



NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety

Wreckage Examination Report

October 13, 2022

A. ACCIDENT WPR22FA184

Location: Cape Girardeau, Missouri
Date: May 22, 2022
Time: 0803 CDT
Operator: Private
Aircraft: Experimental amateur-built Magni M24 Orion Plus
Registration: N590DM

B. PARTICIPANTS or GROUP NAME:

Stephen Stein National Transportation Safety Board Federal Way, Washington
Shane Benedetto Federal Aviation Administration Little Rock, Arkansas
Jordan Paskevich Rotech Flight Safety Vernon, British Columbia, Canada
Bob Heimberger Independent Consultant St. Louis, Missouri

C. SUMMARY

On May 5, 2022, about 0803 central daylight time, an experimental amateur-built M24 Orion Plus gyroplane, N590DM, was substantially damaged when it was involved in an accident near Cape Girardeau, Missouri. The private pilot was fatally injured. The gyroplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

A witness reported that the pilot was ferrying the gyroplane to his home in South Dakota on a cross-country flight and had planned a stopover at Cape Girardeau Regional Airport (CGI). According to preliminary air traffic control (ATC) audio, the pilot informed the ATC tower of his intent to taxi to runway 02. After the controller issued taxi instructions, the pilot requested progressive assistance to the departure runway. A tower controller stated that the pilot departed runway 02 to the northwest. During the gyroplane's climbout, the pilot informed the controller that he wanted to return to the airport and the controller cleared him to land on runway 02. Witnesses stated that the gyroplane made a left turn towards the downwind leg of the airport traffic pattern for runway 02. About this time a witness heard a "crack" coming from the direction of the gyroplane. The same witness immediately observed the gyroplane descend rapidly towards the ground. The controller reported that the gyroplane appeared to enter a spin during the descent. Witnesses estimated that the gyroplane was between 750 ft and 1,000 ft above ground level when the rapid descent began.

The gyroplane impacted a wetland about 1,000 ft west of the departure end of runway 10 at a field elevation of about 330 ft mean sea level. All major structures were accounted for at the accident site. The main wreckage, comprised of the fuselage, rotor, engine, and empennage, was oriented on a northwest heading. A section of the right horizontal stabilizer had separated from the main wreckage and was located 171 ft southwest of the main wreckage. The engine was partially submerged in mud and two propeller blades appeared above the surface; both separated about midspan. Both rotor blades were intact and attached at the rotor hub. The blades exhibited similar impact signatures about 3 ft from the outboard ends and black transfer markings about 3 ft from the hub of each blade. One blade displayed blue transfer markings on the bottom of the blade about 3 ft from the outboard end.



Photograph 1: Accident site

D. DETAILS OF THE INVESTIGATION

The airplane was recovered to Dawson's Aircraft in Clinton, Arkansas where an examination was completed on October 12-13, 2022. The wreckage examination included an inspection of the engine, rudder control system and a portion of the cyclic control system that could not be observed during the onscene examination as the gyroplane was partially submerged in wetland terrain.



Photograph 2: Airplane prior to wreckage examination

D.1 Airframe Examination

D.1.1 Flight Controls

Cyclic System

The following is an excerpt from the National Transportation Safety Board Onscene Examination Report “Flight Controls” section:

“Both multifunction grips remained attached to their respective cyclic controls, which were connected to the torsion rod beneath the center console through the pilot and co-pilot sticks. All hardware was noted as secure. The controls were seized. The aft end of the torsion rod and the control fork could not be observed due to the orientation of the wreckage at the accident site. Both the left and right lower control rods were intact. The lower left control rod was continuous to the rotor head through the upper control rod and idler arm. The lower right control rod was continuous to the idler arm and the upper control rod was separated about midspan. However, the top half of the upper right control rod remained attached at the rotor head.”

The lower right and left control rods were secure at their corresponding control forks with their securing hardware in place. The damage to the right upper control rod was consistent with overload separation.

Rudder

The following is an excerpt from the National Transportation Safety Board Onscene Examination Report “Flight Controls” section:

“The left and right rudder pedals remained attached to the fuselage at both the pilot and co-pilot seats. Both the pilot and co-pilot rudder control link rods were intact and connected to the pulley at the main structure. The rudder cables were continuous to the middle of the cockpit beneath the center console. The cables could not be traced to the rudder control surface due to the orientation of the wreckage. Rudder control authority could not be achieved as the rudder cables were taught and seized. The rudder displayed minor deflection when actuated by hand.”

The rudder cables were continuous from the cockpit to the rudder pivot at the base of the vertical stabilizer. All the securing hardware was in place at the rudder pivot. Both the right and left cables were taught with the left cable hung above a bolt attached to the main structure. After the left rudder cable was released from the bolt using a pry bar both the right and left cables exhibited similar tension.



Photograph 3: Left rudder cable hung on main structure bolt

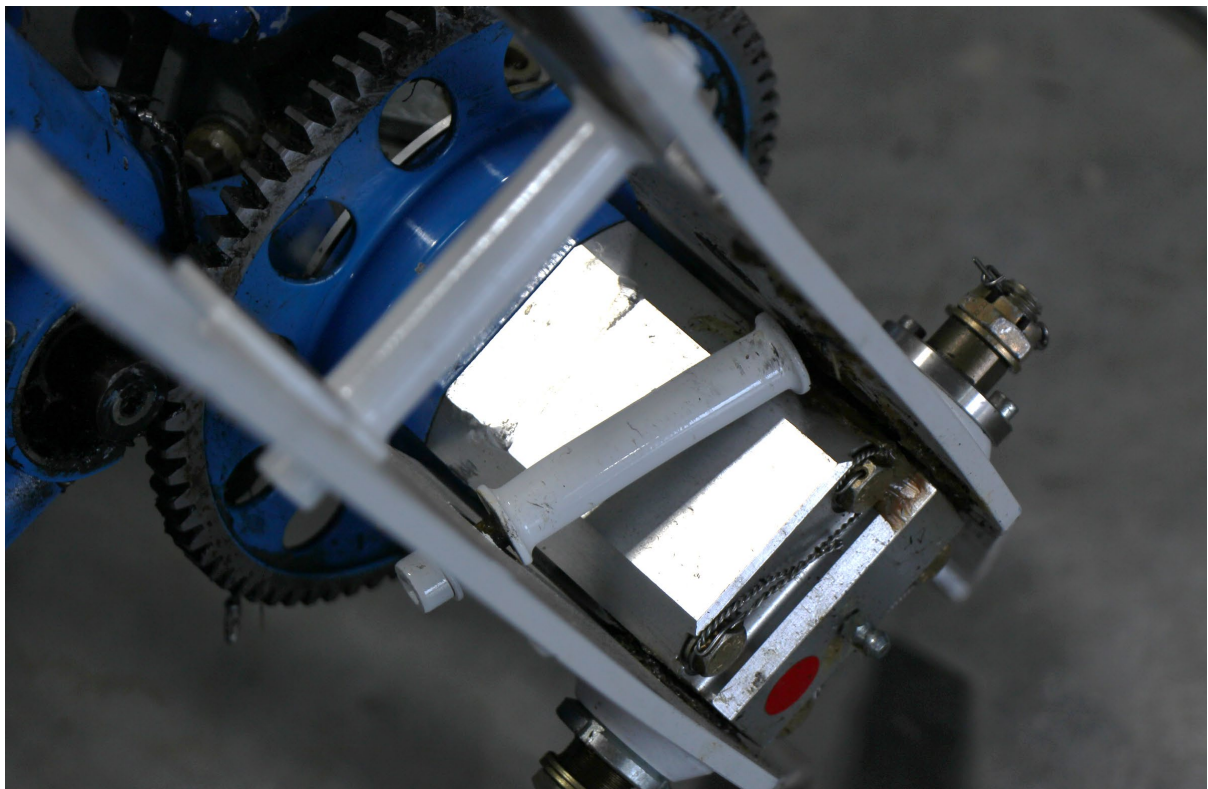
D.1.2 Rotor

The rotor hub bar fairing was removed by recovery personnel during the recovery process, along with the rotor blades. The hub bar was intact and remained attached to the rotor head and notched gear. The blade 1 teetering stop displayed a partial bend and one of the securing bolts had separated at the hub bar. Smooth and continuous movement of the hub bar was achieved when the bar was rotated by hand. The hub block was removed, which exposed a set of lubricated bearings.

The prerotator shaft was continuous from the engine prerotation assembly to the Bendix block. The upper part of the Bendix block, a spur gear was unremarkable in appearance. The prerotator notched gear was bent and the rotor brake cable bracket below it had separated. The rotor brake cable exhibited a gouge mark and the housing was damaged at the bracket location.



Photograph 4: Hub bar and rotor hub



Photograph 5: Blade 1 teetering stop at hub bar



Photograph 6: Upper Bendix part

D.2 Engine Examination

The gyroplane was equipped with a Rotax Engines 915 is2A (s/n 9133597), a water cooled, 141 hp, reciprocating engine. The engine was separated from the airframe at the engine mounts using a reciprocating saw and the oil and fuel lines were separated using hand tools.



Photograph 7: Engine prior to examination

Mechanical continuity was established throughout the rotating group, valve train and accessory section as the crankshaft was manually rotated at the propeller by hand. Thumb compression was achieved at all four cylinders and the valves displayed normal lift when the crankshaft was rotated. Examination of the cylinders combustion chamber interior components using a lighted borescope revealed normal piston face and valve signatures, and no indications of catastrophic engine failure. The valves were intact and did not display any eyebrow marks on the piston tops.

The ignition harness wires were secure at the top and bottom spark plugs. The spark plugs were Rotax BRP 29656 fine wire plugs and all displayed coloration consistent with normal wear. The electrodes were undamaged.



Photograph 8: Top spark plugs

The fuel servo was attached to the mounting pad of the plenum. The throttle control was continuous from the cockpit and remained attached to its respective control arm at the throttle body, which was partially separated from the induction airbox. Throttle arm movement was limited to the fully closed position and a few degrees in the open position due to the orientation of the throttle body. Full movement of the throttle arm was achieved once the throttle body was removed and an inspection of the butterfly valve was unremarkable.

The oil filter was free of debris and the magnetic plug captured some metallic fragments within accepted limits.

The fuel injector assemblies remained attached at their respective mounts, but could not be inspected for obstructions without a functional test.

The turbo charger fan, hot section, and exhaust were attached as a unit and were mounted to the engine case. The turbo filter was free of obstructions. The turbo charger fan had seized, but rotated freely after force was applied. No evidence of rotational deformation or scoring marks were observed on the turbo fan case or the hot section case. The exhaust manifold was unremarkable.

The four bladed ground adjustable propeller remained attached at the crankshaft flange. All four blades were separated about midspan and remained attached to the hub.