
# *Development of Virtual Engine Room Simulators – a modern approach to Operator's training*

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# *Presentation topics*





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# *Motivations*

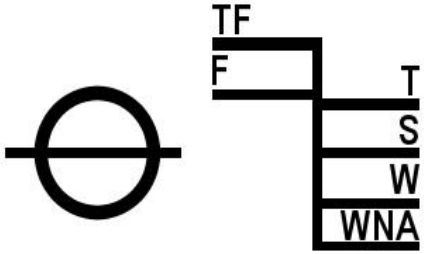
## *Changes in:*

***Engine technology and operator's interface:***

- *in the past: manual start, stop, reversing and cylinder feedrate adjustment*
- *today: hundreds of parameters remotely controlled, dual-fuel and Tier III solutions*

***Training approach:***

- *in the past: long lasting on-board learning from "Mentors"*
- *today: demand for professional and efficient trainings, conducted in various locations, including remote learning*




***Classification Societies rules:***

*Changes in the STCW regulations*
*"The Manila Amendments" (2010) to the STCW Code encouraging simulation methods in crew trainings*

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# Requirements

***Functional requirements:***

*- intuitive navigation and high fidelity of simulation*
*- full integration of the main engine into the ER systems*
*- programmable failure modes, scenarios and wear effects*


***Perceptual requirements:***

*- tree dimensional graphics as a main presentation method*
*- intuitive synergy between 3D graphics and 2D diagrams*
*- comprehensive visualisation of the main engine parameters and its performance using virtual gauges*


***Hardware and software requirements:***

*- low demand on the computer HW and SW performance*
*- modular architecture allowing replacement of SW blocks*
*- possibility to run on multi-display touch-sensitive monitors for the purpose of the Full Mission Simulator (FMS)*



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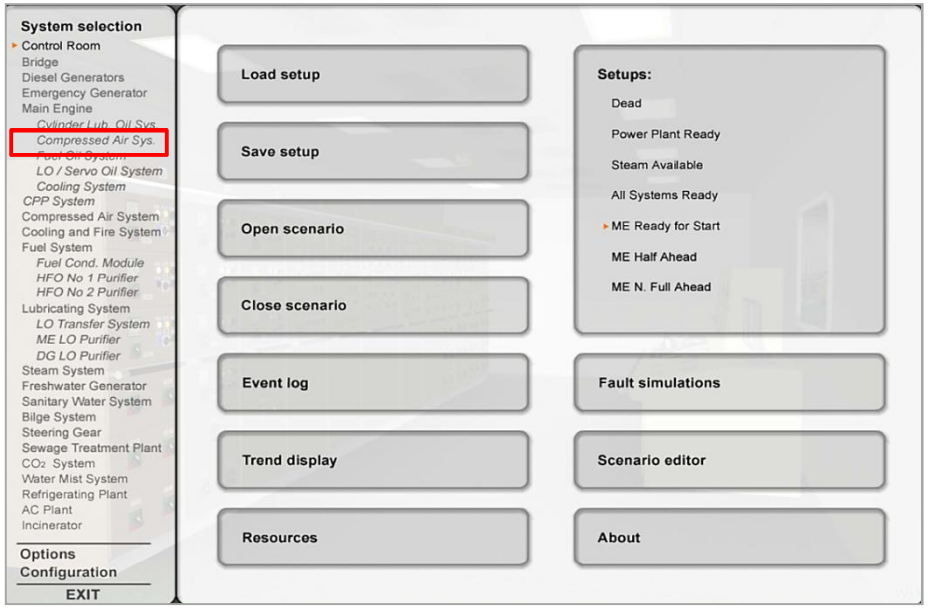
# W-Xpert simulators

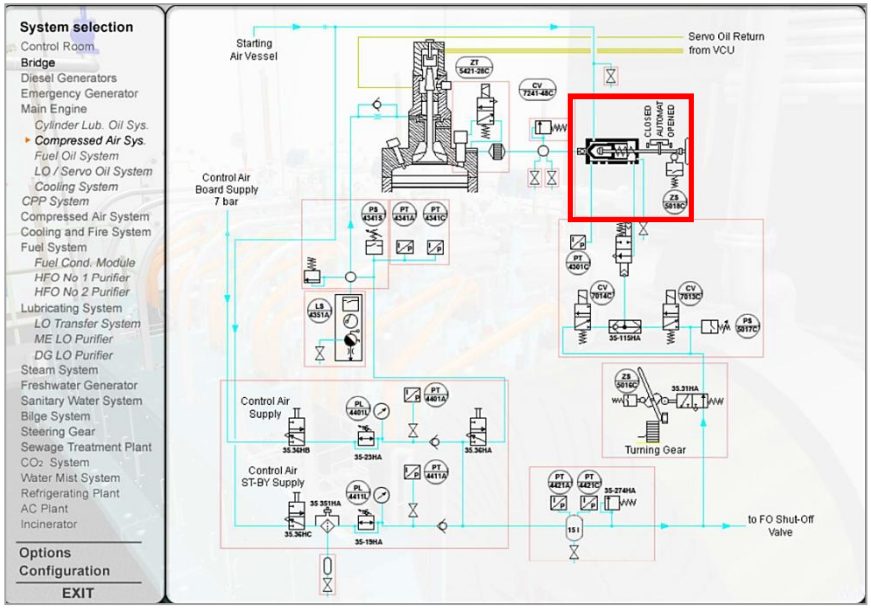
## Layout and internal navigation

### Navigation screen (2D)

*The purpose of the navigation screen is to provide trainees with easy and logical selection of the action theatre. Several functional sub-systems are differentiated from the main engine as shown in the "System Selection".*




*Main navigation screen*




*Example of navigation screen showing the Compressed Air System in 2-dimensional diagram. Marked red part is the main automatic starting shut-off valve shown in 3D with active elements*

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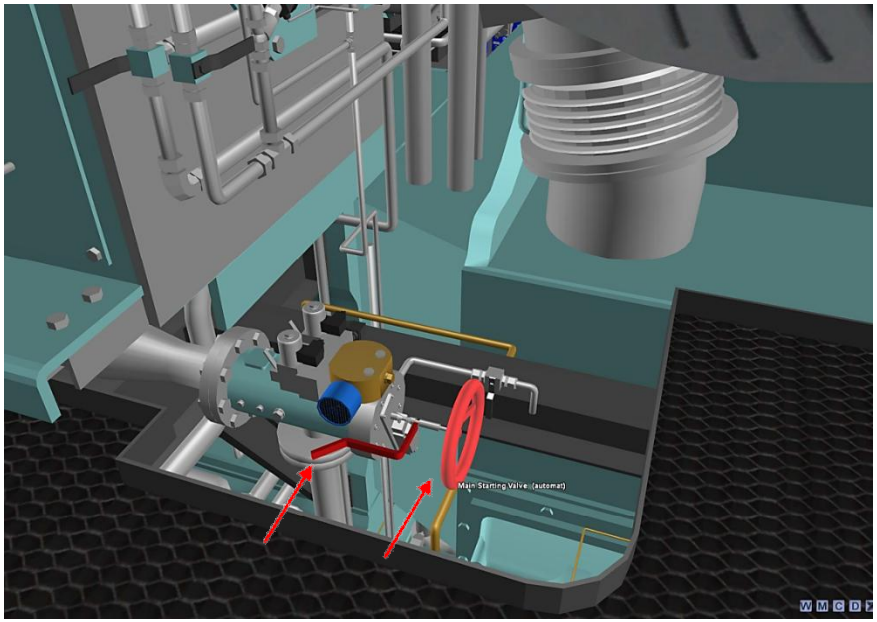
# W-Xpert simulators

## Layout and internal navigation

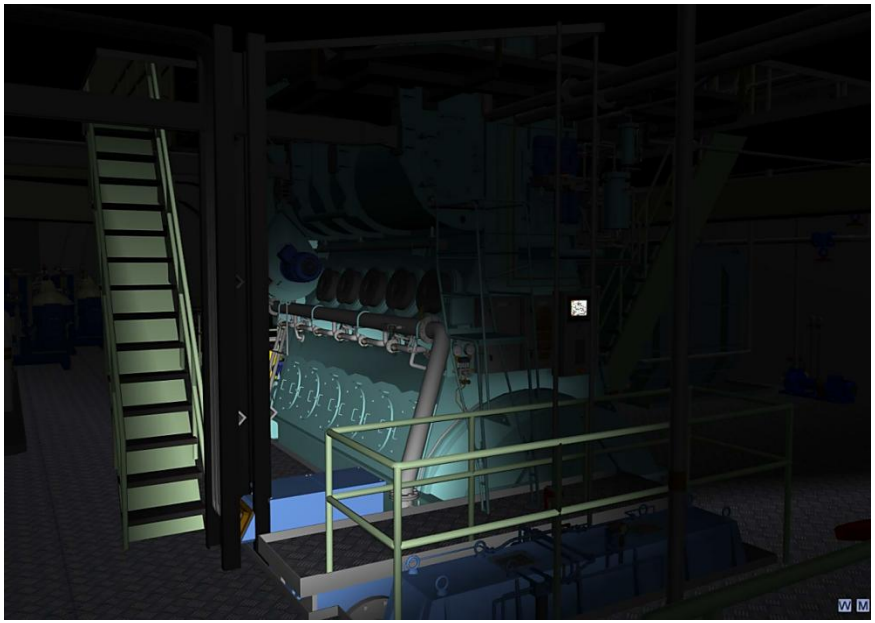
*Action Screen (3D)*

*If an active element needs manual operation by the trainee it will react on a click of the computer pointing device (a mouse).*

*If an active element is actuated as function of a control process it will be visible to the trainee.*



*Action screen, example showing position of the main automatic starting shut-off valve according to the selection on the 2D diagram. Active elements, the locking handle and the wheel are marked red.*



*Action screen, example showing blackout condition with only flashlight available (controlled by a trainee using the pointing device)*



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# W-Xpert simulators

## Layout and internal navigation

### Action Screen (3D)

*The role of the action screen is to present the virtual perspective from the point of view of the trainee. Moving around the engine room is realised by selecting desired location form the "system selection" on the main navigation screen.*
*Zooming function is provided through selecting (clicking) on the highlighted yellow frame markers*

*Action screen, example showing the main console in the ECR with selected zoom on the main engine telegraph and propulsion control system*


*Action screen, example showing close view on the propulsion control system panel selected*



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# *W-Xpert simulators*

## *Functionality*


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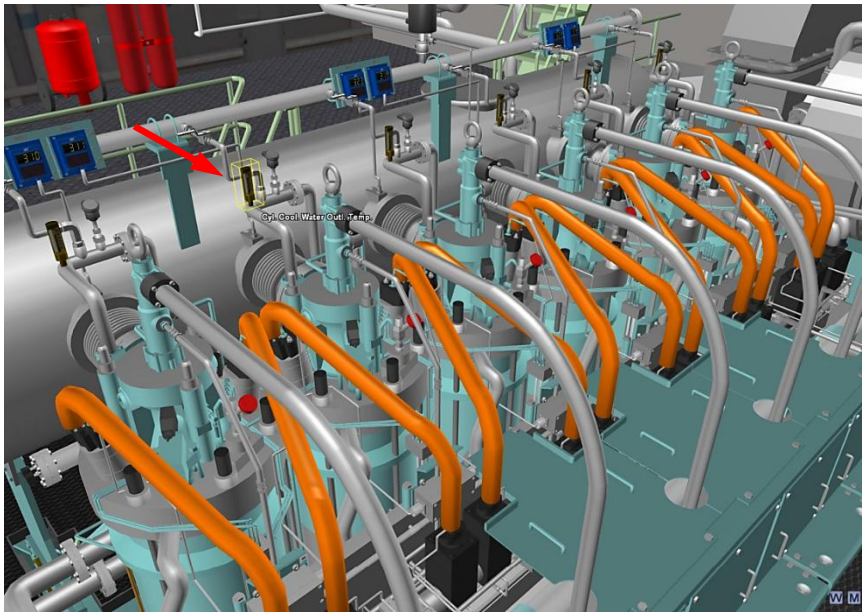
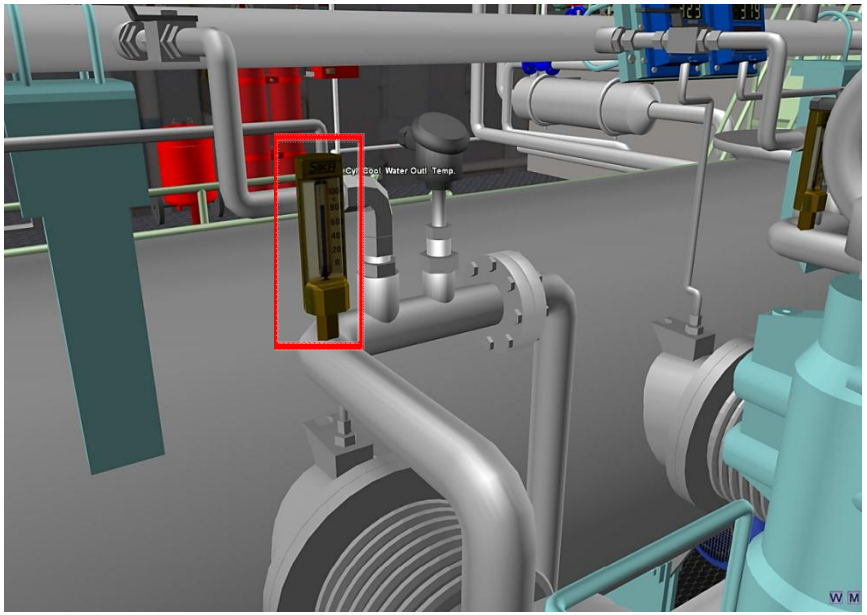
# *W-Xpert simulators*

## *Graphical model of the main engine*

*Active gauges and displays, which are showing operational process values (i.e. temperature, pressures of various media).*



*Action screen, example showing position of local temperature indicators*



*Action screen, example showing close view on the selected local temperature indicator according to the selection made on the 3D view*



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# *W-Xpert simulators*

## *Main engine mathematical model*

*The performance of a virtual engine is based on its real behaviour.*

*The model has been created for the purpose of virtual engine simulators by WinGD development partner Unitest.*

*It based on basic thermodynamic laws and necessary logical structure and it has been calibrated using empirically determined relation between specific fuel oil consumption (sfoc) and $NO_x$ levels.*


*Virtual LDU operator's interface with example adjustments of fuel injection begin offset*



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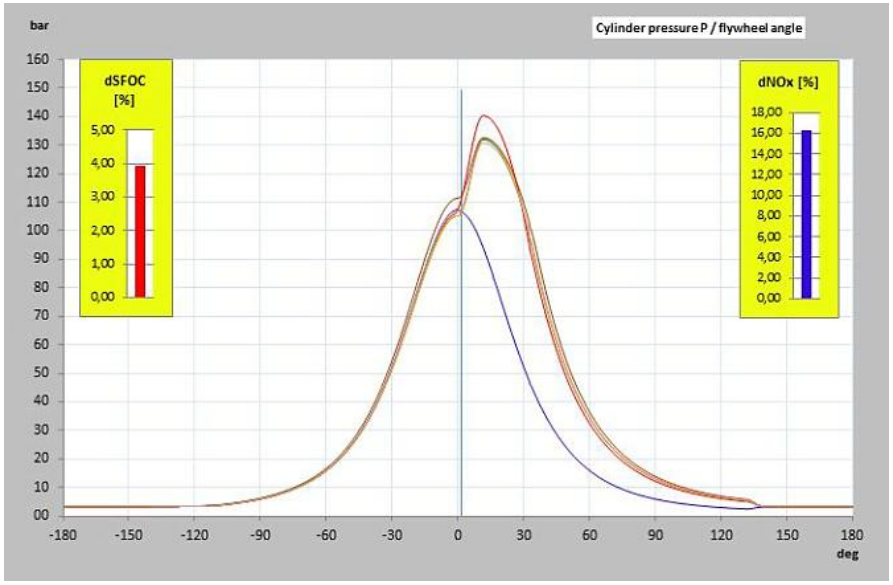
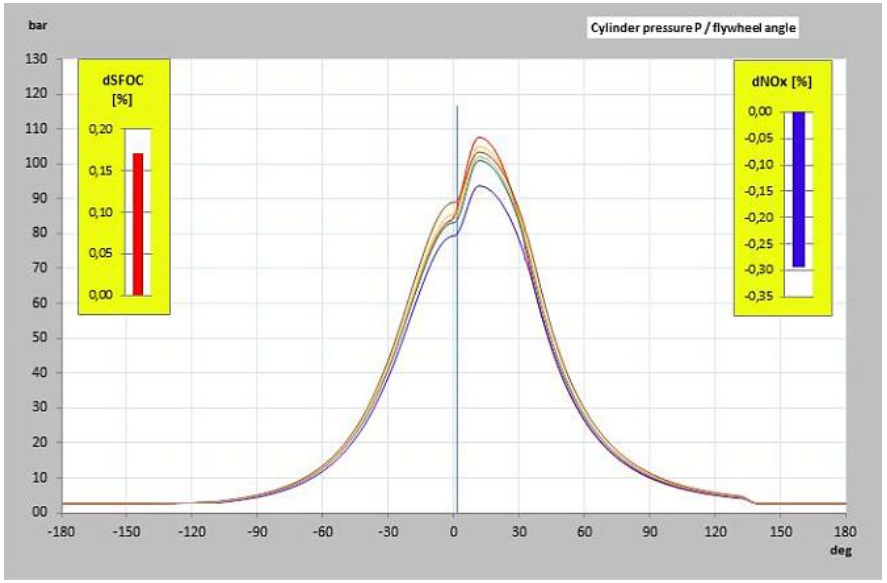
# *W-Xpert simulators*

## *Mathematical model of the main engine*

*As one of its outputs, the mathematical engine model provides the calculated deviation of NOx and sfoc in relation to mentioned values (dNOx and dsfoc respectively), as the comparison to reference values from the Technical File (shop test report) is the best and easiest means of judging the engine's actual performance from the operator's point of view.*




*Virtual ICM display with visualisation of engine performance (one unit cut-off, another -3deg exhaust valve closing offset)*




*Visualisation of engine performance after alterations of parameters (Injection duration -10%, Injection begin offset -2deg, Exhaust valve closing offset -3deg)*

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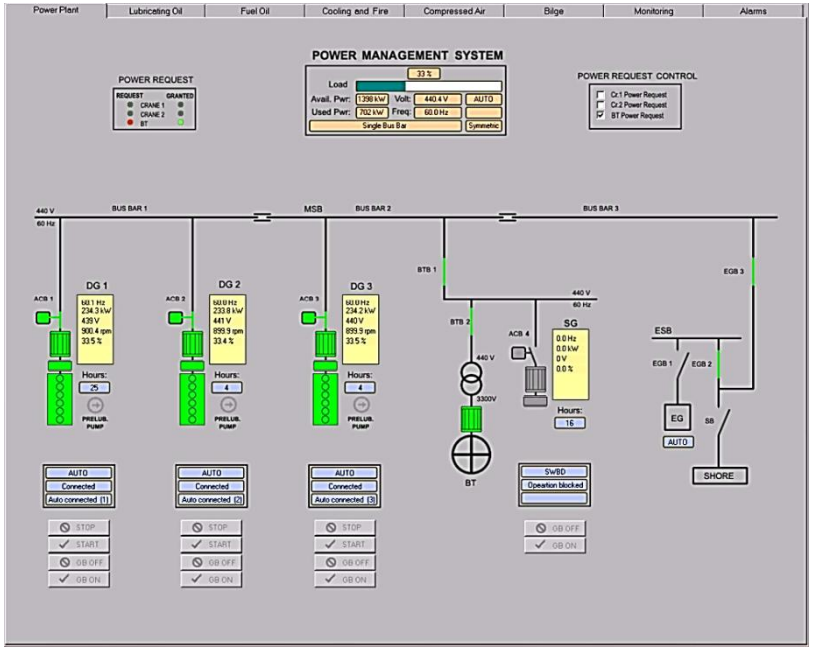
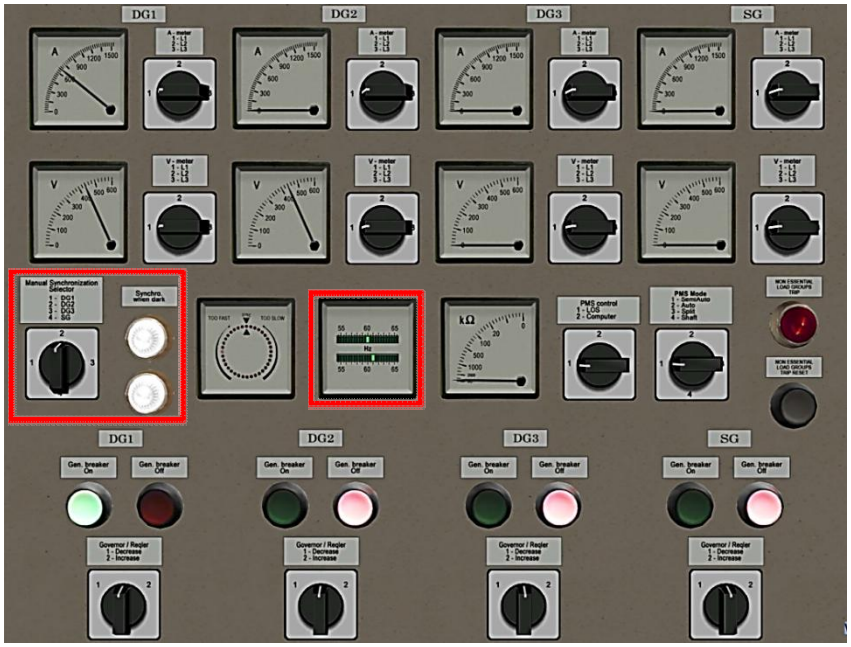
# *W-Xpert simulators*

## *Simulation of engine room systems*

*The virtual engine room power plant model is based on three auxiliary generating sets and a shaft generator when required.*




*PMS screen, example showing situation after requesting the bow thruster availability (all three auxiliary generators synchronised)*




*Auxiliary generators synchronisation panel in the main switchboard screen, example showing situation during manual synchronisation of DG no.2 with bus bars*

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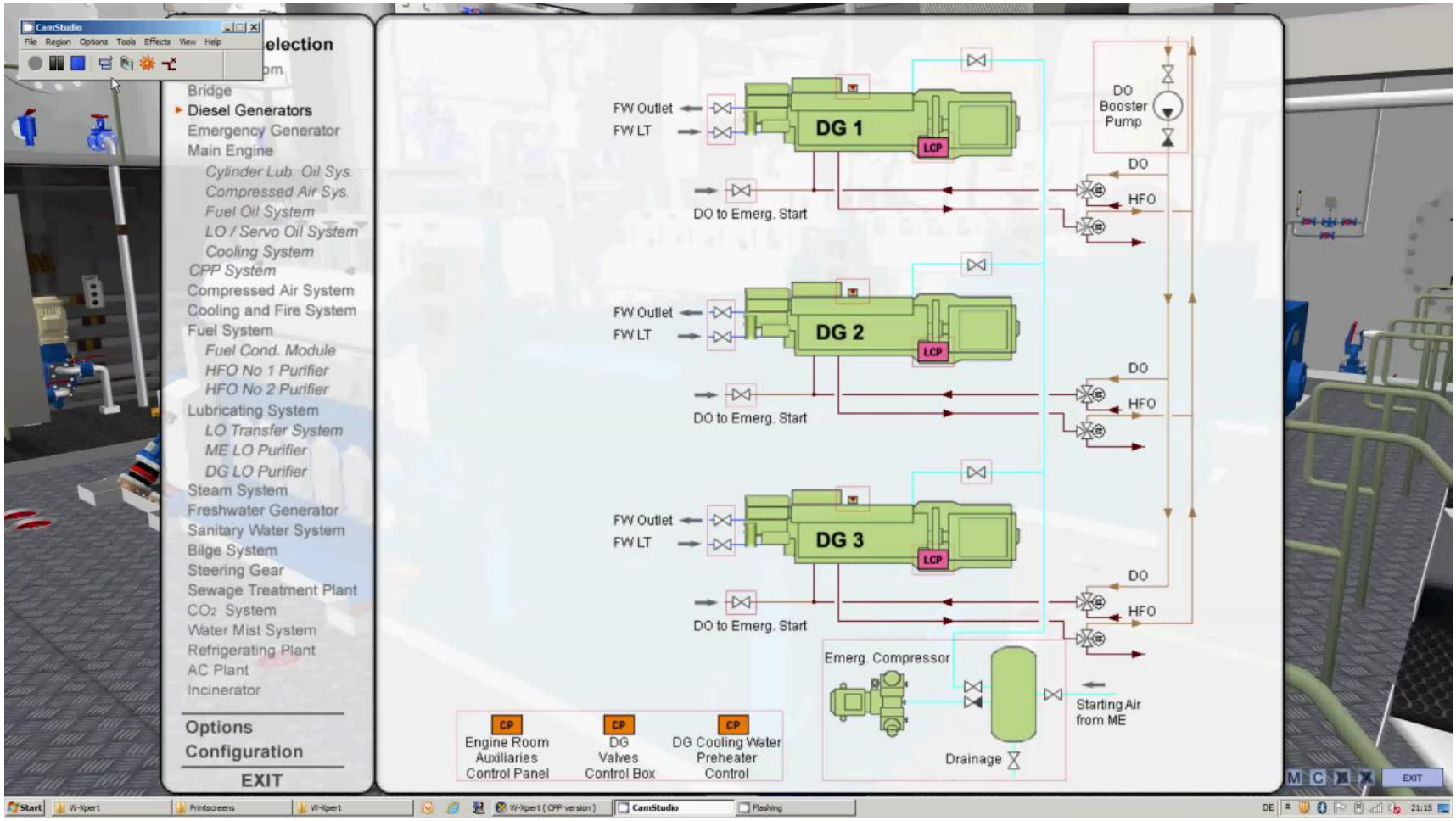
# *W-Xpert simulators*

## *Functionality*

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# *W-Xpert simulators*

## *Current status and further development plans*

WinGD has developed with Unitest virtual simulators of the following engines:
W-X35, W-X72, W-X62, RT-flex50DF

Two additional simulators (W-X82 and W-X92) are under development with delivery planned at the end of 2016.

Based on the availability of touch sensitive displays up-to 70-inch in size, the concept of a Full Mission Simulator (FMS) compatible with the W-Xpert simulators software has been brought to life.


*Full Mission Simulator – example of arrangement of the main Engine Console and the Main Switchboard in the Engine Control Room*



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# *Thank you!*



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# Contact information

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