The Development of a Submarine Freighter

J. Chappuis, Technical Director, Ateliers de Constructions Mécaniques de Vevey, Switzerland
and
F. Abels, Manager, Ingenieurkontor Lübeck GmbH Lübeck, Federal Republic of Germany

The transportation of heavy loads by means of a special heavy load submarine-cARRIER is proposed and the design requirements for such a submarine-cARRIER outlined. Four major conventional carrier types are envisaged, two of which have been further investigated. The systems are described in detail.

INTRODUCTION

In a few decades there has been a tremendous development of subsea technology; this is generally well known and it is unnecessary to emphasize the fact here. This progress has been made under the pressure of various activities when they were extended to the subsea world, for instance scientific research, military research, commercial exploration of mineral wealth, etc. But, today, the most active and demanding of these activities is very probably petroleum exploration and production, when considering only civilian applications.

For some years, petroleum activities have been undertaken in the Arctic area. This orientation has produced a new surge of technological development in general and more specifically in subsea technology. In fact, it can be said that these developments are still in full progress and that we can expect to witness in the future the use of what can still be considered today as exotic means. In this paper, we will present a subsea technological line of development, which is the direct result of this trend, dealing with the transportation of heavy loads.

DESCRIPTION OF THE PROBLEM

If we consider the arctic petroleum quest in northern areas, we have to distinguish several regions, each one with its own particularities. We can, very roughly, make a distinction between at least two main areas:

(1) areas such as northern Norway, Labrador, Nova Scotia, South West Alaska, etc., where the winter ice-shelf disappears in summer, possibly with some remnant drifting ice, or still more serious icebergs;
(2) areas such as North Slope in Alaska or the northern Canadian archipelago, where multi-year ice-shelf or at least high density drift ice still prevails even in summer.

Hereafter, we shall deal with the conditions prevailing in these last areas where very audacious exploration programs have reached a quasi-standard operational status, particularly in the Canadian archipelago. Routine drilling from the ice-shelf in water up to 300 m deep has been described on several occasions.

A certain number of gas and oil fields have already been found, for instance, located in the area included between Melville Island and the Elles Ringes islands (Fig. 1). Work is being carried out to increase the knowledge of the true economic potential of such areas. It is already known that the oil and gas will not necessarily be found in giant or very large pools, but may occur in geologically disconnected pools of a relatively limited size. Such facts have to be taken into account when projecting the data into a production stage. In fact, any production scheme in such areas will have to deal with very difficult problems, resulting not so much from the geological features of the fields, and not necessarily from the fact that products will have to be extracted from sea-bed wells. Much more, the extreme remoteness of the geographical locations, the very difficult climatic conditions, the permanent ice-shelf on the sea and the permafrost on the ground are amongst the most challenging conditions for achieving an economically viable production.

Whatever technical solutions are considered, some fixed structures will have to be located at or near the well heads on the sea-bed. They will be conceived to perform standard operations such as well control, gas separation, polling or several wells together in a manifold system, reinjection for enhanced recovery, etc.

![Figure 1](image-url) Exploration zone on Melville and Elles Ringes islands.