

# Human Factors Research Unit

*At the University of Southampton*

# Human Factors Research Unit (HFRU)

- 3 Academic staff, 3 Research Fellows
- 15 PhDs, 3 technicians
- £0.5 m external funding (EU/UK Govt/Industry)



Investigating  
vibration effects  
using the vertical  
vibrator



Testing machine  
compartments  
on the motion  
simulator

# Our Facilities



# Six-axis Motion Simulator



- The motion system is designed for studies with humans and consists of a 3x2 metre table controlled by 6 hydraulic actuators.
- The unique simulator design allows reproduction of vehicle motion environments.
- The effects of vibration on motion perception, seating dynamics, biodynamic responses, and postural stability are investigated for seated, standing and walking subjects.

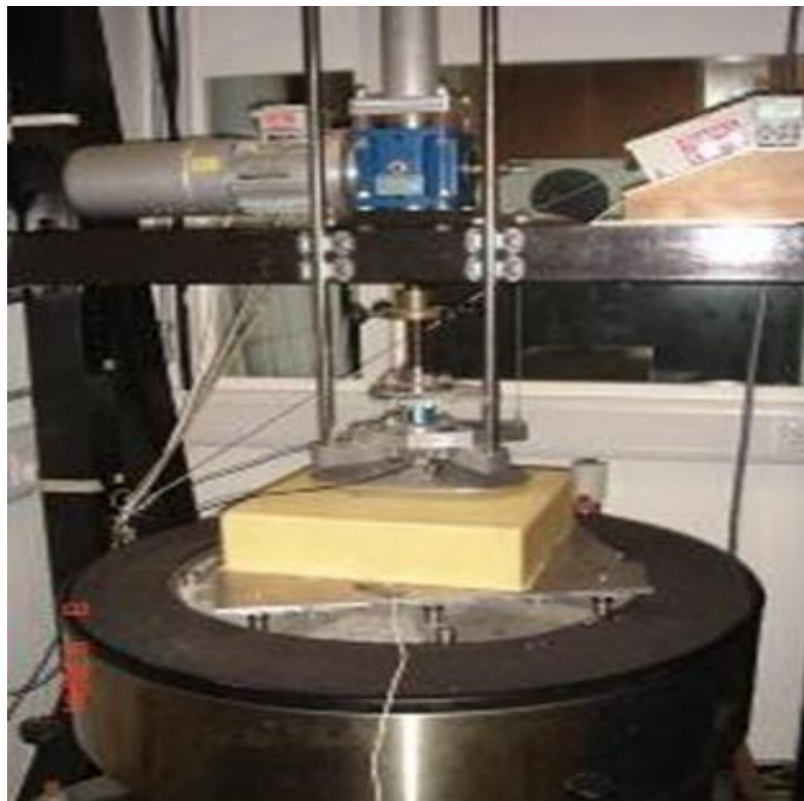
# Turntable

- The motor-driven turntable is capable of reproducing arbitrary continuous or oscillatory yaw motions.
- A human may be positioned on the test rig at various positions relative to the centre of rotation.

# 1-m Horizontal Vibrator

- This vibrator provides horizontal motion for studies with human subjects.
- It is used for fundamental and applied research in areas including human perception of vibration, postural stability, human body impedance, seat performance, and motion sickness.

# Indenter Rig



- The indenter rig is used for measuring the dynamic stiffness of seat cushions and dynamic characteristics of suspension seat components.



# 1-m Vertical Vibrator

- This single-axis human-rated electro-hydraulic vibrator provides vertical motion for studies with human subjects.
- It is used for testing seats for cars, trucks, off-road machinery, rail vehicles, marine craft and aerospace environments according to current standards or the specific requirements of the customer.



# 12m Tilting and Translating Cabin



- This test rig is used for research into motion sickness, discomfort and postural instability caused by low-frequency motions.



# Treadmill

- The treadmill is used for fundamental research into gait analysis and postural stability.
- It is used to provide a walking task for subjects exposed to whole-body vibration.

# Electrodynamical Shakers



- The laboratory has a range of electrodynamic vibrators with varying displacements up to 50 mm.
- Smaller vibrators are suitable for hand-arm vibration studies while the larger vibrators are capable of supporting a person while applying a vibration.

# Research and Enterprise

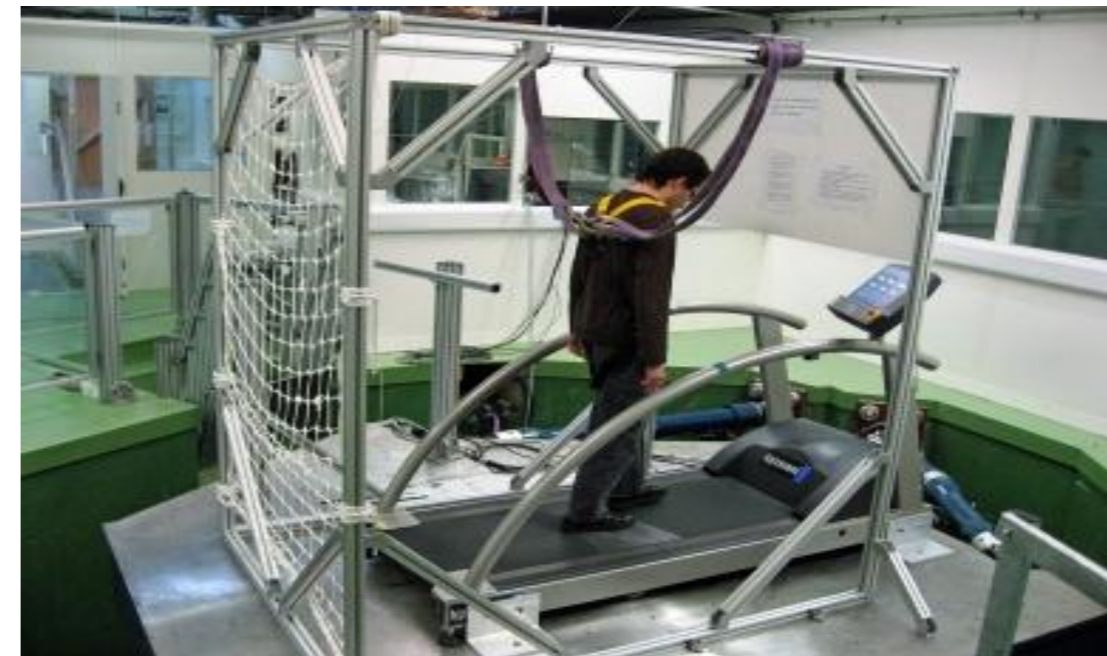


# Technical activities

## Subjective responses to vibration

- Understand factors affecting frequency-weightings for whole-body vibration (e.g. sitting posture and nonlinearity).
- Advance understanding of discomfort caused by combined horizontal and rotational vibration (e.g. roll and lateral acceleration).

Understanding whole body motion with use of the treadmill



# Technical activities

- Advance understanding of tactile perception of vibration.
- Predict motion sickness in land transport.
- Predict discomfort from combined noise and vibration.
- Predict the discomfort and postural stability of standing and walking people exposed to motion in transport.

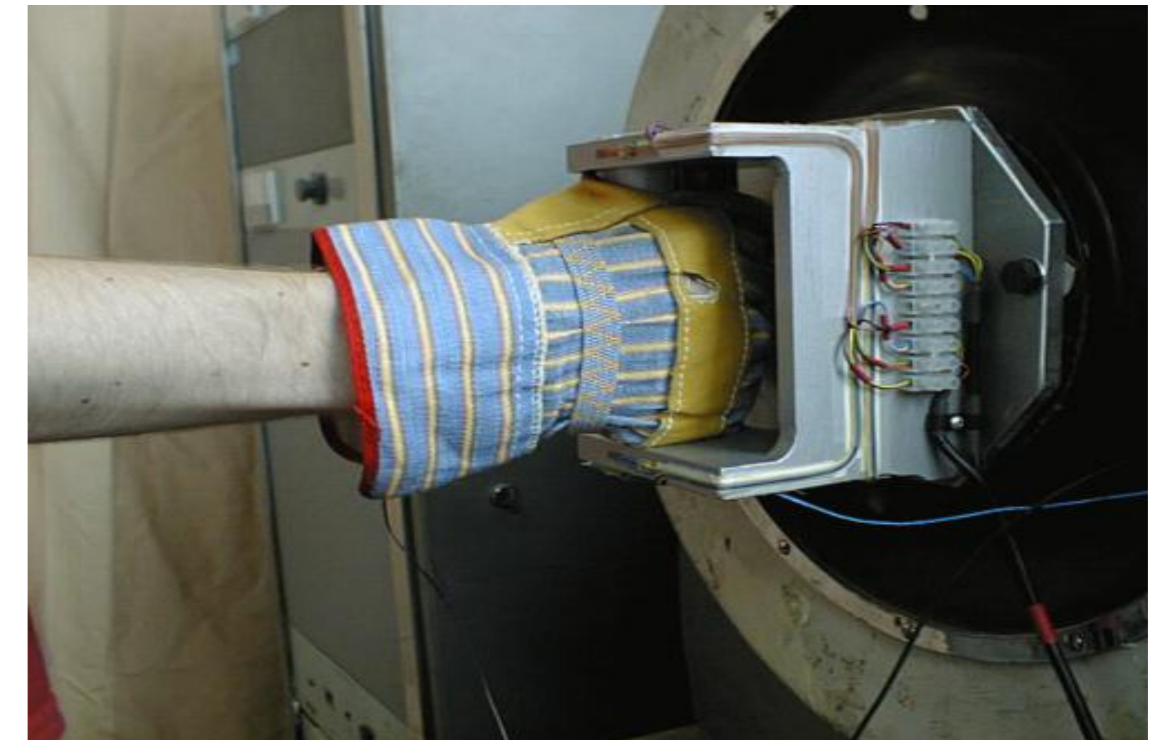
Research into the effects of motion exposure using the motion simulator



# Technical activities

## Biodynamic responses to vibration

- Measure and model the apparent mass and transmissibility of the body with multi-axis vibration excitation.
- Measure and model seat dynamics and interaction with body dynamics.
- Measure and model seat pressure distributions.
- Measure and model hand and glove dynamics.



Glove testing



# Technical activities

## Health effects of vibration

- Understand the mechanisms responsible for vascular changes induced by hand-transmitted vibration.
- Understand how to minimise the risks arising from exposure to whole-body vibration and shocks.



A case of hand-arm vibration disease.

# Technical activities

## Health effects of vibration

- Develop and support *HVLab* diagnostic equipment for assessing the hand-arm vibration syndrome.
- Tests are conducted by experienced staff and involve the determination of thermotactile perception threshold and the measurement of finger re-warming times.



Diagnostic equipment developed by Human Factors Research Unit

# Links to Transport Industry

- Vibration induced by motor vehicles, trains, boats and aircraft can cause discomfort and motion sickness.
- HFRU completes research on behalf of international companies serving the transport industry, to test seats and vehicle compartments for their impact on human comfort levels.