DeSET; Approach of Innovation to Team-up Hyper-Interdisciplinary Project

GEBCO Symposium 2018 Session4 Ocean Mapping Science

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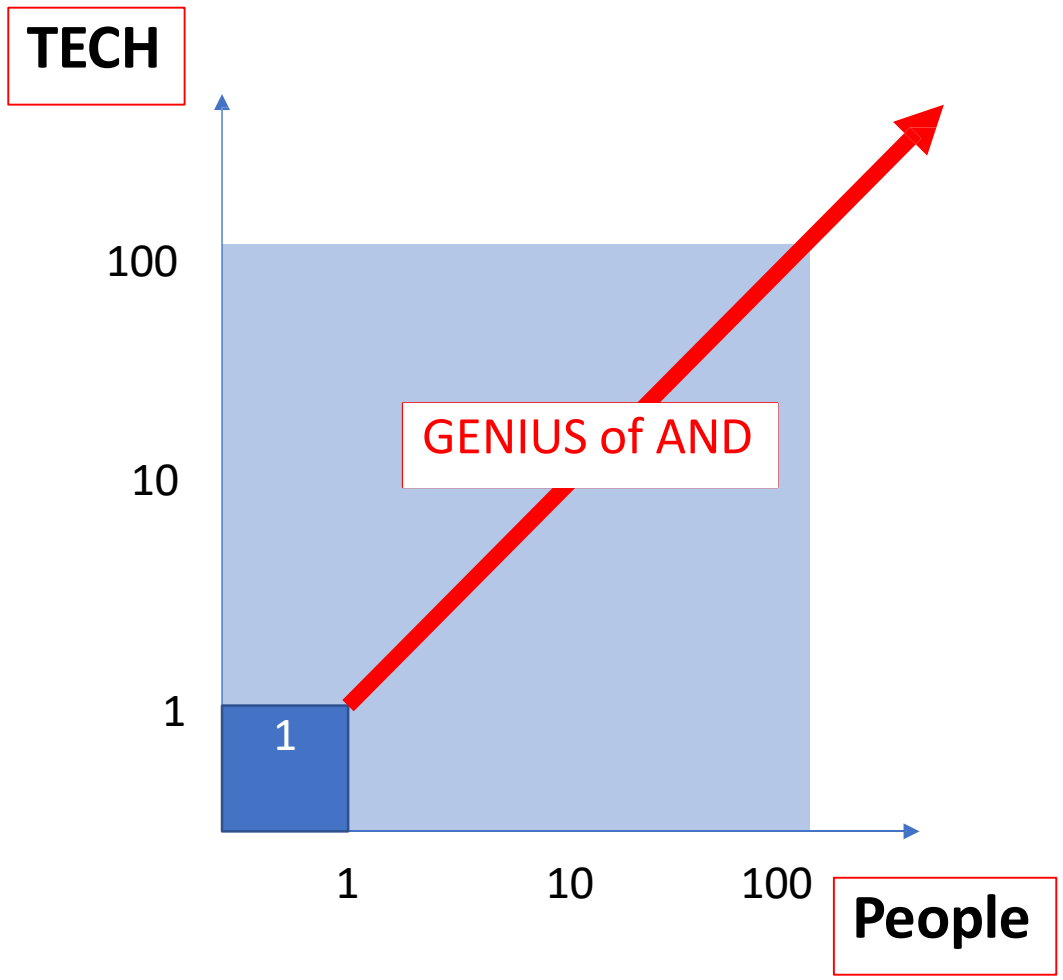
The CHALLENGE

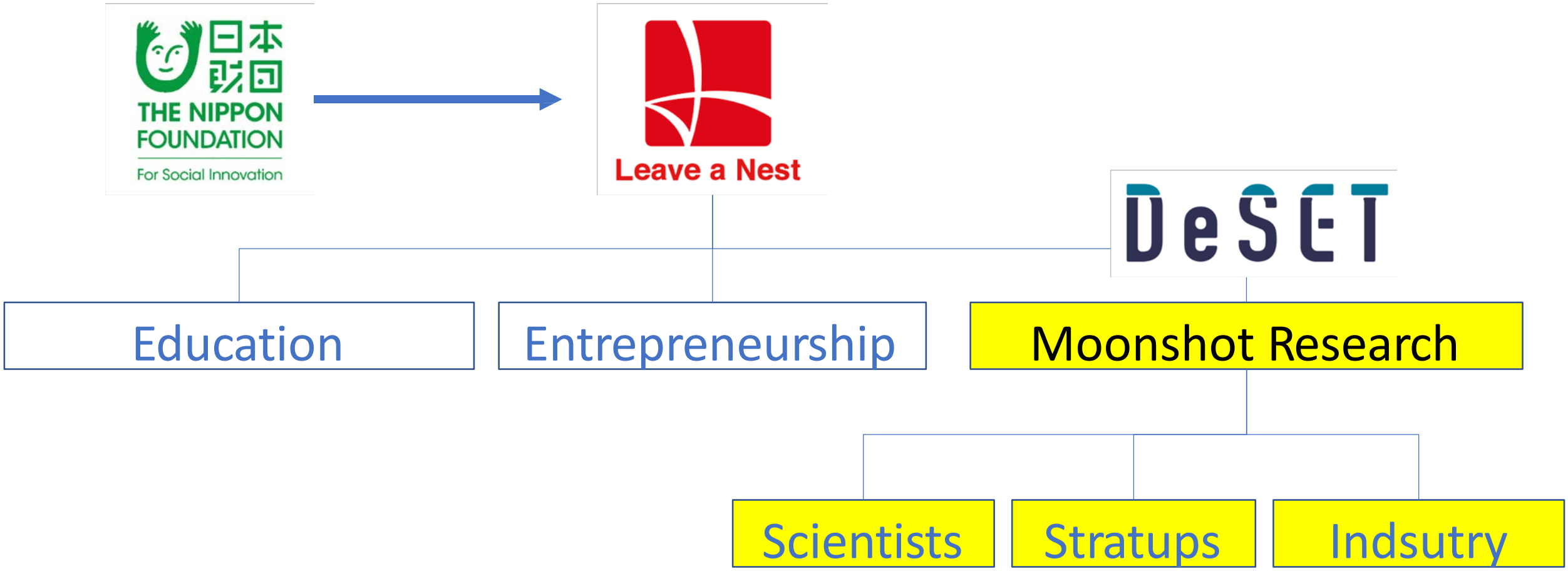


Backcasting from 2030, we need to work now to

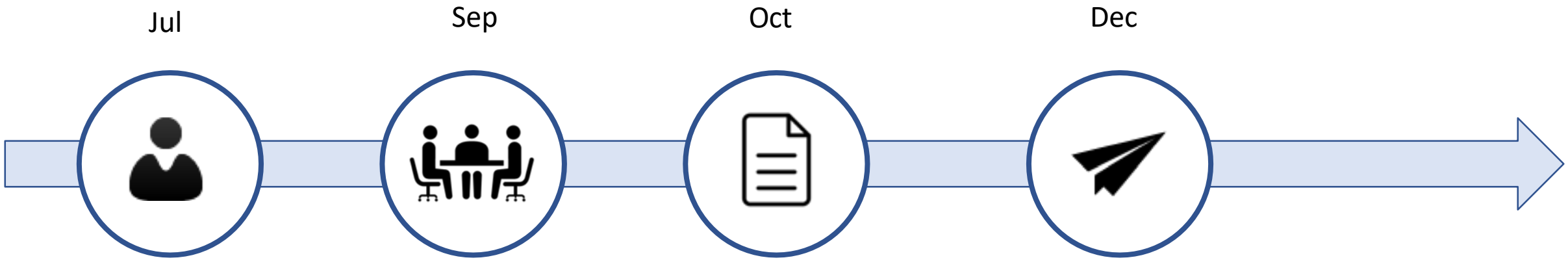
1. **>100X Efficient technology of mapping**
2. **>100X more people engaged, not leaving behind**

Not only technologies, we will create new business, jobs, ecosystem…

Project Structure



HOW IT WORKS



Individual Idea Submission	3day On-site Team-up	Team Application	Launch of Research Project
Collect 40-60 ideas	Mixed into 3-5 teams	3 teams will pass *Leader chosen from company	50M JPY/team 1.5yr

+

Support for;

- Exposure
- Fund-raising
- Biz Dev

3 days On-site Team-up

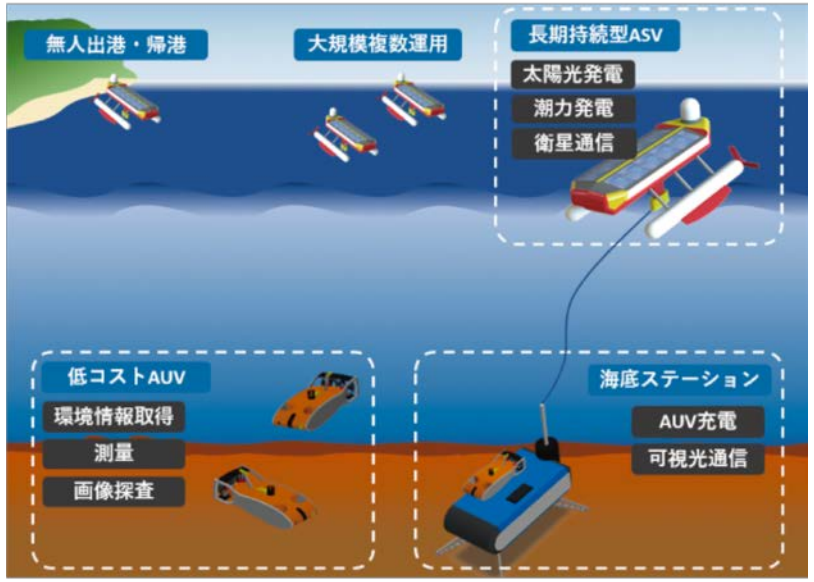
Idea sketches

Discussion

Team-up!!

1st BATCH 3 TEAMS

Subsea Autonomous Station



Speaker

Shohei ITO

CEO of FULLDEPTH

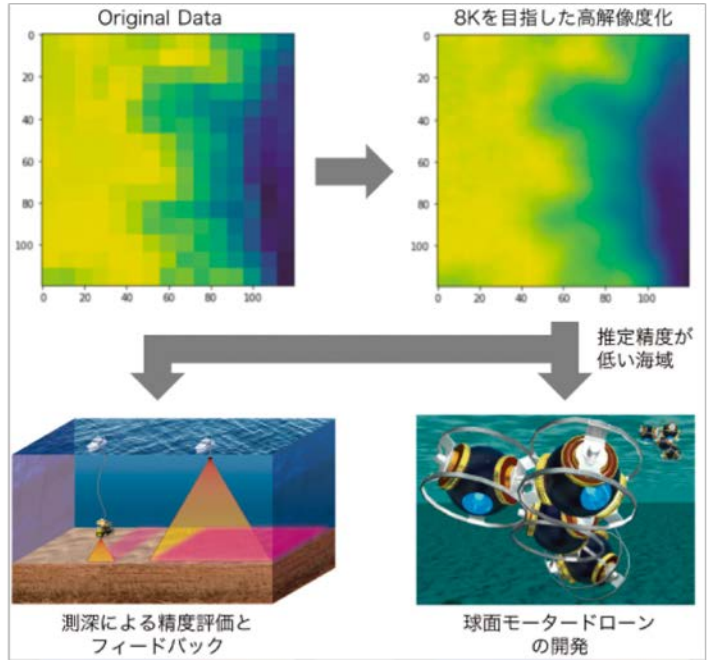
Remote Sensing

Speaker

Toyoki SASAKURA

CEO of AquaFusion

Super resolution AI



Speaker

Motoharu Sonogashira

Kyoto University

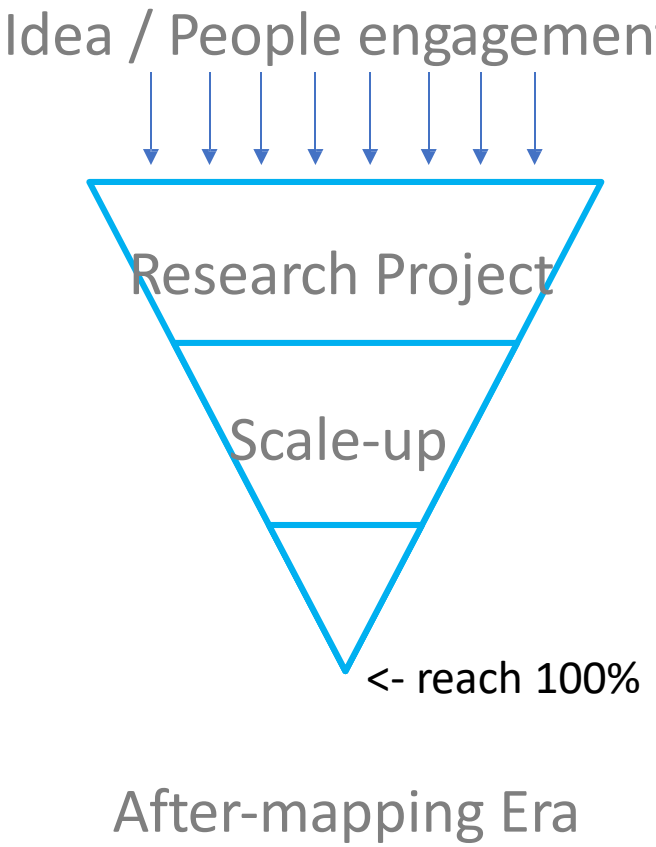
Coming Dec. 2nd BATCH will be announced

Subsea 3D Print Construction

Biologic Agent

Open-Source Swarm Drone

FUTURE PLAN

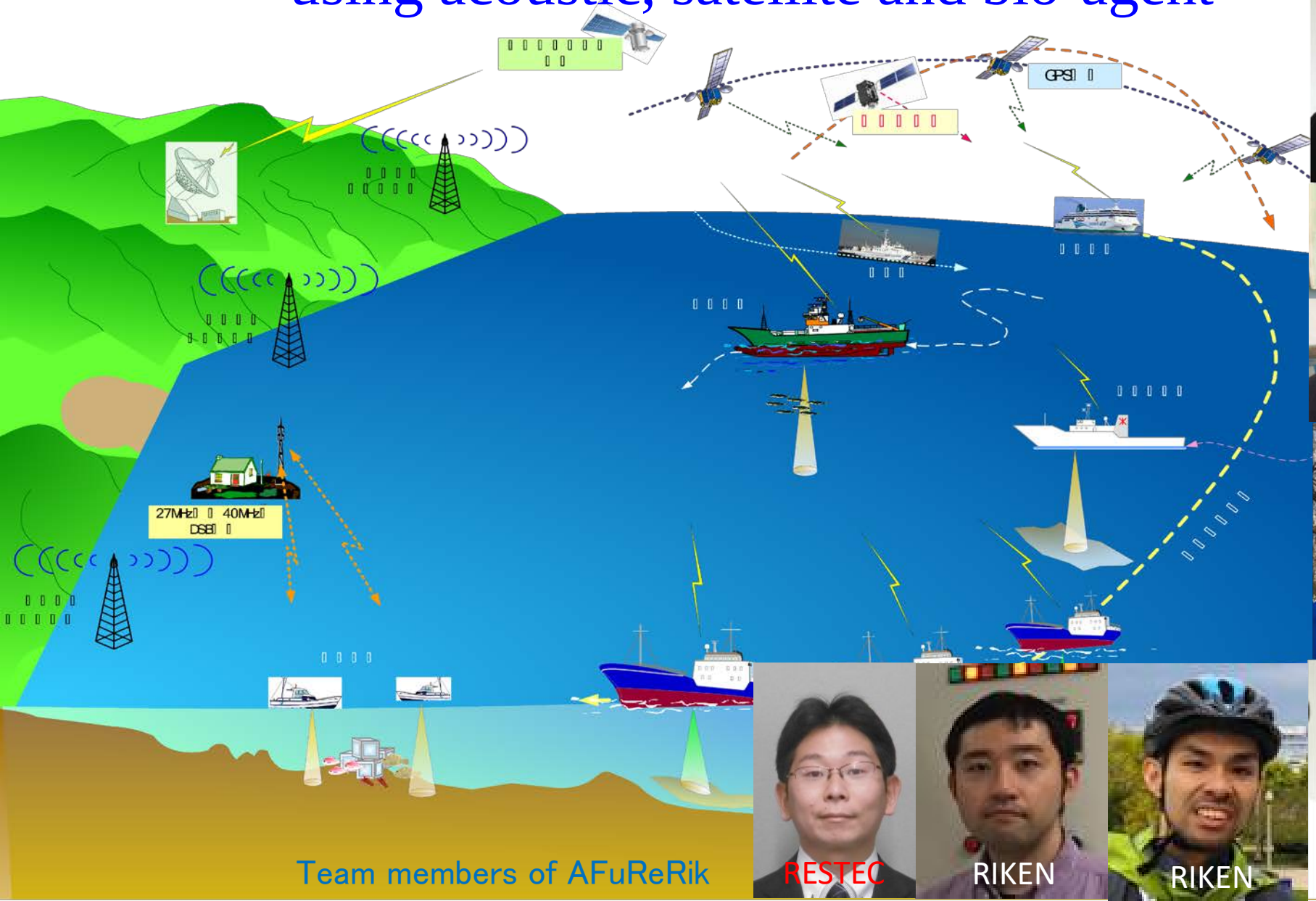


- **Continue talent discovery from broader range**
- **Support transition to Scaleup-ready stage**
- **Evaluate Economics and Scalability of technology**
  - Does cost drop dramatically?
  - After-mapping economy is attractive enough for investment and scale-up?
- **Creating "Shared Vision"** for scaled mapping tech throughout industry/academic/gov

GEBCO

Seabed mapping by remote sensing using acoustic, satellite and bio-agent

DeSET PROJECT




AquaSound


National Fisheries Univ.


Tohoku Gakuin Univ.

RESTEC

RIKEN

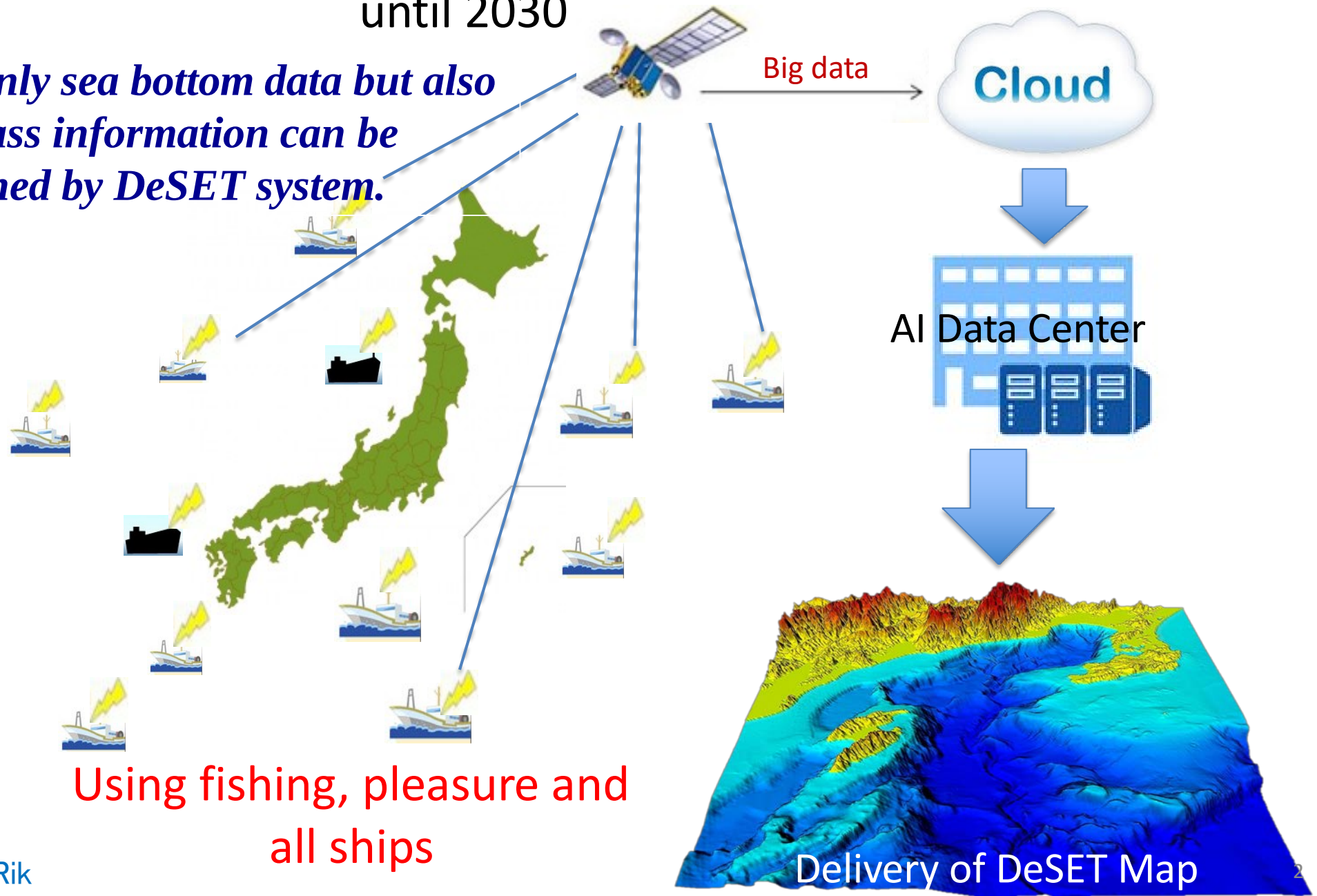
RIKEN


RIKEN

Team members of AFuReRik

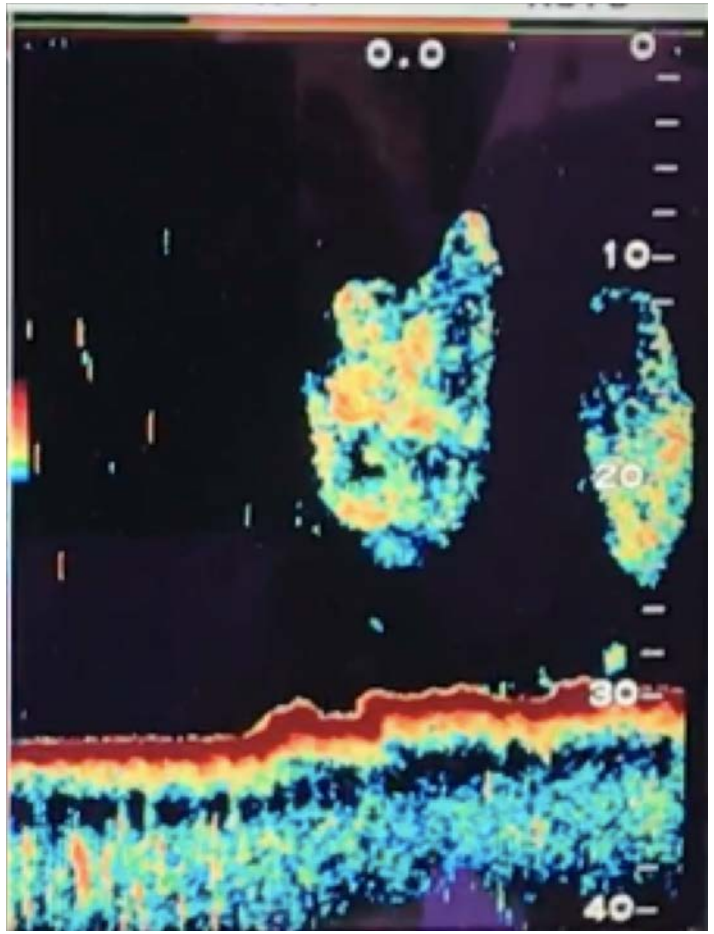
Every body can access to Marine DeSET Map until 2030

Not only sea bottom data but also biomass information can be obtained by DeSET system.

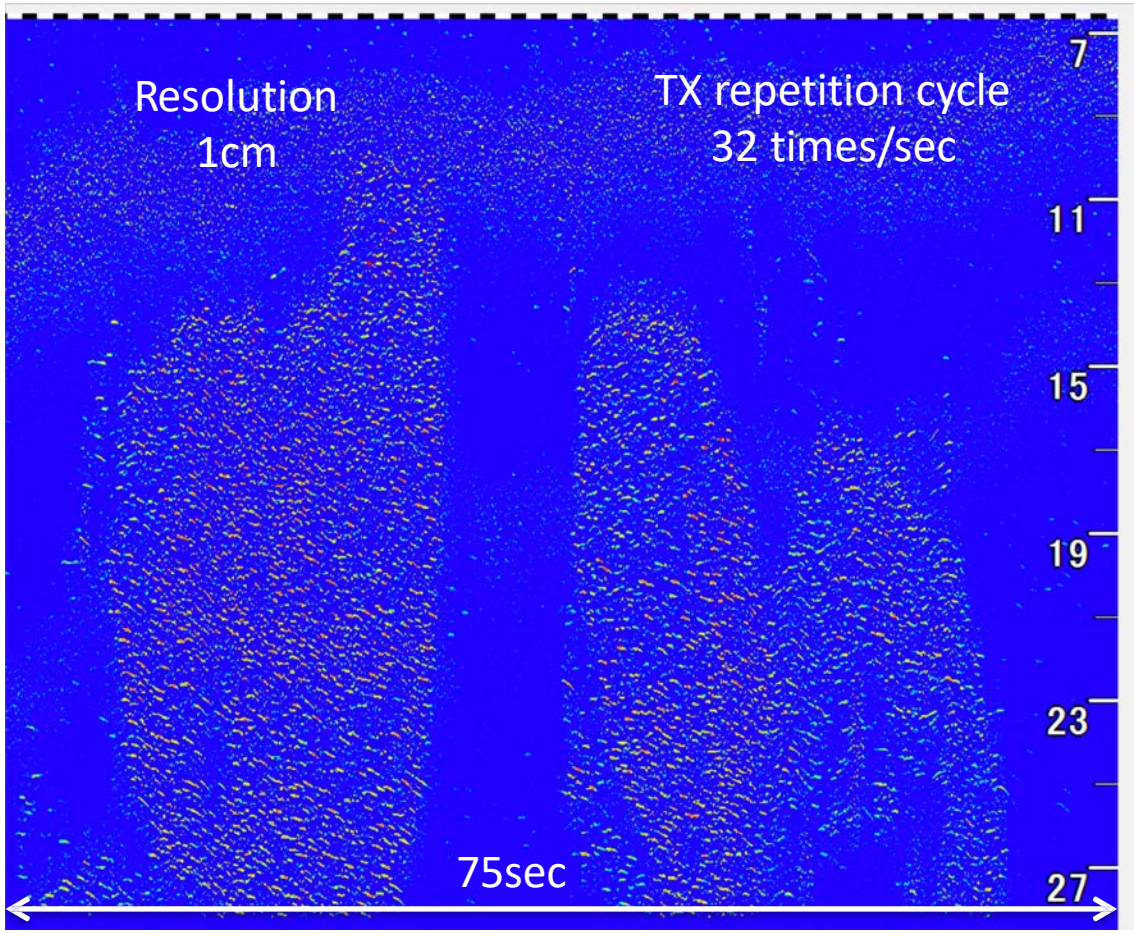


Super resolution Sonar by *FINE* technology

(FINE=First INterval Echosounding)



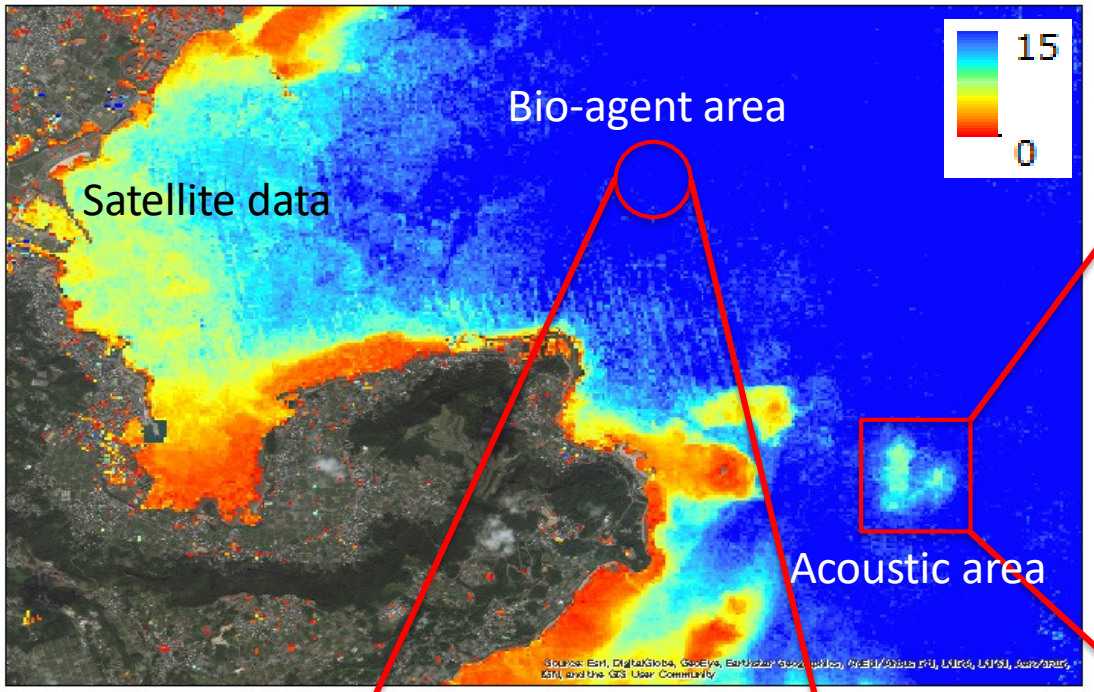
FURUNO FCV-295(200kHz)

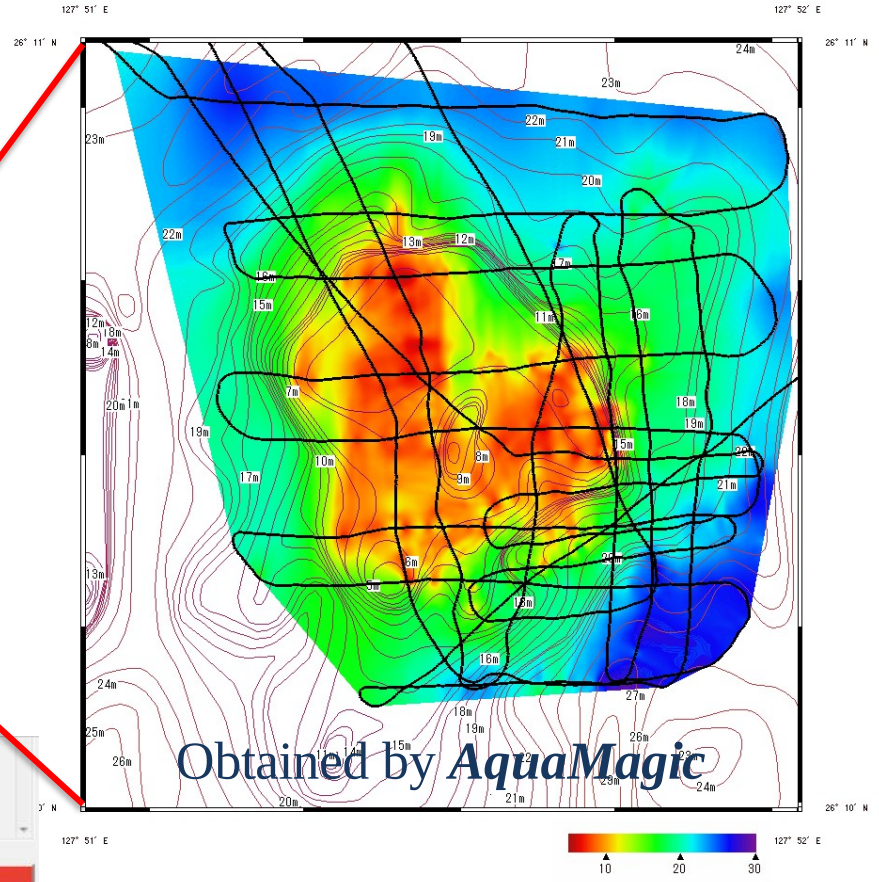


AquaMagic (240kHz)

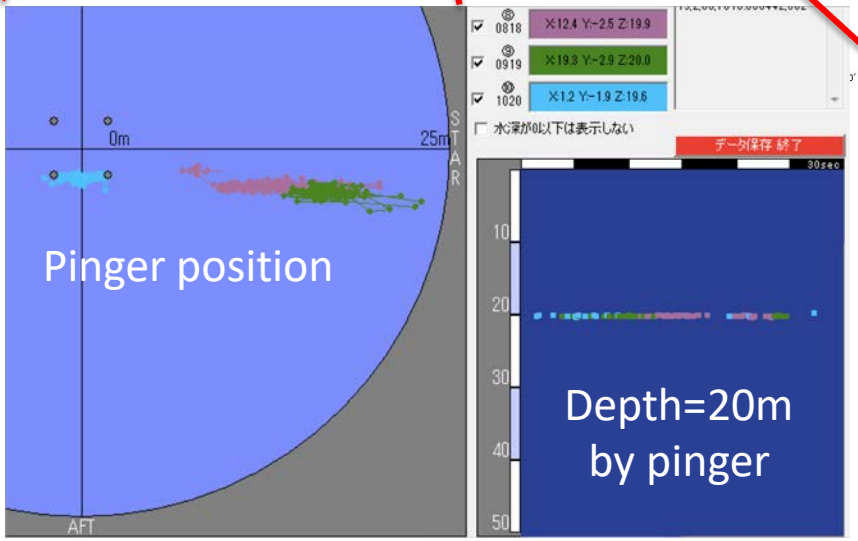
Small anchovy TL≒5cm

Merge of acoustic, satellite and bio-agent data





Torpediniformes



The Marine DeSET Map will be merged satellite, acoustic and bio-agent data.

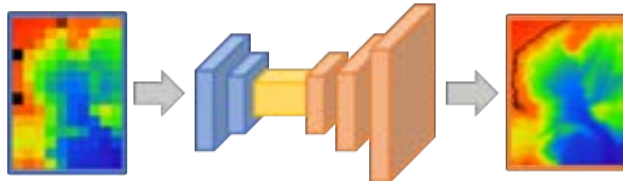
Next year’s expansion

Many of fishing boat would be installed ‘***AquaMagic***’ and not only bottom data but also fisheries information would be collected to DeSET AI Center.

Super-Resolution (SR) AI Team

ESL Environment Simulation Laboratory Co., Ltd.
constructs a bathymetric database.

京都大学 KYOTO UNIVERSITY Kyoto University
researches a SR-AI technology.



ecomott Ecomott Inc.
develops a SR-AI system.

株式会社 アーク・ジオ・サポート Arc Geo Support Co., Ltd.
evaluates the system in the real-world.

TAT 国立大学法人 東京農工大学 Tokyo University of Agriculture and Technology
Tokyo University of Agriculture and Technology
develops spherical-ultrasonic-motor drones.

Q·I Quality& Innovation QI Inc.
evaluates the drones.

Goal

Accelerate ocean floor mapping using AI.

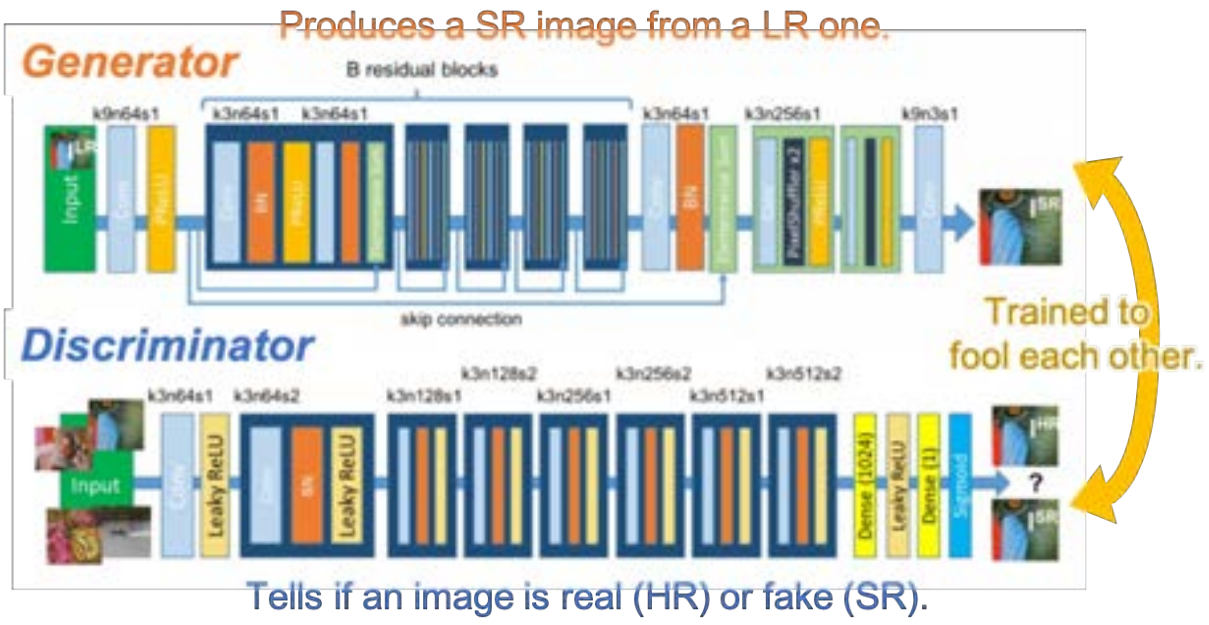
- Automatically obtain high-resolution (HR) bathymetric maps from already-measured low-resolution (LR) data.
  - Use an AI to estimate a HR map of each ocean area from the corresponding LR GEBCO map.

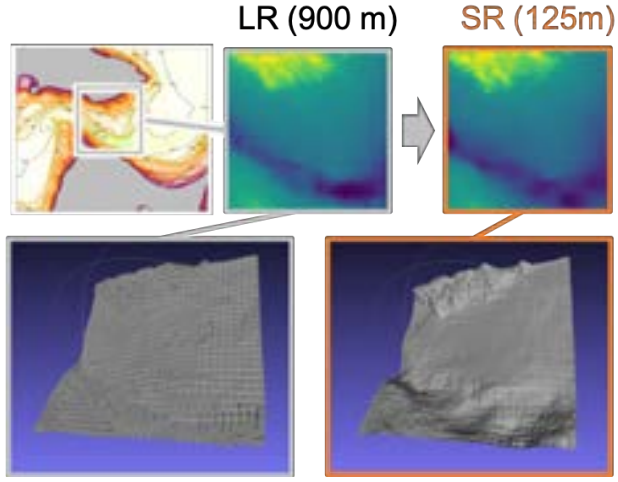
  - Save a lot of measuring time and cost (e.g., labor and fuel) by not going to areas where the AI is accurate enough.
- Propose ocean areas where new measurement is required.
  - Let the AI yield both a HR-map estimate and its uncertainty.
  - Efficiently perform mapping by measuring only areas where AI may not be accurate.

Technology

Apply *learning-based image super-resolution* to bathymetric data.

- Construct a dataset of LR and HR image pairs.
- Train an AI to learn a mapping between LR and HR images.
- Use *generative adversarial networks* (GAN).
  - Preserve structures, e.g., peaks and troughs.
  - Measure the uncertainty of each SR image.

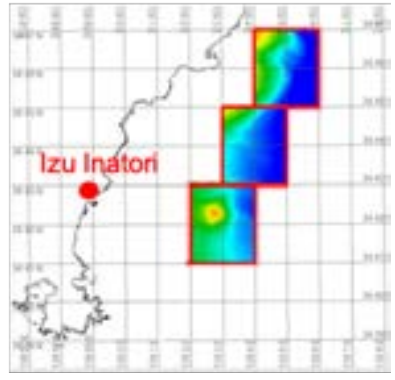




Ledig, et al. "Photo-realistic single image super-resolution using a generative adversarial network." *CVPR*. 2017.

Future Work

1. Improve the accuracy of our SR AI technology.
   - Network parameters should be tuned specifically to bathymetric data (different from general photo images).
   - Shortage of bathymetric (ocean) data may be compensated for by *transfer learning* from topographic (land) data.
2. Evaluate and fine-tune our SR AI system in the real world.
   - We have already measured some real data.



   - Our novel spherical-ultrasonic-motor drones may be used to collect additional data.

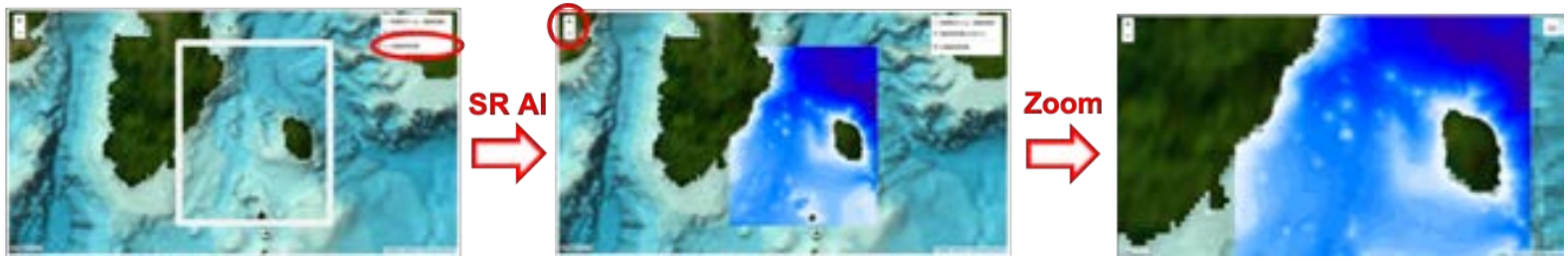
Possible Collaborations

Augmenting training dataset

- With more HR bathymetric images, the accuracy of our SR AI will be significantly improved.
- We do not own provided data nor require longitude/latitude information: just let us pass LR&HR image pairs through our system to update its internal parameters.

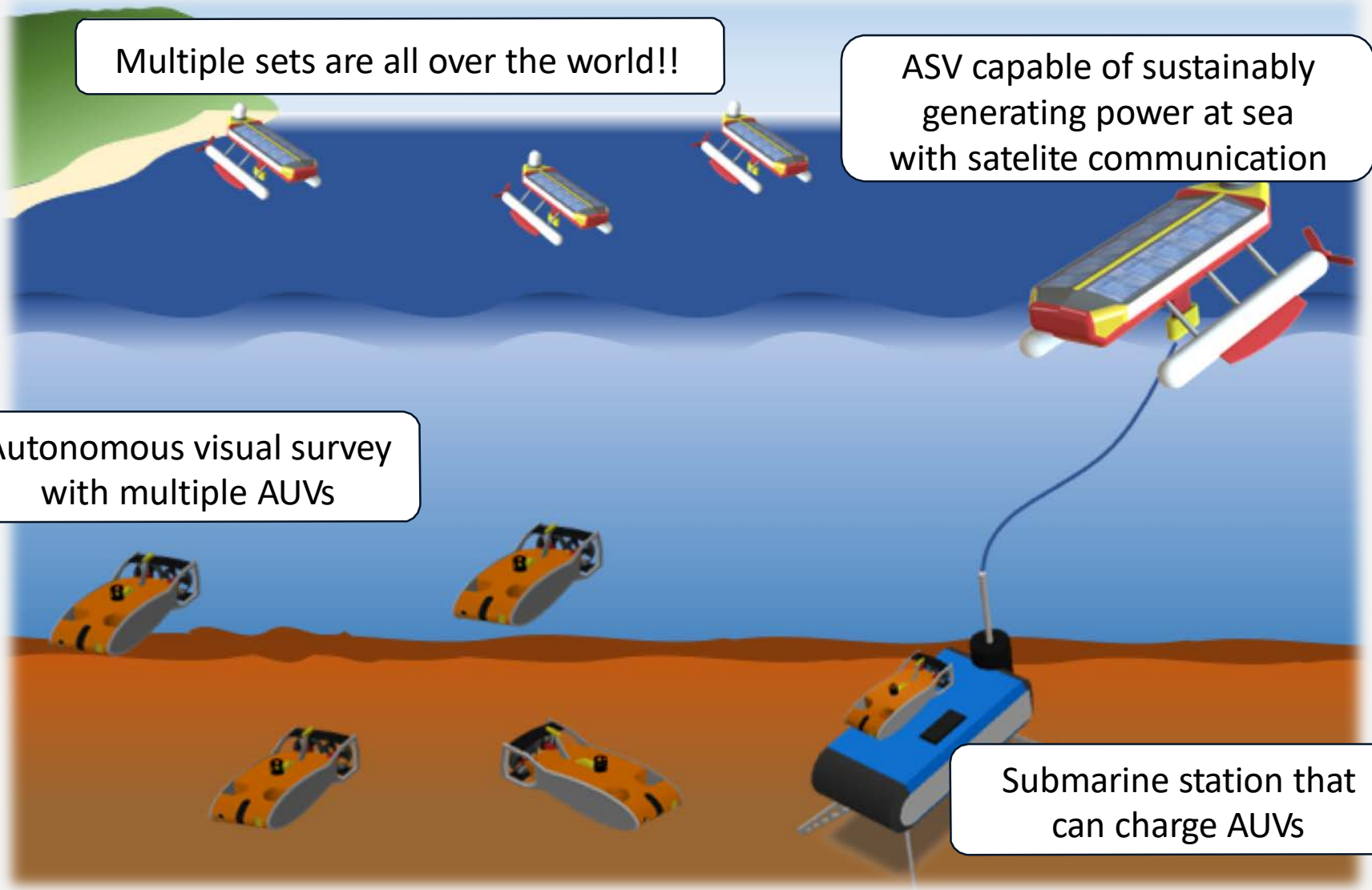
Real-world application

- We are now developing a practical SR-AI system.



- It will benefit everyone who needs HR bathymetric maps.

An unmanned - cean survey s- luti- n ca. a ble - f l- ng-term - . e r ati- n



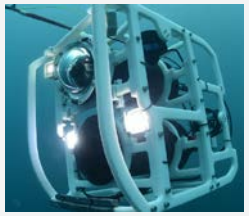
DeSET tea1 l 's 1 e1 bers

Visible Light o mmunication

t sushi Kura1 oto

Outstanding Technology

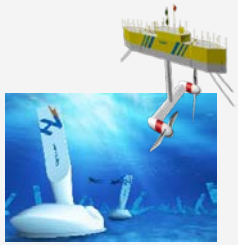
Under Water Drone



Shohei Ito

full depth

Tidal PoA er Generation



Shinji Hieji1 a

岡山大学 OKAYAMA UNIVERSITY

Under Water Robotics

Toshihiro Maki

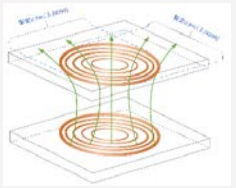
東京大学 生産技術研究所 Institute of Industrial Science, The University of Tokyo

Machining

Hironori Taka1 itsu

成光精密株式会社

Wireless PoA er Transfer



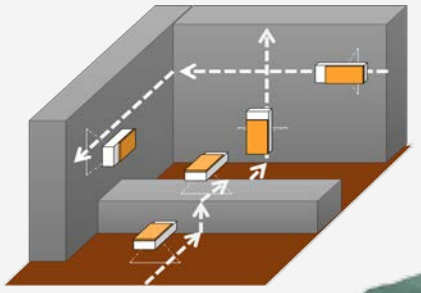
Yasuki Kanazawa

Naturanix Co., Ltd.

full depth

A lightw3ight A -. platform for high-sp332 an2 low-altitA23 SArv3D'

"HA, , ORI 2" aAtomaticallD r3cogniz3s th3 bottom of th3 s3a an2 can crAis3 aAtomaticallD" So w3 can continAoAslDacqAir3 th3 imag3 of th3 s3ab32 an2 cr3at3 a fin3 3D map"



https://www.semanticscholar.org/paper/AUV-HATTORI%3A-A-lightweight-platform-for-high-speed-Maki-Kuranaga/36b4388d3a2228ff43c69785cf20c1e210cb24d0/figure/10

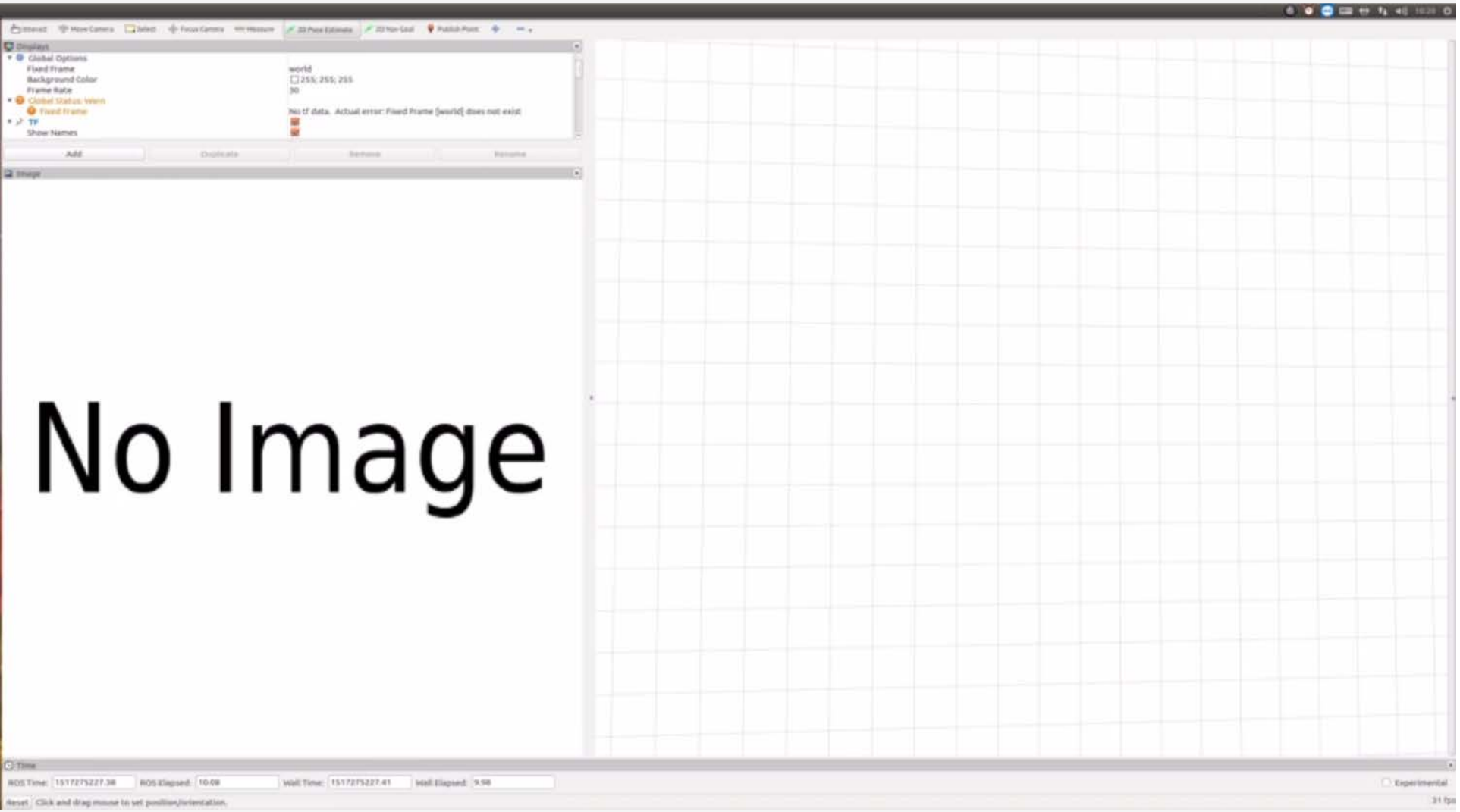
specifications: HATTORI2

Depth rating	300m
Size	360mm(W) x 1050mm(D) x 280mm(H)
Weight	30[kg]
Max. Speed	4[knot]
Equip.	2 x 4K camera (forward , bottom) 1 x HD camera (for measuring attitude)

CONFIDENTIAL

full depth

Autom tic n vig tion long the se floor

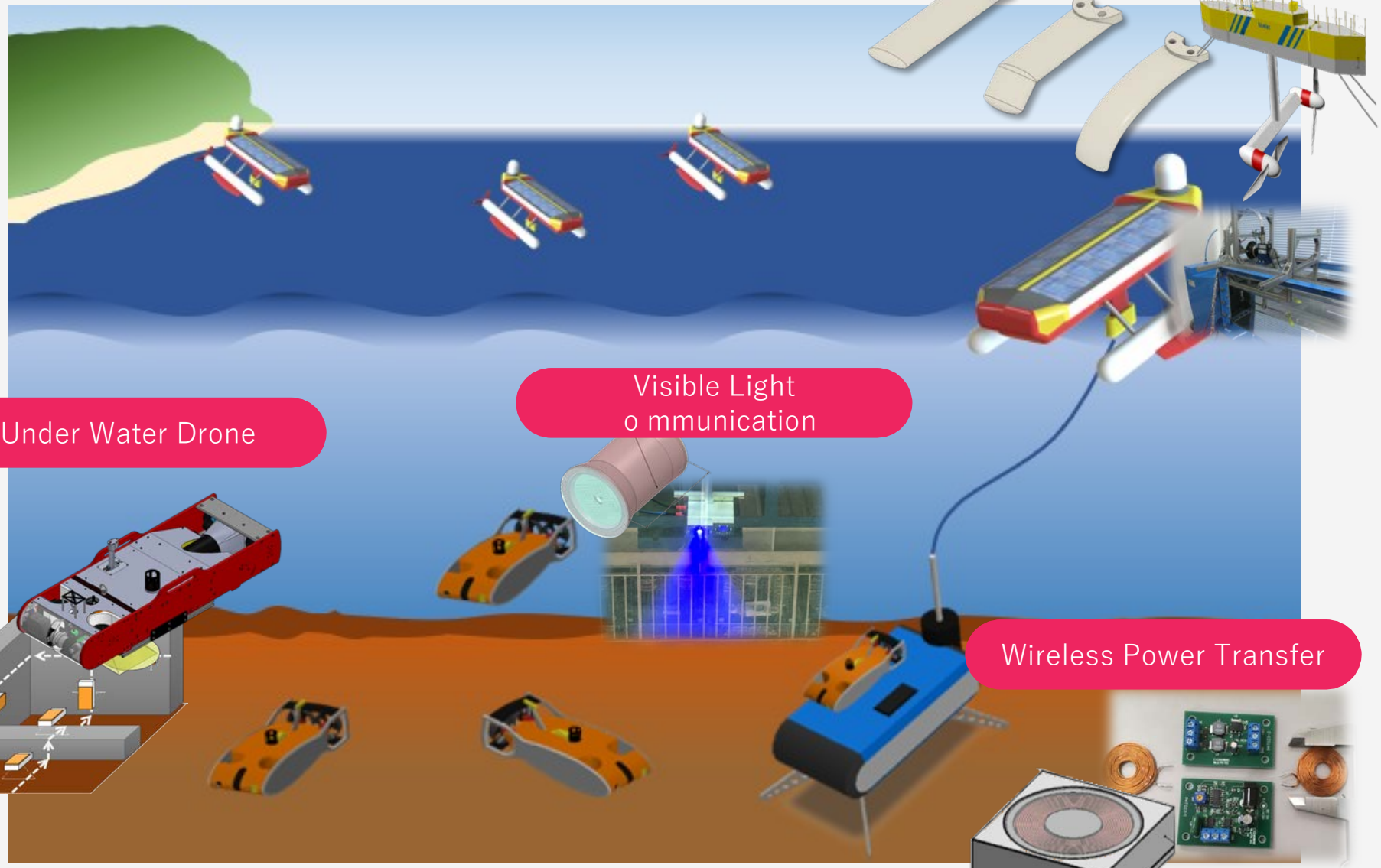


fulldepth

Autom tic n vig tion long the w ll

Prospe ts for the future

Tidal Power Generation



Under Water Drone

Visible Light
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