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*Ship Collision with Bridges and Offshore Structures*

*Collisions des bateaux avec des ponts et des constructions en mer*

*Kollision von Schiffen mit Brücken und "Offshore"-Bauten*

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Change in Nomenclature

The term 'Cowboy Vessels' has been discontinued. These vessels are now termed 'Errant Vessels'.

# Ship/Platform Collision Risk in the U. K. Sector

## Risques de collision dans le secteur britannique

## Kollisionsrisiken von Schiffen und Offshore-Bauten

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**SUMMARY**

A major study of the risk of collision between passing vessels and offshore platforms is described. The study develops a new approach to platform risk estimates, based on the concept of definable shipping lanes. The results available to date indicate that the risk to certain platforms, near to major shipping lanes, is very high, whilst the risk to many others is sufficiently low not to be of significant concern.

**RÉSUMÉ**

L'étude décrit en détail les risques de collision entre les navires et les plates-formes situées au large. Cette étude propose une nouvelle méthode pour évaluer les risques des plates-formes en se fondant sur le concept de voies de navigation définissables. Les résultats montrent que les risques sont très élevés pour certaines plates-formes installées des grandes voies de navigation, tandis qu'ils sont moindres pour les autres plates-formes.

**ZUSAMMENFASSUNG**

Eine größere Untersuchung des Risikos von Kollisionen zwischen Schiffen und Offshore-Bauten wird beschrieben. Eine neue Annäherung an eine Risikoschätzung von Offshore-Bauten auf der Grundlage eines Konzepts festlegbarer Schiffsstraßen wird vorgeschlagen. Die Ergebnisse zeigen ein sehr hohes Risiko für bestimmte Plattformen, die nahe an Hauptschiffahrtsstraßen liegen, während das von vielen anderen ausreichend niedrig und nicht von großer Bedeutung ist.

# 1. INTRODUCTION

## 1.1 Background

Since drilling for North Sea oil and gas began in the mid 1960s, the possibility of ships colliding with offshore platforms or rigs has been of concern to both government and operators. Several studies have been undertaken by organisations in the UK and elsewhere to evaluate the risk of ship collisions and their consequences to both steel and concrete platforms [1,2,3]. During 1980 a review of these studies was undertaken on behalf of the UK Department of Energy by the Marine Technology Support Unit (MATSU) at Harwell [4]. This review concluded that the level of risk from ship collision might be sufficiently high to be of concern, but that there were a number of important omissions and discrepancies in the existing data. Hence the confidence which could be placed in the risk figures was too low for the Department's purposes. A recommendation for a broad based and more rigorous review of the collision hazard was made. This paper describes progress of the subsequent study, by consulting engineers Technica Ltd. to meet that recommendation.

## 1.2 Survey of available data

Before commencing work on a model of ship collisions, a survey was carried out of sources of relevant incident data. Various bodies were approached, such as HM Coast Guard, HM Customs, Trinity House, North Sea Pilots, and the UK Department of Energy (DOEN) Records Office. Of most use were the DOEN's records of safety zone infringements.

These records were examined in all the detail available, with a view to obtaining a picture of the collision hazards to offshore platforms by ships, and the circumstances in which such hazards occurred. The examination of these records highlighted the fact that a disturbing number of vessels passed within a few hundred metres, without altering course, without responding to VHF, or to signalling, marine radio, hailing, or actions by the standby vessel. In most cases, nobody could be seen on the bridge. For the purpose of this study, these vessels have been defined as "cowboy" vessels.

Numerically, Table 1 shows the results that emerged from this examination of UK safety zone infringements:-

Table 1 : Passing vessel infringements in the UK sector for the period 1973-1980

| | |
|---|---|
| Number of passing vessel infringements: | 53 |
| Broken down as follows:- | |
| Definitely classified as "cowboy" vessels | 13 |
| Infringement Definitely due to other causes | 16 |
| Insufficient detailed information was available: | 24 |

## 2. THE MODEL

### 2.1 The Approach Employed

The approach employed was to work from two hypothesis i) that the major cause of collision risk was from these "cowboy" vessels, and ii) that the traffic across the North Sea tended to follow particular routes that could be identified, and subsequently verified by experience and/or traffic surveys.

In developing a ship/offshore platform collision model, the objectives were set of ensuring that it was realistic, pragmatic and applicable to different sea areas. In other words, the model should accord with practical marine experience and the historical data applicable to the North sea.

In addition, the risk arising from vessels on these routes breaking down and then drifting onto the platform was examined. The parameters used in estimating the risk from this model is discussed below.

### 2.2 The Model Input Data

The important parameters required as input to the basic model are as follows:

1. Lane location, lane width, lane traffic, ship speeds.

2. Lane width, expressed as the probability of finding vessels on a cross section of the lane.

3. The percentage of cowboy vessels in any one lane.

4. Input concerned with vessels losing propulsion or steerage:- Details of expected course alterations that vessel would follow when using the platforms for navigational purposes; likelihood of engine or steering failure, stopping distances.

5. Input concerned with ability of platform personnel and nearby vessels to avoid loss of life from drifting vessel hazard.

For the purpose of quantifying the risk from passing vessels that appear not to be aware of the platforms, parameters 1, 2 and 3 are the only ones of concern and these are discussed below.

#### 2.2.1 Shipping Lanes

Two areas have been selected for the study as the typical of likely high and low traffic densities. This enables a methodology to be developed to assess the risk of ship/platform collisions, in both absolute and relative terms, for which the traffic information is basic input.

The results for these two areas of a preliminary analysis of data on shipping movements, and on known origins and destinations of vessels crossing the North Sea, are given in Figure 1 for the Northern and Figure 2 for the Southern areas examined.

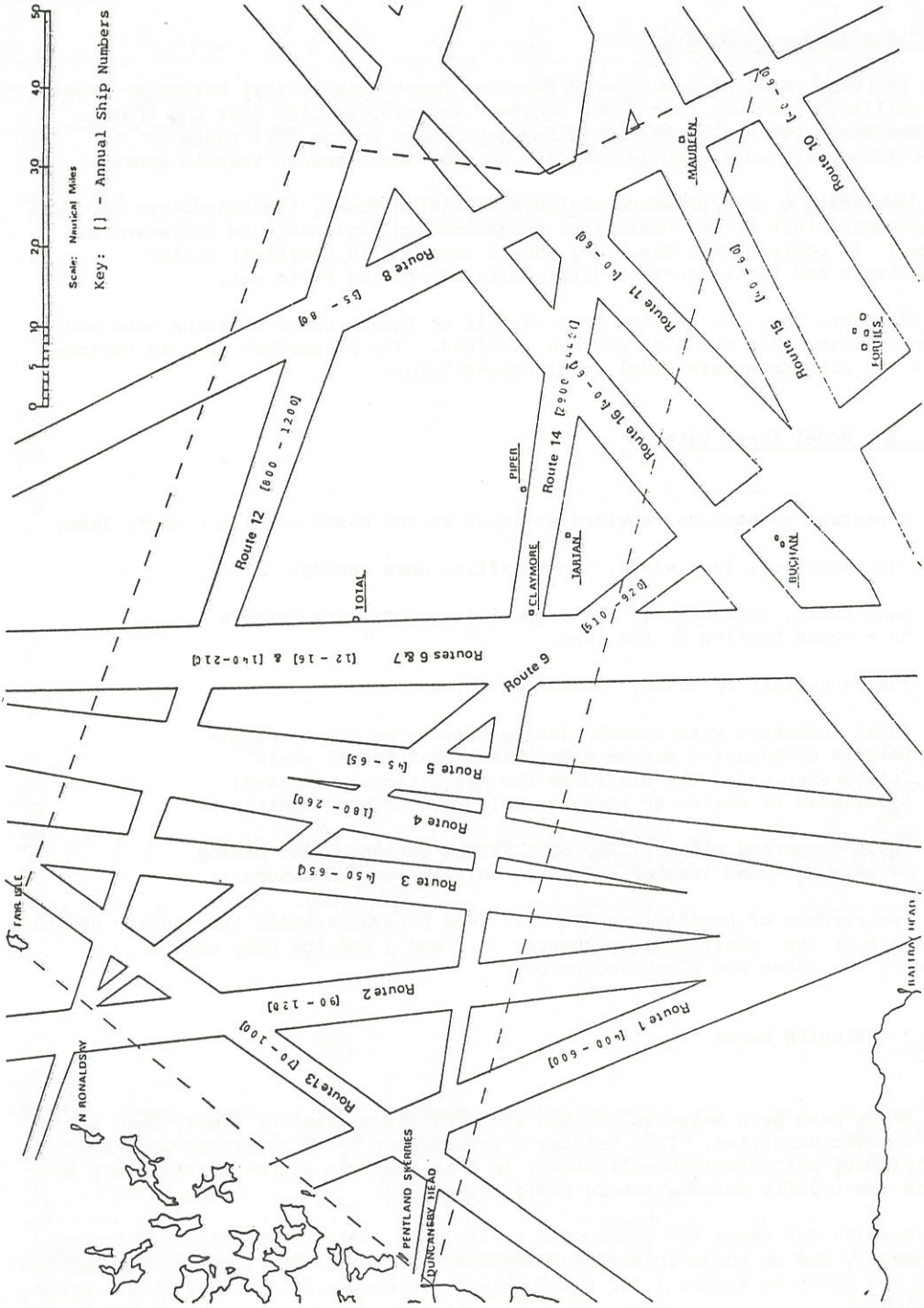


Fig. 1 Northern sector. Commercial shipping routes.

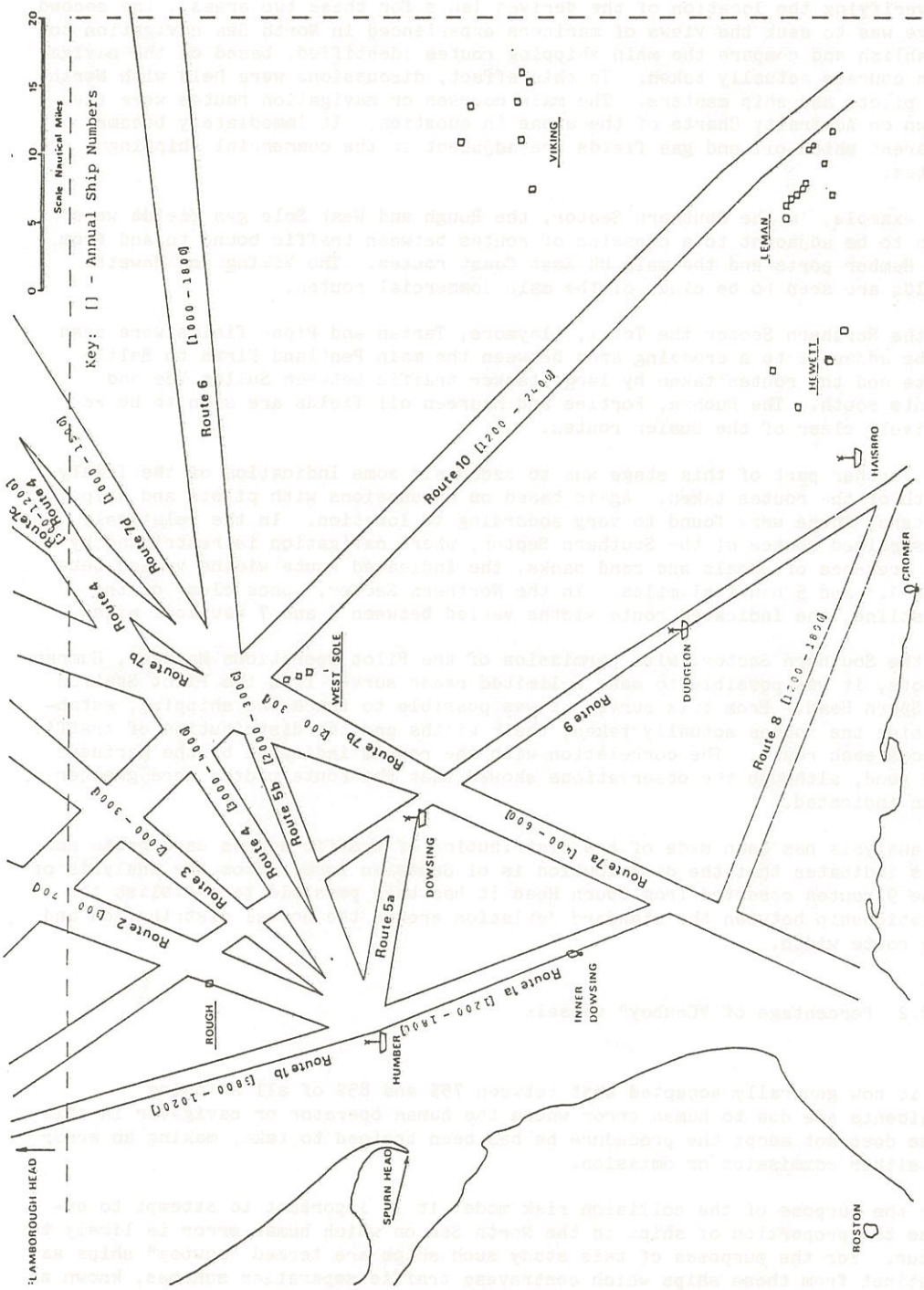


Fig. 2 Southern sector. Commercial shipping routes.

In verifying the location of the derived lanes for these two areas , the second stage was to seek the views of mariners experienced in North Sea navigation to establish and compare the main shipping routes identified, based on the navigation courses actually taken. To this effect, discussions were held with North Sea pilots and ship masters. The main courses or navigation routes were then drawn on Admiralty Charts of the areas in question. It immediately became apparent which oil and gas fields are adjacent to the commercial shipping routes.

For example, in the Southern Sector, the Rough and West Sole gas fields were seen to be adjacent to a crossing of routes between traffic bound to and from the Humber ports and the main UK East Coast routes. The Viking and Hewett fields are seen to be clear of the main commercial routes.

In the Northern Sector the Total, Claymore, Tartan and Piper fields were seen to be adjacent to a crossing area between the main Pentland Firth to Baltic route and the routes taken by large tanker traffic between Sullom Voe and points south. The Buchan, Forties and Maureen oil fields are seen to be relatively clear of the busier routes.

The further part of this stage was to ascertain some indication of the likely width of the routes taken. Again based on discussions with pilots and ship masters, these were found to vary according to location. In the relatively constrained routes of the Southern Sector, where navigation is restricted by the presence of shoals and sand banks, the indicated route widths varied between 1.5 and 5 nautical miles. In the Northern Sector, once clear of the coastline, the indicated route widths varied between 3 and 7 nautical miles.

In the Southern Sector, with permission of the Pilot Operations Manager, Humber Pilots, it was possible to make a limited radar survey from the Pilot Station at Spurn Head. From this survey it was possible to track the shipping, establishing the routes actually taken, their widths and the distribution of traffic across each route. The correlation with the routes indicated by the mariners was good, although the observations showed that the route widths were greater than indicated.

An analysis has been made of the distribution of traffic across each route and this indicates that the distribution is of Gaussian form. From the analysis of some 9 routes observed from Spurn Head it has been possible to establish the relationship between the standard deviation around the normal distribution and the route width.

### 2.2.2 Percentage of "Cowboy" vessels

It is now generally accepted that between 75% and 85% of all shipping accidents are due to human error where the human operator or navigator in this case does not adopt the procedure he has been trained to take, making an error of either commission or omission.

For the purpose of the collision risk model it is important to attempt to define the proportion of ships in the North Sea on which human error is likely to occur. For the purposes of this study such ships are termed "cowboy" ships as distinct from those ships which contravene traffic separation schemes, known as "rogue" ships, and those which do not comply with the construction, manning and equipment requirements internationally agreed in IMO Conventions, known as "sub-standard" ships.

The likely proportion of ships plying the North Sea which may fail to take appropriate action to avoid a collision with an offshore structure has not, to our knowledge, been the subject of investigation. Further, no one source of data is seen as suitable from which a confident expectation of the likely proportion may be determined.

A number of approaches have therefore been selected from which to view this problem. These include an assessment of the numbers of "sub-standard" and "rogue" vessels identified in other studies [5,6] as indicators of the likely upper bound of the "cowboy" population, and the consideration of the human failure rates contained within the series of Norwegian studies of causes and consequences of shipping accidents [7]. Consideration has also been given to the human failure rate in other occupational groups and finally, the subjective views of practising mariners and pilots have been sought.

The results from these approaches indicated a percentage of between 1-15% of the total shipping population as being likely "cowboys" with a bias towards the lower end of the band. In our view, we consider that a realistic range of the proportion of "cowboy" vessels to apply to the mathematical risk model should be between 1-5% of the total shipping population in any one lane.

## 3. RESULTS

### 3.1 Typical output

The output gives the drifting vessel and cowboy vessel collision probabilities for each shipping lane that can affect the platform, and then a grand total, summing the risks from each lane.

### 3.2 Typical results

The results are dependent primarily on one factor: the proximity of the platform to a major shipping route. Other factors, such as the lane width shape, the percentage of cowboy vessels and the minor shipping lanes, all contribute to the absolute level of risk, but not so significantly to the relative risk levels or to the sensitivity of the results.

For platforms in close proximity to the major lanes, the risk level is presently estimated to be of the order of $10^{-1}$ to $10^{-2}$ per year. This figure represents a high level of risk, well above most criteria of acceptability.

For platforms far from such shipping lanes, the risk is no longer dominated by cowboy vessels, and consequently the risk level is substantially lower, in the order of $10^{-5}$ per year. This risk level is comparable to or lower than other quoted figures for 'average' collision risk from passing vessels in the North Sea.

### 3.3 Substantiation of the results

These results are still preliminary, in that further work is currently under way to refine the shipping lane locations, the shipping traffic, the lane width and the percentage of cowboy vessels. If the results are, however, confirmed by this further work, then the results have important implications for North Sea safety.

### 3.4 Implications for North Sea operations

If the comparatively high risk figures for installations in close proximity to major shipping lanes are confirmed then the Department of Energy may need to consider the need for further regulations.

At the time of writing no decisions have been made in this regard, but requirements for fendering, surveillance and warning may have to be reviewed. Measures to meet requirements could be expensive and difficult to implement in view of the international nature of the problem and hence steps will not be taken lightly and, as with all regulations, only after consultation with the industries concerned.

## 4. CONCLUSIONS

i) A model for the risk of passing vessel collisions with offshore platforms in the North Sea has been developed that appears to be capable of providing platform specific estimates of the risk.

ii) The major preliminary results, which at the time of writing are not yet confirmed, are that

   a) The relative risk of collision for various installations are dependent primarily on their proximity to major shipping routes.
   b) Risks for most installations are low and present regulations are adequate to deal with them.
   c) Risks for the most vulnerable installations are unacceptably high and regulatory measures may have to be considered.

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