Reducing costs with end-to-end offshore solutions

The growing DarkPulse family has created a list of world-class capabilities, cementing its position as the leader in infrastructure sensing and monitoring in all domains: air, land, and sea.

By leveraging the expertise and experience of the DarkPulse family of companies, it combines the skills and insight of a global network of experts to undertake the most complex projects, to be a genuine end-to-end solutions provider for offshore wind farms. From the planning phase through to the build, implementation, and testing, all its solutions are ideal for large and small offshore wind farm projects.

Wildlife surveys capabilities

From the start, during the planning stage, there is the need for a range of different surveys to be completed, from construction surveys to marine life.

Recommendations laid out by the US Fish and Wildlife Service's Wind Turbine Guidelines Advisory Committee instruct a tiered approach, that includes preliminary assessments, site characterisation and field studies to predict and evaluate the species and habitats that could be affected by the wind farm.

Using the expertise of two members of the family, Wildlife Specialists and Remote Intelligence, DarkPulse carries out comprehensive wildlife and sea life assessments using unmanned aerial vehicles (UAVs), which are ideal for mapping wildlife habitat and conducting wildlife surveys.

The UAV's ability to fly slow and low provides high quality imagery and information in a very site-specific manner. Unmanned aircraft allow operation in challenging environments, like offshore, creating a digital map of surfaces and structures without the need for human presence eliminating safety issues for surveyors exploring unknown or dangerous terrain. Results can be quickly viewed, shared, and analysed, increasing collaboration and efficiency, as well as reducing manpower costs. All whilst minimising animal and habitat disturbance.

Another member of the DarkPulse family, TerraData, offers aerial and underwater services delivering custom and complex unmanned remote sensing systems, services, and consulting. TerraData performs

integral services of DarkPulse's offerings, which include experienced personnel and leading-edge equipment allowing the company to operate AI assisted inspection services in all mediums.

Their ability to work in diverse marine environments with accuracy, efficiency, and expert results while eliminating risk to humans has been a game-changer. Through their consultancy services, UAVs can be customised to meet the project's unique requirements.

For example, for blade inspections and wildlife surveys, through the expertise of TerraData the drone would be customised with a higher battery capacity and high-resolution camera capabilities to enable it to hover for longer periods of time, whereas for security needs, the UAV may be built with infrared and voice capabilities.

Surveys are not only requirements, but also very fascinating, with the major ocean environmental and marine life concerns relating to offshore wind developments being increased noise levels, risk of collisions, changes to benthic and pelagic habitats, alterations to food webs, and pollution from increased vessel traffic or release of contaminants from seabed sediments.

Communications and security

Within communications and safety plans there is a need for a constant, reliable network to enable workers to operate safely and in new ways during construction and operation. This connectivity allows for the movement of large amounts of data for digital workflows, implementation of IoT based predictive maintenance and improved voice and video communications.

Integrated security systems using a combination of video surveillance with Artificial Intelligence (AI) and video analytics, access control and remote monitoring are the most comprehensive and effective ways to protect wind farms.

A further member of the DarkPulse family tree, Optilan, who already possess a strong delivery pedigree in wind farms, offer a whole array of solutions and services which are turnkey, addressing the complete asset, including turbines, offshore and onshore substations. They also provide the critical fibre and communications systems.

Preventing unauthorised access to wind turbines is fundamental to securing a wind farm, one area of threat can be the access doors to towers that give entry to wiring and network computer equipment.

Traditional security of keyed locks is the minimal level expected but they provide no details about who accessed the site or for how long and key codes can be easily shared. An Optilan security solution example would involve an access control and monitoring system with CCTV which would give complete control over who can gain access to different areas and can grant and revoke access in real time along with history reports to help manage personnel and contractors on site.

With CCTV and access control systems we can ensure personnel security for health and safety as well as monitoring approaching vessels and people trafficking risks.

The observation services that are delivered via CCTV technologies, either enable customers to respond to a security alert or provide a high-resolution visual verification for things like blade inspections and access detection as a response to danger management systems. Implementation of these systems provide remote asset protection.

Monitoring and maintenance

The cost of building and maintaining a wind farm can be vast, so to ensure the stability, long life and optimal design of wind turbine components monitoring and maintenance are essential. Determining and understanding offshore wind farm failure rates and resource requirements for repair is vital for reducing costs and in turn reducing the cost of energy.

Within the last decade an innovative approach towards improved spatial resolution was invented, called dark pulsing, that allowed spatial resolutions in the sub-meter range due to Brillouin sensors historically failing due to low resolutions and temperature/strain cross sensitivity issues.

The DarkPulse BOTDA sensor technology provides a data stream of critical metrics for assessing the health and security of infrastructure and has already been applied successfully in various industries including structural health monitoring of infrastructure, Mining, Oil & Gas, Pipeline and Security.

Specifically for the wind market, our sensors can provide real time monitoring of structural heath changes of turbine blades, structural health and corrosion of towers, temperature changes of turbines, and integrity of array cables so that repair and replacement can be

conducted before a critical failure occurs, protecting assets and lowering costs.

A key challenge for the industry is the wind turbine blades being especially susceptible to several different failures caused by lightning damage, failure of the control system to detect vibration, manufacturing defects leading to deboning, environmental events, crane impact during scheduled maintenance or on-site repair. All types of blade failures can cause significant economic loss and incur negative social impact.

Blade inspections are often conducted for warranty purposes and then every three years thereafter. Despite regular inspections 85% of blade failures are because of poor maintenance. These failures are extremely costly, ranging from £80,000 to £811,000 with the highest reported failure costing £4.8M (TWI Global, 2020). Via the DarkPulse family we are able to offer autonomised drone stations that, through route mapping can carry out blade inspections periodically or as required after a suspected incident by the client.

Around the world, there are over 3,000,000 flashes of lightning every day. That's around 44 strikes every second. And given that wind turbines are tall structures out in the open, they are especially prone to being struck by lightning which can be costly. For example, the US National Lightning Safety Institute states that at one wind farm in the southwest lightning damage alone exceeded $50,000 in the first year of operation, and at another 85 percent of the downtime experienced was lightning-related.

Using the skills and expertise of another DarkPulse family member, TJM Electronics West, we fit sensors and lightning detectors inside the turbine blades which accurately measure and analyse lightning strikes to the blades as well as warning operators.

We offer a range of solutions to significantly reduce costs with our blade inspections that can also be achieved with long range CCTV, AI robotic as well as drone technology, offering reliable early detection and real time identification ensuring immediate and correct incident response by operating staff.

Another point of failure which can be costly to wind farms is the subsea power cables which are frequently reported as an issue for offshore wind farm operators. Such failures are reported to account for 75 to 80% of the total cost of offshore wind insurance claims.

Issues associated with manufacturing and/or installation are reported to be the most common cause of cable failure, with two thirds of cable faults being attributed to contractor error during the installation phases, many of which manifest during the first two years of operation, our solutions reduce the cost of failure, string and export and decrease business interruption and insurance costs.

Using our sensor configurations which includes the patented DarkPulse EREBOS™ system, we use advanced laser-based monitoring systems to provide rapid and accurate monitoring of temperatures, stresses, and strains along the entire sensing cable in real-time via our UI on any device anywhere in the world. These are available for monitoring areas in and around buried or above ground cables that are 100 km or more in length, or for localised areas.

Future thoughts

Thinking about the future, the DarkPulse family services, big data analytics techniques can make significant improvements to wind farm performance and reduce costs. With the recent approval of the Infrastructure Bill, we believe the US has begun its journey towards smart infrastructures which will lead toward smart cities.

DarkPulse is positioning its system and capabilities as the foundational technology for smart cities, which we believe is part of the larger science of Global System Dynamics.

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