Monitoring the stress in the deck of an oil tanker

by Robert Cuffe and Alex Petrie

Taking the world as a whole, shipping losses average about one ship lost every three weeks and although this figure is relatively small compared with the number of ships operating, it is still a significant loss to the insurers. One of the problems presented to the captains of ships at sea is the assessment of the severity of the waves and whether it is prudent to maintain the present course and speed. However, such changes may involve significant time penalties, so that although safety is, of course, of paramount importance, needless changes should be avoided. How can modern technology help the captain to decide whether it is safe to maintain the present course and speed? One way is to monitor the deck deformations on board ship during sea conditions to assess the effect of the waves on the ship. In response to the request from naval architects for data on ship performance, a method using inductive displacement transducers in an on-line system has been developed to monitor deck deformations.

Figure 1 shows the deck of the B.P. tanker *British Ranger,* a VLCC (Very Large Crude-oil Carrier). Displacement transducers of the type W5 ATK in their explosion-proof versions are positioned at points on the top deck. Some of these points are shown circled in Fig. 1. At each measuring point the deformation of the deck is measured in the longitudinal direction by a metal rod 2 m (6.6 ft) long. The rod is fixed to the deck at one end and the other end which is free to move is in contact with the tip of the displacement transducer. In this way the transducer with a maximum displacement of 5 mm (0.2 in) is used to

Fig. 1: The top deck of a VLCC showing the points for monitoring deformation

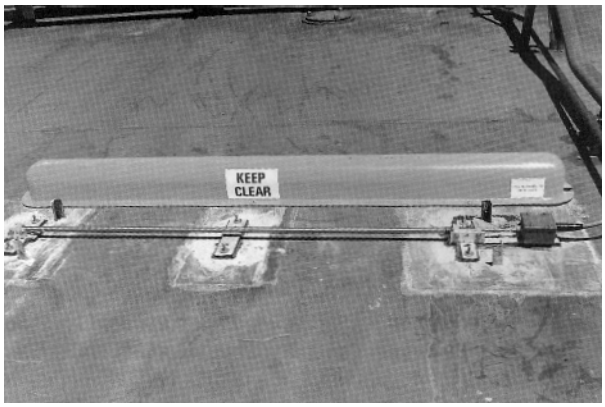

Fig. 2: A measuring point with the protective cover removed

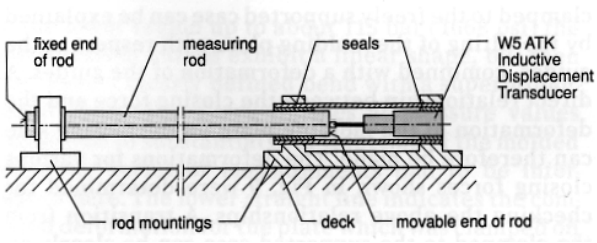

Fig. 3: A diagrammatic representation of the measuring point shown in Fig. 2

measure deck strains occurring over 2 m. The photograph in **Fig. 2** and the diagram in **Fig. 3** illustrate the mounting of the rod and transducer. A steel-reinforced fiberglass cover protects the measuring point.

The signals from the measuring points, which form part of a complete ship monitoring system, are passed to a computer system for storage, evaluation and display. The data can be used to provide warnings for the captain and can later be assessed after the voyage to obtain long-term performance figures. This type of deformation monitoring system has been installed in a number of vessels, the installation varying with the type of vessel and trade. Measuring points can also be installed in tank areas if required.

Robert Cuffe is Managing Director of Ship & Marine Data Systems Ltd., Totnes, U.K. who are specialists in ship measurement systems. **Alex Petrie** is a Sales Engineer with HBM's representatives, Schenck U.K.