



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME EXAMINATION

WPR21LA082

This document contains 60 embedded photos.

A. ACCIDENT

Location: Warm Springs, Oregon
Date: January 9, 2021
Aircraft: Cessna 560, N3RB
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson
Senior Aviation Accident Investigator
National Transportation Safety Board
Western Pacific Regional Office
Los Angeles, CA

Jennifer Barclay
Air Safety Investigator
Textron Aviation
Wichita, KS

Kevin Hanna
Aviation Safety Inspector
FAA FSDO
Scottsdale, AZ

Eugene L Torrisi
Senior Field Support Representative
Pratt and Whitney Canada International
Mesa, AZ

C. SUMMARY

Examination of the airplane was conducted at the facilities of Air Transport, in Phoenix, Arizona from April 13 through April 15, 2021.

All four corners of the airplane along with sections of all control surfaces were recovered in the immediate vicinity of the accident site. The thrust reverser assemblies were found in the stowed position, and both engines displayed damage signatures consistent with operation at impact. The emergency oxygen and environmental control systems were destroyed; however, one mask assembly was located undamaged, and remained within its housing, indicating the emergency oxygen system had not been activated. Fragmentation of the right wing and the long debris field was consistent with a high speed, right wing down collision with the ground. There was no evidence of bird strike, in-flight fire, or door opening.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

General

The airplane sustained significant impact damage, and was heavily fragmented (Photo 1). Immediately recognizable within the debris was the primary left wing spar (Photo 2) and associated skins, two 6-ft-long sections of the aft fuselage and empennage (Photo 3,4) and a section of the front left cockpit wall (Photo 5). All “four corners” and sections of primary flight controls were located. Fragmentation of the right wing and the long debris field was consistent with a high speed, right wing down collision with the ground. There was no evidence of bird strike.

Cabin Doors

The left main cabin entrance door was fragmented into multiple pieces. Associated sections of the door frame were located and similarly fragmented. The door window was intact. The circular lock pins on the left side of the door were in the extended position, and there was no damage to their corresponding lock holes on the cabin frame (Photo 6). The lower left circular pin sustained damage its associated frame hardware and was noted within the door frame (Photo 7). Two of the four square lock pins (one from the top, one from the bottom) around the door were located and appeared extended and their cabin corresponding lock holes were undamaged.

Electrical

The entire electrical system sustained extensive fragmentation to all electrical instruments (Photo 8). The wire looms were tangled within airframe components. A section of the wire loom adjacent to the front left cockpit circuit breaker panel sustained thermal damage (Photo 9). Examination of the wires did not reveal any indication globular metal or other features consistent with electrical arcing, and the back side of the circuit breaker panel sustained minimal thermal damage (Photo 10). The inner surface of the left cockpit panel sustained thermal damage in the area of the circuit breaker panel and left window (Photo 11). On the outside of the panel, there was smoke damage, but no evidence of smoke trails in the direction of flight airflow, or any other similar indication of in-flight fire (Photo 5).

Emergency Door

Fragments of the emergency egress door and frame were located (Photo 13). The release handle was in place, and the locking pin was in the extended position. (Photo 12)

Pilot seat

The pilot (left) seat had separated from the airframe. The left and right lower belts remained attached to the seat (Photo 14). The center belt appeared cut about 16 inches from the tongue. The belt locking mechanism sustained damage, and only the left lower and center belt buckles remained attached.

Empennage

The entire vertical and horizontal stabilizer assembly had detached from the aft fuselage and had fragmented into multiple pieces. The center section of the horizontal stabilizer exhibited leading edge crush damage and aft bending at its tips (Photo 15). The crush damage was about 45 ° in the vertical plane (Photo 16). Most of the fragmented remains of both elevators were recovered, along with one elevator balance weight.

The vertical stabilizer had fragmented into multiple pieces, and the rudder had detached into two pieces, and sustained thermal damage (Photo 17). The rudder balance weight had detached.

Thrust Reversers

Remnant of all four thrust reverser control assemblies were located. Each of their hydraulic servo actuators were in the extended position, which corresponded with the thrust reverser being in the stowed position (Photo 18).

Wings

The left side of the wing center box section had detached from the cabin, was coated in mud, and remained attached to the forward and aft spar of the left wing (Photo 19). The left wing was bent about 10 ° aft at the root intersection (Photo 20). The leading edge of the entire wing (fuel tank) was crushed, had detached into long shards, and exhibited intermittent thermal damage (Photo 21). The wing tip and left position light had detached (Photo 22). The aileron and flap surfaces 1 and 2 had detached from the aft spar and were fragmented (Photo 23).

The right wing was completely fragmented along its entire length (Photo 24). Similar fragmentation of the aileron and both flap surfaces were observed (Photo 25). The right wingtip position light assembly sustained crush damage folding it in on itself. (Photo 26).

Cabin

Complete fragmentation was noted, with only seat remnants, skins, stringers, and fragments remaining.

Landing Gear

The entire left main landing gear trunnion assembly including the wheel had separated (Photo 27) from the airframe mounting points. The right main landing gear assembly had similarly separated in a similar manner, and the wheel hub and oleo strut had detached (Photo 28). The only section of the nose landing gear located was the oleo strut chamber, which appeared to have burst open, and one side of the landing gear fork. (Photo 29)

Flight Controls

All control cables sustained significant fragmentation damage, and were located throughout the wreckage. All push-pull tubes sustained similar fragmentation, except for those of the left wing flap system, located behind the aft spar, which were largely intact (Photo 30, 31).

Fragmented remnants of both control columns, and a single rudder pedal were located (Photo 32). The aileron control cables remained attached to both yoke assemblies (Photo 33, 34).

The rudder cable terminations remained attached to the rudder assembly within the cockpit. The rudder horn torque tube assembly had separated from the base of the rudder, but both controls cables remained attached to the bellcrank (Photo 35).

The elevator cable push-pull tube rod bearing remained attached to the elevator control assembly within the cockpit (Photo 36). The corresponding elevator bellcrank remained within the airframe, and both of its elevator cable terminations remained attached. Similarly the cable ends were in place at the aft elevator bellcrank, along with the push-pull tube ends for the control surfaces (Photo 38). The elevator control horns remained attached. The push-pull tube end for the right horn was attached, the left control had broken off (Photo 39, 40).

The elevator trim actuators had broken beyond limits. The aileron trim tab actuator (left side) was in a position, which according to Cessna documentation, indicated 5 ° tab down. The rudder actuator was in a position, which according to Cessna documentation, indicated 5 ° tab right. The aileron sector assembly was found in the center fuselage section, all its associated cable ends remained attached. (Photo 37).

Climate/Pressurization

The environmental control panel could not be located. The outflow valve assemblies sustained impact damage, and the only recovered components included one outflow valve head with differential control, two poppet outflow valves, two poppet valve covers and a noise suppression screen. Both valve diaphragms were liberated and sustained multiple tears and cuts. (Photo 41). The cabin rate of climb indicator had been crushed, and its indicating needle was not located.

Emergency Oxygen

Remnants of three emergency oxygen system mask assemblies were located. The mask for one passenger system remained housed within the assembly, indicating the oxygen system had not deployed. According to the Pilot's Operating Handbook, should the cabin altitude exceed 13,500 +/-600 ft, an altitude sensing switch will electrically actuate the passenger solenoid valve, supplying 70 PSI oxygen pressure to the passenger manifold. This pressure is sufficient to operate the passenger mask actuators, deploy the doors and drop the continuous flow masks at each passenger seat. The oxygen control panel was located, however the control valve switch was detached, as such a determination of its status could not be ascertained (Photo 42,43).

The valves for the oxygen cylinder were broken off, therefore the tanks were empty, and their oxygen quantity at impact could not be determined.

2.0 Engine Examination

Number 1

The engine was heavily fragmented, liberating many of its components, not all of which were identified (Photo 44). The accessory gearbox (AGB) had detached (Photo 45), and its case had been breached exposing the internal gears. All gears were wet with oil, and there was no evidence of internal catastrophic failure (Photo 46). Both engine Lord mounts were located and found separated from the engine.

The fuel pump, fuel controller unit, and flow divider had all detached. The low compressor fan shroud had detached, was bent, and exhibit radial scoring signatures in the area of the fan blade tips (Photo 47). Neither the low compressor fan, high pressure compressor, nor any combustion stage components were recovered.

The booster stage was located; however all of its blades were liberated, and none were found (Photo 48). The booster stage shaft was separated about 6 inches aft, and the separation features exhibited rotational scoring and a 30 ° lip at the separation (Photo 49). The booster stage stator was torn, and splayed open. The area adjacent to the booster blades exhibited rotational scoring damage.

Number 2

The engine was heavily fragmented, liberating many of its components, not all of which were identified (Photo 50). The accessory gearbox (AGB) had detached, and its case had been breached exposing the internal gears. All gears were wet with oil, and there was no evidence of internal catastrophic failure. Both engine Lord mounts were located, and found separated from the engine. The aft stabilizing mount remained attached to the engine casing. The fuel pump, fuel controller unit, and flow divider had all detached.

The low compressor fan shroud was not located. The low compressor fan remained attached to the booster stage through the inlet cone shaft (Photo 51). The inlet cone had detached and exhibited crush deformation (Photo 53). All but one of the booster stage blades were liberated, the remaining blade was bent and exhibited leading and trailing edge gouges.

Two pressure line hydraulic filters, and one return line hydraulic filter were located. Disassembly revealed that the screens were free of visible debris. (Photo 54)

The drive shaft that connected the booster assembly to the low pressure turbine wheels had separated within the engine core. At the separation, the shaft exhibited twisting features and both failure surfaces, along with rotational scoring midspan (Photo 52, 55)

The high pressure compressor sustained extensive damage to its blades, (Photo 56) fragmenting them and rotating them opposite the direction of rotation (Photo 57). Rubbing, discoloration, and breakthrough were present on the corresponding inner surfaces of the compressor shroud (Photo 58, 59)

The gas generator stage was largely intact, and the gas generator case was opened revealing blade tip rubbing to the high pressure turbine (Photo 60).

3.0 Examination Photos



Photo 1 - Wreckage



Photo 2 – Left Wing Spar



Photo 3 – Aft fuselage



Photo 4 – Aft fuselage



Photo 5 – Front left cockpit wall



Photo 6 – Left side door lock pins and holes



Photo 7 – Square lock pins



Photo 8 – Assorted electrical and avionics components



Photo 9 – Thermal damage to electrical loom

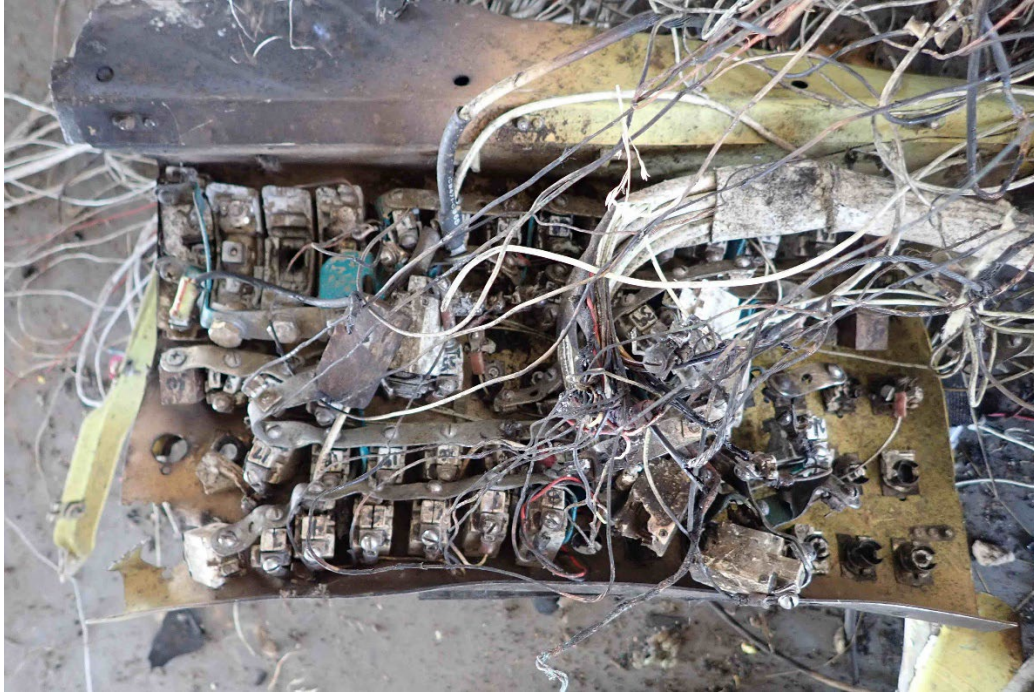


Photo 10 – Circuit breaker panel back side



Photo 11 - Front left cockpit wall inners side



Photo 12 – Emergency door lock pin



Photo 13 – Emergency door frame



Photo 14 – Pilots seat



Photo 15 - Empennage



Photo 16 - Empennage



Photo 17 – Vertical Stabilizer



Photo 18 – Thrust reverser control assemblies



Photo 19 – Left wing box and wing section



Photo 20 – Left wing aft bend



Photo 21 – Left wing leading edge fuel tank



Photo 22 – Left wingtip position light



Photo 23 – Left aileron and flap surfaces



Photo 24 – Right wing



Photo 25 – Right wing aileron and flap surfaces



Photo 26 – Right wingtip position light



Photo 27 – Left main landing gear assembly

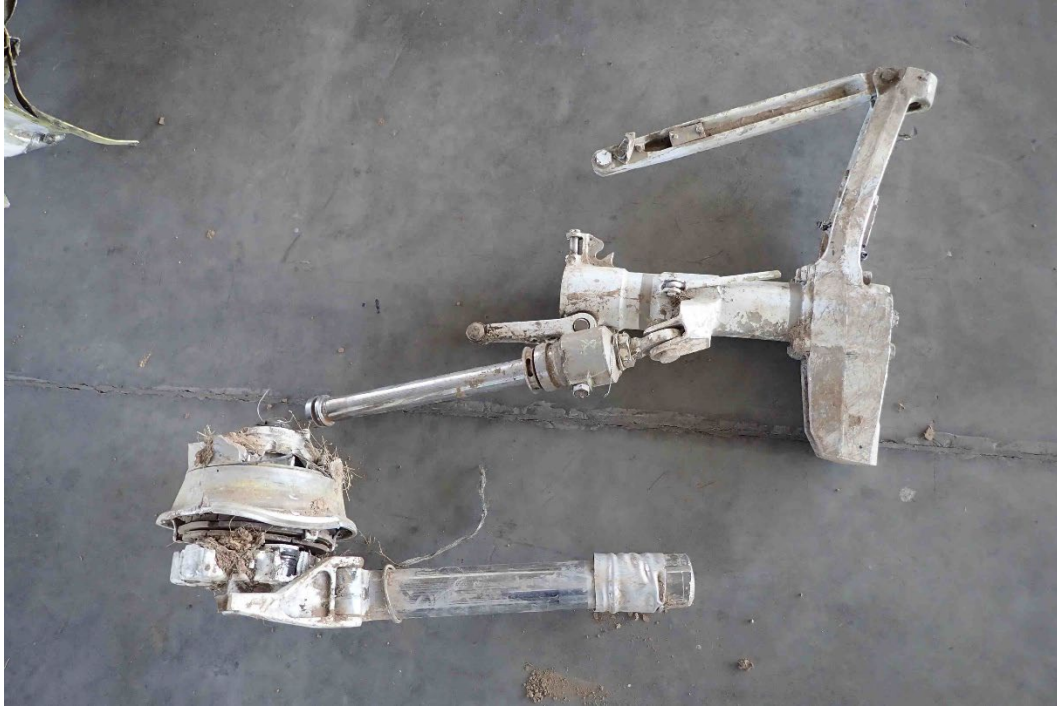


Photo 28 – Right main landing gear assembly



Photo 29 – Nose landing gear fragments



Photo 30 – Left wing flap control system



Photo 31 - Left wing flap control system



Photo 32 - Fragmented remnants of both control columns



Photo 33 – Aileron control cable at yoke assembly

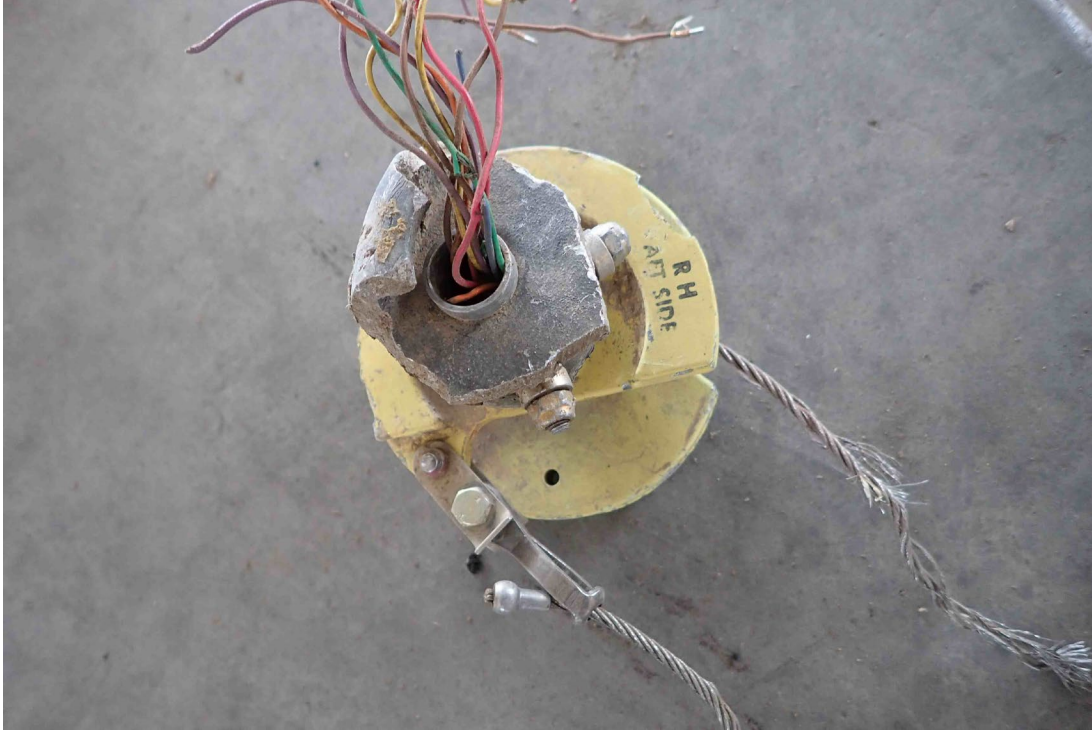


Photo 34 - Aileron control cable at yoke assembly



Photo 35 – Rudder torque tube



Photo 36 - Elevator control assembly



Photo 37 - Aileron sector assembly



Photo 38 – Elevator aft bellcrank



Photo 39 – Elevator control horn



Photo 40 - Elevator control horn



Photo 41 – Environmental control valve components



Photo 42 – Oxygen control panel

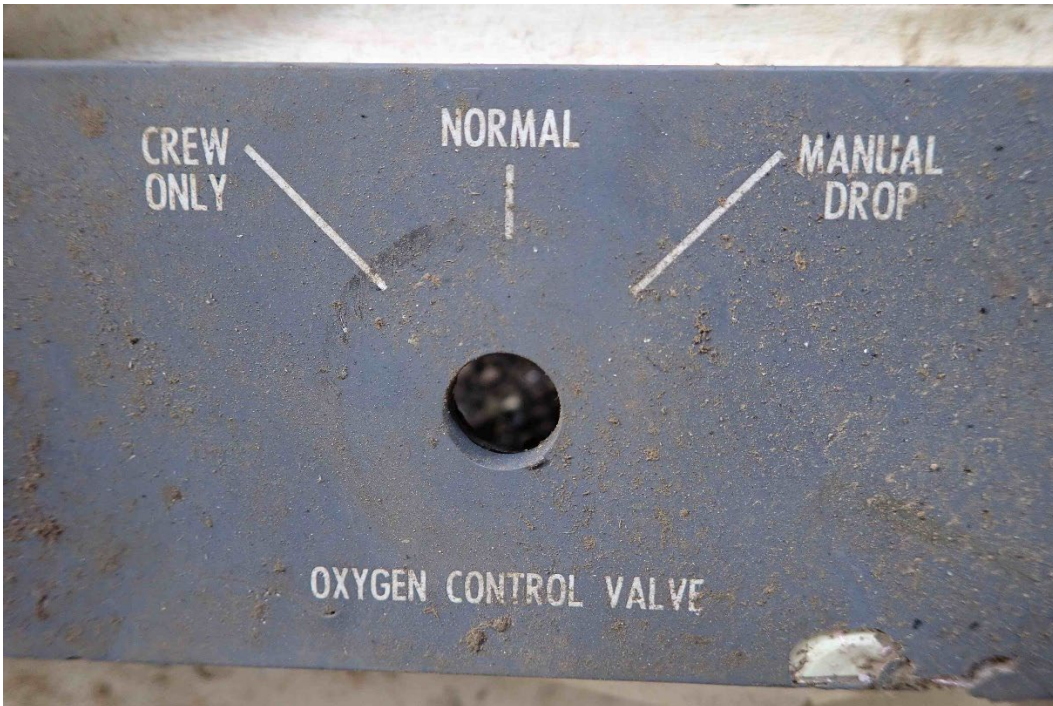


Photo 43 – Oxygen control valve panel opening



Photo 44 – Number 1 engine remnants

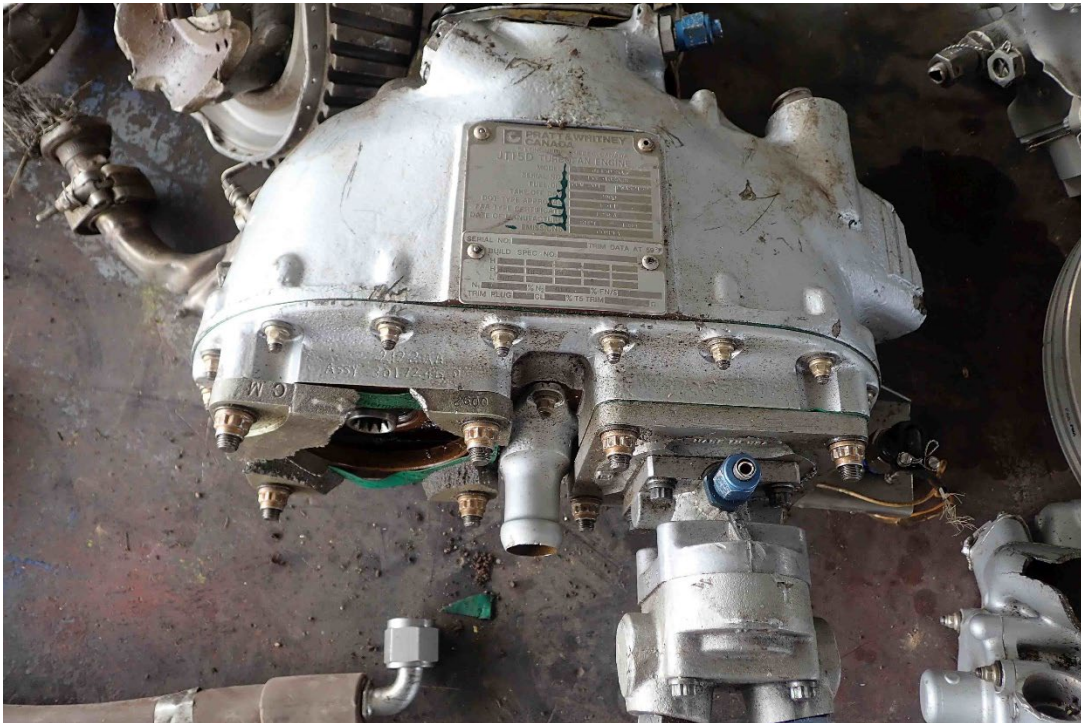


Photo 45 - Number 1 accessory gearbox



Photo 46 - Number 1 accessory gearbox opening



Photo 47 – Number 1 engine low compressor fan shroud



Photo 48 – Number 1 engine booster stage



Photo 49 – Number 1 engine booster stage shaft

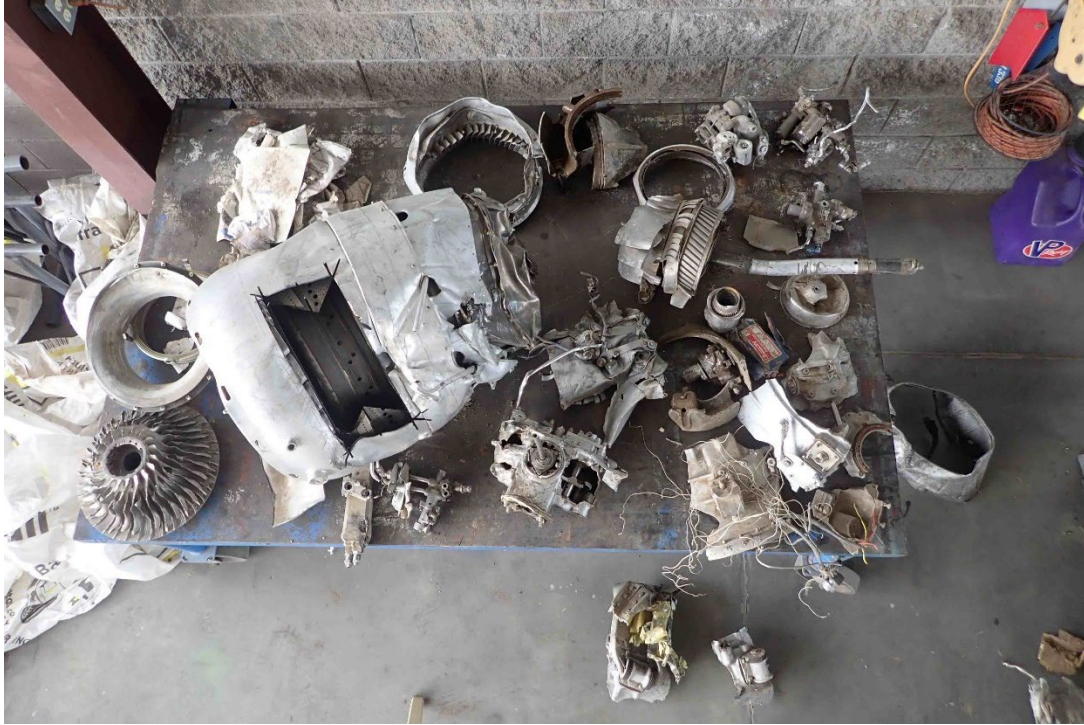


Photo 50 – Number 2 engine components



Photo 51 – Number 2 low compressor fan fragments

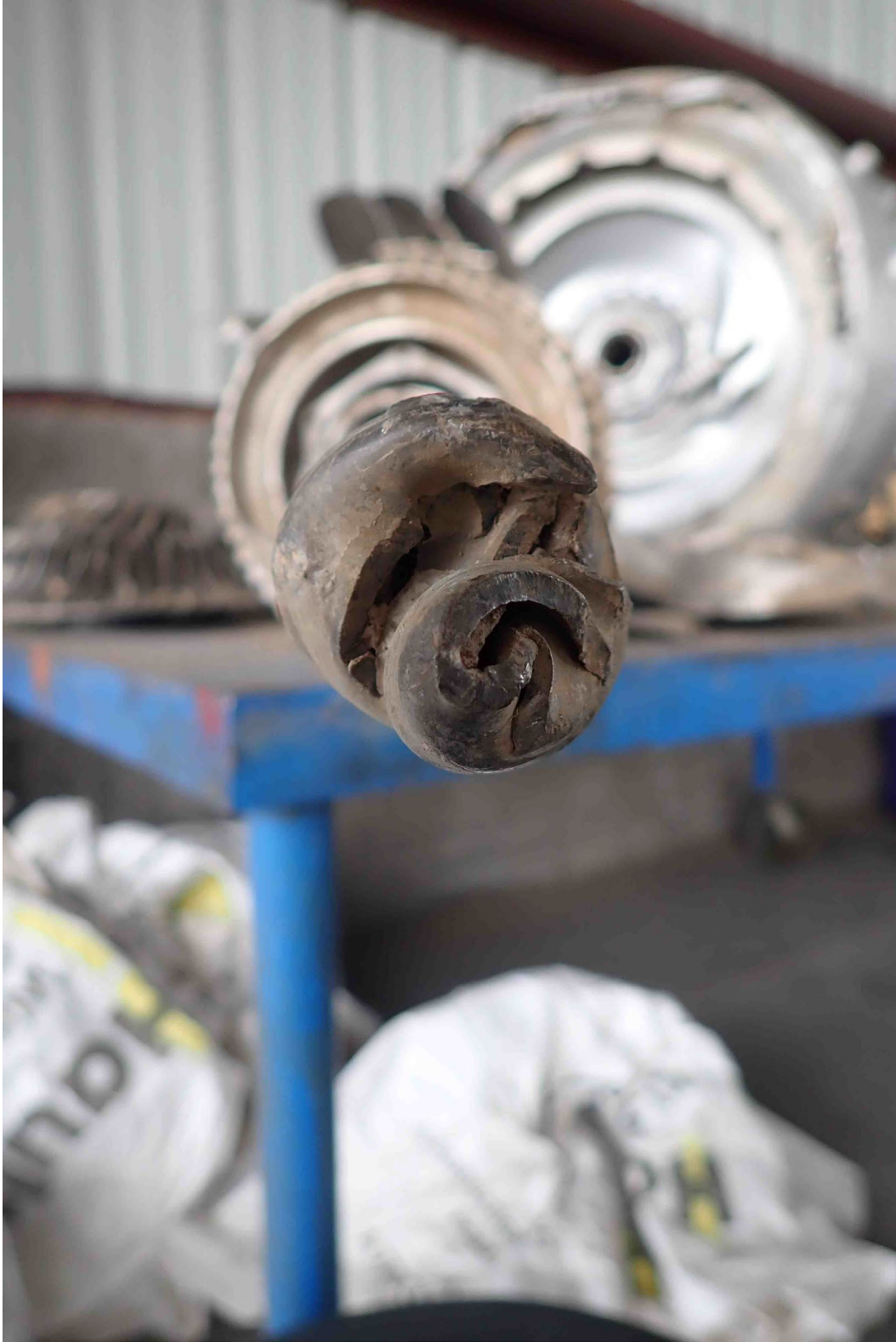


Photo 52 – Number 2 booster assembly driveshaft



Photo 53 – Number 2 engine inlet cone

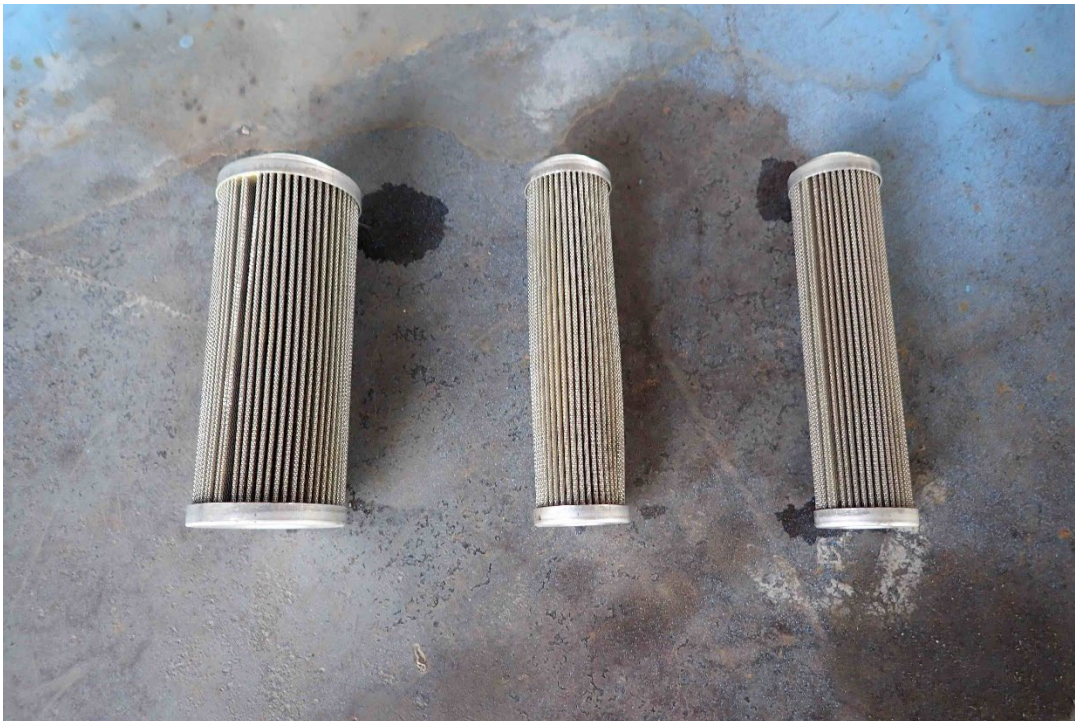


Photo 54 – Number 2 pressure and return hydraulic filters



Photo 55 – Number 2 drive shaft that connects the booster assembly to the low turbine wheel



Photo 56 – Number 2 high pressure compressor



Photo 57- Number 2 high pressure compressor



Photo 58 – Number 2 compressor shroud inner surface



Photo 59 - Number 2 compressor shroud inner surface



Photo 60 – Number 2 gas generator case

Submitted by: Elliott Simpson