



HIGH SPEED CRAFT: HUMAN FACTORS ISSUES

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Introduction

High Speed Craft (HSC):

- *Deliver personnel - BUT*
 - Poor sea conditions reduce performance
 - Motion Induced Fatigue
 - Motion Induced Interruptions
 - Motion Sickness
 - Increased risk of acute and chronic injury
- Need to:
 - Maintain crew and passenger performance,
 - Minimise the risk of injury
 - Ensure that the employer's duty of care is addressed



Motion-Induced-Fatigue

- Anecdotal evidence of fatigue;

“After sitting on a jetty all night we went out and did 110 NM in a near Gale Force 7, and a 3m swell for 8 hours. That’s an average speed of just under 14 knots. Everyone returned to a nearby port as we had no fuel and no interest in travelling back by sea to our home port. Everyone got off the boats shattered and just lay down to give their bodies a rest”.

- Potential for increased risk of injury when physically fatigued



Motion-Induced-Fatigue

Quantifying Motion-Induced-Fatigue

- Trial format
 - Performance Test Battery (PTB)
 - Pre vs. Post scores
 - Sea transits – 80' Deep-V mono hull



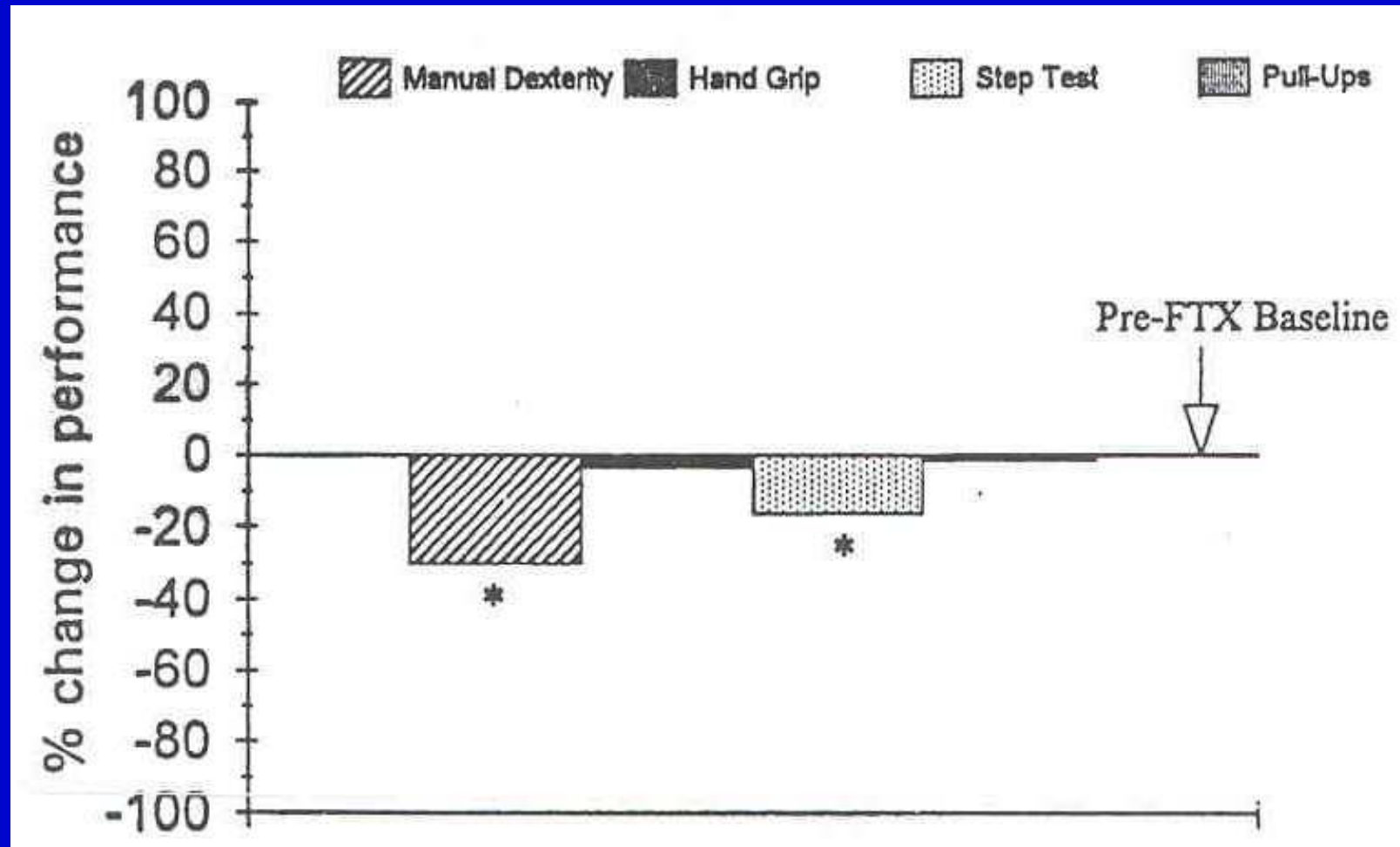
3 Days

ROUGH



Motion-Induced-Fatigue

Trials Results: PTB 1 vs. PTB 2



Motion-Induced-Fatigue

Reducing MIF

- Increase resistance to physical fatigue
 - Targeted physical conditioning ?
- Reduce exposure to HSC shock and vibration
 - HSC design
 - Shock mitigation



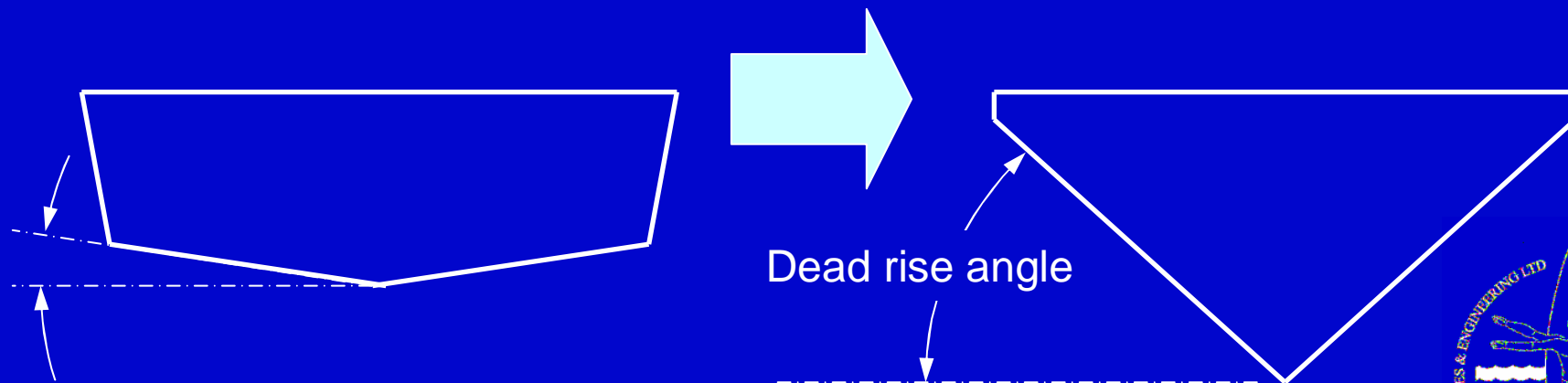
HSC Design



HSC Design

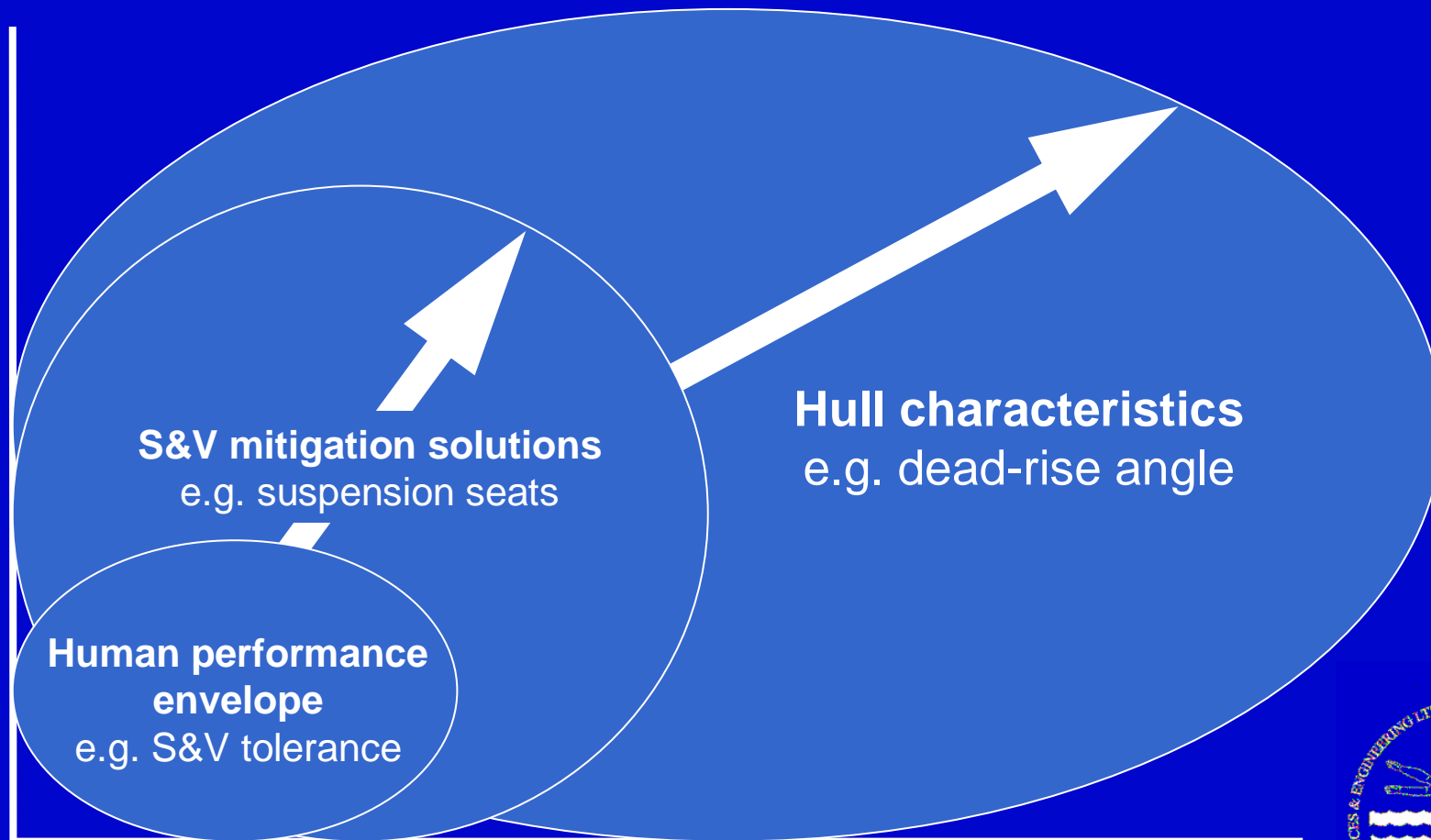
Does mono-hull design make a difference ?

- Optimised Deadrise Hull Analysis
 - Whalen, MSc Thesis, MIT. 2002
- US Navy MkV SOC (length - 82', beam - 17.5')
- Modelling predicted:
 - Increasing dead-rise angle by 6%
 - Reduced mean vertical impact by 20%
 - HSC performance unchanged

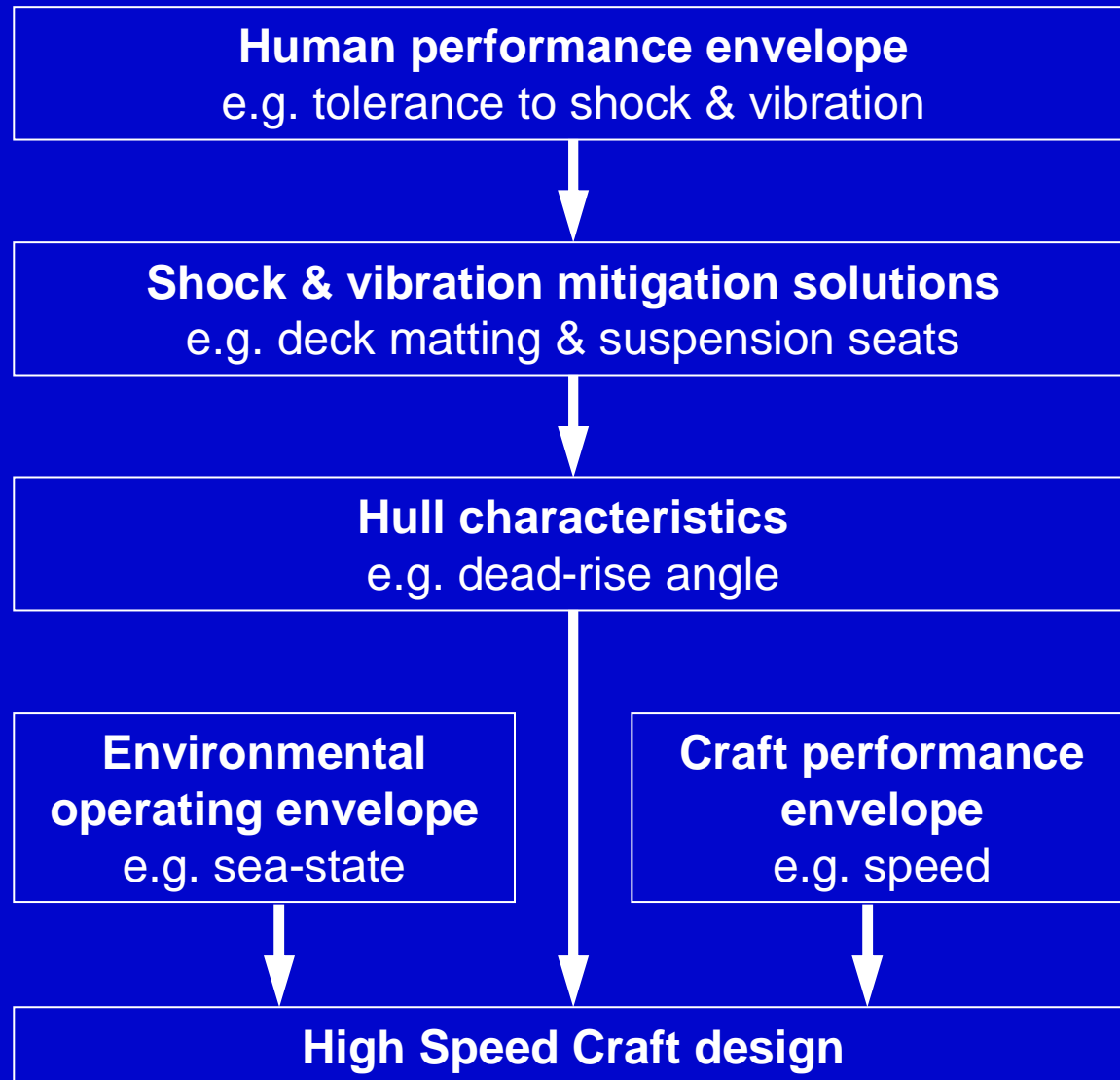


Human-Centred HSC Design Process

- Enhancing the human performance envelope



Human-Centred HSC Design Process



Specific Man-Machine-Interface Requirements

- HSC displays are often illegible
- Controls often designed for calm NOT rough conditions
- Anecdotally reported problems:
 - Chronic shoulder discomfort / injury from engine throttles location
 - Steering wheel and throttles being located for a sitting coxswain when most driving is accomplished whilst standing.
 - Display numerals too small.
 - Displays being located too low so that situational awareness can be lost.
 - Unintuitive displays.
 - Control buttons are too small.



Specific Man-Machine-Interface Requirements

- Interfacing suspension seating with controls



Human-Centred HSC Design Process

How to move forward ?

An HSC Human Factors Engineering Standard

Dobbins, T. (2004) High speed craft design from a human centred perspective. Conference proceedings *Royal Institute of Naval Architects; SURV 6: Surveillance, Pilot and Rescue Craft*, London.

Pierce, E. and Dobbins, T. (2004) Development of a Human Factors Engineering Standard for High Speed Boats. Conference proceedings, Multi Agency Craft Conference, Norfolk VA, USA. June 2004.

Dobbins, T. and Pierce, E. (2005) Developing A Human Factors Design Standard For High Speed Planing Craft. *Accepted for presentation at Royal Institute of Naval Architects conference on Rigid Inflatables*, June 2005, Cowes, IoW. UK.



An HSC Human Factors Engineering Standard

- The 'standards' concept is not new -
 - Design ergonomics
 - ISO 6385 (1981) Ergonomic principles in the design of work systems
 - MOD
 - Def Stan 00-25; Human Factors for Designers of Equipment. Part 12: Systems
 - DPA Sea Technology Group
 - Human Factors Integration Technical Guide, Sea Technology Group Publication 11
 - Air Standardisation Coordination Committee
 - AIR STD 61/116/13: The application of human engineering to advanced aircrew systems



An HSC Human Factors Engineering Standard

- Use standards that are already available (e.g.DEFSTAN)
- Learn from the aerospace community (ASCC standards)
- Make information easily accessible to designers
 - Collate specific information
- Highlight specific HSC issues
 - Magnitude of shock loads, instrumentation & controls
- Document best-practice
- Identify where data is needed - direct research to generate the information
- Dissemination
 - Designers, manufacturers, buyers, end-users,



Conclusions

- HSC provide a harsh working environment
- Fatigue and injury are big problems
 - Targeted physical conditioning
- Human-centred design philosophy for HSC
 - Enhance operational performance
 - Reduce the potential risk of injury
- HF guidelines and standards for HSC design





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