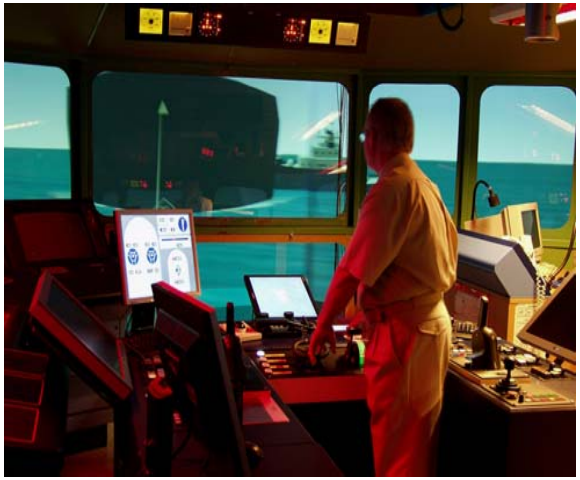




Advanced Training Systems for Tug Masters

- a contribution to navigational safety in ports

by

Aage Damsgaard, Technical Vice President, DMI, Force Technology

EU Project Effective Operations in Ports
SP1 Demonstration, Hamburg, 15.09.2009

Why a tug simulator?

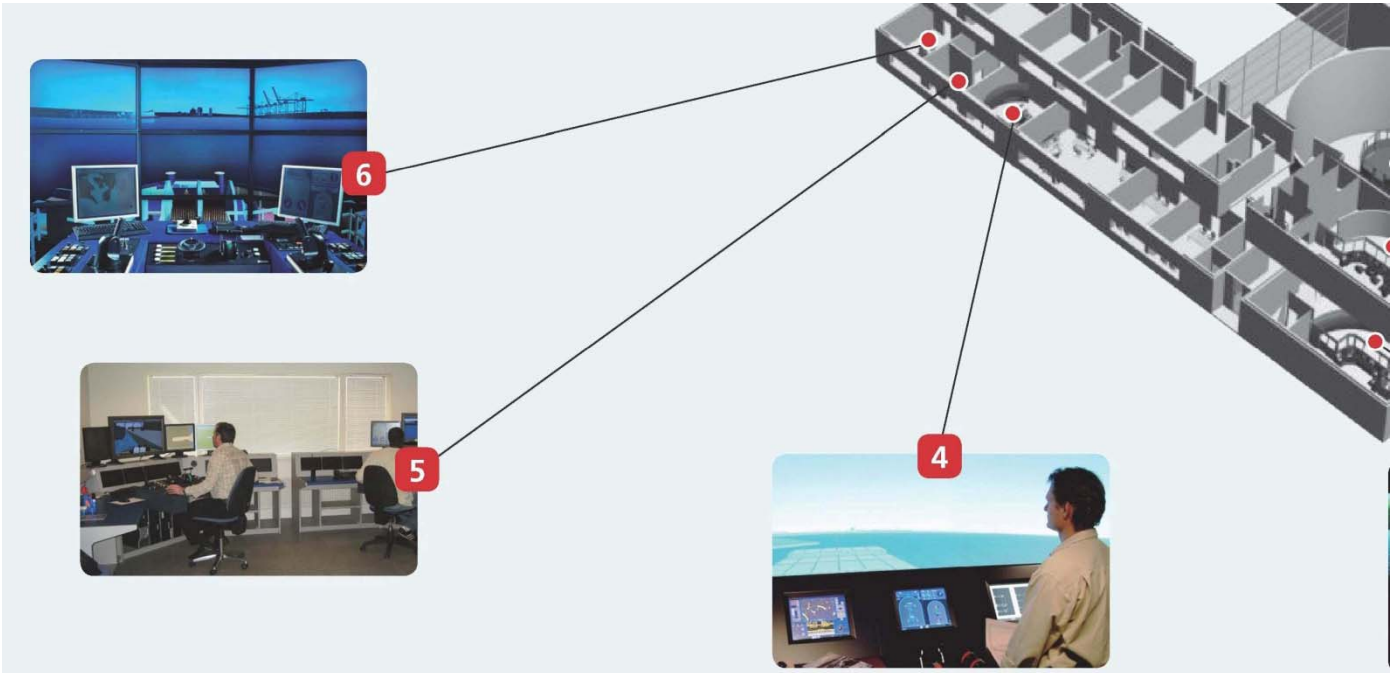
- **Previously, vector tugs were considered adequate for navigational and mooring studies**
- **Simulators have been used for conventional ship handling training for ages**
- **What is the difference between a conventional ship simulator and a tug simulator?**
  - Equivalent to the difference between putting a dog in orbit and putting a man on the Moon, or putting a man on the Moon and a man on Mars
- **Initiative taken by Svitzer in 2003 when they invited international tenders for developing a realistic tug simulator which could be used to accelerate the training of new mates in handling their modern ASD tugs**

Realism is the key word in training

- No vector tug – real tug skipper
- Real tug's response to control commands
- Real tug's response to the environmental conditions
- Real tug's response to hydrodynamic effects from others ships, banks, shallows
- Real ability to push and pull the assisted ship
- Real visual representation of the scenery
- Real equipment on the simulator bridge

How is this realism achieved?

Coupling of multiple interactive simulators

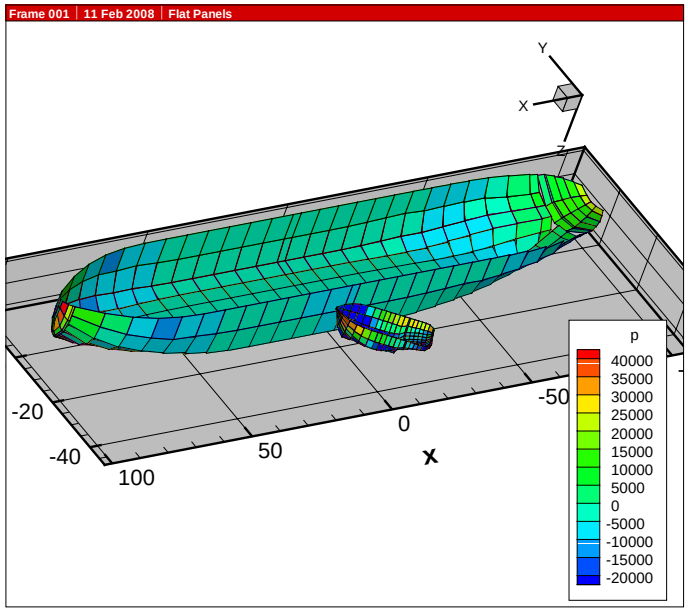


Realistic mathematical tug models

- **Mathematical model formulation allows consideration of all effects (DENMark 1)**
- **Mathematical models based on extensive physical model tests and sea trials (speed, manoeuvrability, seakeeping)**
- **Extensive validation by experienced tug skippers**
- **Control response characteristics properly implemented**
- **First principle modelling of physics (F=M a) in 6 D.o.F.**

EFFORTS Development

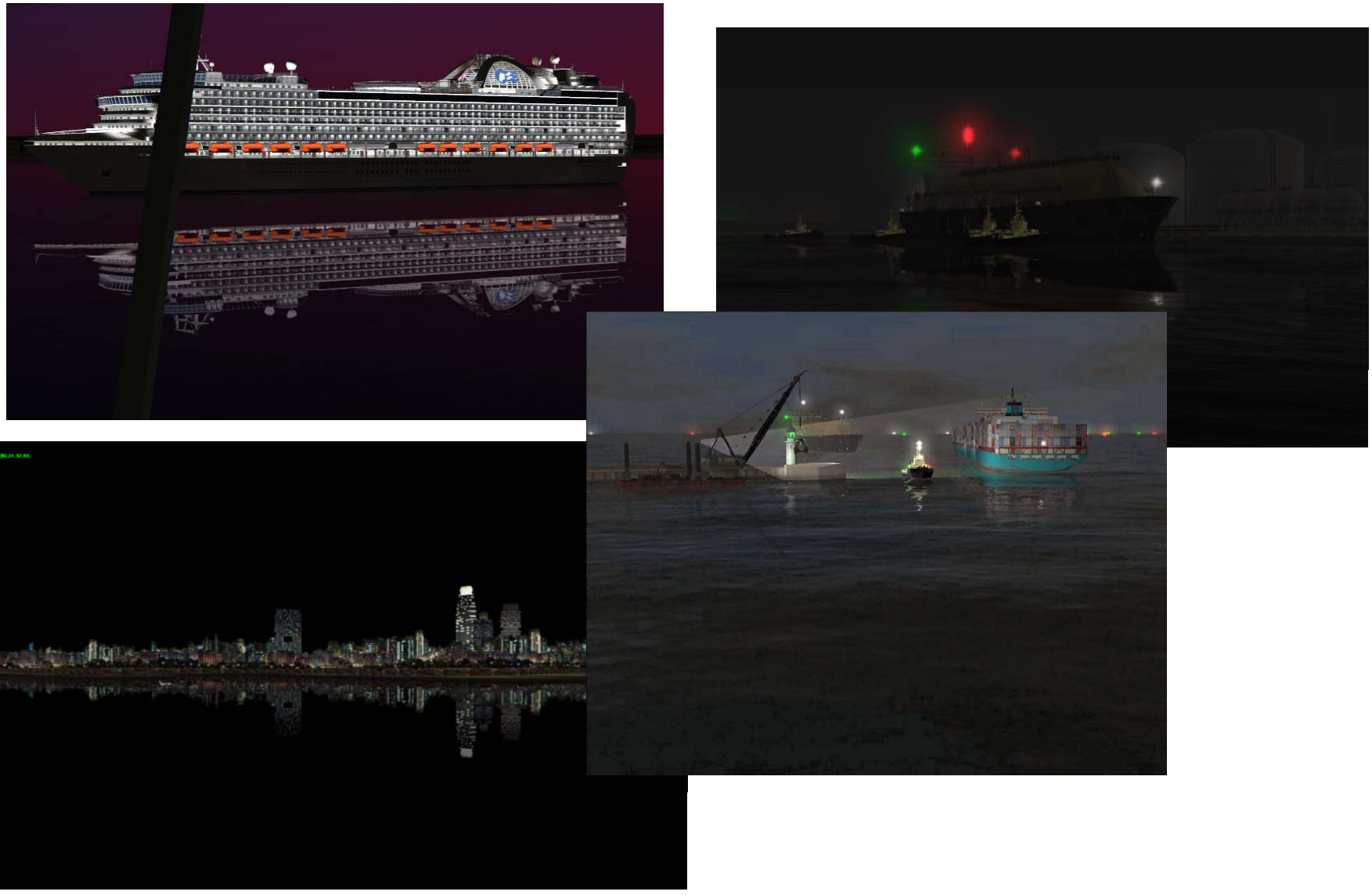
- **Hydrodynamic interaction between tug and assisted ship**
- **3-D collision and fender interaction between tug and assisted ship**
- **Wave effect on tug performance**
- **ROTOR tug with thruster-thruster interaction**



Full Mission Bridge with 27 52” LCD Monitors

Increased realism in the visual systems

Night Textures



EFFORTS: Use of 3D technology

Advantages

- Full 360 degr. View (app 45degr FOV)
- Depth perception
- Speed perception

Disadvantages

- Uncomfortable
- Difficult to see instruments

Improvements

- Lighter materials and wireless connection
- 140-180 degree FOV
- Instrument data inside helmet

Demo tug simulator

- ASD tug ”Svitzer Mars”
- ROTOR tug ”Geest”
- Container vessel
- Port of Hamburg model based on Port ECDIS data
- Interface to Marimatech PPU
- Tug masters from Svitzer and URAG to give instructions to those who wish to try