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INVESTIGATION REPORT

ACCIDENT INFORMATION

Date of accident:	07/14/2015	NTSB file number:	CEN15LA306
Location of accident:	Clark, SD, U.S.A	FAA Inspector:	William Howell
Location of Investigation:	Clark, SD, U.S.A	Law Enforcement:	Unknown
Investigator In charge:	Andrew T. Fox	Coroner/Medical Examiner	Unknown

AIRCRAFT INFORMATION

Aircraft Make:	Air Creation	Aircraft registration:	Non Registered
Aircraft Model:	Clipper 582	Aircraft S/N	Unknown
Propeller make, model & S/N	3 Bladed ARPLAST HELICE		

ENGINE INFORMATION

Engine Type:	Rotax 582 Mod 90	Engine TTSN	Unknown
Engine Serial Number:	4656198	Engine TTSOH	Unknown
Engine Manufacture date:	09/20/1996	Engine position:	Pusher

ADDITIONAL INFORMATION

Persons in attendance:	FAA IIC, William Howell – Rapid City, FSDO		
	Rotax Investigator, Jordan Paskevich – Rotech Flight Safety		
Date of Report:	08/18/2015		
RFS File number:	2015-030		

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08/18/2015	Rotax 582 mod 90	4656198	Non-Registered	2015-030

NTSB Preliminary Report

On July 14, 2015, about 1552 central daylight time, an Air Creation model Clipper 582, an unregistered weight-shift control aircraft, was substantially damaged when it impacted terrain shortly after takeoff from Clark County Airport (8D7), Clark, South Dakota.

The uncertificated pilot and his passenger sustained serious injuries. The flight was conducted under the provisions of 14 Code of Federal Regulations Part 91 without a flight plan. Day visual meteorological conditions prevailed for the local flight that was originating at the time of the accident.

According to a witness, the weight-shift control aircraft had departed using runway 31. He observed the aircraft climb to an altitude of about 100 feet above the runway when he heard a significant reduction of engine power. He then observed the aircraft pitch down, about 10-15 degrees nose down, and roll left, about 20 degrees, before it descended into terrain.

The witness reported that he immediately responded to the accident site to render assistance to the pilot and passenger.

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Initial Inspection

The on-site investigation took place on August 11th 2015 under the supervision of FAA IIC William Howell out of the Rapid City FSDO. The location of the investigation was held at the Clark County Airport, SD in the owners/ pilots hanger.

The aircraft sustained severe frontal impact damage. The Rotax 582 Mod 90 engine was still attached to its engine mount and appeared to be in good physical condition due to its location on the aircraft (Pusher Configuration). The intake silencer (Air box) was separated from the carburetors due to impact and was sitting next the aircraft wreckage on the hanger floor.

The wing cable cords were found wrapped tightly around the propeller shaft indicating the propeller was turning at the time of impact.

The coolant radiator was also separated from the airframe due to impact damage. All three propeller blades were still attached to the propeller hub but also sustained damage.



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Initial Inspection

The engine serial number is 4656198, and was produced in September 20 1996 making the engine 19 years old.

In the Rotax maintenance manual section **10.2) Maintenance schedule** it states that general overhaul of engine to be carried out every five years or every 300 hours whichever comes first.

There were no records found to indicate this engine was ever overhauled.



MAINTENANCE MANUAL

10.2) Maintenance Schedule

The following maintenance is planned and necessary for ROTAX 447 UL SCDI, 503 UL DCDI, 582 UL DCDI and 582 UL DCDI mod. 99:

38	General overhaul of engine 9)																X	11.33	
	Checks and work	2 h	10 h	12.5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h			

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- 1) and after every replacement of gasket(s)
- 2) also after any damage
- 3) according to instructions of manufacturer
- 4) if carbon layer is more than 0,5 mm thick, decarbonize
- 5) if piston ring sticks clean and replace if necessary
- 6) if used in very dusty atmosphere
- 7) wear limit see Service Information 5 UL 91
- 8) If cylinder has been dismantled
- 9) To be carried out every five years or every 300 hours whichever comes first. contact authorized distributor or service center.
- 10) To be examined after every 12,5 hours of operation.
- 11) Necessary only if piston rings are not freely moving

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Detailed Inspection

Spark Plugs: The spark plugs were removed from the engine and examined for condition and proper type.

Type: NGK B8ES

The spark plugs were in good physical condition but had removable resistor caps and a electrode gap of .032. Rotax states the spark plugs should not have a removable resistor caps and have an electrode gap of .018 - .020.

Insufficient spark plug gap can cause pre-ignition, detonation and even engine damage. Too much electrode gap can result in a higher rate of misfires, loss of power, plug fouling and poor fuel economy.

The spark plug electrodes were examined to determine proper carburetor calibration. The spark plug electrodes were brownish in color indicating that the correct carburetor calibration was established. No other anomalies were found with the spark plugs.



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Detailed Inspection

Ignition Modules & Ignition wires

The ignition models and ignition wires were examined for condition and conformity. The ignition modules were the proper type and in good physical condition.



A cracked boot was found on the # 4 MAG spark plug ignition wire. This boot is to protect the contacts from the elements. Rotax maintenance manual section **10.2) Maintenance schedule** it states that checking of the ignition system is to be done every 25 hours. (See **Appendix A for the Rotax Maintenance schedule**)

Rotax maintenance manual section **11.9) Check of the ignition system** states to “ Verify all electrical connections for good contact and ensure there are free of corrosion. Inspect the wiring for wear, damage and corrosion.

Crack in Ignition wire and CDI boot



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Detailed Inspection

Air filter

The air filter was examined for condition and conformity. The air filter was found to be dirty which would affect the overall performance of the engine.



In the Rotax operators manual section **10.3.2) Daily checks**, it states **WARNING:** Repair as necessary all discrepancies and shortcoming before flight. It also states to Verify security and condition of intake silencer and air filter.

10.3.2) Daily checks

▲ **WARNING:** Repair as necessary all discrepancies and shortcoming before flight.

- Verify security and condition of intake silencer and air filter.

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582 DCDI
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In the Rotax installation manual section **10.2) Maintenance Schedule**, it states to clean and oil air filter every 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275 hours. (See **Appendix A** for the Rotax Maintenance schedule)

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Air filter (Continued)

The air filter was found to be a non conforming air filter with no lock wire fixation tabs. In the Rotax installation manual section 17,2) **Air filter** it states that only air filters approved by Rotax are permitted for use. The air filters specified by Rotax are special K&N air filters, with fixation tabs for proper security.

ROTAX
AIRCRAFT ENGINES
INSTALLATION MANUAL

17.2) Air filter

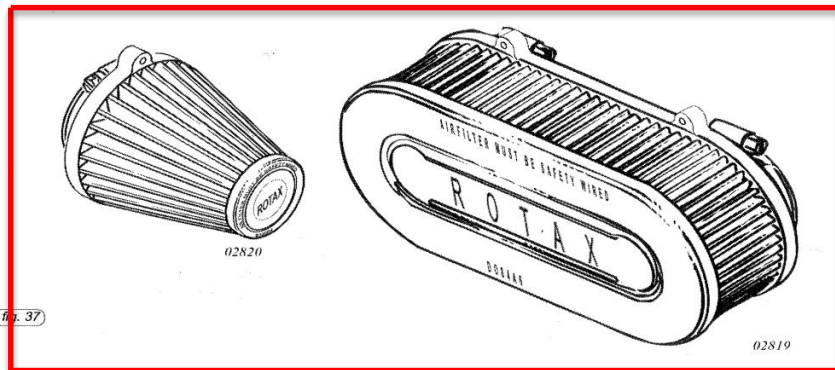
Only air filters approved by ROTAX are permitted for use. The air filters specified by ROTAX are special K & N air filters. Dry filter elements of paper are not allowed for humid operating conditions, as they absorb water, thus reducing the air intake leading to enrichment of the fuel/air mixture.

Two kinds of filter design are applied on these engines:

- Single air filter
- Double air filter

With 2 carburetors on engine, either 2 single air filters or 1 double air filter may be fitted.

■ **WARNING:** Always secure air filters against loss.



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Carburation: The carburetors were examined for proper jetting, fuel contamination and proper installation.

An optional intake silencer was installed on this aircraft. Installation of the intake silencer requires different carburetor main jetting. The main jet that is required to be installed when an intake silencer is used on a Rotax 582 engine is a #145 main jet.

PTO (Power Take off) Carburetor: The PTO carburetor float bowl was removed to inspect for contamination and to examine the main jet.

No contamination was found and the main jet was #145 as required with the use of an intake silencer.

No anomalies were found with the PTO carburetor.

MAG (Magnetoside) Carburetor: The MAG carburetor float bowl was removed to inspect for contamination and to examine the main jet.

A small amount of blue tinged liquid constant with pre mix fuel was found contained within the MAG carburetor float bowl. No contamination was found and the main jet was #145 as required with the use of an intake silencer.

No anomalies were found with the MAG carburetor.



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Detailed Inspection

Fuel Pump:

The fuel pump was examined for condition, proper type and mounting position. The fuel pump was the proper type and in good overall condition. It was mounted with the weep drain hole towards the bottom of the fuel pump as recommended in the Rotax installation manual. No anomalies were found with the fuel pump.



Fuel lines:

The fuel lines were examined for condition, security and proper routing. The fuel line from the fuel primer plunger to the fuel pump was not secured. In the Rotax repair manual section **10.2.5) Elimination of air leaks in the fuel line:** It states that "Some commercial clips are often not very satisfactory on small pipes, as they tend to tighten up oval, creating a possible leak. "Crimp on" clips can be unsatisfactory if incorrectly applied, and are difficult to remove for servicing. Replace all doubtful fuel line clamps with good quality approved ones." Rotax recommended clips are P/N 938 195 which are a spring type clamp.



10.2.5) Elimination of air leaks in the fuel line:

If air leaks are indicated, seek to eliminate them. The arrows on the diagram show possible air leakage points. Some commercial clips are often not very satisfactory on small pipes, as they tend to tighten up oval, creating a possible leak. "Crimp on" clips can be unsatisfactory if incorrectly applied, and are difficult to remove for servicing.

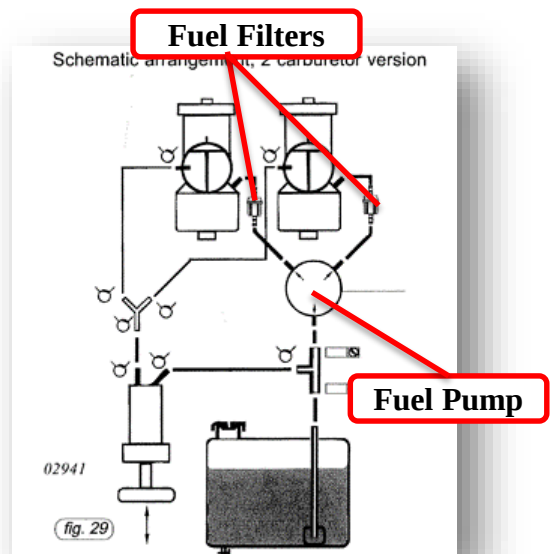
Replace all doubtful fuel line clips with good quality approved ones. Quick release type connectors can cause air leaks, and also produce flow restrictions and possible blockage sites - likewise fuel tap connections and glands. If the fuel tank is below the engine, it is best to leave the fuel tap turned on all the time - use it only in an emergency.

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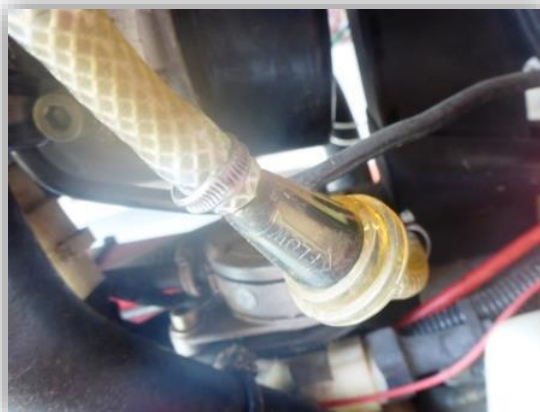
Detailed Inspection

Fuel Lines (Continued) In the Rotax installation manual section 15) Fuel System, page 15-2, it states that "A suitable fuel filter of 0.15mm mesh size must be fitted between fuel pump and the carburetor. No fuel filter was found installed between the fuel pump and Carburetor.

A suitable fuel filter of 0,15 mm mesh size must be fitted between pump and carburetor. Do not use paper filters. The fuel tank must have a drain cock for



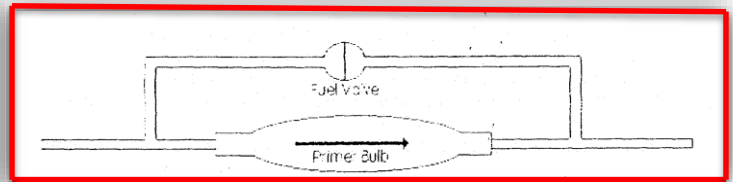
There was only one fuel filter installed on this aircraft (2 are required for dual carburetor set up). The fuel filter was examined for proper type and obstructions. No obstructions were seen. No further anomalies were seen with the fuel filter.



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Fuel Lines (Continued) The fuel system was equipped with a primer bulb between the fuel tank and the fuel pump. Rotax does not state the use of a primer bulb in the Rotax installation manual. Primer bulb check valves can fail causing a blockage of fuel to the engine. It is standard practice and recommended that a by pass system be installed around the primer bulb with the use of a fuel valve as seen in the diagram below.



Lubrication system: The Rotax 582 has an option to have an oil injection pump installed to automatically pre-mix the fuel and oil. This Rotax 582 engine did not have that option installed leaving it up to the operator to pre mix the fuel at a ratio of 50:1. Inspection of the fuel tank and remaining fuel found in carburetor float bowls indicated that the fuel was pre-mixed with oil, as it had a blue tinge to it. It is unknown what the fuel to oil mixture was. No anomalies were found with this system.

Rotary Valve lubrication: The Rotax 582 comes equipped with a separate rotary valve lubrication system. Inspection of this system did not indicate any anomalies and the tank still had evidence of oil contained within it.



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Exhaust System

The exhaust system was examined for condition , modifications and the proper approved type. The exhaust appeared to be in good overall condition and of the proper type. No anomalies found with the exhaust system.



Piston Examination

The exhaust Y pipe was removed to expose the exhaust side of the piston's for seizure and metal transfer marks.



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Piston Examination (PTO – Power take-off side, Piston)

With the exhaust ports exposed the exhaust side of the Power take-off piston could be examined. No metal transfer, vertical scoring or seizure marks were seen on the exhaust side of the Power take-off piston.

The Power take-off piston rings were free in there respective ring land grooves and were in good overall condition. No anomalies were found on the exhaust side of the PTO piston.



Piston Examination (MAG –Magneto side, Piston)

With the exhaust ports exposed, the exhaust side of the MAG piston could be examined. No metal transfer, vertical scoring or seizure marks were seen on the exhaust side of the Power take-off piston.

The MAG piston rings were free in there respective ring land grooves and were in good overall condition. No anomalies were found on the exhaust side of the MAG piston.



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Detailed Inspection

With the exhaust y pipes removed the engine was rotated by hand and continuity was established. Thumb compression was felt though the spark plug holes. From the detailed examination and visual inspection it was determined that a test run was possible.

Preparation for test run: The spark plugs were re-installed in the cylinder heads, the carburetor float bowls were reinstalled onto the carburetors and the exhaust system was reinstalled onto the cylinders.

Due to impact damage, the propeller blades were cut off approximately 6 inches from the propeller hub so it could be turned into a test club and become much safer during test run operation.

The fuel that remained within the fuel tank was sufficient to complete the test run.

This engine was equipped with two starting methods 1: Electric starter, 2: Pull start cord. Due to the damage the aircraft sustained from impact, it was determined that the pull start would be the best method to use to start the engine as the battery and ignition key switch were damaged.

The aircraft was secured with the use of ropes and the fuel system was primed with the use of the primer bulb. Throttle continuity was established with the use of the throttle lever and choke was applied. The primer plunger was activated sending fuel to the intake of the engine.

Test Run: The pull start was pulled several times and the engine started and ran. The engine ran for several seconds, then was manually stopped by limiting the air supply to the carburetors.

A second engine run was done and was recorded by video. The second engine run involved various RPM's along with a steady constant RPM.

The throttle response was quick and a steady RPM was established with ease.

There was no anomalies noted during the engine test run.

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Summary

- There were no records supporting that this engine ever received an overhaul, as required in the Rotax maintenance manual.
- A section of fuel line was not secured with proper connection clamps. This could allow air to be introduced into the fuel system and cause an engine stoppage or failure.
- No fuel line by-pass was found around the primer bulb. If the primer bulb check valve ever became dislodged it could block fuel flow to the carburetors.
- No fuel filter was found installed between the fuel pump and carburetor as required in the Rotax Installation manual.
- Dirty air cleaner was found installed on the engine that could effect the overall performance of the engine.
- Spark plug gaps were beyond the specifications set out in the Rotax maintenance manual.
- Aircraft wing cable cords were found tightly wrapped around the propeller shaft and propeller blades indicating the engine was running at the time of impact.

Conclusion

Other than the above listed installation and maintenance shortfalls, there were no other mechanical anomalies or defects found during the examination and engine test run.

With adequate fuel supply, the engine started and ran with no indication of problems.

Report Completed by: Jordan Paskevich – Rotech Flight Safety – Rotax Aircraft Engines.

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Appendix A



AIRCRAFT ENGINES
MAINTENANCE MANUAL

10.2) Maintenance Schedule

The following maintenance is planned and necessary for ROTAX 447 UL SCDI, 503 UL DCDI, 582 UL DCDI and 582 UL DCDI mod. 99:

	Checks and work	2 h	10 h	12.5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h	chapter	signature
1	Ground run				X												11.1	
2	Level check of liquids	X															11.2	
3	Retorque cylinder head nuts 1)	X															11.3	
4	Retorque exhaust manifold screws 1)	X	X														11.4	
5	Check rew ind starter rope 10)			X													11.5	
6	Check electric starter gear					X		X		X		X		X			11.6	
7	Inspect spark plugs 10)			X													11.7	
8	Replace spark plugs				X	X	X	X	X	X	X	X	X	X	X		11.8	
9	Check ignition system			X													11.9	
10	Check and clean inside spark plug caps 10)			X													11.10	
11	Checking of V- belt tension		X		X	X	X	X	X	X	X	X	X	X	X		11.11	
12	Lubricate ball joints				X	X	X	X	X	X	X	X	X	X	X		11.12	
13	Replace exhaust muffler springs						X			X			X				11.13	
14	Lubricate control cables 3)				X	X	X	X	X	X	X	X	X	X	X		11.14	
15	Check propeller balance and tracking 2,3)				X	X	X	X	X	X	X	X	X	X	X		11.15	
16	Inspect propeller mounting bolts 3)																11.16	
17	Clean and oil air filter				X	X	X	X	X	X	X	X	X	X	X		11.17	
18	Check fuel filter				X	X	X		X	X	X		X	X	X		11.18	
19	Replace fuel filter							X									11.18	
20	Check carburetor(s) and re-adjust (idle speed, cable tension, ...)	X			X		X		X		X		X		X		11.19	
21	Clean carburetor(s) and check for wear					X		X		X		X		X			11.19	
22	Replace jet needle and needle jet								X								11.20	
23	Check fuel pump (measure fuel pressure)						X		X				X				11.21	
24	Check gearbox oil level				X	X	X		X	X	X		X	X	X		11.22	
25	Replace gearbox oil		X					X				X					11.22	
26	Check and adjust gearbox, preload of springs (type B gearbox)							X				X					11.23	
27	Replace rotary valve lubrication oil							X									11.24	
28	Inspect cylinder head and piston crown 4)					X		X		X		X		X			11.25	
29	Inspect piston rings for free movement 5)					X		X		X		X		X			11.26	
30	Check piston diameter 7)					X 6)		X 6)		X		X 6)		X			11.27	
31	Piston ring: check gap 7,11)					X 6)		X 6)		X		X 6)		X			11.28	
32	Piston ring: check axial clearance (rectang. Ring) 8,12)					X 6)		X 6)		X		X 6)		X			11.28	
33	Check cylinder diameter 7,11)					X 6)		X 6)		X		X 6)		X			11.29	
34	Cylinder: check for roundness 7,11)					X 6)		X 6)		X		X 6)		X			11.29	
35	Replace cylinder head-, cylinder base- and exhaust-gasket 8)					X 6)		X 6)		X		X 6)		X			11.30	
36	Inspect piston pin and bearing									X							11.31	
37	Inspect crankshaft and replace outer seals if necessary									X							11.32	
38	General overhaul of engine 9)															X	11.33	
	Checks and work	2 h	10 h	12.5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h		

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- 1) and after every replacement of gasket(s)
- 2) also after any damage
- 3) according to instructions of manufacturer
- 4) if carbon layer is more than 0,5 mm thick, decarbonize
- 5) if piston ring sticks clean and replace if necessary
- 6) if used in very dusty atmosphere
- 7) wear limit see Service Information 5 UL 91
- 8) If cylinder has been dismantled
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