



Centrifuge Report

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2012 was a very busy year for the centrifuge team. Conleth O'Loughlin returned to COFS after a six year absence to take over the reins of centrifuge manager, relieving Christophe Gaudin after ten years of service in this role. Christophe is now focusing more on strategic developments for the centrifuge team, including the new 10 metre diameter centrifuge which is due for commissioning in early 2015 when the entire centrifuge facility and the support team will move to the new Indian Ocean Marine Research Centre currently under construction on the Crawley campus.



Figure 1: Architect's drawing of the new Indian Ocean Marine Research Centre – home of our new centrifuge

We were sorry to say goodbye to Don Herley who left COFS in 2012 after 24 years of service as our beam centrifuge operator. Manuel Palacios has stepped up to the plate to fill the huge hole left by Don's departure and has taken to his new role admirably. We were also sorry to say goodbye to Phil Hortin who has started a new business, although it seems that it is difficult to actually leave COFS, as Phil can often be found either in the centrifuge laboratory or at the O-Tube in Shenton Park. Guido Wager is our new recruit to the team and is doing an excellent job of taking over Phil's role as strain gauge technician.

After weathering the bearing changes in the beam centrifuge during 2011, we faced similar issues in the drum centrifuge when less than perfect T-bar data prompted drum centrifuge operator Bart Thompson to call a halt to operations and investigate the source of relative movement between the tool table and the drum channel. The need for exceptional system balancing and stiffness was revealed when less than one micron of relative movement between the channel and the tooltable caused 10 Newtons variation in T-bar resistance (about 10 kPa in undrained shear strength!). After much head scratching, a redesign of the main bearing to replace the existing spherical bearings with preloaded roller bearings, solved the problem. The result was a significant improvement to system stiffness leading to higher quality test data than ever before.



Figure 2: Installing the new preloaded roller bearing



Figure 3: Rebuilding the drum centrifuge after the bearing replacement

As ever, our success is reliant on the expertise of the technical team that support the facilities. We are looking to the future of physical modelling with work progressing on our actuation control (PACS) with improved hardware and software. These developments will allow greater flexibility as demand for more complex loading sequences in model tests increases. We are working towards using PACS to control all electric drive operations, from the actuators in the centrifuges and in the O-Tube, to electric drive consolidation frames and in our field-testing loading rig.

Other developments during 2012 include the use of MEMS (Micro-Electro Mechanical System) and piezo accelerometers to measure the deceleration of dynamically installed 'torpedo anchors' in centrifuge tests (more on this in the Industry links section) and a new pore pressure sensor which, if successful, may replace the no-longer available Druck PDCR81. The latter development is particularly important and affects physical modellers worldwide. We hope to be in a position to report positively on this in our 2013 report.



Figure 4: A prototype of the COFS new miniature pore pressure sensor

In recent years we have been extending our services to the international physical modelling community by providing advice on centrifuge design and operation, COFS built sensors and our digiDAQ data acquisition system. This year we had an unprecedented number of requests for model T-bars, CPTS, piezocones, piezoballs, load cells etc. to research centres including the US Army Corp of Engineers, National University of Singapore, Dalian University of Technology, Tongji University, Zhejiang University and Institute of Technology, Sligo. 2012 was also a very busy year for industry centrifuge projects as described in the Industry Links section of the report. We would like to take this opportunity to thank our industry clients for their support, including Advanced Geomechanics, TOTAL, Keppel, Delmar, ExxonMobil and Woodside. We look forward to further exciting projects during 2013 and in the years ahead.

