

# The Advantages of Motion for Cabin Emergency Evacuation Training

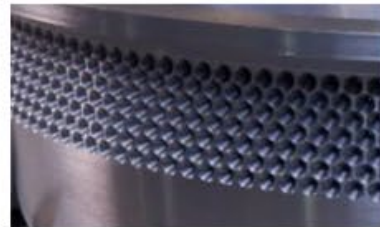
Rik de Swart

- Company Introduction
- Motion for CEET systems
- Motion Perception
- Safety
- Environment
- Experiences from Users
- Round up



- Van Halteren Technologies Group
- Family owned company – circa 650 employees

HAPAM	Van Halteren Metaal	Van Halteren Defence	Van Halteren Naval Technologies	Van Halteren Technologies Boxtel
High voltage disconnectors	Advanced heavy machining	Road wheels	AC / NBC systems	Drive and control technology
Earthing switches	Certified construction work	Simulation & training	Water chillers	Large Projects and Specialized Services
Facilities in the Netherlands, Poland, India	Assembly, measuring	Land systems	Other cooling systems	Systems Engineering and Machining
Plant in Vietnam	Projectmanagement, Engineering	Power packs, ECS	HVAC systems	Cylinder Plant, jobbing activities



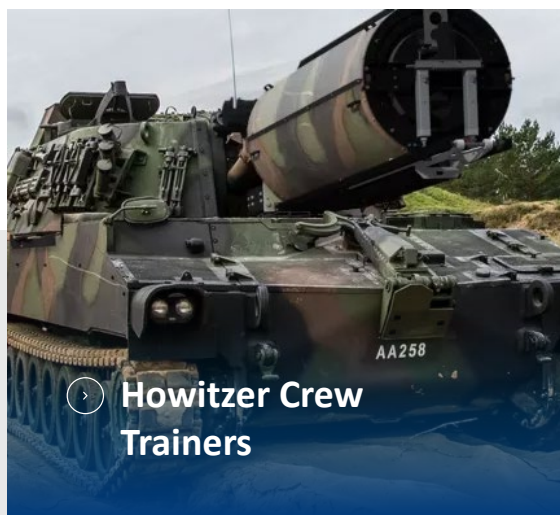


- Transition to Van Halteren Technologies Boxtel
- A new beginning! .... June 2022
- Acquisition of Van Halteren Technologies Boxtel, formerly the Business Unit Large Projects of Bosch Rexroth
- Drive and control technology for projects, systems, large cylinders. Turn-key projects including services





## Products



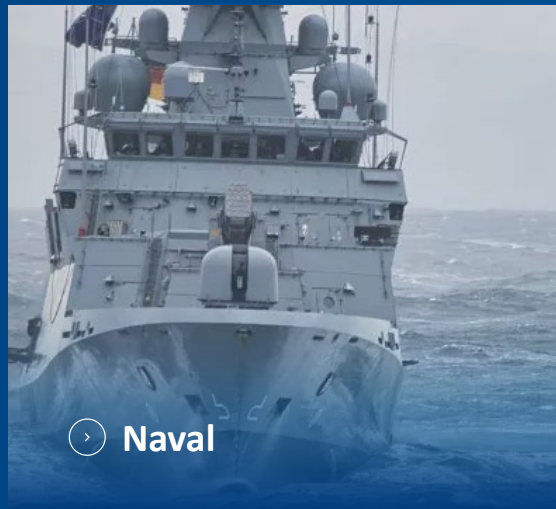




## Projects



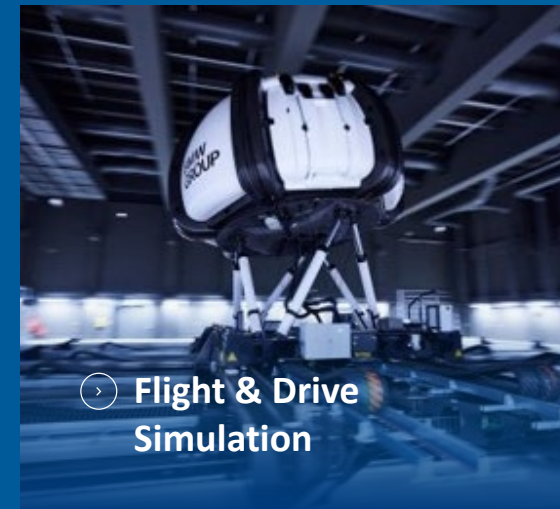
➤ Defence



➤ Naval



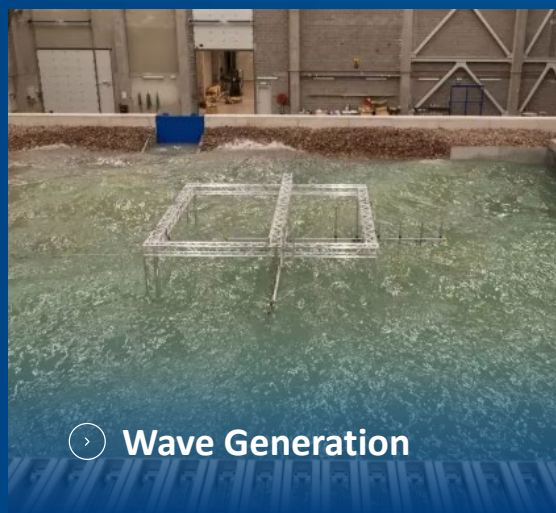
➤ Offshore & Marine



➤ Flight & Drive Simulation



➤ Civil Engineering & Infrastructure



➤ Wave Generation



➤ Power Management



➤ Hydrogen Compression

# VHT Motion Simulation Technology

Location → Part of VHT Netherlands in Boxtel (between Eindhoven and Den Bosch)



History → Formerly known as Hydraudyne (founded 1954)  
→ Started in 1986 with 6DOF systems  
→ Sold over 500 motion systems worldwide



2001 → Part of the VHT group  
VHT Boxtel: 250 employees  
VHT Motion: 20 employees



Technologies  
VHT NL → Civil Projects  
→ Large Hydraulic Cylinders  
→ Marine & Offshore  
→ Specialized Services  
→ Motion Simulation Technology





## 1986 – NLR, Netherlands: 6DOF, Hydraulic 8000 kg





## 1996 – KMW/ DB, Germany – 6DOF, Electric, 2500 kg

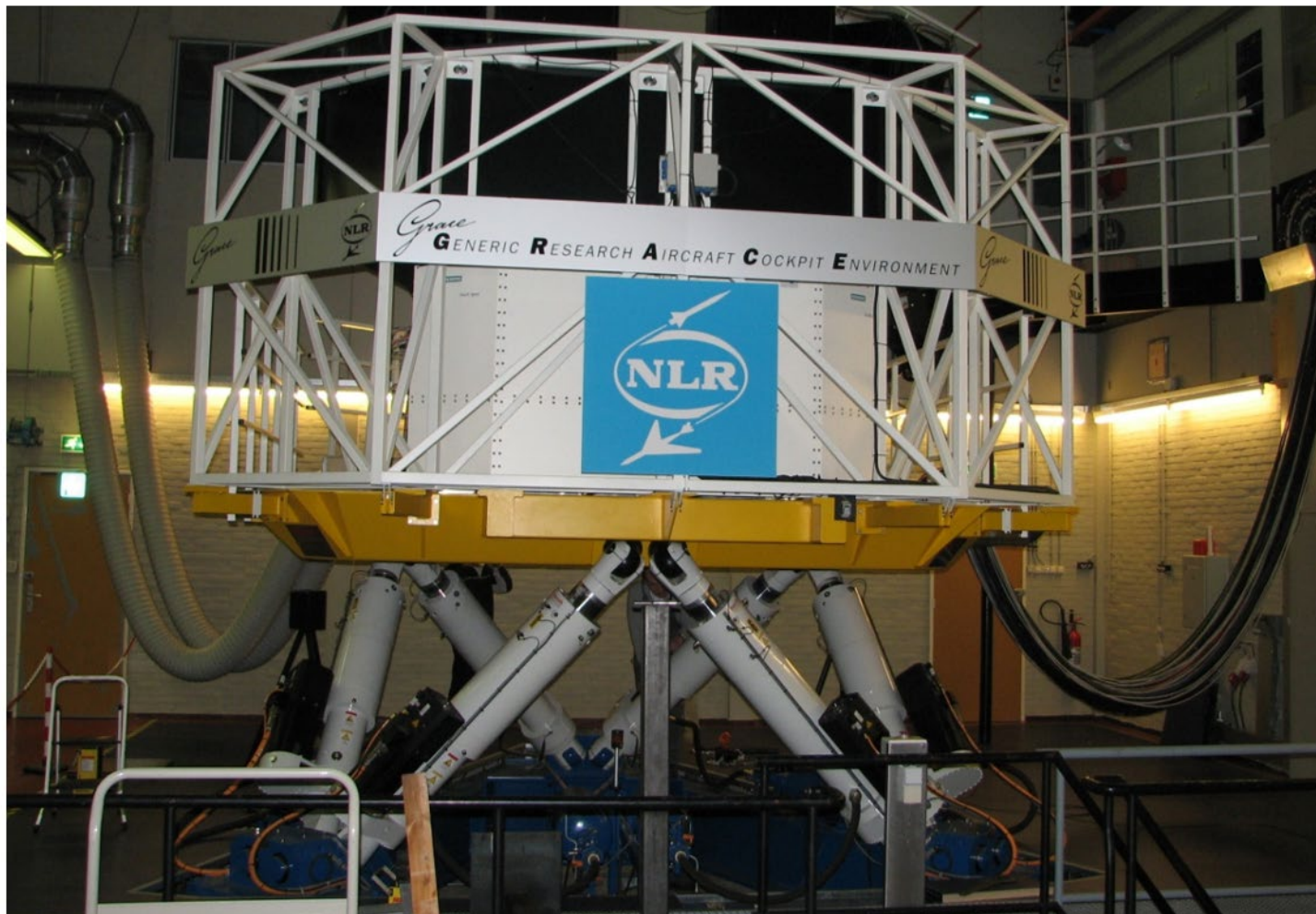


## 1999 – Lufthansa, CMotion-16500 + 17000 + 33000





## 2005 – NLR, Netherlands: 6DOF, Electric 12.500 kg



## 2007 – Opinicus, USA: 6DOF, Electric 8.000 kg





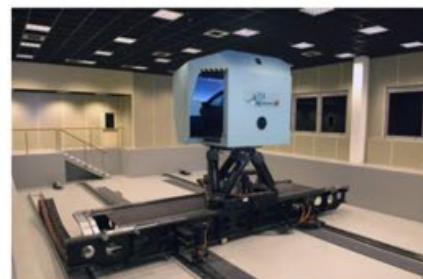
## 2003> – Motion Systems for Advanced Driving Simulators



2003: Renault, France – Advanced Driving Simulator, 1000 kg



2005: University of Leeds, UK – Advanced Driving Simulator, 2500 kg



2007: PSA, France – Advanced Driving Simulator, 1000 kg



2010: VTI, Sweden – Advanced Driving Simulator, 2500 kg



2011: Tongji University, China – Advanced Driving Simulator, 2500 kg



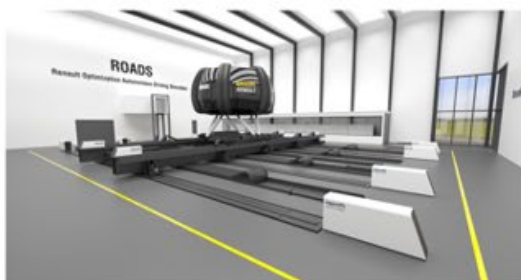
2012: RIOH, China – Advanced Driving Simulator, 4000 kg



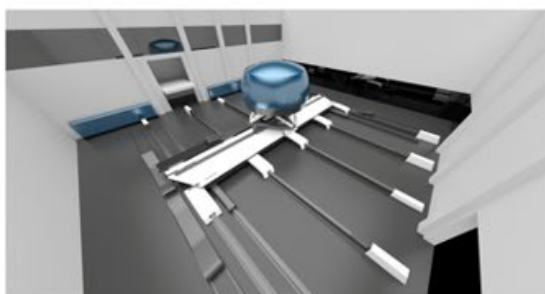
2013: FKFS, Germany – Advanced Driving Simulator, 4000 kg



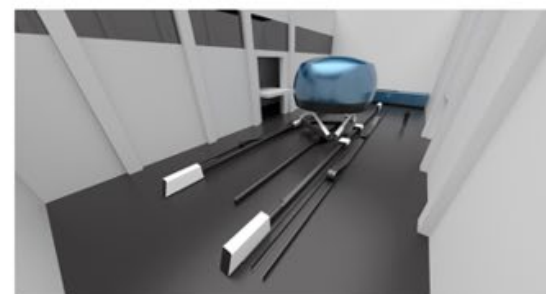
2018: EX, Korea – Advanced Driving Simulator, 6000 kg



2019: Renault, France – Advanced Driving Simulator, 6000 kg



2020: BMW, Germany – Advanced Driving Simulator, 6000 kg



2020: BMW, Germany – Advanced Driving Simulator, 6000 kg

## 6DOF, Electric, 1500/2700 kg





## FFS Level D 6DOF Electric, 9500/ 14000 kg MK2



## Motion for CEET systems





## Motion for CEET systems



- Improve the realism for Cabin Trainers => realistic dynamic aircraft behavior
- Positioning systems not suitable => static positioning, dynamic motion cueing
- Hard landing or severe turbulence => cabin crew make decisions based on perception:
  - Visual cues
  - Audio cues
  - Motion cues
  - Sensory cues.

## Motion for CEET systems



- Human perception dominated by visual information => inhibited by darkness, smoke, limited representation => situational awareness from motion cues.
- In real situation instructor not available => cabin crew must be trained to create the awareness themselves.





- Cabin crew not part control loop as in pilot training => movement accuracy lower level.
- Research learned => three-degrees-of-freedom (3-DoF) motion system, adequate movements, full situational awareness:
  - Roll
  - Pitch
  - Heave



- Simulation scenarios:
  - Static crash positions:
    - Collapsed nose gear
    - A-symmetric main gear collapse
  - Dynamic cueing:
    - Push backs
    - Taxiing
    - Take-off, including runway rumble
    - Take off scenario's (engine flame-out, aborted take-off)
    - In-flight motion
    - Light, moderate and severe turbulence
    - Emergency decent
    - Emergency approach
    - Hard landings
    - Water landings, including floating motion
    - Nose gear collapse after hard landing
    - Main gear collapse after hard landing
    - Roll out at runway with flat tires





- Onboard Cabin Trainer, safety cabin crew ensured
- Cabin crew walk around cabin => motion cues, not cause cabin crew injuries
- Van Halteren Cabin Trainer Motion System safety features:
  - Roll-rate limited => no falling or sliding
  - Zero lateral excursions => no surge, sway or yaw => draws floor underneath from people, cause people to fall
  - Limited accelerations => 0.4g instead of 0.8g for pilot trainers
  - Safety in general => worst case failure conditions, still safe => power failure, smooth descend



- Motion Envelope:
  - Length cabin with 6-DoF (hexapod) => enormous motion envelope => much more facility space than 3-DoF motion system. 3-DoF can be placed close to walls.
- Slides:
  - Motion system friendly for slides. Slides always attached cabin, and touch the floor (see picture).
  - Because 3-DoF: no excursions in sway, surge and yaw => no damage to the slides, better lifetime.







- Total installed base since 1999:
  - 34 CEET Motion systems; 21 narrow body systems, 13 wide body systems
  - Major Airlines; like Lufthansa, Air France, Etihad, Emirates, Air China and KLM
  - Reliability is great, hardly any maintenance needed



## Round up



- Improve the realism for Cabin Trainers => realistic dynamic aircraft behavior
- Research learned => three-degrees-of-freedom (3-DoF) motion, system adequate movements, full situational awareness
- Three-degrees-of-freedom (3-DoF) motion, best solution for safety
- Three-degrees-of-freedom (3-DoF) motion, best solution for facility space, and slide preservation
- Van Halteren has a very large installed base, with highest reliability, and lowest maintenance





Thank you for your  
attention! Please  
contact me if you  
want to know more:

Contact us

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