



Whole body vibration levels in Norwegian military helicopters according to levels defined by EU Vibration directive (2002/44/EC).

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Directive (2002/44/EC)

The exposure limit values and action values

1. The daily exposure limit value is standardized to an eight-hour reference period: **1,15 m/s²**.
2. The daily exposure action value is standardized to an eight-hour reference period: **0,5 m/s²**.

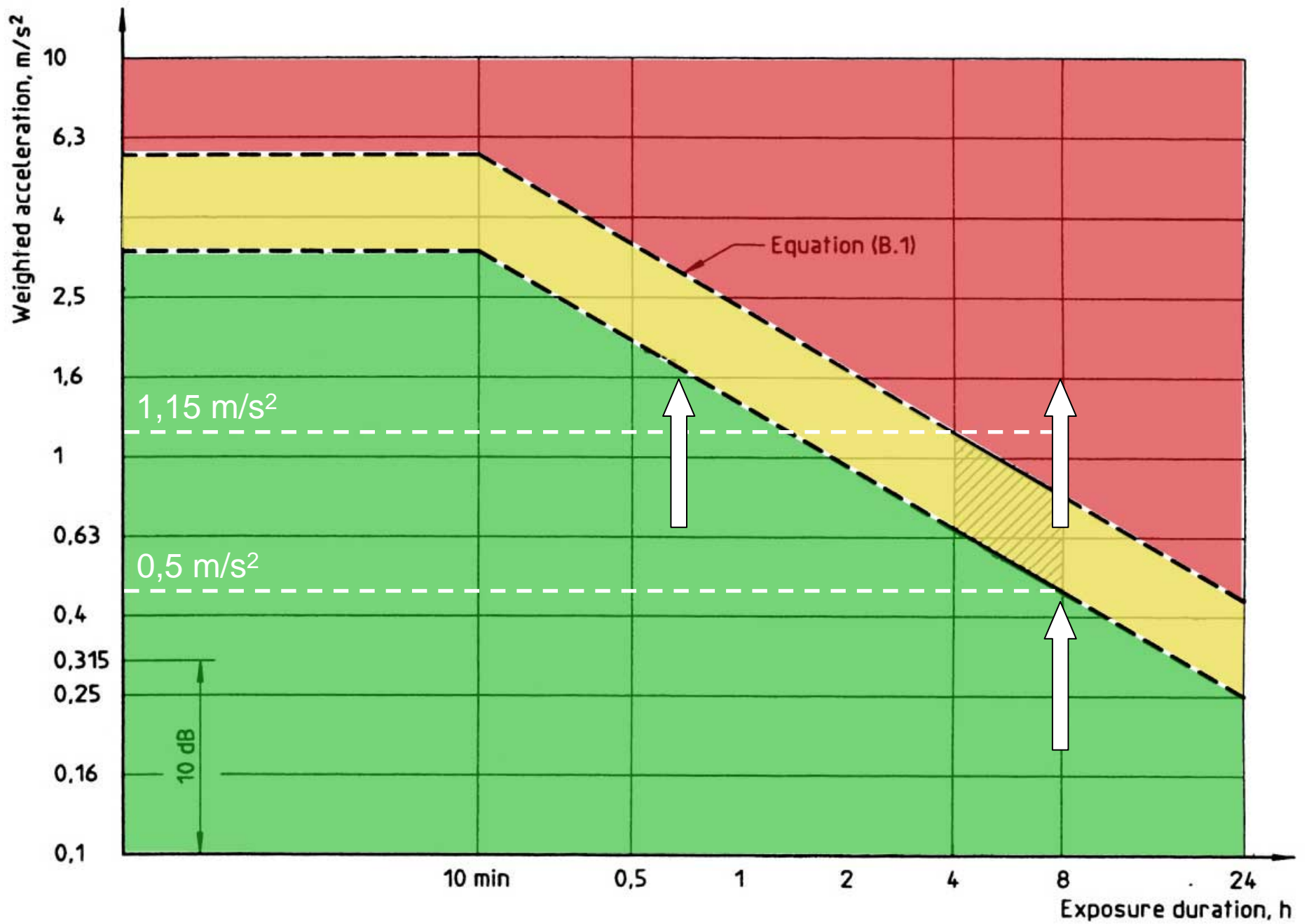


Figure B.1 — Health guidance caution zones (ISO 2631-1)

Method



Test pilot RNoAF



Bell 412SP



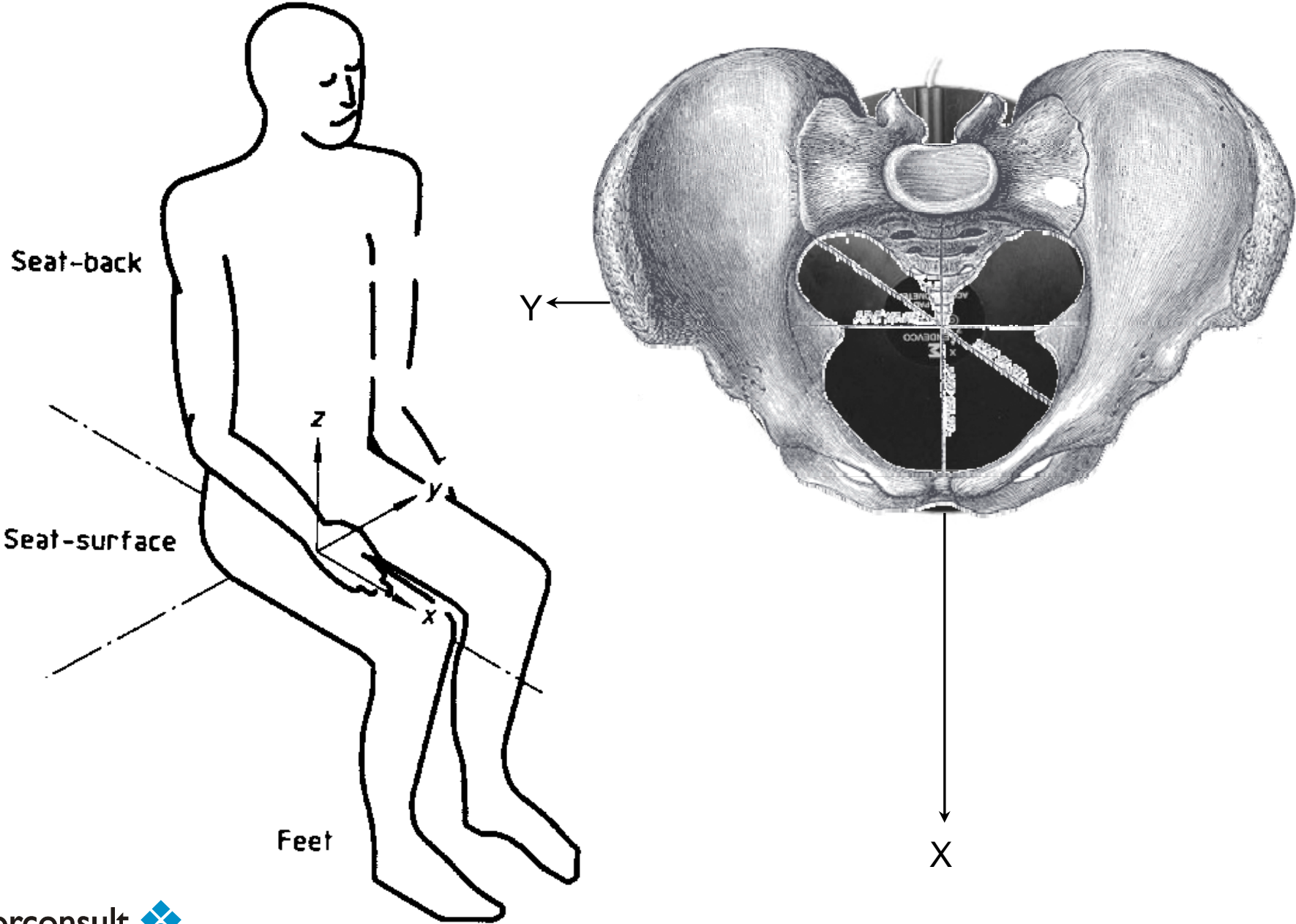
Westland
Sea King Mk43B



Westland
Sea Lynx Mk86



Method



Method

Whole body vibration measurements is according to ISO 2631-1 (1997)

Seat pad

Front end



Laptop with Pulse labshop 10.1 recording and analysis software from Brüel & Kjær.

Method

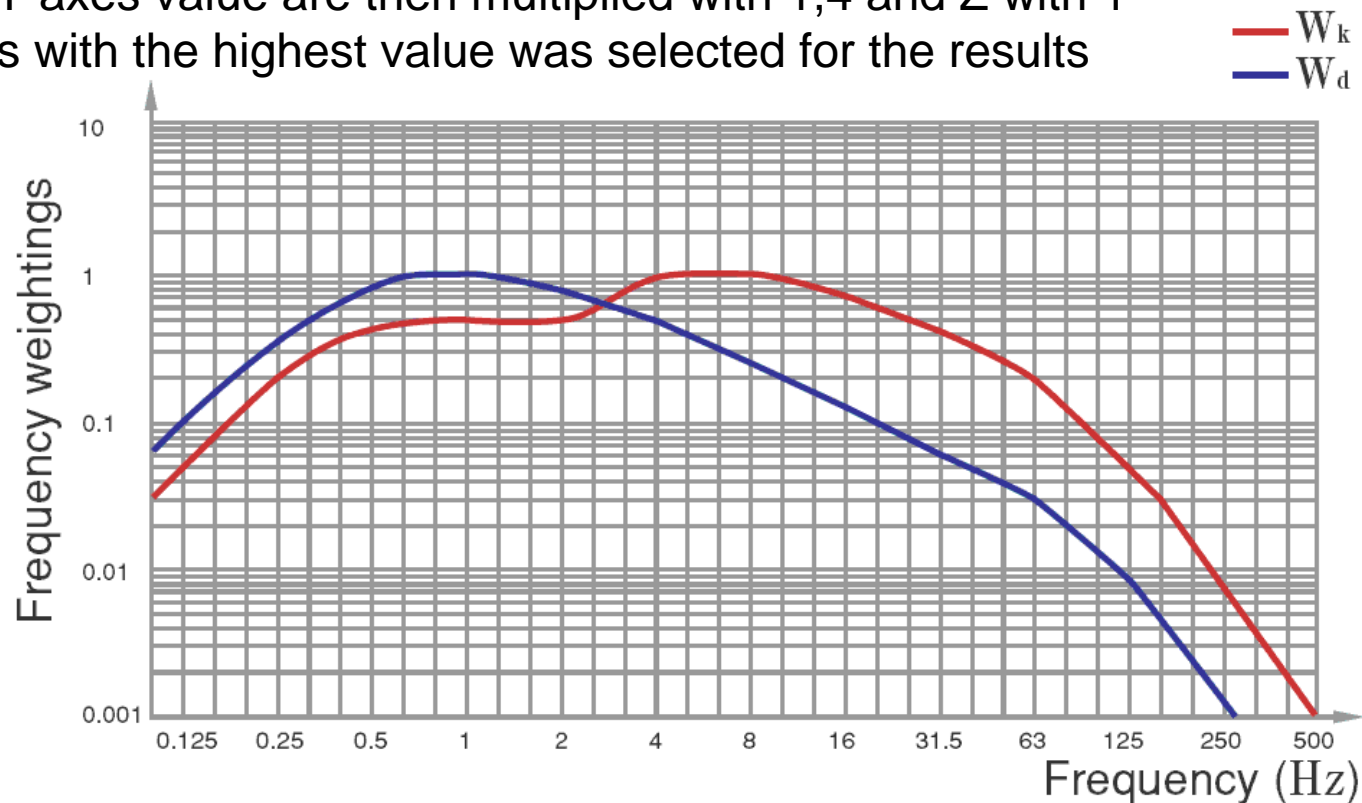
		Bell 412	Sea King MK43B	Sea Lynx Mk86
	Profile	Speed (kt)	Speed (kt)	Speed (kt)
1	Hoover in ground effects:10 feet	0	0	0
2	Hoover out of ground effects: 50 feet	0	0	0
3	Cruise slow speed	60	60	60
4	Cruise normal speed nr:100	120	100	120
5	Cruise normal speed nr:97	120	X	X
6	Climb 1000 feet/min	80	90	80
7	Cruise high level (2000 feet)	120	100	120
8	Descend 1000 feet/min	120	100	120
9	Max Speed (Vne)	140	120	140
10	Turn Left 20 °	120	100	120
11	Turn Left 30 °	120	100	120
12	Turn Left 45 °	100	70	100
13	Slow speed	30	30	30
14	Slow speed	40	40	40
15	Cruise-Hoover	70-0	70-0	70-0
16	Ground running	0	0	0

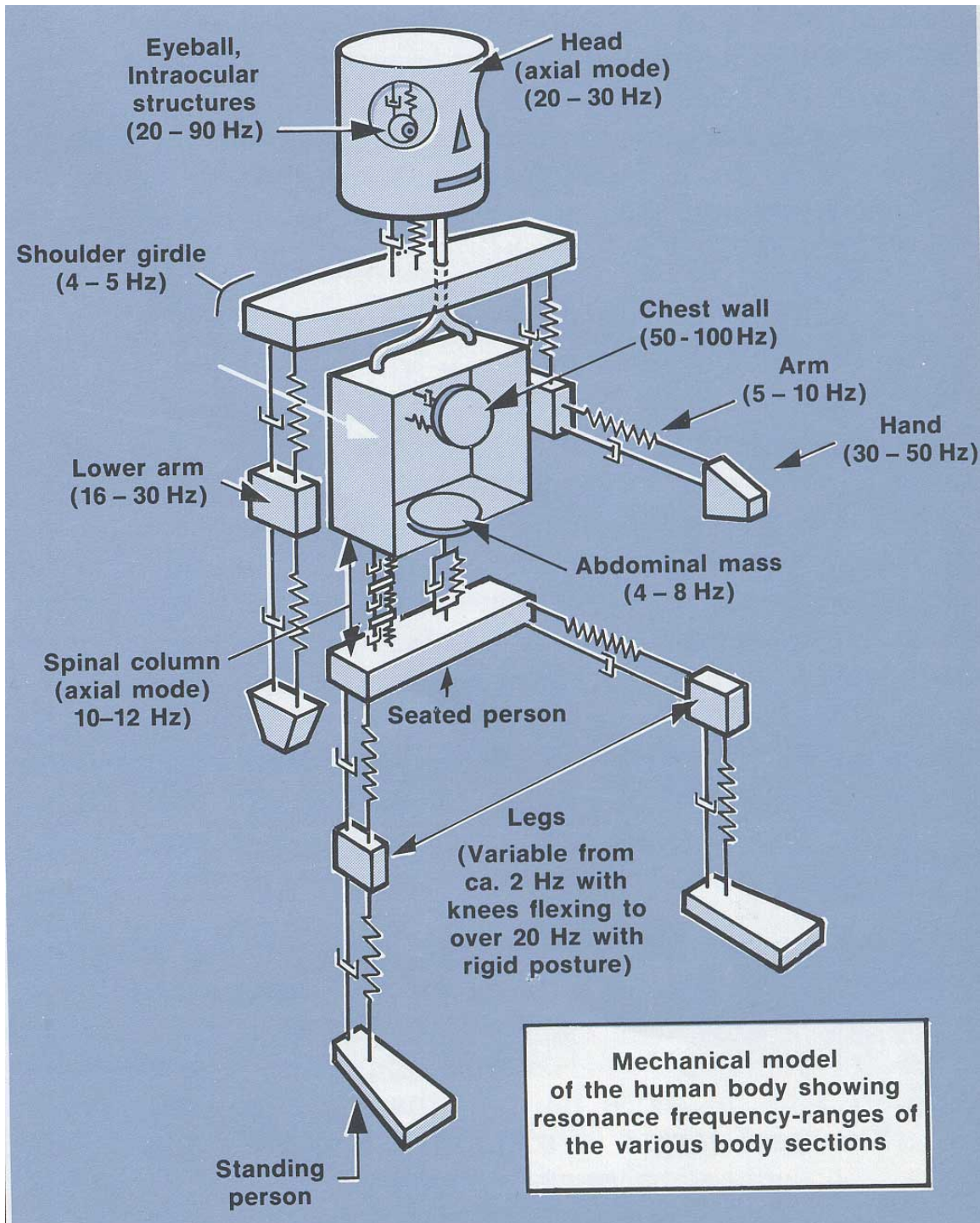
Method

ISO 2631-1: Mechanical vibration and shock – Evaluation of human exposure to whole – body vibration

- each profile was sampled for 60s in x, y and z axis
- measurement frequency range: 1 Hz – 500 Hz
- the frequencies were weighted:
 - W_d : X and Y direction
 - W_k : Z direction

- X and Y axes value are then multiplied with 1,4 and Z with 1
- the axis with the highest value was selected for the results



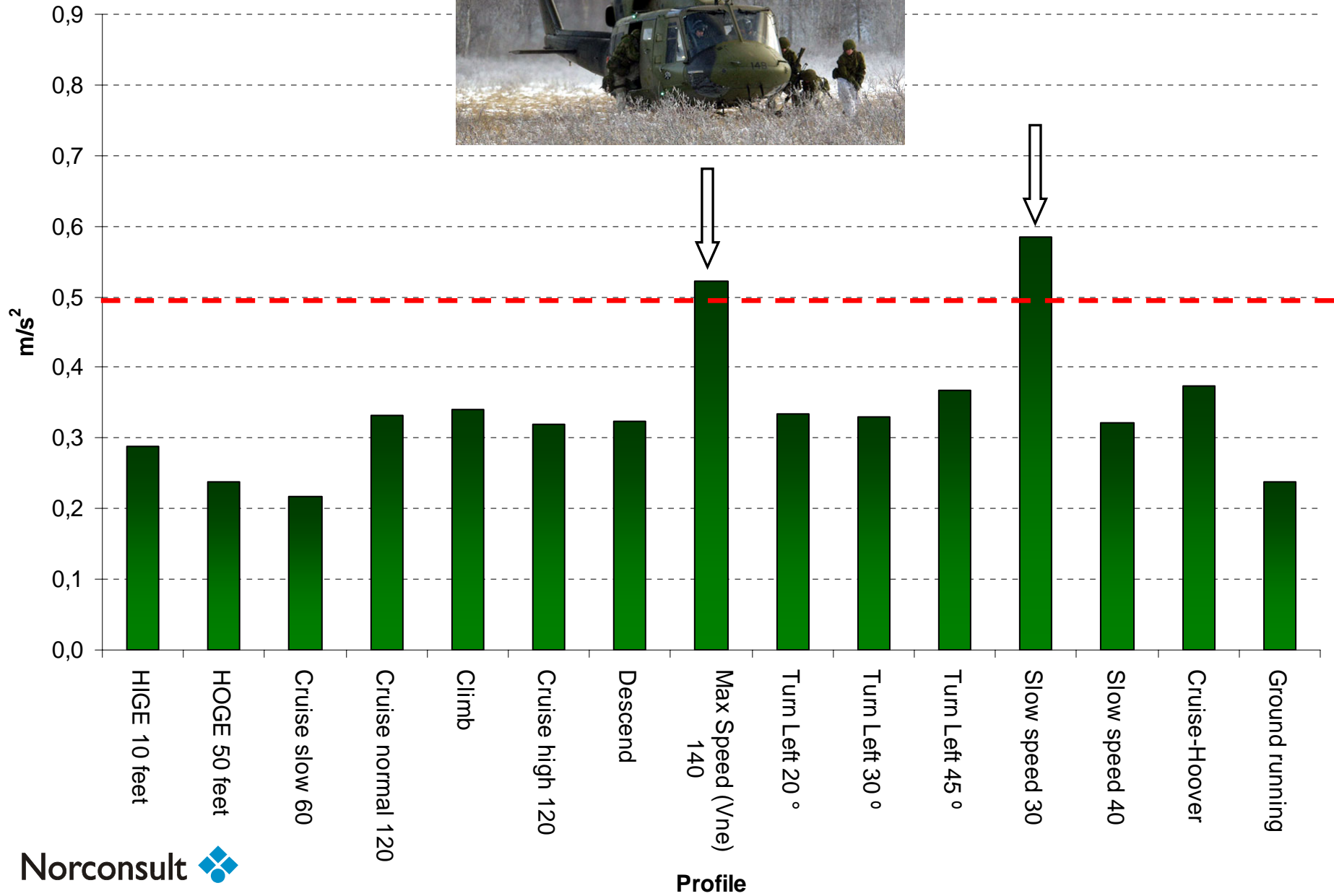


Results



Results

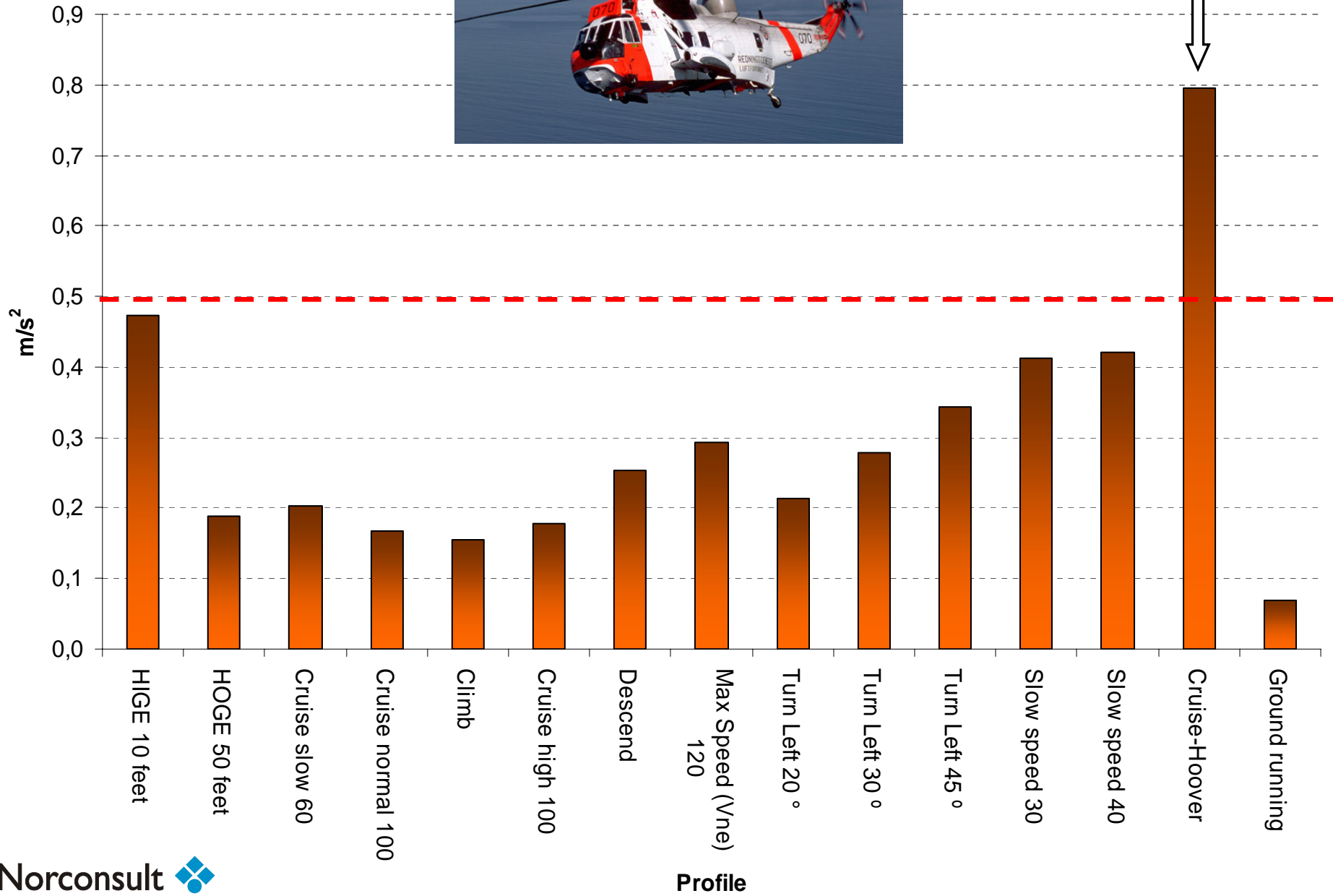
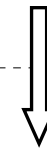
Bell 412



Results



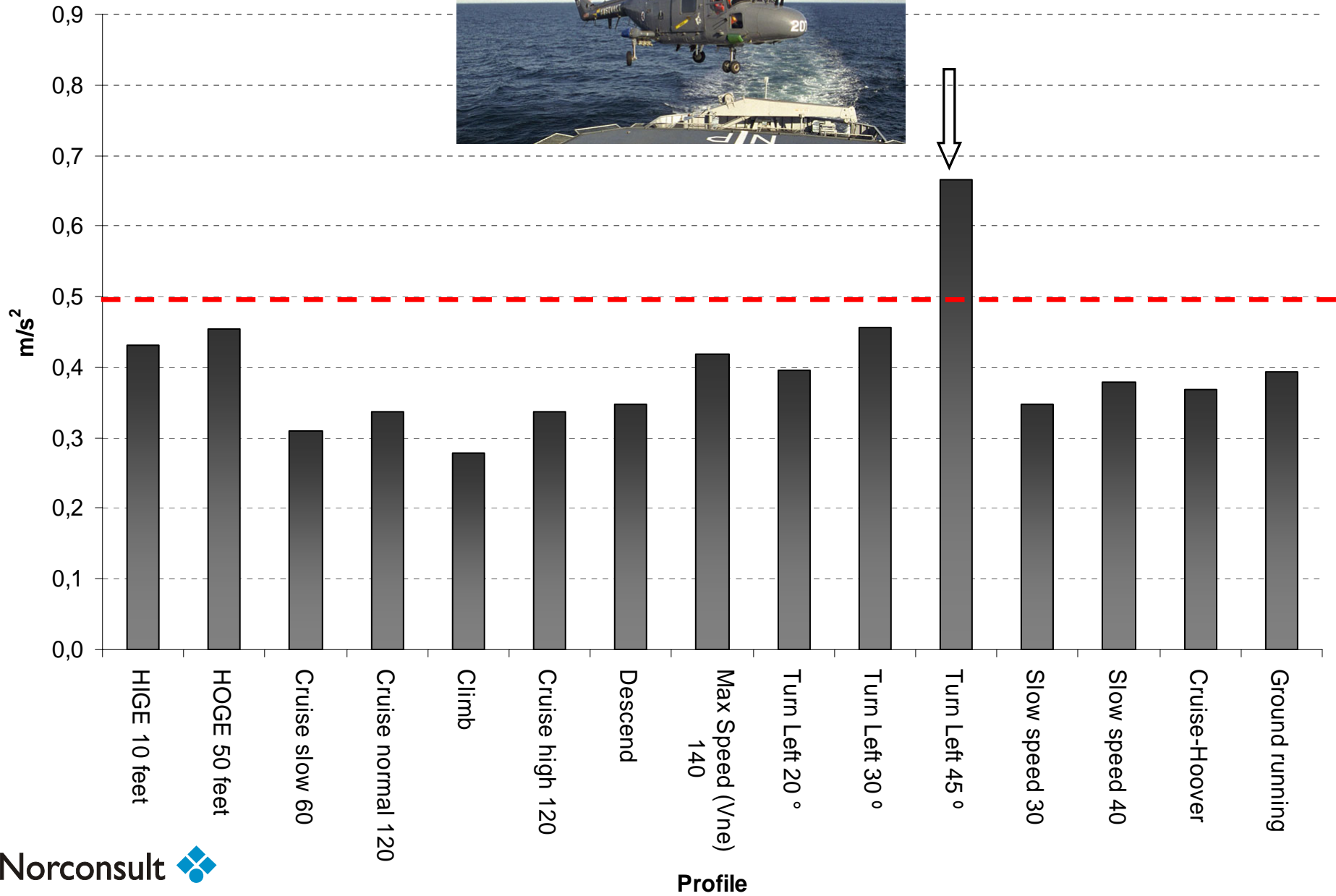
Sea King



Results



Lynx



Results

Daily exposure value: 8 hours (480 minutes)

		m/s ²						
	480	Data				Results		
Profil	Tid (min)	Bell	Sea King	Lynx		Bell	Sea King	Lynx
HIGE 10 feet	15	0,289	0,473	0,432		0,003	0,007	0,006
HOGE 50 feet	20	0,239	0,188	0,455		0,002	0,001	0,009
Cruise slow	40	0,217	0,203	0,311		0,004	0,003	0,008
Cruise normal	90	0,333	0,168	0,338		0,021	0,005	0,021
Climb	35	0,340	0,154	0,279		0,008	0,002	0,006
Cruise high	40	0,319	0,178	0,337		0,008	0,003	0,009
Descend	20	0,323	0,253	0,348		0,004	0,003	0,005
Max Speed (Vne)	35	0,523	0,292	0,419		0,020	0,006	0,013
Turn Left 20 °	35	0,335	0,214	0,395		0,008	0,003	0,011
Turn Left 30 °	10	0,330	0,278	0,456		0,002	0,002	0,004
Turn Left 45 °	30	0,368	0,344	0,665		0,008	0,007	0,028
Slow speed 30	10	0,584	0,412	0,348		0,007	0,004	0,003
Slow speed 40	30	0,321	0,421	0,379		0,006	0,011	0,009
Cruise-Hoover	40	0,373	0,795	0,369		0,012	0,053	0,011
Ground running	30	0,239	0,0697	0,394		0,004	0,000	0,010
TOTALT	480	minutes			(8 hours):	0,344	0,332	0,391
REST	0							
						m/s ²		

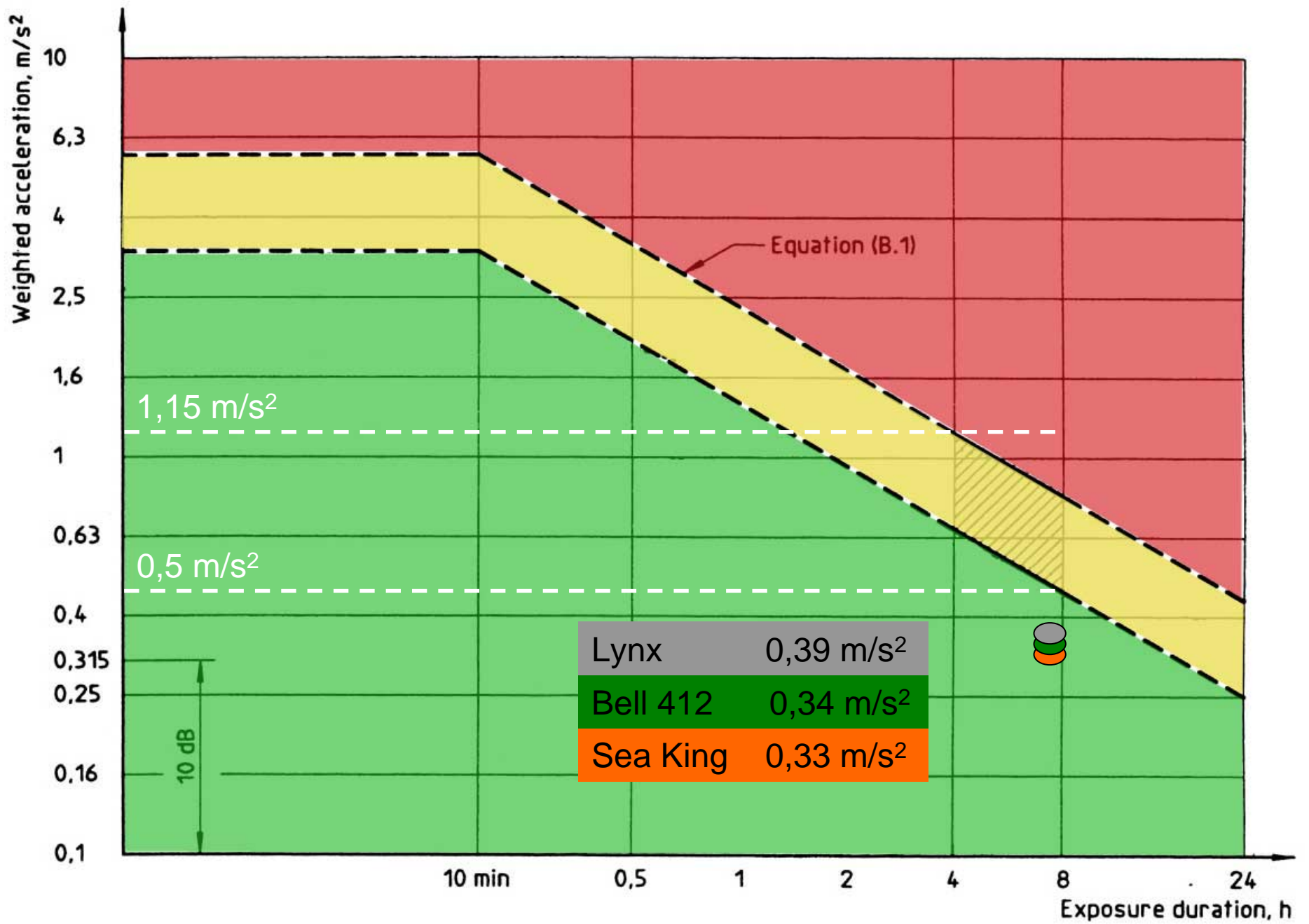


Figure B.1 — Health guidance caution zones

Conclusion

- The results show that military helicopters in the RNoAF have vibration values near the action level.
- In most normal operations pilot exposure will be below the level which is considered a risk to health.



Thank you for your attention!

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