

## The Nereid Under Ice (NUI) Hybrid ROV

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### Abstract

The Nereid Under Ice (NUI) hybrid ROV is the latest in a family of vehicles derived from the Nereus prototype, using an unarmored optical fiber to provide real-time telemetry to and from a battery-powered vehicle allowing much greater lateral maneuverability relative to its support ship than a conventional ROV. During *Polarstern* cruise PS86 (July 2014), dives conducted in the Arctic Ocean (typical water depths ~4000 m) were completed in >80% ice cover beneath multi-year ice that was typically 2-4 m thick (increasing to depths of up to 20 m beneath ridges). Dives extended up to 800 m away from the ship and, over dive durations of approximately 5 hours each, covered survey tracklines of up to 3.7 km at depths varying from “landing” on the underside of the sea-ice to maximum depths of 45 m to conduct upward looking multibeam sonar mapping. Ultimately, the vehicle will be capable of both AUV and ROV mode operations at ranges of 10-20 km away from the support ship and at up to 2000 m water depth (including seafloor as well as under-ice operations). Four dives to evaluate and develop NUI’s overall functioning and its individual engineered subsystems were conducted during PS86. On each dive, dead-reckoning (Ice-locked Doppler sonar and north-seeking gyrocompass) complemented by acoustic ranging provided navigation, supporting closed-loop control of heading, depth, and XY position relative to the ice. Science operations included multibeam transects of under-ice topography, precision vertical profiles for the bio-sensor suite and IR/radiance sensor suite, IR/radiance/multibeam transects at constant depth interlaced with vertical profiles and upward-looking digital still-camera surveys of the ice, including areas rich with algal material. Sea ice optics data and multibeam from dive 004, which provided the under-ice complement to a surface transect including cores, was recently published in Katlein et al. (2015), JGR. Since PS86 the vehicle has achieved standoff distances of up to 5 km in shallow water (not under ice), and effort is on-going to integrate a seven-function electro-hydraulic manipulator arm (completion in April 2016). The presentation will describe the vehicle and provide an overview of recent science and operational trials, and potential future use cases. More information on NUI is available at <http://www.whoi.edu/main/nui>

Dr. Jakuba is a research engineer at the Woods Hole Oceanographic Institution (WHOI), and Joint Program alumnus (2007). His interests revolve around the development of underwater robotic systems in support of oceanographic science. His current projects include the development of a light-tethered ROV for under-ice telepresence (Nereid Under Ice) and the development of a vertical profiling vehicle capable of large volume in situ filtration and RNA preservation for “-omics” studies (Clio).