HighSpeedBoat 2025
OperationsForum

Testing suspension seats for impact protection capacity

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Testing seats...

HSB Hull-slamming impacts **cause injuries**,

- sometimes **severe and** sometimes **permanent**.

The impact also causes **significant physical fatigue,**

- which **reduces operational readiness** (Combat readiness)

Most injuries are **musculoskeletal**, and most affect the **spine**.

New data indicates that the impacts also **damage the brain**.

- **Severely and even lethally**.

Prof Daniel Perl, USU, the world-leading expert on Traumatic Brain Injury,
will talk about this at 15.00 hrs today

Testing seats…

New research indicates that impact-induced **injuries are increasing,** both in numbers and severity

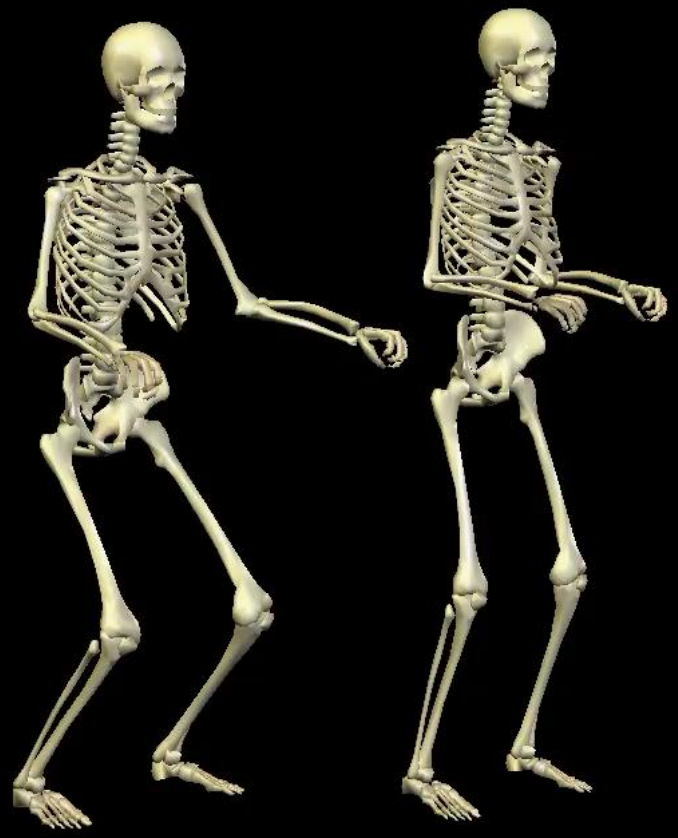
This is remarkable, as most high-speed boats today have suspension seats

Testing seats

In the SWCC survey, published in 2022,
a majority of the operators - **72%** had
experienced **cognitive issues** due to the impacts
- problems driving or navigating the boat

33% had experienced unconsciousness
from impacts hitting the body from below.

Head jolts can accelerate
the head forward
4 times faster
than the body is
accelerated
upwards



Body posture at impact, and
Balance of the head, are critical

Standing at impact is NOT good!
It can amplify impacts 3 times
- and cause severe head jolts

Testing seats

WHAT CAN BE DONE to **Uphold mission readiness** and **Prevent injuries**?

Better boats - better hull shapes.
There are significant differences in sea-keeping /slamming

Active Ride Control Systems
Some can significantly reduce slamming by controlling pitch and roll

Better seats – Suspension seats can prevent injuries

Slow down – This is the most common approach

– But it does not seem to solve the problem

WHY - Does slowing down not solve the problem?

We still don't know:

1. What is the actual slamming exposure on high-speed boats?
2. What is the actual human impact exposure onboard high-speed boats?
3. What impact exposure is sustainable vs injurious?

Today, we still don't know when it's time to slow down (!)
- But we will find out.

At **14.00** today, Prof. Steve Myers will present the 15-nation **NATO study**, **"Human impact exposure onboard HS boats",** which will give the answers.

When we have the results, the boats can give the coxswains real-time information about when exposure becomes risky.

Testing seats

Can Suspension seats be relevantly tested for impact mitigation capacity?

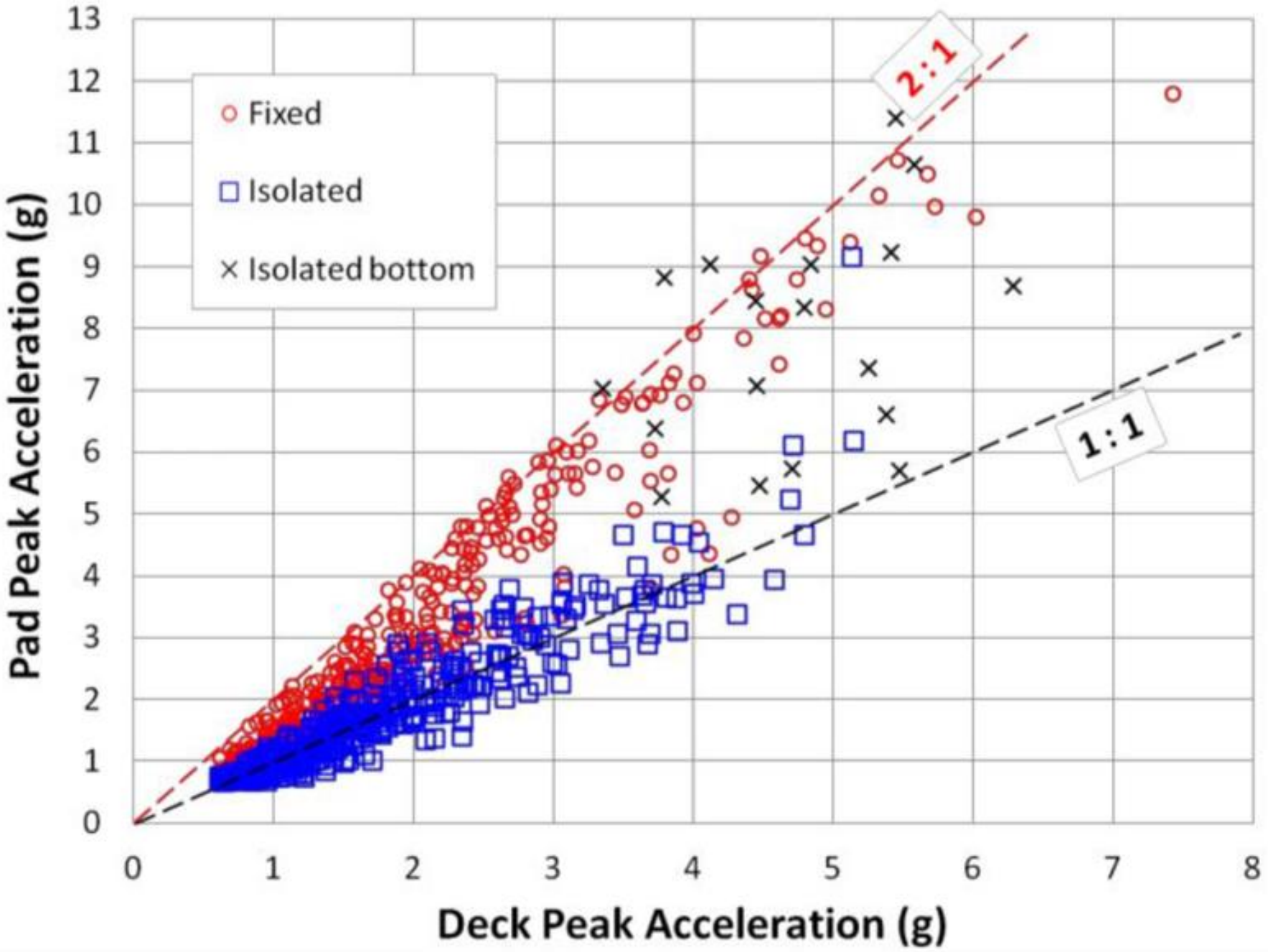
Most suspension seats **amplify** high-magnitude impacts, that cause injuries.

Most seats bottom out when the suspensions reach the end of a stroke and come to an abrupt stop.

This can amplify the impacts by more than 3 times.

Seat producers have created drop test procedures to certify such seats as safe.

Testing seats



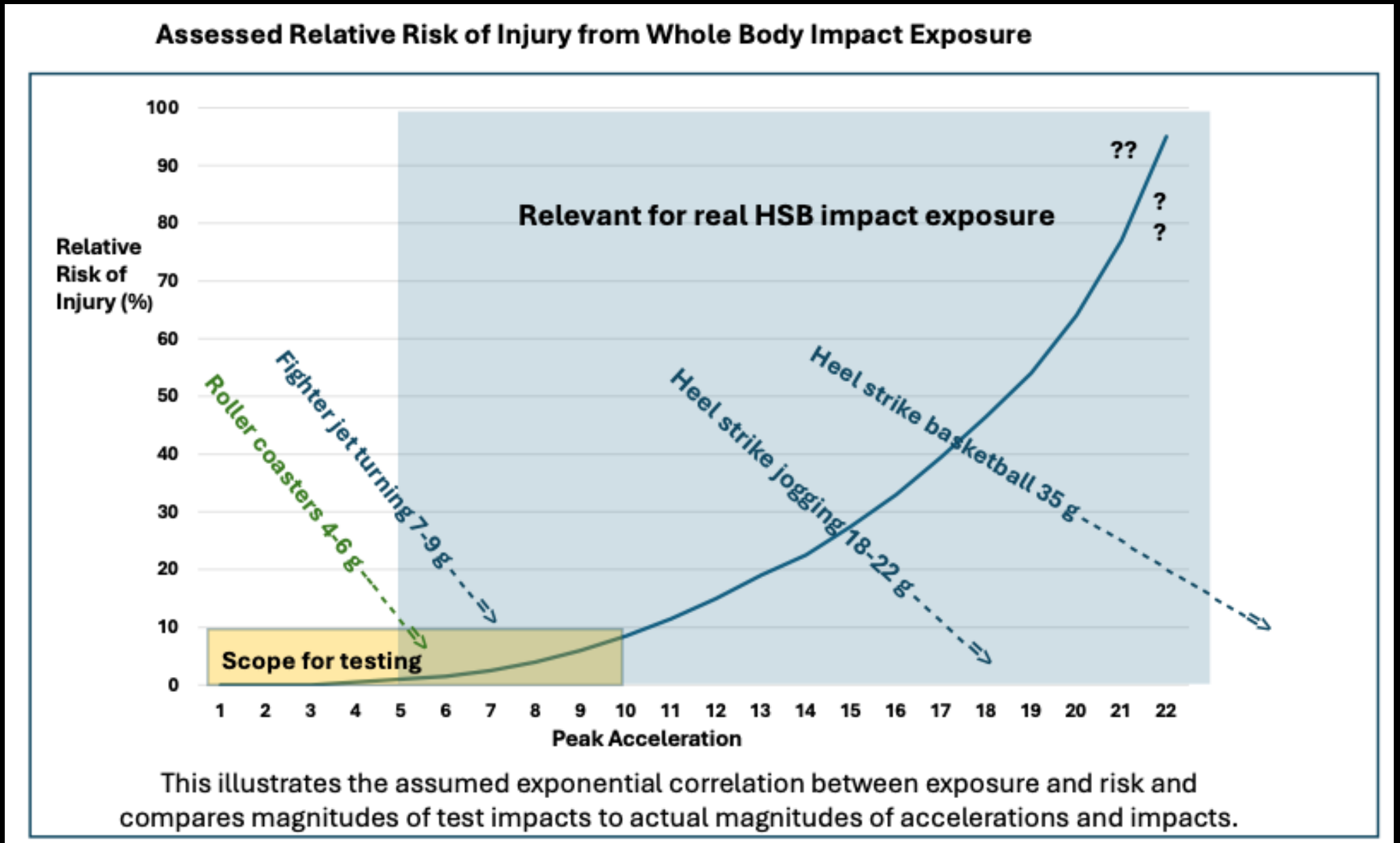
Can Suspension seats be relevantly tested for impact mitigation capacity?

High-speed hull impacts can **exceed 25 g vertical** peak values.
Drop tests can produce impacts of **8-10 g**.

Real hull impacts can **rise from** 0 g to **20 g in 7 ms**.
Drop test impacts reach **8 or 10** g in **50 ms**
Shorter rise times make impacts more severe.

Real hull impacts can transmit **3 times more energy,** and
40- 50 times higher mechanical power than drop tests do.

Can Suspension seats be drop tested for impact mitigation capacity?



Suspension seats CAN be tested for capacity to mitigate real-life impacts

This can be done only using **Empirical, Evidence-based Science**
- on board **real boats**, in relevant **sea conditions**, with **living humans**, seated in **real seats**, comparing **seats side-by-side.**

Impacts must be measured **on the hull** and on the **human subjects.**
Subjects must **switch positions** between the tested seats.

Unbiased Subject Ratings are crucial.

Subject Ratings must be **anonymous**.
The human body is a remarkably sensitive instrument, designed to provide relevant information about what is good for us and what is not.

“If it feels good, it normally is”

Suspension seats CAN be tested for capacity to mitigate actual real-life impacts

An article describing how to do this is submitted for scientific publication

I will be happy to share this as soon as it is published

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