

Historian's Corner

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NOTE: We would like to invite retirees from all Lockheed Martin divisions to consider writing a short article for the Historian's Corner telling about your activities in any of the current member companies. The aerospace industry was in its infancy when many of us entered our careers, and many things were so different from the normal technical, environmental, manufacturing, and financial challenges we faced in previous activities that entirely new perspective and tools were required. As a result, most everyone has had an interesting, or even exciting, event or time that others would enjoy hearing about. After my recent STAR article, I enjoyed hearing from many of my old friends and coworkers who remembered those days - it was great to hear from every one of them. Please share your experiences with us. We will help you put it into final form if you wish. Photos are also desirable.

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Dawn of a New Day - Process Improvements Arrive!

By Bill Cossaboom

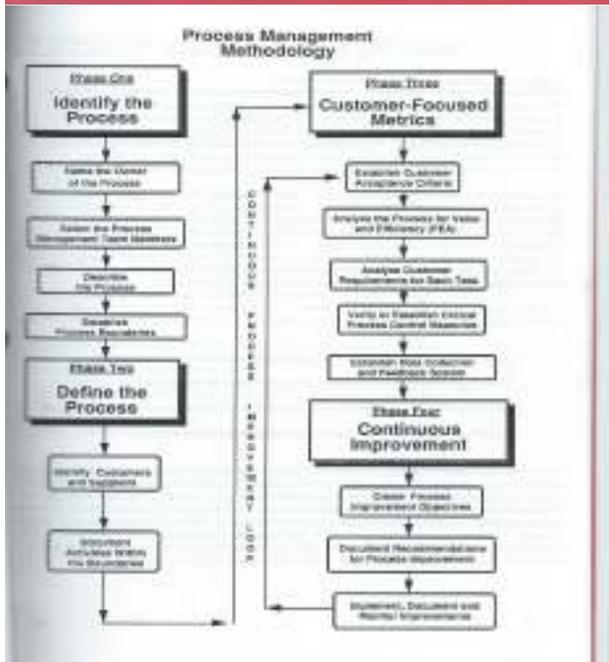
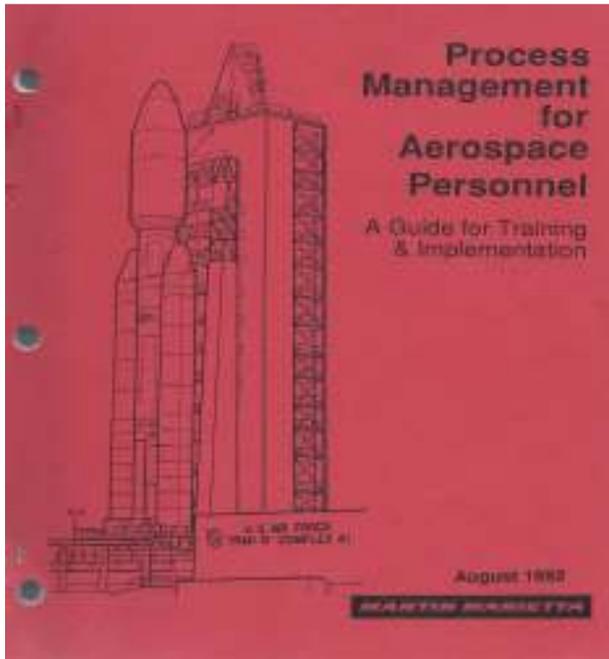
By the end of the 1980's, Space Launch Systems (SLS) was on the verge of entering the 21st Century, thanks to a forward-looking strategic corporation. The embracing then (and now) of process improvement as an overall theme by the corporation has allowed Lockheed Martin to maintain and grow market share to this day - and improvement continues through Kaizen Events, Black belt / Greenbelt activities and other process improvement methodologies. While this article focuses on the beginnings of SLS Quality Assurance improvement activities in the late 1980's and early 1990's, remember that process improvement was embraced and practiced by all organizations within SLS.

At the conclusion of the 1980's, the Quality Assurance practices and processes for Production Operations (Prod. Ops.) were quite different from the organization I had hired into in 1981. I had joined Martin Marietta as an Electrical Inspector 4 in the Second Floor Factory - an area of rigid fixed processes- and by 1988 was an Electrical Quality Engineer (Q.E.). A large component of the change was cultural. The Quality of our goods and services (both external and internal) was no longer the sole 'responsibility' of the quality department, but of every department and employee inputting to the product or service. Organizations began working and communicating with each other real-time, as one common goal became the standard. Concurrent Engineering - the method of Q.E. and all associated departmental stakeholders, working with Engineering Design helped eliminate the 'pass over the wall' approval process for engineering drawings. In those few years, the High Performance Work Team (HPWT) concept and practice became integrated throughout SLS.

Those years, and especially the years 1988-1991 were truly years of re-organization and modernization of how processes were executed. I need also add here, that they were years of great excitement for a young Quality Engineer! We were on the verge of something great, and I hungered to be a contributing part of it.

The first major successful thrust was the adoption in 1988 of a Total Quality Management (TQM) initiative, which focused on employee involvement in their tasks, development of autonomous work teams, continuous process improvement, and a committed management - all of which was measurable. Employees were introduced to the philosophies of such Quality pioneers as Juran, Crosby, and Deming; and introduced to tools such as the Process Flow Chart. Quality Engineers flocked to become members of the American Society for Quality Control (now the American Society for Quality). A notable SLS publication from that period is "Process Management for Aerospace Personnel" (commonly referred to as "The Red Book" - re-issued in 1992) by Martin Marietta's Training Department. The building blocks contained within this manual are still utilized today - such as identifying internal and external customers,

process 'owner', inputs, outputs, identifying process boundaries, documenting process improvement recommendations, creating objectives, and developing a method for measurement.



The "Red Book" cover and a "Red Book" Process Improvement Flow

One of more critical (and best from my point of view at the time) changes for Production Operations was the institution of the 'electronic' MARS (EMARS). MARS, an acronym for the Martin Automatic Reporting System was a paper form (along with the Discrepancy Report) that was used to record hardware non-conformances and their dispositions. The MARS form had five copies. If processed correctly- each copy went *somewhere*, to *someone*, to *some other department!* I remember instructions on the form stated to press hard so that all copies would be legible and to use black ink. We were also instructed to put

'tails' on our S's so that they would not be mistaken for 5's. (I still do that to this day.) I remember getting a bit frustrated because when I pressed hard, the first two or three copies would rip through and the two bottom copies would be perfect! I finally figured out that the paper ripping was because I could only get fine point pens from the departmental cabinet! I started bringing in my own *medium point* pens and things went a lot better! I actually continued that practice until I retired, talk about sustainable process improvement! Although we met on the Factory Floor with some trepidation, all organizations supporting the factory were well trained, and the transition to EMARS really went rather smoothly. A month later, no one could have taken the EMARS away from us!

A significant improvement was made towards inspection requirements, which had at the beginning of the 1980's been focused on in-process manufacturing steps and now shifted to overall product requirements of the final article. For years, the culture had answered corrective actions for non-conformances: 'will add inspection point'.

In the late 1980's-early 1990's, non-valued or redundant inspections were eliminated, necessary inspections were consolidated (where possible) when more than one attribute could be verified by one inspection, inspections that could be verified by test methods were removed from work instructions. The SLS Quality Engineering group was at that time lead by Wendy Adams. Wendy would gather her team together to discuss improvement ideas and the team would adopt accordingly. I remember one Saturday we gathered at our Deer Creek facility with copies of our Manufacturing Processes and began a day's worth of evaluating just where Product Quality Verification Required points needed to be included for maximum product reliability and processing enhancements.

By 1989, Q.E.'s had three significant process improvement areas in their mindset: to provide necessary inspectability to our product, participate with Engineering Design in the establishment of critical characteristics and the dimensioning and tolerancing language which took us from two to three dimensional integrated manufacturing. The Quality Engineering visionary in the field of Geometric Tolerancing (GT) was Dennis Little. Dennis brought the concept to Quality Engineering and conducted many training sessions for all Q.E.'s.

GT in the early 90s described engineering parts and assemblies that accurately expressed the 3-d feature in measurable terms that have a *common definition*. GT continues to be practiced and enhanced as Lockheed Martin currently adapts this valuable tool to interact with 21st Century design methods.

Quality Engineering Material Review Board members began to work with Manufacturing in a program meant to reduce "use as is" and "repair" hardware dispositions, neither disposition contributing to hardware quality or cost effectiveness. This program was successful and was recognized by the customer. In this time period some of the other savings and process streamlining accomplishments were noted:

- Improvement to Wire Line Crimping process,
- Selective inspection of machined barrel sections on the 1st Floor,
- Reduction of heat treat cycle time,
- Coordinated Measuring Machines for 1st Floor Factory.

These were exciting times, as stated previously. I was part of the original HPWT training, which took place in Portland, Oregon. The Wireline team was sent for a week of intensive education in which we gained improvement process skills. I have included a photo of just a few of the process players involved. I can no means mention everyone, but everyone and every discipline was very critical and important in the development of our particular process improvements.



A sampling of Wireline process experts circa 1989.

Back Left to Right: Quality Engineering: The Author, Manufacturing Engineering: Matt Boehm, Wireline Supervisor: John Heslop, Industrial Engineering: Dennis Rushing.

Front Left to Right Technician: unidentified, Technician: Mary Ann Getyl, Technician: Bea Gutierrez, Test: Tammy McCormick.

I am privileged to have been a part of that 'first graduating class and privileged to have worked either for or with real SLS process improvement pioneers.

This article is dedicated to all of you who could open eyes, open minds, and open opportunities during this exciting period: Karen, Dave, Ed, Matt, Irene, Wendy, George, Art, Don, John, Kevin, Cliff, and Dennis. You all know who you are, and all the others who are too numerous to mention.

Thanks for the vision.