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**Factual Observations of Helicopter Mishap**  
**Bell 407; S/N 53498, N503MT**  
**Date of Accident: July 13, 2004**  
**Operator: Med-Trans Corporation**  
**Location: 14 miles NW of Newberry, SC**

**I. Introduction**

On July 13, 2004, an EMS 407 helicopter, S/N 53498 and registration number N503MT, crashed into 100 feet tall pine trees shortly after takeoff. The helicopter had just taken off from the southeast-bound lane of Interstate Highway 26 near a rest area at mile marker 64. The accident site was approximately 14 miles northwest of Newberry, SC. The Med-Trans Corp. helicopter, operating as "Regional One" from the Spartanburg Regional Healthcare System, crashed during hours of darkness at approximately 5:35 a.m. It was reported that a fog layer was present at treetop level when the aircraft landed at the scene and when it tookoff.

This writer observed the wreckage at the accident site on July 13 & 14, 2004. The wreckage was located approximately ½ mile from I-26 near a trail on U.S. Forest Service land. Several trees in the vicinity had evidence of being struck by the main rotor and other helicopter components (See Photo 1). A post crash fire largely consumed the wreckage (See Photo 2).

**II. Wreckage Examination**

Main Rotor

Major remnants of all four main rotor blades and hub assembly components were found in the vicinity of the main wreckage, and fire damage was observed on the root ends of all blades except the Green blade. Some small main rotor blade pieces were found at the base of several trees. On the Red blade, an approximate 5 foot outboard section including the tip area, of leading edge and composite afterbody, was found in the wreckage path about 100 feet from the main wreckage (See Photo 3). Additionally, the Orange main rotor blade tip was found impaled into a tree in the direction of travel approximately 50 feet above ground level (See Photo 4).

The main rotor yoke exhibited extensive damage (See Photo 5). Two of the four yoke flexures, the red and green, were fractured completely through. Most of the composite strands on the orange yoke flexure were fractured but the two flexure halves remained attached to one another by only several strands. The blue flexure also exhibited extensive damage and fractured strands.

The extent of damage to the main rotor blades and main rotor yoke are consistent with the rotor being driven at the time of tree impact.

### Drive Train

The main transmission exhibited extensive fire damage to its outer case. The main K-Flex driveshaft flexures were fractured consistent with overload forces at both the engine and transmission ends (See Photo 6). The fractured K-flex coupling at the transmission end was manually rotated by hand and corresponding rotational movement was observed at the mast. The freewheeling unit's outer case was melted due to exposure to the post crash fire. Additionally, the freewheeling unit would not rotate by hand because of fire damage.

The steel tail rotor driveshaft was fractured consistent with overload forces at the forward end of the shaft (See Photo 7). The oil cooler was in the fire zone and extensively damaged (See Photo 8). Both oil cooler shaft hanger bearings were intact, but would not rotate due to fire damage. Numerous overload fractures were observed in the tubes and end flanges of the aluminum tail rotor driveshafts. All four tail rotor driveshaft hanger bearings on the tailboom rotated freely and contained grease with a color typical to Mobil 28 type grease. When hand rotated by the tail rotor driveshaft input flange, the tail rotor gearbox rotated freely. No chips or debris were noted on the tail rotor gearbox chip detector when it was removed for examination. Additionally, the gearbox was noted to have oil in it.

### Main Fuselage

The first ground impact of the main fuselage was found near a trail (See Photo 9). The wreckage path was oriented in a northwesterly direction. The helicopter then traveled approximately 52 feet before coming to rest. The "at rest" orientation of the wreckage was in an easterly direction.

An intense post crash fire consumed the majority of the main fuselage and charred several trees at the accident site. Seats, seat belts and shoulder harnesses were destroyed by fire. A seat belt buckle was observed in the latched condition. Those sections of the fuselage found near the main wreckage that were not completely destroyed by fire include: the servo supports and associated roof section, instrument panel, and the overhead circuit breaker panel with attached structure (See Photo 10). Additionally, chin bubble pieces and some doors and doorposts were found in the wreckage trail at the base of several trees.

### Tailboom

The tailboom exhibited overload fractures at four locations and was separated into four major sections. Tailboom pieces were found at several locations in the wreckage trail. The first fracture was at the tailboom attach points. The first section of fractured tailboom had been flattened into a U-shape by right to left contact with a tree (See Photo 11). Torn pieces of fuselage attach point material were observed on the first section of

tailboom with the attachment bolts and nuts intact (See Photo 12). Tailboom-to-tree contact evidence was observed on a tree by bark missing about 180° around the tree and approximately 50 feet above the ground (See Photo 13). The second section of tailboom exhibited fractures just forward (2<sup>nd</sup> fracture) and aft (3<sup>rd</sup> fracture) of the horizontal stabilizer (See Photo 14). The third section was from aft of the horizontal stabilizer to the tail rotor gearbox attach point. The attaching rivets that connect the rear of the tailboom to the tail rotor gearbox casting were fractured on the top and left sides of the tailboom. The gearbox casting attachment flange on the tailboom's right side was fractured. The last section of tailboom, the tail rotor gearbox and attaching hardware (See Photo 15), were found on the left side of the wreckage path approximately 100 feet from the main wreckage.

The horizontal stabilizer had an overload fractured left endplate and the right stabilizer was fractured chordwise approximately 12 inches from the tailboom. The left endplate fractured at the attachment flange and puncture marks were observed at the inboard bottom surface of the plate. The right side stabilizer exhibited evidence of having been struck from the front. The vertical fin separated from the tailboom due to overload fractures at the four casting attachment arms. Fallen pine needles and small branches were observed surrounding the fin.

### Controls

Continuity of the fixed flight controls could not be determined due to the extensive post crash fire damage. All observed fractures were consistent with overload forces. The helicopter was in an EMS configuration and did not have the copilot collective or cyclic sticks installed. The pilot's collective stick and the collective jackshaft were found adjacent to one another with the splines at the end of the collective disconnected from the jackshaft. Both were extensively damaged by fire. This writer did not observe the cyclic stick. The cockpit area suffered heavy fire damage. Both the pilot and copilot anti-torque pedals were found embedded in the ground near the initial ground impact point. The control tube from the pilot's pedals to the center console was fractured consistent with overload forces.

The vertical tunnel assembly, that houses four flight control tubes, was in a heavy burn area and only a small amount of fire-damaged tunnel attaching structure was identified. The four tubes were not observed. Overload fractures were observed in the connecting linkage hardware to all three roof mounted servo actuators. The collective and cyclic servos exhibited mechanical damage as the result of impact forces. They were attached to a small piece of roof structure that had fractured and separated from overload impact forces. The servo bodies were not fire damaged, although some attaching hydraulic lines exhibited braided fabric outer material that had been damaged by fire (See Photo 16). Several overload fractures were observed in the bellcranks and web structure between the servos and swashplate (See Photo 17). Additionally, the bottom clevis of the left cyclic control tube that connects between a bellcrank at the tube's bottom end and the non-rotating swashplate left cyclic control arm on it's top end, was fractured at the end of the clevis threads. The collective lever link also fractured in the threads of the top rod end bearing (See Photo 18).

The tail rotor control tube that is housed in the roof structure was intact. A bellcrank attached to the aft end of this tube was fractured consistent with overload forces. Fractures of the long tail rotor control tube in the tailboom corresponded to

locations of tailboom fractures. The tail rotor control linkages at the tail rotor gearbox could not be manipulated by hand and therefore no pitch control movement was observed at the tail rotor hub assembly. It was observed that outboard of the hub assembly, the tail rotor output shaft was bent (See Photo 19). The pitch control tube that operates through the tail rotor output shaft was correspondingly bent and therefore jammed, preventing pitch movement at the tail rotor hub assembly.

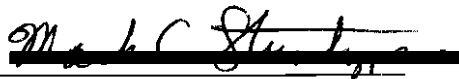
Control continuity was present in the main rotor rotating controls. The swashplate rotated freely along with the rotor system when manipulated by hand. Overload fractures were observed in all four pitch change links and the Blue and Green pitch horns had separated from their respective blades.

#### Fuel System

The fuel cell bags were structurally compromised during the impact. One belly mounted pump was found burned and surrounded by ash (See Photo 20). It was not determined if this was the boost pump located in the aft fuel cell or the transfer pump located in the forward fuel cell.

#### Engine

The engine was extensively damaged by the post crash fire (See Photo 21). The fire consumed the engine gearbox case. The gearbox internal gears were located in the area of the engine. Debris was present at the compressor inlet and the leading edges of the compressor blades were damaged. The ECU was removed and sent to be downloaded by its manufacturer.



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**Engineering Laboratories**

**SUBJECT: EXAMINATION OF A MODEL 407 CAUTION AND WARNING PANEL FROM  
MED TRANS IN NEWBERRY, SOUTH CAROLINA**

## History and Related Data:

- |                        |                           |
|------------------------|---------------------------|
| 1) Part Name:          | Caution and Warning Panel |
| 2) Part Number:        | 407-375-015-109           |
| 3) Vendor Part Number: | 351-38128-205             |
| 4) Part Serial Number: | 534                       |
| 5) Total Part Time:    | Approximately 710 hours   |
| 6) Helicopter Model:   | 407                       |
| 7) Serial Number:      | 53498                     |
| 8) Helicopter Time:    | Approximately 710 hours   |
| 9) CPR Number:         | 24293600                  |

INTRODUCTION

A caution and warning panel from an aircraft involved in an accident was received in the Field Investigations Laboratory to examine the bulbs and filaments.

CONCLUSION

There were 108 bulbs in the 36 caution and warning indicators, three to each indicator. None of the bulb filaments was broken. None of the bulb filaments was stretched a large amount. Two bulb filaments from the Hydraulic System indicator had a small amount of stretch from an undetermined origin.

DISCUSSION

A Model 407 owned by Med Trans was involved in an accident on July 13, 2004 in Newberry, South Carolina. The caution and warning panel from the cockpit was received in the Field Investigations Laboratory to examine the bulbs and filaments. Overall views of the panel as received are shown in Figure 1. The front indicator panel was removed, and the individual bulbs were removed to examine in a stereozoom microscope at 20X magnification. None of the 108 bulb filaments from the 36 indicators was broken. None of the filaments was stretched a large amount. Figure 2 shows closeup views of a 'normal'-looking filament and two filaments from the Hydraulic System indicator, which were both slightly stretched. The origin of the slight stretch was not determined.

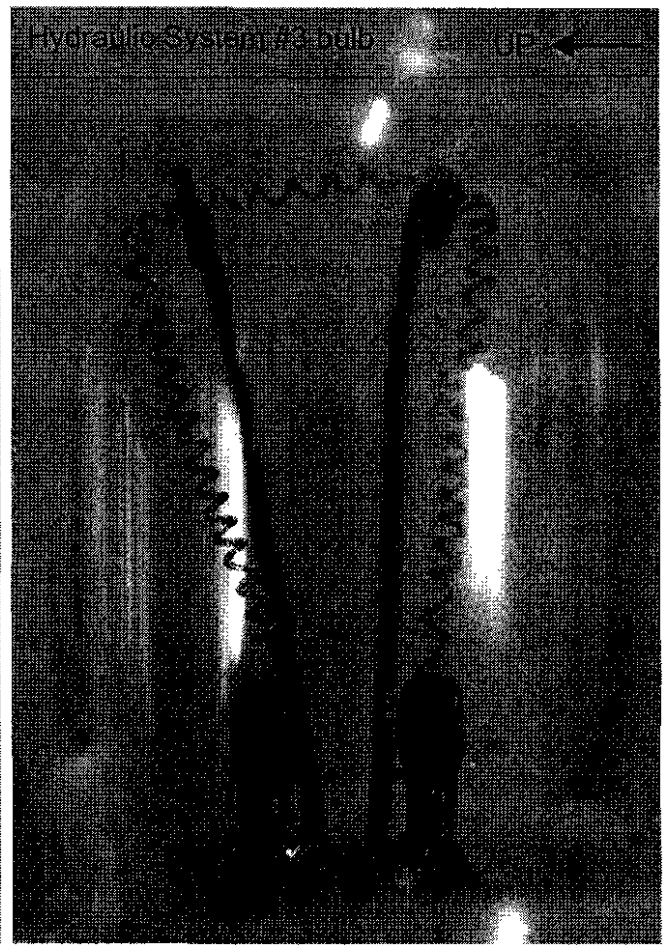


Figure 2: Closeup views of a 'normal'-looking bulb filament and the two Hydraulic System bulbs with slightly stretched filaments.

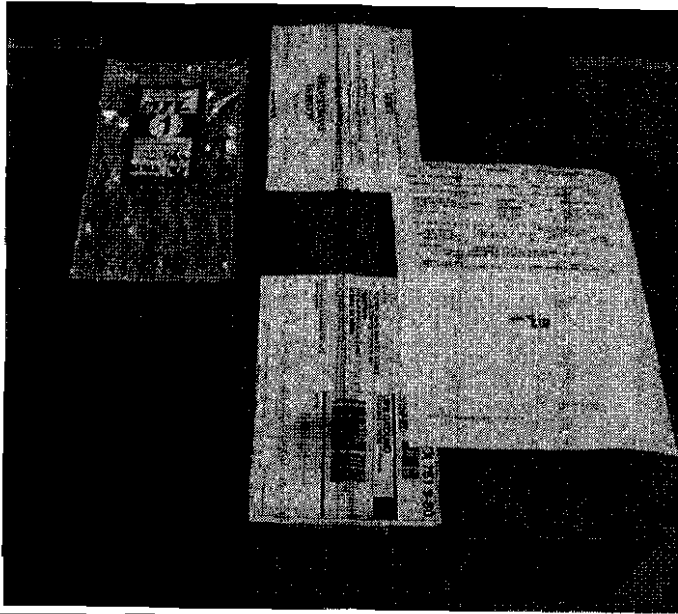


Figure 1: Overall views of the caution and warning panel as received, and with the front indicator panel removed.