Development of APROS Product Data Management (PDM) System

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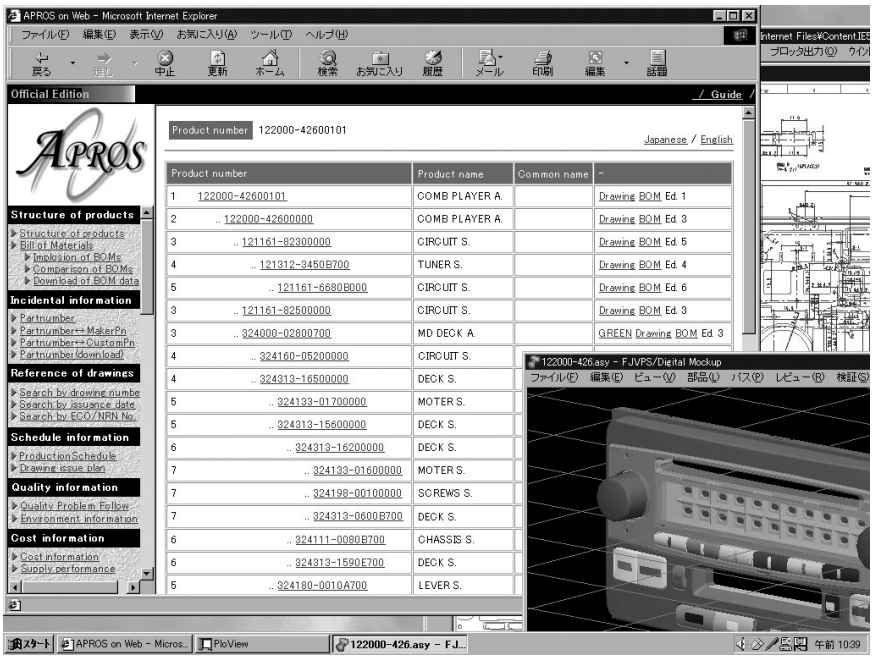

Abstract

In order to meet the needs of the market, shorten product development periods, improve quality and productivity, and reduce costs in the midst of the dramatic changes that are taking place in the world today, it is important to maximize the use of information technology (IT) and to reform the business process through information sharing and business computerization. For the purposes of (1) implementing concurrent (parallel) product development and cooperative design through sharing of technical information, (2) improving intellectual productivity through "knowledge management," and (3) providing company-wide management support that integrates QCD, our company has begun internal development of a Product Data Management (PDM) System for total control of product-related information. This report introduces examples of key points in system structuring, major functions, and system development / configuration, centered on the development of a technical information sharing function which is the root of the Advanced Product Data Management System (APROS) of our company's PDM system,

1 Forward

In order for a company to survive in the current midst of extreme changes in world affairs and the resulting harsh business environments, it is necessary to meet the needs of the market, shorten product development periods, improve quality and productivity, and reduce costs even further.

In order to meet these demands, it is extremely important to maximize the use of information technology (IT) and reform the business process through information sharing and business computerization.

PDM (Product Data Management) systems, for the total control of all product-related information from development to the end of product life, are used widely by companies in Europe and the United States to improve results.

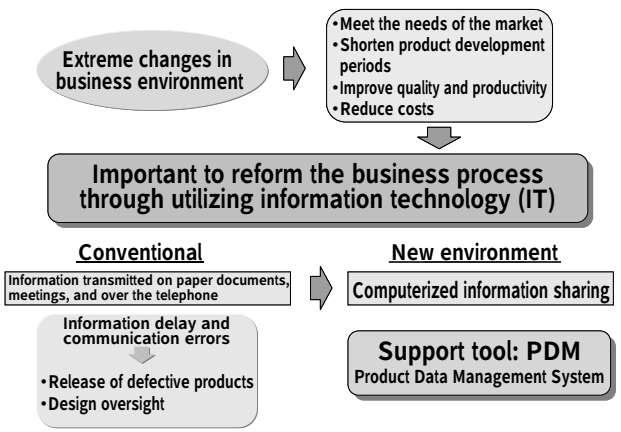

Fig.1 Necessity of PDM System

Having determined that these systems are effective, our company has begun the development of our own PDM system. Rather than customize a commercial PDM package product, we are developing all system functions in-house in order to respond flexibly to user needs and changes in business conditions, which will also make future function expansions easier.

This report introduces key points of the development of our company's PDM system, the Advanced Product Data Management System (APROS).

2 Goals in the Development of APROS

In general, PDM systems primarily support production through the use of shared drawings and the procurement of parts such as through SCM (supply chain management).

With APROS, business is supported for all product development, not just for drawings, through the computerization and sharing of information such as the scheduling, quality, and costs of products, technological know-how, and design and business procedures.

Of these, the following 3 points are especially important goals in the development of APROS.

①Implementing concurrent (parallel) product development and cooperative design through the sharing of technical information

②Improving intellectual productivity through "knowledge management"

③Providing company-wide management support that integrates QCD

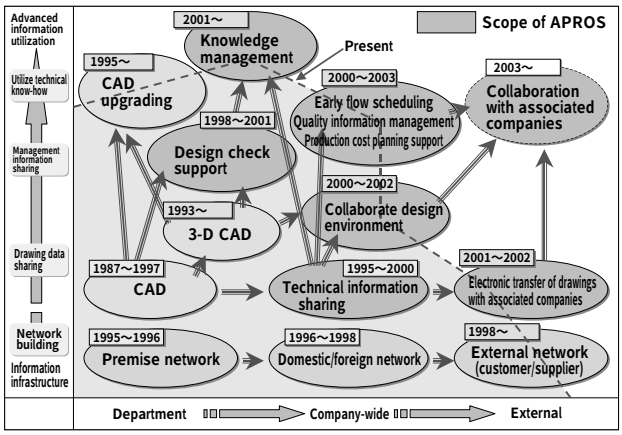

Fig.2 Scope of APROS

①Implementing concurrent product development and cooperative design

To reduce the development period of products, it is necessary to have production related departments start their work as early as possible. This includes work such as parts procurement, production preparation, and preparation of after-sales services, and to proceed concurrently with the design department. This business style is referred to as concurrent engineering.

Although Concurrent operations are performed routinely by most companies in Japan and are not recognized as a particularly new method of operation, this system was originally based on sharing of information through paper documents, meetings, and the telephone. The method had a number of problems such as communication errors and missing information, resulting in the production of defective products and reversal of the design process.

In order to resolve these problems, a fast and accurate communication system from the design department to production related departments was necessary, and is now achieved through computerizing and sharing technical information. In particular, it is important to share product structural data and new parts data from the earliest stages of product development, and to communicate design changes in real time.

Also in order to improve design quality, it is necessary for information to be freely accessible by anyone

during the design stage. This requires reform to a cooperative environment having the participation of everyone including production-related departments.

Since cooperative design allows the opinions of suppliers, manufacturing departments, and service departments to be incorporated before products are produced, it becomes possible to establish good designs from parts productivity, product assembly, and maintenance early on. In addition, because defects and demands from production related departments after mass-production will be reduced, design changes and follow-up processes are also reduced and development periods are shortened.

In order to achieve these goals, it is necessary to create an environment easily understood by anyone, by computerizing information so that data can be shared even when design departments and production related departments are in distant locations, combined with the usage of three dimensional CAD systems.

②Knowledge management

Directly improving design quality and speeding up development require an "improvement of intellectual productivity" through "knowledge management", which navigates design processes and provides information useful for product development, such as engineering techniques and technical information, to engineers.

By standardizing design and management processes and navigating work procedures systematically according to this management process, even inexperienced designers will be able to perform their duties without oversights. In addition, in order to efficiently utilize shared information such as technical knowledge, the system has to be able to not only search by keyword, but also to display intelligently any information relevant to that design process, in combination with the design work navigation.

③Company-wide management support

In order to proceed with product development according to plan, it is important to understand the entire project in real time and accurately follow up on its progress.

The management of the deadline for drawings and parts procurement is essential in the managing progress, but the evaluation of part reliability, evaluation results of prototypes, and the ascertainment of production costs are also important. The results and conditions may become a major factor in design alterations, and have an impact on development schedules.

Therefore, in order to perform total management of the project, it is necessary to create a company-wide environment of information sharing by combining schedule progress (D) (drawings, evaluations, parts procurement, and production preparation), the follow up of recognized concerns (Q) (design reviews, production reviews, parts evaluations, trial product evaluations), and the achievement of production cost objectives (C). Also, it is necessary to be able to show present conditions from a variety of viewpoints (by project, product, parts, etc.), according to the situation and/or application.

3 Main Functions of APROS

It was determined that a system such as the one described below is required to achieve the 3 objectives above.

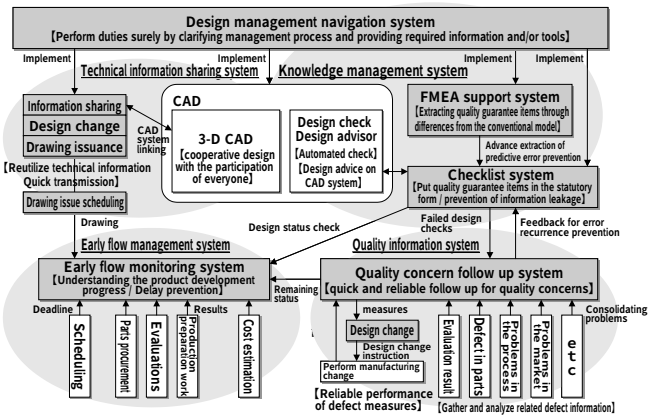

Fig.3 Overview of the APROS system

First, the technical information sharing system will consist of a feature that will computerize and share technical information such as diagrams and design alteration information, and a feature that will publish new diagrams to quickly spread information to production related processes. Combined with 3 dimensional CAD systems, an environment where everyone can participate in the design will be created.

The knowledge management system will consist of the design navigation system which will provide information and tools according to the design situation, and a system that will provide technical knowledge and support design evaluations.

Also, management of the entire company's QCD will be performed with an initial flow management system, providing an understanding of the product development progress and preventing delays, and a quality information system, to find quality problems, help in follow-up measures, and to prevent recurrence. The two systems will tie together with systems from each department and integrate information, allowing the total management of information.

These systems are all linked together, and the total integrated system is APROS.

Development has started to create the system described above.

4 Noteworthy points in the structuring of the technical information sharing system

In the first step of APROS development, a technical information sharing system centered on part number information and diagram data was developed. In the following chapter, an example of the system development is introduced focusing on the technical information sharing system.

First, noteworthy points in the structuring of the system will be introduced.

Departments such as parts procurement, production preparation, and pre-service begin manufacturing and pre-production work once they have received information from the design department. Therefore, vague drawings and plans and incomplete information will result in many revisions, and prevent the start of work. However, since there is a limit to the total product development period, design information must be received as early as possible, even if incomplete, in order to meet deadlines.

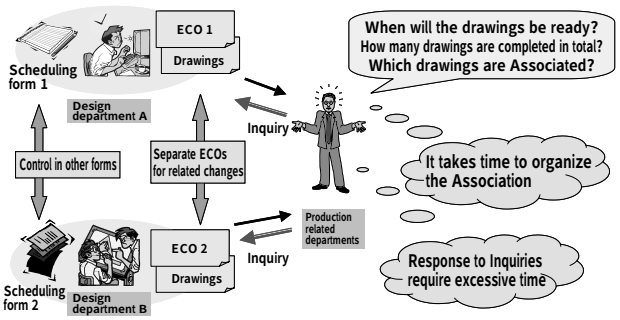

Fig.4 Conventional Concerns

Therefore, production related departments waste many man-hours asking design departments when final drawings will be ready, while organizing products based on fragmented drawings.

In order to solve these problems, we believe it is important to clarify the relationship between the component parts of products and the drawings required for production so that design changes and production preparation work can be performed accurately. The following 4 functions are included in the technical information sharing system.

①Information sharing function: company-wide sharing and reutilization of technical information, such as drawings

②Design change function: creation of ECO (Engineering Change Order) for pre-notification of design change information

③Drawing issuance function: registration of work flowcharts related to drawing issuance, and electronic authorization for drawings, drawing storage, and drawing notification

④Drawing issue scheduling function: comparison of drawing plans and results, and collective display of drawing progress

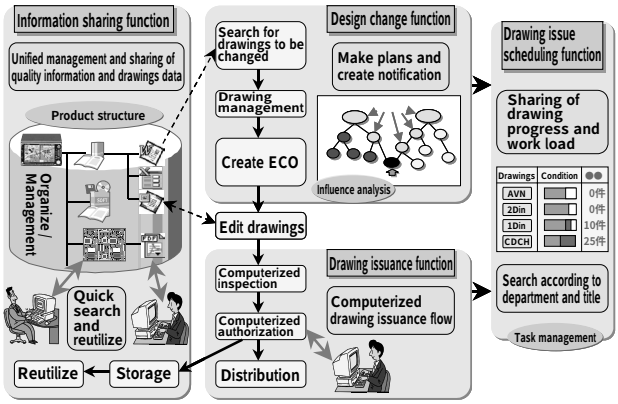

Fig.5 Outline of System Functions at the first step

5 Information sharing function

The information sharing function is for the storage of part number information and drawings data, and linking with CAD systems. It is used for the unified management of technical information for all products company-wide. In addition, the stored technical information can be searched for under a variety of classifications when necessary by anyone, without knowledge of where the data is kept.

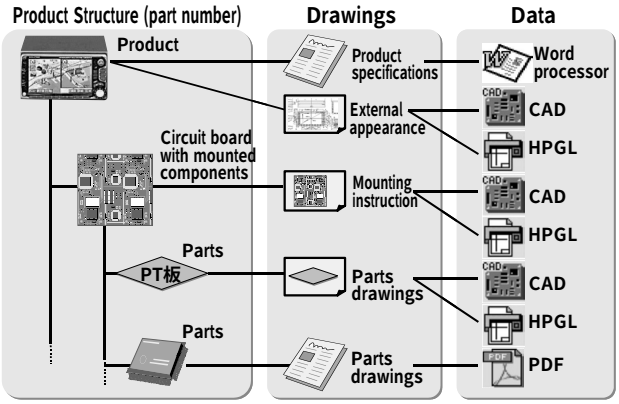

Fig.6 Product Structure

Also, since the information is organized and managed by product, there is an important function called "product structure". "Product structure" displays the part numbers of the component parts of products as a tree graph, showing the skeletal relationship of the information. Each part number is linked with related information and CAD drawings/word processor documentation that represent it. Since the various electronic information for product components can be linked and registered in this way, individuals can manage information themselves, information will not be lost, and time will

not be wasted on searches for design information.

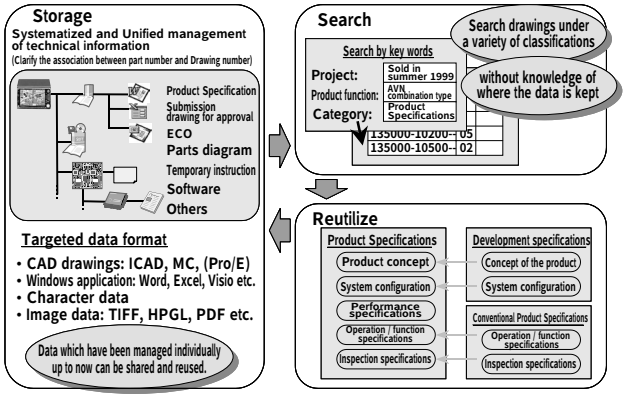

Fig.7 Data Reutilization

Designers in the design department can reutilize registered data to efficiently create similar drawings and modified drawings. In production related departments, since "product structure" is created by the design department at the initial development stage, total product structure and the number of design drawings can be understood in advance, allowing systematic preparation for parts procurement and manufacturing.

6 Design change function

The design change function was designed with the following two development viewpoints: (1) summarize changes according to purpose, and (2) notification of drawing schedules for design changes as well to production related departments in advance.

First, in order to summarize changes according to purpose, "Product Structure" was used to develop an "Influence Analysis Function" that automatically samples the range of the Influence of changes.

Influence analysis automatically selects higher level parts and products that are influenced by the part to which changes are made, and is able to identify the drawings requiring design changes. If making changes

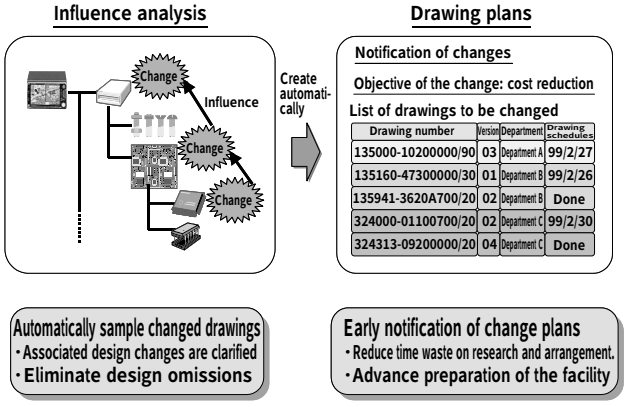

Fig.8 Influence Analysis Function

to common parts, which will have an effect on multiple products, use of this function will reduce time wasted on researches and arrangements, and eliminate design omissions.

In addition, ECO are conventionally issued at the same time as change drawings. Although they have been used as "drawing lists", now they will be changed to "drawing plans" that give prior notification of change purposes, change times, and the issuance schedules of related drawings, and will be issued before the change drawings.

By summarizing ECO by purpose and giving prior notification, since production related departments will already know the purpose of a drawing and the time and amount at which it will be received, change drawings can be processed in order even if received separately.

7 Drawing issuance function

With the drawing issuance function, departments can search for drawing data for reference or as data whenever necessary, without distributing hardcopies to production related departments as has been done in the past. In addition, since it is necessary to know as soon as drawings are issued to production related departments, notifications can be sent by e-mail.

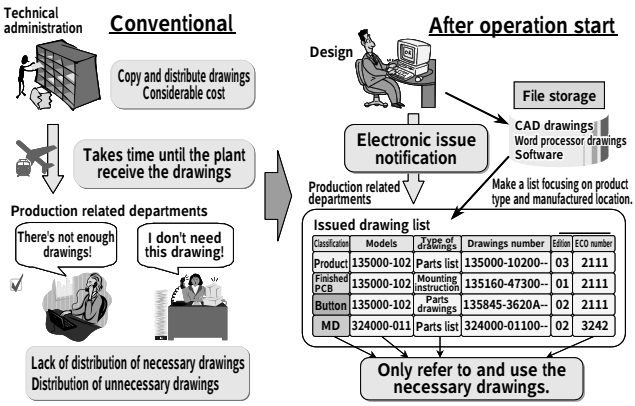

Fig.9 Change in Drawing Issuance Method

As a simple explanation of the flow of drawing issuance, first the drawing data is officially saved with the information sharing function after the management section of the design department has authorized its issuance. At the same time it is being saved, a drawing issuance notification is sent to the production related departments by e-mail, informing them that the data can now be referenced. Once they have received this notification, the production related departments can refer to and/or download the drawings.

This information is sent to the EXTRA serves for

overseas branches once a day, and it is possible to reference this data from overseas branches on the following day.

Compared to prior methods, drawing distribution lead time has been reduced drastically from 2 days to immediate distribution domestically, and from 4 or 5 days to 1 day overseas. In addition, drawing duplication and distribution costs at the technical administration department and filing man-hours at production related departments have been reduced dramatically. Since loss during delivery and filing mistakes will be eliminated, obsolete drawings and wrong drawings will no longer be used.

8 Drawing issue scheduling function

Since most of the operations performed by production related departments are based on drawings issued by the design department, delays in drawings have a dramatic impact on the early flow of plans. With the drawing issue scheduling function, drawing plans and results are shared between departments and the values and graphs for progress conditions can be expressed by project, equipment, section, or product, based on situation and/or operation, making the management of drawing progress conditions easier.

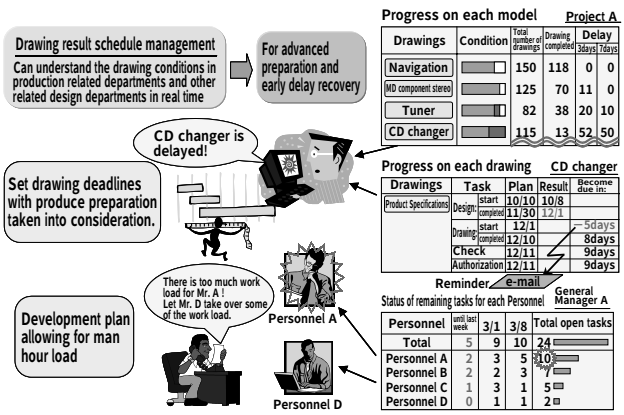

Fig.10 Schedule for Issuing the Drawing

In addition, with the drawing operation flow chart (design, drafting, inspection, authorization) one can find to what point a drawing has currently progressed and where it is tied up, and not just simply whether it is complete or not. When there is a delay in the delivery set for a flow, a delivery delay warning e-mail is automatically sent to the person in charge and the related manager of the section.

With this function, the design department can understand in real time the drawing conditions in other related design departments. In addition, by collectively managing the drawing issuance plans of products, the amount of work and delivery time for each engineer can be accessed, making work load organization and plan revisions easier. In production related departments, since the progress of a number of design departments can be found at once, the schedule can be adjusted while studying the progress condition of the entire project.

In the production control department in particular, progress follow-up work, such as telephone consultations with design departments, can be dramatically reduced. In addition, since drawing delays can be noticed early, rapid recovery is possible.

9 System configuration

Currently, we provide a C/S (client/server) version for ECO creation in design departments and the creation of drawing plans, and a Web version for referring to parts information and drawing progress conditions.

The system can be used at all Fujitsu Ten Group locations, including overseas. The current number of users exceeds 1,500.

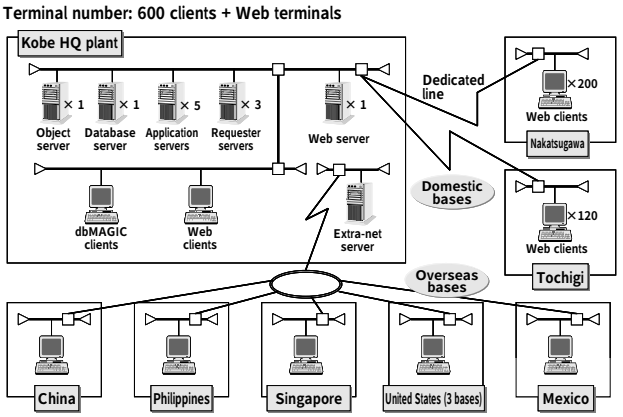

Fig.11 System Configuration

10 System development technique

In general, although most PDM systems are constructed to customize package products, there are problems such as staggering production times and costs and difficulties in responding to customer needs flexibly and rapidly.

With the development of this system, we have introduced dbMAGIC, a RAD (Rapid Application Development) development tool, with the minimum number of functions and a spiral development technique for adding demands.

The important point of this technique to consider is the basic setting for adding demands. With this system, data analysis techniques by T-shaped ER drawings are

used together with a substantial basic setting using a DOA (Data Oriented approach).

User demand for a system is difficult to access without actually using it. However, since the system was made available early, samples and summaries of user demand were faster and total system development time was reduced. In addition, although programming takes up the most time in conventional development, this development technique allows more time for business process improvements and management establishment.

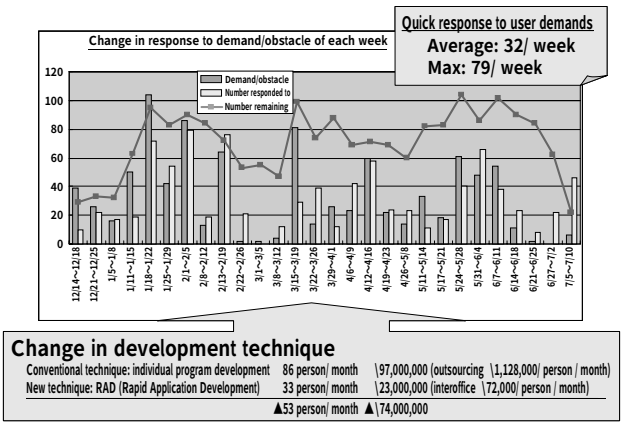

Fig.12 Development Techniques of APROS

11 Effect of technical information sharing system

With product structure as the main component, by seamlessly integrating parts information, drawing data, design change information, and schedule information in the flow of operations, technical information sharing systems can greatly increase results.

First, by improving the precision of design information and preventing drawing storage and distribution mistakes, product quality can be improved. Next, systematic improvements can be made by improving the efficiency of incidental work, such as arrangements, process management, searches and storages of technical information and design information delivery, which are necessary for proceeding with design operations in parallel. In addition, delay prevention and recovery measures can be implemented quickly by sharing progress condition information.

Since the transmission of information to production related departments can be performed accurately and rapidly, total product development time can be reduced.

Q
- Preventing lack of design changes , Design information quality improvement
- Preventing wrong use of drawings such as obsolete drawings

C
- Reduce man hour for searching technique information and man hour for creation of drawings by data reutilization
- Reduce man hour for schedule arrangement and progress management.
- Reduce man hour for storage and distributing the drawings through promoting paperless offices.

D
- Prevention of delays and quick delivery recovery response through sharing information of progress conditions.
- Shortening of drawing distribution lead time.
  domestic 2days → 0 minute, overseas 4days → 1day

Fig.13 Effect of Technical Information Sharing System

12 Future Issues

The technical information sharing system introduced here is the first step of APROS development. Already, other systems are being provided or has begun development, and the system is evolving daily through expanded features and integration of other systems, as the origin of the APROS name, the -Advanced Product data management System- implies.

We will continue to work to achieve the initial development objectives as fast as possible, to correspond to new user needs, and to provide a system that the user will be satisfied in using.

Profiles of Writers

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