Aviation Investigation Final Report

Location:	Chino Hills, California	**Accident Number:**	WPR11LA373
Date & Time:	August 6, 2011, 13:55 Local	**Registration:**	N162CT
Aircraft:	Rotorway Exec	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The flight instructor/owner of the experimental amateur-built helicopter took the rotorcraft-rated private pilot on an informal demonstration flight. The two spent about 40 minutes conducting traffic pattern work at a local airport and then departed the area, flying about 500 feet above ground level. The private pilot was the pilot flying. When the helicopter was about 7 miles from the airport, the pilot noticed that the engine "sputtered," and called it to the attention of the owner, who then took control of the helicopter. The engine ceased operating about the same time. The owner initiated a 180-degree autorotation to a vacant field. Due to some forward speed at touchdown, the landing skids dug into the turf and the helicopter pitched nose down. The main rotor struck the ground and also severed the tail boom, and the helicopter rolled onto its left side. Postaccident examination indicated that there was less than 1 gallon of fuel remaining on board.

The manufacturer's pilots operating handbook did not contain any fuel consumption rate information; the only reference to range or endurance was the statement "Range with maximum fuel at optimum power 180 miles/2 hrs." The owner reported that he began the flight with 17 gallons (the maximum quantity) , and that the engine consumed about 9 gallons per hour; he did not specify the source of that information or the power setting or flight mode for that consumption rate. Since the fuel consumption rate for takeoffs and traffic pattern work can be significantly higher than that for cruise flight at "optimum power," the endurance of the helicopter during the accident flight would have been commensurately less than 2 hours. The helicopter was equipped with a fuel quantity gauge and cockpit instrumentation also provided a means for a pilot to determine the approximate remaining fuel quantity in flight by selecting the "fuel used"' option on the cockpit display. Neither the pilot nor the owner reported using either means to check or monitor fuel quantity during the flight.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A total loss of engine power due to fuel exhaustion as a result of both the owner's and the pilot's failure to determine or monitor the remaining fuel quantity during the flight. Contributing to the accident was the manufacturer's lack of fuel consumption rate data for planning purposes.

Findings

Personnel issues	Fuel planning - Pilot
Aircraft	(general) - Not specified
Aircraft	(general) - Related operating info
Aircraft	Fuel - Related operating info

Factual Information

History of Flight

Enroute-cruise	Loss of engine power (total) (Defining event)
Enroute-cruise	Off-field or emergency landing
Autorotation	Fuel exhaustion

On August 6, 2011, about 1355 Pacific daylight time, an experimental amateur-built RotorWay Exec 162F helicopter, N162CT, was substantially damaged during a forced landing after a complete loss of engine power southwest of Chino Airport (CNO), Chino, California. The certified flight instructor (CFI)/owner and the rotorcraft-rated private pilot were not injured. The instructional flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight.

The helicopter was based at CNO. According to the owner, the private pilot was a former student of his, and the purpose of the flight was to expose the private pilot to the Rotorway helicopter. The owner was seated in the right seat, and the private pilot was seated in the left seat, which was the normal seat for solo flight in that helicopter. The flight originated at CNO, and the pilots spent about 40 minutes conducting traffic pattern work at CNO. They then departed CNO to the southwest, flying at about 500 feet above ground level, with a cruise speed of 80 mph. The private pilot was pilot flying (PF).

When the helicopter was about 3 miles from CNO, the PF noticed that the engine "sputtered," and called it to the attention of the owner, who then took control of the helicopter. The engine ceased operating about the same time, and the owner initiated a 180-degree autorotation to a vacant field. At touchdown, the helicopter had some forward speed, the landing skids dug into the terrain, and the helicopter pitched nose down. The main rotor struck the ground, severed the tail boom, and the helicopter rolled onto its left side.

Flight instructor Information

Certificate:	Commercial; Flight instructor; Private	**Age:**	54
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	July 21, 2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	December 15, 2010
Flight Time:	1984 hours (Total, all aircraft), 415 hours (Total, this make and model), 1871 hours (Pilot In Command, all aircraft), 36 hours (Last 90 days, all aircraft), 9 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Private	**Age:**	53
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3	**Last FAA Medical Exam:**	March 5, 2011
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

The owner held a commercial pilot certificate with a single-engine land rating, and a flight instructor certificate with a helicopter rating. He reported a total flight experience of 1,984 hours, including 415 hours in the accident helicopter make and model. His most recent FAA second-class medical certificate was issued in July 2011, and his most recent flight review was completed in December 2010.

Aircraft and Owner/Operator Information

Aircraft Make:	Rotorway	**Registration:**	N162CT
Model/Series:	Exec 162F	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	6445
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	May 26, 2011 Condition	**Certified Max Gross Wt.:**	1500 lbs
Time Since Last Inspection:	7 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	205 Hrs at time of accident	**Engine Manufacturer:**	Rotorway
ELT:	Not installed	**Engine Model/Series:**	162F
Registered Owner:	On file	**Rated Power:**	150 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

According to the owner, the helicopter was built in 2008, and was equipped with a RotorWay 162F 150hp engine. As of its most recent conditional inspection in May 2011, the helicopter had accumulated a total time in service of 205 hours.

The RotorWay Pilot Operating Handbook (POH) stated that the helicopter was equipped with "RotorWay International's FADEC (Fully Automated Digital Electronic Control)", which was "an electronic engine control system that is unique in the aviation industry. The system is fully redundant; if failure of the primary system occurs, a backup system will automatically activate." No further design or function information regarding the FADEC was provided in the POH.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CNO,650 ft msl	**Distance from Accident Site:**	7 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	45°
Lowest Cloud Condition:	Clear	**Visibility**	8 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	32°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Chino, CA (CNO)	**Type of Flight Plan Filed:**	None
Destination:	Chino, CA (CNO)	**Type of Clearance:**	None
Departure Time:	13:15 Local	**Type of Airspace:**	

The 1353 automated weather observation at CNO, located about 7 miles from the accident site, included winds from 240 degrees at 5 knots; visibility 8 miles, clear skies; temperature 32 degrees C; dew point 13 degrees C; and an altimeter setting of 29.93 inches of mercury.

Airport Information

Airport:	Chino CNO	**Runway Surface Type:**	
Airport Elevation:	650 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	33.974723,-117.63639(est)

The forced landing location selected by the owner was an area of mixed grass and dirt adjacent to a public road, about 7 miles southwest of CNO. The helicopter came to rest on its left side. The aft section of the tailboom was severed, both main rotor blades were damaged, and the fuselage and attached tail boom segment sustained various levels of crush damage. The landing skids were also deformed. There was no fire.

Less than 1 gallon of fuel was observed in the fuel tank after the helicopter was righted, and there was no evidence of tank breaching or fuel leakage.

Independent of the NTSB and FAA, the owner communicated directly with Rotorway, and sent the engine FADEC unit to RotorWay for data download. According to the owner, Rotorway personnel informed him that "the limited data [the FADEC unit] provided did not help him determine what caused the engine to stop." The FADEC data was not provided to the owner, and when the NTSB requested the data from Rotorway by the NTSB, Rotorway responded that it did not retain the data, but that it did not delete the data from the unit either. The data was not recovered by the NTSB.

Communications

After the helicopter had departed the CNO area, the owner requested permission from the CNO air traffic control tower (ATCT) to remain on the ATCT frequency, since the owner planned to remain relatively near the airport. After the engine quit, the owner radioed "mayday" to CNO ATCT, and informed ATCT personnel that the helicopter was "going down." The owner did not report that there were any other communications from or to the CNO ATCT, and the investigation did not obtain any CNO ATCT audio recordings.

Additional Information

Fuel Tank Fitting Seal Information

According to the owner, other owners had experienced fuel leaks as a result of failures of a fitting seal at the bottom of the fuel tank. Research revealed that one owner had posted information about his 'fix' to the problem on a user's website. Research also revealed that Rotorway had issued two mandatory service bulletins, M22 and M24, in 2003 and 2005, respectively. Both M22 and M24 addressed a compatibility issue between the seal material and the fuel. Although the accident helicopter construction was completed in 2008, the owner's maintenance records only indicated incorporation of mandatory service

bulletins through 1998. The owner stated that M22 and M24 did not apply to the helicopter, but that he did not document that fact in the maintenance records.

There were no reports of a fuel leak, or indications of a leak, from the subject location on the accident helicopter.

Fuel Quantity and Consumption Rate Information

The helicopter was equipped with a fuel quantity gauge. Examination of the POH indicated that the helicopter was also equipped with instrumentation capable of displaying "Fuel Used." However, the display of that information was pilot-selectable, chosen from a menu of 13 items total. Several of those other menu items were engine operating parameters, including manifold pressure.

The POH did not contain any fuel consumption rate information; the only reference to range or endurance was the statement "Range with maximum fuel at optimum power 180 miles/2hrs."

NTSB queries to the manufacturer for additional related performance data resulted in the following information from the manufacturer:

- Rotorway "never had performance charts" for the 162F helicopter.

- The consumption rate for a normally aspirated 162F helicopter "is 7 to 8.5 gallons per hr. depending on what type of flying you are doing."

- "There is not performance data available for the 162F helicopter"

- Operations such as "hover training, or making a climb will have a higher burn rate than in a forward cruise. There has never been certified testing done on different loads on the engine showing fuel burn rates."

Since fuel in the tank was not visually observable while the helicopter was on the ground (or airborne), the POH instructed the owner/operator to calibrate an aircraft-specific "dip hose" which was then to be used on the ground to determine fuel quantity. The POH also instructed the owner/operator to use the dip hose "to verify the accuracy of the fuel gauge."

The owner reported that he began the flight with 17 gallons of fuel (the maximum quantity), and that the engine consumed about 9 gallons per hour. He did not specify the engine power setting or flight mode (takeoffs, cruise, etc.) for that consumption rate. In another statement the owner reported that he calculated that the helicopter used about 9 gallons during 40 minutes of traffic pattern activity, which left "7 to 8" gallons for the remainder of the flight. He did not elaborate as to how he derived the 9-gallon value for the 40-minute flight, or why that value did not reconcile with his reported consumption rate of 9 gallons per hour. The owner stated that the total operating time for the flight was 57 minutes.

The investigation did not independently verify fuel tank capacity, the accuracy of the owner-manufactured fuel dip hose, the accuracy of either the fuel quantity gauge or the fuel-used instrumentation, the published performance data, and it did not determine any fuel consumption rates for

the engine/airframe combination for any flight modes.

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	Steve Groover; FAA FSDO; Riverside, CA
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