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# Manufacturing Portion of e-Manufacturing

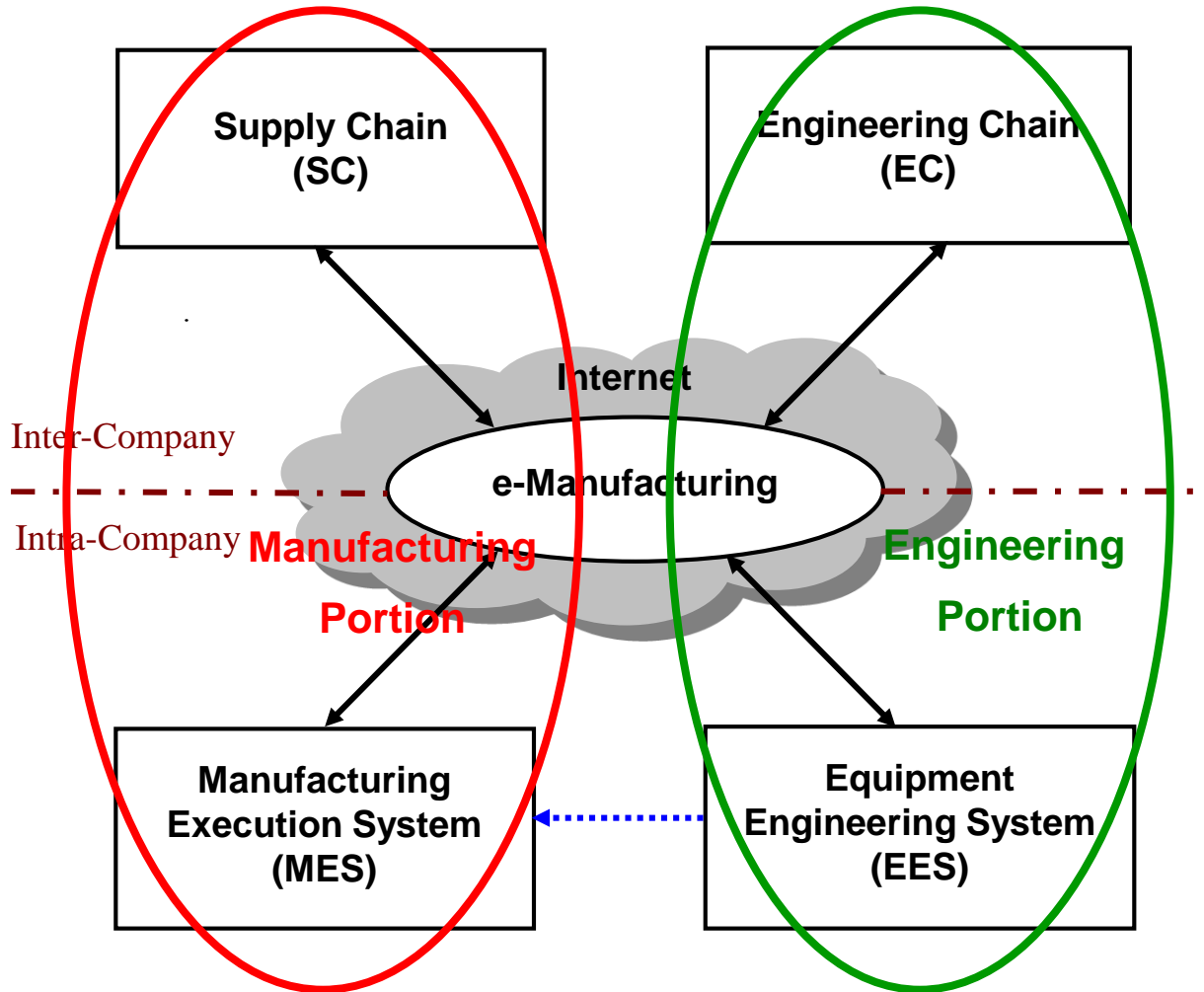
**Fan-Tien Cheng**

**e-Manufacturing Research Center  
National Cheng Kung University  
Tainan, Taiwan, R.O.C.**

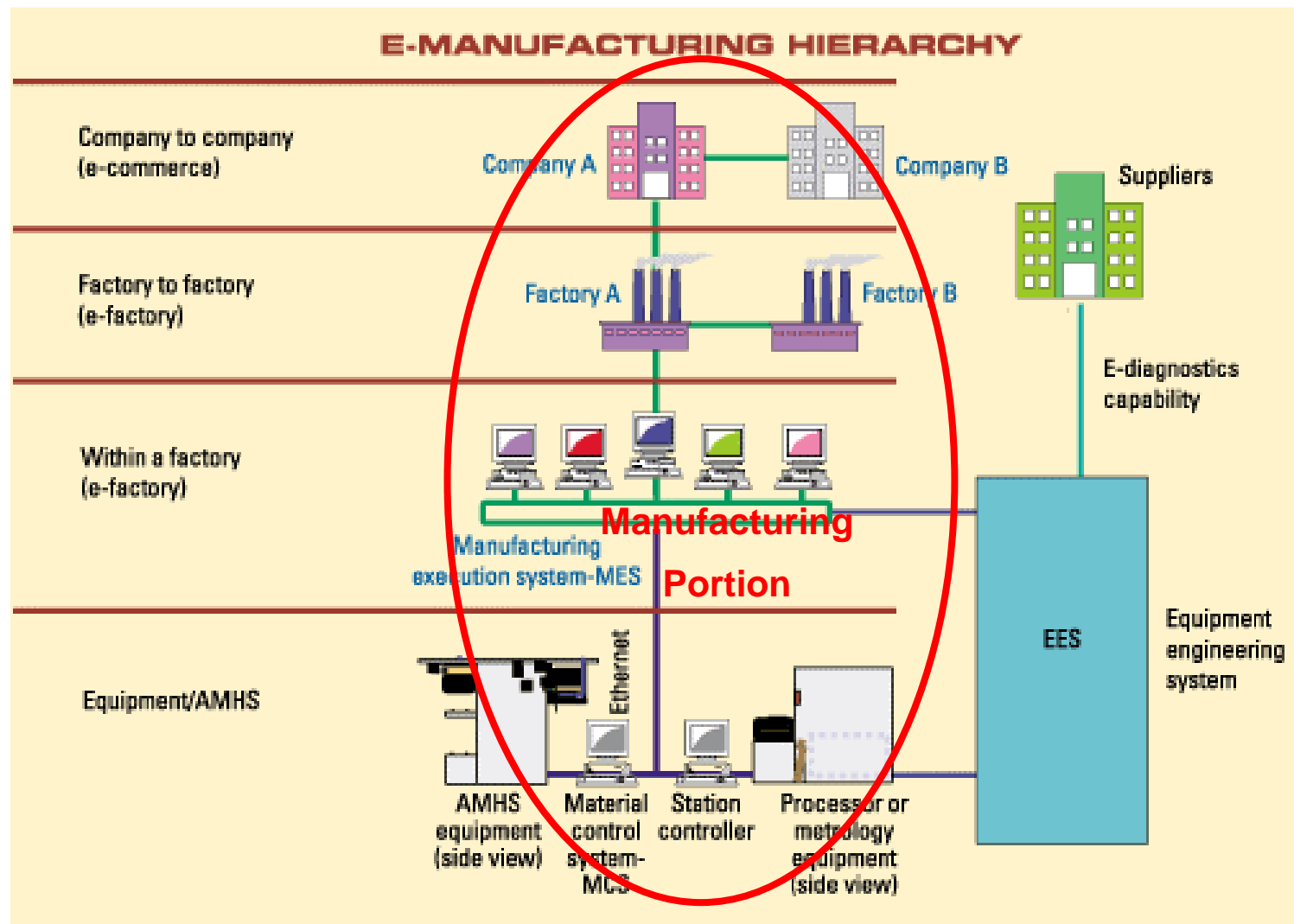
**September 18, 2013**



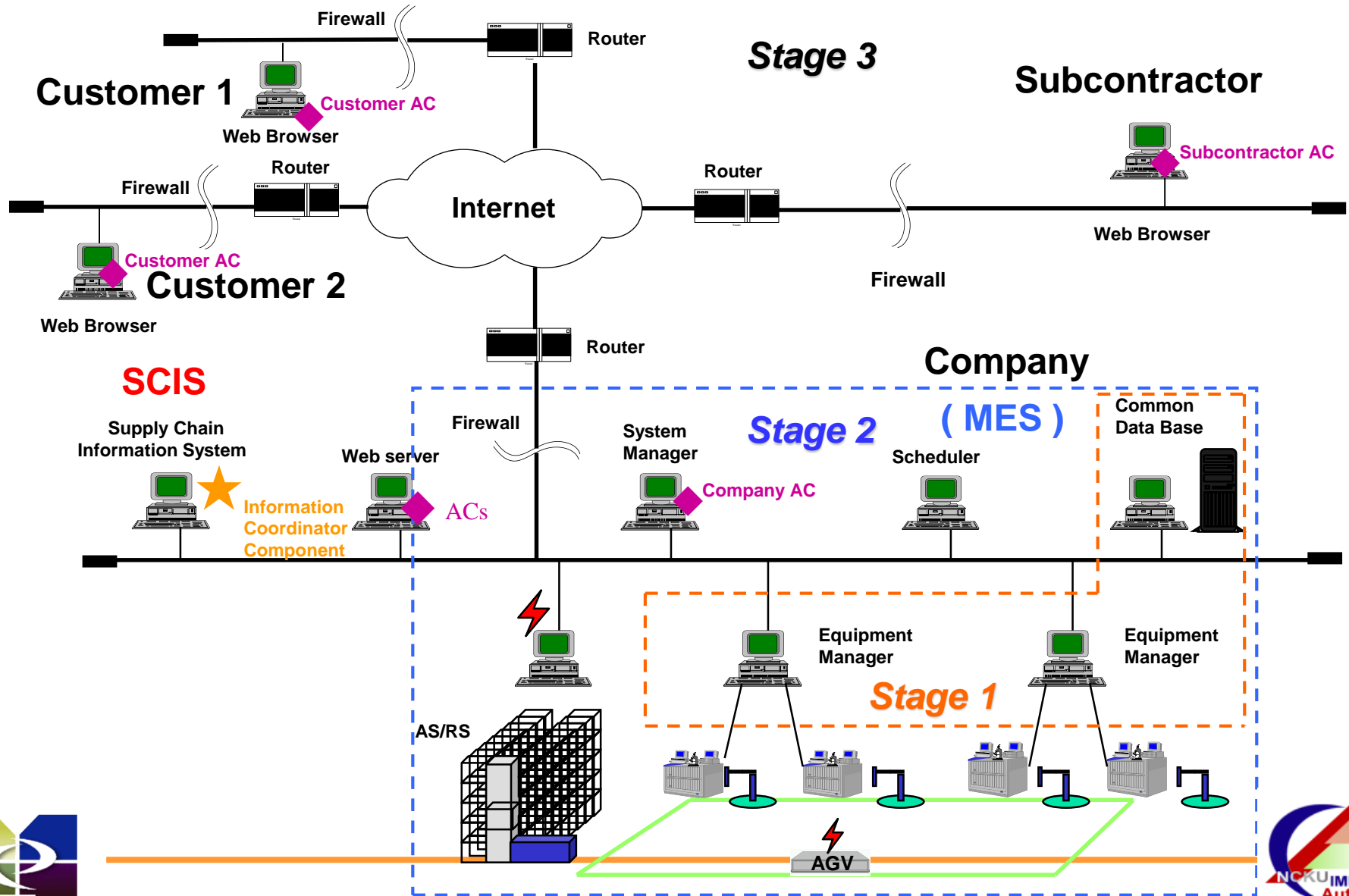
# Four Components of e-Manufacturing



# Manufacturing Portion



# Illustrative Example: Semiconductor Packaging Manufacturing Environment



# Three Stages of Development for Semiconductor Manufacturing Automation

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## Stage I : Generic Equipment Manager

- H.-C. Yang, F.-T. Cheng, and D. Huang, "Development of a Generic Equipment Manager for Semiconductor Manufacturing," in *Proc. 7th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA'99)*, Barcelona, Catalonia, Spain, pp. 727-732, October 1999.

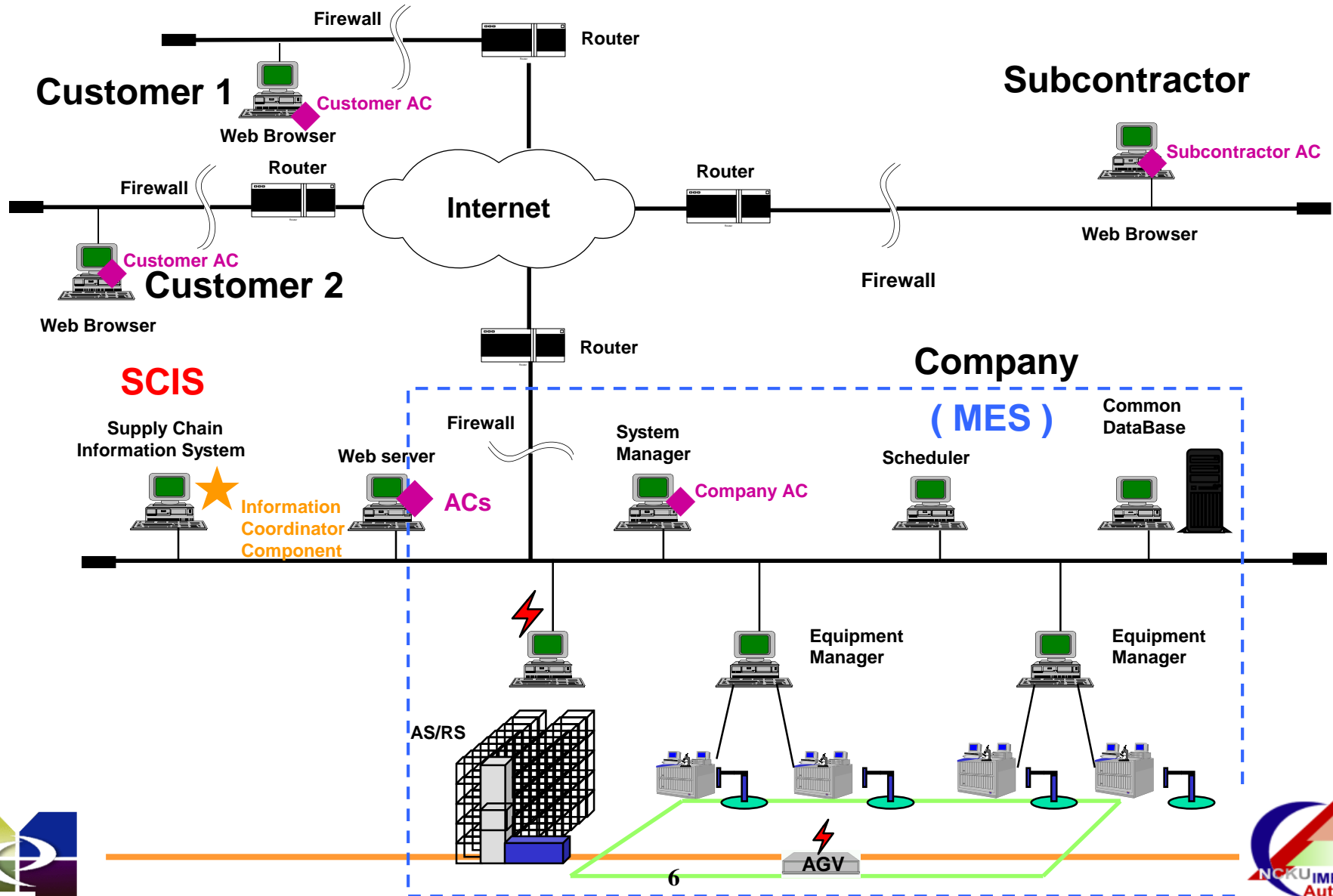
## Stage II : Manufacturing Execution System

- F.-T. Cheng, E. Shen, J.-Y. Deng, and K. Nguyen, "Development of a System Framework for the Computer-Integrated Manufacturing Execution System : a Distributed Object-Oriented Approach," *International Journal of Computer Integrated Manufacturing*, vol. 12, no. 5, pp.384-402, Sept./Oct., 1999.
- F.-T. Cheng, C.-F. Chang, and S.-L. Wu, "Development of Holonic Manufacturing Execution Systems," *Journal of Intelligent Manufacturing*, vol. 15, no. 2, pp. 253-267, April 2004.

## Stage III : Supply Information System

- F.-T. Cheng, H.-C. Yang, and E. Huang, "Development of an Educational Supply Chain Information System Using Object Web Technology," *Journal of the Chinese Institute of Engineers*, vol. 25, no. 6, pp. 735-752, November 2002.
- F.-T. Cheng, H.-C. Yang, and J.-Y. Lin, "Development of Holonic Information Coordination Systems with Failure-Recovery Considerations," *IEEE Transactions on Automation Science and Engineering*, vol. 1, no. 1, pp. 58-72, July 2004.

# Illustrative Example: Semiconductor Packaging Manufacturing Environment



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# **Customer AC (UMC) Places an Order to Company.**



# Customer

## Identification

UserName: eric

Password: \*\*\*\*

CompanyName: UMC

## Order

OrderID:

CompanyName:

TypeID:

Quantity:

DueDate:

## Order Status


## Current Status


## Information Status

```
Please enter username and password
Security check is Ok!
AC is authorized by ISM!
AC bind Order Manager.
AC subscribed the order informati
AC subscribed the packaging statu
AC subscribed the testing status
```

## Command

Initial

Login

Subscribe

Place an Order

Cancel an Order

Query Orders

Deliver Wafers

## Agents

PushConsumerAgent

SecurityAgent

F=0; P=0 T=0

## Order Information

```
OrderID: null
OrderStatus: null
```



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**Customer AC (UMC)  
delivers Wafers to Company.**



# Customer

## Identification

UserName: eric

Password: \*\*\*\*

CompanyName: UMC

## Order

OrderID: CPU1

CompanyName: UMC

TypeID: PIII

Quantity: 30

DueDate: 2000/02/20

## Order Status

Place an order!!

Order Status: OrderConfirmed!!

## Current Status

## Information Status

Please enter username and password  
Security check is Ok!  
AC is authorized by ISM!  
AC bind Order Manager.  
AC subscribed the order informat:  
AC subscribed the packaging statu  
AC subscribed the testing status

Place an order!

Order Status: OrderConfirmed

## Command

Initial

Login

Subscribe

Place an Order

Cancel an Order

Query Orders

Deliver Wafers

## Agents

PushConsumerAgent

SecurityAgent

F=0; P=0 T=0

## Order Information

OrderID: null  
OrderStatus: null

---

**Company starts to run.**

**MES Processing Status  
Shown on Scheduler.**





我的電腦



Outlook  
Express



網路上的芳  
鄰



Internet  
Explorer



資源回收筒



Netscape  
Communicator



My Documents



Orbix Toolbar

Scheduler

Orders waiting to be done

Total Order Accounts

Dispatching Order

Order ID

Quality

DueDay

Company Name

Lot ID

Type ID

Commands

Machine 1 Ready

Machine 2 Ready

Starts in Order1

Starts in Order2

Starts in Order3

Job Done

Order Done

Scheduling Option

☐ By Duesday

☐ By Order

☒ By Weight

☐ By Quantity

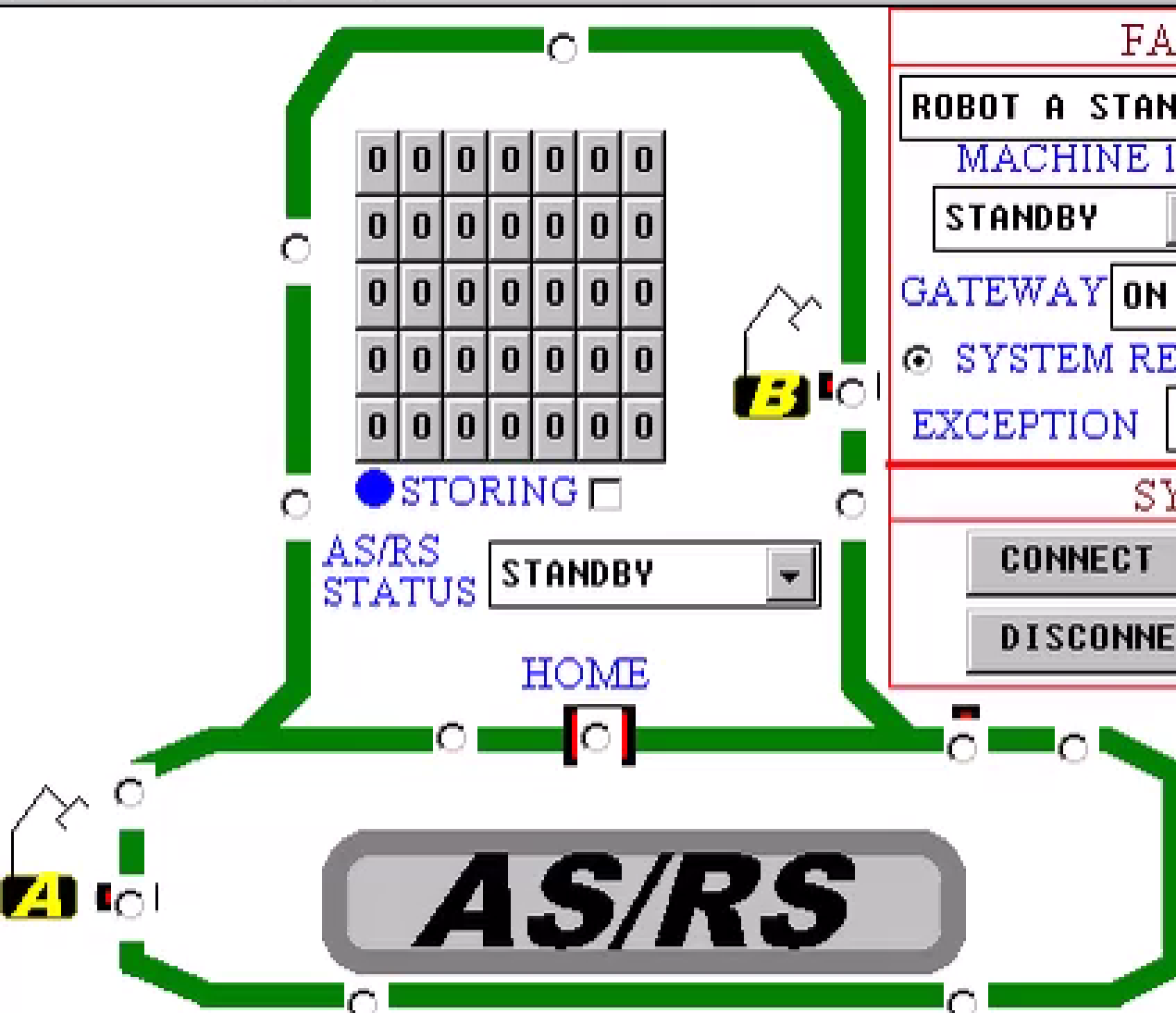
MfgOrderID	CustomerID	OrderID	LotID	Type
------------	------------	---------	-------	------

Connection is OK.... Caps Lock Num Lock PM 03:25 1999/12/12

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# Real Time Shop Flow Control Panel (SFCP).





## FACTORY STATUS

ROBOT A STANDBY

ROBOT B STANDBY

MACHINE 1

MACHINE 2

STANDBY

STANDBY

GATEWAY ON

AGV STANDBY

SYSTEM READY

EXCEPTION NO

## SYSTEM CONTROL

CONNECT

DOWNLOAD

CONFIRM

DISCONNECT

MAIN MENU

## AGV MANUAL OPERATION

HOME

STOP

RESTART

START

MISSION

1

2

3



---

**Display the WIP and Machine  
Status of Company and  
Subcontractor in real time.**





# Customer

## Identification

UserName: eric

Password: \*\*\*\*

CompanyName: UMC

## Order

OrderID: CPU1

CompanyName: UMC

TypeID: PIII

Quantity: 30

DueDate: 2000/02/20

## Order Status

Deliver successful!!!

Total Orders: 1

Order Status: Processing

## Current Status

## Information Status

Please enter username and password  
Security check is Ok!  
AC is authorized by ISM!  
AC bind Order Manager.  
AC subscribed the order information  
AC subscribed the packaging status  
AC subscribed the testing status

Place an order!

Order Status: OrderConfirmed  
Deliver wafers!

Deliver wafers was successful!

## Command

Initial

Login

Subscribe

Place an Order

Cancel an Order

Query Orders

Deliver Wafers

## Agents

PushConsumerAgent

SecurityAgent

F=0; P=0 T=0

## Order Information

OrderID: null  
OrderStatus: null

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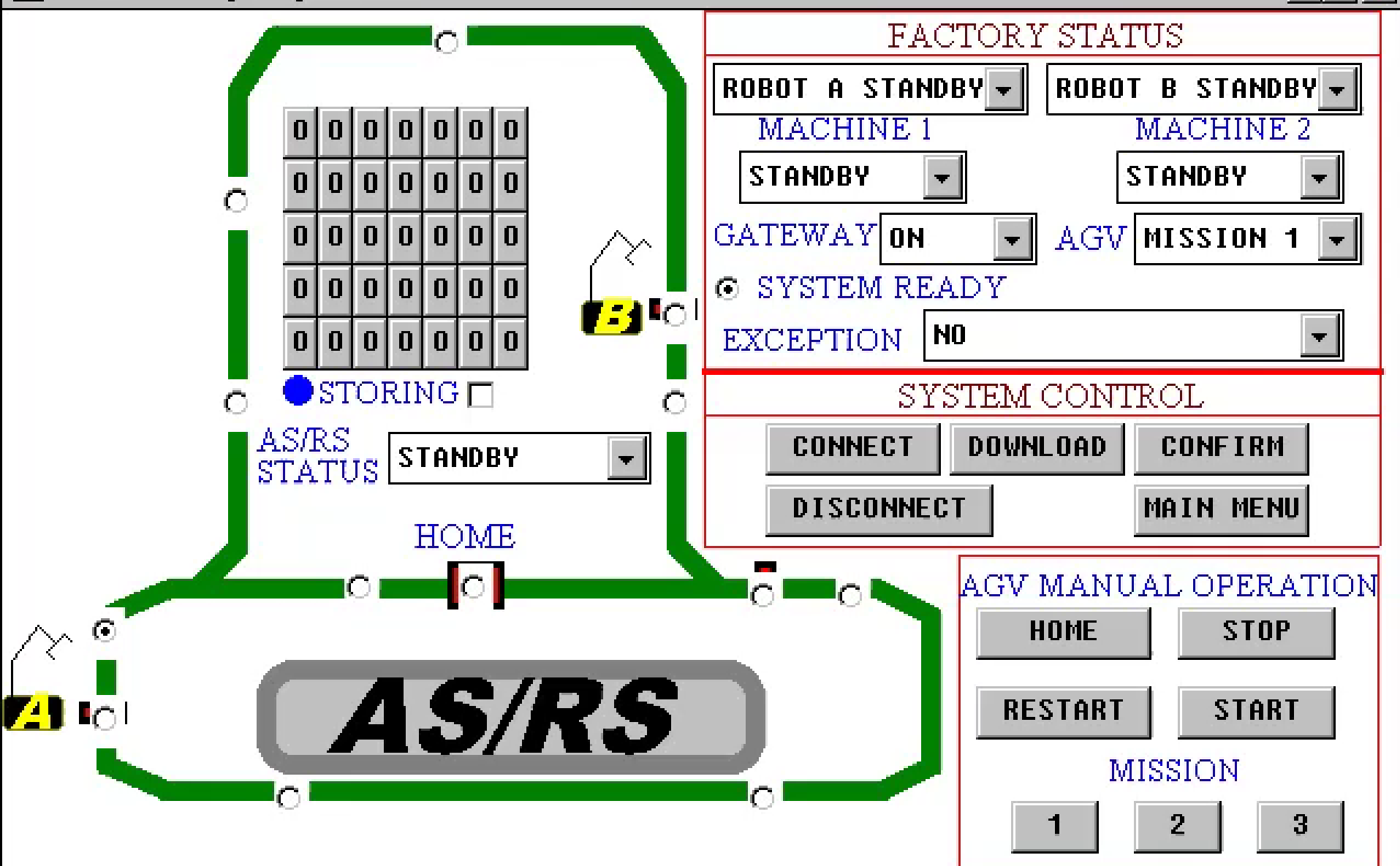
# **AGV Arrives, and AS/RS Retrieves a Lot to AGV**





- 
- **AGV Arrives and Mission 1 is Assigned**
  - **Robot Moves Material to Machine 1**
  - **Machine 1 Starts Processing**







# Customer

## Information Status

Station1Q: 0  
Order Status: Processing  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 0  
Station2Q: 0  
Order Status: Processing  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 0  
Station2Q: 0  
Order Status: Processing  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 0  
Station2Q: 0  
Order Status: Processing  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 0  
Station2Q: 0  
Order Status: Processing  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20

Untitled - EC

File Edit View Management Help

0

Equipment Driver

Initialization

Start HSMS

Stop HSMS

0

Send

Receive

4

Send

Receive

status: 8 ports are well initialized.

Behavior

BIL 15 Step 0 Key ECVAD

Ready

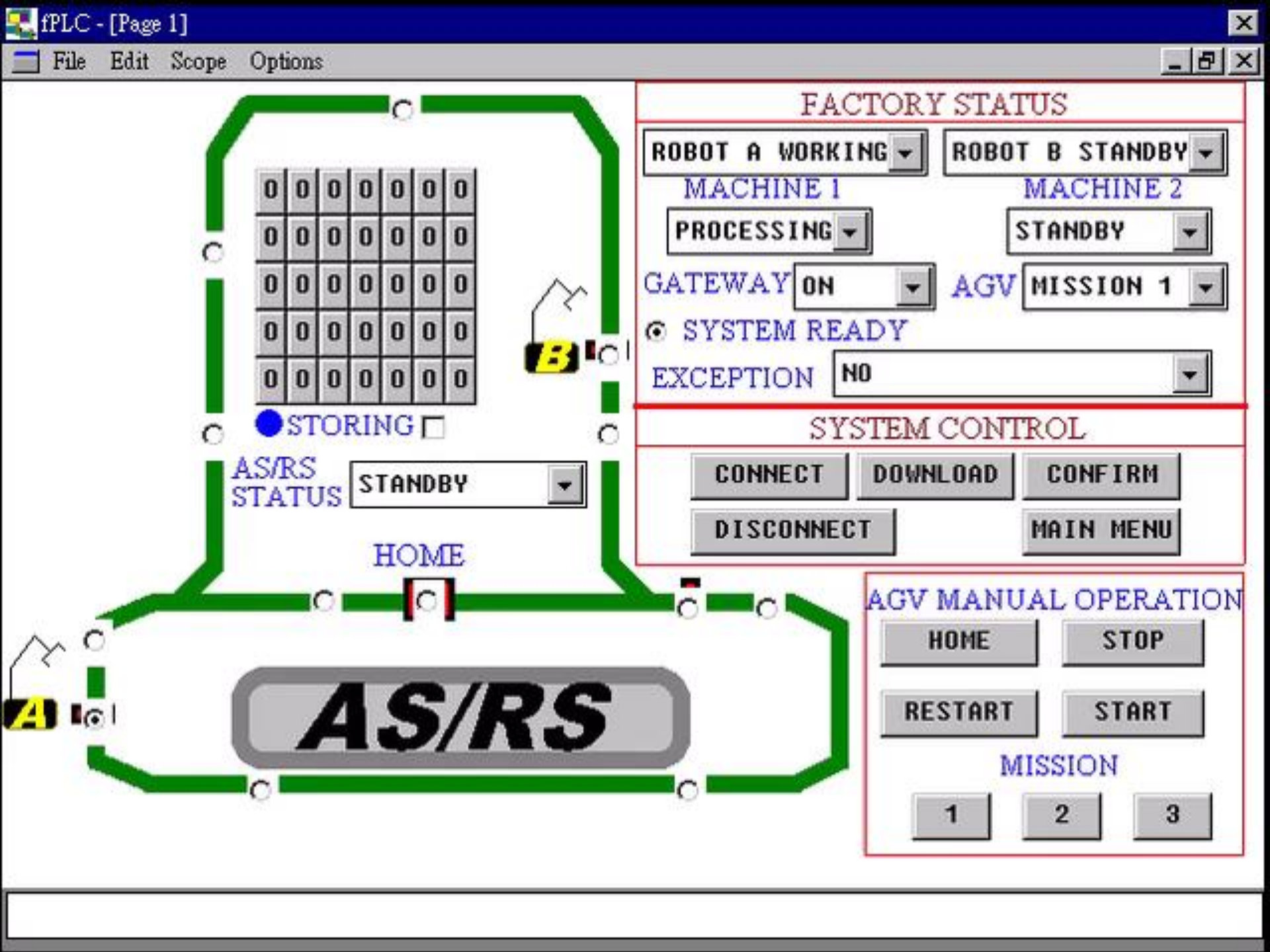
SECSIM Pro - [Runtime Display]

File Edit Search Project Action Options W

23:07:45 Waiting for a new message:

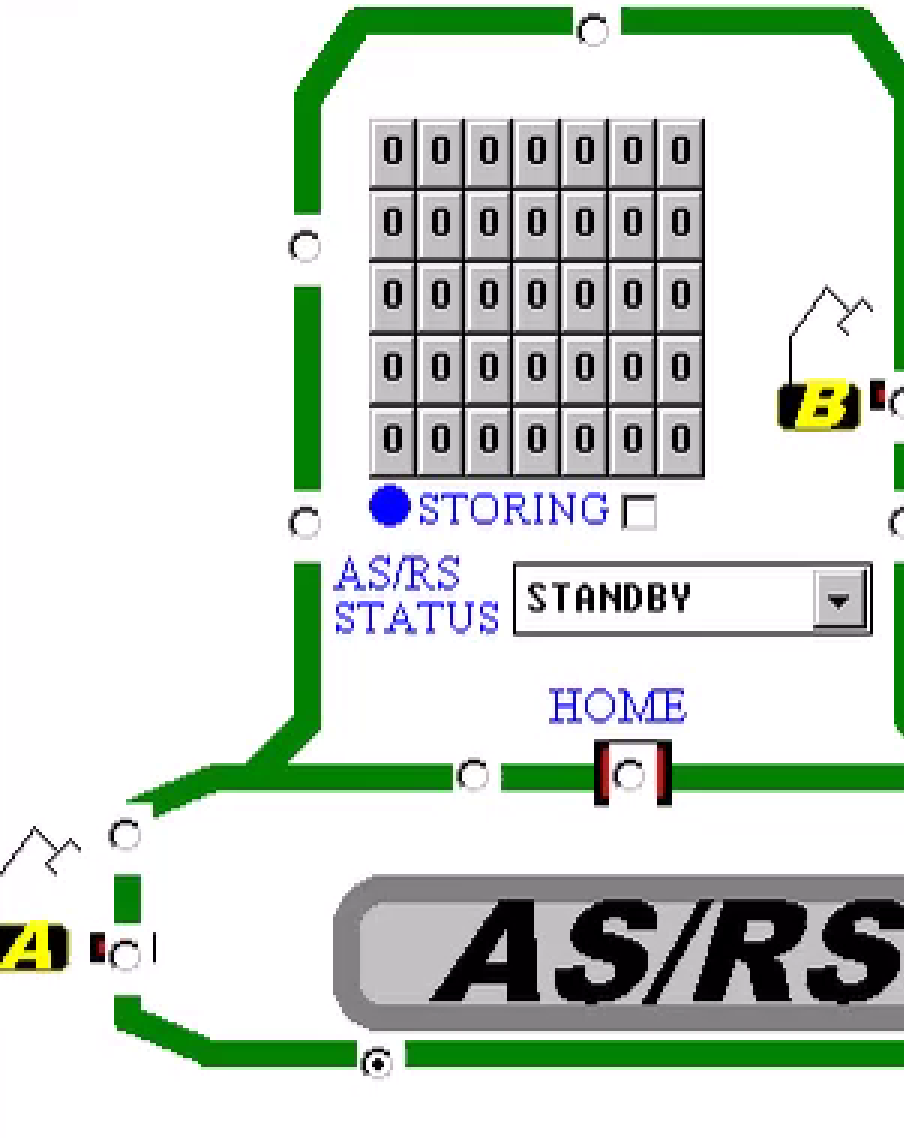
0-0 UnPaused HSM











0 0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0

0 0 0 0 0 0 0

● STORING ☐

AS/RS STATUS

HOME

**AS/RS**

### FACTORY STATUS

ROBOT A STANDBY   
MACHINE 1  
STANDBY

ROBOT B STANDBY   
MACHINE 2  
STANDBY

GATEWAY  AGV

☒ SYSTEM READY

EXCEPTION

### SYSTEM CONTROL

### AGV MANUAL OPERATION

MISSION



- 
- **Company Delivers  
Customer's ICs to Subcontractor**
  - **Subcontractor Starts Processing**



# Customer

Location:

Name: eric

Word: \*\*\*\*

Company Name: UMC

Order ID: CPU1

Company Name: UMC

Order ID: PIII

Quantity: 30

Date: 2000/02/20

Order Status

Order is processing !!

Total Orders: 1

Order Company Name: UMC

Order Status: MachinelDone

Order Status

Customer ID: UMC

Start Time: 1999/11/01

Date: 2000/02/20

Quantity: 30

Information Status

OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 30  
Station2Q: 0  
Order Status: MachinelDone  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 30  
Station2Q: 0  
Order Status: MachinelDone  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 30  
Station2Q: 0  
Order Status: MachinelDone  
OrderID: CPU1  
CustomerID: eric  
StartTime: 1999/11/01  
Due Date: 2000/02/20  
Station1Q: 30  
Station2Q: 0  
Order Status: MachinelDone  
OrderID: CPU1  
CustomerID: UMC  
Station1Q: 30  
Station2Q: 0  
CustomerID: UMC  
Station1Q: 30  
Station2Q: 0  
CustomerID: UMC  
Station1Q: 30  
Station2Q: 0  
CustomerID: UMC  
Station1Q: 30  
Station2Q: 0

Subcontractor Page - Netscape

File Edit View Go Communicator Help



Back



Forward



Reload



Home



Search



Netscape



Bookmarks



Location: http://140.116.86.160:15



Instant Message



WebMail



Contact



People

SCIS.SubcontractorApplet1 will appear below in

## Subcontract

Subcontractor-Order

OrderID CPU1

CustomerID UMC

Due Day 2000/02/20

Quantity 30

TestStatus

Testing Factory is Ready!

Information

CustomerID: UMC

Station1Q: 30

Station2Q: 0

CustomerID: UMC

Station1Q: 30

Station2Q: 0

CustomerID: UMC

Station1Q: 30

Station2Q: 0