Parts, People, Process: The Winning Formula for Emerson Turnarounds and Certified Services

Chris Forland, Operations Consultant
Scott Grunwald, Turnaround Business Manager
Miranda Pilrose, Marketing Manager
Presenters

- Chris Forland
- Scott Grunwald
- Miranda Pilrose
Introduction

- Turnarounds / Outage Challenges
- How can we do this differently?
- Six Step Turnaround Process
- Emerson’s Complement of Services
  - Detailed Capabilities
  - Certified Services
- Program Benefits
  - Technology Integration
  - Sustained Performance
  - Continuous Improvement
  - Financial Payoff
Turnaround Objectives

- Turnarounds (TA) are planned when the cost of a TA is exceeded by the value of improved production as a result of the TA. IE: Benefits > Cost
- Goal – reduce cost & improve results (benefit)
- Cost = Value of lost production + cost of TA goods & services
- Benefits = Shorter TA period + improved production performance & reliability post TA
Turnaround Challenges

- Loss of experienced personnel to plan & execute TA
- Safety & regulatory compliance
- Unplanned work results in extra charges and delays
- Pulling equipment that does not need repair adds cost
- Latent or hidden issues not addressed affects post TA production
- Incorrect repairs result in poor performance and premature failure post TA
- Unit operation not optimized to improved capacity
Six Step Turnaround Program

Premise of program
- Flexibility to adjust turnaround plan diminishes as the start date approaches
- Investment in pre-turnaround planning and equipment analysis offset by performance improvements
- Diagnostic technologies aid customers in pre-planning and analysis as well as post-turnaround performance levels
Six Step Turnaround Program

- By bringing together Emerson’s compliment of services, we can provide a better and broader solutions
- Delivers maximum value in turnaround planning by only doing the work which is necessary
Six Step Turnaround Program

Condition Assessment

Diagnoses the condition and identifies troublesome control loops, electrical systems, instrumentation and control valves BEFORE a planned turnaround
Six Step Turnaround Process

The Six Step Turnaround – BEFORE

- Ahead of the execution team
- Look at control performance issues while the plant is running
  - What makes that process application run most efficiently?
- Find what issues need to be addressed during the turnaround
- Test process dynamics online
Project Kick-Off

- Define scope of the outage, roles and mission of the Emerson Turnaround Team
- Identify key personnel
- Timing and duration, budget, schedule plant walk-down

<table>
<thead>
<tr>
<th>Phase</th>
<th>Event</th>
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<th>Six Step Turnaround</th>
<th>Benefit</th>
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</thead>
<tbody>
<tr>
<td>Kickoff</td>
<td>Pre-plan Kickoff  &gt; 6 months prior</td>
<td>Vendor not involved Vendor selected just prior to turnaround based on first cost of overhaul</td>
<td>Review project plan Review maintenance records</td>
<td>Alignment with turnaround project team Application issues identified</td>
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18 months 6 months Turnaround Begins

Where ideas become solutions.
## Refining the Details

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<tr>
<td>Refine the details</td>
<td>Pre-plan Equipment Selection for overhaul / replacement 3 to 6 mo. prior</td>
<td>Actual condition of equipment not known</td>
<td>Early walk down&lt;br&gt;Internal valve condition determined in place with Emerson proprietary technologies (FlowScanner, DVC w / bypass or outage)&lt;br&gt;Unit production (on line) performance analyzed</td>
<td>Capture device information&lt;br&gt;Avoid unnecessary overhaul &amp; in/out costs&lt;br&gt;Additional issues &amp; opportunities identified</td>
</tr>
<tr>
<td>Refine the details</td>
<td>Pre-plan Review of available in-plant diagnostic technologies 3 to 6 mo. prior</td>
<td>Not done</td>
<td>Review plant’s use of diagnostics in turnaround planning &amp; maintenance&lt;br&gt;Gap analysis to determine how to integrate with plant systems – SAT, CMMS, etc.</td>
<td>Recommendations w / ROI – tech upgrades &amp; how to utilize diagnostics to improve future maintenance &amp; turnarounds</td>
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### Timeline
- **18 months**
- **6 months**
- **Turnaround Begins**

- Develop turnaround scope
  - Review technical options and maintenance practices
  - Prioritize, review records and applications issues
Resource planning, equipment and tooling review, define roles and responsibilities, develop communication plan and train employees, pre-order parts and consumables.
## Turnaround Execution

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<tr>
<td>Execution</td>
<td>Equipment removal</td>
<td>All valves removed and sent to vendor</td>
<td>Only valves needing significant work are removed</td>
<td>Fewer valves repaired</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other valves repaired on site or not at all</td>
<td>Avoided in / out costs</td>
</tr>
<tr>
<td>Execution</td>
<td>Overhaul and / or replacement</td>
<td>Condition determined at vendor</td>
<td>Condition known prior to turnaround for valves w / bypass or DVC w/ outage – remaining valves analyzed in place prior to removal</td>
<td>All parts on hand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Additional work causes delays, overtime and expediting fees, etc.</td>
<td></td>
<td>Complete repair performed on schedule &amp; cost</td>
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- Provide status reports, document change orders and frequent communication

18 months  | 6 months  | Turnaround Begins

Where ideas become solutions.
### Turnaround Execution

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<td>Execution</td>
<td>Safety &amp; performance certification</td>
<td>Performance of repaired valves unknown &amp; not documented</td>
<td>Performance returned to OEM specifications and documented</td>
<td>Enhanced valve performance enables production performance improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impact of improper materials / repair not captured</td>
<td>ASME Conformance and FM Approvals documented</td>
<td>Improved safety and equip. life extension to extend time to next turnaround</td>
</tr>
<tr>
<td>Execution</td>
<td>Diagnostic technology upgrade</td>
<td>Not done</td>
<td>Predictive diagnostic technologies installed &amp; integrated into plant systems</td>
<td>Enable maintenance of new levels of production over time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reduce cost of future turnaround analysis</td>
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- Complete work scope on-time, safely, and to satisfaction
Turnaround Execution

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<td>Execution</td>
<td>Process unit start up</td>
<td>Production units brought on line with pre-turnaround control parameters</td>
<td>Production units brought on line and tuned to new performance levels</td>
<td>Additional production performance delivered and documented</td>
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- On plan for schedule and cost
- Ability to adjust plan as start date approaches
# Post-Turnaround Review

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<tr>
<td>Ongoing production</td>
<td>Post turnaround review</td>
<td>Not done</td>
<td>Itemized budget reconciliation &amp; documented improvements</td>
<td>Verification of costs &amp; benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve curves / asset repair reports loaded into AMS Device Manager (paper copy if NA) for maintenance records</td>
<td>Baseline for ongoing maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Review lessons learned</td>
<td>Analysis to improve future turnarounds</td>
</tr>
<tr>
<td>Ongoing production</td>
<td>Ongoing maintenance</td>
<td>Performed on demand when process affected by device / asset problems Unit performance degrades over time undetected</td>
<td>Alerts from Emerson smart valves and devices prior to process being affected Baseline enables periodic performance analysis</td>
<td>Process upsets avoided Higher level of performance maintained between turnarounds</td>
</tr>
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- Final documentation package and post-outage review meeting
## Future Planning

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<td>Future TA’s</td>
<td>Multi-year program</td>
<td>Not done</td>
<td>Each plant turnaround is a step in systematically improving overall plant performance</td>
<td>Plant production capacity &amp; efficiency improved over time</td>
</tr>
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</table>

- Verify value delivered
- Ask for feedback

![Timeline Diagram](attachment://timeline_diagram.png)

*Where ideas become solutions.*
Six Step Turnaround Program

The Six Step Turnaround – AFTER

- Emerson returns to the plant to repeat tests in order to demonstrate process improvement
- The overall process most efficient; giving maximum benefit
  - Utility equipment
  - Measurement devices
  - Instrumentation
  - Final control elements
  - Process control performance
Instrument & Valve Service Network
North America

Over 800 People in 50+ locations

- Helps customers better manage their control valve and instrument assets
- Through a comprehensive network of best-in-class, reliability based services
- Provided local to or within customer plants
- Using proven maintenance work practices that are supported by PlantWeb® technologies
Instrument & Valve Services

**Equipment Start-up**
- Product start-up / commissioning
- Installation supervision
- On-site services
- Certified calibration

**Asset Reliability**
- Asset management services
- Repair / recondition / replace
- Fisher & Rosemount Certified
- Local / on-site services
  - Field Machining
  - On-Site Service Trailers
- Emergency demand services

**Program Management**
- Turnaround management
- PlantWeb services
- 375 service programs
- Full service provider

**Application of Technology**
- AMS™ Suite - Diagnostic Tools
  - Instrument
  - Valve
- Remote monitoring and analysis
- Preventative maintenance services
- Training

Where ideas become solutions.
Certified Services

- Certified repair supports:
  - Investment protection
  - Risk management
  - Productivity

- Formula for success:
  - Support technicians
  - Proven OEM processes
  - Emerson technology

- Reliable performance:
  - Products
  - Warranty
  - Factory authorized

Where ideas become solutions.
Certified Services

- OEM service protects:
  - Plant safety
  - FM & CSA marks
  - Regulatory exposure

- Consistent service quality:
  - At your site
  - At our service centers

- Benefits:
  - Reduced risk
  - Longer process life
  - Regulatory compliance
  - Consistent quality
  - On site or at service center
  - 24/7/365 Availability
Rosemount Certified Services

- Joint program between Rosemount and Instrument & Valve Services
  - Ensures that all Instrument & Valve Services Service Centers operate to the same quality standards as the Rosemount Factory

- Operational changes to service centers
  - Auditing of all Instrument & Valve Services facilities to ensure standards
  - Implementation of new equipment to meet gaps identified
  - On March 31st, 2008 all Instrument & Valve Services service centers received the Rosemount Certified stamp of approval.

- What does this mean for you
  - ONLY repair program guaranteed to return instruments to Rosemount standards
  - ONLY repair program to insure compliance with FM standards
  - Local Inventory is tracked and included in Rosemount quality communications
  - Technicians trained and updated on Rosemount product enhancements

- How to recognize Rosemount Certified equipment
  - Each device will be tagged with Rosemount Certified Approval
Fisher Certified Services

- Designed to ensure that all Fisher brand valves are repaired to OEM specifications and maintain all markings on valves and the associated instrumentation
  - Preserve North America Electrical Classification markings for instruments in hazardous service (FM/CSA)
  - Ensure body wall and other dimensional requirements are to OEM print
- Quality Repair procedure for all control valve repair business in Instrument & Valve Services
- Provides formalized use of General Customer Specifications for all outages.
- Provide standard final inspection criteria for all of Instrument & Valve Services
- Provides an auditable process which is included as part of the QESH audit protocol
Pre-Turnaround Diagnostics

Conduct pre-turnaround testing to assess and prioritize work tasks

- Inspect Liquid-filled Transformers for leaks and other abnormalities
  - Perform corona detection test, oil analysis and nitrogen gas tests to determine if major maintenance is required
- Conduct infrared inspections to detect weak / hot spots in electrical equipment
- On Line Digital Low Resistance Ohmrometer to detect poor contact in absence of temperature rise
Pre-Turnaround Diagnostics

Conduct pre-turnaround testing to assess and prioritize work tasks

- Conduct online partial discharge testing on cables to detect degrading insulation
- Partial discharge is also exhibited in improperly installed splices and terminations, leading failure modes of cable systems
- Test is online and non-destructive vs traditional High-pot offline tests
Pre-Turnaround Diagnostics

Retrofit existing equipment during TA to improve overall system performance

- Low & medium voltage circuit breaker retrofits (air, vacuum and SF6)
- Modernization of outdated and underrated equipment
- Solid state protective relay retrofits
- Emergency circuit breaker rental and loans
- Replacement parts
Electrical Reliability Services

- Independent electrical testing, maintenance and engineering service company
- Turnaround Services
  - Power and Grounding
  - Infrared Scanning
  - Online Partial Discharge Testing
  - Transformer Services
  - Electrical Preventive Maintenance
THE OPTIMIZED PLANT
Control System Performance

- Pre turnaround – Identify process control performance problems/constraints and improvement opportunities that require a shutdown (TA) for part or all of the implementation
  - Final control element (FCE) application
  - Instrument application and/or new instrumentation/FCE
  - Control scheme, equipment, or piping addition/changes

- Post turnaround process control improvement projects achieve high ROI
  - Re-tune unit control system to maximize production performance once constraints are addressed
Final Control Element Application

- Control valve performance vs. requirements
  - Trim size, characteristic
  - Deadband, resolution, response time (ANSI/ISA 75.25)

- Variable Speed Drive
  - Dynamic response (braking, tuning, etc.)

- Turbine Speed Control
  - Dynamic response, resolution, etc.

- Fan Dampers
  - Deadband, resolution, response time, etc.
Instrument Application / New FCE

- Instrument application
  - Maintenance required
  - Location change required
  - Different technology required
    - Dynamic response
    - Accuracy requirements

- New instrumentation or FCE
  - An additional instrument is required
  - An additional final control element is required
  - Location change for an existing instrument or final control element
Control / Equipment / Piping Changes

- New control schemes may require a shutdown
  - Split range valves (new or change)
  - Valve travel characterizations
  - Additional instrumentation
  - Changes in wiring
- New taps for instrumentation
- Change process piping
- Add process equipment
Post Turnaround Projected ROI

- Complete recommendations from the Pre-Turnaround services
- Foundation established for benefits from additional process control improvement projects
- 200KBPD Refinery benefits in the range of $5 to $10 Mil per year net margin
- Chicago refinery $2.4 Mil per year on only two units
Process Systems & Solutions

- Combination of superior products and technology with industry-specific engineering, consulting, and project management, and maintenance services to help customers achieve the potential of their operations

- Turnaround Services
  - Pre-Turnaround Automation Services
  - Operational improvement
  - Control performance improvement recommendations
  - Online performance analysis

- Sets the basis for future control improvements
Benefits: Improved Efficiency

Project Services
- Implement PlantWeb Architecture

Consultative Services
- Predictive Diagnostics services
- Monitoring and analysis services
- Plant performance optimization

Plant Efficiency
- Startup & Commissioning
- Repair services
- Outage/Turnaround execution

Traditional Services

Traditional

Time
Benefits: Improved Technology

- Business Objective Identification
- Plant Assessment and Benchmarking
- Failure Defense Planning
- Performance Quantification
- Technology Deployment
- Expertise Optimization
- Work Processes Optimization
- Performance Measurement and Analysis
- Improvement Planning

CONTINUOUS IMPROVEMENT

Where ideas become solutions.
Benefits: Financial Payoff

- This process produces a known, quantifiable scope of work **BEFORE** the start of the turnaround; resulting in savings and improved production **POST** turnaround.
- Up to **30%** turnaround **cost reduction** (200KBPD plant w/1000 valves - $1 Mil estimated savings).
- Plant **performance improved** over time as a result of the Six Step Turnaround Program ($11 Mil / yr for 200KBPD Refinery potential).
- **Safety** – ASME conformance and FM Approvals.
Future Planning

- Review of the last and preview of the next turnaround
- Start well in advance with a preliminary evaluation and rough estimate of investment costs and potential benefits
- Target turnarounds more that 6 months away
  - Gather data on control valves
  - Knowledge / history of unit operational problems
- Create a continuum
With Emerson on your team, your turnaround will execute smoothly; ensuring your processes run right and on time - and stay that way.
Where to Get More Information

- Asset Optimization Booth #100
  - www.assetweb.com
- Plant Web® Diagnostic Technologies and Services
  - www.emersonprocess.com/education
- Advanced Applied Technologies Booth
- Control Performance Booth
Questions?