How to integrate FMEA, Control Planning and SPC

By M. Schaeffers

Quality systems like TS 16949 and six sigma require the use of FMEA and SPC. Many text books and consultants advocate the use of these techniques to control and improve processes. Hardly any text book explains how FMEA, Control Planning and SPC can be logically integrated and how to setup these different techniques in an efficient and effective way to get the best of both world without large amounts of engineering time to support these methods.
In this article we will make an attempt to explain how you can setup FMEA, Control Planning and SPC in an efficient and effective way.

In this article we will use the simulation of the tennis ball launcher to explain how FMEA, Control Planning and SPC come together in DataLyzer. The tennis ball launcher fires tennis balls and this process can have special causes of variation influencing the result.

DataLyzer FMEA and Control Plan

The start of process improvement is creating the flow chart and FMEA for the process. Because we only have one process step we don't show the flow chart. The FMEA for the process is shown in figure 1.

Product No: Example tennis ball launcher - Rev 1 (Draft)

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Process Step / Function	Requirement	Potential Failure Mode	Potential Effect(s) of Failure	SEV	CLASS	Potential Cause(s) / of Failure	Current Process: Controls Prevention	OCC	Current Process: Controls Detection	DET	RPN	Recommended Action	Responsibility / Target Completion Date
010 / Fire Launcher	Balls should be on target	Too much variation between shots	Tennis lesson not effective, no way to proceed with lesson	8		Debris on the floor	Cleaning	4	SPC	5	160	Change cleaning procedure	Marc Schaeffers 8-9-2011
		Average incorrect	Adjustments required during lessons making customer unhappy	3		Temperature change		3	SPC	5	45		
						Supplier of balls changed		5	SPC	5	75		
						Spring is wearing and requires maintenance	Maintenance	3	SPC	5	45		

Figure 1: FMEA of tennis ball launcher

In the FMEA we see that there are 4 causes of problems given in the FMEA. Debris on the floor, temperature change, supplier of balls and wear of the spring. Actions can be taken to reduce critical RPN numbers. The FMEA in this screen can be linked to a control plan. In the control plan we establish what we need to control on the shop floor, how we control it and what actions we need to take in case the process is out of control.
In figure 2 we see the control plan for this process

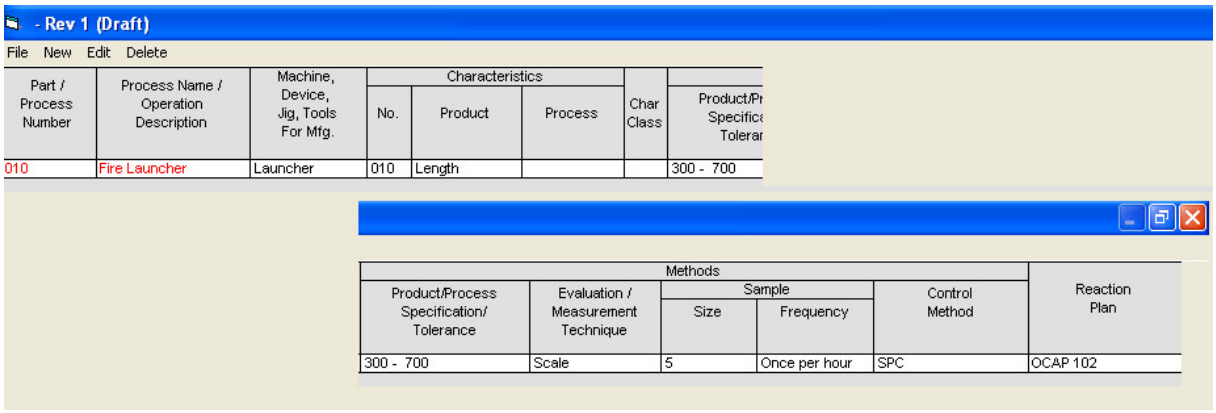

Figure 2: Control Plan for launcher process.

The problem with a control plan is that there is not always a lot of room for all information you like to have available on the shop floor for example you like to have more detailed instructions for the operators and you need to establish reasonable limits to avoid data entry mistakes.

So you need to have a link between the control plan and the SPC setup.

This is shown in figure 3.

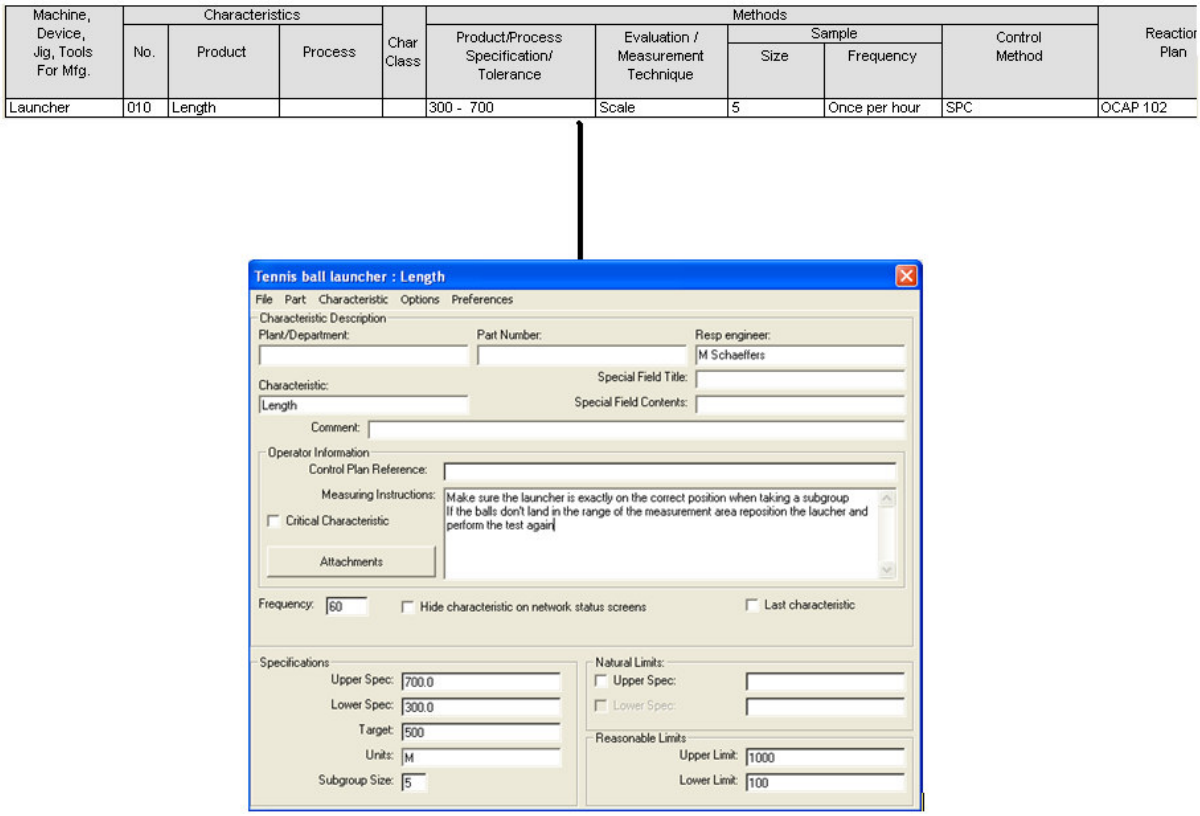

Figure 3: Relation between Control Plan and SPC chart setup

The field reaction plan in the Control Plan is referring to what actions should be taken to correct the process and make sure incorrect products are reworked or rejected. A reaction plan is also often referred to as an out of control action plan (OCAP). Again there is not much space in the control plan to include the full reaction plan so often a reference is made to

another document.

The most effective reaction plan is an OCAP in a flow chart format. An example is given in figure 4.

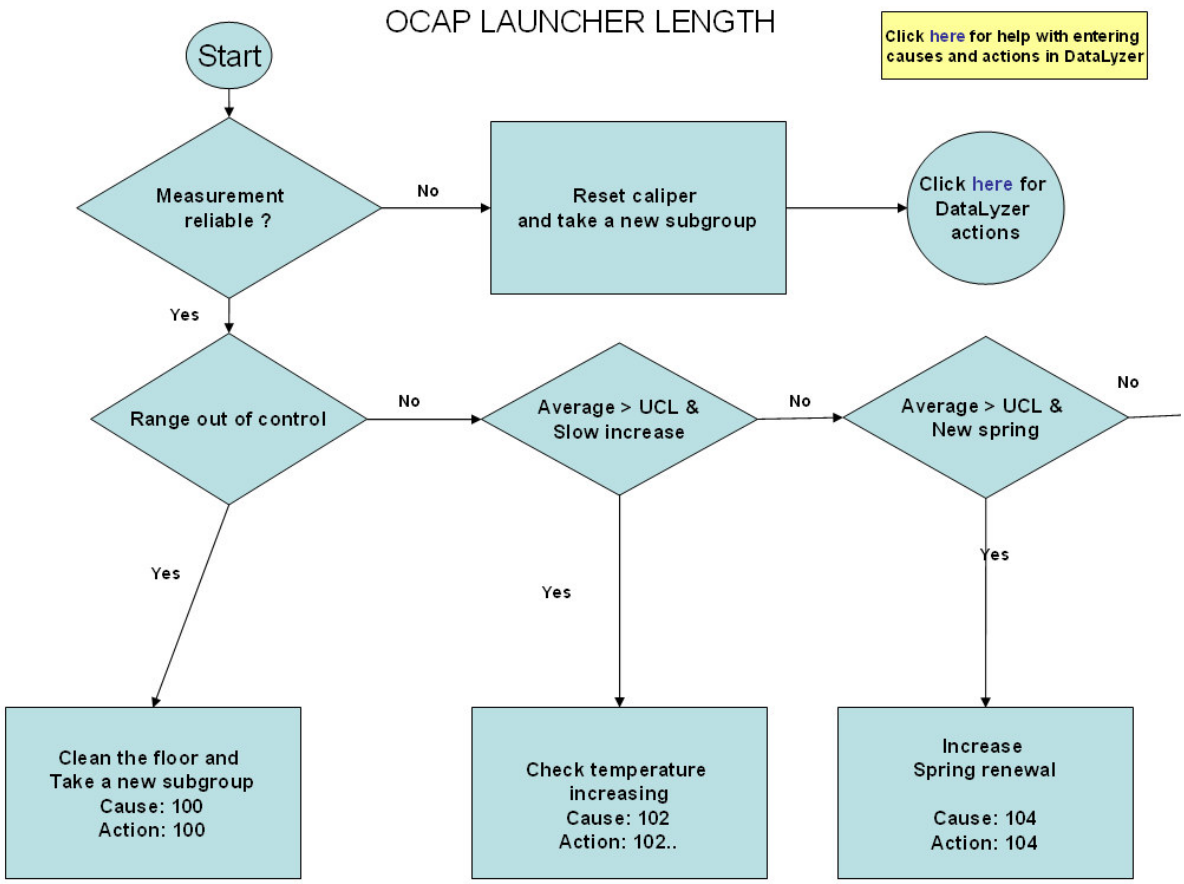

Figure 4: Out of control action plan Launcher

This OCAP gives the operator clear instructions what to do in case of an out of control. In the Control Plan we need to refer to this flow chart by indicating the document number – in this example OCAP 102. So it is important the OCAP document is instantly available in case of an out of control. This is done by linking the OCAP document to the out of control operator window (see figure 5) in the SPC system.

DataLyzer SPC

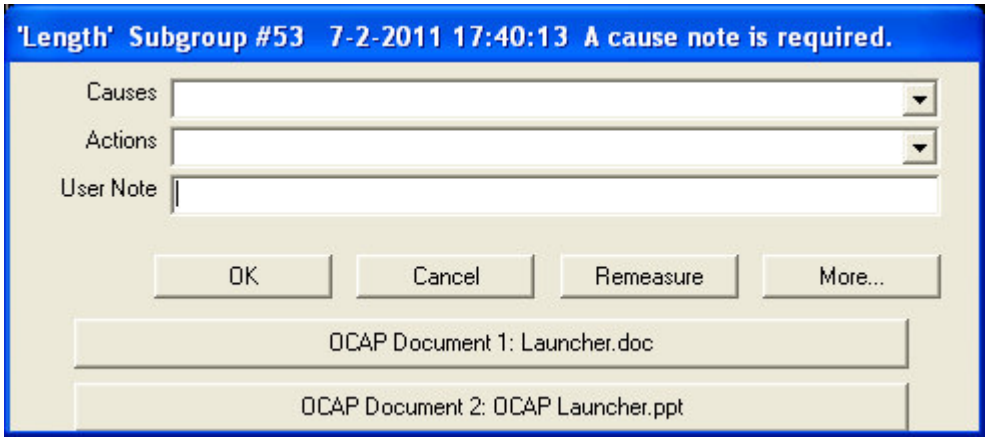

Figure 5: Out of control operator window

What you clearly see that in the OCAP document that for every step where you exit the OCAP flow chart you see a reference to a cause- and actionnumber. These numbers are available in the out of control window and must be selected by the employee handling the out of control. This is shown in figure 6.

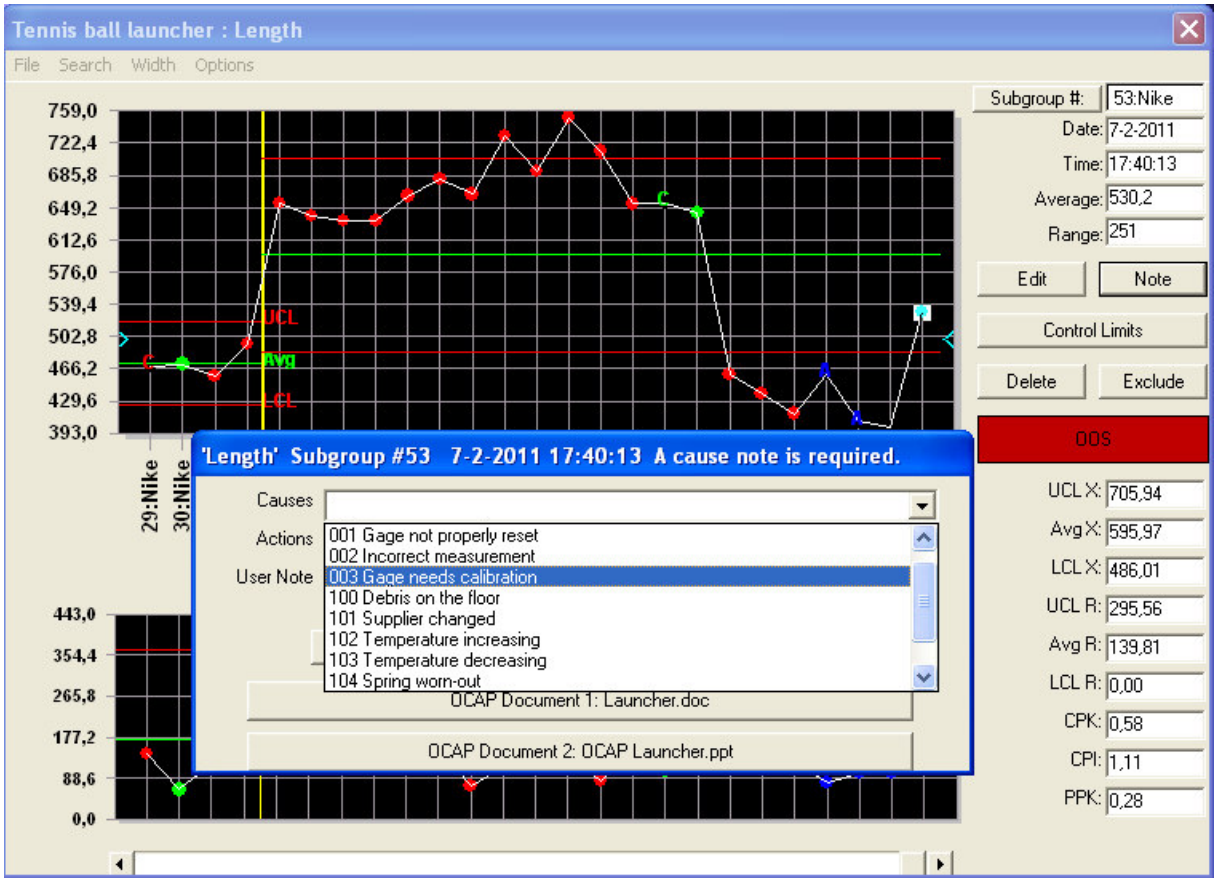

Figure 6: Handling out of control according to OCAP in DataLyzer

So when a subgroup is out of control the operator can view the OCAP, find the cause of the out of control and take the correct action and register the applicable cause and action.

In some cases problems will appear which have not been included in the FMEA and Control Plan process. In our example process the operator faced a problem that a door was open and the wind was severely impacting the process. The chart was out of control and the operator could not select the corresponding cause in the OCAP document.
In that case the operator can make a note in DataLyzer like shown in figure 6.

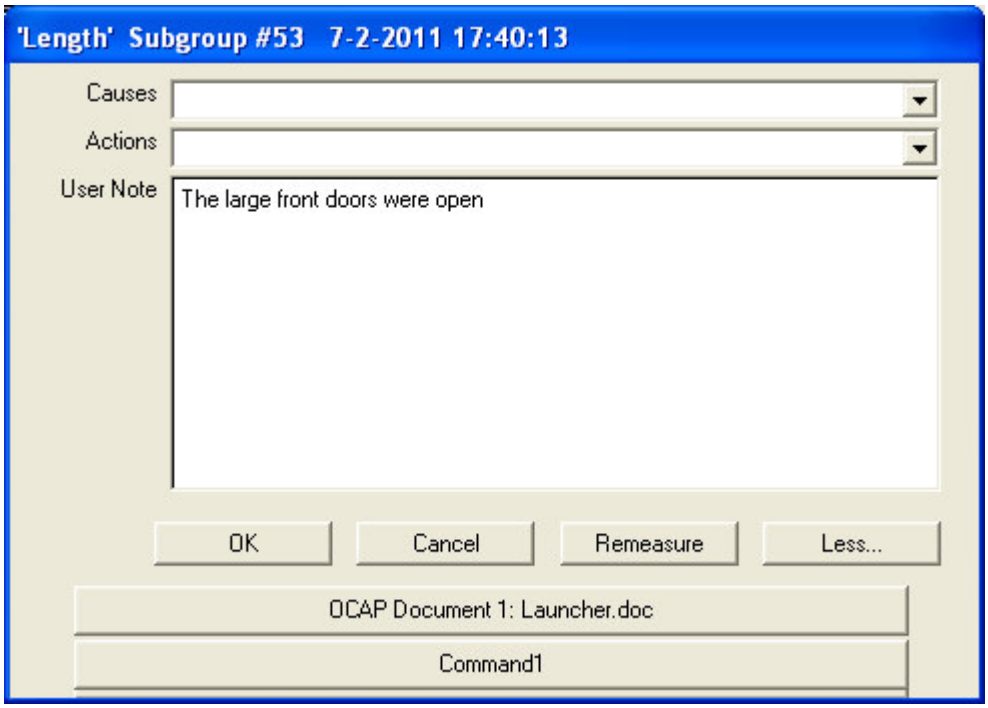

Figure 5: Example of free form note if the cause list is not providing the exact cause

For engineers a free form note indicates a situation which has not been foreseen in the FMEA and Control Plan process. If required the FMEA and Control Plan can be adjusted making FMEA and Control Plan a truly living document. Of course engineers can see lists of free from notes per characteristic defined in the control plan.

Final remarks

The examples explained in this document are created with the standard software DataLyzer Spectrum and DataLyzer FMEA. Flow charts can be created with several program like Powerpoint of Microsoft Visio. Flow chart documents can be linked to the DataLyzer modules.