



International Oil Spill Response Technical Seminar

Technology Research and Experiment Application of Marine Oil Spill Buoy

Rui Yang*

EAIC Dept, China Waterborne Transportation Institute, Beijing, China

Abstract

This paper aimed to optimize the technique parameters of tracking buoy by a hydrodynamic method through an experiment on the sea. A survey was created based on the study of technical characters of oil spill tracking buoy to achieve an allweather whole procedure monitoring propose for oil spill by using of satellite positioning communication mode, which can provide an effective technical method for the rapid response of oil spill emergency.

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1. Introduction

China's crude oil imports reached 285 million tons in 2013, which rose 6.8% from a year earlier. China's crude oil import dependence may top 60 percent, meaning that the risk of the oil spill accidents is obvious. The oil spill accidents have significant impact on marine environment, property and people health, and will cause serious pollution damage to the marine ecological environment and fishery resources.

According to statistics from the relevant organizations, in the past 30 years, there are more than 2100 oil spill events having occurred in China's offshore areas, 70 of which are more than 50 tons. With the rapid economic development, our energy demand sustains high growth and crude oil import records are refreshed constantly.

At present tracking and monitoring methods for oil spill mainly depend on satellite remote sensing(Su Weiguang etal, 2012), radar, aircraft or ship searching, computer simulation and buoy tracking(Wen Zaiyin etal, 2011; Han

* Rui Yang. Tel.: +86 10 65290352; fax: +86 10 65290363.
E-mail address: yangr@wti.ac.cn

Jian, 2010], etc. However, satellite remote sensing can be limited by the time with lagging reaction. Radar and aircraft searching are too expensive, and ship searching has low efficiency. Besides, most of them are limited by the weather conditions. The results of computer simulation are under the influence of people, technology and complex sea states, which will easily lead to larger deviations. After oil spill events, timely and accurately tracking the location of the oil spill and predicting the drift direction can effectively reduce the harm of pollution of oil spill. Therefore, the tracking is of great importance.

The oil tracking buoy is a kind of water surface drifting buoy. It utilizes satellite positioning communication techniques and can effectively track the oil under different sea states. The tracking buoy provides an effective technical measure for the oil spill events. It can track the oil spill drift location fast and accurately, which enable us to take measures earlier to reduce accident damage and warn the sensitive areas, reducing or avoiding pollution. Through the buoy, the contingency cleaning plans can be launched immediately and the effective commands can be made, effectively stopping the spread the spill oil. At the same time, the oil track buoy can also improve the cleaning efficiency, reducing the pollution and the cleaning cost.

2. Main Technical Characters

Based on its hydrodynamic utilized satellite positioning communication technique, the oil tracking buoy has a good tracking ability in different regions, under different sea states and for different oil film.

Marine oil spill tracking and positioning buoy has the advantages of simple structure, light weight, which could be transported and stored easily. It also has strong tracking ability to realize all-weather and all-round tracking, and high positioning accuracy with meter level localization effect.

The use of Beidou satellite positioning communication system can achieve an integrated oil spill information tracking and transmission function. And depending on the application situations, the "maritime satellite communication system + GPS positioning system" and other method could also be used to track and position the oil spill information.

Use small OEM communication positioning integrated module to improve the system reliability efficiently. Select external magnetic proximity switch to realize a reliable and convenient operation.

The C/S architecture based network service model could ensure the system stability, high efficiency and good maintain ability.

3. Buoy Structure Analysis

Maritime Tracking and positioning buoy must have the similar drift characteristics of the spilled oil it tracks with simple structure, light weight, good drift property as far as possible. According to the specific characteristics of buoy satellite communication module, battery and sensing element, and the technical requirements of sealing, transmission capacity, impact resistance, self-centering ability, balance and other of buoy, the design of overall parameters of buoy such as: water area, frontal area, the water height, mass balance should be optimized and modified basing on the hydrodynamic performance of the drift buoy.

4. Hydrodynamic Performance of Buoy

The Tracking motion of a buoy in the sea water will be affect by wind and water below the surface of water. This paper assumes that the buoy is tracking the spilled oil film perfectly, and achieves a force balance when it has the same velocity with the oil film. And if the two velocities are not equal, acceleration will be generated by unbalanced force to adjust the velocity to recover the force balance (Wang Tianlin etal, 2009).

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