Drone inspection

- high resolution images and video

Our drone inspection solutions provide high resolution images and video of otherwise inaccessible areas of your facility. Drone inspection is a cost-effective method for on- and offshore constructions, tanks, wind turbines, chimneys, bridges and other hard to reach installations.

Introduction

Visual inspection by a drone is a quick and cost-effective inspection method, proving high value, ensuring longer inspection intervals, increased knowledge of structural conditions, inspection of damages from corrosion, lightning and more.

Drone inspection enables access to otherwise inaccessible structures and details, offering construction owners immediate action as an alternative to more traditional, time consuming and costly inspection methods like rope access, sky-lifts, cherry pickers and scaffolding.

Benefits

Using a drone inspection solution from FORCE Technology for visual inspection, provides benefits such as:

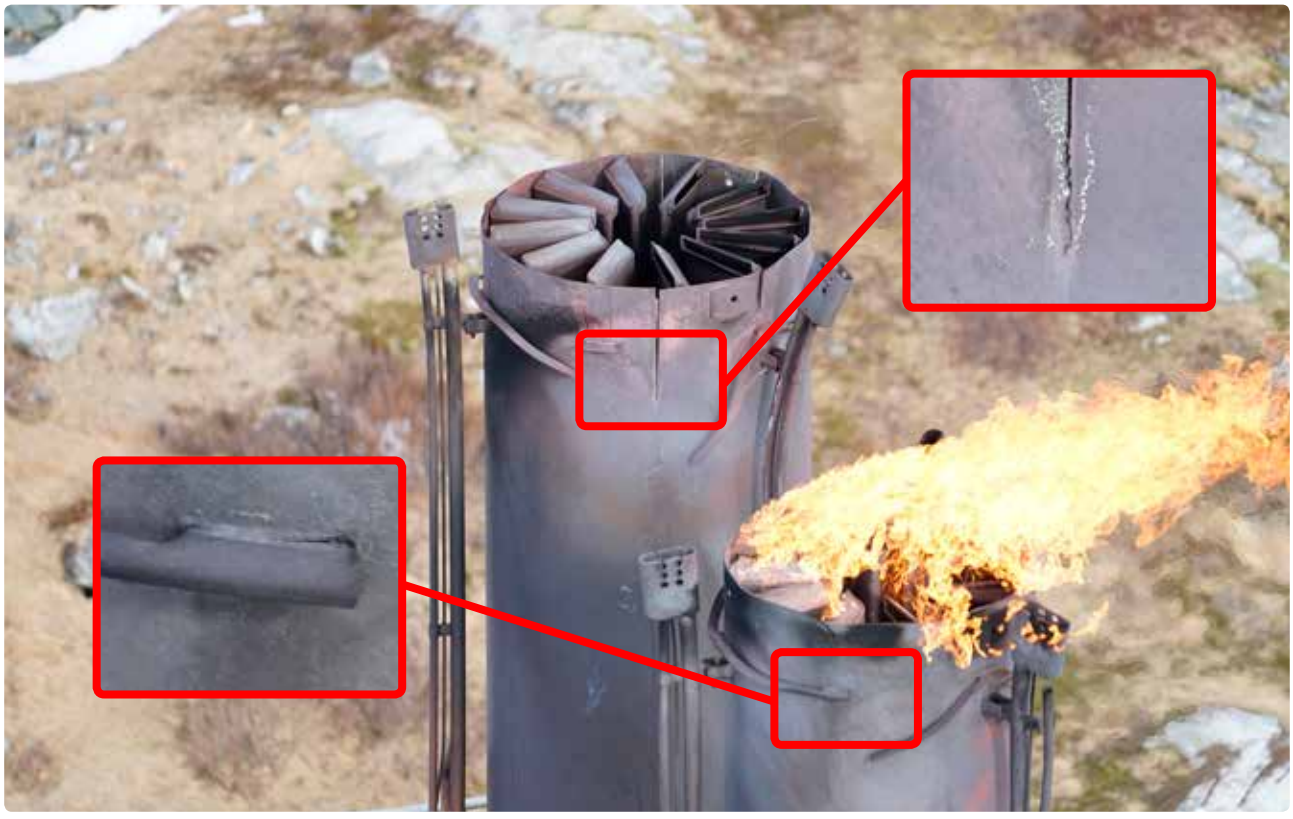
- inspection of areas difficult to access
- preventive maintenance planning and optimised production
- access to areas that pose HSE risk to humans
- fast response time
- quick on-site deployment of the inspection system
- authorized and qualified inspection personnel
- reduced downtime.

Phases of a drone inspection

Task clarification	To ensure the best inspection result, a thorough and exhaustive clarification of the purpose and success criteria for the inspection is essential. As drone inspection is influenced by numerous parameters, a meeting between the client and the pilot/inspector is recommended to ensure that all relevant details are addressed. For instance: • ***Flying:*** Open or closed air space, special permits, precautions, clearing of areas, weather conditions, ect. • ***Inspection:*** Item(s) to be inspected, details of particular interest, video and/or pictures, choice of camera, optics, etc. • ***Practicalities:*** Safety permits, mobilization, transport, contact person, ect. • ***Data analyses:*** Depending on the nature of the inspection, type and extent of analyses/ evaluation of the inspection results must be agreed upon. • ***Report:*** For each task, requirements to the final report (extent, method of delivery, access to original data, etc.) must be agreed upon.
Inspection	During inspection, the drone is operated by a FORCE Technology pilot. Each flight has a duration of up to 20 minutes. During the flight, the inspector operates the camera, records video, and directs the pilot to points of special interest, views of different angels etc. In general, the drone can operate in windspeeds up to 10 m/s.
Reporting/debriefing	When the flying is completed, the obtained data will be analysed as agreed, and reported to the client. A debriefing meeting may be relevant to ensure that all relevant results from the inspection flight is communicated to the client.

Refinery inspection

High quality photos and videos, combined with a fast response time, make drones an ideal candidate for fast condition assessment of critical structures located at hard to reach places. Live flare and chimney inspections at refineries are examples of areas where our drones have been successfully deployed.



Inspection by drone is fast and gives you visual data, which is useful in the maintenance and repair work.

Offshore drone inspection

Offshore constructions

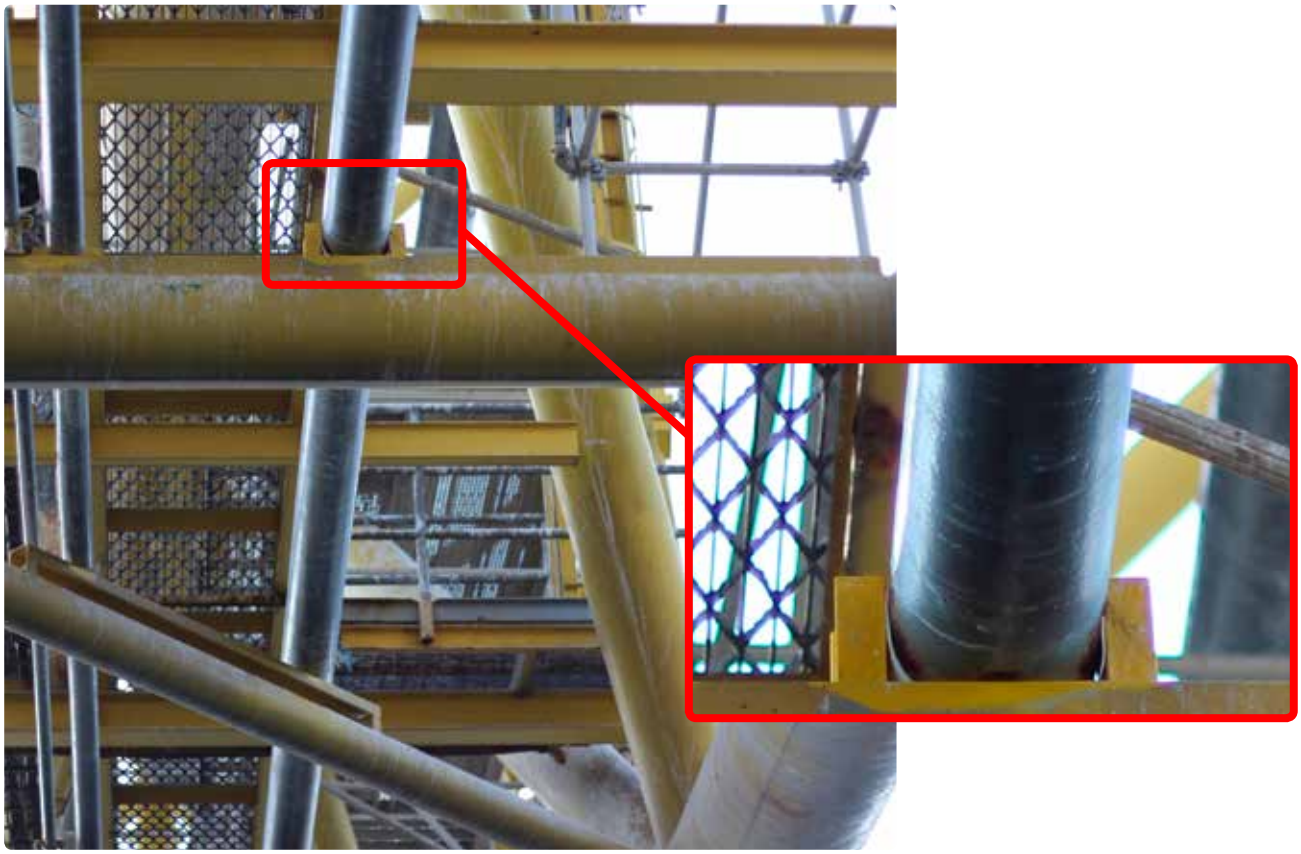
Inspection of critical areas on offshore constructions often requires rope access and shutdown of critical processes. By employing a drone, we can access areas that pose HSE risks faster and safer.

Flares

The remote control feature enables both pilot and inspector to distance themselves from the danger zone, allowing drone inspection of high risk areas, such as a flare and its tower. Detailed images of critical components can be obtained, without disturbing the process.

Bridges

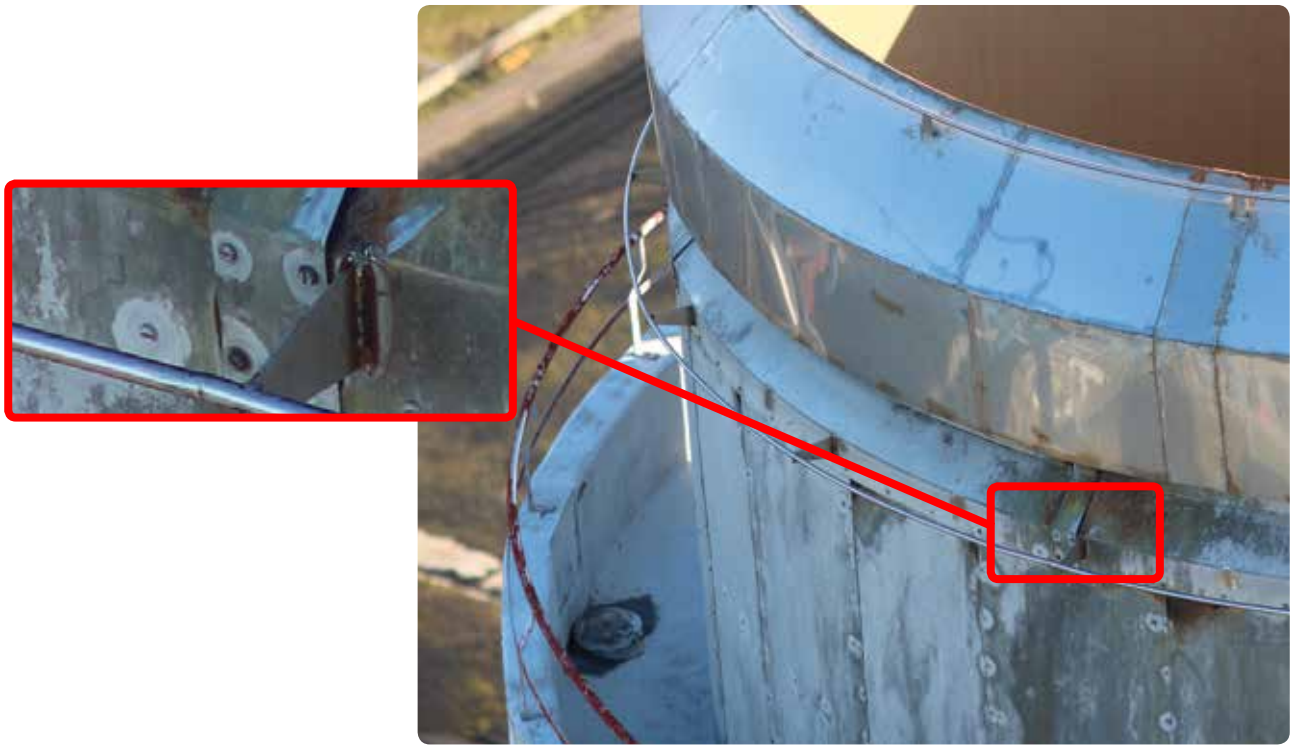
The drone's ability to look up is particularly useful when inspecting bridges. Flying underneath the bridge and inspecting for damages in the concrete, corrosion etc. without the cost of e.g. a rope access team makes drone inspection an attractive alternative.



Drone inspection of chimneys

The drone enables a quick and cost effective inspection of chimneys. Inspection of the general condition and of specific chimney accessories can be performed both as a screening of the surface or by focusing on details.

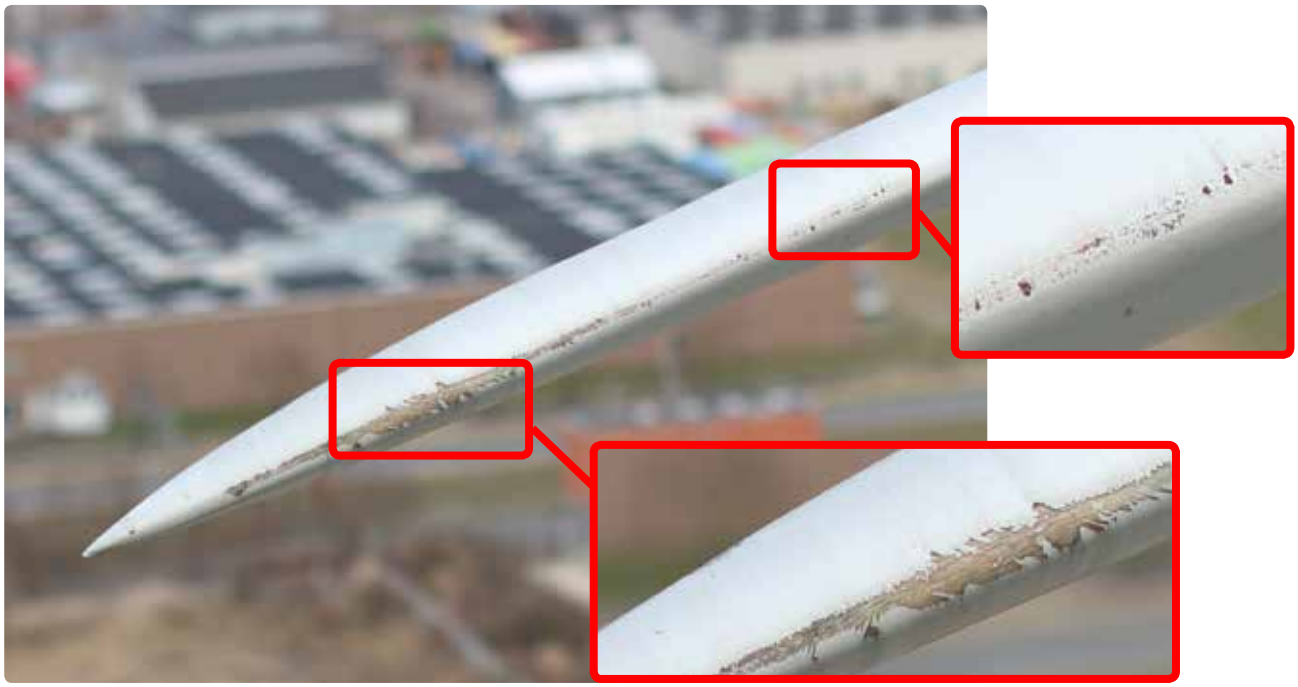
Frequent thunderstorms leave damages from lightning strikes in the concrete, to the lightning conductor or to the chimney structure itself, exposing the reinforcing steel. Drone inspection reveals details of damages and enables immediate action.



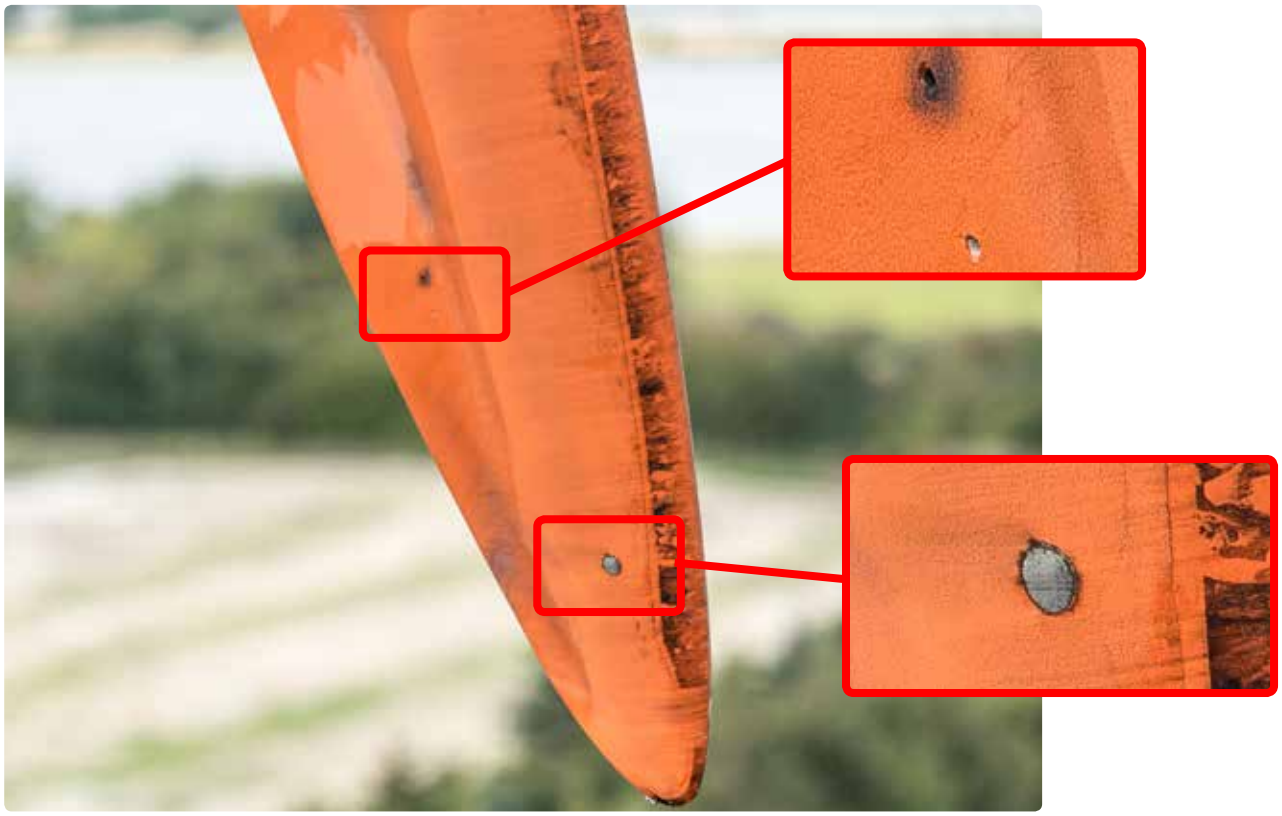
A drone inspection of chimneys reveals corrosion areas and cracks in the concrete. Inspection by drone is fast and gives you visual data, which is useful in the maintenance and repair work.

Drone inspection of wind turbines

Inspecting wind turbines is by its very nature subject to challenging wind conditions. Because of low mobilization costs (small inspection team), fast set up, and high resolution pictures of damages, e.g. on the blades, drone inspection is an attractive method for assessing the condition of the wind turbine. The downtime is hereby minimized and increases the production time.



Damages to the leading edge reduce the production outcome of your wind turbine. A drone inspection reveals damages to the blade and ensures that repairs are carried out in time.



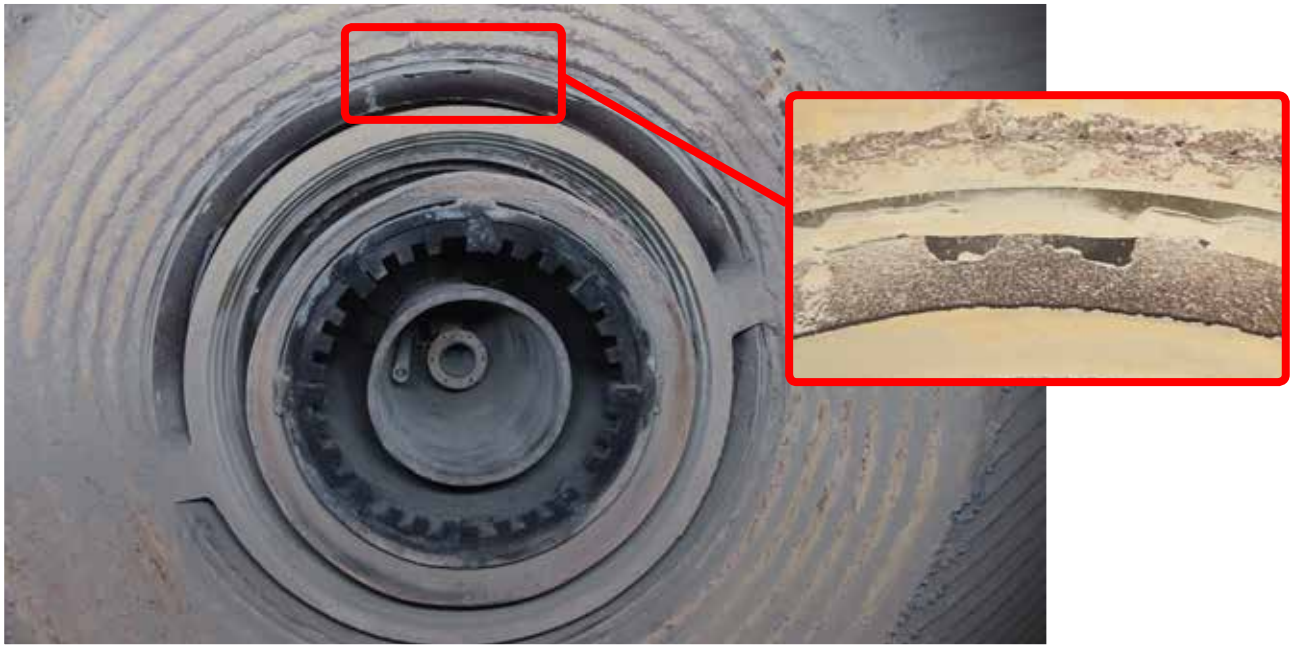
Damages to the lightning receptors can lead to further damage or reduced lifetime of critical components. Through pictures or video, a drone inspection provides you with visual data on damage to the receptors and enables you to carry out repairs in time.

Drone inspection in confined spaces

Drones reduce the costs and time for inspection of confined spaces such as storage tanks and boilers. Equipped with powerful LED panels and cameras, the drones provide a good image quality for remote visual testing (RVT).

The quick deployment time and ability to either screen a whole area or quickly get details of specific points make them ideal for time critical inspections.

The data provided by the drone creates the foundation for better maintenance planning. Thus, the data reduces maintenance related downtime and costs.

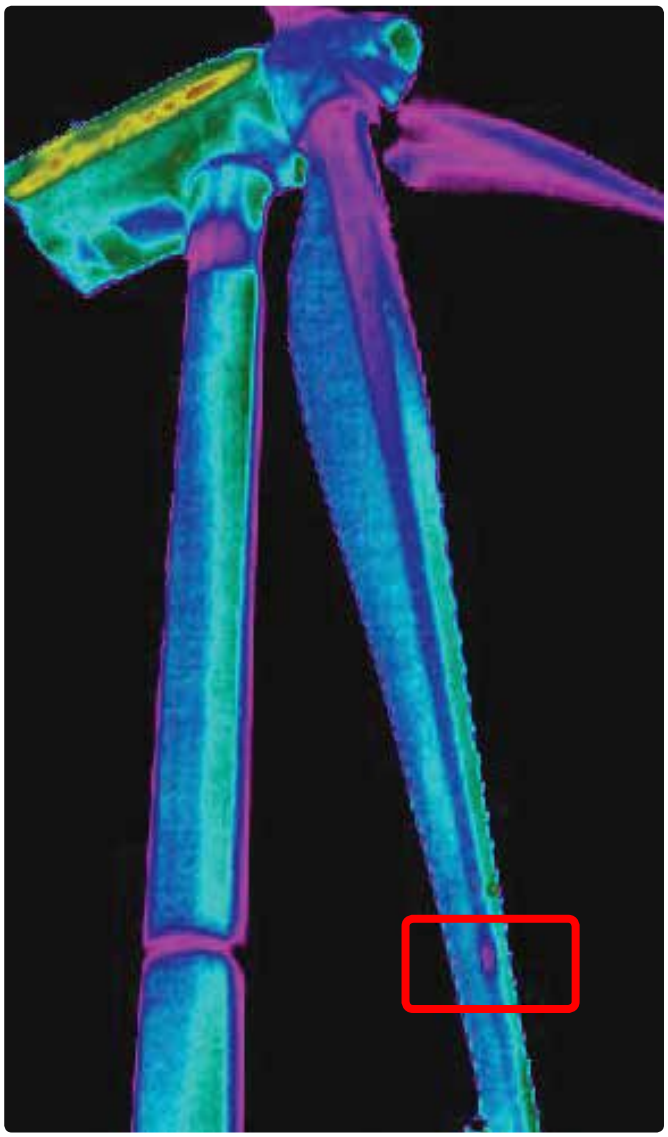


Cracks in boiler detected by drone inspection.

Drone inspection of boiler. Equipped with lights, the drone is well suited for inspection of spaces with little or no light.

Drone inspection of an underground storage tank.

Infrared thermal drone inspection

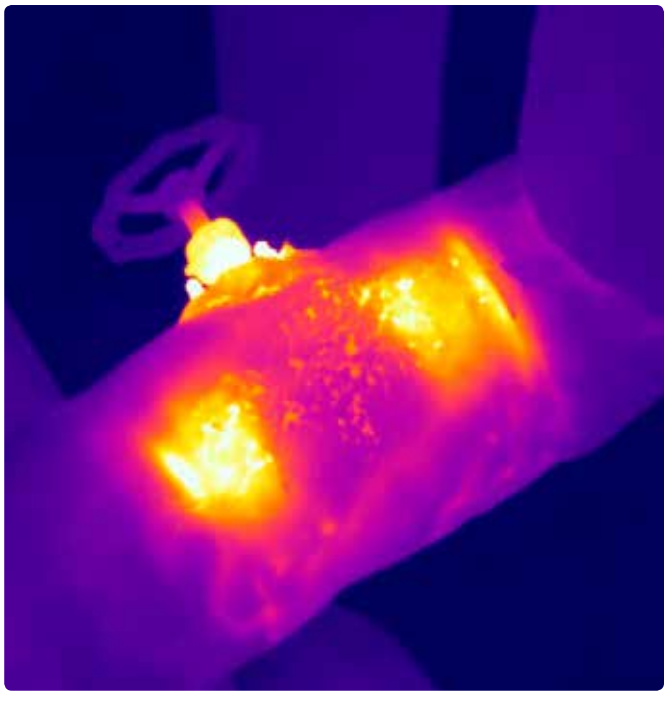


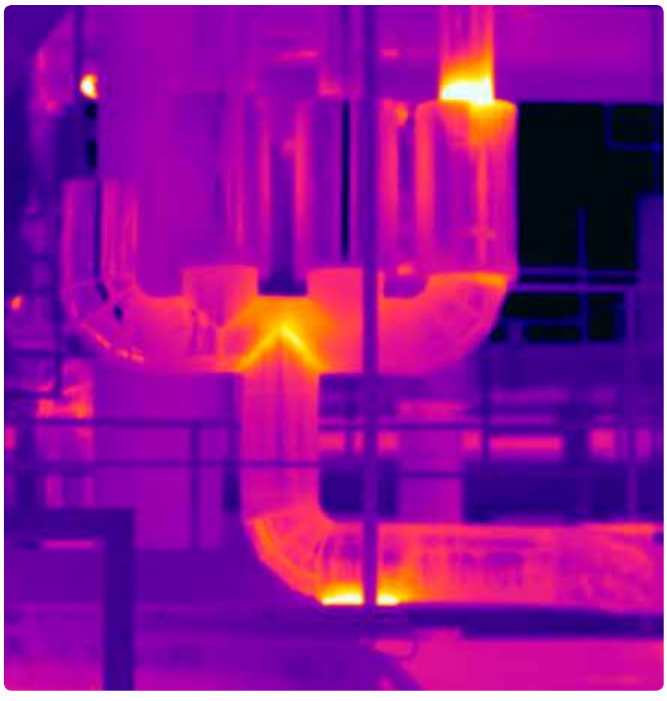
Infrared thermography is a powerful technique for sub-surface examinations. Equipped with a remote controlled thermal camera, the drone monitors the structural health of selected areas by introducing a uniform heat-impact onto the examined area.

Over any defect, which will tend to stop the flow of heat into the material, the surface will remain warmer than its surroundings.

Thermal images or video from the drone can provide details of inefficiency in power plants or quickly pin point a sudden leak in large process plants. The thermal images can furthermore provide details of delamination in wind turbine rotor blades or damaged cells in solar panels.

The temperature profile of the blade surface indicates potential defects. In this picture, the defect is highlighted by the red box.





Both of the above images are examples of thermal inspection of pipelines.

Authorizations

FORCE Technology has been approved by Civil Aviation Authorities to conduct drone operations in the following countries:

- Denmark (AIC B 08/14)
- Sweden (TSFS 2009:88)
- Norway (AIC N 14/13)

If the inspection is not carried out in one of these countries, we will simply obtain a license in the desired country. Drone inspections are always conducted in accordance with local regulations.

Applications

Drone inspection can be applied anywhere outdoor, indoor, onshore and offshore. Any limitations from national or local regulation must be taken into account. Furthermore, any safety procedures of the facility owner must be in compliance with.

The high quality and flexible camera setup onboard the drone is easily configured for general situation images, landscapes, buildings and structures or close ups of specific details of interest, such as corrosion, fractures, fatigue etc.

Ensuring maximum personnel safety

When planning and performing an inspection, personnel safety is essential. A drone inspection improves safety, as everyone are situated at a safe distance from the inspection.

Above and below

In order to retrieve the maximum amount of information from a drone inspection, the item/detail must be viewed from as many angles as possible. Hence, our drones are capable of viewing the item at any angle between +45° up and 90° down, with the ability to change the angle during flight.

Video and still

To illustrate a process or a general situation, video can be the preferred mode of capturing pictures. In order to get the maximum amount of detail, still pictures provide the highest resolution. The flexibility of our drone enables quick shifts between video recording and still photography.

Design features and specifications

Onshore & offshore drone equipment

Design feature:	Specification:
Number of rotors	4 - 8
Weight (depending on model)	1.5 - 12 kg
Max wind speed	8 - 12 m/s
Operating temperature	-10 to +35 degrees Celsius
Endurance/Flight time	15 - 30 min
Propulsion	Electric brushless motors
Camera	12 - 42 MP Fullframe sensor
Redundancy	Motor, autopilot and battery on larger drones

Confined space/indoor drone equipment

Design feature:	Specification:
Outer radius	90 cm
Compact form factor	35 x 20 x 65 cm
Number of rotors	4
Height	20 cm
Weight	2.3 kg
Operating temperature	-10 to +35 degrees Celsius
Endurance/Flight time	15 - 25 min
Propulsion	Electric brushless motors: 600 watts / 7.5 lb thrust

Further information
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