



A member of MISTRAS

June 2016



Carmagen. Partnering in Engineering Excellence.

Unmanned Aerial Vehicle (UAV) Inspections Can Save Time and Money

By Brian Cox

Aetos, a member of MISTRAS Group, Inc.



Flare Stack 70 feet away with 30X Optical Zoom

Equipment inspections within chemical plants and refineries are vital to ensure safe and efficient operations. Maintenance inspections and turnarounds are costly and result in unavoidable downtime.

Aetos, a member of MISTRAS Group, Inc., uses proven Unmanned Aerial Vehicle (UAV) technology that provides an alternative to current methods of turnaround planning, infrastructure inspections, environmental monitoring, and disaster relief.

Use of UAV's can save time, improve safety, and reduce costs in the refining, petrochemical, and power generation industries.

Recently, Aetos inspected 26 assets ranging from steel and concrete furnace chimneys to flare stacks at a refinery located outside San Francisco. Many of the boiler and furnace stacks were over 300 feet tall, and all inspections were completed in only six work days. This significantly reduced associated safety risks, process downtime, and hundreds of man hours.

Aerial remote visual inspection using high resolution, high zoom cameras is presently the number one application for drones in the O&G and petrochemical industries. UAVs can be equipped with a variety of sensors for specific inspection applications. Examples include infrared cameras, gas detection sensors, and hyperspectral cameras.

Upcoming Training Courses

- **API 510 Pressure Vessel Inspection**
September 6-8, 2016
Pasadena, TX
- **API 570 Piping Inspection & Code**
October 10-11, 2016
Las Vegas, NV
- **API 650 Storage Tank Design & Maintenance**
October 13-14, 2016
Las Vegas, NV
- **API 936 Refractory Inspection**
January 31-February 2, 2017
Galveston, TX

For more information, see our website at www.carmagen.com.

Work Highlights

Materials

- Reviewed currently installed equipment material and associated corrosion performance at a refinery. The refinery planned to switch their crude feed from what had typically been run to one with variable and potentially higher TAN and sulfur content, and desired to understand the potential impact ahead of time. Concluded that increased corrosion could be expected in particular units, and recommendations were made for increased sampling and corrosion monitoring.

Operations

- Provided forensic investigation on a hydrogen plant, which had developed hot spots on heater tubes and not met product quality specifications. This resulted in broader commercial complications for product users due to unavailability. Found the "smoking gun" to technical problems/non-performance and made recommendations to see the situation does not reoccur.

Using these cameras and sensors, elevated work can be minimized or even eliminated. UAVs integrated with advanced technologies can also help narrow the focus to specific areas so maintenance crews know exactly what they're dealing with before they leave the ground and can concentrate on target areas. This is especially useful for turnaround planning, or troubleshooting potential problem areas in operating units.



IR Flare Stack Photo

Areas that were once only accessible with scaffolding or rope access can now be accessed using drones at a fraction of the time and cost. Moreover, equipment, such as furnace and flare stacks, can remain in service during UAV operations.

Other UAV applications include inspecting insulation for damage on operating columns, reactors, and elevated piping; open, closed or floating roof tanks; cooling towers and facility roofs, just to name a few.

A recent addition to our UAV fleet permits internal inspection of large diameter pressure vessels, or the shell/roof underside of storage tanks. One potential application is to get a closer look at areas of potential refractory damage before having to install scaffolding (e.g., in the main FCCU, Fluid Coker, and/or Flexicoker vessels).

Unmanned Aerial Systems (UAS) used at Aetos Group are primarily Vertical Takeoff and Landing (VTOL) multi-rotor aircraft. For inspection applications this type of aircraft is best suited because they are able to precisely hold a position in space to acquire data or imagery of a structure. UAS are capable of employing many types of sensors including high resolution video/still cameras, infrared imagers, multispectral and hyperspectral cameras, UV imagers, environmental sensors, and more. Aetos Group has an FAA Section 333 Exemption to operate UAS in the petrochemical industry.

Please contact Vince Carucci (vcarucci@carmagen.com) if you'd like more information on Aetos Group.

