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A flexible and powerful shallow drilling winch even extended to a 4000 m logging winch

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Glaciological research requires winch systems to deploy drilling, logging and sampling equipment. The requirements in terms of pulling force, winding speed and electrical power and data transmission over the cable vary in a wide range. We started off from a shallow drilling winch design with 250 m of commonly used 5.66 mm 4-conductor cable. For the new design we aimed to increase the static pulling force as high as possible to more than 1000 daN, e.g. when breaking the core. The winding speed should vary from a fraction of 1 mm s-1, when penetrating, to more than 1 m s-1, when paying out or reeling in while moving the drill between the surface and the bottom of the hole. State-of-the-art EC motors offer the required dynamic range of more than 10 octaves. As the cable contributes a major fraction of the cross weight, we elaborated on a design with a pluggable drum to adapt to the actually required cable length for the target depth within minutes by switching drums that carry different cable length. The system performed as expected with maximal static pulling forces exceeding 1300 daN, winding speeds exceeding 1 m s-1 with moderate loads of about 200 daN and thus outperformed regularly used older winch designs with collector motors by a factor of more than three. For deployment of oceanic instruments we desired a system with at least 1000 m of single conductor oceanographic instrumentation cable with 3.12 mm cable. After changing the Lebus® sleeves we fitted 1200 m cable on the drum and tested the spool at moderate loads of up to 200 daN. For the deployment of a sediment corer under an ice-shelf 1200 m of cable with a maximal breaking load of more than 1300 daN was desired and we fitted a 3 mm Dyneema cable with a maximal break strength of 1500 daN, which performed as expected. The pulling force requirement for logging deep boreholes of up to 4000 m is only a few 100 daN and winding speeds are less than 0.5 m s-1. We increased the winch drum and the frame to fit 4000 m of the abovementioned oceanographic instrumentation cable. Initial problems with the Lebus® spool due to deforming drum flanks from Aluminium as we experienced during a first test we are confident to solve with stainless drum flanks and little modifications to the overall system. We will present the design and considerations that guided us along the process and conclude that we are surprised by the flexibility of the system and have a powerful winch system for drilling applications in the range of 100 kg cross-weight and a logging winch in the range of less than 350 kg, which is also by about 100 kg lighter than previously existing systems.

Primary authors: TELL, Jan; WILHELMS, Frank (Alfred-Wegener-Institute); HÜTHER, Matthias (Alfred-Wegener-Institut); Mr BROY, Benjamin (Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung); Mrs SCHIWEK, Svenja (Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung); Mr LEMBURG, Johannes (Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung); GONG, Da (Polar Research Center, Jilin University, China)

Presenter: TELL, Jan

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