Wave periods cover a rather narrow range, from a few seconds to around 20 seconds. Offshore systems are designed in such a way that their natural periods, when possible, lie outside this range. Anchoring systems are usually rather soft, so that horizontal motions have their natural periods in the order of one minute or more. Nevertheless resonant motions are observed, due to nonlinear wave loads taking place at the difference frequencies $\omega_i - \omega_j$ of the incoming wave frequencies. For a large part these slowly-varying loads result from the time variation of the wetted hull: integration of a fluctuating pressure over a fluctuating surface yields second-order residuals that vary in time, following the envelope signal. Albeit small in magnitude these slowly-varying second-order loads induce large amplitude resonant responses, known as slow-drift motion.

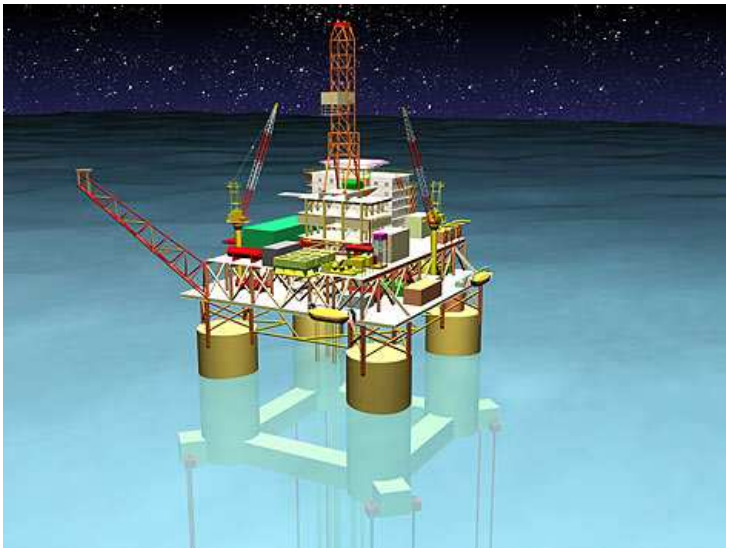

**Figure 1.** Magnolia Tension Leg Platform in the Gulf of Mexico (source www.offshore-technology.com).

Conversely, vertical tethers used for anchoring Tension Leg Platforms (see figure 1.) are extremely stiff, so that natural periods in heave, roll and pitch of TLPs lie usually in the range [2 s - 4 s], well below energetic wave periods. Again resonant responses, known as "springing" and "ringing", have been observed in irregular sea-states. The responsible loads have been a topic of intense research in the past 20 years and it has been established that they are associated with the nonlinearities in the kinematic and dynamic free surface equations.

As one can see from this short introduction, nonlinear effects in wave-body interaction are manifold: some are due to viscosity, flow separation and associated drag forces, others are due to time-variation of the wetted hull, or to the