Real-Time, Interactive Work Instructions
An Industry Update & Success Story

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Real-Time, Interactive Work Instructions

The following Strategic Initiatives of MESA International are associated with this presentation:

Lean Manufacturing
Quality & Regulatory Compliance
Product Lifecycle Management (PLM)
Real-Time Enterprise
Asset Performance Management (APM)
Industry Review of Work Instructions

- Tempo Resources studied the use of Work Instructions during the last 12 months through consulting work with various software and manufacturing companies on shop floor applications
  - Included large and smaller manufacturers
  - Various industries, discrete and process models
  - Focus on business issues, tools used, processes, costs and areas of improvements
    - Integration of existing data, leveraging ERP, PLM, MES
    - Demands from Regulatory and Customer Compliance Requirements
    - Value of Standards, Paper to Paperless
Industry Review of Work Instructions

• After 20 Years experience working with various ERP, MES & PLM software and industry manufacturers
  – Still surprised why so many shop floor operators were still not using standard work documents, many on paper, not leveraging data across the Enterprise
  – Deserved a review of Work Instructions on the Shop Floor

• Goals were to identify
  – Current business problems and related costs
  – Growing requirements & trends
  – New methods, leading technology and results
Current State of Work Instructions

• Manufacturers still need Work Instructions
  – No matter what industry, process model, automation or manual labor
  – Often the most poorly developed documentation on the shop floor
  – Often a primary source of shop floor errors, rework, scrap costs
  – Possibly the most neglected reference tool in Operations

• Specific industries have more pressures and rely heavily on detailed Work Instructions
  – Discrete, manual assembly manufacturing
  – Make to order, custom tailored products
  – Flexible or changing labor force, non-English speaking

• Documents are created by MANY in the Enterprise
  – Engineering, Manufacturing, Quality, Maintenance, others
  – Some electronic, static documents, but mostly paper instructions
Common Practices in Work Instruction Development

Functional Areas Do Not Collaborate with Common Data on Work Instructions

- Instructions created individually by different functional areas
- Created from different sources with different tools
- Published in different formats, no standards, poorly developed
- Instructions not specific to user roles or needs
- Excessive labor costs using ineffective tools, lack of integration with data from existing Enterprise systems

Product Development

Process or Manufacturing Engineering

Quality Management

Maintenance Management

CAD/CAM Drawings

Word Docs Excel, PPT Spreadsheets PDF files

Handwritten Notes

Printed Binders

Wall Charts
Business Issues

• Most manufacturers admit problems with existing Work Instructions that affect their productivity and profitability
  – **Wrong Tools** used to create Work Instructions are costly and ineffective; many looking for a better tool
  – **Lack of standards**, doesn’t support Lean, Six Sigma, ISO and other initiatives impact Quality results
  – **Regulatory & Customer requirements** add more demands on Work Instructions, tracking work performed for traceability and compliance reporting
  – **Hidden Costs** are associated with Work Instructions
Engineering Issues

- **Excessive time** to develop, format, publish Work Instructions
  - Delays in producing revisions to the shop floor

- **No integration** using ‘Office Tools” to ERP PLM MRP MES, no collaboration or leveraging of data
  - No electronic, automated access to product ‘master’ data (Part #’s, routings, BOM …)
  - Difficulty producing standard documents and reusing engineering work
  - Lack of version/revision control with approval process, archive or complete audit trail

- **Engineering documentation** not completely suitable for Shop Floor work instruction needs
Manufacturing Issues

- **Work Instructions not specific to functional roles & tasks**
  - Instructions too focused on engineering specs, design information, product data; details ‘what to build’ not “HOW TO BUILD”
  - Prefer work flow with instructional steps, task guidance with photos, illustrations, video, audio translation, training oriented
  - Require supplemental, manual documents

- **Paper instructions ineffective**
  - Not readily available, quickly outdated, lack change alerts, verification of use or process

*Supplemental Instructions To Job Folder*
Accumulative Costs Resulting From Poor Work Instructions

- Excessive time to author, edit, format, and publish Work Instructions.
- Requires “days to weeks” to publish a new Work Instruction or “months to years” for product manuals using “Office” tools.
- Additional labor to create supplemental ‘how to’ instructions.
- Potential production delays waiting for Instruction updates.
- Risk of production errors, late or wrong orders.
- Increased training costs (new products, new staff, non-English speaking employees).
- Increased inspections, quality tests, procedures & staff.
- Increased scrap, rework, product warranty costs.
- Risk of Regulatory Fines, Compliance Recall / Return Costs.
- Over or under maintenance schedules due to lack of proper machine maintenance instructions.
- Additional costs due to inconsistent or errors in machine set-ups.
- Excessive MRO costs.

= Costs to the Enterprise

- Reduced productivity & profitability.
- Risk to brand name and lower share value.
Leverage pertinent data from ERP, PLM, MRP, Quality, MES systems:

- ERP/PLM systems may contain ‘master’ data (part #’s, routings, BOM’s, process info)
- ERP/MRP systems contain new order and inventory information
- Quality systems have separate test plans, measurement instructions, but share product data
- MES systems may have some integration to PLM or Quality, but often require work orders be linked to static, external documents for Work Instructions

Integrate data with Work Instructions:

Collaboration of data produces a more effective Work Instruction for the shop floor operators.
Attempts With Existing Enterprise Systems

Leveraging Existing Systems to Create Work Instructions Offer Some Improvements, but Lack Appropriate Content and Real-Time Interaction for Operators

Product Development
- ERP
  - PLM
  - MRP

Process or Manufacturing Engineering
- Additional Support Docs

Quality Management
- Quality System

Maintenance Management
- CMMS

Parts List
- Bill Of Materials
- Routings
- Work Orders

Manufacturing Tasks
- Machine Setup
- Build Photos, Dwgs

Test Procedures
- Check Lists
- Measurements & Data Reporting

Maintenance Instructions
- Machine Repairs

Paper Job Package

Static Docs on HMI / MES Operator Interface

Maintenance Instructions

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Growing Requirements
Real-Time, Interactive Instructions

• Most **PREFER** a real-time, paperless interactive Work Instructions
  – More require data collection, electronic signature, traceability of work performed
  – Provide operator feedback to Engineering

• Goals with Real-Time, Paperless Approach
  – Increase productivity, reduce errors
  – Reduce production delays, time looking for instructions
  – Promote guided work flow, verification of work performed, electronic signature, traceability for genealogy reporting
Evolution of Work Instructions

Sketches, Notes Tribal Knowledge on Paper → Standard Shop Floor Job Instructions ERP, MRP, PLM Output → Static Electronic or Paper Instructions Support Engineering Documents using PPT
Next Evolution Is Standard Work, Paperless Instructions

Standard Work Sheets
Produced automatically from data-base and template driven Software
- Includes parts list, process definition, photos, quality signoffs, instructions for data collection
- Designed to support improvement programs such as Lean, Six Sigma, and standards such as ISO

Web-based, Interactive Display
Operators select Work Orders, Work Instructions in Novice or Expert View
- Work flow is guided with specific tasks, detailed photos, video, audio files available when needed
New Technology, New Solutions

• Some ERP, PLM, MES systems have evolved to add more work flow and instructions to their solutions
  – Many still produce paper, or static documents linked to the operator interface screen
  – Some still lack editing for specific role-based needs, rely on other document management, do not solve all business issues
• Rather, newer software (point solutions) are now designed to enhance Engineering documents to allow functional leaders to create more specific, role-based shop floor use
  – A data-base driven approach to deploy paperless instructions to the shop floor in real-time including photos, illustrations, instructions, parts, routings, etc., from simple to complex views
  – Real-time, Electronic Work Flow & Instructions provides operators with interactive functionality, data collection and traceability
  – Offers robust editing tools, rapid development & fast changes
  – Reduces version/revision control issues, collaboration of data
  – Offers integration to ERP, PLM, MRP and MES
  – Lower cost of ownership
Dynamic, Interactive Work Instruction Software

Consolidation

Product Development
Process or Manufacturing Engineering
Quality Management
Maintenance Management

ERP/PLM MRP/MES Integration

Data-base Driven

Work Instruction Software

Work Instruction DB SQL db

Interactive Paperless Deployment

With Real-Time Data Collection and Operator Feedback to Work Instruction Authors

Printed Binders
Wall Charts

Paper or PDF Deployment

Dynamic, Interactive Work Instruction Software

CAD/CAM Drawings
Word Docs .PDF Spreadsheets
Handwritten Notes
Product Info BOM Routings
Shop Floor Knowledge Capture

pdf file
Data-Base Driven Design
Increase Speed, Accuracy, Lower Cost of Ownership

Leverage existing ‘master’ data from Engineering or Planning Systems via controlled, automated integration to Enterprise Systems

Export Product & Process Master Info
(Product Part #’s, BOM, Routings, Operations Info, etc)

Authoring tools to further edit, add photos, import drawings, select format, etc., to finalize Work Instruction

RESULTS:
• Eliminate duplicate entry of data
• Allows ‘master’ data to be managed in one location
• Automatically manage data and ECO’s via audit process

ERP / MRP PLM / PDM database

Automated Integration, Scheduled Updates on a timely basis

Authoring Tool SW

Select Format Template

Publish Options
Print Paper or .PDF file
Real Time, Paperless Network

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Interactive, Real-Time Operator Instructions

- View Work Instructions, Process Info, Procedures, Job-Specific Tasks in Real-time
- Select the Job Work Order with matching Work Instruction
- Collect job or production data (bar code, keyboard) from operations
- Enable operations users to provide feedback/comments on Work instructions back to Engineering Authors

- Electronic Signature
- Quality Signoffs
- Data Collection
  - Serial / Lot #'s
  - User Instruction Verification
  - Other Shop Floor Info
  - Operator Feedback

Authoring Tool SW

Work Instruction DB SQL db

Paper Instructions Or .PDF file

Electronic Work Orders Real-Time Work Instructions

Produce Reports Using Your Report Writer

Quality Manufacturing Maintenance Warehouse Shipping

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Work Instruction Is Built for A Final Assembly Part Number

Subassembly
Parts
Operation
Quality Step

Tree structure design organizes product definitions, process steps, work instructions, photos, video, audio, specific tasks such as Quality, e-signature signoffs, data collection prompts & performance data, etc.

Work Instructions
Media items
Real-time, Interactive Operator & Instructional Views

Simple Operator Interface

- Select Work Orders & matching Work Instructions from pull-down list for the specific work center or task.
- Or, look up an Assembly Instruction from an available Reference library.
- View specific task information in a step by step fashion in Expert or Novice view.
- Prompt operators for data collection tasks such as recording takt time, serial/lot #’s, signoffs with electronic signature for complete tracking.
- Provide operators alerts on revisions.
- Electronic feedback from Shop Floor to Engineering.
Measurable Improvements
With Data-Base Driven Work Instruction Solutions

• 25-75% Reduction in Labor Costs
  – Shorter development, auto formatting, faster turn on change orders

• 20%+ Reduction in Work Instruction Maintenance
  – Integration to ERP/MRP/PLM systems, leveraging existing master product & process data, with automatic, scheduled updates

• 20-40%+ Operational Improvements
  – Improved Standard Work documents processes, reduces errors, rework and scrap costs

• 15%+ Reduction in Training Time
  – Task-specific instructions speed training for new Employees

• An improved documentation tool designed to support Lean, Six Sigma, ISO and regulatory/compliance programs
Sechan is an AS90100 certified, design and build to order, contract manufacturing service provider.

100% Military customer base, DOD direct and Major Defense Prime Contractors.

Looking for a paperless solution, providing an efficient means to maintain customer unique compliance.

Selection of Sequence Software made after:

- Test deployment of an in-house solution
  - Complicated navigation, ERP system access concerns
- Benchmarking/evaluating customer solutions
  - Labor intensive, cumbersome change control
- Review of other commercially available products
Sechan Product Challenges

- Complex, Mission Critical Devices/Systems
  - Military, Aerospace Exactitude
  - Limited automation potential, human factors greatly influence item functional integrity
  - High mix, low volume, constant/frequent change
Sechan Operational Challenges

Process Control Documentation Stressors

Lead Time Reduction Resource Demands Process Data Overload

Increasing Mfg. Velocity
- Short process development cycle
- Little tolerance for iterative refinement

Workforce Flexibility
- Extensive cross training
- Rapid process assimilation
- Working outside of technology comfort zones

Expanding Requirements Data Set
- Industry standards complexity growth
- Customer specific process needs
- Item unique requirements

Concise Clear Process Direction Paramount to Success
Technology Velocity Enablers

- Ability to Access and Leverage Parallel Data Bases
  - ERP System
    - Work Orders
    - Bill of material data
    - Configuration ID
  - Other Data Bases
- Global Process Capture
  - Efficiency
    - No subconscious replication
  - Standardization

No Parallel Data Maintenance

No Collateral Sub-Optimization

25%+ Eng. Labor Savings

ERP, BOM, WO/Inventory Config. Data

Global Process

Company Unique Content

Work Instruction
Streamlined Content Capture
Operator Training Attributes

• Efficient Cross Training
  – Consistent, sequential navigation
  – Selectable levels of direction
  – Definable hold points and instructional comments
  – Operator focus on immediate actions
  – Imbedded media (many from existing data)
    • Pictures and CAD drawings
    • Video and audio components

• Confidence/Comfort Factors
  – Reduced tendency to send conflicting/confounding direction to operator
  – Clear and direct path to ancillary data
Process Data Management

• Information explosion/expansion
  • Design specifics, industry standards, company policies, safety, compliance…
  • Complexity overwhelms operator’s capacity for retention

• Ability to efficiently present key elements
  • Rapid link to “stand alone/autonomous” data bases
  • Most current data always captured
  • Present only the most pertinent elements

• Data accessibility results in more focus on defining and performing critical operations
  • Don’t waste time compiling necessary, but low value/risk content
  • No searching through large, cumbersome documents
Other Advantages

Traditional Process Control Documentation Change Process

-Queue Issues, Looping, Process Lapses, Labor Intensive-

-New Process-

-Electronic Notification/Approval/Distribution-

Major Benefits
-95% Reduction in total change implementation cycle time
-200 Man Hours per month reduction in administrative labor
-Manufacturing engineering capacity gains in excess of 20%
Other Advantages Cont’d

• Configuration control and process customization
  – Work instruction specific to unique work order
  – Record of all changes/revisions
  – Direct ERP link to as built configuration

• Seamless transition to a paperless system
  – Reduced tendency to use un-controlled media
  – Operator acceptance of on-line process/media

• Customer confidence
  – Rapid and complete change incorporation
  – Configuration capture/traceability
Presentation Summary
What are YOUR Issues with Work Instructions?

• Excessive Engineering time to develop, edit and manage Work Instructions?
  – *What would 50-75% savings in engineering labor spent on Work Instructions mean to your company?*

• Improve shop floor access to accurate instructions?
  – *Are shop floor errors increasing scrap, rework, order delays?*

• Errors in Manufacturing resulting from poor, ineffective Work Instructions?
  – *What are the costs of your rework/scrap as a result of errors on the shop floor?*

• Improve reporting for regulatory or customer compliance?
  – *Would verification of work performed, by operator, with validated signature, date/time, and other production data improve your tracking of source problems and genealogy reporting?*
Thank you!

For more information, contact

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