

# ITRS Factory Integration Report-Out

11 April 2000

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# ITRS FI Deliverables for 2000 (1)

## 1. Define 2000 scope and deliver changes per IRC schedule

- ☞ **Status:** Agreement on scope. Tables reviewed with a few value and color changes expected. Additions identified with owners that will resolve

## 2. Publish data models to support and provide more details for the roadmap's requirements and potential solutions

- ☞ **Status:** Investigating addition of SEMATECH or SRC modeling for ITRS

## 3. Hold Cross TWG engagements to improve Factory Integration link to other key ITRS areas for 2000 and 2001

- ☞ **Excellent discussions today. We need more interaction to ensure production equipment [Litho, FEP, Interconnect, Metrology, Assembly, Test] includes process capabilities and other non-shrink productivity improvements [factory centric] from the beginning of use.**
- ☞ **EHS: Standards, Emissions, and Energy Consumption**
- ☞ **Metrology & Defect Reduction: Data Analysis, Process Control, NPW Reduction**
- ☞ **Assembly & Test:: MHS, Reliable Integrated Equipment, Traceability**
- ☞ **Need to engage with Litho (reticles, tools) and FEP/Interconnect (tools)**

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# ITRS FI Deliverables for 2000 (2)

4. Get agreement on 2001 scope and set ground work to start discussion in Q3 2000. Add domestic member expertise to match the new scope

- ☞ Status: Initial scope proposed for 2001 ITRS and member recruiting started. Need follow-up by members for San Francisco

5. Implement a process to drive the roadmap from requirements to implementation

- ☞ Status: Targeting processes that match Litho's success in identifying roadmap requirements and then getting products implemented. Excellent progress in AMHS (300mm Equipment and Single Transport System). More work needed in software systems area.

6. Establish a 100% reliable ITRS/Factory Integration Web Site

- ☞ Agreement by SEMATECH [Thanks Linda Wilson!!] to help

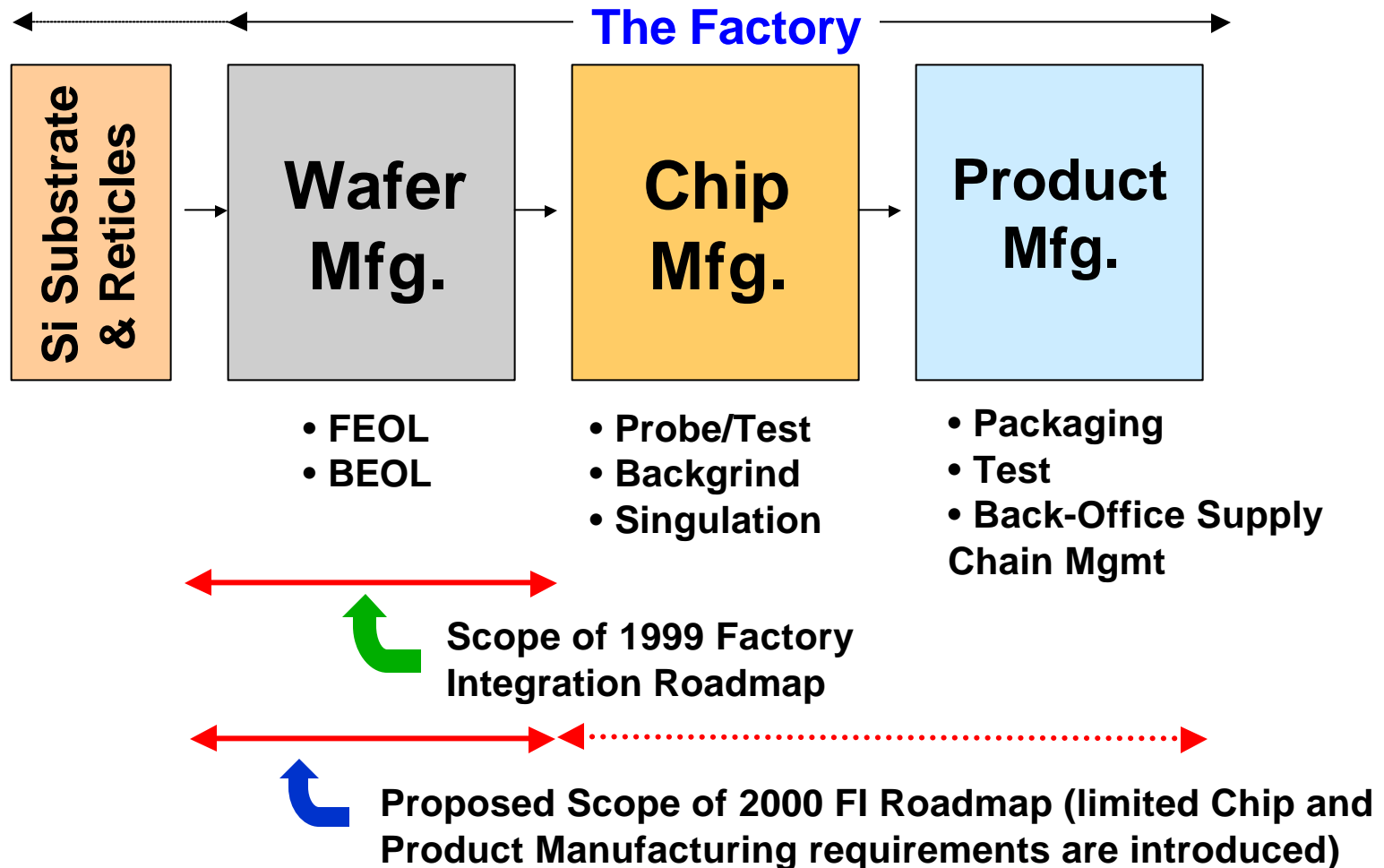
7. Get consistent engagement and contributions from members representing all of the 5 regions

- ☞ Status: Japan and US fully engaged with good participation from Europe. Need Help from IRC to get consistent engagement from Korea & Taiwan

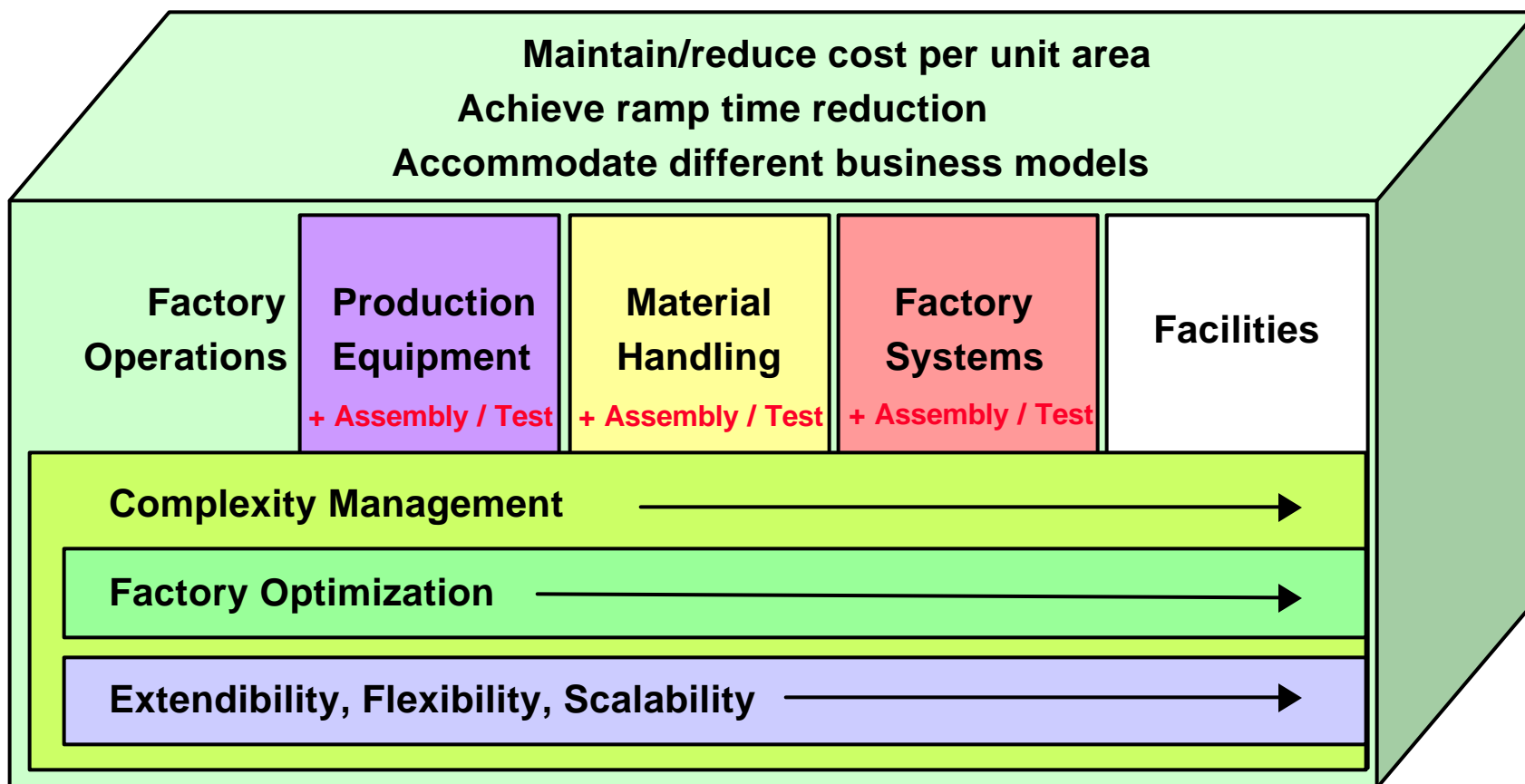
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# Agreed to include Assembly Packaging and Test for the 2000 (+ 2001) ITRS Update



# No Fundamental Changes for 2000 to FI Difficult Challenges & Technology Thrusts



# Focus Discussion Areas

## 1. Equipment Productivity needs significant improvement (Production, MHS, Facilities)

☞ **Problem:** Equipment does not meet productivity requirements per 1999 ITRS

## 2. Material Handling Direct Transportation requirements are making significant progress for 300mm

☞ **Status:** Progress is being made in hardware. Need software support

## 3. Manufacturing and facility systems need extendibility, flexibility and scalability improvements

☞ **Problem:** Manufacturing system flexibility and extendibility is poor

## 4. Need to add Priority (2-3) Assembly/Packaging and Test requirements and Potential Solutions:

☞ **Key Note:** Assembly and Test factories represent a significant cost, cycle time, and segment for semiconductor manufacturing that is not currently covered by FI TWG

☞ **Problem:** Factory and equipment productivity can be significantly improved by using technologies that are being used in the fab



# Improve Equipment Productivity

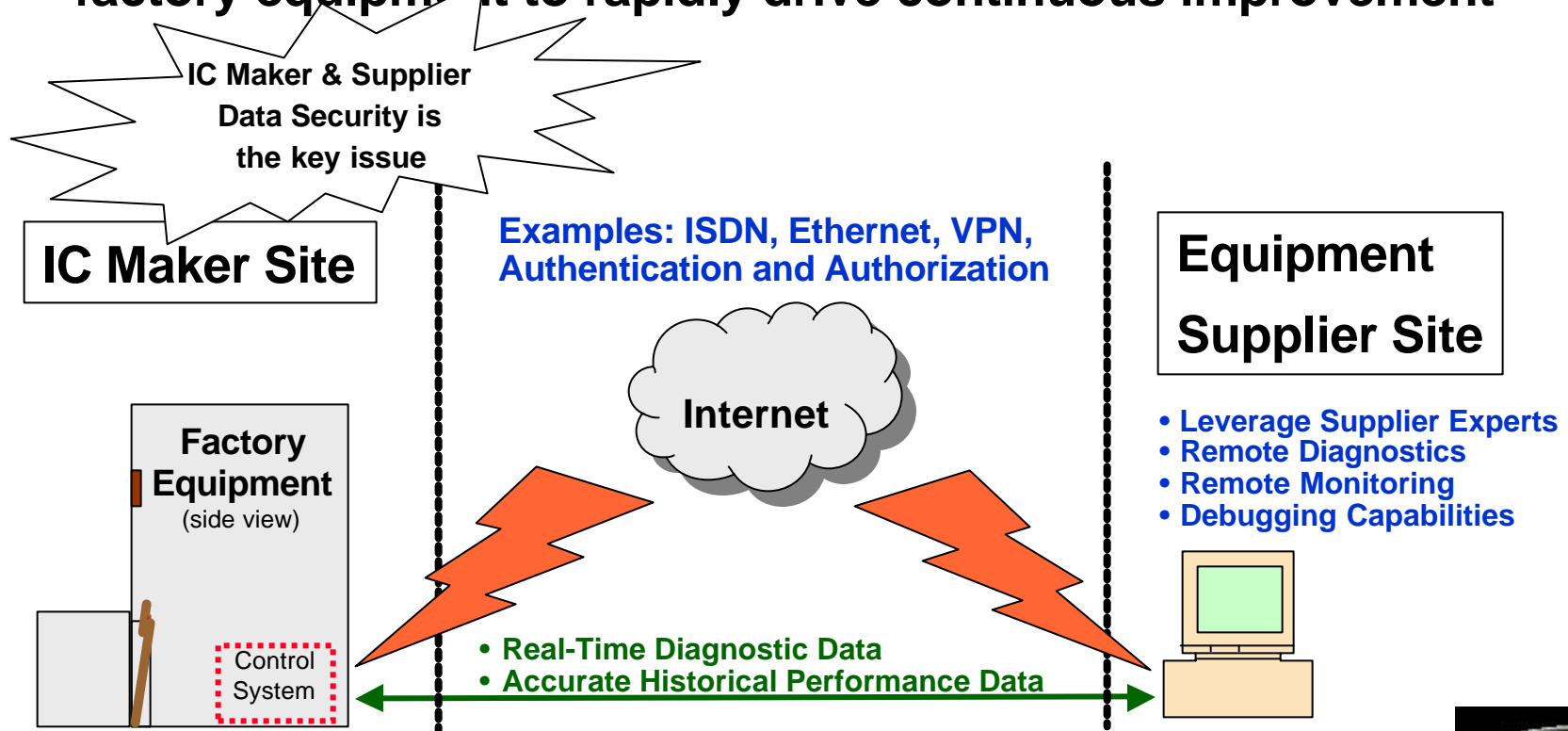
Year Technology Node Wafer Diameter	1999 180 nm 200 mm	2002 130 nm 300 mm	2005 100 nm 300 mm	2008 70 nm 300 mm	2011 50 nm 300 mm	2014 35 nm 450 mm
Bottleneck production equipment OEE [3] (SEMI E79)	75%	87%	89%	91%	92%	92%
Average production equipment OEE [3] (SEMI E79)	55%	65%	71%	78%	80%	82%
% Capital equipment reused from one process node to next	> 70%	> 0%	> 80%	> 80%	> 80%	>20%
Production equipment lead time (months from order to full throughput capability) [5]	< 9 months	< 8 months	< 7 months	< 6 months	< 5 months	<5 months
Process equipment availability [6] (SEMI E10)	> 85%	> 90%	> 93%	> 95%	> 95%	> 95%
Metrology equipment availability [6] (SEMI E10)	> 90%	>95%	>95%	>98%	>98%	>98%
% of equipment to factory systems interface standards defined [2]	75% 300 mm	100% 300 mm	100% 300 mm	100% 300 mm	80% 450 mm	100% 450 mm
% conformance: equipment to factory systems interface standards [2]	100% 200 mm	100% 300 mm	100% 300 mm	100% 300 mm	100% 300 mm	100% 450 mm

- ★ Equipment productivity (availability and overall effectiveness) are not meeting roadmap targets. Need to update tables with actuals + gaps and drive improvements through potential solutions
- ★ 200mm > 300mm bridge equipment are being introduced at 130nm node driven by more productive (run rate, etc.) 300mm equipment
- ★ 300mm software interface standards are defined, but industry implementation is not meeting expectations



# Equipment Productivity Is not Meeting ITRS Expectations: Solutions Needed!

1. Remote monitoring & diagnostics allow supplier experts to rapidly fix factory equipment issues from their sites
2. Suppliers need accurate historical performance data from factory equipment to rapidly drive continuous improvement

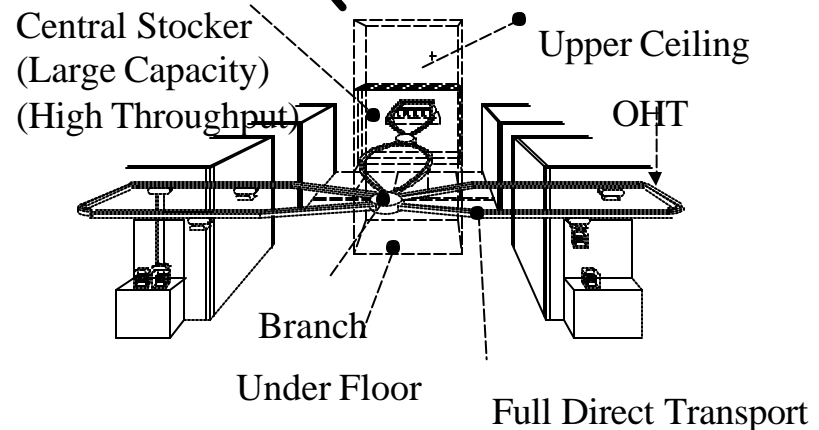
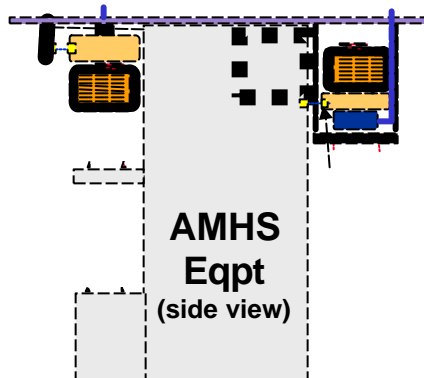


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# Good Progress is being Made towards AMHS Solutions

Year Technology Node Wafer Diameter	1999 180 nm 200 mm	2002 130 nm 300 mm	2005 100 nm 300 mm	2008 70 nm 300 mm	2011 50 nm 300 mm	2014 35 nm 450 mm
Transport system types within a factory	Interbay and intrabay	Interbay and intrabay	Some interbay & intrabay and some direct (one integrated system)	One integrated system	One integrated system	One integrated system
Factory wide carrier delivery time (in minutes)	Ave=10 Maximum=20	Ave=10 Maximum=20	Average=8 Maximum=15	Average=5 Maximum=15	Average=5 Maximum=15	Average=5 Maximum=10



- ★ 300mm AMHS can meet .13um factory requirements based on test line and simulation data

- ★ Excellent progress by AMHS suppliers to develop direct transport solutions
- ★ Need research for Scheduling and control software to support the hardware



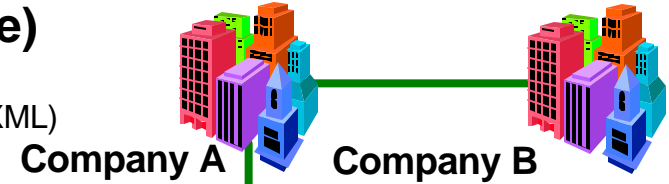
# Continue Use of Standards to Improve Extensibility, Flexibility, and Scalability (EFS)

Outside of ITRS

## Company to Company (E-Commerce)

### Key Standards

- Use of the web is becoming prevalent (RosettaNet -> XML)
- This will be driven outside of Semiconductor industry

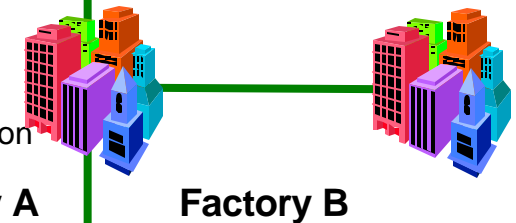


Fragmented Strategy and Standards

## Factory to Factory (E-Factory)

### Factory Communication

- Today: Logistics data using proprietary (SMDX, eFab) communication
- Future: Factory to factory logistics data are communicated via Internet standards (XML)!!

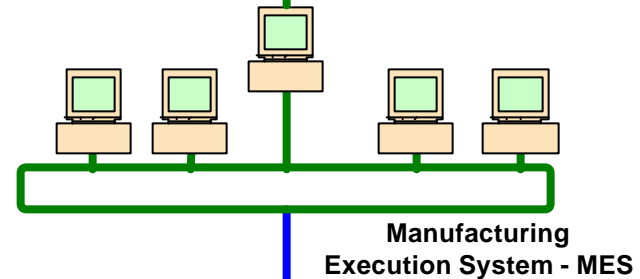


Well Defined Strategy Emerging Standards

## Within a Factory (E-Factory)

### Automation and General Computer Standards

- Today: Few Standards
- Future: SEMI CIM Framework (MES) Standards

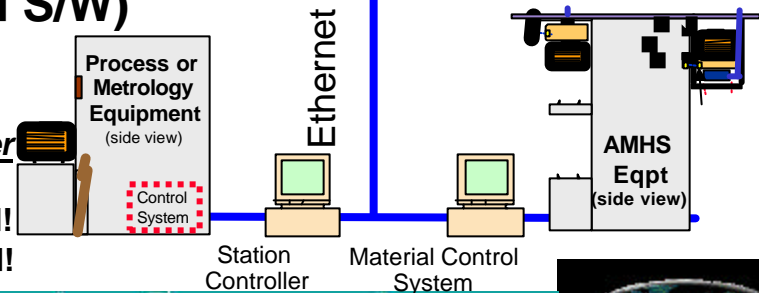


Well Defined Stds & Strategy

## Equipment Standards (H/W and S/W)

### Equipment Communication

- Today's Fab: SECS, GEM
- 300mm Fab: SECS, GEM, HSMS, *CMS, Stocker*, *SEM, IBSEM, etc.*
- Future: Assembly/Test Standards are needed!
- Future: Tool Performance Tracking is needed!



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# Increase Assembly and Test Factory productivity by Effective use of CIM Standards

## Requirement or Need:

Need unit traceability, high equipment availability and utilization, reduced or no misprocessing, lower factory cycle time

## Potential Solutions:

1. Connect 100% of equipment with SECS/GEM/Ethernet to facilitate unit tracing, performance tracking, eliminate misprocessing, and lower cycle time
2. Migrate to Internet standards such as XML (eXtensible Mark-up Language) as the transition in Fab occurs. Drive well defined sync point in the roadmap
3. Leverage mainstream computing technologies at all points in the roadmap

