

National Transportation Safety Board

Office of Aviation Safety
Central Region



CEN21FA304

WRECKAGE EXAMINATION SUMMARY

ACCIDENT

Location: Killeen, Texas
Date: July 4, 2021
Time: 1722 central daylight time (2222 UTC)
Airplane: Focke-Wulf FWP-149D, Registration No. N9145

PARTICIPANTS

Investigator-In-Charge	Andrew Todd Fox National Transportation Safety Board Denver, Colorado
Group Member	Cliff Carpenter Federal Aviation Administration - San Antonio FSDO San Antonio, Texas
Group Member	Mark W. Platt Lycoming Engines Williamsport, Pennsylvania

ACCIDENT SYNOPSIS

On July 4, 2021, about 1722 central daylight time, a Focke-Wulf FWP-149D airplane, N9145, was destroyed when it was involved in an accident near Killeen, Texas. The pilot was fatally injured. The experimental exhibition airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

WRECKAGE EXAMINATION TIMELINE

On July 5, 2021, National Transportation Safety Board (NTSB) Investigator Fox documented the accident site and wreckage with the assistance of a Federal Aviation Administration (FAA) inspector before it was recovered to a secure hangar at the Skylark Field Airport, Killeen, Texas. On July 6-7, 2021, the engine was examined and disassembled with the assistance of a FAA Inspector and a Lycoming Engines investigator. The wreckage was subsequently relocated to Air Salvage of Dallas, Lancaster, Texas, where it was stored until the NTSB released the wreckage on October 6, 2022, to an individual representing the insurance company.

AIRPLANE DESCRIPTION

The airplane was a 1960 Focke-Wulf FWP-149D, serial number (s/n) 167, registration number N9145, as shown in figure 1. The BMW GO-480-B1A6 reciprocating engine, s/n B-188, was equipped with a carburetor and rated at 270 horsepower at 3,400 rpm. The engine provided thrust through a three-blade, constant speed, Piaggio Propeller P1033/G4-DA/EPA-MT-306334/A propeller, s/n 6/5266. The low-wing airplane was of conventional aluminum construction with a retractable tricycle landing gear and wing flaps. The airplane's empty and maximum takeoff weights were 2,630 lbs and 4,004 lbs, respectively. The airplane's total fuel capacity of 62.4 gallons (60.8 gallons usable) was supplied to the engine from four tanks, consisting of two interconnected fuel tanks in each wing. In addition to a main fuel shutoff valve, the airplane was equipped with a fuel tank selector valve that allowed the pilot to select fuel from the left-wing, right-wing, or both left-and-right-wings simultaneously.

The German-built Focke-Wulf FWP-149D airplane was used as a military trainer and was not type-certificated by the Federal Aviation Administration (FAA). The Lycoming GO-480-B1A6 engine model was originally designed, certified, and produced by Avco Lycoming, Williamsport, Pennsylvania. Beginning in 1957, the Lycoming GO-480-B1A6 engine was built under license by BMW Triebwerkbau G.m.b.H for use in German-built airplanes. On February 16, 1961, BMW Triebwerkbau G.m.b.H. received ownership of FAA type-certificate 7E1 for the Lycoming GO-480-B1A6 engine.



Figure 1 - Photo of airplane
(provided by pilot's family)

HISTORY OF OPERATION

A review of available maintenance documentation revealed that the airplane was imported into the United States during 1994 with an airframe total time (AFTT) and engine time since overhaul (TSOH) of 1,944 hours and 903 hours, respectively. The airplane was reassembled and issued a FAA experimental exhibition class airworthiness certificate and associated operating limitations on July 20, 1994, with US-registration number N660BC.

During 2001, the airplane was exported to Canada where the airframe and engine were refurbished and overhauled, respectively. On May 10, 2001, the AFTT and engine TSOH were 1,957 hours and 0.0 hours, respectively. The airplane was registered with a Canadian registration number, C-FWOL, while it operated in Canada between May 2001 and August 2019.

In August 2017, the propeller sustained minor damage when it impacted a towbar during taxi. At that time, the AFTT, engine TSOH, and propeller TSOH were 2,401.6 hours, 444.5 hours, and 39.8 hours respectively. The engine and propeller were removed from the airplane for inspection. On March 21, 2018, the propeller was overhauled. On April 17, 2018, the engine was disassembled, inspected for damage, and reassembled. On June 7, 2018, the engine and propeller were reinstalled on the airplane. On June 15, 2018, the airplane returned to service after a test flight.

On August 31, 2019, the airplane returned to the United States and was subsequently issued a FAA experimental exhibition class airworthiness certificate and associated operating limitations on September 23, 2019, with US-registration number N9145. At that time, the AFTT and TSOH were 2,454.6 hours and 497.5 hours, respectively. The airplane continued to operate in the United States as an experimental airplane until the accident.

MAINTENANCE SUMMARY

Condition/100-hour Inspection

According to maintenance documentation, the airplane's last condition and 100-hour inspections were completed on September 8, 2020. At that time, the AFTT and engine TSOH were 2,512.8 hours and 557.7 hours, respectively.

Recent Maintenance

On October 24, 2020, the pilot annotated his flight logbook that the "chip light came on" during the flight. A review of available maintenance documentation did not reveal any associated maintenance at that time.

On April 6, 2021, the engine oil was changed and the original "coffee-can" oil cooler was replaced with a 6-row oil cooler assembly, part number (p/n) 8406R. At that time, the AFTT and engine TSOH were 2,541.5 hours and 586.4 hours, respectively.

According to the pilot's flight logbook, on June 19, 2021, he annotated that the chip light illuminated again and that there was an unspecified magneto issue. On June 21, 2021, the pilot relocated the airplane from his homebase at Skylark Field Airport (ILE), Killeen, Texas, to Draughon-Miller Central Texas Regional Airport (TPL), Temple, Texas, where his aviation mechanic was based.

According to a mechanic statement, maintenance invoices, and a logbook entry, the mechanic inspected the ignition system and determined the right magneto required repair. The right magneto was removed from the engine and repaired by an overhaul shop on June 29, 2021. Additional maintenance tasks at that time included changing the engine oil, repairing the oil filler neck, and installing new gaskets for the propeller governor and its adapter plate. On July 2, 2021, the mechanic installed the repaired right magneto and completed an engine runup.

The mechanic reported that during the engine run the amber-colored "chip detector" warning light in the cockpit's instrument panel illuminated. He shut down the engine, drained the engine oil into a clean bucket, and followed the wiring associated with the "chip detector" warning light to the oil filtration system housing. Disassembly of the oil filtration device revealed metal contamination inside the filter housing and on the filtration screen.

The mechanic showed the pilot the metal contamination that he found in the oil filtration device. With the pilot present, the mechanic ran a magnet over the screen and determined that the metal contamination did not stick to the magnet. The mechanic and pilot agreed that the metal contamination needed to be sent to a laboratory for additional analysis.

The pilot told the mechanic that he still intended to fly the airplane back to ILE. The mechanic told the pilot that they needed to determine the source of the metal contamination before the pilot flew any trips in the airplane.

The mechanic collected samples before he cleaned the filtration housing, filter screen, and bypass switch. He added new oil to the engine and performed another engine run, during which the "chip light" did not illuminate. Additional information about the airplane's engine oil filtration system and its associated warning light is discussed at the end of this examination summary.

According to last maintenance logbook entry, dated July 2, 2021, the AFTT and engine TSOH were 2,577.7 hours and 620.6 hours, respectively.

Flight History Following Recent Maintenance

On July 3, 2021, the pilot returned to TPL to reposition the airplane back to ILE. The mechanic stated that the pilot completed an engine runup before he departed. The mechanic stated that he believed the airplane was going to remain at ILE until the laboratory results were returned concerning the metal contamination found in the oil filter screen. According to the pilot's flight logbook, on July 3, 2021, the repositioning flight from TPL to ILE was 0.2 hours in duration.

According to FAA ADS-B track data, on July 4, 2021, the pilot flew the airplane from ILE to New Braunfels National Airport (BAZ), New Braunfels, Texas. The airplane was airborne about 0.8 hours during the non-stop flight. After landing at BAZ, the airplane was featured in a static-display of aircraft in conjunction with the airport's Forth-of-July airshow. The accident occurred during the pilot's return flight to ILE after the airshow. The airplane was airborne about 0.8 hours during the accident flight.

The airplane's tachometer was destroyed during the postaccident fire and, as such, the airplane's AFTT and engine TSOH at the time of the accident were calculated using the last maintenance logbook entry, the pilot's online flight logbook, and ADS-B track data. Based on available information, the pilot operated the airplane at least 1.8 hours following the last maintenance that was completed on July 2, 2021.

Based on available information, at the time of the accident, the AFTT and engine TSOH were 2,579.5 hours and 622.4 hours, respectively.

WRECKAGE EXAMINATION (JULY 5-7, 2021)

Accident Site and Main Wreckage

The main wreckage was in a level grass field with several grouping of trees, as shown in figure 2, about 0.2 miles south-southwest of the intersection of East Stagecoach Road and East Trimmier Road, in Killeen, Texas.

The main wreckage was located about 2.2 miles south-southwest of the runway 1 displaced threshold at Skylark Field Airport (ILE), Killeen, Texas, as shown in figure 3, and about 0.5 mile north of the final ADS-B track point, as shown in figure 4.

The initial impact location was 31.051111° north latitude, 97.701944° west longitude, at 774 ft mean sea level (msl). The main wreckage location was 31.051389° north latitude, 97.702222° west longitude, at 775 ft mean sea level (msl).



Figure 2 - Accident site overview

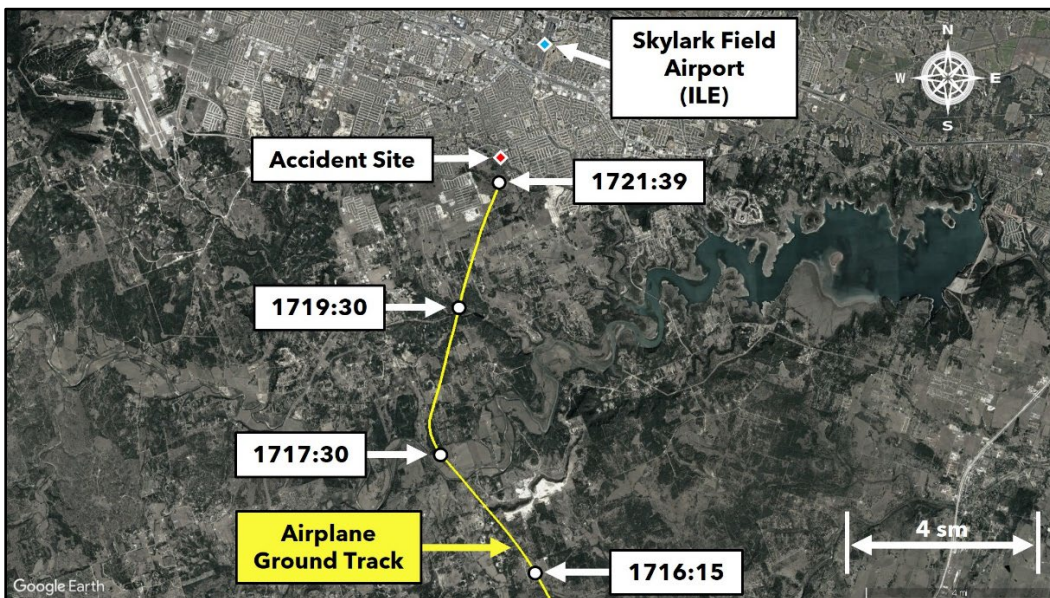


Figure 3 - Airplane's ground track, intended destination, and accident location

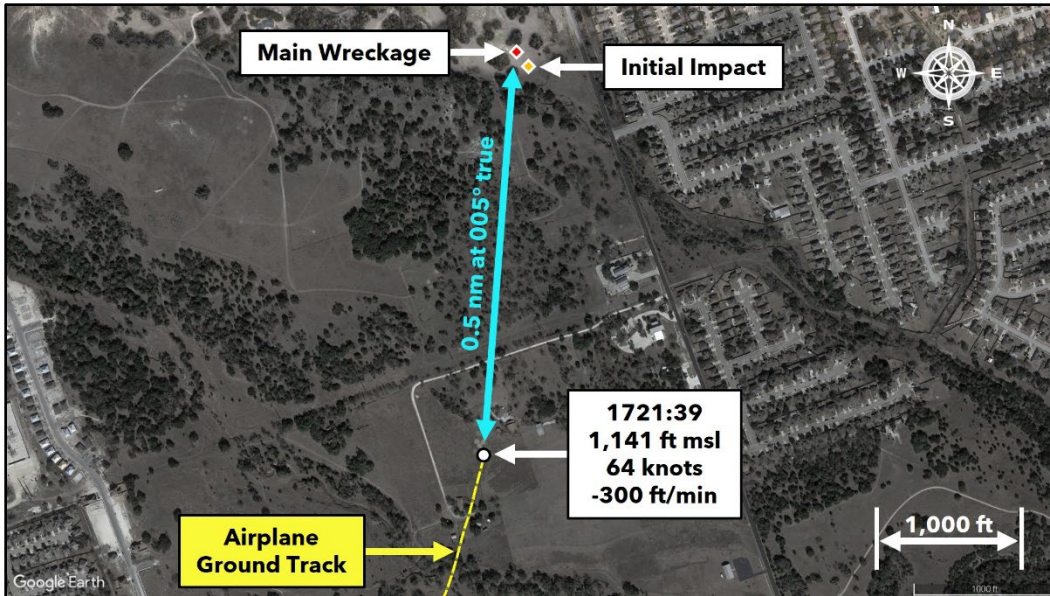


Figure 4 - Airplane's ground track, initial impact point, and main wreckage location

The airplane's initial impact point was a ground scar containing fragments of red navigation light lens material, as shown in figure 5, consistent with the airplane in a left-wing-low attitude at impact. The wreckage debris path was oriented on a 319° true heading and measured about 135 ft long.



Figure 5 - Initial impact point with red navigation lens material from left wingtip

The main wreckage consisted of the cabin and cockpit, right wing, aft fuselage, engine, and propeller, as shown in figure 6. The main cabin and cockpit were destroyed by impact forces and the postimpact fire, as shown in figure 7. The aft fuselage with empennage separated from the remaining fuselage and was resting inverted in front of the cabin, as shown in figure 8 and figure 9. The nose landing gear was found retracted inside the engine compartment. The right wing remained intact, as shown in figure 10, and the right main landing gear and right flap were found retracted. The left wing was found in multiple sections, and the inboard half of the wing was destroyed by impact and fire damage, as shown in figure 11. The left main landing gear was found in the extended position, as shown in figure 12. The left aileron and left wingtip separated from the wing, as shown in figure 13 and figure 14.

All structural components and flight control surfaces were located at the accident site. All observed structural damage to the airplane was consistent with ground impact.

Flight control continuity could not be established due to extensive damage; however, all observed flight control separations were consistent with ground impact, fire related damage, or were cut to facilitate recovery of the wreckage.



Figure 6 - Main wreckage at the accident site



Figure 7 - Cabin, cockpit, and instrument panel



Figure 8 - Main wreckage, aft fuselage, and empennage



Figure 9 - Aft fuselage and empennage



Figure 10 - Right wing, right aileron, and right flap



Figure 11 - Left wing and cabin



Figure 12 - Left wing spar, left flap, and left main landing gear



Figure 13 - Left and right wings after recovery from accident site



Figure 14 - Left and right wings after recovery from accident site

Engine Examination and Disassembly

The engine remained attached to the fuselage through the engine mounts, as shown in figure 15. The engine had sustained significant thermal damage at the rear section encompassing the engine driven accessories, wiring, plumbing, and firewall. The propeller hub and two propeller blades remained attached to the engine, as shown in figure 16. The third propeller blade, as shown in figure 17, separated from the hub during impact and was recovered from an impact crater along the wreckage debris path. The propeller blades were relatively straight and did not exhibit damage typically observed with the absorption of rotational energy at impact.

The engine could not be rotated through the reduction gearbox using the attached propeller. Disassembly of the engine revealed the Nos. 3 and 4 connecting rods separated from their respective crankshaft journals. The No. 3 and No. 4 connecting rod beams were bent, twisted, and deformed. There was significant damage to the internal cavities of the engine crankcase, particularly along the rotational plane of the Nos. 3 and 4 connecting rods and associated rotating crankshaft components, as shown in figure 18 and figure 19.



Figure 15 - Engine after recovery from accident site



Figure 16 - Propeller at accident site



Figure 17 - Propeller after recovery from accident site

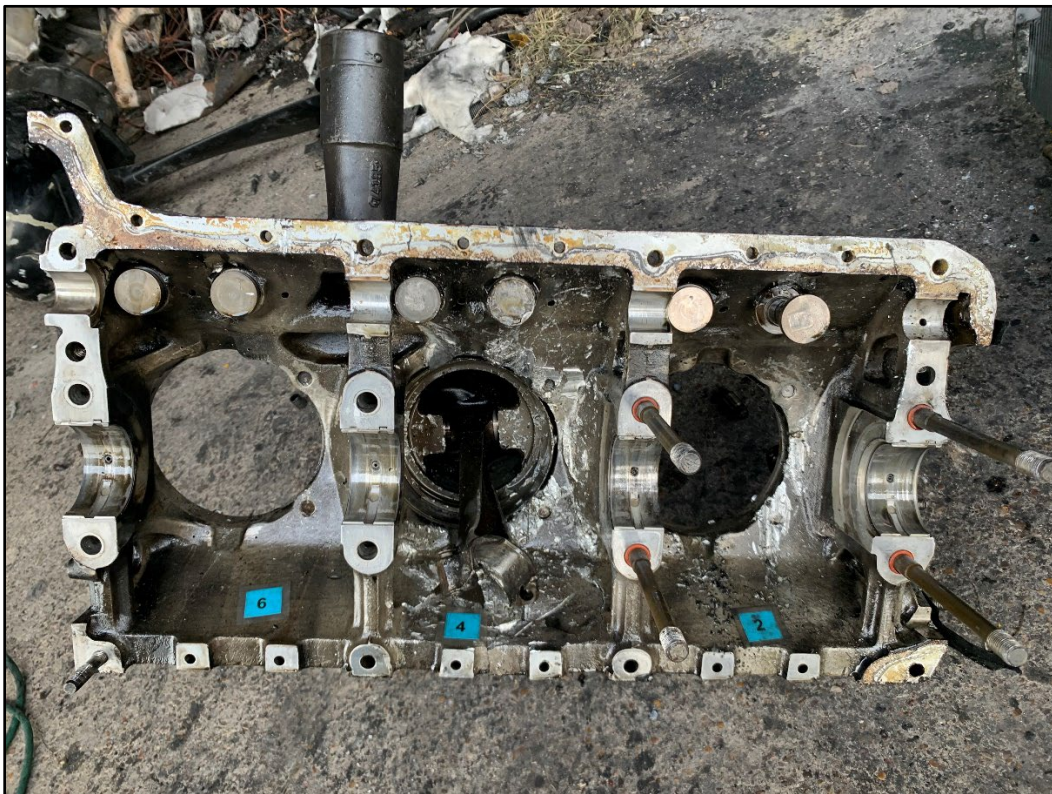


Figure 18 - Crankcase (left side)

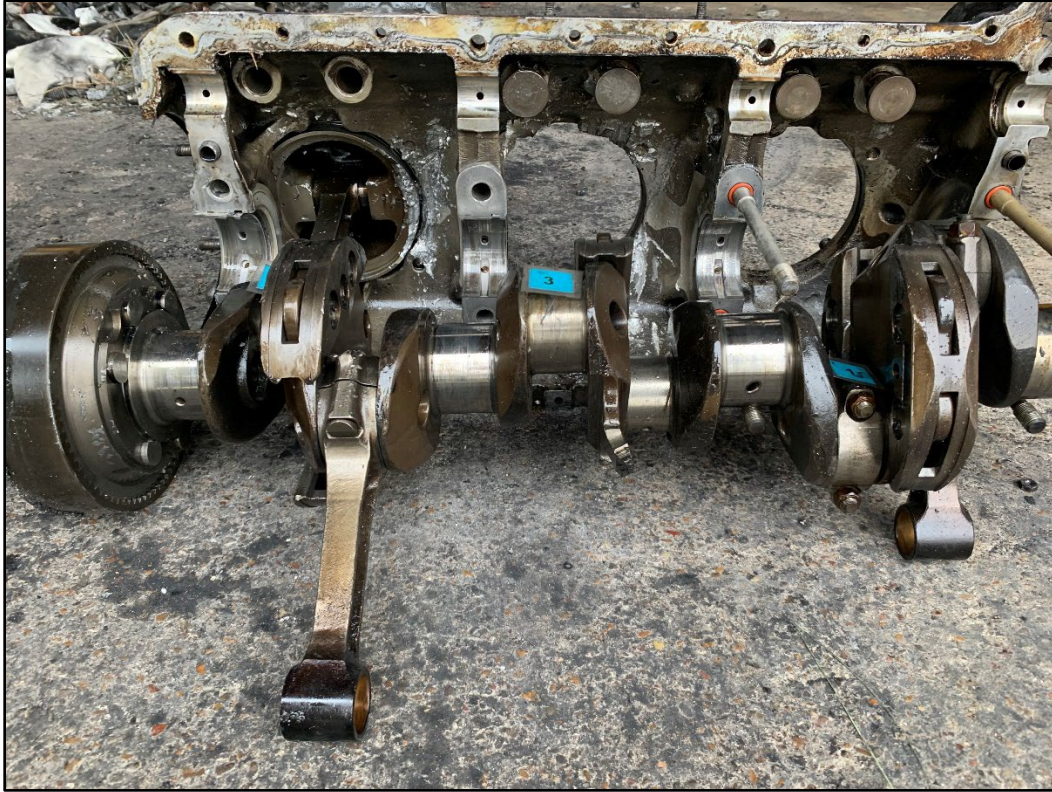


Figure 19 - Crankshaft and crankcase (right side)

There was no evidence of heat distress or a lack of lubrication to the internal engine drivetrain components. The cylinder combustion chambers remained mechanically undamaged, with no evidence of foreign object ingestion or detonation. The propeller reduction gearbox remained intact and free of impact energy damage, and the internal gear assemblies remained free of damage, lubrication deprivation or heat distress signatures. The oil sump exhibited thermal damage that included a large hole, as shown in figure 20 and figure 21.

One of the two crankshaft dynamic counterweights separated from its respective crankshaft counterweight mounting lobe at position No. 3. The crankshaft counterweight mounting lobe at position No. 3 exhibited elongated bores and a tearing/bending appearance, as shown in figure 22 and figure 23.

Several fractured metal items were recovered from inside the crankcase, cylinders Nos. 3 and 4, and the oil sump. The recovered items included pieces of connecting caps, bolts, nuts, bearings, counterweights, counterweight mounting lobes, rollers, bushings, snap rings, and washers, as shown in figure 24. The recovered counterweight rollers, p/n 69433, exhibited fretting/galling signatures at the center bushing (crankshaft) surfaces.

The recovered metal items were submitted to the National Transportation Safety Board (NTSB) Materials Laboratory for additional examination.

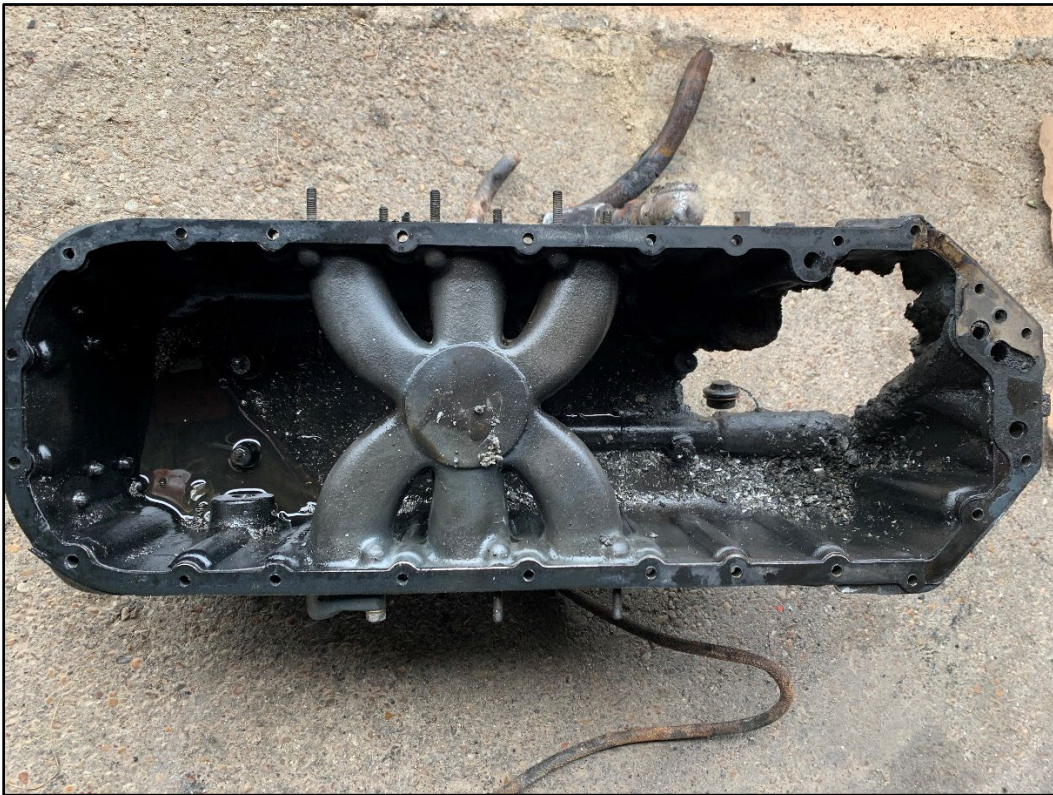


Figure 20 - Engine oil sump



Figure 21 - Metal contamination found in the engine oil sump

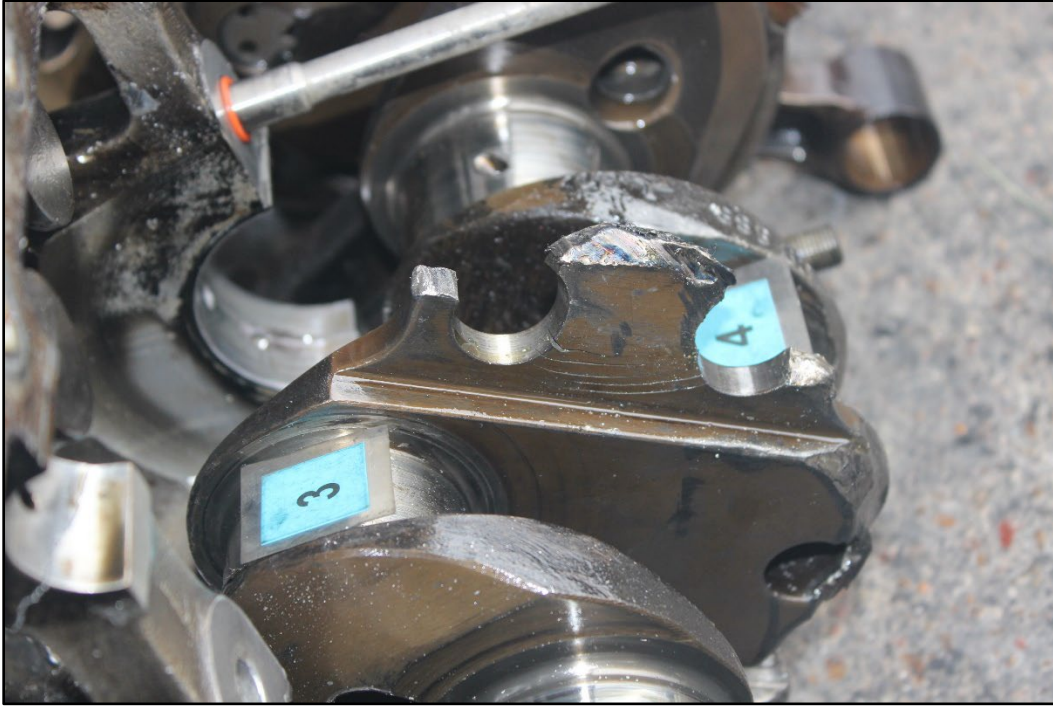


Figure 22 - Crankshaft counterweight mounting lobe at position No. 3
(Lycoming Photo)

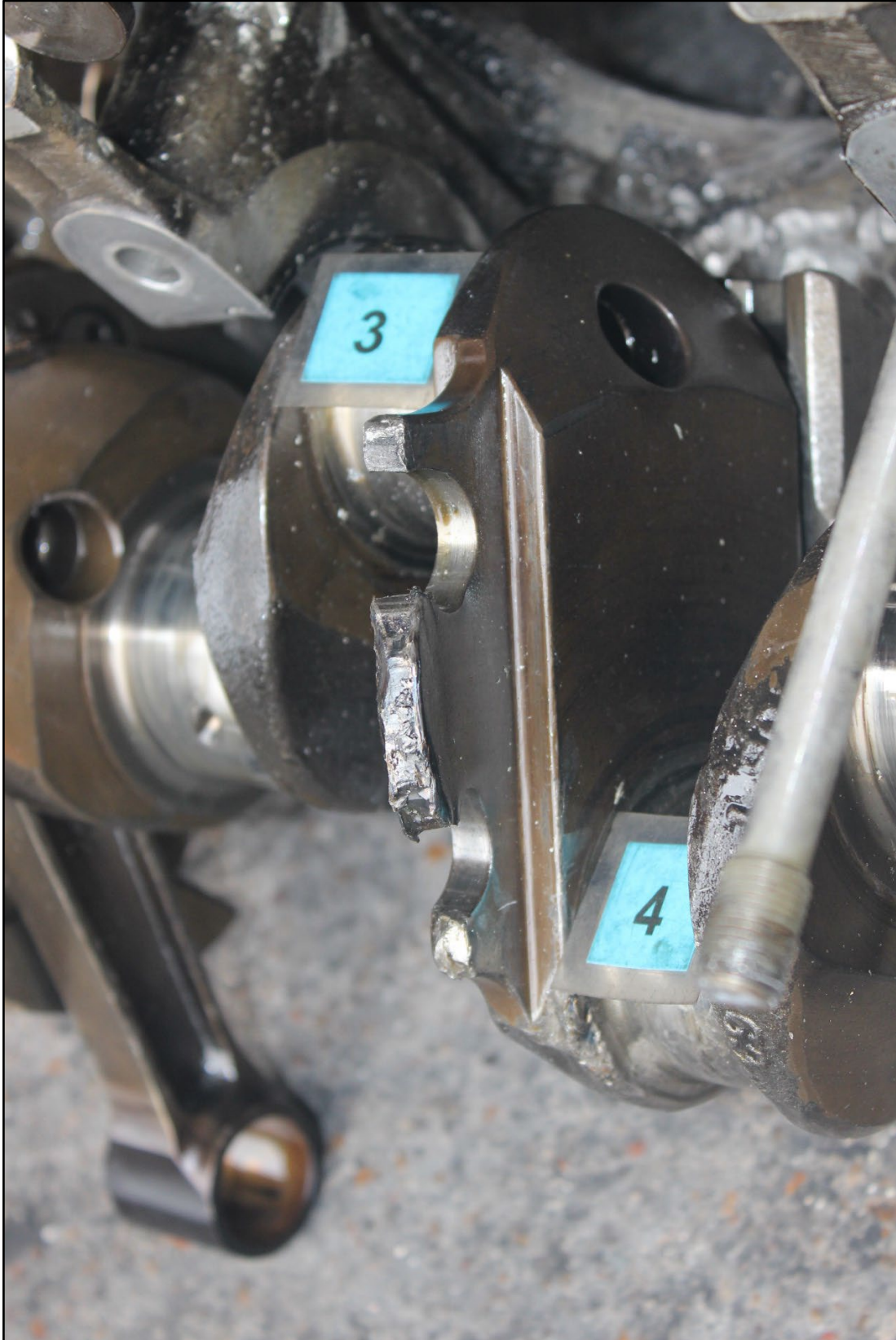


Figure 23 - Crankshaft counterweight mounting lobe at position No. 3
(Lycoming Photo)



Figure 24 - Metal items recovered from inside engine during the examination

The magnetos remained secured to their respective mounting pad and exhibited varying degrees of thermal damage from the postimpact fire, as shown in figure 25. Neither magneto could be functioned tested due to damage. Magneto-to-engine timing could not be ascertained. The ignition harness remained attached to the magnetos and each spark plug, and exhibited significant thermal damage from the postimpact fire.

The spark plugs remained installed at each cylinder with their respective spark plug lead attached. The top spark plugs electrodes appeared mechanically undamaged and according to the Champion Spark Plugs "Check-A-Plug" Chart AV-27, and their electrodes displayed coloration consistent with normal operation, as shown in figure 26. Several spark plugs exhibited static oil soaking that was attributed to the engine positioning at the mishap site and post recovery.

The various fuel supply lines at the engine and firewall exhibited impact and thermal damage; the fuel system was compromised, and no fuel observed. The carburetor was displaced from the engine due to the forces of impact. The throttle/mixture controls were found securely attached at their respective control arms of the carburetor.



Figure 25 - Magnetos



Figure 26 - Top spark plugs

Engine Oil Filtration System

The airplane was equipped with an Aviation Development Corporation (ADC) oil filtration system, p/n 600010-1, as shown in figure 27 and figure 28. A review of product literature revealed that the oil filtration system was equipped with a ball-and-spring "bypass" switch, which when wired to a cockpit warning light offers a visual indication of when the filtration system is bypassing engine oil instead of flowing through the filter screen.

A separate magnetic chip detector was offered as an optional feature for the oil filtration system; however, postaccident examination of the oil filtration system confirmed that the optional chip detector was not installed. As such, the amber warning light installed in the instrument panel was mislabeled "chip detector", as shown in figure 29. The light was a visual indication that the oil filtration system was restricted and, as result, operating in bypass.

The contamination collected from the oil filtration system by the mechanic on July 2, 2021, as shown in figure 30, was submitted to the NTSB Materials Laboratory for identification.



Figure 27 - Engine oil filtration assembly, p/n 600010-1



Figure 28 - Engine oil filtration assembly disassembled

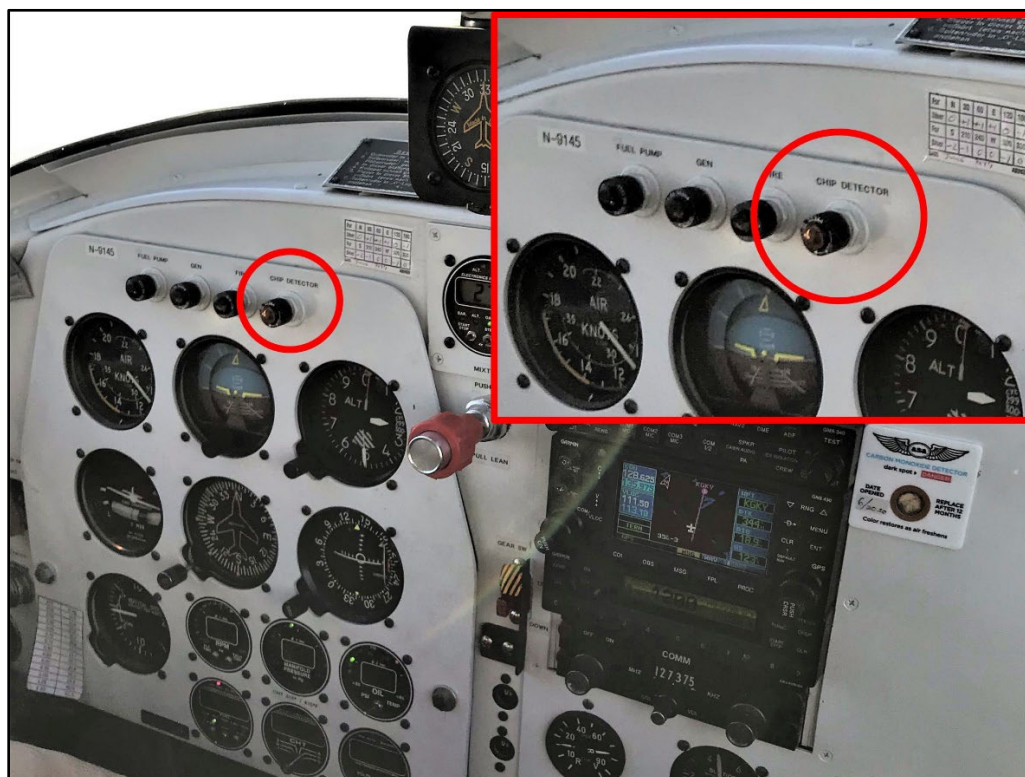


Figure 29 - Instrument panel warning light mislabeled “chip detector” (original photo provided by pilot’s family; cropped and annotated by NTSB)



Figure 30 - Contamination collected from oil filtration screen 2 days before accident