

# Teamcenter for maintenance, repair and overhaul (MRO)

Configuration-driven MRO

Siemens PLM Software

[www.siemens.com/plm](http://www.siemens.com/plm)



Companies can use Teamcenter® software's comprehensive suite of MRO solutions to establish a service data management environment that provides total visibility into complex products that function as capital assets. OEMs can use Teamcenter to manage product knowledge and logistics support data throughout its entire lifecycle, including the service life of their products. Service organizations can use Teamcenter's configuration-driven MRO and digital lifecycle management capabilities to plan their operations more effectively, optimize service execution and better utilize asset, part, tool and equipment inventories.

## TEAMCENTER

## SIEMENS

### **Business challenges**

OEMs, owners and service organizations that support and sustain complex capital assets (such as aircraft, ships, power plants, machinery, medical devices and infrastructure elements) face a demanding array of challenges, including the need to:

- *Leverage design manufacturing and service data.* OEMs need to be able to leverage their design/build knowledge to establish a market advantage when they compete as service providers. OEMs also need to capture as-maintained results from asset owners and other service providers to improve their product offerings.
- *Implement service level and performance-based contracts.* Many of today's customers want their service contracts to measure performance issues that are more meaningful than conventional hourly rate and parts replacement metrics. These contracts need to measure asset availability/reliability and organizational performance factors that reflect a better understanding of assets, parts and supply chain activity.
- *Reduce MRO cycle time.* Service teams need to minimize the turnaround time needed to resolve service events.
- *Minimize MRO costs and improve the use of working capital.* Inventoried levels of parts, tools and equipment need to be optimized to support today's capital assets. Organizations need to keep sufficient quantities of the right parts in reserve without retaining unnecessary overstocks, holding the wrong parts, or incurring costly backorders. Work capacity needs to be increased through leaner operations.
- *Increase service team productivity.* Service organizations can improve productivity by minimizing the time required to perform non-essential tasks (such as searching for instructional information or performing "paperwork"), thereby freeing technicians to resolve their assigned service events. Best practices should enable lean operations and facilitate the capture of intellectual property that ensures the productivity of newly hired service technicians.
- *Maximize operational availability.* Capital assets need to remain operational as long as possible. Sustained operability improves return on asset investment, while enabling individual assets to fully complete their critical missions.

To address these issues, Siemens PLM Software provides Teamcenter for MRO solutions. Teamcenter's product lifecycle management (PLM) technology enables organizations to establish a service data management environment that can capture, organize, optimize and utilize knowledge throughout the entire lifecycle of a complex product – particularly while the product is being maintained and serviced. This environment is extended for service providers with MRO process management applications providing maintenance planning, maintenance, execution and material management. Within this environment, Teamcenter also provides a logistics records management solution that integrates the logistics planning process directly into the engineering process.

By providing the entire service value chain with the ability to access a single source of product and asset definitions, Teamcenter facilitates a collaborative capability for performing MRO planning, execution and material management on a lean basis.

# Introducing Teamcenter for MRO

Teamcenter solutions enable OEMs, owners and service organizations to support complex capital assets with a service data management environment. Companies can use this PLM-enabled environment and the following Teamcenter solutions to communicate asset definitions and maintenance information within a service-oriented context that facilitates the accurate and rapid performance of multiple MRO functions.

- *Service Data Management* provides total visibility to configuration and service knowledge for complex long-life capital assets, including each asset's in-service state and history. Service event management enables OEM and service providers to capture the results of service activities performed elsewhere in the service value chain. The service dashboard provides insight into metrics necessary to effectively manage to commitments such as PBL (performance based logistics) and SLA (service level agreement) contracts.
- *Logistics Records Management* integrates creation and management of logistics support data process into the product engineering process.
- *Maintenance Planning* enables service organizations to perform maintenance planning for assets ranging in complexity from components to entire fleets and installations.
- *Maintenance Execution* enables service organizations to execute auditable maintenance procedures, retain reviewable event histories and capture asset performance/readiness status.

- *Material Management* enables organizations to track and manage all part, tool and equipment inventories used to maintain, repair and overhaul their assets.
- *Reporting and Analytics* allows organizations to examine operational information so they can discern trends in asset performance and reliability, as well as track and analyze asset and organizational KPIs.

By managing asset information in a secure web-native PLM environment, Teamcenter facilitates faster service response. Service teams can access this asset knowledge at anytime from anywhere using any web-enabled device.

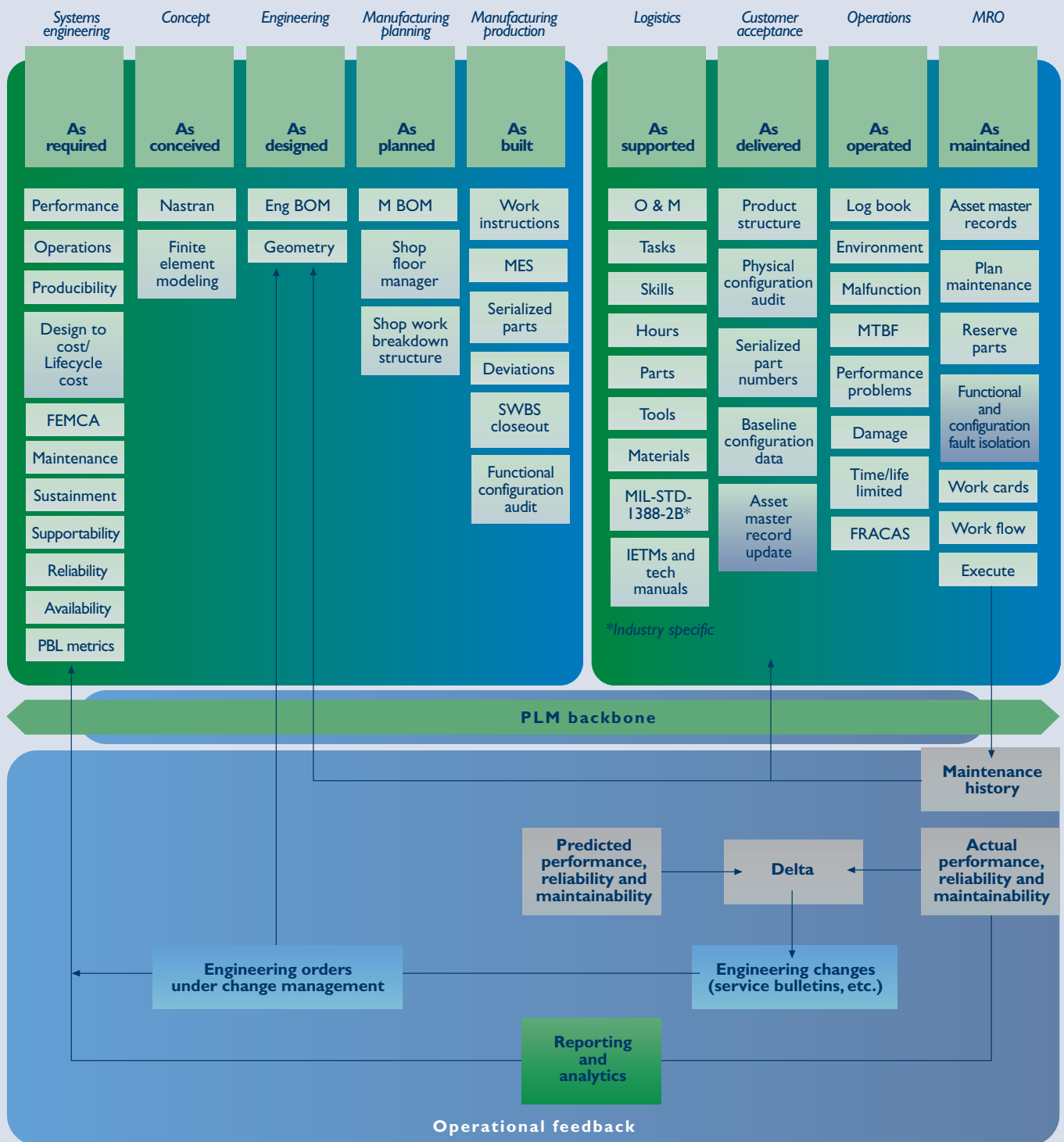
By providing PLM environments with workflow, change, document and configuration management capabilities, Teamcenter allows service teams to work with engineering teams in closed loop processes that drive today's optimized inventory, warranty improvement and "build-in" initiatives. In addition, best practices and lean processes can be implemented and tracked across the entire service chain.

By deploying community-oriented collaboration capabilities across a PLM environment, Teamcenter enables widely dispersed service technicians to visually exchange ideas in real-time conferences, share applications and translate their point-of-service concerns into re-usable intellectual capital.



# What makes Teamcenter's MRO solutions special?

Factor	Differentiation
<p><i>Configuration-driven MRO</i></p>	<p>As product configurations evolve into as-maintained asset configurations, OEMs and service teams have a compelling requirement to maintain configuration control, ensure regulatory compliance, and tightly integrate their operations with product engineering. Teamcenter's configuration-driven MRO capabilities provide the technological base for meeting this need.</p> <p>By capturing, organizing and accessing asset information within the context of its configuration, organizations can rapidly and accurately improve their maintenance planning, maintenance execution and material management activities.</p> <p>Organizations can leverage Teamcenter to establish feedback loops that bring the service concerns of field technicians to the designers and service engineers who develop and support today's complex products.</p> <p>Teamcenter enables service teams to understand an asset's ongoing requirements and compliance constraints. By leveraging a configured structure, service organizations can retain and access all of the information about an asset within a service-related context, including inspection reports, deviations, maintenance procedures, service requirements, and lifecycle limits. Teamcenter also provides the complete history of the asset and its associated support information and monitored parts.</p>
<p><i>Marketplace success</i></p>	<p>Siemens PLM Software's impressive experience across a client base of 51,000 customers includes highly respected <i>and experience</i> companies in the aerospace, defense, manufacturing, health care and high tech and electronics industries.</p> <p>In the aerospace and defense industry alone, solutions from Siemens have accumulated more than one million man-years providing mission-critical capabilities – ten times the combined experience of its PLM competitors.</p> <p>Siemens provides PLM solutions to all 15 of the world's top aerospace companies. Teamcenter is recognized by industry analysts as the number one PLM platform in the world with more seats installed than all of its competitors combined.</p>
<p><i>Proven PLM platform</i></p>	<p>Teamcenter-driven PLM solutions manage much of intellectual capital that defines today's highly complex assets before they reach the in-service stage. Teamcenter is uniquely positioned to link existing product and engineering data into maintenance and material improvement programs.</p>
<p><i>Scalability and openness</i></p>	<p>Teamcenter provides modular and highly scalable solutions that enable companies to address their highest business priorities first – without sacrificing security or export control. Organizations can deploy Teamcenter one step at a time, in a phased approach that ensures a rapid return on investment. Teamcenter-driven PLM environments can be expanded in seamless increments to satisfy the needs for growth, technology enhancement or service-team integration.</p> <p>Teamcenter-driven MRO solutions are delivered on an open PLM foundation that protects investment while facilitating vendor independence. This open foundation allows organizations to integrate Teamcenter with other mission-critical systems, as well as to rapidly accommodate new service providers and other partners.</p>
<p><i>Comprehensive lifecycle coverage</i></p>	<p>Teamcenter for MRO is part of Teamcenter's larger portfolio of digital lifecycle management solutions. Organizations that own product responsibility from concept planning to end-of-life disposition can leverage Teamcenter to manage their entire product lifecycle.</p> <p>Product teams can capture maintenance and reliability requirements determined during the product development cycle and feed these requirements to service organizations to properly assign service objectives and procedures. Similarly, service teams can capture operational observations (such as mean time between failure, time-for-service procedures, failure codes and operational logs) and feed this information back to product and service engineering via closed loop processes.</p>



## Teamcenter's Service Data Management solution

### Service Data Management: facilitating total asset visibility and lifecycle collaboration

Teamcenter's Service Data Management (SDM) solution provides a single source of service data that supports manufacturers as well as service providers with the knowledge they require to be effective in their portions of the lifecycle. For the manufacturer SDM bridges the gaps between product engineering, manufacturing, logistics and services with a single knowledge source that improves collaboration in any direction of the product lifecycle. The service provider utilizes SDM to manage service information anywhere it originates in the service value chain to support service operations. SDM's Service Dashboard provides OEM and service providers with insight

via dashboards and reports into product, asset and process performance metrics that are critical to achieve commitments such as PBL and SLA contracts.

Service Data Management captures, manages, and provides data and metrics on a wide range of operational knowledge including:

- Configuration information that describes the complete status of an asset
- Comprehensive change and event histories that describe individual assets and their related parts
- Technical information (such as life usage characteristics and limits) that define the useful life of each asset's deployed components
- Compliance standards and regulatory requirements that the operational asset must satisfy
- Baselines and common information that combine configuration information, change/event histories, technical information and compliance standards/regulatory requirements for each class of managed asset
- External service event actions and information
- Changes to the asset configuration (such as removal/replacement of serialized components)
- Logs of overhauls, inspections, fault codes, service bulletin incorporations and field orders
- Operational utilization information against the asset or its components
- Deviation authority and reasons for removal/change
- Discrepancies and their corrective actions

Manufacturers leverage Teamcenter's configuration management capabilities to link physical product configurations (i.e., configurations that incorporate serialized part and lot tracking) with as-designed engineering configurations and to link operational feedback with products for next-generation improvements. Owners, operators and third-party service providers use Teamcenter to capture, develop and manage asset and service information from the service value chain.

Subsequently, service teams can access all allowable configurations to determine what approved parts and alternate/substitute parts can be used to resolve a service event as quickly as possible.



## Teamcenter's Logistics Records Management solution

Teamcenter's Logistics Records Management (LRM) provides an industry standards (PLCS ISO 10303-239, GEIA-Std-0007, MilStd-1388, DefStd-0060) inspired logistics data management solution integrated into the single source of product, manufacturing, and sustainment knowledge that supports manufacturers throughout the product lifecycle. LRM improves the accuracy and productivity of your logistics operations by inviting it into the same product knowledge and process environment permitting direct access to the product information required to generate logistics data. Within this integrated environment the logistics team can participate in change and other processes to immediately assess impacts on logistics data.

Logistics Records Management manages key logistics data linking it directly to engineering data:

- Physical product configuration
- Logistic structure with logistic control numbers (LCN)
- Logistics document management
- Part and equipment life characteristic definitions and limits
- Export control compliance (ITAR)
- Integrated change management with impact analysis for logistics/engineering data
- Logistics support records history

Creation and management of logistic support data records for:

- End and indentured items, entities
- Operations and maintenance requirements
- Reliability, availability, maintainability and interoperability requirements and characteristics
- Failure mode, RCM, and IMPC data
- Task data – subtask, skills, personnel requirements, support equipment, provisioned items
- Support and alternate equipment design data and integrated logistic support requirements
- Item identification
- Part application provisioning, manual descriptions and reference designation
- Overhaul kit data
- Article or unit test information, equipment, instructions and program

Teamcenter provides fully integrated logistics support data management within the rest of the product engineering lifecycle environment to reduce the logistics effort and improve collaboration between engineering, manufacturing, logistics, and sustainment. LRM permits the logistician to adopt product changes into logistics data quickly, accurately, and with reduced effort.



# Teamcenter's Maintenance Planning solution

## Planning maintenance for component, subsystem and end-item assets

The key to accelerating the MRO cycle and minimizing its costs rests in the ability to accurately and comprehensively plan the service organization's MRO activities. If organizations incorporate best practices into their MRO plans, they can implement comprehensive maintenance plans that:

- Improve service team productivity
- Maximize asset availability (uptime)
- Accelerate service event turnaround times
- Minimize unnecessary tasks in the MRO cycle
- Incorporate best practices, experience and lean improvements into maintenance procedures
- Deploy assets for efficient service life

To meet these objectives, Teamcenter's Maintenance Planning solution enables organizations to:

- *Establish maintenance requirements and frequency* for an entire base of assets (as well as for specific assets) by capturing information from manufacturer maintenance plans, logistical information, technical manuals, corrosion prevention programs, structural inspections, and asset modification programs. Maintenance Planning also helps organizations recognize requirements driven by unique asset configuration and operating conditions.

- *Analyze each asset* in terms of its operational hours, maintenance cycle and utilization data and then generate a forecasted maintenance schedule for the asset's related equipment and components.
- *Define the resources* for each forecasted requirement in work cards that identify the steps, tools, materials and scheduling that need to be arranged.
- *Account for unscheduled maintenance* by providing resolution procedures and resource requirements for immediate repair or deferred discrepancies.
- *Effectively plan service visits* by eliminating redundant tasks, generating a normalized bill of materials and work instructions, and delivering service forecasts that can be used to plan upcoming visits and assess near term requirements.
- *Gather maintenance requirements* into a broad plan that can be analyzed to minimize duplicate work, combine service events, and reduce the cost of rectifying service bulletins and regulatory compliance maintenance. In addition, organizations often use the plan to capture and implement best practices, past experiences and lean processes that they can subsequently apply across the service chain.



# Teamcenter's Maintenance Execution solution

## Managing the execution of service events

Teamcenter's Maintenance Execution solution enables service organizations to manage the execution of their MRO activities and track service team performance – thereby providing a foundation for today's total quality service initiatives. Equally important, this solution captures key indicators that provide organizations with a basis for supporting performance-driven service initiatives – such as performance based logistics (PBL) and service level agreement contracts (SLA).

Within this context, Maintenance Execution enables service organizations to:

- Digitally distribute work orders, instructions and all necessary documentation to point-of-service technicians
- Track closure of all work requirements, thereby supporting audits for compliance verification audits
- Report service event information back to manufacturers or service integrators via a service event management capability that allows product performance to be fully understood

In the Teamcenter environment, maintenance management begins when service managers create work cards to define what tasks are needed to meet an asset's maintenance requirements. The work card's planning information is retained in Teamcenter, including the steps, tools, materials, skill sets and time needed to complete each forecasted requirement.

As these scheduled requirements are ready to be executed, service managers leverage Maintenance Execution to:

- Sort and assign work orders and associated job cards by work zone, process and skill set
- Digitally distribute the work orders to service team members for subsequent execution
- Support the use of export control regulations by managing work assignments in nationally mixed environments

As the service team performs the maintenance in question, Maintenance Execution tracks the work order in real time by capturing:

- Actual manpower, parts, tools and equipment utilized to complete the task
- Metrics on life-limited parts, deviations, discrepancies and deferred defects
- Corrective actions performed, as well as non-routine findings
- Job card completion information for audit support and compliance verification



# Teamcenter's Material Management solution

## Optimizing asset-related inventories

Today's owners and operators of complex capital assets retain billions of dollars in parts inventory. Commercial aviation alone retains billions in engines and parts. With so much at stake, the need to understand – and improve – the use of working capital has never been greater.

Teamcenter's Material Management solution addresses this objective by enabling organizations to track and manage the part, tool and equipment inventories for the entire asset base. Material Management's robust capabilities can be used to:

- Capture the part, tool and equipment inventories that sustain a managed set of assets in multiple locations
- Track these inventories from purchase to scrap, including across installed, borrowed, in-stock, out-for-repair and scrapped states
- Identify items that constitute expendable and repairable inventories
- Monitor each item's shelf-life, usage rates and demand history
- Leverage usage rates/histories to forecast the organization's material requirements
- Manage vendor bids and their associated parts, services and performance (lead time and quality)
- Implement automated transaction processes, including purchase orders, transfer receipts, and repair orders and their supporting audit trails
- Implement a receiving and stocking process to account for new and transferred parts and equipment
- Track warranty status, including flagging parts, to facilitate warranty claim recovery
- Maintain regulatory compliance records
- Track outsourced overhaul and repair work
- Reserve parts, tools and material inventory to support specific service events, thereby ensuring event completion

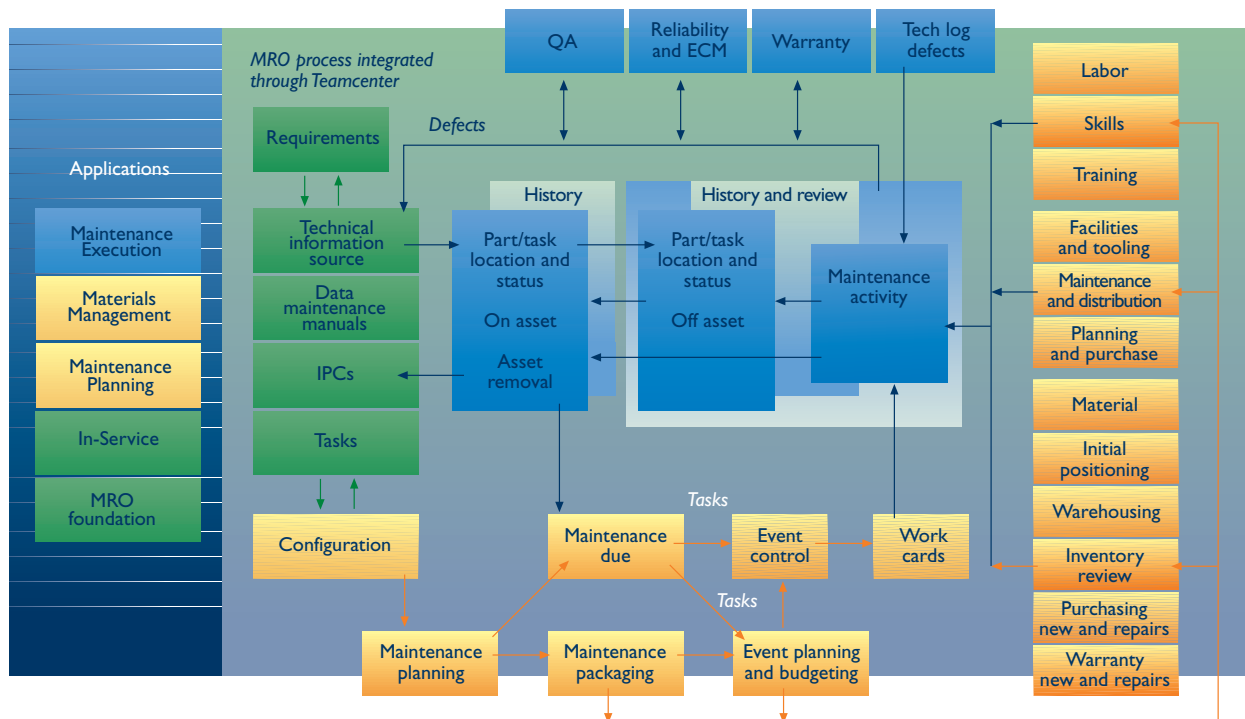


## Teamcenter for MRO benefits

### Solutions

### Benefits

<i>Service Data Management</i>	<ul style="list-style-type: none"> <li>• Provides total visibility to an organization's assets and service offerings under configuration control</li> <li>• Improves asset tracking and life usage by leveraging fully defined lifecycle BOMs</li> <li>• Enables rapid generation and digital distribution of service bulletins</li> <li>• Injects event-driven service experiences into closed-loop product-to-service improvement processes</li> <li>• Incorporates service team concerns into early product lifecycle phases</li> <li>• Delivers global point-of-service knowledge</li> <li>• Manages all asset-related knowledge while providing access within the context of the asset's configuration</li> <li>• Enables manufacturers and service integrators to capture and incorporate asset knowledge and configuration changes that originate elsewhere in the service value chain</li> <li>• Service Dashboard provides insight into asset and process performance via key performance Indicators that enable successful PBL and SLA business contracts</li> </ul>
<i>Logistics Records Management</i>	<ul style="list-style-type: none"> <li>• Provides single source of product and logistics knowledge to improve collaboration</li> <li>• Enables improved productivity in logistics support data creation and management</li> <li>• Facilitates improved change impact assessment and planning across product engineering, logistics, manufacturing and sustainment</li> <li>• Enables customer responsiveness by linking the logistics support data to the latest engineering modifications</li> </ul>
<i>Maintenance Planning</i>	<ul style="list-style-type: none"> <li>• Enables service organizations to capture and apply maintenance-related best practices</li> <li>• Facilitates efficient individual service event planning</li> <li>• Minimizes maintenance cost by facilitating predictive maintenance, efficiently planned service visits and granular asset analysis</li> <li>• Enables manufacturers and service integrators to capture and incorporate asset knowledge and configuration changes that originate elsewhere in the service value chain</li> </ul>
<i>Maintenance Execution</i>	<ul style="list-style-type: none"> <li>• Provides foundation for implementing quality initiatives</li> <li>• Accelerates MRO cycle while assuring compliance with approved maintenance plans</li> <li>• Aligns planning objectives with point-of-service execution and design compliance</li> </ul>
<i>Material Management</i>	<ul style="list-style-type: none"> <li>• Provides cradle-to-grave fine-grain part, tool and equipment visibility and life usage tracking</li> <li>• Streamlines and improves inventory operations and utilization</li> </ul>



## About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with nearly six million licensed seats and 56,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

### Siemens PLM Software

#### Headquarters

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
972 987 3000  
Fax 972 987 3398

#### Americas

Granite Park One  
5800 Granite Parkway  
Suite 600  
Plano, TX 75024  
USA  
800 498 5351  
Fax 972 987 3398

#### Europe

3 Knoll Road  
Camberley  
Surrey GU15 3SY  
United Kingdom  
44 (0) 1276 702000  
Fax 44 (0) 1276 702130

#### Asia-Pacific

Suites 6804-8, 68/F  
Central Plaza  
18 Harbour Road  
WanChai  
Hong Kong  
852 2230 3333  
Fax 852 2230 3210

[www.siemens.com/plm](http://www.siemens.com/plm)

© 2009 Siemens Product Lifecycle Management Software Inc. All rights reserved. Siemens and the Siemens logo are registered trademarks of Siemens AG. Teamcenter, NX, Solid Edge, Tecnomatix, Parasolid, Femap, I-deas and Velocity Series are trademarks or registered trademarks of Siemens Product Lifecycle Management Software Inc. or its subsidiaries in the United States and in other countries. All other logos, trademarks, registered trademarks or service marks used herein are the property of their respective holders.

1404-W 16 8/09