Annex A

Medical report by RNLI consultant occupational physician

[redacted]

CONSULTANT PHYSICIANS IN OCCUPATIONAL MEDICINE

[redacted]

November 24, 2008

[redacted]
Inspector of Marine Accidents
Marine Accident Investigation Branch
Carlton House, Carlton Place,
Southampton
SO15 2DZ

[redacted]

'Wedge' Compression Fractures

Axial loads (loads applied compressively through the longitudinal axis of the spine) are capable of causing spinal fracture if of sufficient magnitude. Typically such fractures occur in the lumbar spine and the mechanism of action is axial compression with a degree of forward flexion. Such fractures are less commonly seen in the thoracic spine. The forward flexion occurs because the centre of gravity of the trunk in a seated individual is situated in the chest just behind the sternum (breast bone). When the load is applied the lumbar spine flexes bringing the front of the vertebrae into apposition and this results in the forward (anterior) parts of adjacent vertebrae coming together causing a wedge shaped crush.

Experimental studies have shown that a number of factors affect the injury risk. These are:

a) The magnitude of the acceleration and the rate at which the acceleration is applied.

Early work with escape systems in military aircraft showed that spinal fracture occurred almost invariably at accelerations as low as 10G when associated with rates of onset of circa 1000G.sec-1, Subsequent development of escape systems showed that the adult male spine, when well restrained, was capable of withstanding higher peak accelerations when the rate of onset was lower. In essence the quicker the onset the more 'brittle' the spine is in its response.

High peak accelerations with high rates of onset can cause the vertebra to 'burst'; in this case the vertebral body, instead of crushing, splits into fragments. This is sometimes called a high energy fracture. Such a fracture is unstable and compromise the spinal cord or spinal nerves with a risk of paralysis.

b) The effect of posture

Clearly, the better the spinal alignment the more protection is afforded against wedge fracture as the load is distributed more evenly across the vertebra. Loads through the spine are carried predominantly by the vertebral bodies but some load is also carried across facet joints. The load is thus effectively triangulated across these with the load shifting to the vertebral body with forward flexion and towards the facet joints with rearwards bending (extension in orthopaedic speak). Twisting puts a torsional load on the intervertebral disc and differentially loads the facet joints. The literature suggests that the effect of this is to reduce the mechanical strength of the vertebra/intervertebral disc unit by about 1/3rd.

c) Seating

Careful attention needs to be paid to seating to ensure that the individual is 'coupled' to the seat as effectively as possible and that any comfort layer helps to attenuate rather than reinforce the impact. It is important on RIBs not to be seated on the sponson as this invariably results in loss of spinal alignment as well as increasing the chance of 'dynamic overshoot' in the event of an impact.

At risk populations

Much of the biomechanical work on the response of vertebral bodies to impact has been undertaken in relation to young adult males. Other work has looked at the increasing vulnerability of the spine in osteoporosis where there is a loss of mineralization in the spine. This can be of such severity in the elderly that fracture occurs spontaneously. The risk of fracture can be determined by measuring Bone Mineral Density by x-ray absorption techniques. Each standard deviation (SD) below normal represents a doubling of fracture risk with 1SD being referred to as osteopenia (a reduction in BMD) and 2.5SD as osteoporosis. Treatment is reserved for this latter group. Clearly small changes in BMD represent a significant increase in risk in potentially hazardous environments such as high speed marine craft.

The most obvious at risk populations are those of post menopausal women and women with a strong family history of osteoporosis. Other groups include those born with hereditary disorders of bone, those who have had prolonged steroid therapy for certain types of disease, those who have a body mass index below 19kg/m2 and those who are on certain types of cancer or immunosuppressant treatment. It should be noted that lighter weight individuals may be at greater risk anyway, irrespective of BMD, as for a given input Force they will experience a higher acceleration than an a heavier individual.

[redacted]

With kind regards

Yours sincerely

[redacted]

Consultant Physician in Occupational Medicine

[redacted]

High-speed craft, motion, ergonomics and injury:
A summary report for the MAIB

HIGH SPEED CRAFT;
MOTION, ERGONOMICS & INJURY:
A summary report for the MAIB.

[redacted]

STR/MAIB//1.0/2008

December 2008

STResearch Ltd
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Mill Lane
Sidlesham
West Sussex
PO20 7NA
UK

CONTENTS

1. Introduction

i) The following background information is provided to the MAIB for their investigation into an injury sustained on a Rigid Inflatable Boat (RIB).

ii) The information provided within this document is a very brief synopsis of the area. It is advised that interested parties obtain more detailed information before any significant decisions are considered.

2. High-speed craft shock and vibration

i) High Speed Craft (HSC) have been shown to experience impacts in excess of 20g perpendicular to the deck, and in excess of 10g parallel to the deck. An example of typical motion experience in a HSC is shown in Figure 1. This illustrates a section of a three hour transit in a 28’ RIB, travelling at ~40 knots, in a sea state 1-2. Note the predominance of impacts of around two to three g, a number of impacts around seven g, and a twenty g impact.

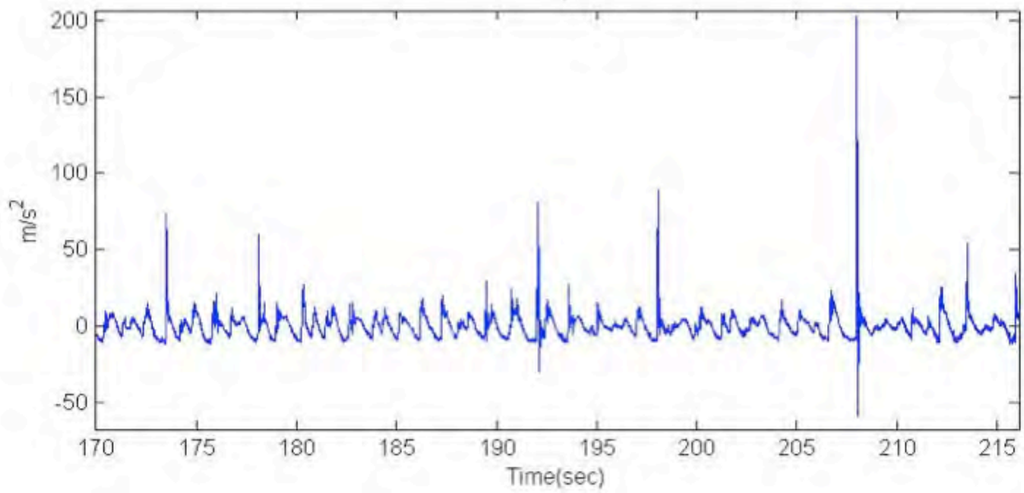

Figure 1. An example of the deck motion (gZ) of a 28’ RIB travelling at ~40 knots in a sea-state 1-2.

ii) Previous research utilised traditional naval architecture methodologies for analysing the motion of HSC such as RIBs. This principally focused on the average vibration (rms), and the Vibration Dose Value (VDV) method that provides an additional emphasis on the shocks encountered. These methods have been found to be ineffective or relatively poor for the analysis of HSC motion.

iii) The motion of HSC can be defined as a series of discreet impacts/shocks. This concept was used by the US Army to develop an analysis methodology (ISO 2631 Pt5) for exposure to repeat shocks of up to 4g in land vehicles.

iv) Recent research by the USN, specifically targeted at HSC motion analysis, has further developed the ISO 2631 Pt5 to increase it’s validity to >14g. UK researchers have developed an analysis methodology for examining the magnitudes and distribution of the impacts, this is known as the Impact Count Index (ICI).

v) The impacts experienced by a HSC are generally greater at the front of the boat and reduce towards of the rear of the craft. Therefore those sitting at the front of the HSC are likely to be exposed to greater impacts than those at the rear.

3. Lower back injuries sustained on HSC.

i) The magnitude of the forces experienced by HSC occupants (re: Section 2.i) put an excessive load on the skeletal system and particularly the lower back. Although the spinal column can tolerate large loads when applied axially, the risk of injury is exacerbated with the application of transverse loads, for which the spine is not designed, and if the spine is misaligned/bent during the application of the force.

ii) Poor spinal postural alignment is common on HSC where seats with poor ergonomics are used and/or the occupants are undertaking activities that result in misalignment.

iii) Examples of seat design features that can lead to increased risk of injury include seat cushions that can result in an increase in the impact magnitude. This is because the individual will still be moving downwards, compressing the cushion, while the boat has landed and is travelling upwards. This results in an increased impact magnitude as the boat seat and occupant are travelling in opposite directions at the point of impact.

iv) Fast jet pilot ejection's and helicopter crash landing have the same issue with seat cushions, and great efforts are made to optimise the cushioning material to reduce the impact magnitude along with using seat-belts to maintain contact between the individual and the seat.

v) Increasing foam thickness may enhance comfort by reducing vibration in relatively benign conditions, but it will lead to an increase in impact magnitude (re: 3.iii). Therefore thinner, firmer cushioning material should be considered along with optimising the shape to distribute the contact pressure.

vi) Handles that are poorly located, e.g. too narrow and low, can result in a lack of support to the torso resulting in poor spinal alignment and the risk of impact injuries from falling. Refer to Section 5 for further information.

4. Shock mitigation

Shock mitigation can be achieved by two means, procedural and engineering solutions.

i. Procedural solutions can be divided into a number of areas

   a. Coxswain training; the coxswain has a direct influence over the crafts motion exposure by their use of the steering and throttle to control the craft. The principal mechanism influencing craft performance and therefore shock exposure is throttle response. The ability of the coxswain to use the throttle to reduce shock exposure, i.e. reduce power before reaching the top of a wave, may be taught, and is enhanced with training. It should be noted that in certain circumstances and sea conditions increasing speed can enhance ride comfort, but, this is a technique for very skilled coxswain. It is understood that there is no recognised course that provides such training to enhance coxswain skill in poor sea conditions.

   b. Sea condition exposure; the greater the sea-state the greater the risk of impacts occurring. The organisation responsible for the HSC transits should, within their risk assessment, document the sea conditions that they are responsible for operating in. In general, emergency operations will take place in harsh sea conditions whilst pleasure rides may be restricted to relatively benign conditions.

   c. Passenger briefing; the individuals should understand what they will be exposed to during a HSC transit. The importance of good posture should be stressed, along with highlighting the risks to health in a similar manner to those for a roller coaster ride.

ii. Engineering solutions; Systems are readily available to reduce exposure to repeated shocks.

   a. A HSC Human Factors Engineering Design Guide is available to the industry as a free download from the internet. This provides assistance to designers, builders, buyers and operators on how to enhance their craft and its operation.

   b. Ergonomics; HSC seats and support features (hand-holds etc.) should be designed to optimise the occupants posture and therefore spinal alignment. The occupant's interaction with the crafts systems (steering, throttle, navigation, communications, etc.) should be designed so that spinal alignment is maintained.

   c. The magnitude of the impact on a HSC are greater at the bow, and reduce towards the stern of the craft. Placing the passengers on seats at the front of the craft will expose them to the greatest impacts. When the coxswain is located at the rear of the craft they will experience a reduced impact magnitude than the passengers. By locating the coxswain at the front of the craft they will receive the greatest impacts and are therefore more likely to reduce speed, also the passengers will be positioned toward the rear of the craft and experience a reduced magnitude of impact. If it is important for a crew person to be able to monitor the passengers (which would be impossible for the coxswain at the front of the craft) then a second crew-member should be located at the rear of the craft.

d. Suspension seats; there are a number of commercially available suspension seats that are designed for HSC applications. A number of these have been tested and shown to reduce the magnitude of exposure to repeated impacts.

e. Suspended deck; although there are a number of patents describing suspended deck systems, only one has been developed and demonstrated in a small HSC. Initial testing has shown that the system is capable of reducing impact magnitudes; further testing is required to verify the results.

f. Hull design; The geometry of the HSC hull has a large effect on the ride comfort and impact exposure. Larger craft have a more comfortable ride, although this is also normally related to an increase in weight that enhances ride comfort. For a mono-hull, the dead-rise angle is also critical to reducing impacts, the steeper the angle the better the ride, whereas the shallower the angle (i.e. a flat bottomed boat) the harsher the ride. Catamarans and multihull designs can also enhance ride comfort although there are often operational requirements that limit the use of these designs.

5. Casualty's posture

Figure 2. An illustration of the casualty’s anticipated posture during the transit

6. Legislation

i) The EU Physical Agents Directive includes the control of exposure to whole body vibration (WBV).

ii) This legislation for the UK marine industry is overseen by the UK Maritime and Coast Guard Agency (MCA). An MCA Marine Guidance Note has been issued and can be found at www.mcga.gov.uk/c4mca/353.pdf.

iii) An example of how extreme HSC motion is compared to terrestrial transport is that the 8 hour WBV exposure action value can be exceeded within 15 minutes in an 8.5m RIB travelling at ~40kts in a seat state 2. The graph shown in Figure 6 indicates how far in excess of the recognised Exposure Action Value (EAV) and Exposure Limit Value (ELV) a 28' RIB travelling at ~40kts in a sea-state 2 will be. At one hour the exposure is 7.5 times the EAV, while at four hours the exposure is 10 times the ELV and 24 times the EAV.

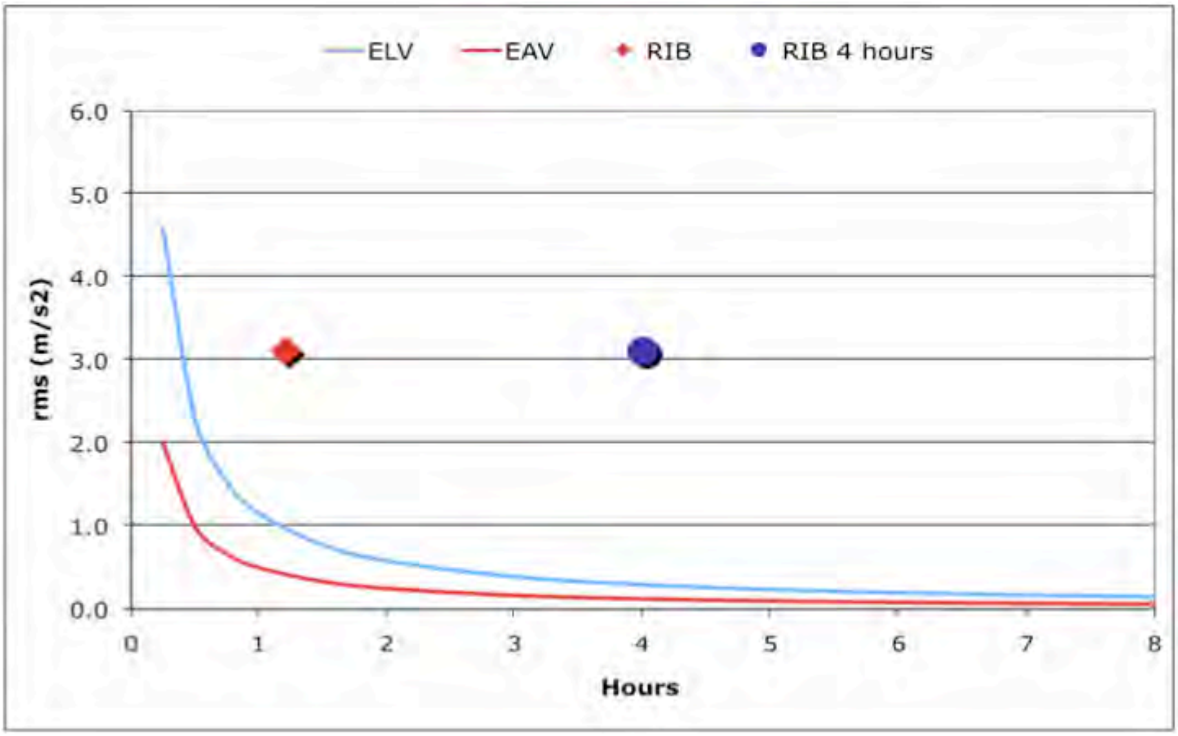

Figure 3. An example of how a 28' RIB travelling at ~40kts in a sea state 2 will exceed the EU WBV Exposure Action and Limit Values.

iv) Compliance with this legislation by the HSC industry sector will assist in reducing both the risk of the acute injuries described above and chronic injuries that are common in professional HSC operators.

7. Bibliography

The following references and documents are provided as sources of further information.

High Speed Craft Human Factors Engineering Design Guide. ABCD-TR-08-01. www.highspeedcraft.org

ASTM F1166-07 Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities.

European Union Directive (2002/44/EC) on the health and safety requirements regarding the exposure of workers to the risks arising from physical agents

ISO 2361-Pt5: Method for evaluation of vibration containing multiple shocks

Ensign, W., Hodgdon, J., Prusaczyk, W.K., Ahlers, S, Shapiro, D., and Lipton, M. (2000), A survey of self-reported injuries among special boat operators; Naval Health Research Centre, Tech Report 00-48.

Carvalhais, A. (2004) Incidence and severity of injury to surf boat operators. Conference Proceedings 75th SAVIAC Conference, Virginia Beach, VA. October 2004.

Fitness for Purpose Inspection of RIB carried out by PLA
on 21 October 2009

FAX TRANSMISSION
VESSEL LICENSING

PORT OF LONDON AUTHORITY
1909 - 2009
A CENTURY OF SERVICE

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TO: [redacted]

FROM: [redacted]

EMAIL: [redacted]@cpbs.co.uk

DATE / TIME: 23rd October 2009

NUMBER OF PAGES: FOUR

MESSAGE:

Dear [redacted]

<u>Fitness for Purpose Inspection of the passenger boat – 'CAPITAL RIB'on 21st October 2009</u>

Following my inspection of your vessel 'CAPITAL RIB', under Byelaw 7.1 of the Craft & Boat Registration & Regulation Byelaws 2000 (as amended) the 'CAPITAL RIB' is not to be worked, navigated, let for hire or used for the purpose for which it is licensed other than in accordance with the restriction(s) set out below until the following remedial works have been carried out to my reasonable satisfaction.

Restrictions on use of the vessels

1. A 4 week period, from the date of this communication, is granted for the vessel to continue to work or navigate while the required remedial works are addressed

<u>DELTA DORY</u>

1. All markings to be displayed in conformance with the PLA Craft & Boat Registration and Regulations Byelaws 2000 (as amended):-

Vessel Name:	CAPITAL RIB
Owner's Name:	CAPITAL PLEASURE BOATS
Owner Number:	3113
PLA Reg. Number:	4963

2. Items observed in the First Aid Kit had expired and should be replaced.
   The First Aid Kit should contain the Minimum of:
   - 4x Triangular Bandages (90cm x 127cm)
   - 6x Standard Dressings (no.8 or 13 BPC)
   - 2x Standard Dressings (no.9 or 14 BPC)
   - 2x Extra Large Un-medicated Dressings (280cm x 17.5cm)
   - 6x Medium Safety Pins
   - 20x Assorted Elastic Adhesive Dressings Medicated BPC
   - 2x Sterile Eye Pads with Attachment
   - 2x Packages containing 15 grammes Sterile Cotton Wool
   - 5 Pairs Large Size Disposable Polyethylene Gloves

3. A sound signal was sighted during the inspection, however it was fitted with an empty gas canister; the canister should be replaced or a suitable alternative provided.

4. One Lifebuoy with a 30 M float line should be onboard; the line should be attached with a loop around the lifebuoy able to travel through 360°; An additional lifebuoy with a battery powered light (unable to be extinguished by water) should also be onboard. Both lifebuoys should be SOLAS approved and suitably marked with the vessel's name. ie.760mm (30") diameter and fitted with 4x bands of Retro Reflective Tape.

5. A suitable anchor was observed during the inspection; The anchor should be provided with a cable of 30 Meters. The cable can either be all chain or chain and rope, the chain and rope configuration will require the chain being a minimum length of 5 meters between the anchor and rope.

6. The buoyancy tube on the Port side was observed to be leaking air around a previous repair adjacent to the control position; this should be investigated further and suitably repaired.

7. The VHF radio observed had a damaged handset cable; the cable should be suitably repaired or replaced.

8. A radar reflector was not sighted during the inspection; a suitable radar reflector should be provided.

9. Fuel shut off located on the Port side within the engine bay; a method of operating the isolator should be provided from outside of the engine space.

10. Engine space ventilation; the air intakes into the engine compartment should be provided with closures (Fire flaps); the closures should also be fitted with suitable seals to prevent the intake of air into the engine space in the event of a fire.

11. A Halon extinguishing system for the engine space was sighted during the inspection; under EC Regulation 2037/2000,all fire-fighting equipment in the EU containing Halons should have been decommissioned before 31st December 2003; the Halon extinguisher should be decommissioned and replaced with a suitable alternative.

12. The batteries observed during the inspection were suitably secured, however they should also be provided with non-conductive covers over the terminals.

13. Under the Fitness For Purpose Scheme for commercial vessels operating in inland waters a bilge alarm should be provided in the engine space.
    - Note: The alarm should be audible in the wheel house.

14. Aft seating console; Port side; the hinged top of the seat was observed to be detached from the base unit; this should be suitably re-affixed.

15. Lifejackets should be provided for all passengers and crew; if the inflatable type are to be used, they should be of an approved type to 150N.

16. When carrying passengers below Denton Wharf, an Inflatable Liferaft, compliant with ISAF, OSR or SOLAS regulation should be provided onboard. The Liferaft should also be provided with a SOLAS B equipment pack.

17. A basic Domestic Safety Management System should be provided onboard and should include:
    - A clear summary of distress communications and urgency and safety procedures
    - An Emergency Response Plan
    - A written safety briefing to be given to all passengers at the start of every voyage

18. During the inspection the available seating for passengers and crew was observed as six; operations should be limited to two crew and four passengers until such time that additional seating is provided up to a maximum total of eight.

Recommendations

At the time of the inspection there was evidence of heavy wear on the buoyancy tubes in the area of the Aft quarters on both Port and Starboard sides. Periodic inspection should be undertaken. Any defects identified should be suitably repaired when necessary.

Appropriate PLA publications including PLA Byelaws, Permanent Notice to Mariners, General Directions for Navigation, Code of Practice for Ship Towage Operation on the Thames, Notice to Mariners and relevant approved charts should be provided onboard, these can either be downloaded from the PLA website. or alternatively please contact PLA on 01474 562269 or at [redacted]@pla.co.uk for copies of these publications. Please note that there is a charge for the Chart Folios.

Third Party Indemnity - Please forward a copy of your Third Party Insurance Certificate for this vessel. Please, also, forward a copy of the new certificate after expiry of the current one.

Please note that working, navigating, letting for hire or using the vessel for the purpose for which it is intended in contravention of Byelaw 7.1, without reasonable excuse, is a criminal offence under Byelaw 7.2 of the Craft & Boat Registration & Regulation Byelaws 2000 (as amended).

In addition to the above, at the vessels next dry docking, the following additional issues will need to be addressed under new requirements introduced on the 1st June 2006:

- An out of water hull inspection of the vessel(s) will need to be completed by the PLA within the next 5 years, please contact myself or Tim Prior to arrange a convenient time to carry out the out of water inspection, within the time limit specified.

NOTE: *VESSEL(S) ABOVE 13.7M WILL REQUIRE DRAFT SCALES*

- Permanent Draft Scales, in metric, will need to be displayed on the vessel both Forward and Aft on the Port and Starboard Sides. This should be completed by 1st June 2011.
- Under the new regulations introduced in June 2006 all hull repairs completed on a vessel should be carried out with the use of insert repairs. Existing doubler plates should be removed from the vessel in two stages, 50% at the vessels next dry docking and 50% at the following dry docking 5 years later.

Should you have any questions, or disagree with any of the above requirements then please do not hesitate to contact this office.

[redacted]

[redacted]
Deputy Marine Surveyor

Annex D

Fugro Seacore Risk Assessment for boat transfer operation

RISK ASSESSMENT **Site or Location:** **Thames Tunnel – Phase 2: Overwater Boreholes** **Risk Assessment No:** RAS 004

Description of Activity / Task: BOAT TRANSPORT AND ACCESS TO JACK UP

General Comments / PPE: Hard Hats, safety boots and lifejackets to be worn at all times during boat transfers. More severe conditions may necessitate survival suits.

See matrix overleaf

No.	Hazard	Possible Consequence	Persons at Risk category	Severity S (1-10)	Likelihood L (1-10)	Risk SxL (1-100)	Control Measures	Residual Risk SxL (1-100)	Risk Action (A-E)
1	Poor weather conditions	Limited or complete inability to navigate boat safely resulting in personal injury and/or damage to the boat/third party property	1,2	7	3	7x3 = 21	Project Manager and Marine Supervisor will keep up to date reliable weather forecasts. Boat operators are trained to Power Boat Level 2 (RYA) and are deemed competent. Control horn and GPS available for poor visibility Bargemaster will assess the conditions at the beginning and throughout the working period. Crew transfer must only take place at the discretion of the Coxswain and ultimately the responsibility of the Bargemaster. Keep VTS and PLA informed of all movements.	7x2 = 14	B
2	Loose articles in boat	Personal injury through moving equipment or loss of equipment.	1,2	4	5	4x5 = 20	All items for transportation to jack up will be securely strapped in boat.	4x3 = 12	A

No.	Hazard	Possible Consequence	Persons at Risk category	Severity S (1-10)	Likelihood L (1-10)	Risk SxL (1-100)	Control Measures	Residual Risk SxL (1-100)	Risk Action (A-E)
3	Boarding the jack-up and /or boat	Falling overboard resulting in personal injury or death Caused by: Contact with an object in the water /boat/jetty Hypothermia Drowning Ladder failure	1,2	8	4	8x4 = 32	Boarding the jack-up is via Method Statement 002 for crew transfer. Employees and visitors will be made aware of the procedure for boarding. Life jackets are worn during all boat activities. Suitable clothing to be worn Jack-up air gap is kept to a minimum which reduces the height above the water line. Life rings available on jack-up. All rope ladders are robust and inspections are carried out prior to works beginning and throughout the works programme. First person up the rope ladder (Crane Operator) must wear safety harness and clip on the fall arrest line. No other operation to be carried out during crew transfer. The crew transfer vessel will be standing-off during any transfer operation and will pick-up any personnel in the event they fall into the water.	8x3 = 24	B
4	Mechanical failure of boat or components	Personnel exposure and possible drift towards obstructions; Fire	1,2	4	4	4x4 = 16	Emergency Equipment/Safety Pack (Oars; flares; VHF radio, fire extinguisher, first aid kit, torch) available on board. Equipment is inspected daily. Crew to be fully briefed on procedures.	4x3=12	A

5.	RIB moving under jack-up caused by tide and/or wind	Personal injury and/or equipment damage	1,2	5	5	5x5 = 25	Competent Hiab operator and boat crew. All crew to be briefed by the Coxswain prior to crew transfer. Tidal state to be assessed to ensure that boat does not swing underneath jack up. If necessary lift boat along flat side of jack up to prevent collision with the scow ends.	5x3= 15	C
6.	Collision	Personal injury or death and/or equipment damage Caused by: Contact with an obstruction/boat/jetty Hypothermia Drowning	1,2	8	4	8x4 = 32	Competent crew onboard at all times. Adhere to maritime and local rules. Keep VTS and PLA informed over VHF radio. Emergency Equipment/Safety Pack (Oars; flares; VHF radio, fire extinguisher; first aid kit, torch) available on board. Equipment is inspected daily.	8x3 = 24	B
7.	Use of Esvagt personnel transfer basket.	Personal injury or death and/or equipment damage Caused by: Falls from height Contact with an obstruction/boat/jetty Hypothermia Drowning	1,2	8	4	7x4 = 28	Competent Coxswain and Crane Operator. Visual check of Esvagt basket each shift prior to use by Bargemaster. Check for any physical defects or damage. Certificate of conformity for basket with 6-monthly thorough examination of lifting equipment.	7x3 = 21	B

							Door strap to be closed by last person inside the basket to close of basket entry point. Strap to be secured from hand rail to basket when alongside the platform to prevent rotation of the basket during transfer. Basket to be retained in a dry clean place - avoid hydraulic oil, diesel spills and drilling mud. Avoid placing basket in an area on the deck of the platform where it becomes an obstruction to personnel - use the purpose built cantilever storage platform provided.		
8.	Use of the inclined access stairs.	Personal injury or death and/or equipment damage Caused by: Falls from height Trapping with by a boat Hypothermia Drowning	1,2	8	4	7x4 = 28	All personnel involved in the crew transfer on the access stairs must wear a life jacket. Competent Coxswain to control boat movements during transfer. The bow of the crew transfer vessel will be pointed in towards the access stairs. Transfer from the front of the crew transfer boat onto the access stairs only. Personnel to await instruction from the Coxswain when to make the transfer.	7x3 = 21	B

							Personnel to access the first step of the ladder one person at a time. The crew transfer boat is to stand-off (pull away) from the access stairway after each person has stepped from the vessel. Ascent on the access stairs must be slow and controlled, maintaining three points of contact at all times using the handrail provided. When descending the access stairway it is advised to walk down backwards.		

Name of Supervisor responsible: Bargemaster

Risk Assessment prepared by: HSE Team Date: 16/01/2009

Risk Assessment checked by: [redacted] Date: 21/04/2010 Signature: [redacted]

Review Date: 21/10/2010

Copy of this Risk Assessment to: Client, Project Manager / Engineer, Supervisor, Safety Advisor (Delete as appropriate).

Fugro Seacore Method Statement for boat transfer operation

CONTENTS

Issue details:	Issue 5	
Distribution:	Controlled copies: Contract File Project Manager	Uncontrolled copies: Client
Originated by: [redacted]	Reviewed/authorised for issue by: [redacted]	

A METHOD STATEMENT IS ONLY A SAFE METHOD WORKING IF IT IS DISCUSSED AND AGREED BEFORE WORK BEGINS AND THEN FOLLOWED BY THOSE CARRYING OUT THE WORK.

1. Introduction

The Fugro fleet of jack-up platforms measure approximately 15 x 12m (depending on configuration) and will be used as platforms for ground investigation works for proposed construction of the Thames Tideway Tunnel in Central London. The contract will be held between Fugro and Thames Water Utilities Ltd (TWUL). This contract is specifically for the over water boreholes.

This Method Statement refers only to the transfer of crew from the shore to and from the jack-up platform.

2. Main Activity / Area of Work

The works are to be undertaken on a stretch of the river Thames through Central London covering Hammersmith to the west to Beckton in the east. The investigation is to confirm ground conditions in order to aid in the design and construction of a utilities tunnel.

Fugro's fleet of jack-up platforms will be used for the rotary drilling and cable percussive boring operations required for the marine works.

Movement of the platforms will take place using a tug and the on board thruster. A Real Time Kinematic (RTK) DGPS system will be used to ensure the correct positioning of the jack up.

The working area for this method statement can be taken to encompass the pier/jetty, the crew transfer vessel and the jack-up platform.

3. Manpower and Supervision

Job Title	Responsibility
Sub Agent [redacted]	Responsible for scheduling and co-ordination with all relevant stakeholders. Ensure development and application of safe systems of work, competence of personnel and that equipment suitable, properly maintained and certified.
Marine Supervisor [redacted]	Responsible for detailed planning and safe execution of all bridge moves. Will review bridge clearances, water depths, currents and weather conditions for each location prior to commencing operation. Ensures compliance with PLA requirements and implementation in accordance with this Method Statement. Shall ensure competent appointed person is in place for the operation.
Bargemaster	Responsible for supervision and control of the barge in accordance with this Method Statement. Communicates with Marine Supervisor and the Skipper of the crew transfer vessel.
Skipper of crew transfer vessel (RIB or other)	Has overall responsibility for the safety of the crew and passengers of the transfer vessel.
First Aider(s)	At least one first aider to be available on each vessel for each shift

4. Associated Documents (Drawings, Manuals, Method Statements, Plans, Permits)

Document(s)	Serial Number(s).
Fugro Seacore Safety Manual	2005 Issue
Construction Phase Plan	FES NEA019003
QA forms	Daily Progress Report (DPR)
Project COSHH Assessment File	Vessel COSHH Files

5. Risk Assessments

Risk assessments relevant to the work activity are held in the Project HSE Plan

RAS 004	Boat transport and access to jack-up

6. Security – Barriers/Fences/Warning Signs

The site is not accessible by members of the public. Only crew members and other authorised personnel involved in the project shall have access to the jack-up platform and access will only be in agreement with the Bargemaster.

7. Constraints/Restrictions/Special Conditions

Working hours will be 24 hours (staffed with 2 x 12 hour shifts) seven days per week. Where Section 61 noise restrictions apply, or as instructed by the Client's Engineer, working hours will be adjusted accordingly. It is noted that access to some of the exploratory hole locations are restricted seasonally.

Access to the jack-up platform should be limited to Crew and Visitors who hold Over Water Working / Sea Survival Certificates. Occasional visitors to the jack-up who do not hold this certificate should make Fugro staff aware before their intended visit and access shall be permitted in agreement with the Bargemaster.

Below is a summary of the **jack-up platform limiting conditions**:

- Crew evacuation: Seas up to 2.0 metres / wind force 7.
- Crew changes: 1.0 metres seas / wind force 6
- Moving: 0.75 metres seas, 1m/s current and wind force 5.
- Craneage operations: Wind speed of 12 m/s or as specified by craneage company and/or crane operators discretion.

Note1.

The limiting conditions (above) are for guidance only and that the final decision shall be made by the Bargemaster based on wind and sea state observations and the weather forecast.

Note 2.

Work outside the guardrails / protected areas / access platforms shall not be undertaken unless a detailed risk assessment has been carried out and the appropriate control measures implemented e.g. fall arrest system block and harness.

8. Plant and Equipment

The following plant and equipment will be used:

- Skate 2D, 2E or Aran 90 class jack-up platform
- Crew transfer boat
- Esvagt personnel transfer basket
- Tender to jack-up (RIB)
- VHF radios
- Life Jackets
- Ladder
- Hiab with man riding winch
- Pedestal deck mounted crane

Note:

All equipment and accessories are all certificated for man-riding duty and be in accordance with the examination schedules.

9. Materials (handling/storage/disposal)

N/A

10. Preparation of Works/Location of Services

The crew transfer will take place to and from a pre-determined appropriate place (generally Temple Pier for Central London and Victoria Deep Marine Compound for down-river locations) along the banks of the River Thames. The transfer shall not take place whilst the platform is in transit.

Crew transfers shall only take place from piers and jetties where permission has been sought from the owners and operators.

11. Emergency Procedures

Emergency procedures are detailed in the project Emergency Response Plan (ERP).

All personnel involved in the marine works will receive a safety briefing from the Bargemaster. The briefing will be recorded on the day sheet and as a toolbox talk record. Where necessary the site staff will be given a site induction by the Principal Contractor.

12. Personal Protective Equipment (PPE) & Safety Equipment

The following personal protective equipment will be worn:

Overalls BS EN 471	Mandatory - all sites/activities
Safety helmet BS EN 397	Mandatory - all sites/activities
Safety boots/shoes BS EN 345	Mandatory - all sites/activities
Safety glasses or goggles BS EN 345/BS EN 3F	Mandatory – where risk assessed
High visibility tabard/jacket jacket BS EN 471	Mandatory - vehicle movements & slinging
Ear defenders/ear plugs BS EN 352	Mandatory - noise above the FAL – 80dB(A)
Lifejacket BS EN ISO 12402-3	Mandatory - working over water / outside the guardrails / crew change.
Safety Harness	Mandatory - working at height /outside a protected area (no other control measure in place e.g. guardrails etc)
Gloves BS EN 374	Mandatory – where risk assesed

13. Methodology & Sequence of Work

- The crew transfer starts at an appropriate location along the river bank (this may change depending on borehole location) where the transfer vessel is embarked. Prior to boarding all crew are to ensure that they are wearing a properly fitting and fastened life jacket and safety boots.
- The transfer vessel will position alongside the pier/jetty to allow the crew to step on board.
- If a ladder is used to access the river, the Coxswain of the transfer vessel will stand-off until the person on the ladder has descended to a level where the transfer can take place. The Coxswain will then drive the transfer vessel generally bow first in towards the access ladder and instruct the person on the ladder to step into the transfer vessel.
- The transfer vessel motors from nominated transfer pier to the jack-up and positions adjacent to the pilot ladder.
- The first drill crew member (the crane operator) will board the jack-up barge by way of the access rope ladder wearing a safety harness and lanyard to operate the deck mounted crane.
- The transfer vessel will then move the side where the deck-mounted crane or hiab is situated and stand-off whilst the crane is being prepared for duty.
- Once onboard, the crane operator will carry out his visual checks on the crane and complete a Lifting Operations Check Sheet prior to commencement of the lifting operation. Then one of the three options will be adopted for the transfer of personnel onboard;

Option 1 – Esvagt transfer basket

- All personnel will be briefed on this method of transfer prior to use during the main project induction.
- If anyone person is uncertain of the procedure and is about to transfer using the Esvagt basket they should consult the Coxswain or Crane Operator for an additional briefing prior to use.
- The Esvagt personnel transfer basket will be removed from its stowage position on deck using the onboard crane and lowered to the appropriate side of the platform where the crew transfer vessel is situated.
- The Esvagt basket will be lowered to the appropriate side of the platform. The level of the basket will depend on the height of the gunwale of the transfer vessel.
- Once the basket is in position of the Coxswain of the transfer vessel will motor into position alongside the basket.
- The Coxswain will steady the crew transfer vessel in the water with the bow generally pointing into the direction of the current or tide.
- The Coxswain will instruct the Crane Operator as to the fine adjustment of the level of the basket up or down using the approved Banksman hand signals.
- When the Coxswain is satisfied that the conditions are safe for crew transfer, he will instruct the first person onboard to climb into the Esvagt basket.

- Once the first person is onboard and inside the roped basket, the second person can board.
- The limit for the transfer for this basket is set at 2 persons maximum for the smaller hiab cranes and 4 persons maximum for the larger centrally mounted 80T/m cranes.
- The closing strap on the basket entrance used should be closed prior to the transfer operation.
- The Coxswain will signal to the Crane Operator that the personnel are safely inside the basket with the closing strap secured and proceed to lift.
- The basket will be lifted in a slow and controlled manner and positioned adjacent to the access point of the jack-up.
- The holding strap attached to the hand rail will be connected to the steel upright on the basket by one of the personnel inside the basket. Once secured, this will prevent any rotation of the basket during the transfer.
- Once the basket is secured to the hand rail, the Crane Operator will signal to the personnel being transferred that it is safe to board the jack-up.
- The last person to leave the basket will disconnect the strap from the basket and signal to the Crane Operator that he has done so.
- The operation will be repeated until all personnel have been transferred.
- The basket will then be stowed.
- See Appendix A for details on Esvagt basket.

Option 2 – transfer using the RIB

- The Crane Operator will lower the RIB secured to the lifting chains. The RIB is fitted with three shackles with a Safe Working Load (SWL) of 2 tonnes each. The shackles are attached to the manufactured lifting point on the RIB. These points are checked visually each time the RIB is used – which come under the LOLER weekly check sheets and the JUIC-01 monthly checks.
- Once the RIB has been lowered, the personnel will step from the transfer vessel into the RIB. A maximum of two at a time shall enter the RIB for lifting.
- Once the crane operator has the signal from the Coxswain of the crew transfer that the crew are ready, the RIB will then be lifted out of the water.
- As the RIB is lifted, the crew transfer vessel will move away.
- The process can be repeated until all personnel are onboard.
- The RIB will be stowed at its designated location, at deck level.
- The access gateway is secured with chains once all crew are onboard.
- At the end of the shift the procedure is reversed from the jack-up to a suitable location along the river bank.

Note 1: A maximum of twelve persons are to be carried by the transfer vessel.

Note 2: There may be times when the jack-up is positioned on a location which is inter-tidal. In this case, refer to RAS 035.

Option 3 – transfer using the access stairway

- The RIB or crew transfer vessel will be driven by a competent and certified Coxswain with minimum RYA 2 level accreditation.
- A life jacket must be worn during the transfer of personnel.
- The RIB or crew transfer vessel will motor in towards the jack-up barge and motor towards the access stairway and slow.
- The Coxswain will request the first person to move to the front (bow) of the vessel and where they must prepare for an instruction to transfer out of the vessel and onto the access stairway.
- The bow of the crew transfer vessel is pressed gently against the bottom of the access stairway and when the Coxswain is satisfied that the conditions are suitable for crew transfer, he will instruct the first person to step over the gunwale of the vessel and onto the access stairs.
- The movement from the vessel to the access stairs must be made purposefully and without hesitation.
- Once on the access stairway, three points of contact must be maintained at all times – two hands and a foot or two feet and one hand. The stairs must be ascended facing the treads with both arms and hands used to hold the hand rail. Any baggage should be placed securely in a correctly worn back-pack or lifted up to the deck by some other means. No loose carrier bags or kit bags should be carried up to deck level on the access stairs.
- The Coxswain of the crew transfer vessel will draw away slowly from the jack up barge whilst the first person ascends the access stairs.
- This process is repeated until all persons are onboard.
- The RIB or crew transfer vessel will either 1] motor away or 2] motor around to the hiab and be lifted onboard the jack up barge with no more than TWO persons inside – the Coxswain plus one.

Appendix A – Esvagt personnel transfer basket

ESVAGT SAFE PERSONNEL TRANSFER BASKET

Facts about the basket

Diameter of Basket - 2600 mm
Height of Basket - 3150 mm
Weight of Basket - 500 kg
Transfer capacity - 4 persons or 500 kg
Gross Mass - 1000 kg
Certificates
Det Norske Veritas, Type Approval Certificate
Danish Technological Institute (Notified body),
EU Type-examination of machinery (CE-marking)
Det Norske Veritas, Product certificate
Force Technology, Field Report (NDT and Load test)
Randers Reb, Chain/wire

Welding

All welding are performed to approve procedures by Det Norske Veritas and by approved welders.
All welding of primary structures are fully penetration tested.

Bottom deck

Bottom deck is of heavy plate stainless steel, the top surface of which has a standard non-slip pattern.

Non-skid flooring

All 4 entrances fitted with non-skid flooring to ensure safe entrance and exit.

Nets

4 nets made by spliced rope are attached to upper and lower stainless steel structure. These nets serve as the principal means whereby personnel secure themselves inside the basket.

The vertical rigid

The vertical rigid (stainless steel) parts of the basket are covered with synthetic foam to reduce risk of injuries and to provide secure, non-slip grips.

Shock absorbing function

Big collars are fitted underneath the deck and provide shock-absorbs function when landing on hard steel decks together with the large orange collar.

Wires

Chain sling or wires are fitted to basket. An "indicator" enclosed in a sleeve made from high visibility synthetic material are connected to wires or chain sling. The "indicator" act as directional guide for crane driver.

Strap-tightener

Strap-tightener is used for tightening the stretcher to the basket when it is in use.

Closing straps

Entrances can be closed under basket operation by webbing straps fitted with fast click-buckle system.

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Annex F

MAIB Safety Flyer

MAIB SAFETY FLYER

Accident to passenger on a Delta 8.5m RIB

At approximately 0708 on 6 May 2010 a male passenger on a *Delta 8.5m* rigid inflatable boat (RIB) suffered lower back wedge compression fractures while the boat was transporting him, together with fellow workers, to a jack-up rig on the River Thames.

The injury occurred when the man landed heavily onto the lid of a locker, which was used as a seat, after he had been momentarily lifted off the lid due to the motion of the craft. At the time of the accident there was a light wind with a slight sea.

The injured passenger was landed ashore and taken to hospital where he was fitted with an external body support brace. He was subsequently off work for several months, while recovering from the accident.

Previous Accidents:

In August 2008 a female passenger on the RIB *Celtic Pioneer* suffered a lower back wedge compression fracture when she landed heavily on her seat after she was momentarily lifted into the air due to the motion of the craft. The MAIB investigated the accident and issued a report[1] which concluded, inter alia, that the operators and skippers of RIBs are not generally aware of the dangers to their passengers associated with shock and vibration in their craft.

The report refers to data obtained during trials conducted on an 8.5m RIB during a high speed passage in calm conditions. The data recorded measurements of the forces acting through the deck of the RIB which were

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[1] *Celtic Pioneer* MAIB Report No 11/2009
http://www.maib.gov.uk/publications/investigation_reports/2009/celtic_pioneer.cfm

constantly in the region of 2g, with regular shocks of between 6g and 10g. Occasional shocks of up to 20g were recorded during the trial.

The magnitude of the repeated shocks experienced during a high speed passage in a small craft can be sufficient to cause impact injuries to both passengers and crew.

Evidence from accidents indicates that impact injuries also occur at lower speeds, when large waves or wakes are encountered.

In the 2 years since the *Celtic Pioneer* accident the MAIB has been made aware of a further 12 accidents which have resulted in lower back compression injuries on board RIBs operating in UK waters.

Lessons Learnt:

- Operators of high speed craft should conduct Whole Body Vibration and shock impact risk assessments in accordance with the requirements of the Vibration Regulations[2] to reduce the risk of injury to their employees and passengers to a level which is as low as reasonably practicable (MGN 353 (M+F) refers).

- Helmsmen should be made aware, through appropriate training, of the risks posed to crew and passengers from shock impacts when conducting high speed passages or when encountering large waves or wakes at lower speeds.

[2] The Merchant Shipping and Fishing Vessels (Control of Vibration at Work) Regulations 2007