Autonomy, AI, and beyond: Ready to disrupt oil and gas inspection and detection

May 22, 2018

Williston Basin Petroleum Conference
Bismarck, ND

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Avitas Systems
a GE venture
The Avitas Systems oil and gas solution

Avitas Systems, a GE Venture: start up agility with large company leverage
Significantly reduced costs, better safety, improved quality & repeatability and more efficient operations
Data capture via aerial robotics
UAV air-based inspections

**BENEFITS**

- Multiple sensor kits: LiDAR, HD RGB, IR, OGI, TDLAS
- Combines sensor and metadata for ease of data integration, management and visualization
- Volumetric data collection and analysis
- Change detection through autonomous flight path, stand off, and sensor control with programmable inspection points
- In-flight data visualization of programmable alert zones and HD aerial video streaming
BVLOS with unmanned aerial systems

FINDING ECONOMIES OF SCALE WITH UAS TECHNOLOGIES

> Up 10x more assets inspected per day
> Quiet and unobtrusive
> Lower costs, more persistent monitoring
> Replaces costly ground windshield time and aerial pipeline patrol
Engineering services 3D model surveys

VISUALIZE MAPPING OF ASSETS

NAVIGATE ASSETS & PROCESS WITH 3D MODELS

ACCESS PLOT PLANS, PROCESS DIAGRAMS, ASSET CATALOGS

POINT & CLICK HIGH RESOLUTION IMAGES
Aerial inspection of the pumper’s check list

> Typical top five priorities:
  - Leak detection
  - Volumetrics
  - Abnormal heat signatures
  - Site security and surrounding conditions
  - Fugitive gas detection

> 80 inspection points classified
  - Automate up to 75% of check points with digital aerial inspection
  - Automate routine inspection to allow operators to service more wells per person
  - Allows operators to focus on maintenance activities
Aerial gas inspection

A SAFER, MORE EFFICIENT APPROACH TO ASSET INSPECTION

AVITAS SYSTEMS SOLUTION

> Rotocopter and OGI camera combination
> Weather station
> Controlled flight and inspection plan
> Real-time data analysis
> Repeatable process with autonomous data collection
> Cloud-based storage and reporting
> Ability to mount RGB and IR cameras

BENEFITS

> Better visibility, more thorough inspection
> Increase safety
> Reduce manual labor
> Decrease in costs
> Faster, more reliable process
> More efficient, high-quality inspections with comprehensive data collection
> Meets EPA 40 CFR 60, Subpart OOOOa Requirements

ADVANCED FEATURES

> OGI sensor quantitative enhancements
> Augmentation with TDLAS
> Broad view of assets; visualized leaks
Advanced analytics
Three key sources of industrial data for integration

**SYSTEMS DATA**
- Historical inspection and maintenance data
- System-wide operational metrics
- Performance metrics at asset and system levels
- Workflow history and planning

**INSPECTION DATA**
- Sensors + Platform
  - Visual / RGB, infrared
  - LiDAR
  - Ultrasonic, acoustic
  - Optical gas imaging
- Robotics + Platform
  - Unmanned Aerial Vehicles
  - Autonomous Underwater Vehicles
  - Crawlers
  - PIG
  - Fully autonomous navigation

**ASSET PERFORMANCE DATA**
- Metrics typically tracked by customers:
  - Pump vibration, temperature, noise, boost pressure, and runtime
  - Wellhead placement, pressure, flowrate
Image analytics for automated defect recognition

Families of deep learning algorithms, such as fully convolutional networks

INPUT IMAGE

DEEP LEARNING NETWORK

DEEP-LEARNED DEFECTS

> Paint breakdown
> Insulation breakdown
> Loose, cracked, broken, or missing bolts
> Cracking
> Corrosion
> Concrete spalling
> Heat distortion
> Etc.
Analytics overview

MACHINE LEARNING

- A library of models for intelligent, risk-based decision making
- Rapidly trained and deployed machine learning algorithms
- Continuous and deep learning using field data

PHYSICS-BASED MODELING

- Hybrid approach with data-driven empirical models fused with physics models
- Prediction of asset conditions
- Cross-industry deep domain knowledge applied from in-house subject matter experts

OUTCOME

- As-built and 3D models
- 4D temporal and predictive modeling
- Operational models
- Continuous assessment of inspection strategy/risk
Accelerating future capabilities

Built upon exponential technologies

Convergence of key exponential technology areas

- Smaller / improved sensors
- Deep learning/analytics
- Improved robotic platforms

Inspection capabilities

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