

EMS Industry Complexities: The Need for a Comprehensive ERP System With Extensive Tools

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Overview

- Firstronic: An Evolving Company
- An Overview of Typical Electronics Manufacturing Services (EMS) Challenges
- Key Plex Benefits for a High Complexity Operational Model
- Plex and Lean Manufacturing
- The Results: Two Years After Implementation
- Lessons Learned in Implementation
- Looking Ahead

Firstronic Global Footprint



Manufacturing & Engineering Facilities



Procurement Center



RMA, Refurbish & Repair Center



Design & Engineering Center

- Grand Rapids, MI
- Czech Republic (JV)
- Juarez, Mexico (launching new plant)
- Shanghai, China (JV)
- Goa, India (JV)

- International Purchasing Office (IPO) in Hong Kong through Maxway JV

- JV with FSEG in Pennsylvania

- JV with Dorner Works Grand Rapids and Novi Michigan

Firstronic

An Evolving Company

Two Years Ago

- Grand Rapids factory
- 45 employees
- An average of 1.5 product launches (with PPAP) per month
- BOM line items managed: Thousands
- Systems strategy: Low-end MRP system combined with home-grown modifications
 - MIS highly spreadsheet driven

Today

- Grand Rapids factory, strategic alliances in the Czech Republic and China to support regional manufacturing requirements. Mexico factory planned to open later this year.
- 190 employees
- BOM line items managed: Hundreds
- An average of 3 product launches (with PPAP) per month
- Systems strategy: 24/7 paperless visibility with Plex

The Mid-Tier EMS Challenge

An Atmosphere of Controlled Chaos

Typical OEM Production Environment

- Product lines developed around a specific capabilities model
- High levels of component commonality
- Predictable forecasts (may even be level loading demand by outsourcing variable demand)
- One set of quality standards
- Good long-term visibility into new products and capabilities requirement changes

Typical EMS Production Environment

- 20-30 customers with unique approved vendor lists (AVLs)
- Mission critical product from a range of industries requiring compliance with multiple standards such as ISO 9001, ISO/TS16949, ISO 13485 and AS9100
- High mix, variable demand batch production
- Capabilities requirements driven by customer requirements

Firstronic Electronic Manufacturing Services



The Growth Challenge

Complexity Grows Before Revenue

- EMS is a low margin industry where overhead cost must be minimized through efficient practices
- Mission critical products such as automotive and medical can have long ramp-up periods
 - Volume production can come a year after a series of product qualification runs
- Project launches are more difficult to manage than volume production because of the number of variables that must be watched
- Systems strategy needs to 'force multiply' program management and supply chain management resources

Plex Operational Benefits

Working Smarter, Not Harder

Operational Support

- Comprehensive enough to support migration to a paperless environment
- Flexible
- Accessible remotely
- “Best practice” user group network

Customer Requirements

- Supports traceability and quality data collection requirements for medical & automotive customers
- Accessible remotely
- EDI/Portal Support

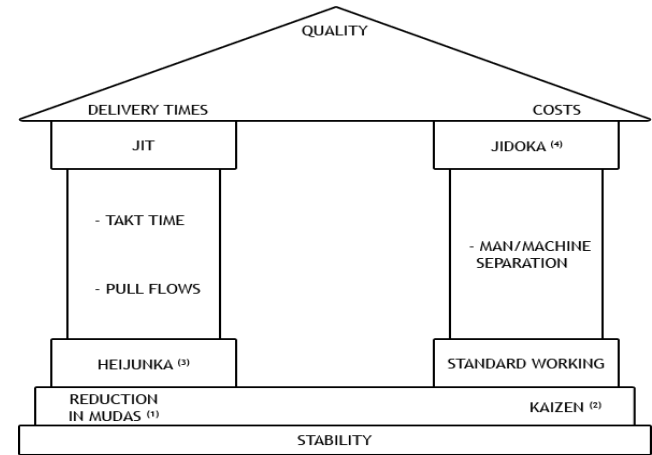
Scalable

- Allows modules to be added as business grows
- Ability to support multiple sites

Firstronic's Operational Improvement Strategy

Implementation of Lean Manufacturing

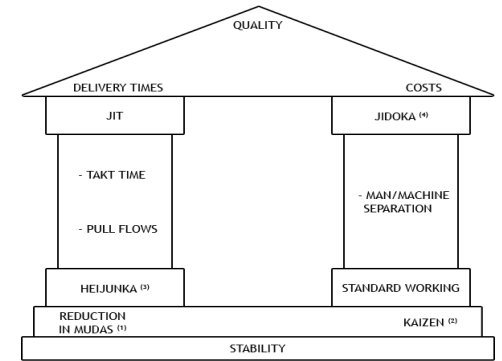
- Holistic approach to Lean manufacturing
 - Synchronous Flow Manufacturing
 - Supply Chain Management focus
 - Optimized lot sizes
 - Defined buffers maintained by suppliers
 - Re-stocking triggered by pull signals
 - Vendor Managed Inventory (VMI) limited to maximize production floor space



Firstronic's Operational Improvement Strategy

Implementation of Lean Manufacturing (continued)

- Synchronous Flow Manufacturing
 - Managing Constraints
 - Small Transfer Batch Sizes
 - Quick Changeovers/Setups
 - Standardized Process/Equipment approach to minimize variation
 - Workforce cross-trained to enable deployment among the operations having greatest demand
 - Continuous Improvement/Elimination of Defects
 - Production status highly visible to enable quick identification of bottlenecks



Plex Benefits for Lean Manufacturing

Supply Chain Management

- Integrated ability to monitor our response to customer demand
 - Forecast
 - Customer Portals/EDI
 - Component Inventory
 - Job Scheduling
 - WIP – Production/Inventory Tracking
 - Scheduling Shipping
 - Real-Time

Plex Benefits for Lean Manufacturing

Online Documentation Management

- Operator access directly from Workstation Control Panel
 - Work Instructions
 - Quality Manual

The screenshot displays the Plex Workstation Control Panel interface. At the top, there are buttons for 'Exit Control Panel' and 'Wiki', and a 'Control Panel' header with the Plex logo. The main area is divided into several sections:

- Workcenter:** 'Select Solder 1', 'Next Operation: Depanel A'.
- Setup:** 'Job 2965', '90-02613-5009', '20 - Selective Solder (180 Ea/hr)'.
- Workcenter Status:** 'Production', 'OK'.
- Checksheets:** Three columns listing operators (Irene Scopel, NaQuisha Smith) and their required tasks (Hand Insert Operator, Solder Set Up, First Piece / Hand Insertion, Operator).
- Production History:** Job Quantity: 740.000 Ea, Produced: 210.000, Balance Required: 530.000.
- Operators:** 'ene Scopel 8:37 AM Production', 'AQUISHA SMITH 8:39 AM Production'.
- Links:** 'Workcenter Log'.
- Other Functions:** 'View Attachments' (circled in yellow), 'Tooling', 'Checksheets'.
- Bulletin:** 'Building: Firstronic Quality Document Index Folder', 'Part Operation: ** Assembly Instruction Rev E **' (circled in yellow).


Plex Benefits for Lean Manufacturing

New Version

Quality Enhancement through Document Management

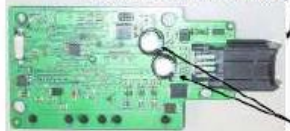
- Ties Work Instructions, Control Plan & FEMA
- No More Redlines
- Real Time Updates

Current

| | | | |
|---|--|---|--|
|  | | Assembly Instruction DHTer Board Assembly Assembly Process | Number: 98-0213-5009 Date of Issue: 01/28/2014 Doc. Rev: 0 |
| Approved by: (required on first page only) | | | |

2. Insert/install components, per table.

- 1st Operator - Install pcb into pallet - and inserts C3 & C4 first - noting Polarity
- 2nd Operator - Install J1 - Verify C3 and C4 polarity. Applies Top Flat cover over pallet
Press & ensure connector is flush to pcb's.



Note Polarity

- Run the first piece through the solder machine to verify set-up.
- Remove the first piece from the solder pallet and visually inspect for any type of solder defects. If you need assistance, contact your supervisor, quality, or process engineer.
- If the first piece is acceptable, continue to run production boards.

| PLM TYPE | PLC CLASS | TOOLS REQUIRED | PRE REQUIRED | JOB NUMBER | TEST MARCH/APPLICATION | WORK CENTER NO. 20 | | | | | | | | | | | | |
|--|---|---|--------------|------------|------------------------|-----------------------------------|--------------|---|-------------------|---|-----------------------------|----------------------------------|---------------------------|---|----------|----|----------------------------|---|
| 2 | PLC | PLATE, SOLDER, SOLDERING IRON, SOLDER, SOLDERING MEDIUM, SOLDERING TIPS | | | | SELECTIVE SOLDER-INJECTION | | | | | | | | | | | | |
| PROGRAMS & TOOLING SOLDER PALLET ID# 28773 MACHINE ERSA VERSAFLOW Soldering System ERSA PROGRAM Tag ID# 4 | | | | | | | | | | | | | | | | | | |
| MATERIALS <table border="1"> <thead> <tr> <th>P/N</th> <th>QTY. REF.</th> <th>DESCRIPTION</th> <th>QTY</th> </tr> </thead> <tbody> <tr> <td>38-18793</td> <td>C3, C4</td> <td>ELKO 500UF 35V 20% RADIAL</td> <td>2</td> </tr> <tr> <td>38-14677</td> <td>J1</td> <td>CON HDR 8PDR 100 RJA BLACK</td> <td>1</td> </tr> </tbody> </table> <p>Note Polarity: white (negative) side towards J1</p> <p>Trim the leads of the capacitors to 0.130" from body of component the Hepp machine is preset to these settings. Trim a couple and sample fit them on a board to ensure correct length is correct then proceed to trim them all.</p> <p>Ensure J1 connector is fully seated with PCB</p> | | | | | | | P/N | QTY. REF. | DESCRIPTION | QTY | 38-18793 | C3, C4 | ELKO 500UF 35V 20% RADIAL | 2 | 38-14677 | J1 | CON HDR 8PDR 100 RJA BLACK | 1 |
| P/N | QTY. REF. | DESCRIPTION | QTY | | | | | | | | | | | | | | | |
| 38-18793 | C3, C4 | ELKO 500UF 35V 20% RADIAL | 2 | | | | | | | | | | | | | | | |
| 38-14677 | J1 | CON HDR 8PDR 100 RJA BLACK | 1 | | | | | | | | | | | | | | | |
| ASSOCIATED WORK INSTRUCTION EN-004 W1 ERSA | | | | | | | | | | | | | | | | | | |
| CONDUCT 1ST PIECE INSPECTION | | | | | | | | | | | | | | | | | | |
| REJECTION REACTION PLAN <table border="1"> <thead> <tr> <th>BOARD DEFECT</th> <th>ISOLATE AND REMOVE PER SUSPECT MATERIAL PROCEDURE</th> </tr> </thead> <tbody> <tr> <td>COMPONENT MISSING</td> <td>ISOLATE AND REMOVE PER SUSPECT MATERIAL PROCEDURE</td> </tr> <tr> <td>NO SFT PRICE IN VET 8 BOARD</td> <td>STOP LINE/ACTIVITY ASSEMBLY LEAD</td> </tr> </tbody> </table> | | | | | | | BOARD DEFECT | ISOLATE AND REMOVE PER SUSPECT MATERIAL PROCEDURE | COMPONENT MISSING | ISOLATE AND REMOVE PER SUSPECT MATERIAL PROCEDURE | NO SFT PRICE IN VET 8 BOARD | STOP LINE/ACTIVITY ASSEMBLY LEAD | | | | | | |
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| COMPONENT MISSING | ISOLATE AND REMOVE PER SUSPECT MATERIAL PROCEDURE | | | | | | | | | | | | | | | | | |
| NO SFT PRICE IN VET 8 BOARD | STOP LINE/ACTIVITY ASSEMBLY LEAD | | | | | | | | | | | | | | | | | |
| APPROVAL APPROVED BY: Maurice Helmsbyck DATE: 03/18/14 | | | | | | | | | | | | | | | | | | |
| KEY CUSTOMER FOCUS TEAM MEMBERS PM: Maurice Helmsbyck TEST ENG: Mark Nuss QM: Christina Foley | | | | | | | | | | | | | | | | | | |
| PRODUCT INFORMATION DURA DURA ITEM NUMBER: 98-0213-5009 QA-619 P3 11/11/2010 | | | | | | | | | | | | | | | | | | |

Plex Benefits for Lean Manufacturing

Document Integrity & Continuous Improvement

- Data control through document control system
 - Online approval process
 - Ability to set review frequency, review actions and retention periods
 - Ability to track and store revisions plus create distributions logs

| | |
|--|---|
| Review Frequency: | <input type="text" value="36"/> Months |
| Starting Date: | <input type="text" value="5/14/09"/> |
| Review Action: | <input type="text" value="Review and Approve"/> |
| Next Review Date: | 5/14/15 |
| Generate Direct Link URL: <small>Generate a URL that you can use to link directly to this document from outside of Plex. The normal login procedure is still required before the document is displayed.</small> | |
| Image: <input type="radio"/> Automatic or | |
| Revision E-Mail Notification | |
| Group: | <input type="text" value="Document Distribution Te"/> |
| Security Roles: | + |
| Document No: | 8382512 |
| Distribution Log: | <input checked="" type="checkbox"/> |
| Lock Properties: | <input type="checkbox"/> |
| Track Revisions: | <input checked="" type="checkbox"/> |
| Store Revisions: | <input checked="" type="checkbox"/> |
| Display Control Footer: | <input checked="" type="checkbox"/> |
| Require Approvals: | <input checked="" type="checkbox"/> |
| Approvers: | + Maurice Hellebuyck , Rick Herndon , Sandy Kolp , Keith Kolp , Tony Bellitto |
| Referencing This Document: | <input type="text" value="Read-Only References"/> |

Plex Benefits for Lean Manufacturing

Production

- Enhanced Quality support
 - Verification of start-up activities monitored through Plex check sheets
 - Part-to-part scanning of reels at SMT verifies part numbers against documentation ensuring correct feeders with correct parts are loaded
 - Inspection history with SPC capabilities now available within the system
 - Inventory traceability through each step in the manufacturing process through container serial numbers

| Checksheet 247289 - In Process | | | | | | |
|--------------------------------|--|---|-----------------|--|--------------|---|
| Part | Operation | Inspection Step | Workcenter | SPC Checksheet Container Text | Job No | |
| 90-02613-5009Rev | Selective Solder | Solder Set Up First Piece / Hand Insertion | Select Solder 1 | | 2774 | |
| Date/Time | Inspector | | Note | | | |
| 5/29/14 11:59 AM | Scopel, Irene | | | | | |
| No | Specification | Target | Limits | Gage | Measurements | Hide/Note |
| 14.1 | First Piece Verification with X-Ray | Ensure that first piece is tagged with green toe tag and signed off by operator. | | <input checked="" type="radio"/> Pass <input type="radio"/> Fail | | <input type="checkbox"/> <input type="checkbox"/> |
| 16.5 | Connector Height | Verify the Connector height by using TF-360 | | <input checked="" type="radio"/> Pass: Accept <input type="radio"/> Fail: Reject | | <input type="checkbox"/> <input type="checkbox"/> |
| 12 | Set Up Verification | All jobs require a second person to perform a set up verification. Operator and person performing verification must input their clock #s. | | | 296 280 | <input type="checkbox"/> <input type="checkbox"/> |
| 18 | Selective Solder - Correct Pallet | Correct Solder Pallets per Assembly Instruction. Inspect pallet to ensure that there is no damage or excessive wear. | | <input checked="" type="radio"/> Pass: 28773 <input type="radio"/> Fail: 27883 | | <input type="checkbox"/> <input type="checkbox"/> |
| 19 | Set Up Selective Solder - Correct Solder Program | Correct program setup per the assembly instructions. | | <input checked="" type="radio"/> Pass: TAG ID#9 <input type="radio"/> Fail: TAG ID#4 | | <input type="checkbox"/> <input type="checkbox"/> |

Plex Benefits for Lean Manufacturing

Production – SPC Checksheets

Plex Systems, Inc. (US) | https://www.plexonline.com/5ea644ca-243f-4323-bba1-4dd8f9cfba45/Rendering_Engine/default.aspx?Request=Show&RequestData=SourceType(Screen)SourceKey(14809)ScreenParameters(Workcenter_Key=|Job_Key=|Part_Of

Back Wiki Print Add PLEX

SPC Checksheets

Type: In Process Checksheet No: Pass/Fail: Step: Add

Part No: 90-02613 Revision: Date Range: Today Date Begin: 5/29/2014 12:00 AM Date End: 5/29/2014 11:59 PM

Workcenter: Op: Description: Use Report Server:

Building: Department: Search

Container: Search

Contains empty measurements Contains measurements out of specification

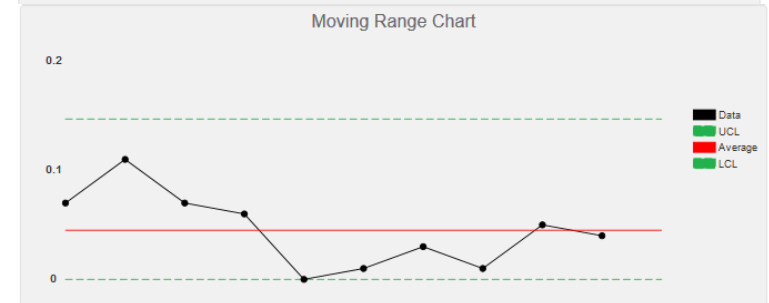
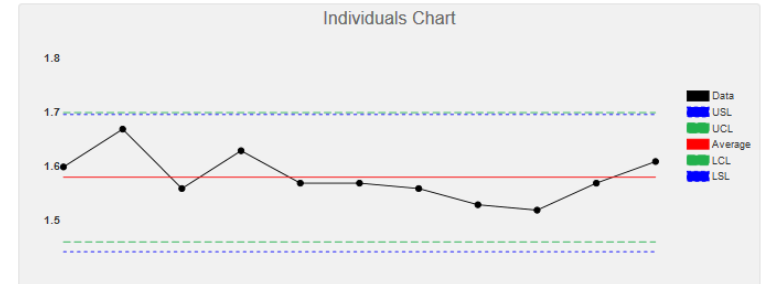
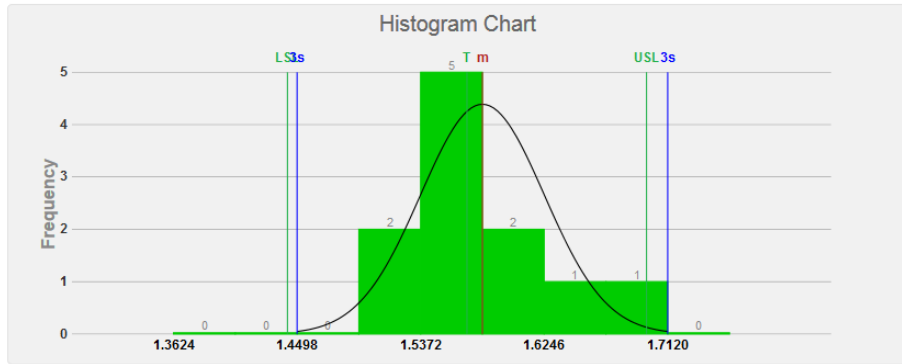
| Checksheet | Type | Part | Op | Step | Workcenter | Container | Date | Note |
|------------|------------|---------------|-----------------------------|--|-----------------|-----------|--------------------|------|
| 247289 | In Process | 90-02613-5009 | Selective Solder | Solder Set Up First Piece / Hand Insertion | Select Solder 1 | | 5/29/2014 11:59 AM | |
| 247288 | In Process | 90-02613-5009 | Selective Solder | Hand Insert Operator | Select Solder 1 | | 5/29/2014 11:59 AM | |
| 247285 | In Process | 90-02613-5009 | Functional Test - EOL (WIP) | Packout | DURA EOL 1 | S509400 | 5/29/2014 11:54 AM | |
| 247283 | In Process | 90-02613-5009 | Functional Test - EOL (WIP) | Test Operator | DURA EOL 1 | S509400 | 5/29/2014 11:54 AM | |
| 247282 | In Process | 90-02613-5009 | ICT | Test Operator | Teradyne TS LH | S509363 | 5/29/2014 11:47 AM | |
| 247281 | In Process | 90-02613-5009 | ICT | Test Set Up | Teradyne TS LH | S509363 | 5/29/2014 11:47 AM | |
| 247271 | In Process | 90-02613-5009 | ICT | Test Operator | Teradyne TS LH | S509318 | 5/29/2014 11:25 AM | |
| 247270 | In Process | 90-02613-5009 | ICT | Test Set Up | Teradyne TS LH | S509318 | 5/29/2014 11:25 AM | |
| 247269 | In Process | 90-02613-5009 | ICT | Test Operator | Teradyne TS LH | S509316 | 5/29/2014 11:25 AM | |
| 247268 | In Process | 90-02613-5009 | ICT | Test Set Up | Teradyne TS LH | S509316 | 5/29/2014 11:25 AM | |
| 247265 | In Process | 90-02613-5009 | Depanel A | Depanel Operator | Auto Router 1 | S509287 | 5/29/2014 11:13 AM | |
| 247264 | In Process | 90-02613-5009 | Depanel A | Depanel First Piece | Auto Router 1 | S509287 | 5/29/2014 11:13 AM | |
| 247263 | In Process | 90-02613-5009 | Depanel A | Depanel Set Up | Auto Router 1 | S509287 | 5/29/2014 11:13 AM | |
| 247262 | In Process | 90-02613-5009 | Depanel A | Depanel Operator | Auto Router 1 | S509286 | 5/29/2014 11:12 AM | |
| 247261 | In Process | 90-02613-5009 | Depanel A | Depanel First Piece | Auto Router 1 | S509286 | 5/29/2014 11:12 AM | |
| 247260 | In Process | 90-02613-5009 | Depanel A | Depanel Set Up | Auto Router 1 | S509286 | 5/29/2014 11:11 AM | |
| 247259 | In Process | 90-02613-5009 | Depanel A | Depanel Operator | Auto Router 1 | | 5/29/2014 11:06 AM | |
| 247258 | In Process | 90-02613-5009 | Depanel A | Depanel First Piece | Auto Router 1 | | 5/29/2014 11:06 AM | |

Plex Benefits for Lean Manufacturing

Production – Quality Statistics

| Chart Statistics | | | | | | | | | |
|------------------|----------------|------------------------|------------------------|---------------------|-----------------------------|--------------|------------|--------------------|--|
| Data | Specifications | Central Tendency | Dispersion | Distribution | Capability/Performance | | | Prediction | |
| Min: 1.520 | Tol.: 0.254 | <u>Extended Limits</u> | <u>Extended Limits</u> | σ : 0.044 | CR (1/Cp): 1.032 | Pp: 0.969 | ZU: 2.657 | % Above: 0.000 | |
| Max: 1.670 | USL: 1.697 | UCLx: 1.701 | UCLr: 0.147 | +3 σ : 1.712 | Cp (Tol/6 σ): 0.969 | Ppk: 0.886 | ZL: 3.156 | % Below: 0.000 | |
| Mean: 1.581 | Target: 1.570 | EXDBar: 1.581 | ERBar: 0.045 | Mean: 1.581 | Cpk: 0.886 | kurt: -0.741 | CPU: 0.886 | % OoS: 0.000 | |
| Count: 11.000 | LSL: 1.443 | LCLx: 1.461 | LCLr: 0.000 | -3 σ : 1.450 | cc (R/d2): N/A | skew: 0.520 | CPL: 1.052 | % In Spec: 100.000 | |
| | | | | | | d2: N/A | | | |

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|------------------|----------------|------------------------|------------------------|---------------------|-----------------------------|--------------|------------|--------------------|--|
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| | | | | | | d2: N/A | | | |



Plex Benefits for Lean Manufacturing

Production

- Enhanced HR support
 - Integration of time and attendance tracking with automatic points system
 - Training is streamlined and tracked with the System
- Optimized support for customer requirements
 - Inventory traceability through each step in the manufacturing process through container serial numbers
 - Customer portal allows customers to monitor production status including orders and inventory

Plex Benefits for Lean Manufacturing

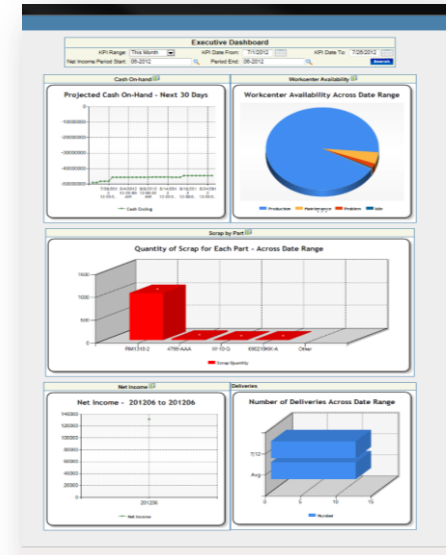
Production

- Cloud Based Model
 - Minimal IT Staff Requirements
 - Plant Floor Infrastructure Support Focus
 - Focuses our Technical Resources on Core Competencies
- Real-Time System
 - 24 X 7, 4 Shift Model
 - Remote Access
- Continuous Improvement Process
 - Monthly Metrics Support
 - Quicker Fiscal Closing with SCAR process
 - Supplier Scorecard

The Results After Two Years

Plex's Features Enhance Our Competitive Advantage

- Plex implemented in only 4 months
- Inventory turns have increased from 4-5 annually to 10-12 annually
- 2 buyers manage 400+ parts
- Operational improvement driven by dashboard which measures:
 - Revenue
 - Inventory Levels/Turns: by customer and by program
 - Warranty Returns
 - Labor to Plan
 - Purchase Price Variance
 - On Time Delivery: by customer and by program
 - Backlog



Lessons Learned in Implementation

If we had to do it all over again..

- Understanding how many Plex stations are needed
- More relaxed schedule
- More Training for Plant Floor & Front Office Personnel
- Plex Documentation
- Plex Community
- Plex Functional Champion



Looking Ahead

Future Enhancements

- Intelliplex/ODBC
- Machine Interface
- Serialization Process Efficiency
- Kanban Module?
- Supplier EDI or Portal?
- Mexico Facility
- El Paso Warehouse or 3PL?
- JV Partner Integration/Collaboration
- Waterfall Charts



Questions?