

## Requirements in Innovative Environments



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## Everyone Agrees

- Requirements are really important
- They do not want to do it themselves
- It is really hard to do requirements
- You never know if you are right, and often – you are wrong
  
- Requirements are close enough, let's just get started on the “real” work
  - Everyone knows what they need to be doing...

## Further

- Where does a “reasonably” sized company get guidance on how to do this upstream process?
- What are the essential elements and hints, that can improve the success rate?
- How can I best manage my project so this does not bite me down the road?

## Requirements Solution

- A solution is needed for “normal” people
- Experience in defense and aerospace industry provided exposure to techniques needed for complex systems
- Teaching Senior Design for St. Thomas provided a “lab” to use essential elements on quick turn (2 semester or 9 month) long projects
- Consulting experience shows that a 9 month project is representative of the complexity of many industrial projects

## Agenda

- What is the innovation process and types of innovation
- Key requirement points with flexibilities
- Execution for typical projects

Executive survey indicates 80% believe innovation is more important than cost reductions for moving the company forward.

## Innovation Process

- Find opportunity
- Concept solutions
- Select preferred
- Test solution
- Get to market
- Evaluate

## Product Development Process

- Product vision or operational concept
- Requirements
- Concept development
- Preliminary design
- Detailed design
- Fabrication
- Integrate and test
- Launch/ deliver to customer

## Innovation Types

- Incremental
- Discontinuous
- Radical
- Disruptive

How is this handled differently at a large company versus a start up?

## Per IEEE Std 830 – 1993

- *Complete*—All external behaviors are defined
- *Unambiguous*—Every requirement has one and only one interpretation
- *Correct*—Every requirement stated is one that software shall meet
- *Consistent*—No subset of requirements conflict with each other
- *Verifiable*—A cost-effective finite process exists to show that each requirement has been successfully implemented
- *Modifiable*—SRS structure and style are such that any changes to requirements can be made easily, completely, and consistently while retaining structure and style.
- *Traceable*—Origin of each requirement is clear, and structure facilitates referencing each requirement within lower-level documentation
- *Ranked for importance*—Each requirement rated for criticality to system, based on negative impact should requirement not be implemented
- *Ranked for stability*—Each requirement rated for likelihood to change, based on changing expectations or level of uncertainty in its description

Bail, 2008

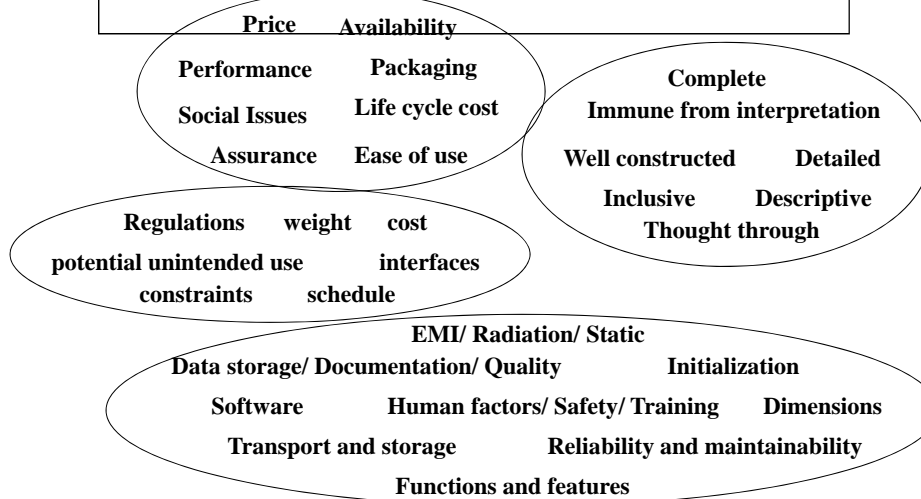
## Requirement Errors

- **Incorrect facts (49%)**
- **Omissions (31%)**
- **Inconsistency (13%)**
- **Ambiguity (5%)**
- **Misplaced (2%)**

Hooks and Farry, 2001

“70% of projects fail due to poor requirements” – Parendo, 2011

## Requirement Considerations



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## Example Requirement Template

Requirement	Source	Owner	Justification/ Analysis	Test Method	Approved
Meet Transmission laws	FCC	Jerry	Wireless communication must comply	Inspection	Yes
Must be produced in 3 colors	Marketing survey	Bob	Typical requirement	N/a – already producing colors with current material	Yes
Shall produce x (TBD) db for input sources within 120 (TBR) degree fan of point of vision	Top level Requirement, flow down from section 3.1.1.2	Sally	Directional reception is a current practice for new devices, standards require further study	Functional test	No
Must use a 5 layer hybrid construction	?	Bill	This is solution and does not directly impact user – is this truly needed? Or should it be a maximum for manufacturability?	Inspection	No

Accountability, cover key areas

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## Planning for Requirements

- In some situations, majority of items are defined before project starts
- In some situations, the requirements are expected to float
- Time is needed for requirements up front on a project.
  - Can create redesign loops in the development cycle if not done well – Parendo, 2012

## Requirements Process

- Scope product
- Develop operational concepts
- Identify interfaces
- Write requirements
- Capture rationale
  - Level requirements
- Assess verification
  - Format requirements
- Baseline requirements

Hooks and Farry, 2001

## Requirements During Development

- Some may change but all can not change
- Those that may change should have a “freeze” date for a decision to be made
  - Date driven by tooling, other design activity, or other cost impact
- Product development in phases
  - Release an acceptable product and learn from field experience.

## Requirements During Development

- Tracking and reporting is key
  - How many requirements that are:
    - New, TBD, TBR, In review, Approved
    - How many changed since last review, trending
  - During testing, it becomes
    - Not started, test plan drafted, test plan approved, test executing, test complete, report in progress, report complete



## Resolving Conflicts

- **Recognize a conflict exists**
  - Many “unintended consequences” during development
  - Quality Function Deployment (QFD) or risk management can help with this
- **Can resolution be resolved with an “obvious” solution?**
- **Is Design of Experiments or Triz needed to address a complex situation?**
  - Pareto, 2001
- **Confirm conflict is resolved**

## Conclusion

- **Requirements are a major contributor to NPD delays**
- **Developing requirements and resolving conflicts are key yet challenging skills**
- **If you want to see the reference materials – visit our website**
  - [www.PerrysSolutions.com](http://www.PerrysSolutions.com)
  - If interested, email us to be on our quarterly newsletter where we share recent trends and learning points
    - Newsletters are all archived on our publications page