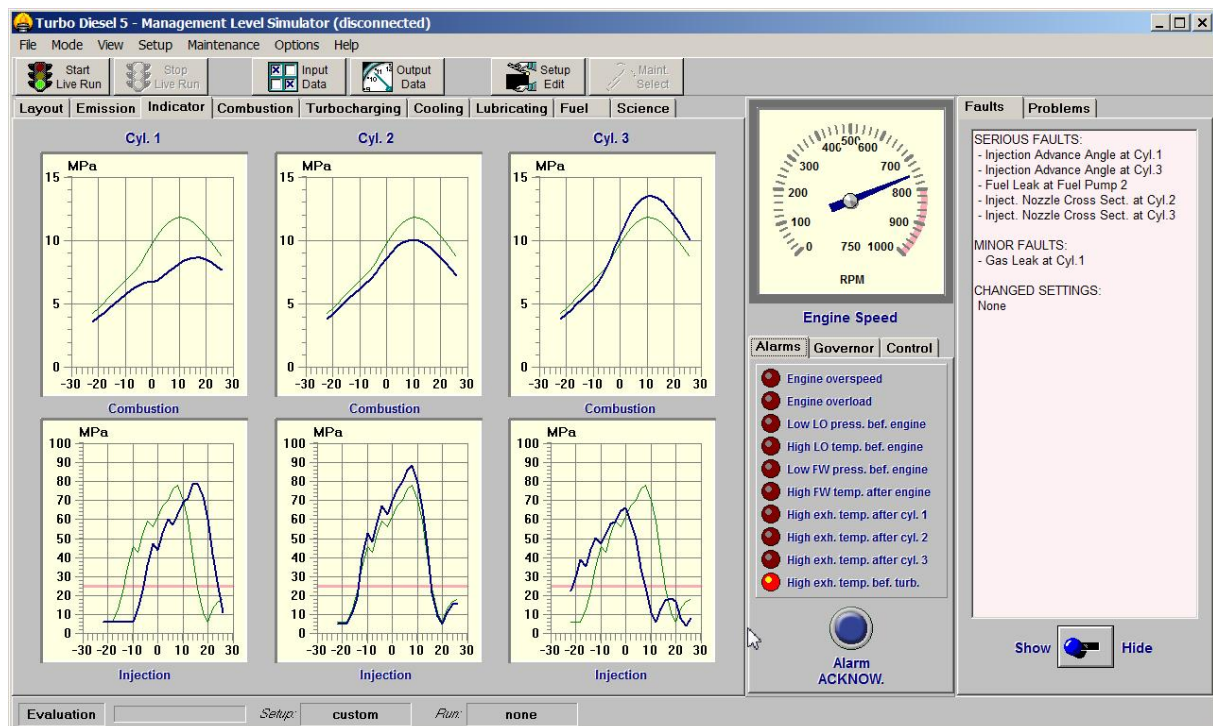




Management Level Simulator

Turbo Diesel 5

Turbo Diesel 5 is a management level simulator which makes the engineer responsible for the operation and maintenance of a marine diesel engine. **Turbo Diesel 5** is particularly effective in the teaching how load and other operation conditions affect the engine parameters; fault recognition; breakdowns; and the relationship between engine technical state and the maintenance actions. **Turbo Diesel 5** simulates also the influence of the engine technical state on the exhaust emission which is compared with MARPOL limit curve.



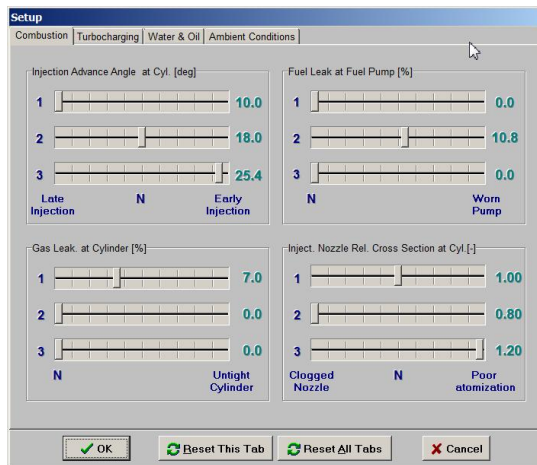
Turbo Diesel 5 is an ideal complement to the marine engineer training syllabus. It enhances student's understanding of engine operations, and gives valuable transfer training to more experienced engineers.

Turbo Diesel 5 has been developed to comply with:

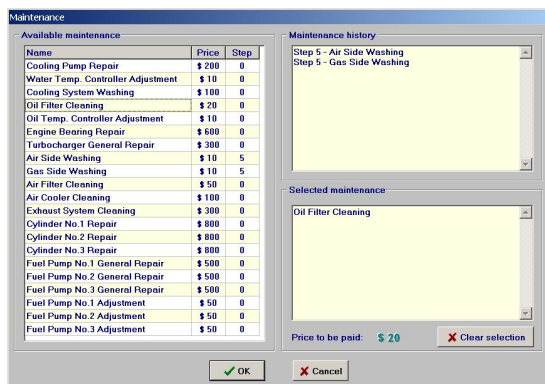
- **STCW 2010 Code: Table A-III/2**, with the following competencies:
 - “Manage safe and effective maintenance and repair procedures” *including knowledge of planning maintenance and planning repairs.*
 - “Detect and identify the cause of machinery malfunctions and correct faults” *including the location of faults and action to prevent damage, the adjustment of equipment and non-destructive examination.*
- **STCW Model Course 7.02 Function 3** “Maintenance and repair at the management level”.

Management Level Simulator - Turbo Diesel 5

Turbo Diesel 5 has two main operation modes:

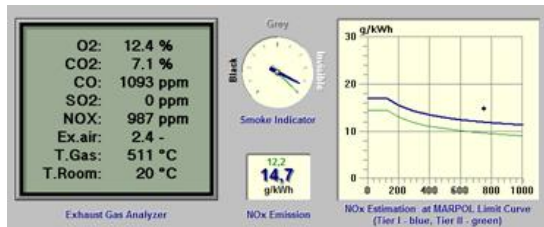


Evaluation mode (default): The trainee can freely change the technical state of the engine elements as well as the engine load and operation conditions. This includes the possibility of inspecting the present technical state of the engine elements. This mode can be used for testing the relation between the engine operation conditions or the technical state on one side and the engine operation parameters on the other side.

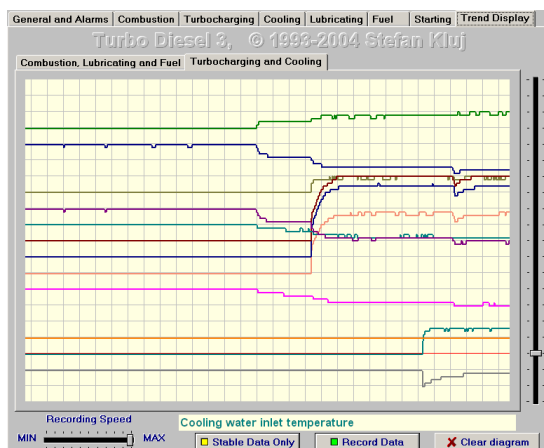


Live Run mode: Changes in the engine technical state are simulated automatically "in the background" by the computer. The trainee can only perform maintenance and repair activity and change the engine speed, but he cannot control directly the present technical state. The maintenance tasks have their conventional prices and all these expenses will be taken into account later while calculating the final results. The duration of successful diesel operations renders the player certain incomes; so the final result is actually the difference between the global income and the global cost. The Live Run is very useful for diagnostic knowledge assessment.

Turbo Diesel 5 can display:

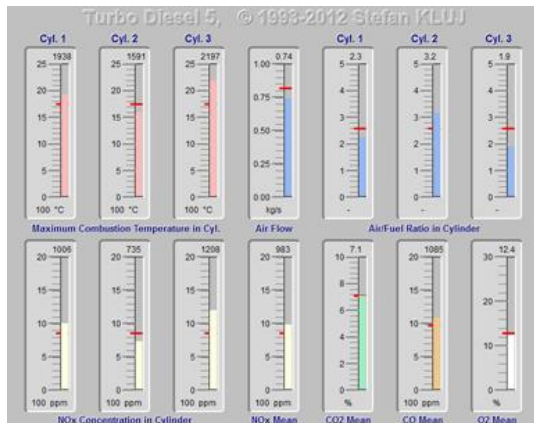


Exhaust gas content: The O_2 , CO , CO_2 , NO_x concentration in the exhaust gases are displayed online. Many faults will influence this content and the additional, customizable fine can be applied in the Live Run mode for the increased emission of NO_x which also shown at the MARPOL limit curve.

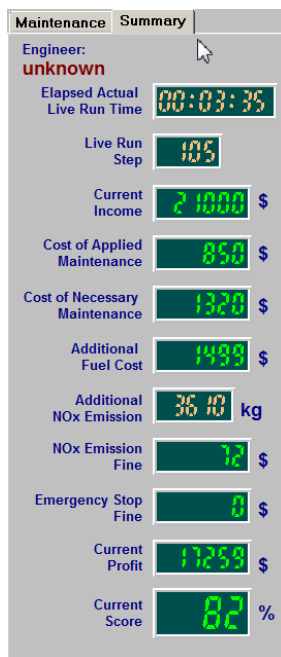


Time diagram: The time diagram shows the parameter deviation change as a function of a time. This feature is especially useful in Live Run mode.

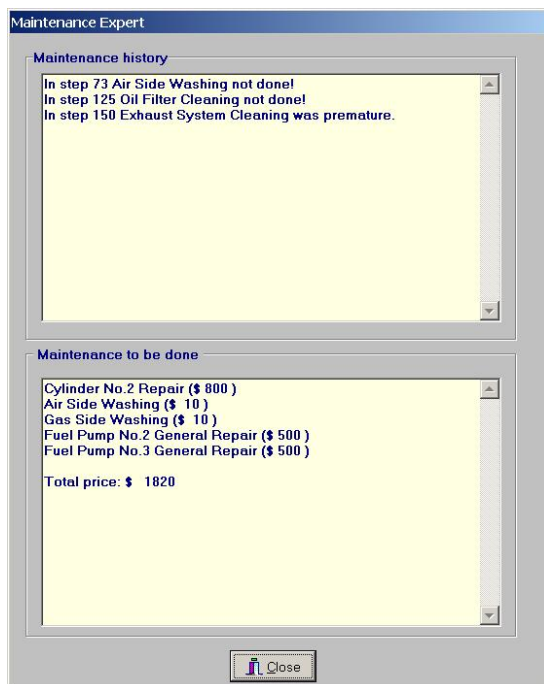
Management Level Simulator - Turbo Diesel 5



Scientific Data: The certain number of calculated engine data like a max. combustion temperature, an air flow, an air/fuel ratio in cylinders or NO_x concentration in the single cylinders can be also displayed on request. This data is very useful for the better understanding how the engine faults influence an air pollution and which maintenance strategy should be applied in order to prevent it. The instructor can select a requested information scope which is displayed on the screen. This feature is especially useful for the knowledge assessment.



Turbo Diesel 5 shows plenty of very useful information when working in the Live Run Mode. Every day of the engine operation brings a certain profit counted in dollars. However, the applied maintenance has to be paid also in dollars and the cost of the necessary but not applied maintenance will added at the end of the live run. The cost of the additional fuel consumption caused by the poor technical state of the engine will be taken into consideration as well. Finally the fine for the additional, unnecessary NO_x emission will be counted too. Every emergency stop caused by the engine bad technical state will cause the special fine which like all above mentioned components will influence the final score of the live run. Typically, the score above 60% is necessary in order to pass the automated assessment.



The **Maintenance Expert** on the other hand can always suggest necessary maintenance and evaluate which maintenance was necessary but not done. The upper **History** sub-window shows information about necessary (but not done) and the unnecessary (but done) maintenance. This information is very useful especially when working in Run Replay mode. The lower **To Do** window shows all maintenance necessary in the current technical state. This feature should be very useful in the Live Run especially, mainly at the early stage of education.

Management Level Simulator - Turbo Diesel 5

The following engine parameters can be observed in Turbo Diesel 5:

- set engine revolution speed
- set engine load
- actual engine revolution speed
- engine torque
- engine power
- engine specific fuel consumption
- engine mean effective pressure
- cylinder combustion pressure curves (for each cylinder separately)
- fuel pump injection pressure curves (for each cylinder separately)
- cylinder maximum pressure (for each cylinder separately)
- cylinder exhaust gas temperature (for each cylinder separately)
- cylinder mean indication pressure (for each cylinder separately)
- lubricating oil inlet pressure
- lubricating oil inlet temperature
- lubricating oil outlet temperature
- cooling water inlet pressure
- cooling water inlet temperature
- cooling water outlet temperature
- ambient air pressure
- ambient air temperature
- turbocharger revolution speed
- scavenge air pressure
- scavenge air temperature
- air flow
- exhaust gas pressure before turbine
- air pressure drop at the air filter
- air pressure drop at the air cooler
- air temperature after the air cooler
- exhaust gas temperature before turbine
- exhaust gas pressure after turbine

Hardware and software requirements:

- PC-class computer (min. Pentium i3),
- minimum 2 GB of RAM (recommended 4 GB),
- hard disk drive with about 300 MB free space,
- graphic adapter, working with min. resolution 1280x768, 512 MB RAM and True Color mode (please consider that the program can not be used at lower screen resolution),
- Microsoft Windows™ XP, Vista, 7,
- Sound card with speakers or headphones

For further information please contact:

The following simulations can be chosen and mixed in Turbo Diesel 5:

- air filter - an increase of the air path resistance
- air blower - a decrease of the air flow efficiency
- gas turbine - an increase of the gas path resistance
- air cooler - a decrease of the air resistance
- gas leak through the piston rings or valves (or both)
- fuel effective quantity decrease
- injection advance angle change
- decrease of cooling efficiency
- friction coefficient increase
- set engine speed change
- engine load change
- ambient air (pressure and temperature)
- air cooling water flow change
- cylinder cooling water temperature
- lubricating oil temperature change
- lubricating oil pressure drop at the oil filter
- clogged and worn injector nozzle

The following maintenance and repairs can be simulated in Turbo Diesel 5:

- cooling pump repair,
- water temp. controller adjustment,
- cooling system washing,
- lubricating pump repair,
- oil filter cleaning,
- oil temp. controller adjustment,
- engine bearing repair,
- turbocharger general repair,
- air side washing ,
- gas side washing,
- air filter cleaning,
- air cooler cleaning,
- exhaust system cleaning,
- cylinder general repair (piston rings and cylinder head)
- fuel pump general repair,
- fuel pump adjustment.
- injection valve repair.