GETTING MORE FROM PC-BASED SIMULATORS

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INTRODUCTION

Simulation is a mature technology delivered in many configurations to meet many requirements. Today we have desktop and notebook computer technology capable of meeting all the visual and modelling requirements of bridge simulation *and more*. It is the **"and more"** where I believe that significant value can be obtained from PC-based simulators.

Full bridge simulators are provided on the basis that instructors will be controlling and monitoring exercises. Transferring the same style to PC-based simulators can leave the student "playing" if he is using the simulator unsupervised.

The "and more" element requires a design which allows cost-effective training <u>and</u> excellent interactivity, feedback and assessment facilities. Providing the "and more" element means that the active presence of an instructor is not a requirement for effective use of the simulator.

This paper describes how PC Maritime's Rule of the Road training simulator, **Officer of the Watch**™, adds control and structure to enable focused delivery of training material and efficient assessment of the students' results.

KEY DESIGN REQUIREMENTS

OOW is designed to be equally effective in a formal training environment where supervision and advice is available to the student and, by virtue of the portability of PC technology, for *distance learning* remotely onboard, at company offices or indeed wherever a computer is available. It is therefore vital that some key design requirements are fulfilled:

Ease of use.

Few users have time to learn arcane program commands. The user interface design must be intuitive so that users with limited computer experience are not distracted or delayed by language or culture from attending to the learning objectives of their time on the system. Customer experience has proved that students, with the aid of a 4-page graphic student reference card, are proficient users of **Officer of the Watch**™ in less than one hour.

Structured learning

A free-form environment where students can "discover" principles and concepts for themselves and learn from their mistakes is a valid use of simulation and **Officer of the Watch**™ provides this application. However, the danger with free-form simulation is that the learning objective of a carefully constructed exercise is destroyed if the student is able to make a premature alteration in course or speed which avoids assessment of the encounter. If however, the simulation is intelligently controlled

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so that the student is forced to confront the situation designed to test him, he will be motivated to perform well and his attention will be focused on a satisfactory outcome to the exercise.

Interaction

To provide measurable training outcomes, the system should convey, reinforce and test knowledge and engage the student in the development of his analysis and decision-making skills.

Officer of the Watch™ contains the following interactive facilities to aid this process:

■ Multiple-choice questions and dialogue boxes

■ The Expert System

The instructor can incorporate into any exercise messages (*Figure 1*), to give direction and provide guidance, and multiple-choice questions (*Figure 2*) to test knowledge.

When designing the multiple-choice questions the Instructor can draw on a complete database of graphic images of navigation marks and vessels. If vessels currently active in an exercise are displayed, the vessel's aspect will be the same as her aspect when the question appears, together with any shapes by day or lights at night.

Alternatively the instructor can define a vessel, her constraints, aspect and the time of day to produce course material testing the student's knowledge of the Rules. When selecting vessels, the list of constraints applicable to the vessel automatically change to ensure that they are valid for the type of vessel.

Figure 1

Figure 2

Development of analysis and decision-making skills is aided by the OOW EXPERT SYSTEM which contains a knowledge base of the International Regulations for Preventing Collisions at Sea. The
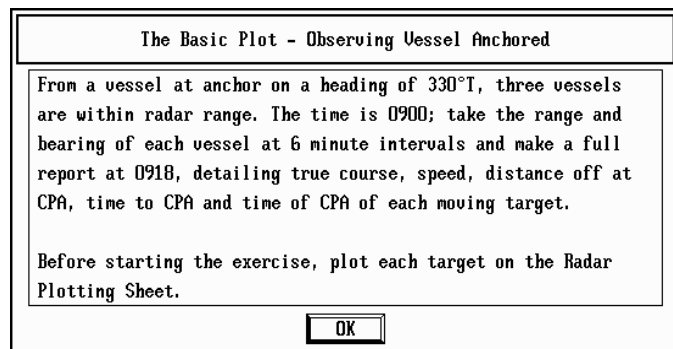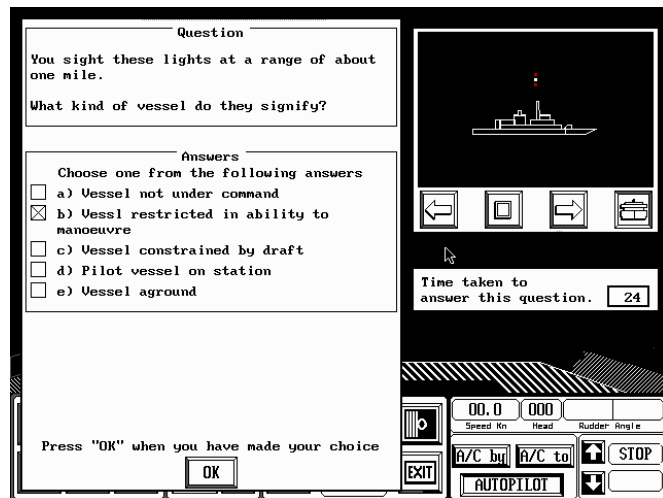
Expert System monitors the actions of all vessels and allows target vessels to be directed to obey the Rules, so that an exercise develops interactively with vessels responding to the student's decisions.

The Expert System also provides advice to the student with an analysis of the Rules which apply to any encounter together with detailed information about the target's type, aspect, constraints, CPA, TCPA and so on.

ASSESSING THE RESULTS

Figure 3

Officer of the Watch™ records all the actions taken by the student (use of radar, binoculars, change of course, results of questions etc) to enable an instructor to quickly review a student's watchkeeping procedures and to assess the results of multiple-choice questions.
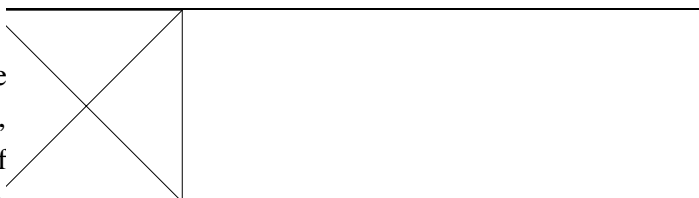
Analysis of this information is provided in a series of logs which can be displayed during an exercise or on its completion.

The **Bridge Log** contains a record of navigational information and the student's log entries.

A **Full Log** records all events which have occurred during an exercise.

A **Question and Answer Log** lists the correct answers for each question above the student's own answers (*Figure 3*).

A **Profile Log** (*Figure 4*) provides an analysis of the percentage of time spent in each area of the simulator to provide the instructor with an instant readout of the student's style of watchkeeping. To make it even easier to assess a student's performance, for example to see if the student is keeping a balanced visual

Figure 4

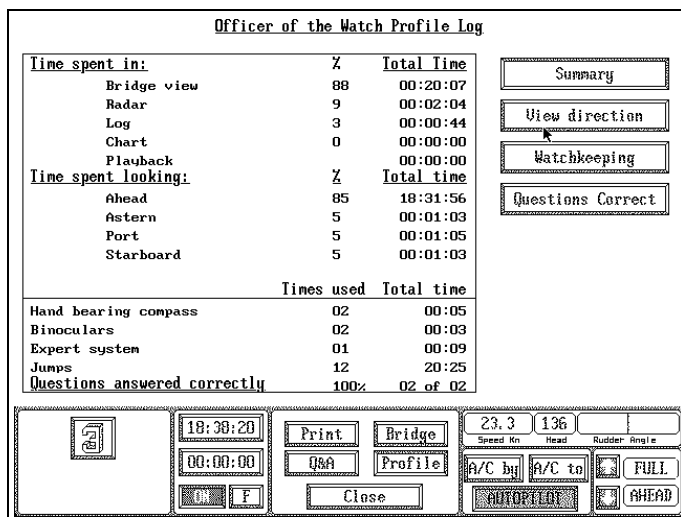lookout, this information is also provided graphically in the form of bar and pie charts.

The **Playback** view shows the charted area with the start positions of all vessels as well as land, depth contours and navigation marks. Buttons allow time-marked tracks of the vessels to be run forwards in slow or fast time or to be paused. Additional tools allow the user to expand or contract the chart view, measure range and bearing between any two points (such as between a specific time on the track of two vessels), and to get information about the course, speed and constraints for any vessel at any time along its track (*Figure 5*).
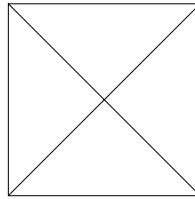

Figure 5

The Playback view provides a forum for debate and debriefing, particularly if a LCD projection panel is used with an overhead projector to project the image onto a large screen. The actions of Own Ship and target ships can be analysed in depth and lessons learned. This facility is also useful in a straight teaching mode, where the program can be used to illustrate points.

CONTROLLING AND FOCUSING THE STUDENT'S ATTENTION

The built-in control provided by the Expert System allows instructors to create realistic and truly interactive lessons which react to the student's decisions and actions and will not therefore perform in the same way each time the lesson is run. Any target vessel controlled by the Expert System which alters course to avoid collision will resume course and speed as soon as it is passed and clear. Rogue vessels can be defined to follow predefined tracks and waypoints.

A demanding exercise consists of a combination of "controlled" and rogue vessels which are refreshed with new vessels as the encounter situations pass. This is useful for simulating busy traffic zones. Simpler exercises can consist of one or more controlled or rogue vessels.

When the training objective is to teach or test a specific element of watchkeeping procedure the provision of the full capabilities of the simulator provides distractions. It is therefore desirable to limit the student's access to only those elements of the simulator which are relevant.

Hence, when designing an exercise in **Officer of the Watch**™ the instructor can deny access to any of the elements or tools of the simulation (such as the visual view, the radar, the playback, the expert system the telegraph and the autopilot). This denial of access can apply for the whole duration of the lesson or just a part of it. For example, if the purpose of a lesson is to develop radar plotting skills, then access could be denied to the visual view; or if the success of a lesson depends on the student assessing a situation during the first 6 minutes of the lesson without altering his course or speed, then

the autopilot and telegraph can be disabled for this period and then released to him when the time has come to take action.

Consider another problem. You set up an exercise with a scenario to provide practice in the action required under Rule 15 - Crossing situation. The student runs the exercise and after a few minutes has made his assessment and carried out an action. You would really like to introduce more targets at, say 6 minute intervals, to reinforce his understanding of this rule. But he has probably altered course and/or speed and you cannot predict his position at that time.

To overcome this problem, **Officer of the Watch**™ provides a facility to introduce new targets in a **position** relative to whatever Own Ship's position might be at any time. For example, introducing a target ship after 6 minutes at a range of 3nm, bearing 60° from Own Ship on a relative course of 285° ensures that you create the desired crossing situation without worrying about the actual position or course of the Own Ship.

A SPECIMEN TRAINING COURSE WITH OOW

A significant "hidden" cost associated with training and the use of simulators is the effort and expertise required to produce effective course material. In addition to providing the environment where the training material is delivered to the student PC Maritime have also developed a range of courses, with full references and supporting documentation, covering elements of IMO model courses, ranging from the identification of lights and shapes to simulation case studies. This enables users to gain immediate benefit from the system.

Specimen training programme with OOW Course Modules		
Cadet Training		
1	Initial learning	Modules 1-5 (see brochure for details)
2	Radar Plotting	Module 6 (see brochure)
3	Rule of the Road Testing	Modules 1a, 2a 4a & 5a
		As 1, 2, 4 & 5 without prompts and clues
4	Bridge watchkeeping simulations	*Simulations designed to prepare the cadet for bridge watchkeeping*
Junior Officer training and Senior Officer refresher training		
1	Advanced Session 1	*Simulations in open and confined water.*
2	Advanced Session 2	*Simulations designed to put an officer under pressure and recognise limitations imposed by manouevering characteristics.*
3	Advanced Session 3	*As session 2 in restricted visibility*

4	Case Studies	*Case studies of real incidents or recognised problem situations.*

CONCLUSION

I believe that the PC-based simulators are of the greatest benefit when they provide structured learning and that the foundation of this is interaction and feedback.

Bridge watchkeeping is a skill which is passed down through the generations, reinforced by the student's own experience. Simulation, through a structured development of an understanding of the Rules, and treatment of problem areas through case studies can provide concentrated practice which means that a student need not rely on situations occurring naturally to develop his experience.

The portability and flexibility of today's personal computer means that effective training and practice can be made available to the student onboard, at shore offices or at colleges. Companies and colleges gain an effective tool for assessment and monitoring progress.

I hope that I have shown that, with good design and attention to instructional methodologies, PC-based simulators have a specific role to play in maritime training for the development and assessment of knowledge and skills and that this role is supplementary and complementary to formal courses and full-scale bridge simulators.

NOTES

Further information on **Officer of the Watch** can be obtained from PC Maritime Ltd, Bain Clarkson House, Brunswick Road, Plymouth, Devon, UK. Tel +44 1752 254205 Fax +44 1752 253599