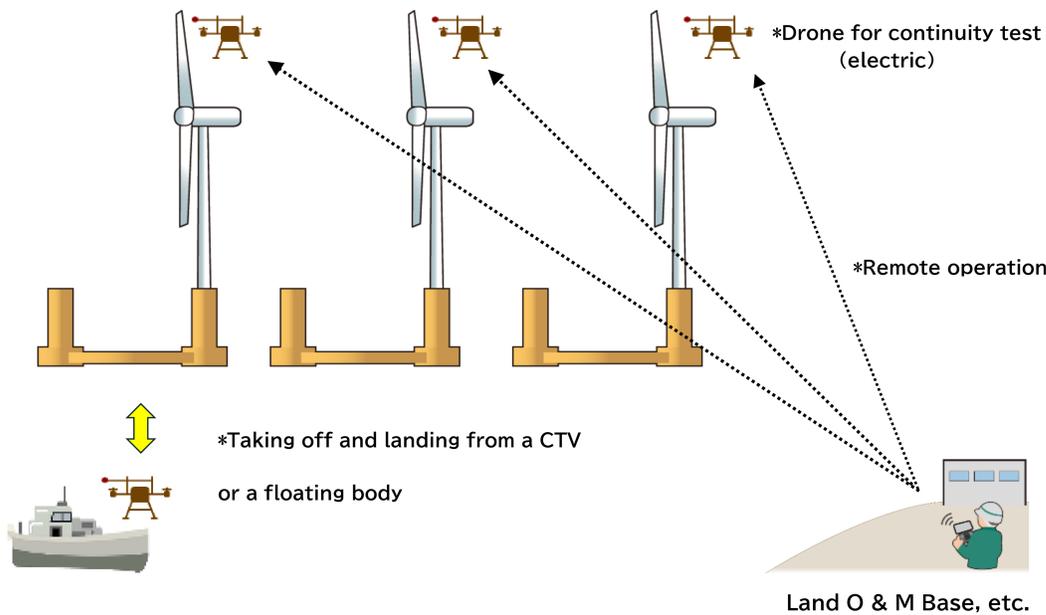


[Overview of Research & Development]

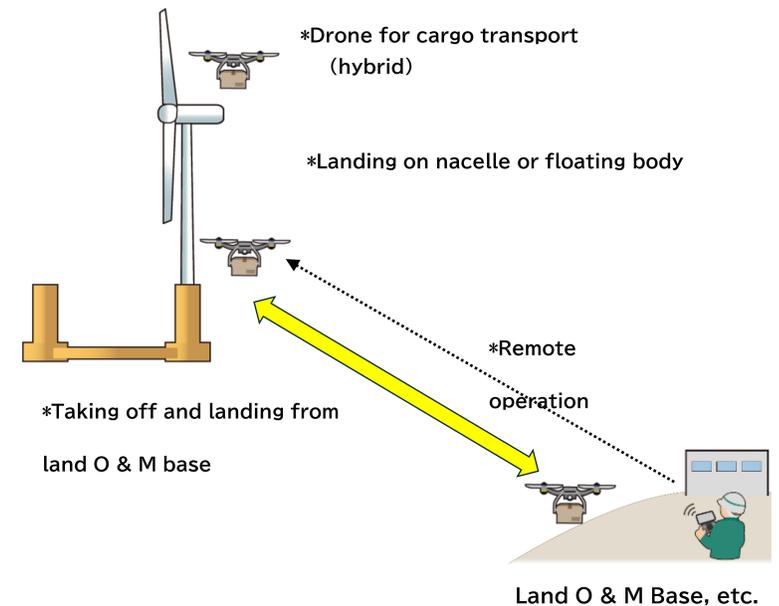
[O-3]: Continuity test of blade downconductor by remote operation

Background	Considering the future expansion of floating offshore wind power generation on a large scale and expansion to the EEZ, it is essential to improve the efficiency of continuity tests currently conducted by rope workers to reduce O & M costs.
Issues	In Phase 1 (elemental technology development) of the GI Fund Project, we have developed a technology for continuity test of blade downconductor using a drone that combines direct operation by a local operator and AI control. However, it is necessary to further improve efficiency considering the shortage of trained operators and the increase in the number of wind turbines installed, etc.
Solution	We will develop technology that enables operators to remotely control multiple drones from a monitoring and control room installed at a land O & M base.



[O-4]: Transportation of supplies by drone

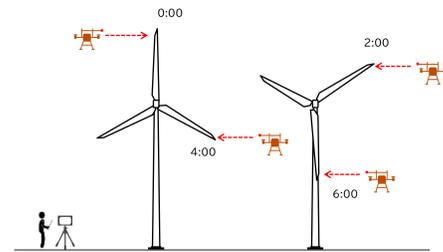
Background	When a shortage of supplies (tools, materials, etc.) is discovered during an inspection of an offshore wind turbine, they are currently replenished by marine transportation, which requires time to arrange and therefore increases downtime. Therefore, it is necessary to establish a more efficient transportation method.
Issues	In Phase 1 (elemental technology development) of the GI Fund Project, a hybrid drone for visual inspection that can fly continuously for 120 minutes was developed. However, it is necessary to develop technology for safe transportation of supplies.
Solution	We will develop technologies for avoiding contact with blades, transporting heavy objects, autonomous landing on floating bodies, and remote operation of drones from monitoring and control rooms installed at land O & M bases.



[Research & Development Status in Phase 1]

Demonstration status of continuity test drones

< Onshore wind turbine >



Confirmation of continuity test of downconductor at various blade positions



Test device contacted with receptor, continuity confirmed. (at 6:00 position)

< Floating offshore wind turbine >

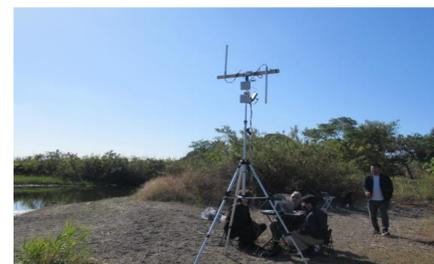


Taking off and landing a drone from a floating body



Contacting the tester to the receptor, checking continuity of downconductor. (at 0:00 position)

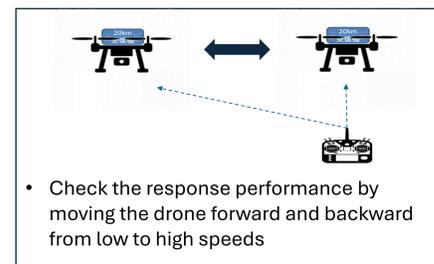
Demonstration status of drones for cargo transport



Checking communication at a point 20 km away from land (at Lake Biwa)



120 minutes of successful continuous flight (at Test Field)



Checking the response performance (collision prevention) of the drone (at Test Field)



Various performance verification tests, such as wind resistance, were conducted. (at Oita Industrial Science and Technology Center)

Research & Development items of drones for continuity test of downconductor

Item	Description
Communication system	To construct a mobile communication system capable of satisfying high speed, large capacity and low delay in order to cope with remote operation.
Equipment installation location	Determine the location of various equipment (System body, antenna, etc.) on the floating body.
Cable route	Cable route and connection method required for communication are determined.

* These R & D items apply also to the drones for transportation of supplies

Research & Development items of drones for transportation of supplies

Item	Contents
Contact avoidance technology	A flight control technology that automatically avoids collision and/or contact with moving wind turbine blades will be developed.
Heavy load transportation	Continuous flight (between land and wind turbine) and a load-bearing capacity of 10 kg will be verified by actual drone operation.
Autonomous landing technology	AI image analysis will be developed to recognize markers installed at the landing point and autonomous landing technology will be developed.

At the facilities of the Southern Akita Floating Offshore Wind Power Project, those demonstration tests will be conducted and the issues will be identified and improved, aiming for early social implementation.