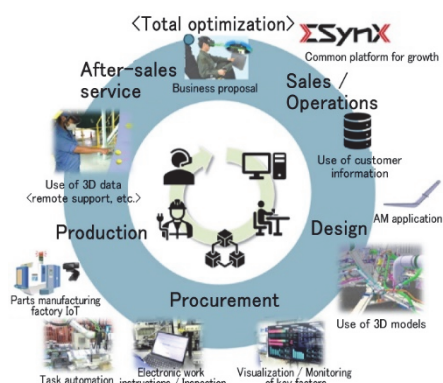


Pioneering the Future of Integrated Defense & Space Systems: Embracing Digital Transformation in High-Security Environments



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The initiative to achieve digital proficiency is an activity to promote change by determining the direction in which the businesses of Mitsubishi Heavy Industries, Ltd. should go, based on political, economic, social and technological trends surrounding the Integrated Defense & Space Systems segment. This report describes the challenges that have been faced in relation to this initiative, a vision of the future to be realized with new possibilities and the current state of the initiative. Chapter 2 provides the details of changes taking into account the surrounding environment, while referring to individual plans to enable the company to continuously grow.

1. Introduction

The promotion of DX (digital transformation) is a recent social trend associated with the need to have stronger competitiveness, enable more flexible work styles, create new businesses and handle labor shortages. The major customers of the Integrated Defense & Space Systems segment of Mitsubishi Heavy Industries, Ltd. (hereinafter referred to as MHI) are also promoting the utilization of digital technology in response to increased defense spending and reducing the required manpower/workload. Under such circumstances, MHI has especially promoted DX since 2024, including organizational restructuring. While keeping the increase in the number of employees to a minimum, digital technology and other means are utilized to achieve effective/efficient workflow and the resulting maximum throughput, with the eventual aim of transforming business models and expanding the business area.

2. Taking on the challenge of change in light of the surrounding environment

In the initiative to achieve digital proficiency, which fully started in 2024 with the aim of opening up new possibilities and a future for the Integrated Defense & Space Systems segment, MHI is tackling the challenges of (1) formulating a road map, (2) building a systematic framework and (3) fostering a mindset for improvement. As shown in **Figure 1**, the three-year road map consists of three phases, starting with digitization followed by digitalization and DX. The related activities are being promoted. When it comes to building a systematic framework, MHI set up a lead unit for the entire segment, in addition to each division having an office/group to facilitate the ongoing activities. Fostering the mindset for improvement involves exhaustively considering the value that can be provided to customers and improving the application of digital technology to this end. The activities are promoted in such a way that no one confuses the means with the end.

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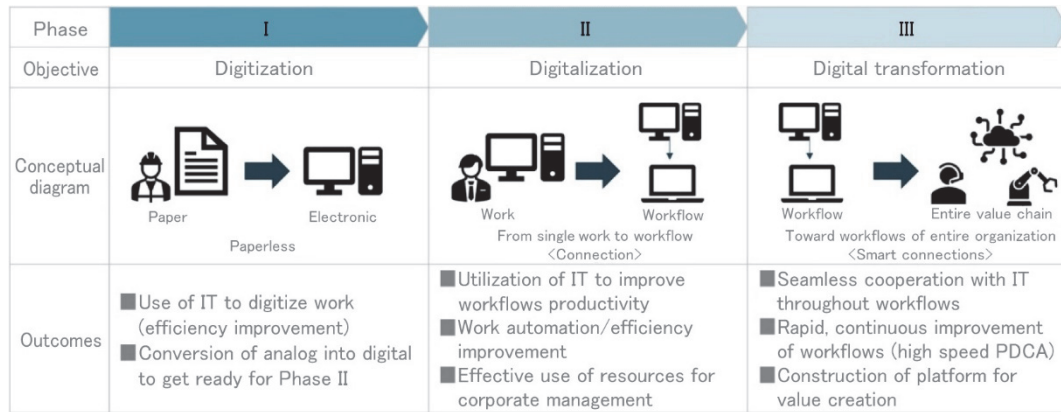


Figure 1 Steps toward digital proficiency

2.1 Digitization (paperless)

Digitization pertains to the conversion of analog information into digital data. Creating a database from the archived documents makes it possible to not only achieve a paperless work environment but also utilize the obtained data. In fiscal 2024, besides creating a necessary environment, a database was built from 145 kinds of documents such as facility inspection sheets. In fiscal 2025, data from 2,025 kinds of documents will be incorporated into the database, intending to eliminate all paper documents.

In proceeding with digitization, the first hurdle to clear was the hesitation in departing from paper-based work, as shown in **Figure 2**. This made it essential to gradually create an environment and culture that can lead everyone to get ready for the change, rather than implementing a changeover all at once. This approach has begun to take effect, despite the initial objections raised because of the reasons such as the high level demand for security in the field of defense, the deeply rooted paper-based work procedures and the strength of documentary evidence, and the burden caused by handling both paper-based and paperless work. A database was gradually built up by implementing the change in a top-down manner, starting small and broadening the scope of trial by the pilot testing team, and encouraging assigning digitally savvy personnel. The users then started reaping the benefits such as the improved work efficiency, and more and more people supported the change. A subcommittee to improve the infrastructure was launched to work with the Digital Innovation Headquarters. The framework for a wireless network that enables the use of computers and tablets was set based on MHI's IT security standards, to make the infrastructure practically workable. In the beginning of fiscal 2024, the availability of wireless connection on the premises was 65%, which was raised to 85% by the end of the same year. Further improvement is in progress, aiming to achieve 100% in fiscal 2025.

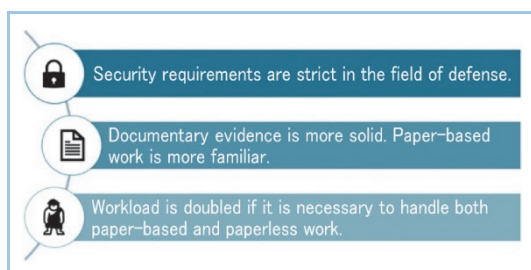


Figure 2 Setbacks to digitization

In creating a database, its incorporation into the system and the utilization of existing technology (i.e., digitization of the information on paper) are simultaneously worked on, which was the decision made after taking the next step of digitalization into consideration. This approach served the dual purpose of creating data that are available for use and fostering a suitable corporate culture.

2.2 Digitalization (optimization of entire process)

Digitalization pertains to an effort to enhance added value by giving new value to workflows or products/services using digital technology. In the Integrated Defense & Space Systems segment,

most of the approaches relate to the production rate increase and the shortening of lead time, aiming to maximize the throughput by applying digital technology in such a way that data can be utilized throughout the processes from upstream to downstream. In fiscal 2024, study sessions with the related departments were held to identify the yet-to-be-connected processes and systems by mapping As-Is and designing To-Be along the value chain. Data integration was planned, prioritizing where the bigger effects were expected. In fiscal 2025, which is in the execution phase, the activities are being promoted accordingly. Two example applications of digital technology for digitalization are presented below.

(1) First case of digital technology utilization

End-to-end process of production using 3D model (creation of platform for XR conversion)

With its advance, augmented reality (AR) has also come to be used in the manufacturing industry, extending reality by overlaying digital information onto the real world through a display. To view in AR, 3D models have to be converted into an AR-compatible format before being imported into an appropriate app or platform for display in AR. This process used to involve performing a task that heavily relied on an individual's skills, or changing the conversion technique depending on the AR device to be used. This made it impossible to convert and use 3D models without help from a relevant department. However, as part of digitalization, a common platform for easy conversion has been developed and implemented. This tool transforms production because 3D models can be utilized throughout the stages from basic design to detailed design, production technology and quality assurance, enabling to advance from 2D and improve QCD.

(2) Second case of digital technology utilization

Factory IoT

To reduce the product lead time and improve the production rate, the operating rate of an existing parts manufacturing facility needs to increase. It is a process required to estimate the current operating rate, analyze the cause of a facility shutdown and take improvement measures. Although various technologies can serve as a simple method for understanding the operating rate (e.g., based on the information from warning lights), MHI aims to transform facilities with IoT by implementing an intelligent end-to-end system that records the facility's conditions before/after a shutdown, identifies the cause of the shutdown, and suggests a solution. Aggregation of data from various sensors of the facility takes place in the IoT kit, into which AI technology is integrated to predict failure occurrence in certain components of the facility. The accumulated data can be used, for example, to manage the replacement parts inventory and determine the frequency of facility inspection. Thus, the goal of the development is to create a facility with no failures or shutdowns. This mechanism will also be fed back to the Digital Innovation Headquarters for its standard systems/apps that are in use company-wide, to help facilitate the implementation of IoT into the entire MHI Group and its path to digital proficiency. A factory IoT subcommittee was launched to enable prompt cross-departmental application in the Integrated Defense & Space Systems segment.

2.3 DX (digital transformation)

While defined differently depending on the company or organization, the term DX signifies the "transformation of business model" and the "expansion of business area" in the Integrated Defense & Space Systems segment. The first priority was placed on expanding the business area, especially focusing on the activities relating to maintenance repair overhaul (MRO). The use of AI and IoT technologies in relation to data on the production, product management and such is under consideration to propose solutions that satisfy customer needs.

By accelerating the promotion of DX, prompt responses to the rapidly changing market become possible, which leads to stronger competitiveness. Study sessions with the relevant departments for intensive discussions about DX were held to identify gaps between the current state and the desired one. The identified issues were clarified and discussed to find solutions, based on which the action plan is being formulated. In DX for manufacturing, the improvement of throughput with a shorter production lead time is also attempted by renewing or updating the systems by which data are linked to CRM, PLM, ERP, MES and IoT.

3. Conclusion

This report describes MHI's initiative to achieve digital proficiency, which started about two years ago, in the Integrated Defense & Space Systems segment. In the challenge taken to open up a future with new possibilities, which is now in the process of being mapped out, MHI makes full use of digital technology to review business models, entire workflow and corporate culture with the aim of bringing transformation across the company. The importance of further utilization of digital technology is expected to increase, to help society grow sustainably while facing the uncertainties in the business environment surrounding MHI Group. Fiscal 2026 is the last year of the three-year road map. MHI will provide an MRO system that contributes to national defense through data-driven operation, while aiming to establish a systematic framework enabling production with unparalleled agility with the use of technologies such as digital twins, as part of DX for manufacturing. The Integrated Defense & Space Systems segment will continue moving along a never-ending path to digital proficiency by flexibly handling changes to cope with any forthcoming difficulties.