Managing Inspection Data for School Bus Assembly

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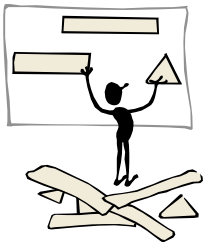
The Situation: A manufacturer of school buses had an abundance of data but too little information about what was happening in their daily assembly operations. In-process inspection during assembly was producing defect reports based on manual checklists. With over 500 inspection points spread through 8 work cells, assembly of as many as 30 buses in a day produced an overwhelming amount of data. The time required to transcribe the data to a summary form was a significant barrier for using data as feedback to drive quality improvement initiatives.

Key Issues: The Company engaged ***DMA Systems*** in order to provide a comprehensive solution that would deliver:

- Automated data recording that would still retain ease of mobility for line inspectors to do their work.
- Standardized data recording that would enable analysis of manufacturing problems.
- Reduced turnaround time for producing a summary for each day's inspections from 30 days to overnight.



Design Sessions: Solution design was a collaborative discovery process with participation from quality management, engineering, IT staff and DMA Systems. The initial objective was to find a way to standardize data recording and reporting. Following an initial pilot evaluation the solution would be deployed to all assembly areas. The following are key requirements determined during the discovery sessions.

1. *Inspectors must retain freedom of movement through the work cell.*
2. *Data recording must be flexible enough to accommodate changes in inspection routines.*
3. *Inspectors must be able to correct recording errors on-the-fly.*
4. *Minimize impact on the existing IT infrastructure.*
5. *Hardware must be rugged enough to withstand operating conditions in a moderately harsh metal fabrication environment.*
6. *No incremental work for IT operations personnel (outsourced).*

In short, the solution had to be self-contained and it had to deliver electronic data recording that was as easy to use as pencil, paper and clipboard.

Solution Highlights

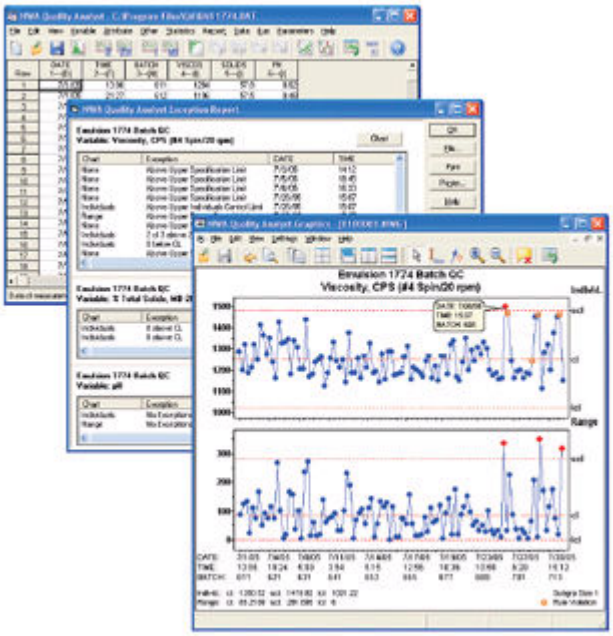
Data Recording: Based on previous work done by the company, defect codes and inspection points were standardized as a set of barcodes. These were sorted into logical groups that corresponded to inspection points associated with each work cell. Barcodes were printed on laminated sheets, which inspectors could carry on a clipboard. Inspectors were equipped with portable data terminals that allowed a mixture of scanned and keypad input. The data terminals were programmed with an easy-to-follow question and answer dialogue that would act as an electronic checklist. Custom interface software was developed in order to manage data extraction from the terminals so that each day's inspection results could easily be uploaded to a central repository on the network.

Reporting: Three levels of standard reports were developed:

- Daily cost-weighted Pareto charts for use in production meetings to highlights specific concerns in each work cell.
- SPC control charts of total defects for evaluation of quality improvements over time.

- Tabulation in Microsoft Excel of defects and part shortages on each bus for management of rework.

Implementation: The system was launched in a single work cell for a 1-month trial period. During that time, inspectors adapted quickly to the new data recording practices and some modifications to the procedure were introduced in order to ensure smooth operation. Pareto charts showing the previous day's top five issues were reviewed in daily production meetings and also posted on bulletin boards in each work cell. Acceptance by factory personnel was high, which, in turn, encouraged implementation of quality improvement measures to reduce overall defect rates. Accessibility of accurate information about part shortages also gave important feedback to material control personnel to assist their supply chain planning. Operation expanded to more than half the work cells in the factory within the first six months of operation.



Real-Time Reporting: As use of the system grew it became evident that requirements for managing rework would drive the turnaround time for inspection data to real time. Although the ideal state would be to eliminate the need for rework altogether, the initial objective was to minimize costs by ensuring that all repairs were carried out before a unit left the work cell. This meant modifying the data recording process in order to:

- Produce a checklist of work to be done so that it could be attached as a traveler on the assembly while it was in the work cell.
- Retain the mobility and ease-of-use of the portable data terminals.

An RF-based recording system would be required. Because of other IT initiatives, the company was planning to deploy computers into each work cell, but overall cost was a concern. As well, the outsourcing arrangement for IT support favoured retaining a self-contained solution that would not require any modification to the network infrastructure.

Simple observation of work patterns in the factory indicated that work cells were U-shaped and inspectors within each cell stayed within roughly 50 feet of a central point. This provided an opportunity to use cordless bar code scanners as the recording device. These were much lower in cost than full RF data terminals and could be interfaced directly to the PC's in the work cells without any special network arrangements. The data recoding dialogue previously developed for the portable data terminals was transferred to an application program running on the PC in the work cell. The computer monitors were located centrally within the cell with the monitors elevated for visibility. Data validation within the program used the screen background colour (Green = OK; Red = Stop) to give feedback if an error was detected. Inspectors could remain mobile and initiate printing of the traveler sheet on completion of their inspection sequence by scanning a special bar code entry on their worksheet.

Benefits: The final design and implementation were a collaborative effort by a cross-functional team of which DMA Systems was an integral part. Highlights of the final implementation include:

- 15 months from initial exploration to full deployment of real time reporting throughout the factory.
- High participation from all business areas affected by the system.
- Reduction in quality reporting turnaround from one month to real time.
- Reduced overall cost of quality through decreases in defect rates and part shortages.

DMA Systems

***Bill Neaves**, principal consultant of DMA Systems, served as solution architect and technology integrator throughout the project. DMA Systems supplied all software components, including custom code. Solution delivery included component technologies from:*

NWA Northwest Analytical The Leader in SPC

symbol The Enterprise Mobility Company™

***DMA Systems Inc**. provides a full range of system integration services for factory floor data collection and analysis. For more information please contact us:*

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