

Development of DSS (Drawing Support System)

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ABSTRACT

The DSS system operates on CAD software (hereafter, “CATIA V5”). It inputs the drawing history, components and other management information (hereafter, “parts management information”), compares this information with the information of the technical parts table system (hereafter, “NEWS”) that comprehensively manages basic automobile product information, and checks for compatibility between the two.

An interface was developed to efficiently input parts management information, and the series of tasks to feed back the results of the compatibility check with NEWS to the drawings and correct the drawings was automated. In addition, security measures, when connecting with external networks, were strengthened, enabling the DSS system to be used not only by Honda R&D Co., Ltd, but also with suppliers’ system environments via the internet.

This effectively reduced the drawing creation and issue processing time needed for designers to create and correct drawings by approximately 35% compared to the CATIA V4 drawing support system.

1. Introduction

The CATIA V4 drawing support system (hereafter, “old system”) extracts parts management information from the title blocks and composition columns in the drawing data, and checks this information. This old system was developed and deployed in-house, but creating drawing frames and composition columns and correcting check results required much processing time, and there were issues with ensuring security and external database connections. For these reasons the old system was not provided to suppliers, and there were the following issues and limitations when creating and issuing drawings.

(1) Complicated drawing creation procedures

When designers created drawings, they had to create title blocks and composition columns while manually positioning standardized symbol shapes (i.e., table frame lines used to express composition columns, and symbols and text inside blocks and columns) that conform to the drawing creation rules, including technical standards designated as drawing creation rules. For example, when there are multiple components, composition columns

should be created by selecting from the symbol shapes for each component.

(2) Parts table information check function

The series of check tasks was not automated, so corrections required much processing time. Part names and quantities applied in the composition column were checked manually, which took much processing time.

(3) Lack of drawing creation environments at suppliers

When each supplier issues drawings, drawings created according to in-house rules should be submitted to the designers in charge. However, the old system had security, communication performance and other issues, so it was not provided to suppliers. Designers had to check drawings created by suppliers and correct the title blocks, composition columns and other drawing information using the old system, which imposed a heavy workload.

To address these issues with the old system, a drawing support system (DSS) was developed in conjunction with the shift to the CATIA V5 system. This new DSS system supports the creation of parts management information and compares it with NEWS to check for compatibility between the two.

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2. Development Goals

In CATIA V5, files are divided into drawing (2D) and product/part (3D) files. A function that links and manages these files enables the reuse of existing data and makes it easy to divide work between multiple designers. The V5 technical characteristics were used to address the aforementioned issues and develop a new drawing support system with the following goals.

- (1) Developing a system that supports the creation of drawing and parts management information for CATIA V5, and increasing the work efficiency of designers.
- (2) Developing functions linked with NEWS that check and automatically correct parts management information, and enhancing the drawing quality check automation functions.
- (3) Strengthening security measures, providing drawing support tools to suppliers, and increasing convenience.

Figure 1 shows the system overview. The system aimed to enhance drawing quality and simplify drawing creation procedures by centralizing drawing support functions (drawing support commands) such as automatic title block and composition column placement, drawing information input, and input results checking.

Additional development goals included linking with Web Help to enable designers to make corrections while referencing Help corresponding to the error factors, maintaining security, and enabling suppliers to also use the DSS.

Strengthening the link with NEWS, increasing the drawing check function accuracy, minimizing drawing rejections, and reducing the lead time until drawing issue by 35% were also set as goals.

In addition, system construction aimed to facilitate links between each system to enable easy function expansion in the future, such as 3D attribute information.

3. Functions Developed for the DSS

New functions were implemented in accordance with the development goals. The developed functions are described below.

3.1. Parts Management Information Creation Support Function

In the data structure of the old system, attribute information required for drawing and parts management was held within text and other symbol shapes. Designers used multiple drawing commands to first locate symbol shapes on the drawing, and then entered the attribute information. This created issues such as low work efficiency and the inability to flexibly relocate symbol shapes.

The new system uses a data structure that separates and enables individual handling of symbol shapes and attribute information. The link between symbol shapes and attribute information is managed inside the system, enabling designers to input parts management information without the need to pay conscious attention to symbol shapes. Title blocks and composition columns can be efficiently created and flexibly laid out on drawings by inputting the parts management information from a special user interface window used to create title blocks and composition columns, and designating the location coordinates on the drawing (Fig. 2).

In addition, Excel import and export functions were also developed. The import function inputs title block and composition column information described in the dedicated Excel format to the individual title blocks and composition columns on the DSS. The export function outputs a list of the individual title blocks and composition columns on the DSS in the dedicated Excel format.

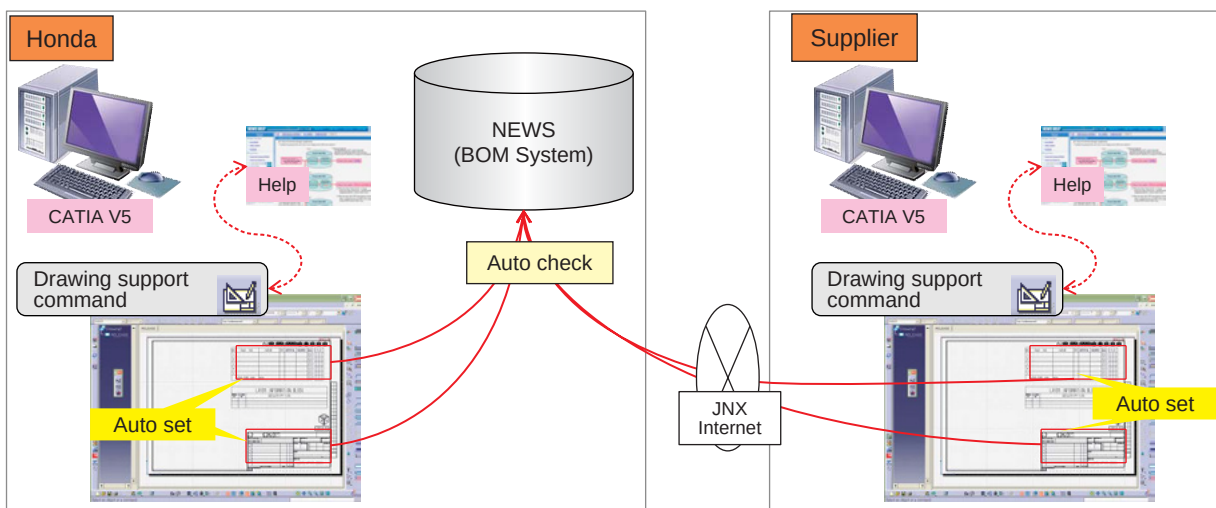


Fig. 1 Image of DSS

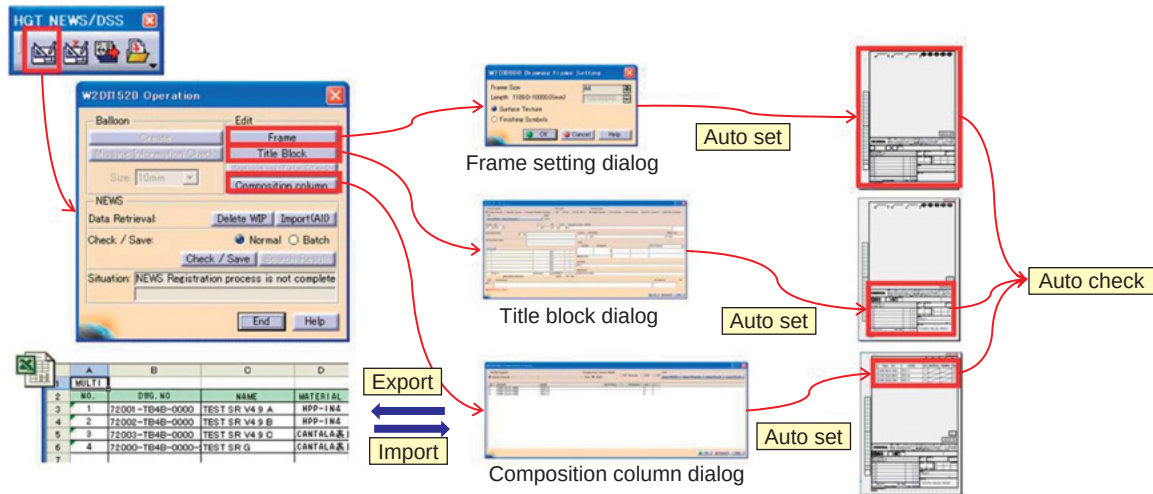


Fig. 2 2D drawing support

Input errors may occur when designers manually input part numbers and part names on the DSS, but this information can be input to the DSS without input errors by copying the composition information from NEWS, pasting it to the dedicated Excel format, and thereby importing the information.

3.2. Parts Management Information Check and Correction Function

A function was developed that links the two DSS and NEWS systems by socket communication, and automatically checks the parts management information (Fig. 3). This function outputs the parts management information created by the DSS as a text file, connects with the NEWS distributor server ((A) in the figure), and issues a processing request to a NEWS calculation server that is not currently performing processing ((B) in the

figure). The NEWS calculation server then checks the compatibility with the basic product information in the NEWS database. The overall processing speed is increased by connecting multiple NEWS calculation servers in parallel and distributing the processing.

Compatibility is checked by comparing the part number history (design change history), part names, and applied part quantities, and the check results are stored on the NAS ((C) in the figure). When the drawing check results in an error, the check results are fed back to the DSS as a text file ((D) in the figure) so that the parts information is automatically kept up to date. In addition, when contents require confirmation by the designer, correction confirmation locations are highlighted on the drawing, providing the flexibility for designers to judge the need for the corrections. A Help window showing error messages and remedies at the same time is also displayed, enabling drawings to be corrected while checking these contents. Drawings with large numbers of components may have 300 or more composition columns. Compatibility was checked by tracing the design change history for these components, which resulted in a heavy workload on designers. Formerly all parts management information was checked manually, but the DSS enables automatic checking.

3.3. Supplier DSS Functions

Figure 4 shows the flow when the drawing check is performed using the supplier DSS. First, a text file containing the parts table information is created locally within the supplier's system environment from the drawing data. A connection is made with the certification server located in the DMZ area, and SSL certification and login certification are received. Installation of a reverse proxy server enables a proxy response to the certification server, which further enhances security. A firewall is installed in the DMZ to help prevent illegal access from the outside.

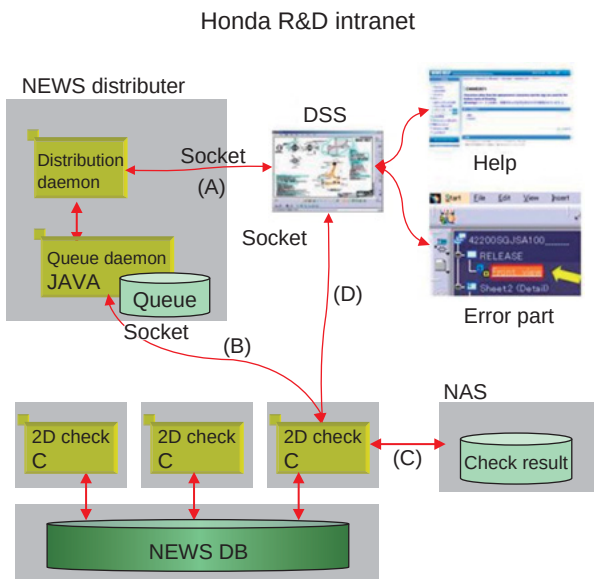


Fig. 3 DSS check flow

After that, the parts table information file is uploaded from the Servlet to a server located within the Honda intranet. The check is performed in the same manner as that of the in-house DSS, and the check results file is output via the server to the supplier's local terminal. Finally, the check results are displayed in the supplier DSS dialog.

The Remote Method Invocation over Internet Inter-ORB Protocol (RMI-IIOP), which is the industry standard for inter-system links, was used as the connection protocol from the external DMZ area to the server located in the Honda R&D intranet.

Each supplier is given a unique manufacturer ID tag as a measure to strengthen software security. This manufacturer ID tag contains the manufacturer code, manufacturer name, and a site name that notes the Honda

facilities abbreviation. When an attempt is made to perform the drawing check using the supplier DSS without this manufacturer ID tag included in the module, control is performed to disable the drawing check execution.

An installer was created for introducing the DSS in order to increase supplier system environment construction and operation efficiency. As shown in Fig. 5, the supplier DSS main program and Help can be installed separately, enabling the software to be provided with the minimum difference module size.

4. Effects

4.1. Increased Drawing Creation Work Efficiency

The DSS unified the drawing functions into a single function, enabling automatic creation of drawing frames, title blocks, composition columns and other items using a single unified command (Fig. 6).

4.2. Enhanced Drawing Quality Check Function

The drawing quality check function was enhanced by linking with NEWS and introducing a mutual check system for parts table information and drawing information when creating drawings.

Automation of checks both simplified and increased the speed of designer work. This increased drawing creation efficiency and the enhanced drawing quality check function reduced the designer work time by 35% or more compared to the old system (Fig. 7).

4.3. Provision of a Drawing Creation Environment to Suppliers

The supplier DSS provides the same functions as those in the in-house version, and contributes to enhanced drawing creation efficiency and drawing quality check functions at suppliers. As of August 2009, the DSS is being used by 210 suppliers both domestically and overseas.

4.4. Enhanced System Capability

The DSS integrated part of the drawing check function with the drawing creation function, which shortened the

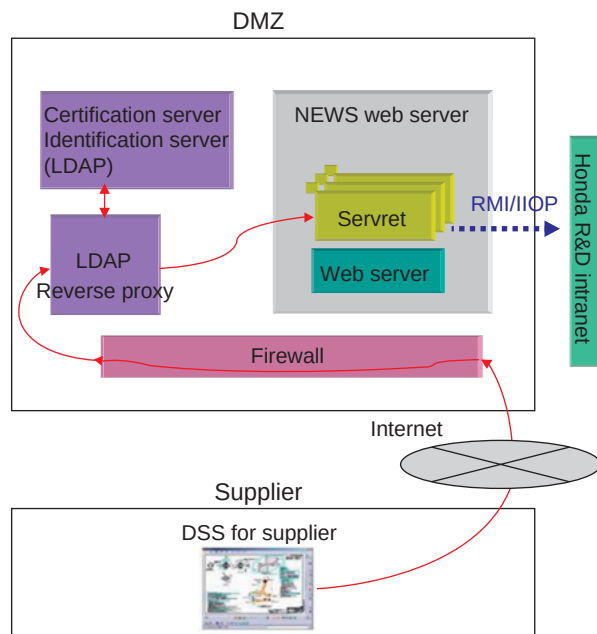


Fig. 4 Supplier DSS check flow

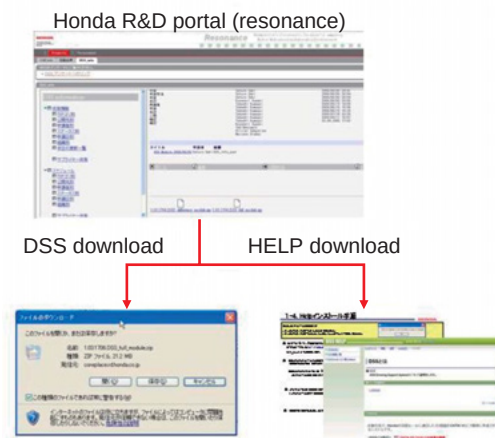


Fig. 5 Supplier DSS difference installer

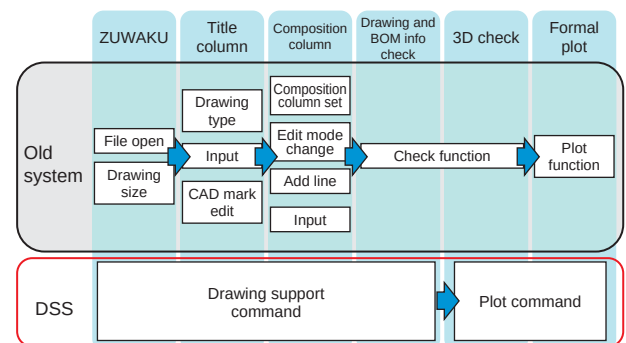


Fig. 6 Unification of command

time required for drawing checks while at the same time increasing the check accuracy. Parallel connection of multiple processing servers and other measures were also taken, which enhanced system stability, increased the overall processing speed, and otherwise secured performance equal to or better than that of the old system.

In addition, strengthening the link with NEWS increased system convenience and facilitated links with other systems.

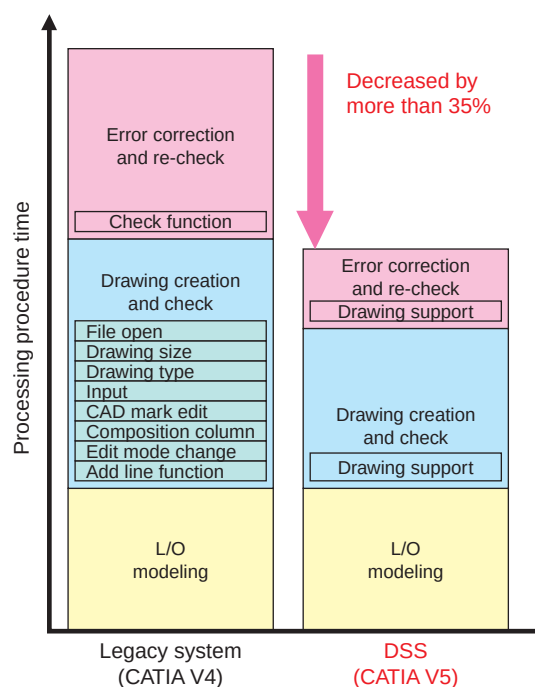


Fig. 7 Processing procedure time

5. Conclusion

Development of the DSS increased designer work efficiency, enhanced the drawing quality check automation function, and reduced the drawing creation and issue processing time by approximately 35%. In addition, security measures were strengthened, and the DSS was also provided to suppliers, which increased convenience.

Marked advances are being made in 3D modeling technology, and in the future the drawing data format will shift from 2D to 3D, and expand to a data format that holds 3D attribute information.

Future DSS developments include the ability to load and check 3D attribute information written on models, and enhancements enabling the exchange of accurate data with downstream processes in the same manner as the current drawing check. In addition, efforts will be made to construct a system that can more easily realize links with NEWS and other systems, and to deploy a system that can contribute to model development.

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