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On-Line Information System for Meeting Order Processing Services, "KOSMOS Ⅱ"

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The body can be viewed from the next page.

On-Line Information System for Meeting Order Processing Services, "KOSMOS II"*

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Synopsis:

KOSMOS II (Kawatetsu On-line System for Meeting Order Processing Services) was refurbished to improve marketing competitiveness, achieve higher efficiency in production and transportation, and generally upgrade the quality of administrative activities. The new KOSMOS II system, which was simultaneously developed in and applied to Kawasaki Steel's entire product lines, integrates various sales-related sub-systems ranging from order entry to delivery and accounts receivable, taking advantage of the most up-to-date computer system. Anticipating future needs, KOSMOS II is also tied to major trading firm systems in a secure, on-line communications network. KOSMOS II went into service in January 1985. The originally planned goals of the system have been satisfactorily met, and new functions are already being added.

1 Introduction

Systematization in the fields of sales, production, and distribution at the Head Office of Kawasaki Steel began with the credit PCS (punch card system) in 1958. With the plate order entry system, which was put into operation in 1965 and constituted the first on-line system in the company, systematization reached the stage of full-scale application. After various stages of expansion to cover additional product types and functions, the system included most of the main activities of the company by the mid-1970's.

However, these systems had difficulty in coping with recent changes in the environment surrounding the iron and steel industry brought about by developments in respective fields and differences in intersteelworks, intersystem, and inter-product-type system levels. On the other hand, communications networks and computer hardware and software showed rapid progress.

In this environment, a comprehensive restructuring of the existing system was undertaken. Up-to-date systems technology was adopted with the aim of improving marketing competitiveness, achieving higher efficiency in production and transportation, and generally upgrading the quality of administrative activities. Study of a new Head Office sales and distribution system called "KOSMOS II (Kawatetsu On-line System for Meeting Order Processing Services)" began in 1982. KOSMOS II was put into operation in stages, beginning in January 1985, and after three years of operation, is functioning smoothly and has achieved the originally planned goals.

This paper reports the background which necessitated restructuring of the earlier system, the aims of the KOSMOS II system, and its main features.

2 Background and Aims of System Development

2.1 Evolution of the System

The evolution of the present system is described below in terms of the three categories of order entry, accounts receivable, and physical distribution.

(1) Order Entry

The antecedents of this function was the sales information system, which was put into operation in 1967 as the company's first on-line system. First structured by product type and mainly employed batch processing, the system was subsequently refurbished into a real-time processing system in the mid-1970's, covering all products under three cate-

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gories, ① plates and sheets, ② bars and pipes, and ③ other special types of products.

In the current system, these three lines were restructured into a single system covering all products in an on-line system tied to affiliated companies and trading firms, while maintaining system consistency and integration with these firms.

(2) Accounts Receivable

The PCS credit system was put into operation in 1957. Simultaneously with the development of the order entry system, structuring of the accounts receivable system and refurbishing of the credit system began in 1969. System functions expanded until the KOSMOS II restructuring.

(3) Physical Distribution

Starting about 1975, systematization of cruising control and account calculation was promoted. These systems have now been restructured as the transportation base system, covering all transportation bases, and the cruising control system for domestic marine transport.

2.2 Background of System Restructuring

When the decision was made to restructure earlier systems, the environment surrounding the Japanese steel industry was harsh, owing to import restrictions in the United States, the expansion of steelmaking capacity in developing countries, and competition from alternative materials. Higher efficiency and a leaner, more resilient corporate structure were urgent necessities in overcoming these difficulties.

While quantitative expansion of production was out of the question, automation and the integration of processes were promoted to improve competitiveness. These mass-production measures encouraged the trend toward larger lot sizes. On the other hand, however, user needs were becoming diversified and increasingly sophisticated. High quality products were being demanded, and a trend toward multi-kind, small-lot production became pronounced. Thus a system was necessary which could satisfy the contradicting needs of customers and steel producers, and be operated as part of a slimmer organization.

Fortunately, information processing techniques and communications networks had made rapid progress, making possible the construction of a flexible, comprehensive system capable of satisfying the requirements mentioned above.

2.3 System Aims

The goals of the KOSMOS II system are as follows:

(1) Strengthening Sales Competitiveness
- ·Establishment of delivery assurance system.
- ·Expediting of pre-study of inquiries.
- ·Response to diversified customer demands.
- ·Enhancement of information services.

(2) Improving Efficiency of Production and Transportation
- ·Quick response to changes in operating conditions.
- ·Confirmation of consistency in sales, production, and transportation control.
- ·Introduction of planning indexes.

(3) Enhancing Administrative Efficiency
- ·Elimination of redundant activities.
- ·Improvement of delivery system.
- ·Thoroughgoing paperless operation.

To achieve these aims, the following concrete tasks were set for the structuring of the system.

(1) Rationalization of Sales Activities and Accounts Receivable Operation

Simplification of office work, paperless operation, and automation of checking.

(2) Higher Efficiency of Pre-Study of Inquiries and Quality Specification Design

Promotion of standardization, expeditious execution of pre-study of inquiries, and automation of specification additions.

(3) Establishment of Production Plan and Order Adjustment Function

Optimization of production plan by comparison of plural proposals, formulation of semi-weekly plans, distribution of orders among factories based on the semi-weekly plans, and improvement of delivery arrangements.

(4) Establishment of Delivery System

Establishment of requisite data base and simplification of system.

(5) Establishment of Product Distribution Control System

Strengthening of product distribution control including transportation bases, standardization of transportation base activities, and systematic allocation of ships.

(6) Structuring and Utilization of Data Bases

Formation of data bases for control information, including sales, production, quality, distribution, and cost.

3 System Outline[1-3]

3.1 Scope of System

Of a steelmaker's main business activities, ranging from order receiving to accounts receivable, this system covers Head Office operations such as business negotiations, pre-study of inquiries, received-order processing, specification addition, order adjustment, delivery, physical distribution (arrangement of transportation and transportation bases), accounts receivable, and related planning and control. The system and the relationship of its functions are shown in **Fig. 1**.

The system covers all types of steel products. It also carries out, using networks and an IBM 3090/200 at the Kobe Head Office, host-to-host computer communica-

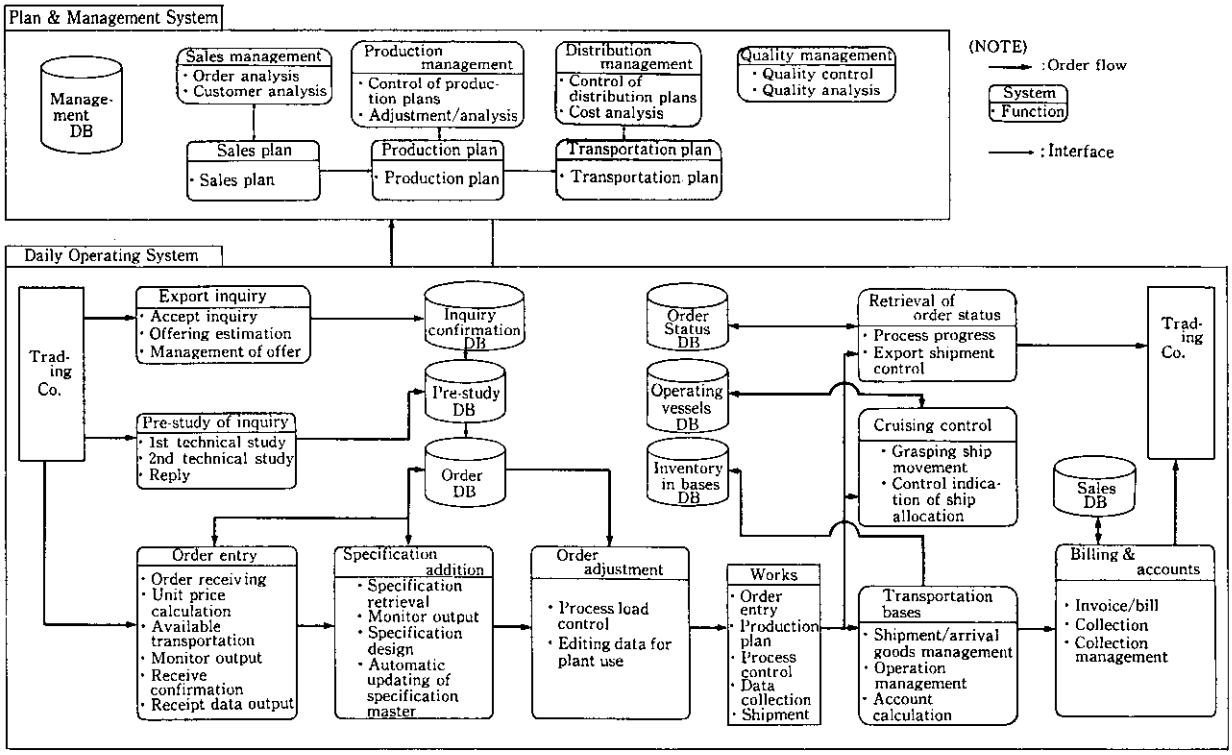

Fig. 1 System conception

tions with steelworks, manufacturing plants, associated companies, and general trading firms, as well as communications with terminals in the company's business offices, transportation bases, and associated companies.

3.2 Contents and Features of Sub-Systems

3.2.1 Export negotiation support system

This sub-system supports export negotiations involving trading firms, including the receipt and pre-study of inquiries and confirmation of contracts, and is the first of its kind developed in the steel industry. In the past, business negotiations with trading firms required paper documentation and face-to-face talks. With this system, the exchange of information with trading firms is processed on-line (transmission and processing at any time), expediting the conclusion of transactions and improving the efficiency of work processing by inter-company paperless communications.

The sub-system supports the person in charge of sales in the conclusion of contracts with trading firms, and the exchange via terminal of information regarding inquiries, offers, and contract confirmation. Contract confirmations obtained by this exchange of information are also used in confirming the accuracy of order information received later.

This sub-system is currently applied to OCTG, and its expansion to other product lines is under consideration.

3.2.2 Inquiry pre-study system

This system supports pre-study of inquiries to determine the possibility of manufacturing the items in question. It covers seven main lines of products, including steel plate, hot-rolled steel sheet, cold-rolled steel sheet, and steel pipe.

When the trading firm or the Sales Department inputs on-line the customer's required quality information, this sub-system collates the contents of the output with facility specifications, the technical level of operations and manufacturing records, automatically determining whether manufacture is feasible or not. If automatic determination is impossible, the inquiry pre-study department manually examines the possibility of manufacture and replies to the trading firm or the Sales Department, adding any indicated comments and/or stipulations. This sub-system also permits inquiries from the trading firm or Sales Department about the progress of the pre-study operation.

Through this systematization, pre-study of inquiries has been expedited, and the ratio of the same-time or same-day replies has improved, promoting the standardization of quality design.

3.2.3 Received order processing system

This sub-system covers all types of steel materials. Its scope ranges from order authorization by the person in charge of sales to the return of received data to the trading firm. The items processed by this sub-system

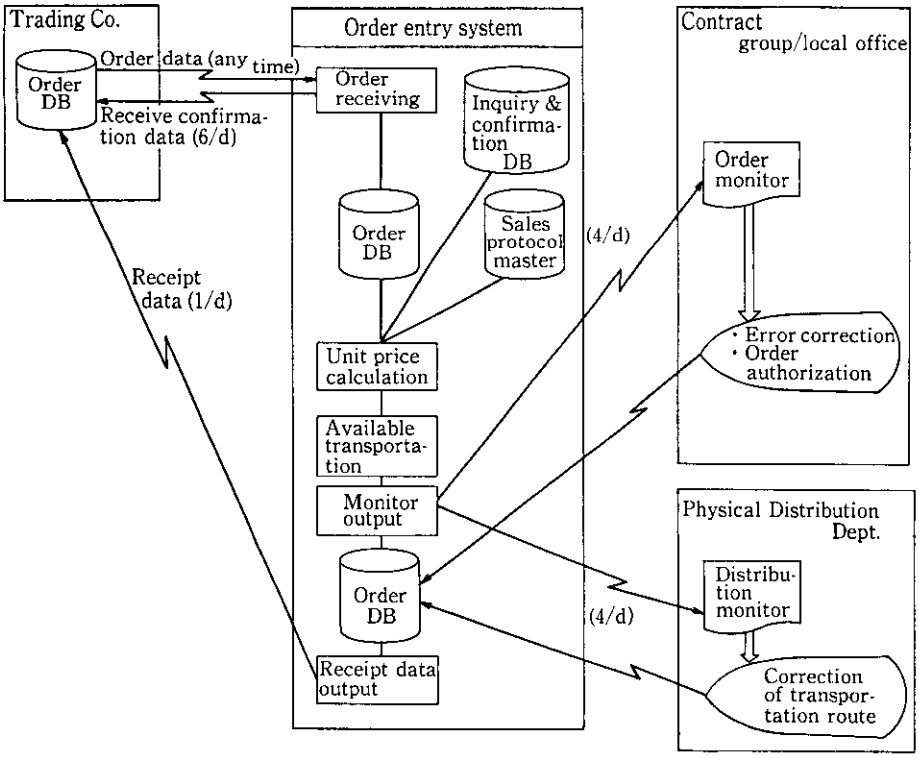

Fig. 2 Order entry system

are shown in **Fig. 2.**

All exchanges of information with trading firms are carried out on-line, and paperless processing of orders has been realized. Processing of received orders has also become faster, because transmission and receipt of information are possible at any time.

This system also automatically checks order contents and calculates sales prices, reducing the office work load. Further, it contributes to reduced transport costs by automatically noting the optimal transportation routes and facilities.

3.2.4 Specification addition system

The addition of specifications to orders is carried out in the pre-study stage at the Head Office, with the aim of correctly conveying customer quality specifications to the manufacturing plant and standardizing quality design.

This system supports the specification addition process, and adds specifications such as guaranteed quality and manufacturing specifications to orders for seven major product lines in the same way as in the inquiry pre-study system. This is done automatically for standing orders, such as those for automotive steel sheet, in which the order content is the same for some period of time; specifications are added from various specification masters already registered. For new orders, inquiry pre-study information and standard specifications are automatically added, and the inquiry pre-study section makes additions and corrections, determining the final specification. The flow chart of this process is shown in **Fig. 3.**

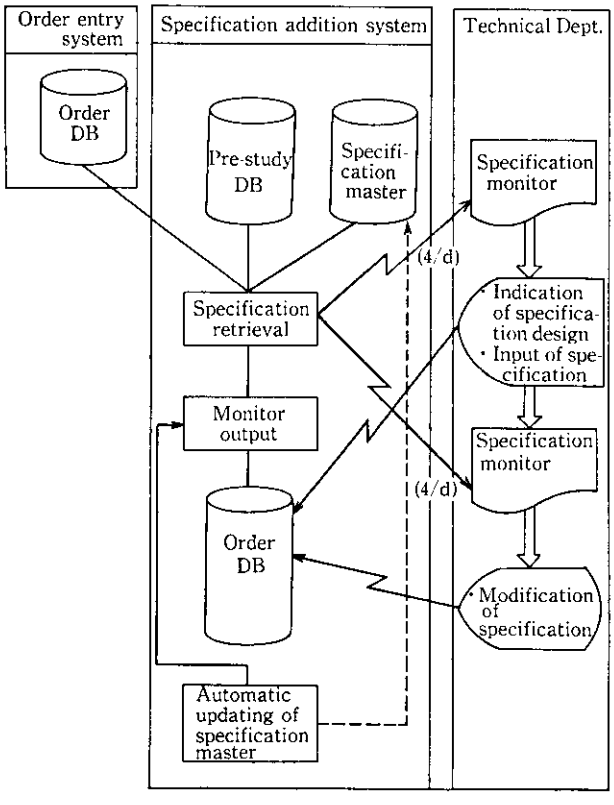

Fig. 3 Specification addition system

The specification master includes the customer list, standard, size, application, and packaging masters.

3.2.5 Order adjustment system

To meet customer delivery requirements, it is necessary to manage production operations on the basis of standard processing days determined by product type, in consideration of the status of orders received, including product type and specification make-up, and lot composition. The Head Office Production Control Department while adjusting order groups, productions plans, and process loads in order to meet delivery schedules, distributes orders among production sites and determines production priorities. This overall operation is called "order adjustment."

The order adjustment system supports these operations for all types of steel material. The system is of a conversational type. The process flow and process days are accessed for each order in accordance with standard values, the daily order quantity per process is compared with the production capacity of the process, and order adjustments are made, incorporating human judgment. The flow chart of process is shown in **Fig. 4**.

3.2.6 Delivery system

Recently, customers' schedule requirements have become stricter, and a timely grasp of the status of processes, of inventories, and shipments from distribution bases has become essential.

This system, which covers seven major product lines, collects data on-line regarding the progress of orders; items range from order receiving to product delivery. Up-to-the-minute date on orders, process status, invoices, arrivals, inventories and shipments at distribution bases, and transportation is processed into unidimensional form, then supplied to the departments concerned. The system also supplies data on-line to trading firms, ensuring agreement of data with that in the company. The application of this system has simplified the delivery system.

In addition, the system supports functions as broad-reaching as export shipment plans and ship and cargo arrangement.

3.2.7 Ship operation adjustment system

This system supports operations ranging from ship assignment plans for domestic transport to actual ship assignment.

Raw material transportation between factories and the transportation of products to customers and nearby transportation bases are mostly carried out by ship. Kawasaki Steel has about 120 vessels for its exclusive use, but double assignments and long-time anchoring occur at shipment and delivery ports and loading rates pose problems. Therefore, this system is structured to increase the efficiency of ship operation.

This system is a conversational one for predicting

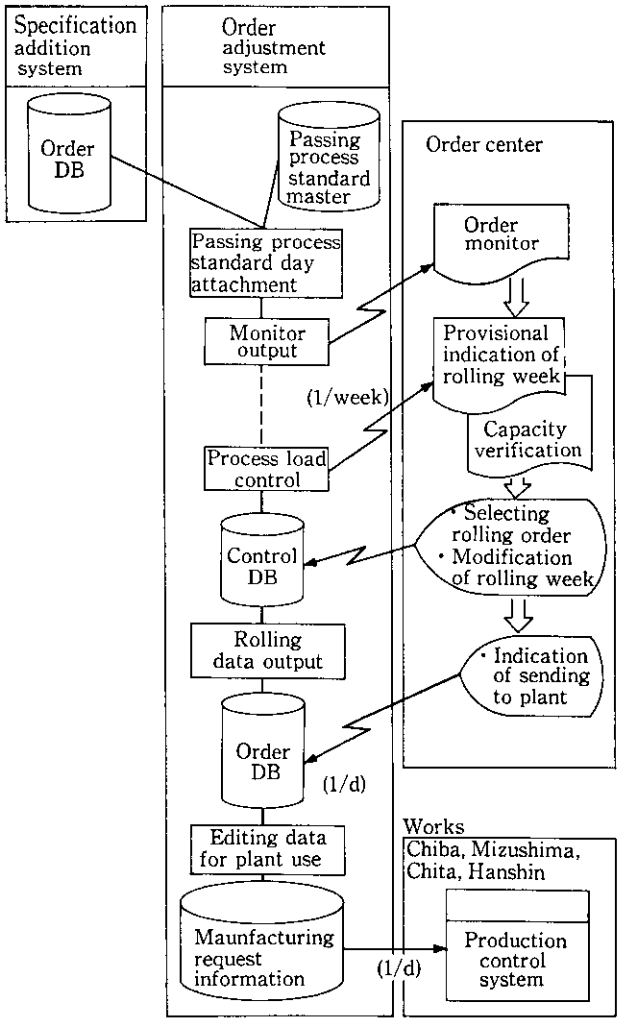

Fig. 4 Order adjustment system

cargo-loading condition on the basis of weekly delivery plans, and formulates ship allocation plans and makes ship assignments in consideration of berth conditions at ports, based on on-line information. Ship assignment information is transmitted, in the form of ship assignment instructions and pre-arrangment instructions, to the works shipping section and to transportation bases. The system outline is shown in **Fig. 5**.

This system is operated at the Ship Assignment Center, which was newly established simultaneously with the start-up of the system.

3.2.8 Transportation base system

Transportation bases have been established at main demand locations with the aim of improving transportation efficiency. Efforts are made to ensure optimum delivery to the consumer, by solving the problems posed by factory-to-user distance and differences in production and delivery lots.

In recent years, delivery conditions have become stricter, as typified by "just-in-time delivery." The

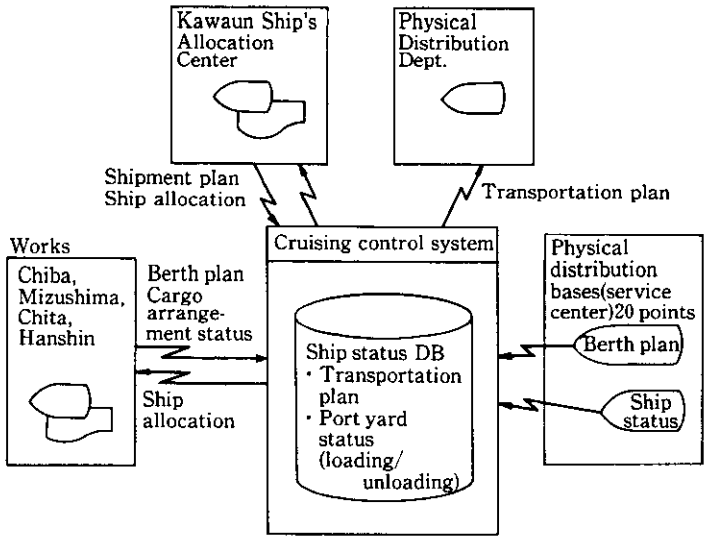

Fig. 5 Cruising control system

structuring of this system recognizes the importance of response to such demands as a significant user service.

This on-line system supports the total transportation base operation, ranging from pre-arrangement based on estimated shipment information from production sites to incoming inventory management, delivery instructions, shipment flow management, inventory control, account calculation, and billing. Terminals are installed at 20 main transportation bases.

Originally planned objectives have been achieved, realizing the standardization of activities at all bases.

3.2.9 Accounts receivable system

This system performs sales and billing processing, accounts receivable management, and bill-collection management on the basis of delivery data and shipment data generated by production units and transportation bases. This is the field in which systematization made the greatest progress in the past, but in this system, computerization of all products and functions and thoroughgoing paperless communications with trading firms have been implemented to achieve drastic labor savings as well as the quick and accurate processing of accounts receivable and bill collection. The content of the system is shown in **Fig. 6**.

3.2.10 Production plan system

Production planning is performed at the Head Office, and means the formulation of optimum production plans (including distribution of orders to production units) in consideration of the balance of orders and the production capacities of the respective facilities. Orders are forwarded from the Sales Department, and production plans are made on a monthly, three-month, and six-month basis.

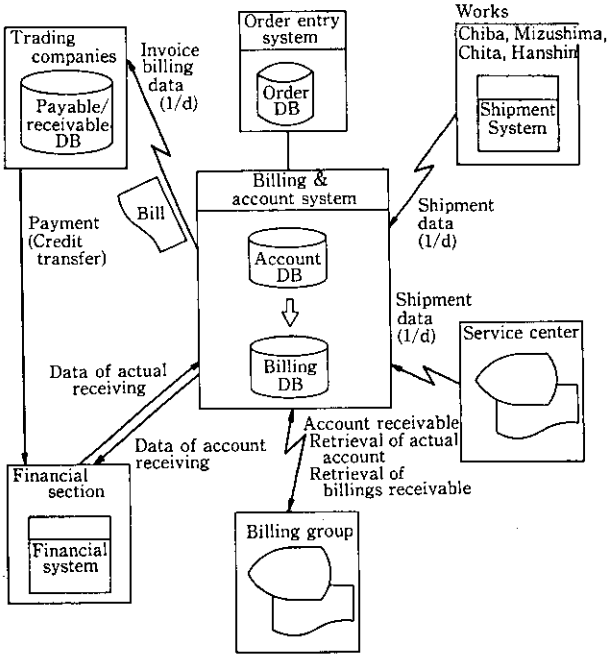

Fig. 6 Billing and account system

The system, as shown in **Fig. 7**, accumulates necessary rolling quantities for the respective major processes by product type in response to orders and balances the necessary rolling quantities and rolling capacities against inventory on hand. The work load on this system is tremendous, because its operation covers a wide variety of control particulars (about 200 items, including yield, production capacity, and inventory) required for calculating rolling quantities and checking consistency. The operation of the system consists of repeating, by trial and error, the process of "total calculation → detailed

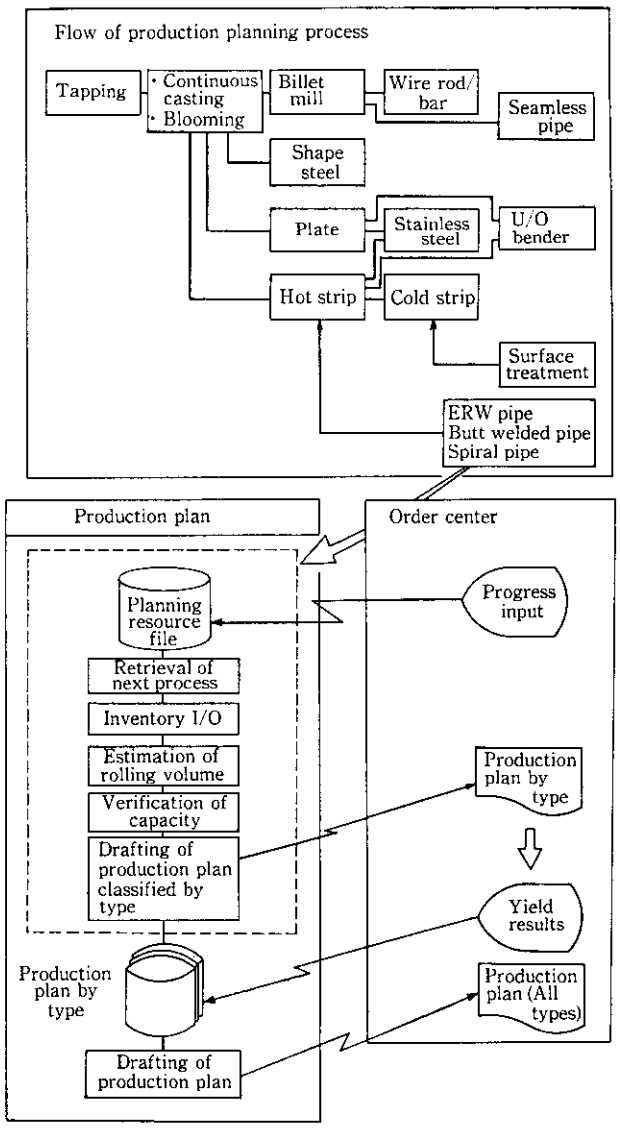

Fig. 7 Production plan system

calculation → adjustment → replanning → readjustment."

This system is a conversational-type simulation system utilizing commercial decision-making support tools, and has realized quick formulation of optimum production plans.

3.2.11 Control and analysis system

This system structures the management data base, using information accumulated in various sub-systems and cost price data, and periodically supplies analysis data necessary for planning and control in various fields. Data is held for at least five years.

The system is operated by the utilizing departments using a simplified language (FOCUS, by Ashisuto Ltd.), but in order to achieve simplification of request registration, freedom of operation execution, secrecy, and effective utilization of computer resources, an operation system called "FRIEND"[4] was devised and is used for support.

3.3 Technical Features of System

Design and technical features of the systems are described below.

3.3.1 Single system covering all product types

In the past, order entry (received order processing, specification addition, and order adjustment) was handled by systems classified by product type, but the KOSMOS II is a single system covering all types of steel. The basic flow ranging from the receipt of orders to manufacturing request information has been standardized in a system skeleton common to all product lines, while processing requirements arising from peculiar product characteristics (for instance, specification additions) are treated as modules and added to the system skeleton. Through adoption of this system construction, a reduction of system scale and a shortening of the development period were achieved. Maintenance productivity has also greatly improved.

3.3.2 Structuring of inter-company and inter-steelworks networks

Aimed at a thoroughgoing adoption of paperless communications and higher efficiency in office work processing, intercompany networks with trading firms were constructed. These are networks between different types of equipment employing, as a communication protocol, the rule of telecommunications protocol of the Federation of Bankers' Associations of Japan. Transmission and processing are possible at any time.

Simultaneously with the start-up of this system, a nation-wide network extending from Sapporo to Fukuoka was constructed, and the company's steelworks and other production sites were linked by SNA (System Network Architecture) and FNA (Fujitsu Network Architecture).

3.3.3 System security

Utilization of this system extends over a wide scope, covering the Sales, Production, and Physical Distribution Departments, as well as affiliated companies and trading companies, making data security a major system problem. System security measures are categorized hierarchically in terms of the physical computer, logical computer, application, data records, and fields. Total security is guaranteed by use of makers' software and application programs.

3.3.4 Backup recovery measures

The quantity of data handled by this system amounts to about 35 GB (using data compress). Since much of the data is contained in data bases which can be accessed by an on-line system 24 hours a day, recov-

ery measures are a major system problem.

As measures against physical destruction of the data base, an early restart has been made possible by the adoption of data-base dump and transition logging. As measures against logic destruction, data-base access and correction utilities have been developed. Thorough execution of job design standards, such as the use of catalog files, has been adopted to cope with the destruction of general files.

3.3.5 Measures to guarantee response time

Since most of the present sub-systems employ on-line processing and the number of conversations per day amounts to 90 000–120 000 cases on average, or 3–5 cases per second. One of the outstanding features of this system is that data length per transaction is very long. For instance, a single received-order item contains about 6 000 digits on average. The number of instances of data-base access is also great, in the case of received-order processing, about 60 times.

In consideration of these facts, the necessities of system operation required a guaranteed maximum external response time of 7 seconds. This target was attained by various measures, such as permanent residence of programs in memory, data base accessing methods, region allotment, and DASD allotment.

4 Conclusions

A Head Office sales, production, and physical distribution system called "KOSMOS II" established at Kawasaki Steel has been described. Earlier systems were restructured and integrated to form KOSMOS II with the aim of improving marketing competitiveness, increasing transportation efficiency, and upgrading the quality of administrative activities. In this system, simultaneous development and operation was achieved, covering the company's entire product line in a single system and ranging from order receipt to product delivery. The company also become the first steelmaker to construct a network which includes trading firms, realizing on-line inter-company information exchange.

After three years of system operation, the company has now expanded the system's functions as planned initially, achieving the originally targetted results.

However, as the sales environment becomes increasingly competitive, many problems remain unsolved, especially from the viewpoint of information processing. For instance, the construction of a network with customers is desirable as is a system structured to unify product distributors, including coil centers and dealers.

The authors would like to express their deep indebtedness to the staff concerned of the steelmakers, trading firms, computer makers, and software houses, who rendered invaluable cooperation in the construction of this system.

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