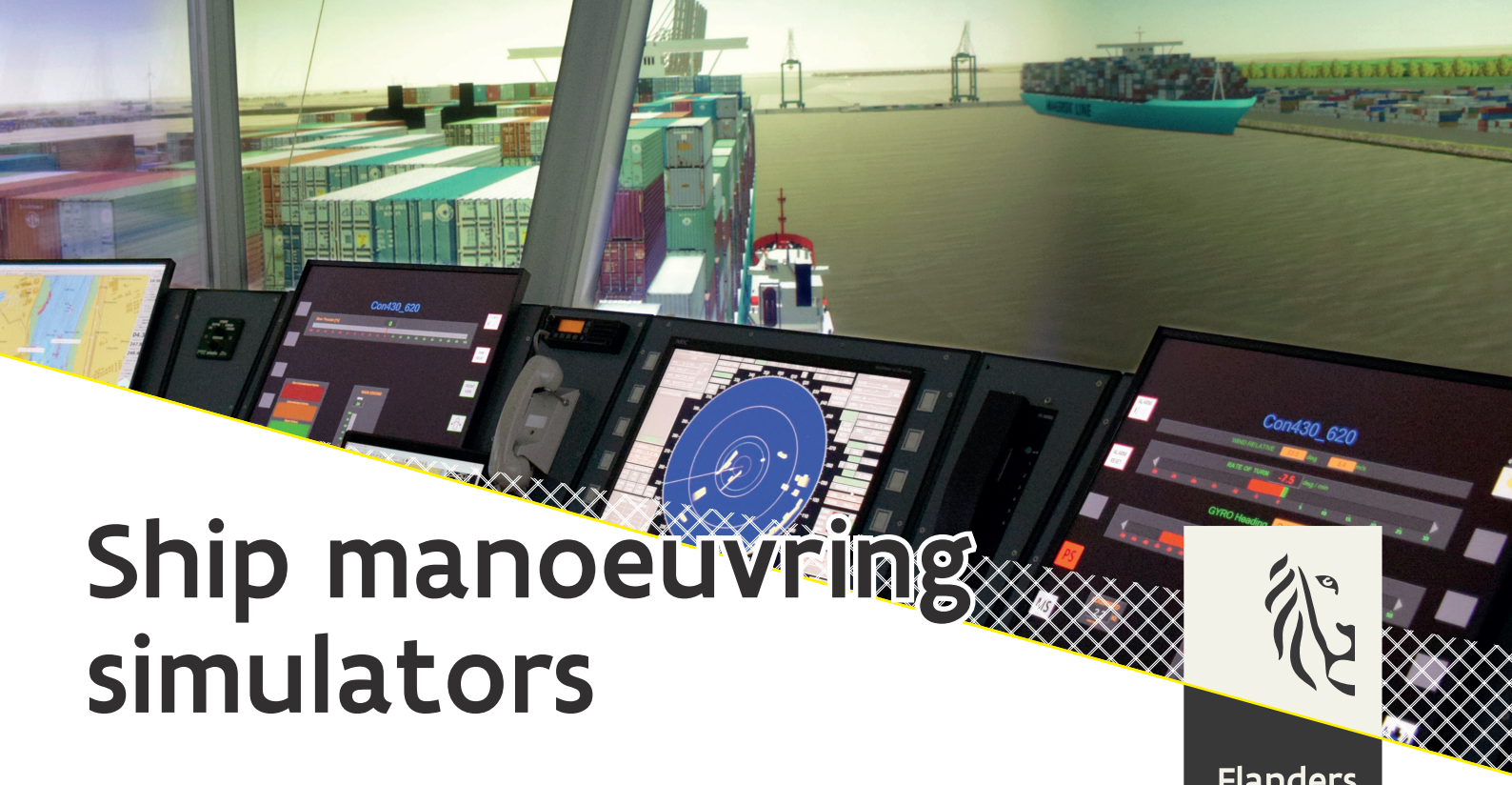


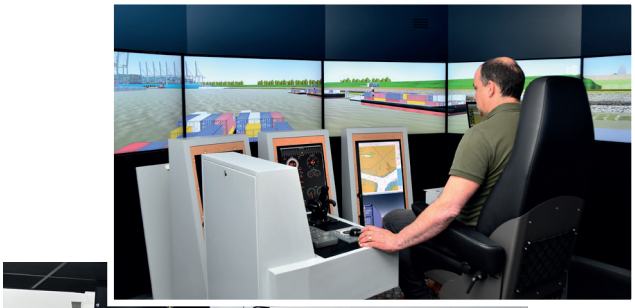
Ship manoeuvring simulators

Flanders
State of the Art

The ship manoeuvring simulator comprises various components. There is firstly the mathematical model. This is the calculating core behind vessel motions. Different forces act upon a sailing vessel: forces generated by the movement of the vessel through the displaced water, by wind, current, waves and other passing vessels.

Secondly, the simulator has a navigation bridge. From the instruments, the radar and the exterior view through the windows of the simulated bridge, the captain or pilot can see how the vessel behaves. With adaptive commands (rudder(s), telegraph, tugboat assistance) he/ she steers the vessel. Dependent on these commands, the interaction of forces on the vessel can be calculated. From this, the speed and the new position of the vessel is calculated and displayed on instruments and radar. In this manner, manoeuvring is simulated as realistically as possible.

Flanders Hydraulics has three complete bridge simulators:



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Simulator SIM 360+ Bridge

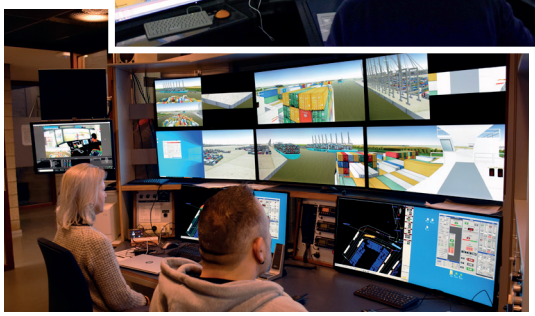
- computer-generated perspective image of the surroundings projected on a cylindrical screen
- under projection, a surplus valua for quay and lock manoeuvres
- PPU (Portable Pilot Unit) with integrated QASTOR application
- automatic radar plot device (ARPA radar)
- quadrophonic sound system
- VHF radio
- Electronic Chart Display Information System (ECDIS)

LARA: Inland navigation simulator:

- Bridge with 210° aerial view displayed on seven 52" LCD monitors
- Equipped with ECDIS and radar
- Controllable camera views
- Controllable bridge height as on many inland vessels
- View vertical down (Manoeuvres close to a wall or lock)
- Command section as conventional vessel or Voith (tug boats)

Simulator SIM 225 Bridge

- A field of view of 225° horizontally and 35° vertically
- Augmented rear view provided by four 85" screens
- Possibility to change the viewing direction so that the ship can be visualised from bow to stern
- PPU (Portable Pilot Unit) with integrated QASTOR application
- automatic radar plot device (ARPA radar)
- quadrophonic sound system
- VHF radio
- Electronic Chart Display Information System (ECDIS)



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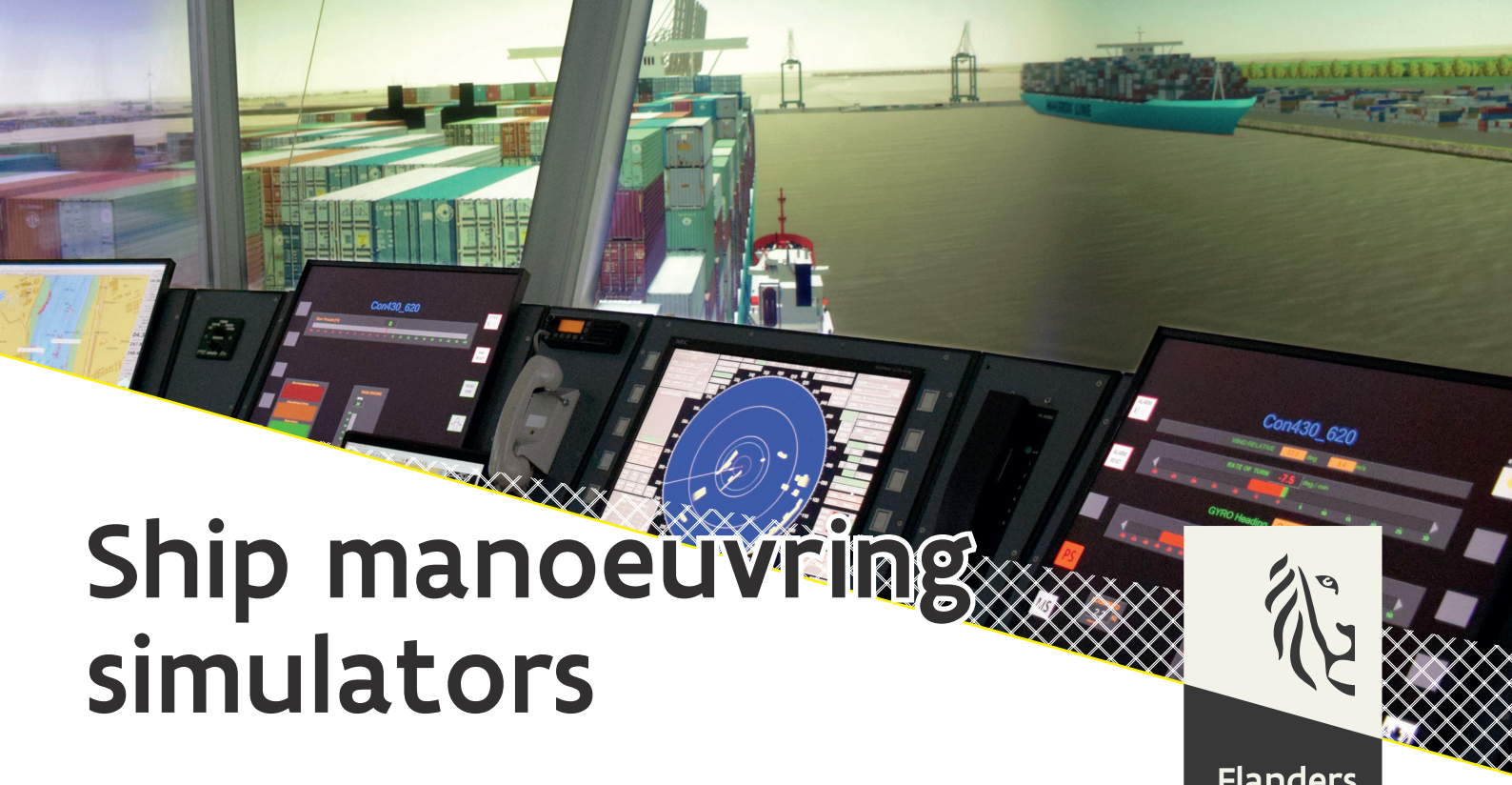

Ship manoeuvring simulators

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Mathematical model

The most important component of the simulator is the mathematical model. On the one hand, it predicts the effect of external forces acting upon the vessel and on the other hand, the hydrodynamic forces acting on the vessel's hull, rudder and propeller.

The mass and all forces acting upon the vessel are calculated five times per second. The new position, speed and course of the vessel are derived from this. At this new position, all the forces are calculated anew for a next time step. From these calculations again the position, speed and course of the vessel can be derived allowing the vessel to continue to sail up to the end of the manoeuvre.

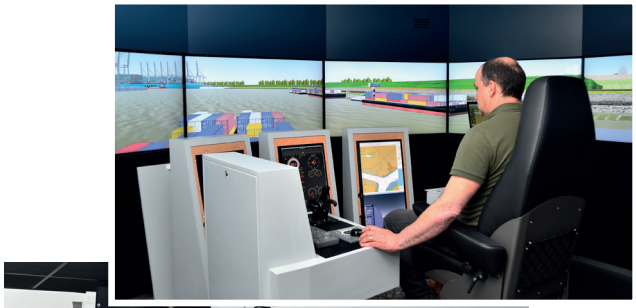
Ship's bridge

The ship's bridge is equipped with the necessary instruments and control devices for the steering of the various types of vessels (e.g. container ship, cruise ship, tugboat etc.).

Instructor area

The exercise conditions (ships, place, current, wind etc.) can be set up in the instructor area. It is also possible to set the atmospheric conditions of the exterior view. These can range from a very calm sea with a haze up to rough storm conditions.

The instructor controls the movement of other vessels and can thus stimulate the navigator on the bridge to anticipate this. The instructor also operates tugboat assistance requested for bridges, lock chambers and ship traffic lights.



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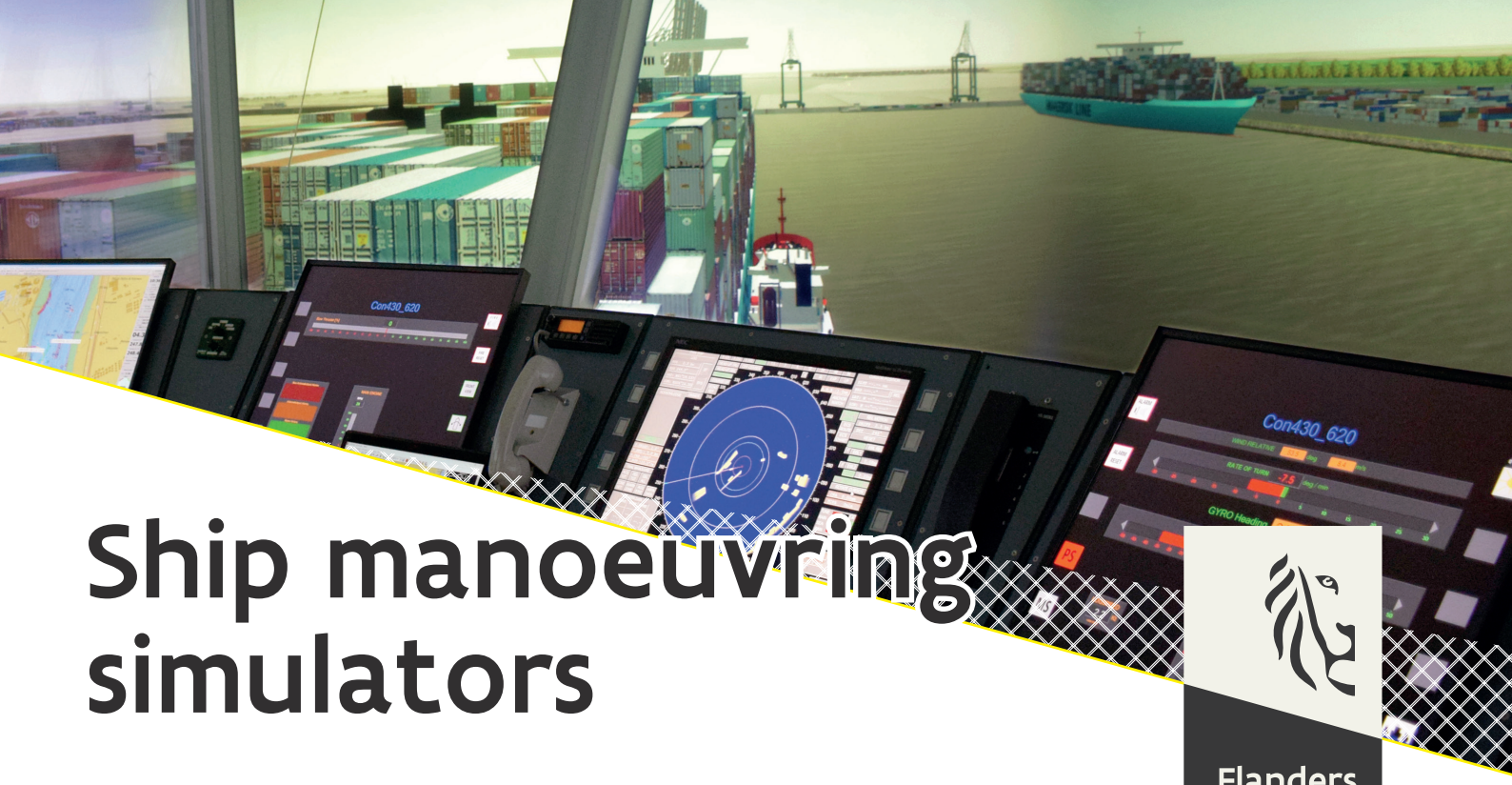

Ship manoeuvring simulators

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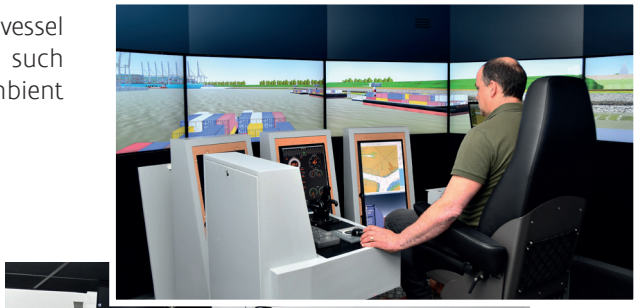
Exterior view

The exterior view is a display of the surroundings visible from the ship's bridge up to a distance of some 10 kilometres on both sides of the waterway. The time for creating an exterior view can be estimated to be approx. 30 to 40 working days, but it strongly depends on the extend and the detailing of the surroundings to be displayed.The first task when creating an exterior view is to explore and to photograph the environment; the objective of this will be clarified later.

After the on site work, the design phase follows. One starts with making a wire frame model. Angles, lines and surfaces are added at the correct height in order to obtain a three-dimensional representation of the surroundings. The wireframe model must still be clad. This can be accomplished through colouring the different surfaces. Finally, parts of the photos of the area are draped as a layer over the wireframe model. The buildings are finished similar to as they are in reality.

Later, target ships are also inserted which will meet the own vessel controlled on the bridge during the simulation. Finally animations such as smoke, undulating water, weather conditions, indicating lights, ambient sound etc. are added to the exterior view.



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