July 30, 2010

Offshore Helicopter Safety Inquiry

Marine Institute – Offshore Safety and Survival Centre

The Marine Institute through its Offshore Safety and Survival Centre (MI-OSSC) appreciates the opportunity to present this written submission to the Offshore Helicopter Safety inquiry

It is noted that the specific mandate of the inquiry is to inquire into, report on, and make recommendations in respect of:
(a) safety plan requirements,
(b) search and rescue obligations of helicopter operators,
(c) the role of the C-NLOPB and other regulators.

Within the scope of this mandate, Inquiry Counsel, in consultation with parties with standing and other stakeholders, have identified a number of issues for consideration. This submission responds in detail to issue for consideration number 12 (offshore helicopter safety training) and also offer some suggestions for consideration with respect to issue for consideration number 21 (safety conferences).

With respect to our detailed response to issue 12, this will be addressed in the following format:

- Current Practice at the Marine Institute
- Response to Consultants' Reports
- Opportunities for Improvement (short term)
- Knowledge gaps /Opportunities for Research (medium/longer term)

Issue 12- What are the appropriate standards of offshore helicopter safety training to ensure that the risk to passengers is as low as is reasonably practicable, both during training and helicopter transport?

Marine Institute Current Practice

The training requirements for offshore petroleum related helicopter travel in Eastern Canada are to successfully complete a Basic Safety Training (BST) , Basic Safety Recurrent (BST-R) or Offshore Safety Introduction (OSI) course. With this training completed travel is permitted within the certificate validity period.

Each of these courses is designed to provide personnel with a basic understanding of the hazards associated with working in an offshore environment, the knowledge and skills necessary to react effectively to offshore emergencies and the ability to care for themselves and others in a survival situation. The difference between them is that the BST is the preparatory course for new entrants to the industry, the BST-R is aimed at refreshing the skills and knowledge of those already in the industry and the OSI is aimed at short term visitors to offshore installations. Whilst these courses have differing content and duration, they all contain essentially the same module with respect to the training for Helicopter Safety and Emergency Procedures and Helicopter Underwater Escape Trainer (HUET) exercises.

The purpose of the helicopter escape training is to provide trainees with knowledge regarding the appropriate response to an emergency situation, an appreciation of the disorientation that can result from a sinking and/or inversion in the water as well as to provide skills and knowledge that will assist them in responding to such a situation. In a ditching scenario in which the helicopter lands on the water and remains upright it is very important that persons in the helicopter work as a team to avoid destabilizing the helicopter. Team training is included as part of the training course for response to this situation.

Helicopter Underwater Escape Training involves placing individuals in a situation over which they have limited or no control, in an environment in which they are unable to breathe and can easily become disorientated. The

training is highly stressful to a significant number of individuals and also must be carefully controlled to ensure that individuals do not suffer harm during the exercise.

For this reason, the approach taken by the MI-OSSC to this training is:

1. To ensure that training is conducted in a progressive manner i.e. the degree of difficulty of the exercises is incrementally increased and students do not move on to a more difficult evolution until they are comfortable with the preceding evolution;
2. To limit both class sizes and instructor student ratios during the practical exercises, class size is capped at twelve. The maximum class size of twelve plus the one/one ratio of instructor to student, allows time and attention to be given to weaker or more highly stressed students;
3. To ensure that the training is carried out in a reasonably representative environment, details of the ditching and egress process are replicated e.g. helicopter body rotates at representative rate, seat belts must be manually released, windows representative of the size of typical offshore helicopters require to be removed, helicopter passenger transportation suits are worn and pool temperature is kept low. Notwithstanding, the prime focus of the training is to ensure that the student is comfortable in responding to a situation of disorientation and to understand and practice the individual tasks required to successfully manage an escape;
4. To ensure that students are aware of the various situations that could confront them in a helicopter emergency, the following are discussed and reviewed in the classroom: exiting from an aisle seat while inverted; dealing with an auxiliary fuel tank; clearing an exit while inverted; dealing with stroking seats; identification of the major differences between the MI-OSSC HUET and helicopters flying offshore Canada;
5. To ensure that the student is protected against harm, selected risk management procedures include: maintaining an air gap when HUET is underwater, emergency release devices fitted on seat belts which can be released by safety divers, low instructor-student ratio, safety divers in the water, emergency responders on deck, ensuring that exercises undertaken can be accomplished within breath hold times

and limiting the potential of injury which might arise from interactions between students;

6. To keep up to date with international standards of training through regular interactions and communications with other training providers. The Marine Institute was a founder member of the International Association for Safety and Survival Training (IASST). The IASST mission is: *To facilitate the exchange of information on matters relating to safety in the maritime environment and to promote continuous improvement in safety and survival training internationally*. The association has a membership of over one hundred training providers worldwide. Members meet and communicate regularly and as well engage in the mutual exchange of instructors with the objective of sharing experience and best practices with respect to safety, survival and emergency response training. Approximately 60% of the membership is engaged in the delivery of helicopter underwater escape training;
7. To deliver all training within an ISO 9001 quality environment, regular internal and external audits confirm that training is delivered consistently to the required standard.

Response to Consultants' Reports

Two of the consultants engaged by the inquiry commissioner provided opinions on helicopter underwater escape training, Dr. Susan Coleshaw and Mr. Michael Taber.

Based in the United Kingdom, Dr. Coleshaw has undertaken an extensive amount of research related to helicopter underwater escape training on behalf of the Offshore Petroleum Industry Training Organization (OPITO), the Civil Aviation authority (CAA) and the Health and Safety Executive (HSE).

It is MI-OSSC's opinion that her report accurately represents the current state of knowledge and best practice with respect to training for civilian populations and presents in our view a very balanced assessment of the current state of the art of helicopter underwater escape training as well as what is reasonably practicable for a civilian population. She provides arguments for and against higher fidelity training and identifies the need to cover all essential procedures in training.

Key comments she makes in her report which MI-OSSC has strived to incorporate into our current training delivery model are:

- Disorientation is known to be one of the most difficult factors that individuals must learn to cope with in an inverted helicopter
- Coping with a training situation allows the individual to develop coping mechanisms and thus manage a real life-threatening event more effectively.
- When considering the fidelity of escape procedures, it is important that each step in the escape process is covered by the practical training
- Trainees need to be familiar with their personal protective equipment (PPE) and know what if any actions have to be taken to make their PPE ready for use in the event of an emergency
- When considering changes to HUET training, it is necessary to balance the need for training fidelity against the stress that may be induced in individuals as well as other safety issues when making training more and more realistic
- To cover the different scenarios that could be experienced, a number of different training scenarios are needed: evacuation from floating helicopter leaving the cabin in a controlled manner, underwater escape from a submerged helicopter and underwater escape from a capsized/inverted helicopter
- Part task learning whereby trainee's skills are built up in an incremental fashion (reference to report by Mills and Muir 1999.)

Dr. Coleshaw notes the fact that removal of windows has only recently been introduced as a competency requirement in the UK sector referencing recent work undertaken by Kozey et al 2006 which indicates the benefit of this training despite higher stress levels. It should be noted that when removing windows underwater, trainees in that sector have the opportunity to use emergency escape breathing devices. Because of the different system selected for Canada, the emergency breathing device cannot be deployed safely during the helicopter escape exercises so trainees here do not have access to supplementary air.

Dr. Coleshaw also notes that UK training procedures now stipulate a maximum of four delegates in the HUET to reduce the risk of injuries (and to allow competence to be assessed). This means that no 'cross-cabin' escape is undertaken. These two issues are discussed further under "recommendations for way ahead".

Currently based in Ontario, Mr. Taber is a research scientist with offshore safety training experience through employment at Survival Systems Training Ltd (SSTL) in Dartmouth Nova Scotia. Mr. Taber references many of the same research and studies in his report as those referenced by Dr. Coleshaw, but comes to different conclusions with respect to appropriate standards which in our opinion are less balanced with respect to risk/benefit for HUET training for civilian populations. In other respects, Mr. Taber's report offers very useful information.

The reason behind the difference in perspective may well arise from the fact that Mr. Taber, according to his resume, spent eight years in the military and a further nine years working as an instructor and research coordinator for Survival Systems Training Ltd. a key training provider to the Canadian military.

While Mr. Taber acknowledges that it may be argued that military personal need to be trained to a higher standard due to the fact they are placed in a more hostile environment on a more regular basis, he is of the opinion that training of basic HUET skill sets should not be reduced merely because the likelihood of using the skills is less. We have no problem with this statement except that it also needs to be considered that there are differences between military and civilian populations and as well, civilian training has to be carried out within a Provincial statutory framework which legislates a requirement to identify and mitigate against risk of injury.

In his comparison (Table 3 page 28) he identifies MI-OSSC HUET skill set requirements as, total exercises 5, total underwater escapes 3 with 2 inversions. Whilst the number of exercises is correct this statement does not, in our opinion, offer a complete picture as the number of exercises represent only training evolutions; it is not representative of the skill sets/confidence which have been built to achieve those evolutions. This analysis does not reflect the fact that MI-OSSC provides step-by-step part-task learning whereby students can progressively build their skills and weak students are able to develop coping strategies. By the time students start their HUET training, they have already completed a pool session thus developing their in-water skills. Our incremental approach to the HUET exercise allows students to build on the skills they have already mastered and develop new skills. Every attempt is made to not unduly task-load students in the HUET.

It appears that no credit is given for the straight down exercise. It is recognized that a straight down sinking is highly unlikely in a real helicopter incident, however, in our opinion (and as noted in Dr. Coleshaw's report) this exercise is an important step in building students confidence and skill level before the inversion. Instructors are able to evaluate and provide feedback to the point the student's face enters the water. Students are able to experience the effect of buoyancy and thus realize the importance of land marking and always having a handhold on something solid as they move to and out the exit. Students have an opportunity to practice; clearing the exit, breath hold, releasing seatbelt, pulling themselves to and out through the window before being expected to do the same while inverted. More importantly, the instructor has an opportunity to provide feedback and, if necessary, have the student repeat the exercise to correct any issue which might complicate the inversion exercise for the student.

Opportunities for Improvement (short term)

Competency Standards

The inclusion of additional detail in the Canadian Association of Petroleum Producers (CAPP) training standards and in particular details which outline what competency standards are expected to be achieved and how they will be measured would greatly assist in ensuring a common approach and standard to helicopter training in the Eastern Canada offshore. It is our understanding that CAPP is at this time in discussion with Det Norske Veritas (DNV) with the objective of engaging this organization to work with the training providers and industry to assist in the development/updating of appropriate competency standards for the BST, BST-R and OSI courses. This organization has significant experience and credibility in this capacity and MI- OSSC looks forward to the opportunity to work with them.

Training Evolutions

The approach MI-OSSC takes to window ejection in training is to instruct that, in the event of a helicopter ditching, the passenger should remove the window as soon as possible after impact while the helicopter is on the surface. The reason

for this approach is that if the window can be ejected above water then there is a much greater chance of success as the ejection of the window is not impeded by external water pressure, the movement of the arm is not impeded by possible rushing water and as well the passenger is less likely to be disorientated. Despite this, it is recognized that a helicopter can overturn quickly and windows on one side of the helicopter could potentially be submerged before the passenger has had opportunity to remove the window. The inclusion, therefore, of an evolution in which the window is jettisoned underwater is desirable. This exercise has not been included at MI-OSSC to date because the configuration of the installed HUET does not allow us to effectively manage the risk of this exercise. Plans are in place to acquire and install a new HUET and as soon as this has been done this exercise evolution will be considered for inclusion. Based on Mr. Michael Taber's 2005 study on this issue, referenced in his report to the inquiry which indicated that 34.7% of recurrent trainees undertaking this exercise required some form of assistance, we would, however, caution, that should this particular exercise be mandatory (i.e. required to be completed without assistance for certification to be issued) this could lead to the possibility that a segment of the offshore workforce would no longer be permitted to fly offshore. More research would be helpful.

Aisle Position Training

MI-OSSC previously required students to complete a training evolution in which they sat in an aisle seat with another student in the window seat. This practice was discontinued for risk management reasons as there were a number of incidents in which students suffered injury as a result of collisions during the egress. The heavy boot which is fitted to the Helly Hansen suit would likely increase the potential of injury. Nevertheless, when a new, larger HUET is in place we will re-examine the potential for aisle position training.

Cross Aisle Training

MI-OSSC previously required students complete a training evolution in which they were required to exit across the aisle. This evolution was again discontinued for risk management reasons. The time to execute the exercise was in excess of the breath hold capacity of a significant number of students. As Dr. Coleshaw indicated in her report, this exercise may be reintroduced in the UK with students using emergency breathing devices. It should be noted that the pressurized air

breathing devices adopted by Canada cannot safely be used in the HUET, therefore, will not be available to support this exercise. Nevertheless, MI-OSSC will explore the possibility of adding the exercise in consultation with clients and regulators.

Physical Fidelity

The Maclean and Gibson HUET, currently installed at the MI–OSSC, provides for excellent representation of the disorientation following a helicopter incident and a reasonable representation of a typical helicopter exit. There is, however, an opportunity to enhance training with a HUET that more closely represents specific features of helicopters operating offshore Newfoundland. Plans are currently in place to acquire such a unit.

Environmental Fidelity

In considering the enhancement of environmental fidelity, it is essential to consider the increased stress on trainees as well as the increased potential for injury. Enhancing environmental fidelity would include, exercises in cold water, darkness, waves and wind. The possibility of such enhancements will be discussed with clients and regulators.

Knowledge gaps /Opportunities for Research (medium/longer term)

Dive Mask

As part of the passenger safety system which includes the Helicopter Passenger Transportation Suit System and the Helicopter Underwater Emergency Breathing Apparatus (HUEBA), the dive mask provides a number of potential benefits in assisting survivors escape from a submerged helicopter. Some of these benefits are: aid in vision; protection from cold shock; protection from aviation fuel ; increased breath hold time; reduced disorientation; providing a means of blocking off nose which is essential during HUEBA use; reduced stress levels, important during training as it allows students to get more out of the practical, rather than “just getting through it.”

While the dive mask has been part of the helicopter passenger safety system for some time, documentation to either support its continued use or to dismiss it is limited (CAA report 2003). For this reason MI-OSSC conducted a pilot study (2007) on the use of masks by students in HUET exercises. MI-OSSC is currently working on development of a full test plan that will include the following:

1. time it takes to correctly don the mask, comparing those with training to those without
2. breath hold time in cold water for students with a mask compared to those without.
3. the impact that having a mask on has on the reduction of cold shock
4. stress levels in HUET students wearing a mask compared to those with no mask
5. the ability of HUET students to successfully escape a submerged helicopter with a mask compared to those without
6. the time it takes for students to escape a submerged HUET with a mask compared to those without
7. the effectiveness of the mask in reducing disorientation
8. the development of a standard or specification for a dive mask to be used with the flight suit
9. identification of the types and styles of mask presently available on the market
10. conduct of in-water trials of available masks to identify most suitable for East Coast Canada
11. in the event that no available suitable mask can be found, design and manufacture a mask

Collection of Performance Data

The quantity of high quality data on individual performance and stress levels during a range of exercise evolutions is quite limited. There is a need for such data to be collected to provide a quantifiable basis which can be used to support decision making processes in particular in relation to feasibility of increasing environmental fidelity.

Given that there are varying approaches to helicopter underwater escape training, it would perhaps be of value to conduct a study which compares learning

retention, stress levels in training and relevant factors associated with these differing approaches.

Simulation

Muscle memory has been identified as a potentially important factor in escape under an emergency situation. Developing muscle memory requires many repetitions of a task over an extended time period. This is not possible to develop in the limited number of training exercises conducted at three yearly intervals during BST training. It may be worth considering whether there would be value in a high fidelity land based simulator which could allow practice of the necessary actions to remove windows or exits in a safe environment.

Cold Water Exposure

The ability to deal with cold shock and disorientation is critical to survival in the event of a helicopter ditching. More work needs to be done in this area to determine if there is a quantifiable benefit that can accrue from risk managed cold water training.

Issue 21. Should there be safety conferences for all parties involved in offshore helicopter transport, and if so, how often should they be held?

Marine Institute Offer of Support

Conferences provide an effective way of sharing best practices and information and an annual or bi-annual conference on aspects of helicopter transport would, in our opinion, offer great value.

As with any conference it is important to open it up to a wide range of experts and stakeholders at the national and/or international level. There may be benefit in aligning with international organizations having a mandate or mission related to a specific aspect of helicopter safety.

Two possible international organizations in this category are the International Association for Safety and Survival Training (IASST) (www.iasst.com)and the

International Maritime Rescue Federation (IMRF). (www.international-maritime-rescue.org)

With respect to the former, a conference, initially conceived in 2008, on the topic of *Extreme Survival – getting home when the odds are stacked against you*, will be hosted by the Marine Institute in St. John's, October 2012. With respect to the latter, the Marine Institute has had preliminary discussions with the organization regarding the possible convening of a conference in St.John's on a topic related to rescue in cold and hostile waters.

The Marine Institute has considerable experience in the organization/facilitation of conferences and would be willing to assist as required.