Automated Analysis of Eddy Current Data Using RevospECT™

4th International CANDU In-service Inspection Workshop
June 18-21, 2012  Toronto, Canada

Tom O’Dell
General Manager,
RevospECT Business and Field Operations
RevospECT Inspection Solution

• RevospECT is an inspection solution that replaces the manual analysis process
  – Small team of specialists
  – Revolutionary hardware & software
  – Automatic, high speed analysis of inspection data
  – Any combination of: Bobbin, MRPC, or Array

• Comprehensive and consistent analysis results time after time
• Incredible speed and accuracy, RevospECT delivers additional value over manual analysis used today
Value Proposition

• RevospECT provides value by addressing key industry issues created by manual Steam Generator Analysis
  • Human Performance variability
  • Consistency and accuracy of analysis results
  • Current and future labor force challenges
  • Costs and schedule of special interest testing scope expansions or schedule changes
  • Unpredictability and stability of cost, schedule, and results
RevospECT Performance Attributes

• Lower Cost of Inspections

• High Speed Results – Analysis in step with Acquisition

• Complete and comprehensive
  • Simultaneous analysis of multiple inspection techniques

• Flexible with demand

• Provides Additional Value from the Inspection
  • Noise measurement
  • Auto-comparison to historical data
  • Proper dispositions of overcalls
RevospECT Hardware Architecture

- Dashboard Clients
- RevospECT Hardware Architecture
- Site Data
- Data Drive Mapping
- Procedures & Results Drive Mapping
- Scheduler Drive Mapping
- RevospECT Configuration
- RevospECT Database
- Results, Procedures, & Database
- RevospECT Scheduler
- Scheduler
- Processing Farm
- RevospECT Nodes
RevospECT Processing Farm

Processing Farm

- Distributed Processing
- Scalable Bandwidth
- Nodes serially process tube files
- Scheduler manages queue of tube files
RevospECT Software Architecture

- System architecture supports well planned process flow for execution consistency
  - Regions of Interest Detection and Segmentation
  - Auto Analysis Analyzer Configuration
  - Analyzer Mapping
  - Final Acceptance
  - Reporting
  - System/Configuration Control

- System configuration created prior to inspection
RevospECT Structured Process Flow

Performance orientated architecture

- **Control**
  - Job specific configuration
  - Configuration lock and Version
  - Overall analysis process control

- **Operation**
  - Efficient operational dashboard
  - Distributed scheduled processing

- **Analyzing**
  - Detailed & accurate ROI sorting
  - Analysis mapping
  - Multiple path analysis
  - Simultaneous technique analysis

- **Validation**
  - Extended classification
  - Multiple call rationalization
  - Multi-analysis reconciliation

- **Reporting**
  - Database results
  - Query and review tools
RevospECT Dashboard Screen
Discrete Location Analysis

- Tubes are subdivided into hierarchal locales
- Analyzers are mapped to specific locales
- Configuration Coverage auditable
RevospECT Analyzers

Auto System Analyzers

- Configured to meet technique attributes for analysis, specific to ROI’s
- Contains all logic to detect and classify
- Analyzer Signal Process:

```
Analyzer
  \-- Detection
    \-- Extraction → Measurement → Discrimination → Coding
  \-- Classification
```
RevospECT Analysis Mapping

Mapping
- Mirrors the analysis plan
- Links analyzers to ROI’s
- Many to Many relationships exist
- One size fits all analyzer rarely exists
Final Acceptance

• Analyzers report flaws to RevospECT database

• Final acceptance rationalizes results
  – Broad Spectrum comparison
  – Confirmation Checks
  – Addressing history
  – Confidence with SNR
  – Overlap resolution
  – Proximity filter
Field Implementation Models

- **Manual / Manual / Tertiary**
  - Primary
  - Secondary
  - Resolution
  - RevospECT
  - Results
  - Site Level III

- **Manual / Auto**
  - Primary
  - Secondary
  - Result
  - RevospECT
  - Site Level III

- **Dual Auto**
  - Primary
  - Secondary
  - Result
  - RevospECT
  - Site Level III

- **Stand Alone Single Pass Model**
  - RevospECT
  - Result
  - Site Level III
Deployment: RevospECT

**Inspection Utilities**
- Production Procedure
- Eddynet / WP
- Database Server
- License Manager

**Data Repository**
- Setups
- Exported Results
- Data files

**Results Database**
- Eddynet / AN
- Eddynet / DM

Local Network

Eddynet / AQ Team

Eddynet / DM Team

RevospECT Team
Deployment: RevospECT Remote

- Local RevospECT Client Machines
- Local Network
- Remote Desktop on Local Clients
- Local Eddynet/AN Client Machine
- Internet
- Remote RevospECT Analysis Team
Deployment: Manual/RevospECT

Inspection Utilities
- Production Procedure
- EddyNet / WP
- Database Server
- License Manager

Data Repository
- Setups
- Exported Results
- Data files

Results Database
- EddyNet / AN
- EddyNet / DM

Local Network

EddyNet / AQ Team
EddyNet / AN Team
EddyNet / DM Team
RevospECT Team
RevospECT Implementation

Configuration Flow

Vessel Documentation

Inspection Requirements

Historical Data

Landmark Information

ROI Setup

Analyzer Setup

Mapping

Configuration Validation

Final Acceptance

Approved Configuration
Field Experience Summary

Inspections to Date:

- 19 inspections
- 600MA, 600TT, 690TT, Alloy 800, Monel
- Bobbin, MRPC™ and X-Probe™
- Tailored deployment models
- Targeted customer goals
Duke Energy:

“… The use of RevospECT™ allowed Duke to reduce the time and cost to complete the inspection. Based on the favorable experience, Duke plans to use RevospECT™ during its upcoming Unit 2 steam generator inspection.”
Dominion:

“… The transition to array probes and RevospECT provided the best opportunity to reduce the steam generator examination schedule impact without reducing scope and still maintain high quality examinations…”
RevospECT Market Differentiation

- Support of multiple inspection technique methods
- Lean crew size
- Analysis results without human intervention
- Hardware & Software extendability
- Robust configuration control process
- Additional Customer value in special inspection measurements
- PC based solution
Thank You