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AURORA BOREALIS - Icebreaking Deep-Sea Drilling Platform and Multi-Purpose Research Vessel

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Future breakthroughs in scientific deep-sea drilling critically depend on our ability to perform field expeditions with state-of-the-art technologies and modern infrastructures. This will require major investments, both in terms of generating new, as well as maintaining and renovating existing infrastructure. Diverse models for science operations are presently projected, also within the context of scientific needs after the current phase of the IODP will come to an end. In spite of its critical role in global climate and tectonic evolution, the Arctic Ocean is one of the most unexplored ocean basins of the world, its geologic and paleo-environmental history remaining largely unknown. Restricted by circulating sea ice, scientific drilling has been slow to arrive in the Arctic Ocean. This lack of data remains and represents one of the largest gaps of information in modern Earth Science.

We here report on the finalised technical planning of a new European research icebreaker and deep-sea drilling vessel, the AURORA BOREALIS, designed with an all-season capability of endurance in permanently ice-covered waters. The icebreaker will be able to carry out deep-sea drilling in ice-covered deep-sea basins primarily during the more favorable summer seasons in order to fulfill the needs of the IODP or its eventual successor as a Mission-Specific Platform. AURORA BOREALIS will be the most advanced polar research vessel in the world with a multi-functional role of drilling in deep ocean basins and supporting climate and environmental research and decision support for stakeholder governments within the next 35-40 years. It will feature the highest attainable icebreaker classification, considerably surpassing in performance all currently operating research icebreakers.

New technological features to be implemented include a novel hull design and specialized dynamic positioning systems for operations under closed sea-ice cover conditions with up to 2.5 m ice thickness, combined with advanced ice-forecasting support. The vessel is planned to operate routinely without ice management support by additional icebreakers, thus reducing operational costs for scientific drilling in polar regions considerably. Two moon-pools (7x7 m each) will allow routine deployment of Remotely Operated Vehicles (ROV) and Autonomous Underwater Vehicles (AUV) in ice conditions. A dedicated deep-sea drilling rig with full weather protection will enable sampling of the ocean floor in water depths between 100 and 5000 m with more than 1000 m penetration under polar conditions.

The modular arrangement of science space with hangars, the possibility to flexibly equip the ship with laboratory or supply containers and with helicopters, addresses the needs of diverse disciplines in marine research. This icebreaker will allow to stage long international, interdisciplinary drilling expeditions in the central Arctic. In a long-term perspective, AURORA BOREALIS will also be used to address Antarctic research targets, both in its mode as a regular research and a scientific drilling vessel.