Coke Drum Resource Management
Reliability Focus for Safety

Market Need

- Over 400 coke drums currently in operation and increasing annually
- Fires from through-wall cracks - safety risk
- Processing heavier crude oils
- Higher production demands
- Lost profit opportunities due to through-wall cracks ($1MM+ each)
- High capital replacement costs
- Long lead time for replacement
Holistic Approach throughout Life Cycle

Condition Assessment

- Technologies to assess the condition of the drums while offline (or inside cycles)
  - LASER Profiling
  - Remote Video
  - Automated UT – Combined PA and Dual TOFD
    - Time of Flight Diffraction Ultrasonic (TOFD)
    - Phased Array (PA) Ultrasonic
  - Traditional UT
  - Others
Drum Diagnostics LASER Scan & Video

*Quest TruTec Advantages*
- Stabilized Tensioned Cable System
- Centered/Repeatable
- Hi-Resolution
- Quick (inside cycle or during t/a)
  - Setup – 45 minutes
  - LASER Scan – 30 minutes
  - Video - Circumferential/Longitudinal welds – 60 minutes
  - Video – Problematic areas identified by LASER Scan – 30-60 Minutes
- Independent of Owner Operator Assistance
- Economical

System Overview

**LASER**
- Infrared LASER Ranging Device
- Mirror allows 360° sweep
- Stabilized for sharp, high resolution image
- +/- 1/8” accuracy
- Approx. 30 readings per square inch
System Overview

- Video
  - High resolution color video camera
  - Joystick controlled pan/tilt
  - 24X Zoom
  - Mechanical and electronic image stabilization

System Overview

- Class I - Division II
  - All equipment entering the drum is pressurized and monitored.
  - If pressure falls below preset limit, entire system is shut down.
LaserView™ Software Provided

Advantages

- Side-by-side comparison of past scans
- Drill down capability
- Bulge severity indicator
- Loaded locally at client site
AUT for Girth Weld Seams by Magnetic Crawler

- Available to perform AUT Scanning for bulges identified during Laser Scan
- Height Limitation of 8"

Automated UT

Phased Array UT Combined with Dual Time of Flight Diffraction

Graphics Provided by S.H.I. Examination and Inspection
Porosity

Omniscan Phased Array Inspection of Plate/Butt Weld

Omniscan analysis view of one-line scan using 45-70 degree sector scan. Red areas on C scan display non-fusion in the weld.
**Omniscan Phased Array Inspection of Plate/Butt Weld**

Tomoview offline (computer based) analysis of Omniscan phased array data file. S-scan, C-scan, D-scan, and B-scan displaying slag inclusions in 12.7mm V weld.

**Finite Element Analysis**

- Integrated stress analysis/life assessment software has been developed.
- LASER profile is used to create 3D finite element model of drum.
- Bulge geometry is accurately represented by FE mesh.
Remaining Life Assessment

- Finite element model along with the field measurements are utilized to calculate "Cycles to Initiation" which is a prediction of the number of coking cycles required to initiate cracking.
Remaining Life Assessment

- Upon further analysis, the total cycles to through-wall cracking is determined.
- The stress analysis & life assessment can be performed onsite.
- LifeQuest Viewer software allows client to view 3D maps of bulging, stresses and remaining life.