Safety Alert

From the International Association of Drilling Contractors

ALERT 09 – 14

HELICOPTER OPERATIONS – GROUND RESONANCE PHENOMENA

WHAT HAPPENED:

A helicopter on a routine crew change flight to a MODU landed on the helideck. The pilot and the HLO (Helicopter Landing Officer) gave each other the “thumbs up” signal indicating that it was safe for the HLO and his crew to carry on with their duties.

The HLO & his two Helideck Assistants (HA) approached the chopper The HLO exchanged manifests with the pilot passing it through the cockpit door window, the HLO then opened the forward main passenger door and passed the pilot some food for the return trip. At this time the HAs were unloading the luggage from the helicopter side locker which is located on the starboard aft side of the aircraft.

At this point the pilot started to wave at the HLO with both hands as if to tell him to back off from the aircraft, Realizing that there was something wrong, the HLO shouted and beckoned for his men to back off from the aircraft and retreat to a safe location. The HLO retreated but had not cleared the helideck, one HA managed to clear the helideck but the second HA, who was unloading the luggage from the aircraft, first secured and locked the luggage compartment, then he turned to leave the aircraft as it started to lift off from the rig. It lifted approx two metres (two and half feet) and then turned counter clockwise towards him. He stated at that time that he was about three metres (ten feet) from the chopper and that when he saw the tail of the chopper coming towards him he crouched down and rolled away from the aircraft. He then made his way to a safe and clear area at the main access and egress point to the helideck. He suffered no injury to himself although he and the other HA were extremely shook up.

When the pilot had landed the chopper for the second time the HLO informed him that he should not have lifted off until the all clear was given from the HLO, thereby letting him know that he and his assistants were clear and safe; and that it was safe to take off. The HLO stated that the pilot gave no reason for his actions. He reaffirmed that the radio communication with pilot was operational but no messages were relayed to him.

WHAT CAUSED IT:

The cause of this incident was an unusual condition called ground resonance. When the aircraft landed one of its skids rested on one of the helicopter lash down points on the helideck. Resulting in the helicopter laying at a slight angle which was the precursor to a problem which causes and aircraft rotor to oscillate. Had this been allowed to continue there was a risk of the aircraft flipping over on the deck

CORRECTIVE ACTIONS: To address this incident, these companies did the following:

The actions of the pilot and helideck crew averted a major accident. By lifting off the pilot was able to allow the aircraft to stabilize. As a result of the incident the following actions were agreed to by the MODU owner and the helicopter company.

The Corrective Actions stated in this alert are one company’s attempts to address the incident, and do not necessarily reflect the position of IADC or the IADC HSE Committee.

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Immediate

1. Issue a Safety Alert to the industry on the subject of Ground Resonance.
2. HLO's were instructed that they are not to provide waiter service to flights. **As the supervisor he must not be given any distraction.** Food can be passed by an HA when safe to do so.

Short Term

1. Added a procedure to the HLO instructions that prior to physical contact with the Helicopter, the HLO will visually observe under it from a safe distance and assess the skid location of the helicopter. If it is resting on a raised tie down bracket, the pilot will be notified by radio and will lift off and manoeuvre off to a safe set down point or will confirm he intends to shutdown the engines on the aircraft.
2. All helideck crew members are to be provided with "listen in" only head sets or the HLO is to ensure all crew have heard and understood the emergency clear request; and that all are accounted for off the helideck.
3. The tie down brackets are to be painted (if permitted) and in accordance with correct regulations to identify the bracket positions to assist in recommendation "1" above.

Long Term

1. Number of helideck brackets is to be reduced by removal and fitting of blanking plates to only those required for specific operating aircraft.
2. Check what coverage is given in training on aircraft with skids on purely metal decks and also Ground Resonance actions.

Ground Resonance is a phenomenon that has damaged or destroyed helicopters and killed pilots, passengers, and bystanders. The US National Transportation Safety Board records 34 incidents in the United States since 1990, not including military helicopters or incidents that did not injure people or destroy the helicopter.

Not all types of helicopters are susceptible to ground resonance. Some two-blade helicopters are exempt because their "teetering" rotors are a single rigid structure, like a see-saw. The only rotors that can produce ground resonance are those with three or more blades. Multi-blade rotors have lead-lag hinges, which allow blades to speed up and slow down at different points as they circle the mast while the helicopter is moving forward. The hinges keep the fluctuating lift and drag forces on each blade from inflicting excessive stresses on the rotor hub. Snubbers and dampers limit the motions of the blades.

Because it is massive and spinning at a high speed, the rotor of a helicopter must be properly balanced. If the lead-lag hinges allow the blades to depart from perfect symmetry, the rotor's center of gravity shifts slightly to one side of the mast, throwing the system out of balance.

Anything that is springy has a favorite frequency of vibration—its natural frequency—which is determined in part by its size and mass. That is why tuning forks always produce a certain tone, and why boats of different sizes rock at different rates. When two things with the same or similar natural frequencies are in contact, or sometimes even merely close to each another, and one of them begins to vibrate, it may "excite" the other to vibrate as well. The ability of one vibrating object to create this sympathetic vibration in another is what enables the rotor blades to gain control of the entire helicopter.

The helicopter's airframe has its own natural frequency, which can be excited by an out-of-balance rotor. Usually there is a triggering event: a bump or a landing or takeoff on sloping ground or with a little sideways or forward motion. A jolt moves the mast while the blades, because of the freedom of motion allowed by their hinges, lag a little behind. The rotor, now slightly out of balance, begins to wobble like a slowing top.

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If the characteristic vibration frequency of the airframe is close enough to the rate of rotation of the rotor, it joins the dance, amplifying the rotor wobble.

The destruction is wrought by the considerable energy stored in the rotor blades. The shaking rapidly grows in violence, exceeding the strength of the mast, transmission mounts, and landing gear. The cyclic control in the cockpit flails about so violently that the pilot cannot hold it, the rotor blades strike the tail boom or the cockpit, parts begin falling off, and moments later the helicopter may be destroyed.

If ground resonance begins, the pilot's best option is to get the helicopter into the air. Once the tires or skids are no longer touching the ground, the vibration fades. If the rotors do not have sufficient speed for flight the next best remedy is to eliminate lift by reducing blade pitch; shut down the engine; and hope for the best while waiting for the rotor to slow.

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