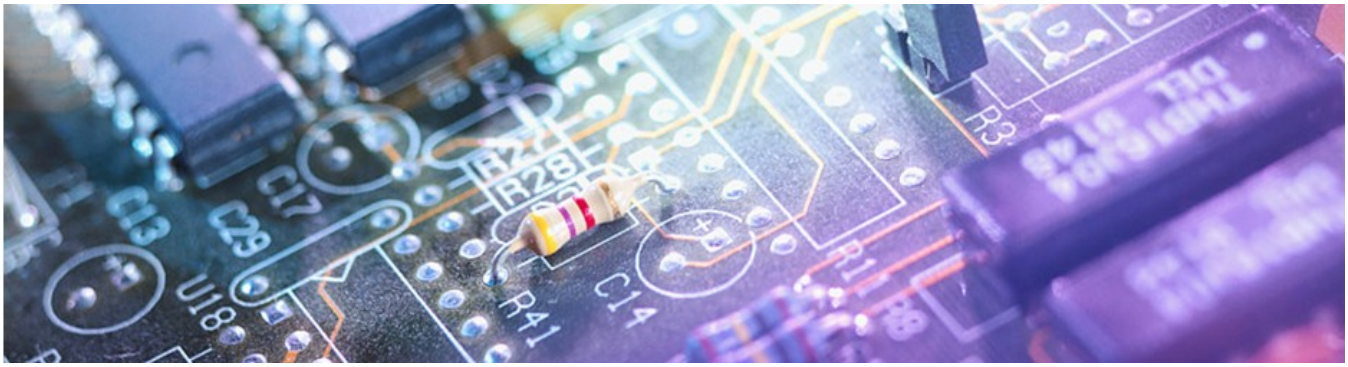
Network Adaptive Production Scheduler

Asprova
Industry Solution

Catalogue with case study reports and samples



High technology

Asprova Corporation
http://www.asprova.com/

The characteristics and problems of High Tech companies

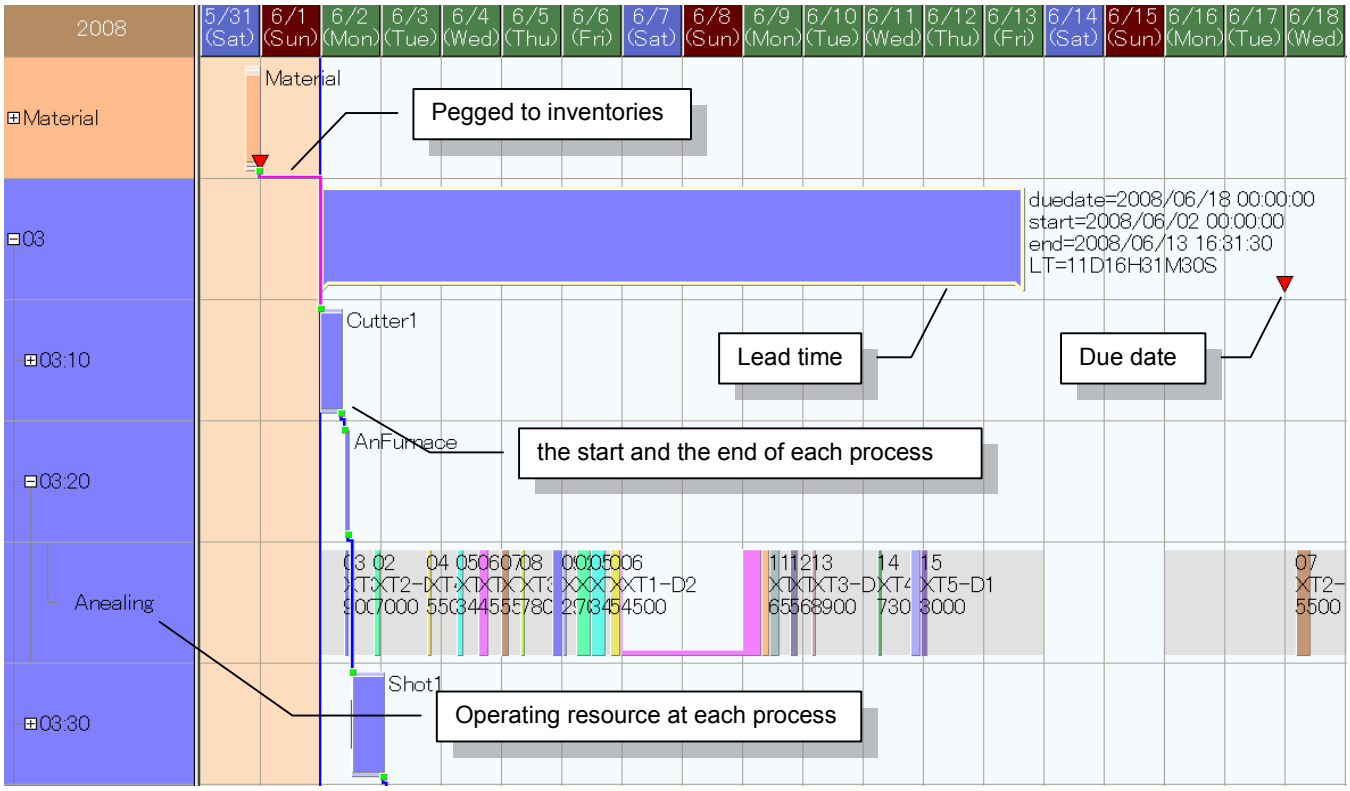
The products diversification, the shortening products' lifecycles, and the volatile demand changes are quite distinct in the high tech industry. Companies in this field are required to develop precise sales and production predictions in order to minimize stock-outs and inventories by calculating MRP and schedules, forecasting the demand based on the information from its market as well as from its sales forces and by demand forecasting software. In actuality, however, the demands can never be calculated correctly because they are affected by tastes and fashion of general street-level consumers, and the high tech companies have to manage the gap between forecast and the actual results. Depending on products, "Vertical startup", in which new plant and equipment run full production volume in order to achieve their planned performance level immediately at the start of production, and "Vertical shutdown" at the end of a product's life are carried out. In this way, even bigger demand changes occur and affect material suppliers, and these suppliers must deal with the situation. This problem, or "bullwhip effect" is fierce even in the global market. Companies must manage the demand changes by minimizing inventories.

To deal with the fierce demand changes, inventory reduction by scheduling with finite capacity must be realized. Visualization of scheduling results and progress in each process is very important.

Asprova's high speed production schedulers which enable "visualization" of schedules have served our clients' needs. The following is the introduction of Asprova's solution.

Finding the due date by schedulers with finite capacity

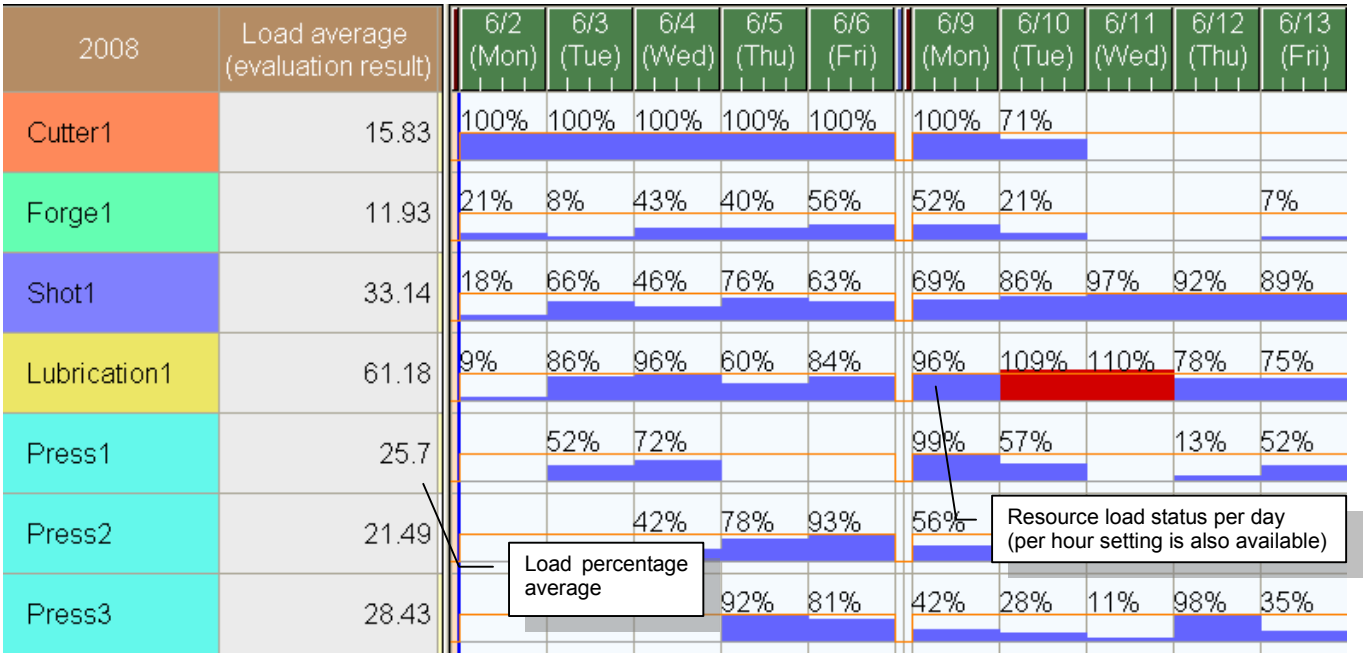
Schedulers with finite capacity make production plans which can be directly used as work instructions. Schedulers can manage urgent orders and due date changes, allocating inventories.



◆ Order Gantt Chart: enables checking of overdue orders, wait times of each process, inventory allocation. The Order Gantt Chart's standard feature includes a Resource Gantt Chart, an Instruction Gantt Chart, an item Gantt Chart, overdue flags. The Order Gantt Chart is easily operated with the mouse.

Efficient load adjustment

Asprova is capable of efficient load allocation to multiple production lines. Asprova also manages to take into account facility investment simulations and manpower employment planning. Shift changes per facility or worker are easily operated with the mouse.



◆ Load graph: current load status is recognizable in one view. Displayed periods, displayed resources, and text display are customizable at your will. In addition, inventory graphs and leading time graphs are included as a standard feature.

Skill map to manage workers capacity

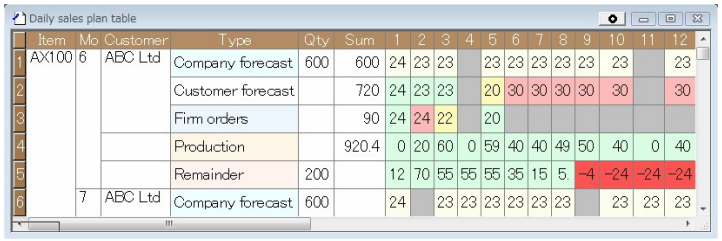
The "Skill map", a table to set up process skill of employees, is provided as a standard feature. It enables managing of employees' capacity, ability/inability and processing speed, separate to integrated master tables such as the BOM(Bill of Materials) and resource capacities.

	Resource code	Resource name	Recieve	Inspect 1	Cut 1	Treat 1	Cut 2	Forge	Die	Fix 1	Join	Fix 2	Treat 2	Adjust	Inspect 2	Deliver
1	0001489	Smith	○				○	○	○		○					
2	0001857	Johnson	○				○	○	○		○				○	
3	0001899	Williams														
4	0001945	Jones	○	○	○											○
5	0101938	Brown				○				○	○	○				
6	0101959	Davis											○	○		
7	0102848	Miller				○				○	○	○				
8	0102859	Wilson														○
9	0102933	Moore				○				○	○	○				

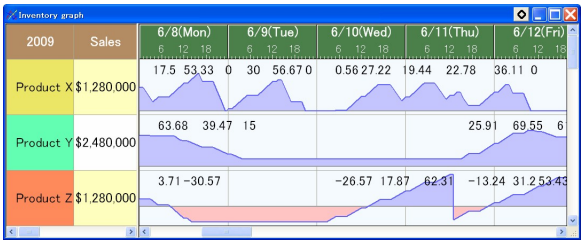
◆ Up to 999 skill types can be added. Displays and input means are also easily customized.

Production Scheduling pegged to inventories and order information

Registering orders not only per production unit/lot but also per sales order unit/lot is possible. Production schedules planning, eliminating unnecessary inventory, can be made while taking into account safety inventories.



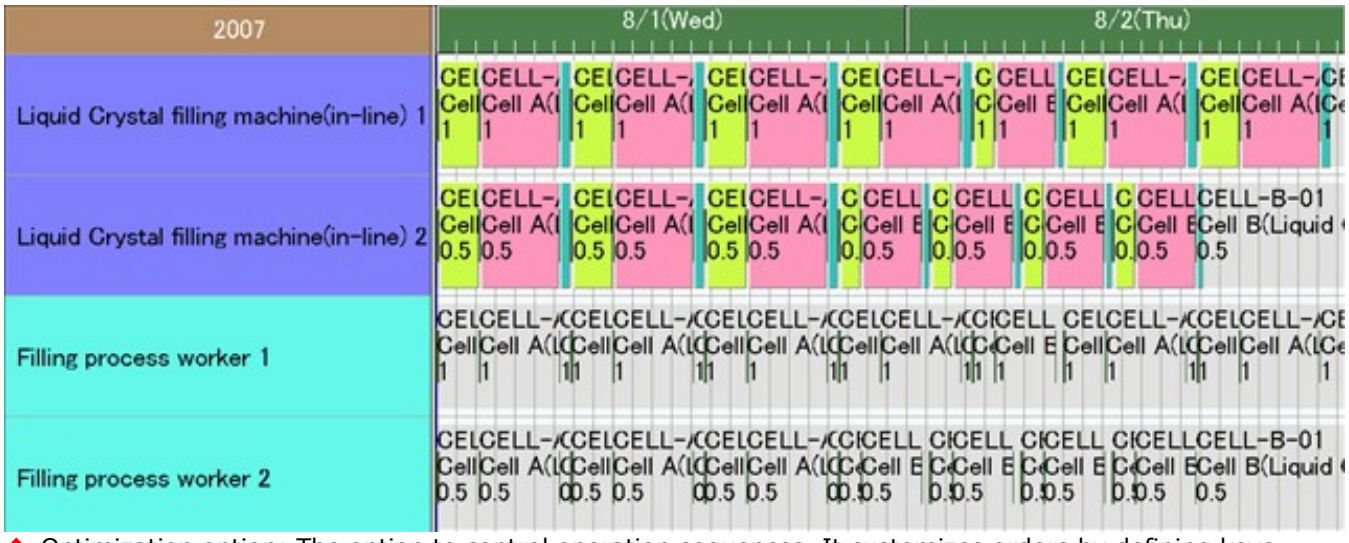
◆ Sales plan table: The information on orders for a certain period can be registered with the accuracy of company forecast, sales forecast, customer forecast, and confirmed orders.
∗Sales order option is required.



◆ Inventory graph: inventory changes and material requirement can be calculated at one view. In addition, production graphs and consumption graphs are available. Calculation functionality for each term is also included.

Operation sequence control with strict delivery dates

Asprova is adaptive to automated processes operated by complicated machinery. Optimization options, which control operation sequences as keeping delivery dates, are effective.

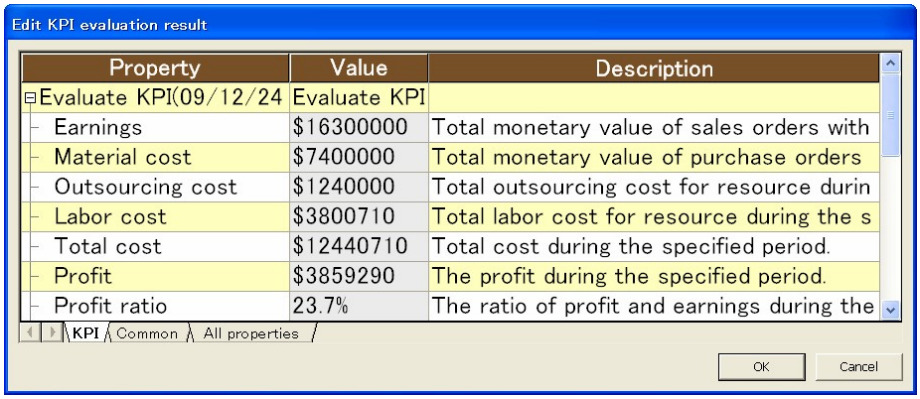


◆ Optimization option: The option to control operation sequences. It customizes orders by defining keys.

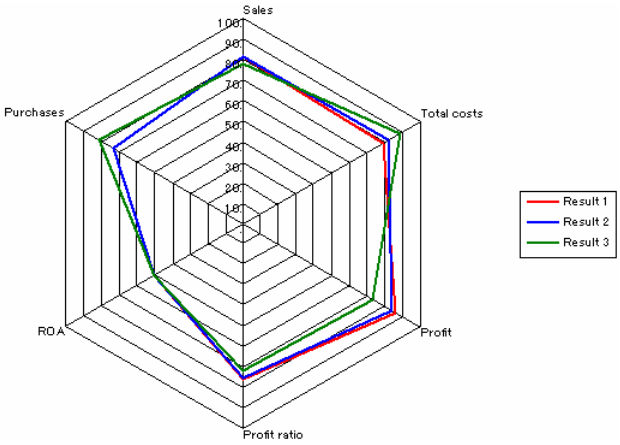
Evaluation of the result of scheduling and simulation by KPI

Key Performance Index ("KPI") including sales, profits, profit rates, the material cost can be calculated by cost per item and working cost per resource. Calculation formulae can be freely customized. Also, standard cost breakdown can be calculated. It can be used to verify the result of facility investment simulation as well.

∗ KPI option is required



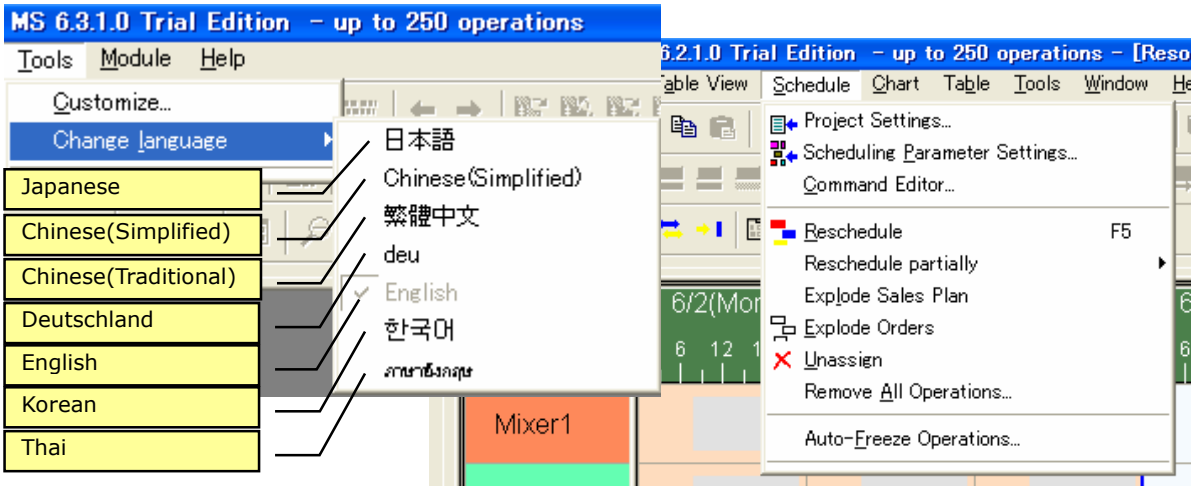
◆ KPI(Key Performance Index): KPI can evaluate the calculation result and keep records.



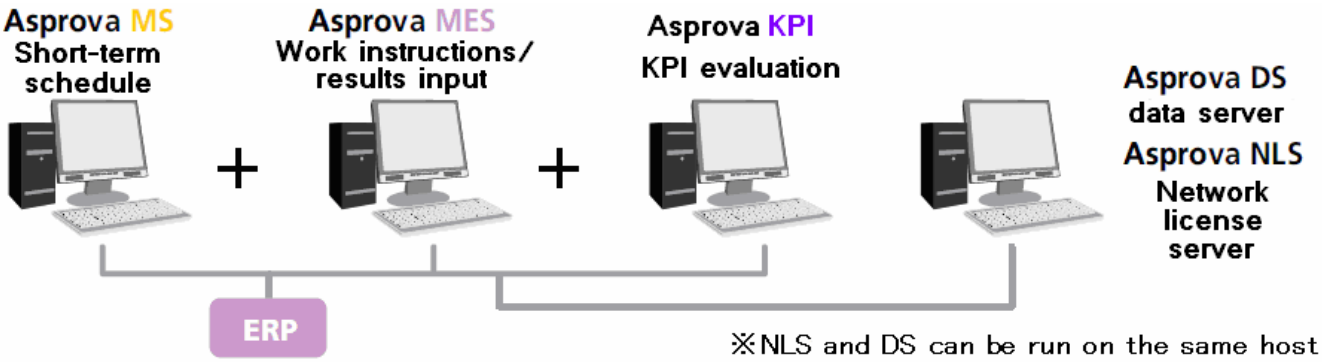
◆ KPI radar chart: KPI radar chart enables comparison of the simulation result by radar chart. (with HTML View)

Adaptable to global network

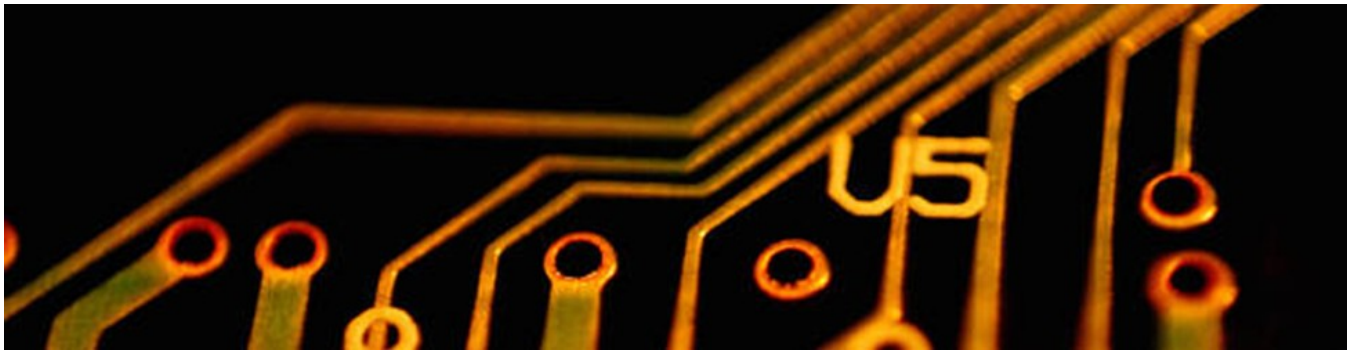
Asprova is available in Japanese, English, Chinese (Simplified Chinese and Traditional Chinese), Korean, German, Spanish, Portuguese, and Thai. Using the same package enables very close co-operation and understanding between different plants.



◆ Adaptable to Multi-languages: Displayed languages can be changed during running.



◆ Adaptable to Network: production scheduling is shared through the network.



Introduction to the case studies

To read our latest case study, please go to

http://www.asprova.com/em/case/index.html

Mitsubishi Electric Corporation
Founded: January 15, 1921
Capital: 175,820 million yen
Annual turnover: 3,604,185 million yen
Number of employees: 99,444

Nagoya Plant

Production of: heavy electric machinery systems, industrial mechatronics, information and telecommunications systems, electronic devices, manufacturing and sales of home electric appliances, etc.

URL: http://www.mitsubishielectric.co.jp

Shortening Scheduling Time and Reducing Implementation Overheads with Asprova

Mitsubishi Electric Corporation's Nagoya Plant manufactures equipment related to Factory Automation (hereafter referred to as FA), and holds a workforce of about 5,000 employees. This plant manufactures a diverse range of products including electrical discharge machines, laser processing machines, sequencers, programmable indicators, inverters, servo machinery, NC equipment, and industrial robots.

The plant which manufactures electrical discharge processing machines is a model plant for the Mitsubishi Electric Corporation advocated FA integrated solution "e-F@ctory". The introduction of this e-F@ctory took place in 2001 when the plant facilities were refurbished. At that time, Asprova was adopted as a production scheduler. Yoshihiro Kato, Manager of the Electrical Discharge Machine Tool Department, Mechatronics Machine Tool Division, comments on the issues prior to the introduction of Asprova, the reasons why Asprova was adopted, and the effects on its introduction.

"Scheduling took up to 5-10 minutes with the old in-house developed scheduler"

For electrical discharge processing machines processed at this plant, the number of processing parts per machine is about 8 parts. Asprova schedules the manufacturing processes that are divided up into about 1,300 orders every monthly. For these operations, use of Asprova allows optimization of the operational planning taking into account the set up work such as the tool replacement of the machining centers, etc.

Yoshihiro Kato
Electrical discharge Machine Tool Department Manager,
Mechatronics Machine Tool Division

Although we have developed our own in-house scheduler in the past, it required a great deal of troublesome work in establishing a system. In addition, scheduling took a long time when it is put in actual use. In order to solve such problems, we considered the introduction of the packaged solution Asprova.

Introduction of Asprova coincided with FA system refurbishment

The "e-F@ctory" is a solution based on the concept of utilizing computerized technology to allow visualization of the plant status, and aims at improving productivity at the shop floor. On-site information such as production results, operational results, and quality information from facilities and equipment is streamed in on a real time basis. This information system is used to support improvements in quality, construction schedule and productivity. Mitsubishi Electric Corporation cooperates with a number of partners and provides access to e-F@ctory to the plants of our user companies. The electrical discharge processing machine plant of Nagoya Works is known as a model plant w here this e-F@ctory has been introduced. Given these circumstances, we are continually receiving requests to visit the plant and study our implementation.

This plant manufactures electrical discharge processing machines, which literally grind down metal materials through the utilization of the "electrical discharge" phenomenon and are commonly use in producing dies and moulds. The Nagoya plant manufactures both "wire-type electrical discharge processing machines" which employ a wire with the thickness of a hair at their processing electrode and "shaped electrical discharge process machines", which employ an electrode that fits the shape of the product.

Asprova is used on the production line which processes parts such as the columns and beds that compose the bulk of electrical discharge processing machines. This production line consists of automated warehouse where materials are stored, unmanned transport vehicles that transport parts, two horizontal machining centers and one "5 face processing machine."

The 4 types of processing treatments - milling, end mill, boring, tapping - are carried out while the product is kept in a fixed position. In this situation, no processing can be undertaken on the side which is currently clamped down. Following the completion of the first processing, the remaining processing is undertaken after turning the product over.

As stated earlier, the said plant renovated the plant facilities and equipment in 2001. The introduction of Asprova for line scheduling was carried out at the same time as the e-F@ctory changes were made.

Asprova APS

Points highly rated by Mitsubishi Electric Corporation :
- Scheduling time reduction
- Implemenation schedule reduced by about 80%

The aforementioned production control system manages the overall production planning for electrical discharge processing machines. After taking into account the receiving orders status, it also determines the number of units to be manufactured monthly, and prepares a “rough schedule” plan that extends until the point of shipping. The manufacturing period per machine is set up for three to four days, based on which the instructions are to be given on both starting date and completion date.

Asprova first excludes the machines that need to be outsourced, and then sets up the schedules for both starting date and completion date. Then the required parts will be calculated, along with the manufacturing processes necessary. After that, those results will be assigned to the processing machine.

Scheduling by Asprova is run both once a month and once a week. Yoshihiro Kato comments on the timing of scheduling.

“Scheduling is done once a month in order to make the detailed planning for manufacturing processes based on the rough schedule planning. Electrical Discharge Processing Machines are produced by so-called “lot-based production”. After their production planning is set up once a month, it normally remains unchanged.

Scheduling is then done once a week on Saturday in order to make changes on the type of operations, based on the busyness of input work. Employees normally work at the plant on Monday through Friday either on a 2 shift system or with a daytime work plus overtime system. The shift type for the coming week is decided on Saturday. This is where the weekly Asprova schedule is applied.”

Prior to the introduction of Asprova, the plant depended on the in-house developed COBOL language based system to carry out this kind of scheduling. Around that time, each scheduling took up to 5 to 10 minutes at a time.

“Back then, the scheduling was not undertaken for the whole month but was done on the case-by-case basis. That is to say, the orders were first sequenced up based on their due dates. After a certain order was dealt with, the remaining ones that were in need of scheduling were carried out one-by-one, with consideration given to their priority and whether the necessary parts were actually available at the time. However, such scheduling took 5 to 10 minutes at a time.” says Mr. Kato.

In addition, the facilities and equipment that had been in place before 2001 were introduced at the plant in 1982. The aforementioned COBOL based scheduling system was also established at that time. It was estimated that that it would be necessary for 24 senior engineers to spend about 1 year in order to re-establish a similar system, including software and peripheral interface portions.

“Asprova not only shortened scheduling time down to 1-2 seconds but also reduced our implementation schedule by about 80%”

“After the introduction of e-F@ctory, there were times when we utilized the new information system. At that time, we were considering using package software which would allow for faster scheduling and require neither an extra introduction lead time nor an introduction cost,” says Mr. Kato. In response to these needs, Asprova was introduced.

“We started the project after the introduction of e-F@ctory. Around that time, we began studying schedulers and the first information we received was about Asprova. So we made a thorough investigation on this product, and learned that our plant in Nakatsugawa had already purchased 8 packages of Asprova. To find out more about it, we went there and heard that they hadn’t purchased all of them at once but instead had gradually increased the extent to which Asprova was applied. With these repeat purchases of Asprova indicating that our sister plant had found the package very beneficial, we attended Asprova seminars and were also convinced that this product could be of great use.”

Scheduling speed was the foremost point considered when evaluating Asprova. “The scheduling speed of Asprova is really fast. It produces results within 1 or 2 seconds,” says Mr. Kato.

By replacing our in-house developed scheduler with Asprova, “our implementation schedule has been reduced by 80%” says Mr. Kato. Asprova has not only improved the scheduling time a great deal but also drastically shortened the implementation overhead.

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Mitsubishi Heavy Industries, Ltd.

Main office address : 2-16-5 Konan, Minato-ku, Tokyo
3-3-1 Minato-mirai, Nishi-ku, Yokohama
Established : November 1, 1950
Capitalization : 265.6 billion (as of March 31, 2008)
Annual sales : (Consolidated) 3.203 trillion (April 1, 2007 to March 31, 2008) Mitsubishi Heavy Industries Ltd (MHI)
Nagoya Guidance and Propulsion Systems production at 160.9 billion (April 1, 2007 to March 31, 2008)
Number of employees : 33,089 (as of March 31, 2008)
At Nagoya Guidance and Propulsion Systems : 1,810 (as of April 1, 2007)
Business areas : Development, production and sale of products for energy, aeronautics and aerospace
Nagoya Guidance and Propulsion Systems : Development, production and repair of air body components, aircraft and aerospace engines, controllers
URL : http://www.mhi.co.jp

MHI installed Asprova to automate scheduling work and, with the addition of the Sales option, found it very effective in making production planning more uniform.

The Nagoya Guidance and Propulsion Systems (NGPS) of Mitsubishi Heavy Industries (MHI) Ltd., was founded in 1920 as the Nagoya Plant of Mitsubishi Internal Combustion Engine Manufacturing Co. Ltd. (*Mitsubishi Nainenki Seizo KK*). It started as an aircraft division with the manufacture and repair of aircraft and aircraft engines. Since then MHI has participated in a wide variety of aircraft and aerospace development and in the launching of rockets. At the present time, more than half of its production goes into related products such as aircraft guidance systems.
In 2003, NGPS installed Asprova to get greater efficiency out of the planning they had been doing manually up to that time. In 2007, they added the Sales option to obtain more uniform production planning. Kazuhiro Yoshino, manager of the Production-engineering Department at NGPS Works told us about the background for Asprova installation, the efficiencies gained through installation and the future outlook for the program.

We installed Asprova to achieve greater precision in automating our scheduling work

The subject for today's installation of Asprova installation is the production line that builds a device known as a disk, a component that is part of the structure of aircraft engines used in private aircraft and is used to convert the force of combusting gases within the engine into dynamic power. The flow of production is one in which NGPS produces a wide variety of parts that include these disks and supplies them to the engine manufacturers. The engine maker assembles those parts into final form and ships the engine to the airline company.
Since 2003, NGPS has been working on increasing the efficiency of scheduling, which until then was done by hand. At that time, manual scheduling often required a complete reworking of the schedule, which led to a constant problem of delayed operations. Then, when the revisions were complete, they would find that the very situation for which the revisions had been made was completely different preventing them from making accurate forecasts of completion.That was the situation that led to NGPS's decision to install Asprova.They also wanted to lighten the operational load and make schedules that were much more precise. Kazuhiro Yoshino, manager of the Manufacturing Department's Production Engineering Section gave the reasons that they selected Asprova.
"The first reason for our selection was the large number of parameters that we, the user, could assign for ourselves. I'm sure that this is the case at any plant, but there are particular conditions and requirements here that are unique to us. Asprova's flexibility really fills the bill in that regard."
We tried a lot of other schedulers, and almost all of them support the production lines that are part of the assembly system, but we judged that Asprova was the one product that best took care of the main lines in our process system. (Yoshino).
We placed the focus for the installation of Asprova on our disk production line, and the reason for placing there was that the equipment is fixed, the line is limited, and a decrease in the number of items will hold down and variable factors. In short, the flow of disk manufacturing goes through cutting material→grooving→drilling holes →rounding→aperture polishing→inspection--a total of about 15 processes including detailed items.

■Comments from the customer

Kazuhiro Yoshino
Manager,
Production-engineering Department,
Manufacturing Division of NGPS Works,
Mitsubishi Heavy Industries, Ltd.

Our initial intention in installing Asprova was to automate the scheduling of work, but we were unable to fit in maintenance of master data and that did not lead to the result we had hoped for. However, a smaller core system, and the arrival of the Asprova Sales option gave greater incentive to use Asprova to the utmost extent that we could. We have now broadened the ways in which the system is used and that includes leveling our production planning. Asprova uses opportunities gained through releasing the order-receive option to smooth out production planning

■Points on which Asprova was highly praised

- Automates scheduling operations that had been done by hand led to greater efficiencies.
- Makes production planning more uniform
- More precise production plans

After installing Asprova, work conditions required that NGPS reach an operational level at which it would have sufficient forward motion. But that led to snags caused primarily by the human element. As Mr. Yoshino tells it, those snags arose from the enormous time and effort required by employees to assemble and collate data.
"Our core system at that time was centered on a host computer, and its data was incorporated automatically into Asprova, but the work of creating master data was quite difficult. We dealt with the problem by getting the data through batch processing and then manually, but there were limits to what we could do. Asprova would conduct master maintenance and our people who were in charge of the system would have to learn how to operate it. But that created a situation in which they were the only people who knew how to run it. The everyday work was what got the highest priority and maintenance was frequently neglected. We were not doing very well in our use of the new system."
We broke through that bottleneck in 2006 when Asprova encouraged us to replace that core system with a more downsized system. That again placed the spotlight on Asprova. It was very easy for us to incorporate the master data and the progress data in Asprova through linkage between servers.
And under this timing for moving to a smaller system, Asprova released the "Sales option" that pegged and linked production planning within the factory to Sales data. This is another of the factors further spurring on our active use of Asprova.
"I was one of those working in the production planning department and we wanted to make our planning more uniform. We build a predetermined number of engine frames annually, and we can manufacture new items on an ordered production basis. However, we also repair components and overhaul engines. The replacement parts that we need for those jobs and the number of orders we have for them can fluctuate wildly depending on what the situation is with the airline companies so we really need to have forecasts on production. That was another of the reasons we thought we would be able to make good use of Asprova for setting up production planning." (Yoshino)
This is why Sales data had to be incorporated in Asprova and linked to draft planning operations, something that was made possible with the release of the Sales option.
"The time at which our core system was reduced in size and the time when the Sales option was released coincided very well. We were able to solve the problems previous to that in operations with Asprova and at the same time achieved the new goal of making production planning more uniform," says Mr. Yoshino

Developed a user interface for easier operation, one that takes into consideration ease of use at the plant site

Replacement of the core system was completed in February 2007, and the adjustments made in Asprova, with its object as the disk production line, were finished in June 2007. NGPS then embarked on the development of an interface that would improve Asprova operability. Yoshino explained to us what was behind that move:
"We had a problem with the direct viewing of Asprova during actual operations. To use Asprova, one has to be trained in its operation and that provided to be quite an additional load for people on the floor. Any situation where only designated persons are able to operate equipment is something to be avoided. So a new user interface was developed that allowed anyone to use the Asprova."
The easiest way to operate for people on site is to not have them directly manipulate Asprova but to enter conditions, click on a button and generate a schedule automatically. We developed the interface for that purpose, and it was completed at the end of 2007.

Installing the Sales option gave faster speeds and greater precision to production planning

NGPS started installing the Sales option at the end of November 2007, completed installation in about one month and then took two or three months to tune it before putting it into online operation. That made it possible to draft a production plan from order data, all the while taking safe inventory into consideration.
"Now, for example, we assign quantities in inventory and everyone knows exactly what that data is. Before, we had to go directly to the people in charge and ask them. Now, management people can look at the data and debate the adjustments needed in production planning. Another thing is that we can accurately measure the number of lots for each part that flows buy in whatever number of units, one or two, and that greatly enhances the precision of production planning. Each supervisor reviews the various details of the operation, and if, at that time, they find any factors responsible for fluctuations, those factors are be organized together and the work rescheduled. We must repeat the detailed approach toward work on site that is the Asprova parameter known as conditional assignment, otherwise we won't get results like those shown in the image. This is an operation that cannot be avoided if you intend to get the best use out of Asprova," says Yoshino
NGSP reexamines its production planning in three month units, but the use of the installed Sales option, has allowed operations that once took a total of one week to accomplish are now be done in one or two days.
When different parts enter the same process or when there is a conflict between equipment in the production process, each employee in charge must get together and work on a solution. However, that was not getting done well enough. Yoshino says, "The plans were getting made, but there were scheduling problems that made them difficult to execute. "Creating a production plan that took everything, even equipment planning, into account, solved these problems.
"At the present time, we are devising a production plan using Asprova once every two weeks. Then we make manual adjustments of the created plan every week. Ideally we would like to run Asprova every day to make adjustments in the schedule but we have a pretty firmly established tradition of handing out work instructions to the work floor that are written on paper and we just can't change that too quickly. We are going to start taking more time to set up and transmit daily instructions electronically. If we do that we will also be raising the frequency with which we operate Asprova.
"In the future, we are going to have more automatic understanding of performance and by building a structure that will reflect more on Asprova we will further raise the level of precision in Asprova production planning."

Asprova Corporation

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ASPROVA
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SCHEDULING SYSTEM FOR SEMICONDUCTOR MANUFACTURING

Casio Micronics Co., Ltd.

February 15, 2007

- **Company Overview**
- **Characteristics of the system**
- **Background of and effects brought by introduction of the system**

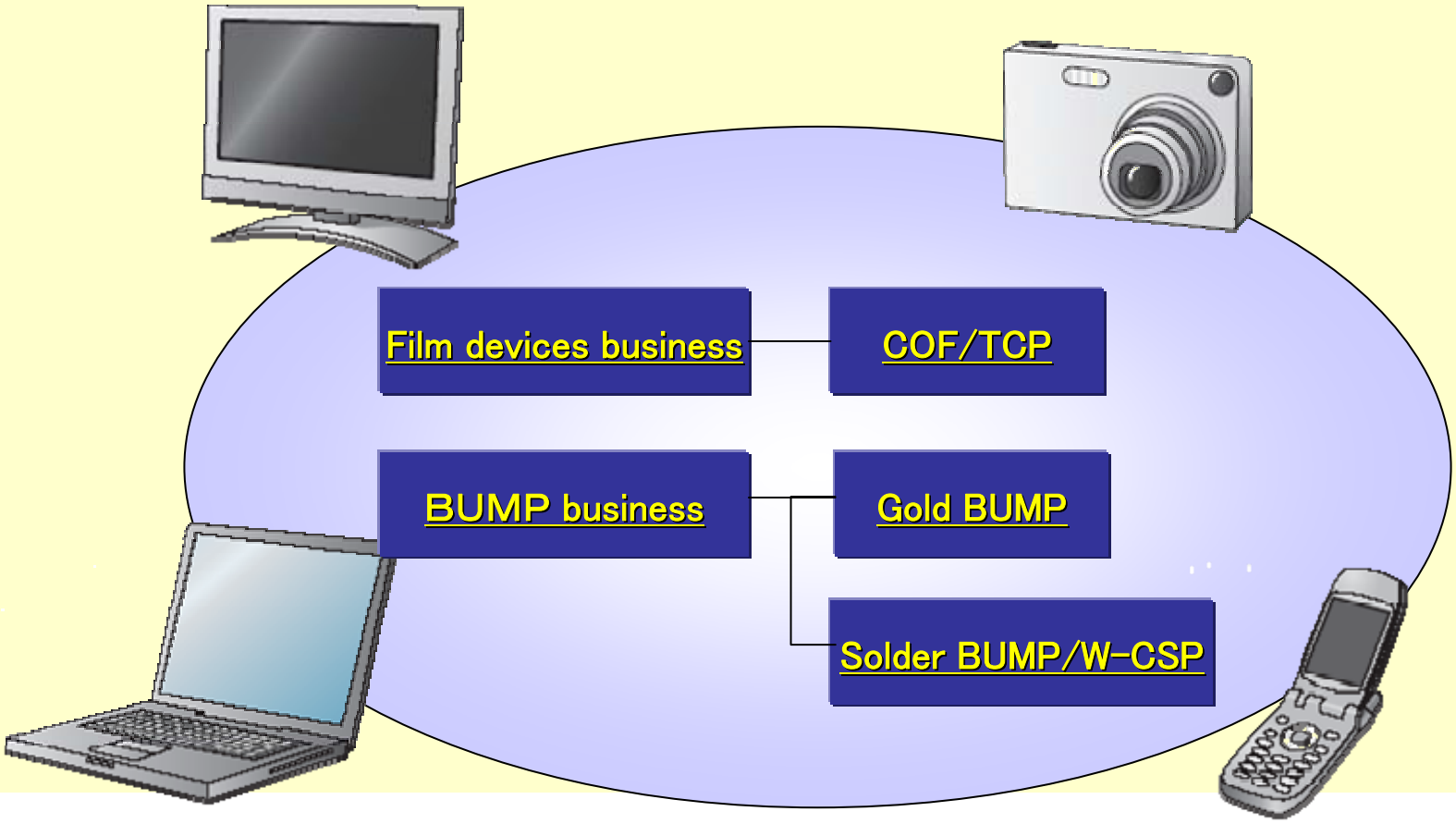
1. **Outline of implementation**
   - **System overview**
   - **Implementation schedule**
   - **Introduction cost**
2. **Explanation of scheduling system**
3. **About periphery systems**
4. **System issues**
5. **Wrap up**

OUTLINE OF COMPANY

Founded:	**July 25, 1987**
Lines of business:	**BUMP Business** **Film Devices Business**
Production base:	**Ohme Works（No. 1 & No. 2 plants）** **Yamanashi Works（No. 1 & No. 2 plants）**
Capital:	**2,992 Million yen (as of March 31, 2006)**
Turnover:	**25.1 billion yen (March 2006)**
No. of employees:	**630 (March 2006)**
Stock exchange:	**JASDAQ**
Securities code:	**6760**
Newspaper listing name:	**C Micro**
Newspaper listing column:	**J stock**

OUTLINES OF BUSINESS

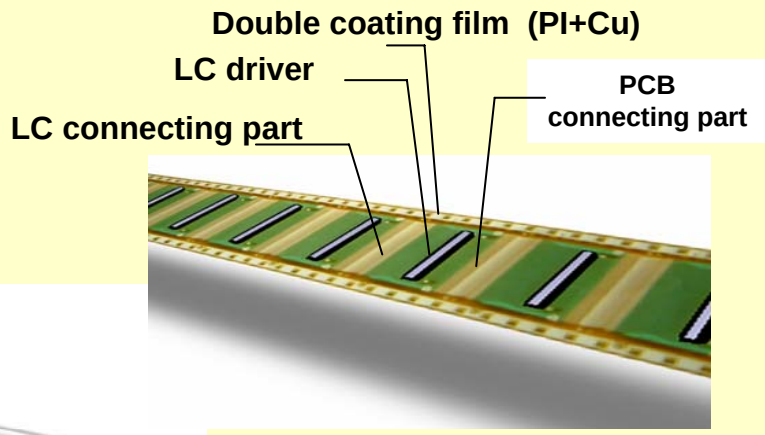
CONSTANTLY UPHOLDS THE INNOVATION OF
DIGITAL EQUIPMENT WITH MICRO METER BASED UNIQUE
AND REVOLUTIONARY TECHNOLOGIES

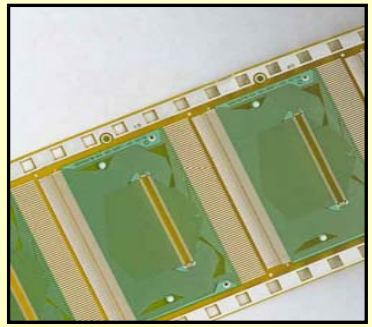


FILM DEVICES BUSINESS

Used in large screen thin type PCs/LCD televisions for low cost

〈 COF structure 〉

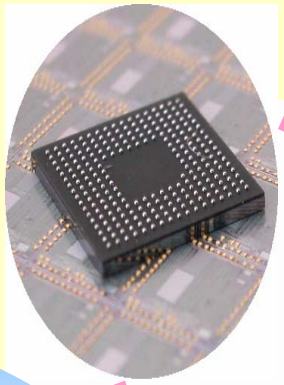




PI : polyimide
Cu : copper

BUMP BUSINESS

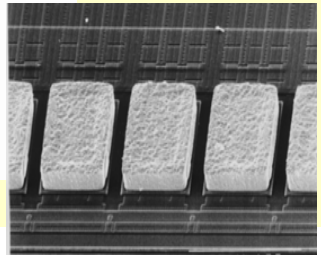
《 SOLDER BUMP/W-CSP 》



Weight saving for
multifunction mobile information
terminal equipment

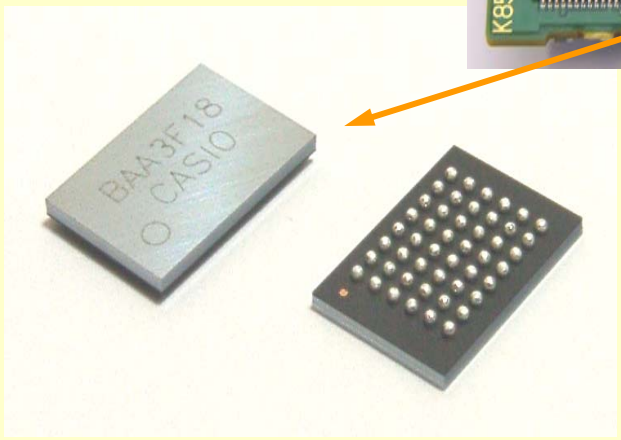
《 GOLD BUMP 》

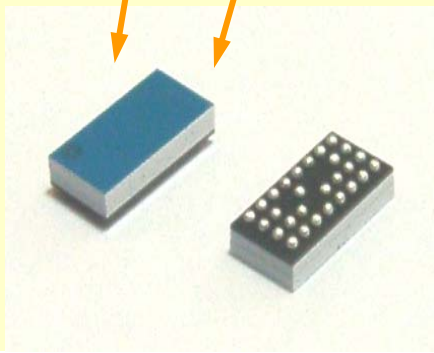
Constantly evolving
high definition
color LC display



W-CSP APPLICATION EXAMPLES

Example of use (digital camera)





PRODUCT CHARACTERISTICS

W-CSP: items handled by the scheduling system

（1） Wafer inch size
5Φ、6Φ、8Φ、(12Φ)

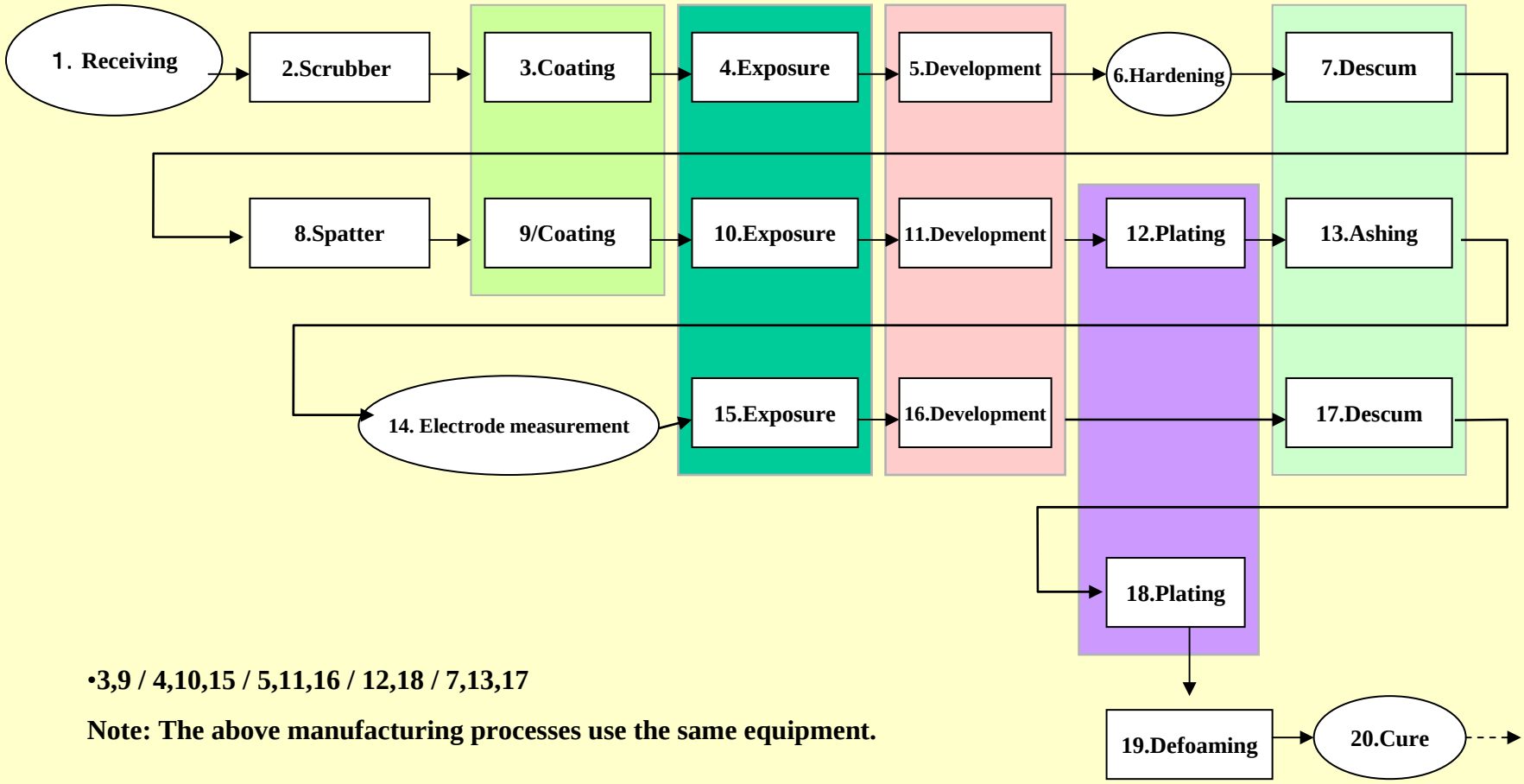
（2） No. of models **About 100/month**

（3） Lot size
Mass production 25 sheets(1～25 sheets)
Proto type 1 sheet ～ 10 sheets

（4） No. of processes **Min. 9 ～ Max. 67**

（5） Lead time **Prototype 4 days ～ 14 days**
Mass production 7 days ～ 10 days

CHARACTERISTICS OF MANUFACTURING PROCESSES



•3,9 / 4,10,15 / 5,11,16 / 12,18 / 7,13,17

Note: The above manufacturing processes use the same equipment.

BACKGROUND INTRODUCTION

1. **Intends to bring W-CSP business to our 3rd pillar of operation, which started full-scale mass production in 2004, and to attain the number one share in the world.**
2. **As this was a new package, it generated a number of sales order alterations in proportion to the increases in sales orders. Also, the percentage of its prototype was high. It was thus predicted that the definite scheduling adjustments would not be carried out manually.**
3. **This didn't mean that we had to depend on an expensive package specially designed for semi-conductor processing. Nonetheless, we didn't have enough time to prepare in-house developed scheduling software.**
4. **Our group company has introduced SMT based scheduler in the past. We were thus not worried about its validity.**

EFFECTIVENESS OF INTRODUCTION

1. **The company is not managed in a wait-and-see style but a mind-set for preparing planning is now permeating.**

2. **Productivity enhancement judging by results of the operation improvements as well as the information processing improvements.**

   - Production productivity per person
   Enhanced by 43%
   - Operational time in preparing planning
   Shortened to 1/6

3. **The manufacturing lead time was shortened.**
   - Lead time **Shortened by 20%**
   - Unevenness of lead time **Reduced by 30%**

1.1 SYSTEM OVERVIEW

SCHEDULING SYSTEM

HOST I/F, SCHEDULING, SETUP, WORK INSTRUCTIONS SHEET

ENVIRONMENTAL IMPROVEMENTS FOR THE OPERATION OF SCHEDULING SYSTEM

MASTER IMPROVEMENT

→ **RESOURCE MASTER REGISTRATION AS/400 MASTER MAINTENANCE**

- RESOUCE MASTER
- PROCESS MASTER

IMMEDIACY OF ACTUAL DATA RESULTS AND IMPROVING THEIR ACCURACY
PREVENTIONF OF INPUT MISTAKES

→ **ACTUAL RESULTS ARE INPUT (BARCODE IS INPUT) BY WIRELESS HANDY TERMINAL**

RECOGNIZING ORDER NO. (BARCODE) WHEN INPUTTING ACTUAL RESULTS

→ **ID LABEL ISSUE**

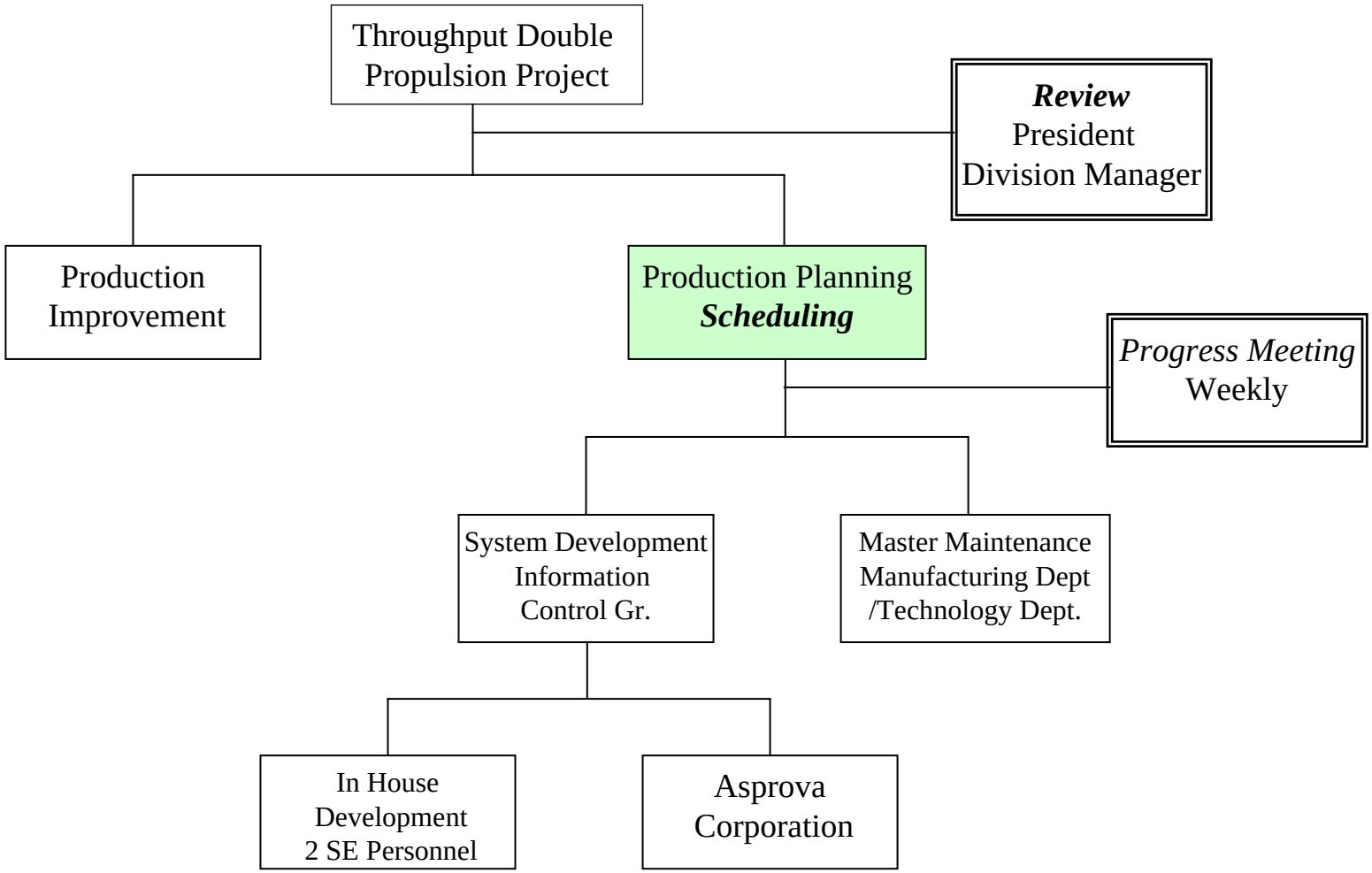
PREVENTION OF RECIPE INPUTTING TROUBLE

→ **RECIPE MANAGEMENT SYSTEM**

ESTABLISHING SUB-SYSTEM

PERIPHERY SYSTEM

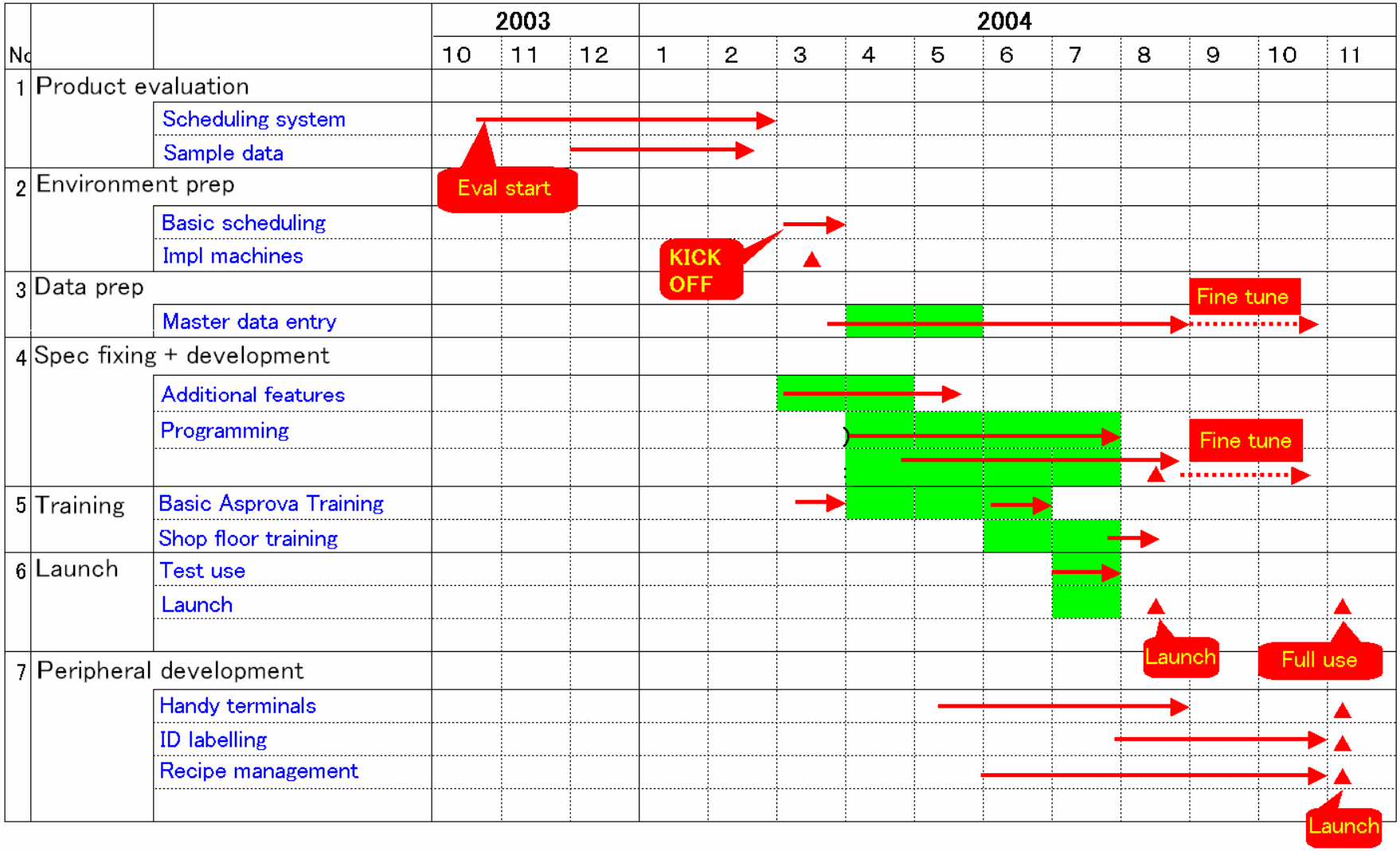
1.2 IMPLEMENTATION STRUCTURE



1.3 IMPLEMENTATION SCHEDULE

Plan

ASPROVA Implementation Plan (and results)



1.4 INTRODUCTION COST (REFERENCE)

■ASPROVA: License (option available）

For planning and executing main unit(server) 1 set

For shop floor 1 set

Maintenance fee

■ I/F Development: Incorporating data from AS/400

Actual results, master(manufacturing process, equipment), order

■ Consultation: For 6 months（about 10 times）

■ Introduction Equipment: ASPROVA operating PC 2 sets

Total **About 15,000,000 yen**

(Scheduling system only)

2. EXPLANATION OF SCHEDULING SYSTEM

2.1 Information Referenced Diagram

2.2 Master Registration

2.3 Order Input

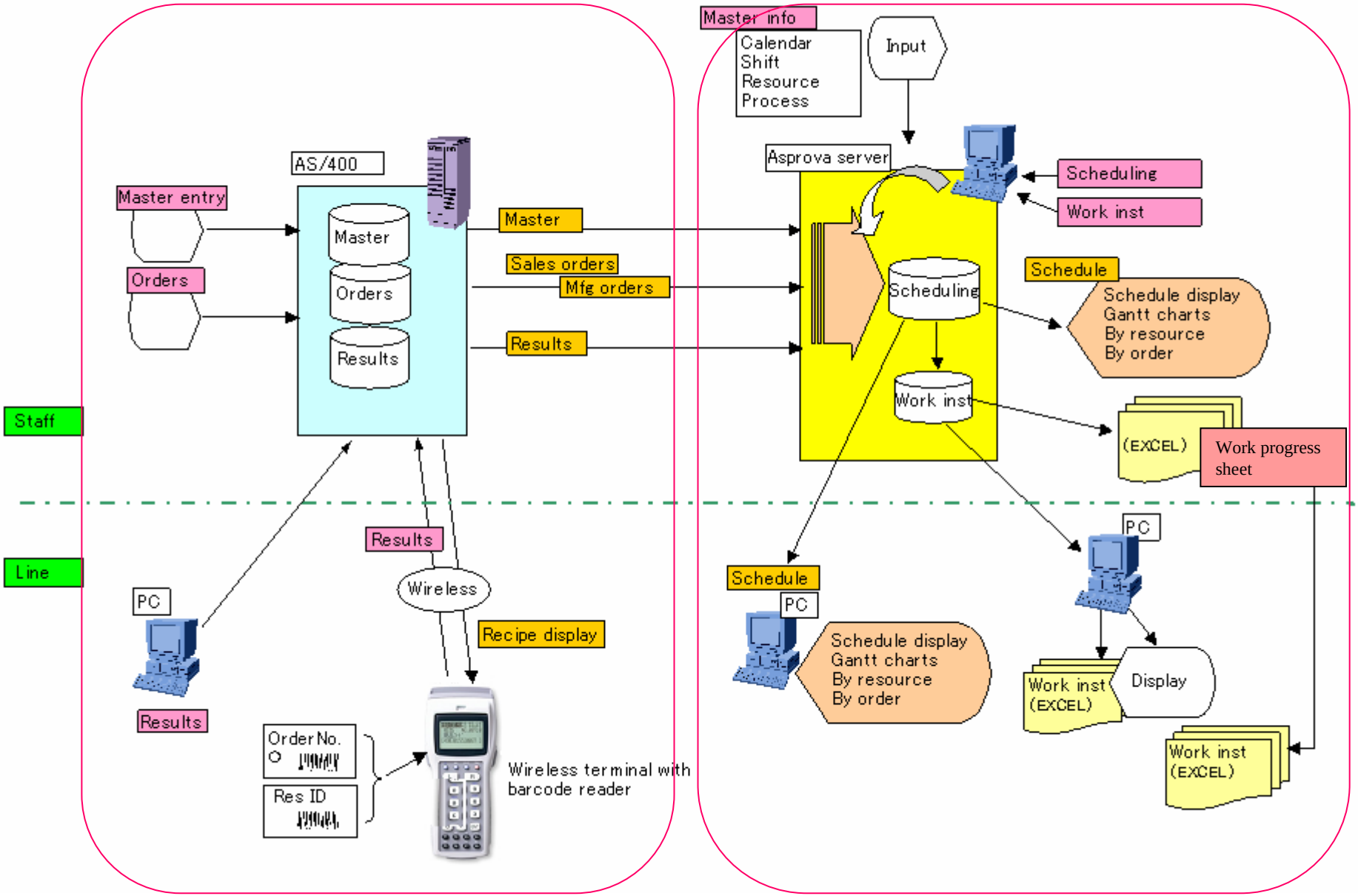
2.4 Actual Results Input

2.5 Work Instructions Sheet

2.6 Operational Flow

2.7 Work Progress Table

2. 1 INFORMATION REFERENCED DIAGAM



2.2 MASTER REGISTRATION

Outline of data: No. of manufacturing process: about 70
No. of equipment: about 80
Operating 24 hours, 360 days/year

Incorporating the manufacturing process/equipment information from host machine (AS400)

∗ Coinciding manufacturing processes, resource names and codes

∗ Synchronization of update information

(synchronization of maintenance timing)

Inputting master data designed for scheduler

Master registration examples that fit our company's production characteristics

∗ Calendar (maintenance time registration for equipment)

∗ Shift table (24 hours 4 groups 2 shifts structure)

∗ Overlapping, lot wrap up (furnace resource) operation

ASPROVA INTEGRATED MASTER SETUP EXAMPLE

	品目	工程番号	工程コード	指図種別	指図コード	品目/資源	先行	前段取り	製造	後段取り	重なり方法	重なりM
722				使用指図	M	wf確認作業_000			10m		ES	
722	QCAB	10	受入検査_C100	使用指図	M	受入作業_000			1m		ES	
722				出力指図	Out	QCAB-10			1			
723		20	スクラバー洗浄_C120	入力指図	In	QCAB-10			1		ES	
723				使用指図	M	スクラバーT2#2_004			1.1mp+(4.3m-1.1m)		ES	
723				出力指図	Out	QCAB-20			1			
723		30	PI塗布_C140	入力指図	In	QCAB-20			1		ES	
723				使用指図	M	塗布WLP#2_002			2.3mp+(19.2m-2.3m)	12	ES	
723				使用指図	M	塗布WLP#3_003			2.3mp+(19.2m-2.3m)	12	ES	
723				出力指図	Out	QCAB-30			1			
723		40	PI露光_C150	入力指図	In	QCAB-30			1		ES	
723				使用指図	M	ステッパ#8_008			1.6mp+(2.1m-1.6m)		ES	
723				使用指図	M	ステッパ#9_009			1.6mp+(2.1m-1.6m)		ES	
724				出力指図	Out	QCAB-40			1			
724		50	PI現像_C160	入力指図	In	QCAB-40			1		ES	
724				使用指図	M	現像WLP#2_002			2.3mp+(2.9m-2.3m)		ES	
724				使用指図	M	現像WLP#3_003			2.3mp+(2.9m-2.3m)		ES	
724				出力指図	Out	QCAB-50			1			
724		60	PI現像検査_C170	入力指図	In	QCAB-50			1		ES	
724				使用指図	M	OSTWLP#1_001			1.0mp+(1.5m-1.0m)		ES	
724				出力指図	Out	QCAB-60			1			
724		70	硬化_C180	入力指図	In	QCAB-60			1		ES	
724				使用指図	M	硬化炉WLP#1_001			440m		ES	
725				出力指図	Out	QCAB-70			1			

- **Manufacturing process, resource code: Combined manufacturing process name and code (simple display, combined when master is synchronized)**
- **Manufacturing process number (order) : Handles manufacturing processs adding simulation by skipping every 10 digits**
- **Manufacturing ability: time saved when registering new items by preparing the master separately Default equipment prepared for each wafer size**

2.3 ORDER INPUT

Receiving Order Production, Approximately 200 Orders Per Month, 100 models (Asprova in Place)

* Sales order:
  - Input when the order is placed from a client
* Manufacturing order:
  - Prepared when a manufacturing process is input
  - Prepared by host machine's manufacturing process control system

Sales orders and manufacturing orders loaded from host machine.

Scheduling method:

* **Appointing "FORWARD" based on the input date**
* Sales orders (based on the scheduled warehousing date)
* Manufacturing order (based on the manufacturing process input date)
* Priority given based on the needs of urgency etc.

2.4 INPUTTING ACTUAL RESULTS

Imported from host machine (AS400) manufacturing process control system

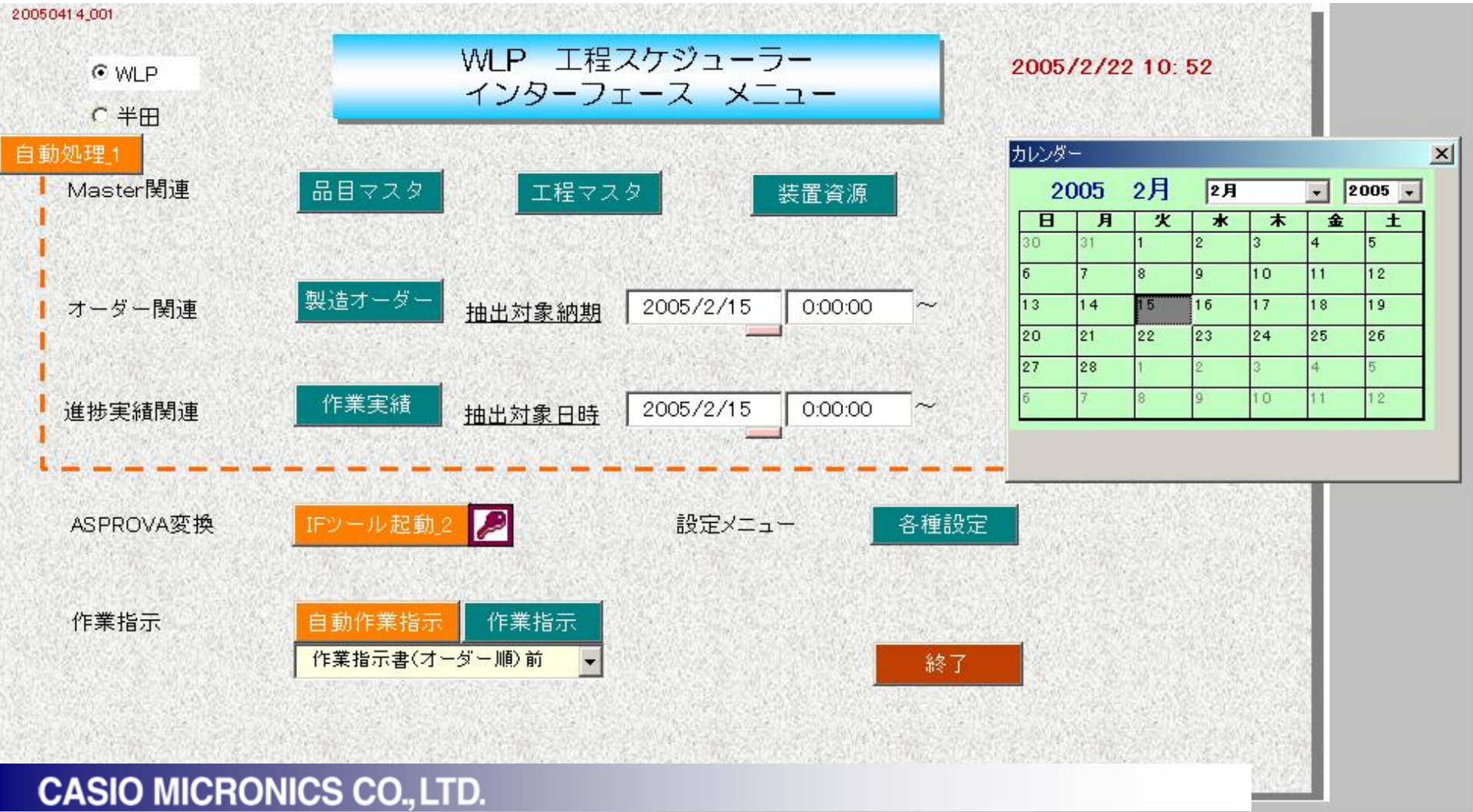
* Actual operational results input automatically (completed time, number of finished item) for each model, each manufacturing lot, and each manufacturing process
* Automatically deletes manufacturing orders, using actual data results

Timing:

*At time of scheduling（once a day, around 17:00）

ASPROVA ◆ PROCESSING MENU BETWEEN HOST MACHINES

Prepared a menu for handling the interface data, using EXCEL with which the shop floor staff are familiar.



2.5 WORK INSTRUCTIONS SHEET

This sheet is like a ledger sheet which makes it easy to give instructions to production site using ASPROVA scheduling results.

Details of ledger sheet:

*Outputs each manufacturing process's scheduled production time, which is assigned by the scheduler. This is done for each manufacturing process as well as each equipment.
*Times are continually upgraded with hourly imported actual data results.
*Contains comments such as urgency, etc. if special instructions are required for some operations.

Operation of ledger sheet:

*The output work instructions sheets are distributed to shop floor staff at each manufacturing process, and the work is carried out.
*Defects or delayed input that occurred when the manufacturing processes were input are reflected to the next day's production planning using the actual results, and work instructions are reviewed on a daily basis.

2.5 WORK INSTRUCTIONS SHEET

WLP 作業指示書(工程順)

後工程

最終更新時間

計画範囲: 11月 14日 9:00 - 11月 16日 9:00　04/11/15 : 12:03 現在

NO	Wf径	工程名		資源名		ロットNo		オーダーNO	品目名	数量	開始時間	終了時間
1	8φ	C500	PIアッシング	001	アッシャーWLP#1_001	QG1604L002	0	M118 9615	ES-AMKOR	3	14/ 18:14	14/ 18:20
	6φ					QCAJ04L002	0	M119 4557	LC99809	20	14/ 20:34	14/ 21:01
	8φ					QG1004K003	0	M117 3242	ES8-YOUSOKEN	6	14/ 22:28	14/ 22:38
						QG0304L001	0	M119 2880	ES8-YOUSOKEN-P	5	15/ 04:38	15/ 04:47
	5φ					QAAA04L004	0	M119 3621	TB154	25	15/ 07:38	15/ 08:11
	8φ					QGAG04L015	0	M119 3615	ZT4103BDS-Z	25	15/ 10:38	15/ 11:11
						QGAG04L016	0	M119 3616	ZT4103BDS-Z	25	15 / 05:13	15 / 05:41
						QGAG04L017	0	M119 3617	ZT4103BDS-Z	25	15/ 16:38	15/ 17:11
						QGAG04L018	0	M119 3618	ZT4103BDS-Z	25	15/ 19:38	15/ 20:11
						QGAG04L019	0	M119 3619	ZT4103BDS-Z	25	15/ 22:38	15/ 23:11
						QGAG04L020	0	M119 3620	ZT4103BDS-Z	25	16/ 01:38	16/ 02:11
	5φ					QAAA04L006	0	M119 4555	TB154	23	16/ 04:24	16/ 04:54
	6φ					QCAJ04L001	0	M119 4556	LC99809	25	16/ 07:24	16/ 07:57
									5φ	48		
									6φ	45		
									8φ	164		

Manufacturing process retaining status (Indicated in grey)

Reflects the input results on an hourly basis

Work in progress : Updates in red letter

Completed work : Half transparent letter

2.6 OPERATIONAL FLOW

8:50 CHANGING SHIFTS

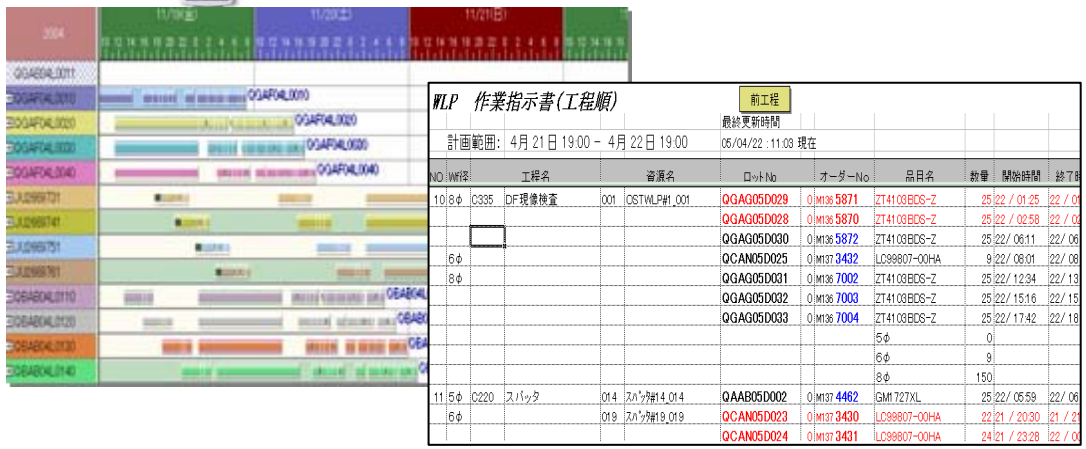
*Administrative staff accepts sales orders.
* Schedule forecast to customers
* Master maintenance

*Operator inputs actual results.

Automatically updates the actual results on an hourly basis

17:00 SCHEDULING PROCESSING & PREPARING WORK INSTRUCTIONS SHEET

* Rescheduling & preparing work instructions sheet based on new sales orders and actual operational results



WLP 作業指示書(工程順)

前工程

最終更新時間

計画範囲: 4月 21日 19:00 - 4月 22日 19:00 05/04/22 : 11:03 現在

NO	W作	工程名	資源名		ロットNo	オーダーNo	品目名	数量	開始時間	終了時
10	8φ	C335	DF現像検査	001	OSTWLLP#1_001	QGAG05D029	0 M136 5871	ZT410BDS-Z	25	22 / 01:25	22 / 01
						QGAG05D028	0 M136 5870	ZT410BDS-Z	25	22 / 02:58	22 / 02
						QGAG05D030	0 M136 5872	ZT410BDS-Z	25	22/ 06:11	22/ 06
	6φ					QCAN05D025	0 M137 3432	LC99807-00HA	9	22/ 08:01	22/ 08
	8φ					QGAG05D031	0 M136 7002	ZT410BDS-Z	25	22/ 12:34	22/ 13
						QGAG05D032	0 M136 7003	ZT410BDS-Z	25	22/ 15:16	22/ 15
						QGAG05D033	0 M136 7004	ZT410BDS-Z	25	22/ 17:42	22/ 18
								5φ	0		
								6φ	9		
								8φ	150		
11	5φ	C220	スパッタ	014	スパッタ#14_014	QAAB05D002	0 M137 4462	GM1727XL	25	22/ 05:59	22/ 06
	6φ			019	スパッタ#19_019	QCAN05D023	0 M137 3430	LC99807-00HA	22	21 / 20:30	21 / 21
						QCAN05D024	0 M137 3431	LC99807-00HA	24	21 / 23:28	22 / 01

17:30 DISTRIBUTING WORK INSTRCUTIONS SHEET

Referring work instructions sheet (sharing)

20:50 CHANGING SHIFTS

*Operator inputs actual results.

2.7 WORK PROGRESS TABLE

Since the work instruction sheet doesn't provide all the information, the work progress status (from input to completion) is displayed in the form of a list where the comparison is made between the planning and the actual result for each manufacturing order.

DETAILS OF LEDGER SHEET

-Makes a comparison between the scheduler prepared plan (from input to completion) and its actual result for each major manufacturing process.

-Selects the planning data, to which the comparison is to be made, from the past ones that were planned at the arbitrary point of time.

OPERATION OF LEDGER SHEET

-Selects the past schedule for which the comparison needs to be made with the actual result.

-Possible to prepare a table as needed (possible to have continual updating of the actual results on an hourly basis.)

-Makes the comparison between the planned and the actual results, and analyzes the planning accuracy and the issues.

WLP　作業進捗表

ASPROVA データ：operation_0504251759.csv 使用

計画範囲：2005/04/24 － 2005/05/14

最終更新：2005/04/26 17:04:56 現在

次回更新：

▼ 出力開始日

NO	オーダーNO / ロットNO	数量		4/23	4/24	4/25	4/26	4/27
				9 12 15 18 21 0 3 6	9 12 15 18 21 0 3 6	9 12 15 18 21 0 3 6	9 12 15 18 21 0 3 6	9 12 15 18 21 0 3 6
1	17 M1376118	25	予定					
2	8 QGAG05D051 0		実績					
3								
1	18 M1376137	25	予定					
2	8 QGAN05D005 0		実績					
3								
1	19 M1376191	24	予定					
2	8 QGAN05D006 0		実績					
3								
1	20 M1376192	25	予定					
2	8 QGAV05D001 0		実績					
3								
1	21 M1376193	25	予定					
2	8 QGAV05D002 0		実績					
3								
1	22 M1376194	25	予定					
2	8 QGAV05D003 0		実績					
3								
1	23 M1376300	2	予定					
2	8 QG9505D003 0		実績					
3								
1	24 M1376382	2	予定					
2	6 QC1305D001 0		実績					
3								
1	25 M1376786	25	予定					
2	8 QGAG05E001 0		実績					
3								
1	26 M1376787	25	予定					
2	8 QGAG05E002 0		実績					
3								
1	27 M1378589	25	予定					
2	8 QGAG05E003 0		実績					
3								
1	28 M1378590	25	予定					
2	8 QGAG05E004 0		実績					
3								
1	29 M1378591	24	予定					
2	8 QGAN05E001 0		実績					
3								
1	30 M1378592	24	予定					
2	8 QGAN05E002 0		実績					
3								
1	31 M1378593	24	予定					
2	8 QGAN05E003 0		実績					

進捗表

M1376191 QGAN

[Plan]－[Actual result]

NO	工程		計画 開始時間		計画 終了時間		計画 工程待	計画 所要時間	実績 開始時間		実績 終了時間		実績 工程待	実績 所要時間	投入 差	所要 差
39	C380	Tiエッチング	24	22:15	24	22:42	0:01	0:27	24	22:15	24	22:42	0:01	0:27	0:00	0:00
40	C385	Tiエッチング検査	24	22:42	24	22:44	0:00	0:02	24	22:42	24	22:44	0:00	0:02	0:00	0:00
41	C390	再配線厚測定	24	22:45	24	22:55	0:01	0:10	24	22:45	24	22:55	0:01	0:10	0:00	0:00
42	C400	ポスト厚測定	24	22:55	24	23:05	0:00	0:10	24	22:55	24	23:05	0:00	0:10	0:00	0:00
43	C410	シェア強度測定	24	23:22	24	23:32	0:17	0:10	24	23:22	24	23:32	0:17	0:10	0:00	0:00
44	C420	外観検査	25	1:01	25	2:11	1:29	1:10	25	1:01	25	2:11	1:29	1:10	0:00	0:00
45	C500	PIアッシング	25	2:36	25	3:05	0:25	0:29	25	2:36	25	3:05	0:25	0:29	0:00	0:00
46	C510	ウェハ厚測定	25	3:10	25	3:15	0:05	0:05	25	3:10	25	3:15	0:05	0:05	0:00	0:00
47	C520	樹脂印刷	25	4:21	25	5:05	1:06	0:44	25	4:21	25	5:05	1:06	0:44	0:00	0:00
48	C530	脱泡	25	5:06	25	5:08	0:01	0:02	25	5:06	25	5:08	0:01	0:02	0:00	0:00
49	C540	キュア	25	5:15	25	15:45	0:07	10:30	25	5:15	25	15:45			0:00	0:00
50	C560	樹脂研削	25	15:45	25	16:45	0:00	1:00	25	15:45	25	16:45			0:00	0:00
51	C580	端子表面処理	25	16:46	25	17:42	0:01	0:56	25	16:46	25	17:42			0:00	0:00
52	C600	保護テープ貼付	2	19:48	25	20:26	2:06	0:38	25	18:10	25	18:50	0:28	0:40	1:38	－ 0:02
53	C620	Si研削	2	20:26	25	21:14	0:00	0:48	25	18:49	25	19:50	#####	1:01	1:37	－ 0:13
54	C640	保護テープ剥離	2	21:18	25	21:56	0:04	0:38	25	20:10	25	20:35	0:20	0:25	1:08	0:13
55	C642	超音波洗浄1	2	2:14	26	2:44	4:18	0:30	25	20:56	25	21:23	0:21	0:27	5:18	0:03
56	C650	フラックス印刷	2	3:35	26	5:01	0:51	1:26	25	22:57	25	23:40	1:34	0:43	4:38	0:43
57	C680	半田ボール搭載		:39	26	7:16	0:38	1:37	26	0:20	26	1:16	0:40	0:56	5:19	0:41
58	C700	リフロー		:16	26	8:30	0:00	1:14	26	1:20	26	2:04	0:04	0:44	5:56	0:30
59	C720	フラックス洗浄	26	8:30	26	9:30	0:00	1:00	26	4:30	26	5:41	2:26	1:11	4:00	－ 0:11
60	C745	端子高さ(径)測定	26	9:30	26	9:50	0:00	0:20	26	6:00				0:15	3:30	0:05
61	C750	端子シェア強度測定	26	9:50	26	9:57	0:00	0:07	26	6:1				0:05	3:35	0:02
62	C780	レーザーマーク	26	10:04	26	11:41	0:07	1:37	26	10:4				:32	－ 0:42	0:05
63	C782	超音波洗浄2	26	13:04	26	13:34	1:23	0:30	26	14:30				0:25	－ 1:26	0:05
64	C790	wf外観検査	26	13:34	26	13:36	0:00	0:02	26	15:44	26	16:13	0:49	0:29	－ 2:10	－ 0:27
65	C900	wf確認	26	13:36	26	13:46	0:00	0:10	26	16:14	26	16:20	0:01	0:06	－ 2:38	0:04

Slow against planning ST

Plan

Delayed actual results input against planning

3. PERIPHERY SYSTEM

*** Establishing Sub-System in Order to Operate Scheduling System**

3.1 Actual data input, using a wireless handy terminal

3.2 ID label printing

3.3 Recipe control system

3.1 INPUTTING ACTUAL DATA (INPUT BARCODE), USING A WIRELESS HANDY TERMINAL

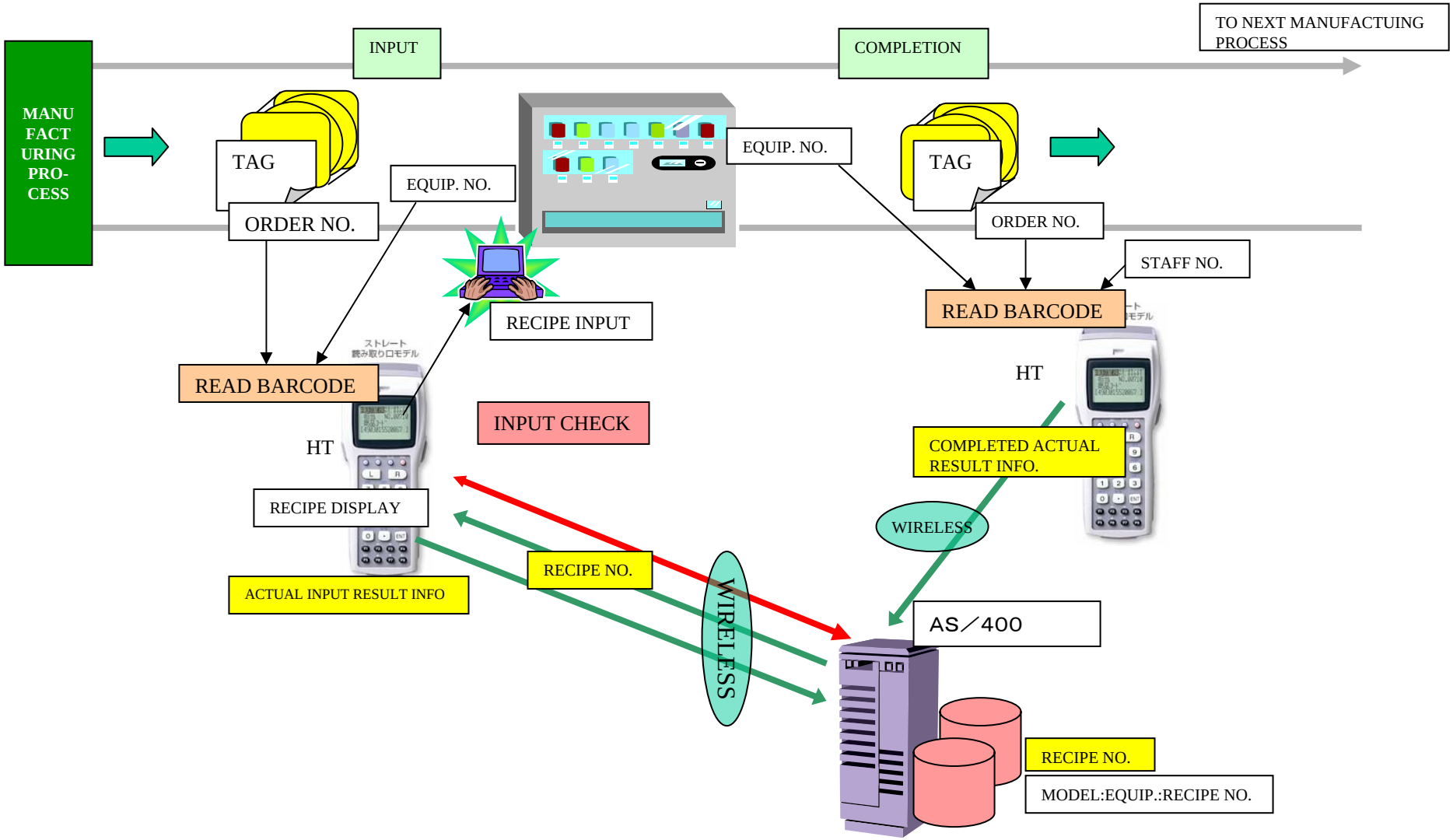
PURPOSE:

- **Improve the accuracy of scheduling system, by inputting the actual data into AS/400 in a timely manner.**
- **Implement accurate and easy input processing through the adoption of barcodes and the input of actual results in system time (promoting the input of the whole manufacturing processes)**
- **Provides the person in charge of operation (i.e., operator) with the operational procedures as well as the recipe information in order to prevent operational mistakes.**

OUTLINE:

- **Connection is made with AS/400 online terminal, in order to synchronize with the actual results input currently in use.**
- **Introduces a portable type wireless "handy terminal" equipped with a barcode reader.**

OUTLINE FLOW DIAGRAM FOR HANDY TERMINAL (HT) INPUT SYSTEM



3.2 ID LABEL ISSUING SYSTEM

Purpose

- Inputting of the actual results of manufacturing processes in a timely manner
- Prevention of mistakes such as mixing up lot cards and the actual item

Outline

- Replaces the ID label number on carrier cases that travel between manufacturing processes with an automated output sheet, complete with bar codes
- Links the ID label with a lot card by displaying the last 4 digits of order numbers
- Simultaneously processes the ID label upon the output of a lot card

OUTLINE OF FLOW DIAGRAM FOR ID LABEL ISSUING SYSTEM

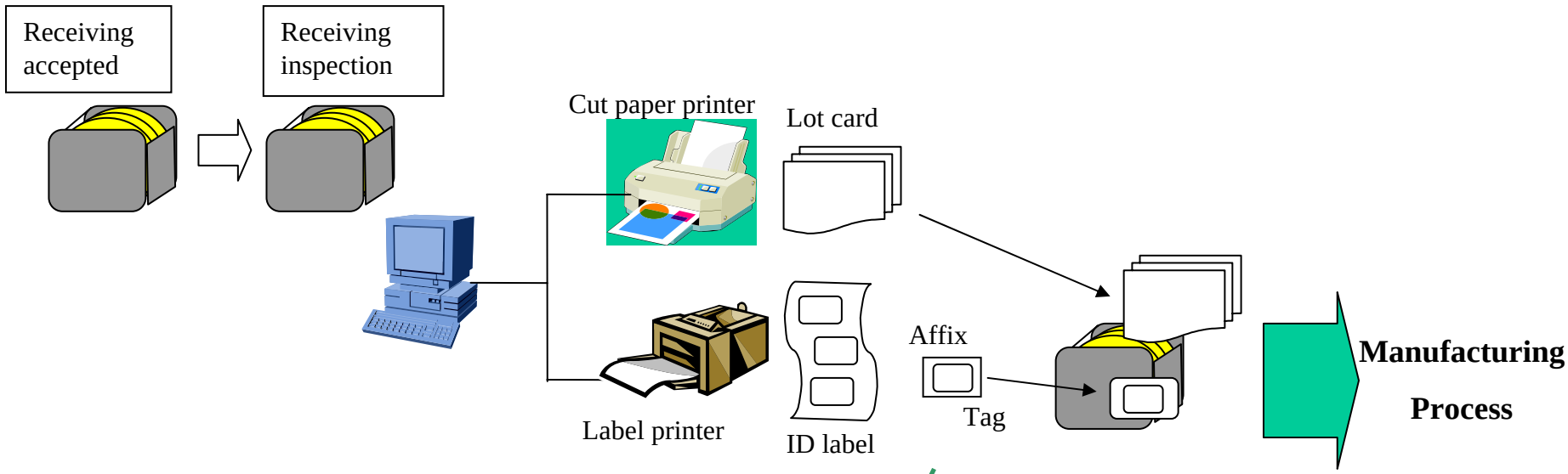
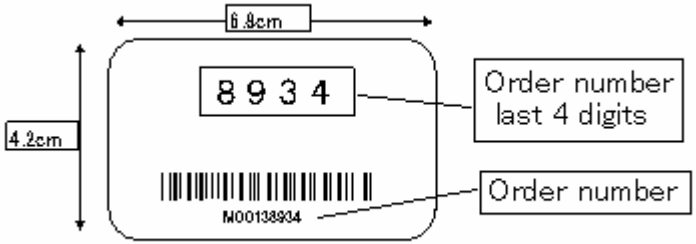


Image of ID label



ID Label

ID label and HT

3.3 RECIPE MANAGEMENT SYSTEM

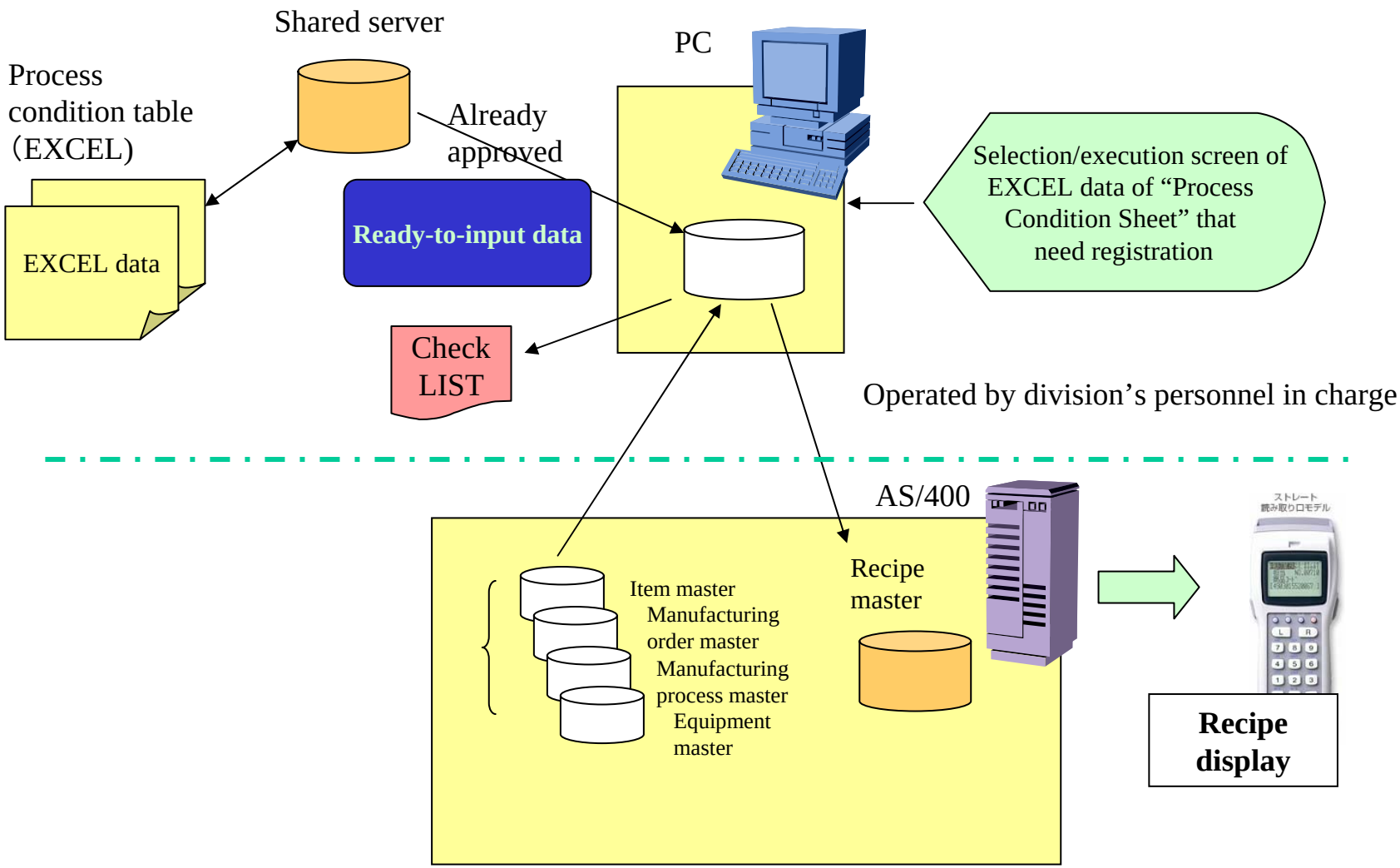
Purpose

- Avoids mistakes in inputting the recipe during the manufacturing processing operations and thus improves the yield ratio
- The database of recipes will be compiled and utilized for speeding up various recipe outputs (i.e., screen/ledger sheet) as well as for the recipe output system of equipment which is under planning

Outline

- Establishes data base on host machine (AS400)
- Utilizes the data based recipe data for recipe output screen at HT, a lot card, etc.

OUTLINE OF BUSINESS FLOW DIAGRAM FOR RECIPE MANAGEMENT



RECIPE SCREEN（ACTUAL EXAMPLE）

Manufacturing process name

Equipment name

Recipe

Special instructions

Input: Taro Maikuro

Order No.: M1193619A

Laser mark

Laser mark: WLP#1

ZZZZ_YYY123BC

Seal spec. : 10-0-4-

9869

F1:UP F3:BK F4:CHG

4.SYSTEM ISSUES

- Improvement planning accuracy
  - More accurate scheduling can be obtained through the registration of human resources (i.e., operator skill)
- Expanding to other products
  - This scheduling system provides both the flexibility and speed required for sales order driven production

5.WRAP UP

Tips for utilization of ASPROVA

-Clearly specify the purpose of the scheduling system
-Set up scheduling to fit company's own production (in this case: sales order based production, complex manufacturing processes)
-Strike a balance between detail of master table, and accuracy of the resulting schedule

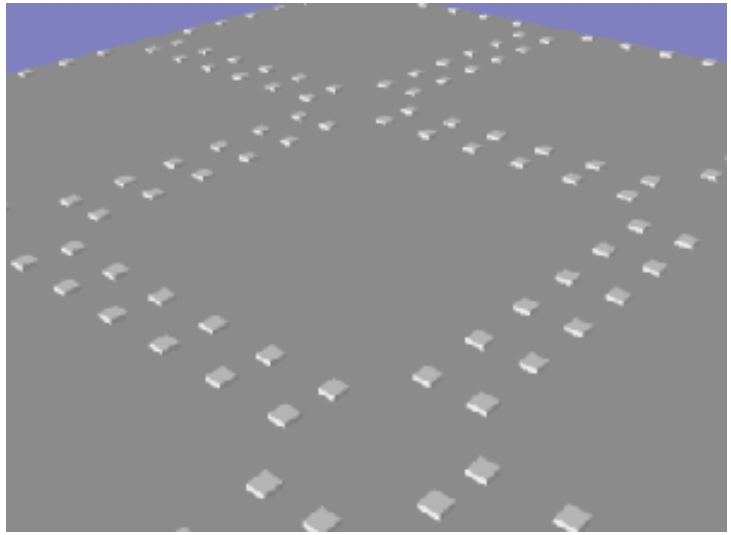
Linking to process management system

-Avoids inputting master twice
-Ensures consistency with ASPROVA by keeping information in a standard format
-Requires immediate input of all available results data

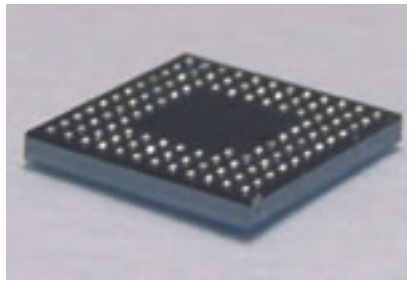
Utilizing schedule information

-Favor a work instructions sheet over a Gantt chart at the shop floor
-Narrow down what you want in order to gain effective results
-Use the scheduling system to further improve manufacturing processes

WLP manufacturing process



Completed product



ASPROVA

Case Study 2

Mitsubishi Electric Corporation, Nakatsugawa Works

Electric Manufacturer Chooses Asprova for GUI and Rich Features Shortens Planning Cycle and Improves Scheduling Process

Mitsubishi Electric Corporation's Nakatsugawa Works specializes in the manufacture of ventilation fans for home and business use, ventilating air cleaners, and industrial blowers. Prior to the introduction of Asprova, schedules were prepared through weeks of manual labor based on lists of processing jobs generated by the host computer in ignorance of the capacity of machines in the factory. However, as a result of the introduction of Asprova, the time required to prepare schedules has been reduced, and the cycle over which the processing plans are output by the host computer has been shortened. The benefits of introducing Asprova have been so apparent that it is now being used in 5 divisions within the Nakatsugawa Works.

Problems Prior to Introduction

- INORDINATE time required for workgroup leaders to draft schedules by based on one-month processing plans output by the host computer
- UNNECESSARY setup time and simple errors resulting from the manual scheduling

Reason for Introducing Asprova

- ASPROVA's user-friendly GUI
- ASPROVA's large number of standard features
- ASPROVA's fast scheduling speed.

Benefits of Introduction

- REDUCED time workgroup leaders spend preparing schedules, allowing them to undertake other tasks, such as following up on component delivery dates and processing vouchers.
- ELIMINATED the problems of unnecessary setup time and simple scheduling errors.
- ENABLED more frequent outputting processing plans from the host for more flexibility in host-side planning changes, without adverse effect on the preparation of processing schedules.
- SIMPLIFIED process of searching for particular manufacturing items.

Planning Requires Enormous Work

At Mitsubishi Electric Corporation's Nakatsugawa Works, schedules are drafted for two sets of processes: component processing and product assembly processes. Prior to the introduction of scheduling software, lists of infinite-capacity processing jobs corresponding to assembly schedules for the next month were output twice a month from the host computer to each workgroup. Each workgroup leader would refer to these infinite-capacity lists while attempting to manually prepare finite-capacity processing schedule, taking into account conditions such as standard times, operating times, setup times, etc. It was also necessary to respond to changes in schedule, resulting in some 2 weeks of each month being taken up by schedule preparation and revision. In addition to taking a lot of time to prepare, these schedules often included unnecessary setup time and simple errors because of the huge volume of data that needed to be considered.

In order to solve these problems, Mitsubishi began to consider the introduction of a scheduling system, and Asprova was the first product they saw demonstrated. The demonstration was conducted by Tokai NTT Data Communications Systems Corporation, a certified distributor of Asprova. Mitsubishi was particularly impressed by Asprova's high-speed scheduling, the large number of standard features, and the ease of viewing of its user interface. "We were impressed by Asprova's scheduling functions", says Mr. Yoji Tanaka, Director of the Manufacturing Planning Department's System Engineering Section. In order to increase the client's understanding of the product, Tokai NTT Data Communications Systems Corporation, with the cooperation of the staff responsible for schedule preparation, conducted a two-day demonstration using actual data.

Data Volume

Finished products	3,000
Total items	7,100
Resources	55
Processes	1 or 2
Scheduling period	3 months
Scheduling cycle	daily to once per month
Lots in scheduling period	10,000
Jobs in scheduling period	20,000

Mitsubishi Electric Corporation, Nakatsugawa Works

1-3 Komamba-cho, Nakatsugawa-shi, Gifu-ken 508-8666 Japan
Year of Establishment: 1943
Employees: 1,350 (Male: 1,130; Female: 220)

Nakatsugawa Works was originally established as a branch factory of Mitsubishi Electric Corporation's Nagoya Works, and has since been involved primarily in the manufacture of products involving wind and air, including ventilation fans for home and business use, ventilating air cleaners, industrial blowers, and hot-air heaters.

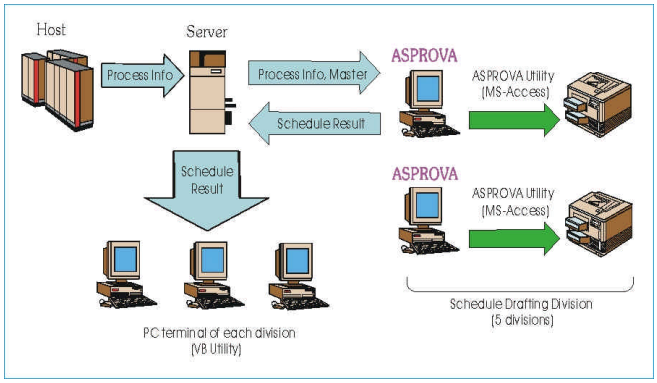


Figure 1: System Configuration
Data stored on the host computer is divided up according to workgroup and is sent via a server to the scheduling division in which each workgroup is located. Each scheduling division constructs a schedule using Asprova and outputs work directives using the Asprova Data Management Utility. Data from the schedule is also sent back to the server, where it may be accessed from PC terminals using VB utilities developed in-house.

"We became confident that Asprova was the product for us", says Mr. Takuhiro Suzumura, Chief Technician of the Manufacturing Processing Section of the Residential Ventilation Manufacturing Department. Thus, after detailed evaluation of the product by the System Engineering Section and by factory managers, the company decided to introduce Asprova.

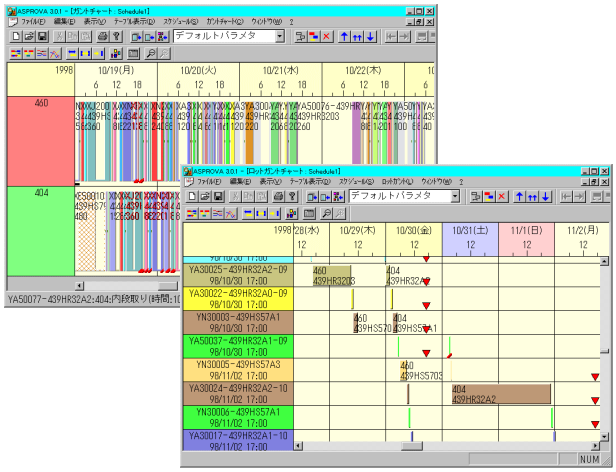


Figure 2: Viewing Asprova Schedules:
Gantt Charts and Lot Gantt Charts

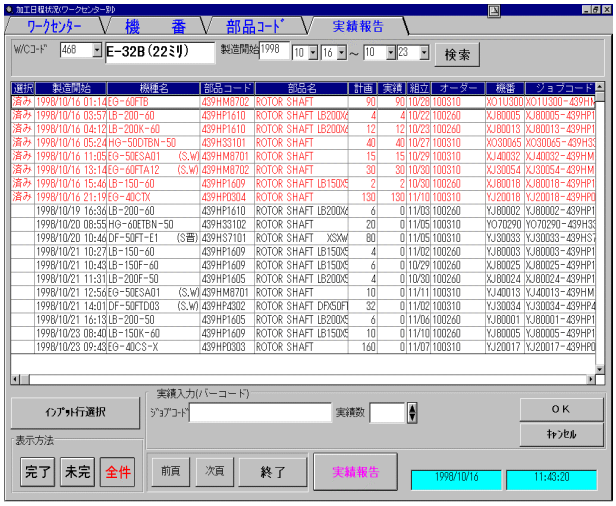


Figure 3: Screenshot of VB Application Developed In-House
Schedule data stored on the server may be accessed from PC terminals.

Asprova peripheral development and installation was largely carried out by the System Engineering Section. Mr. Masakazu Kajita, an engineer in the Manufacturing Planning Department's System Engineering Section, indicates that the collection of data and establishment of master settings was a more difficult task than that of peripheral development. "For divisions with reliable original data, the procedure takes less than a month, but where no such data exist, it is an extremely time-consuming process". Asprova is currently being used in 5 divisions, and data are being collected and conditions determined in preparation for the introduction of Asprova to a 6th division.

Asprova Enables Shortening of Planning Cycle and Improvement of Scheduling Process

As a result of the introduction of Asprova, workgroup leaders now spend less time preparing schedules, and are able to allocate more time to tasks other than scheduling, such as following up on component delivery dates and processing vouchers. Asprova has also solved the problem of unnecessary setup time and simple errors being included in schedules, and greatly reduced the effort required to search for relevant items when making schedule modifications.

At the same time, the Nakatsugawa Works has reduced the cycle for outputting processing plans in order to respond more flexibly to planning changes on the host side. Where plans were previously output twice a month, they are now output as often as once a day for some items. This transition was effected smoothly due to the use of Asprova for schedule preparation. "We wouldn't be able to prepare schedules on such a short cycle without Asprova", says Mr. Suzumura. Asprova has thus been effective not only in improving the process of schedule preparation, but also in supporting improvements on the host side.

Asprova is currently being used in Mitsubishi Electric Corporation's Nakatsugawa Works with virtually no problems whatsoever. An RDBMS has also been introduced to make effective use of the data compiled using Asprova, and is available for use from client PCs, together with applications for other peripheral functions such as inputting production results and viewing processing plans. The staff at Nakatsugawa Works are currently exploring ways of making even more effective use of Asprova data, including the introduction of a paperless system, and the use of Asprova in preparing processing schedules for the assembly line.

Asprova Corporation
Gotanda Mikado Bulding 8F, 2-5-8 Hiratsuka, Shinagawa-ku, Tokyo 142-0051, Japan
Phone: +81-3-5498-7071 Website: www.asprova.com e-mail: universal@asprova.com

Optical lens

Basic process flow	Grind=>polish⇒core removal=>evaporate⇒juncture⇒ press mold ⇒adjust⇒inspect
Issues and conditions before installment	Calculating both the start and the end days of production from fixed lead time infinitely accumulated by MRP. Implausible plans/Plans lack of plausibility. The above cause a lot of in-progress inventories
Solutions to the issues	Making schedule plans under which manufacturing power and the constraining factors of each process are considered.
Reasons for choosing Asprova	Excellent scheduling functionality, great installment record, GUI operability, and especially Asprova's ability to make scheduling plans that takes into account of facility constraints and its load
Data volume	The number of orders：7,000/2months The number of BOM items：10,000 The number of line in BOM：200,000 The number of main resources：150 The number of sub-main resources：10
The role of install operator	Supporting the basic model building – Supporting the data expansion – Supporting the operation
Year of the installment	2006
Difficulties of the installment	Modeling the butch treatment in the thermal process
The devices of the installment	Avoiding the settings to get complex by clarifying the covered area of Asprova and that of actual operation
Current status and after effect	Asprova at work, testing whether the operation instructions based on the scheduling result of each process are practical in the fields
SIer/Installer	Canon IT Solutions Inc

Semiconductor wafer

Basic process flow	Oxidize=>Coat⇒Expose⇒Develop⇒Etch⇒Resist remove（･･･20～30times repeatedly）⇒Test⇒Shipping inspect
Issues and conditions before installment	The current planning method cannot make feasible plans, because the method calculated the loads in only specific processes as it was constrained by planning lead time
Solutions to the issues	Making the practical plan with the settings that take into account constraint conditions of each process (200-300 processes).
Reasons for choosing Asprova	While launching the new system and reviewing the field operations, installment of Asprova as schedulers for each process was decided. Asprova's great installment records in semiconductor companies, low price, and event options were the determining factors.
Data volume	The number of orders：1,500/2months The number of BOM items：200 The number of line in BOM：300,000 The number of main resources：200 The number of sub-main resources：15,000
The role of install operator	Supporting in building the basic model – Supporting the data expansion – Developing the plug-ins - Supporting the operation
Year of the installment	2005-2006
Difficulties of the installment	Master maintenance and constraining conditions specific to semiconductor manufacturers
The devices of the	Making full use of specs, additional properties, and expressions to

installment	model master data, such as process and device maintenance, and constraining conditions, such as constraints of receipts and reticules, both specific to semiconductor manufacturers
The devices of the installment	New systems at work based on operation instruction from the result of scheduling by Asprova
SIer/Installer	Canon IT Solution Inc

Medical equipment

Basic process flow	Mold=>Burr⇒Inspect⇒Seal⇒Sterilize⇒Pack
Issues and conditions before installment	Based on sales orders, the inputting plan in the [neck/bottle neck] process was made and the initial inputting plan in the first process which tied up with the former plan was made. The plans were made by excel and with low preciseness. To avoid stock-outs, workers in the production field tend to keep some inventories. Installing Asprova with PBB, the solution to the issue.
Solutions to the issues	Installing Asprova with PBB -> Realizing precise process scheduling -> Reducing inventories by stock control based on the plans
Reasons for choosing Asprova	Sharing the conditions of the factory by detailed plans for each facility, reducing inventories, and realizing the data tracing functionality
Data volume	The number of orders：5000 The number of operation：18000 The number of main resources：130 The number of sub-main resources：90 The number of BOM items：800 The number of lines in BOM：10,000 Resource capacity：23000
The role of install operator	Defining the requirements - Building the model – Designing and developing the plug-ins - Supporting the operation
Year of the installment	2002 - 2007
Difficulties of the installment	Realizing the detailed requirements of planning, and exchanging data between the production control package and Asprova
The devices of the installment	Realizing the setting method of inputting lots →Generating lots by setting the inputting dates and facilities of each lot
The devices of the installment	Currently operated, improving the functionalities of peripheral devices →Planning now takes into account the actual performance results daily (Planning was done once a week before the installation)
SIer/Installer	Canon IT Solutions Inc

Drilling machine、Laser beam machine

Basic process flow	Body assembly：Unit assembly=>Adjust=>Wiring and pipe work=>Control Panel assembly=>Final adjust Machining process：Rough⇒Burr⇒Mirror finish⇒Treat⇒Coat (to Unit assembly)
Issues and conditions before installment	Making production plans of body assembly(final) and of directly linked machine processing /control panel assembly Make purchase plans of material based on production plans

	*Body assembly, machine processing, and control panel assembly have multiple processes.
Solutions to the issues	After [fixing/determining] the production plans of body assembly, order of required [parts/member] including machine processed goods and control panels are generated and developed to the upper process
Reasons for choosing Asprova	Installing Asprova and [its] production management package was decided, because it enabled to do scheduling for each process and to make purchase plans based on the former plan
Data volume	Body assembly The number of orders:100/m The number of operation:700 The number of main resources:80 The number of sub-main resources:5 The number of BOM items:1000 The number of line in BOM:6,000
The role of install operator	Building the model – Expanding Data - Developing the plug-ins - Supporting the implementation
Year of the installment	2003/8-2004/10
Difficulties of the installment	Making case-by-case outsourcing orders based on the plan, because of the long working hours(2 days) for roughing during machine processing. Outsourcing process was not established.
The devices of the installment	Making the new functionalities: the plug-in in the Gantt chart to make outsource orders, and the feature to select process, add new master table for outsourcing orders, and re-assign those orders
The devices of the installment	Currently operated to generate orders for body assembly and five key parts, and to make purchase plans for required parts based on the plans calculated by Asprova
SIer/Installer	Canon IT Solution Inc

Electronic Panel soldering

Basic process flow	Automated soldering 1=>Automated soldering 2=>Inspection ⇒ Hand installing 1⇒Hand installing 2⇒Unit assembly
Issues and conditions before installment	No production plans to each process Reducing the burden of MRP planner Achieving the appropriate in-progress inventory control between the process of automated mounting 1 and 2
Solutions to the issues	Adapting the automated production planner(scheduler) of each process Achieving the appropriate inventory control from the section B to A by auto-replenish production
Reasons for choosing Asprova	The great install record and the excellent feature to make production plans with the auto-replenish order function Enabling to visualize the plans of both administration section and production section with the monitor version
Data volume	Automatic machine(Section A) The number of orders:500/m The number of operation:1300 The number of main resources:15 The number of BOM items:130 The number of line in BOM:1,000
The role of install operator	Building the model – Expanding Data - Developing the peripheral devices - Supporting the operation
Year of the	2004/11～2006/6

installment	
Difficulties of the installment	The reflow temperature of automatic soldering and the continuous build-in of like products
The devices of the installment	Grouping the reflow temperatures of each product and inputting to the master table the sequences in each group to utilize that as the dispatching key
The devices of the installment	Currently operated only in the section A (Expanding its use to the section B was suspended by factory relocation and layout changes) Currently the production method has been under review.　Asprova's model change is highly evaluated.
SIer/Installer	Canon IT Solution Inc

Metallurgical dust products、Bearing、Machinery parts

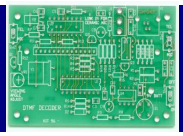
Basic process flow	Molding=>Sintering ⇒ Processing ⇒ Cleaning ⇒ Oil　immersing ⇒ Inspecting⇒Packing
Issues and conditions before installment	No production scheduler to each facility No possible production plan which directly linked with each process
Solutions to the issues	Making production plans by the scheduler Making possible production plans which are taken into account of the constraints of facilities, the facility loads, and the constraints between the processes
Reasons for choosing Asprova	Compared with other schedulers, Asprova had user-friendly Gantt chart, excellent operability, and wide variety of functionalities
Data volume	The number of orders：2000/m　The number of operation：13000　The number of main resources：350　The number of sub-main resources：220 The number of BOM items：4500　The number of line in BOM：55,000
The role of install operator	Building the model – Expanding Data - Developing the peripheral devices – Developing　—Supporting the operation
Year of the installment	2005/10～2006/3
Difficulties of the installment	The start time of next process, the automatic machinery run during night time in the molding process, the start times of production in the next process is in next days, after workers leave *The production management system which is the upper system had limitations in setting up the master table
The devices of the installment	Adjusting the assigning position in the next process by calculating the start time, making full use of scheduling parameter. Expressing continuous furnaces, considering inputting time, production time, and including the move time among furnaces into time constraints
The devices of the installment	Currently operated and expanding its use to other factories
SIer/Installer	Canon IT Solution Inc

Introduction to the sample data

The sample data, the case studies of our clients who installed Asprova, is introduced here. If Industry sample data is needed, please sign up at the membership registration page of our website or at

http://www.asprova.com/en/asprova/document_library.html

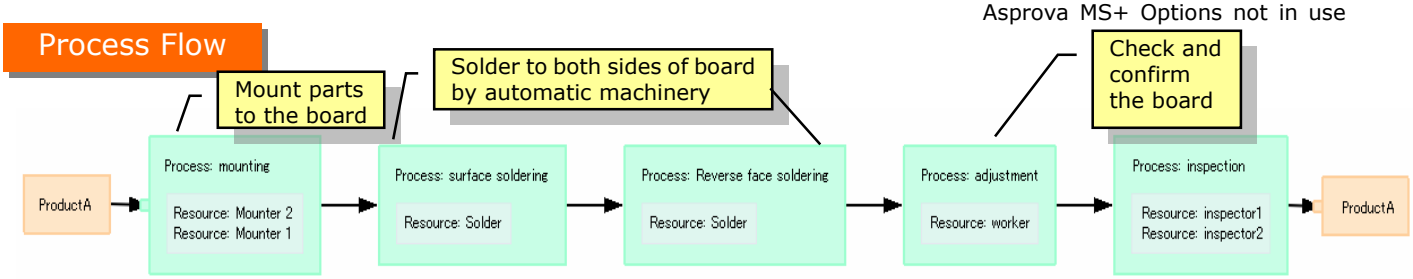
No.7 Discrete type

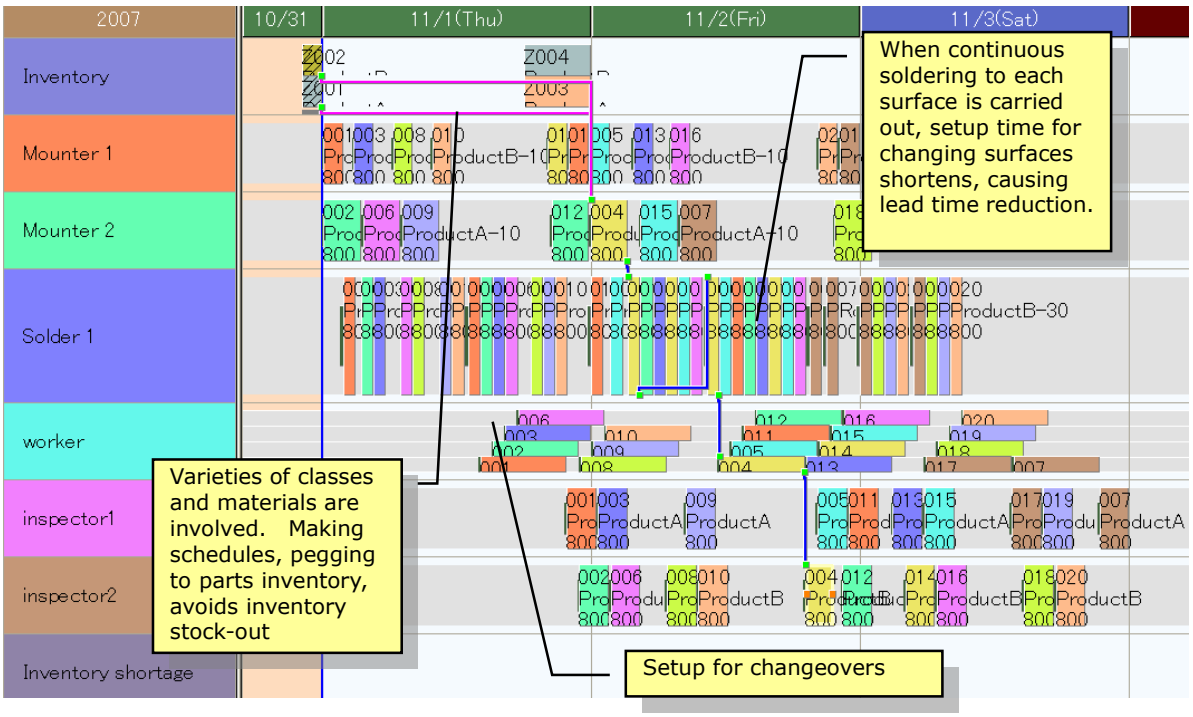


PC board(soldered)

Asprova MS+ Options not in use

Process Flow





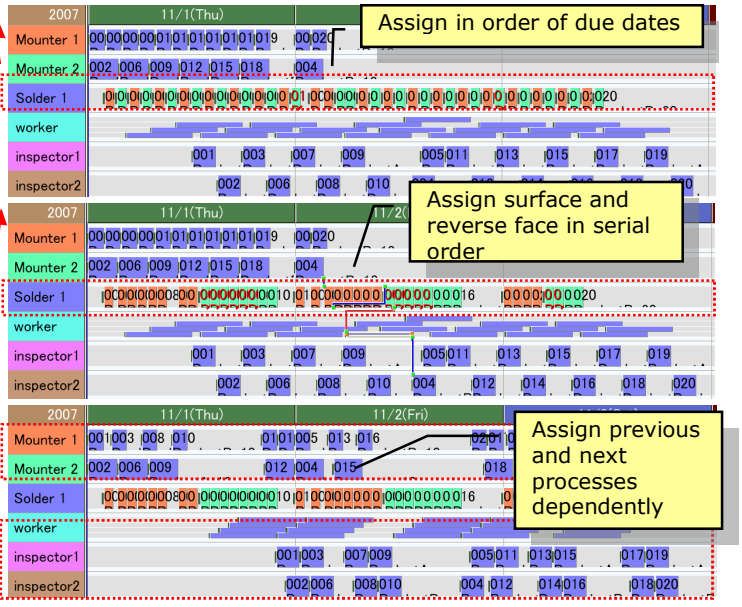
Scheduling parameter to optimize the soldering process

	Code	Dispatching rule	Filter orders	Filter operations	Resource selection method	Temporary operation fix
38	⊟scheduling parameter					
39	⊞default scheduilng parameter	ME.Work_Order.Order			Optimal re	None
40	⊞soldering process	Roundup((ME.Work_S		ME.Opera	Current re	None
41	⊞solder-mounting process	ME.Work_Order.Order			Current re	Bottleneck
42	⊞re-assign off limit orders	ME.Work_Order.Order	ME.Start		Optimal re	None

Setup for changing in soldering process

	Resource	Item L	Item R	Setup time
1	Solder	*	*	20M
2	Solder	!	*	20M
3	Solder	Surface	Surface	0S
4	Solder	Reverse face	Reverse face	0S

The screenshot of optimization of soldering process



Data

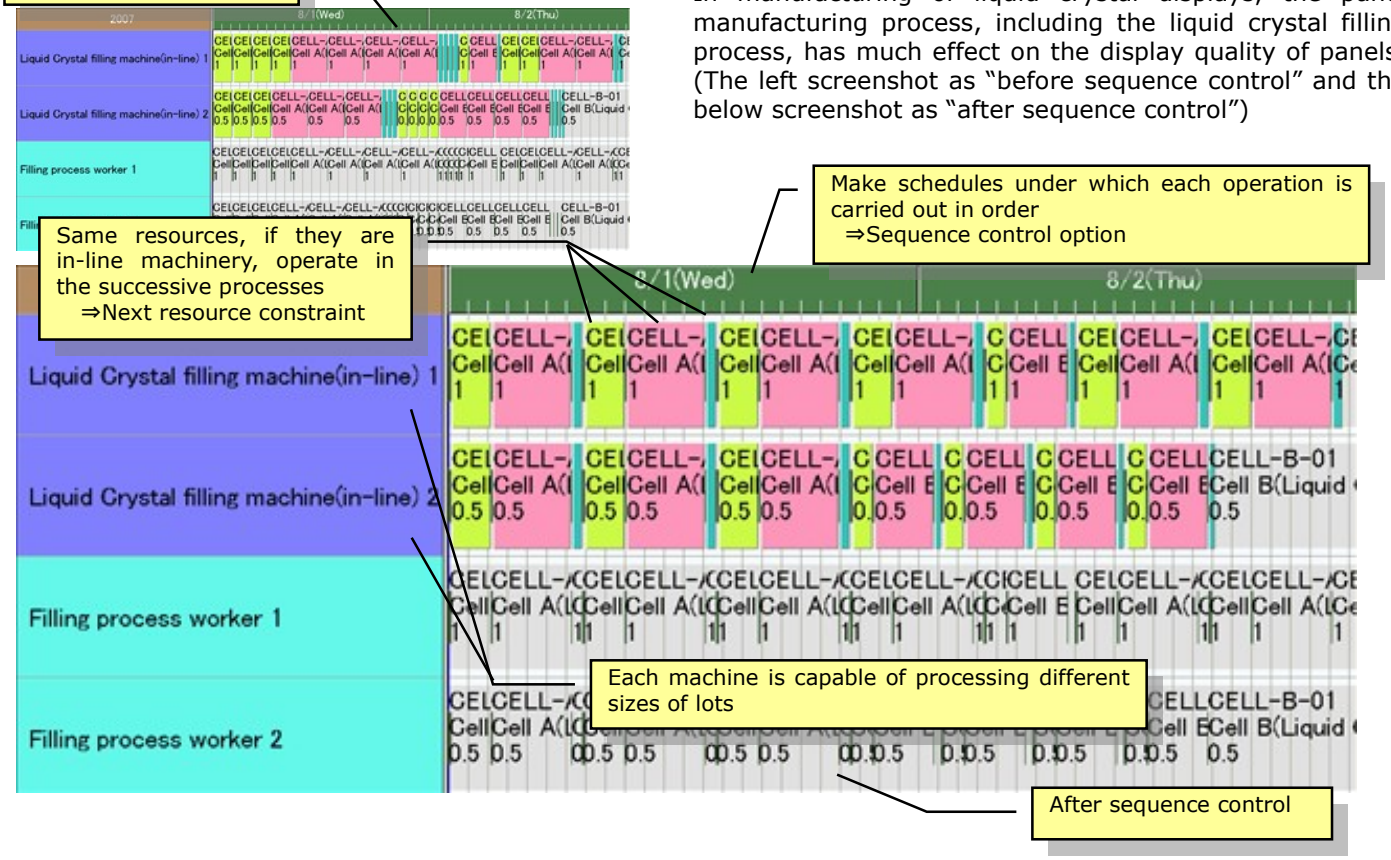
PC board.ar4

ASPROVA
No.7 Discrete type

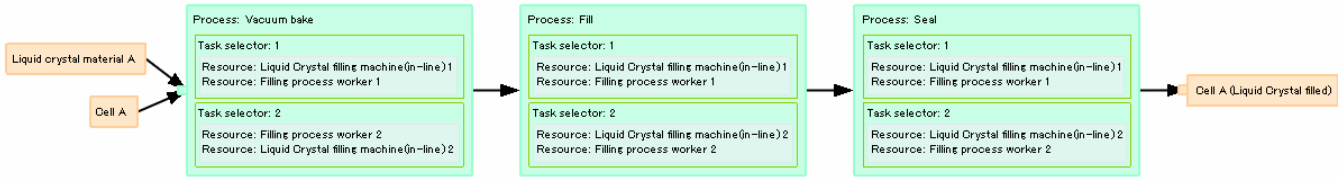
Liquid Crystal Panel(Filling)

Asprova MS+Optimization OP

In manufacturing of liquid crystal displays, the panel manufacturing process, including the liquid crystal filling process, has much effect on the display quality of panels. (The left screenshot as "before sequence control" and the below screenshot as "after sequence control")



Process Flow



Lot size per machine setting (Resource table)

	Resource code	Resource split size MIN	Resource split size MAX	Resource size U
1	Liquid Crystal filling machine(in-line) 1	1	1	
3	Liquid Crystal filling machine(in-line) 2	0.5	0.5	

Next resource setting by in-line machine (Resource table)

	Resource code	Next resources
1	Liquid Crystal filling machine(in-line) 1	Liquid Crystal filling machine(in-line) 1
2	Liquid Crystal filling machine(in-line) 2	Liquid Crystal filling machine(in-line) 2

Integrated Master Editor

	Item	Process code	Task selector	Instruction code	Resource/Item	Setup	Production
1	Cell A (Liquid Crystal filled)	Vacuum bake		In0	Cell A		1
2				In1	Liquid crystal material A		1
3			1	M	Liquid Crystal filling machine(in-line	0	2h
4				S0	Filling process worker 1	10m	
5			2	M	Liquid Crystal filling machine(in-line	0	2h
6				S0	Filling process worker 2	10m	
7		Fill		In0	Cell A(Liquid Crystal filled)-10		
8			1	M	Liquid Crystal filling machine(in-line	0	4h
9				S0	Filling process worker 1	5m	
10			2	M	Liquid Crystal filling machine(in-line	0	4h
11				S0	Filling process worker 2	5m	
12		Seal		In0	Cell A(Liquid crystal filled)-20		
13			1	M	Liquid Crystal filling machine(in-line	0	30m
14				S0	Filling process worker 1	5m	
15			2	M	Liquid Crystal filling machine(in-line	0	30m
16				S0	Filling process worker 2	5m	

Data

Liquid crystal panel(filling).ar4

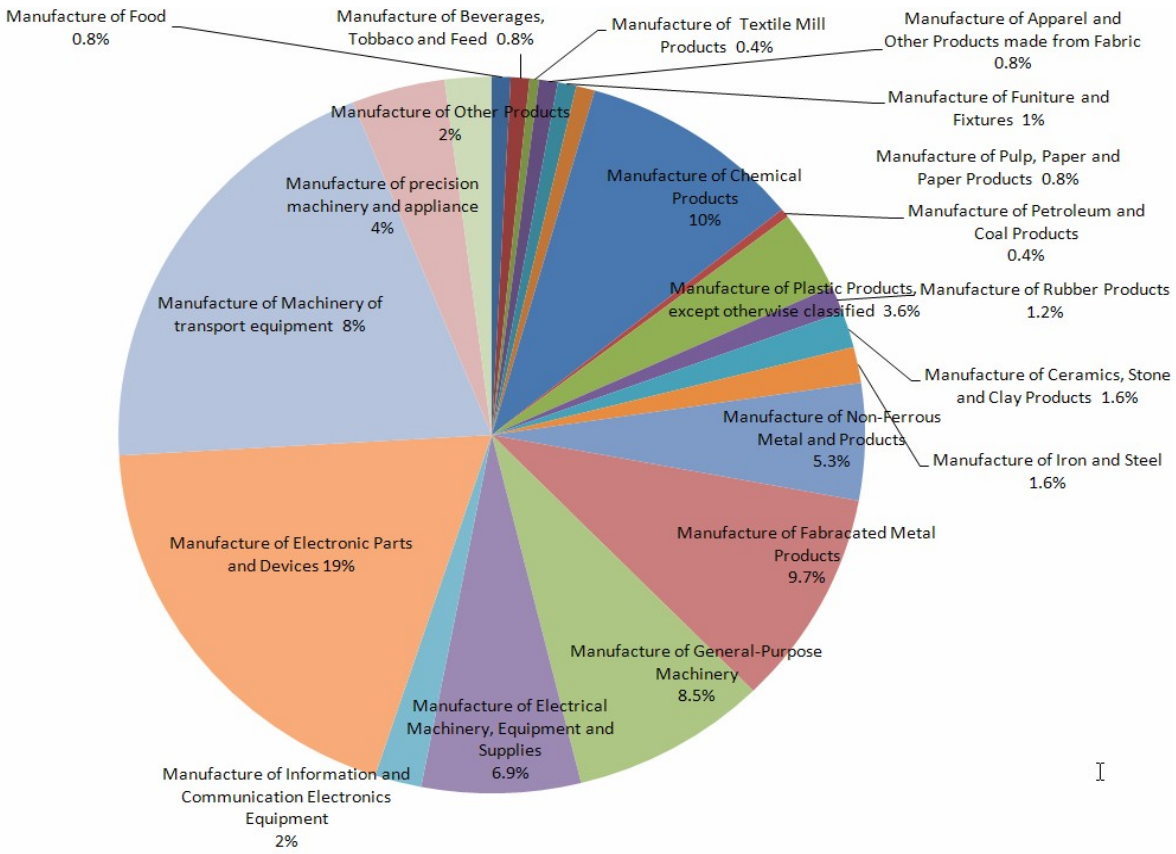
Key points of process Manufacturing

1. Manufacturing starts in the bulk production process and branches into more than one process to produce multiple products in most cases
2. In-process goods have little time to leave being unprocessed. (They must be put in the next process immediately)
3. Tank resources tend to become constraining factors: “The tanks are not available after next process gets done”, “The tanks can deal with only certain items together”, ”Items wait for the orders coming in the tanks”, and ”Cleaning the tanks”
4. Dealing with piece goods: efficiency is needed.
5. Dealing with unaccountable units, such as kilogram, meter, and liter

Related features

Auto-replenish production, Time period grouping, Time constraint MAX option, Resource lock time option, Event option, Safety stock, Inventory constraints, Assigning workers, Skill map, Furnace resource, Inventory graphs, Load graphs, Production/purchase plans, Sequence control option, Evaluate schedule, Operation split

The fields of Asprova users



Electric Electronics	LEDs, connectors, solderless terminals, microprocessors, printed circuit boards, silicon wafers, air conditioner cases (plastic molding), speakers, ceramics, watches, semiconductors, lead frames, CD-ROMs, CD-R / DVD / CD-ROM drives, electric wire, LCDs, stereos, photo masks, WF cables, sockets, mobile phones, connectors for mobile-phones, IC packages, aluminum electrolytic capacitors, photoresist, TFT modules, piston rings, needles, piano wire, printer pins, automotive meters, photoelectric board, digital cameras, car navigation systems, refrigerators, light fixtures, sensors, signal controllers, solar-powered battery modules, vacuum fluorescent displays, batteries, multipolar connectors, power cables, mainframe computers, projection equipment, quartz transmission equipment, desktop PCs, carbon electrodes, projectors, printers, power boards. heating equipment controllers, solar cell wafers, medical electrical equipment, SD cards, portal media players, connectors, bar code readers…
Automotive	Engine parts, doors, chassis, interior (plastic molding), metal molds, shock absorbers, vehicle inspections, pipes, tubes, engines, cranes, rubber, aircraft parts, test bodies, brake parts, high-pressure hose, seat fabrics, wire rope, transmissions, camshafts, crankshafts, cases, wire harnesses, motorcycles, bicycles, railway carriages, external parts for ships, anti-vibration equipment for vehicles, tires, movable cranes…
Machinery	Looms, kitchen appliances, machine tools, agricultural machinery, industrial machinery, optical instruments, light fixtures, air conditioners, heating appliances, plastic parts for office equipment, control computers, material handling equipment, power transmission equipment, power-driven hand tools, internal combustion engines, in-line instrumentation systems, wafer visual inspection equipment, centrifuges, sewing machines, heat treatment equipment, tanks, water tanks, turbines, condensers, model engines, vacuum pumps, wafer precision equipment, food products machinery, electric facilities, gas and water-related tools, water supply-related instruments, electric welders, stage lighting fixtures, sewing machine parts, pumps, ultrasonic diagnosis equipment, CNC, robot transfer machines, nuclear equipment, crystal units, rubber hose. Fire alarm equipment…
Metal	Drills, screws, cannons, wire, plumbing fixtures, guard rails, pipes, magnet wire, steel, sheet metal parts, fences, metal bridge parts, blades, connecting rods, nuts, industrial precious metal products, drawing alloys, aluminum for beverage cans, blades for cutting machines, gears, metal springs, timer parts, precision gears, aluminum foil, sheet copper, ship plates, drawn copper products, specialty steel products, cutting tool tips, lubricating oil packaging, beverage cans, magnets, seamless pipes, large scale pumps, process pump, coupling, clad steel sheet, transmission gear…
Non-metal	Corks, packaging, textiles, paper, shipping blocks, camera films, rubber products, ABS resin, synthetic resin, UV ink, gravure ink, printing of packing materials, coated abrasives, resin hose, coating materials, dental materials, film sheets, ceramic base for electronic parts, tiles, firebricks, new ceramics, catalysts, paper clay, fasteners, glass for LCD displays, adhesives, packing tape, stencil paper for wigs, sensitized resin, natural resin, cosmetics materials, inorganic pigments, lenses for microscopes, nonwoven fabric, aluminum foil, man-made leather, aluminum cans, resin mold, silicon wafer…
Consumer goods	Fermented soybeans, detergent, flour, plastic bags, plastic food containers, plastic models, office goods, fishing reels, microwave dinners, wood processing, socks, cans, cosmetics, rubber stamps, ballpoint pens, shampoo, shopping bags, cardboard, home exterior products, drinking water, entranceways, underfloor storage units, fixture components, shoes, toy parts, necklaces, stockings, office furniture & fixtures, coffee beans. Labels, envelopes, stationery, candy, gummy, seasoning, steel furniture, toner cartridge, curtains, food trays…
Medical	Medical products, test drugs, medical equipment, laboratory testing reagents, granulated powder, pills, endoscope, dental materials, clinical test medicine, chemicals…
Chemical	Adhesives, plastic, asphalt, silicon, motor oil, polyethylene, polypropylene, molding materials, rubber, fluorine chemical products, polyvinyl chloride, polyvinyl chloride paste, plastic paint products, make up products, chemical substances…

System requirements

Item	Requirement	
Memory	At least 1GB	
Hard Disk space	At least 300MB hard disk space	
CPU	Faster than 1GHz(If 64bit, it's compatible to x64)	
OS	Windows Server 2003 Windows 2000 Server	Windows Vista Windows XP Professional Windows 2000
Other	If using 64bit-CPU, compatible to x64	

※The requirement of Memory, hard disk space, and CPU depends on its usage and the amount of data dealt with.

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※Product specs are sometimes changed upon version-ups.

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