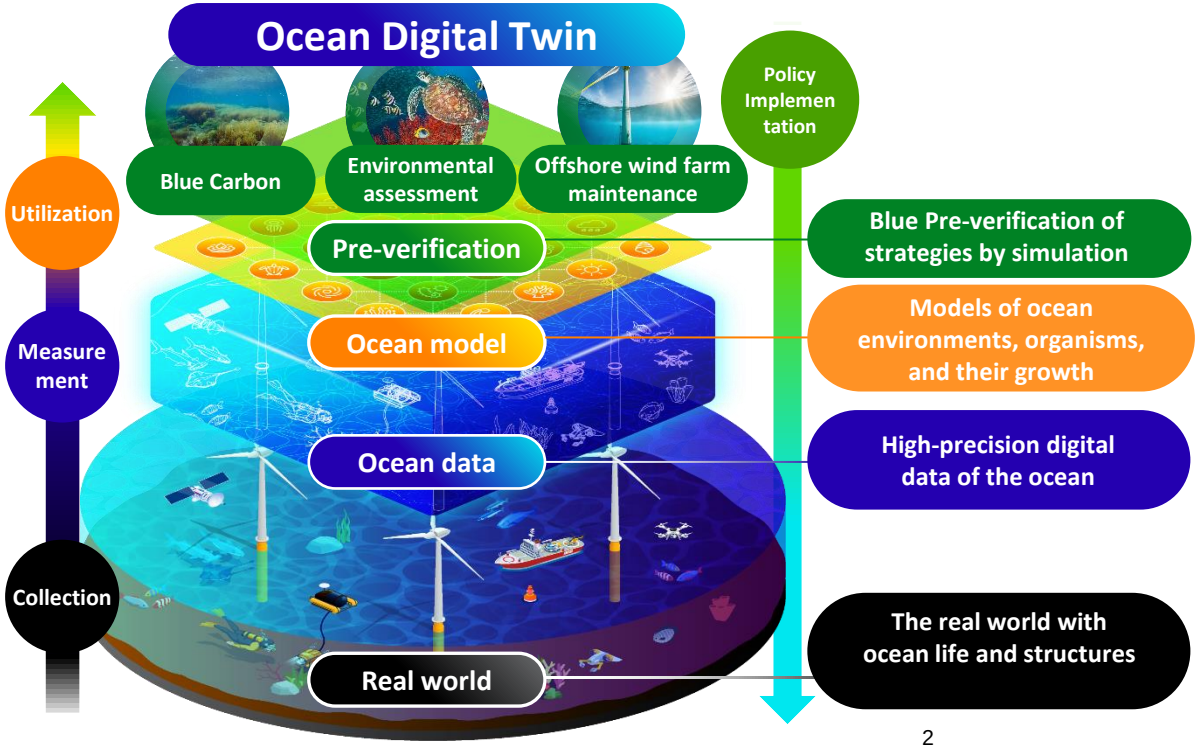
Fujitsu’s initiatives on ocean digital twin

Fujitsu's "Ocean Digital Twin"

FUJITSU

- Plan & verify results of measures for various social issues by digitizing the ocean (surface, underwater, seabed)
- Resolve various social issues such as decarbonization and biodiversity conservation in the ocean



Contribute to carbon neutrality and biodiversity conservation through blue carbon measures

- Focus on marine organisms (seaweed,seagrass) as sources of CO_2 absorption
- Develop a digital twin for pre-verification of biological growth to increase seaweed beds

Digitalization of seaweed beds growth

FUJITSU

Policy: Develop a model to numerically simulate changes of seaweed bed growth etc.

Challenge: Accurately measure the species of each seaweeds, volume and its changes.

3D measurement with centimeter-scale resolution

In ocean environments, data acquisition is challenging due to the unique conditions of turbidity and wave.

Traditional acoustic sonar has insufficient resolution for identifying seaweed species and calculating volume.

Seaweed bed

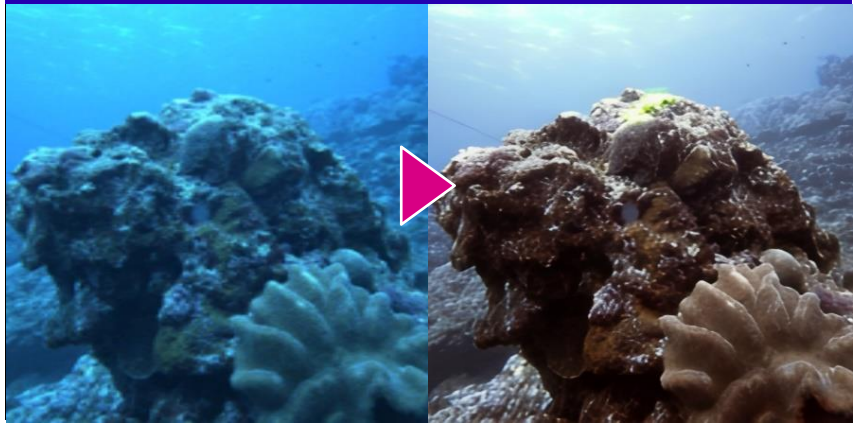
Real-world ocean environment with turbidity

Developed AI-based technologies for underwater 3D data acquisition

FUJITSU

- Developed technology for precise 3D shape data acquisition using camera & LiDAR
- Precise digitalization is possible even in challenging ocean environment, such as turbidity and waves

Technology 1：
Image enhancement AI technology to restore color and contour of underwater objects

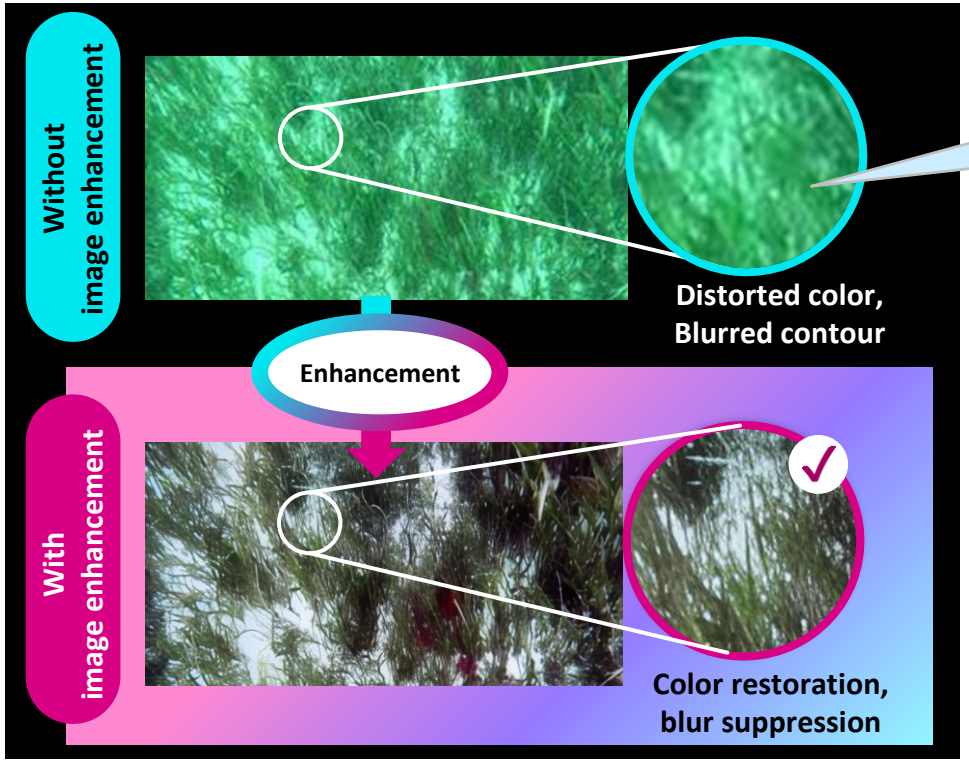


Technology 2：
Underwater 3D measurement technology captures real-time 3D movements of underwater objects

Technology1: Image enhancement AI

FUJITSU

Image enhancement AI technology restores the color and contour of underwater objects



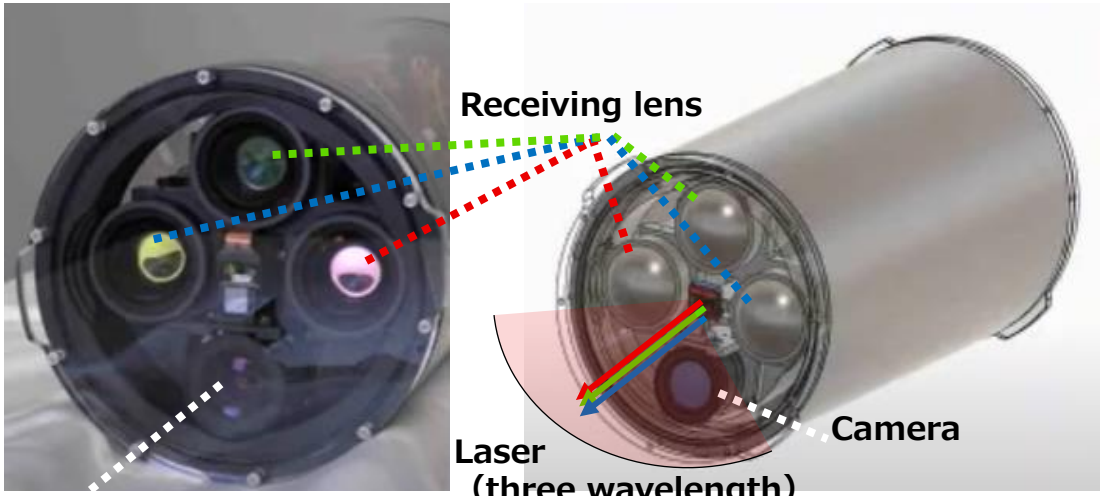
Images captured by underwater camera degrade in color and contour.

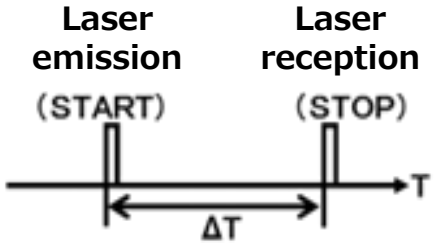
- Developed image enhancement AI technology using deep learning optimized for underwater objects.
- By restoring the subject's true colors and improving blurred contours, it's possible to prevent errors in object recognition and 3D processing, enabling accurate shape measurement for each object.

Technology2: Underwater 3D measurement

FUJITSU

By introducing underwater LiDAR, the distance to objects can be measured rapidly and accurately in real time.





Distance to the object = (speed of light × ΔT)/2

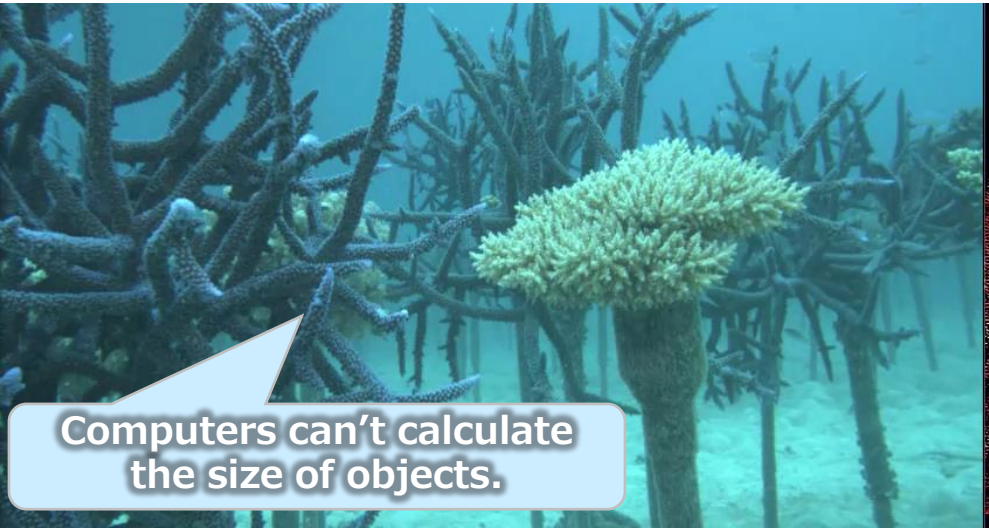
Direct distance measurement enables the acquisition of the object's 3D shape.

Three color laser light : The appropriate wavelength can be selected based on the underwater condition (turbidity etc...)

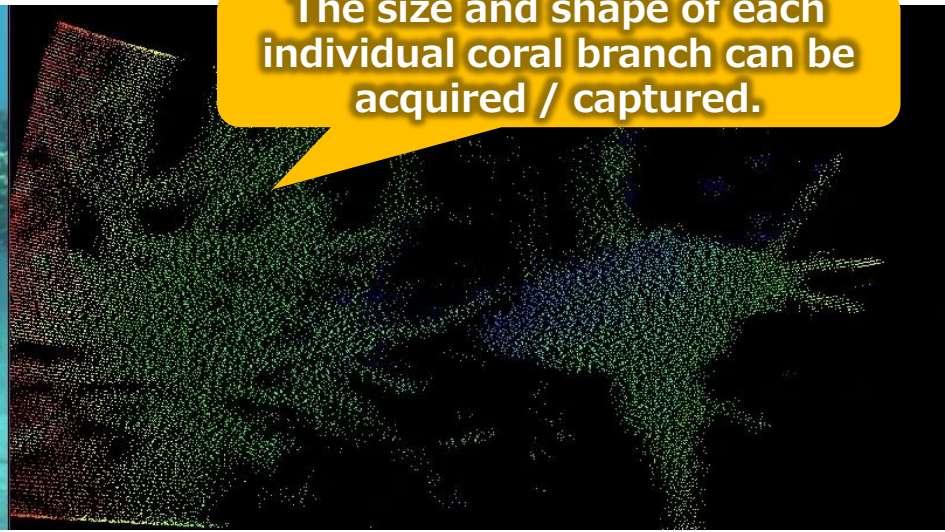
Technology2: Underwater 3D measurement

FUJITSU

Real-time and precise 3D measurements can be achieved from a moving autonomous underwater vehicle, even in challenging ocean environments such as waves and turbulence.



Camera view



3D lidar view

near far

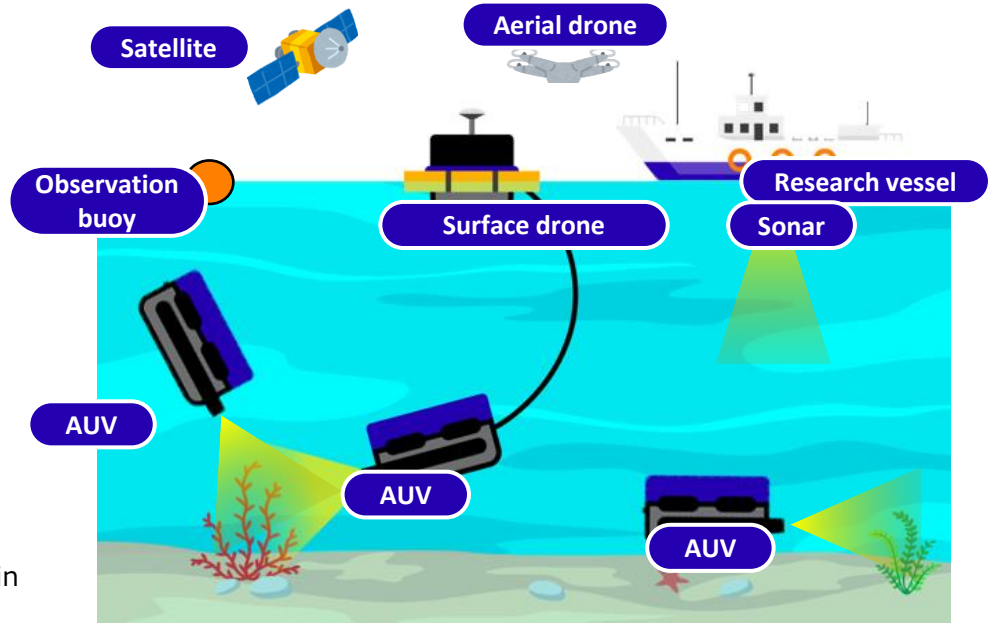
Measurements in real ocean environments using Autonomous underwater vehicle(AUV)

FUJITSU

Real-time acquisition of precise 3D shape data of coral reefs using AUV

Conducted demonstration experiment in Ishigaki Island, Okinawa in cooperation with National Maritime Research Institute, National Institute of Maritime, Port and Aviation Technology (NMRI).

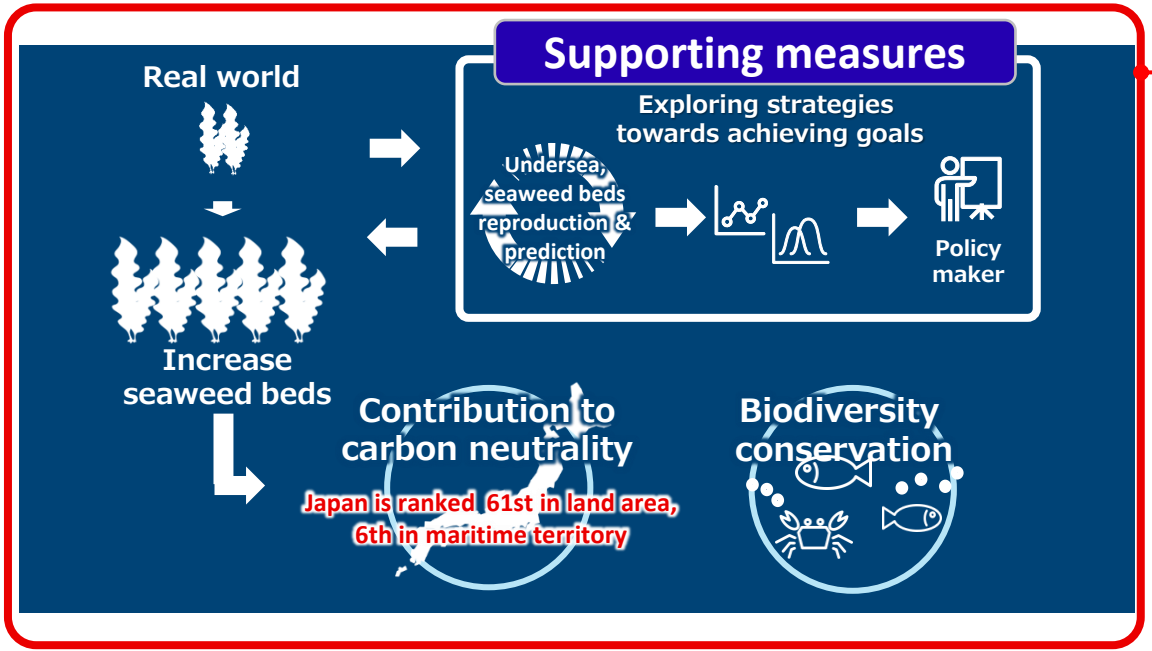
Utilizing AUVs and satellites to collect digital data on ocean conditions

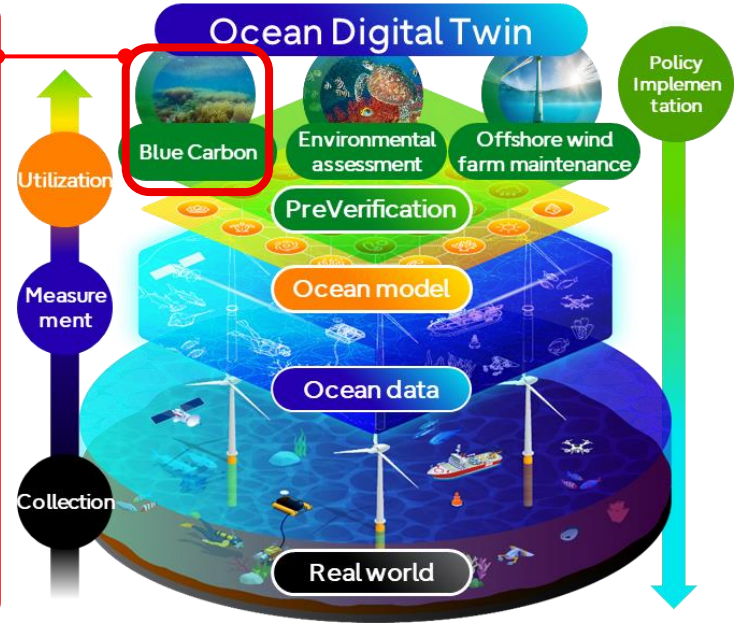


Support for marine policy initiatives utilizing ocean digital twin

FUJITSU

Simulating the growth conditions of marine organisms in spatial contexts, aiming to validate the effect of climate change mitigation measures in advance.





Thank you