



UK MoD Approach to Managing Whole Body Shock and Vibration in Small Fast Craft

Cdr Richard Finnemore RN (Rtd), NCS Ltd.
Representing UK MoD



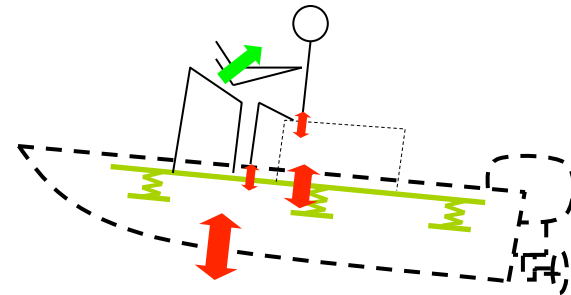
Introduction

- Boats are used widely to deliver mission success by 5 Operational Duty Holders
 - Royal Navy
 - Royal Fleet Auxiliary
 - Royal Marines
 - British Army
 - MoD Police
- Personnel must be delivered in a state 'fit-to-fight'.
- Approx 5000 annual users utilising 1000 boats across 28 classes.



The Operating Environment

- Operation in planing regime is essential which results in people being exposed to significant slam loads.
 - 20+g have been experienced.
- Operators have learnt to deal with the shock by 'riding' the seat using legs as shock absorbers and improving core strength to resist impact on vital organs.
- Since early 2000s the MoD has utilised a number of shock attenuating seats but most operators still prefer to 'ride' the seat.



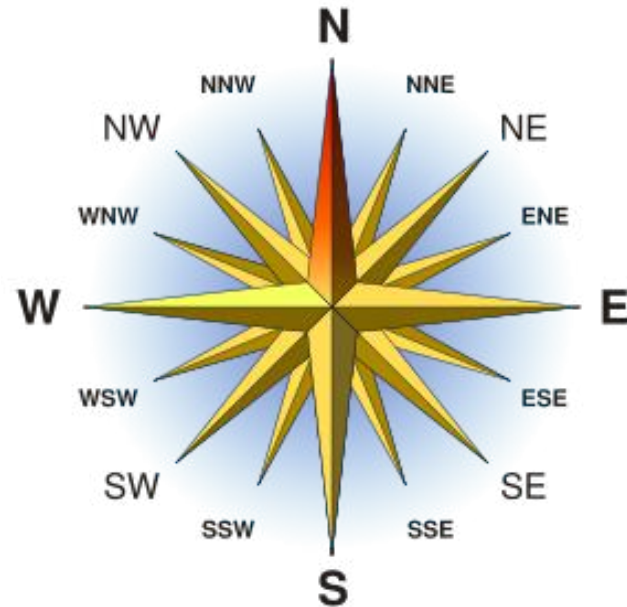
The Legislation

- EU Physical Agents (Vibration) Directive 2002/44/EC incorporated into UK law
 - The Control of Vibration at Work Regulations 2005
 - Merchant Shipping and Fishing Vessels (Control of Vibration at work) Regulations 2007)
- The legislation (Regulation 4) has set limits based on an 8 hour exposure in 24 hours as follows.
 - Exposure Action Value - $0.5 \text{ m/s}^2 \text{ A}(8)$.
 - Exposure Limit Value - $1.15 \text{ m/s}^2 \text{ A}(8)$.
- The MoD can apply for exemption against Regulation 4 only.



Setting The Direction

- In 2009 the MoD MWBV Advisory Group defined two high level aims:
 - *identify levels of vibration that are safe (ie the risk of harm has been reduced to levels that are ALARP).*
 - *to obtain an enduring exemption from the legislation based on medical evidence and reducing levels of exposure through equipment design where practicable.*
- Exemption and Derogation endorsed in June 2010 valid until July 2015.



Transition to Funded Project

- Senior Management lead the Maritime Whole Body Vibration Project Board (MWBVPB) established in 2011.
 - Project defined to meet the Regulations using the standard Defence Lines of Development (DLOD) process
 - Training – Crews and line managers
 - Doctrine - Review the need to use small fast craft
 - Information – Health Monitoring, Staff awareness
 - Equipment - Risk assessment, Procurement of seats
 - Personnel – Numbers of trained people (load spread)



Legislative Requirements To Meet an ALARP System

- There are 13 Regulations that the MoD must address to be compliant or ALARP - Regulation 4,5,6,7 and 8.
 - Regulation 4: Exposure limit and action values
 - Regulation 5: Assessment of risk to health created by vibration at the workplace
 - Regulation 6: Elimination or control of exposure to vibration at the workplace
 - Regulation 7: Health monitoring
 - Regulation 8: Information, instruction and training
 - Regulation 11: Exemptions relating to the Ministry of Defence



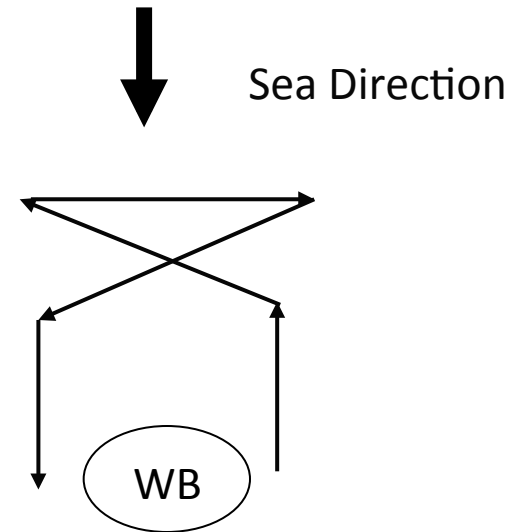
Regulation 4 – Exposure Limit and Action Value

- MoD exemption remains in place until 2015 with the following conditions:
 - Demonstrable progress is made towards reducing shock and vibration experienced by passengers and crew.
 - Progress towards reducing shock and vibration is reported routinely at the MoD Maritime Safety Board.
 - It can be shown that passengers and crew at risk are identified through risk analysis, health monitoring and good management of this risks are as low as reasonably practicable (Regulation 5,6,7 and 8).
- No foreseeable change to limits.
- Anecdotal evidence suggests the applied limits may have value.



Regulation 5 – Risk Assessment

- MoD Exposure Survey
 - Complete for 28 classes at SS3 or less
 - Concentrate on RHIBS for SS3+
 - completed Mar 13
- Results
 - No real problems with displacement craft (launches etc)
 - No problems with RHIBS if kept below 15 knts
 - Time to reach A8 can be anywhere between 20 mins to 4hrs in RHIBS depending on speed and SS. (Half these times if using VDV values)
- Intend concentrating effort to Reduce the Risk of Harm to RHIB Crews and Passengers



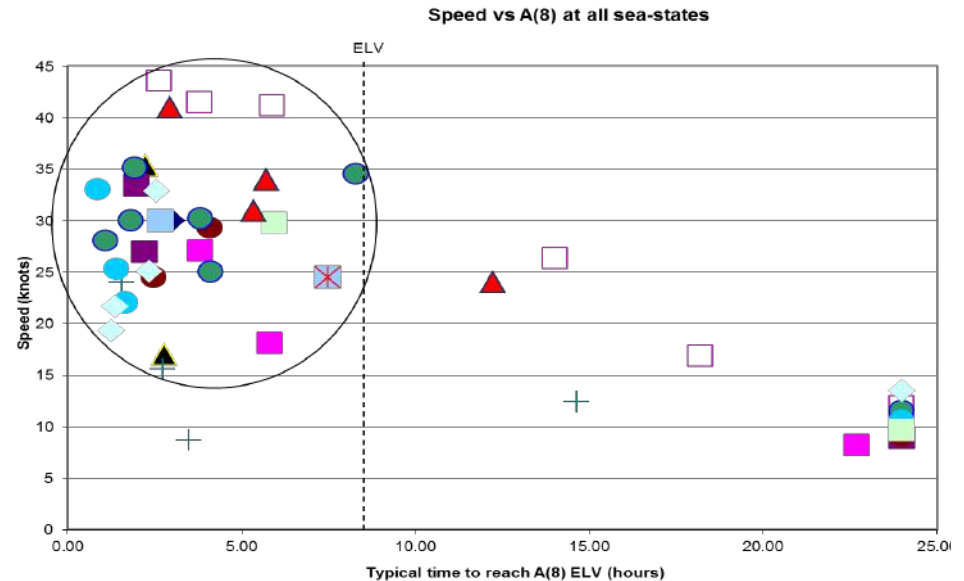
3 Min runs per leg



Exposure Survey

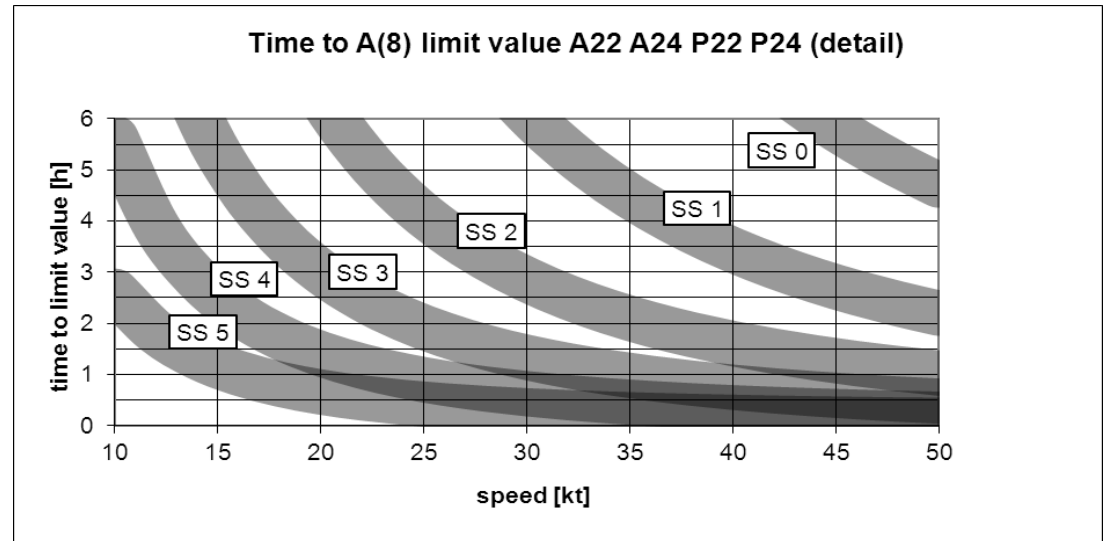
- Conducted on 28 classes of vessels
 - Standard operating pattern
 - Various sea states
 - Various speeds
 - 180 hours of data
- The A(8) WBV exposure limit can be exceeded well within the 8 hour period when conducting certain mission profiles.

Speed vs time to reach A(8)
ELV for 15 classes of planing
craft in all sea-states



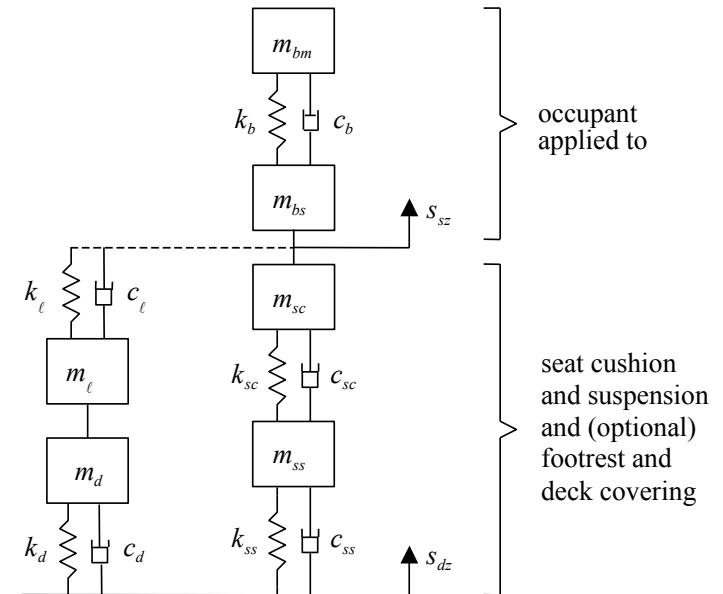
Operational Guidance

- Based on exposure survey data
- Still a need to complete operational task
- Decision is always left to authorising officer
- Graph allows them to decide how much risk they are carrying
- Currently running Fleet Trial to gather actual operational data – started Jan 14 using 24 data loggers



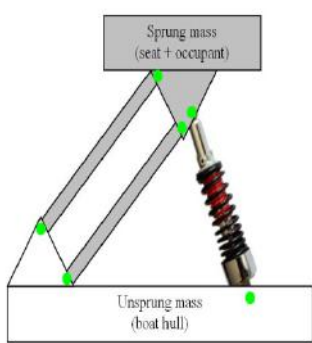
Regulation 6 – Elimination or Control of Exposure

- MoD Technical Equipment Programme – NDP
 - Desk Top Modelling
 - ISVR Southampton
 - Design and write a seat testing protocol (to compare like with like)
 - Test 5 different types of suspension design
 - Designed a seat testing protocol used as a stage 1 selection tool for the current seat procurement competition
- DSTL Research
 - Hull shapes and human factors (seating, console) in the design of future craft

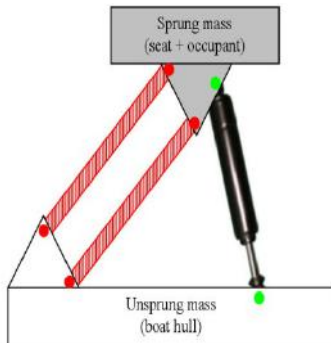


Technical Understanding of Equipment

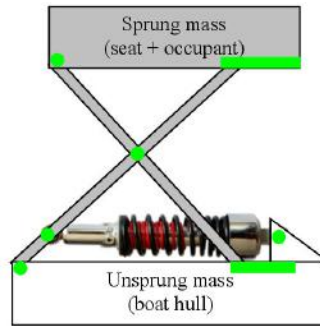
- Market Research Completed in 2011
 - At least 68 different seats



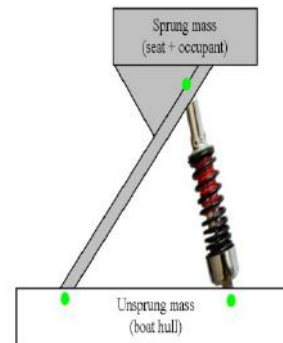
Double Wishbone



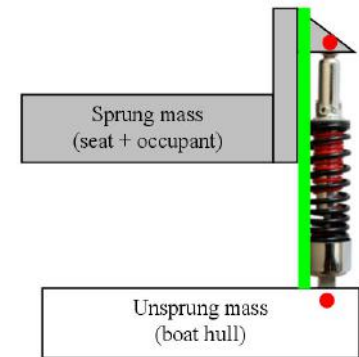
Leaf Spring



Scissors

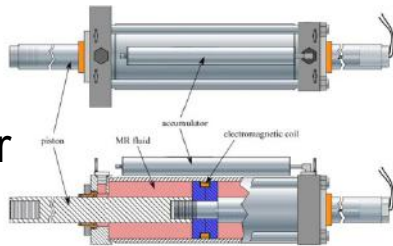


Swing Arm



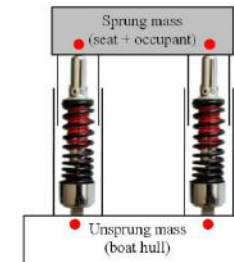
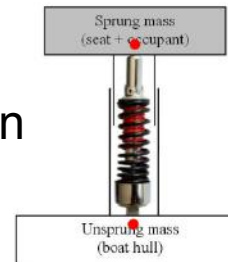
Linear

MR Damper



- = Free movement around point
- = Rigid connection
- = Free linear movement
- ▨ = Leaf-spring

MacPherson Strut



Regulation 7 – Health Monitoring

- HSE Review of MoD Health Monitoring elements concerning Maritime WBV only.
- Developing a Small Craft Mission and Health Monitoring Database
- INM sponsored PhD research projects at Southampton University
 - Predicting discomfort caused by WBV and shock in high speed marine craft.
 - Predicting the force in the body caused by WBV and shock in high speed marine craft.
 - Reports due 2016

RN Mission Data Sheet

WBV Information For: Royal Navy Unit: A1234 Mission Date: 07/11/2012

Mission Task: A234 Light Condition: Night
Mission Description: Diving Operations Operating Area: Estuary
Mission Start Time: 13:15:00 Calculated Time: 02L00
Mission End Time: 17:15:00 Number of Crafts uses: Two

Type Of Craft: FASTER Motor Launch Sea State: 2
Craft Serial Number: A12345HH Estimate Max Speed: 20-30
Wind Speed: 10-20 Estimated Average Speed: 10-20
Wave Height: 6 Passenger Number: 4
Percentage On Plane: 15-20 Discomfort/Injury/Pain? Yes
Crew Number: 2 Add more Boats

Craft Serial Number: A12345HH Add Injury Details Save Close

Do you agree to your service staff being recorded (Y/N)?
Service Number: _____

Completed By: _____
Rank: _____
Number: _____
Examined By: _____
Rank: _____
Number: _____

Back view diagram showing numbered points 1-14 on the back and neck.

Pain Area From The Body: B = Right Ankle / Foot
Pain Level: 5 = Fairly Painful
Additional Equipment: Body Armour Add More Injury Details Remove From List

Pain Area: 9 = Left Shoulder 3 = A little Painful
4 = Lower Back / Buttocks 4 = Fairly Painful
B = Right Ankle / Foot 5 = Fairly Painful

0 1 2 3 4 5 6 7 8 9 10

OK Cancel

Regulation 8 – Instruction, Information and Training

- Training Needs Analysis identified
 - Updates to coxswain training courses (roll out now)
 - Training manuals and boat crew log books (complete by summer 2014)
 - Introduction of a new MWBV Line Management course (due late 2014)
- Complete review on operational requirement
 - Do we need to do this task
 - Can it be done by a different means
 - Can we better resource boat crews
 - Can we change boat types
- Promulgating information
 - Face to face briefings – Roadshows
 - H&S Poster Campaign
- Mission Briefings
 - Pre and post mission brief to include MWBV issues – completion of HM Database



Conclusions

- The MoD has adopted a multi-faced approach that complies with the law and which reduces the risk of harm to ALARP.
 - Regulation 4 – an exemption to ensure the law is not an unreasonable impediment to operational effectiveness.
 - Regulation 5 - a risk assessment identifying the magnitudes, type and duration of exposure.
 - Regulation 6 – encouraging a culture that speed is only to be used when absolutely required in order to minimise exposure time and implementing an equipment upgrade programme to introduce shock-mitigating technologies into craft where reasonably practicable.
 - Regulation 7 – introduce a standardised health monitoring process across all users and automate the process using the Defence Information Infrastructure.
 - Regulation 8 – introduced specific training elements to cover WBV and provide information that allows the Commands to make informed decisions regarding capability versus risk reduction.



QUESTIONS

- First we will hear from Dr Tom Coe about the technical aspects of the MoD programme then:

JOINT Q+A SESSION

