport Elevation:** | 100 ft msl | **Runway Surface Condition:** | Dry;Rough |
| **Runway Used:** | 25 | **IFR Approach:** | None |
| **Runway Length/Width:** | 3593 ft / 30 ft | **VFR Approach/Landing:** | Full stop |

## Wreckage and Impact Information

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| **Crew Injuries:** | 1 None | **Aircraft Damage:** | Substantial |
| **Passenger Injuries:** | 2 None | **Aircraft Fire:** | None |
| **Ground Injuries:** | N/A | **Aircraft Explosion:** | None |
| **Total Injuries:** | 3 None | **Latitude, Longitude:** | |

## Administrative Information

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| **Investigator In Charge (IIC):** | Keliher, Zoe |
| **Additional Participating Persons:** | Rod Ziegler; Federal Aviation Administration; Seattle, WA |
| **Original Publish Date:** | February 28, 2008 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=66237 |