How Floaters Respond To Subsea Blowouts

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Common wisdom in the oil industry suggests that floating drilling vessels will sink suddenly if a subsea blowout occurs beneath them. Well-control schools and texts on floating drilling often describe how the gas bubbles "aerate" the water and rob the vessel of buoyant support.

This belief is completely false. Recent technical studies clearly demonstrate that the actual loss of buoyancy in a blowout is quite small for all believable well rates and reasonable water depths.

No one will deny that a blowout offshore (or anywhere) is a dangerous situation that requires prompt and decisive action. The notion that the drilling vessel is about to disappear beneath the surface can only add to an atmosphere of panic and invite critical mistakes. This misconception also may cloud policy decisions on such matters as riserless drilling and wellcontrol.

Technical Study

The Massachusetts Institute of Technology Department of Ocean Engineering recently investigated this controversial subject.[1] The study included a survey of actual blowout incidents involving floaters, development of a computer model of a vessel in a blowout, and large-scale experiments with a floating object in a bubble plume.

Research focused on vessel response, and did not address the risk of fire and explosion, an ever-present danger in any blowout. Conoco Inc. and Gulf Oil Corp. jointly funded the effort, which built on previous work supported by Exxon Corp. The experimental program was sponsored by the U.S. Navy and the Department of the Interior.

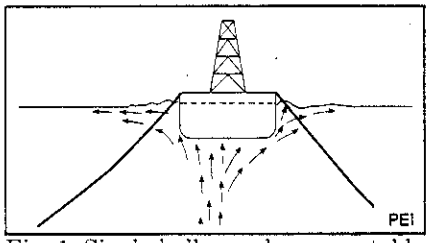

Fig. 1. Single-hull vessels are unstable over the center of a blowout, but the actual loss of buoyancy is quite small.

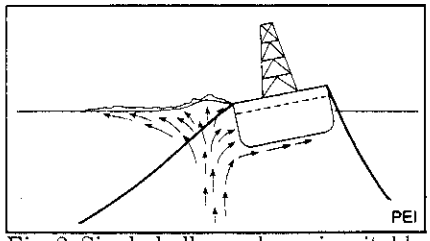

Fig. 2. Single-hull vessels are inevitably pushed to one side by blowout plumes, and mooring lines can cause them to heel into the plume.

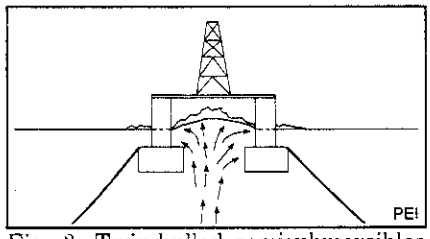

Fig. 3. Twin-hulled semisubmersibles are naturally centered over blowouts, and their low-placed moorings cause little heel.

Actual Incidents

Actual blowout situations were surveyed extensively. The researchers studied public reports and interviewed company and contractor personnel. To encourage free discussion, it was agreed to report only general trends, not particular accidents by location, rig name, or company.

The survey encompassed 11 incidents – eight involving barge or ship types and three with semisubmersibles. Major conclusions were:

- In all cases where the vessel sank (about one-third of the incidents), the sinking could not be related to density reduction in the plume. Instead, hull damage due to explosion and downflooding of open compartments were the major factors.
- Some apparent loss of freeboard and a definite list or heel angle into the boil were observed in most cases, especially on ships or barges. A few situations included a report of an increase in freeboard.
- Low freeboard ships or barges were most prone to sinking. They experienced large amounts of water on deck. This effect was not observed on semisubmersibles.

Further study of blowout characteristics revealed a mechanism that explains the dramatic effect of a blowout on a ship or barge. Fig. 1 shows how the single-hull vessel is unstable over the center of the blowout. Inevitably, it will be pushed to one side (Fig. 2). Then, the mooring lines at the main deck will hold it against the outflowing current from the blowout and cause it to heel into the plume. In this position, water can come over the side – and jet up the moonpool – to fill any open or damaged compartments.

In contrast, the twin-hulled semisubmersible (Fig. 3) is naturally centered over the blowout, and its low-placed moorings cause little heel. Two key actions will prevent sinking on a ship-shaped vessel: (1) close all watertight doors so com-