Maneuvering Simulations

The Glosten Associates are leaders in the use of maneuvering simulation for safety assessments of ports and harbors with respect to the transport of oil by ship. We have analyzed and designed escort practices for oil tankers in Prince William Sound, Puget Sound, San Francisco Bay, Los Angeles/Long Beach, Newfoundland, Hawaii, Asia, and Africa. We have worked with the U.S. Coast Guard, oil companies, port authorities, and environmental groups.

Glosten has developed and verified a fast-time, PC-based ship maneuvering simulator called SHIPMAN (Figure 1). The program may be used to evaluate ship arrival, berthing, and departure maneuvers and also to calculate the requirements for escort tugs.

The program is very interactive and comparable to bridge-level instructions to the helmsman or tug captain. Tugs can be called into service during the simulation and instructed to carry out typical assistance maneuvers. Ship control is available for propeller and rudder actions. Tug control options include type of tug, type of assistance, time delay for engagement, and tug location alongside vessel.

SHIPMAN has been in development since 1990 and has a library that contains physical descriptions and calibrated hydrodynamic models of numerous ships and tugs. It has been validated using full-scale tests (Figure 2).

Figure 1. SHIPMAN screen shot

The program incorporates wind, current, and wave forces and can include shallow water and bank effects. Results of the simulation include the vessel track (in user-defined coordinates), velocities and accelerations at each instant in time, a complete log of ship commands and tug assistance maneuvers, and plot files. Ship trajectories may be plotted on a maneuvering grid or on site-specific geography and bathymetry.

Our experience with tugs, model tests, and full-scale trials has proven the importance of including the speed-dependent aspects of tug force capabilities. Our models of speed-dependent tug assist forces provide a simulation of assisted ship maneuvers that is better than comparable assessments by competing simulators.

Project examples include:

- Puget Sound tanker escort plans and tug selection
- Operations assessment in Prince William Sound
- San Francisco Bay tanker escort regulations
- Los Angeles/Long Beach tanker escort regulations
- Tanker operations at SPMs and FSOs
- Tanker lightering and tug modeling
- Development and production of maneuvering posters and maneuvering booklets (Figure 3)
We have modeled at-speed performance of both conventional and tractor tugs. Examples include:

- A major escort tug design study including full-scale trials of emergency assistance maneuvers with a 4,000 HP escort tug and a loaded 70,000 DWT tanker
- Model tests of a 7,200 HP escort tug
- Extensive computer simulations of emergency assistance maneuvers (e.g., Figure 4)
- A study of the assist tug requirements for bulk carriers using the Orinoco River in Venezuela
- A feasibility study to identify tug requirements for docking an LNG carrier in heavy seas (Figure 5)