Rethinking oil rig safety

Performance criteria and helicopter flying techniques have been subjects of concern in recent times. Capt David Peel gives his personal view of a complex subject.

Relatively large sums of money have been spent by the oil industry over the years in an attempt to improve passenger survival following a helicopter ditching. The mandatory wearing of immersion suits, locator beacons, excess dinghy requirements, and a position reporting bureaucracy designed more for wreck location than collision avoidance, are all part of the survival package.

In complete contrast, very little effort or cash has been invested in improving operating safety margins or standards. Rig helideck landing criteria are largely arbitrary and generally common to all types of helicopter. Rig approach and landing techniques are generally ad hoc and un-researched, and helideck size and obstacle clearance are not performance related.

Without precise requirements, offshore helicopter design improvement has been almost non-existent, and any improvements, such as better single-engine performance, have been largely coincidental.

It is no accident that Westland, as reported recently in Flight, assumed that the pitching deck of a warship is synonymous with an oil rig helideck. Unfortunately the extra safety margin conferred by the engine-out hover capability of the EH.101 will probably be interpreted by rig designers as a reason for making helidecks even smaller.

It would seem, historically, that two assumptions have predominated in shaping offshore helicopter operations. Firstly, that because the helicopter is capable of VTOL operations, a landing and take-off area slightly larger than the helicopter itself is all that is required to ensure the safest operation. Secondly, that in all other respects the helicopter is a fixed-wing aircraft and should therefore conform to fixed-wing procedures.

Is there any advantage in increasing helideck dimensions, and can landing and take-offs be made safer? To answer these questions sensibly one must look at the helicopter flight envelope in more detail, and at the performance of an aircraft which is generally representative, such as the Sikorsky S-61N. The S-61N has a smaller power-to-weight ratio than later machines, and therefore any procedure which enhances its performance is likely to benefit other helicopter types.

The ability of the helicopter to operate vertically is well known but, outside the helicopter piloting profession, it is not generally realised that vertical operations demand the use of the highest engine power levels, and take place in the most critical area of the flight envelope. At high all-up weight, with all engines operating, directional control can become very limited, because tail rotor thrust is monopolised to counter engine torque. It requires very little imagination to envisage the sort of yaw control problems that may have to be dealt with following an engine failure in the hover, at high power settings, when the main rotor r.p.m.s are also decaying rapidly.

The helicopter is also least aerodynamically efficient at zero airspeed, but its efficiency increases dramatically with very small speed increases, as can be seen from the typical power versus true airspeed (TAS) graph.

The vertical acceleration of a helicopter at any given airspeed will, by Newton's first law, be equal to the resultant upward thrust of the rotor system minus the weight of the helicopter, divided by the helicopter's mass. Extra lift will normally be induced in the rotor system by descent, while, conversely, lift will decrease with ascent. If only small periods of deflections from level flight are considered, the effects of induced lift will not be significant.

It follows that, for small excursions from level flight, it is practical to view the helicopter as a simple projectile. It also follows that the maximum rate of descent will follow an engine failure at maximum power output. This fact in itself indicates that, for public transport operations, level-flight manoeuvres requiring high power settings should be avoided whenever possible.

This is the first pointer to safer operations. The approach or take-off profile which requires the least applied power will result in the lowest rate of descent following an engine failure. Furthermore, if the power required to fly a particular approach is below maximum single-engine