Universal Splice Machine (USM)

(No text required for this slide. Leave up until the first presenter steps up to the podium)
Good afternoon. My name is Mark Adams. Let me introduce the rest of our team:

Pat Wishall,
Ron Gill,
Mike Caldarera,
Sal Gutierrez,
Jeff Stagner…and, Daniel Munoz, our presentation driver.

We’re from the Boeing Company’s C17 Program located in Long Beach, California.
Our presentation is regarding the Universal Splice Machine, or USM…a portable, automated system using electro-magnets to hold parts as it drills and inserts fasteners along the fuselage of the C17.
Section 1A.a... The C17 Program manages data and processes using a 7 step, Continuous Improvement Model...our Process Based Management System, or PBM. Continuous in that improvements are incorporated at Step 7, re-validated in Step 3, then repeated through the model.

To select the project, we used data and tools specific to understanding where improvements could be made to our current process.
Types of data and tools used to select the project, and why

Key to project selection were…

• Lean Value Stream Mapping…to stimulate stakeholder understanding of where those opportunities for improvement existed within our current process.

• Trend Analysis of Performance Metrics…to determine tendencies and anticipated results based on actual data gathered from past and present production statistics.

• …and, Brainstorming sessions…where stakeholders generated a large number of ideas from diverse expertise.

CLICK
Section 1A.b… The project was selected due to the impact of repetitive motion injuries on man-power and workman’s compensation cost.

Along with that, we found that performance metrics showed significant opportunity for improving process efficiency.
This chart shows the USM’s significant improvement potential when compared with the other projects considered…robotic torque box drilling, and updating panel-drilling machinery.

The USM ranked highest overall…particularly in the areas of efficiency and in leveraging new technologies. Selecting the USM paved the way for increasing employee safety, corporate-wide application, and business growth.
Section 1A.c... Involvement of potential stakeholders in project selection was based on their function within the current value stream. Internal and external stakeholders provided feedback and rationale on how they…and our goals...would be affected.

For example, production and ergonomic representatives provided health and safety recommendations.

Supplier Management provided data on machinery acquisition.

NC Programming supplied data on programming costs and cycle time.

Support personnel...Engineering, Quality, and Planning...provided cost and time analysis for facilities, risk assessment, and potential return-on-investment.
**Section 1B.a...** The project is linked to our C-17 20-year strategy emphasizing value creation for our customers...the need to improve processes, reduce cost, schedule, and span time, while providing high quality products through advanced technology.

Through brainstorming and feedback from potential stakeholder surveys, we summarized this into a list of Organizational goals linked to our performance metrics.
**Affected organizational goals, performance measures, and strategies**

<table>
<thead>
<tr>
<th>Organizational Goals (Performance Metrics)</th>
<th>USM Project Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Use of Company assets (COST)</td>
<td>Reduce Repetitive Tasks Through Automation (Budget to Hours)</td>
</tr>
<tr>
<td>Provide the highest Quality (QUALITY)</td>
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</tr>
<tr>
<td>Lower the cost of doing business (CYCLE TIME)</td>
<td>Reduce Waste (Reduce hours required to build product)</td>
</tr>
<tr>
<td>Reduces overall Timeliness (SPAN TIME)</td>
<td>Enhance Span Time (Optimize workload of required days)</td>
</tr>
</tbody>
</table>

- Achieve aggressive, sustainable improvements to Safety, Quality, Schedule and Cost
- Relentlessly improve and integrate processes
- Accelerate Technology Integration

Project goals were determined through surveys and interviews identifying stakeholder needs and concerns..
Section 1B.b… Types of project impact on organizational goals and measures are:

Incorporating technology increases process efficiency and product quality… positively impacting our goals and metrics for efficiency, quality, cycle and span time.

Automation minimizes injury risk and ergonomic issues… reducing lost man-hours and related liabilities.

And, adopting Lean principles eliminates waste… enhancing the efficient use of our greatest asset… our employees.
### Section 1B.c

The degree of impact on our goals and performance metrics was determined through team consensus of stakeholder surveys, as well as data analysis for projected outcomes and return-on-investment.

Based on ability to improve performance or satisfy the organizational goals, impact was rated either high (exceeds requirement), medium (meets requirement), or low (minimal impact).
### 1B.c Degree of impact on each goal/performance measure, and how this was determined

<table>
<thead>
<tr>
<th>Organizational Goals (Performance Metrics)</th>
<th>USM Project Goals</th>
<th>Project Impact on Organization Goals and Performance Measures</th>
<th>Degree of Impact to Goals and Strategies</th>
<th>Degree of Impact to Performance Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Use of Company assets (COST)</td>
<td>Reduce Repetitive Tasks Through Automation (Budget to Hours)</td>
<td>Incorporating Lean reduces wasted efforts, and automation eliminates repetitive motions, alleviating harsh ergonomic environment</td>
<td>MED (Meets)</td>
<td>HIGH (Exceeds)</td>
</tr>
<tr>
<td>Provide the highest Quality (QUALITY)</td>
<td>Provide Greater Quality (Reduce Repair/Rework)</td>
<td>Quality is increased and defects are reduced as automation is introduced</td>
<td>MED (Meets)</td>
<td>HIGH (Exceeds)</td>
</tr>
<tr>
<td>Lower the cost of doing business (CYCLE TIME)</td>
<td>Reduce Waste (Reduce hours required to build product)</td>
<td>Speed and accuracy of automation reduces cost by optimizing asset utilization</td>
<td>LOW (Minimal)</td>
<td>HIGH (Exceeds)</td>
</tr>
<tr>
<td>Reduces overall Timeliness (SPAN TIME)</td>
<td>Enhance Span Time (Optimize workload of required days)</td>
<td>Minimizing span time means no delinquent deliveries</td>
<td>MED (Meets)</td>
<td>HIGH (Exceeds)</td>
</tr>
</tbody>
</table>

For example, incorporating lean and alleviating ergonomic issues would only meet organizational goals, but the potential to increase efficiency by 300% would far exceed the requirement on our team’s “budget” performance metric.
Section 1C.a... Our potential stakeholders were identified using our current value stream map seen in 1A.c.

As part of the manufacturing process, Production, support personnel, and our Lean and Ergonomics groups comprised our Internal stakeholders.

Outside the process...our Customer, Supplier, and Research and Development groups...made up our external stakeholders.

During brainstorming, information like process ownership and subject matter expertise, defined stakeholder disciplines and roles.
Section 1C.b... Types of potential impact on stakeholders was determined through brainstorming, stakeholder survey, and root cause and value stream analysis.
For example, stakeholder surveys identified initial responses of potential impact on each stakeholder. Their perspectives helped the team identify end-user impact not previously thought of.

Follow-up brainstorming led to the creation of root cause diagrams that classify causes in variation associated with our current process.

Value stream mapping helped identify process flow and potential road blocks where impact seemed greatest.

Positive impact included eliminating waste, reducing cost and span time.

While negative impact included lower customer satisfaction, and loss of revenues and company credibility should the project fail.

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### Types of potential impact on stakeholders, and explain how these were determined

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Positive Impact</th>
<th>Negative Impact</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production (C17 Assembly)</td>
<td>Ergonomic Issues Gone</td>
<td>Possible Loss of Job</td>
<td>HIGH</td>
</tr>
<tr>
<td></td>
<td>Performance Metric Levels Up</td>
<td>Technology Learning Curve</td>
<td></td>
</tr>
<tr>
<td>Support (Production Staff)</td>
<td>Greater Mechanic Trust</td>
<td>Lower Mechanic Trust</td>
<td>HIGH</td>
</tr>
<tr>
<td></td>
<td>Sets New Industry Benchmarks</td>
<td>Chance of Project Failure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adds to Group Achievements</td>
<td>Large Amount of Initial Work</td>
<td></td>
</tr>
<tr>
<td>Lean Enterprise (Lean Principles &amp; Ergonomics)</td>
<td>Promotes Lean Initiatives</td>
<td>No Negative Impact</td>
<td>LOW</td>
</tr>
<tr>
<td></td>
<td>Enhances Global Leadership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer (Corporate and C17 End-Users)</td>
<td>Lowers Product Costs</td>
<td>Chance of Project Failure</td>
<td>MED</td>
</tr>
<tr>
<td></td>
<td>Sets New Industry Benchmarks</td>
<td>Lower Customer Satisfaction</td>
<td></td>
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<tr>
<td></td>
<td>Promotes Corporate-wide Use</td>
<td>Loss of Revenues</td>
<td></td>
</tr>
<tr>
<td>Suppliers (USM)</td>
<td>Added Work - Greater Revenues</td>
<td>USM Failure</td>
<td>HIGH</td>
</tr>
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<td></td>
<td>Sets New Industry Benchmark</td>
<td>Loss of Revenues</td>
<td></td>
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<tr>
<td></td>
<td>Enriches Supplier Stock</td>
<td>Lower Credibility</td>
<td></td>
</tr>
<tr>
<td>Research (Phantom Works)</td>
<td>Proves out Development</td>
<td>Electro-Magnetics Failure</td>
<td>HIGH</td>
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To 1C.c
Section 1C.c... The degree of potential impact on stakeholders depended on the expected change to their overall environment.

The team agreed on a simple matrix to determine the degree of potential impact on stakeholders. Impact...positive or negative...having 10% or greater expected change to the stakeholder and our project goals rated high... 6% to 9% medium... and, 0 to 5%, low.

CLICK
Degree of potential impact on stakeholders, and explain how this was determined

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For example, impact to production ranked high from the immediate and direct effect on their performance.

Impact to Support personnel ranked high since project success relied heavily on their ability to implement.

Whereas, impact to Lean stakeholders was low since lean application is already a program-wide standard that wouldn’t change due to the project.

Next up, Pat Wishall, with the analysis of our current situation…

Click to Criteria 2
Thank you Mark… CLICK
Section 2A.a… Methods and tools to identify improvement opportunities were…

- The 5S+1, a disciplined Lean method of organization and cleanliness. As our foundation, it established a clutter-free work environment focused on waste elimination and safety improvement.

- Team members attended lean conferences and conducted benchmarking visits to internal and external users of automated drilling technology to learn from best practices in the industry.

- Visual observation of the current process with face-to-face interviews of manufacturing end-users to obtain task level information.
...and, as our primary tool to identify improvement opportunities in lead time, the team used value stream mapping of the current process.
Section 2A.b... Analysis of data to identify potential improvement opportunities focused on how the current process related to performance and trends.

Performance data from benchmarked automation users in the commercial sector indicated that improvements in efficiency and injury reduction were feasible.

Process observation identified steps in our process having the greatest potential for improvement... drilling, countersinking, deburring, and fastener installation... all were slow and inefficient due to repetitive motion and poor mechanic ergonomics.
This chart shows the potential improvement opportunities obtained from our analysis. Also, whether or not the team felt our project could address that opportunity.

For example, it was “Unknown” if any portable method existed for installing fasteners without hand-deburring.

![Click](To 2A.c)
### Section 2A.c...

Since stakeholders were involved in the initial brainstorming of our current value stream, they were immediately involved in identifying potential improvement opportunities.

Production stakeholders provided input concerning process waste leading to flat-lined performance, schedule, and quality.

Support stakeholders gave input on design inefficiencies, documentation, and tooling.

Our Lean stakeholder studied the process from a physical stand point, identifying deficiencies in ergonomics contributing to injuries.
Section 2B.a... The methods and tools we used during brainstorming sessions to identify final improvement opportunities were the “5 Why’s”, and Cause and Effect diagrams, both proven industry tools for problem solving and solution identification.

Using our list of potential improvement opportunities, we applied the “5 Why’s” on each of them to obtain structured responses to populate and clearly define our Cause and Effect diagram. This provided a way to visualize, arrange and present data suitable for analysis.
Section 2B.b... Analysis of data to select our final improvement opportunities was facilitated using this method...which provided a visual tool identifying common characteristics from one area in our Cause and Effect Diagram to another. Having the highest overall influence on performance levels and repetitive motion tasks, these characteristics were listed as final improvement opportunities.

For example, we applied the “5 Why’s” to our potential improvement of having 4000 fasteners, then inserted the answers into our Cause and Effect diagram.

Seen here, hand drilling proved to be a common source of variation throughout our Cause and Effect. This made it evident that if addressed, we could eliminate the negative influence hand drilling had on process improvement and performance. So, it was listed as a final improvement opportunity.
Section 2B.c... Our final list of improvement opportunities was determined through team consensus after analysis of performance trend data, associated implementation costs, and subject-matter-expertise. Our final list consisted of hand drilling, countersinking, deburring, man-power requirements, total fastener requirements, and the method for installing fasteners.

Impact was determined through stakeholder consensus using proven validation tools.

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</table>

| Hand Drilling Techniques | ● | ● | ● | ● |
| Countersinking Methods  | ● | ● | ● | ● |
| Hand Deburring of Holes | ● | ● | ● | ● |
| Man-Power Requirements  | ● | ● | ● | ● |
| Total Fasteners Required| ● | ● | ● | ● |
| Fastener Installation Methods| ● | ● | ● | ● |

**IMPACT:** ● = High  ● = Medium High  ● = Medium  ● = Medium Low  ● = Low or None
Identify the improvement opportunities, and explain validation of the final improvement opportunities

<table>
<thead>
<tr>
<th>Final List of Improvement Opportunities</th>
<th>Validation Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value Stream Mapping</td>
</tr>
<tr>
<td>Hand Drilling Techniques</td>
<td>✔</td>
</tr>
<tr>
<td>Countersinking Methods</td>
<td>✔</td>
</tr>
<tr>
<td>Hand Deburring of Holes</td>
<td>✔</td>
</tr>
<tr>
<td>Man-Power Requirements</td>
<td>✔</td>
</tr>
<tr>
<td>Total Fasteners Required</td>
<td>✔</td>
</tr>
<tr>
<td>Fastener Installation Methods</td>
<td>✔</td>
</tr>
</tbody>
</table>

This validation chart shows the tools used and their related improvement opportunities.

- Value Stream Mapping by the entire team
- Performance Trend Analysis by support stakeholders
- Stakeholder Surveys for customer feedback
- ...and, One-On-One Interviews with our mechanics

More 2B.c
For example, the team revisited our value stream to verify the opportunities within our process, then support stakeholders ran performance trend data attributed to each opportunity.

This information was given to stakeholders for their concurrence. Then, we interviewed our mechanics during a “hands-on” walk-thru for their input and validation.

Here’s Ron with our Solution Development.
Criteria 1  Criteria 2  Criteria 3  Criteria 4  Criteria 5

Solution Development

Thank you Pat...  

To 3A.a
Section 3A.a... The methods and tools used to develop potential solutions focused on knowledge from best practices found during benchmarking.

We conducted brainstorming sessions using lessons learned from the best practices, as well as feedback from users of the automated systems we benchmarked, as in the case of the flex rails used on Boeing’s 787 program.

Again, our main tool was value stream mapping, which allowed the team to assess impact of potential solutions before implementation. For example: the use of stationary (or, monument) versus portable riveting systems.
Section 3A.b… We analyzed data to develop potential solutions by combining subject-matter expert knowledge with benchmarking, internet research, stakeholder interviews, and lean conference attendance to create a “high-level” list of potential solutions that raise performance and lower injury rates.
Each potential solution was noted in our Cause and Effect diagram wherever the solution would affect our final list of improvement opportunities found in 2B.c.

Next, we inserted the solutions into our current Value Stream to identify road blocks.
This visual approach facilitated an analysis of feasibility, bringing to front the most significant potential solutions.

For example, lowering the total fasteners required meant a 6 to 8% reduction in repetitive motion, man-hours, and span and cycle time, and a low implementation cost, making it viable for final solution consideration.
Section 3A.c... The criteria used to select our final solution was a combination of corporate funding requirements, and our project goals...

- Elimination of safety and human factors

- Highest Rate-Of-Return

- Lowest Risk Factor

- Use of new Technologies

- Lean application

- …and, Performance Enhancement capabilities.

This guaranteed a selection satisfying project and organizational goals, while enhancing performance.

CLICK
Each potential solution was evaluated for its' capacity to improve the process in each of the criteria categories. Simply put…the solution crossing the most hurdles wins.
Section 3B.a... The methods and tools to select our final solution were:

- Brainstorming as our thought generating tool to discuss viability of potential solutions, and their impact on our current process, goals, and funding requirements.

- We inserted each potential solution into our Value Stream Map for process flow validation, adherence to project goals, and projected cost and span time data.

- A team member Process Walk-Thru for “hands-on” understanding of each process step for validation of the final solution capabilities.

- ...and, Goal and Funding Validation… our sanity check to optimize potential solutions into one final solution satisfying all project requirements.
Section 3B.b... To analyze data to select our final solution we used value stream mapping to envision and assess the impact of final solutions.

This assessment, coupled with on-site walk-thru’s, gave us a way to determine shop floor impact and process improvement value.
For example, we compared and analyzed value stream maps with stationary drilling systems, and with portable drilling systems.
This method showed that an automated drilling device with fastener insertion capabilities, combined with electro-magnetic clamping, provided the highest benefit...reducing repetitive motion, span and cycle times, while enhancing quality without exceeding funding requirements, or elevating risk factors.
Section 3B.c... Involvement of stakeholders during final solution selection varied depending on discipline and process role.

Most participated in brainstorming, goal identification, value-stream mapping, potential solution evaluation, and final solution consensus.

Stakeholders, such as our customer, played lesser roles in solution selection, but did provide high-level goals, expectations, and funding requirements, paving the way to our final solution.

By aligning our project objectives to those requirements and expectations, then providing regular statusing of the project, we were able to keep the interests of those stakeholders uncompromised.

Because of process role and expertise, the majority of involvement came from production, support, and supplier stakeholders. This was due to their knowledge of the existing process, prior Lean training, and the direct influence the final solution would have on them.
Section 3C.a... Our final solution was a combination of potential solutions - NC programmed drilling and electro-magnetic clamping... to maximize speed and accuracy, while achieving first-time quality, burrless holes with fastener installation in a portable unit.
We validated our solution by creating a value stream map containing the new process, then ran computer simulations…verifying process flow, cycle time, and cost reduction data. This simulation proved to reduce ergonomic and repetitive motion issues, and lower man-power needs from 4 to 1, enhancing the efficiency and cost of our build cycle.
### Section 3C.b...

Expected Tangible benefits were determined through benchmarking results from similar projects, and computer simulation time-study data of our final solution...

- Reduce man-load by 3
- A 50% reduction in rework and repair
- A 72% reduction in direct labor hours
- …and, a reduction in span time from 6 to 2 days.
### 3C.b Tangible and intangible benefits expected to be realized

<table>
<thead>
<tr>
<th>Organizational Goals (Performance Metrics)</th>
<th>USM Project Goals</th>
<th>Tools Used To Determine Intangible Benefits</th>
<th>Intangible Benefits (Expected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Use of Company assets (COST)</td>
<td>Provide the highest Quality (QUALITY)</td>
<td>One-On-One Interviews</td>
<td>Incorporate Lean Principles into the process to make better use of all company assets involved with the process.</td>
</tr>
<tr>
<td>Provide the highest Quality (QUALITY)</td>
<td>Decrease Time of tasks through Automation (Budget to Hours)</td>
<td></td>
<td>Improve mechanic morale by helping them achieve greater accomplishments in their workmanship. Greater customer satisfaction and confidence.</td>
</tr>
<tr>
<td>Lower the cost of doing business (CYCLE TIME)</td>
<td>Reduce Waste (Reduce hours required to build product)</td>
<td>Stakeholder Surveys</td>
<td>Lower the cost of doing business by instilling a greater work ethic and desire to achieve optimum work capacity. Greater customer satisfaction and confidence.</td>
</tr>
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<td>Reduces overall Timeliness (SPAN TIME)</td>
<td>Enhance Span Time (Optimize workload of required days)</td>
<td></td>
<td>Stimulate team collaboration and a willingness to give way to new ideas and technologies that will enhance performance levels.</td>
</tr>
</tbody>
</table>

Expected intangible benefits obtained from stakeholder surveys and interviews showed leaning out the process makes better use of assets by eliminating wasted efforts… enhancing performance, bringing a feeling of achievement and confidence, while stimulating team collaboration for continuous improvement.
Section 3C.c... Data used to justify implementation of our final solution came from our Cost and Benefits Analysis required to meet organizational goals for corporate funding. This included safety, regulatory, contractual, cost savings, assumptions, and risk analysis data.

CLICK
For example, benefits included a 480 labor hour savings, a Return-On-Investment of roughly 3 to 1, and a nearly 29% Rate-Of-Return.

Assumptions included electro-magnetics to enable burrless drilling as a low to medium risk for a new technology.

Mike Caldarera will now take you through our project implementation and results…

To Criteria 4
Thank you Ron… CLICK
Section 4A.a... Stakeholder involvement in implementation consisted of three phases.

"After Okay to Proceed" allowed the start of construction on the USM by our Supplier Stakeholders.

Production and Support began revising process and procedure documentation.

Lean and Production performed a “5S+1” on the area to make way for the USM.

During “Production Readiness”, stakeholders participated in USM training and testing... a hands on walk thru of the new process... and, a Readiness Review to obtain full stakeholder buy-in to proceed to the “In Production” phase.

There, Production operated the USM and made recommendations for enhancements. Support observed the process, gathered data, and verified quality.

Other stakeholder groups did their own process observation, statistical analysis, problem mitigation, and safety compliance verification.
Section 4A.b… We identified resistance in several ways:

• The apparent face-to-face disparity between production mechanics and support personnel stakeholders during team meetings

• …and, through stakeholder surveys and interviews.

Types of resistance included:

• Mechanics currently doing the work didn’t want to be involved for fear of losing jobs

• Production management having to answer for lower than normal performance levels during training and implementation phases.

• …and, our NC mechanics’ fear of unknown health risks associated with the new technology.
We addressed resistance through “one-on-one” interaction. For example, our NC mechanic’s fear of electro-magnetic interference with pacemakers and hearing aids was eliminated when we provided safety test data showing no chance of magnetic conflict.
Section 4A.c... Stakeholder buy-in was ensured in two ways.

First, through complete ownership, participation and consensus from all project team members throughout the various phases of the project...conception, goal setting, improvement identification, solution selection and development, and implementation requirements.
Secondly, corporate stakeholder buy-in was ensured by adhering to corporate funding requirements through our cost and benefits analysis documenting anticipated benefits, risk assessment, return-on-investment, and internal rate of return.

Once resistance due to safety and job loss was mitigated, and the data supporting implementation was made available to production stakeholders, full buy-in by all stakeholders was achieved.
Section 4B.a... The plan to implement our final solution started with the creation of a list itemizing high-level requirements for a successful implementation.

Through brainstorming, each requirement was detailed to the lowest level to ensure all items and tasks would be tracked.

Each task was entered into an off-the-shelf software, project management tool, then given a start and end date for completion.

Tasks included:
Full project management capabilities… documentation, mentoring, and conflict mitigation.

Training for production and NC programming personnel on USM technology and use.

A Production Readiness Review verifying task completion and acceptability.

A stakeholder process walk-thru to choreograph the first day of actual production. This included a list of tasks outlining each stakeholder group responsibility during initial production start-up.

…and, stakeholder briefings for implementation awareness, results, and future improvement opportunities.
Section 4B.b... The USM caused dramatic changes to our procedures to implement, and sustain results.

Our program governs each discipline by a specific set of procedures addressing the “How-To’s” of accomplishing daily tasks.

For example, production works to a set of process standards detailing fabrication, assembly, rework and repair of aircraft parts. For our project, a entirely new standard was created describing the usage of the USM.

To sustain results, the work accomplished by these standards goes through a set of checks and periodic audits for accuracy and maintainability that further enhances next time quality.

CLICK
Section 4B.c... We have a pre-existing system for measuring and sustaining results found within our PBM database.

To measure results, PBM has various automated sources that capture real-time production data concerning hours charged, cycle time, and rework and repair. This data is charted in the form of our performance metrics to show “actuals”, expectations, and trends, then reviewed daily to plan work needs.

To sustain results, when the system identifies problem areas or negative trends, the process owner receives a corrective action notification, or CPAS. This forces immediate response on how they intend to rectify the situation.

Similar to a problem solving project, CPAS requires root cause analysis, solution development, and implementation phases. It tracks action items, due dates, etc... issuing automated reminders that action items are coming due until the final CPAS buy-off is complete.

Here’s Sal Gutierrez with Section 4C…
Thank you Mike…

Section 4C.a… Here we see the tangible benefits realized, and how they correspond to our organizational and project goals, and our expected benefits derived from our cost and benefits analysis.

- Reduced man-load from 4 to 1 mechanic
- Enhanced Quality by 50%
- Reduced hours worked from 311 to 97
- …and, reduced span time from 6 days to only 2

**Tangible and intangible results realized**

<table>
<thead>
<tr>
<th>Organizational Goals (Performance Metrics)</th>
<th>USM Project Goals</th>
<th>Tangible Benefits (Expected)</th>
<th>Tangible Benefits (Realized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient Use of Company assets (COST)</td>
<td>Reduce Repetitive Tasks Through Automation (Budget to Hours)</td>
<td>Reduce man-load by 3</td>
<td>4 to 1 Reduction in man-load requirements (300% increase in efficiency)</td>
</tr>
<tr>
<td>Provide the highest Quality (QUALITY)</td>
<td>Provide Greater Quality (Reduce Repair/Rework)</td>
<td>Reduce defects in workmanship by 50% or more</td>
<td>2 to 1 Reduction in workmanship defects (50% decrease)</td>
</tr>
<tr>
<td>Lower the cost of doing business (CYCLE TIME)</td>
<td>Reduce Waste (Reduce hours required to build product)</td>
<td>Save 220 Direct Hours (72% reduction)</td>
<td>214 Hour Reduction in Direct Hours- 311 to 97 (70% reduction)</td>
</tr>
<tr>
<td>Reduces overall Timeliness (SPAN TIME)</td>
<td>Enhance Span Time (Optimize workload of required days)</td>
<td>Reduce Span Time to 2 Days</td>
<td>4 Day Reduction in Span Time - 6 to 2 (60% reduction)</td>
</tr>
</tbody>
</table>

CLICK More 4C.a
This chart shows intangible benefits, realized and expected, and how they effect our organizational and project goals.

**Improved Ergonomics, enhanced mechanic efficiency and workmanship.**

**User-friendly process that eliminated wasted effort, promoting greater mechanic confidence in support staff capabilities.**

…and, greater employee morale, evident through sustained results in positive performance trends, and mechanics changing their initial project disapproval to thanking project team members for the time and cost savings of USM implementation.
Section 4C.b... Here’s how our project results link to our organizational and project goals, and performance measures…

With organizational goals as our governing source, we created our project goals with the intent to meet or surpass source requirements. Knowing this meant results that meet or surpass project goals would validate our original justification and project implementation funding.
Here we see our project results as they feed our performance metrics... the report card on how well our project addressed organizational goals.

Incorporating Lean positively impacted the efficient use of company assets by reducing waste in the process.

Automated drilling and eliminating the need for hand deburring, enhanced our product quality, and positively changed cycle and span times by reducing process steps from 6 to 3.

Automation increased the safety of our mechanics by reducing the chance for repetitive motion injuries.
Sharing results with stakeholders was a team effort. Team members supplied their peers and first line management with “Before and After” trend data.

Project management shared results at the departmental and program levels directly or through our 5-15 reporting process which disseminates briefings between levels of management.

The information is passed on by our leadership team to the corporate level via intranet and direct reporting methods.
As positive performance trends became apparent, production walk-thru’s and surveys provided positive feedback of project success, and that results communication was received as intended.

5-15 reporting guaranteed that results were shared throughout, providing documented proof that information was received properly from one level to the next.

Verification also came from performance awards presented to the team, and as other corporate programs chose to benchmark the USM.

Now, Jeff Stagner will take you through team management…

CLICK
Thank you Sal... CLICK
Section 5A... Team member selection and involvement was based on assigned responsibility, subject-matter expertise, process ownership, and relative need throughout project development, planning, implementation, and follow-up.

We considered communication skills and their ability to interact in a team-based structure.
Explain how team members were selected, and how they were involved throughout the project

This chart depicts members, disciplines, roles, and their involvement.

Some project team members were assigned because they support the production team daily, and are aware of that team’s structure and requirements.

Other members were assigned by management, or selected based on expertise.

All team members attended regular meetings either directly or through teleconferencing for brainstorming and statusing of action items and project needs.

After implementation, project management gathered data, then began briefing stakeholder groups on project results.
Section 5B… The team was prepared to work together through a program-wide, employee involvement based training.

Considered a corporate role model, this 4-Stage training focuses on team formation, building, collaboration, and performance… promoting strong team membership for efficient team operation.
Necessary to fostering respect, creativity, and participation...the training touches on establishing guidelines, expectations, goal setting, measuring results, and learning how to choose and apply quality and lean tools.
Section 5C… The team managed performance and ensured effectiveness by first establishing a project mission statement to maintain focus during discussions.

We created a meeting room with real-time computer access for brainstorming and statusing, providing team members the latest updated information.

We used proven, off-the-shelf project management software for tracking and statusing action items, milestones, and delays in progress.
Accountability meetings to assess risk indicators, then briefed stakeholder groups to expedite constraint mitigation.

We created work-around plans to guarantee continued quality and schedule in case of problems during implementation.

These tools and methods ensured our project goals of developing a safer work environment, lowering cost, and promoting first-time quality by minimizing risks, and optimizing team performance and efficiency.
On behalf of our team, thank you. Are there any questions?