



UNIVERSITY OF ICELAND

SCHOOL OF ENGINEERING AND NATURAL SCIENCES

FACULTY OF INDUSTRIAL ENGINEERING,
MECHANICAL ENGINEERING AND COMPUTER SCIENCE

The Impact of Hull Design for Impact Reduction of High Speed Craft

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Objective

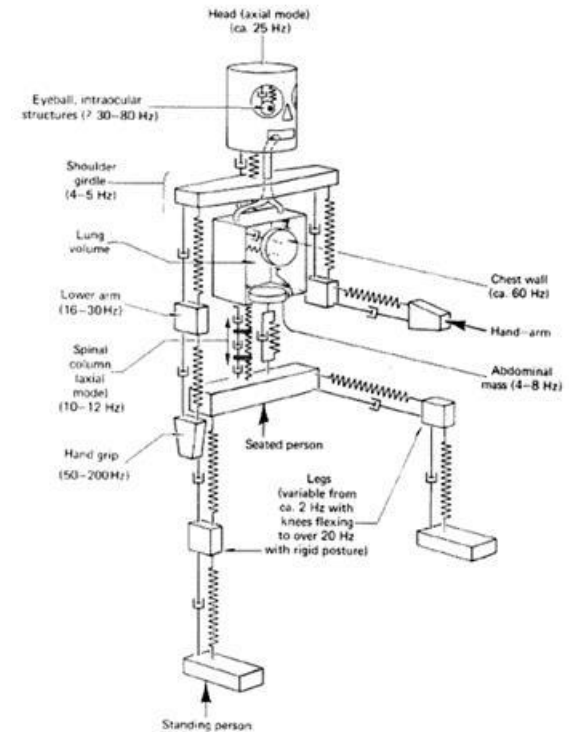
The aim of this project is to compare different hull designs and measure the impact or acceleration onboard when sailing in different weather and sea conditions.

Part 1:

Introduction - First comparison test

Motivation

Crews of high speed marine vessels, length 6 –15 m and capable of speeds in excess of 20 knots, are exposed to uncomfortable motions that causes physical and mental fatigue.





Evaluation criteria

WBV health guidance caution zones.:

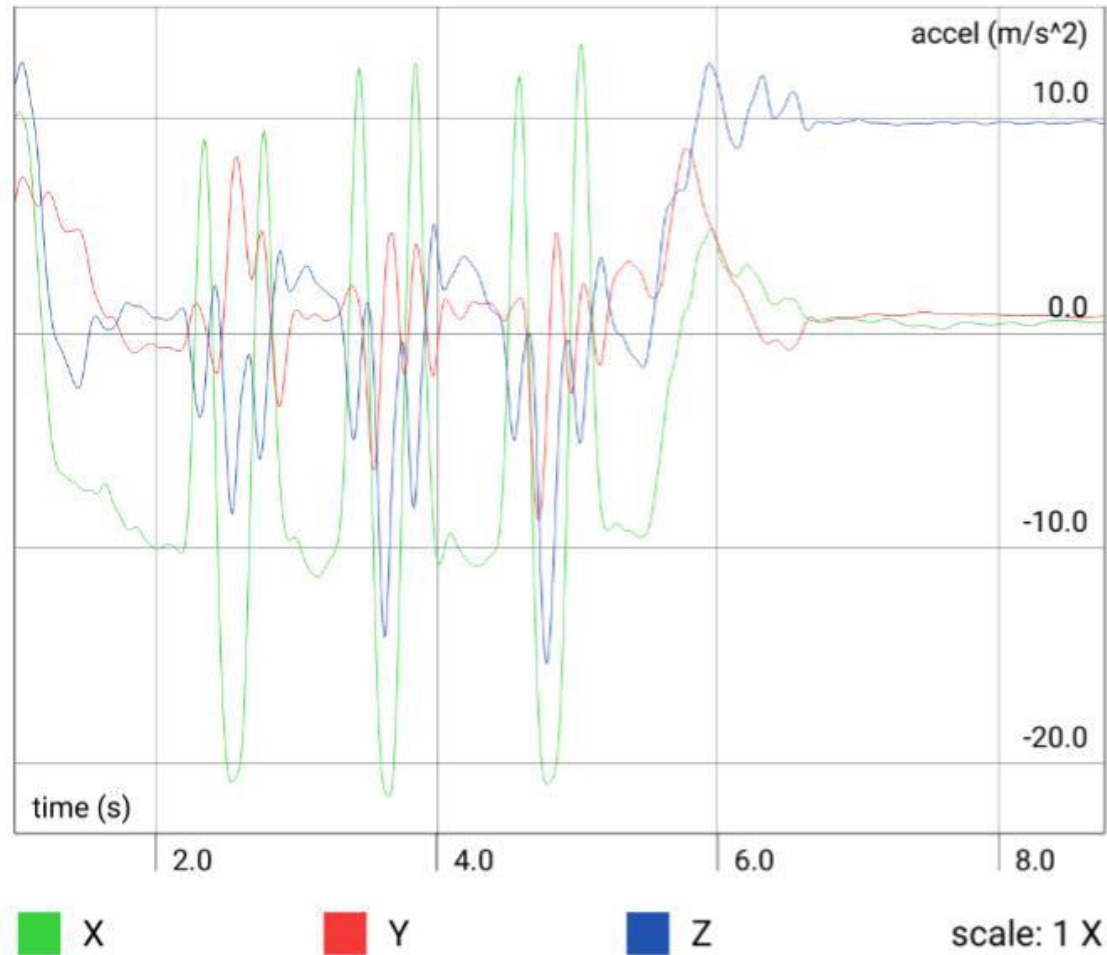
ISO 2631 (1997) offers a combination of three evaluation methods R.M.S., VDV and MTV V

RMS limits of the health guidance caution zone as 2.8 m/s^2 (24 hour) and 5.6 m/s^2 (10 min).

VDV (Vibration Dose Values) is defined by the between $8.5 \text{ m/s}^{1.75}$ (24 hour) and $17 \text{ m/s}^{1.75}$ (10 min).



Test



Methods

The two boats ran side-by-side, both with two 3 axis Dyena Acceleration Recorders model no: 120301-04.

- Stefnir ÍS-7747 built by Rafnar, Iceland with a **Rafnar hull** design.
- Þórður ÍS-7738 built by Holen Mek. Verksted, Norway, with a **Vee hull** design.

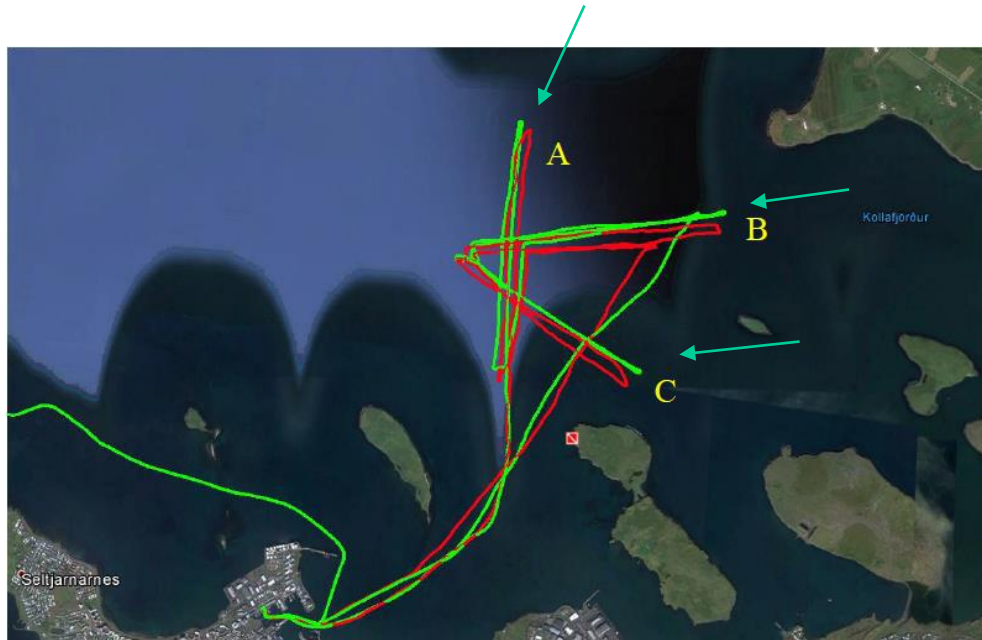


Boat	Stefnir ÍS-7747	Þórður ÍS-7738
Type	Leiftur RIB 1100	RS #118 (Rauna)
Material	Glassfiber	Aluminum
Length overall	11.00 m	9.55 m
Length	8.79 m	8.79 m
Max Beam	3.20 m	3.60 m
Draught	0.55 m	0.65 m
Max Speed	40 kn	33 kn

Sailing route

The green curve showing the route for Stefnir and the red curve showing the route for Þórður.

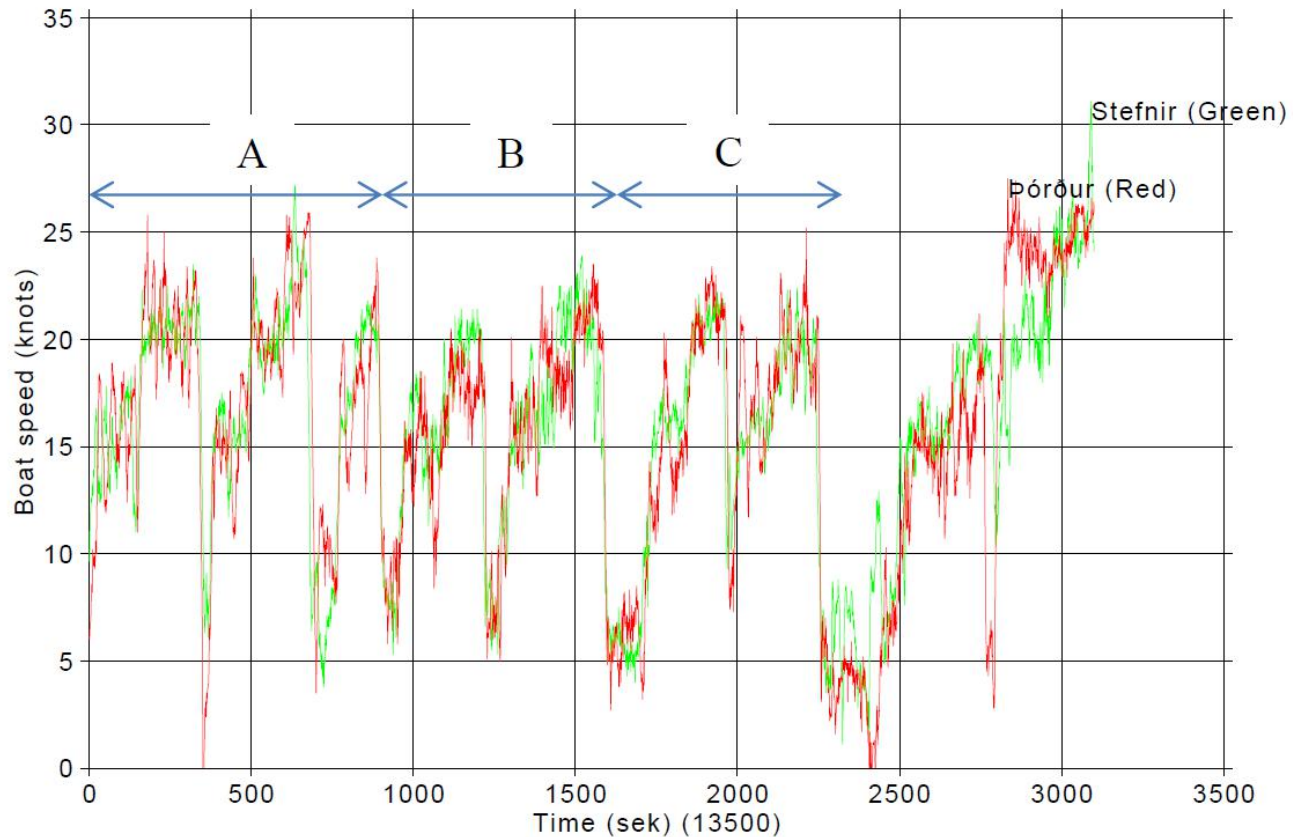
Wind speed: 15 – 20 knots Gusts: 30 knots Sea waves: 0,7-1,5 m





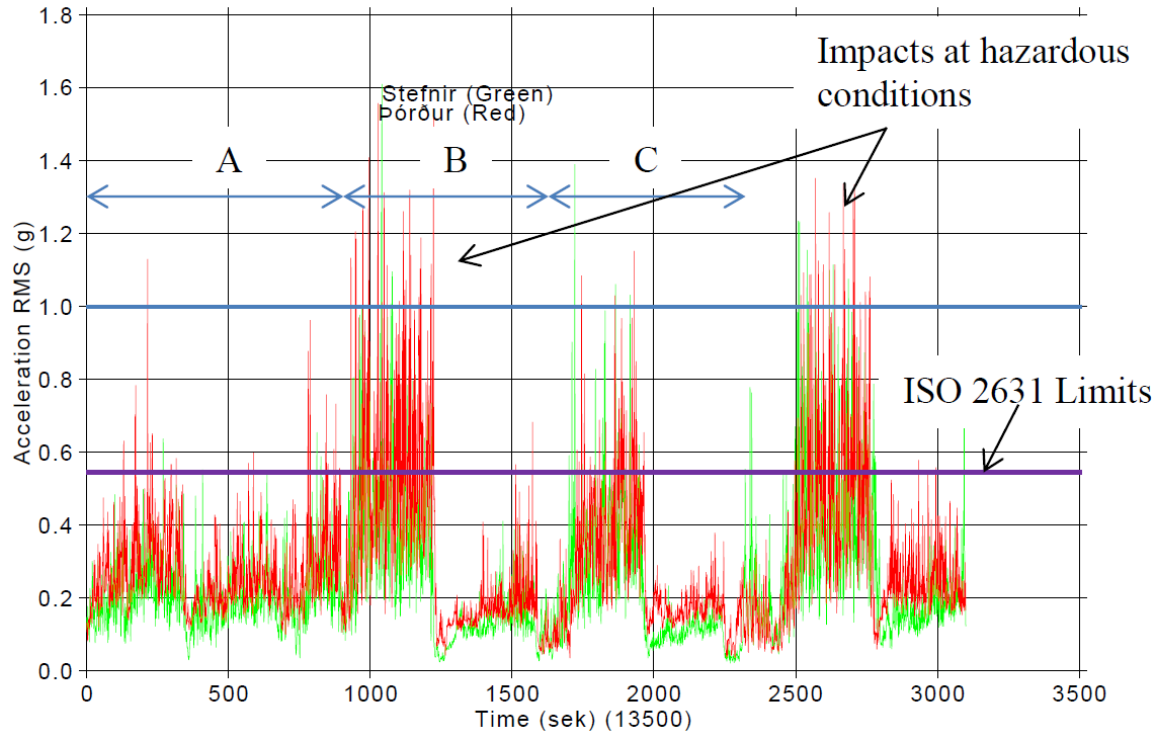
Boat speed

Boat speed during the measurements.



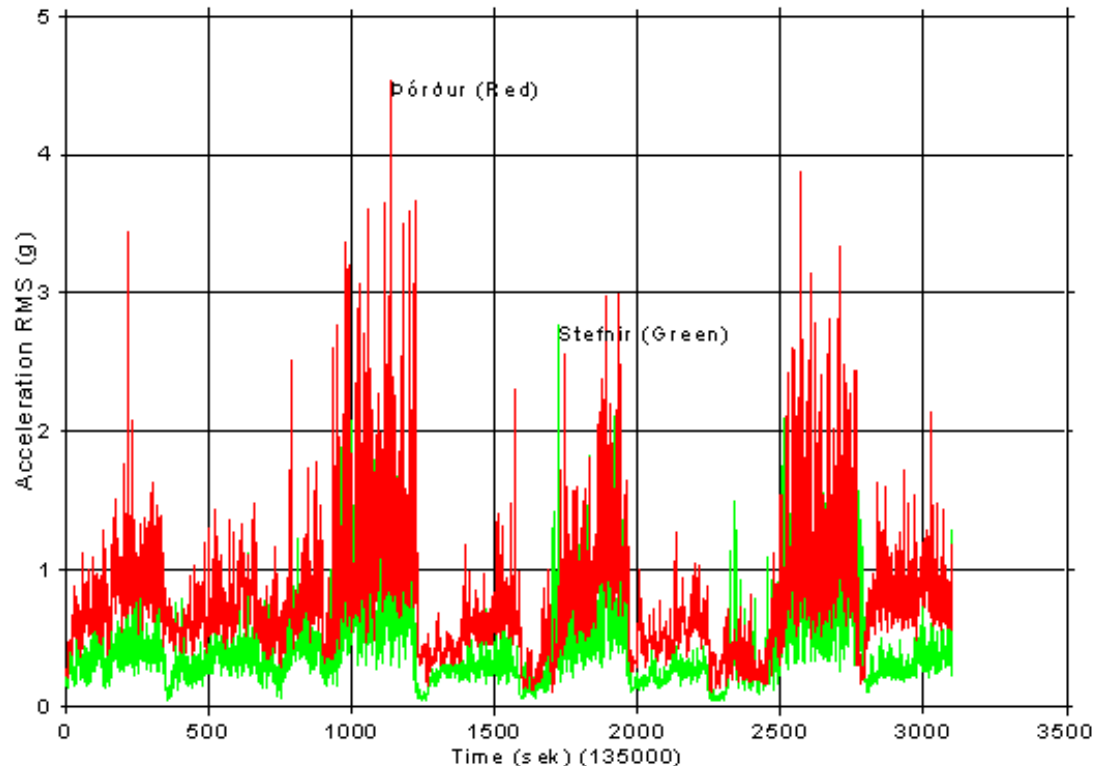
Overall RMS acceleration at the cockpit

Root Mean Square of combined xyz acceleration in g at the cockpit location for both boats.



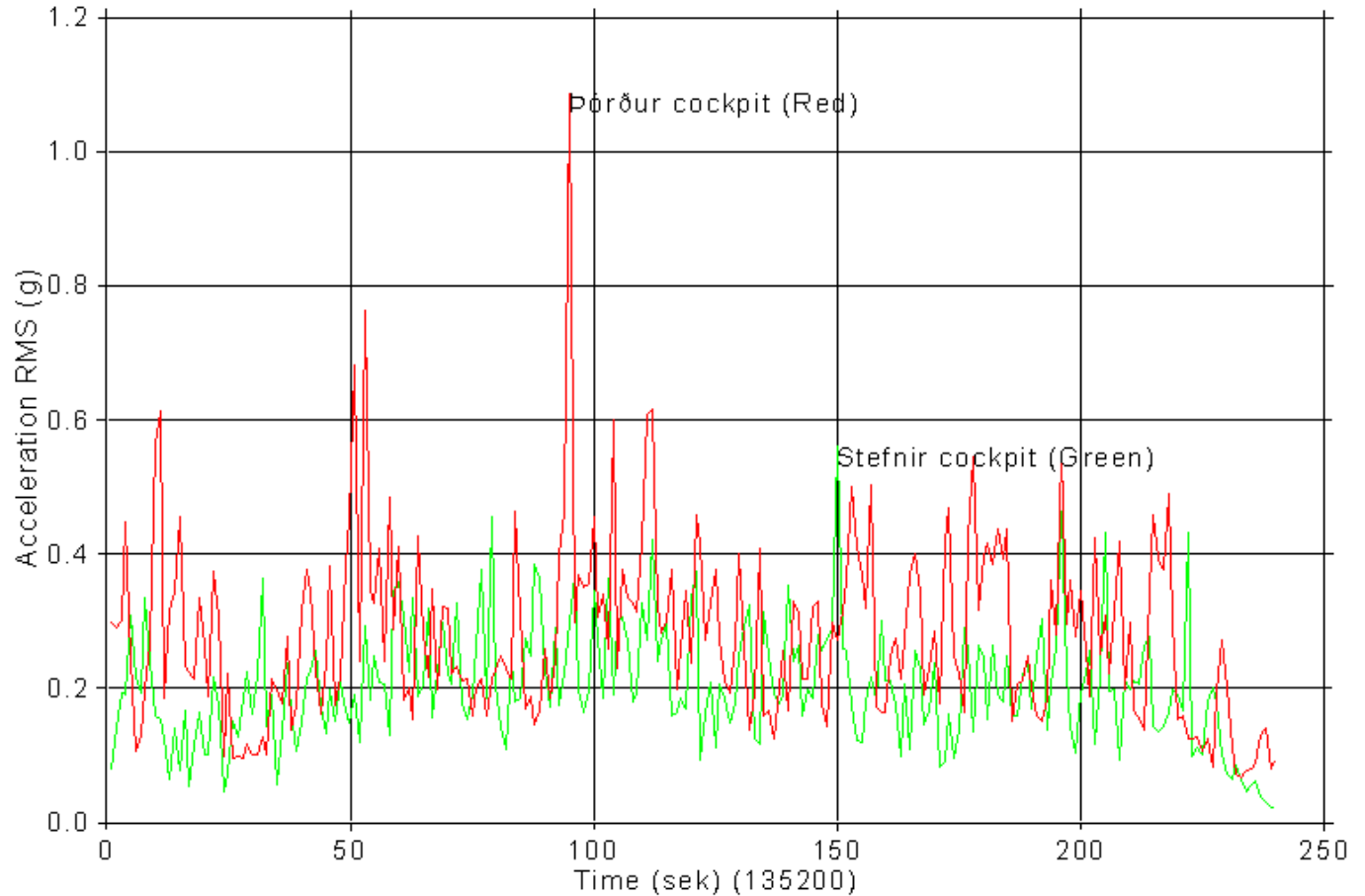
Overall RMS acceleration at the bow

Root Mean Square of combined xyz acceleration in g at the bow location for both boats.





RMS y acceleration (g) in the cockpit, sailing route A





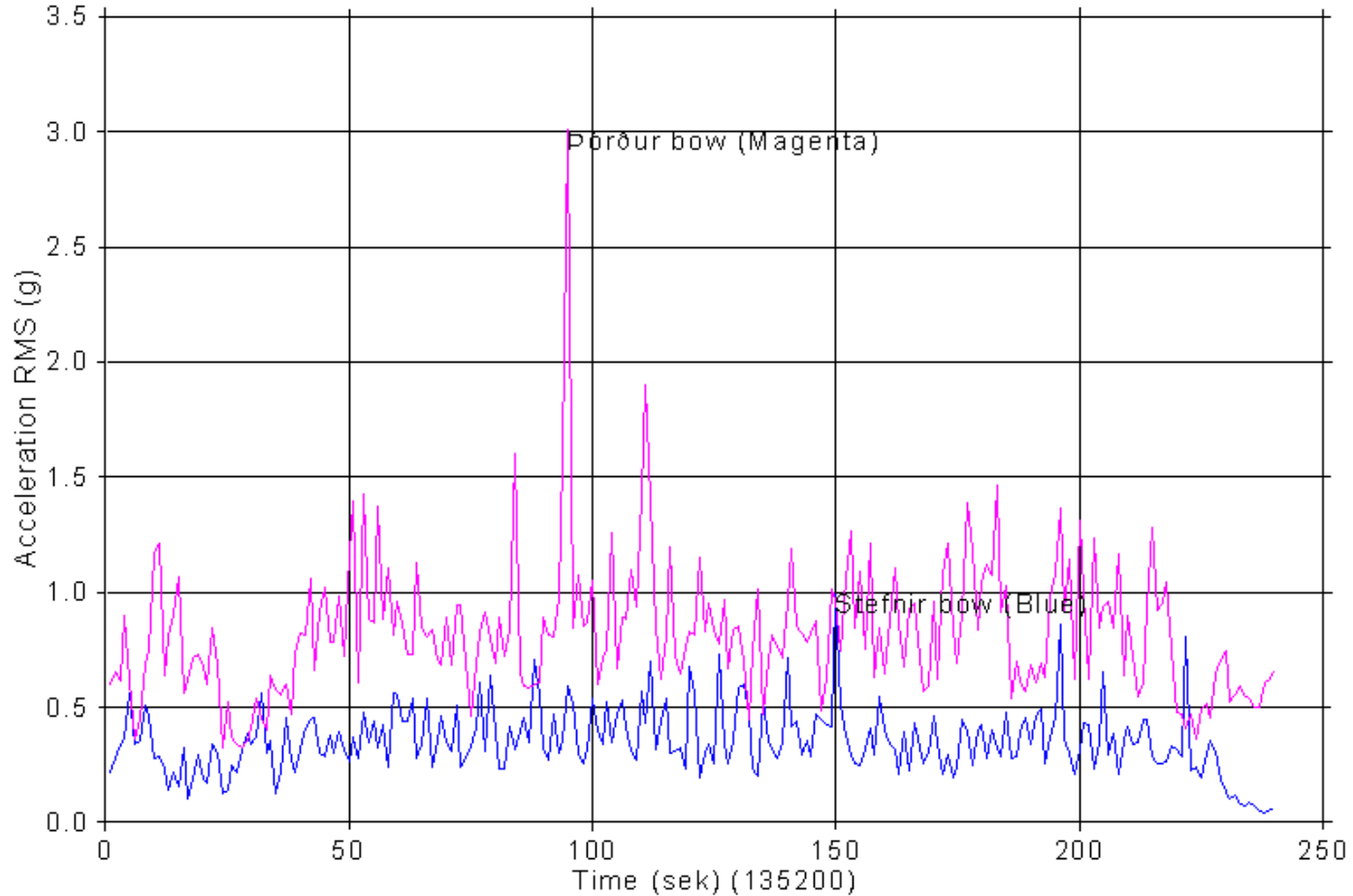
Results

The number of RMS acceleration amplitudes in y direction above the limits and the RMS mean value for each sailing route.

Sailing Route	Stefnir cockpit			Þórður cockpit		
	y RMS >0.57 g	y RMS > 1.00 g	y RMS mean	y RMS >0.57 g	y RMS > 1.00 g	y RMS mean
A	0	0	0.20	7	1	0.27
B	0	0	0.09	0	0	0.14
C	6	0	0.19	26	1	0.27



RMS y acceleration (g) at the bow, sailing route A





Results

The number of RMS acceleration amplitudes in y direction above the limits and the RMS mean value for each sailing route.

Sailing	Stefnir bow			Þórður bow		
	y RMS >0.57 g	y RMS > 1.00 g	y RMS mean	y RMS >0.57 g	y RMS > 1.00 g	y RMS mean
A	14	0	0.35	203	48	0.82
B	3	0	0.23	67	7	0.51
C	54	6	0.56	120	57	1.07



Summary:

In the cockpit the number of values of RMS acceleration in y direction above ISO 2631 (1997) 10 min limits or 0.57 g is 33 for Þórður but only 6 for Stefnir.

At the bow At the bow the number of impacts over 1 g is 112 for Þórður and only 6 for Stefnir.

When sailing against the wind and sea waves the mean value of RMS combined y acceleration is 35% - 121% higher at Þórður compared to Stefnir for different locations.



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