NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

April 14, 2020

ENGINE EXAMINATION

WPR20FA057

This document contains 2 embedded photos.

A. ACCIDENT

Location:	Santa Clarita, CA
Date:	January 4, 2020
Aircraft:	N151WR Amateur built experimental TM-1 Thunder Mustang
NTSB IIC:	Albert Nixon

B. EXAMINATION PARTICIPANTS:

Albert Nixon (Virtual)
Senior Aviation Accident Investigator
National Transportation Safety Board
Federal Way, WA 98003

C. SUMMARY

Examination of the recovered engine was conducted on April 14, 2020, at the facilities of Air Transport, in Phoenix, Arizona, by a certified airframe and powerplant mechanic, under the oversight of the NTSB investigator-in-charge. The examination of the engine revealed evidence consistent with engine detonation. No additional mechanical anomalies or malfunctions not associated with the engine detonation were observed that would have precluded preimpact normal operation.

D. DETAILS OF THE INVESTIGATION

1.0 Engine Examination

Examination revealed that the Falconer V-12 engine had separated from the fuselage. All the engine components and accessories were present and remained attached to the airframe. The engine appeared intact, with impact damage noted on the engine mount support tubes on the right side of the engine. No rotation of the crankshaft was able to be accomplished due to the impact and thermal damage sustained by the engine. A borescope inspection of the cylinders revealed evidence of that the 6 right side cylinders had relatively normal operating conditions, however, on the left side of the engine, The Nos. 1, 3, and 5 cylinders were nearly black in color.

The intake manifold, valve cover, and intake plenum were removed from the engine. The exhaust valve push rod for the No. 5 cylinder was not secured and observed lying inside the engine consistent with improper installation. The left side head assembly was removed and revealed that the Nos. 1, 3, and 5 cylinders head attachment areas each had metal deformation consistent with an internal combustion gas leak. The No. 1 cylinder had metal deformation

through a coolant passageway and the crankcase, and about a 1 cm wide by 3 ml deep hole was observed. Additionally, discoloration and metal deformation near the hole was consistent with extreme hot gasses. On the Nos. 3 and 5 cylinders, the hot combustion gasses had only penetrated into the coolant passageway and had not yet burnt through the crankcase.

All the sparkplugs were removed, and the spark plug electrodes were dark in color and exhibited normal wear signatures when compared to the Champion Check-A-Plug comparison chart, except for cylinders Nos. 1, 3, and 5, (left side), which exhibited black in color and were oily and carbon fouled. The No. 1 cylinder was significantly darker in color that the others. The Nos. 3 and 5 cylinders were dark but not as black as the No. 1 cylinder.

The engine was disassembled and revealed cylinder damage consistent with detonation. The cylinders piston top and cylinder heads were absent of any carbon build up and exhibited a sandblasted appearance consistent with detonation. Further, the cylinders exhibited damage consistent with detonation at the cylinder head and piston face edges. Traces of oil were present in engine and no coolant was observed in the engine. The electronic engine control from the left side was not found in the wreckage.

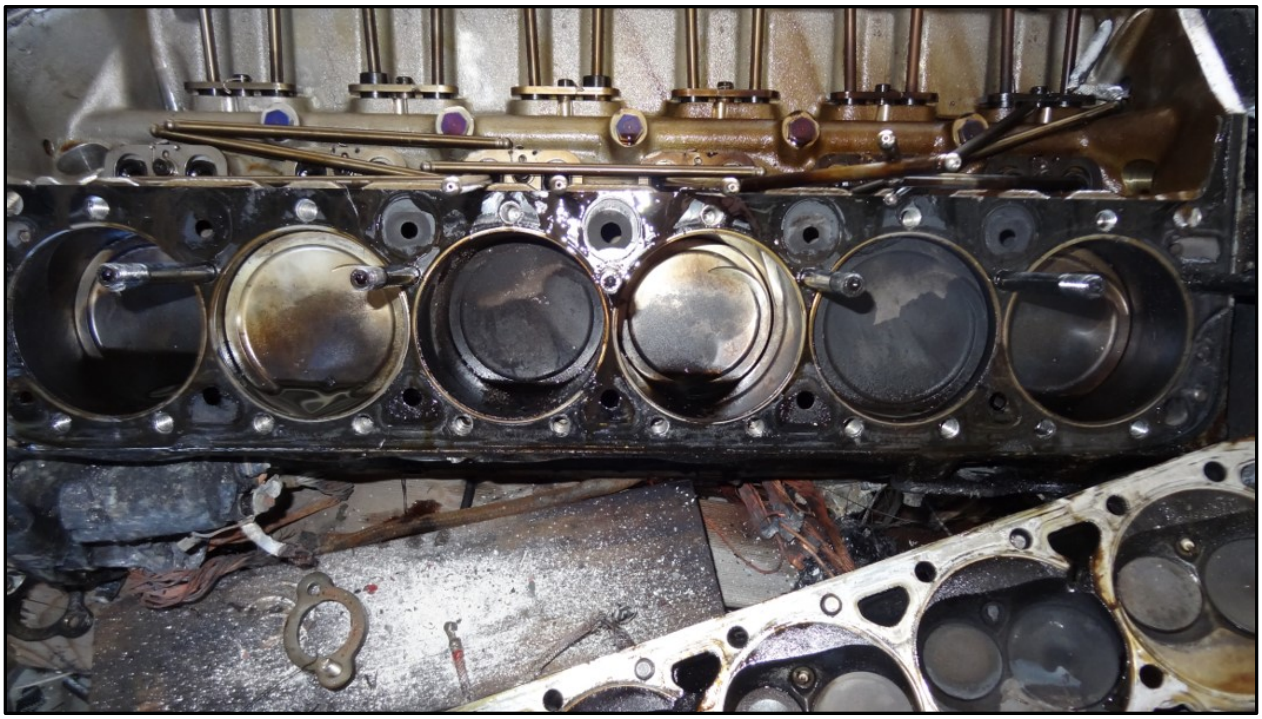

Figure 1: Engine cylinders as observed from the left side.

Figure 2: No. 2 cylinder internal damage.

Figure 3: No. 1 cylinder metal deformation.

fuel manifold was removed, and each fuel injector was examined. The fuel injectors sustained various degrees of thermal damage but no obstruction to flow was notes.

The four-bladed propeller was not attached to the crankshaft propeller flange.

Submitted by: Albert Nixon