Capgemini

Journey towards a Model-Based Enterprise

The aerospace and defense industry's vision and progress towards true digital transformation

Every major aerospace and defense operation in the world is pursuing model-based initiatives at some scale. Some are finding new ways to compete by aligning their entire operations – from design to manufacturing to sustainment – to utilize new practices and technologies such as 3D models, digital twins/digital threads, simulations, advanced analytics, and other emerging technologies. Many are gaining new competitive advantages, superior customer outcomes, and more profits. Some have programs in place. Others have untested experiments. But many are moving towards the profound digital transformation of becoming a Model-Based Enterprise (MBE).

Some will become leaders in these practices, others will follow, others will fail.

What does this mean to how fast your enterprise becomes model-based? We've looked at some of the best implementations, and what we see is consistent: the journey to a Model-Based Enterprise is happening. Where are you in the race?

The vision for a Model-Based Enterprise and why it is critical now

The industry is changing rapidly, and the leaders are the ones taking the greatest strides forward. We can see four Cs of dramatic, significant change: Connectivity, Collaboration, Compression, and Complexity. For example, we are experiencing new levels and demands for connectivity with the rise of the digital thread, comprehensive configuration management, the increased use of advanced analytics and AI, and the rapid emergence of the industrial Internet of Things. The need for real-time, omni-channel, interdisciplinary collaboration is becoming more important as more actors need to communicate and work together than ever before. Most in A&D are experiencing intense multi-axis compression as schedules and budgets tighten, pushing everyone to do more with less time, fewer resources, and with few errors. Lastly, increasing product complexity continues to make the overall value chain more challenging, including the increase in multi-domain products, the need for longer product lifespans, and increasingly complex regulatory environments.

This presents an opportunity: equip a changing, tech-savvy workforce with the tools and information they need to build smarter designs, products, and servitization models that better serve customer demands, and do it faster, with the most advanced features, better quality, lower costs, and higher profits. It also presents an imperative: transform or be in trouble as customers move to competitors, market share suffers, margins whither, and the incoming workforce rejects participation. Today, A&D companies must:

- Produce more, improved products with better quality and at lower costs
- Meet customer demands and rising expectations more effectively, which is not a choice but a requirement
- Change engineering approaches to produce more complex designs, yet make them more consumable by the manufacturing systems
- Streamline design and supply-chain processes and data with manufacturing partners
- Take advantage of new technologies, both in execution and in the product itself
- Design for the entire lifecycle of the product through retirement, including transforming the aftermarket/ sustainment phase in new ways that transform availability and revenue
- Stay competitive, not fall behind – and even take the lead
- Address an evolving workforce where new, younger employees who don't know a world without social media or smartphones demand a digital workplace and process, and need to be recruited and retained to replace older, retiring workers.

These opportunities, imperatives, and demands inspire a new vision, that of the Model-Based Enterprise.

Industry trends in smart product development

DIGITAL THREAD CONNECTIVITY

- End-to-end digital thread connections
- Comprehensive configuration management
- Advanced analytics and AI
- Industrial IoT/smart connected devices
- Industry 4.0

VALUE-CHAIN COLLABORATION

- Real-time
- Omni-channel
- Interdisciplinary
- Internal and external
- Digital twins
- Model-based design through sustainment
- IP access and protection

MULTI-AXIS COMPRESSION

- Product opportunities
- Schedule and budget
- Knowledge resources
- Industry consolidation (M&A)

INCREASING PRODUCT COMPLEXITY

- Multi-domain products
- Value chain
- Product lifespan
- Regulatory environment

Rise of the Model-Based Enterprise

The MBE is a company that uses computer-based modeling and simulation, algorithms, and optimization capabilities (e.g., finite capacity scheduling, service parts demand and distribution optimization, diagnostics, prescription, prognostics, autonomics, etc.) in all aspects of the value chain. They are used in program development, engineering, manufacturing, and servicing of assets and products, in a way that the models and data are connected and interoperable throughout the organization. It's a vision of seamless end-to-end operations that reduces waste, increases lean operations, achieves Six Sigma, and improves customer satisfaction. Its aim is to create tighter design cycles, reduce time to market, and drive more valuable, productive relationships: all critical to sustaining long-term profits and staying competitive.

The core concept of the MBE started with model-based design, the practice of using an annotated model (think of a state-of-the-art computerized 3D model, complete with every kind of materials/environmental/physics, etc. simulation possible) with all of its associated data elements (such as digital twins and digital-thread environment, with historical, real-time, and predicted data being incorporated from tens of thousands or millions of occurrences from the real-world).

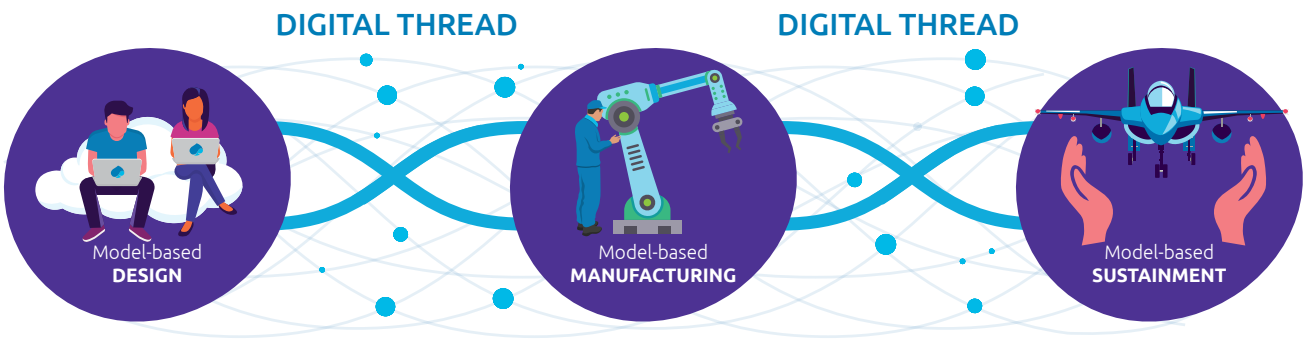
The MBE is the extension of these practices throughout the value chain.

Consider the Model-Based Enterprise the most visible highlight of perhaps a broader operational evolution: digital transformation across the enterprise. This would include the use of data and integration beyond the product to include prices, commodity markets, demand, financials, inventory, supply planning, maintenance, workforce, weather – anything that helps the enterprise to act and succeed. It's about using data throughout the enterprise to know the real truth, to get it at the right time, to analyze and aggregate it, and then use the intelligence to make optimal decisions and act presciently, precisely, and accurately, often in a purposeful "sense and respond" decision cycle (e.g., an OODA loop of Observe, Orient, Decide, Act, or a SIDR loop of Sense, Interpret, Decide, Respond).

A view of the Model-Based Enterprise

Shown below is a high-level view of the MBE and its associated practices, processes, and new technologies. Understanding the scope of MBEs can be complicated, as can the scope of digital transformation, as it encompasses many different mixes of competencies and capabilities across a multitude of functions. For simplicity, we categorize by Design (or Engineering), Manufacturing, and Sustainment, but the entire transformation goes deeper.

Model-Based Enterprise: data flows in a feedback loop through the digital thread



People

Processes

Tools and technology

Materials

Environment

	Model-based design	Model-based manufacturing	Model-based sustainment
Representative practices	• Design and planning • Virtual evaluation • Prototype • Tests • Simulation • Model-based definition for design and development • Establishment of system • Engineering process at life-cycle stages • Standards • Model-based definition for life-cycle stages	• Execution • Realization process • User model data • Creator of systems • Documentation • Realization (materials, processes, worker, test, certifications, etc.) • Model-based definition for realization	• Virtual – physical model integration • Support digital content • Virtual – augmented training • Digital twin as-maintained configuration • Service part obsolescence • Performance-based asset health management • Case-based troubleshooting • Performance-based service part lifecycle management
Representative digital trends	**Advanced software** • PLM/ALM • CAD/CAM • CAE • Data security **Cloud** • Digital thread **Simulation** • Simulation-based design • Digital twins **Big data and analytics** • Artificial intelligence **Additive manufacturing** • Digital prototyping • 3D blueprinting	**Advanced software** • PLM/ALM • Inventory management • Data security **Cloud** • Digital thread **Simulation** • Simulation-based production • Digital twin • Augmented reality • 3D drawings • Model-based instructions (MBI) • Blockchain • Smart contracts **Big data and analytics** • Artificial intelligence **Additive manufacturing** • 3D blueprinting • Advanced robots • Cobotics • Drones	**Advanced software** • Prognostic health management • Multi-echelon service parts optimization • Autonomic logistics • Causal demand forecasting **Canonical data integration** • Digital thread • Open services for lifecycle collaboration • Industrial IoT • RFID tags and wireless sensors **Simulation** • Digital twins **Augmented reality** • Bots/smart tablets/smart glasses **Big data and analytics** • Data lakes and microservices • Artificial intelligence/case-based reasoning diagnostics and prescription • Predictive and prognostic analytics • Case-based reasoning diagnostics • Repair task prescription **Advanced robots** • Drones/automated guided vehicles **Blockchain** • Blockchain for service parts traceability and legality

The enterprise in Model-Base Enterprise

Most importantly, the transformation must occur across the enterprise, at the early stages of design, through manufacturing, and until the retirement of the product at the end of its lifecycle. These programs and efforts need to be coordinated so that models, data, and information assist and coordinate efforts across departments. No data should ever step out of the digital process and become paper-based or stand-alone. The connection and collaboration must grow, be managed, and sustained as an orchestrated effort. This is the true MBE: one which can coordinate the entire enterprise, not one which launches spot efforts here and there, even if they claim to be the hottest new practices or technologies.

Critical factors for successful MBE digital transformation

Listed below are key areas organizations must get right to succeed with MBE journeys. They characterize the types of transformation that must occur.

Leadership:

Active participation by senior leadership is likely the largest critical factor for success. It must be committed, repetitive, vocal, and explicit in driving change, and must reward transformation, deter nay-sayers, and remove those not on board regardless of level or tenure.

Cultural change:

As was mentioned earlier, with a younger, more tech-savvy workforce entering companies, there is more reception to all things digital. Companies must manage expectations and training needs of existing older workforces and build transformation change-management strategies around adoption. In addition to training on new technology, there will be a need to invest in transforming job roles to fit the new digital enterprise.

Policy:

As with individual contributor transformation, executives need to be coached around capabilities, new corporate strategies in the marketplace, technology investment approaches, and workforce planning and development. Legally, executives need to reconsider how co-development and intellectual property (IP) strategies and contracts need to be updated for the new digital enterprise. Additionally, corporations must address security as part of the enterprise strategy to protect the integrity of the data and ensure customers have confidence in the protection of their data against competitors or non-friendly foreign entities.

Cost benefits:

Financial planning by the business must conceive of ways to understand how to communicate, track, and document benefits of MBE investments in technology and resources. The operation should develop new performance KPIs to account for improvements in product and manufacturing quality, speed to market, and sustainment optimization through MBE.

Legacy data and sustainment:

Corporate strategies have to be developed as part of MBE transitions to account for legacy products still operating and the support of the legacy data around that product. Digital transformations will also affect the manufacturing and sustainment ecosystems, as some suppliers unable to transition to the new MBE paradigm will need to be replaced.

Changing development approaches:

MBE starts at concept. Engineering, sales, and executives need to not only change the tools to manage the digital MBE environment, but processes and sharing of information will need to be transformed as well. The old approach of organizations developing products in a siloed waterfall approach is slowly dying, and corporations must build the culture and infrastructure to support this new Agile-Dev Ops team-development environment.

Technology considerations:

Enterprises, as they update or install new technology platforms to enable MBE, must ensure that the infrastructure surrounding these digital approaches can support product lifecycles. They must account for using machine learning and AI to reduce design errors, improve manufacturing quality, and improve product availability for the customer. Adopting new data-exchange standards and big-data approaches to analytics and data storage requires just as much investment and planning as the MBE tools themselves.

This is a general view of MBE, but what about what's really happening in the industry? Where can real companies with real constraints, customers, employees, and operations go from here?

The real journey for today's leading aerospace and defense enterprises

As with any future-forward operating trend, there are always plenty of pundits, analysts, strategists, and other business theoreticians who have the magic plan for success. True leaders in change will always be the first to tread into uncharted territory, and the followers can similarly be the ones who wait too long.

To get a sense of the progress in the MBE marketplace, we've examined some of the newer and unfolding stories from leading aerospace and defense companies. These accounts provide a reality check through actions that are being pursued and generating investment. Companies may also get a sense of where their own MBE and digital transformation efforts are in comparison to their peers and competitors. Additionally, these examples may help:

- Understand trends and what is working
- Gain a competitive benchmark of progress
- Formulate strategy
- Create a vision and plan
- Create the case for change
- Execute to plan.

Many of these accounts are self-reported via the press or company websites, presumably to inform customers, suppliers, recruits, and investors. It would be reasonable to assume that successes may be accentuated more so than pitfalls.

The lessons and stories are organized by functional areas: design, manufacturing, and sustainment, with the final stories being those who are putting it together at an enterprise level.

Industry vision and progress in design

Across the A&D industry, companies are making moves to transform engineering processes with model-based design and, as a result, they are driving new efficiencies, improving collaboration, and empowering their engineering teams.

DESIGN

Using Model-Based Systems Engineering (MBSE) to accelerate lead times and cut costs in systems development[1]

Airbus, for example, has made great strides implementing MBSE approaches to support its engineering vision. To get there, it needed a new MBSE tool that was flexible enough to adapt to the system-engineering vocabulary and concepts and to adjust easily to evolving needs. Using Papyrus as the backbone of the MBSE modeling tool, called FAST, the company is able to quickly build customized products with system-designer-friendly concepts, and at reasonable costs.

In supporting its upstream operational and functional analysis, FAST is enabling clear definition of the functions needed to operate the system. The streamlined domain-specific language facilitates communications between the operations and the system-design teams. It has also opened the doors to important early design analysis and verification. Airbus also implemented its own infrastructure functionality that is providing a semantic data model for multi-disciplinary integration– from bid all the way through system, functional, and mechanical engineering. MBSE has been key in helping the company achieve more ambitious lead times and cost-reduction targets in systems development.

[1]Papyrus website. Airbus website; Systems Engineering Research Centre: Transforming Systems Engineering through Model-Centric Engineering.

Embracing best practices in MBE and completing the digital thread[2]

Raytheon Missile System (RMS) is focusing its MBE efforts on embracing best practices in the development of domain-centric tools and completing the digital thread across the program lifecycle. It is using MBE-centric reviews, such as systems engineering technical reviews, to ensure completeness and find errors, omissions, risks, and opportunities. The review data is further being captured in engineering tools for decision making, providing a history of design decisions and creating the basis for future development and investigation. Multi-disciplinary efforts are being incorporated into one review with OSLC (Open Services for Lifecycle Collaboration) linking, and one-page guidance sheets are being used to help non-domain users learn from the review.

The company's MBE future lies in completing the digital thread by increasing integration of digital models across the program lifecycle by involving supply chain, operations, manufacturing, and customer collaboration.

Raytheon is also pursuing improvements in digital system model analysis through metrics determination and cross-discipline trade studies.

Bringing simplicity and insight to complex engineering processes[3]

A major producer of submarines and aircraft carriers, Newport News Shipbuilding (NNS) has incorporated digital technology to improve the management of its complex shipbuilding processes. As part of its Integrated Ship Building capability, NNS transitioned from drawing-based products to digital-based processes, leveraging tools from Siemens.

For model-based engineering, NNS is using the computer-aided design (CAD) tool NX from Siemens to create 3D design models, which it uses to create artifacts and reuse them across planning, scheduling, verification, and validation processes. Siemens' Teamcenter is used for PLM-centric work like product structuring, change management, and management of CAD artifacts. NNS is also using Siemens' 4GD application, a fourth-generation design application with shipbuilding-specific features built to manage and visualize large complex structures in 3D space and extend those models to graphics.

Going forward, NNS is significantly leveraging a digital thread and has taken great efforts to ensure that information transfers smoothly from engineering to manufacturing.

Industry vision and progress in manufacturing

Digital engineering innovations are also creating downstream benefits that enable tighter collaboration and more efficiency with manufacturing teams. Enterprises are using model-based capabilities to industrialize innovation at scale while being more agile and flexible in making changes across their manufacturing processes.

[2] Model Based Engineering at Raytheon Missile Systems, A Case Study. Jan2017.
[3] NIST: A Matrixed Approach to Model-Based Product Implementation.

Weaving a digital thread from engineering to manufacturing[4]

Raytheon is also creating a digital through line to bring innovation to manufacturing operations. The company has made significant investments in various disciplines that support its model-based enterprise capabilities. It is supporting manufacturing using common product data management, mechanical CAD, process reinvention, and systems for manufacturing.

MBSE enables Raytheon's system design process to yield more accurate and consistent digital-thread output and provides actionable information through upstream and downstream impact analysis across the product lifecycle. And its hardware digital thread provides the basis for model-based manufacturing and the creation of digital twins.

Enabling condition-based factory maintenance to reduce cycle times and rework[5]

Digital technology is helping manufacturers keep equipment up and running to manage higher demand and limited resources. For example, three of GE Aviation's facilities manufacture high-pressure nozzles and shrouds used in the hottest part of jet engines, making precision manufacturing a must.

It partnered with GE Digital to implement GE's Predix Asset Performance Management (APM) solution on GE Aviation's LEAP production line to model machine data with maintenance history from 260 connected machines. The APM solution collects data on machine status, utilization, and performance, and provides troubleshooting solutions as well as understanding the root cause of the problem from any location.

GE Aviation is seeing improvements in its workflow now that work orders are generated from machine conditions versus a scheduled calendar. Machine repair teams are alerted to an issue before an operator on the floor even realizes there is an issue. With actionable data, cycle times have improved by five percent and rework has reduced from eight to 10 percent to less than one percent.

Bringing VR, AR, and 3D modelling to fabrication and construction[6]

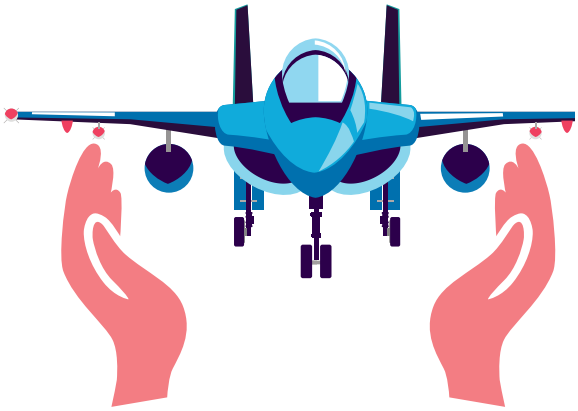
As discussed earlier, Newport News Shipbuilding (NNS) has transformed its engineering practices through an Integrated Ship Building framework. And these changes are enabling a new path for manufacturing as well. Its model-based approach to ship building is leveraging 3D models, AR, and VR for fabrication and construction processes. This approach also integrates engineering and manufacturing processes by leveraging a digital thread.

Through model-based manufacturing, visuals derived from 3D models are used to create and manage visual work instructions for manufacturing and construction. Also, visual build management allows the company to track the status of the ship-building plan versus the schedule in 3D, and users can assess the impact of schedule changes due to environmental and supply chain events. With its digital-twins approach, NNS is planning to create a 3D version of the shipyard so it can model the entire construction facility (such as cranes, dry docks, and factory/foundry) and efficiently assess the impact of material movement, fabrication, and activities across the shipyard.

[4] Modeling Practices at Raytheon. INCOSE MBSE Workshop, 2013; Pulling the Digital Thread with MBSE, 2017.

[5] GE Digital website; GE Aviation website.

[6] NIST. A Matrixed Approach to Model-Based Product Implementation.



SUSTAINMENT

Industry vision and progress in sustainment

Just as A&D companies are deploying automation, model-based methods, and predictive maintenance in manufacturing operations, they are also carrying these capabilities into sustainment activities. Ambitious projects are reimagining sustainment operations as they improve asset utilization, reliability, and cost, accelerate aircraft maintenance, and drive operational efficiency, including changing revenue and monetization models. And the move to asset-servitized business models are the holy grail for most within the industry.

Rebooting the MRO sector and creating a digital thread from in-service aircraft back to aircraft design[7]

In Singapore, a major MRO (maintenance, repair, and overhaul) market, Airbus saw an opportunity to help MRO providers use digital technology to meet demands for faster maintenance and improved operational efficiency for airline customers with growing fleets of aircraft. So, in 2016, Airbus launched its "Hangar of the future" to explore the digitalization and automation of maintenance on in-service aircraft.

This leading-edge MRO hanger incorporates innovative IoT-connected technologies, such as robots, drones, scanners, cameras, and non-destructive sensors. This is enabling automated inspection and data collection when aircraft enter the hanger. The hanger features automated task planning and real-time supervision of workers. Streamlined maintenance activities are powered by augmented reality, and data storage and sharing are enabling predictive maintenance.

Airbus' open-data platform, Skywise, provides precise data collection to predict required maintenance tasks and optimize maintenance planning and task execution in order to minimize aircraft on-ground time. It brings together engineering data, operational data, and supplier data into an environment for advanced analytics applications.

For example, the Skywise platform manages the vast amount of data coming from Airbus' in-service aircraft. The platform combines airline, supplier, and OEM data and conducts in-depth data analysis to develop applications aimed at anticipating and optimizing maintenance and, more generally, improving airline operations and fleet performance.

Airbus will offer free access to anonymized operational data to any airline that submits its own. Thus, participating airlines benefit from a useful benchmarking tool, while Airbus receives the data it needs to refine its paid-for predictive maintenance product. Maintenance data can be archived and stored and sent back to the manufacturer's premises. The platform will have historical data, and the company plans to analyze this data to improve aircraft designs and solve manufacturing defects.

Enabling in-flight condition reporting to efficiently plan maintenance[8]

For the F-35 aircraft, Lockheed Martin has been using an Autonomic Logistics Information System (ALIS). The seamless, embedded solution integrates aircraft performance, operational parameters, aircraft configuration, scheduled maintenance, component history, diagnostics, prognostics, health management, and service support. A single, secure information environment provides users with up-to-date information on any of these areas using web-enabled applications on a distributed network. Essentially, condition reporting of aircraft wellness is automatically reported in-flight, so crews on the ground can rapidly marshal appropriate maintenance and repair efforts.

The F-35 is the first tactical aviation system to have sustainment tools engineered in concert with the aircraft for efficiency and cost effectiveness. ALIS gives F-35 Lightning II operators the ability to plan ahead, maintain, and sustain their systems over the life of the aircraft. Compared to previous aircrafts, a higher fidelity of information about the F-35 fleet is tracked within ALIS to reduce operations and maintenance costs and increase aircraft availability.

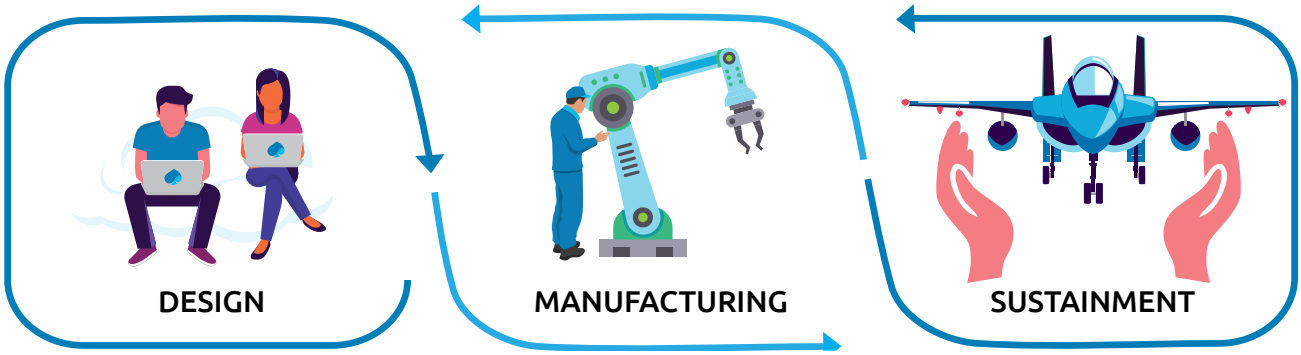
Enabling smart sustainment in defense asset management[9]

Raytheon Australia is applying smart sustainment models directly to defense asset sustainment. This change in efficiency and effectiveness required fundamental reforms at the enterprise and individual system level. Raytheon Australia underpinned its smart sustainment methodology with an Integrated Logistics Capability (ILS). This includes tools for maintaining data integrity and enhanced logistics support analysis and decisions. The ILS process-governance framework is tailored for the Australian defense environment, and it has experienced ILS sustainment engineering management personnel.

Raytheon's sustainment model is established within a performance-based framework linked to capability outcomes. This helps in effectively driving the right behaviors and integration between functions to achieve the desired results in terms of cost, availability, and capability. The systems approach ensures enhanced customer force preparedness through improved availability and capability growth while driving down the total cost of ownership.

Enterprises are putting the enterprise view together

As these examples have shown, today's A&D leaders are making real progress in bringing model-based approaches to their engineering, manufacturing, and sustainment efforts. They are also making big investments to tie these digital capabilities together to maximize value across the enterprise – where data flows without friction, silos become a thing of the past, and true connections are forged between the physical and digital world.



[7] Airbus Singapore website. Airbus: Digitizing maintenance for end-to-end continuity; Manufacturing Operations Management: Six Innovation Areas Leading to the Model-Based MRO Enterprise; MRO Global Online.

[8] Lockheed Martin website; IFS World.

[9] Model Based Engineering at Raytheon Missile Systems, A Case Study. Jan 2017.

Creating true digital twins to link the physical and digital world[10]

Lockheed Martin had made progress toward creating a digital tapestry by using software to share information between multiple applications and machines through digital threads, but this wasn't addressing the notion of digital twins.

So, in 2017, the company introduced the Digiverse vision, a next-generation digital environment. The framework integrates people, processes, tools, materials, environment, and data, linking both the physical and digital domains across the entire product lifecycle and all disciplines. Digiverse mirrors the physical world by creating complete digital twins of everything. Each ecosystem hub is a digital twin that connects the digital world with the physical world and with the right information, through a common data language.

Leveraging Digiverse, Lockheed is creating a manufacturing environment that is flexible, scalable, and responsive to the changing needs of the aerospace and defense industry. The manufacturing hub connects multiple simulations into a single virtual picture. It translates, connects, and integrates the digital and physical domains. Factory digital twins data can be reused anytime.

Enabling a common MBE framework across the enterprise[11]

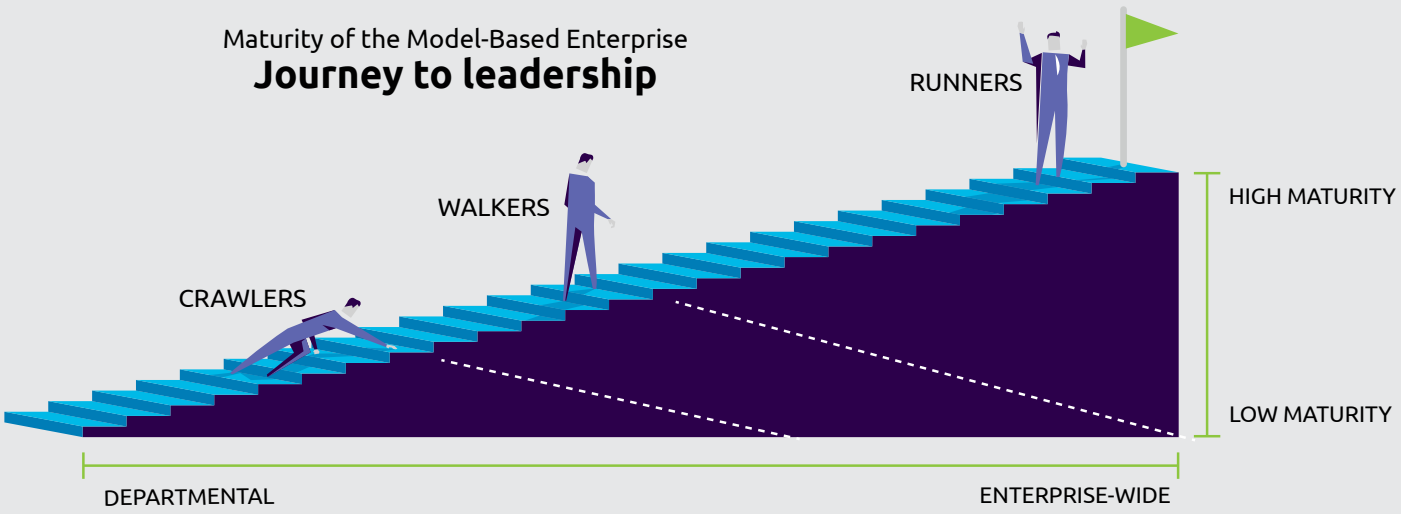
Boeing has been making progress in the push to transform its business into a Model-Based Enterprise. Boeing had been running more than 2,500 applications related to product realization, which were in use by nearly 40,000 engineers. It needed to integrate data sources faster and reduce friction across the system.

In 2017, Boeing signed a 30-year contract for approximately $1 billion with Dassault Systèmes to purchase and consolidate on the 3DEXPERIENCE platform (3DX). Boeing intends to consolidate its program set with 3DX, which means in the long run all other solutions will be phased out to focus exclusively on Dassault Systèmes' 3DX applications. The digital switchover of Boeing's production system will provide a competitive advantage in the commercial field by reducing excessive delivery times.

The model-based approach will help the company reach a whole new performance level by combining form and fit in 3D models with function in CAE and systems simulation. Boeing will be able to modernize its infrastructure, leverage legacy data, and eventually connect and remove silos across the value chain with data-driven apps. And it will transform to an MBE as design reuse and engineering productivity improve.

[10] Lockheed Martin. The Product Digiverse. 2018.

[11] Engineering.com. Aerial Combat: Dassault Takes Off with the Boeing Win, But Siemens Lands One of the Year's Largest PLM Contract; Dassault website; Boeing website.



CRAWLERS	WALKERS	RUNNERS
• One-off spot solutions, projects • Little strategic value • Departmental	• More inclusive/comprehensive • Ongoing programs • Functional focus/support	• MBE operating models • Long-term strategic value • Executive/enterprise support

Ranking progress

The achievement of realizing a Model-Based Enterprise is essentially the realization of it being integrated across the enterprise. A simple view of maturity in MBE can be determined effectively by the spot-solution or local nature of an MBE project versus how firmly adopted it is as a base operating model throughout the enterprise.

The beginners or "crawlers" may only have one-off single use-case experiences that provide little big-picture strategic value. They are usually department- or even team-centric activities that may only affect a single product line and single phase of the value chain.

Mid-maturity operations (or "walkers") have larger ongoing programs that integrate multiple functions and are recognized by divisional or functional leadership.

The most mature are those supported as enterprise-wide programs and fully adopted as business-as-usual operating models. They typically represent the most strategic value across the enterprise, have executive support, and most likely have linkages into the extended enterprise of suppliers and customers.

The competitive race is on

The industry is marching to a new drum beat. The power and advantages of becoming a Model-Based Enterprise and pursuing digital transformation are quickly becoming proven in the real world. Amidst rapidly changing data and analytics capabilities, a flood of new and promising technologies, increasingly demanding customers, and a quickly evolving workforce, companies are pushing themselves to be reborn, reinvent, revolutionize, and renew their enterprises. The MBE is today's and tomorrow's target, and the leaders are moving quickly into more mature and comprehensive visions for it. The followers may be more careful learners but do so at the risk of being left behind.

The decision is to understand where you are in the race now and to decide how fast you should go.

About Capgemini

A global leader in consulting, technology services and digital transformation, Capgemini is at the forefront of innovation to address the entire breadth of clients' opportunities in the evolving world of cloud, digital and platforms. Building on its strong 50-year heritage and deep industry-specific expertise, Capgemini enables organizations to realize their business ambitions through an array of services from strategy to operations. Capgemini is driven by the conviction that the business value of technology comes from and through people. It is a multicultural company of over 200,000 team members in more than 40 countries. The Group reported 2018 global revenues of EUR 13.2 billion (about $15.6 billion USD at 2018 average rate).

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