

# Collaborative Design Solutions Helping Manufacturers Thrive in the New Normal

Manufacturers looking to stay competitive need to create products with characteristics that address market needs, while responding rapidly to changes in these needs as they supply the products to market. Product design workplaces are responding by collaborating on design work through collaborative work with suppliers and between overseas and domestic sites. By using this collaborative approach, the workplaces are working on making products more competitive by giving design work shorter lead times, higher efficiency, and higher quality. Design work also needs to be done remotely to prevent the spread of COVID-19 and prepare for the era of the “new normal” once COVID-19 is under control. The Hitachi Digital Supply Chain/Design service has been developed and provided by Hitachi to help promote collaborative design and remote work. This article looks at how this service will be used to assist design work in the future.

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## 1. Introduction

The rise of COVID-19 has created some unprecedented challenges for the manufacturing sector. Supply chains have been disrupted, employees have been restricted from going to work, bringing manufacturing to a standstill, and steps have been needed to ensure employee safety. These conditions have created a growing paradigm shift as manufacturers prepare for the coming era of the “new normal” once the pandemic is under control. This paradigm shift calls for work style reforms along with a digital transformation to help make the reforms possible.

Even design work needs to be done remotely to avoid the “three C’s” (closed spaces, crowded places, and close-contact settings). However, work environment and equipment restrictions can sometimes make onsite work mandatory, while working remotely can lead to declining work efficiency that delays development schedules. Another challenge with remote work is the need to deal with the

information leakage risk that arises as work terminals or operation data are removed from the office.

Hitachi Digital Supply Chain/Design (DSC/DS) is a solution developed and provided by Hitachi that enables design work to be done collaboratively by multiple sites<sup>(1),(2)</sup>. It is designed to help make smoothly orchestrated design work possible in the era of the new normal.

This article describes DSC/DS-based collaborative design solutions designed to help overcome the challenges described above and allow manufacturers to thrive in the era of the new normal.

## 2. Design Work Issues for the New Normal

Design work calls for decisions on product structure and form that incorporate various considerations such as design, function, quality, price, and regulations. The processes used are wide-ranging and complex as a result. Individual design processes can require extensive experience and knowledge, leading to horizontal specialization across different sites

or departments. For example, structural designers use computer-aided design (CAD) systems to do design and drawing work on computers. They construct virtual models (CAD models) in three-dimensional (3D) space while referring to design rule documentation, and create designs while using evaluation tools to assess properties such as strength and ease of assembly. Designers do design work while referring to CAD models, design sheets, defect information, and other data stored for existing products designed in the past.

When facilitating collaborative design in the era of the new normal, the design work characteristics described above will create the following challenges for providing IT infrastructure and reviewing work procedures.

(1) Providing a work-anywhere design environment

Designers handle massive amounts of highly confidential design information such as CAD models. So, environments designed to facilitate remote work need to enable home use of CAD and design tools, while providing ease of operation and response times adequate for work use. They also need to handle the risk of information leakage or removal.

(2) Systematizing work processes and making work progress transparent

Design work is organized through horizontal specialization at each site or department. When work is done remotely, it is important to ensure that the progress of operations done by multiple sites or departments is transparent, and

to enable smooth transfers of design-related information. (3) Passing along design skills, making use of design expertise

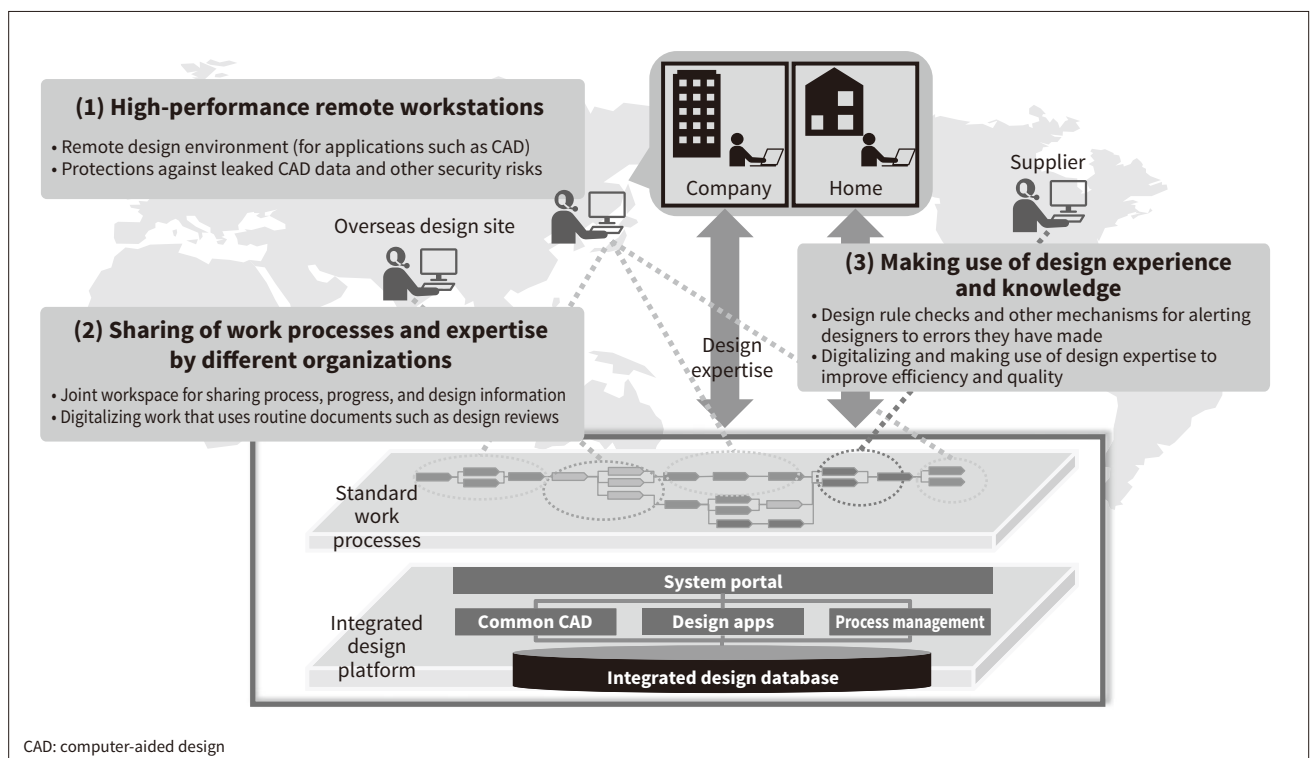
Design work calls for the advanced design skills needed to accommodate restrictions and limiting factors such as shape, material, and machining conditions. Experienced designers have traditionally passed their skills along to young designers by providing in-person guidance and precautions at the design workplace. The era of the new normal will need systems or mechanisms to enable these skills to be smoothly acquired and passed along from remote environments.

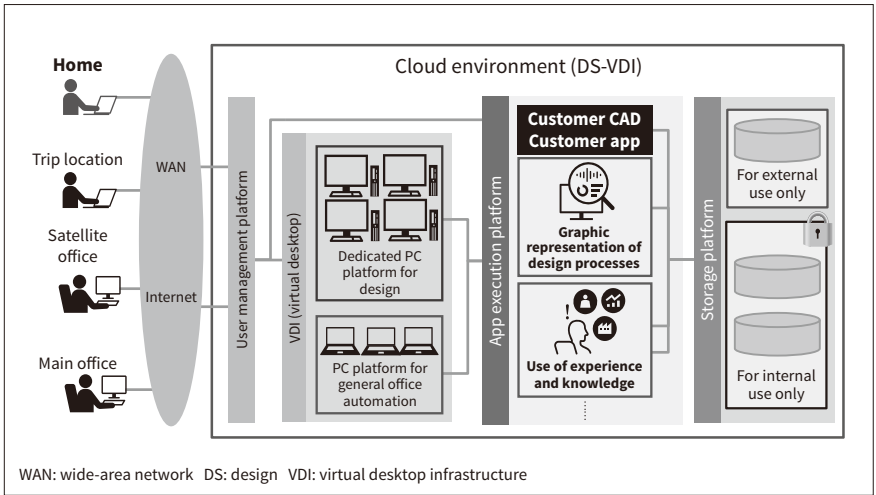
### 3. Collaborative Design Environment Adapted to the New Normal

Hitachi is addressing the three issues above by providing a collaborative design environment that integrates the solutions comprising DSC/DS. The first challenge (providing a work-anywhere design environment) could be overcome by providing high-performance remote workstations. The second challenge (systematizing work processes and making work progress transparent) could be overcome by providing an environment that enables different organizations to share work processes and expertise. The third challenge (passing along design skills, making use of design expertise) could be overcome by providing an environment for making use of design experience and knowledge (see **Figure 1**). The features of each of these solutions are described below.

**Figure 1 – Design Work Solutions for the New Normal**

By providing standard work processes and using an integrated design platform, Hitachi has created solutions that will enable collaborative design work in the era of the new normal.





**Figure 2 — High-performance Remote Workstations**

Use of the cloud-based VDI platform environment provides access to a design environment that can be flexibly scaled from various locations.

(1) High-performance remote workstations

This solution consists of high-performance remote workstations used for cloud-based integrated management of the design environment and design data. The workstations can be used from designer operation terminals over a network (see Figure 2). The virtual desktop infrastructure (DS-VDI) service developed and provided by Hitachi lets designers store data and use CAD or other design applications on network-based virtual terminals with specifications that the designer can flexibly modify. No special terminals are needed. The service enables design work to be done in any physical location, whether in the office, on the road, or at home. It also minimizes the risk of leaked information since doing all the work on the cloud eliminates the need

to remove data or transfer it between designers and clients. These features enable remote work with no loss of quality.

(2) Environment enabling different organizations to share work processes and expertise

This solution is an environment that lets different organizations share work processes and expertise using standardized processes and a unified system environment (see Figure 3). Hitachi provides process management system (DS-PMS) to let different sites or departments share standard work processes written in the work breakdown structure (WBS) format. Sharing standard processes eliminates work omissions. Progress and work product documentation can also be registered to make it easy to monitor progress and share information about the tasks comprising these

**Figure 3 — Environment Enabling Different Organizations to Share Work Processes and Expertise**

This environment improves work efficiency and quality by systematizing work processes and providing unified management of design information tied to work processes.



processes. DS-PMS also has a notification function used when a task is finished. It notifies other designers who refer to the work product of that task when working, enabling different sites or departments to work together smoothly. For each task, there is a unified way to look up instructions, past work products, reference information, and expertise provided by experienced designers. This feature reduces the time and effort needed to search for required information, so it should help improve design quality by letting designers focus on design work.

(3) Environment for making use of design experience and knowledge

This solution is an environment for passing skills on to designers by using IT systems that use design information conveying experience and knowledge acquired in the past.

The next section presents specific examples of how these solutions are used.

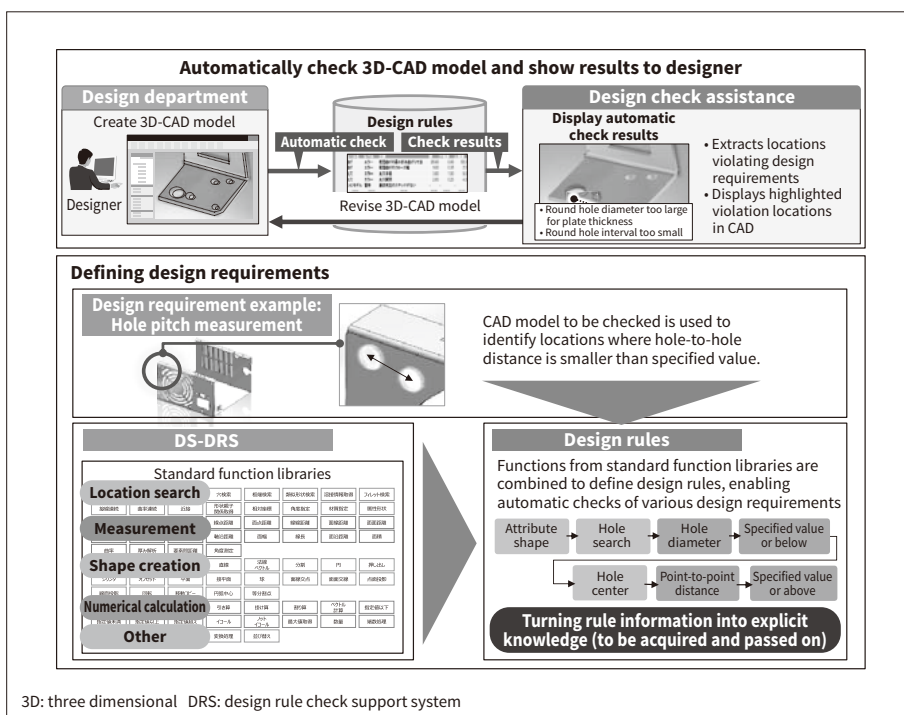
3. 1

**Defining Design Rules to Prevent Omitted Requirements**

Once acquired, design requirements are defined and handled as design rules as a way to prevent requirements being omitted from designs (see **Figure 4**)<sup>(3)</sup>. Inexperienced designers find it difficult to keep track of every design rule in the wide array of rules spanning areas such as manufacturing, maintenance, safety, and regulations. Hitachi has addressed this issue by providing the design rule check support system (DS-DRS), a system that enables the design requirements of three-dimensional computer-aided design (3D-CAD) models to be defined and checked as design rules. This

feature improves the quality of created CAD models and boosts check process efficiency. Designers are also shown information substantiating the design requirements as a way to give them a better understanding of these requirements that they can assimilate as personal knowledge. DS-DRS has reduced the design lead time of Hitachi Group products by about 30% by automating check processes and reducing the number of reworked processes.

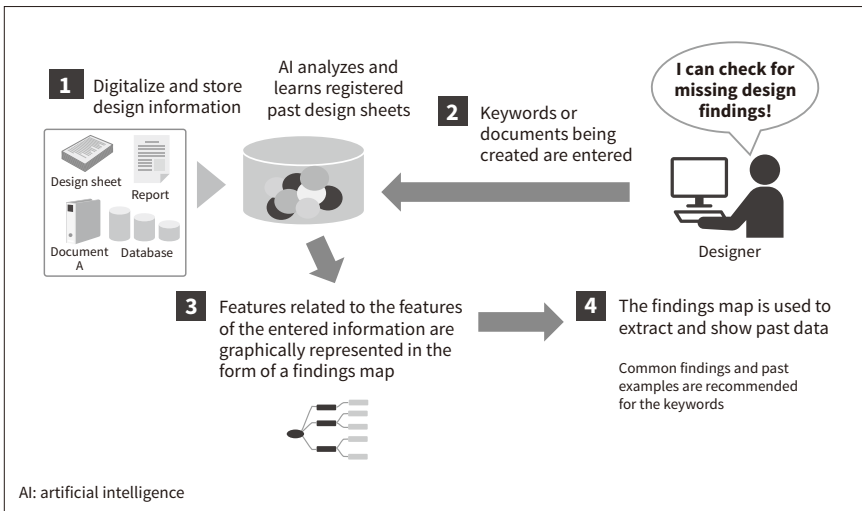
Advances in manufacturing equipment or technology can cause changes in design requirements. This issue can be addressed by enabling new rules to be accommodated by updating the rules for each condition as each change occurs, and making ongoing touch-ups. The bottom of **Figure 4** illustrates how design requirements are defined as design rules. The design in this example requires a certain minimum hole pitch determined by the machining equipment and product strength specifications. DS-DRS has libraries of standard functions that include a shape recognition function group that finds shapes to be checked in CAD models, and a geometric feature value calculation function group used to measure dimensions. The required functions can be brought together from these standard function libraries and defined as design rules, letting the system measure hole pitches and identify any locations of less than the specified value. This feature can be used to automate complex checks that were previously done manually, as well as to flexibly handle a wide range of design rules created from company-specific expertise. It can also turn rule check information into explicit knowledge, making it easy to acquire and pass on past design requirements or the knowledge and experience of skilled designers.



**Figure 4 — Checking Design Requirements**

Design quality is improved by automatically checking the design requirements of models created in 3D-CAD, showing the results to the designer and prompting for revisions. Design rules can be defined by combining DS-DRS standard function libraries to support various design requirements.

3D: three dimensional DRS: design rule check support system



**Figure 5 — AI-based Use of Past Examples**

AI is used to analyze massive amounts of past design information and display a findings map to enable identification of missing design findings.

### 3. 2

#### Improving Quality and Efficiency by Graphically Representing Design Information

Digital design information is acquired, systematized, and graphically represented as a way to improve design work quality and efficiency. New product design and design reviews are studied using past design examples. Designers look up past design information by running simple searches by keyword. However, searches alone can sometimes result in omissions when the search results lack review findings or necessary information. Hitachi has addressed this problem by providing a function enabling exhaustive tracing of acquired information. The function uses artificial intelligence (AI) to analyze and systematize massive quantities of digital design information that is then graphically represented in the form of a findings map (see **Figure 5**). It makes searches for information more accurate, allows information to be used by different development projects or design departments, and enables the use of past examples in the findings of experienced designers.

## 4. Conclusions

This article has shown how Hitachi's DSC/DS collaborative design solution is an effective way to solve the issues facing design work amid the need to prevent the spread of COVID-19 and to prepare for the era of the new normal once the pandemic is under control. Design work in the new normal era will likely need IT-based reforms for improving the previous standards of work efficiency and design quality, rather than just ways of designing efficiently by the old methods. Hitachi aims to bring value to the manufacturing industry by augmenting DSC/DS with a lineup of solutions that enable more advanced design work.

### References

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