CHAPTER 18

Fabless Menu

A “Fabless Company” is considered to be a company that out-sources the manufacturing of one or more stages of production to an outside company. Such companies are often rapid growing companies that require a simple but effective ERP system including features such as order entry, purchasing, forecasting, and product definition and accounting. In particular, the planning (production control) department of the company must be able to manage and monitor the whole manufacturing process despite the fact that it is not in-house. Outsourcing Service Providers must be able to log-in to the ERP system or import filters take the OSP’s data and import the data into the ERP to allow visibility as to lot status. This chapter describes the “ERP2020 Fabless Module” that provides these additional ERP functions. When pertinent, the discussion here also refers to the ERP2020’s internal tables. This has been done to provide an insight to users who may be interested in creating their own custom reports.

Concepts and Definitions

Manufacturing Jobs and Lots

A fabless manufacturing cycle could, for example, consist of wafer-fabrication at a wafer-foundry, followed by out-sourced wafer-sort, out-sourced assembly, and then outsourced electrical testing. ERP2020 links the stages together by considering the various stages to be part of one **job**. As lots are sent out for these stages, each stage is considered a separate lot in a “virtual chain”. All these lots in the virtual chain belong to a single ERP2020 Job which provides the total-cycle identification and links the various lots.

In this virtual chain, a lot is created, processed, and then closed after a new lot (with a different lot number, but the same job number) is created for the next stage I.E. A lot is created for the first stage and upon completion (of all its traveler steps defined for that location) a new lot is spawned for the second stage/location and then the original lot is closed. The lot for the second outsourced stage will spawn a new lot upon its completion for the final location. The lot for the final stage is called the “Surviving” lot. After the traveler is completed for the surviving lot, the lot is transferred to inventory. After passing any quality inspections, it is ready to be pulled and shipped to an end customer.

Each stage requires creation of travelers, accounting authorization (Buy-Orders), and subsequent financial tracking of each sub-contracting activity. The “Fabless Option” of ERP2020 automates all the steps in the fabless build process and provides a consistent manufacturing process.

Routing-Card

The Routing-Card (or Bill of Routing) is a recipe that defines where and how to build the product. The “where” defines the sub-contractor and the “how” defines the traveler steps to be followed by each sub-contractor when they receive the job. The Routing-Card also contains planned (projected) cycle times and yields for each stage. A Routing-Card may also be considered as a super-traveler that

defines all the manufacturing stages of a product, referencing any “intermediate” part-number(s), suppliers, cost data, and the build-instructions (from the associated travelers). See figure 18.1 on page 18.3

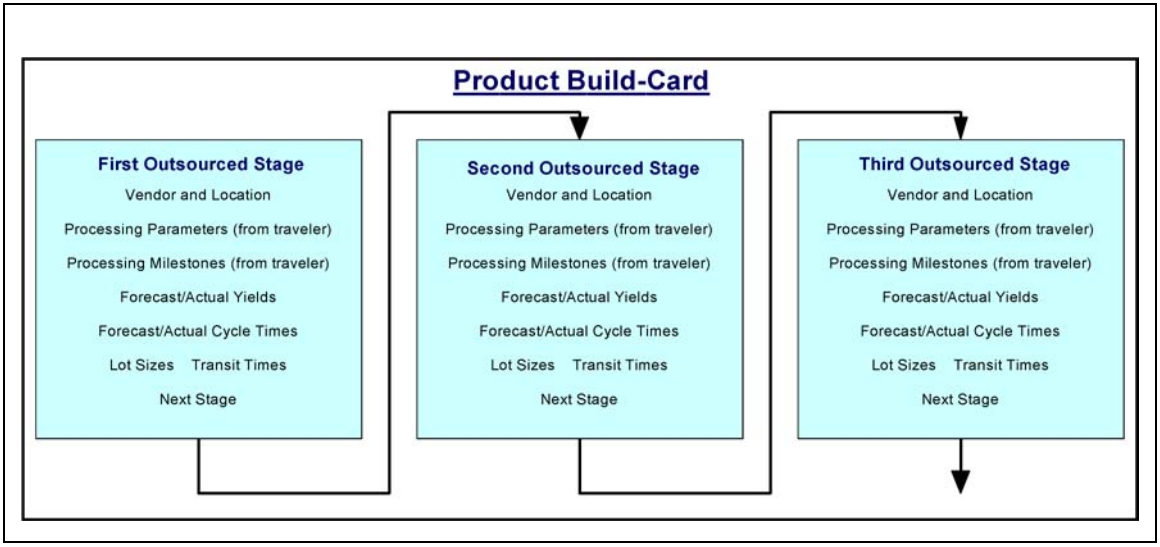


FIGURE 18.1

Each stage in the Routing-Card represents a virtual lot, which, upon its completion, will spawn the next virtual lot until the desired end-product is achieved. As an example, a Routing-Card may contain three steps, where the first item will define the “wafer-fabrication” stage, the second item will define the assembly stage, and the third item will define the final electrical-test stage. Each step includes cycle times, projected yields, minimum lot sizes and transformation factors. By linking the stages together, the correct quantities can be started to fulfill an order and the progress (and its impact on the scheduling of the order) can be tracked.

Nested Routing-Cards

Intermediate products are products that are not shipped to the customer, but are used for the manufacture of end-products. The user may manufacture the intermediate products, store them in inventory, and pull them as required. An example of an intermediate product would be “un-metallized wafers” which will be pulled from inventory when a customized product is being built. The ability to create inter-

mediate products allows the user to “nest” Routing-Cards when defining a Routing-Card for an end-product. Intermediate products may be used to make more than one finished (or “end”) product, and the ability to handle such “parent” intermediate products is an important part of the ERP2020 engine.

Pre-requisites For Building And Shipping Products

Before the manufacturing and business process can start, the user needs to populate data in various tables:

1) The Part Master File (or PRODUCTS table) must be populated with the list of products (devices) manufactured by the company. The list of products includes “intermediate” and “end-products”.

2) The SUPPLIERS table must be populated with a list of all suppliers that will be used during the manufacturing process. This table is populated and updated via the QA menu.

3) The AVL/AML lists must be current. A record is created for each product/service required and associated to one or more suppliers.

4) Blanket Buy-Orders must exist for each supplier. Buy-Orders will be automatically appended with line items (assuming their limits have not been exceeded) as the sub-contracting ensues.

5) A Routing-Card must be created for each manufactured product. If the Routing-Card references an intermediate product, then the Routing-Card for that product must also exist.

6) Finally, a valid sales-order (or a forecast which has been released for build) must exist. In either case the manufactured product is destined for inventory before it is shipped to the end-customer.

The Fabless Build Process via a Fabless-Chain Job

The build process is managed via the following transaction:

a) Each Manufactured item in the Routing-Card is checked for inventory quantities. Any quantities available are grouped and pulled-in on a stock-priority setting followed by first-in first-out basis.

b) Each Lot-item in the Routing-card spawns the creation of a separate lot. The quantities required are adjusted after accounting for any material that will be pulled from inventory. These proposed lots are presented within a job-creation window. The user may re-assign unique lot numbers suggested by the ERP2020. All lots in this virtual lot chain will be bound into a single “build” job.

c) Each lot in this job exists only for the applicable stage in the cycle. The completion of one lot (one step in the manufacturing process) spawns a new lot as product transformation occurs and/or a different supplier is involved.

Upon acceptance of a build transaction, the system **automatically** performs the following tasks:

1. A new build job is created and a unique tracking number is assigned to this job. The job contains a sub-table which lists all the lots contemplated in the virtual chain.
2. Items are pulled from inventory for all the intermediate parts in the chain. The Inventory table is updated and corresponding records are created in the Inventory-Pulls table.
3. A sub-contracting slip for the first lot is created. Other sub-contracting slips will be created as other lots are spawned during the manufacturing process.
4. A new line-item in the Buy-Order associated with the first lot is created. Other line-items will be created as other lots are spawned during the manufacturing process. These line-items are automatically made available to the buyers for their review. (See “Real-time Auto-Buy-Items Window” on page 13.5.)
5. A traveler for the first lot is created (based on the Steps File attached in the Routing-Card). Other travelers will be created as other lots are spawned during the manufacturing process.
6. An inventory record is created. This record will track the progress of the build-job and at any point in time will show the latest (based on yield and schedule variations) projected date of maturity and expected output quantity of the product being manufactured. The product quantities will always be shown in the units of the end-product (accounting for any transformations that have transpired or are pending)

Note: The traveler steps may have BOMS associated with them as necessary. The raw-materials defined in a BOM are pulled when the step to which the BOM is attached is punched-in. This material is different from the “intermediate” parts pulled in item (2) above. Attaching BOMs to travelers become necessary when the Fabless-Company undertakes to supply raw-material to the supplier. A typical example would be the practice of the company supplying lead-frames to BGA substrates the an Assembly House.

Tracking of Lots

Lot-updating is performed in a similar manner to in-house “Floor” lot processing, with the lot being punched-in when a step is being implemented and punched-out when the step has been completed. However the punch in and punch out of the various steps may be at a higher level (less detailed) than if a ERP2020 traveler was being used to process lots internally. Punch in and punch out will normally

be accomplished using a special subcontractor web page access, not using the ERP2020 client. For some subcontractors, such as specialized wafer fab foundries, automatic interface between ERP2020 and the vendor may be possible.

When a fabless lot is punched in, the expected-out date for the lot may be changed. If a change is made then the difference introduced by the change is used to update the expected completion dates for the subsequent-lots in the job (that remain to be spawned). Therefore the final completion date and ship date is kept current at all times.

After the last step of a lot has been completed, it is ready to be moved to the next stage. The next stage may be the next lot in the chain or a transfer to inventory. When a lot “expires” after spawning a new lot (or moving to inventory), the progressive count of the current lot is set to zero and the system data is updated to acknowledge “receipt” of the lot (in the “LotsToSuppliers” table). In addition, the Buy-Order item associated with the lot is updated with the new counts.

Sales Order and Forecast Entry and Release.

Incoming purchase orders (or sales orders), are entered and stored in two sections: a main PO table (PO_LOG) and a related line item table (PO_Items). The main table contains the purchase-order number, the amount of the purchase order, the customers' name, default billing and shipping address, etc. In the main PO table, the PO number is unique I.E., only one record can exist with a specific PO-number. In the related line item table (PO_Items), there are usually many line items linked to the same PO-number.

Records in the PO-items table are usually entered via the form of the parent purchase-order. Each PO-item is either for a service or a manufactured part. If it is not for service then upon its creation it is set as an "un-released" item. An un-released item must be released via a controlled process before it can trigger a manufacturing job and, via a separate control, before a shipment can be made against it. In addition to orders attached to a specific purchase-order "soft" orders (line-items) may also be created. Soft line-items may also be created via periodic transposition of marketing forecast. The status from "soft" to "firm" may be converted via a controlled procedure.These items are not associated with a specific purchase order (or customer) and are labelled as "unassigned". ERP2020 allows the user to start a build-job from a soft-order, if, and only if, the "OKtoBuild" characteristic of the line-item is set. It does not however allow the user to ship unless the forecast has been released and converted into a firm sales order-item. Only a firm sales order-item can create a "ship-job".

An unassigned soft order can be assigned to any customer and any purchase-order any time prior to the creation of a ship-job. Customer-specific forecasts may be entered and converted to valid orders when the customer confirms the demand with a purchase order. However, a forecast entry does not have to be associated to a customer or a purchase-order when it is created. It is tracked by a unique identifier and may be associated later to an existing or new purchase order. A forecast item maintains a comprehensive log of all modifications made to it all the way through to its maturity and fulfillment, or its cancellation.

Notes:

1) A "Build-Job" is a fabless-mode-job that details the process of building the desired end-product. After it is completed the product being built is transferred to finished-goods inventory and the job is closed. Typically there are no monies to be invoiced against this job.

2) A "Ship-Job" is a job that details the shipping of product to fulfil a form sales-order item. It is created (via pulling material from finished goods), shipped, and invoiced.

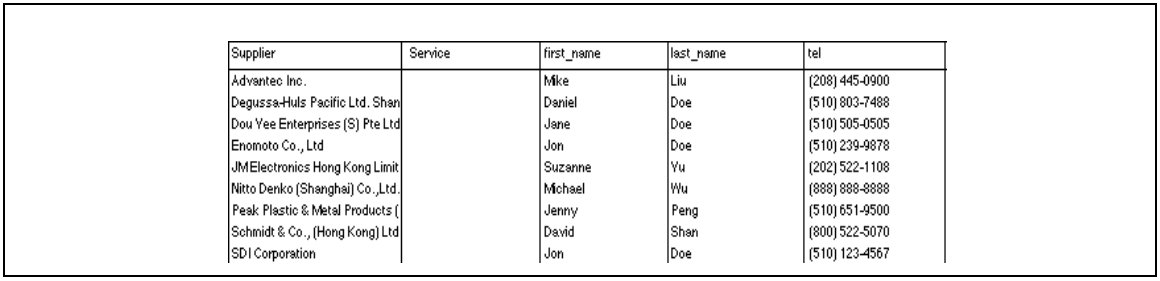
3) A forecast-item in the PO_Items table is a physically separate record from a forecast-item in the Forecast table, however, it may have been created via a **transposition** of a marketing-forecast-entry (or a partial quantity of it) in Forecast table. The record created in the PO_Items table via the transposition of a marketing-forecast-record is an **orphan** item that does **not** belong to any specific customer or Sales Order (Purchase order from a customer). The ERP2020 allows this transposition so that **all** build-jobs, created to satisfy a firm order (booking) or a marketing-forecast based build-plan are created via a **single** interface, thereby tightly controlling the authorization and initiation a manufacturing process.

Fabless-mode menus:

•Menu: Supplier

Menu-Item: *Show Approved Suppliers*

This menu lists all the suppliers **approved** by the Quality Assurance department (via the QA menu), as shown in figure 18.2 on page 18.9:



Supplier	Service	first_name	last_name	tel
Advantec Inc.		Mike	Liu	(208) 445-0900
Degussa-Huls Pacific Ltd. Shan		Daniel	Doe	(510) 803-7488
Dou Yee Enterprises (S) Pte Ltd		Jane	Doe	(510) 505-0505
Enomoto Co., Ltd		Jon	Doe	(510) 239-9878
JM Electronics Hong Kong Limit		Suzanne	Yu	(202) 522-1108
Nitto Denko (Shanghai) Co.,Ltd.		Michael	Wu	(888) 888-8888
Peak Plastic & Metal Products (		Jenny	Peng	(510) 651-9500
Schmidt & Co., (Hong Kong) Ltd		David	Shan	(800) 522-5070
SDI Corporation		Jon	Doe	(510) 123-4567

FIGURE 18.2

Double clicking an item in this list will provide details on a particular supplier as shown in figure 18.3 on page 18.10:

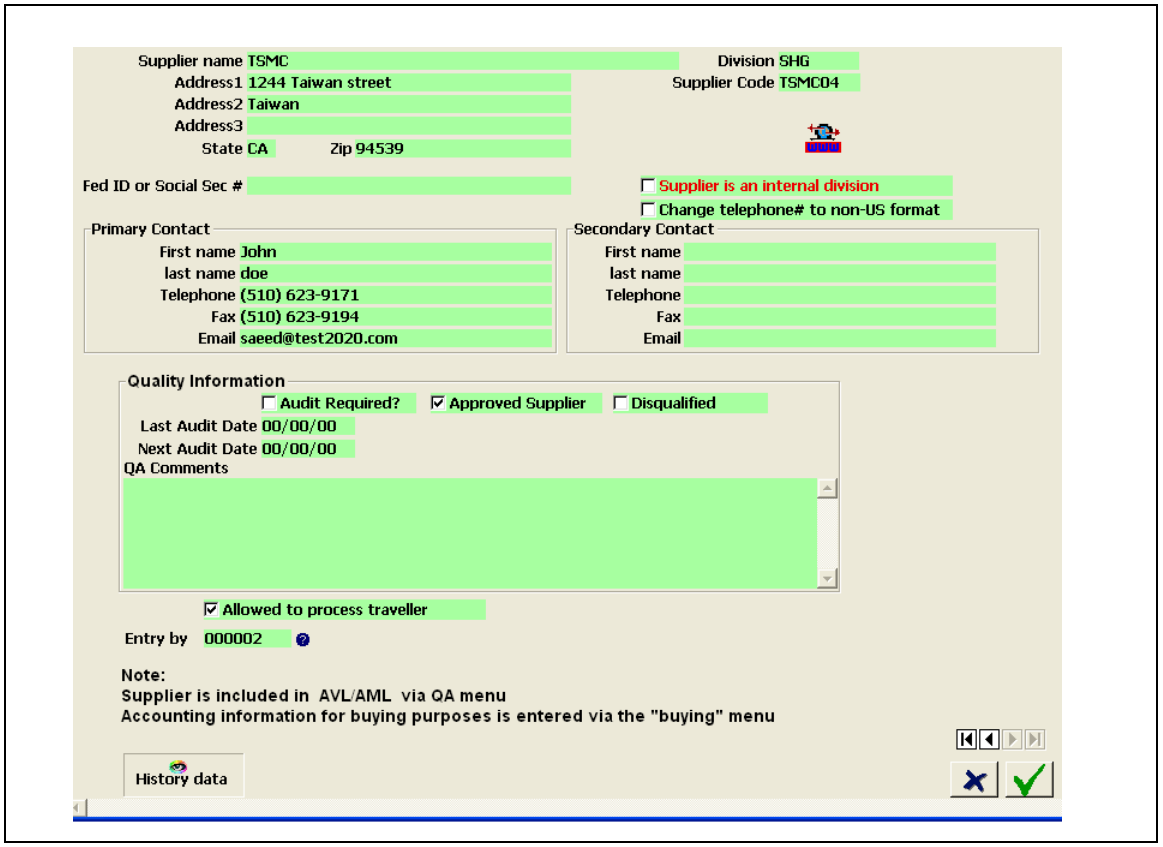


FIGURE 18.3

This instance of the form is for display only and the fields are not modifiable. To modify, the record, use the “Modify” menu-item.

The fields in the form are as follows:

Supplier name: Name of the Supplier.

Address:	Supplier's address.
Fed Id or Social Sec.#:	Federal Identification for the supplier (US applications only).
Contact info:	Contact information of the Supplier. It can be changed via Modify menu item.
☐Supplier is an internal Division.	If the check box is checked then the supplier is an internal division of the enterprise.
☐Telephone # to non-US.	Check to change the telephone number format to non US format. This is for international users.
☐Audit required:	This flag (set by QA) indicates that the supplier must be audited before procurement can take place.
☐Approved Supplier	The checkbox is set when the supplier is approved.
☐Disqualified	The checkbox is set when the supplier is disqualified.
Last Audit Date:	The date of the last audit if the Audit Required checkbox is set.
Next Audit Date	If the "Audit Required" checkbox is set, the date the next audit is due.
☐Allowed to process traveller:	If set then the supplier can collaborate on a traveler. This means that for those traveler steps which will be implemented by the supplier, the supplier is allowed to enter information into ERP2020 via the internet.
QA Comments:	Any other information for QA.
History data button	Provides purchasing data on the supplier. This information is put in a 4D Write document. See figure 18.4 on page 18.11

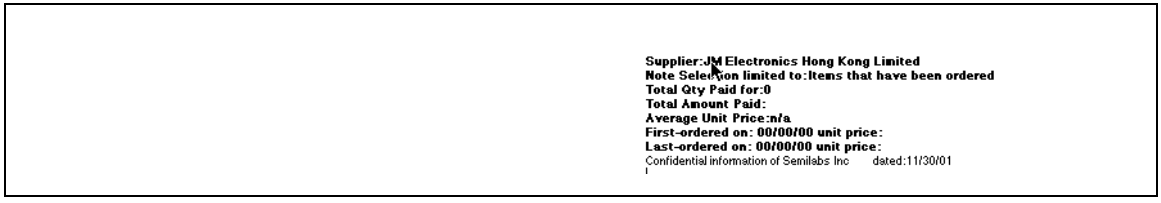


FIGURE 18.4


Login Account Button

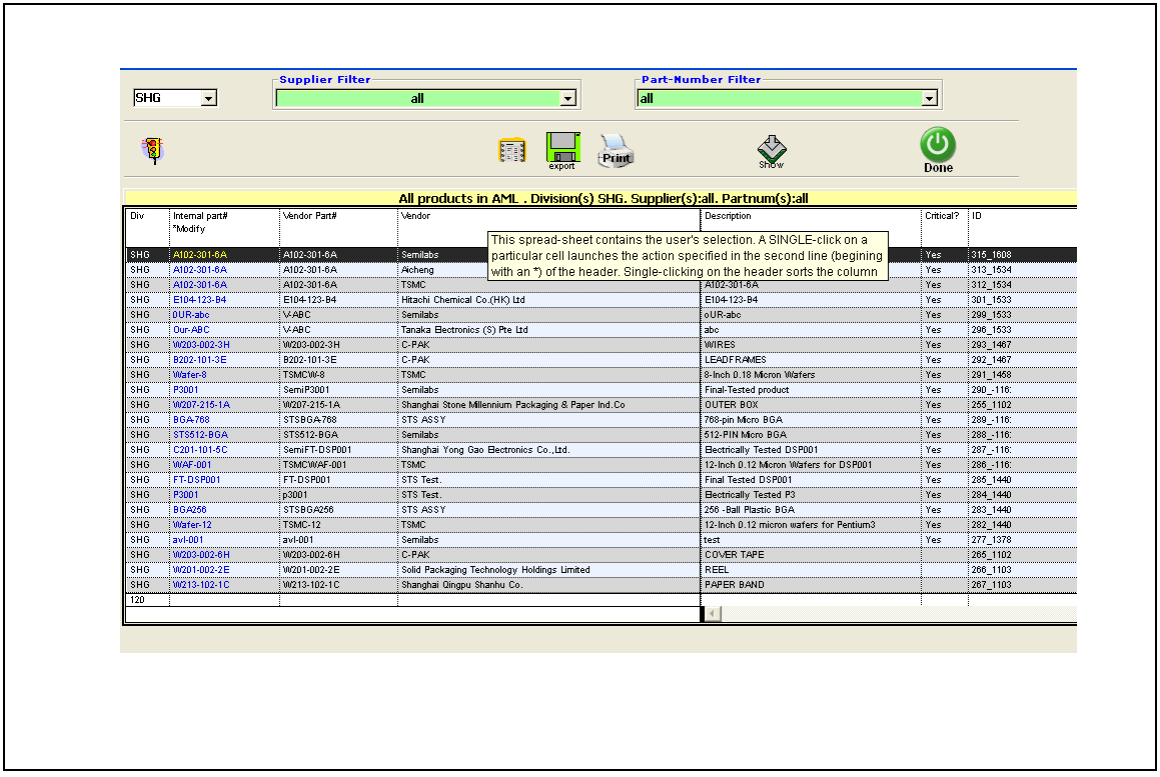
This button allows the user to assign a user-login-account to the supplier. Using the assigned user-name and password the supplier may login to the ERP2020 system to update the traveler steps being performed by the supplier.

Note: The account will be created if a sample **user** named “Supplier_Template” has been created by the administrator in the Users and Groups database. This “Supplier_Template” user must belong to the Suppliers group **only** and the startup-method assigned to this user must be set to “none”. If this user does not exist then a new supplier-specific web-access user-account cannot be created. For details on creating the “Customer_Template” user-account see “Manage Users & Groups” on page 1.9.65

•Menu: Supplier

Menu-Item: *Show Supplier by Product*

This menu provides a list of all products in the AML and the associated suppliers via an interactive spreadsheet. See figure 18.5 on page 18.13



Div	Internal part# *Modify	Vendor Part#	Vendor	Description	Critical?	ID
SHG	AI02-301-6A	AI02-301-6A	Semilabs		Yes	315_1608
SHG	AI02-301-6A	AI02-301-6A	Aicheng		Yes	313_1534
SHG	AI02-301-6A	AI02-301-6A	TSMC	AI02-301-6A	Yes	312_1534
SHG	EI04-123-B4	EI04-123-B4	Hitachi Chemical Co.(HK) Ltd	EI04-123-B4	Yes	301_1533
SHG	OUR-abc	V-ABC	Semilabs	oUR-abc	Yes	299_1533
SHG	Our-ABC	V-ABC	Tanaka Electronics (S) Pte Ltd	abc	Yes	296_1533
SHG	W203-002-3H	W203-002-3H	C-PAK	WIRES	Yes	293_1467
SHG	B202-101-3E	B202-101-3E	C-PAK	LEADFRAMES	Yes	292_1467
SHG	Wafer-8	TSMCW-8	TSMC	8-Inch 0.18 Micron Wafers	Yes	291_1468
SHG	P3001	SemiP3001	Semilabs	Final-Tested product	Yes	290_-116:
SHG	W207-215-1A	W207-215-1A	Shanghai Stone Millennium Packaging & Paper Ind.Co	OUTER BOX	Yes	255_1102
SHG	BGA-768	STSBGA-768	STS ASSY	768-pin Micro BGA	Yes	289_-116:
SHG	STS512-BGA	STS512-BGA	Semilabs	512-PIN Micro BGA	Yes	288_-116:
SHG	C201-101-5C	SemiFT-DSP001	Shanghai Yong Gao Electronics Co.,Ltd.	Electrically Tested DSP001	Yes	287_-116:
SHG	WAF-001	TSMCWAF-001	TSMC	12-Inch 0.12 Micron Wafers for DSP001	Yes	286_-116:
SHG	FT-DSP001	FT-DSP001	STS Test.	Final Tested DSP001	Yes	285_1440
SHG	P3001	p3001	STS Test.	Electrically Tested P3	Yes	284_1440
SHG	BGA256	STSBGA256	STS ASSY	256 -Ball Plastic BGA	Yes	283_1440
SHG	Wafer-12	TSMC-12	TSMC	12-Inch 0.12 micron wafers for Pentium3	Yes	282_1440
SHG	avl-001	avl-001	Semilabs	test	Yes	277_1378
SHG	W203-002-6H	W203-002-6H	C-PAK	COVER TAPE		265_1102
SHG	W201-002-2E	W201-002-2E	Solid Packaging Technology Holdings Limited	REEL		266_1103
SHG	W213-102-1C	W213-102-1C	Shanghai Qingpu Shanhu Co.	PAPER BAND		267_1103
120						

FIGURE 18.5

Note that the AML list is maintained by the Quality Assurance department, via the QA menu. (See “AVL/AML” on page 8.71.)

Clicking the particular item invokes the following details form. See figure 18.6 on page 18.14

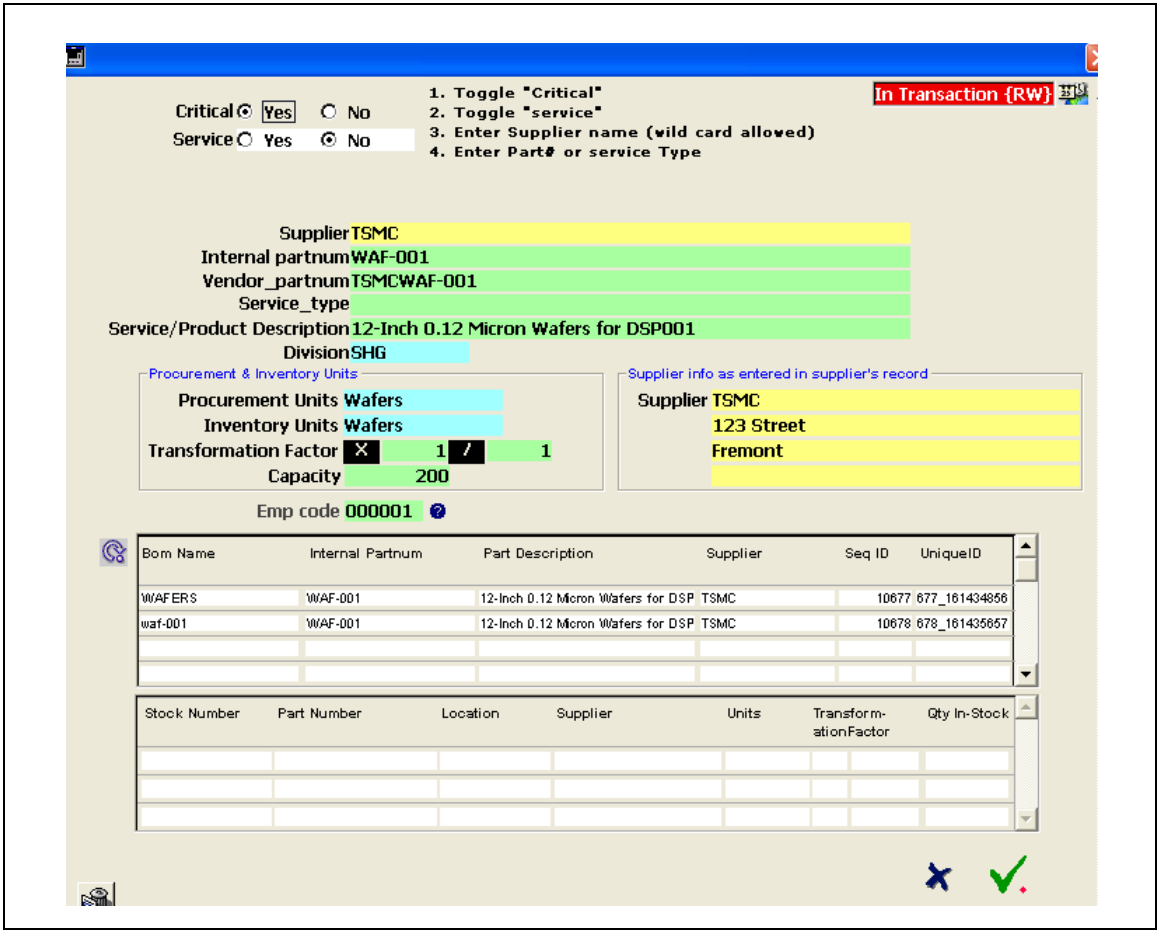


FIGURE 18.6

Menu-Item: *Show Supplier By Service*

This menu provides a list of all **services** in the AML and the associated suppliers

Menu-Item:*ADD*

This menu allows the user to add a supplier to the ERP2020 database via the following form. See figure 18.7 on page 18.15.

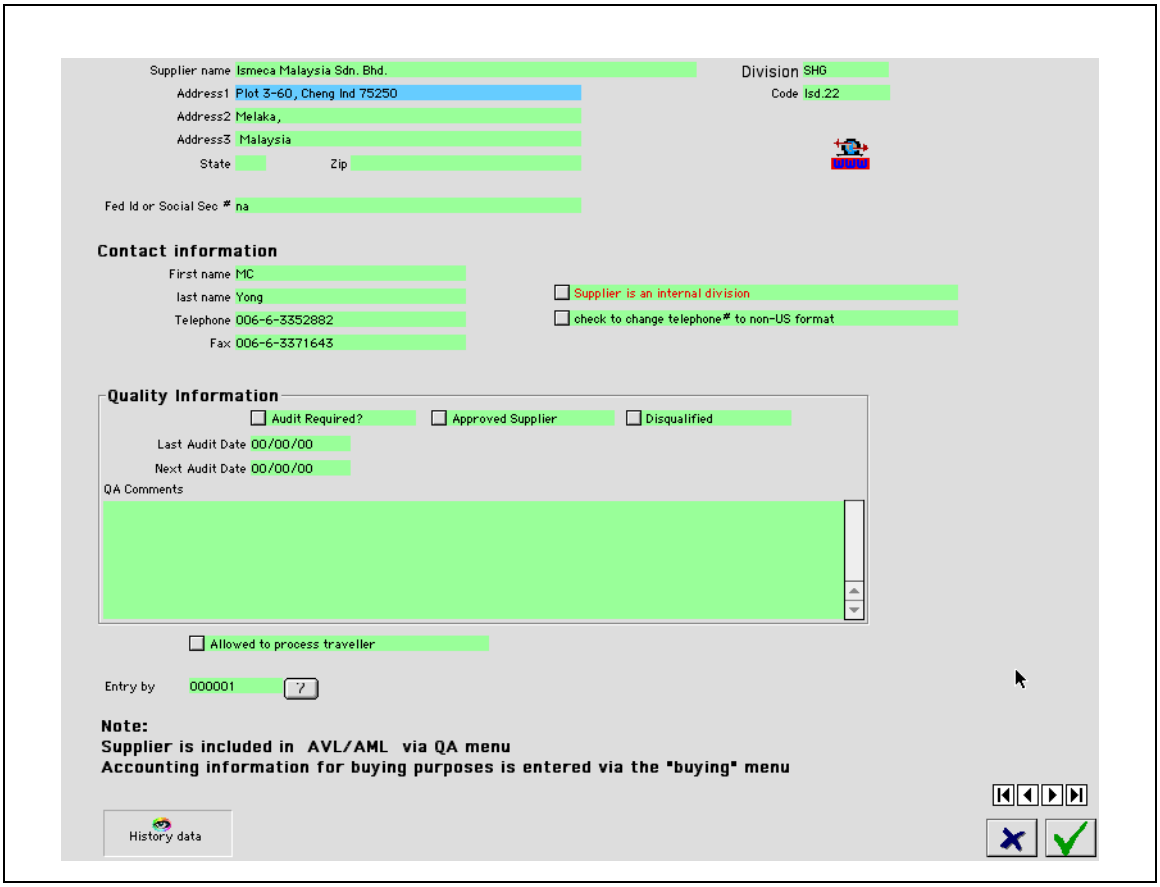


FIGURE 18.7

Menu-Item:*Modify*

This menu allows the user to modify the supplier record. The form used to modify the data is the same as used in the “Add” menu.

•Menu: Demand & Supply

Menu-Item: *Demand Spreadsheet*

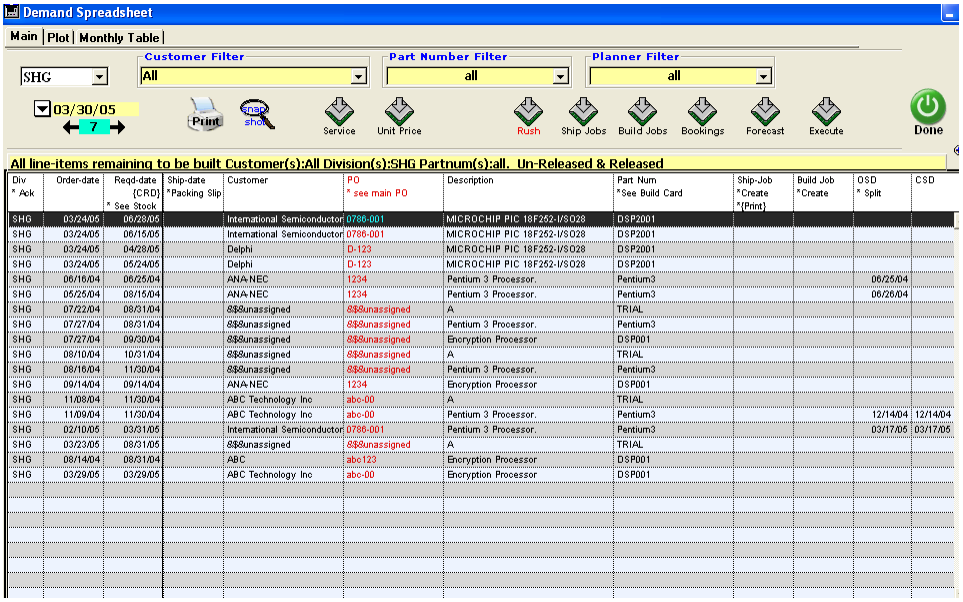
This spreadsheet can be populated by all firm and soft order items. A firm order-item is an item that is associated with a specific purchase-order from a customer. A soft-order-item may or may not be customer-specific. If it is customer-specific then it is added to an existing customer-purchase-order as a “Un-released” item. A non-customer-specific order-item is an item that has been transposed from a marketing-forecast and does not have any specific customer (or purchase-order) associated with it.

All order-items (entries in the PO_Items table) can be reviewed, processed and updated via the Demand Spreadsheet.

A multi-paged interface provides the user macro and micro views of Orders, Backlogs, Shipping, and Billing. The constituent pages are shown in figure 18.8 on page 18.17,figure 18.10 on page 18.24, and figure 18.11 on page 18.26.

The first page provides a micro view, with access to each order item. The second and third pages provide macro views and trends in graphical and tabular formats.

The first page contains a spreadsheet that provides a comprehensive interface to manage and monitor individual order items. The execution of an order, be it via the authorization of a “Build-job” (start a manufacturing job to full-fill the order) or via a “Ship-job” (pull from inventory for shipment) is conducted via this spreadsheet.



Div * Ack	Order-date	Reqd-date {CRD} * See Stock	Ship-date *Packing Slip	Customer	PO * see main PO	Description	Part Num *See Build Card	Ship-Job *Create *{Print}	Build Job *Create	OSD * Split	CSD
SHG	03/24/05	06/28/05		International Semiconductor	0786-001	MICROCHIP PIC 18F252-I/SO28	DSP2001				
SHG	03/24/05	06/15/05		International Semiconductor	0786-001	MICROCHIP PIC 18F252-I/SO28	DSP2001				
SHG	03/24/05	04/28/05		Delphi	D-123	MICROCHIP PIC 18F252-I/SO28	DSP2001				
SHG	03/24/05	05/24/05		Delphi	D-123	MICROCHIP PIC 18F252-I/SO28	DSP2001				
SHG	06/16/04	06/25/04		ANA-NEC	1234	Pentium 3 Processor.	Pentium3			06/25/04	
SHG	05/25/04	08/15/04		ANA-NEC	1234	Pentium 3 Processor.	Pentium3			06/26/04	
SHG	07/22/04	08/31/04		&&unassigned	&&unassigned	A	TRIAL				
SHG	07/27/04	08/31/04		&&unassigned	&&unassigned	Pentium 3 Processor.	Pentium3				
SHG	07/27/04	09/30/04		&&unassigned	&&unassigned	Encryption Processor	DSP001				
SHG	08/10/04	10/31/04		&&unassigned	&&unassigned	A	TRIAL				
SHG	08/16/04	11/30/04		&&unassigned	&&unassigned	Pentium 3 Processor.	Pentium3				
SHG	09/14/04	09/14/04		ANA-NEC	1234	Encryption Processor	DSP001				
SHG	11/08/04	11/30/04		ABC Technology Inc	abc-00	A	TRIAL				
SHG	11/09/04	11/30/04		ABC Technology Inc	abc-00	Pentium 3 Processor.	Pentium3			12/14/04	12/14/04
SHG	02/10/05	03/31/05		International Semiconductor	0786-001	Pentium 3 Processor.	Pentium3			03/17/05	03/17/05
SHG	03/23/05	08/31/05		&&unassigned	&&unassigned	A	TRIAL				
SHG	08/14/04	08/31/04		ABC	abc123	Encryption Processor	DSP001				
SHG	03/29/05	03/29/05		ABC Technology Inc	abc-00	Encryption Processor	DSP001				

FIGURE 18.8

Demand Spreadsheet Filters:

Customer	The customer-filter allows the user to limit all subsequently-chosen queries to the selected customer. It works in conjunction with the part-number filter.
Part-number	The part-number filter allows the user to limit all subsequently-chosen queries to the selected part-number. It works in conjunction with the customer filter.
Planner	The planner filter allows the user to limit the Build-Job and Ship-Job queries to the selected planner.

Demand Spreadsheet columns:

The columns of the Demand Spreadsheet display data from the PO-Line-items table. The fields in this table are discussed in detail below. See “Sales-Order record {PO-items} field details:” on page 18.29. The data displayed by the columns is detailed below:

Division	Division that owns the order
Order Date	This is the date that the order was placed by the customer.
Required Date {CRD}	Date by which the order must be shipped. Also referred to as the Customer-Request Date.
Ship Date	If the row depicts a firm sales order and the order has been shipped then this column will show the date on which the shipment took place.
Customer	Customer’s name if the order is customer-specific.
PO	Purchase-Order number, if the item is attached to a firm purchase order.
Description	Item description.
Part-Number	Part-number being ordered.
Ship-Job	If the order has been fulfilled then this column displays the number of the job used to ship (and then invoice).
Build-Job	If a build-process was initiated by this item then this column displays the job-number that launched the build-process.
OSD	This column displays the original scheduled date. (of completion of the build-job). This is the original date when the build-process is **expected** to be completed. The “expected” date is calculated using the data in the Routing-Card.
CSD	This column displays the current scheduled date (of completion of the build-job). When a build-job is started, this date is set to the OSD. This date will be automatically **revised and updated** whenever the schedule is changed on any of the lots in the virtual chain. To revise

	scheduled dates in the job-chain see “Managing a Build-Job:” on page 2.18.66
Quantity	Quantity required (demanded) by the item.
Un-released	This column displays the status of the order. If un-released then no shipment can be made against the order until it is released. Note that a separate field called “OK to Build” authorizes the building process even though the item may not be released.
ID	Uniquely identifies an order (PO-item)

Pull-down menus:

Build-in queries are provided by the pull-down menus behind each of the Query buttons shown below in figure 18.1 on page 18.3:

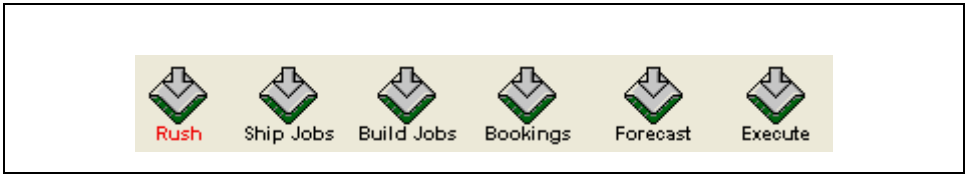


FIGURE 18.1

Execute Menus:

All Product Items	Based on the filters, this will populate the spreadsheets with **all** line-items in the demand spreadsheet, irrespective of their status, as to whether a they have been built or shipped, released or unreleased. The selection will be reduced by the filter selections of part-number and customer.
Recommended Start by Month	This menu will populate the spreadsheet with all build-jobs that must be started this month to meet their respective CRDs.

Items Remaining to be Built	This menu will populate the spreadsheet with all items that have not been shipped and have not been submitted to manufacturing. Using this selection the user may start executing the orders by shipping from inventory or alternatively, building and then shipping.The list of items will show all items whether or not they have been upgraded to "OK to Build".
Requiring Build Authorization	This menu will list all items whose "OK to Build" flag has **not** been set.
Un-Released items	Items with the "Un-Released" flag set to true. Note that by default all sales-order items (that are product-related) have this flag set to true when the items are first **created**.

Forecast Menus:

Forecast Demand	This menu populates the spreadsheet with all items that have been transposed from the marketing forecast-plan.
Awaiting Build-Approval	This menu populates the spreadsheet with all forecast items that have not yet been approved to commit to manufacturing.

Bookings Menus:

All	This menu will populate the spreadsheet with all firm orders in the data-base irrespective of their status.Selection filters will apply.
All Soft-Bookings	These are customer orders that have not been released.
CRD this month	This pull-down menu will populate the spreadsheet with all sales-order items whose CRD (Customer Request dates) fall in the selected month and still do not have a ship-job associated with them.
Shipped this month	Will provide a list of all items that were shipped to the customer via a ship-job. Note that a ship-job must go through the regular shipping

process before the Sales-Order-item is updated with the physical ship-date. To ship a job see “Ship lots {Processed | Boxstock}.” on page 1.5.14.

Build-Jobs Menus:

WIP	This menu will populate the spreadsheet with all items in the demand spreadsheet that are associated with an **active** build-job (IE the manufacturing process is ongoing).
Build Jobs started this day	This menu will list all items with build-jobs started on a selected day. The selected date may be changed via the pop-up calendar.
Build Jobs started this month	This menu will list all items with build-jobs started within a selected time interval. The time interval is based on the month selected via the pop-up calendar.
In finished Goods	This menu will list all items, not-shipped against, whose build-jobs have been completed and the product is therefore in Finished-Goods. If an item in this list has been released then the item is “shippable”.

Ship-Jobs Menus:

Shipped this date	This menu item will list all sales-order items that have been shipped on the selected date.
Shipped this Period	This menu item will list all sales-order items that have been shipped within the selected month.
Pulled this date	This menu item will list all sales-order items that have been pulled from inventory on the selected date.
Pulled this Period	This menu item will list all sales-order items that have been pulled from inventory within the selected month.

Rush Button Menus:

Delayed Shipments	This menu will list all items that have missed the shipment date.
Shipments Due before	This menu item will list all items whose CRD is less than or equal to the selected date plus a variable number of days (as selected by the counter shown above).

Demand-Spreadsheet hyper-links:

*See Stock Status	When a build-job has been created for a selected Sales-Order item, the user may review the inventory-stock record (and any reservations against it) associated with the build.
* See main PO	Allows the user to browse the purchase-order and all line-items related to it.
* Create (Ship-Job)	If the line-item is a valid sales order (I.E. it is associated with a valid sales-order and has been released) and a ship job has not been created then the user may create a ship job for a particular line-item by clicking in this column. The ship-job will be created if **eligible** inventory is available. If the eligible inventory stock is less than the quantity required, then the line-item in the sales order will be split so that partial fulfilment of the order can take place.If inventory for the particular part-number exists but is not eligible to be pulled (because it is inactive, has expired, is pending Quality-inspection or is locked by another item) then a dialog detailing the ineligible stock will be displayed.
*Create (Build-Job)	If the line-item is a valid one (i.e. it is not void and has been **released for build**) and has **not** been fulfilled (i.e. Ship and Build job-numbers are 0) then a build job will be created. For details on the build-process see “The Fabless Build Process via a Fabless-Chain Job” on page 2.18.4)
* Un-Peg	If the line-item does not have a ship-job associated with it (but does have an associated build-job) and the item has made a reservation tag on a specific inventory stock, then this action will allow the user to release (“un-peg”) the inventory reservation.

* Release	When a line-item is added to a sales order it is saved as an “Un-Released” item and the “OKtoBuild” flag is not set so that a build or ship job creation is subject to “release” of the line-item. Clicking in this column allows the user to modify the selected line-item and release it so that a ship or build-job may be created. Note that any time a sales order line-item is modified the changes made are appended to the History field for traceability purposes.
* See	The user may view the details of the selected item in read-only mode.
Split	A line-item in the sales-order which has not been shipped and does not have a build-job associated with it, may be split into multiple line-items. The split is conducted within a transaction and the user is allowed to review the mother and child items before committing the transaction. The system ensures that the sum of quantity-ordered for all the line-items (mother and multiple child-items) is equal to the original quantity ordered in the mother-item. The split is conducted via the dialog shown below:

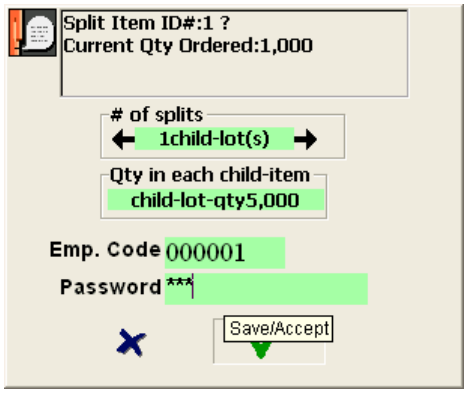


FIGURE 18.9

Demand-Spreadsheet, Graphical Macro and Maicro Views

The second tab of the spreadsheet provides a graphical monthly trend shown in figure 18.10 on page 18.24.

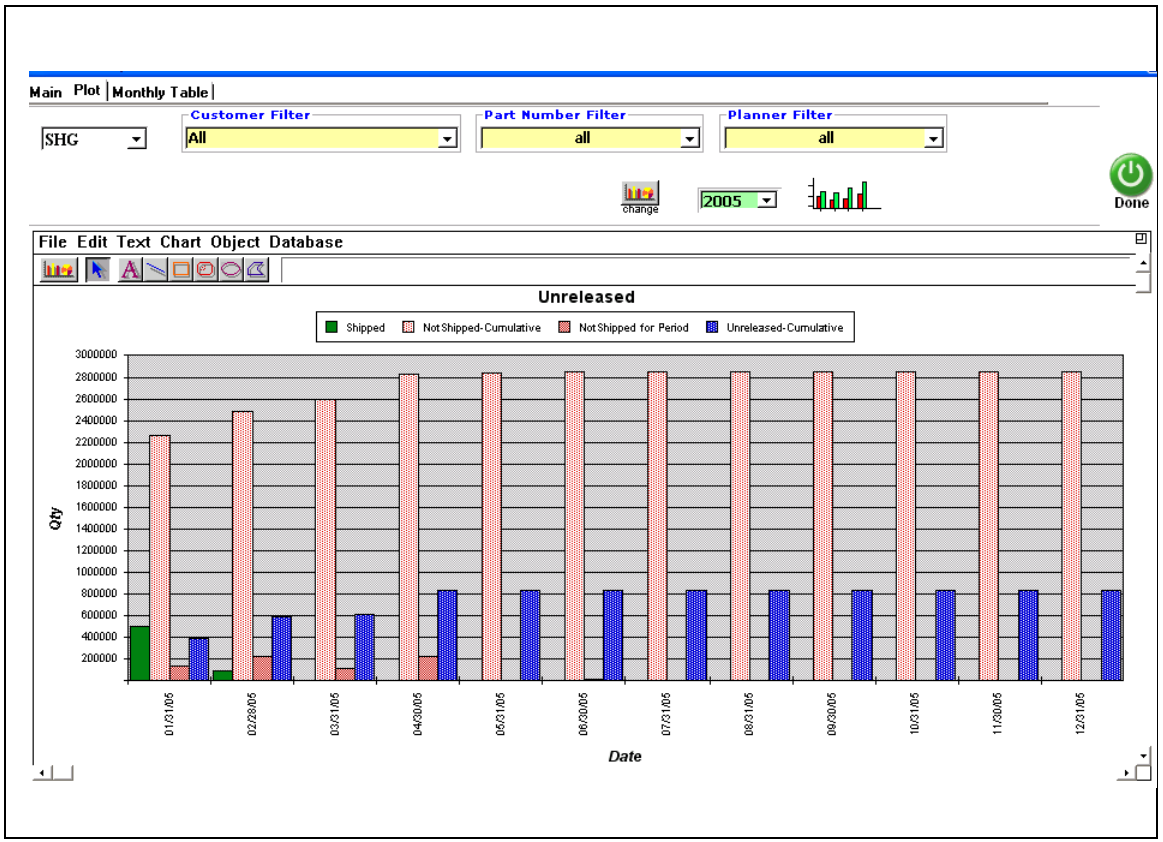


FIGURE 18.10

Demand SpreadSheet Plot Menus:

Plot Supply and Demand — This menu plots the Supply and Demand trend over the 12-month period for the selected year. A two or three dimensional, **interactive** graph shows the Shipped, Not-Shipped, Cumulative-Not-shipped and

Cumulative-Unreleased over each period. The Shipped depicts what has been physically shipped in the period (based on the ship-date). The Not-shipped depicts the unshipped in the given period (based on the CRD). The Not-shipped -Cumulative depicts the unshipped from the current period plus the unshipped from prior periods. The first period of the graph accumulates the total delinquency prior to the beginning of the first period of the graph.The Unreleased -Cumulative depicts the unreleased from the current period plus the unreleased from prior periods. The first period of the graph accumulates the total unreleased prior to the beginning of the first period of the graph.

All filters are applicable for the graph.

Interactive Mode of Supply and Demand Graph:

The data of records behind each column (of any series) in the graph may be displayed when the user presses the control-key and points the cursor on the column. For example the data shown below in figure 18.2 on page 18.9 shows the selection of records when the user focusses the cursor on the first column of the “shipped” series. The user may zoom in to a particular item by double-clicking to open the detail-form.

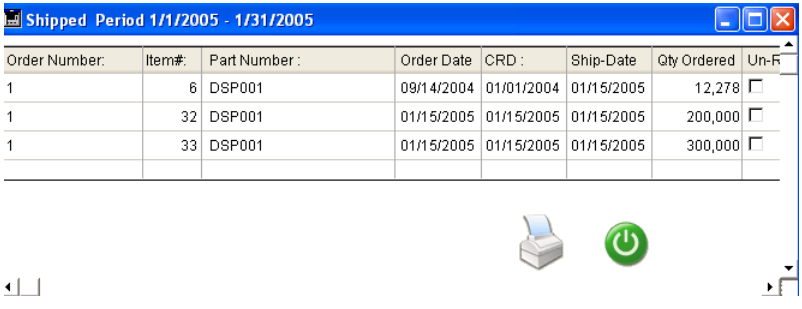
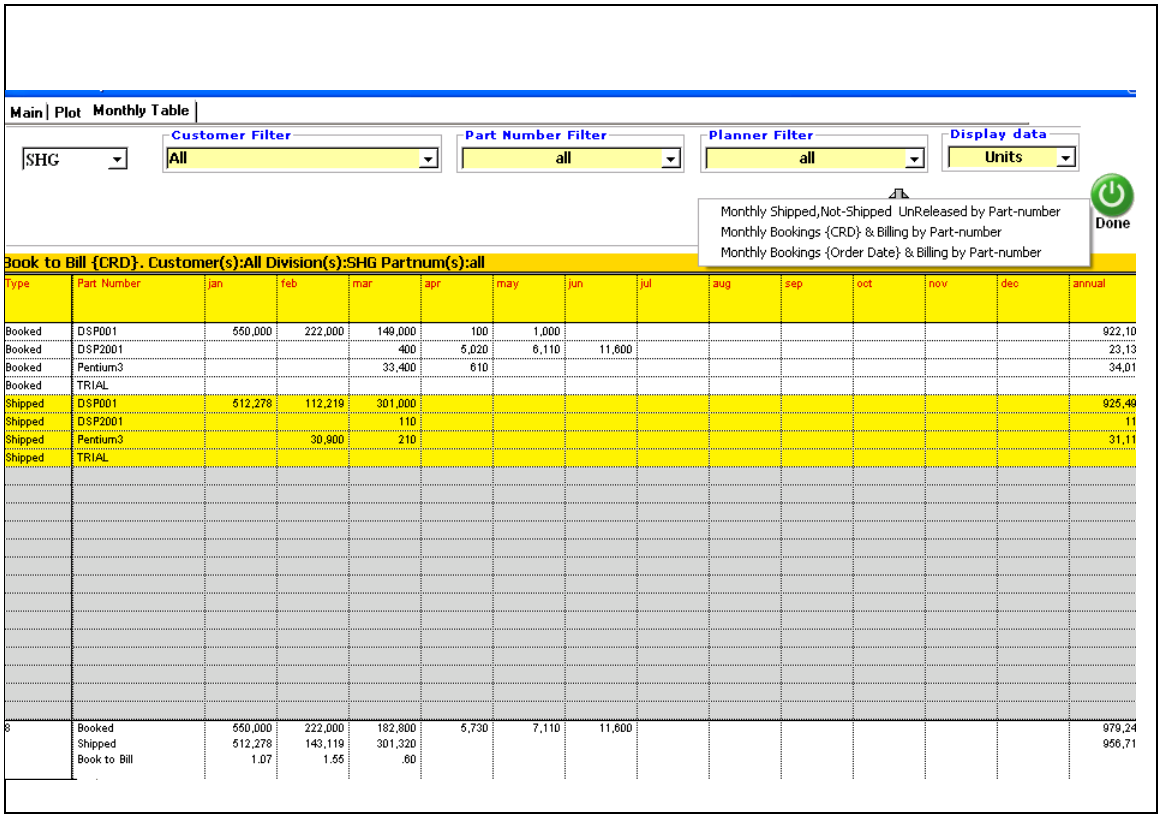


FIGURE 18.2

Demand SpreadSheet, Tabular Macro View by Period:

The third tab provides a tabular representation of the data shown in figure 18.11 on page 18.26.



Type	Part Number	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	annual
Booked	DSP001	550,000	222,000	149,000	100	1,000								922,10
Booked	DSP2001			400	5,020	6,110	11,600							23,13
Booked	Pentium3			33,400	610									34,01
Booked	TRIAL													
Shipped	DSP001	512,278	112,219	301,000										925,49
Shipped	DSP2001			110										11
Shipped	Pentium3		30,900	210										31,11
Shipped	TRIAL													
8	Booked	550,000	222,000	182,800	5,730	7,110	11,600							979,24
	Shipped	512,278	143,119	301,320										956,71
	Book to Bill	1.07	1.55	.60										

Figure18.11.

This spreadsheet allows the user to review the monthly bookings, shipping, and billing data. The data may be viewed by quantity of units or by revenue. The data may be accumulated for all parts and all customers or be filtered by customer and or part-number. This spreadsheet displays data on a monthly and cumulative annual basis.

Tabular View Menus:

The first menu creates three rows of data for each part-number. The first row shows the monthly **shipped**. The second rows shows the monthly **not-shipped**, or backlog (released and un-released

orders minus shipped). The third row shows monthly "**un-released**". The data shown in these rows may be in units or dollar-amount, based on the setting of the "Display Data" filter.

Shipped	All items shipped in the month
Not Shipped	All items, whether or not firm, not shipped.
Un-Released	This is the un-released component of the Not-Shipped category

TABLE 18.12

The second and third menus deal with the **Book-To-Bill** ratio. The second menu shows the billings (based on the physical ship-date) and the bookings based on the **Customer-Request-Date** (CRD). The third menu shows the billings (based on the physical ship-date) and the bookings based on the **Order-Date** (even though the request-dates may be phased in the future). The booking and billing data is by definition based on firm orders.

Converting a soft-order to a firm-order:

As discussed earlier, when building to forecast, the forecast is first transposed to a soft sales-order item (PO_item). The transposition may have occurred piece-meal (the monthly forecast was spread over several PO_items) or all at once (one PO_item was created for the total monthly forecasted quantity). The transposition is necessary because all build-orders are started via the Sales-Order items. The user may also at anytime upgrade a soft-order-item to a firm-order-item. This is done by assigning the item to an existing purchase-order from a customer. The upgrading of the order is done via the "Release" column-specific action in the Demand Spreadsheet. The form which facilitates the upgrade is shown in figure 18.13 on page 18.28.

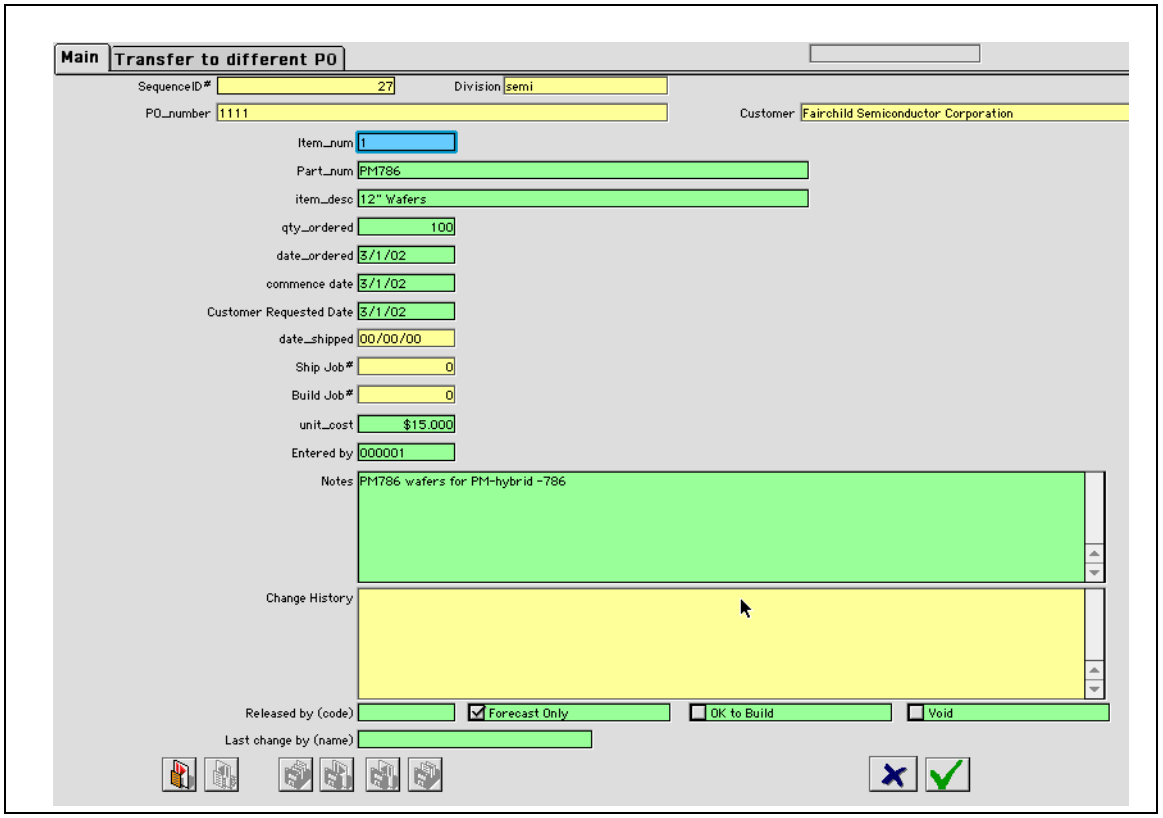


FIGURE 18.13

The second tab of this form allows the user to attach (establish a relationship) the forecast-item (in the PO_Items table) to a valid purchase-order (in the PO_Log table). See figure 18.14 on page 18.29.

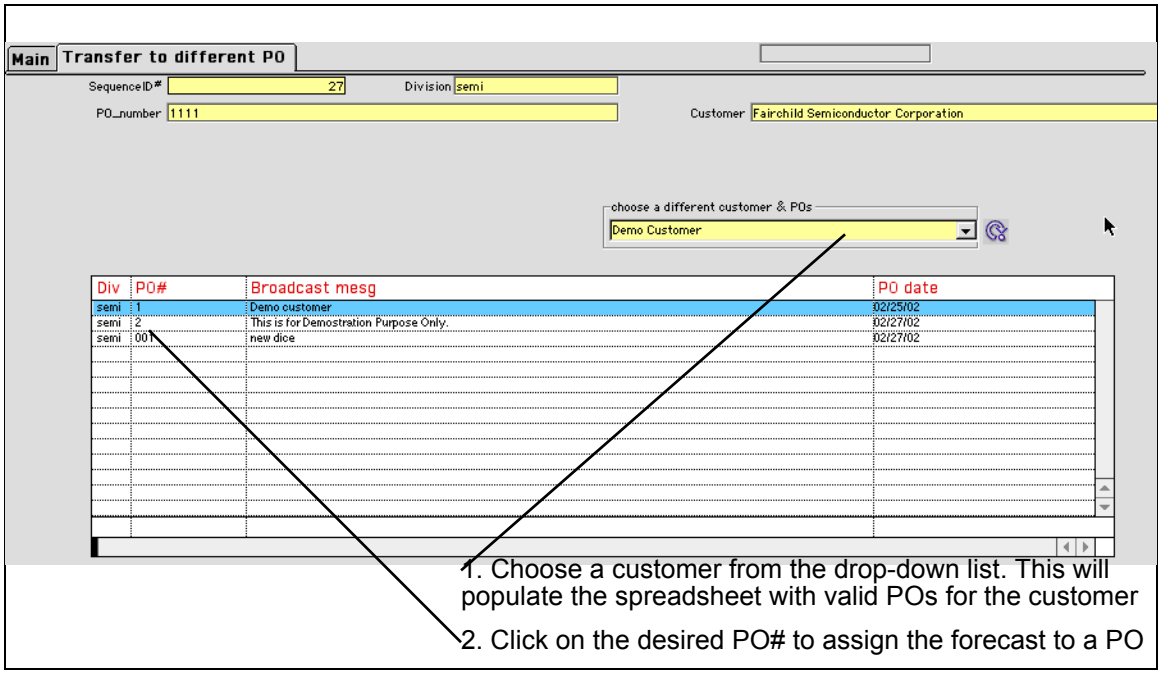


FIGURE 18.14

The preceding graphic in figure 18.14 on page 18.29 shows the two-step process required to relate a soft-order-item in the PO_Items table to a pre-existing, and valid customer-purchase-order.

When a PO_item is upgraded from Soft to Firm, the system will automatically reserve the inventory-stock (WIP or final) that was created by a build-job started by the PO_item. This feature is particularly useful when the user wants to secure inventory for a specific customer by pegging WIP inventory.

Sales-Order record {PO-items} field details:

For a discussion on PO-items fields see “PO-items detail-form fields:” on page 1.11.59

Fabless Build-Process:

Step1:

The Sales Order contains an itemized list of orders from the customer (firm orders). Each item in the list details the part-number, the quantity and date required, etc. Sales-order items may also include items transposed from forecast. These items do not have a specific customer associated with them (soft orders). All items are displayed and managed via the Sales-Order spreadsheet discussed in the preceding section. The build-process is started via this spread-sheet. If the product (part-number) required by the sales order item is in inventory then a new “Ship-Job” (named as such to reflect that the order-execution requires a mere shipping of available product and does not require a build-process) is made via an inventory pull. The Ship-Job is then shipped and invoiced, fullfilling the Sales order. If additional product-quantity is needed then the build-process is started. The build process is identical for both firm and soft orders except that a firm order “reserves” or “pegs” the WIP inventory record created via the build-process. The reservation is made to assure primary availability of the inventory (when it matures) for the firm order against which the build was authorized.

The build-process rules are shown below. See figure 18.15 on page 18.31.

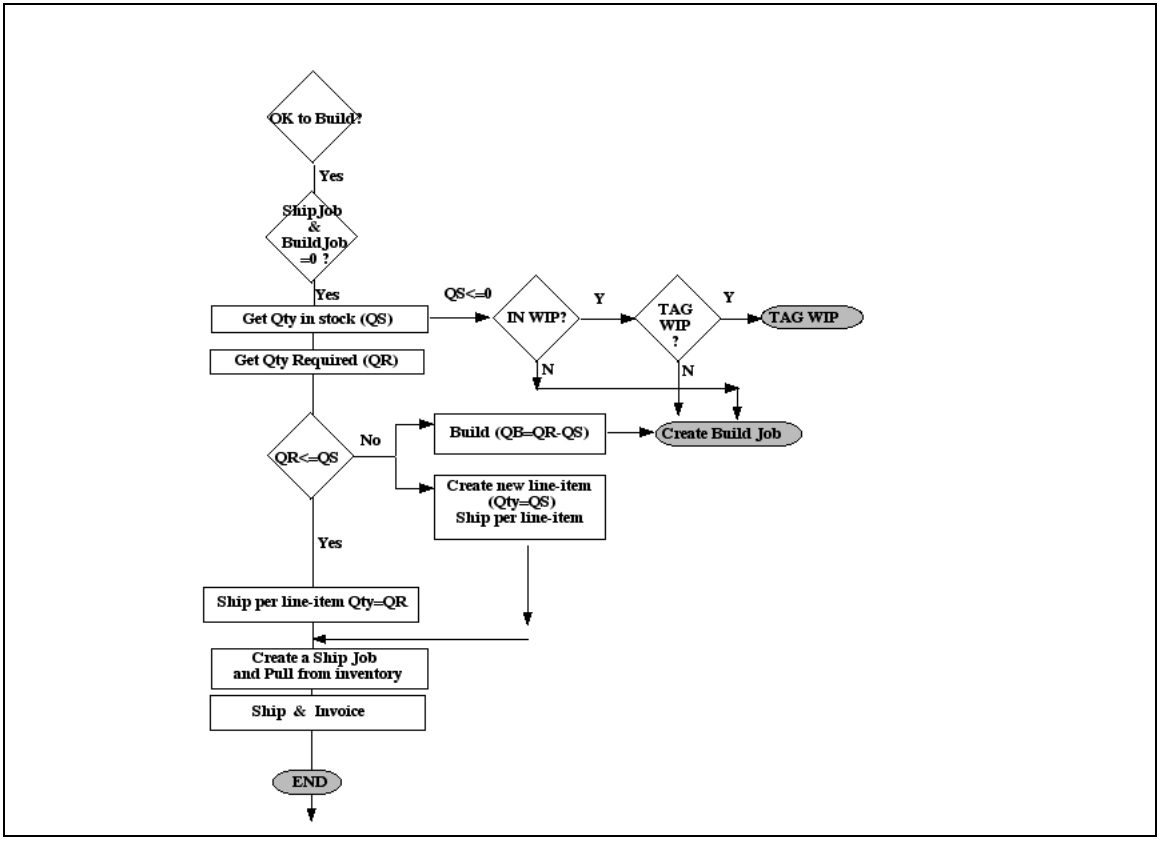


FIGURE 18.15

Using a step-by-step process the user is guided to the creation of the lots in the virtual chain (as defined by the routing-card). Once the build-job is created the build manufacturing process is managed by the travelers associated with each lot in the virtual chain. Starting with the first lot in the chain, suc-

cessive lots are created upon completion of respective preceding lots. The completion of the last lot will culminate in the product demanded by the sales order. See figure 18.16 on page 18.32.

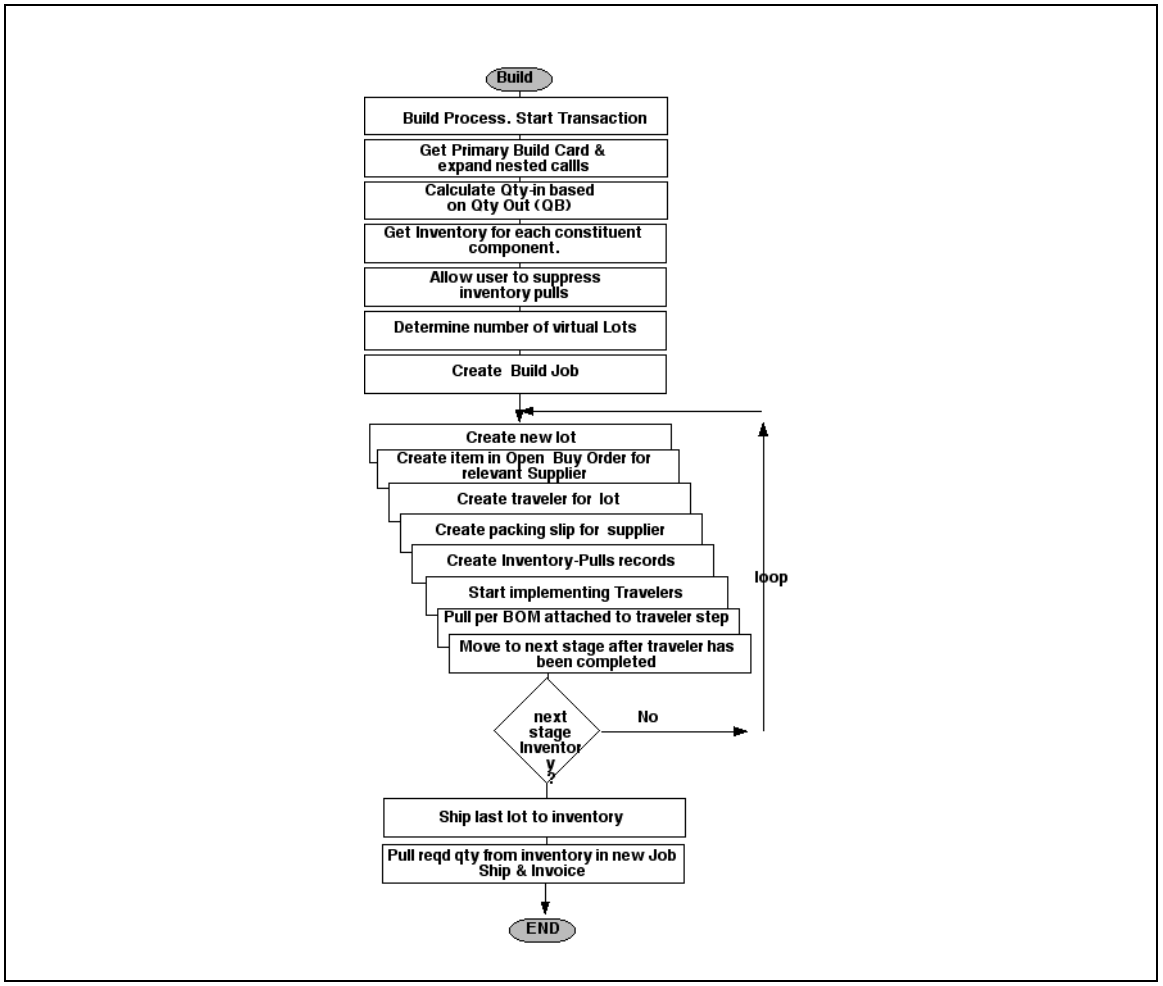


FIGURE 18.16

The first-step in the build-process is to determine the quantities of materials to be ordered based on the requirement of the sales-order (or forecast) and the expected yields and capacity constraints

defined by the Routing-Card. This determination is made via the Build-Optimization spreadsheet shown in figure 18.17 on page 18.33.

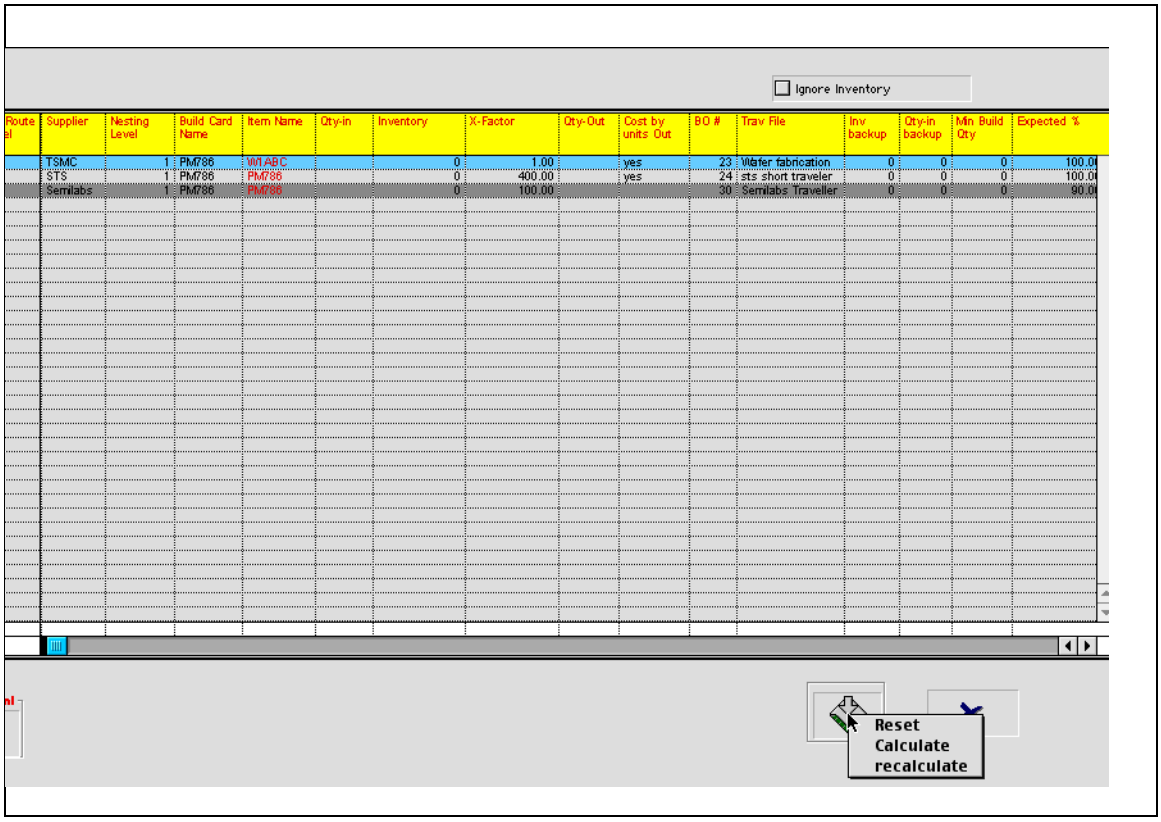


FIGURE 18.17

This spreadsheet expands the parent Routing-Card and all nested Routing-Cards to define the lot-creation requirements. It will allow the user to determine how many wafers need to be started to obtain the required amount of the end product. The routing defined in the Routing-Card will also determine how many stages are required to complete the process. Each stage will represent a lot, in a chain of lots. All lots in this chain will be bound into a single job called a “Build” job. Each item in the spreadsheet represents a lot that will be created. For those stages that may have multiple alternate vendors, an extra item in the spreadsheet will be included per stage per vendor. For example, an assembly stage may have several vendors defined in the Routing-Card. Items with a darker shade of grey color are

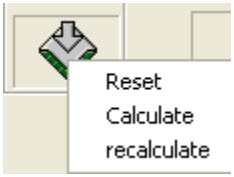
alternate items to a specific default item. The user may override the default-vendor and select any alternate vendor by clicking in the column labelled “Alt Route”.

Column data:

#	Sequence-number of the lots in the virtual chain.
ref#	This is the number of an in item in the Routing-Card. When an alternate exists for a given item then all alternates will have the same reference number. Selecting a cell within this column allows the user to change to a different alternate.
Alt-Route	When multiple suppliers exist for a single stage, the user may select any supplier by clicking on the appropriate row in this column.
Supplier	Name of the supplier who will process the lot, as specified in the Routing-Card. See “Routing-Card Items” on page 18.75.
Nesting Level	Shows the nesting level of the Routing-Card which was called by a parent Routing-Card and then expanded. ERP2020 allows un-limited nesting levels as long as there is no circular relationship in the nesting which would put the expansion process into an infinite loop. The error-check function in the manufacturing process would check, flag, and abort the process upon encountering such a condition.
Routing Card Name	Name of the Routing-Card being used to define the manufacture of the lot. The last item will represent the primary Routing-Card that completely defines the manufacturing flow of the end-product. Other Routing-Card in this column are nested Routing-Cards.
Item Name	Name of the item within the Routing-Card.See “Routing-Card Items” on page 18.75.
Qty-In	This is the quantity that is required to be manufactured. It is calculated based on the number of units required in the sales order.
Inventory	Shows the number of pieces that will be pulled from inventory. The default calculation pulls the maximum available inventory to complete the requirement. The user may modify this by double-clicking and entering the desired quantity. The user may bypass inventory all together by checking the “ignore inventory” check box.

Routing-CardTransformation) Factor	When a product is transformed in a given stage (for example the transformation of wafers to die), the projected output quantity from this stage is multiplied by the transformation factor. For example, in the IC-assembly stage a transformation factor of 400 would imply that the gross expected yield of each wafer is 400 die per wafer (DPW). The total out from any stage will be determined by the product of the transformation factor and the expected stage-yield. See “Routing-Card Items” on page 18.75.
Cost by Units Out	The supplier will be paid by the number of units shipped out of a lot instead of the number of units into the lot.See “Routing-Card Items” on page 18.75.
BO#	The open Buy-Order to be used for the processing of the lot defined by the Routing-Card item.
Traveler File	Name of the Steps File to be used to create the traveler steps that will dictate the lot processing requirements for the lot defined by the Routing-Card item. See “Routing-Card Items” on page 18.75.
Inv -Backup	This column is used for temporary storage of data during quantity-determination computations.
Qty-in -Backup	This column is used for temporary storage of data during quantity-determination computations.
Min-Build Qty	This column shows the minimum-build requirements at any stage. For example, a wafer-fabrication step may have a minimum-build requirement of 24 wafers. The Min-Build quantity is defined in the Routing-Card.See “Routing-Card Items” on page 18.75.
Expected%	This column shows the expected yield (in percentage) out of any step.See “Routing-Card Items” on page 18.75.
Max-Build Qty	This column shows the max-build (capacity) constraint at any stage. For example, a wafer-fabrication step may have a maximum-build capacity of 1000 wafers. The Max-Build quantity is defined in the Routing-Card.See “Routing-Card Items” on page 18.75.

Form Menus:



Calculate	This menu option will calculate the quantities to be manufactured in each lot. Inventory will be taken into account unless the “ignore inventory” check-box is checked. This menu item **must** be executed before the “Build” menu (discussed below) will be available to the user.
Re-calculate	This menu option allows the user to re-calculate the Quantities based on any manual modifications of pullable inventory made by the user.
Build	This menu option will launch the next step of the build process. This next step (See “Step2:” on page 18.37.) allows the user to monitor and control Build-Job details. These details include assignment of lot-numbers to the lots that will be spawned as the process progresses. The user **must** have executed the “Calculate” menu discussed above, for this menu to be available.

Fabless Build-Process:

Step2:

This step serves as a confirmation step of the build requested by the user. The following screen shows the line-item in the sales order which was the basis of build-request. The table labeled “inventory-cart” lists all the stock-items (if any) that will be pulled from inventory. See figure 18.18 on page 18.37

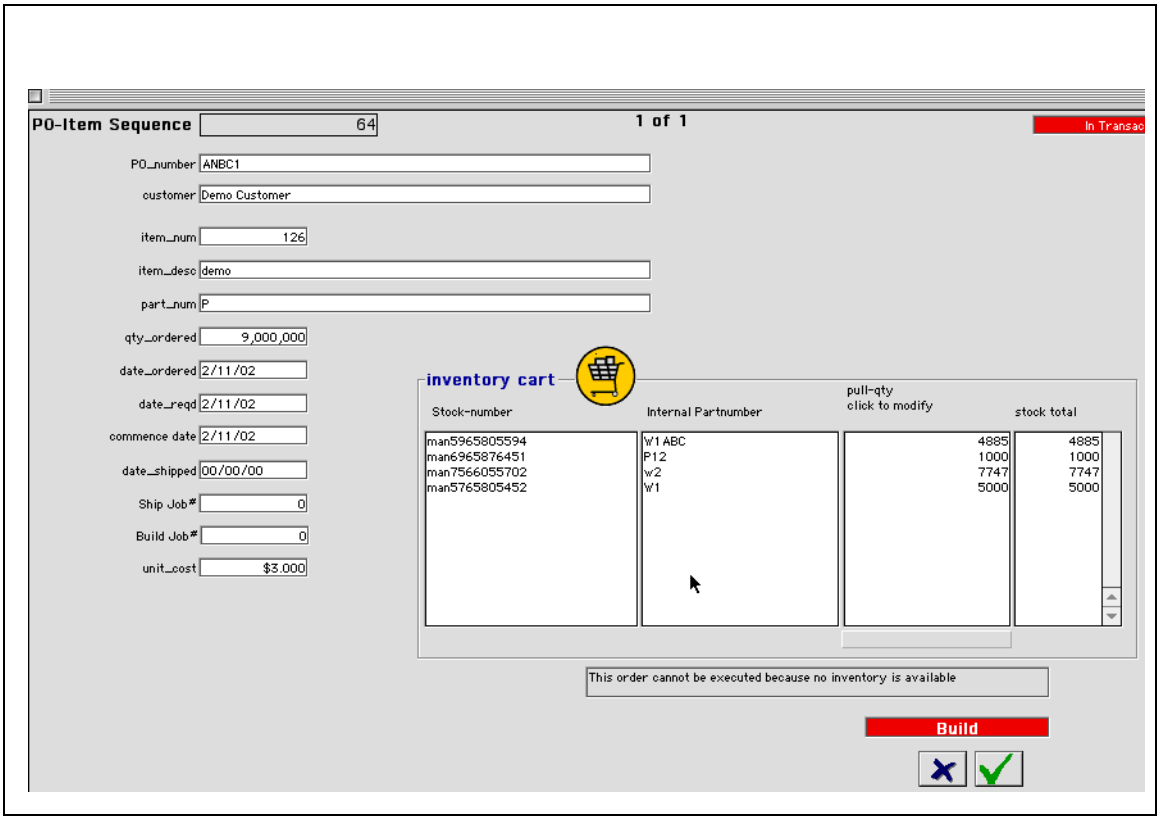


FIGURE 18.18

Fabless Build-Process:

Step3:

This step will detail the lot-creation scheme, detailing the suggested lot-numbers, their suggested quantities and their eventual routing. This is the final step of the build-process. Acceptance of this form (See figure 18.19 on page 18.38) will validate the entire transaction and create the Build-Job and con-

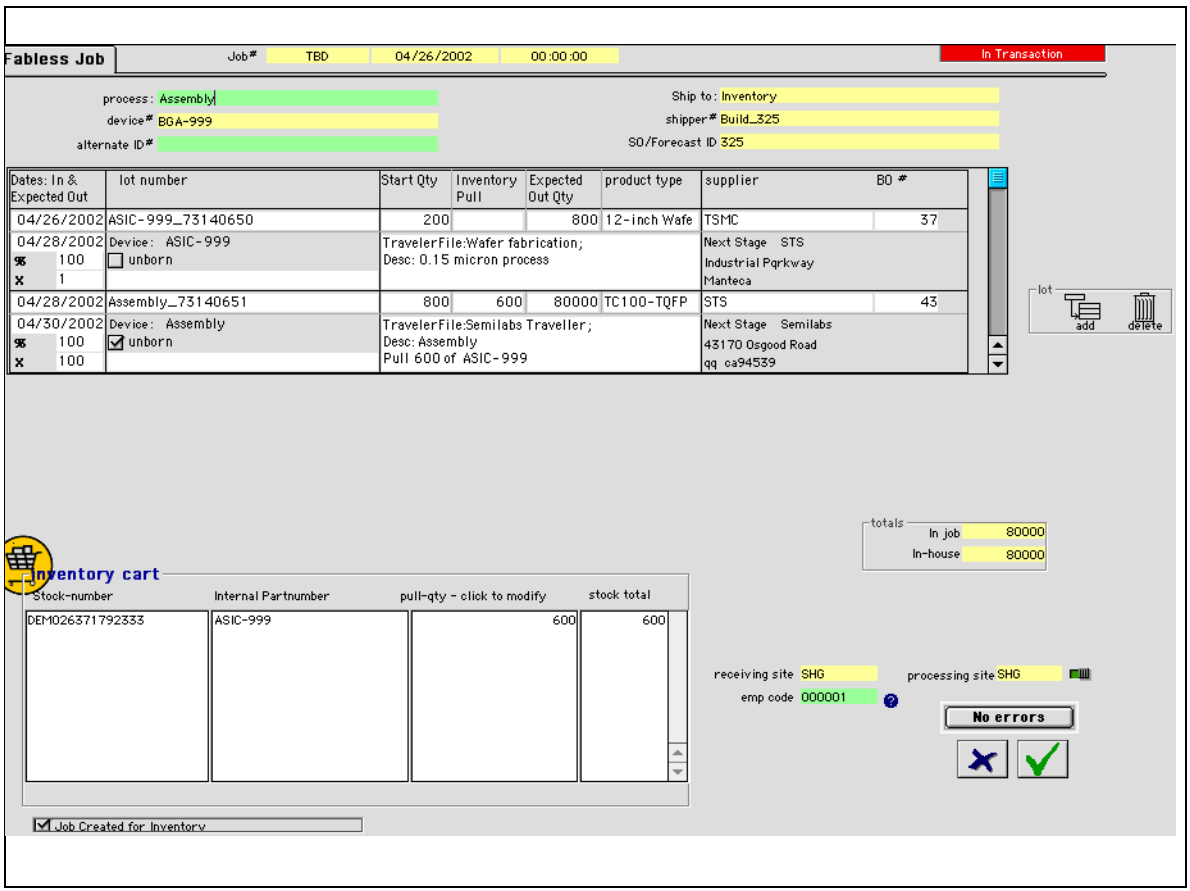


FIGURE 18.19

summate all related actions (such as creation of buy-orders, packing slips etc.).

Build-Job Form-fields:

Device	Preset via Routing-Card
Shipper#	Preset via Routing-Card. This field is set to “Build_nnn” where nnn is the unique ID of the Sales Order line-item that was the origin of this build-job.
Customer	This field is Preset to “inventory”, indicating that once the manufacturing process for the job has been completed the end-product will be moved to inventory.
Process	The process field is used to categorize. The value of this field is populated via a user-defined list.

Accepting this screen would create a build-job record in the (Receiver table) and create the **first** lot in the chain (in the LOTINFO table), its traveler (in the LOTSTEPS table), the appropriate entry in the buy-orders (in the BUY_ITEMS), and an entry in the LOTSTOSUPPLIER table. This table maintains the packing-slips associated with the movement of a specific lot between various suppliers. Additionally, an inventory record will be created. The inventory record is recallable by the Build-Job number. At any point in time this record will show the projected quantity (in terms of the end product), that will be received in inventory by the “maturity date” as defined in the record. The maturity date will track the planned or actual completion date of the last lot in the chain.

Once the build-job has been created the job-processing is conducted via the Lot-Punch-in, lot-Punch-out, and lot-staging menus discussed in the menu labelled “Lot Movement” on page 2.18.49.

Any intermediate-parts pullable from inventory will also be pulled and the appropriate records will be created in the INV_USAGE_MANY table, documenting the inventory pulls by the job. The build-job creation process discussed above is pictorially depicted in figure 18.20 on page 18.41.

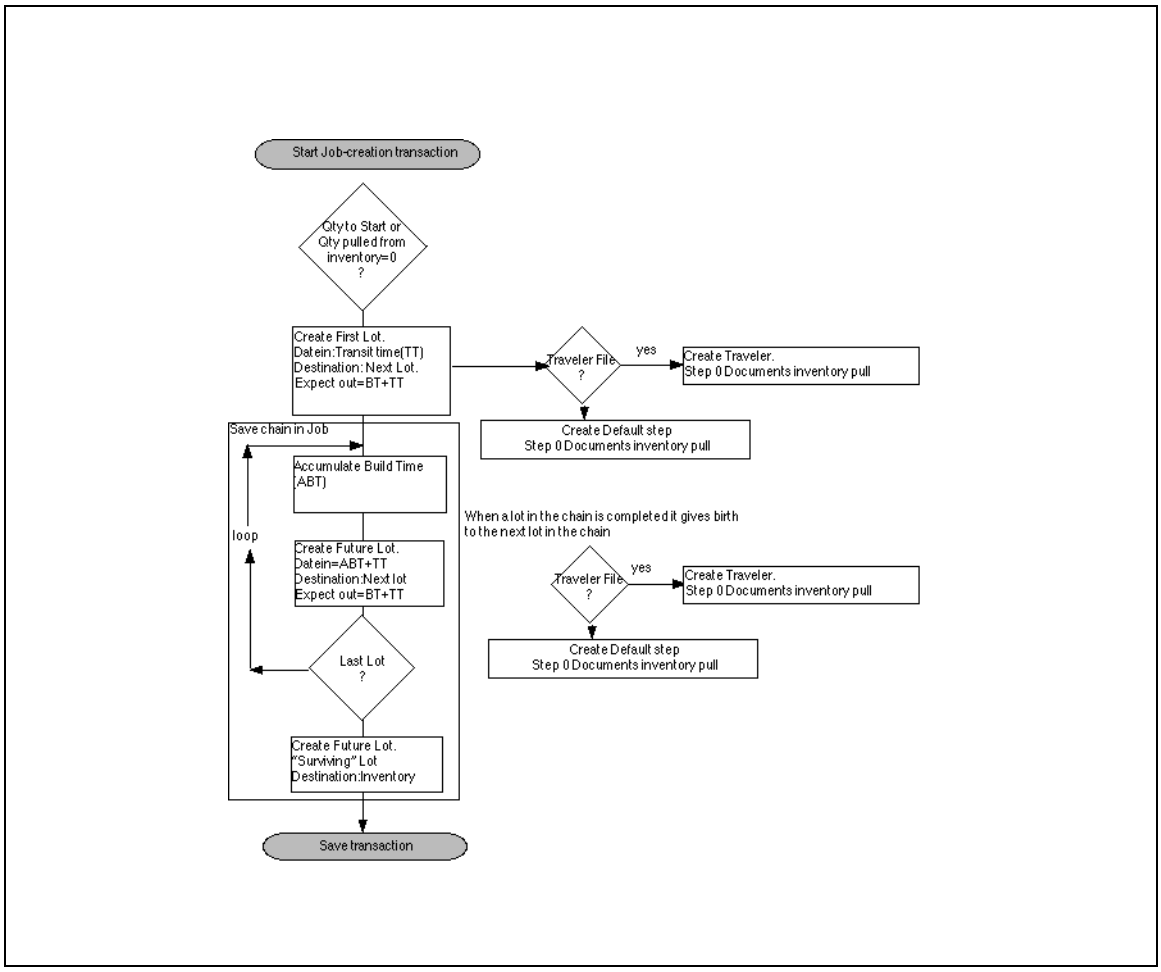


FIGURE 18.20

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Database transactions upon creation of a Build Job:

Table	Field Name	Value
RECEIVER		Create Build-Job-record. This record, with a unique Job-Number, will bind all lots in the fabless-chain. The record may be viewed and modified via the Integrated-Spreadsheet.See “Integrated Spread Sheet.” on page 18.56.
	Customer	Inventory
	Inventory_Job	True
	Fabless_Job	True
	Device-Number	Routing-Card Device-Number
	Lot-Subtable	Create all lots in Chain. Parent-ID of a lot is the ID of the preceding lot. Split-Level of all lots is set to zero. First lot is classified as BORN Subsequent lots are UNBORN Last lot is surviving Lot.
LOTINFO		Create first-lot record. Subsequent lots will be created as the preceding lots are completed.The record may be viewed and modified via the Integrated-Spreadsheet.See “Integrated Spread Sheet.” on page 18.56.
	Area	Name of the supplier working on the Lot
BUY-ITEMS		Create a buy-item for the Lot that has been created. This item will be automatically updated to record the date of receipt (when the current lot has been moved to the next-stage) along with the actual quantity. The record may be viewed and modified via the Integrated-Spreadsheet.See “Integrated Spread Sheet.” on page 18.56.
LOTSTOSUP-PLIERS		This table contains a record of all packing-slips that signify the “receipt” of a lot by the supplier currently working on the lot. In the fabless-mode a packing-slip is created and automatically updated to register the “sending” of a lot to a supplier (when the lot is created) and its “receipt” from the supplier when it is sent to the next stage. The user may manually modify this record to record any exceptions to the automated process. The record may be viewed and modified via the “Packing-List spreadsheet”. See “Packing-List Spreadsheet” on page 18.67.

TABLE 19.

Table	Field Name	Value
LOTSTEPS		Traveler steps for the Lot. The records may be viewed and modified via the Integrated-Spreadsheet.See “Integrated Spread Sheet.” on page 18.56.
INVENTORY		An (WIP) inventory record is created with the projected quantity and its maturity date.The record may be viewed and modified via the Integrated-Spreadsheet.See “Integrated Spread Sheet.” on page 18.56.
	Stock-Number	Same as the LOTID of the last {surviving} lot in the chain. LOTID = Job Number + Original Lot-number
	Vendor	Self
	WIP-Code	Set to “1”. Signifies that the stock-item is in manufacturing. (WIP-inventory). This field is reset to zero when the last lot in the chain is shipped to finished goods.
	Build-Job-Number	Same as the unique Job-number of the Build-Job.
	Locked & LockedID	When an inventory item has not matured (i.e. it is WIP inventory) the locked attribute is always set. If the record in the PO_Items table, “creator” that created the build-job was a valid purchase-order from a customer then the locked attribute remains set even after the inventory item has matured. If the PO_Items record was unassigned to a customer then the locked attribute is reset after the inventory item has matured. Inventory locking assures that the stock in inventory is available for fulfillment to the “creator”. Once a ship-job for the “creator” is made the excess inventory is released.

TABLE 19.

Table	Field Name	Value
INVENTORY RESERVA-TION		If a PO-item that was the source of the build-job is customer-specific (i.e. it has been assigned to a valid PO) then a reservation record associated with the WIP inventory-stock will be created. This reservation record ties back to the PO-item and reserves the quantity requested by the PO-item. The reserva-tion-record may be viewed and modified via the Integrated-Spreadsheet.See “Integrated Spread Sheet.” on page 18.56. If the PO-item was created via the **transposition** of a Marketing Forecast and at the time the build-job was created, the PO_item was **not** associated to any PO (and was therefore not customer-specific) then **no** inventory reserva-tion takes place.
PO_items		Update record
	BuildJob	Job-number of new build-job
	Data-Type	This binary-encoded field is set as follows: Bit 1 =1 If the PO_item is associated with a valid PO Bit 2 =1 If a build-job was started Bit 16 =1 If the PO_item was created via a transposition of the forecast.
Note:		When a lot is split a new build-job is created. The mother job and its associ-ated records are corrected accordingly.

TABLE 19.

•Menu: Demand & Supply

Menu-Item: *Rolling Status*

Available to promise:

The Rolling status allows the user to analyze the supply and demand of a given Part-number over a period of time. The period of time may be sliced on a daily, weekly, or monthly basis. The supply and demand data is presented in a tabular format, with separate groups of columns for each time-slice. In each time-slice group, separate columns of data show the supply-side data by listing product quantities in WIP and Inventory. The transformation from WIP to inventory is properly projected into the future, based on the expected-completion dates and cycle-times of current WIP lots. Each time-slice group also has a separate demand-column based on **unfulfilled** Sales Orders. The demand distribution over the time-slices is based on the “Customer-Request-Dates” of the Sales-Orders. As an option the user may also add the fore-cast-quantity column to the demand-time-slice group. Because the forecast is stored on a monthly basis, this option works only with the monthly time-slice. While the column data shows the forward-looking supply and demand quantities, the rows break-down the product into its interim states (interim part-numbers are defined by the Routing-Card. For information on the Routing-Card see “Create card” on page 2.18.73), thereby showing the product in its various stages of manufacturing.

The first column of the spread-sheet lists the interim-products (representing the various manufacturing stages) and their culmination into the end-product. The end-product is underlined for clarity.

To see an example of the Rolling-Status spread-sheet see figure 18.1 on page 18.46.

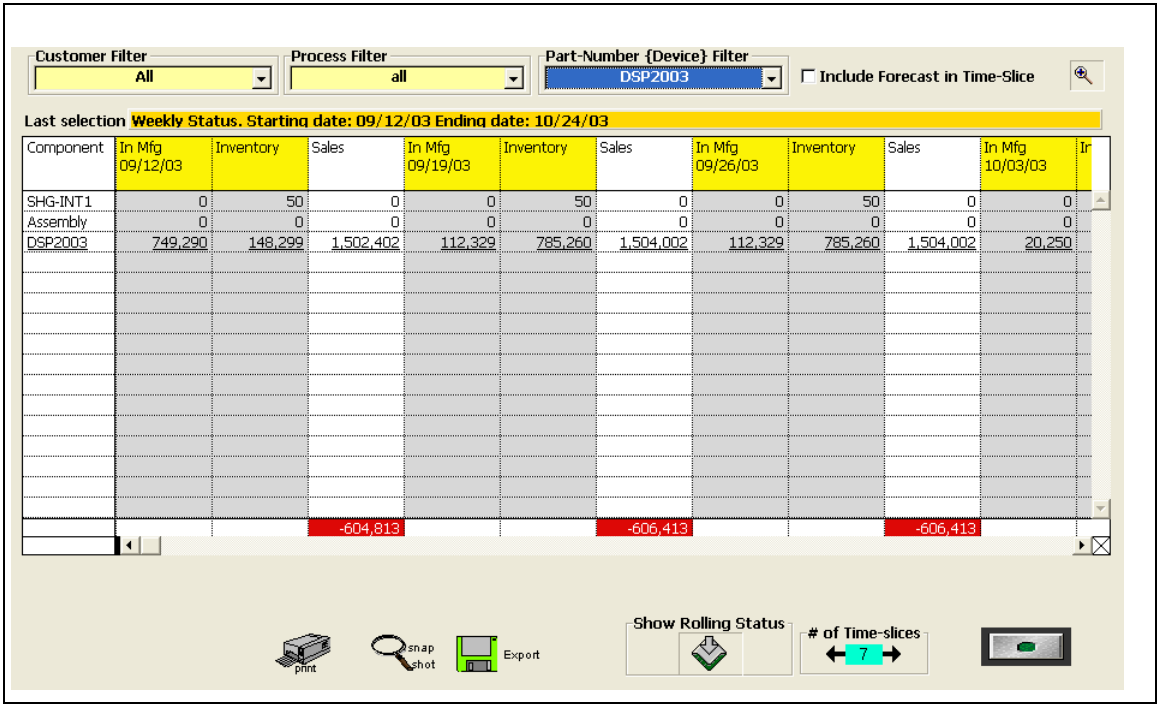


FIGURE 18.1

Rolling-Status Spread-Sheet Filters

Part-Number {Device} Filter	The Rolling-Status spread-sheet provides the rolling status on a per part basis. The user must use this filter to select the specific part.
Customer Filter	When this filter is applied, the Sales-Column-data is filtered by the selected customer.
Number of Time-Slices	This allows the user to set the forward-limit (date) of the time period for which the rolling status will be generated. Each time-slice may be a day, a week, or a month based on the rolling status-mode.

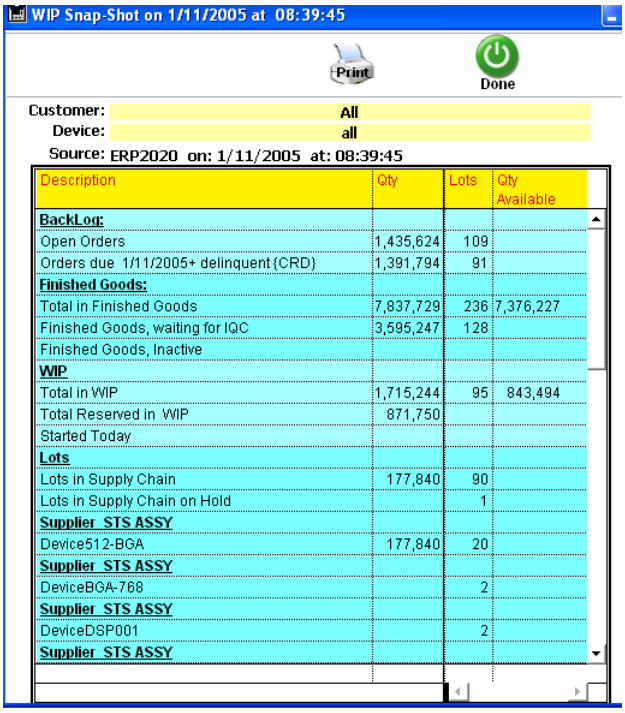
Rolling-Status Spread-Sheet data:

Component	This column lists the interim and end-products. The end-product is underlined for clarity.
In Manufacturing	This column displays the quantity in manufacturing for the first time-slice and the projected quantity in manufacturing for future time-slices. Based on the maturity date of the WIP stock the WIP inventory will be moved in finished-goods inventory in the appropriate time-slice.
Inventory	This column represents the actual quantity in finished-goods-inventory for the first time-slice and the projected quantity in finished-goods-inventory for future time-slices. Based on the maturity date of the WIP stock the finished-goods-inventory will be increased in the appropriate time-slices.
Sales	This column shows the total quantity requested by unfulfilled PO_items whose CRD is less than the date of the time-slice. Note that unfulfilled will include those items whose “forecast” flag is false, ship-job is zero, customer & part-number match the selected filters.
Forecast	This column displays the monthly marketing forecast projected in the Forecast-table.

Rolling-Status Spread-Sheet Buttons

Show Rolling Status	This button provides a pull-down menu option to generate the status on a daily, weekly, or monthly basis. When forecast is included then only the monthly time-slice option is available, since forecast is maintained on a monthly basis.

Snap Shot	This button allows the user to get a real-time snap-shot. The snap shot provides a real-time status of WIP and Inventory, listing the total lots and total lot quantities at various stages of manufacturing. The Snap-Shot also breaks-down lots and lot-quantities by supplier-locations, providing a quick status of supplier loading. A sample snap-shot is shown below in figure 18.3 on page 18.48.



Description	Qty	Lots	Qty Available
BackLog:			
Open Orders	1,435,624	109	
Orders due 1/11/2005+ delinquent {CRD}	1,391,794	91	
Finished Goods:			
Total in Finished Goods	7,837,729	236	7,376,227
Finished Goods, waiting for IQC	3,595,247	128	
Finished Goods, Inactive			
WIP			
Total in WIP	1,715,244	95	843,494
Total Reserved in WIP	871,750		
Started Today			
Lots			
Lots in Supply Chain	177,840	90	
Lots in Supply Chain on Hold		1	
Supplier_STS ASSY			
Device512-BGA	177,840	20	
Supplier_STS ASSY			
DeviceBGA-768		2	
Supplier_STS ASSY			
DeviceDSP001		2	
Supplier_STS ASSY			

FIGURE 18.3

•Menu: Lot Movement

Menu-Item: *Ship lot to Sub*

This menu allows the user to ship an internal lot to a sub-contractor (supplier) so that the latter may perform sub-contracted services on the lot. Note that in the virtual manufacturing mode where a build-job is created via a Routing-Card, this menu will not be used since the shipment process to a sub-contractor is done automatically by the ERP2020. If manual intervention is required this menu is used. See figure 18.2 on page 18.49.

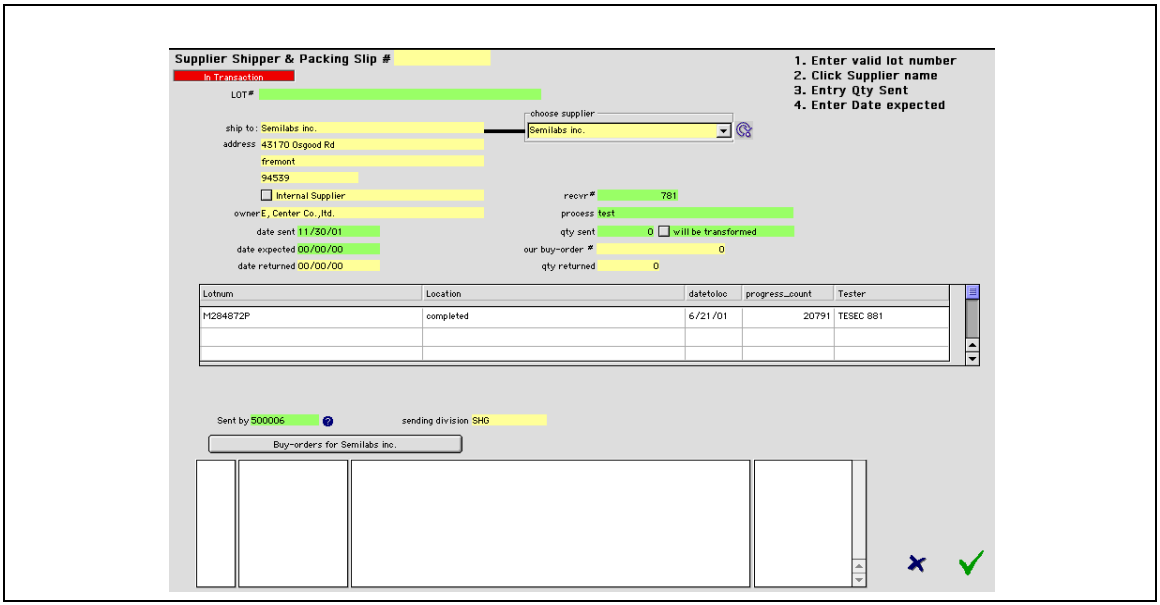


FIGURE 18.2

The fields in the form are as follows:

Lot#- The user must enter the lot number of the lot that will be shipped to the supplier for “sub-contracted” processing. The user may display a list of records by using the wild-card character “@”. In a wild-card selection, the list will show the first 1000 lots only. The ERP2020 system will check to confirm that the lot chosen is presently in house i.e.

it has not been shipped back to the customer and/or is not presently with a subcontractor. See figure 18.3 on page 18.50.

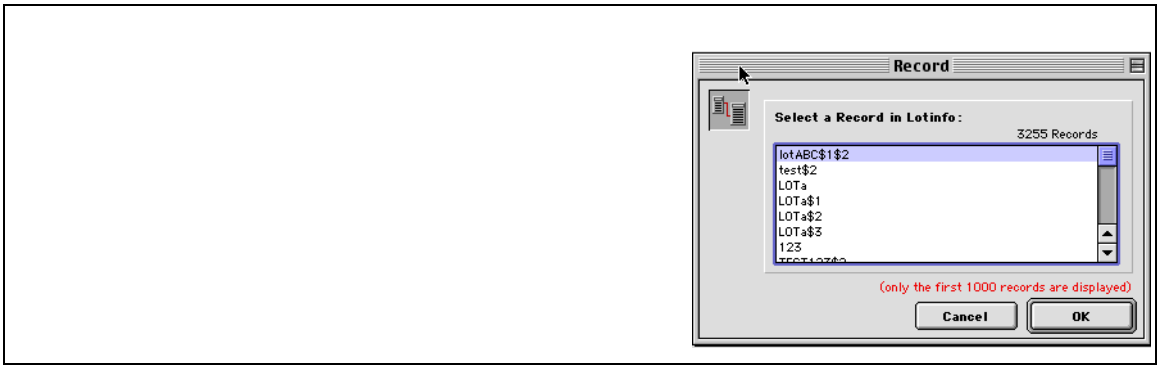


FIGURE 18.3

Process — This field is selected from a list. It pertains to the type of service to be performed by the sub-contractor. See figure 18.4 on page 18.50.

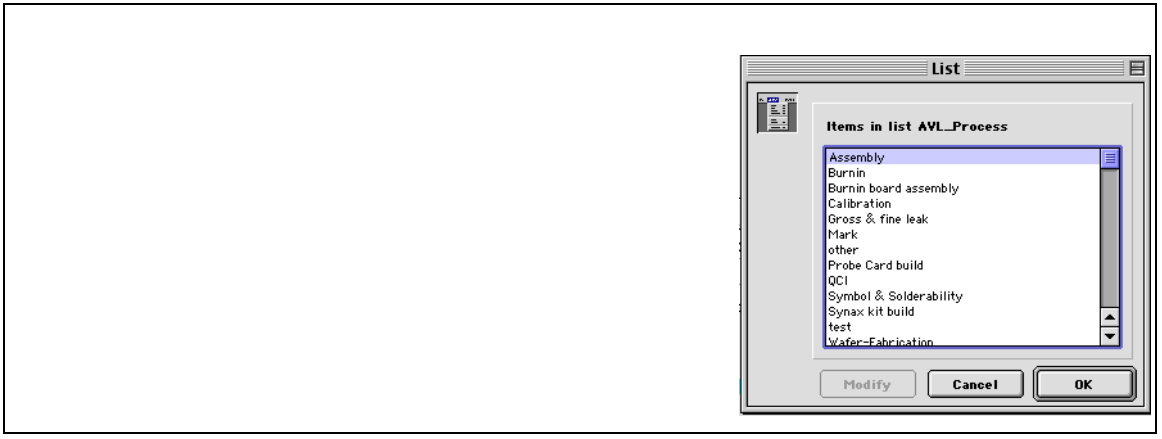


FIGURE 18.4

Ship to:, Address:, Owner: — These Fields are automatically filled by choosing Supplier from the “Choose Supplier” Drop down menu. The information was added earlier by the user via “Add Supplier” menu-item under “Supplier” menu.

date sent: — Date the lot is being sent. This field is taken automatically from the server.

date expected:	Date on which the lot will be returned.
qty-sent	Quantity of units that are being shipped to the supplier.
Button	Refreshes the Suppliers list. The list is populated only with those suppliers that are Approved and are allowed to Process the Traveler.

Menu-Item: *Receive lot from SUB*

-Receive a lot from a subcontractor back into the ERP2020. Note that in the virtual manufacturing mode where a build-job is created via a Routing-Card, this menu will not be used since the shipment process to a sub-contractor and its receipt is done automatically by the ERP2020. If manual intervention is required this menu is used
See figure 18.5 on page 18.51.
.

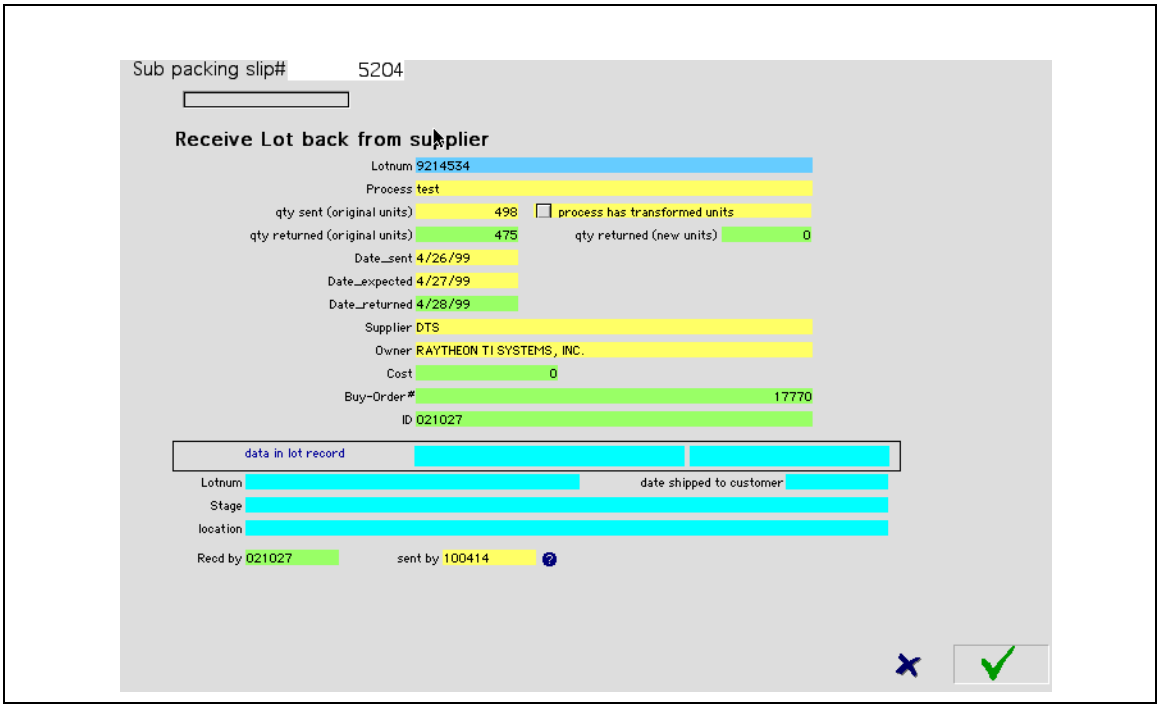


FIGURE 18.5

Menu-Item:*Punch-in Traveler*

Each lot in the virtual chain may have a detailed traveler or a just single lot-step associated to it, depending upon whether or not the Routing-Card item specific to the lot has or does not have a Steps File associated with it. Attaching a detailed traveler to the lot allows the user to track yields and defects at various stages of a lot's manufacturing process, however, the definition and the details of the traveler have to be agreed upon by the supplier because the data is generated by the latter. The Supplier may provide this data to the Fabless company (using the ERP2020) via logging into the ERP2020 over the WEB or the ERP2020 may obtain the data via a WEB adapter to the Supplier's WIP database or a scheduled ASCII file exchange, etc. While the ERP2020 is adaptable to receiving data in many formats, the Data-exchange facilities may not exist or may not be available to the Fabless company. This menu allows the Fabless User to perform their own lot-tracking if the supplier is not updating the ERP2020 or a WEB adapter is not available. The punch-in of a traveler step is an acknowledgement of the start of a step. It is discussed in detail in the chapter describing the floor menu. See "Start STEP" on page 6.12.

Menu-Item:*Punch-out Traveler*

Each lot in the virtual chain may have a detailed traveler or just a single lot-step associated to it, depending upon whether or not the Routing-Card item specific to the lot has or does not have a Steps File associated with it. Attaching a detailed traveler to the lot allows the user to track yields and defects at various stages of a lot's manufacturing process, however, the definition and the details of the traveler have to be agreed upon by the supplier because the data is generated by the latter. The Supplier may provide this data to the Fabless company (using the ERP2020) via logging into the ERP2020 over the WEB or the ERP2020 may obtain the data via a WEB adapter to the Supplier's WIP database or a scheduled ASCII file exchange, etc. While the ERP2020 is adaptable to receiving data in many formats, the Data-exchange facilities may not exist or may not be available to the Fabless company. This menu allows the Fabless User to perform their own lot-tracking if the supplier is not updating the ERP2020 or a WEB adapter is not available. The punch-out of a traveler step is an acknowledgement of the completion of a step. It is discussed in detail in the chapter describing the floor menu. See "Done with Step." on page 6.26.

Menu-Item: *Move to next stage*

When a lot in the virtual chain is completed it is ready to spawn the next lot in the chain or ready to be simply moved to inventory depending upon whether or not it is an intermediate or “surviving” lot. This menu moves the lot to the next appropriate stage. When a lot is moved to the next stage its progressive count is delivered to the next lot (or inventory) and its own progressive and current count fields are then reset to zero. During this process the ERP2020 also automatically performs the following actions in the background:

1) If the processing of the lot will be charged by the supplier based on the number of units out (as opposed to the number of units in) then the purchase order entry (buy-item) which was originally created for the supplier will be updated with the new quantity.

2) The Buy-item will also be updated with the date of “receipt” of the maturing lot.

3) The packing slip (created in the LOTSTOSUPPLIER) table will be updated to acknowledge receipt of the material. Simultaneously a new packing-slip will be created to document the transference of the lot to the next stage in the chain.

4) A new buy-item will be created for the next supplier in the chain.

5) A WIP inventory record is updated to reflect the new projected output quantity (based on modified actual output from the previous stage) and new final completion date. The WIP inventory will mature to finished-good inventory when all stages have been completed and the “surviving-lot” is being moved to inventory.

The form invoked by this menu is shown below in figure 18.6 on page 18.54.

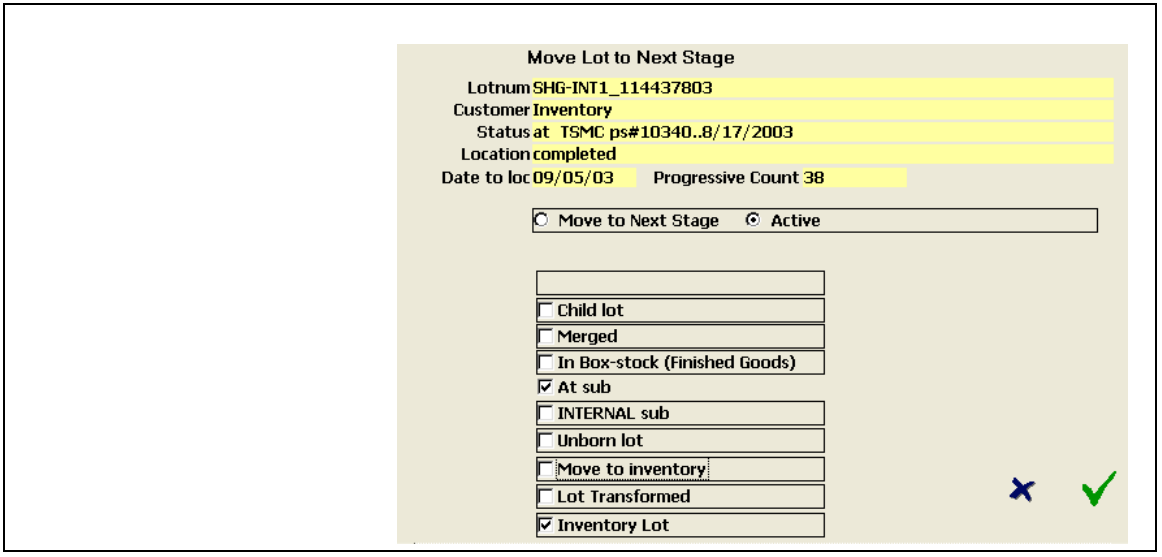


FIGURE 18.6

Once the “surviving” lot of the chain has been moved to finished-goods, the inventory stock thus created (subsequent to an incoming quality-inspection) is ready to be pulled via a “ship-job”, physically shipped, and invoiced. For discussion on creation of a ship-job see “Demand-Spreadsheet hyperlinks:” on page 2.18.22. For discussion on how to physically ship a job see “Ship lots {Processed | Box-stock}.” on page 1.5.14.

Move to Next Stage — To move a lot to its next stage (which may be the next lot in the chain or inventory, if it is the lot in the chain), the user must set this radio-button and then accept the form. If the lot has been completed, it will be moved to the next stage.

Move to Inventory — When the lot being moved is the last lot in the Fabless-Chain, this check box will be set.When the lot being moved is **not** the last lot in the chain (“intermediate-lot”), this check-box will be unchecked. They may however to elect to move an intermediate-lot to inventory by setting this check-box prior to setting the “Move to Next Stage” Radio Button. If the user moves an intermediate lot to inventory then the WIP-inventory stock-item associated with the Job, to which the lot belongs will be converted to an matured inventory stock-item. The

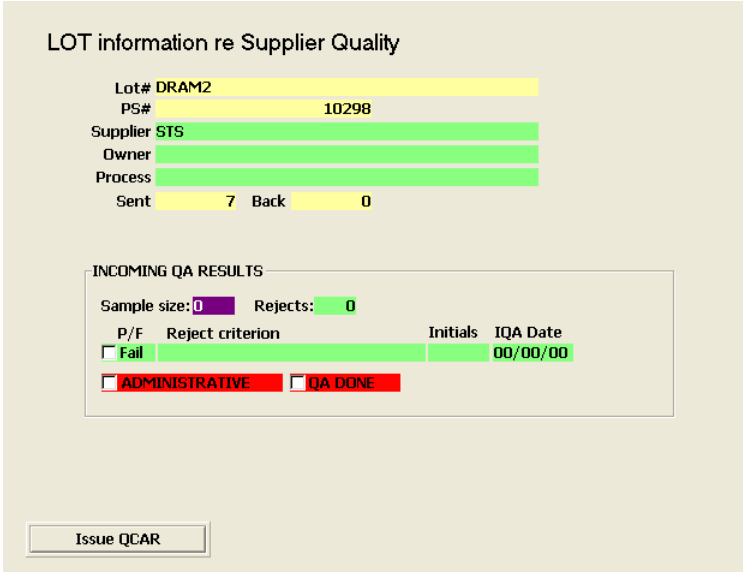
part-number of the this stock-item will be set to the Device-Number of the intermediate lot being moved to inventory.

The lot can be moved to the next stage only after all processing steps in the traveler have been completed and any transformations specified in the Routing-Card have taken place.

mode packing-slips are created and updated automatically. Any manual intervention may be conducted via this method.

*Update Quality

Clicking on a cell in this column allows the user to update quality information on the lot referenced by the packing-slip. In addition to updating quality data the user may also create a lot-specific QCAR. For more information on QCAR see also “QCARs Menu page 8.34” on page 1.8.1. The data-entry form for quality-data update is shown below:



•**Menu:** WIP

Menu-Item: *Integrated Spread Sheet.*

The WIP menus provide the user with both macro nd micro views of WIP data. The drill-down capability provides access down to the individual steps in the lot-traveler. Additionally the user may link to all corresponding transactions in other modules, such as transactions related to quality-data, purchasing, Inventory, etc. This menu-item provides **integrated** and **interactive** "Lot-Planning", "Buying", and "Inventory" review and management spreadsheets. The user may seamlessly move between the various modules to review and track WIP along with all other associated transactions in the enterprise. The lot-management pane of the Integrated Spreadsheet is shown below in figure 18.7 on

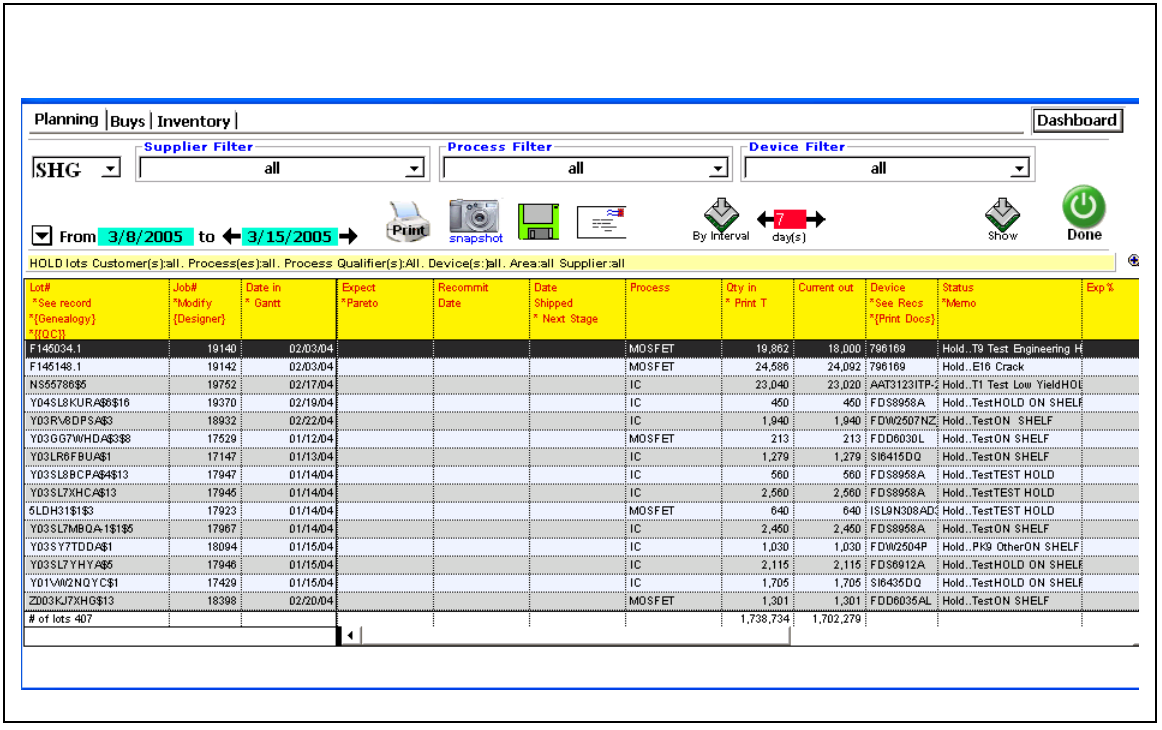


FIGURE 18.7

page 18.56.

Column-Specific Hyper-Links:

* Lot	The selected lot and its component traveler steps may be reviewed and, with proper access privilege, modified. Lot splitting and Lot merging and lot-outsourcing may also be managed via this link.
* Modify	The user may modify the Job record which binds the fabless-lot-chain.
* Gantt	This option allows the user to print a real-time Gantt chart for all lots in the Job. The user may change the expected-out date of a lot and save it with the Job. This change also permeates through to the Demand (Sales-Order) item that triggered the build-job and all other additional items that may have made reservations against the product being built via the Job. In the Sales-Order item(s) the Current-Scheduled-Date is changed to the expected-out date of the last-lot in the chain. Similarly the WIP-inventory date-in (which is a future-date) is also changed to reflect the change. For more details on this See “Managing a Build-Job:” on page 18.66.
* Next Stage	The selected lot can be moved to the next stage. The next stage by default is the next lot in the chain or inventory if the lot being moved is a “Surviving Lot”. When a Surviving Lot is moved into inventory, the Stock-Number of the inventory item is set to the Lot ID for traceability purposes. This short-cut performs the same function as the namesake-menu item. See “Move to next stage” on page 18.53.
* Email T	The user may email the traveler to an enterable address.
* Print T	The user may print the condensed form of the traveler for the lot defined by the selected row.
*See Record	The user may review all related-data associated with the lot. The related-data includes AML data, Inventory-Pull data, Purchasing Data, Inventory-data and Supplier-Routing data.
* {Print Docs}	This link is invoked when the user press the control-key. The user may print a documentation set for the fabless build-job. The documentation set includes routing documentation, Gantt charts showing the status of the constituent lots, corresponding Buy-Items automati-

cally issued, and any inventory-pulls of raw-materials associated with the Job.

Purchasing Tab of Integrated Spreadsheet

The second-tab of the spreadsheet launches the buying (purchasing) interface. The available pull-down menus allow the user to review buy-items automatically issued to subcontractors (against limited blanket orders) by the Build-Job. See figure 18.8 on page 18.58.

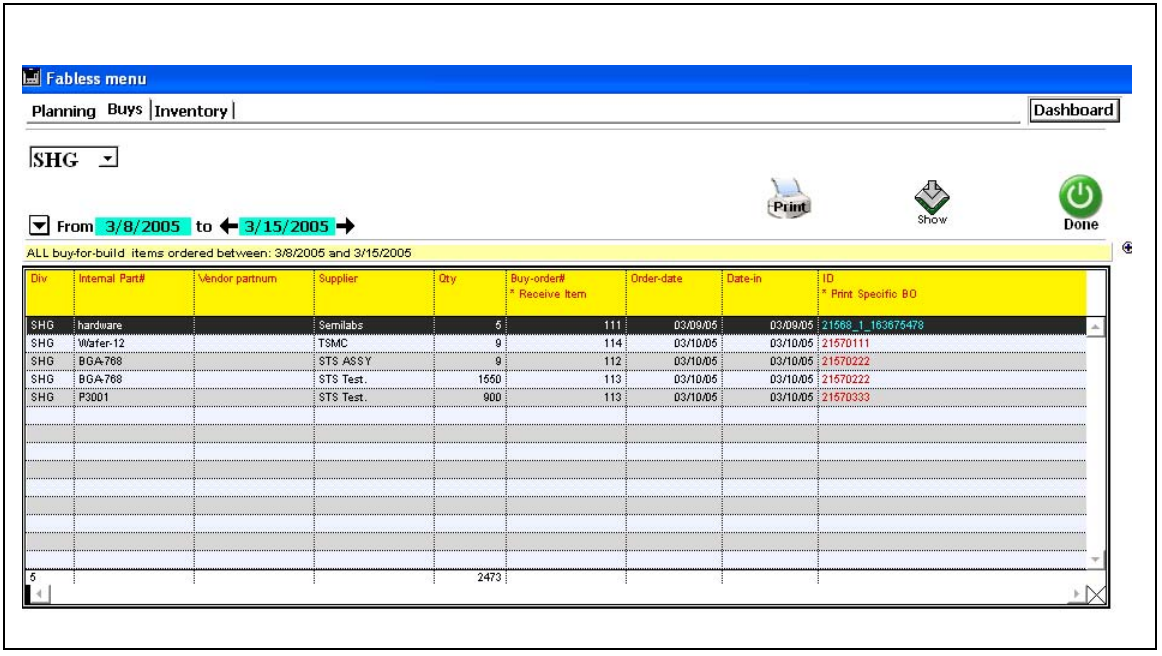


FIGURE 18.8

* Receive Item	Clicking on the column associated with this action allows the user to open the Buy-order and browse/modify material-receipt information that gets automatically generated by the system.
* Print Specific BO	Clicking on the column associated with this action prints (or emails, depending upon the option in the dashboard) a portion of the Buy-Order that is specific to the item defined by the selected row. The purchase-order number thus printed is appended with the unique sequence ID of the buy-item. The unique ID is an internal unique non-modifiable field associated with the buy-item. It is not the item-number of the item within a buy-order since the latter is open to modification by the user. The footer of the buy-order also includes a "traceability code". This code singularly identifies the lot (via its ID field) associated with the buy-item. Note that the LOT-ID field is also a unique non-modifiable field that identifies a lot. It remains unchanged even if the user modifies the lot-number subsequent to the lot-number assigned to the lot during its creation process. This scheme allows the user to issue a buy-order to the vendor and maintaine traceability to the lot being manufactured while at the same time allowing the user to change the lot-number any time later.The printout below is an example of an item-specific buy-order that may be transmitted to the vendor. See figure 18.9 on page 18.60.

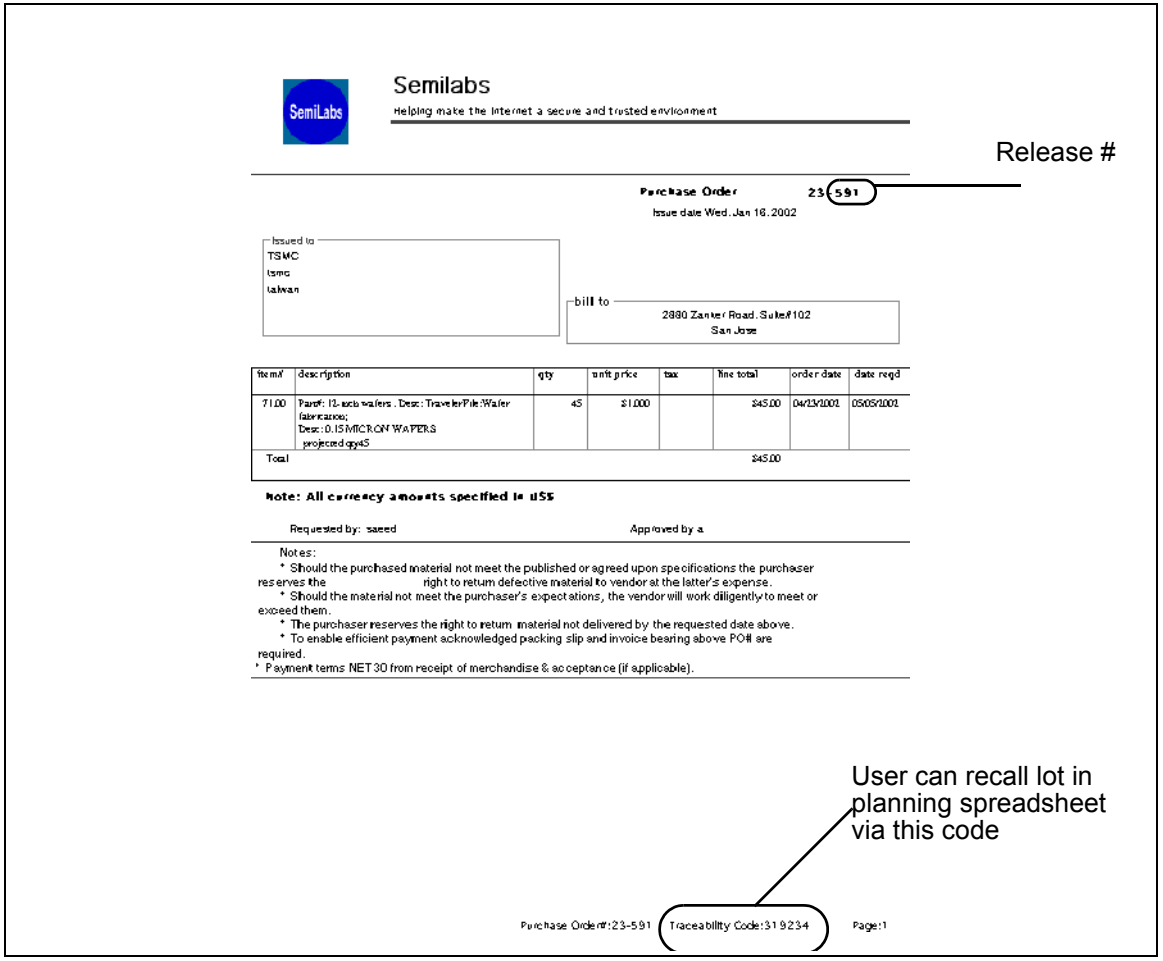
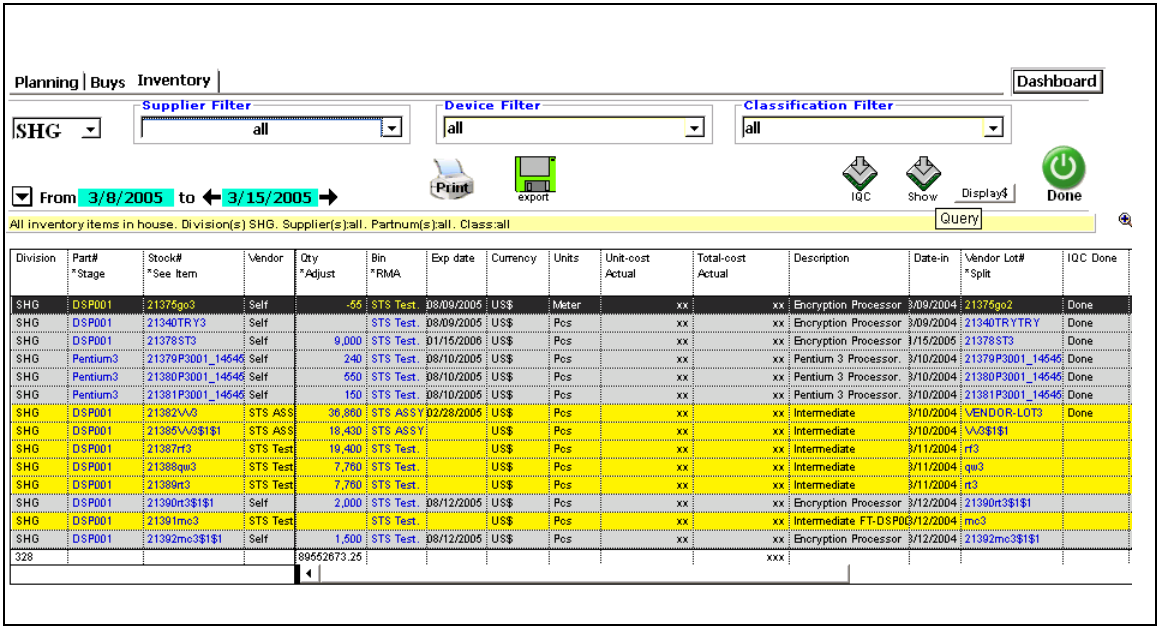

Semilabs
Helping make the Internet a secure and trusted environment
Release #
Purchase Order 23-591
Issue date Wed. Jan 16, 2002
Issued to
TSMC
tsmc
taiwan
bill to
2880 Zanker Road, Suite#102
San Jose
item# description qty unit price tax line total order date date reqd
71.00 Part#: 12-inch wafers . Desc: TravelerPile:Wafer fabricance; Desc: 0.15MICRON WAFERS projected qty45 45 $1.000 $45.00 04/13/2001 05/05/2001
Total $45.00
Note: All currency amounts specified in US$
Requested by: saeed Approved by a
Notes:
* Should the purchased material not meet the published or agreed upon specifications the purchaser reserves the right to return defective material to vendor at the latter's expense.
* Should the material not meet the purchaser's expectations, the vendor will work diligently to meet or exceed them.
* The purchaser reserves the right to return material not delivered by the requested date above.
* To enable efficient payment acknowledged packing slip and invoice bearing above PO# are required.
* Payment terms NET 30 from receipt of merchandise & acceptance (if applicable).
User can recall lot in planning spreadsheet via this code
Purchase Order#:23-591
Traceability Code:319234
Page:1

FIGURE 18.9

Inventory Tab of Integrated Spreadsheet

The third tab in the integrated spreadsheet invokes the inventory spreadsheet. See figure 18.10 on page 18.61.

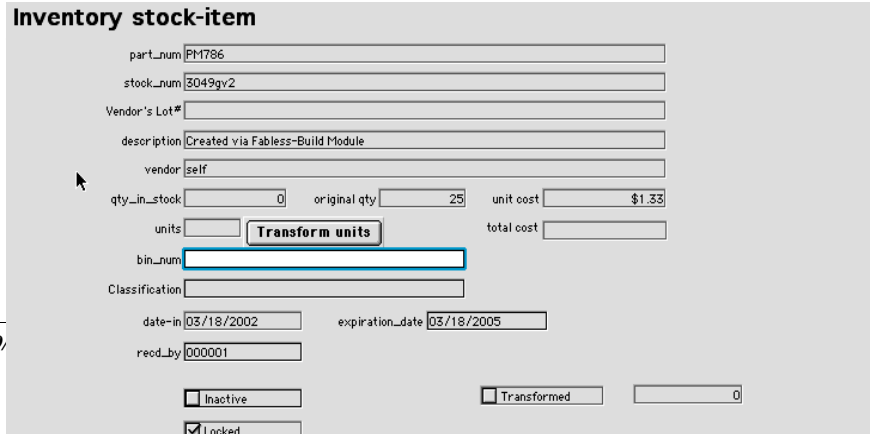


Division	Part# *Stage	Stock# *See Item	Vendor	Qty *Adjust	Bin *RMA	Exp date	Currency	Units	Unit-cost Actual	Total-cost Actual	Description	Date-in	Vendor Lot# *Split	IQC Done
SHG	DSP001	21375go3	Self	-55	STS Test.	08/09/2005	US$	Meter	xx	xx	Encryption Processor	3/09/2004	21375go2	Done
SHG	DSP001	21340TRY3	Self		STS Test.	08/09/2005	US$	Pcs	xx	xx	Encryption Processor	3/09/2004	21340TRYTRY	Done
SHG	DSP001	21378ST3	Self	9,000	STS Test.	01/15/2006	US$	Pcs	xx	xx	Encryption Processor	3/15/2005	21378ST3	Done
SHG	Pentium3	21379P3001_14646	Self	240	STS Test.	08/10/2005	US$	Pcs	xx	xx	Pentium 3 Processor.	3/10/2004	21379P3001_14646	Done
SHG	Pentium3	21380P3001_14646	Self	550	STS Test.	08/10/2005	US$	Pcs	xx	xx	Pentium 3 Processor.	3/10/2004	21380P3001_14646	Done
SHG	Pentium3	21381P3001_14646	Self	150	STS Test.	08/10/2005	US$	Pcs	xx	xx	Pentium 3 Processor.	3/10/2004	21381P3001_14646	Done
SHG	DSP001	21382VV3	STS ASS	36,860	STS ASSY	02/28/2005	US$	Pcs	xx	xx	Intermediate	3/10/2004	VENDOR-LOT3	Done
SHG	DSP001	21385VV3$1$1	STS ASS	18,430	STS ASSY		US$	Pcs	xx	xx	Intermediate	3/10/2004	VV3$1$1	
SHG	DSP001	21387rt3	STS Test	19,400	STS Test.		US$	Pcs	xx	xx	Intermediate	3/11/2004	rt3	
SHG	DSP001	21388qw3	STS Test	7,760	STS Test.		US$	Pcs	xx	xx	Intermediate	3/11/2004	qw3	
SHG	DSP001	21389rt3	STS Test	7,760	STS Test.		US$	Pcs	xx	xx	Intermediate	3/11/2004	rt3	
SHG	DSP001	21390rt3$1$1	Self	2,000	STS Test.	08/12/2005	US$	Pcs	xx	xx	Encryption Processor	3/12/2004	21390rt3$1$1	
SHG	DSP001	21391mc3	STS Test		STS Test.		US$	Pcs	xx	xx	Intermediate FT-DSP03	3/12/2004	mc3	
SHG	DSP001	21392mc3$1$1	Self	1,500	STS Test.	08/12/2005	US$	Pcs	xx	xx	Encryption Processor	3/12/2004	21392mc3$1$1	
328				89552673.25						xxx				

FIGURE 18.10

Spreadsheet filters:

SupplierInventory may be fil-



	by the chosen supplier.
Device	Inventory may be chosen via a specific part-number. The part-number drop-down list is constructed from all parts in inventory.
End & Intermediate Products	These lists are constructed from the end and intermediate products defined in the products table. These dropdown lists are only available in the fabless-option of the ERP2020.
Classification	In addition to part-numbers, inventory has a second classification field. This field is controlled via a list and allows the user to group various part-numbers into a common classification.

Column-Specific hyper-links:

* Update IQC	When a lot is received into inventory Incoming Quality Inspection must be performed. When a user single-clicks on a cell in the column labeled with this heading, the action invokes the IQC form. If the lot fails IQC the user may issue a QCAR and/or return the defective material back to the last vendor in the chain. Note that any inventory

stock is not pullable until IQC has been done and the material has passed the inspection. See figure 18.11 on page 18.63.

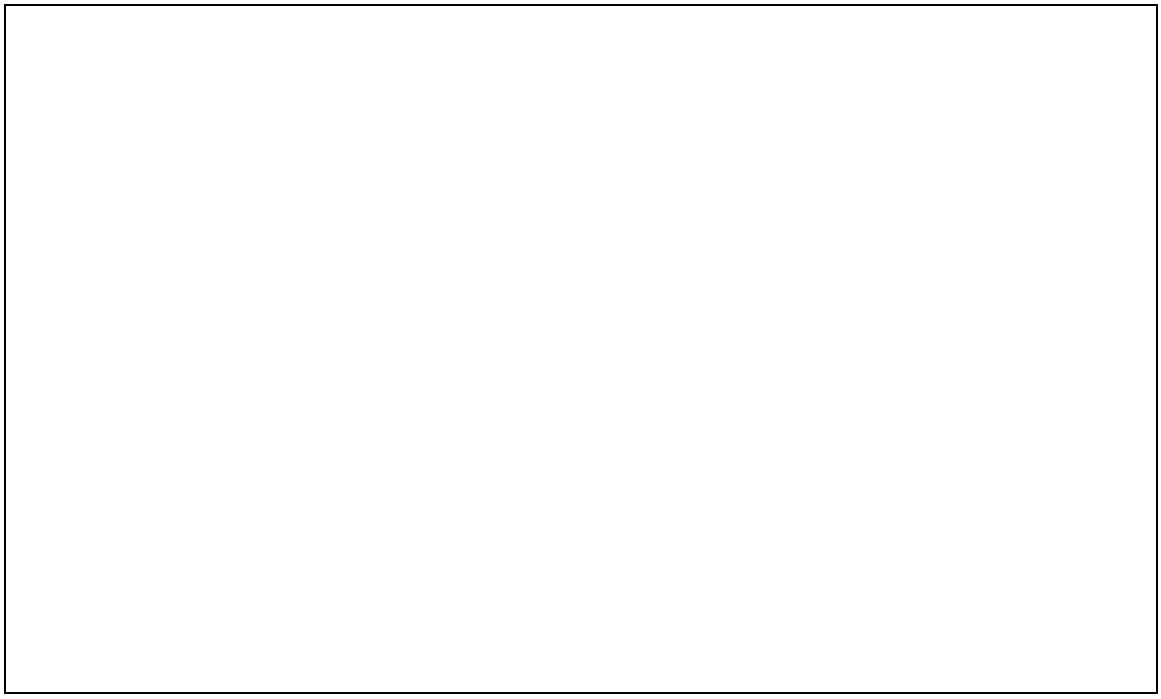


FIGURE 18.11

* See

When a user single-clicks on a cell in the column labeled with this heading, the user may browse the details of the selected inventory stock and any sales-order (or forecast-based) reservations associated to this stock. The inventory-record form is shown in figure 18.12 on page 18.64. The first page of the form shows the stock details and the second page shows what reservations (also called pegging), if any, have been made against the selected inventory stock. Note that inventory stock shown in the spread-sheet includes both finished-products and products still in the manufacturing process. Products

still in the manufacturing process will be “locked” and “inactive” with the appropriate data in the “Locked status” field.

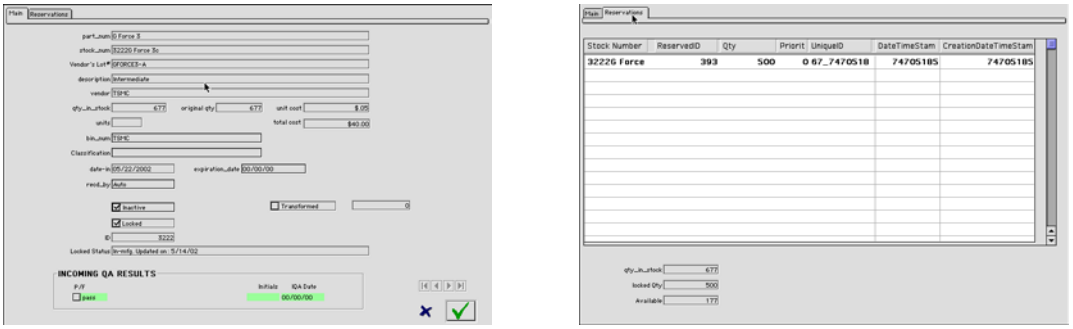


FIGURE 18.12

This form also allows the user to reverse the transfer of the final lot in the chain. The reversal process moves the lot from inventory back to the last lot in the fabless job-chain.

Pull-down Menus:

The first pull-down button creates queries based on Incoming Quality Inspection criteria. See figure 18.13 on page 18.64.

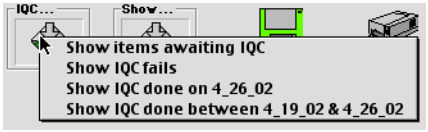


FIGURE 18.13

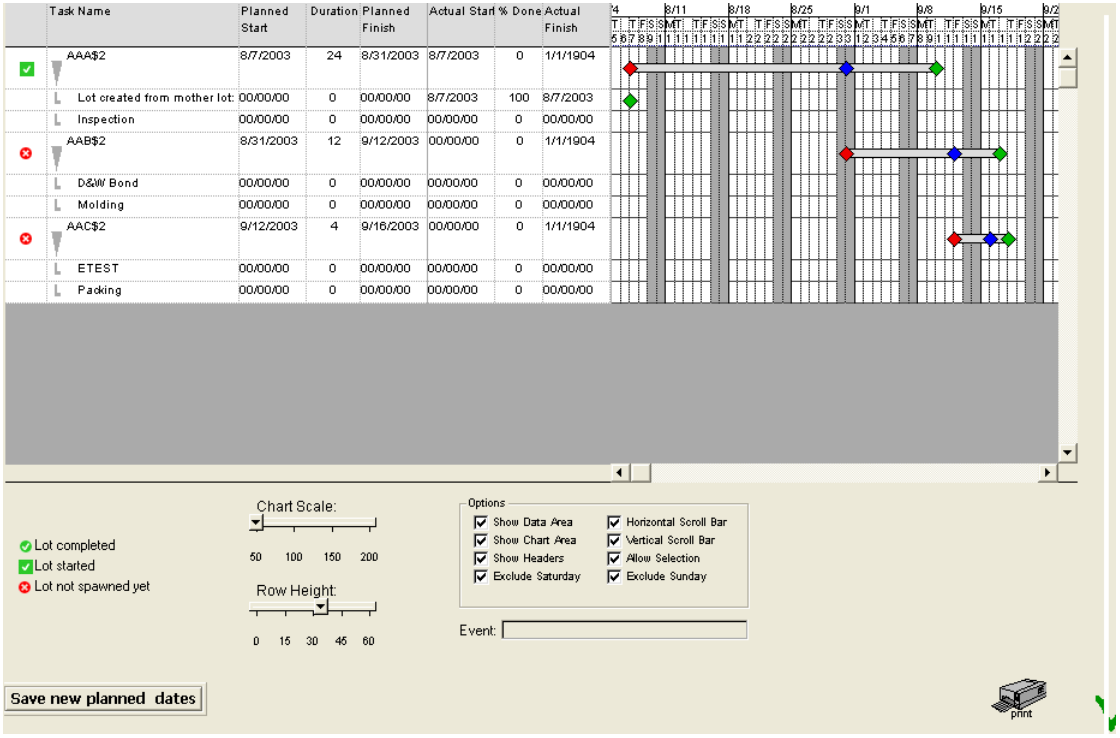
The second pull-down button creates queries related to the inventory-stock in general. The user may create a query based on a variable day or a variable time interval. The last item of the pull-down menu provides inventory which is pres-

ently being built. These items show the projected-out quantity of the finished product requested by the build-job. The date-in of the inventory is a future date, based on the current-scheduled out-date of the finished product. The “WIP” inventory is updated each-time a lot in the virtual chain matures and transforms to the next lot. See figure 18.14 on page 18.65.

FIGURE 18.14

Managing a Build-Job:

build-job and its constituent lots can be completely monitored and managed via the integrated-spread-sheet. The Gantt-chart option provided by this spread-sheet provides a convenient means of getting a snap-shot of each lot in the chain. The user may also change the expected-out dates (of a lot that has not been completed and shipped to the next stage) with the convenience of dragging bars.



If the user changes the expected {planned}-out date of an lot in the chain then all subsequent lots are moved to track the new expected completion date of the preceding lot(s). To permanently save the changes in the data-base (and update the Current-Schedule-Date in the Sales-Order item and the Maturity date in the WIP inventory record) the user must click the “Save new planned dates” button.

•**Menu:** WIP

Menu-Item: *Packing-List Spreadsheet*

Each time a lot is outsourced to a supplier, a packing-slip is generated. These packing slips serve as physical documents for transfer of lots. The packing-slip record contains information on quantities sent-out and received back and dates of transfer to and from the supplier. This menu allows the user to manage the packing-slips associated with the shipment and receipt of lots to and by various sub-contractors in the chain. The packing-slips are managed by via the spreadsheet shown below in figure 18.15 on page 18.67:

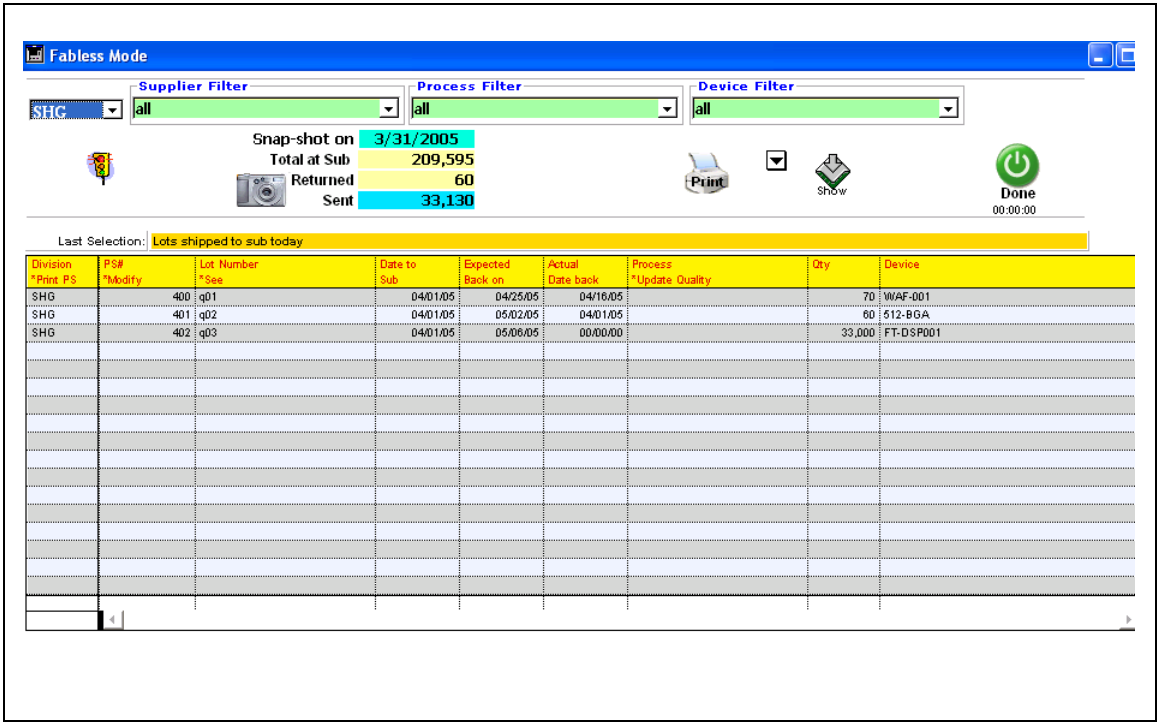


Figure18.15.

Packing-List Spreadsheet columns & column-specific hyper-links:

PS#	Each shipment to a sub-contractor generates a packing-slip with a unique packing-slip number. A packing-slip is recalled and updated via this unique number. Clicking on a cell in this column will allow the user to review or update the selected packing-slip.
Lot Number	This column shows the lot-number of the lot that was outsourced via the selected packing-slip.
Date to Sub	Date the lot was sent to the Supplier.
Expected return date	Date the lot is expected to be returned from the Supplier.
Actual Date of Return	Date the lot was returned by the Supplier
Process (*Update Quality)	Process-category for which the lot was out-sourced. The hyper-link in this column allows the user to update quality data based on incoming inspection of the lot returned by the supplier.

•Menu:Quality

Menu-Item:*Inspection*

When a lot is outsourced a packing-slip is generated to document the transfer of the lot to and from the supplier. Upon return each lot (under its packing-slip) may be inspected for incoming quality. This menu-item allows the user to enter quality-data pertaining to this inspection. The form used to enter this data is shown below in figure 18.16 on page 18.69. This menu provides the same function as the hyper-link in the Pakcing-List Spreadsheet.

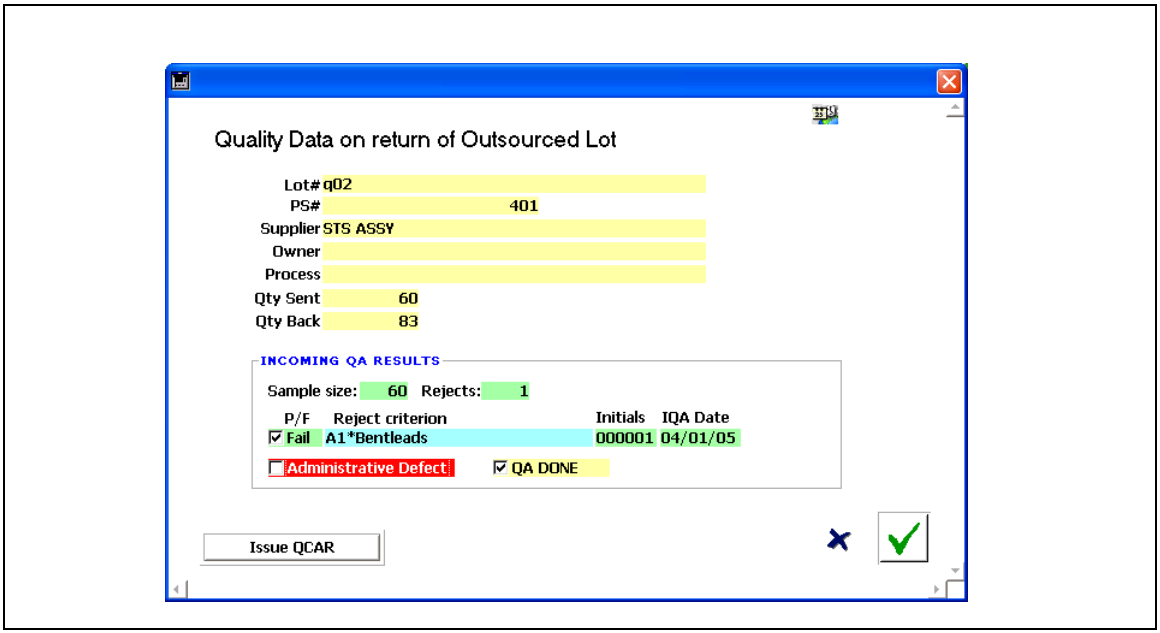


Figure18.16.

•Menu: Plots

Menu-Item: *Quality*

This menu item allows the user to plot quality-data over weekly periodicity. The quality data is distributed into three plots. The first plot shows a distribution of lots inspected and lots rejects over weekly time periods. The data is also presented alongside the plot in tabular format. The LRR (lot rejection ratio) is also calculated and specified in the table. The second plot shows the PPM (Parts {defects} per million) data. This data is also presented alongside in tabular format. The third plot is a Defect Pareto plot, listing the quality-rejection categories that have been assigned to the quality discrepancies.

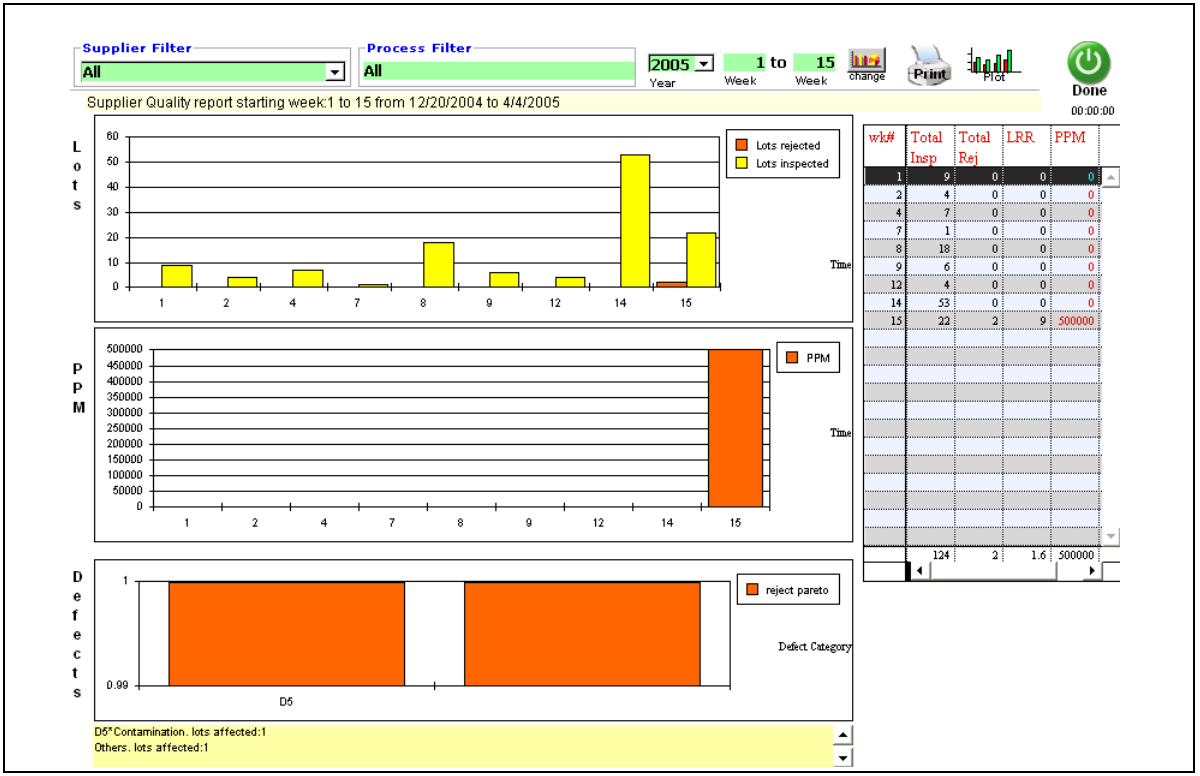


FIGURE 18.17

The plot-data selection may be narrowed by using the Supplier and Process filters. For a detailed discussion on the quality-plot see “Quality” on page 1.12.15.

•Menu: Plots

Menu-Item: *Cycle Time*

This menu item allows the user to plot cycle-time-data. Cycle-time data for suppliers is obtained from the sent and received dates stored in the packing-slips. A packing-slip is generated each time a lot is outsourced. The plot is in the histogram format, showing the percentage of lots delivered within a specific time-period (specified in days). Tabular representation of the data is also provided. The cycle-time-plot data-selection may be narrowed via Supplier, Device-Number and Process filters. For a detailed discussion on this plot see “Cycle Times” on page 1.12.7. The cycle-time-plot dialog is shown below in Figure 18.5 on page 18.51. Hyper-links in the table allow the user to review the data-selections as shown below in figure 18.4 on page 18.72

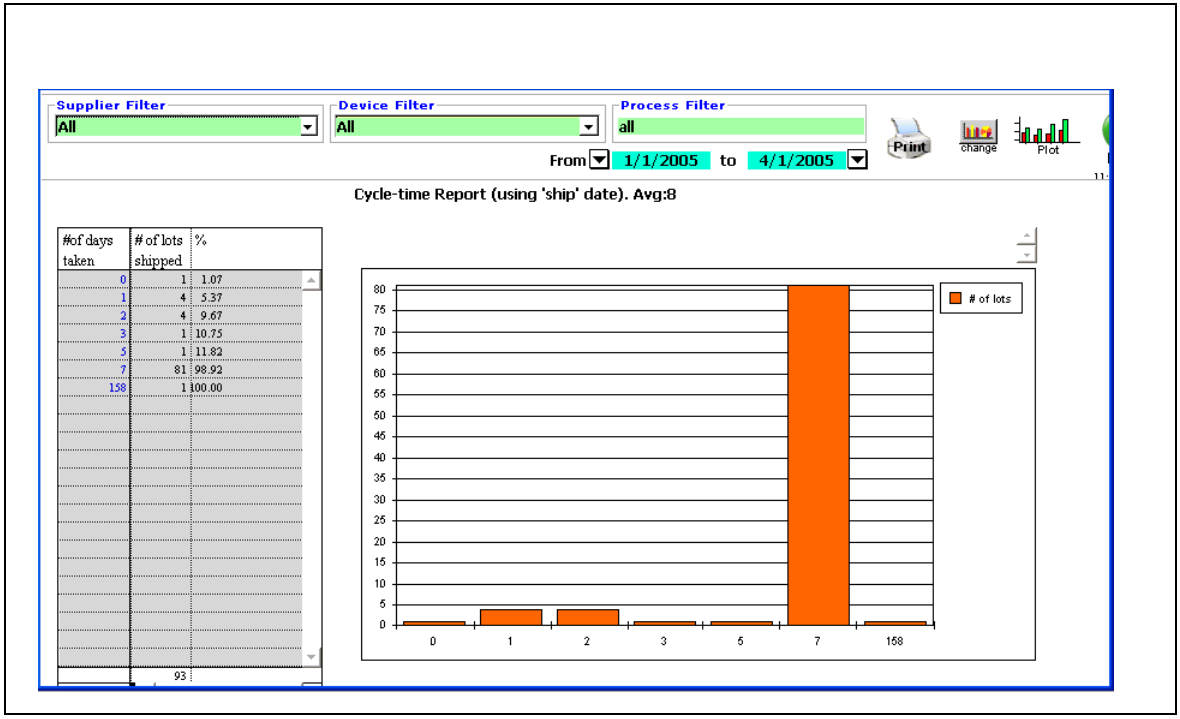


FIGURE 18.18

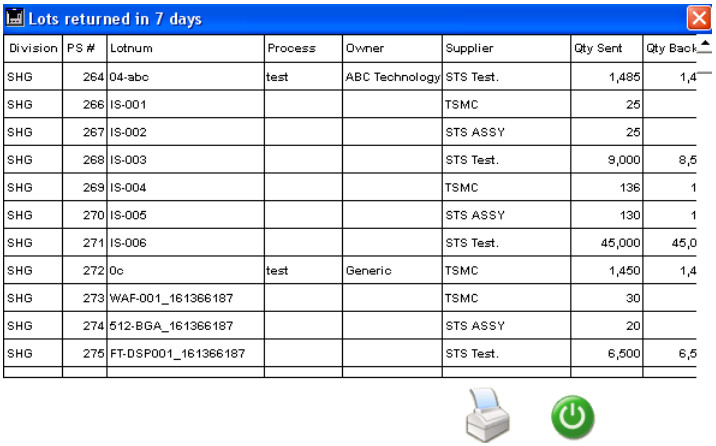

Lots returned in 7 days
Division PS # Lotnum Process Owner Supplier Qty Sent Qty Back
SHG 264 04-abc test ABC Technology STS Test. 1,485 1,4
SHG 266 IS-001 TSMC 25
SHG 267 IS-002 STS ASSY 25
SHG 268 IS-003 STS Test. 9,000 8,5
SHG 269 IS-004 TSMC 136 1
SHG 270 IS-005 STS ASSY 130 1
SHG 271 IS-006 STS Test. 45,000 45,0
SHG 272 0c test Generic TSMC 1,450 1,4
SHG 273 WAF-001_161366187 TSMC 30
SHG 274 512-BGA_161366187 STS ASSY 20
SHG 275 FT-DSP001_161366187 STS Test. 6,500 6,5

FIGURE 18.4

•Menu: Routing-Card

Menu-Item: *Create card*

The Routing-Card defines the virtual-lot chain for the manufacture of a particular product. It comprises of multiple line-items. The line-items are stored in a sub-table with the parent Routing-Card record. Each item is identified by a unique part-number or a unique-process. This menu allows the user to create a Routing-Card. The Routing-Card is created by first defining the fields in the parent record and then adding entries in the sub-table to define the various stages of manufacturing. The entries in the sub-table are created by double-clicking in the blank area of the sub-table. See figure 18.19 on

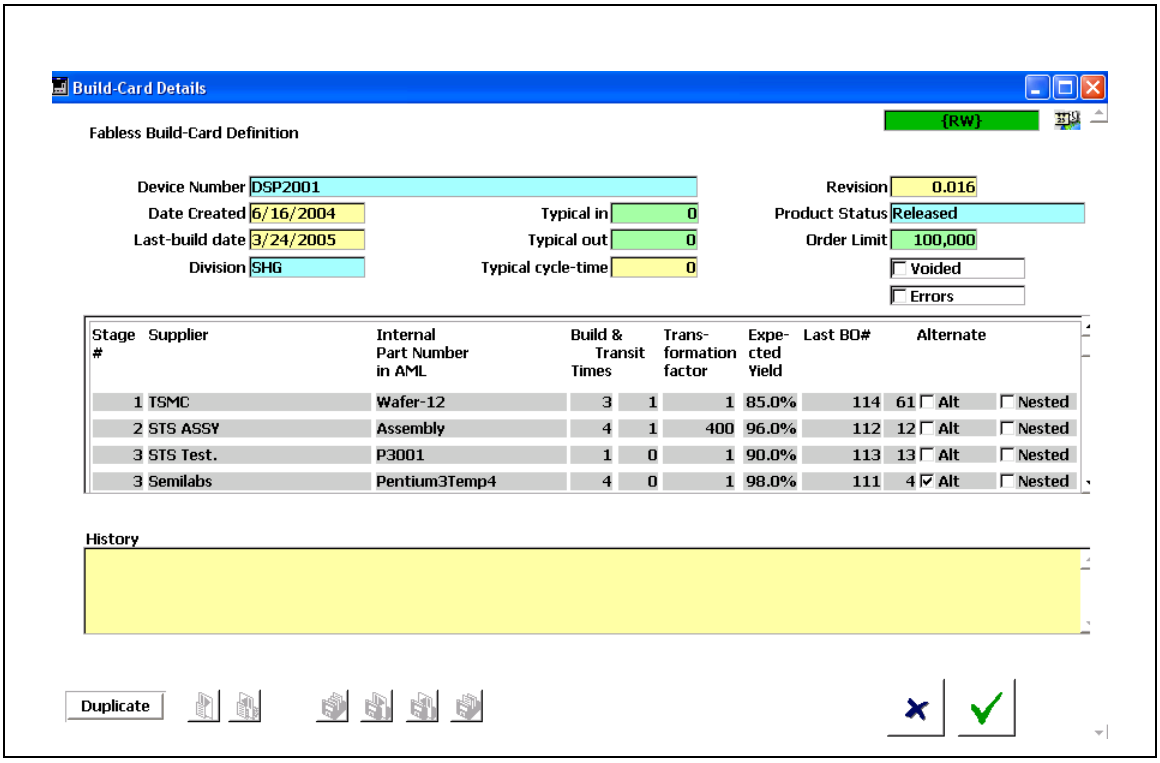


FIGURE 18.19

page 18.73.

Device Number — Name/Number of the device being built. Chosen via the list called "AllPartsList". This list contains all part-numbers defined in the "Products" table whether or not these parts are intermediate or end products. The "End Product" is a product that is shippable to an end

	customer. The intermediate product being one that is used as a component in the manufacture of the end product.
Product Status	This field reflects the product qualification status. A product may be in a qualification or released state. The value of this field is populated via a controlled list. This field in conjunction with the Order Limit controls the maximum buildable quantity for a product.
Order Limit	The limit over which a build-job will be disallowed. This field in conjunction with the Product Status controls the maximum buildable quantity for a product.
Date_created	Date on which the Routing-Card was created.
Last Build date	Last date on which the Build_card was used to create a Job.
Division	Division owning the Routing-Card.
Typical In	After the Routing-Card has been created and all the items entered the user may enter a quantity here and based on the various transformation factors the Typical Out field will be populated.
Typical_out	After the Routing-Card has been created and all the items entered the user may enter a quantity here and based on the various transformation factors the Typical In field will be populated. This value is the required number of units that need to be started in item 1 of the Routing-Card to obtain the desired quantity. When the reverse calculation is made the ERP2020 system will round off the Typical In field to the next highest integer.
Typical Cycle Time	This is the sum total of all the Build and Transit times defined in each step of the Routing-Card.

Routing-Card Items

Double-clicking in the blank area of the table allows the user to create new in-items in the sub-table via figure 18.20 on page 18.75.

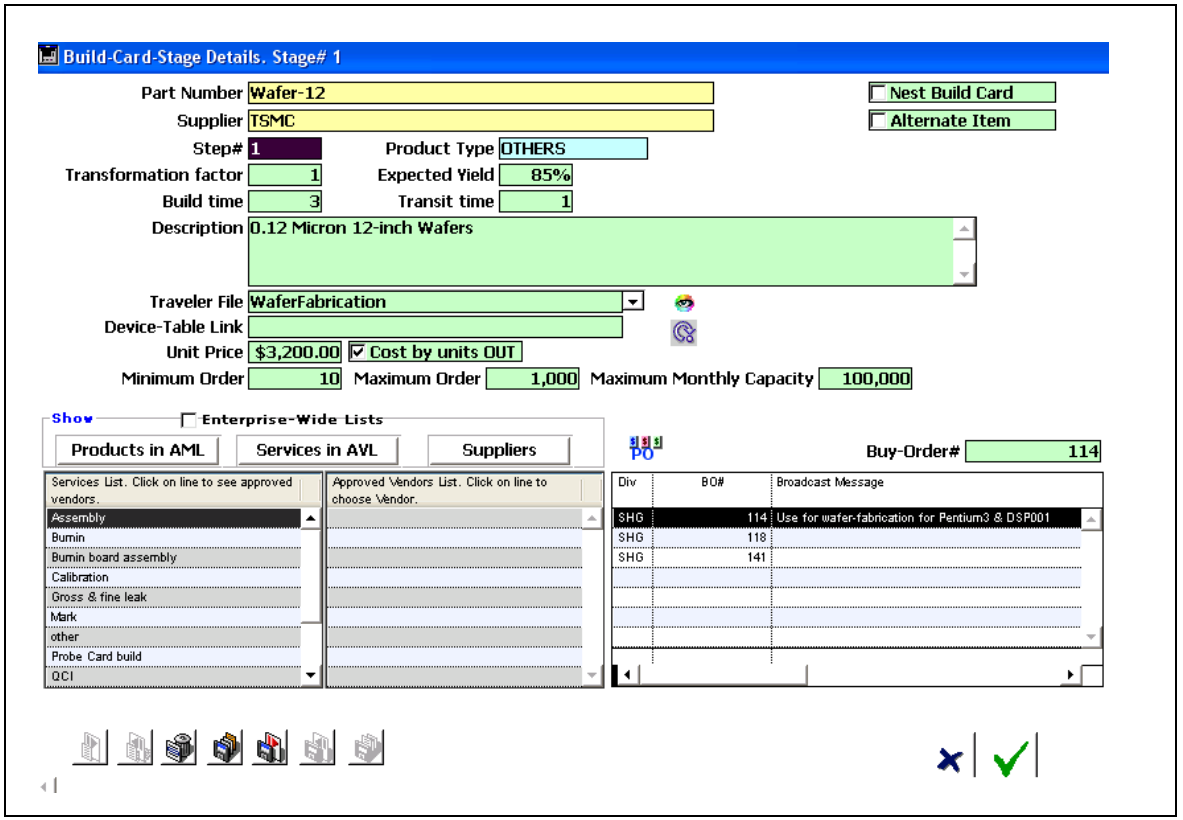


FIGURE 18.20

Partnum	The name of the intermediate part that will be manufactured in this step. The last item in the Routing-Card must have the same part-number as the parent record.
Nest Routing Card	If this box is checked then this item will call a nested Routing-Card with the name specified in the part-number field.
Alternate Item	If this box is checked then this item is an alternate to another item with the same step#.

Step#	The sequence number of the step. The lot created by each step will eventually spawn a new lot defined by the succeeding step. The step# must be unique for each stage, however, alternate items for the same stage must have the same step#.
Routing-CardTransformation Factor	If the transformation factor is >1 then the units have changed. For example, at a Wafer-Saw step, a transformation factor of 400 would state that each wafer in, would yield 400 gross die out (DPW).
Expected yield	Expected yield as a percentage for the Lot.
Build Time	Total time in days to build the Lot defined by a step.
Transit Time	Total transit time into a lot (before the lot can be started). In the virtual chain, the planned date-in of a successor lot will be equal to the date-in of the previous lot, plus the build-time of the previous lot and the transit times of the current-lot.
Qty-In determines Qty-Out	This field is used as a working field during the creation of a Job via a Routing-Card to determine the required and expected units in and out of the operation defined by the step.
Qty-Out determines Qty-In	This field is used as a working field during the creation of a Job via a Routing-Card to determine the required and expected units in and out of the operation defined by the step.
Description	Description of the required operation. This field will be used to describe the Buy-Item created by this transaction with the supplier.
Supplier	Name of the supplier (chosen from the approved vendors list) that will build the part or provide the service required by this step.
Traveler File	When a lot is created the steps in the traveler will be derived from this Steps File. Note that the Steps file is created in its normal manner using the Shipping and Receiving menu. The only difference being that instead of being specific to a customer, the Steps file is a “Generic” steps file, i.e. the Customer Field is set to “Generic” signifying that the Steps File does not belong to a specific customer.
Unit Cost	Cost per unit for lot-processing defined by this item. This cost per unit multiplied by the lot-quantity will be the basis of payment to the sub-contractor. Note that this cost per unit does not include the cost of

	materials that will be used via a BOM attached to the traveler. The cost of materials pulled (via the BOM) is computed separately.
Cost by Units Out	The supplier will be paid by the number of units shipped out of a lot instead of the number of units into the lot. When a lot is completed, the buy-item associated with the activity is updated to reflect the number of good units being shipped to inventory or to the next lot, depending on whether or not the current lot is the last lot of the virtual chain.

•Menu:Routing-Card

Menu-Item:*Display Card*

This menu allows the user to browse through the Routing-Cards without locking them from modification by another user.

•Menu:Routing-Card

Menu-Item:*Modify Card*

This menu allows the user to modify a Routing-Card.The record selection is made via the Buil-Card spreadsheet shown below in figure 18.5 on page 18.78.

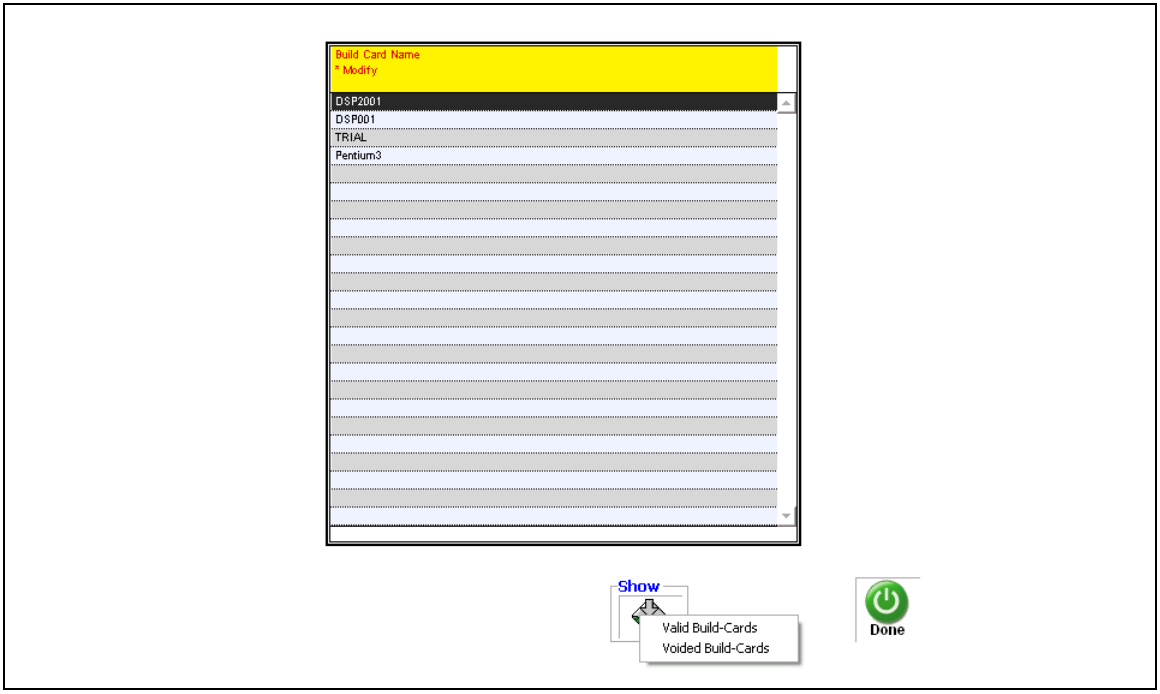


FIGURE 18.5

•Menu:Products

Menu-Item:*Add to List*

This menu allows the user to add a product name and its description to the Products Table. Each record added to this list may be either an end or intermediate product depending upon whether or not it is shippable to a customer. All products built by the company must be defined in the details shown in the form in figure 18.21 on page 18.79. The form has two pages. The first page contains part-details, while the second page contains a table that lists quantity-based pricing. This quantity-based unit-pric-

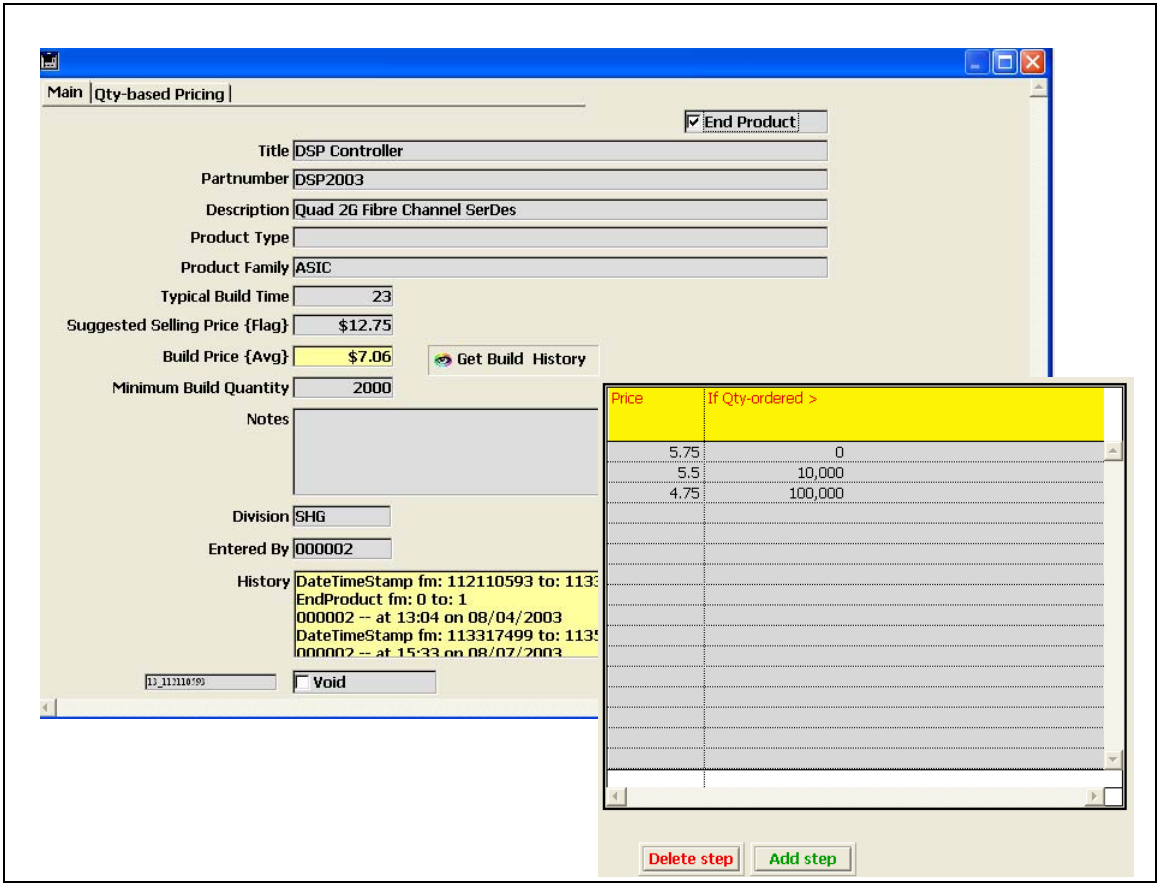


FIGURE 18.21

ing is applied to a forecast record, based on the forecasted quantity for a given period. See “Setting unit-pricing for a forecast record:” on page 18.93.

When the user saves a record three lists are updated. These lists are:

EndPartsList.	This list is available during the creation of the Routing-Card.
AllPartsList	This list is used internally to maintain a table of records containing statistical data pertaining to unit-cost, order dates and cycle-times.
ManufacturedPartsList	This list is available during the creation of the constituent items in the Routing-Card.
Partnum	Unique number for the part (product). This part-number will be added to the appropriate lists after the record is saved.
Description	A brief description of the part.
Product Type	A Type categorization.
Product Family	A family categorization field.
Typical Build-time	This time is used for planning purposes. When a firm booking is entered in the system or a marketing-forecast for a given period is entered into the Sales-Order table, the suggested “Commence Date” for a job (to satisfy the order) is set by subtracting this value from the CRD.
Suggested Selling Price	If the price in the Sales Order is less than this selling price, the sales-order will **not** be released. Also if quantity based pricing is **not** defined then when creating forecast-records this price will server as the default.
Minimum Build Quantity	If the requested quantity in the Sales Order is less than this number then the sales order will not be released.
Notes	Associated notes limited to a a maximum of 32,000 characters.
History	Change history is automatically updated. This text field can store a maximum of 32,000 characters.
Entered By	This field must be re-entered each time any change is made to the record.

•Menu:Products

Menu-Item:*Spread Sheet*

This menu invokes a spreadsheet that provides the user with the ability to browse and modify data in the products table. See.figure 18.22 on page 18.81.

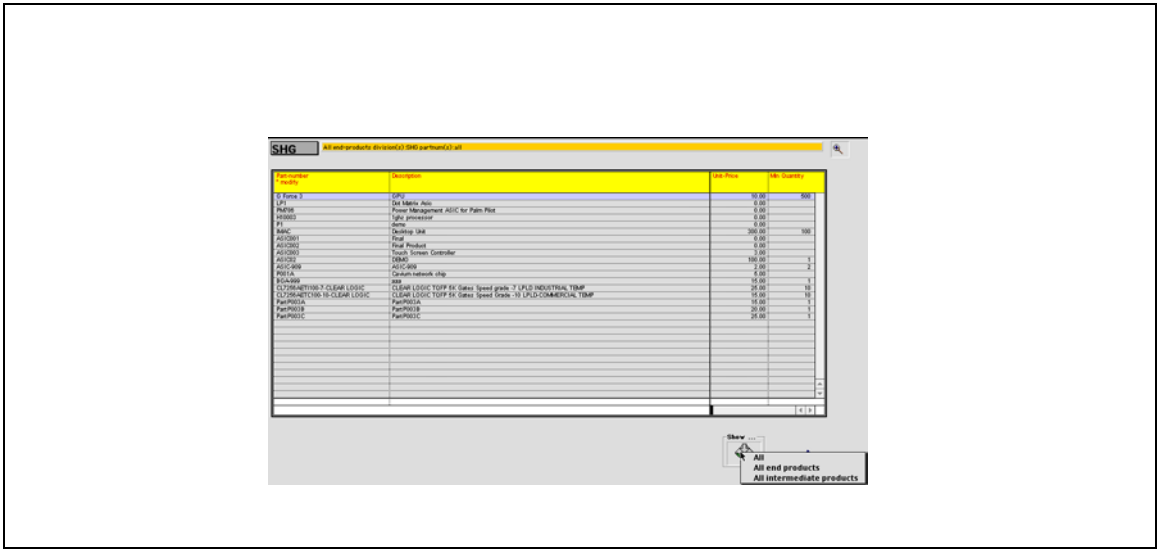


FIGURE 18.22

Product Spreadsheet Column-specific actions:

Modify	Clicking on a cell in column one allows the user to modify the record for the selected part. The user may also browse historical build-data-statistics during the modification session of the record.
Print Status Report	Clicking on a cell in this column allows the user to print a condensed production status report for the selected part. This report is the same report as the “Status Report” discussed under the menu-item “Status Report” on page 2.18.82.

•Menu: Products

Menu-Item: *Status Report*

This menu-item provides a user with a status report of current WIP, current inventory & current confirmed orders by part-number. This report may also be scheduled for automatic circulation on a daily duty cycle. This report is also available on a specific-part basis via the “products spreadsheet”. See “Product Spreadsheet Column-specific actions:” on page 18.81. This report lists per product (defined in the products list) the following:

1) The confirmed-order quantities not yet fulfilled.

2) The total quantity in manufacturing (based on projected yields).

3) The reservations list for the quantity in manufacturing. (This list provides the purchase-order line-item number, the quantity reserved for the line-item and the priority assigned to the line-item)

4) Total quantity available in WIP. This is the quantity not spoken for via a confirmed purchased order.

5) Quantity presently in inventory (in the form of finished goods).

6) The reservations list for the quantity in inventory. (This list provides the purchase-order line-item number, the quantity reserved for the line-item and the priority assigned to the line-item).

4) Total quantity available in inventory. This is the quantity not spoken for via a confirmed purchased order.

Forecasting Menu

The ERP2020 system provides the facility to maintain Forecast data by Division, Customer, Part-number, and Sales Office. Separate records are maintained for Marketing Forecast Data. To maintain the integrity of data entered by various sources, the system automatically generates placeholder records for monthly forecast data. The fore-cast data consists of monthly projected-quantity and the projected average-unit-price. A place-holder is a pre-assigned record for a given division, part-number, customer, and year. The user then enters forecast data in these records. The data for all the months in a calendar year is contained in a single record. Separate Place-holder records are created for Sales & Marketing departments. Each Sales- forecast placeholder is completely defined by the Division, Customer (from the active Customer-Log), Partnumber, Sales Office, and the year of the forecast. Each Marketing-Forecast placeholder contains information for Division Part-number and year only. The Marketing forecast place-holder being a placeholder for the total quantity required per year, per part-number and per division, inclusive of all customers. When a user enters forecast data the user modifies an existing placeholder ensuring the prevention of redundancy and the accuracy of data. Note that an additional Sales-Forecast place-holder is created for each part-number, Division, year, and Sales-Office without a customer-name assigned to it. This place-holder is used for all data not associated to a given customer.

•Menu: Forecast

Menu-Item: *Review*

This menu item launches a multi-purpose and multi-page, spread-sheet. The first page of the spread-sheet that allows the user to browse and (with sufficient privileges) modify Sales and Marketing forecast data. (See Figure 18.23 on page 18.84). The second page of the spreadsheet allows the user to review the data in graphical format. (See Figure 18.28 on page 18.94)

In addition the user may create place-holders for the forecast entries, perform variance analysis on Marketing vs. Sales Forecast, Marketing Forecast, vs. Actual Builds, and Build vs. actual Ships. The user may also transpose a forecast quantity for a given month to a forecast entry into the PO_Items table to subsequently start a Build Job.

The data downloaded in the spreadsheet may be filtered by Division, Customer, Part-number, Year, and Ownership (Sales vs. Marketing). Each row in the spreadsheet represents a record in the FORECASTDATA table and is uniquely identified by the ID field. The forecast data in the spreadsheet is directly editable (by double-clicking in a cell and then entering the new data) and only a single save is

required to save all the edits in the data-base. However historical data and the data of the current month are frozen (indicated in the spread-sheet as yellow columns) and are not editable. All cells whose data has changed are highlighted to provide the user with a visual indication. Additionally, the last column of the table stores a “data changed” flag so that only those rows of the spreadsheet that have been changed will be updated in the database. See figure 18.23 on page 18.84.

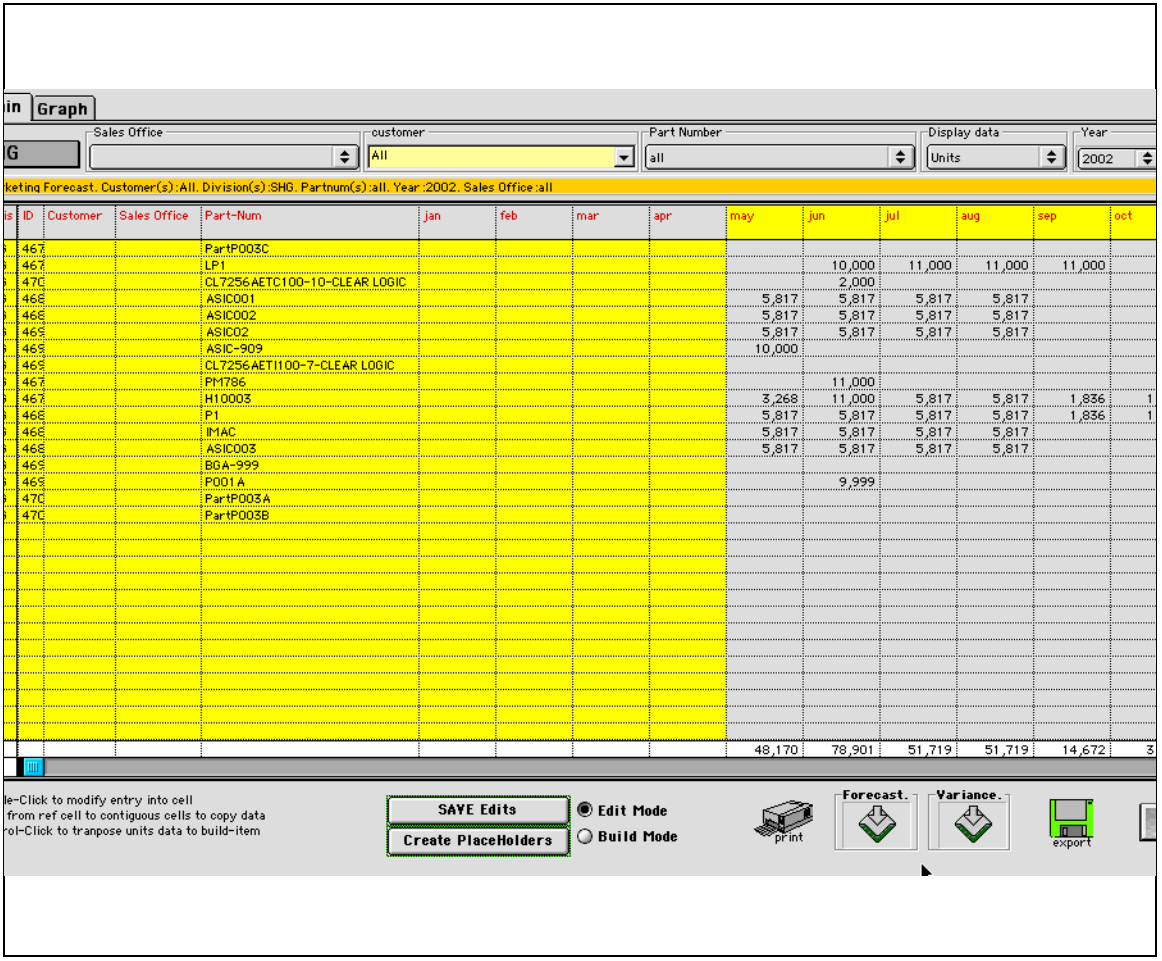


FIGURE 18.23

Forecast-Spreadsheet columns and column-specific actions:

ID	This column displays the unique ID of the forecast-record whose data is being displayed in a particular row. The user may display or modify this record directly by clicking on a cell in this column.
Sales Office	If the data being displayed is related to forecast from the sales department (as opposed to the marketing department) then this column displays the sales-office-number that is the source of the forecast.
Jan.-Dec.	These twelve columns display monthly data. The data being displayed depends upon the state of the “Display data” filter (See “Spreadsheet filters:” on page 18.61.). If the selection via this filter is “Units” then these columns display the unit-quantity forecasted for each month. The footer of the spreadsheet displays the monthly total of all quantities in each column. If the selection via this filter is “Unit-Price” then these columns display the average unit-price forecasted for each month. The footer of the spreadsheet displays the range (minimum and maximum values) of the total of all unit-prices displayed in each column.
Annual	If the selection via this filter is “Units” then this column displays the sum of the unit-quantities forecasted for all months of the selected year.

Forecast-Spreadsheet filters:

Sales Office:	Filters the data downloaded into the spreadsheet by the chosen sales office. This selection does not have any effect when the user requests marketing forecast data.
Customer:	Filters the data downloaded into the spreadsheet by the chosen customer. This filter has no effect when the user requests marketing forecast data.
PartNumber:	Filters the data downloaded into the spreadsheet by the chosen part-number.
Display data:	The data downloaded may be the number of units per month, the corresponding unit price or the revenue based on the number of units

forecasted and their associated unit price. Note that when the unit-price is being displayed the spread-sheet provides additional information on the statistics and any existing error conditions. See “Spread-Sheet format when displaying Unit-Price” on page 18.90.

Year: Calendar year for which data is to be downloaded.

Forecast-Spreadsheet Buttons:

Save Edits — The user may change the marketing/sales forecasts and then save them into the database. This is a batch-mode save that saves all modified entries (in a given mode) as one transaction.

Create PlaceHolder Records — This button creates place-holder records for a selected partnumber, sales office etc., if the records don’t already exist.

Edit Mode: — When this radio-button is set then the spreadsheet is in the edit-mode as opposed to the build-mode

Build Mode: — When this radio button is set then the spreadsheet entries cannot be modified. In this mode the user may transpose a marketing forecast item into a forecast-item in the PO_Items table. The latter being the basis of the creation of a build or ship job for the requested product and its required quantity.

Pull-Down Menus

Forecast Data

Variance

This button provides pull-down menus to review variance between Marketing forecast and Build quantities, Builds and Ships, and Marketing forecast vs. Sales forecast.

When variance data is shown the quantities are consolidated for all customers for a given part-number and division. The information in the footer shows the variance as opposed to the totals. See figure 18.24 on page 18.87.

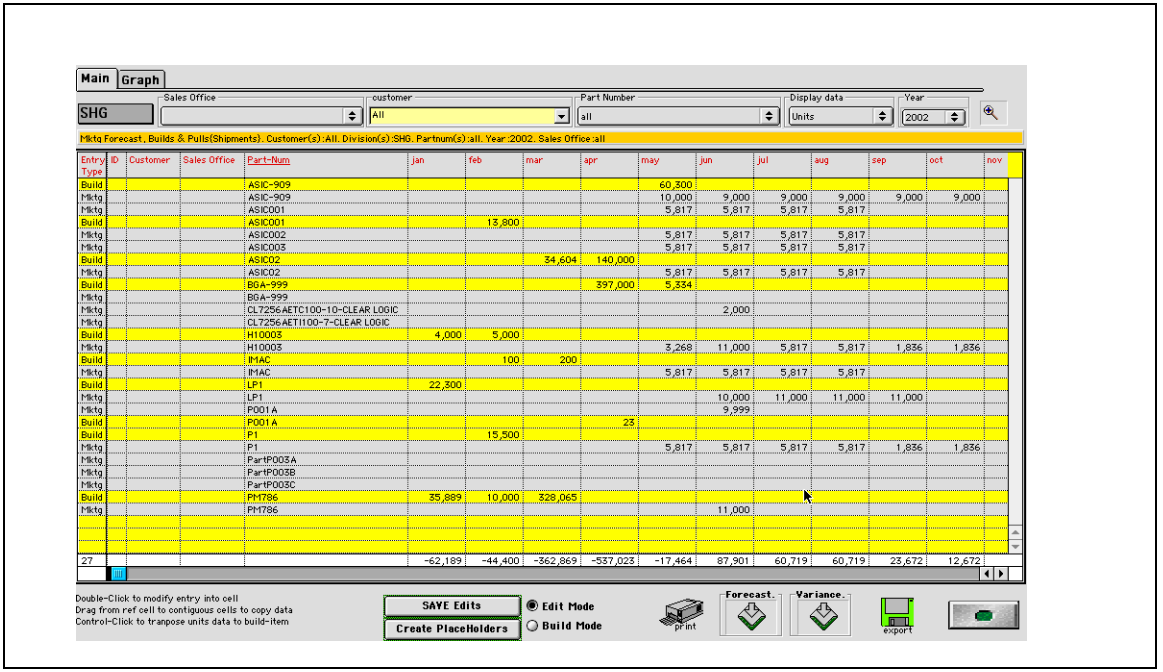


FIGURE 18.24

The forecasting spreadsheet has a built-in tool to perform special pasting functions in a row of cells,

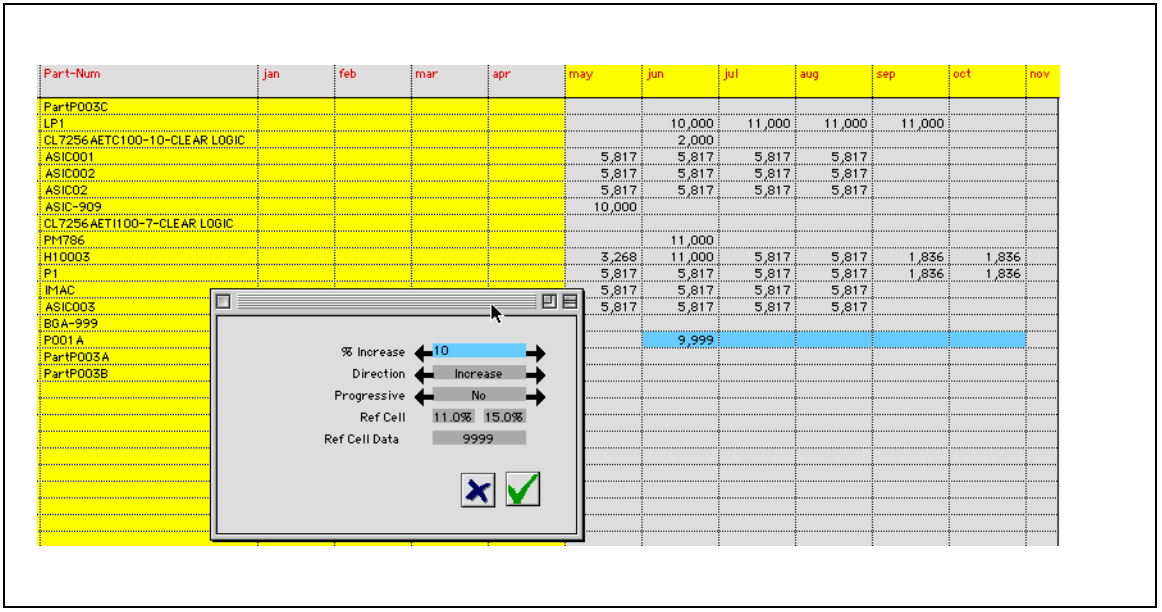


FIGURE 18.25

based on the data in a reference cell and selectable variables in the pasting-tool. This tool is invoked by clicking on a reference cell and the dragging to the right to make a selection of cells into which data has to be pasted. The left-most cell in a row is the reference-cell and its data is pasted into other cells, modified by the parameters in the tool. The spreadsheet must be in the edit mode for this tool to be invoked.

Building Via the Marketing Forecast menu:

The user may transpose a marketing forecast entry into a Build Entry (PO_Items table record). To accomplish this the user must first change the mode of the spreadsheet to “Build” mode (see “Forecast-record buttons:” on page 2.18.93) and then download Marketing Forecast data into the spreadsheet. Once the data has been downloaded the user must then Control-Click on an entry in the

spreadsheet. The ERP2020 will first check to see if any transpositions to the PO_items table have already occurred for selected period. The user will be flagged if any such items already exist. The user will also be informed what if any of the transposed items have been converted build-processes (build-jobs). If the sum of the quantities specified in the prior transformations is less than the quantity required for the month then the user may transpose the remainder from the forecast table to the PO_Items table. Since a marketing-forecast entry is non-customer specific, the build-item thus created has the customer-name and purchase-order fields set to "&$&unassigned". The build item thus created may then be used to create a build job. The transposition is performed under a transaction and is validated by the user via the Transposition form shown in Figure 18.26 on page 18.89.

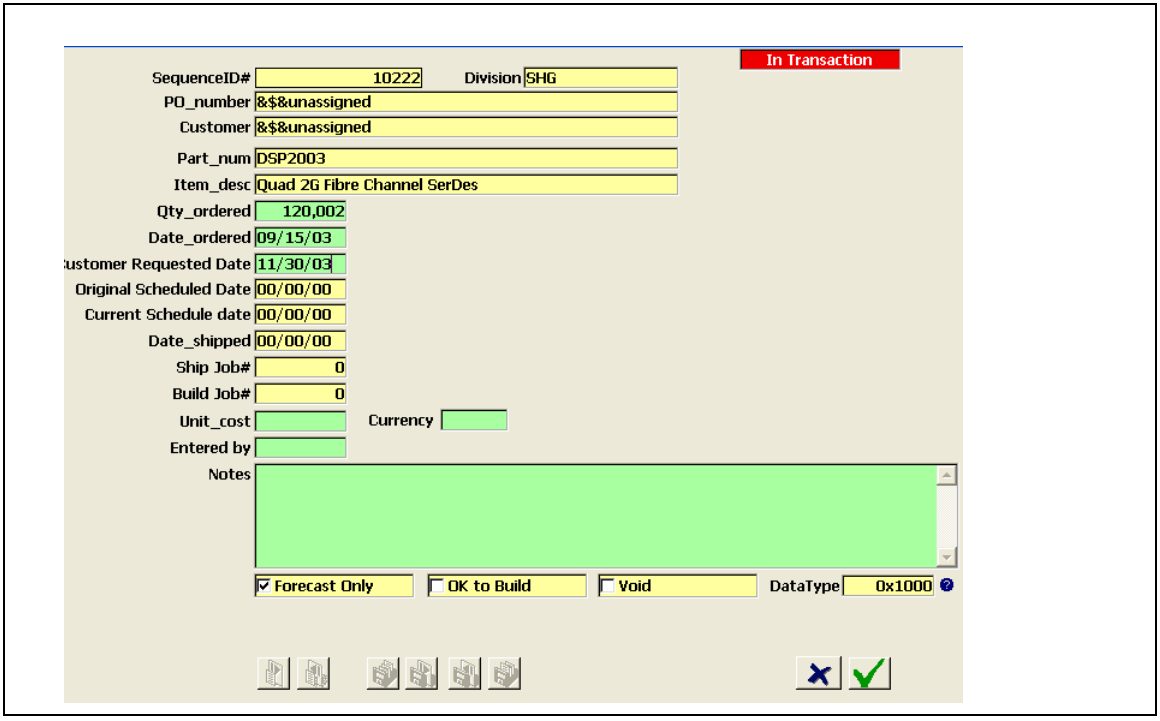


FIGURE 18.26

Forecast-Transposition form-fields

Customer Request Date: Although the transaction is not customer-specific, the CRD is set to the last date of the month to which the forecast belongs.

Commence Date	This date is the suggested start-date of a Manufacturing Job (required to build the product). It is calculated by subtracting the planned build-time of the product, as defined in the Product-Definition List (Fabless Parts Master). The Commence-Data is set based on the Prouduct-Definition instead of the Routing-Card because the latter may not be available when the forecast is first being developed.
Unit-Price	Although the transaction is not customer-specific, the unit-price value is set to the pricing set in the Marketing Forecast record for the selected period (month).
Currency	The current is set to the default sales currency as defined in the House-Keeping record.

SpreadSheet format when displaying Unit-Price

To be able to develop an accurate revenue forecast, the unit-pricing data entered for each device and each period must be accurate. For example, the unit-price data must always be entered If any quantity has been entered in the forecast. Additionally, a statistical sanity check is desirable to validate the unit prices that have been entered. To facilitate this process the spreadsheet display in the unit-price mode provides extra information in the body and the footers of the spread-sheet.

The footer section is expanded in this mode to display the Minimum, Maximum, and Average unit-prices in a given period. When the minimum and average are calculated, any zero unit-prices are excluded. The average unit price is calculated by first calculating the revenue for each period (Sum of the product of quantity and unit-price) and then dividing the total revenue for the period by the total quantity stated in the period.

For the special case when the user may have defined a quantity **without** an accompanying unit-price, the error-condition is indicated by highlighting the cell (in CYAN) and also displaying a total error-count for the period in the last line of the footer.

A sample display of the Forecast spread-sheet in the unit price mode is shown below in figure 18.27 on page 18.91.

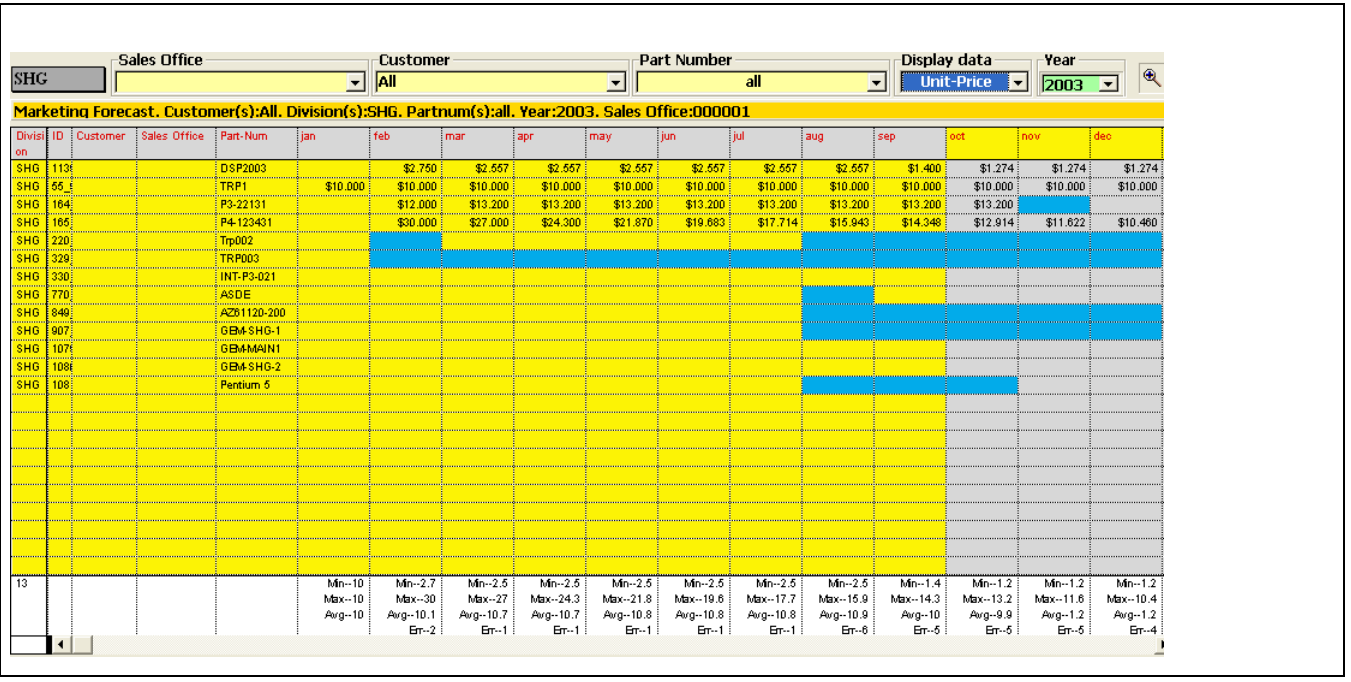


FIGURE 18.27

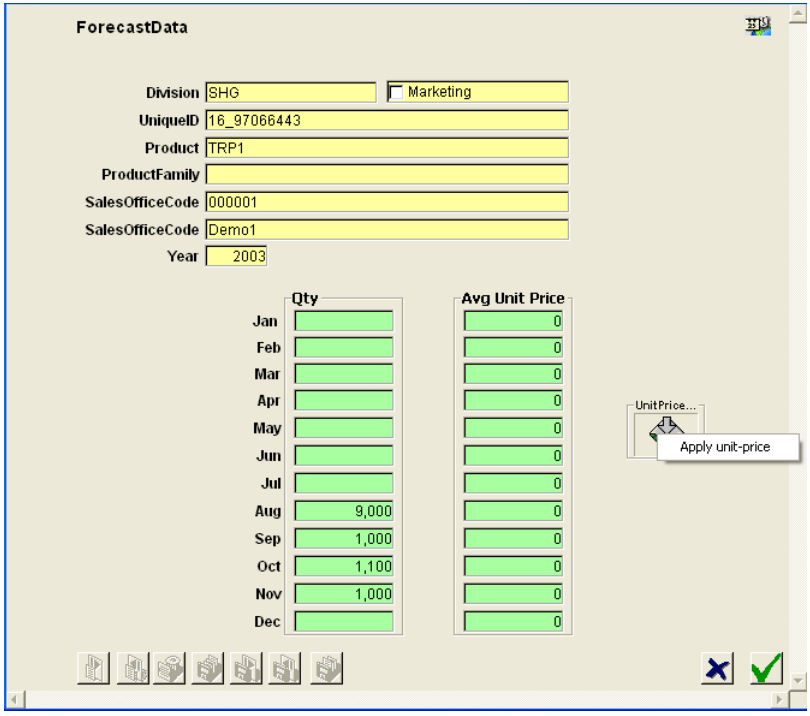
Adjusting Spread-sheet column widths:

The user may resize spread-sheet column-widths using the button whose icon is shown above. A column may also be “hidden” by minimizing its column-width (1-pixel). The width settings may be stored locally on a client and reloaded during a spreadsheet-session. The width-settings pull-down menus are shown below. The “Expand” menu expands all the columns on a best-fit basis. The “load-Settings”

menu resizes the columns according to last stored settings. The “Save Settings” menu allows the user to save the user’s preferred settings into a local file. Note that the “Save Settings” menu is displayed only if the Windows control-key is pressed.

Direct access to forecast-record:

The ERP2020 maintains a separate record for each marketing or sales forecast entry. Each record is identified by a unique ID. Each row in the forecast spreadsheet represents a unique record. The user may directly access any record shown in the spreadsheet by clicking on a cell in the second column (column-header is “ID”) of the spreadsheet. With sufficient privileges the user may modify (if the windows-control key is pressed) the record data. The form used to display or modify the forecast record is shown below:



Forecast-record buttons:

Setting unit-pricing for a forecast record:

Apply Unit-Price

This button allows the user to automatically assign a unit-price to each period based on the quantity forecasted for the period. The quantity-based pricing is defined in the Part-Number record in the Master Parts list. See “Products” on page 18.79. If quantity based pricing is not defined then the default selling price is assigned. The assignment takes place only if

a) The Qty projected for the period is non-zero.

b) The unit-price is presently zero or was zero when the record was loaded.

c) Date cannot be modified for preceding periods.

Viewing forecast data in graphical format:

The second page of the Forecast spreadsheet allows the user to review the forecasted quantity, associated unit-price, and revenue data in a graphical format. All the spreadsheet filters are also operational via this interface.

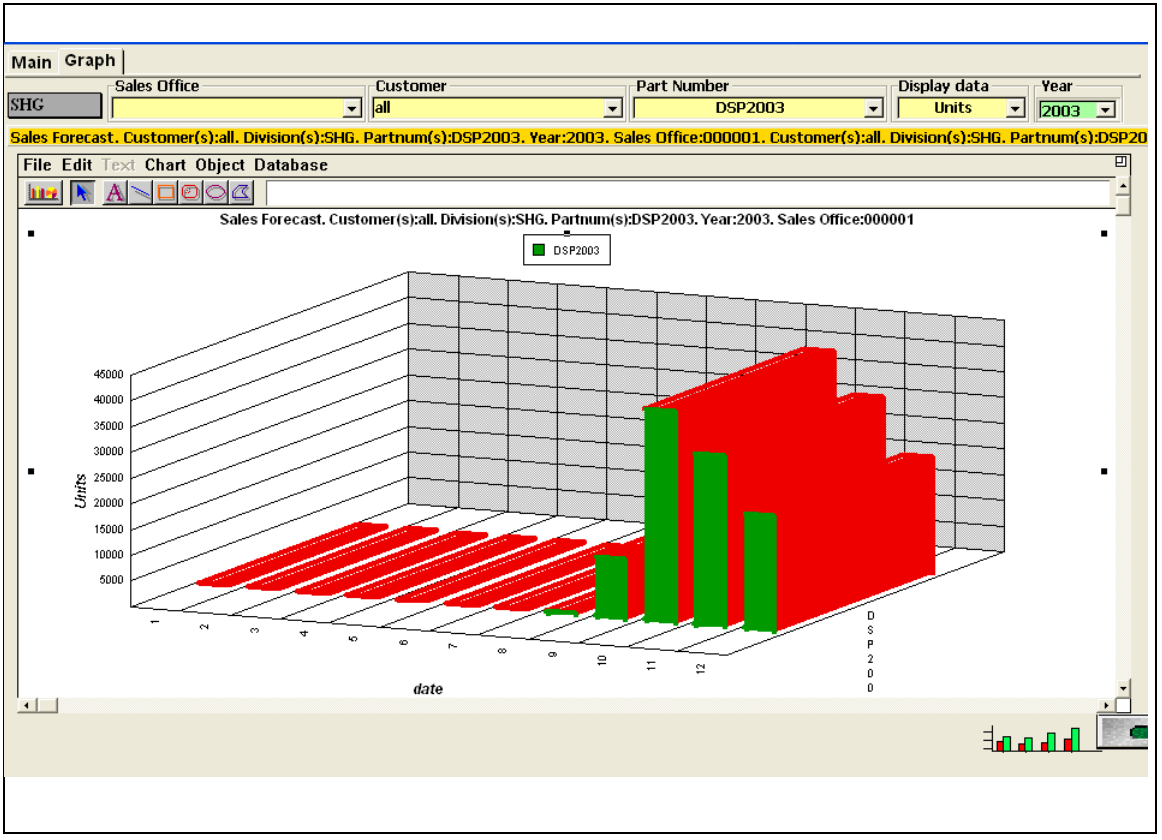


FIGURE 18.28

Additional Information

Purchase Order Entry

Purchase orders and line items are entered using the accounting menu, as described in Chapter 11, however, the screen is shown here as the fields have such an impact on this section.

The various fields that characterize a record in the PO_Items table are discussed below:

Forecast	If true then the item is a forecast entry. By default any entry when saved is considered a forecast, so that it may be subsequently modified by a controlled process.
Void	If true then the entry is voided, effectively deleted although it can be reinstated.
OKtoBuild	If set then the forecast may be used to create a build-job.
Ship-Jobnumber	If non-zero then it indicates that a ship-job was created to fulfill the order described by the item.
Build-Jobnumber	If non-zero then it indicates that a build-job was created to build the product defined in the item.

Records in the PO_Items table may be created either via the 4D Client or a WEB browser. The latter facility is intended to provide sales representatives a convenient means to enter a forecast entry from remote locations. The forecast entries must then be reviewed and released internally via a controlled process. Access to the various menus in the fabless mode is available via the “Sales Order” link in the menu-bar loaded on the top of each web page.

Browser Based Data Entry: Sales Orders and Forecasts

For more information see Chapter: “Web Access.” Some examples are shown here to illustrate the capabilities of the ERP2020 system for remote access via a browser.

The screen below shows the complete set of menu options along the top. These options are controlled in the House Keeping options, to allow any subset of the menu options shown. For example, a remote

Sales Office or distributor would typically only see the “Quote” and “Sales Order” menu options. This screen also shows generic selections that a typical user would see.(figure 18.29 on page 18.96)

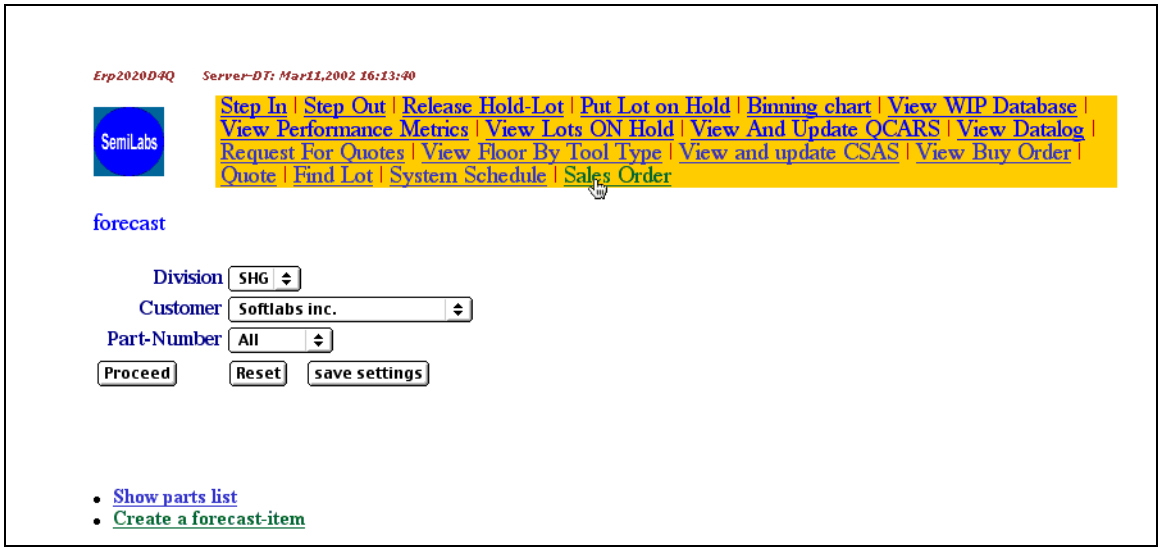


FIGURE 18.29

The WEB entry screen (figure 18.30 on page 18.97) shown below is invoked via the “Create forecast-item” hyper link:

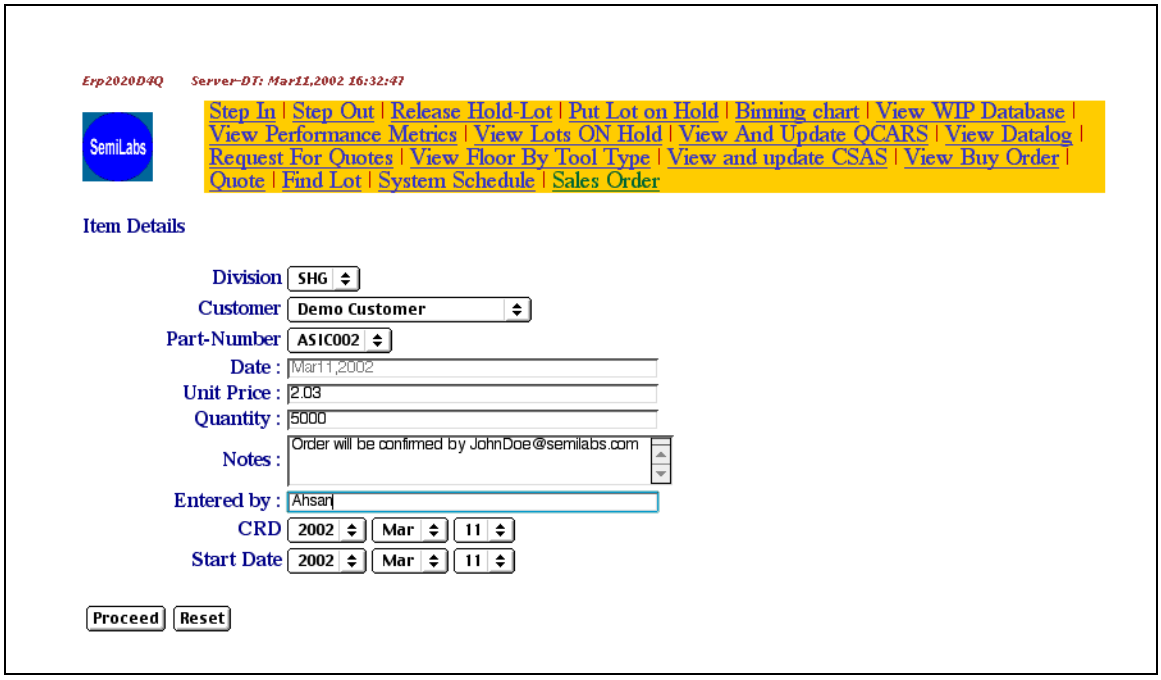


FIGURE 18.30

Other menus (links) provide the user the ability to review orders/forecasts, product lists, and detailed product-guidelines via the browser interface. See figure 18.31 on page 18.98.

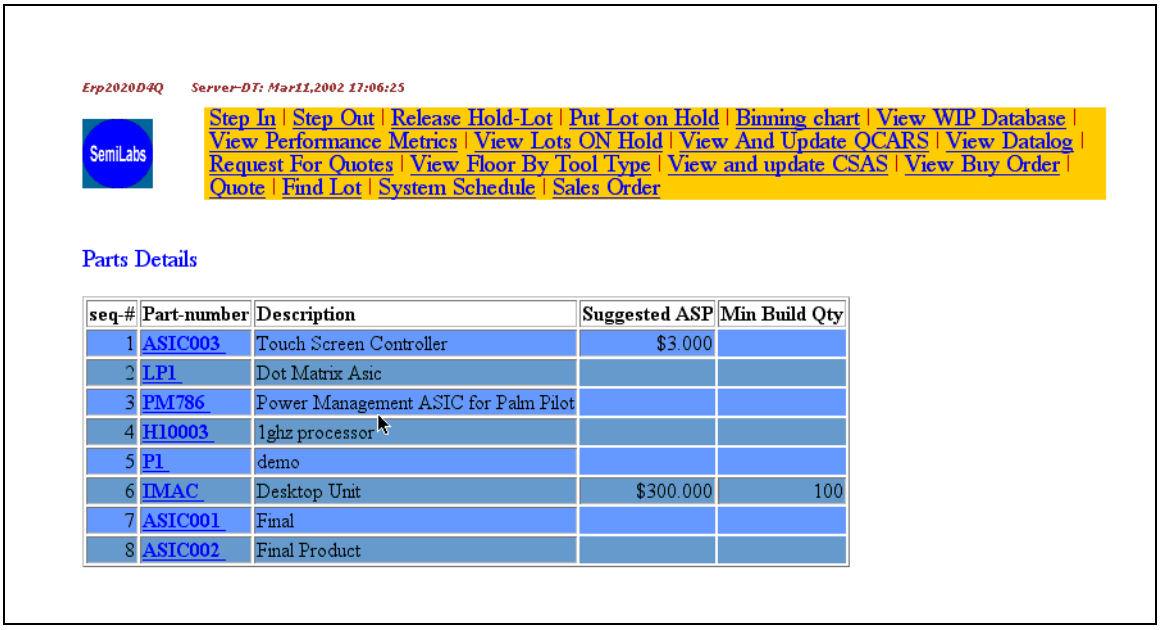


FIGURE 18.31

See figure 18.32 on page 18.99 and figure 18.33 on page 18.100 to see the forecast-selection and forecast-browsing/editing screens.

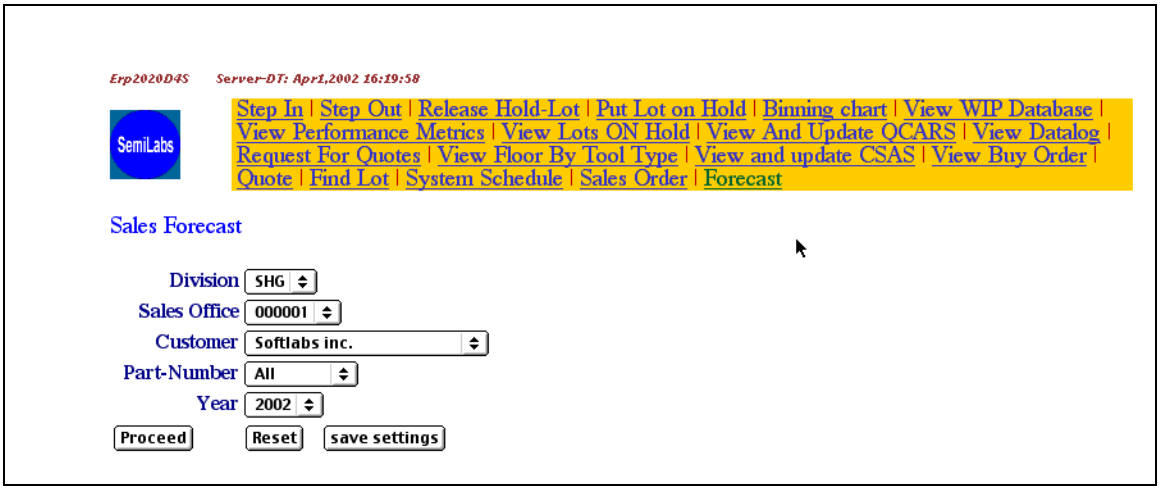
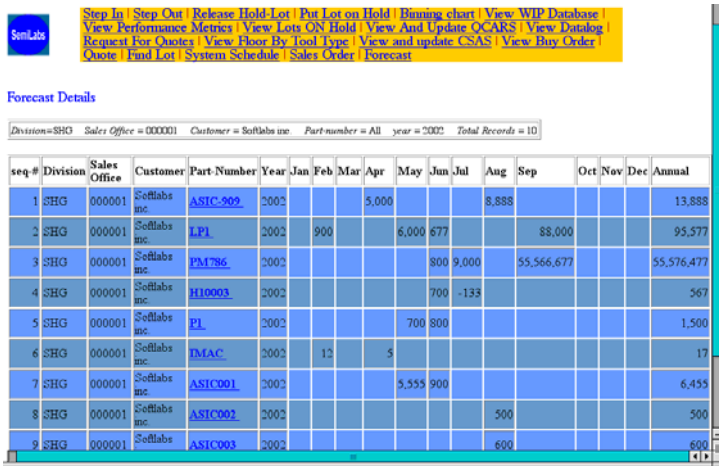


FIGURE 18.32



seq-#	Division	Sales Office	Customer	Part-Number	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	SHG	000001	Softlabs inc	ASIC-909	2002				5,000				8,888					13,888
2	SHG	000001	Softlabs inc	LP1	2002		900			6,000	677			88,000				95,577
3	SHG	000001	Softlabs inc	PM786	2002						800	9,000		55,566,677				55,576,477
4	SHG	000001	Softlabs inc	H10003	2002						700	-133						567
5	SHG	000001	Softlabs inc	P1	2002					700	800							1,500
6	SHG	000001	Softlabs inc	TMAC	2002		12		5									17
7	SHG	000001	Softlabs inc	ASIC001	2002					5,555	900							6,455
8	SHG	000001	Softlabs inc	ASIC002	2002								500					500
9	SHG	000001	Softlabs	ASIC003	2002								600					600

FIGURE 18.33