Completing the Enterprise Landscape

SOLUMINA

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Solumina is designed for companies that manufacture or service complex products with multiple levels of sub-assemblies, and that are subject to frequent engineering changes.

**Paperless Documentation**

The transition to a complete paperless system for operations process management will yield the following immediate benefits:

- Elimination of clerical work needed to update, distribute and replace documents
- Fast deployment of Engineering changes to the shop
- Consistent job performance using the correct and latest versions of drawings, instructions, and parts

**Complete Information Kit for the Operator**

Solumina work orders are more than just travelers. They include work instructions with all the required information for the job displayed online at an operator’s fingertips.

Work orders are created from work plans containing the prescribed manufacturing, inspection or maintenance process. Work plans are authored by Process Engineers and Quality Engineers bringing together operation sequence, work instructions, inspection plans, bills of parts and materials, drawings, 3D models, videos, specifications, tooling, time standards.

Requirements for data collection are authored right into the work instruction text or illustrations. You can specify which operations require additional quality or customer buy-off signatures. Requirements for operator skills or certifications are also verified at work order execution.

**Illustrated Interactive Work Instructions**

Solumina offers a rich set of presentation tools for display of instructions and data. Work instructions can be simple, containing only text, or text with illustrations- or can be more sophisticated containing slideshows with marked up drawings, 3D model animations, or videos. Dynamic slide shows stop at specific points of the movie or animation with instructions and data collection requirements.

Work instructions include hyperlinks to supplementary documents such as drawings and standard operating procedures. Linked documents can reside in an external repository such as a PDM system. Links to supplementary documents can include bookmark information to take the user to a specific place or view within the document.
Library of Standard Text and Operations

Reusable instruction segments are managed in the Library of Standard Text, Standard Operations and Standard Procedures and Illustrations. Standard text or operations can be copied into work instructions or inserted as a reference. Historical integrity is maintained for referenced standard text objects. Revisions to library information are propagated and incorporated into new revisions of work plans.

Operation Flow Diagram

Work orders are not limited to a linear sequence routing. The Operation Flow Diagram allows definition of complex operation sequences that can include parallel sequences, alternate sequences, and loop-back nodes. Alternate operation sequences can be planned into the workflow to allow the shop to take a different path based on criteria such as work center capacity or test results. Operation sequences for standard repair or test-select loops can also be launched off decision points following inspection operations.

Linked to Engineering Data

Work instructions are assembled from database objects and presented to the user as a single scrollable document resembling the former paper document. Objects and subsections have their own privileges and rules for view and update. Only authorized users can make changes to specific subsections and only at specific stages in the work flow sequence. Change history is recorded for each object and subsection.

Objects that originated in Engineering CAD/PDM systems including product structure and 3D models are locked from modification and cross referenced. Where-used functions expedite incorporation of changes into manufacturing processes as the engineering object revisions come in.

In contrast, work instruction solutions that are based on word processing and file management software cannot achieve the same level of detail control over different elements of a work instruction, and require integration of several software programs.

Change Control

Configuration and change control can be daunting tasks when planning the manufacturing, maintenance or overhaul of complex products with intricate processes. Solumina streamlines and expedites this process facilitating the deployment of instruction revisions to the shop floor including retrofit instructions for units in process.

Planning work packages, work plan revisions and work order alterations are tied to the original Engineering authorizations (e.g., an Engineering Change Order or Notification).

The workflow configuration controls the number and order of functional groups involved in the authoring, review and approval processes. Communications between functional groups preserve review discussions and recommendations.

A complete history of “who,” “what,” and “when” is recorded for each changed object in each work plan revision and work order alteration.

Figure 2

Operation Flow Diagram
Task Management

Authoring and approval tasks are prioritized and assigned within each Planning Work Package. The task dispatch list provides visibility of who is assigned and active on each task.

Change Release and Deployment

Work plan revisions are tied to future work orders based on the effectivities assigned to the revision. The effectivity range can be specified as dates, serial numbers, lot numbers, or end-unit numbers (e.g., fuselage numbers).

Units in process can be at various stages of production. Depending on the urgency of the change and the work already completed, the process planner can supersede work instructions entirely, retrofit the unit, or allow the unit to be completed to earlier specifications. Work orders can be updated to the latest work plan revision with a single supersede command, as long as the specific changes do not impact completed work.

In-process units might require supplemental instructions to retrofit the unit to the latest engineering changes. Visibility of the work order status and the ability to place in-process units on hold facilitate the task for the process planner.

The integration of process planning and execution is complete. Units are placed on hold for Work Order Alterations. Work instructions can be copied from the latest work plan revision, and changes can be propagated to other work orders with a single command.

Figure 3

Engineering Product Data Objects are Linked to Process Work Instructions
PROCESS EXECUTION

Solumina radically improves the efficiency of your shop. Operators will spend more time doing the job they are trained to do, and less time looking for documents, waiting for corrections, or waiting for repair instructions. Learning curves and potential for mistakes are greatly reduced with enhanced work instructions. Managers can make quicker decisions and assignments using the graphical view of the work schedule, resources and constraints. As-built history is instantly available for reports and analysis.

Complete and Current Job Information

All the information required to do the job is “kitted” for the operator. Work instructions contain links to pictures, slide shows, drawings and process specifications. The operator always views the correct and latest version of drawings, specifications and parts. Required parts and tools are also listed. An operator is always alerted to conditions holding up a job.

Enhanced Work Instructions

Solumina provides the operator with easy to follow instructions that reduce the learning curve and errors. Instructions for simpler jobs can be text descriptions complemented with links to illustrations and bookmarked drawings; instructions for more difficult jobs can be intricate animated slide shows that incorporate marked-up drawings, 3D models or videos, and prompt the user for data collection when required.

Paperwork Reduction

Solumina eliminates the need for most of the paper documents used on the shop including books of standard procedures, work orders, amendments to work orders, printed work instructions, drawings, and nonconformance documents. A paper-lite phase is supported to help transition to a paperless process.

Straightforward Operation

Solumina configuration optimizes the user interface for different types of work centers. Some work centers require employees to work on assigned jobs and other work centers allow operators to assign jobs to themselves. Some centers work units in batches, others one at a time. The user interface is configured to surface only those options required for the current job and work center, and provide speed buttons for most-used commands.

Online Data Collection

Data collection is launched directly from the work instructions. A data collection form with a spreadsheet feel is optimized for data entry. Solumina lets you know what data is still required to complete the job. The operator is alerted when entered data is outside specified control limits.
Buy-Off Signatures

Operators and inspectors “stamp” work completion and approvals online. These buy-off stamps are stored as part of a unit’s history. Inspectors can point out an oversight or initiate discrepancy reports directly from a buy-off point in the work order. Solumina is compliant with FDA Title 21-CFR-Part-11 regulations on electronic signatures.

Certification Verification

Solumina ensures that the operator has the required certification for the job. The operator is also warned about certifications close to expiration.

Planned Routing Decisions

An operator or supervisor has the option to choose among alternate routings planned into the work sequence. Alternate sequences provide flexibility to divert units to different work centers, or to handle additional steps based on test results.

Discrepancies and Defects

A discrepancy report can be initiated directly from a work order and can also be initiated independently for incidents not tied to a specific job. For example, completed parts could be damaged in transit, and require discrepancy documentation and rework. Discrepancies are automatically routed for disposition to the appropriate personnel. The job is placed on hold until disposition instructions are approved. For more information on discrepancies, please refer to the description of Solumina’s Process Quality functionality.
Supervisory Tools

To manage the shop, you need visibility of schedules, resources and constraints. The Solumina graphical dispatch brings all this information together for the supervisor using Gantt charts, histograms, alerts, and tabbed pages with additional information about each job. The supervisor knows which jobs are ready and which jobs are held up, and can easily assign and reassign jobs to accommodate unplanned absences or machine downtime.

- Gantt charts show priorities, the master schedule, the revised schedule and actual dates. Authorized production personnel can make adjustments to the schedule to accommodate constraints.
- Histograms graphically display the assigned load for each employee. You can assign employees by dragging jobs from the Gantt chart to the employees on the histogram.
- Alerts are displayed for job constraints, such as liens or delays for parts or tools.

Liens

Liens act as virtual red tags on the units identifying open discrepancies and rework. Special authorizations can be given to specific units allowing work to proceed up to a certain point with these lien conditions. Visibility of the liens is never lost throughout the process, even when liens are inherited from installed subassemblies.

As-Designed, As-Built, As-Maintained

Solumina stores all history on each unit, including work instructions, data collection, buy-off signatures, discrepancies, rework, and complete product genealogy. Product genealogy keeps track of materials, components and subassemblies used for each unit. The complete tree of nested components is available. Solumina not only maintains installation records, it also maintains removal records. History for a subassembly and its components moves with that subassembly when it is removed.

Product genealogy is maintained for products tracked by serial number, lot number or work order number, and is preserved through work order splits and lot splits.

Figure 7

Complete Visibility of Work in Process
Solumina provides a complete paperless system for the documentation, tracking and disposition of discrepancies and for management of corrective actions, from root-cause analysis to effectiveness verification.

Deliver a quality product consistently and with confidence, fully leveraging the functionality in Solumina. Solumina provides functionality to monitor your processes and identify the areas where enhanced work instructions are needed the most.

**Product Control**

All data and documentation are tied to each unit identified by serial or lot number. Product genealogy includes installed and removed components and subassemblies, making it easy to determine where a certain component or material was used.

**Process Control**

Solumina provides process control that assures:

- Proper operator skill and current certification
- Proper tools with calibration dates
- Complete and latest process documentation
- Controlled change procedures for process instructions

**Inspection and Test Plans**

The inspection plan prescribes how to verify that the product is built or serviced to engineering specifications. Inspection plans are incorporated into work instructions and include the following elements:

- Inspection and test operations
- Data collection requirements with control limits
- Certified buy-off stamp requirements

**Figure 8**

Drill Down from Metrics to Work Center to the Work Order
**Product Verification**

Solumina’s integrated system enforces the requirements of the inspection plan during process execution. Work order operations cannot be completed until all data collection requirements are fulfilled. Data points outside control limits are immediately highlighted for the operator. Inspection and test operations force verification points in the process sequence. Work is stopped until inspectors record their “stamp” of approval at specified buy-off points.

**Discrepancies**

Discrepancy records document defective or non-conforming product, components, or product specifications. Discrepancy history is tied to each production unit or production lot.

**Full Integration with Process Execution.** Discrepancies can be initiated from inspection or buy-off points in the work order, and can also be initiated for incidents independent from the current operation or work order.

**Configurable Workflow.** The disposition, review and approval workflow is configured to handle complex routing requirements for different types of discrepancies. Communications further complement the process, documenting review and discussion threads.

**Dispositioning.** A unit’s disposition can include instructions to rework, repair, or scrap the unit. Authoring and approval of supplemental or alternate work instructions are part of the dispositioning process. A defective installed component or subassembly can be fixed in place or removed. When a defective component is removed, its defect history stays with the component and its removal history stays with the unit.

**Disposition Instructions**

Disposition instructions include supplemental and alternate work instructions for units requiring rework or repair. Disposition instructions can be inserted in the same work order or handled in a supplemental work order.

**Authoring.** Disposition instructions are authored with the same tools used to author the work plan instructions and alter the work order instructions—the Process Engineer uses one application for all his authoring needs and is able to copy from work plans, work orders or template repair instructions.

**Execution.** When dispositioning is completed and approved, the disposition instructions are dispatched to the shop. Rework and repair jobs are highlighted in the dispatch list which includes planned and unplanned jobs. The operator executes rework and repair operations with the same screens and steps used for planned operations. Solumina also provides commands to easily navigate among the related discrepancies, supplemental work orders, and the original work order.
**Corrective and Preventive Action**

Solumina’s closed-loop corrective and preventive action process manages requests, action items and verifications. Each corrective action is a project coordinated by a facilitator responsible for following up on action items until there is an agreement and commitment on resolutions.

**Requests.** Corrective action can be requested from discrepancies or corrective action requests. Corrective action requests are created to track internally or externally initiated issues like recurring defects, or customer satisfaction concerns. Several requests can be linked to a single corrective action.

**Investigation and Action Items.** Action items track investigation, root-cause analysis, and resolution commitments. Action items are routed according to the specified responsible departments. The root-cause analysis process can enforce check list and specific forms to be filled out for different types of issues.

**Verifications.** The corrective action process is not complete until implementation is verified and proven effective. Solumina allows scheduling of implementation verification tasks according to the commitment dates. Subsequent effectiveness verifications allow time to prove the success of the prescribed solutions.

**Repairing, Scrapping, Salvaging, Shelving**

Scrapping or shelving a unit cancels all work activities on the unit. Shelved units, like scrapped units, are set aside incomplete. Rework orders can be created to complete or retrofit scrapped or shelved units. Salvage work orders are used to remove components or subassemblies from scrapped units.

**Quality Metrics**

Quality issues impact the ability to meet schedule and cost objectives. Solumina provides reports and charts to view quality metrics and drill down into problem areas for more details.

**Six-Sigma and Defect Normalization.** Solumina can produce Six-Sigma metrics normalizing defect data per defect opportunity.

**Product Recalls**

If your product is subject to recalls or warranty issues, you can quickly query product genealogy information to determine exactly which products contain or used a suspect component or material.
Reports and Graphs
Reports and graphs provide visibility of shop floor status, metrics, expectations and trends. From summary reports or graphs you can drill down to the detailed data in work orders or discrepancies.

As-Designed, As-Built, As-Maintained Unit History
Solumina provides a full audit trail of the work process from design to execution and inspection. Unit history for the entire tree of subassemblies and components includes production data, product genealogy, discrepancies, changes to instructions, installation and removal of parts, rework and repairs.

Regulatory Compliance
Solumina meets the strictest process management and integrity requirements of the industry including ISO9001, AS9100, ISO13485, FAA, and FDA Title 21 CFR Parts 11 and 820.

Performance and Scalability
Solumina has a track record of proven performance with large user populations. Multiple configuration and deployment options are supported.

System Integration
Solumina provides mechanisms for client-to-client integration, application-to-application interfacing, and business-to-business collaboration, including standard XML interfaces. Solumina integration enables a direct link between the shop floor and key enterprise systems, like ERP and PDM applications.

Secured Access and Data
Application and database access are controlled by roles, privileges and user login. Additional IP protection and ITAR security controls are enable through Solumina’s Security Groups functionality.

Adaptability
Solumina is configurable to specific organizational structures and practices. Configuration features include functional roles, workflow, work center dispatch rules, supplemental business rules, product extensions, and tailored presentation.

Implementation and Support Services
iBASEt provides configuration, integration, project management, training, and product support services to ensure a successful product implementation.
Solumina is an Operations Process Management (OPM) software suite that manages work and quality processes for the manufacturing and MRO (Maintenance, Repair and Overhaul) of highly engineered products. Solumina functional modules include Process Planning (CAPP), Manufacturing Execution System (MES), Quality Management System (QMS, CAPA), Supplier Quality Assurance (SQA), and Maintenance, Repair and Overhaul (MRO) in one integrated system.

Solumina is uniquely designed to manage the product life cycle, beginning with product and process quality specifications into the supply chain, continuing with the manufacture of component parts, the assembly of product, and the aftermarket service of each product unit until retirement.

Solumina functional modules include:

- **Solumina Operations Process Management for Manufacturing**
  - Manufacturing Execution System
  - Quality Assurance System (QA, Discrepancies, CAPA)

- **Solumina Operations Process Management for Maintenance, Repair and Overhaul**
  - Maintenance Requirements Planning
  - Maintenance Task Planning
  - Maintenance Online Execution, Non-routine Execution

- **Solumina Supplier Quality Assurance**
  - Supplier Inspection Planning
  - Receiving and Source Inspection
  - Discrepancy Reporting and Corrective Actions

More papers and resources available for download at the Library section of our website: www.solumina.com.