



CASE NOTES

During the course of the investigation, the following observation and facts were collected:

A representative of Airbus Helicopters assisted in providing the following list of facts collected at the accident site:

- The energy pathway that the helicopter came down through the trees was approximately 50°, and on an easterly heading (approximately 110°)
- Trees in the area were approximately 70 feet tall.
- The helicopter came to rest on the ground approximately 60 feet forward from the first tree strike and resting on its right side.
- One pine tree broke in to the cabin through the right side and through the cockpit just below the instrument panel and across the pilot's lap area.
- Both the left-side doors were on, and both the right-side doors had been removed prior to the flight.
- The pilot was seated in the right front seat and was seriously injured. The USFS employee seated in the left front seat sustained minor injuries.
- The fatal occupant was the USFS employee seated on the rear right seat. His legs would straddle the plastic sphere dispenser (PSD) machine. He was secured to the helicopter with a chest harness.
- The PSD hopper was empty and the helicopter was returning when the accident occurred.
- The bottom of the fuel tank was crushed and broken open. However, as the aircraft was resting on its side, approximately 20 gallons remained in the tank. The smell of fuel was present about the accident site.
- The tail boom was broken in two places at the fuselage tail boom junction and just forward of the horizontal stabilizers.
- Both horizontal stabilizers were bent up.
- Two of the main rotor blade star arms were broken with near perpendicular breaks. One of the MRB's was daggered into the ground as the helicopter came to rest on its right side.
- Flight control continuity was confirmed from the input controls to the tail rotor system and to the main rotor dynamic systems.
- Neither of the front two crew seats were attenuated; the pilot seat was broken on the rails.
- All 3 occupants were wearing helmets.
- Only the right side controls were installed.

- The main transmission chip detector was clear and any visible debris.
- The twist grip was in the “idle” position

During opening of cowlings to inspect the engine, the main fuel line was found not properly secured. Below is a picture as found at the accident site.

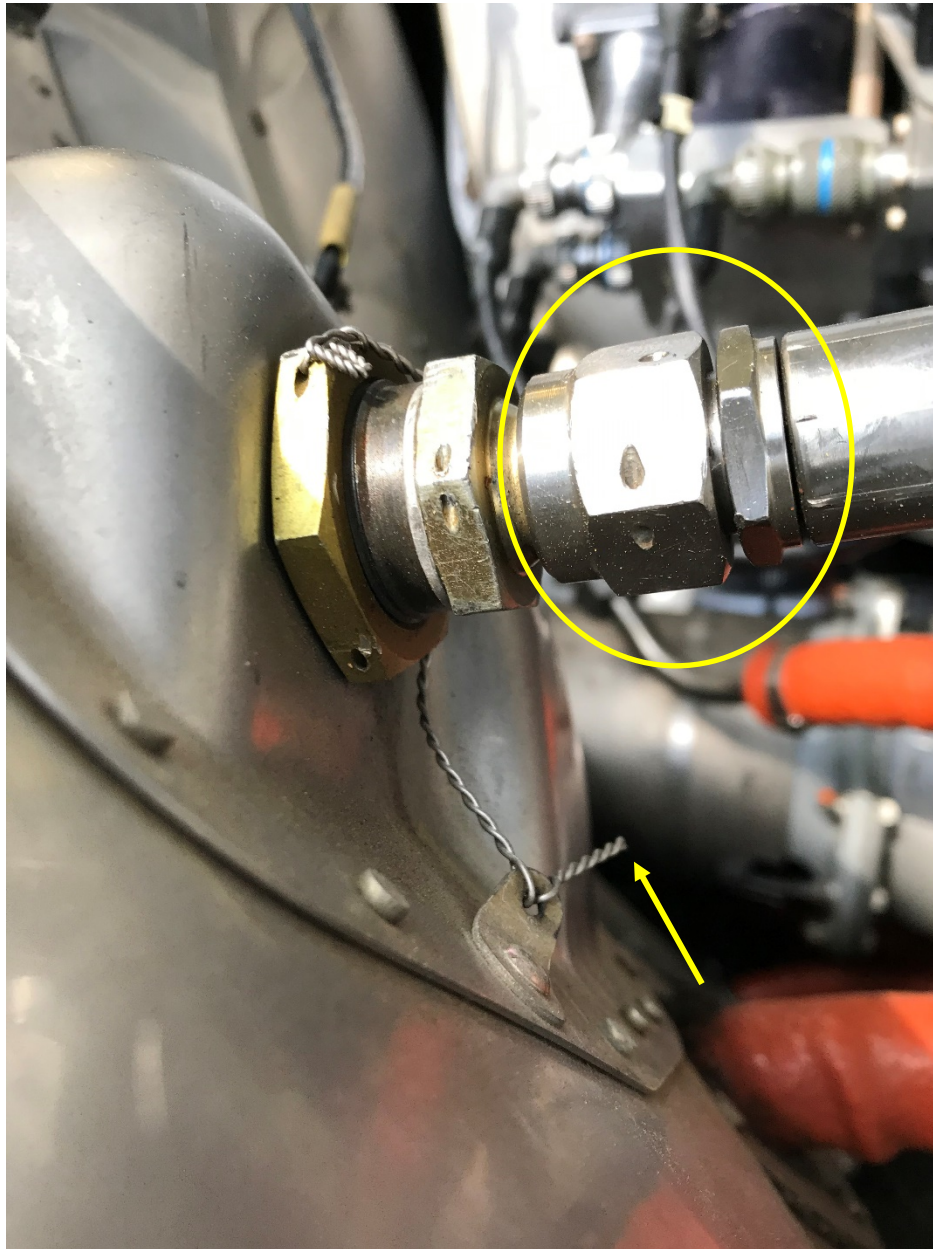


Figure 1 Cut safety wire and no safety wire on b-nut

When the fuel line was found improperly secured, it was requested that Mountain Air inspect the other AS350 helicopters that they operate. A review of the remaining fleet found all the fuel lines properly secured.

A representative of Safran Engines assisted in collecting the following information on-scene:

- The accident engine was an Arriel 2B1, s/n 23434. It had approximately 1,748.9 hours since new.
- The engine as found was still mounted in the helicopter laying on its right side still under the engine cowling. The cowling was removed to observe the left side of the engine.
- A check of security of all the fuel, oil, and air lines revealed the fuel line between the firewall and HMU (shutoff valve/fuel pipe interface) was loose and without safety wire.
- All other fuel, oil, and air lines were found tight with proper safties.
- All electrical connections were found tight.
- The intake bellmouth had been partially separated from the module 2 casing and the axial compressor / gas generator could be rotated easily by hand.
- There was no foreign object damage on the axial compressor.
- The front support bolts had been sheared and was binding against the freewheel shaft so rotation and proper operation of the freewheel clutch could not be confirmed.
- The free turbine was intact (no blade shedding) but rotation could not be confirmed due to the bound freewheel shaft.
- The digital engine control unit (DECU) was removed for a later download.

The DECU was sent to Safran's facility for a data download. On April 11, 2019, the DECU was downloaded under the auspices of the FAA's Rotorcraft Directorate.

The last recorded fault in the DECU was a "P3 drift or engine flame out" in Block #8 of the Fault Context on channel A. The fault occurred at 2hr:22min:09sec after the DECU was energized. At the time of recording of the block, the engine control was in automatic mode with both logical inputs and outputs indicated flight mode which are the normal conditions for flight. In addition, N2 recorded 97.05%, which is close to the nominal value. At that time, N1=83.70% and $dN1/dt = -13.31\%$, which indicated that N1 was dropping rapidly and would account for the recorded "P3 drift or engine flame out" message. No fault related to the event could be seen on channel B. After the memory download, the functional check in real-time of the DECU was performed and no fault was declared by the DECU during that check.

The pilot made the initial statement that the engine stopped producing power. The USFS employee seated in the front-left seat reported that the engine just quit, and everything went silent.

An examination of the helmets and available restraints was conducted by the FAA CAMI. No anomalies were detected with any of the materials.

The helicopter was equipped with a SEI Industries Premo MK III Plastic Sphere Dispenser. According to company documents, the purpose of this device *"is to inject ethylene glycol into plastic spheres containing potassium permanganate and then immediately eject the activated sphere from the aircraft. The addition of ethylene glycol to potassium permanganate creates a rapid exothermic reaction that has sufficient intensity to ignite the plastic spheres and ignite the designated burn area. The dispenser is composed of a power train, glycol and water reservoirs, pumps, slipper blocks and an injection*

mechanism. Accessory components of the dispenser include the tie-down straps, power supply cable with breakaway connection and controls."

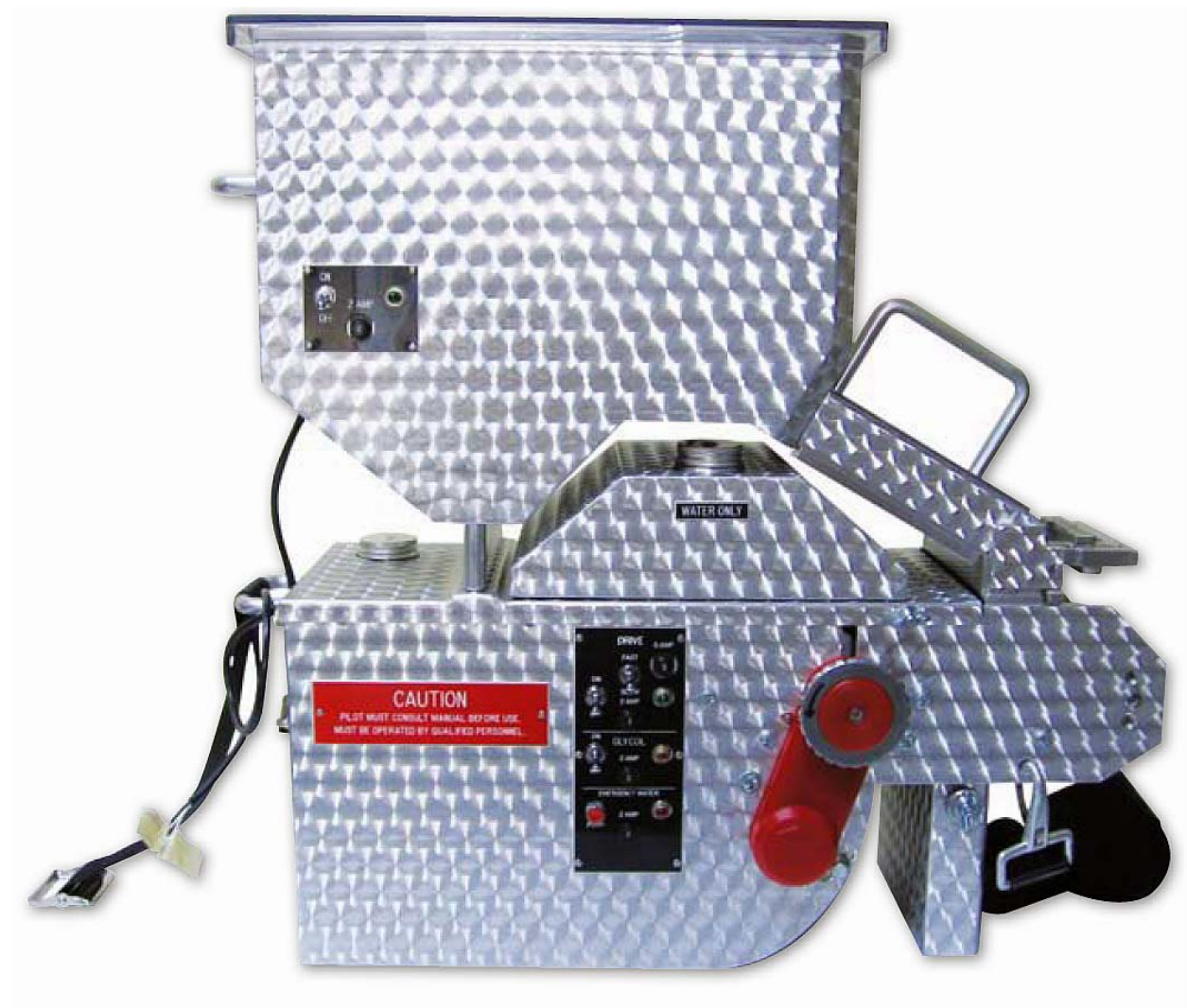


Figure 2 Exemplar Premo MKIII PSD

The Premo MK III PSD was examined and did not appear to contribute to the accident.

For reference, here is a picture of an exemplar device installed on an Airbus AS350 helicopter, found at <https://www.integratedequipment.com.au/products/sei-ignition-systems/premo-psd> (accessed 3/30/2021)



Figure 3 Exemplar picture of PSD installation

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