

ECE180DA (Winter 2026)
Systems Design I

Lecture 3: Design reviews, part 2
January 27, 2026

Design

- Fundamental questions:
 - **What** is a problem worth solving?
 - **Why** would a solution be meaningful?
- Design
 - **Given**: real world (universe of tools, universe of problems)
 - **Do**: identify requirements, capabilities, and dependencies of problems and tools
 - **Goal**: validate optimality of problem + tool combination

Solving real-world problems

technologies → **solution** → **application** := project

The design process ensures that the **best** technologies are engineered in the **best** way to address the **best** problem.

... understanding resource constraints along the way.

Design risk

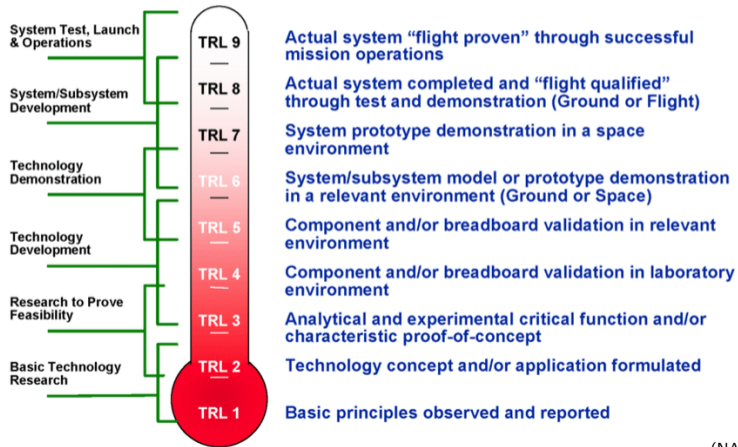
Top level risk: total value (reward) does not justify total investment (cost)

- Rewards:
 - Productivity / efficiency
 - Physical or mental health
 - Quality of life
 - Social / societal benefit
- Costs:
 - Design + development
 - Fixed / setup
 - Marginal
 - Operational

Incremental justification

- **To whom?** “stakeholders”
- **When?** “early and often”
- **How?** “design review”:
 - Identify risks that have been mitigated
 - Thoroughly characterize risks that will be mitigated with new resources
 - Acknowledge remaining / outstanding risks
 - Break down spent and required resources
 - **“Show your work”**

Design process metric: Technology Readiness Level (TRL)



(NASA / source unknown)

ECE180 assignments

- ~~Concept Review(s) (*CR): P0-P1~~ ✓
- Requirements Review (RR) +
System Design Review (SDR): P2-P4
- Preliminary Design Review (PDR): P5-P6
- Critical Design Review (CDR) +
Test Readiness Review (TRR): P8
- Final Design Review (FDR): P9
- ~~Production Readiness Review (PRR)~~

Forward risk management

- **Risks to mitigate:** ~~No generated value, no source of investment~~
→ ~~Concept reviews~~ = P0-P1 ✓
- **Risks to mitigate:** Value improperly quantified, confounding factors on value, Unassessed costs, integration mismatch
→ Requirements Review / System Design Review (RR/SDR) = P2-P4
- **Risks to mitigate:** Incomplete solution, insufficient resources
→ Preliminary Design Review (PDR) = P5-6
- **Risks to mitigate:** Insufficient technical capabilities
→ Critical Design Review (CDR) = P8
- **Risks to mitigate:** Real-world uncertainties, better value proposition from competitors
→ Final Design Review (FDR) = P9
- **Risks to mitigate:** ~~Manufacturing / scaling uncertainties~~
→ ~~Production Readiness Review (PRR)~~ = ~~Out of scope~~

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TRL 2: Project formulation → Requirement Review (RR) / P2-P4

- **Risks to mitigate:** Value improperly quantified, confounding factors on value
- **Goal:** Explicate the problem
- **Sources:** User studies, interviews, market research
- **Process:**
 - Define precisely
 - Position and justify
 - Find root causes

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- **Risks to mitigate:** Unassessed costs, integration mismatch
- **Goal:** Artifact definition
- **Sources:** Technical research, product analysis
- **Process:**
 - Clarify objectives
 - Establish functions
 - Set requirements
 - Determine capabilities

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Running example: AR blimp



Problem explication / RR

- Element definition
- Root cause analysis (fishbone diagram)
- Objective tree
- House of quality / roof diagram

Element definition

- Intended practice / other practice
- Artifact
- Problem
- Technology
- Uses
- Perception
- Addresses
- Environment
- Function
- Behavior
- Structure
- Intended effects
- Side effects

Next up

- Done by now:
 - Video lectures A1, A2
- Thursday / Friday lab:
 - Present P3 (**problem explication**, due Thursday 11am for everyone)
- To be done before next Monday:
 - Video lecture A3 (**block diagrams / design for debugging**)