Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 42 (1983)

Artikel: Minimizing the risk with vessel traffic management systems
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DOI: https://doi.org/10.5169/seals-32404

Minimizing the Risk with Vessel Traffic Management Systems

Réduction des risques avec des systèmes de gestion de la navigation maritime

Verminderung des Risikos mit Systemen zur Schiffsverkehrssteuerung

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SUMMARY
This paper examines the need for sophisticated radar surveillance of marine traffic and, in particular, vessel traffic management at the interface between shipping and the rapidly expanding offshore oil industry with particular reference to the North Sea.

RÉSUMÉ
Cette étude se penche sur la nécessité d'une meilleure surveillance radar de la navigation maritime, et, plus particulièrement, de la gestion de la navigation maritime tenant compte du transport maritime et de la croissance rapide de l'industrie pétrolière en mer, en particulier en Mer du Nord.

ZUSAMMENFASSUNG
Der Artikel untersucht die Notwendigkeit einer besseren Radarüberwachung des Marineverkehrs und besonders der Schiffsverkehrssteuerung, welche die Schiffahrt und die rasch wachsende Meeres-Ölindustrie in der Nordsee berücksichtigt.

1. HISTORICAL

1.1 Traditionally, the principle of freedom of the seas has meant for many centruries, the right of the Shipmaster to navigate his Vessel where and how he deems it to be safe, practicable, and in the best commercial interests of his Owners. If it is conceeded that every Vessel is, at all times, under the conscientious and competent control of an experienced Master and Bridge Watchkeeper, then it would seem that there can be no argument against this long standing concept. Without exception the law of every Maritime Nation places the ultimate responsibility upon the Master of a Vessel for the safe navigation and conduct of his vessel and in such circumstances it cannot be doubted that the Shipmaster must, even where a degree of external control is exercised over his function, be the final arbiter in regard to the handling of his Vessel with due regard to circumstances prevailing at any moment.

1.2 "Experience" with "Competence" on the Bridge of a Vessel unfortunately, is not always sufficient to ensure that catastrophe is avoided. When, in the early post war years, Merchant Vessels were being equipped with Marine Radar there came into existence the term "Radar Assisted Collision", perhaps the first and worst example being the collision between the "Andrea Doria" and "Stockholm" in the open seas off the Nantucket Lightship in July of 1956 when the "Andrea Doria" sank with the loss of 43 lives. The Automatic Steering boon brought with it in many ships the one man watch system displacing the 'lookout' on the grounds that the Bridge Watchkeeper could now concentrate on this duty. The infamous "Torrey Canyon" stranding on the Seven Stones Reef in March 1967 effectively illustrated the fallacy of this principle. Even the introduction of Hyperbolic Navigation lent itself to demonstrations of human failure in that, within the confines of the North Sea; that most treacherous of crowded waters; some Mariners discovered a method of simplifying the use of their Decca Lane Receivers whereby a crossing from one coast to another could be accomplished by setting the Vessel initially on a suitable "Lane" indicated on one of the three Decometers and then, by making small adjustments of course necessary to hold the Vessel on the selected Lane, the crossing became simplified and avoided the need for the inconvenience of plotting on the Chart. Inevitably this gave rise to the extremely precise "Decca Assisted Collision" when ships bound in opposite directions elected to navigate directly towards one another on the same lane.

1.3 Radar Surveillance and direct Control of Aircraft from Ground Stations is universally accepted and, within the confines of Marine Pilotage Waters generally, similar Surveillance and Control is often exercised under the laws of Nations or the bye-laws of the Marine Authorities in whose jurisdiction a particular waterway lies, though it must be stated that very many Authorities still rely more on data gathered from V.H.F. reports and processed by manual plotting than upon the more reliable output of a modern Computerised Radar Facility. In the offshore Sea Lanes however the situation is not so clearly defined and where Surveillance exists, the principle of "Control", is by International agreement, one of "Advice" which may or may not be accepted by the Shipmaster. However, the experience of Shipping in the dense traffic situations of the separation lanes in the Dover Strait and off the Cherbourg Peninsula has, over the years, led to tacit acceptance of the efficiency of the systems of Radar Coverage and precise Advice of the British and French Operators at Dover, Cap Gris Nez and Cherbourg to the point that for all practical purposes the Radar Surveillance 'Advice' within these areas function to a considerable extent as 'Control'. Significantly, collisions in the Dover Strait Seaway show the following statistical decline.

- Collisions during period:-

1956/60	1961/65	1966/70	1971/75	1976/80
62	80	48	21	16

- In addition, the U.S. Coastguard in 1979, estimated that the introduction of "Automated Advanced Surveillance would reduce the incidence of collisions by some 35%.

2. THE OFFSHORE ENVIRONMENT

2.1 In commercially modest circumstances prospecting for Hydrocarbon Deposits in the Offshore Environment has proceeded over many years principally in the Gulf of Mexico. Exploration in the North Sea commenced on 26th. December 1964 from the Drilling Rig "Mr. Cap" and the first 'show' of Methane Gas was found by the Rig "Sea Gem" on 20th. September 1965. From that date onwards exploration was stepped up by all Countries bordering the North Sea but proceeded at a leisurely pace while agreement was reached on precise surveying criteria, the establishment of Median Lines and extent of National Zones for exploration and exploitation of discoveries.

2.2 In 1973 the price of Oil rose astronomically. The immediate result was an intense stimulation of offshore Hydrocarbon exploration and development throughout the world, principally and most dramatically in the North Sea, where permanent Platforms and mobile Drilling Rigs have proliferated into and across the shipping lanes. This process continues as Governments lease off blocks in their National Zones and discoveries continue to be made. Paradoxically, the higher the rise in the price of Hydrocarbons, the greater will be the proliferation of Platforms and Drilling Rigs in the North Sea, the English Channel and the Western Approaches to the Channel as, due to better returns on investment, marginal fields become economical to exploit.

2.3 At present, December 1982, the locations of fixed Platforms in the North Sea is as depicted in Figure 1. It will be seen from this Figure that the disposition of permanent structures referred to as "Platforms" is fairly dense down the middle of the North Sea on either side of the median Line separating the British, Norwegian, Danish and German Offshore Zones and directly across every shipping route between the Coasts of Britain and Norway, Denmark and the seaway of the Skagerak. In addition Platform Installations now extend in an arc from the coast of Norfolk in England to a point not far from Ijmuiden in Holland and directly across the main shipping lanes from the Channel to the many European Ports.

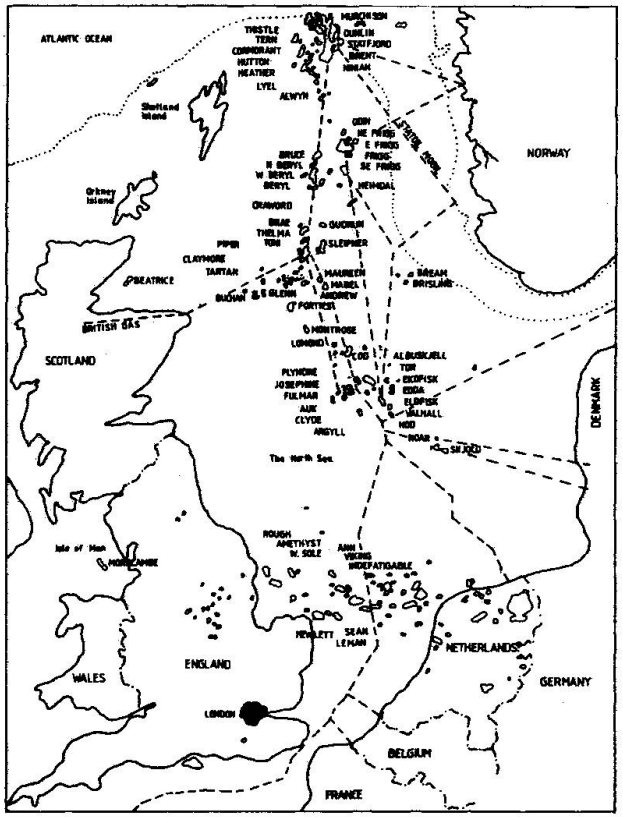

Fig. 1

2.4 As well as the permanent "Platforms" both installed and intended, exploration is continuing throughout the area from some forty two essentially mobile Drilling "Rigs"; Jack-up Structures in the more shallow seas of the Southern North Sea and Semi-Submersible moored Structures in the deeper waters further north. Other Semi-Submersible Rigs have been working west of Brest in the approaches to the Channel within a few Nautical Miles of the edge of the Continental Shelf and directly across the access shipping lanes from the Atlantic and the Bay of Biscay, Blocks have been leased off the English Channel south of the Isle of Wight and beyond the limits of the exising Radar Surveillance Systems. it is only a question of time before exploration begins in this area and, if discoveries are made, Permanent platforms will be installed to replace the Exploration Rigs.

3. PLATFORM AND RIG RESPONSIBILITIES

3.1 Similar to the status of the Master of a Vessel or Captain of an Aircraft the Operational and Administrative control of a Platform or Rig is vested by International Law in an "Offshore Installation Manager" (O.I.M.)

3.2 The O.I.M. has total responsibility for all activity on the Installation and for the conduct of shipping within a circular sea area surrounding the Installation out to a radius of 500 metres from the Installation. The particular intention underlining the regulations which govern the appointment of an O.I.M. is one of maximum safety both towards the personnel on the Installation and in the control of environmental hazards resulting from the incidents of Blow-outs experienced in drilling or errors in production proceedures. Ever present is the possibility of a drilling operation striking into a pocket of lethal Hydrogen Sulphide Gas or of highly inflamable Methane or other by-product Gasses of petroleum formation. Heavy inflamable gasses flowing outboard and down wind from an Installation could in theory be ignited by a heat source on a Vessel in the vicinity of the Installation with

catastrophic flash-back possibility, and it is specifically for this reason, and the possibility of collision with the structure, that the jurisdiction of the O.I.M. is extended by this arbitrary radius of 500 metres.

3.3 Generally speaking Platforms tend to be positioned in groups in that economics mitigate against too many single Platform production system. Figure 2 shows the current disposition of Platforms in the 'Oil Basin' west of the Shetland Islands in the Northern part of the North Sea and also indicates the independent Operators controlling the fields in which the Platforms are located. Since most operating Companies are representative of Partnerships, the listing is by no means exhaustive of the total of all the interests in the area.

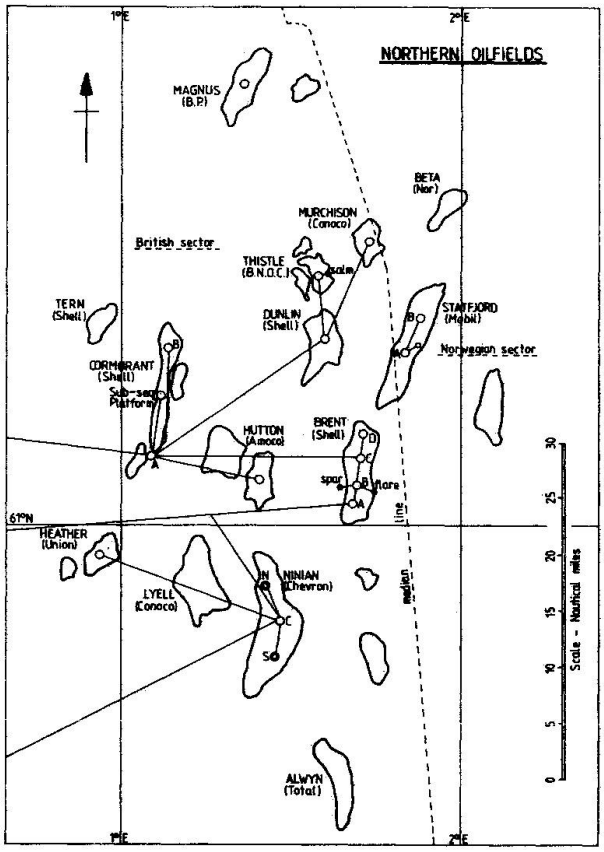

Fig. 2

3.4 Some, though not all, Platforms employ qualified Mariners as "Marine Controllers" to whom the O.I.M. delegates the task of directing the activities of Vessels in the vicinity of the Platform or Installation. In some Fields; notably the large Brent, Dunlin, Cormorant Complex of Shell; the Statfjord Field of Mobil and the Ninian Field of Chevron: a Marine Controller Organisation exists to direct the activities of shipping within the whole Complex. Some, but as yet only a few, have a Radar Installation with which the Marine Controller can achieve a complete appreciation of the shipping situation around his Platform or field including any unauthorised entry into the relevant 500 metre circle zones. The very extensive Shell Complex is one that does not have a Radar Installation on the grounds that the equipment cannot be classed as a productive asset in terms of the main objective: the production of Oil. Appreciation of marine activity in this extensive environment is totally dependant on Radio communications and manual recording.

4. MARINE RADAR AND VESSEL TRAFFIC MANAGEMENT

4.1 Since its introduction into Merchant Vessels in the early post war years Marine Radar has undergone continuous improvement in terms of Scanner Design Display Readability, target Separation, True Motion facility, Automatic Anti-Collision Plotting and other refinements. The inovation of the Electronic CHIP however opened the door to fully Computerised Systems such as the "Data Bridge" anti-collision system and its complementary Fixed Station Control Installation; the Vessel Traffic Management System or VTMS.

4.2 Developed specifically for Marine Traffic Control the VTMS consists essentially of a Computerised Console with a large Daylight Visual Display Unit, colour sensitive for fine definition of fixed and mobile Targets. Through the use of Data Extractor Units and Modems the Computer within a single Consul is provided with the data drawn from up to seven Radar Transceivers whether "S" or "X" band. The Modems permit the transfer of data and control of the remote Radar Systems by signals passed on any narrow band systems ranging from Radio Voice Circuits, Forward Scatter Dish Systems to Telephone Lines. The Data input to the Computer is digested, filtered, colated, offset corrected and displayed on the V.D.U. as a consolidated picture of the entire area scanned or, by Operator selection, a particular section of the area requiring more detailed or closer observation. Permanent features relating to a particular area under surveillance as, for example, sub-sea Well Completions, Pipelines, Wrecks etc., which would not normally be detected by Radar, may also be displayed by incorporating them in the Computer's controlling programme.

4.3 The system is, on selection, fully automatic in that the operator can set parameters which will cause alarms to be activated if and when these parameters are transgressed. In effect this implies that the system will operate as a marine security system unassisted at all times, calling attention to potentional danger by highlighting the transgressing Target or Targets and providing amplification data on a subsiduary Display Cathode Ray Tube. A single Computerised Console is capable of simultaneously handling up to one hundred Moving Targets and one hundred Stationary Targets but by using Consoles in cascade there is practically no limit to the target handling ability of such a system.

4.4 Initially designed for Harbour and Estuary Shipping Control one of the first installations of VTMS was at Teeside in England. Sponsored by Phillips Petroleum for use by the Tees Harbour Control specifically for protection of the Ekofisk to Teeside Oil Pipeline in the anchorage off the Tees, the system has been effective in preventing damage to the main Ekofisk to Teeside Oil Pipeline over the past five years. In addition to Teesport, Harbour Control VTM Systems are being installed as far apart as Bintulu in Malaysia and Gothenburg in Sweden. In the offshore environment installations are being progressed in the Northern North-Sea Fields by British Petroleum on the single Platform of the Magnus Field with input to the Console from two Radar Scanners. By Mobil in the Statfjord Field where the Operator will have the choice of using seven Scanners separately disposed around three Platforms. Conoco, on their Murchison Platform, have fitted only a Standard Marine Anti-Collision Radar.

4.5 By far the most ambitious project being undertaken at present is the installation in the Gulf of Campeche off the coast of Mexico covering a sea area of some 3,900 square Nautical Miles and using six Consoles in cascade the system is designed to enable control of this vast area to be exercised from any one of four widely separated locations.

4.6 Objections that have been leveled against installing Radar Systems on Oil or Gas Platforms have been on three main counts. Firstly, it was assumed that Scanners would need to be installed at a height superior to all other equipment in order to achieve an all round Radar 'view'. The installation of a single basic Marine Radar on the Murchison Platform gave credence to this view but with the ability of a VTMS to collect and process a number inputs this is no longer necessary. Compact Scanner, Transceiver and Data Extractor Units can be mounted in small Box Units and positioned conveniently overside of Platform Modules to achieve total coverage in sectors. Additionally, they may be made to sector scan in order to prevent transmissions radiating into the Structure or part of the Structure. Secondly, it was assumed that the operation of Radar Scanners could cause electrical sparking which would not be acceptable in the designated Gas Hazard areas of a Structure. The ease with which a modern Scanner system can be purged with inert Nitrogen Gas removes any cause for concern in this respect. Finally it has been argued that occasionally a Platform needs to impose Radio Silence when a Radio Controlled Explosive Charge was being lowered and subsequently fired in a drilled well and this would have to include the shutting down of a Radar System. Undoubtedly this would be the case of a Radar Installation on a single Platform. However in the case of an Installation distributed between several Platforms such as that being fitted to the Statfjord Field, coverage is automatically taken over by one or more Scanners on adjacent Platforms. In the Southern North-Sea Fields no surveillance Radar is installed and none is contemplated at the present time.

5. CONCLUSIONS

5.1 In major shipping lanes control of shipping is not only desirable but, where it exists even in the form of "Advice", has been proved to be benifical, is becoming more and more acceptable and has substantially reduced the risk of collision.

5.2 The proliferation of Platforms (Fixed Structures) and Rigs (Mobile Structures) in the Offshore Environment of the North Sea is reaching the point where its interface with shipping routes is becoming so congested that Shipping Control will have to be introduced if, in the long term, serious accident and massive sea polution is to be avoided.

5.3 Marine Control in Offshore Energy Fields, where it exists, is inward looking and directed only at the specific interests of the Platform or Field, being concerned solely with its own dedicated Shipping. The standard of control varies from practically nothing to one of sophistication but, at no point is it directed towards assisting the safe navigation of Shipping not directly concerned with activities inimical to its own particular interests.

5.4 That total Shipping Control must, sooner than later, become essential in the Offshore Energy Fields is apparent. The questions that need to be addressed by National Authorities are therefore.

- In the North Sea, the English Channel and its Western Approaches, can Shipping Control be left to the Energy Industry subject to legislation to improve Control Facilities by the installation of V.T.M.S. on every Energy Field Offshore and formal training of Marine Controllers?

- If the Control can rest with the Energy Industry, how would it be operated in respect of the Mobile Rigs, especially those drilling wildcat or single exploratory wells?

- If Control is to be exercised by a National Agency, then by whom and who would be responsible for financing the installation of VTMS and employment of Controllers?

- Is it practical to try and combine the commercial interests of the Energy Industry with an International Maritime Control Facility or should International Consultative bodies such as IMC be considering setting up independant Radar Control Stations in the Offshore Environment?

6. NOTES

The Dover Strait Routing System commenced in 1967, and VTMS Radar Surveillance in 1971.

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