ABSTRACT
The sloshing of liquids in general and LNG in particular can be
controlled, restricted and even eliminated in a predictable manner. This
paper addresses the theoretical principles and basis of such
predictability. The essence of this theory is the creation of a virtually
100% enclosed liquid volume within a larger containment system,
which is hence less than 100% filled. Furthermore the enclosure is
designed and constructed such that there is no speed nor acceleration
difference between liquid and containment system and that all forces
and momentums required to achieve this are transferable between the
enclosure and the liquid.

KEY WORDS: Anti-sloshing Theory

INTRODUCTION

Physical principles of containment systems with inflatable
rigid element(s)

Sloshing
The introduction of anti-slosh theories commence with a base reference
case of a mobile liquid holder of a horizontal cylinder type. The key
theories allowing for the prediction of the sloshing behavior will be
enlightened by the following example case. A tank trailer representative
horizontal cylinder shape tank of diameter = 2 meter, Length = 10
meter hence volume = 31 cubic meters, will be used for visualization.

RESULTS FOR EXAMPLE TANK

Filling rate Lateral slosh frequency Longitudinal slosh frequency
40% 0,56 Hz 0,147 Hz
50% 0,58 Hz 0,150 Hz
60% 0,61 Hz 0,159 Hz

Sloshing conclusion
Refer (paragraph 3.2 of TNO rapport 2006-D-R0441, “Een anti-
sloshing airbag voor tanktrailers, 7 september 2006”, ir. J.M.J.
Oostvogels, personal communication).
The frequencies of sloshing have been calculated for a representative
tank for two directions: lateral and longitudinal for various filling rates.
It appears that higher filling rates result in slightly higher frequencies in
both directions. The sideward oscillations are approximately four times