

ME 1110 – Engineering Practice 1

Engineering Drawing and Design - Lecture 19

Failure Mode and Effects Analysis FMEA

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www.staff.city.ac.uk/~ra600/intro.htm

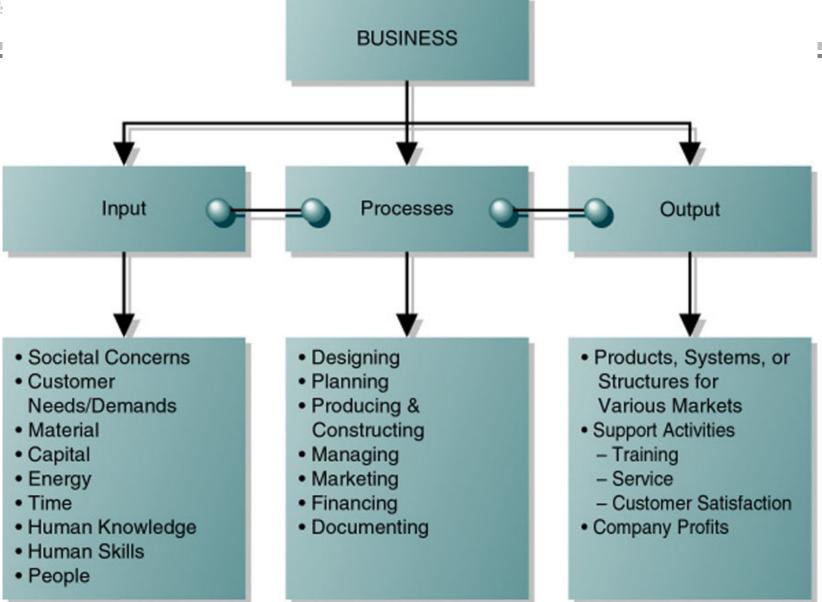




Objectives for today

 Lear FMEA – one of the methods for assessing potential failure and their effects

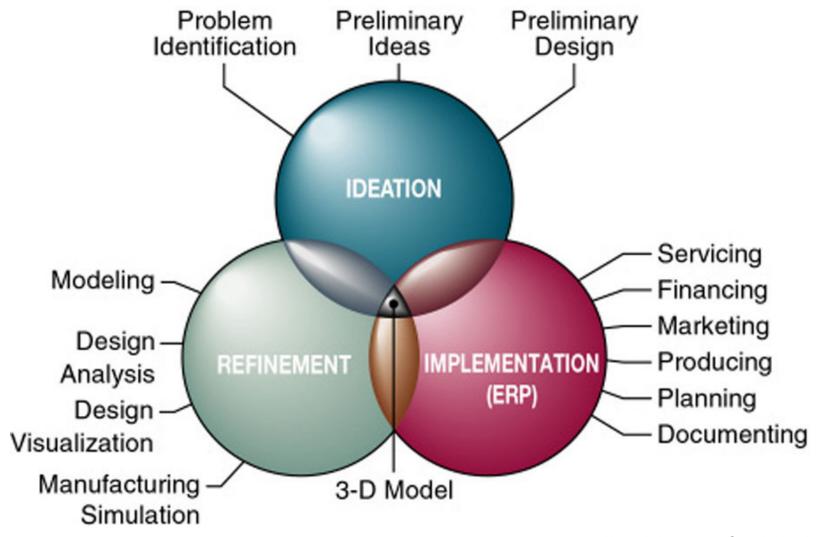








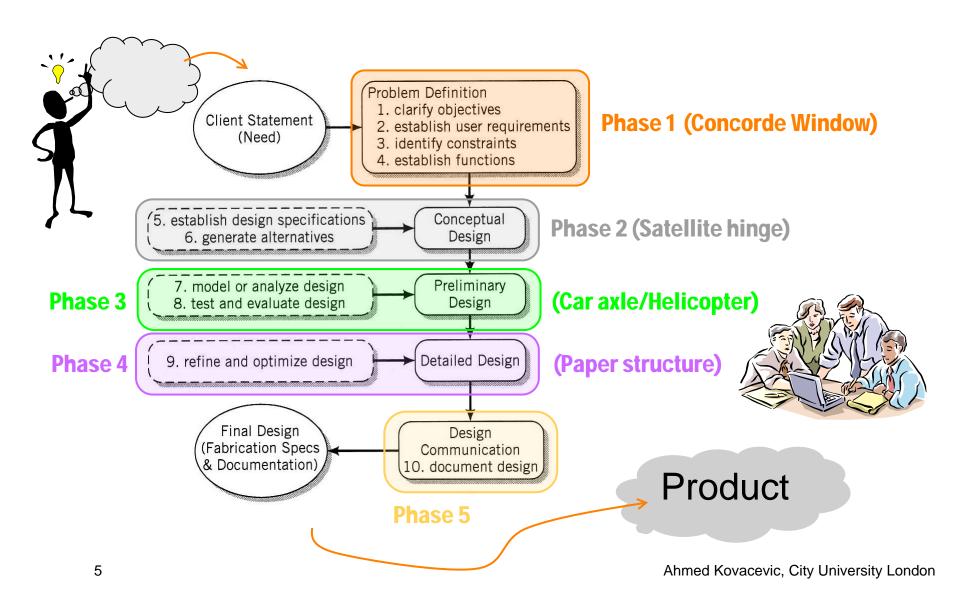
Phases of Engineering Design







Engineering Design Process





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Failure Mode and Effects Analysis

A failure mode is any event, which causes a functional failure of a machine or a system!

Failure effects describe what happens when a failure mode occurs

The best way to address all failure modes and to estimate their effects is to list all functions and to analyse how each of these can fail and what causes will it make.



"A problem well-defined is half solved."



"Not solving the root cause of a problem is like putting an amateur in the boxing ring...if he is hit, his hands go where it hurts, and his opponent will hit him somewhere else." Adapted from Demosthenes



MOVIES



FMEA in Design and Maintenance

- Any Design and/or Maintenance process shall ensure that all of the following seven questions are answered satisfactorily in the sequence shown below:
- 1. FUNCTIONS What are the functions and associated desired standards of performance of the asset in its present operating context?
- 2. **FUNCTIONAL FAILURES** In what ways can it fail to fulfil its functions?
- 3. FAILURE MODES What causes each functional failure?
- 4. FAILURE EFFECTS What happens when each failure occurs?
- 5. FAILURE CONSEQUENCES In what way does each failure matters?
- 6. **PROACTIVE TASKS** and **TASK INTERVALS** What should be done to predict or prevent each failure?
- 7. **DEFAULT ACTIONS** What should be done if a suitable proactive task cannot be found?



Categories of failure modes

Failure modes can be classified in to three groups:

- 1. When capability falls below desired performance
 - » Deterioration
 - » Lubrication failure
 - » Dirt
 - » Disassembly
 - » 'Capability reducing 'human errors.
- 2. When desired performance rises above initial capability
 - » Sustained, deliberate overloading
 - » Sustained, unintentional overloading
 - » Sudden, unintentional overloading
 - » Incorrect process material.
- 3. When the asset is not capable of doing what is wanted from the outset.



How detailed?

Failure modes should be defined in enough detail for it to be possible to select a suitable failure management policy.

- Too little detail and/or too few failure modes lead to superficial and sometimes dangerous analyses.
- Too many failure modes and/or too much detail causes the entire RCM process to take much longer than it needs to.



The effects of failure

While describing the effects of a failure, the followings should be recorded:

- What evidence that the failure has happened/occurred?
 - » Warning signals, smell, noise, leak, fire, smoke ...
- In what way it poses a threat to safety or the environment?
 - » Cause explosion, fire, leak if hazardous chemicals, colapse of structure ...
- In what way it affects production or operation?
 - » How does it affects production or process
- What *physical damage* is caused by the failure?
 - » Effects on other parts and processes, cost …
- What must be done to prevent or to repair the failure?
 - Replace components or subsystems, lubricate on time





Sources of information about Modes and effects

One needs to be proactive, while drawing up the FMEA, as such, much emphasis should be placed on what could happen than what has happened.

The common sources of information with a brief review of their main advantages and disadvantages are:

- » The manufacturer or vendor of the equipment
- » Other users of the same equipment
- » Technical history records
- » The people who operate and maintain the equipment

System Subsystem Part Humber	LTN2001 CPS SSU Receiver Card 488230-100		Potential	Revision B Prepared By Robert Crow FMEA Date 8/18/1992 Revision Date										
Design Lead	J. Davies:	-												
			Potential	P r o	Current Design	D e	R P	Recommended	Responsibility & Target Completion Date	Action Results				
Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure	S Cause(s)/ e Mechanism(s) // of Failure							Actions Taken	New Sev	NewOcc	HewDet	Hew RPH
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