AS13100 / RM13004 PROCESS FMEA WEBINAR

Application of RM13004 in a Complex Assembly Environment

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Questions & Answers

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Overview

The AESQ RM13004 Subject Matter Interest Group held a Webinar that focused on the application of the AS13100 Requirements and RM13004 Process FMEA Guidance document in a complex assembly environment, in our case Rolle-Royce Civil Large Engine Assembly & Test.

In total over 500 people registered for the event, from over 200 organisations in 34 countries.

A copy of the Webinar has been recorded and is available from the AESQ website at https://aesq.sae-itc.com/past-events

The following questions were asked during this Webinar session using the chat function.

The answers included here are the views of Rolls-Royce but I would hope also representative of the AESQ member companies.

If you have any further questions or require clarification on anything covered in the webinar then you can contact the RM13004 Defect Prevention Toolkit Subject Matter Interest Group at https://aesq.sae-itc.com/defect-prevention or join the RM13004 Community of Practice on LinkedIn at https://www.linkedin.com/groups/9044623/

You may also find further information about AESQ's PFMEA approach by downloading RM13004 Reference Manual (https://aesq.sae-itc.com/defect-prevention) or by viewing other recorded Webinars (https://aesq.sae-itc.com/past-events) on the AESQ website.

Thank you for showing an interest in this very important defect prevention quality tool. If there are any topics of particular interest, then please contact us using the links above.

Regards

Quality Executive
Rolls-Royce Civil Aerospace
Assembly & Test

March 23rd 2024

Questions and Answers

Question 1: Would you use a Human Factors FMEA format against a particular process?

We have found that the most useful way to apply a Human Factors FMEA is in a particular area where the environment is similar for everyone. This can be a manual assembly area or an office such as design or certification office.

In practice this has been in a work area where everyone is doing the same or similar task e.g. inspection, engine module assembly, engine testing, etc. When defining an area to apply it the following points were helpful;

- Tasks are similar (physical and mental demands)
- Pressure / focus on delivery or quality
- Environment (layout, noise, lighting)

The Webinar and Presentation material for 'Using an FMEA Approach to Reducing the Human Error Zone - May 18, 2023' is available on the AESQ website for a more detailed explanation that you may find useful. Follow this link https://aesq.sae-itc.com/past-events

Question 2: Human Factors risk needs to be shared with process designers to eliminate human variability to process success

We agree. There are many opportunities to mitigate the effects of 'the dirty dozen' through good workplace design and ergonomics.

Process designers need to be well educated in the fundamentals of Human Factors and how their effects can be mitigated.

Question 3: How do you reduce cell phone use and employee conversations?

Cell phone use has become a major issue over the years for many organisations. Having a clearly defined policy for not allowing personal belongings into the work area because of the FOD risk or ITAR controls is how some companies have done it.

Employee conversations on the other hand rely on good supervision and clear rules on what is acceptable. Again process / workplace design for critical operations can influence the environment to avoid the effects of distractions due to employee interactions.

Conversations to engage the teams on why these things are important and how they can link to Product Safety and Quality, as well as Health & Safety risks is important too.

An answer from an attendee during the session:

Shouldn't allow cellphones at all ITAR comes into play, remember?

Question 4: When rolling out HM (Human Factors) across our company, should we be completing a HF PFMEA in all areas from Goods-in to despatch?

It is our opinion that that approach would be useful as each area has its own challenges and will have different HF risks that need to be mitigated.

It is not a mandated requirement from AESQ AS13100 however but a good practice that we have found very useful in Rolls-Royce. We are sharing it via AESQ because we believe that others may benefit from the approach.

Question 5: Is AESQ reviewing option for reverse FMEA standard in future?, (similar to this concept)

No, there are no plans at present to develop guidance around this topic.

Question 6: Have you benchmarked against defect reduction in a high-end silicon chip factory? Defectivity reduction efforts are manic as defects drive yield and reliability. I am not sure how much this has been driven by FMEA.

No we have not but would be interested to hear from anyone who has.

Question 7: Does a good fmea lead to a better control plan for key characteristics?

Absolutely. There is a clear link between the risk profile identified from the Process FMEA to what needs to be controlled in the process (Control Plan). It also helps prioritise key process controls (key characteristics).

Often these include only those characteristics identified by Design during the DFMEA but we have found that a good PFMEA will also identify critical processes that need the same level of control due to their potential impact on product safety.

You can find more information on the links between the PFMEA, Control Plan and Key Characteristics in RM13004 or the RM13004 Process FMEA Webinars from 2021. Simply follow this link https://aesq.sae-itc.com/past-events

Question 8: What do we do when the representative accessing your PFMEA does not agree with what we think, and wants us to just enter what he tells on the forms? This is not how this should work, is it? Just to clear this up, this is a customer representative who tells us to enter what he seems correct on the PFMEA documentation, not really knowing our processes.

It is difficult for me to answer this as I am not familiar with the example under discussion. Provided that the Process FMEA has met the requirements from AS13100 Chapter C and is in line with the guidance from RM13004 then the PFMEA should be acceptable to any AESQ representative.

You can contact the AESQ RM13004 Subject Matter Interest Group if you wish to discuss this issue further. I would be happy to provide an objective view of the PFMEA and how it matches the expectations of AS13100 and RM13004.

I know that we still have work to do to get everyone in our own organisations up to the required standard in order to get better consistency in interpretation of the standards.

Question 9: I don't really understand how you are using the human factor in the PFMEA?

I am sorry about that. We only intended to show a short example of how to manage 'operator error' in an assembly PFMEA. However, there is a more detailed explanation available from our 2023 Webinar that Steve and I led.

The Webinar and Presentation material for 'Using an FMEA Approach to Reducing the Human Error Zone - May 18, 2023' is available on the AESQ website for a more detailed explanation that you may find useful. Follow this link https://aesq.sae-itc.com/past-events

Question 10: how many times did you dedicate to complete "robust" version of PFMEA at RR?

We have been driving the AS13004 / RM13004 approach in Rolls-Royce since its launch in 2017, and to be honest even before that in some areas as this was how we have done our PFMEAs since 2010(ish).

We have hundreds of examples, both from within RR operations and our external supply chain where the robust application of RM13004 has resulted in zero defects at product launch.

Some of these successes have been showcased in our Supplier Forums (including Tokyo (2018), Hartford (2019) and Toulouse (2019) to name a few). The materials for these presentations is available from the AESQ on the ‘Past Events’ webpage.

Question 11: Is it required to have a separate Human Factor FMEA ?

It is not a requirement of AS13100 or RM13004 to have a separate HF FMEA. We have provided our experience of using it as we thought it may be useful for some other organisations.

We would strongly recommend that you do not try to include the Human Factor considerations into a Product Process FMEA as described in AS13100 / RM13004 as it will create a significant amount of additional line items which, in our opinion, will not add any value.

Question 12: How can we reduce the high RPN numbers on the PFMEA? what is the standard practice?

There is now improved guidance on how this should be done, including the use of Action Priority Grids, in the latest version of RM13004 published in January 2024.

Question 13: Have you any insight as to how you can help adoption of pFMEA in the operations space; where the shop provide pull to a live document - my experience is that it remains in the ME space

See Question 14 answer.

Question 14: How can we increase cross-functional engagement in PFMEA sessions?

The key to this, in my experience, is that the support functions need to be trained in FMEA and it should be made clear what their role is and the value that they will bring to the conversation.

For example we have found that by bringing in the fitters or quality engineers to discuss the process with Manufacturing Engineering using the FMEA structure creates valuable insights that would not otherwise be identified. Having sat in many of these meetings it tends to happen quite naturally and having experienced it you would not go back to a pure engineering PFMEA creation process.

For the Operators / fitters the value they get is to get the problems they see everyday recognised and documented in the PFMEA along with the opportunity to suggest improvements to the process. In many case the issues were not new and had been raised previously but now with the RPN ratings they may find that they are prioritised for improvement.

Harj had many examples of this when working directly with the fitters on the shop floor when developing the PFMEA in Rolls-Royce.

Question 15: Do you apply MBSE in your assignment of manufacturing risk to say key functional or technical performance measures?

I apologize but I am not sure what you mean by MBSE. Could you contact us and clarify?

https://aesq.sae-itc.com/defect-prevention

Question 16: Is it a requirement per the AS13100 to have PFMEA in place or is this more of a smart move to prevent issues for happening in the first place?

Having a robust Process FMEA in place for is a clear requirement of AS13100 (see Chapter C Section 21.4).

It is mandated for New Product Introduction, Design and Process Changes as well as for Source Changes that are managed through APQP/PPAP.

It is not intended to be applied retrospectively unless there are major quality issues where it's use may be valuable.

Question 17: Is there a process around asking permission to implement a poke-yoke on parts that are produced and assembled at a sub-tier? For example QN raised for misalignment internally, fix available but, need customer permission to change part from Drawing to remove potential failure mode. DAR?

If it is a product design change then I would imagine for most cases customer approval would be required. It is crucial in these cases that a business case can be created to help the customer evaluate the benefit of approving such changes.

Question 18: Would RR supply the DFMEA?

No we would not provide a DFMEA document for several reasons, including Intellectual Property, etc.

As described in RM13004 (severity rating notes), the DFMEA may not be able to provide the insight required by the PFMEA team to determine the potential effects or severity rating in any case. It is more useful as a reference for the Design Engineer to provide an interpretation of the data in the DFMEA to answer the questions for the PFMEA team.

Question 19: In 2016 on the Zero Defects roll out training, it was stated that engineers would be available to identify what the real effect and severity of a potential failure mode was! would this still be the case?

Yes, that is still the intent although I know for certain suppliers it has proven difficult to get the access to the right design resource.

Question 20: Are there contacts within RR who can be contacted for PFMEA support?

In the first instance the supplier should contact their assigned Manufacturing Engineer or Supplier Management Representative.

Question 21: Do you use any particular software to manage your PFMEA documents?

In Rolls-Royce we use Reliasoft xFMEA software for both Design and Process FMEA. See the upcoming AESQ Webinar for more details on how it is used within RR https://aesq.sae-itc.com/events

Question 22: Is PFMEA more for new products as opposed to legacy products? Should it be implemented for legacy products?

The best time to do a PFMEA is as part of the New Product Introduction (APQP). The outputs may influence the process design so we want to do it before we spend any money.

Legacy products may get picked up though when there is a product (design) or process change that the customer requires you to control through APQP/PPAP. Source changes

are another scenario where APQP/PPAP may be used to control the change on a legacy part and hence a PFMEA will be required.

Question 23: After using Reliasoft software, did you manage to avoid any mis-alignment issues between PFMEA and Control plans?

In Rolls-Royce, we have not found any issues. We have set up xFMEA so we can create the Control Plan directly from the PFMEA with minimal intervention.

Question 24: How do we explain our process and submit a successful PFMEA when the customer representative does not want to learn our process and wants us only to enter what he thinks is correct? I don't believe this is the correct way to do this, but if we don't do this, our PFMEA will not be accepted by customer and we cannot ship produced parts.

See Question 8.

Question 25: Just would like to clarify on the PFMEA Template, For AS13004 What is the RPN value that does not require Corrective Action? I saw some value on the beginning, is it the value need to follow across the board?

See Question 12.

Question 26: Do you think the development of a relevant PFD is a good way to develop your CFT?

Yes indeed. The Cross Functional Team (CFT) should be used throughout the APQP / PPAP process and not just for the deployment of key tools such as PFMEA, etc.

We have found that it is a common mistake that many organizations miss out on the deployment of a suitably trained and experienced CFT when deploying these tools.

Question 27: I have been asked on occasions to update PFMEA for issues related to repair activities (parts returned from service), is that normal practice?

It is not something that is in the scope of AS13100 / RM13004 as we are focussed on new product manufacture but I can see that there is benefit to using this approach for service and repair processes too (but I am biased).