16.63 Assignment 8

Failure Modes and Effects Analysis: Roller coaster car design

While discussing the progress of your Fault Tree Analysis with Disney, you mention the differences between FTA and FMEA. The project management is intrigued by this, and believes FMEA might be a better approach. In fact, they decided that your next task is to perform a FMEA on the same design you chose for FTA. To facilitate a reasonable comparison, project management expects a FMEA worksheet that includes at least 4 different components of the roller coaster car design and at least 5 total failure modes analyzed. In your report they also expect a brief comparison between your FTA and FMEA results, including comments on relative time required and accident scenarios or outcomes that were easily captured in one but not the other.

Since the qualitative FTA study began, the project management has received criticism from other Disney departments who believe that quantitative methods (quantitative FTA, quantitative event trees, PRA, etc.) are much more appropriate and comprehensive. From a management decision-making perspective, the other departments also appreciate how easy quantitative results are to use. If the overall number is less than or equal to the desired probability of injury/death, then the engineering effort is sufficient and can be approved. Otherwise, further engineering is necessary until the desired probability reflects an "acceptable risk". They believe that safety is best enforced by relying on the clear and precise probabilities that are provided with quantitative methods.

In a conference call the managers overseeing your pilot study said they expect a response to this criticism in your report. They admit to being ill-informed on this issue and haven't formed an opinion yet, especially since there are still other departments that argue against quantitative methods and claim they are inappropriate, require too many unwarranted assumptions, and can lead to overconfidence. Your project management wants to hear your position so they can make an informed decision on the matter. You can respond however you wish, but at a minimum you must explain the major strengths/weaknesses of each and you must make a specific actionable recommendation about how management should proceed with the limited resources available. For example, you may:

- Agree with the criticism and amend your analyses to be quantitative
- Agree with the criticism and detail exactly how to obtain the numerical data needed
- Argue against any quantification
- Suggest other areas in which the engineering resources would be better spent (and argue why that adds more value than quantification)
- Propose and justify some other action

Resources

As before, you are encouraged to seek and use any information you can find online for this assignment. Of course, you should cite any resources used.

Deliverables

The following deliverables must be submitted for this pilot study

- Word document
    - 3-4 pages single spaced
    - FMEA worksheet
        - Include at least 4 components
        - Include at least 5 failure modes total
    - Written text describing your FMEA (about ½ to 1 page)
        - Describe at least 2 plausible accident scenarios
        - Compare FMEA results with FTA results
            - Time required
            - Scenarios easily captured in one but not the other, vice versa
    - Response about qualitative/quantitative criticism (about 1 page)
        - Explain the strengths and limitations
        - Make a specific actionable recommendation
        - Justify your recommendation
- Powerpoint presentation
    - ~5-10 minutes
    - Explain part of your FMEA worksheet (include 2 components)
    - Compare / contrast FMEA vs. FTA results
    - Summarize your response to management

16.63J / ESD.03J System Safety
Fall 2012