LOW ENERGY VESSEL COLLISIONS ON THE NORWEGIAN CONTINENTAL SHELF 1982-1994

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ABSTRACT

The paper describe the collision incidents which have been reported on Norwegian platforms in the periode 1982-94. A comparison with british experience is done. Discussion are made related to collision frequencies, type of platforms, causes of collisions, size of vessels, fendering and unauthorized vessels.

INTRODUCTION

From the United Kingdom a large number of reports (as Wicks et al, 1992 and Ellinas, 1993) have been issued during several years, giving information about the British vessel collisions. Some summaries have also been given from the Norwegian Continental Shelf (Hamre et al, 1991 and Vegge and Kvitrud, 1993). This paper will review the collisions reported to the Norwegian Petroleum Directorate (NPD).

The paper will also review the differences between the UK and the Norwegian offshore collisions.

Incidents which are not included here are:

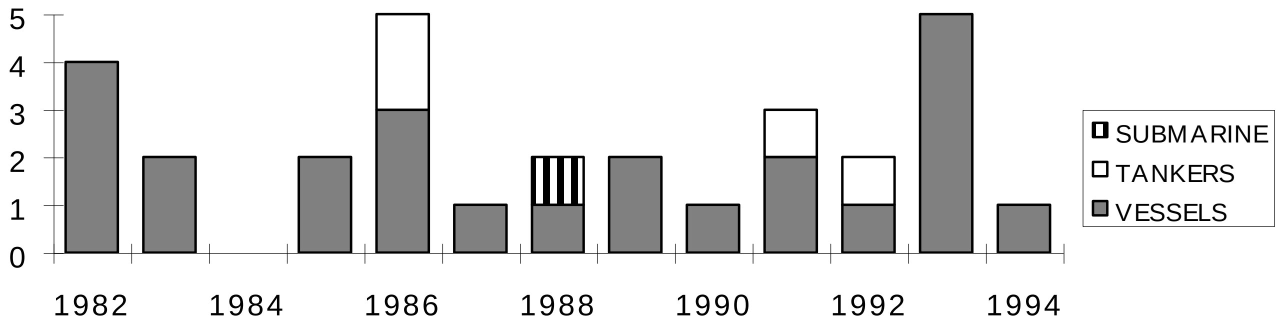
- collisions to pipelines
- collisions between subsea installations and fishing equipment
- scratching on platforms from wires or anchor chains used by vessels
- contact between the platforms catenary anchor systems and vessels or equipment

COLLISION FREQUENCIES

During the period 1982 to 1994, 30 collisions have been reported on the Norwegian Continental Shelf. A brief review of the events are listed in table 1. A more detailed description of the events is found in Kvitrud (1994). A total of 25 vessel collisions have been reported, one collision caused by a submarine and four by tankers. The type of vessels causing collisions are three diving vessel, nineteen supply / guard / rescue vessels and two pipe lying vessels.

The relationship between type of vessel and the time of occurence of the respective collision is shown in fig. 1:

Figure 1 : Norwegian offshore collisions 1982-94



The frequency of vessel collisions on the UK sector differs in the papers used for this discussion. The frequency of the Norwegian collisions is significantly lower than reported by Wicks et al (1992) and Ellinas (1993). Based on 975 platform years, they report a frequency of 0.13 per platform year on the damages on the Norwegian platforms should then give an indication. The relevant damages should be dents or scratches. The structures are inspected regularly both visually and by non destructive testing methods. The findings from the investigations are reported to NPD and filed in the CODAM system (Tesdal, 1985).

Reviewing all the dents, a large number of dents have been reported in the areas close the sea surface. The majority of the dents are found to occur on the top of the braces, indicating a dropped object history. Only two dents are found to occur reported in the area of plus/minus 5 meter from the sea surface, in a position where a collision could have occurred, indicating a possibility of non british shelf. Based on about 880 Norwegian platform years, an average collision frequency of 0.03 per platform year is found.

A reason for the difference in frequency might be a considerable lack of reporting of Norwegian offshore collisions. A review of reported collisions. The dents could also be older than 1982. A large number of scratches have also been found during in-service inspection of the platforms close to the sea surface. Again it is difficult to decide if the cause is an unreported vessel collisions or not. The contradicting figures from the UK and the Norwegian shelf are unresolved.

TYPE OF PLATFORM AND DAMAGE

The amount of data for comparison studies between different types of platforms are limited. Except from the loading buoys, there is hardly statistical evidence to say that some substructures are more exposed than others.

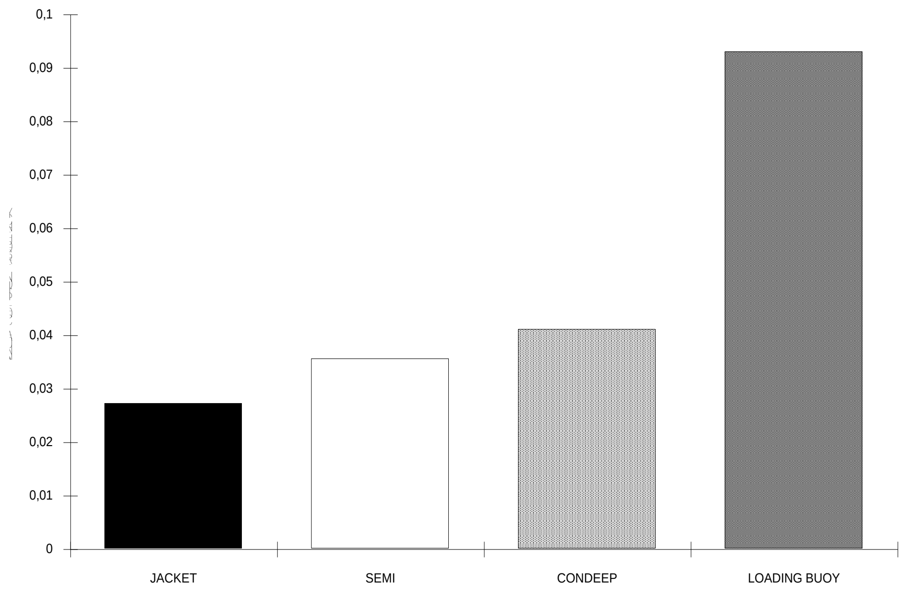


Figure 2 : Annual collision frequency rate on different types of platform 1982-1993

One vessel has been involved in three collisions and another two in two collisions. Four platforms have suffered from two collisions each.

The structural damage on the platforms have in general been small or insignificant. The largest damages were on 2/4-H (jacket) in its collision with a diving vessel, Oseberg B in its collision with a submarine and in the four tanker collisions with loading buoys. All these collisions have caused expensive structural repair work. The collision on Ula also caused vibration giving production loss on the field. Except from the incident at Oseberg; information about collision velocities are not available.

THE CAUSES OF THE COLLISIONS

The causes of the collisions are about the same in the Norwegian and the UK sector. About one half is connected to loading operations. Slightly more than one half is connected to misjudgement and the rest is due to faults in equipment. Some collisions have a technical faults as an initiating event, which afterwards has been combined with misjudgement or human errors afterwards. The initiating event in such situations are listed in table 1.

The reported equipment faults are :

a) failure in generator
b) failure in the dynamic positioning (DP)-system
c) malfunctioning of the thrusters
d) wrong signals to the DP-system and errors in the alarm system
e) loss of power
f) automatic emergency stop of engine caused by to high number of revolutions
g) automatic stop caused by low lubricating oil pressure
h) mechanical fault on the thruster

The human errors are usually done when manoeuvring in heavy seas or strong current. Some incidences have been caused by personell disregarding error messages on control panels.

The tanker collisions have all been with loading buoys. With four collisions a collision frequency of 0.09 pr operating year or about 0.1% pr loading operation is found. Situations which almost have lead to collisions, have also been reported between Petrojarl and the tanker Petroskald in 1986 and on the tanker Ragnhild Knutsen at a loading buoy at Statfjord in 1992. All the tanker collisions have been caused by errors in the dynamic positioning system. The incident at Petrojarl was caused by loss of power on the tanker.

The DP-system is a computer based system governing the machinery on a vessel. It gives instructions when the vessel should move - the power and the direction of the movement. If the vessel is in a wrong position, the deviation is calculated and instructions are given to the machinery to go to the correct position. If the DP-system receives wrong position from the positioning system, the consequences might be serious.

In connection with all the tanker collisions the positioning system Microfix has played a major role. The same is the case with the near collision in 1992. The problems with this system are related to:

a) The positioning system Artemis is at any time referring the position relative to the tip of the loading buoy. If the loading buoy is moving, the coordinates will be updated. Microfix as back-up system will every minute get its reference position updated by Artemis. If Artemis fails, the last Artemis position will be frozen in the Microfix system. Microfix has reference to the earth, where the position of the buoy is given as a fixed Point in the software. If the buoy is moving, movements of 20-30m is easily obtained which the Microfix system will not notice.
b) When using the Microfix, four stations are used as a reference. Some stations are frequently off without any warning, and the signal is lost. When you start again, the first signals are unstable and might give you a completely wrong position.

c) The quality is also depending on the number of users in an area. A new user might create problems for someone who is using the system already.

More information on the Microfix system can be found in Helgøy (1994). Because of the problems; the Microfix system was replaced by an other system for Statoils offshore loading operations, from 1.7.1994.

SIZE AND AGE OF THE VESSELS

A relationship between the vessel sizes and the respective number of collisions is shown in fig. 3. The relative numbers of the smallest and largest vessels are much higher than reported from UK side (Ellinas, 1993). The sizes are mainly taken from Dayton (1987) and DnV (1986, 1988 and 1994). The reports don't give any information about the actual weight. The UK data (Ellinas, 1993) indicate differences in sizes between the vessels colliding in different parts of the UK sector. Ellinas has not defined the limits of south, central and northern North Sea, but a similar exercise on the Norwegian data, using 59 degree north as the boarder, give a distribution as showed on the figure 3. Neglecting the tanker collisions a geographical trend, as shown in the UK data, is not observable in the Norwegian data. Loading buoys in Norway are presently only used in the area north of 59 degree north.

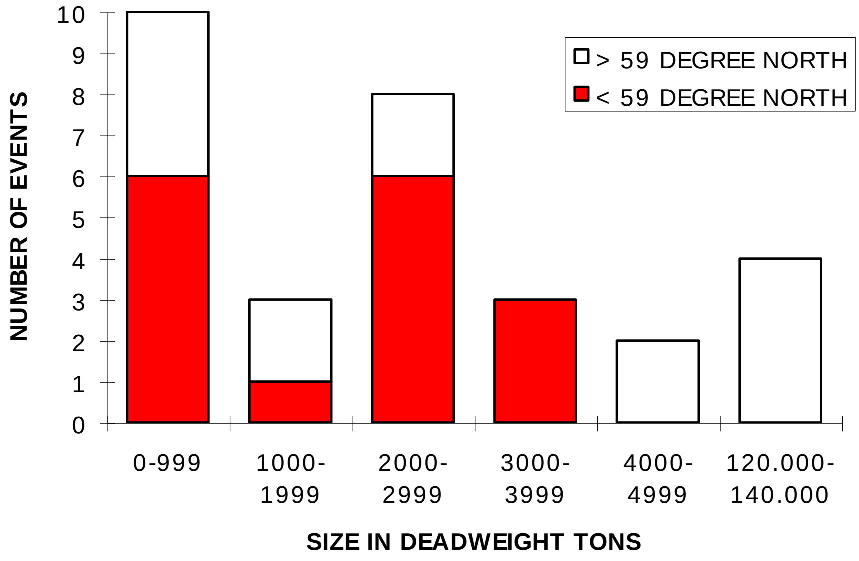


Figure 3 : Size of the colliding vessels distributed on geographical location

As demonstrated in figure 4; there is no clear relation between vessels colliding and the age of the vessels.

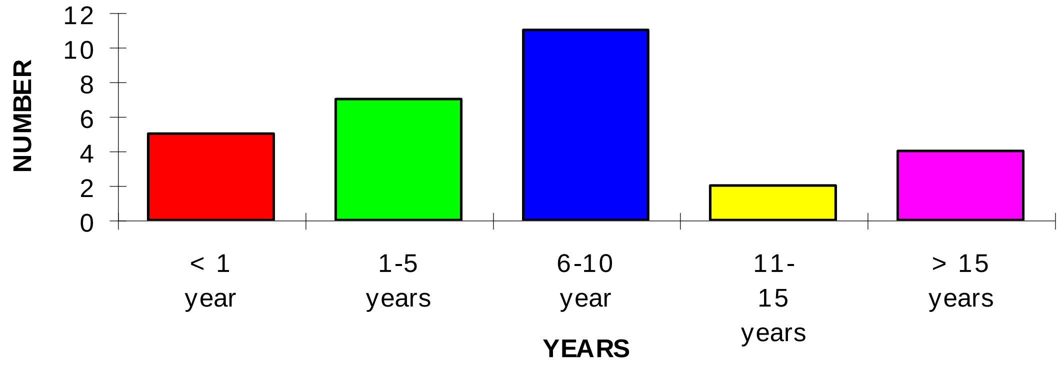


Figure 4 : Age of the colliding vessels on the Norwegian Continental Shelf in the period 1982-1994

FENDERING

Based on the UK collisions, Wicks et al (1992) reports that where fendering was provided, it was generally successful in preventing damage to the platform.

In Norway collisions with boat bumpers or boat bumpers support have been reported on

SEDCO 707, Ekofisk 2/4-D, Odin, Deepsea Bergen, Gyda and Ula. In the cases where boat bumpers have been hit, damage on the main structure has only been reported on Odin. Here the boat first hit the boat bumper and then hit a leg of the platform. As in the UK, the boat bumpers have prevented damage on the platforms in several of the cases.

NPD has not required the platforms to have boat bumpers. This is due to that the fenders on some occasions have been torn loose, fallen down and caused damage on subsea members of the platform. The need for fendering should be evaluated case by case.

UNAUTHORISED VESSELS

Only one collision has occurred with a non authorised vessel. It was the submarine collision at Oseberg in 1988. For further details reference is made to Sveen (1989). With 30 collisions, the submarine collision represents about 3% of the events. This is about the same as reported by Wicks et al (1992) on the UK sector (5%).

When looking at situations with vessels moving at full speed and almost causing a collision, we only have one reported situation. The German vessel Navaro was close to collide with the semi submersible Dyvi Delta at Haltenbanken in 1986. On several occasions vessels have passed inside the safety zone, but without being an immediate danger to the platforms.

On one occasion a fishing vessel got its fishing gear stuck in a surface anchor buoy of a semisubmersible. This event occurred in 1982.

A review of drifting objects in the Norwegian Continental Shelf is given by Tysnæs (1989). As demonstrated in figure 5; the number of drifting objects is low. No situation have occurred where drifting objects have been inside the safety zone since 1979.

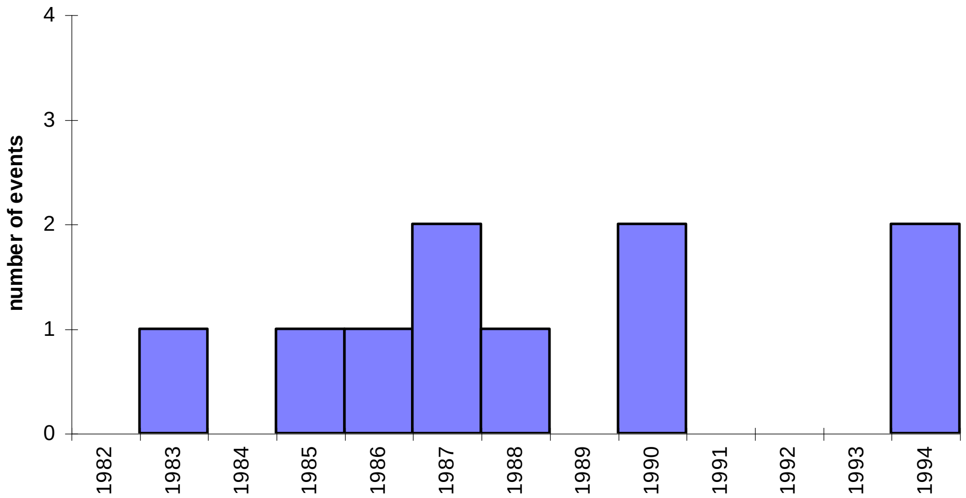


Figure 5 : Drifting objects in the vicinity of Norwegian platforms in the period of 1982-1994.

SUMMARY

The Norwegian collision experience is to a large extent similar to what has been reported on the UK sector, but it has a lower frequency.

A type of collisions, which seems to be specific for the Norwegian sector, is the large number of collisions caused by errors in the DP systems.

The NPD guidelines (1992) concerning loads and load effects recommend a collision design to cover all the vessels which regularly visit the platforms. Relevant masses should be used, but the size of the vessel should normally not be selected less than 5000 tons. The velocity can be determined based on the assumption of a drifting ship, or on the assumption of erroneous operation of the ship. The Norwegian offshore experience, as reported in this paper, seems to support our guidance.

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Table 1: Collision events:

collision date	platform	type	vessel	type	size (dwt)	built	failure
130482	2/4-H	jacket	Seaway Falcon	diving	1636	1975	electric generator
010782	Valhall QP	jacket	Tender Turbot	standby	2015	1980	human error
290982	SEDCO 707	semi	Trønderhav	standby	ca 1000	1963	human error
261082	SEDCO 707	semi	Trønderhav	standby	ca 1000	1963	human error
120183	2/4-D	jacket	West Plover	supply	889	1974	human error
101183	Odin	jacket	Jagima	standby?	ca 500	1983	human error
090585	2/4-H	jacket	Seaway Harrier	diving	2000	1985	DP-system
010885	2/4-C	jacket	Active Duke	supply	3250	1985	controll panel
250586	COD 7/11-A	jacket	Rescue Tern	standby	812	1976	human error
230186	Statfjord-C-SPM	loading buoy	Polyviking	tanker	130.700	1983	DP-system
090686	Statfjord-B-SPM	loading buoy	Polytraveller	tanker	125.690	1979	DP-system
290786	Gullfaks A	condeep	Flexservice 2	pipe-laying	2495	1979	DP-system
241286	Odin	jacket	North Safe	standby	ca 500	1971	human error
011287	2/4-A	jacket	Nor Truck	supply	2495	1979	loss of power
060388	Oseberg B	jacket	U-27	sub-marine	ca 500	-	human error
150588	16/11-S	jacket	Geo Boy	standby	508	1951	human error
051189	Deepsea Bergen	semi	Strilhavet	rescue	ca 1000	1963	machinery failure
141289	TCP2	condeep	Tender Fighter	standby	2629	1986	human error
260790	Poly-confidence	semi-flotel	Maersk Rover	standby	2000	1980	human error
020491	Polar Pioner	semi	Ocean Star	guard	878	1976	human error
101091	Gullfaks-SPM1	loading buoy	Sarita	tanker	124.472	1986	DP-system
031191	Gyda	jacket	Northern Clipper	supply	2480	1983	human error
170192	Statfjord-C-SPM	loading buoy	Evita	tanker	126.352	1988	DP-system
100792	2/4-A	jacket	Seaway Harrier	diving	2000	1985	DP-system
120493	Sleipner R	jacket	Normand Gard	supply	790	1985	Loss of power
270493	Eldfisk 2/7-B	jacket	Sound Truck	supply	3370	1983	Human error
080993	Albuskjell 2/4-F	jacket	Rescue Tern	supply	800	1974	mechanical failure
200593	Oseberg A	condeep	Maersk Forwarder	supply	4640	1993	machanical failure
300893	Ula-QP	jacket	Highland Star	supply	3075	1991	mechanical failure
210894	Brage	jacket	Northern Clipper	supply	4568	1994	DP-system