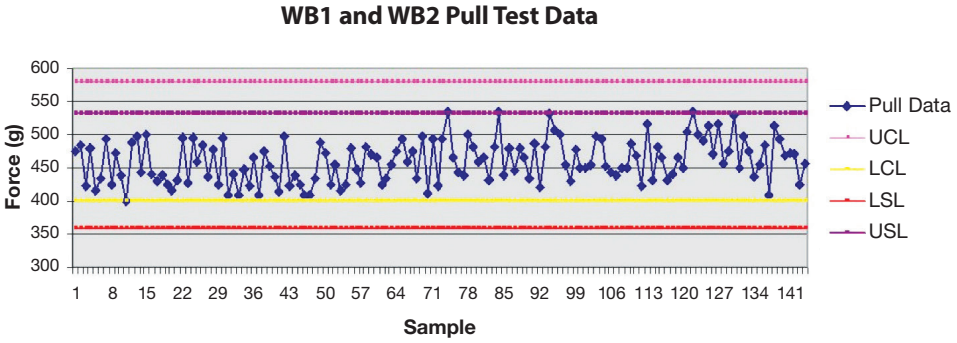
Quality Management Systems in the Microelectronic Assembly Business

William Boyce
SMART Microsystems Ltd.

THERE ARE MANY QUALITY MANAGEMENT systems (QMS) that are used in the microelectronic assembly business, too many to list them all here. AS9100 is for aerospace, IATF for automotive, ISO13485 for medical, ISO17025 for calibration and test labs, just to mention a few. Most of these standards are based on the ISO9001 QMS, and for good reason—ISO 9001 is viewed by most people as the minimum table stakes of good business practice. At SMART Microsystems, we have chosen to be ISO 9001-2015 registered, completing our eigth annual reassessment external audit in November. Although ISO has gone through a lot of changes over the years, the guiding principles are still just plain common sense for the microelectronics assembly business. The seven ISO guiding principles are: customer focus, process approach, continuous improvement, evidence-based decision making, leadership, engagement of people, relationship management.

Customer focus seems like a simple enough concept, but exactly how is it implemented in practice? We like to say that the "voice of the customer" is ever present in the beginning, the end, and everywhere in between in the internal processes of any work being performed. We also reach back to our customers to get feedback on their unique perspective of what they think of the work we have performed for them. We document the feedback and record it for future reference.

The process approach can be as simple or as complicated as we please. ISO 9001 does not dictate how an organization conducts business but requires that one can produce evidence of the process. At SMART we use a simple but effective method of tracking work in process. All work in process at SMART has a "traveler" document with it that contains all of the information needed to complete the work required for that job. This document then becomes a permanent record when the job is complete. In addition, all of the major activities that are customer related have a well-documented process.



SPC data for evidence based decision making.

Document # 12345 — *PROCESS* — **FAILURE MODES AND EFFECTS (PROCESS FMEA)**

____ System
__X__ Subsystem
____ Component

Design Responsibility: Company X — Prepared by: BM
Key Dates: — FMEA Date (rev A): 1/1/2016
Core Team:

Process Step/Function	Requirement	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s) Mechanism(s) of Failure	Controls Prevention	Occur	Controls Detection	Detect	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Actions Taken Completion Date	Sev	Occ	Det	RPN	
Header Assembly																			
Operation 105: Kit Materials	Purpose: Provides all the proper materials for the build	Kitted Wrong wire - Wire too small	Will not bond	4		Inproper marking	Operator training, Process Specs, Machine Set Up/PM's	4	Bonder will not work, rev control software	2	32								
		Kitted Wrong wire - Wire too large	Will not load in wire bonder	1		Improper marking or improper reading by operator	Not able to process	4	Wont feed in equipment	2	8								
		Kitted Wrong wire - wrong material	Will not bond	4		Inproper marking	Operator training, Process Specs, Machine Set Up/PM's	4	Bonder will not work, rev control software	2	32								
		Damaged Sense element	no or weak output	7		Improper handeling	Operator training, Process Specs, Machine Set Up/PM's	3	FFT	3	63								
		Incorrect Number of Parts/Material	Cannot complete build	1		Operator error	Not able to process	1	not able to complete	5	5								
		Wrong Capillary kitted	Will not bond wire properly	5		Improper marking or improper reading by operator	Operator training, Process Specs, Machine Set Up/PM's	3	Pull test	2	30								
		Incorrect adhesive	Will not bond wire properly	6		Improper marking or improper reading by operator	Operator training, Process Specs, Machine Set Up/PM's	3	Inspect	3	54								
Operation 110: Prep Adhesive	Transfer adhesive from primary container to 3cc dispense syringe barrels	Material out of date	Poor adhesion or bondline thickness	7		Incorrect labeling	Scheduled inventory logging	2	Work instructions / traveler	5	70								
			Will not process in dispense	3				5		3	45								
			Does not cure properly	5				5	Final test	3	75								
Operation 115: 100% Incomming Inspection	Purpose: Inspect headers and die before assembly	Rejecting good material	Insufficient materil to complete build	1		Inpropper or insufficient training	Work instructions and training	3	Visual Inspection	8	24								

Example of PFMEA.

Continuous improvement is a major focus of ISO 9001-2015. It is no longer adequate to simply demonstrate what has been done through the year, but also how the organization has improved. What defined steps the organization is taking to improve. In our case, we conduct regular quality training of the entire staff to continuously improve our implementation of the QMS. We also perform regularly scheduled reviews of our processes and customer feedback at our scheduled management review meetings.

Evidence-based decision making is a process like any other. It takes a certain level of organizational discipline to establish and maintain the process. There are a lot of tools that are available to facilitate the effort, like DFMEA, PFMEA, SPC, design reviews, and

DOE. We use all of these tools and some others, on a regular basis, to bring quantitative data to the decision-making process. The microelectronics assembly business is a very technical and detail-oriented business, so tools like a FMEA and DOE are a natural fit. Over time, these tools have become a staple of our business, it just so happens that they also fit the ISO evidence-based decision making model.

Leadership, engagement of people, and relationship management are all basic requirements of good and effective leadership in any business. In the new ISO 9001 standard there is a very real focus on the engagement of management. In fact, the quality representative position in an organization has been eliminated in the new standard. This is driving action and engagement to higher levels in the organization. This means that the executive level manager in the organization can no longer just push the requirements on to the quality representative, they must be engaged. This approach fosters a top-down effect that demonstrates to everyone in the organization that the top management is quality centric, and has real buy-in. I think that we can all agree that this is good for any organization.

When most people that have been in business for some time think of ISO compliance, they think of a lot of meaningless

paperwork and painful audits. But this is quite simply not the case, because the current ISO compliance does not dictate the method you use, only the results. Having just completed our annual registration reassessment audit with no findings, we often get the question "how do you do that?". The answer is actually quite simple. As a microelectronics assembly business, we were ISO compliant long before we achieved ISO registration. In fact, internally as an organization, our audits are a non-event because nothing changes, and no special preparation is required by the staff. We simply keep doing those things we have been doing all along. So, if your organization is doing all of the things that are required to be a good and customer focused business, you are already ISO compliant, so why not get credit for it and achieve registration. At SMART we use ISO registered suppliers, and we love to have ISO registered customers.

For more information about SMART services visit smartmicrosystems.com.

William Boyce is the Engineering Manager at SMART Microsystems. He has served in senior engineering roles over the last 19 years with accomplishments that include manufactured automotive sensors. He is certified in EIT and Six Sigma Green Belt and is an industry recognized expert in Al wire bonding. Additionally, he designed and led the metrology lab and machine shop at Sensata. Mr. Boyce earned a Bachelor of Science in Engineering degree from the University of Rhode Island and has been a member of the IMAPS New England Chapter for over 15 years.

SMART Microsystems Ltd.
141 Innovation Drive
Elyria, Ohio 44035

Telephone: 440-366-4203
info@smartmicrosystems.com
www.smartmicrosystems.com

SMART MICROSYSTEMS™