

Automated Offshore Aerial Delivery of Spareparts

**By Anders la Cour-Harbo, Aalborg University, Denmark
ADD2Wind Project Manager
Jonas Nørholm Larsen, Energy Cluster, Denmark**



Automated offshore delivery of spare parts is the goal of the ADD2Wind innovation project (2020-24) funded (€2 million) by the Danish Energy Technology Development and Demonstration Programme. The project partners are Aalborg University (DK), Aeroscout (CH), EMG (DK), Energy Cluster Denmark (DK), Loxar (DK), Ørsted (DK), Vattenfall (SE), Siemens Gamesa Renewable Energy (DK), Vestas (DK).

The consortium works with two scenarios: Planned and unplanned offshore services. Planned is when a lot of equipment is needed by technicians working at a wind farm. Unplanned is when a component suddenly breaks and needs replacement. In both cases, it is the intent to use automatic drones for the delivery of the spare parts.

In the planned services scenario, the drones from the ADD2wind project conduct regular cargo transport missions between the port and the wind farm. Up to 500 kg of spare parts can easily be used for each turbine during a planned service period. We imagine a situation where our delivery drone flies between 500 & 1000 times back and forth between the service port and the wind farm with equipment during weeks of service – a solution that is much cheaper than single flights on demand.

A Green Alternative

The offshore wind farms to be serviced are located more than 30 kilometres from shore, and drones can be a cost-efficient and green alternative to the vessels used today.

The vessels use 50 to 100 times more fuel than our drone. And the drone is not susceptible to waves and changing tides. If a technician is missing something, we can deliver the spare parts by drone within 30 to 45 minutes. Our drone can be in the air for up to three hours.

Cargo Container

The drone in the ADD2wind project will operate with a specially designed cargo container. When it approaches the offshore wind turbine, the drone lowers the cargo container down onto the helideck on top of the turbine nacelle. This is done using a specialized winch. Afterward, a technician can easily retrieve the bag through a hatch.

The consortium's mission is to supply a drone that can fly automatically to the wind turbine. When it approaches the wind turbine, the drone control is taken over by a remote pilot to ensure safe delivery. The drone is fitted with a video camera and a scanning LIDAR to provide situational awareness for the pilot.

Offshore Wind Industry

Some of the major global players in offshore wind



participate in the project. Vattenfall and Ørsted own a large number of wind farms, and Siemens Gamesa and Vestas are two of the major offshore wind turbine manufacturers.

The wind industry players are the “problem owners” in the project. They see the potential in the technology and are willing to collaborate on innovation. The SMEs in the project are the “problem solvers” alongside us at the university. Aeroscout from Switzerland is building the drone and conducts the test flights. At Aalborg University we are building the equipment installed on the drone required for the delivery.

The Esbjerg-based company EMG is developing the drone-borne delivery container. It must be suitable for transportation in open air, be waterproof, and ultimately have the capability of enduring days in stormy weather on top of a turbine in the North Sea. It is being purpose-designed and has double layers of foam inside to keep the cargo in prime condition.

Next Step

The project partners expect to test the drone technology at offshore turbines located onshore in early 2023. An offshore test is expected to be completed during autumn 2023. The project partners are ready for testing, but are still waiting for flight permissions from the authorities in Denmark. The intention is to test the technology on three onshore wind turbines with a height of 140 metres located in the western part of Denmark in 2023. Moreover, the permissions to fly in Switzerland have already been obtained and an initial test of the delivery technology is planned for November 2023.

It is expected that the project partners will have a fully functional prototype available for deployment by the end of the project period in 2024. Currently, the focus is on potential problems and safety issues. What happens if you lose GPS, and what happens if the delivery bag does not detach? Such challenges will be addressed during the test flights in the upcoming months.