

## EBE02 – Faculty of Engineering and the Built Environment Master's IP Assessment Form

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**Contact:**  
 Ms René Carlse  
 Tel: (021) 650 5278  
 E-mail: Rene.Carlse@uct.ac.za

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Name	Jamie Nicholas Jacobson
Student number	JCBJAM007
E-mail address	<a href="mailto:Jamie.jaybay@gmail.com">Jamie.jaybay@gmail.com</a>
Telephone number	0214385669
Department and Faculty	Electrical Department, Engineering and the Built Environment
Dissertation title	SHARC Buoy: Firmware design for a Novel, Low-cost Autonomous Platform for the Antarctic Marginal Ice Zone in the Southern Ocean
Target hand-in date	11 <sup>th</sup> December 2020
Supervisor/s name/s	Robyn Verrinder Amit Mishra Marcello Vichi

<p>Abstract</p> <p>(may be copied from thesis)</p>	<p>In recognition of the growing importance of the role played by Antarctic Ocean-Atmospheric Processes as a responder to global climate events, this project initiated the design and development of an autonomous system for in-situ monitoring of the antarctic climate. The goal of this project was to design a first-generation, autonomous sensing platform while this thesis focused on developing the firmware for the system. The device will provide data on the life cycle of Sea Ice in the Marginal Ice Zone.</p> <p>Current research focuses on developing models for Sea Ice Interaction in the Marginal Ice Zone where phenomenon such as Waves in Ice is, as of yet, unexplained. Key measurements contributing to this phenomenon are Significant Wave Height, Environmental Temperature and Pressure, and Sea Ice Drift. Technology has played a prominent role in global climate science. Sea Gliders and Ocean buoys have seen extensive use in developing bio-geo-chemical Models in Antarctica. These devices are stationed in regions too dangerous to station humans</p> <p>The project started with the identification of a set of user requirements generated through engagements with key project stakeholders. The buoy was required to survive the Antarctic climate and survive off limited infrastructure. The device also had to contain a Global Positioning System to record global coordinates, a temperature sensor, digital barometer and Inertial Measurement Unit to measure waves in ice. The device was built with a portable power source supplied by commercial-grade batteries in series with a temperature-resistant Low Dropout Regulator, and a power sensor to monitor the module. A satellite modem was added to transmit data remotely through a reliable satellite network. Finally, flash chips were used to store data permanently. Code was developed in C for the STM32I4 micro-controller with custom API libraries developed for each electronic module. An algorithmic state machine was implemented to sequence various sensor events. The sensors were uninitialized when not used and turned off with the processor put into deep sleep mode to optimize the firmware for low power consumption</p> <p>The resulting firmware was successfully validated against a suite of unit tests both for systems and subsystems. Full system tests were performed by running the buoy in an open field and continuously monitoring the transmissions. Due to the COVID 19 pandemic, final testing of the system could not take place in Antarctica</p> <p>The device successfully demonstrates a proof of concept that, through further testing and power optimization, can bridge the technological divide.</p>
<p>Funder</p> <p>Who funded the project? Ignore any bursaries or scholarships received.</p>	<p>National Research Foundation (NRF)</p>
<p>Patenting opportunities</p> <p>Describe any IP that you feel may be worth protecting.</p>	<p>N/A</p>



Public disclosure  Has there already been any presentation or publication of the work?	N/A
Research materials  Are there any research materials (cultures, software, etc. – for full description, see <a href="#">UCT IP Policy</a> ) that have been developed? If so, broadly describe them and indicate who will become the custodian of them, if not your supervisor.	N/A

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