Hi There, Martin Shaw of Reliability Solutions here

You may remember my blog at start of last year on Holistic Reliability, let me remind you where the term originates and how we progressed during 2017;
Holistic *'is a belief that the parts of something are intimately interconnected and explicable only by reference to the whole'*
Throughout the last year Reliability Solutions have continued to develop the holistic model with many different customers and have presented it at several independent conferences where it has been extremely well received as a very interesting approach that resonates with engineers

Why do we need this model?

It is very difficult to now make realistic Reliability predictions from limited sample testing as field failure rate targets are so low with today's technology that representative statistical testing is rarely possible. Using simulation models NEVER gives an accurate prediction that will correlate strongly with actual field failure data and testing is commonly not capable of stimulating sufficient 'real' defects, hence we need an alternate approach

When and who can use the model

It is advisable the Holistic model is applied from earliest possible step in the design cycle in order that each factor can be measured as it is completed and hence a 'running' of 'fluid' score is available throughout the design phase and into pilot or initial mass production, at which stage the final scores are input. Project Managers make excellent use of this tool to monitor how each group is performing (Design Product Eng, Test Eng, Quality, etc.) and the effect of their work is obvious from each factor scoring. It is very clear if the product score is sufficiently high at early stage of using the model, hence the teams performing poorest can get the required focus to ensure improvements made EARLY that will enhance product in later stage of development cycle.
Finally a score at the end point before moving into full blown mass production is available to truly judge how well this product will perform in manufacture and in the field

Holistic Model Background

It has always been the case there are a range of contributing factors that have a direct effect on product reliability , the trick is in finding a way to bring together these *'intimately interconnected'* factors or parts which come together to affect the *'whole'* product

Reliability Solutions are now in a very strong position to start releasing the holistic model and how to develop it in such a way it will have direct representation and relation to the end product reliability and also quality levels.
This is an exciting time as we start to apply the solution model which companies have been waiting on for many years, though they never actually realised it, **up until now that is !!**

How would your company develop their unique holistic model to drive World Class Reliability?

1. Must look critically at your product and define the key elements that guarantee customer satisfaction
    a. This may be function, appearance, durability, feel, ease of operation, etc.

2. Set out the methods to achieve your objectives which can assist the developer or manufacturer to achieve their goals

    a. This could be how to ensure consistency in manufacture with near perfect tolerance matching
    b. Ensuring manufacturing capability is high enough to guarantee high volume production with maximum yield
    c. Minimising opportunity for Early Life defect escapes to the field
    d. Etc.

3. Defining the tools available to support achievement of the objectives within short life cycles

    a. Perhaps a modified and Effective DFMEA
    b. A faster and more effective form of Accelerated Reliability Testing
    c. A strong Design Quality test approach to mix function with stress and Maximise defect detectability levels
    d. A detailed manufacturing readiness review method to ensure a pragmatic and objective approach to internal critical assessment
    e. Contract Manufacturer detailed process review which is NOT an old fashioned style of Quality audit which adds little value

4. Map out the product and set up a method to apply the selected and necessary tools in an organised manner with a weighted scoring approach which relates directly to the contribution each tool can make in achieving your objectives of World Class Quality and Reliability;

    a. Design for Assembly review following a detailed approach developed from lessons learned and product analysis will have significant effect on a low cost high volume product which requires error free easy assembly
    b. Design Quality testing and Design Maturity measurement will greatly enhance the reliability of a complex product with wide range of operational capability
    c. Mould Tool readiness review will be important when manufacturing products with moulded covers or plastic clipping covers to monitor and manage final tool acceptance that produces tight tolerance parts

5. Decide on how to measure each factor;

    a. Design Quality would have a % Design Maturity measurement
    b. Design for Assembly will be a % rating score
    c. Early Life Reliability Testing will be rated on no. of defects detected (if for example 0, would gain maximum 100% score)
    d. Set targets for initial Mass Production yield levels and score this factor related to yield targets
    e. Etc.

As an example, let us consider the FMEA scoring model (applicable for DFMEA and PFMEA) which works well to score this factor

RPN Groupings	99	199	299	399	499	599	699	799	899	999
Qty Issues	45	5	8	1	5	4	0	4	0	0
Total Grouping Scores		50		9		9				4
Score Scaling (Weight)		2		8		32				128
Adjusted Group Scoring		100		72		288				512
								Tot RPN Score		972

Score Rules				
>900	0	0%	2 Low affect	
801-900	0.25	25%	8 Medium affect	
601-800	0.5	50%	32 High affect	
501-600	0.75	75%	128 Severe affect	
<500	1	100%		

In the above scoring model, FMEA is performed as normal and RPN levels calculated for each possible issue are grouped as above into 4 different categories which have score scaling applied in relation to seriousness of the issues as defined by RPN calculations

Score Rules are then used to assess what % of the FMEA weighted score (ref point 4. Of this document) is achieved
In the example above we can see an overall FMEA score of ‘972’ which falls into the category of >900, hence a ‘0’ score which when multiplied by the FMEA weighted score (could be 10% for example) will obviously provide a ‘0’ overall Nett Score

6. Pull the Holistic Reliability scoring table together, dependent on product type and the assessment factors which are regarded as most appropriate, an example with range of key factors is shown below;

NEW PRODUCT HOLISTIC RELIABILITY SCORING MODEL — **Scoring Matrix Targets**

Key Measures / Review Points	Max Score	% Score / Weighting	Actual Score	
1. DFMEA				*DFMEA Scoring*
Prototype	7	1	**7**	>900=0, 801-900=0.25, 601-800=0.5, 501-600=0.75, <500=1
Final Design Level	3	1	**3**	>900=0, 801-900=0.25, 601-800=0.5, 501-600=0.75, <500=2
Note - Scores achieved from RPN summaries in DFMEA report				
2. Product Lvl DFM/DFA				
Prototype	7	100	**7**	Output % scores from DFA will be available, use as report
Final Design Level	3	92	**2.76**	
			0	
Note - Scores achieved from DFMA Report Score				
3. PFMEA				*PFMEA Scoring*
Final design Level	7	1	**7**	>900=0, 801-900=0.25, 601-800=0.5, 501-600=0.75, <500=1
MP Trial	3	1	**3**	>900=0, 801-900=0.25, 601-800=0.5, 501-600=0.75, <500=2
Note - Scores achieved from RPN summaries in PFMEA report				
4. PCBA DFSS (DESIGN FOR SIX SIGMA)				
CAD Design level	7	75	**5.25**	Output % scores from DFSS will be available, use as report
Pre Production	3	95	**2.85**	Output % scores from DFSS will be available, use as report
Note - Scores achieved from DFSS Report Score				
5. Gross Design Maturity (DQ compliance testing / RD)				
Product Realization	12	89	**10.68**	Take % Design Maturity levels from DQA Test output
MP Trial	8	98	**7.84**	Take % Design Maturity levels from DQA Test output

As mentioned earlier, the maximum scores are allocated against each key measurement point with the appropriate weighting applied which can be the direct % score from the test / assessment such as Design Maturity or Design for Assembly (DFA) or it can be from a score that is measured against a relative target (DFMEA for example)
The complexity of the product will determine how many factors are used in the Holistic matrix and can often run up to 12 individual key items

7. Develop the complete scoring model which truly reflects the needs of your product type and a comprehensive Holistic Scoring model is now ready to use

Where Next??

Throughout the remainder of 2018 Martin Shaw will provide detailed examples of how to actually set up scoring of each factor in order you can build up your own unique model within your company. A webinar presentation will be available in February with ongoing material sent out each month to help you grow your own model