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Vibration Mitigation

Whole body vibration affects crew & passengers on fast craft

The professional maritime sector recognises the need to reduce the effects of Whole Body Vibration (WBV) but this is not a straightforward process for those operating planing craft. These vessels can expose crews and passengers to high levels of repeated shock and vibration which has been shown to increase the risk of injury.

In flat sea conditions there is vibration from the engine, gearbox and shaft but the crew and passengers are not exposed to harmful vibration. All fast boat operators know that waves change everything! Waves can be wind blown and build up in a few minutes but WBV exposure on planing craft is usually caused by continuous 'hammering' from short steep seas or wind against tide conditions. Repeated shock on planing craft is usually caused by random 'hits' from head sea impacts, crossing seas or overtaking following seas.

Professional maritime organisations use planing craft to perform a wide range of operations. The tasks performed by personnel after a fast boat transit are often physical and include ship boarding, law enforcement, sea rescue and more recently wind farm maintenance. The



(Photo courtesy FRC International)

Fast boats are a challenging workplace and the UK MCA Marine Guidance Note, MGN 353 titled 'Control of Vibration at Work' states that, 'Whole body vibration may be most apparent in smaller, fast craft such as fast rescue boats, RIBs or work boats, particularly when operating in choppy conditions.'

consistent objective is that boat crews are not injured and passengers arrive safely at their destination ready to perform a task.

Millions of workers around the world are exposed to mechanical vibration transmitted to the whole body through industrial seating, flooring and decks. WBV can affect back, neck, knees and joints. Fast boats are a challenging workplace and the UK MCA Marine Guidance Note, MGN 353 titled 'Control of Vibration at Work' states that, 'Whole body vibration may be most apparent

in smaller, fast craft such as fast rescue boats, RIBs or work boats, particularly when operating in choppy conditions.'

For example anyone onboard a pilot cutter at planing speed needs to be aware of vibration at sea. Although the onboard tasks are not physical for pilots there is the ladder climb. A pilot may have difficulty climbing and will be less effective onboard ship when suffering from back pain or a recurring injury aggravated by the cutter transit in rough conditions. Cognitive ability for navigation and

decision making also needs to be considered after any open sea transit.

However, the need for awareness of WBV issues is not limited to small vessels. According to Commander Chris Pratt, MBE AFNI, of UK Border Agency, 'WBV risks can apply to many ship types and in many work areas. For these reasons, a developed professional awareness of these issues applies throughout the maritime environment. Big ship people cannot be ruled out as many large ship types now carry fast



rescue craft. If anything, these people should be primary targets as they use these boats less often than the main working groups do. For these reasons, they are probably far less aware of the issues and risks.'

To highlight these issues FRC International hosted the WBV & H-SURV Seminars at the RNLI Lifeboat College, Poole UK, on 10th & 11th July 2012. These seminars attracted over fifty delegates from maritime sectors including military, SAR, government agencies, port authorities, police, and commercial operators. Boat builders, specialist equipment manufacturers and naval architects also attended. The WBV seminar is internationally recognised by The Nautical Institute and Captain Harry Gale, Technical Director of the Institute, was in attendance for both days.

FRC Director John Haynes AFNI, who introduced the seminars said, 'stopping fast craft operations is not a realistic option, but making them safer is essential. The internationally recognised FRC training and qualification structure supports competence based interoperability between both individuals and professional maritime organisations. The objective is that a genuine best practice

approach helps crews to remain safe and healthy. Besides prolonging the career of boat operators this approach leads to a more effective organisation.'

Dr Trevor Dobbins led the technical presentations by assessing the current situation and how the FRC WBV & H-SURV Seminar can support the fast craft industry worldwide. Throughout the two day seminar Dr Dobbins included various papers co-authored with experts from around the world. New tools developed to assist the professional sector include the HSC Motion Analysis Guide and a simple 4x4 Risk Assessment. He had recently presented new concepts to the US Navy, at the HiPer Craft 2012 conference in Norfolk VA, and passed on what are now becoming global views on both whole body vibration and health surveillance. This evolving knowledge and genuine best practice underpinned the two day programme.

Specialist manufacturers gained a lot of new knowledge from the event. David Price, from US boat builder Tampa Yacht Manufacturing, said, 'This is probably the best seminar on any subject I have ever been to. It has been open and very informative.' End user organisations attending the WBV and

H-SURV Seminars were keen to know what steps others are taking to address the issues of WBV and health surveillance. Alan Cartwright, Head of Marine Engineering for the Port of London Authority, said, 'What I found most useful about the WBV seminar was discussion with practitioners and providers, also the presentation, from Dr Tom Gunston, about vibration measurement.'

Dr Tom Gunston delivered a detailed presentation on the technical aspects of RS (Repeated Shock) and WBV (Whole Body Vibration) analysis. His in depth understanding of ISO and international measuring methods and the resulting metrics highlighted glaring errors in certain international organisations mathematics and measuring methods. There are ongoing debates from academics around the world regarding the use of rms and VDV for the assessment of vibration exposure to people on boats. Impact Count Index and the USN Ride Severity Index were discussed along with the development of ISO 2631 Part5 (Sed-8) update.

WBV is a major consideration in the US for military boat builders. Naval Surface Warfare Command will assess all future craft for operator exposure to shock levels

that could cause musculoskeletal, boat-related injuries. The latest combatant craft requirements refer to the standard Sed-8, which relates to a daily exposure dose over 8 hours.

The Human-Boat-Interface (HBI) is the technical name for how crews and passengers come into contact with the boat. Certain designs of suspension seating have feet off the deck, but generally there are three points of contact. Hands are in contact through a handhold, or for the helmsman through the wheel and controls. Feet are in contact with the boat through the deck. The backside is in contact with the boat through the seat base. Depending on the seat height and design, it may be carrying most of a person's body weight. Fast boat operators need to consider, what happens if the seat or suspension mechanism is damaged or broken.

It is now possible to measure vibration on boats by using accelerometers and data loggers. But how much vibration is too much vibration for the human body? That is a question that academics around the world have considered at length. The UK Health and Safety Executive (HSE) consider Exposure Action Value (EAV) and Exposure



Limit Value (ELV) to be the most relevant. The Exposure Action Value is a daily amount of vibration exposure above which action needs to be taken to control exposure. The Exposure Limit Value is the maximum amount of vibration a person may be exposed to on any single day. In simple terms the greater the exposure level, the greater the risk and the more action will need to be taken to reduce the risk.

The WBV & H-SURV seminars delivered informative presentations that were enhanced by audience participation. On day one John Haynes used a

SWOT analysis approach to discuss UK MCA Mariners Guidance Notes. These MGNs need to be read by operators to assist in understanding EAV (Exposure Action Value) and ELV (Exposure Limit Value) as part of compliance with the EC Vibration Directive, July 2010. The discussion showed that the numbers are difficult to comply with and many attendees were eager to know more about the metrics.

The seminar introduced various innovative concepts. Development of the suspended deck was discussed as a novel means of delivering shock mitigation to the

entire deck area. This could be used to protect personnel, console, controls, sensitive equipment and payload. Integration into an existing boat design has been proven and trials are underway. James Glover, managing director of DYENA, discussed the various hardware options that are currently available for recording vibration and acceleration. He introduced a small waterproof 'black box' with built in GPS that is designed as a vibration exposure recorder on boats.

To close day two of the seminar FRC Training Director Jon Hill AFNI

referred to his military experience operating fast boats and said, 'WBV is a global problem and the injury statistics are growing. WBV awareness is relevant to all sectors affected by this major health and safety issue.'

FRC International have developed specialist WBV Awareness Courses, recognised by The Nautical Institute, with the objective of understanding that WBV exposure affects all planing craft. These short courses define and benchmark best practice and provide a consistent approach to WBV compliance for the professional maritime sector.

For further information:
FRC International
WBV Awareness Courses
www.frc-wbv.com
EC Vibration Directive
Mariners Guidance Notes
www.vibrationdirective.com



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