# Business challenges

OEMs, owners and service organizations that support and sustain complex capital assets (such as aircraft, ships, power plants, machinery, medical devices and infra -structure 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 service cycle time. Service teams need to minimize the turnaround time needed to resolve service events.
- Minimize service 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 along 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-driven maintenance, repair and overhaul (MRO) solutions. Teamcenter's product lifecycle management (PLM) technology enables organizations to establish a service 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 enabling accurate maintenance planning and execution. 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 and execution on a lean basis.

# Introducing Teamcenter's MRO solutions

Teamcenter solutions enable OEMs, owners and service organizations to support complex capital assets with a service 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 service functions.

- Service Data Management provides total visibility to configuration and service knowledge for complex long-life capital assets, including each asset's in-service status and history. Service event management enables OEM and service providers to capture the results of service activities performed in-house or outsourced 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.

- Service Request Managements enables reactive service organizations to efficiently manage service requests in ways that improve responsiveness and increase customer satisfaction, while facilitating cost controls and service standards
- Service Planning enables service organizations to leverage planning information so that it can be used for preventative, conditional or reliability-based maintenance.
- 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.
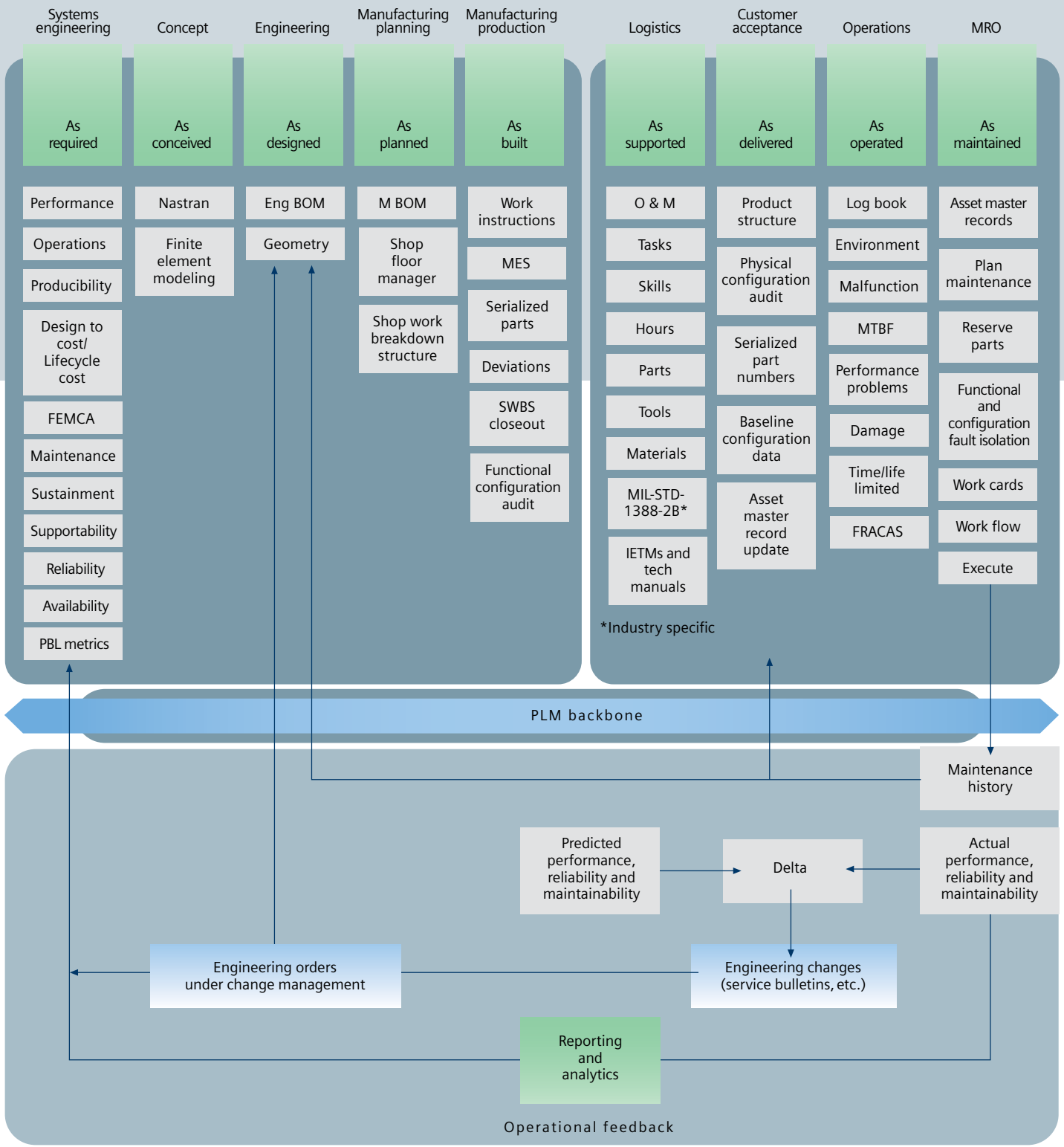
By managing asset information in a secure web-native PLM environment, Teamcenter facilitates faster service response. Service teams can access this asset knowledge at anytime from any-where using any web-enabled device.

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 |
|---|---|
| Configuration-driven service | 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 service capabilities provide the technological base for meeting this need. |
| | By capturing, organizing and accessing asset information within the context of its configuration, organizations can rapidly and accurately improve maintenance planning and maintenance execution activities. |
| | Organizations can leverage Teamcenter to establish feedback loops that bring the service concerns of field technicians to the product and service engineers who develop and support today's complex products. |
| | 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. |
| Marketplace success | Siemens PLM Software's impressive experience across a client base of 65,000 customers includes highly respected and experienced companies in the aerospace, defense, manufacturing, energy, health care and high tech and electronics industries. |
| | Teamcenter is recognized by industry analysts as the leading PLM platform in the world with more seats installed than all of its competitors combined. |
| Proven PLM platform | 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. |
| Scalability and openness | 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. |
| | 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. |
| Comprehensive lifecycle coverage | Teamcenter's MRO solutions are 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. |
| | 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. |

| Systems engineering | Concept | Engineering | Manufacturing planning | Manufacturing production | | Logistics | Customer acceptance | Operations | MRO |
|---|---|---|---|---|---|---|---|---|---|
| As required | As conceived | As designed | As planned | As built | | As supported | As delivered | As operated | As maintained |
| Performance | Nastran | Eng BOM | M BOM | Work instructions | | O & M | Product structure | Log book | Asset master records |
| Operations | Finite element modeling | Geometry | Shop floor manager | MES | | Tasks | Physical configuration audit | Environment | Plan maintenance |
| Producibility | | | Shop work breakdown structure | Serialized parts | | Skills | | Malfunction | |
| Design to cost/ Lifecycle cost | | | | Deviations | | Hours | Serialized part numbers | MTBF | Reserve parts |
| FEMCA | | | | SWBS closeout | | Parts | Baseline configuration data | Performance problems | Functional and configuration fault isolation |
| Maintenance | | | | Functional configuration audit | | Tools | | Damage | |
| Sustainment | | | | | | Materials | Asset master record update | Time/life limited | Work cards |
| Supportability | | | | | | MIL-STD-1388-2B* | | FRACAS | Work flow |
| Reliability | | | | | | IETMs and tech manuals | | | Execute |
| Availability | | | | | | | | | |
| PBL metrics | | | | | | | | | |

*Industry specific

**PLM backbone**

Maintenance history

Predicted performance, reliability and maintainability → Delta ← Actual performance, reliability and maintainability

Engineering orders under change management

Engineering changes (service bulletins, etc.)

Reporting and analytics

Operational feedback

# Teamcenter's Service Data Management solution

**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
• 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, including life characteristics, life limits and location
- 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 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 in-house and 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 Service Request Management solution

**Managing the reactive service environment**

Teamcenter's Service Request Management solution addresses the requirements of reactive service organizations to manage demands for service in an efficient environment that promotes customer satisfaction and responsiveness while reducing costs and variation in services. Some products and industries require an on-demand service operations business model. This solution allows service providers to standardize their service offerings and implement processes to streamline service events.

Service Request Management enables service organizations to:

• Manage customer contact information, quotes and approvals
• Define standard service offerings and organize them into catalogs specific to a part, system or product with estimates for parts and labor
• Establish and manage service requests containing service activities from catalogs or custom activities
• Utilize workflows to track service request approvals by customer, business and technical personal
• Roll up estimates and actuals for service requests to improve quotes and offerings

Within the ad hoc reactive services environment, Teamcenter ensures customer interaction and communication is not lost. The service organization using Service Request Management can organize service information and offerings to reduce variation in performance, minimize costs and execute mutually approved service activities to achieve business and customer satisfaction goals.

# Teamcenter's Service Planning solution

**Managing the advanced service environment**

Teamcenter's Service Planning solution addresses the requirements of service organizations executing advanced operational models where detailed service planning information is required for preventative, conditional or reliability-based maintenance. Complex products in many industries require more aggressive services to prevent safety failures or operational interruptions. Adoption of performance-based and service-level contracts requires a more proactive approach for servicing assets and meeting business objectives.

Service Planning enables service organizations to:

• Establish service plans around the configurations of products and assets
• Define service requirements and frequencies for classes of assets and specific assets

• Create and manage service tasks, work instructions, resources and estimates to satisfy service requirements
• Utilize workflows to sign-off on service planning elements
• Establish safety and hazardous notices for material and service tasks
• Roll up estimates for service tasks (cost and time)
• Import and export service planning information with other systems

By facilitating an environment that provides advanced services for complex assets, Teamcenter ensures that service can be accurately and effectively planned. The service organization using Service Planning can organize service information to reduce risk, cost and cycle time while improving asset availability and reliability.

# Teamcenter for MRO benefits

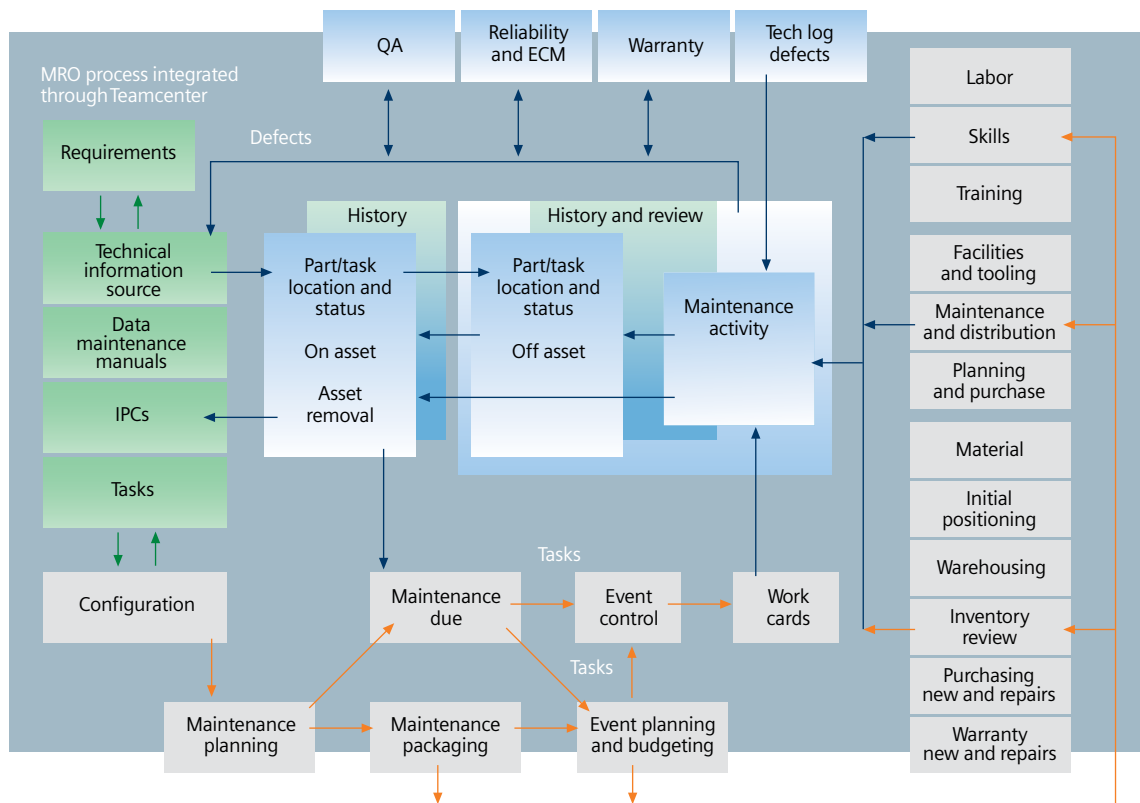| Solutions | Benefits |
|---|---|
| Service Data Management | • Provides total visibility to an organization's assets and service offerings under configuration control<br>• Improves asset tracking and life usage by leveraging fully defined lifecycle BOMs<br>• Enables rapid generation and digital distribution of service bulletins<br>• Injects event-driven service experiences into closed-loop product-to-service improvement processes<br>• Incorporates service team concerns into early product lifecycle phases<br>• Delivers global point-of-service knowledge<br>• Manages all asset-related knowledge while providing access within the context of the asset's configuration<br>• Enables manufacturers and service integrators to capture and incorporate asset knowledge and configuration changes that originate elsewhere in the service value chain<br>• Provides a service dashboard that facilitates insight into asset and process performance via key performance indicators that enable successful PBL and SLA business contracts |
| Service Request Management | • Improves service quotes by establishing service catalogs with standard offerings<br>• Improves work scope definition and approval by providing standard and ad hoc service content<br>• Facilitates cost control by capturing actual service costs and comparing them with standard estimates<br>• Improves customer satisfaction by increasing customer participation and communication in service-related processes<br>• Facilitates better service planning by leveraging service standards<br>• Improves service by facilitating closure of service requests and leveraging feedback loops that ensure business management and customer participation |
| Service Planning | • Enables service compliance and planning by establishing service plans for assets and product variants<br>• Improves service efficiency by facilitating accurate and detailed service event planning<br>• Increases asset availability and reliability by defining service requirements and frequencies that support advanced service operational models<br>• Enhances service quality by ensuring that approved service procedures are defined and followed<br>• Encourages hazard and safety compliance by defining notices that are applicable to specific materials, parts, service tasks or work cards<br>• Improves service cycle performance by facilitating faster diagnostic and service procedures tied to fault codes |

MRO process integrated through Teamcenter

| QA | Reliability and ECM | Warranty | Tech log defects |
|---|---|---|---|

Labor

Skills

Training

Requirements

Defects

Technical information source

Data maintenance manuals

IPCs

Tasks

Facilities and tooling

Maintenance and distribution

Planning and purchase

History

History and review

Part/task location and status

On asset

Asset removal

Part/task location and status

Off asset

Maintenance activity

Material

Initial positioning

Warehousing

Inventory review

Purchasing new and repairs

Warranty new and repairs

Configuration

Maintenance due

Tasks

Event control

Work cards

Tasks

Maintenance planning

Maintenance packaging

Event planning and budgeting

## 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 6.7 million licensed seats and 63,000 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*.

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