

Invention Disclosure Form

This form is to be used by the University staff and students for disclosure of information relating to an invention or proposed commercial venture for the University to assess the idea and provide advice and support, including ensuring that any intellectual property rights are protected on behalf of the individual and the University. The University may also use such information to facilitate commercial exploitation of the invention for the benefit of the people of South Africa (IPR Act of 2008). The information you provide on this disclosure form will be reviewed by the CPUT TTO and feedback will be provided on its assessment and decision on the Intellectual Property (IP) protection. Please be advised that all information you provide within this document will be treated with strict confidentiality. **Please submit this form prior to any public disclosure of the IP (i.e., presentations, talks, seminars, submission of a journal article, thesis/dissertation library database etc) preferably 90 days prior to public disclosure.**

Privacy Notice:

In terms of the requirements of the Protection of Personal Information Act (2021), that safeguards the integrity and sensitivity of private information. CPUT is required to carefully manage the data capture and storage process of Personal Information within the lawful framework as set out in the Act. We will collect, retain, and transfer the personal information you have provided for as long as the invention case remains active and until invention cases are destroyed.

The details you have provided will be shared with the following entities:

- i. The National Intellectual Property Management Office (NIPMO)
- ii. IP Attorneys in South Africa and their Foreign Associates
- iii. The Department of Higher Education and Training (DHET) for reporting of Innovation Outputs

The submission of this form permits the CPUT TTO to share your personal information with the abovementioned entities. Please complete all sections with as much detail as possible and provide signatures at the end of this document

Title

Provide a brief title of your innovation.

The development of an electric powered subsea robotic crawler for dredging

Provide the industry this innovation falls under i.e., health, engineering, agriculture, ICT, biotechnology

1. Mining
2. Oil and gas
3. Ocean engineering industries
4. Underwater research companies and for military applications

What is the current stage of development of your innovation? Idea, basic research, proven concept, prototype
Substantiate.

Prototype Substantiate

Description

Give a brief description of your innovation.

The current rising global demand for ocean-based recoverable minerals and natural resources is inspiring research and growing interests in the field of ocean dredging. However, current hydraulic-powered dredging crawlers are prone to causing ocean pollution because of hydraulic leakages, heavy vibrations, and underwater noise. These underwater crawlers also consume relatively high power because of their mass. Hence, in this research, we have modelled, designed, and manufactured a scaled-down electric-powered subsea robotic crawler for underwater mining/dredging applications. The prototype is designed to compete with a scaled-down version of a real-world hydraulic-powered Remotely Operated Subsea Tractor MK3 (ROST). This research also highlights the possibilities of eliminating sea pollution caused by hydraulic leakages in hydraulic-powered subsea crawlers by replacing them with electric-powered ones. Furthermore, this research shows that electric-powered crawlers will be lighter than hydraulic-powered equivalents; hence, they will consume less energy during operation.

What will your innovation be used for? What problem does it solve?

The electric-powered robotic subsea dredging crawler will be used for ocean floor mining and dredging of diamond, gold, silver, iron and other related minerals. This piece of equipment will solve ocean hydraulic pollution and high energy consumption of conventional machines used to perform the same task.

What are the existing solutions for this problem?

The existing solution is the Hydraulic MK3 ROST

What are the advantages of your innovation and how does it improve on the present situation?

The advantage of this research is to reduce ocean pollution and high energy consumption for offshore operations. It also introduces us to the advancement in ocean robotics which leads to solving industrial problems using robotics and software algorithm.

What is new about your innovation?

The ocean robot is driven by an electronic system that includes a motor and servo motor controller, and micro controller (MyRIO). Furthermore, this system was controlled over Wi-Fi.

How and why does it work? What is the science behind the innovation? Are there any other uses of the innovation?

This system has been tested over 1.8 meters in the swimming pool. The model comprises a robot-driving base, a 2DOF robotic arm with nozzles at the end effector, and 2 pumps for loosening and dredging the seafloor respectively. Two DC motors connected to tank-tread chain links were used to propel the driving base as a differential drive robot. The control system was implemented using LabVIEW programming language to create a Graphical User Interface for various controls.

Development of innovation

When and where was the innovation first conceived?

Cape Peninsula University of Technology-AMTL

When was the innovation first reduced to practice?

June 16, 2022

What practical work has been done to date on the innovation? Has the innovation been tested in the laboratory or has it been used? If so please give results.

The first design model is completed and tested at the lab, data was collected, and certain engineering software were used to assess the performance.

Who did what in the development of the innovation?

This innovation was invented by Mike Oluwaseun Ojumu a postgraduate student at the Cape Peninsula University of technology. It was funded by the Adaptronics Advanced Manufacturing Technology Laboratory. It was supervised by Prof. Oscar Philander and Prof. Atanda Raji

What are your future plans for developing the innovation? Do you have funds in place for this work, and what do you think you will achieve in this area in the next 12 months?

Currently looking towards further advancing this development during my Ph.D. research. This will include further optimization of the drive performance, implementation of sensors, and optimization using propellers. At the moment, I do not have funding for my Ph.D. research which would be starting next year.

Competing companies / possible collaborators

Are you aware of any companies who have an interest in the area, e.g. companies who sponsor research or who attend relevant conferences? If so, please supply the companies' names (and contact details, if you have them).

1. De-beers group,
2. International mining, and dredging holding south Africa,
3. Mineral Council South Africa.
4. Gu Cobalt Congo
5. Roan mining equipment (pty) Ltd
6. Donald brown group of companies
7. Transnet
8. South African International Maritime Institute (SAIMI)

Literature / patents

Do you know of any published literature (including patents) relevant to your innovation?

No, I do not.

Have you done any literature/patent searches? Briefly describe the results.

No, I have not.

Disclosure

Have you published, verbally, electronically or in writing, anything relevant to the innovation, and if so when

and what? Please tell us about abstracts, web pages and presentations as well as any published articles.

1. Oral presentation at the CPUT conference 2021
2. Poster presentation at SUPAC 20221
3. Departmental presentation at Mechanical Engineering conference CPUT 2022
4. Submitted a paper journal at SAIMM.

SAIMM Journals Abstract: Ocean robotic subsea dredging crawlers are dynamically and remotely controlled vehicles that utilize two tracks used for deep sea mining and recovery operations. These exploration machines are released from a mother ship into the ocean bed to perform dredging activities and they energetically move around with tracks on the seabed. The achievement of the structural design is the most critical aspect for ocean crawlers as current ocean crawlers such as the MK3 ROST are hydraulically powered. This paper aims at developing a scaled-down model, simulating, and performing the static loading analysis of an electric-powered robotic subsea dredging crawler (EPRSDC).

In achieving this research aim, the modeling, simulation, and analysis were carried out using modeling software such as Solidworks which was used in assembling the structural frame using Tetrix max robotics kit. The Tetrix max robotics kit's structural components were produced from 1050 aircraft-grade aluminum. The results were used in optimizing and considering other materials. The maximum defected regions in the EPRSDC were further used in identifying the vulnerable defected areas for improvement.

Who have you told about the innovation? When did you do this and where?

Around April 2022, I made my intention known to family and friends about my innovation.

When did you first describe the innovation in writing or electronically? Do lab book records exist, or personal notes?

April 2021 based on personal notes

Do you have plans to publish the work or present the work at a conference? If so, what is the timescale and where will the publication take place? If a draft paper exists, please provide a copy.

Currently planning to make a publication at a conference in 2023, the paper will be sent to your office when finalized and accepted by my supervisor.

Funders / Third Parties

What funds supported the work leading to this innovation?

No external funding at this stage except funding from AMTL and CPUT.

Are you a party to any other agreement(s) pertaining to the innovation (e.g. material transfer agreement, collaboration agreement, research contract, patent agreement with another entity)?

No, I am not.

Does the invention relate to an indigenous biological resource, or does any indigenous knowledge relate to the invention? If so, please list and provide details of stakeholders.

No, it not not

Inventors

Include Inventors from other institutions – note their affiliation in Department & Group/Unit field. Please add additional tables if necessary.

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Race	Black
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FULL names [as per ID document]	Oscar Philander
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Postal address & code if external, or CPUT internal mail delivery address.	
Nationality	

Share in Intellectual Property Creation

An "Inventor" must contribute intellectual property to the inventive step that resulted in the invention.

Only the details of enablers who the inventors have decided should receive a share in future royalty income should be provided in the following tables – add additional tables if necessary. The enablers' details will not be disclosed on the patent publication. For benefit share A plus B must equal to 100%.

	Inventor Name	Affiliation	Percentage contribution (%)	Benefit Share (%)	Signature and date
1	Mike Oluwaseun Ojumu	AMTL-CPUT	55%	55%	
2	A/Prof Oscar Philander	AMTL-CPUT	25%	25%	
3	A/Pro Raji Atander	Electrical Engineering	20%	20%	
4					
			Total = 100%	Total A =	
Enabler Name					
1					
2					
3					
4					
				Total B =	

Declaration (inventors only)

I, the undersigned confirm that I accept the Intellectual Property Share recorded above and acknowledge that these percentages will be used to apportion any future revenue that may accrue to the CPUT inventors and enablers (if included), in terms of the CPUT IP Policy, from any commercialization of this invention. I also understand that in the event that an additional valid inventor claimant is identified in the future, the existing inventor shares will be diluted accordingly.

Full Name: Mike Oluwaseun Ojumu

Signature: 

Date: 01/11/2022

Full Name: _____

Signature: _____

Date: _____

Full Name: _____

Signature: _____

Date: _____

Full Name: _____

Signature: _____

Date: _____