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The Warren Cycle

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A new teaching tool enables trainee officers of limited experience to regulate their thinking when they are troubleshooting equipment malfunctions on the bridge – and has wider applications.

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Educators have long perceived that the amount of actual watchkeeping experience a trainee Officer of the Watch (OOW) receives is insufficient for the demands of today's industry. The United Kingdom's Maritime and Coastguard Agency (MCA) requires six months bridge watchkeeping as part of the sea time component of training. This must consist of watchkeeping duties where the individual is on the bridge for at least eight hours per day. Currently, there is no sign of this critically important real life training period increasing – indeed it has even been suggested that time spent learning within a simulated environment could be a realistic and more cost-effective alternative to time spent on a vessel.

Those involved in the training of OOW candidates understand that they have a very limited timeframe within which to develop a student's understanding and competency in bridge watchkeeping principles. They have to make the most of the time that they have with the students in order to bring them up to the required level.

Theoretical understanding is important to the development of a good officer, but simulator training is more relevant to an OOW's daily work on the bridge. In order to help students develop quickly, a broad variety of approaches have been attempted over the years. These have ranged from one afternoon per week 'simulated sea time OOW training' to a series of Navigation Aids and Equipment Simulator Training (NAEST-O) 'introductory sessions', all designed to act as an educational ramp for students.

Many of the seafarers the authors have taught readily admit that, as a trainee OOW, their bridge watchkeeping experience is confined to menial tasks not directly connected to the safe navigation of the vessel. They also state that they learn the fundamentals of navigation from the chartwork and passage planning modules during periods of shore-based study. For many students, being in control of the bridge environment is a daunting experience. This is largely because their role has principally been as a spectator to the decision-making process rather than a participant in it.

Over the years, the authors have watched these candidates unsuccessfully try to put their learned theoretical knowledge into practice in the live simulated environment that has become the NAEST-O course. Parallels were drawn with traditional teaching methods where mnemonics and study aids are employed to aid students' comprehension. It became apparent that a formulaic teaching tool for troubleshooting the malfunction of critical bridge equipment was required to assist students in the constantly evolving, often high-pressure, environment of the modern ship's bridge.

When an inexperienced trainee or newly qualified officer has to deal with a failure of critical bridge equipment, they do so in a disjointed way characterised by a great deal of confusion and misdirected energy. Recognising that situations like this generate overwhelming mental stress for the inexperienced, an approach was devised to help them regulate their thinking.

Two Models

Emergency response is a large and complicated topic that requires some simplification for students to digest in the initial stages of their training. This simplification was delivered through the development of two separate and distinct models. These are:

- The Problem-Solving Circle
- The Warren Cycle.

The Problem-Solving Circle

The Problem-Solving Circle (Fig. 1) presents students with a simplified approach that is based on the well-known APEM (Appraise, Plan, Execute, Monitor) process of planning a passage.

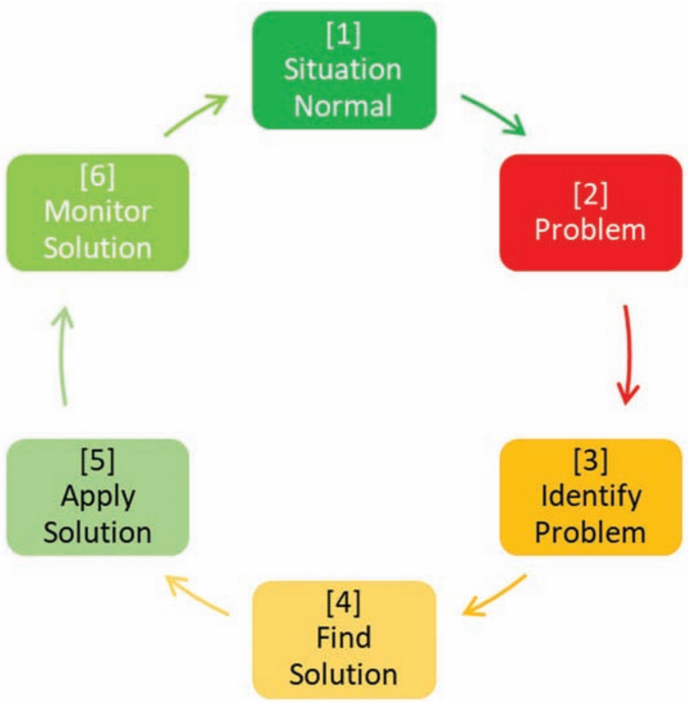

Fig. 1: The Problem-Solving Circle.

The circle is composed of six parts:

- Begin at Situation Normal [1].
- Realise that there is a problem [2]
- APPRAISE [3] the situation by gathering information to identify the problem.
- PLAN [4] how to resolve the situation by finding a solution and formulating a course of action.
- EXECUTE [5] the plan by applying the solution identified.
- MONITOR [6] the result of the action taken by observing its effect upon the problem.

As students already have some experience in using this process, it requires little additional training to allow them to deploy it when they are attempting to address a failure of navigation equipment while they are in the simulator.

The Warren Cycle

The Warren Cycle (Fig. 2) is designed to further develop the approach introduced by the Problem-Solving Circle. It is introduced at a later point in the course once students have accumulated more experience in a simulated environment and improved their understanding of practical bridge watchkeeping considerations.

Initially, the cycle had no name. This proved problematic for staff as they filled in session feedback forms. In need of an easily recognisable term of reference, they began to refer to the model as the Warren Cycle, after its principal developer. The name stuck. *[Jonathan Warren is far too modest to have done this himself and, although he does find it amusing, he is rather embarrassed about it – but credit where credit is due.]*

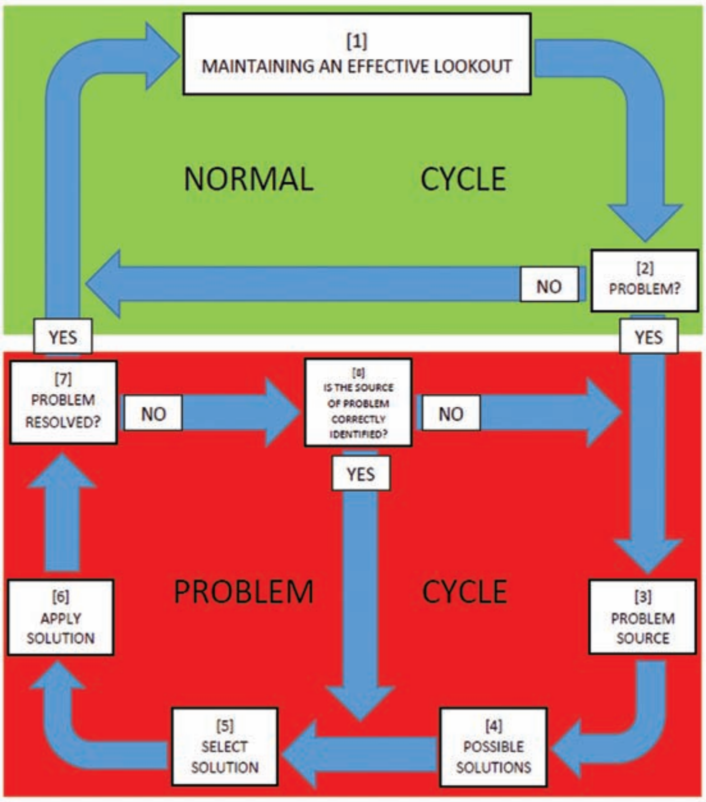

Fig. 2: The Warren Cycle

The Warren Cycle divides the Problem-Solving Circle into two cycles: 'normal' and 'problem'. Within the 'normal cycle' the OOW is maintaining an effective lookout [1] and everything is proceeding according to plan. An officer may be operating within the normal cycle for days, weeks or months until a specific problem arises [2]. Of all of the steps in the cycle, step 2 – realising that there is a problem – is the most important. In simulated exercises, the authors have seen with alarming regularity that students do not realise when the vessel has entered the problem cycle.

Upon realising that a problem exists, the 'problem cycle' is entered and the OOW must follow a process to restore the situation to 'normal'. Here the key is to determine the nature of the problem correctly [3] so that possible solutions can be identified [4] before the solution most likely to succeed can be pinpointed [5] and applied [6]. After taking action, the OOW must then monitor the situation to determine if their action has resolved the problem [7]. If it has, the vessel re-enters the 'normal cycle' [1]. If not, then the situation needs to be reassessed [8]. This will result in one of the two outcomes:

- Another possible solution is selected from those already identified [step 8 and then 5].
- Reassessing the nature of the problem to identify its root cause, generating a new range of possible solutions, and then selecting a new option to pursue [step 8 and then 3].

The OOW may have to progress through the cycle multiple times until the problem is resolved and the vessel re-enters the 'normal cycle'.

A trainee OOW is expected to follow this cycle when they are troubleshooting an equipment malfunction during an exercise in the ship's bridge simulator. However, it is important to state that following the cycle does not relieve the student of the responsibility for calling the Master. Throughout their training, it is enforced in the minds of these potential officers that they may call the Master at any point in the cycle – even if they believe that they are safely operating within the 'normal cycle' but have doubts. Calling the Master in time may avoid the need to enter the 'problem cycle' in the first place. Ultimately, it is the responsibility of the OOW either to solve the problem or to call for assistance.

Shortcomings of a simulated environment

The simulated environment approximates to reality. No simulator is capable of fully re-creating the complexities of real life. Humans respond to a wide range of stimuli that it is not currently possible to replicate within a simulated exercise. Changes in the movement of the vessel, the engine tone, the angle of light streaming into the bridge – all these cues for determining that the vessel has moved from the 'normal cycle' into the 'problem cycle' are absent from the simulated environment. As a result, a 'real life OOW' might realise that they are in the problem cycle much quicker than a 'simulator OOW'. Consequently, the main obstacle for the OOW in the simulated bridge is to perceive that there is a problem in the first place.

Subsequently, in real life, solutions are also relatively simpler. Hands-on processes can be followed: visible buttons can be pressed, and dials turned. However, in the simulated environment, the OOW lacks the immediacy of reality, and after choosing a solution, has to figure out how to apply it by negotiating a menu structure on a computer that is pretending to be a control console. This tends to compound the problem and can lead to students becoming agitated once they realise that their preferred solution is not resolving the problem. This often contributes to them losing control of the situation and going to pieces much quicker than perhaps would be the case on a real bridge.

Case study – complete gyro failure

The cycle was developed after hundreds of students were observed over the course of years. To demonstrate how effective it can be, let us take one particular case study. The student in question had sufficient documented sea time on deepsea foreign going vessels with watchkeeping hours to meet the minimum requirements of the MCA. Despite all of this, in previous simulator exercises the student was prone to panicking in the event of bridge equipment failure – jumping to wrong conclusions, frantically spinning the helm without waiting for the vessel to respond, and not calling the Master. In one case, this led to the vessel running aground after steering in circles. In another case, it led to a collision with another vessel. Thankfully, in this regard the simulator is much more forgiving than the real world.

After being taught the problem-solving circle, followed by the Warren Cycle, and then given additional time in the simulator, the student in question was placed in a new exercise. In this exercise, it was a pleasant afternoon in mid-summer. The vessel was eastbound in the Mediterranean Sea, having left Barcelona two days earlier bound for Gioia Tauro in southern Italy. There was a light breeze and calm sea. The officer of the watch was maintaining an effective lookout [1] when a range of alarms sounded to indicate a problem [2]. The loudest of these alarms seemed to be from the radar, which had switched display orientation and was also displaying an alarm box identifying an 'azi error'. Whilst not sure exactly what this meant, the OOW assumed that the problem was coming from the radar [3]. It could be a:

- Radar display mode switch failure – because the display orientation had changed from the North Up mode selected by the officer of the watch to the Head Up display
- ARPA failure – because all the acquired plots had been dropped
- Software failure – because a number of the buttons on the radar display screen, when pushed, appeared to be non-functional.

A range of ideas on how to solve the problem immediately come to mind [4]. The OOW began to move through the stages of the Warren Cycle for each of these possibilities in turn, using the appropriate menus, in an attempt to resolve the problem. Was it a radar display mode switch failure? [steps 3, 4, 5, 6, 7 and then 8]. An ARPA failure? [steps 3, 4, 5, 6, 7 and then 8]. Software problem? [steps 3, 4, 5, 6, 7, and then 8]. In each case, all the steps were completed, the possibility was eliminated and the cycle restarted, but the problem remained.

Alarms were still sounding and the ship began to weave from port to starboard. The autopilot was struggling to maintain the ship's course. All this had happened within a minute. The problem had escalated quickly. It was time to get some help. The OOW telephoned the Master, briefly explained the situation and asked for assistance.

Upon finishing the call, the OOW realised that the problem had been misidentified [8]. It was not the radar. Both of the independent radar units had the same issue with their display. The problem must lie with one of the systems feeding them. As both radar units had reverted to Head Up display the gyrocompass must be causing the problem [3]. The OOW switched to the standby gyrocompass [4, 5, 6].

The vessel was steadying on its course as the Master arrived on the bridge. The radars were still in Head Up display, but the OOW was able to switch them back to North Up while explaining their actions to the Master. Both the Master and the OOW then stood on the bridge to monitor the effectiveness of the officer's action [7]. After a time, it was apparent that the action taken had been effective. The problem had been solved [8]. The vessel had returned to the 'normal cycle' [1]. Satisfied with the situation, the Master left the bridge.

Feedback

The majority of post-course feedback gathered from debriefing the hundreds of students taught using this cycle has been positive. One particular response stands out. The person in question reported that their use of the cycle is now not just limited to bridge equipment failures. They also use it to organise their thinking in all sorts of high-pressure situations: maritime-related, academic, social and domestic. With this being the case the authors offer it in this article for use by others who might find it useful in their own teaching or mentoring and hope that it may prove beneficial to all concerned.

The developers

Jonathan Warren has more than 20 years' seagoing experience, and has sailed in many different ship types worldwide. He is now at Liverpool John Moores University, teaching across the Deck Officer syllabus. During this time, he has also delivered simulator courses using both Transas and Kongsberg simulators and run the university's NAEST-O course.

Alan Bury spent a decade at sea as a Deck Officer before deciding to make the transition from ship to shore. While completing his PhD, he qualified to teach and began delivering elements of the Deck Officer syllabus along with the ECDIS and NAEST-O courses. His current research focus is the development of improved methods for educating seafarers within a simulated ship's bridge environment.