



PACIFIC SOUTHWEST REGION

August 7th, 2015

Rapid Lessons Sharing TAIL ROTOR STRIKE

A rotor strike may seem benign, but even contact with a small shrub can cause damage to other components. In this case, good risk management and decision making was applied and the company elected to complete repairs in the field.

On August 7, 2015, a Bell 205A1++ (Medium) Helicopter equipped with a fixed tank and snorkel experienced a tail rotor strike while landing to retrieve the Helitack crew supporting an initial attack on the San Bernardino National Forest.

After a recon of the area, the pilot and the Helitack crew noted several suitable areas to land and selected one located at the center of the Middle Fork within the dry alluvial river bed adjacent to the fire. Although it was characterized by rocks, shrubs, and an occasional tree snag, it was suitable based on his selected (**6Ss, 2Ws**) considerations. After deploying the crew, the helicopter then conducted water drops to support the fire which was located only about 75 yards up the adjacent hillside.



Figure A



LZ Selection Considerations (pilot): (in addition to IHOG standards)

6 Ss: Size, Shape, Slope, Surface, Surroundings, Sun
2 Ws: Wind, Wires

After completing a fuel cycle and refueling, the pilot returned to land and wait for the crew to board and to depart the fire.

Aware that he had the snorkel deployed he initially planned to land at a large turnout next to the river, but he found the spot was now occupied by "crew buggies". The pilot then flew to the original landing spot, but found it compromised by a hose lay running through it. He then circled several more times, evaluating potential sites, finally selecting one slightly down canyon. He pulled into a hover over the spot, carefully placed the snorkel pump on the ground and eased forward, descending until the tails of the skids were touching the riverbed. At that point he determined that the aft CG (center of gravity) attitude of the helicopter, combined with the down sloping ground, made for an unfavorable landing combination. He elected to lift and find another spot.



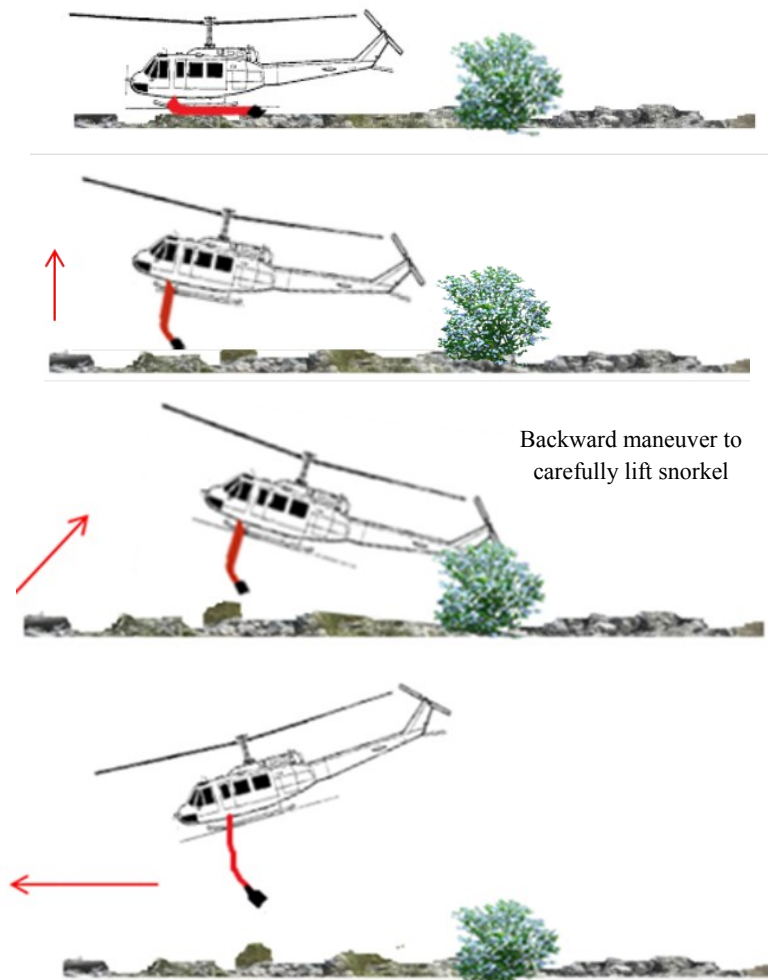
Alluvial river beds, like those in Lytle Canyon are very common LZs in this area, and are often the only viable places to land.

Rotor Strike Event: The pilot is very meticulous about the operation of the helicopter and is careful with the equipment. The technique to lift the snorkel off the ground, without dragging and damaging it on the rocks, involves lifting the snorkel hose off the ground while maneuvering slightly backwards. While similar (although reversed) to the flight profile when landing, the exaggerated tail low attitude while moving backwards involves somewhat more exposure to potential damage to the rotor, especially since visibility to the rear of the helicopter is negligible. While performing this maneuver, the helicopter struck a shrub (about 5'tall) with the tail rotor.

LZ where tail rotor strike occurred, circle identifies "strike" shrub (helicopter was in front of the shrub shown, facing down valley)



Figure B.



The Pilot determined that the aft CG attitude of the helicopter, combined with the down sloping ground, made for an unfavorable landing combination, so he decided to lift and find a better spot.

Lifting the skids, while keeping snorkel stationary on the ground

Backward maneuver to carefully lift snorkel



In moving backwards, the helicopter struck a shrub (about 5' tall) with the tail rotor .

The pilot did not feel or hear the strike, but the helicopter manager and crew on the adjacent hill heard an abnormal "whack, whack" like a rotor blade had struck "something". The crew radioed the pilot to ask if he was OK, and he indicated that he was. At that time, the pilot had no knowledge of the rotor strike and proceeded to land at a more suitable spot. After the crew arrived at the helicopter, they examined both rotor systems (main and tail) and found signatures indicating a tail rotor strike (see figure B). The crew then searched for the strike object, and found a shrub with recent damage approximately 100 yds. upstream from where the pilot had first attempted to land.

Figure C

Tail rotor strikes can damage other parts or adjacent components as well as tail rotor blades, tail rotor drive shaft, 90 and 42 degree gear box mounts, and tail fin and tail boom mounts.



SUCCESSSES:

Sound Risk Management and Decision Making:

Flight crew asked for a Spot Weather Forecast to ascertain if the aircraft was in danger of predicted flooding if left at site over night.

Pilot and Mechanic assessed damage, and although it appeared minor, they elected to stay on site to complete repairs.

SMS success: Under the company's Safety Management System, the tail rotor blade strike was treated like a high impact strike and all precautions were taken, without blame placed on the pilot.

CRM: Pilot conducted a high-level reconnaissance before descending to the unimproved landing site and utilized the Helitak Crew onboard to help identify hazards as well as potential alternate LZs using the 6 Ss and 2 Ws protocol.

LESSONS LEARNED

Aircraft CG: There is a SIGNIFICANT difference in the empty CG hover attitude of a tanked Type II helicopter vs a non-tanked version. While the cg is within specifications, it can be at the aft portion of the allowable CG. Because the normal hover attitude is tail low, it is an especially important consideration when landing in obstacle-rich environments, such as confined areas or helispots. Coordination with the Helitak crew concerning placement or removal of internal cargo is especially important to minimize aft CG loading.

Marshallers: Helitack crews are cognizant of the use of marshallers for land-

ing at unimproved, remote sites and they utilize this practice whenever possible. Marshallers assist in the identification of hazards and can effectively communicate those hazards to the pilot during the landing sequence. In this case, all marshallers were on the hill engaged with the IA and not available to assist. Even if a marshaller is not present, marking the location on the ground of the skid tip with a colored rock or flagging, at the spot where a successful landing is completed, will assist in the safe placement of the helicopter during subsequent landings.

"I could have sent him [pilot] down to Glen Helen to wait for us..." Helitack Captain

CRM 7 Skills—Assertiveness: When the pilot encountered the hose lay in the alternate landing spot, he felt he could have been more assertive in asking the crew to move it.

"I could have asked them to move the hose, but I didn't want to impact them while they were busy..." Pilot

LESSONS LEARNED

Tank Design Considerations: When landing a helicopter with a fixed tank, the parameters for a suitable LZ must allow for the take-off and landing technique required for the snorkel configuration. This helicopter was equipped with an Isolair tank system, in which the tank fill is on the front. Conversely, a Simplex fixed tank system has the snorkel connected to the aft end of the tank.

Isolair Tank System



Snorkel connected at front of the tank

ISOLAIR CONSIDERATIONS (connected to tank on front)

- When landing, the snorkel is placed on the ground, then the pilot moves **forward** into the LZ
- During take-off the pilot must move **backward** to ensure that the snorkel is not “drug forward” against the rocks, prior to initiating forward flight.



Simplex Tank System



Snorkel connected at rear of the tank

SIMPLEX TANK CONSIDERATIONS: (connected to tank on rear)

- When landing, the snorkel is placed on the ground, then the pilot moves **backward** into the LZ
- During take-off the pilot must move **forward** to ensure that the snorkel is not “drug backward” against the rocks, prior to initiating forward flight.

TAKE AWAY: All tanked medium helicopters, regardless of tank design, will need to consider larger LZ's because of the technique required to land or take off with the snorkel connected to the tank. Obstacles that might not present clearance issues for non-tanked mediums can become significant hazards due to the pronounced tail low attitude and rearward movement required during takeoff and landing.