STRESS LEVELS ASSOCIATED WITH HUET:
THE IMPLICATIONS OF HIGHER FIDELITY TRAINING
USING EXITS

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CONFIDENTIAL REPORT 
SC 155 

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November 2006
Acknowledgements
Grateful thanks are offered to those members of the offshore workforce and training staff who freely gave their time to complete questionnaires. Thanks also go to Dr Andrew Goodge and Dr Wendy Doig who commented on the medical aspects of HUET training.

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She currently holds an honorary position as a Visiting Fellow of Cranfield University and is a Fellow of the Ergonomics Society. She is Chairman of the BSI committee and a member of the European (CEN) Technical Committee responsible for lifejacket and immersion suit standards. Clients include the Health and Safety Executive, the Civil Aviation Authority, the European Commission, equipment manufacturers and offshore operators.
GLOSSARY

Anxiety: A transitory emotional state characterised by subjective, consciously perceived feelings of apprehension and tension, heightened by activation of parts of the nervous system. State anxiety refers to the current point in time. Trait anxiety refers to proneness to anxiety states.

Fear: A state of high anxiety, normally where the cause is known.

Memory – declarative: That aspect of memory that stores facts and experiences of events. Includes learning and knowledge and is subject to forgetting. Refers to memories that can be consciously discussed or 'declared'.

Memory – procedural: That aspect of memory that applies to acquisition and long-term memory of skills and procedures such as how to complete a skilled action. It does not necessarily involve conscious thought e.g. learning to ride a bike.

Memory – working: Short-term storage of information that is being processed in any of a range of cognitive tasks.

Panic: Sudden unexpected surges of anxiety that may lead the individual to have to quickly get out of whatever situation they happen to be in. (Panic behaviour in real accidents has been interpreted as a rapid series of rational responses).

Phobia: Fear of a particular situation or things that are not dangerous and that most people do not find troublesome.

Stress: A term used to describe the potentially harmful effects of an environmental demand on the body. It describes things that make us anxious and our reaction to them.

ACRONYMS

BOSIET Basic Offshore Safety Induction and Emergency Training

FOET Further Offshore Emergency Training

HUET Helicopter Underwater Escape Training

OPITO Offshore Petroleum Industry Training Organisation

OGP International Association of Oil and Gas Producers

OLF Norwegian Oil Industry Association

UKOOA UK Offshore Operators Association
Management Summary

This short report reviewing the implications of introducing the operation and removal of exits into BOSIET and FOET courses was commissioned by UKOOA and OPITO, with funding from OPITO. The research was instigated following a consultation process on proposed changes to the OPITO Basic and Further emergency response training courses, where concerns were raised regarding the levels of stress and anxiety that may be experienced by some course delegates, the possibility that stress levels may be increased by the introduction of exit operation and the potential health risks associated with such a change.

A review of the literature relating to stress provided evidence that stress is a normal response to a perceived threatening situation that helps the body to react in an appropriate manner. Whilst low levels of stress may be beneficial, higher levels are undesirable. Anticipatory anxiety appears to be a particular problem associated with emergency response training, caused in part by negative rumours and the emotive nature of discussions relating to HUET training. Stress and anxiety experienced prior to and during HUET training is linked to a fear of what could happen and a perceived lack of control over events during the training.

When considering the impact of including the operation of exits into training, the evidence suggests that levels of stress may increase somewhat in a proportion of delegates, but that those who receive comprehensive higher fidelity training will be more confident as a result of this training. Course delegates and training staff interviewed after HUET training involving exits were not particularly worried by the experience of using exits and the majority supported the introduction of exits into the BOSIET and FOET courses.

With regard to delegate health, the main concern remains with those delegates who may experience high levels of anxiety prior to and during HUET training. It is suggested that an approach should be taken whereby levels of stress should be reduced to as low a level as possible through a process of continuous improvement. It is recommended that some changes should be made to the training and that measures should be taken to identify and provide additional help to those suffering from stress and anxiety.

Report prepared and authorised by: SRK Coleshaw

Signature: ........................................
Consultant

Date: ..................
1.0 INTRODUCTION

1.1 BACKGROUND

Mr Bob Kyle of UKOOA and Mr Iain Emslie of OPITO approached SRK Coleshaw (Independent Consultant) regarding a proposed revision of the OPITO standards on BOSIET (Basic Offshore Safety Induction and Emergency Training) and FOET (Further Offshore Emergency Training). A proposal had been made to incorporate the operation of emergency exits into helicopter underwater escape training (HUET) in BOSIET & FOET standards. The rationale for this change is that "The operation of the emergency exit is seen as the last link in the survival chain during underwater escape. At present the training misses out this link and trainees never practice the skills or techniques involved despite practicing all other aspects of escape. Various reports and studies (e.g. Cranfield report) have recommended more “realistic” HUET training including the operation of emergency exits. HUET training standards in other countries (e.g. Norway, Netherlands) include the use of exits and UK personnel have had to do additional training to work in other sectors" (OPITO, 2006b).

The consultation process re-opened concern among the workforce about stress levels associated with HUET. In feedback received following consultation (OPITO, 2006a), one UKOOA member company recommended that a full evaluation of the potential health risks be undertaken prior to implementing the changes. This company supported the use of representative exits during HUET training. Whilst they cautioned that Offshore Safety Representatives had a more negative view and had expressed strong concerns about stress and safety risks associated with increasing the fidelity of HUET training, they also stated that the Offshore Safety Representatives had expressed concern over discontinuing real smoke exercises "as these are judged to increase the confidence of participants to deal with real events". There was also a view expressed by a Contractor company that fire-fighting training should be made more challenging. This contradictory standpoint regarding the fidelity and stress versus challenge of training demonstrates a real problem relating to the emotive nature of discussions about HUET training.

Another UKOOA member company also called for further research and discussion prior to any changes in HUET training introducing the operation of an exit. They stated “There are clearly opposing camps in this area of in-water training; namely those who feel that the more realistic the HUET exercise is the more effective the training will be, and those who feel that the whole training experience and the HUET in particular is already sufficiently testing and achieves an adequate level of competence among trainees. There is in fact a third camp who feel that even the current training (and HUET in particular) is excessive”. They further stated " A number of people expressed genuine concern that the physical and psychological demands placed on people by this training may become excessive, and some people suggested that they already are excessive. A couple of people were moved to write to me as concerned individuals, owning up to being seriously stressed already by the HUET exercises and doubting that they would be able to complete the new series of HUET exercises described in the revised standards". This demonstrates a widespread perception within the offshore workforce, both that HUET training is already too stressful and that the proposed changes will increase stress levels.

An opposing viewpoint was expressed following the initiative of four volunteers who attended a Norwegian training course requiring the operation of exits. The overall feedback from this group was that the removal of exits did not add any additional stress and did not make much difference to the training in terms of anxiety or difficulty.
The last major change of the training programmes was implemented in 1995, when BOSIET and FOET training was reduced in duration and made more focussed. Changes have since been made to HUET training. Following the introduction of emergency breathing systems (EBS) by a majority of operators working in the UK sector of the North Sea, the donning, deployment and use of EBS was introduced into the OPITO HUET programme in 2003. The impact of introducing EBS into the training programme has not been evaluated, but it was hoped that for most course delegates, EBS should increase confidence, provide more time to make an escape, and thus reduce the stress and anxiety associated with underwater escape. It is not known if this is the case. This factor must be considered alongside the impact of adding in the operation of emergency exits in the training programme, as the two factors may interact.

The Association of Gas Producers (OGP, 1989) has recommended “every Company or Contractor personnel travelling regularly on company chartered or owned helicopters offshore should have attended a HUET course (minimum one day for initial course)” (OGP, 1989). They also recommend a 3 year goal for frequency of training, but recognise that this may vary according to the operation, exposure, identified threats and the quality of training given. They recognise the high standard and quality of training given in the North Sea environment. It is interesting that they recommend that temperate climate HUET facilities “should have the correct emergency exit mechanism installed for the less frequent flier to familiarise himself in the wet environment”. The current OPITO standards (e.g. BOSIET standard) require delegates to be able to operate a realistic helicopter exit mechanism under dry conditions (OPITO, 2003).

A number of questions are thus raised: 1) Are the proposed changes likely to alter the level of stress experienced by BOSIET and FOET delegates? 2) If stress and anxiety levels are increased, are these levels likely to be unacceptable to a significant proportion of course delegates? 3) Is long-term health likely to be affected by the stress of HUET training? 4) Is there an effect of age on the stress responses or the ability of delegates to complete HUET training? 5) Do the perceptions regarding HUET training match the reality and, if not, what can be done to change this situation?

1.2 AIMS AND OBJECTIVES

The aim of this study is thus to review and evaluate the possible impact of increasing the fidelity of BOSIET and FOET training by the use of emergency exits during helicopter underwater escape exercises. The review will cover a number of concerns raised during consultation with the offshore industry, in particular, the levels of stress that may be experienced by course delegates and associated potential health risks.

The objectives are to:

- Review current knowledge relating to the level of stress experienced during HUET training;
- Investigate the effects of stress on learning, procedural memory and retention of knowledge and skills;
- Determine what represents an acceptable level of stress, considering medical and general health status;
- Investigate the effects of an ageing population on the above factors;
- Consider the impact of changing HUET training to include the operation of emergency exits, based upon the above factors;
- Consider means of reducing levels of stress during training, perhaps by modifying the method of training delivery.
- Consider means of changing the perceptions about HUET training and thereby reduce any unnecessary anxiety and stress.
2.0 METHODS

2.1 LITERATURE REVIEW

A comprehensive literature search was conducted, using medical/health/biomedical databases such as 'PubMed' and Internet search engines to locate industry-specific documentation. A library of papers held by the author and relating to this area was also used. Existing papers and recent advances were reviewed and evaluated to provide an up-to-date picture of current knowledge.

Previous studies of stress during offshore emergency response training were compared with studies from similarly demanding situations in an attempt to quantify the level of stress experienced during HUET training.

Consideration was also given to the implications of stress in relation to the health of those undertaking training.

2.2 CONSULTATION

Questionnaires were used to survey a small number of training staff and course delegates undergoing HUET training that involved the operation of exits (Appendix 1). A number of training organisations were contacted and asked when they would be running a course of this type. Permission was then requested to interview a selection of delegates on completion of the course, plus the training staff running the training on that occasion. In two cases, a 'European' add-on/upgrade type course was selected. In this case, delegates had previously completed an OPITO approved BOSIET course. In one case, an OLF Further training course was selected. This latter course included 7 exercises using the helicopter simulator.

A small number of UKOOA approved occupational physicians were also contacted to gather their views on the incidence of stress in training, its effect on workforce health and the implications of adding exits into training.
3.0 RATIONALE FOR HUET TRAINING

Helicopter underwater escape training has been developed over many years in response to helicopter crew and passengers having great difficulty escaping or being trapped inside the helicopter following submergence or capsize.

As far back as 1973, survivors of helicopter water impacts identified in-rushing water, disorientation and an inability to reach or open escape hatches as the main problems in escaping from the aircraft (Rice and Greear, 1973). They recommended that "realistic underwater escape training" should be implemented. The Naval Centre, Norfolk, USA studied helicopter crashes into water from 1969 to 1975, involving more than 400 men (Ryack et al, 1986). They reported that "fewer than 8% of those who had received training in the Dilbert Dunker died in such crashes, compared to more than 20% who had not". They considered that the training provided individuals with familiarity with the crash environment and confidence in their ability to cope with the emergency situation. HUET training for all navy helicopter crew members was recommended.

The benefits of HUET training are difficult to quantify but there are many cases where HUET training has contributed to a positive outcome. Hytten (1989) interviewed five crew members from a rescue helicopter who survived a crash into the cold water of a lake. One untrained crew member died. His colleagues observed that he had shown a panic reaction causing him to swallow fuel. This was put down to lack of training. He was a poor swimmer and was wearing inadequate clothing resulting in hypothermia. Of the five survivors four had received simulated helicopter accident training prior to the crash. It was reported that the four HUET trained survivors claimed, "the training was of decisive moment in their escape and survival". Comments from structured interviews with the survivors included:

- "He described his behaviour as a reflex conditioned by two simulator training experiences;"
- He underlined the importance of knowing how to evacuate and the reduction of confusion resulting from training;
- Training prevented panic reactions;
- The effect of training was felt to be confidence in his own ability to get out of a submerged helicopter;
- Training had taught him to stay calm during the evacuation process and had prevented the development of panic;
- Training had also given him a behaviour pattern which he could activate in the real situation;
- Helicopter simulator training for him prevented the occurrence of panic … the most important aspect of training was claimed to be the assurance it had given him of being able to stop breathing for the necessary seconds it would take to get out .."

Interestingly, it was found that none of the survivors carried out the exact behaviours they had been taught in training and the real situation was reported to have been very different from the simulator experience, but nonetheless, they considered the training to have been very important in their survival. Training had provided self-confidence and the ability to cope with the real situation.

This view was supported by Hytten, Jensen & Vaernes (1989) who found that most individuals undertaking HUET training developed a positive expectancy for future coping. Of the 78 participants in their study, 88% considered that they were in a better condition to
cope with a helicopter crash after completing the course. A similar proportion, 78%, reported an increased confidence in flying. The authors considered that coping was developed through repetition and controlled action in this unusual situation.

During the investigation following the helicopter crash near the Cormorant Alpha platform in the North Sea two of the survivors were interviewed. Both considered that the helicopter escape and survival course that they had completed prior to the incident had contributed to their survival, despite the helicopter simulator bearing "little or no resemblance to the passenger cabin of [a] real helicopter" (AAIB, 1993). This suggests that the benefits of training for these individuals may have come from a level of preparedness and knowledge about what to expect. Whilst the helicopter simulator was not considered to have high fidelity with a real cabin, it was sufficient for those individuals to learn the procedures that helped them make their escape in the real emergency situation.
4.0 REVIEW OF STRESS

4.1 STRESS - CONCEPT, RESPONSES AND COPING

The term 'stress' has many different meanings and can be used in a number of ways. Stress is generally used to describe the harmful effects of an environmental demand on the body. It can be split down into a number of components: (1) stress stimuli or 'stressors'; (2) the processing systems during the demanding period or event; (3) stress responses following the demanding period or event (Ursin and Olff, 1993). When considering stress during HUET training we need to consider all three components: the factors causing stress; what happens during training and how this affects the individual and their subjective experience; and the consequences of this experience, on both short-term and long-term health. Stressors may include prior perceptions of what might happen during training, the fear of being underwater and not being able to breathe, the fear of being trapped and unable to escape from the helicopter simulator, peer pressure and the 'ego-threats' of not being able to cope. The level of control an individual has over a particular situation or event is known to influence psychophysiological function (e.g. Breier et al, 1987) with lack of control acting as a stressor.

The human body responds to stressors in a number of ways that allow the body to cope with the demands of the situation. The physiological response involves a general arousal or activation of the central nervous system. This initial response has been described as the 'fright, fight, flight' reaction, resulting from stimulation of the sympathetic nervous system and the release of adrenalin. Heart rate and blood pressure increase, breathing rate increases, muscle blood flow increases, and in extreme cases, perspiration and pallor may be observed. These responses prepare the body for action. This condition is associated with the subjective experience of anxiety, an emotional state characterised by feelings of apprehension and tension that can interfere with the individual's ability to perform tasks.

Later stress responses include activation of the hypothalamus-pituitary-adrenal (HPA) axis and the consequent release of glucocorticoid hormones such as cortisol. These hormones bring about the release of energy, with an increased production of glucose and reduced uptake by tissues, with the release of free fatty acids from adipose tissue and stimulation of protein breakdown. Glucocorticoids are also thought to suppress immune functions and may therefore have effects on long-term health.

Whilst mild levels of activation may be experienced by the individual as a pleasant 'thrill', high levels of activation can be experienced as unpleasant and 'stressful', depending upon the individual and the situation (Ursin and Olff, 1993). The level of activation, and of anxiety experienced is thus important. Above the optimum level, performance may be impaired. It is also important to note that individuals adapt to stressful situations over time. According to Hytten (1989) "when fear is confronted and coped with at one intensity, it is probable that one will cope with a new fear-provoking situation of greater intensity". Thus, coping with a training situation allows the individual to develop coping mechanisms and thus manage a real life-threatening event more effectively.

In real emergencies, victims show a range of behaviours in response to the threat. Muir (1999) has described a number of behavioural responses experienced by passengers involved in transport accidents. These include the following:

**Fear** The two reactions to fear are 'fight' and 'flight'. The most frequently reported reaction in an accident is flight, providing the impetus to rapidly escape.
Anxiety  This is experienced by the majority of passengers in an emergency situation and may impair their performance of actions that are novel and difficult (HUET training aims to reduce the novelty of the situation).

Disorientation  In a helicopter this results from a reduction in visibility, in-rushing water and the change in orientation following capsize. This will increase levels of anxiety and may result in a failure to locate an exit.

Depersonalisation  Witness reports from life-threatening events indicate that the passage of time seems to slow. This is thought to be as a result of people detaching themselves from the actual situation in order to think and respond more effectively.

Panic  It is thought that true instances of panic amongst passengers in accidents are rare and are usually due to feelings of being confined. Behaviour in accidents that might be regarded as panic can be interpreted as a rapid series of rational responses.

Inaction  It is thought that between 10 and 25% of people do little or nothing to escape from danger. Evidence from accidents seems to indicate that there are many more instances of behavioural inaction than panic.

Inaction or 'freezing' is of great concern in the helicopter emergency situation. This may add to the anxiety of an individual who is not seated next to an exit, facing the prospect that the person seated next to the exit will not make a rapid escape and will effectively block the exit. Leach (2004) suggested that 'freezing' could be accounted for by time constraints on the cognitive processing of information in a rapidly unfolding, real-time environment.

The main aims of training must therefore be to reduce the likelihood of these behaviours. This can be achieved through familiarisation with likely scenarios, familiarisation with the equipment that might be used and the procedures that must be followed, thereby generating confidence, coping skills and a positive outcome expectancy.

4.2 EFFECTS OF PSYCHOLOGICAL AND PHYSIOLOGICAL STRESS ON PERFORMANCE

Performance in a threatening situation will depend upon the level of perceived threat, the coping abilities of the individual and the resultant level of stress experienced. It has been reported that lack of control over a stress condition can result in higher levels of reported helplessness, tension, anxiety and physiological activation of the HPA axis (Breier et al, 1987). Whilst low levels of anxiety can be experienced without any significant decrement in performance (see Idzikowski & Baddeley, 1983) there is a large amount of literature showing that higher levels of stress result in cortisol release that is known to affect cognitive function.

Much of the focus on the effects of stress on performance has thus focussed on the effects of cortisol on the body and its role in the stress response. Cortisol is known to be produced in response to both psychological and physiological stressors, although there is a wide variability in cortisol response between individuals. Cortisol levels have been linked both to defence and to coping (see Harris, 1995 for review).

It is also known that glucocorticoids (such as cortisol), secreted in response to stress, have an affect on cognitive performance by impairing declarative memory recall, defined as the conscious recollection of learned material (Elzinga et al, 2005; Kirschbaum et al,
1996; Sauro et al, 2003). Anticipation of a stressful event has been shown to play a more significant role than the actual stressor in impairing declarative memory (Lupien et al, 1997). However, whilst declarative memory was impaired, the study by Kirschbaum et al (1996) showed no impairment in a procedural memory task. This suggests that those experiencing stress and anxiety may find it more difficult to remember instructions during the training, but the process of learning the physical actions or tasks required to complete the escape exercises may not be affected by stress.

In a study of the effects of acute stress on immune and cognitive performance during emergency response training, Robinson (2005) found no changes in short-term working memory but did show some impairment of declarative memory in the period prior to HUET training. Robinson cites several reports of survival experiences where individuals have failed to carry out life-saving behaviours requiring procedural memory. She found some impairment in working and procedural memory during the impact stage of training, whilst poor decision-making was observed during the recovery phase. Caution should be taken in interpreting the effect on procedural memory as the test used was a word task and did not involve a physical task. Her overall conclusion was that "cognitive performance is very robust and dysfunctions were, on the whole, difficult to elicit" (Robinson, 2005; p227). She considered that the impact stage (HUET exercises) was the part of the threatening situation when the individual was most susceptible to cognitive impairment. Thus, anything that can be done to reduce the perception of threat during the HUET exercises should help to improve procedural memory, learning and hopefully, retention of that learning.

4.3 STUDIES OF STRESS DURING OFFSHORE EMERGENCY RESPONSE TRAINING

An early study of HUET training of US navy personnel (using a prototype breathing device) showed a decrease in anxiety over the course of three days of training (Ryack et al, 1986), leading to a recommendation in support of HUET training for all crew members.

The first major study of the psychological and physiological effects of helicopter underwater escape training was conducted by Hytten et al (1989) in Norway. Overall, most of the 78 trainees developed a positive response outcome expectancy and increased confidence in flying. Anxiety levels were low in those with earlier similar experience. Higher levels of anxiety were found in those who perceived the ditching as more demanding than expected. The authors considered that high anxiety levels prevent the development of a positive response outcome expectancy by interfering with the cognitive functions needed during training. A more individualised approach to training was recommended.

Work in Canada looked at the potential benefits of using an emergency breathing system (EBS) to aid underwater escape (Bohemier, Chandler & Gill; 1990). They found that use of EBS was beneficial in helping subjects to deal with more difficult seat positions (cross-cabin escapes) and resulted in an improved probability of making a successful escape over a sequence of 7 exercises. Both with and without EBS, subjects showed an increasing ability to cope with disorientation as experience in the simulator was gained.

A comprehensive study of stress during all aspects of offshore survival training, conducted from 1991 to 1994, Harris, Coleshaw & MacKenzie (1996) found the highest levels of anxiety at the time of enrolment onto the course and prior to HUET training. Pre-course
anticipatory anxiety was associated with an increase in urinary and saliva cortisol levels, suggesting arousal of the nervous system. Anxiety levels, both early morning and pre-event, when placed in chronological order, decreased over the duration of the course, suggesting a degree of habituation with time as individuals learned to cope with the experience.

The mean state anxiety score for combined trainees prior to HUET training (42.3±12.0) was similar to the mean score for college students under examination conditions (43.0 - males; 43.7 - females) reported by Spielberger et al (1970).

Both mean state anxiety scores and heart rates were higher in the combined group compared to the refresher group prior to HUET training (Harris, Coleshaw & MacKenzie, 1996). State anxiety was also found to be higher in young compared to older trainees in the refresher group, but this negative correlation with age was not found in the combined group who were mostly attending a course for the first time. Both of these findings may be explained by a greater level of apprehension and anticipatory anxiety in those attending their first training course, whilst the older, more experienced individuals who had attended training on multiple occasions knew what to expect and had developed coping strategies.

Not surprisingly, non-swimmers were more anxious than swimmers. Smokers tended to experience higher levels of state anxiety and coped less well than non-smokers, whilst anxiety was also higher in those who rated themselves less fit. These latter two factors are important, as physical inactivity and smoking are both coronary risk factors.

A later study by Muir and Mills (1999), commissioned by Shell, which aimed to develop a training standard for underwater survival, found that higher fidelity training (including operation of emergency exits) caused more stress. However, they supported the need for "part-task learning whereby trainees skills are built up in an incremental fashion". Trainees' performance and confidence were both improved as a result of conducting two inversions. Many experienced severe disorientation in the first inversion and "learnt more during a second inversion when they knew what to expect". Those who had experienced the higher fidelity training were more confident as a result of their training. Levels of stress measured during a test inversion were lower in those who had completed an inversion during training than in those who had not completed an inversion during training. The authors also supported comprehensive classroom and practical training in the use of EBS. They found that "participants were able to remain in the helicopter simulator for longer periods and stated that the increased window of opportunity for escape due to use of the air-pocket helped reduce feelings of panic".

A recent study of the cognitive and neuroimmune responses to the pre-impact, impact, recoil, rescue and post-trauma stages of survival training (Robinson 2005) showed some cognitive impairment during the impact and recovery phases of HUET training (see also Section 4.2). This suggests that high levels of stress could have an effect on training outcomes and the ability of delegates to learn and retain information relating to escape procedures, a factor that should be considered when assessing the impact of the proposed changes.

4.4 STRESS IN OTHER THREATENING SITUATIONS

Studies of stress in threatening situations are limited by the difficulties of obtaining controlled data. Those studies that have been conducted use a wide variety of physiological and psychological measures making comparisons and estimates of the level
of stress experienced in other similar situations very difficult. Studies that have been conducted tend to fall into a number of areas:

- Emergency response training e.g. fire-fighters;
- Military personnel undergoing training;
- Potentially dangerous sports such as parachuting;
- Everyday phobias such as fear of driving.

Fire-fighting requires personnel to perform under conditions of severe short-term stress. They are exposed to both physiological and psychological stressors. Heart rates up to 86% of maximum, over 150 beats per min (Kivimaki & Luse, 1994), and elevated cortisol levels (Smith et al, 2005) have been recorded during fire-fighting drills. Impairment in cognitive functioning has been demonstrated by reduced task-focused thinking (intentional thinking aloud) during solitary smoke diving (Kivimaki & Luse, 1994). In a study of stress and coping in the follow-up to a hotel fire rescue, 10% of the relatively inexperienced non-professional fire-fighters present claimed that "stress reactions disturbed them in executing effective rescue work" (Hytten & Hasle, 1989). The majority considered that more training and preparation could have improved their effort. The professional fire-fighters involved were said to have 'digested' the disaster experience more easily, coping better with the extreme stress of the situation.

Idzikowski and Baddeley (1983) reviewed a number of studies of military and sports parachuting and showed increased activation of heart rate, respiration, hormone secretions (e.g. adrenaline) and blood glucose levels preceding and during the jumps. Levels of anxiety increased as the time of the jump drew closer, with novices showing the greatest physiological arousal at the time of exit from the aircraft. In one study, experienced sports parachutists showed a moderate increase in arousal before entering the aircraft, putting down to excitement and anticipation of the forthcoming jump. This finding must be tempered by the fact that there is a high drop-out rate from the sport of parachuting after the first jump and it follows that experienced parachutists are those who are not frightened by the experience but enjoy the low levels of apprehension experienced. Experienced parachutists are thus a self-selected group who appear capable of coping with any anxiety experienced. When an element of uncertainty was added into an experienced parachutist's jumps (by telling him that his [main] parachute might fail on a number of occasions due to incorrect packing) his responses regressed towards those of a novice jumper (see Idzikowski and Baddeley, 1983). It was also noticed that those parachutists who adapted well did not deny their fear. A more recent study of military parachutist trainees showed a deterioration in performance of cognitive and psychomotor tests prior to the tower and aircraft jumps, which correlated with the level of anxiety experienced (Sharma et al, 1994). They referred to an "internal fear in paratroopers even when they are fully trained and experienced". This was considered to be due to a lack of control over events and the fact that the real threat of military operations remained. This military situation is thus different to the HUET training situation where the real threat of a helicopter accident during the working life of an offshore worker is extremely low.

Studies in divers suggest that the greater the perceived danger of a dive due to increasing depth, the greater the impairment of performance of manual dexterity tests (Idzikowski and Baddeley, 1983; Mears and Cleary, 1980). This decrement in performance correlated with an increase in self-reported anxiety. The effect could not be explained by depth per se as tests in a land-based pressure chamber showed only a small impairment due to depth. It was "concluded that heightened anxiety was the most likely explanation for the marked performance decrement observed in novice divers during an open sea dive" and that this was associated with perceived risk (see Mears and Cleary, 1980). Diving under
excellent, clear and calm water conditions showed the least decrement in performance, considered to be due to a less anxiety-provoking environment (see Idzikowski and Baddeley, 1983). SCUBA diving is considered to be a high-risk sport, with a consensus view that many injuries and fatalities are caused by panic (Morgan, 1995). However, it has been shown that levels of anxiety in this type of environment can be reduced by giving trainees a realistic expectancy of what might be experienced underwater, training them in how to cope with the environment and their own negative thoughts. Training is considered to be paramount in limiting the damage and injuries incurred in many diving accidents.

A study of individuals with a situational phobia about driving showed higher state anxiety and secreted more cortisol, not only during the actual exposure but also in anticipation of the exposure (Alpers et al, 2003). Whereas the anxiety ratings habituated with time over 3 driving sessions, there was little habituation of the cortisol response. These authors suggest that a lack of control over the stressor may have contributed to the physiological activation. This lack of control is similar to the situation found during HUET training. Trainees have a limited level of control over the helicopter simulator exercises, often having to follow set procedures within a group training session.

Driving is a multiple task activity where the driver must be able to operate the vehicle whilst also concentrating on other vehicles, pedestrians, signs etc. With dual/multiple task activities there is evidence that secondary task performance may deteriorate in frightening situations. One of the reasons for this may be a narrowing of attention due to elevated arousal levels. As a result, the individual may show a tendency to miss peripheral stimuli. This also has parallels with HUET training where the individual must concentrate on the operation of equipment (e.g. EBS and harness) whilst also focussing on the escape route.

Phobic anxiety is commonly reported in association with commercial flying, both in passengers but also in some aircrew members (Medialdea & Tejada, 2005). An anticipatory state anxiety and an inability to relax despite adequate explanations of the true situation were described. Those with a fear of flying often recognised that their fears were unreasonable. In aircrew members, flying phobia was associated with a history of prior aircraft accidents, stressful life events, depression and other mental disorders (Medialdea & Tejada, 2005). Treatment techniques included desensitisation, relaxation training, and in some cases, treatment of the psychiatric disorder.

The study of aircrew members (Medialdea & Tejada, 2005) also showed that some individuals will continue in a profession despite experiencing anxiety if the rewards are sufficient to justify this. It might have been predicted that self-selection would have caused pilots suffering from anxiety to leave the profession. Self-selection has been demonstrated in air-traffic controllers (Collins et al, 1991). A group of 1,790 air-traffic controllers reported significantly lower state (current) and trait (proneness) levels of anxiety than did either college students or military recruits. The low anxiety characteristic was also related to job success during field training.

In Idzikowski and Baddeley's (1983) summing up on the fear of dangerous and threatening environments they concluded: "the magnitude of any response will depend on a number of factors:
(a) the individual's predisposition towards feeling anxious (trait anxiety) and being aroused (trait-arousal);
(b) the individual's assessment of the dangerousness of the situation and his [her] ability to cope with it;
(c) previous exposure."
4.5 IMPACT OF STRESS ON HEALTH STATUS

As described earlier, stress generally means the mental and physical response of the body to demands placed upon it. There is an optimal level of arousal that means that a little stress will help the body to react to a challenge or threat, whereas an excessive response to a stressor can have negative effects.

When considering the health impact of stress, the main concern for most people, and the concern with the greatest potential impact is the risk of coronary heart disease. There are now known to be many coronary risk factors. Action can be taken by the individual to reduce some of the major factors that include smoking, high blood pressure, high blood cholesterol and physical inactivity. The main risk factors particularly associated with sudden cardiac death are reported to be an elevated resting heart rate (≥ 90 beats/min), heavy drinking and arrhythmia/irregular heart beat (Shaper et al, 1993; Wannamethee et al, 1995).

Most of the literature considering the effects of stress on coronary health focuses on chronic psychosocial stressors such as work control, personal relationships and life events such as bereavement. Effects of anxiety on the risk of coronary heart disease have concentrated on trait anxiety, referring to how prone an individual may be to anxiety and differences between people in their background tendency to respond to perceived threatening situations. A number of large prospective studies have shown an association between chronic anxiety and fatal coronary heart disease, in particular, sudden cardiac death (Haines et al, 1987; Kawachi et al, 1994; Albert et al, 2005). There are a number of possible causes. It has been suggested that acute stress, such as bereavement, may trigger irregular heart rhythms and myocardial ischaemia (restricted blood flow to the tissues of the heart) (Rozanski et al, 1999). Rozanski et al (1999) recognised that psychosocial stresses tend to cluster together and when they do so, the resultant risk for cardiac events is often substantially elevated. These authors also commented on the impact of 'sudden' stressors (e.g. a high work-load exercise test without warm-up) compared to 'graded stressors (e.g. graded exercise test with increasing work-loads). It is significant that the severity of cardiac events found in the graded stressor was much less than that found with the sudden stressor. It can therefore be supposed that 'graded' training will benefit the health of trainees. It has also been recognised that psychological factors usually have no acute deleterious effects in the normal heart, whereas in the diseased heart, the consequences may be hazardous (Hartel, 1987). In many cases of sudden death, there was a history of previous myocardial infarction or known cardiovascular disease (Greene et al, 1972).

A lower level of risk was proposed by Bunker et al (2003). An Expert Working Group of the National Heart Foundation of Australia undertook a systematic review of the evidence relating to major psychosocial risk factors to determine whether there were any independent associations between any of the risk factors and the development or progression of coronary heart disease or the occurrence of acute cardiac events. The group found "no strong or consistent evidence for a causal association between chronic life events, work-related stressors (job control, demands and strain), Type A behaviour patterns, hostility, anxiety disorders or panic disorders and coronary heart disease". They compared the increased risk contributed by these factors as being of similar order to factors such as smoking and hypertension.

Whatever the true level of risk, it should be recognised that psychosocial support, regular exercise, stress reduction training, a sense of humour and optimism have all been cited as means of reducing the risks of stress on cardiovascular health (Das & O'Keefe, 2006).
When considering the potential for sudden cardiac deaths during training, anecdotal evidence suggests that risks are very low. Fifteen years ago Doig and Horsley (1991) reported 3 deaths over a 5-year period that led to the introduction of medical screening for course delegates. Since 1991, medical screening has become the norm. OPITO guidance relating to BOSIET and FOET training recognises that the training contains "physically demanding and stressful elements". It is therefore now an OPITO requirement that trainees either possess a valid, current UKOOA medical certificate or undergo an appropriate medical screening prior to commencing training (OPITO, 2003). Employment offshore is dependent upon a medical examination conducted on a 3-yearly basis for personnel aged up to 39 years, every 2 years for those aged to 40-50 years and annually for those over 51 years (this is due to change in January 2007 to a 2-yearly UKOOA medical for all, irrespective of age). The UKOOA medical guidelines state that the cardiovascular system should be free from acute or chronic disease and that hypertension is acceptable provided it is uncomplicated and well controlled by treatment. This should screen out some individuals with known cardiovascular disease who may be at higher risk. The author is only aware of two fatalities (including one in the UK) since 1991 where offshore emergency response training may have contributed to the cause. This is despite training numbers of tens of thousands per year in the UK alone. It is also interesting to note that heart rate responses measured during HUET training have been shown to be lower than those measured during other events during emergency response training, some of which are more physically demanding (Harris, Coleshaw & MacKenzie, 1996).

Consultation with a number of UKOOA registered occupational physicians identified a number of issues. Stressors discussed included both the potential threat experienced by some individuals, but also the fear that job security depended upon successful completion of the course. The personal view of one medical officer was that emergency response training is much less stressful now than it had been 10 to 15 years ago, related to continuous changes and improvements to the training and the way it was delivered (e.g. less machismo attitudes). A strategy of minimising stress where possible was supported.

Whilst previous research has demonstrated that individuals exposed to a stressful event can have an increased risk of illness due to a suppression of immune function, Robinson (2005, p228) found no evidence that exposure to the threat of survival training could result in immuno-suppression.

4.6 EFFECTS OF AGE

The increasing average age of the offshore workforce has been a concern for a number of years. A recent survey conducted by RGU in association with the OCA and COGENT showed a small number of people aged over 65 years still working offshore, and a significant number aged 55 to 64 years old (1,000 people in this survey) (see Energy International, Jan 2006). It is generally considered that the older members of the offshore workforce are a self-selected group of experienced personnel. Such individuals are likely to have completed emergency response training on a repeated basis. It can be supposed that most of this group will have developed coping skills with regard to any anxieties they may have regarding the training. Some concern remains regarding any new recruits to the industry in the older age groups who may not have developed coping skills.

An inverse relationship between age of the individual and levels of anxiety in refresher (further) course delegates was found in the 1994 study of stress in survival course trainees (Harris, Coleshaw & MacKenzie, 1996), i.e. younger individuals were more anxious than their older peers. No effect of age was found for combined (basic) course delegates. This suggested that the refresher course delegates had gained benefit from
repeated training and the experience of undergoing repeated HUET training. Self-selection was also thought to play a part, with the more anxious individuals leaving the industry over time.

The physical demands of HUET training are unlikely to increase significantly as a result of the use of removable emergency exits. Whilst a little force is needed to remove exit windows in some of the current helicopter simulators, it is not considered that this would bar older members of the workforce (it could be more of a problem for smaller female members of the workforce with low upper body strength). A limited survey of delegates who have undertaken HUET training using exits (see Section 5 of this report) demonstrated that only light or moderate amounts of pressure had to be applied to the windows to push them out.

4.7 COPING TECHNIQUES FOR THE REDUCTION OF FEAR AND ANXIETY

As previously discussed, anxiety in the HUET training situation is primarily caused by apprehension and fear of the perceived threat posed by the underwater escape exercises. In those suffering from anxiety, the perceived threat is likely to be out of proportion to the actual low levels of risk associated with the training procedures.

Most people are able to cope with mild levels of anxiety and phobias relating to a specific event by reasoning with themselves that the event will only last for a few hours and that once the event has been completed, the feelings will disappear. Others are known to experience much higher levels of anxiety and need help to cope with their psychological and physiological responses to the stressor situation.

Social factors are an important factor when groups of people are exposed to a potentially threatening situation. Peer pressure can have a very negative effect on individuals suffering from anxiety, inhibiting these individuals from admitting to their fears and possibly stopping them from asking for more help or time (e.g. when others are wanting to speed up the process, finish the task and get home). Conversely, positive support from other group members could be of great help to the more anxious members of the group and should be encouraged at all times.

A number of early behavioural signs of discomfort and anxiety have been identified by Bachrach and Egstrom (1987):

- **Stalling and organising behaviour** - actions and tasks undertaken to delay the actual start of the action.
- **Forgetfulness** - a means of avoiding doing something, linked to stalling. This may include forgetting to bring essential items of equipment required for a practical session, used as a delaying tactic.
- **Errors** - a high incidence of errors may be indicative of tension and discomfort. Initial errors should disappear if training is effective and the trainee is relaxed. It should be a cause for concern if errors persist.
- **Perceptual narrowing** - the individual may show signs of tunnel vision, with apprehension associated with focussing on just one issue.
- **Humour** - may elicit a release of tension.
- **Irritability** - this can be a way of expressing and thus reducing tension.
- **Bravado** - machismo attitudes may be a sign of tension.

All of these behaviours are normal but when frequency and/or intensity appear to be in excess, they may indicate a level of anxiety that requires attention.
A number of techniques are generally recommended for helping people with anxiety and phobias:

- Talking about the problem - it is generally considered helpful to voice fears to someone who is trusted by the sufferer.
- Self-help groups - people with similar experiences communicate with each other. By understanding the specific problems they are able to empathise, and may suggest helpful ways of coping with the situation.
- Relaxation techniques - may help the person cope and control their anxiety.
- Breathing techniques - learning how to breathe efficiently and slowly can be used to overcome anxiety and panic attacks and aid relaxation.
- Distraction - may involve refocusing the mind by concentrating hard on one thing to absorb attention.
- Psychotherapy - intensive treatment that helps the person to understand and come to terms with the phobia or anxiety.
- Medication - drugs such as tranquillisers can relieve severe anxiety in the short term.

It is obvious from the above list that some coping techniques are more appropriate than others to the training environment. Emphasis should be given to talking about the problems that may be experienced by some delegates, acknowledging that anxiety is a normal reaction to an unknown or feared situation, and providing reassurances about the safety measures taken during the practical training. Simple breathing/relaxation techniques could be carried out in class as a fun component of training, or, used individually, providing a distracting activity to those experiencing anxiety.
5.0 HUET TRAINING SURVEYS

5.1 COURSE DELEGATES

Questionnaires were completed by 42 course delegates at four training establishments attending a 'European' add-on course (generally 2 days training following an OPITO BOSIET course to cover other European requirements). A further 4 delegates were questioned following an OLF 'Further' course.

Of those on the European course, 45% had undertaken HUET training before, and this group had attended from 1 up to 7 courses previously (mean 2.5). Eleven of the 19 delegates in this group had previous experience of removing exits on at least one previous occasion.

When asked about how anxious they were feeling just prior to the HUET exercises in water, 48% (20/42) felt 'no anxiety', 43% (18/42) felt 'a little anxious' and 10% (4/42) felt 'very anxious'. Reasons for feeling 'very anxious' were all associated with the ability to breath underwater and inverted or to use of the newly introduced EBS equipment:

- "Holding my breath when being turned over and not being able to see not knowing what to expect having never done this before";
- "Don't like having rebreather in mouth. Phobia I've had for a long time – not improving";
- "Will I be able to breath properly? Don't like being turned around and upside down".
- "Had problems using the rebreather pressing button at wrong time – not getting air".

The delegate who made the last of these comments stated that the instruction he had received had been much more reassuring than on previous courses. He later stated that he had been given sufficient time to become confident in the use of the EBS but considered that EBS had made the HUET exercises much more difficult. This information is conflicting. Whilst the individual agreed that he had been given enough time, he was obviously still worried about carrying out the correct procedure and would have benefited from longer initial training with repeated operation of the equipment.

Other causes of anxiety included being a non-swimmer, fear of drowning, not getting out and disorientation. Whilst one individual was a little concerned about windows not opening, another commented that exits were the least of his worries, he was much more concerned about being turned upside down in water.

When rating the most difficult components of HUET training, 36% of the group cited 'disorientation' 29% cited 'use of EBS' and 12% cited 'remembering instructions' as the most difficult factor. No one cited removing the exit/window as being the most difficult factor. This may be due to the fact that 52% found it 'very easy' and 40% found it 'easy' to operate the exit/window.

Forty of the 42 delegates, when asked "Do you think that everyone should get the opportunity to remove exits during HUET training", answered in the affirmative. The question did not specifically refer to operation under water but in those directly interviewed where this was added, the answer was still positive. Most acknowledged that exit operation would be required in the real situation whilst one commented that it was better to cope with controlled stress than have non-realistic training. Of the two who did not
agree that everyone should get the opportunity to remove exits during HUET training, one considered that the exits were not realistic exits and that if there were realistic seals, then it would be a good thing. The other delegate to disagree gave the reason that "it was pretty easy".

A number of questions were focussed on the EBS training that has been undertaken over the last three years. The implementation of EBS use can be considered to be comparable to the proposed implementation of exits in HUET training. Courses were extended to allow time for training in the use of a new and unfamiliar piece of equipment. Experience with EBS training was therefore considered to be useful to the debate about introducing exits into training.

When asked about EBS training, 88% considered that they had been given sufficient time to become confident in its use whilst 12% (5/42) did not feel they had sufficient time. The opportunity to spend more time practicing was reported by 83% of the group. Of these 35 individuals, 13 accepted more practice whilst 20 did not (no response from two). One commented that she just "wanted it over". Of the seven who reported not being given the opportunity to spend more time practicing use of the EBS, five stated that they would have accepted more practice if it had been offered (one individual felt that he was rushed through the EBS training); one would not have accepted more practice if it had been offered (no response from one).

A number of delegates commented that whilst undertaking the HUET exercises, they were having to concentrate on thinking about how to use the EBS, taking their attention away from other components of the escape process. This again suggests that more initial in-water training would be beneficial to ensure good levels of learning. The ideal would be a situation where trainees are able to use EBS without having to think too much about what actions to take (more like driving a car). In a real threatening situation they would then be able to concentrate on the particular situation to which they were exposed and concentrate on locating the best escape route.

All individuals were either 'satisfied' (55%) or 'very satisfied' (45%) with the way they had coped with HUET training whilst all but one were either neutral or more confident about their ability to cope in a real helicopter accident.

Finally, the delegates were asked if there were any changes they would like to see made to the HUET course. Responses included the following:

- "More time to practice, lot of new information to take in, difficult to remember".
- "Some way for individuals to experience being turned upside down in some smaller equipment to get over apprehension without having to try and get out of the HUET simulator. Have smaller groups i.e. 8 at a time not 16, split to give more time to get to know equipment".
- "Water section needs to be longer. Less people i.e. <16 in pool".
- "More time on rebreather would be helpful. Too many in water session (16). Longer time would be helpful to raise confidence".
- "Halve no. of delegates. More time with apparatus. More ‘dunks’".
- "Would benefit from smaller class size".
- "Maybe lights out, wave machine, sea conditions".
- "Needs to be more realistic. Window seals. Door to operate."
- Little difference from Basic course last year. "Didn't learn much more this year than last".
- "Like to see [course] being shorter. Not a lot of difference from UK basic – would have preferred a single course".
Would like to see an outline sequence of the HUET exercises in the joining instructions – "to overcome fears of the unknown".

Too much time waiting at poolside. (N.B. Groups of 4 taken through all HUET exercises before next group started, thus, long wait for last group after initial in-water training).

"Bit colder water, more realistic window design".

"HUET in colder water, darkness or spray, waves".

"Use cylinders with EBS".

"More military type training – it's been diffused to fit recruitment in current industry". (N.B. Delegate had previous experience of real threatening situations in Chieftain tanks).

"More exercises in the HUET. Should come second nature".

"If anything, more realistic".

"Would have liked briefing at start of course about what each component would entail".

"Window seats should only be manned by people who have done HUET with door removal".

Suggestion to block an exit so that delegate must escape through a different exit.

The most common suggestion was found to be a desire for more time in the water and smaller groups. Only one individual was looking for a shorter course and that related to the current requirement for a 2-day add-on to the BOSIET course for those working in the rest of Europe. Several called for training to be more realistic.

Very similar responses were gained from the small group who undertook the OLF Further training course, including 7 HUET exercises and the removal of windows. One individual commented that windows had been added to the course since his last training and that it was "good to get confidence in a controlled environment". One of the four delegates considered that the number of exercises should be reduced.

5.2 TRAINING STAFF

Seven members of training staff at three training organisations completed the questionnaire (Appendix 1).

When asked whether they considered that HUET training in the BOSIET and FOET courses should be made more realistic by requiring the operation and removal of emergency exits, 100% answered in the affirmative.

When asked how often delegates failed to complete underwater escape due to difficulties operating an exit, 29% considered that failures were 'never observed', 57% that failures were 'very infrequent' and 14% that failures were 'infrequent'. Where problems were occasionally experienced, delegates were given additional opportunities to complete the exercise.

Training staff were asked to list factors that they considered most likely to cause stress in some delegates. A range of factors were offered:

- Rumours and hearsay;
- Problems with EBS training;
- Operation/removal of windows;
- Fear of water;
- Inability to swim;
• Fear of the unknown;
• Peer pressure;
• Equipment failure;
• Previous unpleasant experience;
• Getting trapped in the HUET;
• Inability to hold breath.

Responses were mixed when asked if they thought that the removal of exits increased the stress experienced by delegates. Of those who said yes, one emphasised the desire to make training realistic but in a controlled environment. There was also a comment that non-swimmers were especially prone to stress. Of the respondents who considered no further stress was experienced, one considered that the previous exercises gave delegates sufficient confidence to remove any anxiety.

Most of those interviewed stated that they had gained experience of recognising the symptoms of stress whilst on the job. Three of the seven said that they had received training in how to identify and help anxious/stressed course delegates whilst only one of the seven stated that he had received training in understanding the physiological aspects of stress alongside student-centred learning.

When questioned regarding what actions they would take to help a very anxious individual cope with helicopter underwater escape, three (43%) suggested that they would provide reassurance and try to instil confidence in the delegate. All six suggested that they would want to spend more time with the delegate, whilst 4 (57%) cited the benefits of one-to-one training. One stated the need to be positive and not patronise the individual.

All staff interviewed considered that they had sufficient time to spend on one-to-one tuition with delegates experiencing problems, although they weren’t sure that such offers would necessarily be taken up.

The majority of the training staff questioned considered that the introduction of EBS had made HUET training either ‘much easier’ (4/7) or ‘a little easier’ (2/7) for the majority of delegates. One considered that "some find it easier, some more difficult". They considered that EBS gave delegates more confidence, especially in the capsize exercises and that EBS reduced panic and the fear of being trapped, in the knowledge that they had air to breathe. One commented that nose clips were an added benefit, preventing water going up the nose (a real problem for some in the past), although one thought that the nose clip design was poor.

It was recognised that some delegates do have problems with the EBS training, gagging on the mouthpiece and the issue of false teeth being cited. There was a general consensus that most of the initial problems experienced when learning to use EBS correctly were overcome and that generally, delegates were then able to experience the benefits of the equipment. They felt that once delegates had become used to the EBS they then considered it was better than they had previously thought.

One member of staff considered that delegates could do with more time in the water during initial wet training to provide further practice in the use of EBS and gain additional confidence. He favoured one-to-one training and was concerned that group training with up to 8 delegates in the water presented a problem when one delegate was observed to be experiencing problems. This raises the issue of peer pressure and the question about whether one individual will admit to problems and request more time when the other members of the group say that they are happy to proceed. All trainers said that they were
able to spend one-to-one time with delegates if requested, but it was uncertain whether delegates would always request more time.

When questioned about the impact of EBS on training one member of staff stated, "some of the old and bold doggedly state that they would rather hold their breath, not understanding that in North Sea temperature it would be almost impossible". This raises a question about whether members of the offshore industry receive enough information about why new equipment such as EBS is implemented. Do the North Sea workforce have sufficient understanding of cold shock to appreciate that escape times may be longer than breath-hold time in water temperatures of 10°C or less? Care must therefore be taken when implementing any changes in training to ensure that all sectors understand why the change is being made and, that the benefits are emphasised.
6.0 DISCUSSION

6.1 ROLE OF HUET TRAINING

HUET training has been developed over many years with the aim of improving the survival chances of crew and passengers in the event of a helicopter water impact.

Practical training involving the simulation of the real emergency situation allows individuals to become aware of and gain some familiarity with the conditions within a flooded helicopter cabin. Training should provide delegates with knowledge of the escape process and allow them time to learn the complex tasks and physical actions required to make a successful escape. There is evidence to show that practical training with a high degree of fidelity with the real environment will increase the prospect of survival in a real helicopter incident. Disorientation is known to be one of the most difficult factors that individuals must learn to cope with. By experiencing disorientation in a controlled environment its impact in a real event will be diminished. Likewise, prior knowledge of what might be experienced during HUET training should decrease the impact of that training. Exercises are planned to allow trainees to build up confidence, whilst maintaining a certain level of personal control over the process. By undertaking training in a controlled environment, delegates are able to gradually build up coping skills that will allow them to deal with the demands of the situation.

The current practice of graded training, gradually increasing the complexity of the task with progressive exercises is very beneficial when considering the potential anxiety and stress experienced by some delegates. This allows individuals suffering from anxiety to gradually develop coping skills and gain confidence, with a minimum negative impact on their health.

6.2 THE CASE FOR INCLUDING THE OPERATION OF EXITS

As stated previously (Section 1.1) the rationale for the proposal to include operation of exits into the BOSIET and FOET courses was that "the operation of the emergency exit is seen as the last link in the survival chain during underwater escape. At present the training misses out this link and trainees never practice the skills or techniques involved despite practicing all other aspects of escape" (OPITO, 2006b). Given the differences in the methods of operation of different helicopter doors and windows (Brooks and Bohemier, 1997) it is essential that offshore personnel gain practice operating a range of exits, and have some experience of removing at least a representative example in the underwater environment. Those who have operated an exit successfully in training will have confidence that this can be achieved in a real event and should have a better chance of survival.

HUET training standards in countries such as Norway and the Netherlands already include the use of exits within their training requirements. This difference in jurisdiction is important for two reasons. The first relates to different levels of training amongst offshore personnel and potentially different prospects of survival as a consequence. One potential worst-case scenario is a helicopter incident where individuals who had received exit training made a successful escape whilst those without exit training did not. It can be envisaged that the perception would then be that those without exit training had received a lower standard of training. Whilst there is a desire to reduce the risks of training to as low a level as possible, there is also a similar responsibility to reduce risk in the event of a real helicopter incident.
The second consequence of the current difference in training standards is that many OPITO-approved training organisations are already providing HUET training courses where exits are removed as a part of the training exercises. These establishments have thus developed equipment and procedures relating to the operation of exits and have experience of putting delegates through such a course. The current limited survey of delegates who had just completed such a course showed that the operation of exits was not a major concern and that all those questioned considered that this should be a component of OPITO emergency response training courses.

### 6.3 STRESS AND THE IMPLICATIONS OF INCLUDING OPERATION OF EXITS

It is known that a proportion of the offshore workforce experience stress and anxiety during HUET training. While the majority experience no stress or only mild levels of stress, some have more severe problems that could be debilitating, at least in the short-term. Highest levels of stress are experienced: (1) just prior to the course, in anticipation of the events included in emergency response training; (2) during the pre-impact period immediately before HUET training. The anticipatory responses are most common in trainees attending a course for the first time, there being evidence that those with previous experience of emergency response training show lower levels of stress and anxiety. This suggests that a significant component of the stress experienced is caused by fear of the unknown.

When considering whether the operation of exits will increase the level of stress experienced, a controlled trial found that higher fidelity HUET training exercises including the operation of emergency exits caused more measurable stress than exercises without exits (Mills and Muir, 1999). However, those who undertook the higher fidelity training were reported to have been "more confident as a result of their training and their stress levels during a simulated emergency were lower than those participants who had not experienced an inversion". This may explain the result of the brief survey undertaken in the present study where delegates who had just completed a higher fidelity course including the operation of exits did not include operation and removal of exits in the factors that were causing them anxiety prior to the course and did not report removal of the exits as being a major difficulty factor during the escape exercises. This reflects the feedback gained from the study relating to the use of EBS. A number of the participants were anxious about using the EBS before training, but most of this group recognised the benefits. To some extent, the additional training provided to give delegates confidence and assess competence in the use of EBS was taking the focus away from the operation of exits. This may reflect the ease with which the exits were removed in the helicopter simulators observed. Consideration must be given to how representative are the forces required to remove these exits compared to a real exit.

Observation of a number of helicopter simulators has shown that the force of in-rushing water often pushes out the occasional window on one side of the helicopter simulator. This mimics the real situation where survivors have reported exits being pushed out by the forces of the impact. It would therefore be difficult to assess competence in operating and removing an exit during the capsize exercise. In the current training requirements, use of EBS during capsize exercises is not mandatory and not part of the assessment process. Given the concern over the levels of stress that may be experienced by delegates consideration should be given to a similar requirement for the operation and use of exits. In this case, it is suggested that the operation and use of exits underwater be assessed during a partial immersion, but that delegates should also participate in a capsize exercise involving the operation of exits.
The current practice of grading training, gradually increasing the complexity of the task with progressive exercises should be continued. This view is supported by the findings of Mills and Muir (1999) who recommended part-task learning where skills are developed in an incremental manner. This allows individuals suffering from anxiety to develop coping skills step-by-step, gaining confidence at each stage. Graded training should also reduce any negative health impact on individuals suffering from anxiety. Some may consider this 'excessive' but the health and safety of personnel and the effectiveness of training must be given highest priority.

The evidence suggests that stress and arousal have various effects on cognitive performance. There does appear to be some impairment in declarative memory (the memory of facts and experiences) particularly during the pre-threat period of training prior to the HUET exercises, which could result in instructions not being remembered. The affects of stress on procedural memory are less certain. Although some impairment was found by Robinson (2005) the result was not conclusive, as the test used did not involve the memory of physical tasks. Overall the evidence suggests that the period prior to the exercises in the helicopter simulator is the time when any impairment in cognitive performance is most likely to occur. Anything that can be done to reduce anxiety and reduce the perception of threat before and during HUET training should help to improve the memory of instructions, procedural memory and long-term learning.

Without a large prospective study it is difficult to assess the effects of stress during training on long-term health. Despite the lack of available information, the experience over many years, including many thousands of trainees each year, suggests that sudden cardiac events are extremely unlikely. The main problem lies with the small group of individuals who lose sleep before the training and suffer high levels of anxiety particularly before and during training. Measures can be taken to help these individuals, both by providing individual support and by a process of continuous improvement to reduce stressors to as low a level as is reasonable practicable during training.

### 6.4 MEANS OF REDUCING STRESS LEVELS

A more flexible and individualised approach to training would allow delegates who are confident and obviously comfortable with equipment to be fast-tracked whilst those who are anxious or require (rather than necessarily request) more time to overcome problems with equipment and gain confidence are given this extra time before proceeding to exercises in the simulator.

One of the main problems for the training staff when considering anxious delegates is that the latter may not want to admit or talk about their feelings and concerns. Staff therefore need training in how to recognise and help those experiencing anxiety during the training.

Mills and Muir (1999) recommended that training staff should be given training and made aware of how to recognise and manage trainees who are finding the HUET session stressful. They found only one training provider who provided their employees with training in how to deal with and manage stressful trainees. Only one training officer in the current survey had received full training of this type. Whilst most experienced members of staff will generally be able to identify which delegates are feeling anxious (they may look pale or tense, go quiet and stop communicating with their peers, or become irritable) they may not have been trained in how to help anxious delegates. Consultation with the training providers suggests that they give special attention during shallow water training to those identified as experiencing 'difficulties' with the training. This does not necessarily encompass the problems of high anxiety, where an individual may complete a task in the...
correct order, but still be experiencing high levels of stress. It is therefore considered that the recommendation of Mills and Muir be reconsidered and actioned.

During consultation with trainees undergoing HUET training with exits, one delegate talked positively about the reassurance offered by training staff during the helicopter safety briefings. When considering the training situation it appears appropriate to discuss trainees’ possible anxieties at some point during the classroom sessions, and provide the reassurance that anxiety is a normal response to an unknown or feared situation. Clear explanations of each step in the training process will help to reduce fear of the unknown. Reassurance can also be given regarding the fact that individuals will be given the opportunity to build up their confidence in shallow water before entering the helicopter simulator. As most anxiety is due to fear of the unknown or a feeling of lack of control over the situation, training should allow the individual to progress at a pace that allows them to overcome their fears as well as overcoming any problems that they may be experiencing. Non-swimmers are an obvious group who will need extra help.

When considering the possibility that the inclusion of removable exits into training will increase levels of anxiety, then the same principles should be applied. The greatest fear will be the possibility of being trapped underwater, upside-down, inside the HUET and unable to operate the exit and escape. Anxious individuals are likely to worry that they will operate the exit incorrectly or it will take too long to operate and remove the exit. In a situation where greater force was required to remove the exit than was anticipated, panic underwater could well be induced. As the added component here is the operation of the exit, then it is considered imperative that delegates are provided with an opportunity to operate an exit prior to the underwater and capsize exercises in the helicopter simulator. As a minimum this should be carried out in a classroom or at the pool-side using representative exits, but ideally it should be undertaken in shallow water where the pressures and forces required are likely to be similar to those that will be experienced in the HUET. In the HUET exercises, delegates will then be undertaking procedures that have been learnt in a more controlled and less 'stressful' shallow water environment.

Finally, one further measure that should be considered is a campaign to reduce the negative rumours and stories that cause much of the anticipatory anxiety. Many of the stories are years out of date and do not reflect current training procedures. Effort should be taken to present a positive message extolling the benefits of HUET training and the skills that can be gained. Information should also be given explaining the reasons for including the operation and removal of exits and the associated benefits of providing a higher level of fidelity in training.
7.0 RECOMMENDATIONS

7.1 HUET TRAINING

Recommendation 1
A more flexible and individualised approach to training should be considered, allowing competent individuals to be fast-tracked whilst the less confident are given more time to develop competence.

Recommendation 2
The ethos of providing step-by-step part-task learning should be maintained. This allows all delegates to progressively build up skills and allows anxious delegates to develop coping strategies.

Recommendation 3
During BOSIET courses, more time should be provided for initial wet training to increase the level of competence achieved in the use of equipment prior to exercises in the helicopter simulator. This may allow the number of exercises in the helicopter simulator to be limited in both BOSIET and FOET courses.

Recommendation 4
Decisions regarding the optimum number of HUET exercises should be based on maximising training benefits and reducing levels of stress in delegates.

7.2 OPERATION AND REMOVAL OF EXITS

Recommendation 5
OPITO training courses should cover the operation and removal of exits during practical wet exercises.

Recommendation 6
All delegates should be given the opportunity to operate emergency exits before commencing the exercises in the helicopter simulator, either in the classroom, in a dry helicopter simulator, or during the initial wet training in the pool. This initial training would allow a level of competence to be developed i.e. learning where to apply pressure and how much pressure is required; and allow each individual to become confident in their ability to operate and remove a ‘push-out’ window prior to the HUET exercises.

Recommendation 7
It should be a minimum competence requirement to operate and remove a ‘push-out’ window during a partial submersion. Delegates should also participate in a capsize exercise involving the operation of ‘push-out’ windows.

7.3 STRESS/ANXIETY

Recommendation 8
When considering the health and well-being of individuals attending emergency response training, levels of stress and anxiety should be reduced to a level as low as is reasonably practicable, through a process of continuous improvement.
Recommendation 9
Particular measures should be taken to reduce the levels of anticipatory anxiety experienced by some course delegates prior to helicopter underwater escape training. This could include:

a. Information given to delegates before attending a course that explains what to expect and provides reassurance about the safety of the course. (This could take the form of a page on the OPITO web site and include information about the benefits of HUET training).
b. Delegates who have successfully completed HUET training should be encouraged to take a positive message back to the workforce, to change the culture of rumours, horror stories and negative feedback.

Recommendation 10
Consideration should be given to the provision of one-to-one training in the use of the equipment (exits and EBS) during the initial wet training in the pool so that those delegates suffering from anxiety can be given individual attention without feeling pressure from their peers.

Recommendation 11
Delegates should be allowed more time during initial wet training to gain confidence in an environment where they feel they have control over the outcome.

Recommendation 12
Where required, more time should be given to initial training in the use of EBS so that once in the helicopter simulator, delegates are concentrating on the escape procedures, including the operation and removal of exits, and are not still having to think about how to breathe using the EBS.

Recommendation 13
Training staff should be given training in the causes and consequences of stress/anxiety, coping skills and how to help/manage delegates who are suffering from anxiety. Additional reassurance and help could then be given to those experiencing problems.
8.0 REFERENCES


Stress due to exits


OPITO (2006a) Feedback received following consultation on proposed changes to BOSIET/FOET – June 06.

OPITO (2006b) Emergency response standards; Workgroup No 1 Amendment / Rationale. 28-3-2006.


Summers F (1996) Procedural skill decay and optimal retraining periods for helicopter underwater escape training. IFAP; Willetton, Western Australia.


APPENDIX 1

QUESTIONNAIRES
HUET TRAINING OFFICER QUESTIONNAIRE

Date: ..........................
Training Organisation: ..............................

1. In your opinion, has the introduction of the emergency breathing system/rebreather generally made HUET training easier or more difficult for the delegates to complete?

   Majority find it much easier  Majority find it a little easier  Some find it easier, some more difficult  Majority find it little more difficult  Majority find it much more difficult

   [ ]  [ ]  [ ]  [ ]  [ ]

2. What benefits do you think delegates gain from using the emergency breathing system/rebreather during underwater escape?

   ..................................................................................................................................................................
   ..................................................................................................................................................................
   ..................................................................................................................................................................

3. What problems (if any) do delegates experience when using the rebreather?

   ..................................................................................................................................................................
   ..................................................................................................................................................................
   ..................................................................................................................................................................

4. In your opinion, has the introduction of the rebreather reduced or increased the level of anxiety experienced by delegates completing underwater escape? (Tick one or more boxes)

   Majority are less anxious  No difference observed  Some more, some less anxious  Majority are more anxious

   [ ]  [ ]  [ ]  [ ]

Comment: ..............................................................................................................................................
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Majority find it much easier  Majority find it a little easier  Some find it easier, some more difficult  Majority find it little more difficult  Majority find it much more difficult

   [ ]  [ ]  [ ]  [ ]  [ ]
5. Do you consider that trainees receive sufficient practice using the rebreather in shallow water to use it competently in the HUET?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
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</tbody>
</table>

Comment: ..........................................................................................................................

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6. In your experience, how often do delegates fail to complete an underwater escape due to difficulties operating an exit mechanism?

<table>
<thead>
<tr>
<th>Failures never observed</th>
<th>Failures are very infrequent</th>
<th>Failures are infrequent</th>
<th>Failures frequently observed</th>
</tr>
</thead>
<tbody>
<tr>
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Comment: ..........................................................................................................................

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7. Do you consider that HUET training in the BOSIET and FOET courses should be made more realistic by requiring the operation and removal of emergency exits?

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<thead>
<tr>
<th>Yes</th>
<th>No</th>
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<tbody>
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</table>

8. Do you think HUET training could be made less stressful?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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</table>

If yes, how?

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9. Please list the factors that you consider most likely to cause stress in some delegates (most important first):

1) ...........................................................................................................

2) ...........................................................................................................

3) ...........................................................................................................

4) ...........................................................................................................

10. As a trainer, have you received training in how to identify and help an anxious/stressed course delegate?

   Yes ☐      No ☐

If yes, what did this training cover?

................................................................................................................
................................................................................................................

11. If faced with a very anxious course delegate, what actions would you take to help this individual cope with helicopter underwater escape?

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................................................................................................................
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12. Do you feel that you have sufficient time to spend on one-to-one tuition with delegates who are experiencing problems?

   Yes ☐      No ☐

13. Do you consider that the requirement to remove exits increases the stress experienced by course delegates?

   Yes ☐      No ☐
Any other comments?

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Thank you for your help
POST TRAINING QUESTIONNAIRE

BACKGROUND

Date: .....................

Course: ..............................................

Basic / Further   (please circle)

Have you undertaken HUET training on a previous occasion?

Yes / No   (please circle)

If yes, how many previous HUET courses have you attended? ......................

Is this first course you have attended where you have been required to remove exits?

Yes / No   (please circle)

If no, how many courses have you attended where you have been required to remove an exit?

......................

TODAY'S HUET TRAINING

1. Just prior to the HUET exercises in water, how anxious were you feeling?
   
   Very anxious          A little anxious          No anxiety felt
   
   □                      □                        □

2. If anxious, what concerns did you have at this time?

   ......................................................................................................................
   ......................................................................................................................
   ......................................................................................................................
   ......................................................................................................................

Questionnaire for delegates
3. What did you find to be the most difficult part of the HUET training? Please rank the most difficult factor as 1, and the second most difficult as 2 etc.

- Swimming underwater? ☐
- Holding breath? ☐
- Using the emergency breathing device? ☐
- Disorientation? ☐
- Releasing harness? ☐
- Locating exit? ☐
- Removing exit/window? ☐
- Remembering instructions? ☐
- Exiting through exit/window? ☐

4. Were you given the opportunity to operate an exit before completing the escape exercises in the HUET?

Yes / No (please circle)

If yes, when?

………………………………………………………………………………………………………
………………………………………………………………………………………………………

5. How difficult was it to operate the exit?

- Very easy ☐
- Easy ☐
- A little difficult ☐
- Very difficult ☐

6. How much pressure did you need to apply to push out the exit?

- Very little pressure ☐
- A moderate amount of pressure ☐
- A large amount of pressure ☐

7. Do you think that everyone should get the opportunity to remove exits during HUET training?

Yes / No (please circle)

8. Were you using an emergency breathing device in this exercise?

Yes / No (please circle)

Type? ....................................................

Questionnaire for delegates
9. Did you feel that you had sufficient time to become confident in the use of the emergency breathing device?
   Yes / No  (please circle)

10. Were you given the opportunity to spend more time practicing use of the emergency breathing device?
    Yes / No  (please circle)

    If yes, did you accept more practice?
    Yes / No  (please circle)

    If no, would you have accepted more practice if offered?
    Yes / No  (please circle)

11. Did the emergency breathing device make the HUET exercises easier or more difficult to complete?

    Much easier  A little easier  About the same  A little more difficult  Much more difficult
    ☐  ☐  ☐  ☐  ☐  ☐

12. How satisfied are you with the way you coped with the underwater escape training?

    Very satisfied  Satisfied  Undecided  Dissatisfied
    ☐  ☐  ☐  ☐

13. How much more confident do you now feel of coping with a real helicopter ditching than you did prior to this session?

    Much more  More  About the same  Less  Much less
    ☐  ☐  ☐  ☐  ☐

14. What changes, if any, would you like to see made to this training?

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Thank you for your help

Questionnaire for delegates