# Stowage Plan Generation and Optimization Engine for Large Container Ships

Principal Investigator:
Asst Prof Low Yoke Hean, Malcolm
yhlow@ntu.edu.sg

Team Members at SCE:
Assoc Prof Huang Shell Ying
Assoc Prof Hsu Wenjing
Mr Xiao Xiantao

## Overview

Stowage planning for container ships is an important part of container transportation business and it greatly affects a shipping line's operating cost. A good stowage plan has to take into consideration many different factors including ship stability, container movement handling cost, cargo types and their port of destinations etc. Existing stowage planning process in all major shipping lines worldwide mainly relies on human planners to generate and fine tune stowage plans for individual ships with the aid of computerised stability checking software. The quality of the stowage plan generated relies very much on the experience of the stowage planners, who must obtain their domain knowledge through several years of on-the-job training onboard container ships.

With the arrival of container ships that can carry more than ten thousand containers and the increase in worldwide shipping volume, shipping lines are facing increasing challenge to cope with the worldwide round-the-clock demand for generating efficient and stable stowage plans for their ships as they move between ports. Adding to this, difficulties in hiring qualified personnel for a seafaring career and maintaining an ever larger team of stowage planners also makes the manual planning process increasingly difficult.

This research project aims to first develop a stowage plan generation module to automate the stowage generation process to produce feasible plans according to manual solution standard. A stowage optimization module will be developed next to provide better solutions with regards to the optimization objectives such as cost and ship stability.

## Significance

The potential impacts from the outcome of this research are in terms of improvement in ship stability as well as cost saving in operating the ship. The stowage plan generation and optimization module will take into consideration stability requirements such as the metacentric height (GM), lashing and line of visibility in order to generate optimized stowage plans that have improved ship stability and sailing conditions.

An optimized stowage plan can help a shipping line save on operating cost in the following three ways. Firstly, the stowage plan generation and optimization module will be able to reduce the time it takes for a human planner to generate a stowage plan. This will enable the human planner to have additional time to generate stowage plans for more ships. This allows the shipping line to saving on manpower cost in hiring human planners to cope with the increasing worldwide shipping demand. Secondly, the stowage plan generation and optimization module will be able to reduce container movement handling cost by optimizing the plan to minimize the number of re-handling of containers at each port. Thirdly, an optimized stowage plan will help to establish a ship stability profile with reduced ballast thereby leading to saving in fuel consumption for the ship.

The stowage plan generation and optimization module will be developed using both commercial optimization software (ILOG, LINDO) as well as optimization technique based on tabu-search. This research project is supported by a grant from the Maritime Port Authority of Singapore.

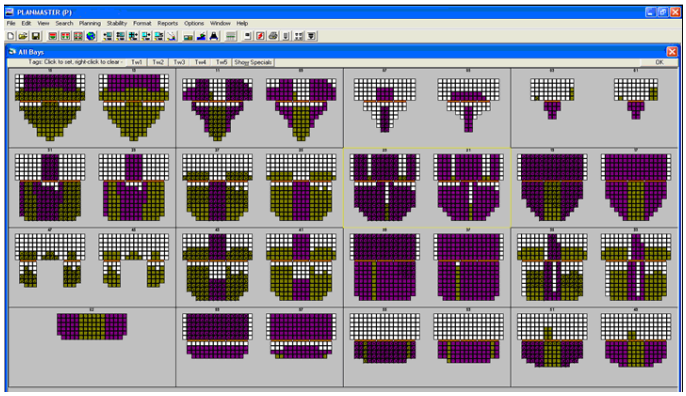

Figure 1: Example of a Stowage Plan for a Container Ship