

中光層珊瑚礁探秘： 水下遙控無人載具的應用

國立海洋生物博物館企劃研究組
王立雪 副研究員兼組主任



海生館

教育 ↔ 研究 ↔ 水族館



海洋生物教育及研究中心

~26 位博士級研究人員

- 企劃研究組
- 生物馴養組
- 展示組
- 科學教育組

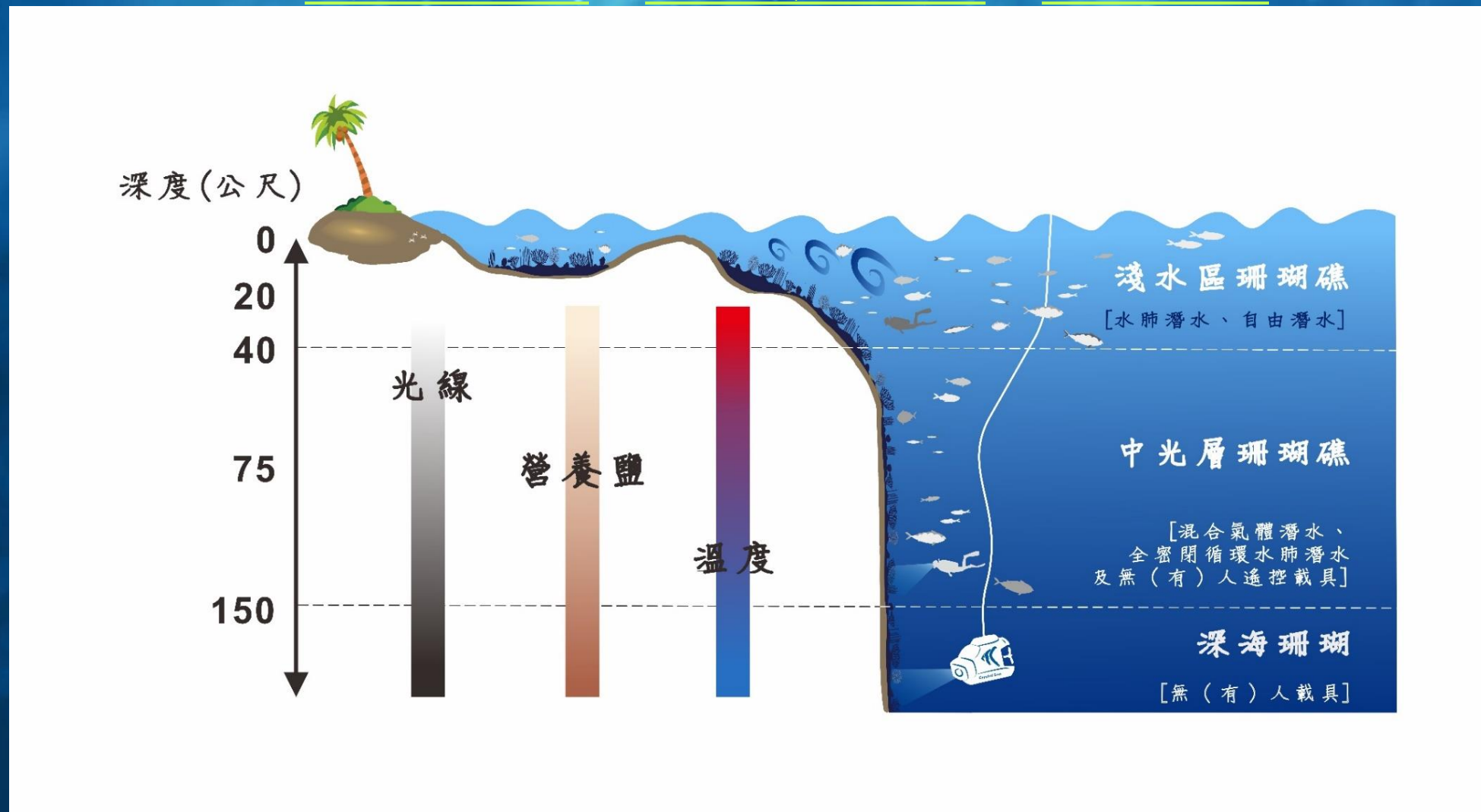


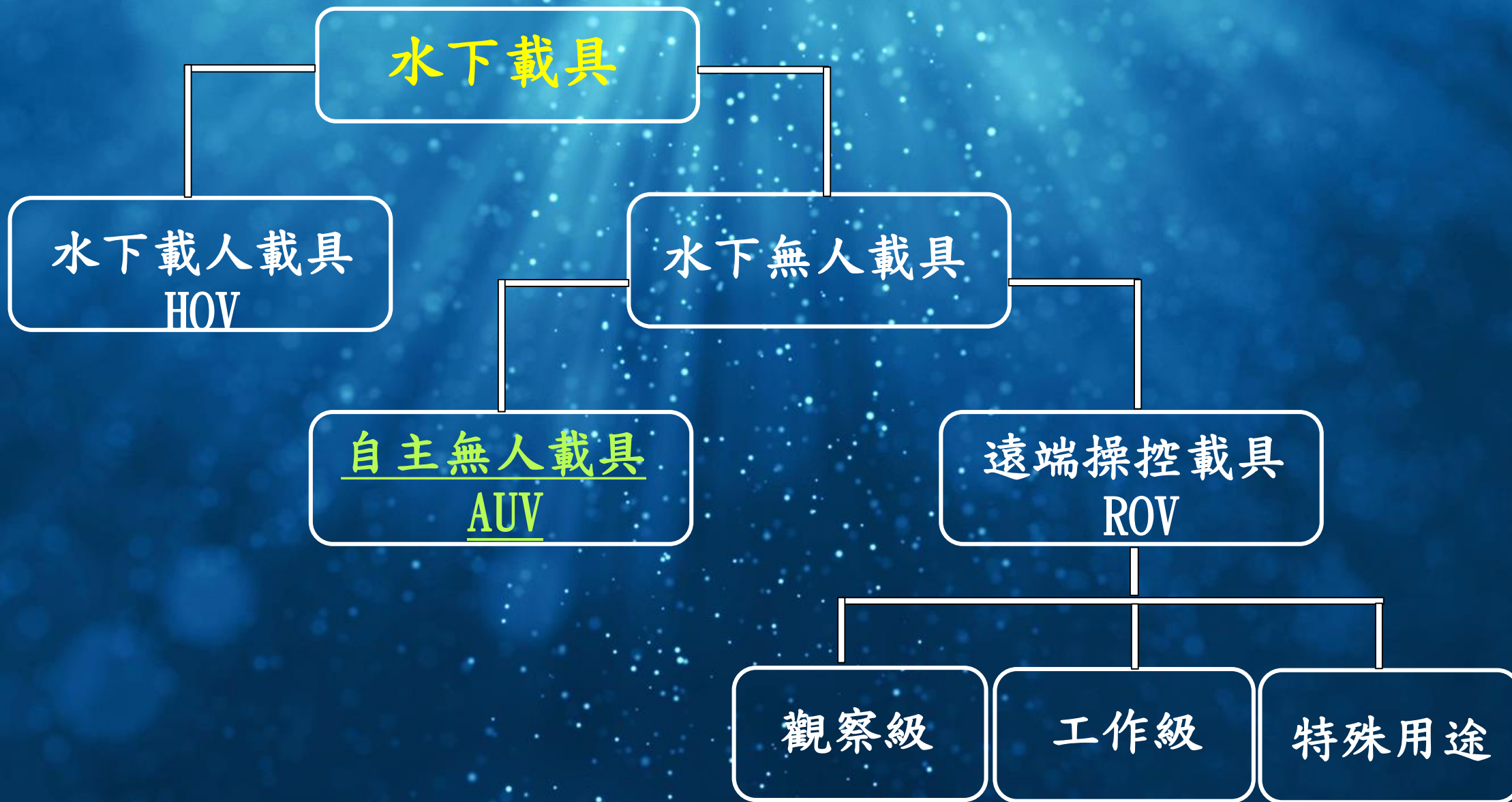
主要研究主題

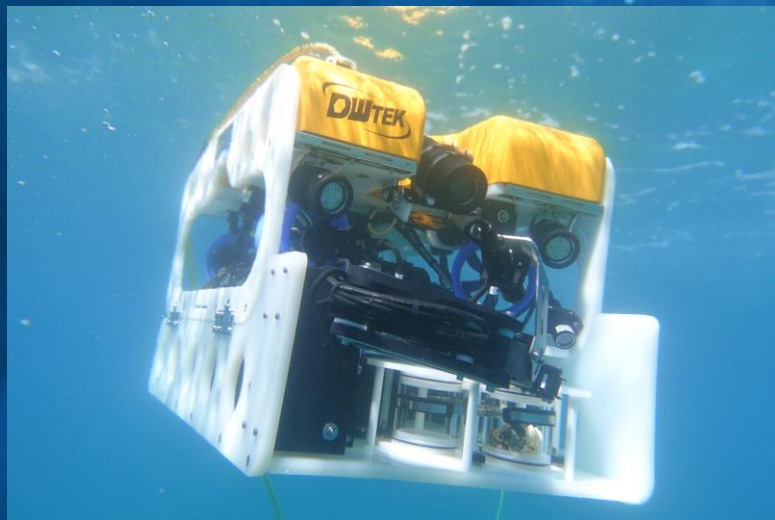
- ~ 展場生物及環境科學
- ~ 海洋天然物研究
- ~ 珊瑚動物細胞、分子生物、生理與生化研究
- ~ 珊瑚礁生物繁養殖研究
- ~ 海洋生物多樣性及標本典藏

珊瑚礁生態系：光線穿透多寡，可分為

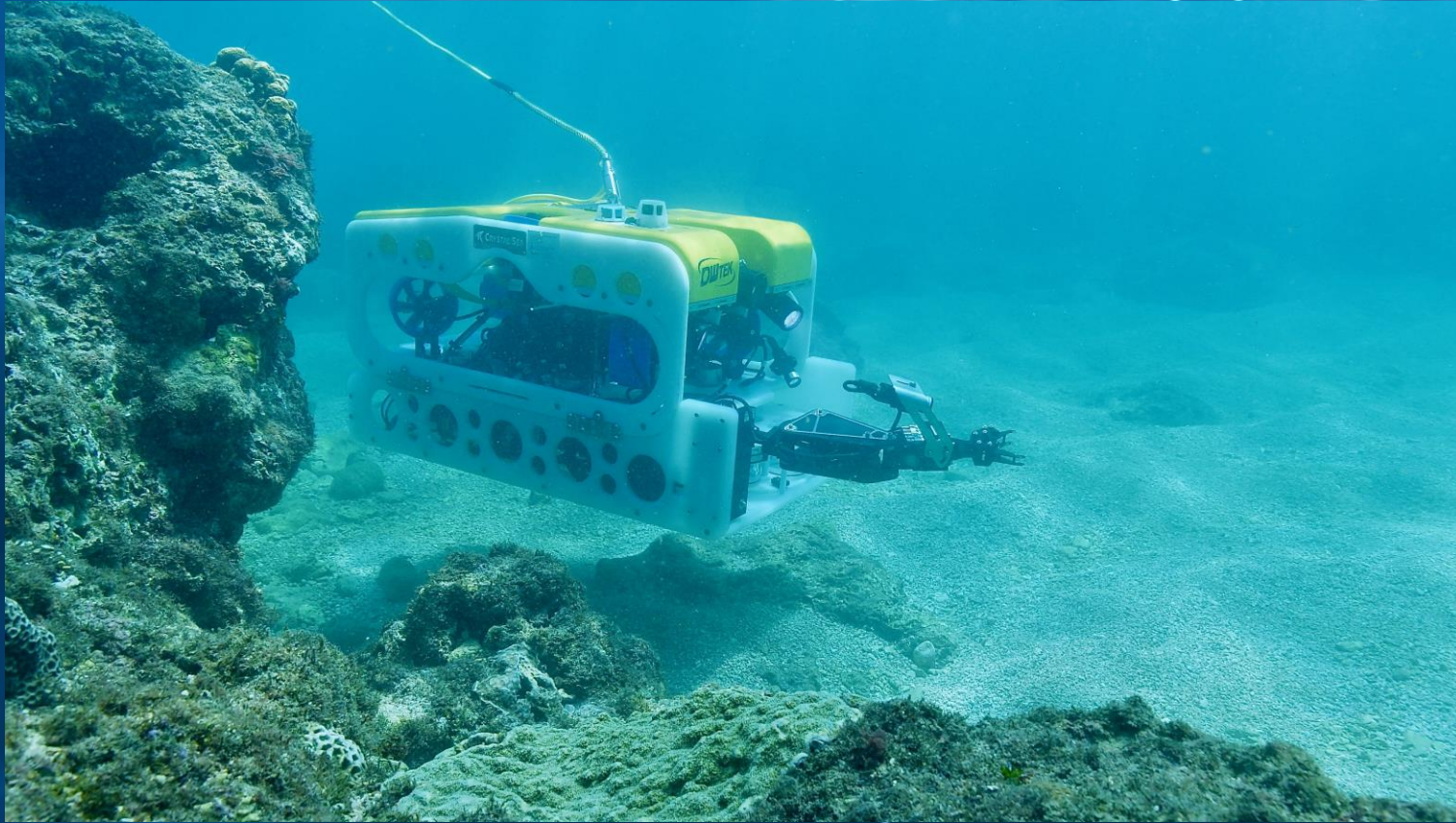
淺水珊瑚礁、中光層珊瑚礁、深海珊瑚







中型ROV



<1000m

六個推進器

五軸機械手臂

航速：4節

可調角度HD 攝影機X1

高度計

深度計

水下定位(USBL)

側掃聲納

照度計

溫度計

濁度計

ROV 出任務



ROV漁港練習



觀察型ROV

<100m

4個推進器

航速：2節

高度計

深度計

4K攝影

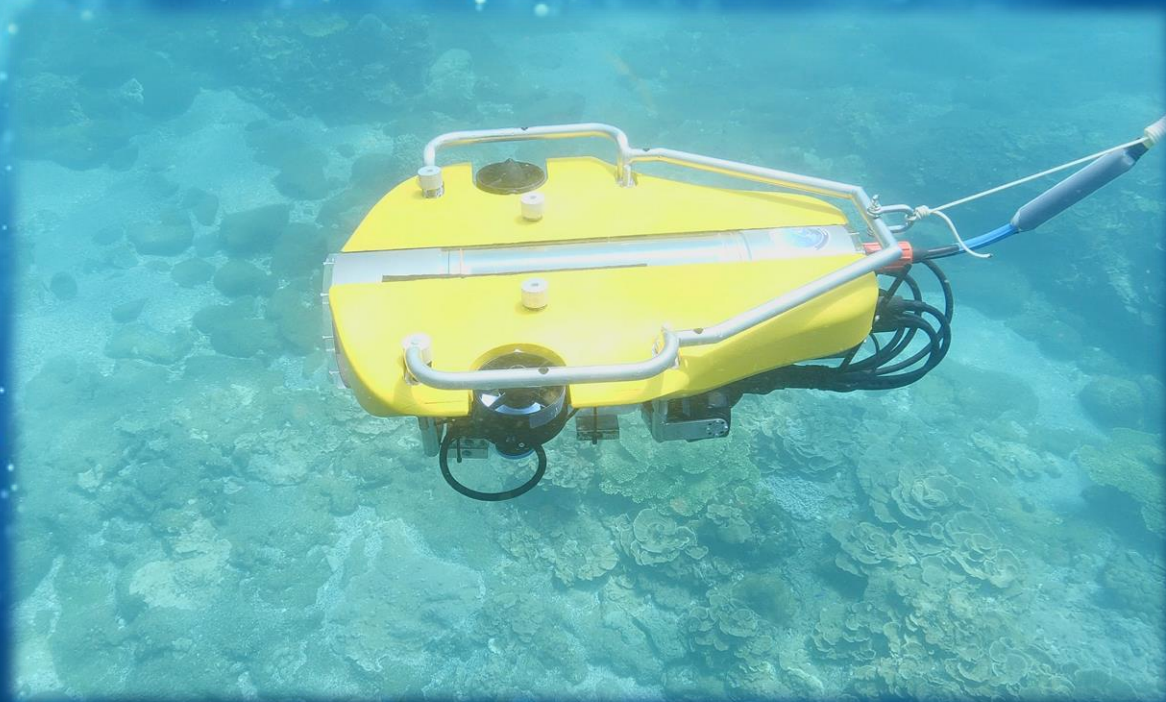
溫度計

照度偵測器

LED白光燈

珊瑚藍光燈

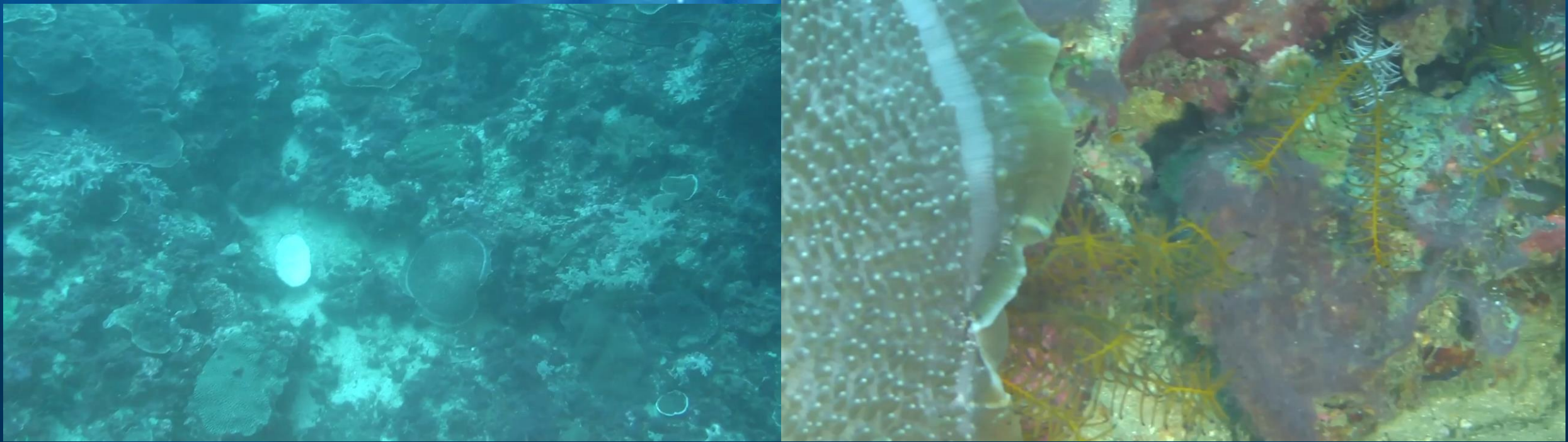
雷射測距



ROV海生館珊瑚王國館探秘



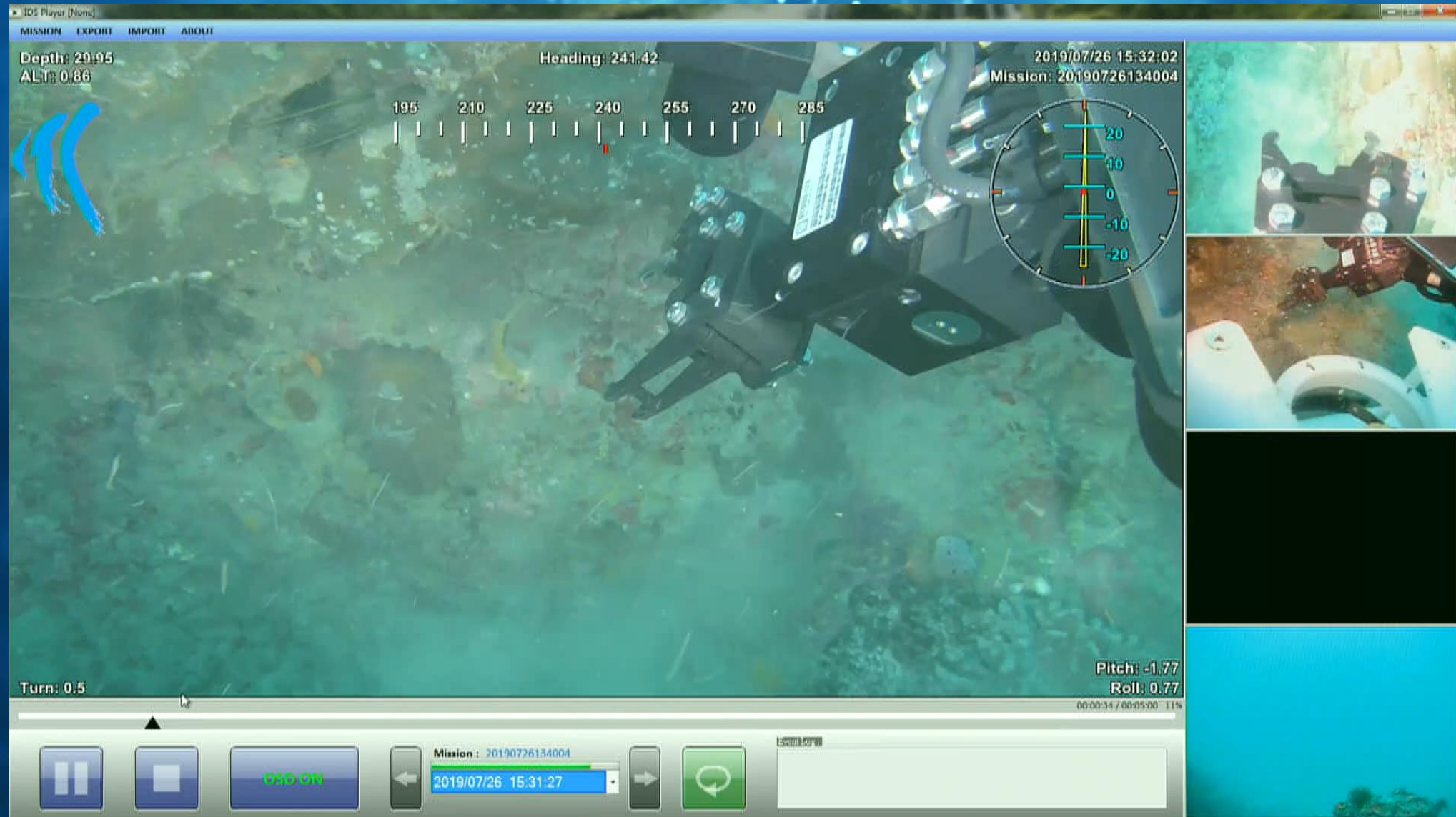
珊瑚礁探勘-墾丁獨立礁



珊瑚礁探勘-墾丁獨立礁



珊瑚礁探勘-墾丁獨立礁



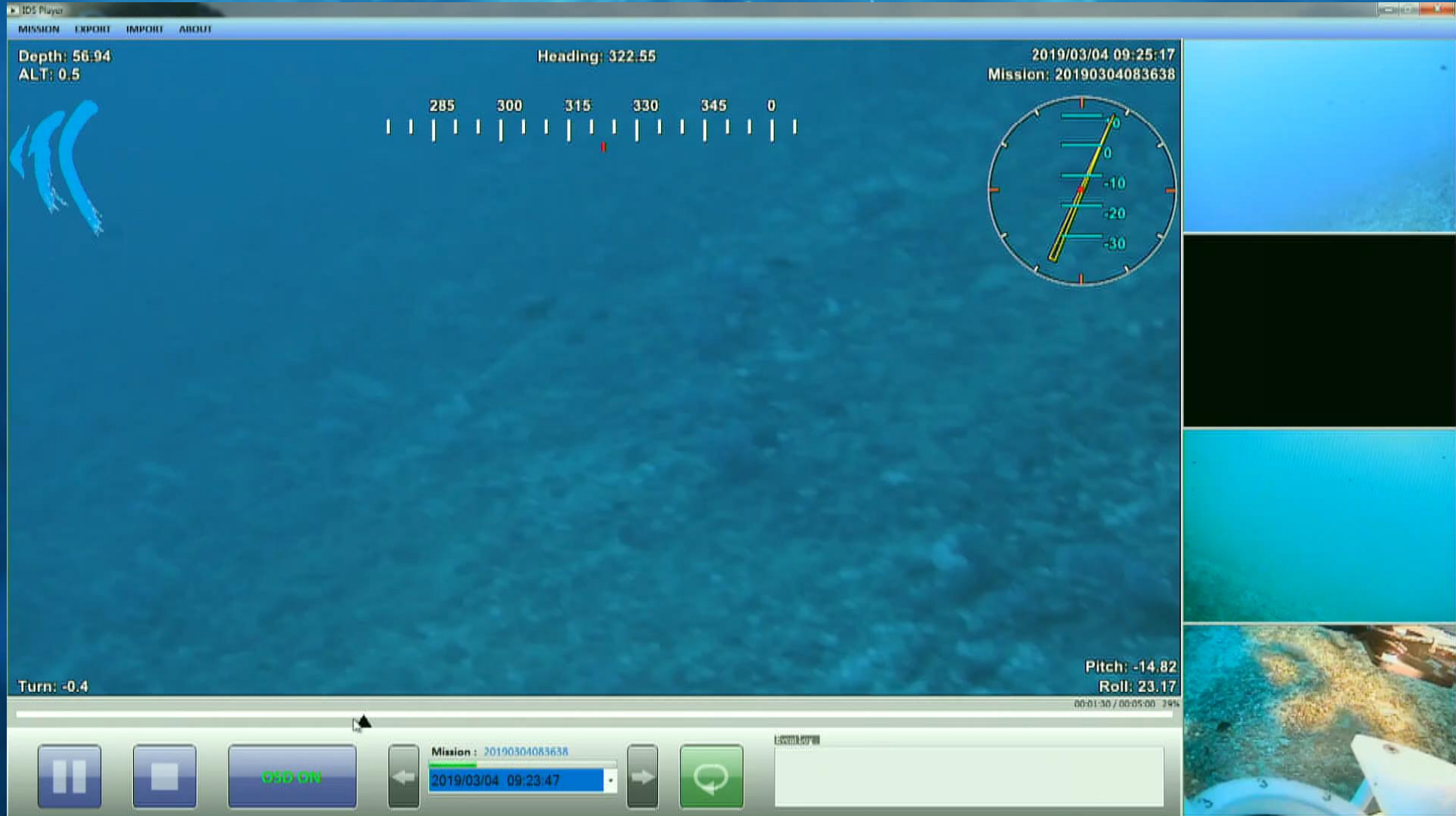
中光層珊瑚礁探勘-後壁湖外



中光層珊瑚礁探勘-合界



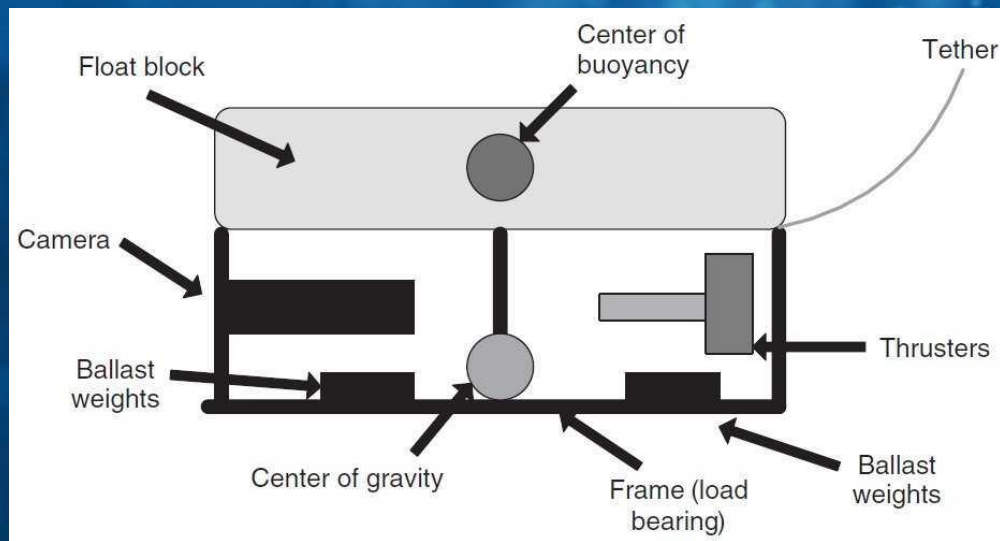
中光層珊瑚礁探勘-合界



海洋生物營隊實作

水下無人載具在科普教育上之實踐

科學原理啟發、機械設備操作及成果



Source: The ROV Manual: A User Guide for Observation Class Remotely Operated Vehicles



Development of a remote operated vehicle for coastal exploration

By Chong Ing Kai and Reuben Ng



Current problem

Currently, divers are deployed to do coastal exploration, such as observation of coral reefs. But there are many disadvantages. First, it is very expensive to start a diving operation. Next, it is time consuming, and thirdly, divers can endanger their lives from risks such as decompression sickness.

Solution

Our solution would have a few specifications in order to solve the problems above. It should be fast, utilizing Artificial Intelligence and data logging via the GoPro 7 instead of normal humans for data collection, materials used must be cheap, and most importantly, it should do all of these without damaging the corals or the immediate environment.



Why we made it

- Make coastal exploration more cost efficient
- Reduce chances of injuries during diving expedition
- Help monitor the coral reefs and the marine ecosystems

Advantages:

ROV advantages	Current solutions
Cheaper compared to the cost of one dive	Expeditions are expensive and cost about \$700 for 7 weeks
Safe, as there is minimal human involvement needed to observe the coral reefs, due to the use of the GoPro7 and artificial intelligence	When a diver dives, they may endanger their lives
Faster and lighter	A diver swimming in the water is very slow, especially when the diver is carrying heavy equipment like oxygen tanks

Prototype

A remotely operated vehicle that can move on water, which surveys the coral reefs for research purposes. Researchers can watch what the ROV is recording live using the livestream function on a phone. With the implementation of a radio control unit, it could travel up to 250 meters currently, making it ideal for coastal exploration. In addition, a dual hull design is used, which was inspired by the design of the catamaran, and it has a few advantages, including increased stability and speed, as well as being able to spin in place.



Design of a catamaran and a monohull



Matlab code

Matlab program

The program first randomises the datasets and partitions them into two kinds of data sets. They are training sets, which are used to train the computer what kind of features should a living coral have and what features should a dead coral have, and validation sets, which are used to cross check the computer's evaluation of the new picture. Then, we extract features from all the datasets from all categories and create a 'visual vocabulary'. As such, we are able to classify our image. The results would be shown as an array, and it correctly identifies the picture on the left that it is a living coral.



Example of results

Further research

Coral health is dependent on a few factors, such as the salinity of the water, the temperature and the pH of water. As such, the future project is that we would want to implement sensors on the ROV, where it can collect water samples and measure the various factors, and send it to the researchers immediately once it gets readings. This would allow researchers to know what factor is causing the corals to bleach and die and would be able to take the necessary actions.

Bibliography

Parkinson, A. (2015, August 17). Sailboat Debate: Monohull vs. Catamaran. Retrieved from <https://www.yachtinternational.com/owners-lounge/sail-debate-monohull-vs-catamaran>
Object Detection and Recognition Code Examples. (n.d.). Retrieved from https://www.mathworks.com/campaigns/offers/object-detection-and-recognition.confirmation.html?objectid=1547284582134&portal_mail_user=Student

Image processing and recognition

We have coded a Matlab program to allow it to process the images of corals and enabled it to recognise whether the coral is a healthy coral or a dead coral. First, we collected a few pictorial samples of living corals and unhealthy or dead corals. These pictures would serve as training and validation sets to enable us to identify if the picture of the coral that we have taken is a living coral or an unhealthy coral.

Tests

First test: Floatation of ROV



Second test: Testing electronics



Fourth test: Data processing

Tests	First test	Second test	Third test	Fourth test	Fifth test	Accuracy
Living coral image	Living	Dead	Living	Living	Living	80%
Dead coral image	Dead	Dead	Dead	Dead	Dead	100%

Third test: GoPro photo taking via livestream



Development of a Remotely Operated Vehicle to assist in data collection of coral reefs

Best in Category
Sustainability and Environmental Studies
towards Engineering and Design

**Chong Ing Kai and
Ng Zhi En Reuben**

Development of a Remotely Operated Vehicle
to Assist in Data Collection of Coral Reefs



直播服務

ROV 中光層探測與直播

國立海洋生物博物館的直播影片。
由 XSplite API 發佈 [?] · 3月19日上午9:26 · 🌐

墾丁合界水下80米



和朋友一同觀賞這段影片 舉辦影片趴

6,128 觸及人數 764 互動次數 加強推廣貼文

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直播



8,843
觸及人數

995
互動次數

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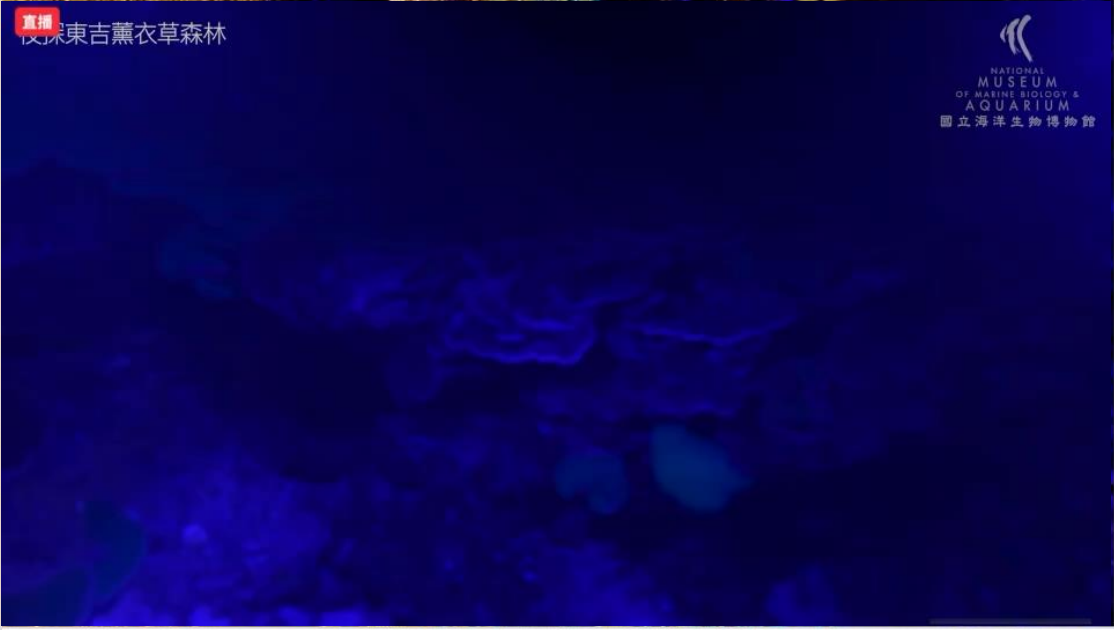
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直播

夜探東吉薰衣草森林



14,062
觸及人數

2,016
互動次數

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👍❤️😮 你和其他165人

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探索海洋就到海生館

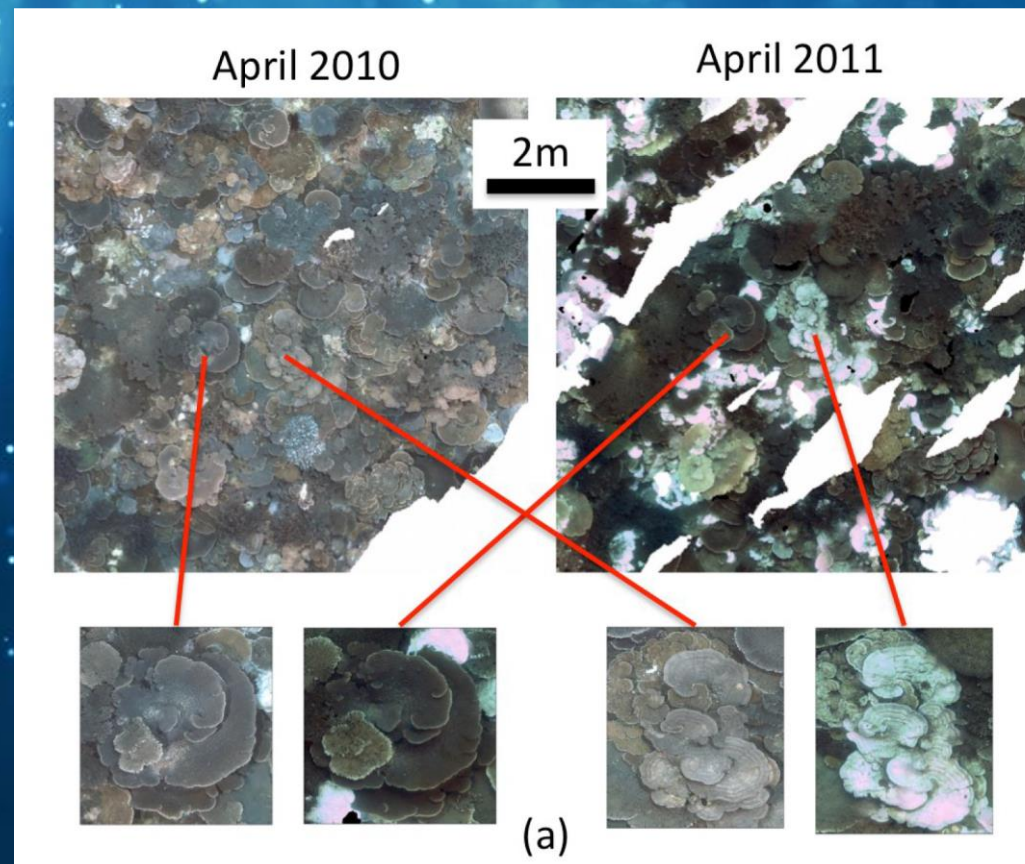


謝謝聆聽

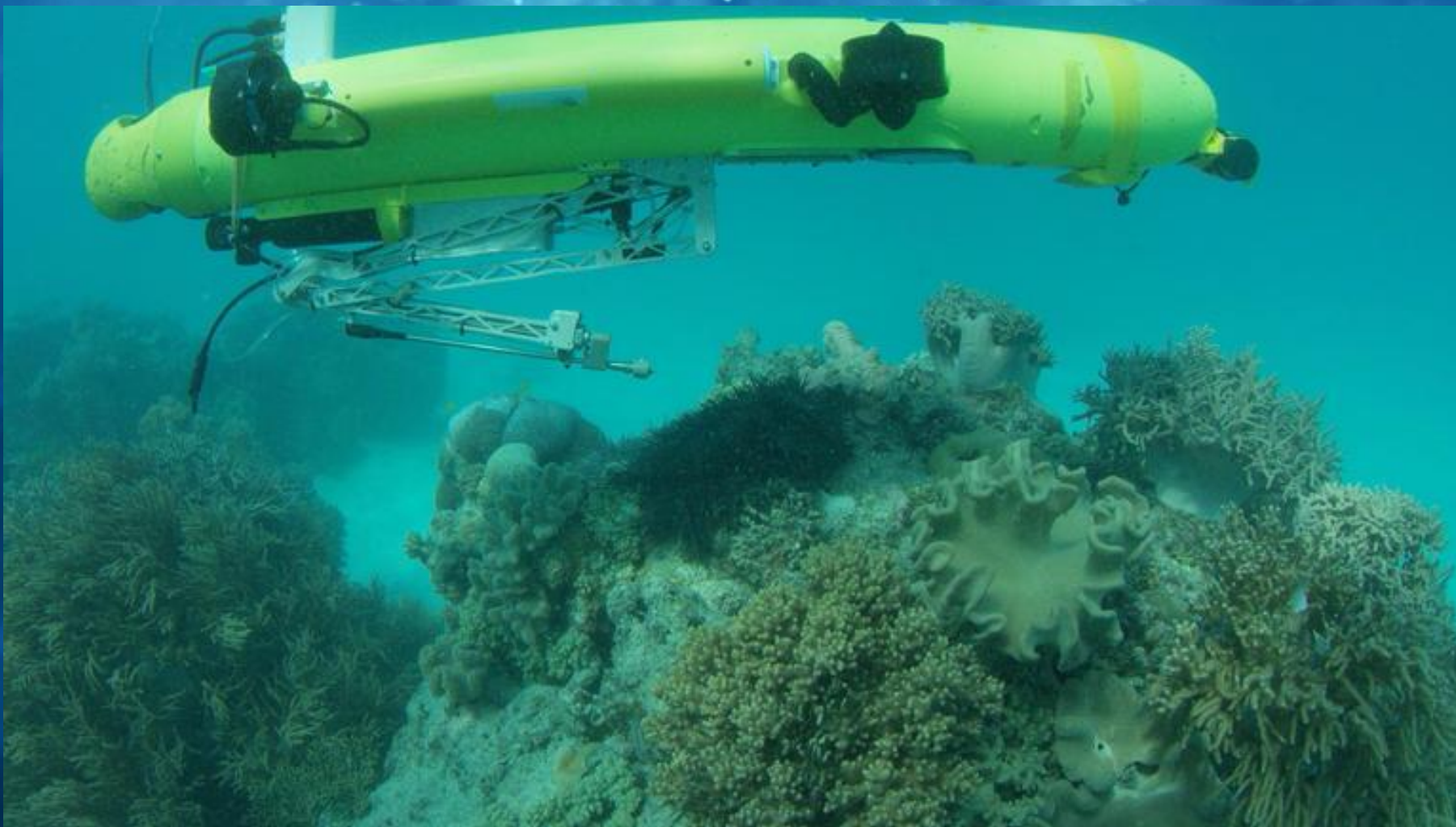


航向未來與探索未知

AUV在珊瑚礁的應用：長期自動化調查珊瑚覆蓋率與白化現象偵測



AUV在珊瑚礁的應用：清除棘冠海星





淺水區珊瑚礁





中光層珊瑚礁

深海珊瑚

