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## ABS Development of a Guide for Compressed Natural Gas Carrier

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### Abstract

This paper will discuss the various technical issues to be considered for all aspects of a Compressed Natural Gas (CNG) Carrier project. These requirements were derived from ABS Class review of several CNG Carrier projects under the framework of the ABS Guidance Notes for the Approval of Novel Concepts.

This paper outlines the steps used to issue various levels of approval under the ABS Novel Concepts Guidance Notes and how the AIP process laid a foundation for development of the ABS Guide for Building and Classing CNG Carriers.

The ABS CNG Guide addresses all issues related to safety of the CNG containment system and the CNG Carrier. It includes requirements for design of the ship structure, the process systems for gas transfer, and also the ancillary marine systems as well as the containment system design itself. The entire process is framed in the context of risk assessment and the ALARP principle. The Guide also allows use of advanced pressure vessel codes or Limit State approaches for design of containment system by tying reliability targets to the risk associated with failure of the containment system. The principal concerns of all CNG developers and the administration is the development of safe and cost effective containment systems. CNG containment systems must optimize weight while maintaining sufficient strength to contain the CNG under the operating pressure. Also considered are the necessary criteria to have CNG carriers suitable for their intended service in the shipping community and resolution of regulatory issues. By publishing such a guideline ABS is helping marine community to develop novel method of transportation of natural gas.

### Introduction

Since the 1960's there has been a desire to transport natural gas in a gaseous state. The initial design for Columbia Gas back in the 1960's known as the "bottle ship". During the last decade there has been a renewed interest in transporting natural gas to monetize stranded gas. The present shipment of natural gas by sea is regulated by the International Gas Code (IGC Code) and covers transport as a liquid. Thus the IGC Code forms a good basis as starting point of criteria for other methods of transportation of gas by ship.

Transporting natural gas as a liquid has some significant advantages with respect to quantity moved. When gas is liquefied, it has a reduction in volume of over 600. Thus, to achieve the same capability for a compressed natural gas carrier (CNG Carrier) in compression one would have to increase the pressure to over 600 atmospheres. This appears to be beyond present capabilities and also greater than any present compressed natural gas concept considers. In spite of this, the concept has a place in the movement of gas by sea even in reduced volumes. The economics of CNG transport falls some where between, that of subsea pipelines and LNG transport.

In developing Rules, one must consider safety of life environment and property at sea. Thus the primary focus of this paper is the safety for the CNG Carrier and not the optimization of the design with respect to efficiency or return on investment. However, the efficient use of energy is environmentally friendly and the process involving the compression of gas is more energy efficient than liquefying it.

ABS has provided Approval in Principle (AIP) to a number of concepts before drafting the present Guide for Vessels Intended to Carry Compressed Natural Gases in Bulk. The guide, issued in 2005, is available on the ABS web site at [www.eagle.org](http://www.eagle.org). The subsequent sections of this paper will describe the methodology used in the evaluation of the concepts and how the Guide was derived from these efforts.

### Methods to Bring Gas to Market

Presently there are a number of means being considered to augment the movement of gas from a field to market in lieu of a subsea pipeline or Liquefied Gas Carrier (LNG Carrier). When first approached by the designers in the nineties, ABS provided a list of criteria that would need to be satisfied. The initial list referred to the ABS Rules and IGC Code. Risk