Desensitizing a Pilot with a Phobic Response to Required Helicopter Underwater Escape Training

Christopher J. Brooks, Peter N. Gibbs, Jacqueline L. Jenkins, and Scott McLeod

OVER THE LAST 35 YR, it has been well established that flying in a helicopter over water is potentially dangerous and sometimes fatal. Depending on the time of day, sea state, water temperature, and weather conditions, if the helicopter ditches or ‘flies in’, there is a 20–50% chance that the crew and passengers will not survive the accident (2,3,6,7,12). It has also been demonstrated by Cunningham (4) that practical helicopter underwater escape training (HUET) improves the survival rate in helicopter ditchings. He showed in 1978 that in 234 ditchings, the survival rate for those who had previous underwater egress training was 91.5%, compared with 66% for those with no training. Since then, the majority of navies and coastguards in the world and the majority of offshore oil industries have made a HUET course mandatory for all their aircrew, and in many cases, their passengers as well.

We describe the case of a student pilot in the Canadian Forces who had gone solo on the Bell-206 Jet Ranger (a multipurpose utility helicopter), but was told that he was destined to fly with the maritime helicopter squadron (over water) instead of the tactical (army) helicopter squadron. Unfortunately he had a severe phobia for HUET, the result of a frightening experience during a marine survival training course. Our goal was to treat him for his phobia using a desensitization program conducted in the helicopter underwater escape trainer. This program exposed him in a step-wise manner, from simple vertical submersions up to the neck in water, to complex inverted underwater cross-cabin escapes in full aircrew equipment. This relieved his phobia and gave him the confidence to proceed with a standard HUET course, enabling continuation of aircrew training.

CASE REPORT

Student Background and Incident Where the Specific Phobia Was Acquired

A man in his early 20s presented with a history of a phobia for the HUET course. Although he was an average swimmer initially with no serious fear of water, his problem started at his Sea Survival Course. The student was the first member on his course to undergo the marine parachute-dragging portion of the course. He donned the harness and was hooked into the towing rig on the back of the zodiac inflatable boat. Once the boat was underway, as is normal procedure, he was rapidly lowered into the water, whereupon he had been directed to locate and operate the quick release fitting (QRF) on the harness to free himself from the parachute. Unfortunately, for whatever reason, he was unable to release the harness completely and was dragged underwater for some time before the tow was stopped. Then he was physically released by one of the instructors. Not surprisingly, he was considerably shaken up and, as a result, developed a phobia to being trapped underwater, such as the situation in a HUET course.

Keywords: systematic desensitization, phobia, helicopter, underwater escape, training.
The cause of the problem is now speculation, but there are a few likely explanations why the QRF did not release. These all have relevance in how he was subsequently treated. First, his anxiety level may have been such that he did not grip the QRF firmly enough to complete its full rotation for release. Second, it could be that his wet slippery glove simply slipped off the QRF and, being partially underwater, he did not make or was unsuccessful in a second attempt to locate and rotate it, perhaps due to 'freezing' behavior. Leach (10,11) proposed that 'freezing' behavior is the result of cognitive paralysis from an overloaded supervisory attentional system. The role of this system is to plan and make critical decisions in complex situations. Paradoxically, this system is very vulnerable to overload if events unfurl too quickly (e.g., being suddenly immersed underwater and not being able to release the parachute harness when this event has never been previously practiced) and the appropriate response is not readily available in long-term memory. It takes longer to process information when presented at a rapid rate in working memory when relevant cues are being mixed up and presented with irrelevant cues. Therefore, he may have frozen because working memory was too slow to process a required action due to the time constraint and the intense stress of the situation.

The third possible cause for his being unable to release the harness is that being the first to conduct the exercise, he did not have the luxury of having observed one of his colleagues perform the dragging exercise and possibly over-emphasize how critical it is to get a good hold on the QRF. In our experience such critical issues are addressed in the classroom, but it is inherently difficult for students to fully appreciate the significance. As occasionally happens, if the QRF is not cleanly operated in one smooth rotation, it only releases on one or two of the four tabs, and those still locked into the fitting are then very difficult to release due to uneven pressure exerted on them by the towline. And fourth, it is possible, although unlikely, that the QRF was worn or otherwise faulty and difficult to operate.

Regardless, the experience left him a frightened student, who to his credit managed with much trepidation to complete the course. His principle phobia was being trapped underwater in a harness that he could not release and that he would drown through inability to breath-hold for long enough. He was then told that he was going to be posted to the maritime helicopter training squadron rather than a tactical (army) helicopter squadron. The anecdotal evidence among the pilots on the training squadron was that the HUET course was a frightening experience. So after his already unfortunate experience, he reported to his flight surgeon that he did not want to undergo the training. The flight surgeon referred him to a psychologist, who reviewed his pre-morbid condition and considered him to be otherwise fit to fly a helicopter and to be a good candidate for desensitization training.

The Therapy Plan

Since 1984, Survival Systems Training, Ltd., in Dartmouth, Nova Scotia, has trained 3000–5000 students per year in helicopter underwater escape using the Modular Escape Training System. The principle author was asked by the Canadian Forces if his team could design a desensitizing course for this particular student on the advice of his psychologist. He had no general fear of being in water. As stated above, his phobia consisted of the thought of being physically restrained underwater, inability to breath-hold underwater long enough to make an escape, and not being able to escape when strapped into a helicopter seat. This had developed because of his inability to unlock his parachute harness when dragged underwater during his sea survival training. His phobia manifested in feelings of anxiety and fear when just thinking about the helicopter underwater escape training. He was seriously considering requesting a medical release from the service if he was transferred to flying maritime helicopters.

There are two treatment options for such student’s phobia: flooding or systematic desensitization (13). The flooding method exposes the patient to their phobic situation immediately (e.g., for someone with a fear of snakes, a flooding treatment would be confining the patient in a room with snakes). In this specific case, the flooding method would require our student to be restrained in the helicopter seat, immediately submerged, and inverted with the window in place. Then, without any previous practice of the easier situations, be placed in a potential drowning situation (i.e., inversion, submersion, with no exit in place). It was discussed between the medical team and investigators that the flooding method would likely aggravate and intensify his phobia to the point where after the one submersion he would not psychologically be able to continue. Furthermore, this was considered unsafe, both for the instructor and the student, and unethical.

Systematic desensitization, on the other hand, involves repeated exposures, but in a graded hierarchy of increasingly difficult conditions as the patient gains confidence in his/her ability to cope and respond. With repeated exposure, the “fearful expectations about the upcoming encounter” are overcome through cognitive-behavior therapy (13). This is where the student slowly learns to cope with his/her problem and demonstrates a more favorable behavior toward the stimulus (e.g., in continuation with the example above, the systematic desensitization treatment method would start with exposure the patient to a movie of snakes, then gradually introducing real snakes into the patient’s proximity).

Therefore, we concluded that our student was a good candidate for the systematic desensitization method and tailored the program in this manner. We learned from the experience of Banken and Mahone (1), who used cognitive-behavior therapy, specifically a stress inoculation training intervention, to help a student pilot cope with the stress he was experiencing in undergraduate pilot training. Therefore, it was decided to use a modified version of the regular training protocol to ensure that the student adequately learned each step of the evacuation sequence. For this case study, the team...
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consisted of 1) a specialist in aviation medicine and the human factors of helicopter underwater escape; 2) a specialist marine survival instructor who had trained over 30,000 students; and 3) a Masters in Kinesiology graduate and experienced safety diver in helicopter underwater escape training.

Requirements

The stressful events and challenges typically experienced by a new class of students on a HUET course are listed below in chronological order. Each needed to be addressed in a stepwise manner in treating the phobia.

**Prior to arrival:** Rumors on the flight line and the oil rigs that it is a terrifying experience that should be avoided if at all possible.

**What is involved in a typical HUET training course?:** In the Modular Egress Training System (METS), the trainee is shown how to adopt a crash position and then operate the exit above water, and perform an upright escape underwater first without an exit present, then with the exit fitted. A succession of inverted egress trials are subsequently performed, first without the exit and then with the exit in place. In the inverted underwater egress sequence, the trainee must assume the correct crash position, wait for the METS motion to cease and the majority of bubbles to subside before each one of them performs a specific sequence of actions in order to escape:

1. While holding on to the seat pan with one hand, with the other hand locate and operate the exit mechanism or push-out window.
2. Firmly grasp the open sill of the window on the fuselage with the hand that released the exit.
3. While gripping the sill with this hand, the other hand has to release the seat belt.
4. Transfer the hand that undid the seat belt to the sill and pull oneself through the exit and swim to the surface.

**Problems that are encountered in the METS:**

1. Inrushing water being forced up the nose on submersion, producing a sensation of impending drowning;
2. Difficulty with getting a breath-hold before being engulfed in the water;
3. Being physically restrained underwater, in a potential drowning situation;
4. Being inverted underwater and disoriented, which leads to:
   A) inhalation of water and water in the sinuses;
   B) poor visibility underwater; and
   C) inability to locate jettison mechanism and jettison exit; getting lost in the cockpit/cabin and having to be assisted out; and
5. Social anxiety of performing in front of fellow course members. In the HUET course, individuals may well be aware and thinking of the fact that they are being evaluated by their peers, which causes further anxiety (5).
6. Claustrophobic effect of cumbersome equipment such as a survival suit/liner, helmet, boots, and gloves, along with loss of tactility required to release the QR or harness release mechanism, disconnect intercom communication system cords, and physically feel for the exit mechanisms.

These problems are generally worst for an anxious student who is attending the course with his peers and does not want to appear afraid. Therefore, we developed procedures and a sequence of training runs to ameliorate their impact, and the student would not be witnessed by his peers.

**Practical Application**

First, the student was introduced to the therapy team. Second, a short history was taken to delve into the cause of the phobia. The flight surgeon had previously performed a physical evaluation; therefore, it was unnecessary to do another. The student presented with his medical documents and stated that he wanted to continue flying helicopters in the Air Force, but that due to supply and demand he would have to fly Navy rather than Army helicopters. He reported that he was very frightened of being submerged underwater (that is vertically) and that he was even more frightened of being inverted at the same time. The thoughts of having water driven up his nose and the requirement to breath-hold gave him bad dreams and the possibility of not being able to undo his harness made him break into cold sweats. This enabled the team to tailor the schedule to address the students’ phobia.

Third, the schedule was described to the student, a full tour both around and in the METS at the poolside was conducted, and all the safety measures were described. It was explained that progress would be made at the student’s pace and the student could withdraw at any time. Also, only the aviation medical physician, the instructor, the safety diver, and the crane operator would be involved—no other observers. Two full days were set aside to conduct the step-wise desensitization. If all progressed well, at the end of the first day, the objective was for the student to have conducted an inverted underwater escape through an open hatch while wearing a coverall and a face mask and have commenced to decrease his anxiety to the training. This would be a 180° roll where the head and body position starts from a position of 3 o'clock and rolls around to an inversion at 6 o'clock. This is considered the biggest milestone and potentially the most difficult to achieve for all students who undergo normal training.

For this milestone to be achieved, it is important to use the graded training method, which starts with simple tasks and gradually increases difficulty as the trainee increases confidence (8) and decreases anxiety (9). This permits more effective encoding of these skills into long-term memory, which will produce a more rapid and effective response in a real emergency due to positive cognitive and behavioral control (9). The positive cognitive effects of removing the anxiety is that working-memory can more effectively encode this skill into long-term memory, and with practice, the transition to skilled performance (and ultimately automatic
performance) has less dependence on working memory, which is slow and effortful. Therefore, with more practice, the action is performed faster and more skillfully in training, which translates to better performance in a real emergency (14).

On the second day, it was planned to continue to build confidence through more repetitive exposure. Then the physical and cognitive challenges of the escape would increase through more complex clothing and headgear, reduced nasal protection, greater roll angle, and added obstacles such as exit doors in place. The ultimate objective was for the student to successfully make at least two unaided cross-cabin escapes wearing full equipment from either the left- or right-hand seat after an inversion with the head and body position starting at 12 o’clock and rotating all the way around to 6 o’clock (180° outside roll) with the exit door in. Table I outlines all the different combinations of attire and escape parameters used during the program by degree of difficulty and phobia provocation.

The orders of complexity in the matrices of Table II and Table III were deliberately designed to address each of the parameters, the first being the problem of inrushing water and ability to release the QRF with wet gloved hands. With the student strapped in wearing a coverall and gloves, the METS was lowered vertically, first slowly and later rapidly, until the water was up to neck level. Then, with the head still out of the water, the student was taught how to unstrap, locate and jettison the exits with wet gloved hands, and finally make an escape through an open window with no exit in place. For all runs and conditions, the hand position of the student was to remain on the controls of the helicopter until submersion had occurred.

Learning the optimum time to take a breath-hold and building confidence in the ability to escape the trainer from underwater were the next events to be addressed. Again dressed in a coverall with the addition of a diver’s facemask, the student was first lowered vertically at a slow rate until the head was immersed and later, when ready, at faster rates. As the student gained confidence, the facemask was replaced with a nose clip, and eventually no nasal protection was used as he developed confidence in his breath-holding ability. At this stage, the object was for the student to demonstrate the ability to unstrap and make a simple non-inverted escape through an open hatch; that is, for these escapes, no exit door was in place.

The next step was to achieve the main milestone involving the first exposure to disorientation. As described above, the objective was for the student, dressed in a coverall, gloves, and wearing a facemask and hockey helmet, to strap in, assume the crash position, and make a simple escape from the inverted immersed METS, still without the exit door in place. Then, once the student had built up confidence for this challenge, more and more escape complexities were added [e.g., replacing the hockey helmet with an aircrew helmet; replacing the coverall with an immersion suit; exchanging the facemask with a nose clip, and then removing nasal protection; increase the rate of submersion changing the roll direction from an inside roll to water touch

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothing</td>
<td>Coverall + gloves</td>
<td>Immersion suit</td>
<td>No protection</td>
</tr>
<tr>
<td>Head gear</td>
<td>Hockey helmet</td>
<td>Aircrew helmet</td>
<td>Cross cabin</td>
</tr>
<tr>
<td>Exit status</td>
<td>Open</td>
<td>Fitted in place</td>
<td>RHS/LHS</td>
</tr>
<tr>
<td>Nasal protection</td>
<td>Face mask</td>
<td>Nose clip</td>
<td>Total submersion</td>
</tr>
<tr>
<td>Seat position</td>
<td>Direct Escape</td>
<td>Direct Escape</td>
<td>1) inversion 180°</td>
</tr>
<tr>
<td>Submersion and breath-holding training</td>
<td>Slow to neck vertical/stop</td>
<td>Fast vertical/stop/total submersion</td>
<td>2) inversion 180°</td>
</tr>
</tbody>
</table>

RHS/LHS = right-hand seat/left-hand seat.

### Table II. Day 1, Training Run Parameters and Sequence.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Training Run or Exposure</th>
</tr>
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<tbody>
<tr>
<td>Submersion speed, direction</td>
<td>Slow to neck/stop/fast underwater</td>
<td>5</td>
</tr>
<tr>
<td>Exit door jettison</td>
<td>Fast vertical/total submersion</td>
<td>6</td>
</tr>
<tr>
<td>seat position, removal</td>
<td>N/A - removed</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>At surface</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Underwater</td>
<td>X</td>
</tr>
<tr>
<td>Seat Position</td>
<td>Direct exit right hand side</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Direct exit left hand side</td>
<td>X</td>
</tr>
<tr>
<td>Nasal Protection</td>
<td>Face mask</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Nose clip</td>
<td>X</td>
</tr>
<tr>
<td>Clothing</td>
<td>Coverall + Gloves</td>
<td>X</td>
</tr>
<tr>
<td>Helmet</td>
<td>Hockey</td>
<td>X</td>
</tr>
</tbody>
</table>
down to where the student goes around the outside of the roll. These factors require the student to refine his/her breath-hold technique as the roll parameters change.

The final scheduled runs required the student to conduct unaided direct escapes from both right and left seats in full equipment after an outside roll. This was first with the exit doors in place and wearing no nasal protection and finally cross-cabin escapes with no exit in place (this is because theoretically, the pilot in the adjacent seat would have already escaped through this exit). By this time, the student should have become skilled at breath holding, locating and jettisoning the exit, be confident in his ability, and, therefore, execute a skilled response instead of a panicked, ineffective response, potentially leading to drowning.

Day 1 Therapy Sessions

On Day 1, runs 1–4 were performed with the exit in place and from the right-hand seat with a four point harness. The exit was jettisoned by the student when a stop was made at the surface, before water entry. Submersions were vertical (lowered straight into the water to the neck, no roll), therefore, no nasal protection was needed. He wore coveralls, gloves, and a hockey helmet.

In Runs 5–8, the student had nasal protection in all exposures, either a facemask or a nose clip. Again all of the submersions were vertical, but he also experienced an over-the-head submersion for the first time. After two more submersions in the right-hand seat, he was transferred to the left-hand seat. In exposure 8, the student achieved an over-the-head vertical submersion in which he was required to jettison the exit underwater instead of at the surface. Table II outlines runs 5–8 to aid in the understanding of the graded difficulty of these runs.

Table III outlines runs 9–14. The student still had nasal protection in all exposures, but for the first time wore an immersion suit. He was required to jettison the exit underwater in all of these trials except Run 9. In Runs 10–12, he was introduced to using an aircrew helmet. Then in Runs 13 and 14, he accomplished jettisoning the exit inverted underwater while wearing a facemask.

Day 2 Therapy Sessions

The second day of exposures, runs 15–24, commenced with inversions with the aid of a facemask, first from the right-hand seat with the exit out, then from the left-hand seat with the exit in place. The exposures proceeded in a similar manner with changing nasal protection and seat position. Then the direction of the METS rotation was changed from an inside to an outside roll before the immersion was stopped. He also progressed from an attire of coverall, gloves, and a hockey helmet to an immersion suit with gloves and an aircrew helmet. The immersion suit was worn from exposure 19 onwards, the first submersion with no nasal protection. In the last several exposures, runs 25–33, complexities were added successively, including cross-cabin escapes where there was no exit in place.

DISCUSSION

The student arrived looked very pale and very anxious. At the end of the first day, the team was encouraged by the fact that his anxiety had been reduced and he expressed a desire to start again the following day. After completion of Day 2, he left us smiling with renewed confidence and a sense of achievement, having overcome his phobia of helicopter underwater escape training.

The desensitization protocol was successful in alleviating the student’s phobia to the HUET course. In our opinion, this is due to the fact that training started with simple tasks to allow the student to gain confidence, and then as he increased in confidence and decreased anxiety, more difficult tasks were added until he finally achieved all the required submersion configurations. He stated that he felt confident in his ability to escape the METS and he became increasingly more pleased with the progress he had made as he gained more confidence. Coincidental with this, his anxiety toward the training was significantly decreased if not eliminated. Indeed, on completion he expressed the opinion that he was now looking forward to doing the HUET course with his colleagues.

HUET courses have been shown to save lives (4), although many would still prefer not to take it due to the anxiety it causes. However, it is required for the
majority of those who fly in a helicopter over water for a living. If the HUET course is not completed, they will likely lose their job. Therefore, the majority of HUET schools have protocols in place for those who demonstrate anxiety and need further instruction.

This program consisted of 33 training runs. This was the first such program to be implemented at our establishment and, therefore, it may have been overly cautious and excessive; however, now we have established a baseline from which to work from. Other students with anxiety toward the HUET course may not need such extensive training, and each program should be tailored accordingly as the student proceeds, depending on how rapidly their anxiety decreases and their ability to learn the tasks. Communication between the instructor, the student, and the investigator should be ongoing in order to establish the appropriate course of action to alleviate the anxiety and complete the HUET course.

Finally, the treatment would appear very cost effective—2 days of specialist training compared with the loss of a potentially good pilot in which a considerable investment in training time, jet fuel, and wages had been spent. At the end of the program, our team 1) considered him fit to continue training as a maritime helicopter pilot, and for future standard helicopter underwater escape training; and 2) recommended that he take a scuba course to help prepare him for using an emergency breathing system.

We would like to report the first known case of a formal desensitization program to successfully treat a student pilot who had a phobic anxiety of training in the METS. The results show that this type of training can be effective in enabling management of emotions during a highly stressful situation. Normally, training would be discontinued and the student re-mustered or released from the service. Our objective was to let the flight surgeon community know that there now is an alternative to grounding, although we caution that each phobia will have to be treated on an individual case-by-case basis. Caution should be taken when attending to anyone experiencing anxiety or a phobia.

REFERENCES