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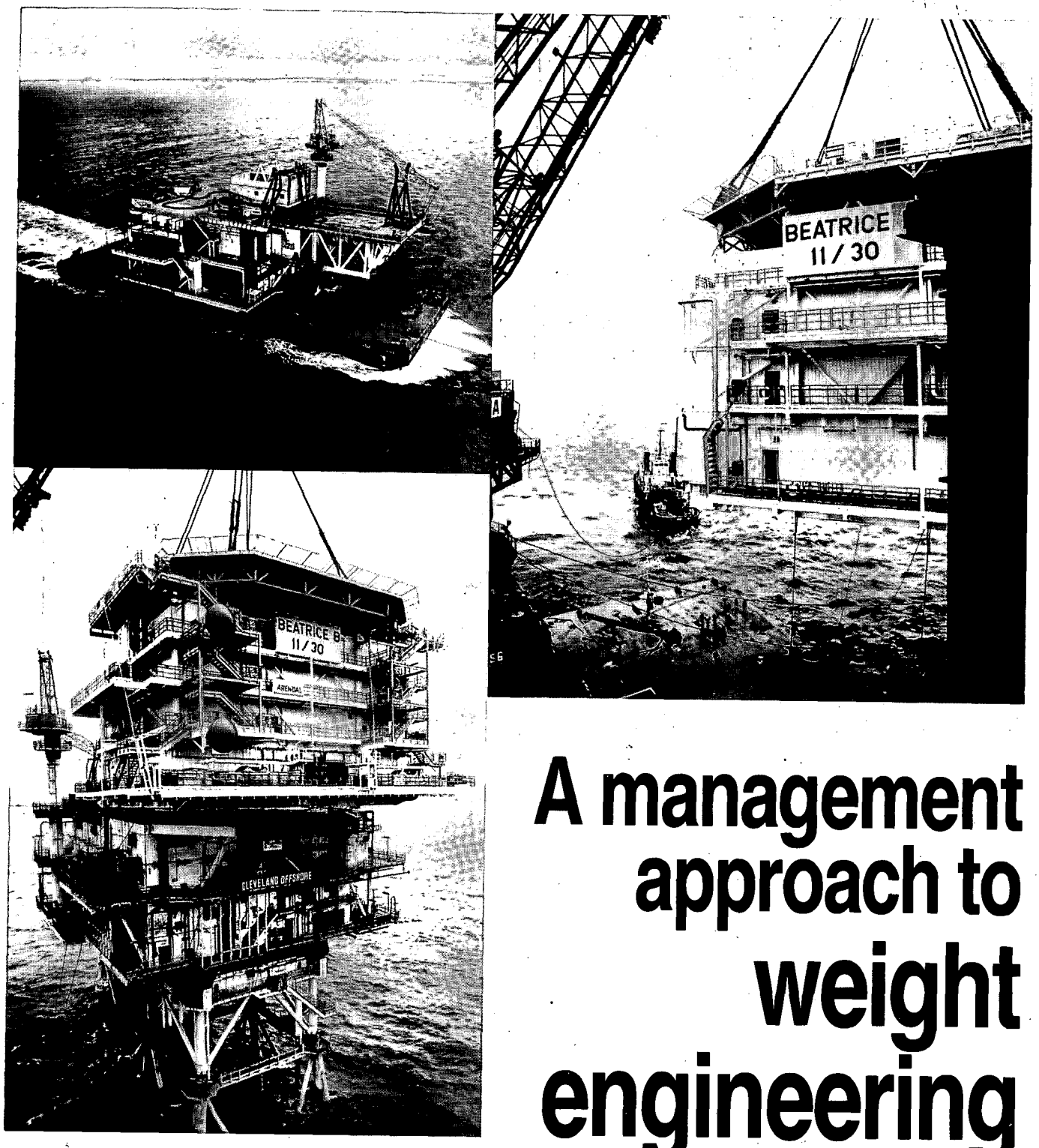

A management approach to weight engineering

WHAT IS UEG?

UEG is the research and information group for the underwater and offshore engineering industries. Its main function is to provide a means of cooperation between its members, including government, in solving common technical problems, obtaining and sharing information and in providing an industry-based focus for research.

UEG is non-profit-making and its financial base is provided by the annual subscriptions of its members. Additional finance for individual projects is obtained from industrial and government organisations interested in any of the specific project areas.

Membership of the Group is open to any organisation with an interest or involvement in underwater or offshore engineering. Each member's subscription is set in relation to their size and involvement in underwater or offshore engineering.

To ensure its industrial relevance, UEG's programme is defined and selected by a number of committees through which member representatives are able to put forward their future research needs. Currently four Working Groups advise the UEG staff on research requirements in the following areas: Diving and Man under Water: Offshore Structures: Underwater Engineering: and Maintenance of Offshore Installations.

The UEG Committee determines the Group's policy and overall programme and authorises expenditure on individual projects. The Committee is responsible to the Council of UEG's parent organisation CIRIA (the Construction Industry Research and Information Association) and operates within limits set by the Council.

UEG projects are managed by the full-time staff and industrial involvement is provided by Steering Groups with membership drawn from the relevant sector of the offshore industry.

UEG implements its projects by placing contracts with those best able to undertake the work, and has no laboratory facilities of its own. By avoiding the constraints and long-term commitment of specialised staff and laboratories, the Group offers the flexibility of operation required to undertake research work associated with the changing needs of the offshore industry.

The results of all UEG projects are published in reports which are issued free of charge to members. Selected reports are later sold at a very much higher price to non-members. The proceeds of additional sales are used to assist in financing the future research programme.

In addition to contact with its members UEG maintains links with many other research and technical organisations concerned with offshore and underwater engineering. It is the official channel for the release to industry of the Royal Navy Diving Tables and other related information.

The activities of UEG are outlined in the UEG Annual Report available free of charge from the address below

Requests for further information about UEG, including enquiries about membership, should be sent to the Manager, UEG, 6 Storey's Gate, Westminster, London SW1P 3AU

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THE RESEARCH AND INFORMATION GROUP FOR THE UNDERWATER AND OFFSHORE ENGINEERING INDUSTRIES
A PART OF CIRIA-THE CONSTRUCTION INDUSTRY RESEARCH AND INFORMATION ASSOCIATION

Foreword

The project leading to this report was carried out under contract to UEG by Ove Arup & Partners, where the staff engaged on the work were Mr P A Craddock, Mr C Bell and Dr J Miles. The work was financed through UEG by a joint venture of five oil companies and the project managed by Mr R J Simpson. The report has been prepared with the assistance of a Project Steering Group.

The Group comprised:

Mr R J Simpson (Chairman)	UEG
Mr P A Craddock	Ove Arup & Partners
Dr N Dick	Britoil Plc
Mr D G M Eggar	BP International Ltd
Mr B Fowler	McDermott Engineering London
Mr A W Gilfillan	YARD Ltd
Dr J Miles	Ove Arup & Partners
Mr A Quennelle	Total Exploration and Production
Mr V D Stiggins	Phillips Petroleum Company UK Ltd
Mr P Teymourian	Gulf Oil Corporation
Mr A M Thompson	Britoil Plc
Mr R K Venables	UEG

Summary

This Report reviews the working practices of some 30 companies which have a particular concern in the control of weight in structures on or offshore, and records their views on the origins and solutions of the problems involved. It is evident that, although the starting points are similar, the methods are not, and that although effective management of weight is possible, it is not always achieved.

Apparent causes of poor weight control are identified, and a scheme of weight management is described which can overcome defects in existing systems of control. Emphasis is given to the view that weight control, to be effective, must be treated as an independent engineering discipline, and given due importance and authority within the overall project.

The use of computers in weight control and existing weighing techniques are discussed in the Appendices.

Contents

Explanation of Terms

The improper use of terms and definitions in the practice of weight control in the offshore industry has often lead to confusion and errors. For the purpose of this report the following terms have been defined and their adoption is recommended. Although given in terms of weight, the definitions will also apply in the prediction and determination of centres of gravity.

Weight Engineering
The complete science and technology of weight awareness, from accurately predicting weights through to measuring them, and the processing of weight data to draw objective and valid conclusions.

Weight Control
A system of management whereby, at any stage, accumulated weights can be checked against previously predicted levels and, if discrepancies are detected, corrected to achieve a final target weight within a predetermined tolerance.

Weight Monitoring
The ascertaining and recording of the weight of each individual item or predefined groups of items to be added to a structure so that at any time the total accumulated weight and the position of the centre of gravity can be calculated.

Minimum Weight Design
The design of a structure of the least possible weight, that will fulfil the operating requirements, irrespective of capital cost, time or complexity.

Optimum Weight Design
The system wherein account is taken of capital cost, operating cost, schedule and ease of fabrication to produce an optimum design.

Estimated Weight
A figure, quoted on the basis of experience, to give an early indication of the final weight of an item or structure. This figure improves in accuracy during the course of a project.

Tolerance
The error limits which accompany an 'Estimated Weight' to indicate the degree of confidence with which it is predicted. This value should reduce during the course of a project.

Contingency
An additional quantity in weight terms which may be added to or included in the 'Estimated Weight' of a structure or item to allow for components as yet neither identified nor predictable.

Target Weight
The weight of an assembly or structure which includes all 'Estimated Weights' together with their 'Tolerances' and a 'Contingency'.

Weighed Weight
The actual 'as-weighed' weight of an item, structure or assembly at a particular stage of fabrication.

Dry Weight
The weight of an item without any operating fluids or, in the case of a storage unit, empty.

Test Weight
The weight of an item under test conditions; e.g. for a pressure vessel or piping under hydrostatic test, full of water.

Lift Weight
The total weight of an assembly or structure in a condition suitable for lifting, including all shackles, slings, pad-eyes etc., that is to say the total load at the hook.

Operating Weight
The weight of a system under normal operating conditions; to include typical levels of, for example, coolant, lubricant, fuel etc.

1. Introduction

1.1 BACKGROUND AND OBJECTIVES

Within the offshore industry, the value of accurate prediction and monitoring of the weights and centres of gravity of structures from conception through to operation is well acknowledged. However, a general appreciation of the subject of weight control and its effect on costs appears to be lacking.

The objectives of the present study were:

1. To review the procedures for weight control in the offshore and other industries;
2. To determine the value and effectiveness of weight control and especially isolate and identify the deficiencies that exist;
3. To formulate and recommend basic principles upon which an efficient weight control system can be based.

This report is the result of those studies and is intended to form a guide to weight control for project management.

1.2 SCOPE

This report reviews the procedures adopted both on and offshore where weight is significant. It is based upon discussions with representatives of a wide cross section of industry and draws upon their experiences to make recommendations for the control of weight and centres of gravity on offshore structures. During the course of the investigation, the varying degrees of importance attached to weight by different industries have been considered.

This report puts forward the foundations upon which good weight engineering can be based in order to achieve the target weights set for a project, or to allow target weights to be modified with confidence.

2. Current Practice in the Offshore Industry

2.1 INTRODUCTION

This Section is intended to convey an overall picture and does not attempt to go into detail. Information concerning the details of particular projects is not freely available within the offshore industry, and weight control is a particularly sensitive area. Companies are naturally unwilling to discuss weight control procedures that have failed to work and which may have jeopardised the success of major projects. In some cases, the information is not available because the records have not been kept.

2.2 TERMINOLOGY

No weight control terminology is universally accepted throughout the offshore industry. This fundamental shortcoming has given rise to misunderstanding and error in communication during the course of projects.

The lack of common terminology extends right through the scale of platform components from relatively small items of equipment to items of major structure. Even such commonly used terms as 'topsides' or 'deck structures' have different meanings within different companies.

The most common area in which misunderstandings have arisen is in equipment supply. Vendors' literature sometimes does not differentiate between dry weights (without lubricants or other liquids) and operating weights (in the working condition with lubricants, fuel and other normal contents included). For power plants, it is not always clear whether quoted weights include exhaust ducting, mountings and other essential ancillary structures. The introduction of a standard weight classification system would help to make clear exactly what items are included in the weight quoted by the supplier or manufacturer.