

In-service Flare Stack Inspection by UAV

Undertake ultrasonic testing with remotely operated aerial drones for on-stream, in-service corrosion surveys of chimneys, flares and flue stacks.



Overview

Unmanned aerial vehicles (UAVs) or drones, are increasingly providing non-destructive testing (NDT) practitioners across a wide range of industries new tools to conduct inspections in remote or inaccessible areas, without compromising the operators safety, reducing operational costs and maintaining quality data.

Voliro, a global supplier of the multi-purpose flying robotic platform "Voliro T," integrates Ionix HotSense ultrasonic testing into its payload to conduct both precise wall thickness and coating measurements across a wide range of temperatures, surfaces and configurations to offer reliable and accurate wall thickness data.

Chimney and flare stacks are increasingly a focus of asset integrity inspection by owners due to relatively low legislative inspection requirements compared to pressure vessels, and several recent failures which has highlighted a growing need to verify the integrity of these large, inaccessible and complex components.

The Challenge

Significant corrosion can occur in stacks and flares due to the presence of acidic compounds in the gases, in the presence of moisture and at elevated temperatures.

A refinery operator sought to inspect their stacks to determine fitness for service but faced the challenges of:

- Due to inaccessibility, stacks are challenging to inspect, requiring costly scaffold or rope access and require shutdown or isolation of the stack, disrupting process and production.
- Specifically, the transitional region from carbon to stainless steel can promote accelerated wall loss, at surface temperatures in excess of 100 °C / 200 °F

Thus requiring a solution that:

- Is robust to couple to components in inclement weather or difficult to access locations.
- Resistant to wear from rough, or un-prepared surfaces that may be inaccessible to conventional surface preparation.
- Provide reliable, precise and accurate measurements of wall thickness from as thin as 1 mm in steel.



Fig. 1 Ionix HS582i probe in use on a Voliro T UAV platform

The Solution

Ionix' HotSense UT platform, provides a dual element transducer package with frequencies at 2.5 and 5 MHz, which are integrated in to the Voliro T UAV ultrasonic payload for immediate implementation.

- The HotSense UT transducers were chosen for their wide operating temperature range -55 to +350 °C (-67 to +662 °F).
- Increased wear resistance and robust construction to offer longer probe life.
- Increased sensitivity to make reliable and accurate wall thickness measurements even with reduced coupling on rough surfaces, from 1 mm to 500 mm.
- Manufactured in compliance with international standards to easily fit directly into existing UT inspection procedures
- Quick to deploy, calibrate and begin taking measurements.

Execution

- The Voliro-T aerial platform, was fitted with a HotSense UT payload, including a HS5122I high-temperature capable transducer and couplant for a series of stack inspections, with conventionally hard to reach (at height) or access areas, in hazardous locations and on capital intensive equipment.
- The stack was accessible by the UAV in any orientation, at up to 200 points per hour, whilst the asset is on-stream with no loss of productivity.

- Live A-scan, auto peak detection was adopted for fast, reliable wall thickness data at elevated temperatures.
- It is estimated that the drone solution performed UT inspections 5-10 X faster than by conventional, manned methods, and included inspections that have not previously been possible.
- Multiple, reliable wall thickness measurements were be undertaken in flight, across a wide thickness range with high accuracy (0.06 mm in steel).