

Electronic Manufacturing Services' Profitability & Time-to-Market Significantly Improves Using ProLINE-RoadRunner



CASE STUDY:

EMS INTERNATIONAL MOVES FROM PROGRAM-AT-TEST TO PROGRAM-AT-PLACEMENT

EMS International

Company:	Electronic Manufacturing Services
Business:	Contract Manufacturing
Locations	85
Employees	60,000
Annual Revenues	\$6 billion
Diversification Vehicle	Acquisitions

XP Wireless

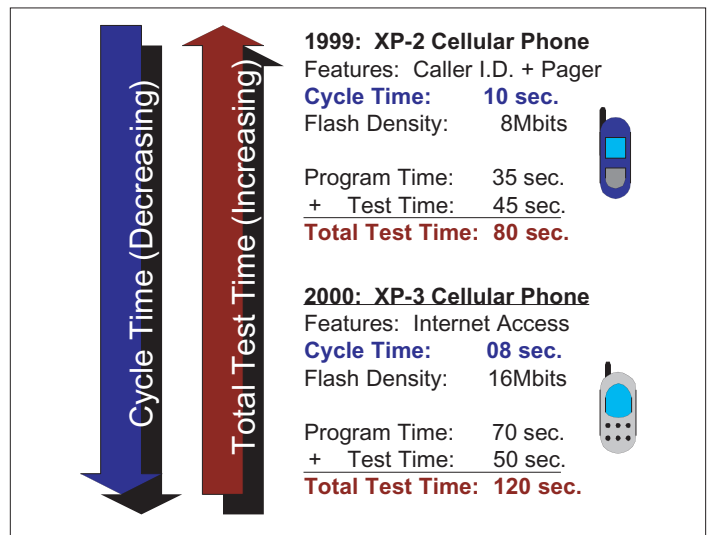
XP Wireless is one of the fastest growing cellular phone manufacturers in the world with just over 8% worldwide market share. Since 1998 XP Wireless has contracted out their manufacturing to EMS International, a global contract manufacturing service provider. This allows XP Wireless to focus on their core competency, the design of innovative wireless products.

History of Flash Programming at EMS Shanghai					
Regional Focus: Cellular phones & hand held organizers					
Customer: XP Wireless					
# of Lines: 5					
Uptime: 6 days/wk (22hrs/day)					
Year	Flash Density	Program Time	Test Time	Cycle Time	Racks Test Bays
1998 XP-1	4Mbit	20 sec	40 sec	15 sec	10 Racks 20 Test Bays
1999 XP-2	8Mbit	35 sec	45 sec	10 sec	20 Racks 40 Test Bays
2000 XP-3	16Mbit	70 sec	50 sec	08 sec	40 Racks 75 Test Bays
2001 XP-4	32Mbit	140 sec	60 sec	06 sec	85 Racks 170 Test Bays
2002 XP-5	64/128 Mbit	TBD	TBD	TBD	TBD

The Problem (Year 2000)

I am a production manager at EMS International in Shanghai, China. I have profit and loss responsibility for five production lines. I just received a big order from XP Wireless to produce 1.1 million XP-3 cellular phones per month over the next six months. The XP-3 features Internet access and uses a 16Mbit Flash Memory device. Our five production lines were optimized to produce 800,000 XP-2 cellular phones per month. I reconfigured the line management software to support the new component placement sequence for the XP-3. However, to increase monthly production by 300,000 phones, cycle times will have to be reduced from 10 to 8 seconds. To do so, I will have to purchase 20 additional Racks adding four per line for a total of 35 Test Bays. Corporate Management is telling me to reduce costs and work within my current floor space allocations.

PRODUCTION TRENDS AT EMS



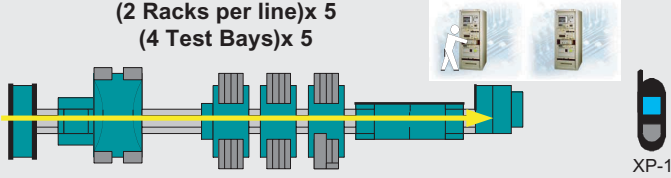
PRODUCTION TRENDS AT EMS INTERNATIONAL

Production Line Layouts at EMS (x 5 Lines) (Higher Flash Densities Impact Functional Test)

1998

(2 Racks per line)x 5
(4 Test Bays)x 5

4Mbit

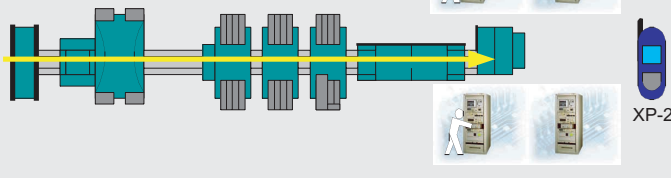


XP-1

1999

(4 Racks per line)x 5
(8 Test Bays)x 5

8Mbit



XP-2

2000

(8 Racks per line)x 5
(15 Test Bays)x 5

16Mbit

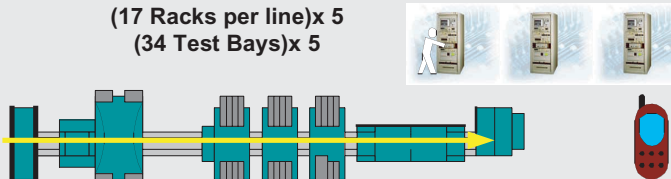


XP-3

2001

(17 Racks per line)x 5
(34 Test Bays)x 5

32Mbit

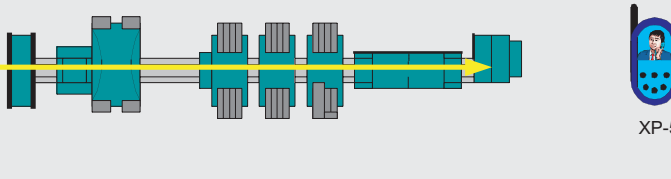


XP-4

2002

(Lots of Racks per line)x 5
(x 2 Test Bays per Rack)x 5

64/128
Mbit



XP-5

Producing the XP-3 Cellular Phone (Year 2000)

In 1999 we had four Racks per line, totaling 20 for all five lines. Each Rack included two Test Bays. To meet our new production demands in 2000 will require adding four more Racks per line, totaling 40 for all five lines. My production lines are growing larger with each new generation of phone.

ADVANCES IN CELLULAR TECHNOLOGY BRING MANUFACTURING CHALLENGES TO EMS

XP Wireless Cellular Phone Enhancements

- 1998 Basic Cellular Phone
- 1999 Add Caller I.D. + Pager Support
- 2000 Add Internet Access
- 2001 Add PDA features
- 2002 Add Live Video Broadcast

More features require higher density Flash

- 1998 4Mbit
- 1999 8Mbit
- 2000 16Mbit
- 2001 32Mbit
- 2002 64/128Mbit

Higher density = longer programming times

- 1998 20 seconds
- 1999 35 seconds
- 2000 70 seconds
- 2001 140 seconds
- 2002 TBD

More features result in longer test times

- 1998 40 seconds
- 1999 45 seconds
- 2000 50 seconds
- 2001 60 seconds
- 2002 TBD

Production cycle times decreasing

- 1998 16 seconds
- 1999 10 seconds
- 2000 08 seconds
- 2001 06 seconds
- 2002 TBD

Total Number of Racks increasing (5 lines)

- 1998 10 Racks (20 Test Bays)
- 1999 20 Racks (40 Test Bays)
- 2000 40 Racks (75 Test Bays)
- 2001 85 Racks (170 Test Bays)
- 2002 TBD

LINE BALANCING USING PROLINE-ROADRUNNER

Lean Manufacturing Improvements at EMS Using ProLINE-RoadRunner

I was introduced to the ProLINE-RoadRunner at the recent Apex Trade Show. I met with a Data I/O sales representative who constructed an economic model to help me understand the benefits of using ProLINE-RoadRunner, tailored to my production environment. After reviewing all the economic benefits I canceled my order for 20 Racks (35 Test Bays) and purchased six ProLINE-RoadRunners. We installed one RoadRunner on each of our five production lines using the sixth RoadRunner as a backup unit.

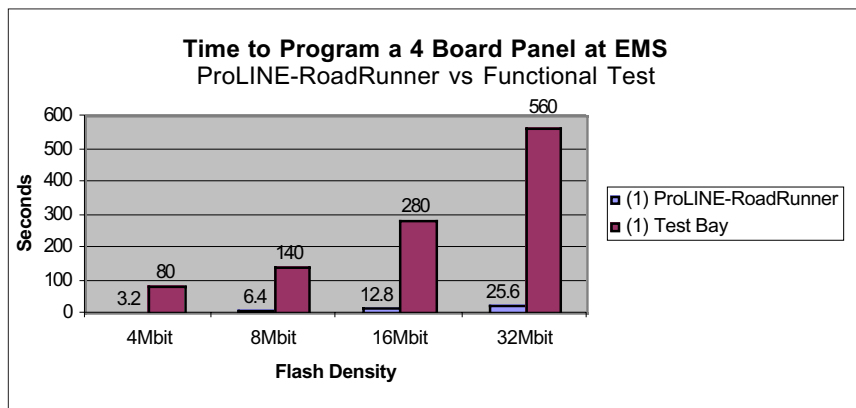
ProLINE-RoadRunner simplified our value flow to support Lean Manufacturing by using the least amount of resources (time, people, equipment, and floor space).

Doubling Programming Capacity at EMS

What really excites me about ProLINE-RoadRunner is that I can instantly double my programming capacity by simply adding a second RoadRunner alongside the first without consuming any additional floor space. This is especially appealing with the speed at which XP-Wireless is developing more sophisticated cellular phones.

ProLINE-RoadRunner Supports Fast Cycle Times Adding a Second ProLINE-RoadRunner (Doubles Programming Capacity)				
Flash Density	Program/Verify Times	Throughput 1 RoadRunner	Cycle Times 1 RoadRunner	Cycle Times 2 RoadRunners
4Mbit	4 devices/3.2sec	679pph	5.3 sec.	2.7sec.
8Mbit	4 devices/6.4sec.	590pph	6.1sec.	3.1sec.
16Mbit	4 devices/12.8sec.	467pph	7.7 sec.	3.9sec.
32Mbit	4 devices/25.6sec.	330pph	10.9 sec.	5.5sec.

HIGH-SPEED FLASH MEMORY PROGRAMMING USING PROLINE-ROADRUNNER



**2000
16Mbit**

High Quality Testing at EMS using Functional Test

(EMS) Eliminates Waste Using ProLINE-RoadRunner

One RoadRunner replaces

- 4 Racks per line
- 8 Test Bays per line

Five RoadRunners replace

- 20 Racks (5 lines)
- 40 Test Bays (5 lines)

COMPLIMENTING FUNCTIONAL TEST USING PROLINE-ROADRUNNER

RoadRunners are programming 99% of the Flash Memory data on the placement machine.

- feature and function sets

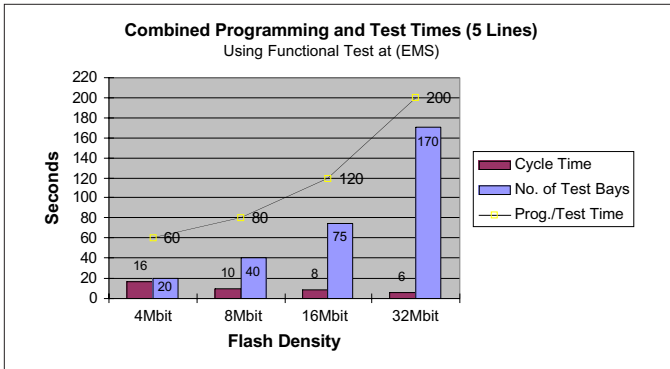
Functional Test Racks are programming just 1% of the Flash Memory data at the end of the production line, providing flexibility for phone configurations just prior to shipment.

- Serialization
- Custom I.D.

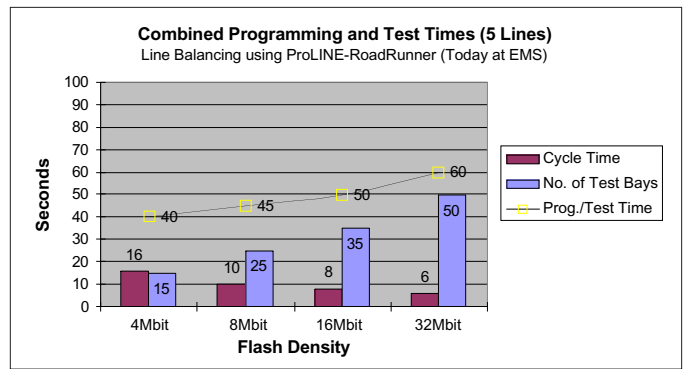


- Reduce programmer/test time
- Optimize test (Expand Coverage)
- Reduce number of testers
- Optimize floor space utilization
- Balance the production line
- Only verified parts get placed
- Reduce board scrap costs
- High throughput at lower cost
- Fast code changes using TaskLink™
- Increase manufacturing profits

PROCESS CONTROL PROBLEMS AT EMS FLASH PROGRAMMING AT FUNCTIONAL TEST



PROCESS CONTROL STABILIZES AT EMS USING PROLINE-ROADRUNNER

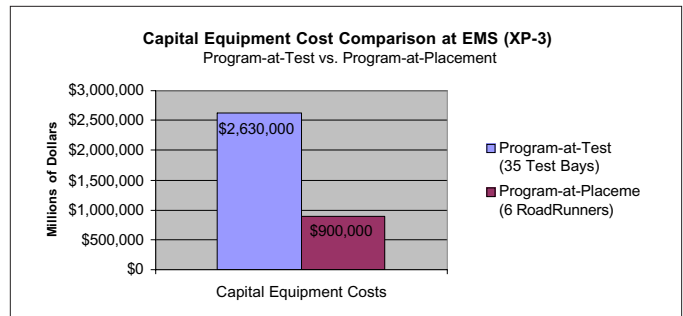


PRODUCTION DILEMMA AT EMS FLASH PROGRAMMING AT FUNCTIONAL TEST

The only thing **Decreasing** in Production at EMS are **Production Cycle Times**

Production Cycle Times	Decreasing
Number of Test Racks	Increasing
Flash Programming Times	Increasing
Functional Test Times	Increasing
Operator Overhead Costs	Increasing
Floor Space Requirements	Increasing
Risk of Production Bottlenecks	Increasing
Manufacturing Costs	Increasing

CAPITAL EQUIPMENT COST COMPARISON AT EMS (TO PRODUCE 1.1 MILLION XP-3 PHONES PER MONTH)



Manufacturing Costs Skyrocket at EMS

Prior to learning about the ProLINE-RoadRunner, my only two options were to buy 20 Racks with 35 Test Bays and expand the production area, or outsource to a programming center. I've been through the forecasting headaches associated with outsourcing and preferred not to move away from just-in-time programming. Either way it was going to significantly increase our manufacturing costs.

Test Fault Coverage and Quality Significantly Improves Using ProLINE-RoadRunner

It was extremely challenging to keep our test quality levels high as longer programming times consumed valuable test time. Using ProLINE-RoadRunner is allowing our functional testers to do what they do best, test products. Test engineers at EMS are now focusing on improving the test quality rather than sacrificing it to keep up with production demands.

Complimenting Functional Test with ProLINE-RoadRunner at EMS

In the past when we thought of Line Balancing, it referred only to the board assembly area, e.g. (balancing the component placement sequence between machines to provide the highest daily throughput). Our Assembly and Test Managers lived in two different worlds, each focusing only on their areas of expertise.

ProLINE-RoadRunner brings a new approach to line balancing. It brought our Test and Assembly Managers together to look at solutions that **increase manufacturing profits by working together**. Implementing the use of ProLINE-RoadRunner from Data I/O has significantly reduced our manufacturing costs and given us a huge advantage over our competitors.