

Deltares GeoCentrifuge

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Web site: <https://www.deltares.nl/en/research-facilities/geofacilities/geocentrifuge>

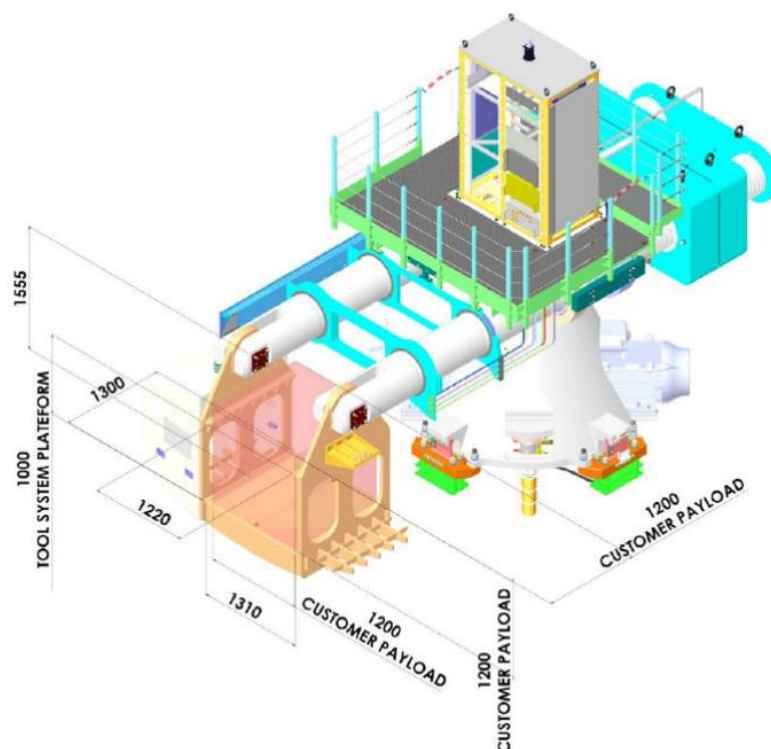
Owner: Deltares

Location: Delft, the Netherlands

Introduction

Operational since 2021, the GeoCentrifuge facility is an extension of the physical modelling capabilities of the Geo-Engineering unit at Deltares. The centrifuge is used for conducting cutting-edge research on many facades of geotechnical/civil engineering such as energy infrastructures, flood defences, and mitigation of geo-hazards. The facility is also providing its capabilities of emerging technologies within the offshore wind market to investigate the proof of concept and design aspects of innovative foundation solutions.

The centrifuge itself amasses a platform radius of 5 meters with a payload capacity of 260g-tonne and in the maximum load configuration, the rotational speed achieved is 340 km/h with a rotational speed of 3 revolutions per second. Deltares GeoCentrifuge is fitted with a suite of high-end data logger systems and a wide array of sensors. Beyond the conventional instrumentation capabilities, the high-resolution camera systems with high-definition (resolution of 31 MP) and high-speed (2 MP at 2500 fps) video recording capabilities are also available on board the centrifuge basket. Beyond the advanced monitoring and instrumentation systems, a 4D robot can be used for in-flight manipulation of models. The 4D robot (Actidyn Controlled Tool System or 4-D ACTS) itself is also fitted with advanced fiber optic instruments and other bespoke sensors and tools such as CPT probes.



The Deltares GeoCentrifuge schematics with basic dimensions.

Key Technical Specifications

Beam Centrifuge	
Manufacturer	Actidyn; Model: C72-3
Year established	2021; Deltares, Delft
Radius to base of soil container	5 m
Capacity	260 g-tonne
Bucket area and height	1.2 m x 1.2 m with a 1.8 m height
Major equipment	4DOF Robotic loading system

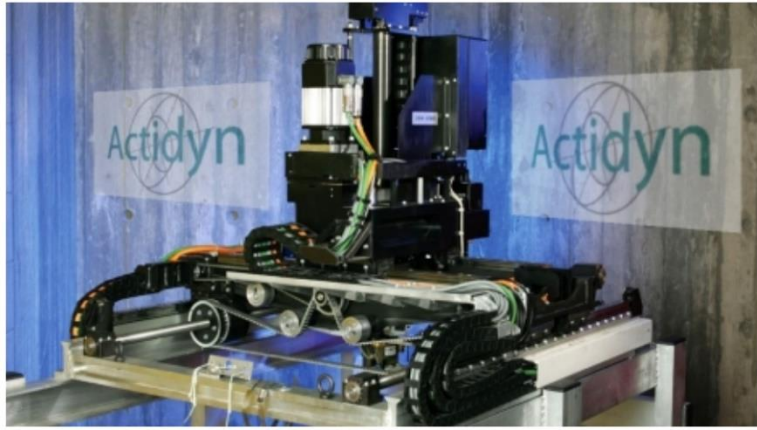
The centrifuge is equipped with two test control systems which are designed to perform any remote action that could be needed during centrifuge experiments. The system is completely designed and built by Deltares and uses CompactRIO hardware and software from National Instruments as heart of the system. The CompactRIO system consists of a controller with a processor and user-programmable FPGA (field programmable gate array) that is equipped with conditioned I/O modules. These modules provide a wide range of functions and come in a rugged industrial form suitable for use in harsh environments.



Deltares GeoCentrifuge, Actidyn - Model: C72-3

The centrifuge data acquisition system consists of HBM QuantumX modules in combination with CatMan AP software. Furthermore, four 4K color cameras and two high-speed color cameras have been added to the centrifuge equipment. The 4K cameras are manufactured by Flir Systems Inc. and are of the type ORYX 31Mpix with a resolution of 31 MP (megapixel) at 26 fps frame rate. These cameras can be monitored real time on the test control desk in the control room and the images are also stored for later analysis purposes. For high-speed applications, two cameras manufactured by AOS Technologies AG of the type L-VIT 2500 are available to capture images with a resolution of 2 MP at 2500 fps frame rate for a period of 4 s.

In addition to the in-flight hydraulic or electric actuation capabilities, 4-D ACTS (Actidyn Controlled Tool System) or 4 degree-of-freedom (DOF) robot is also available to answer advanced testing needs.



A photograph of the 4 DOF robot system capable of in-flight operation which is produced by Actidyn under the 4-D ACTS (Actidyn Controlled Tool System) designation