

# Project Management

Uğur Murat Leloğlu, PhD.



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## Who Am I?

- ❶ B.Sc. 1991, M.Sc. 1995, Ph.D. 2001: METU EE
- ❷ July 1997 – July 1998: Researcher at École Nationale Supérieure des Télécommunications
- ❸ July 2001 – September 2002: SSTL + Surrey Space Center, Surrey University
- ❹ 2004-2011: Institute Director of Space Technologies Research Institute of TÜBİTAK
- ❺ 2013-... : Academic staff of [GGIT](#)
- ❻ Worked on: Image processing, Computer vision, Remote sensing, Spacecraft system design



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## Outline

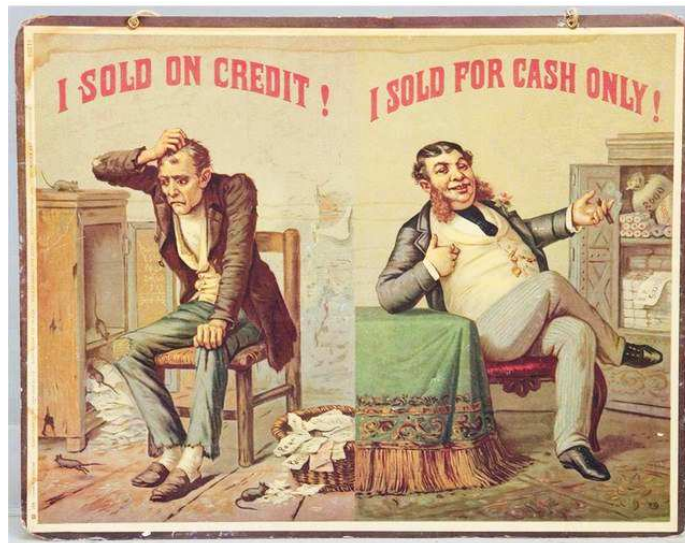
- ❶ Why do you need to learn project management?
- ❷ What is a project?
- ❸ What is project management?
- ❹ Project breakdown structures
- ❺ Project phasing
- ❻ Project schedule



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## Why do I need to learn PM



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## Why do I need to learn PM



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## Why do I need to learn PM

- ❶ Those of you who will have a professional work will be part of projects
- ❶ You will need to manage your work package
- ❶ Over time, you will be forced to manage larger projects, it is inevitable
- ❶ You need to understand what is going on, otherwise you will be blamed for the failure of others
- ❶ The concepts are useful in daily life



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## What is a Project

- ❶ “A [project](#) is a temporary endeavor designed to produce a unique product, service or result with a defined beginning and end (usually time-constrained, and often constrained by funding or [deliverables](#)) undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value” (wiki, project management)



## What is a Project

- ❶ Collection of related or connected activities to develop a product or a service
- ❶ It should have a customer
- ❶ Projects should have a schedule, well defined start and conclusion times
- ❶ Resources (may be limited) should be defined
- ❶ Usually has a limited budget
- ❶ A project name must be specified
- ❶ Expected outcomes must be defined



## What is not a Project

- ❶ Explorations
- ❶ Something going on indefinitely
- ❶ One team or one person working alone
- ❶ Creating the same thing multiple times
- ❶ No constraints on time, cost or performance



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## Daily routine jobs vs. Projects

Routine service jobs	Projects
Repeated without any modification	Not repeatable
Routine	A new product or a service
Continuous	Done once
Done before	Never done before
Repeated in the same way	Not repeated in a similar manner
Using experience and past knowledge	Little or no experience from the past projects
Known	Ambiguity
Example: Student registration	EE 494 projects



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# Historical and Modern Projects



27<sup>th</sup> Century BC



2<sup>nd</sup> Century AD



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Modern

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## Project Management

- ❶ “**Project management** is the discipline of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria”
- ❶ The primary constraints are scope, time, quality and budget (wiki, project management)
- ❶ “**Program management** ... is the process of managing several related projects, often with the intention of improving an organization's performance.” (wiki, program management)



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# Project Management

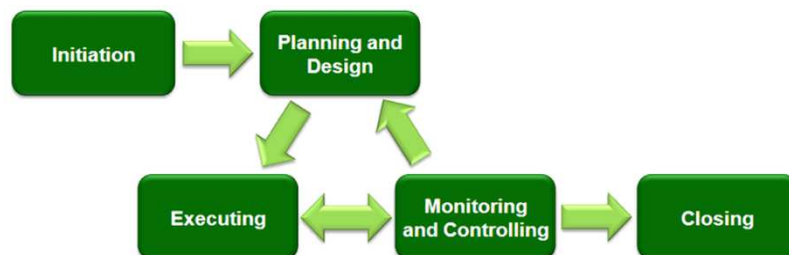
- ❶ Process of guiding a project from its beginning through its performance to its closure
- ❷ Usually has a manager responsible for coordinating all project activities for successful completion of the Project
- ❸ Main goal of PM, balance the trade-offs among:
  - ★ Scope (i.e., what is delivered)
  - ★ Budget
  - ★ Time



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## The Five Process Groups



- ❶ Initiating
- ❷ Planning
- ❸ Executing
- ❹ Monitoring & Controlling
- ❺ Closing



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## The Nine Knowledge Areas

- ❶ Integration
- ❷ **Scope**
- ❸ **Time**
- ❹ **Cost**
- ❺ Quality
- ❻ Communications
- ❼ Human Resources
- ❽ Risk
- ❾ Procurement



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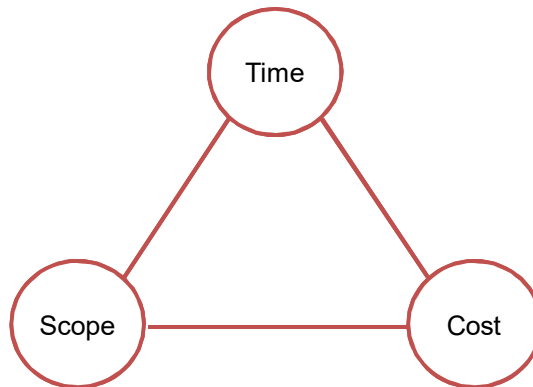
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Knowledge Areas	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Integration	Develop Project Charter	Develop Project Management Plan	Direct & Manage Project Execution	Monitor & Control Project Work Perform Integrated Change Control	Close Project or Phase
Scope		Collect Requirements Define Scope Create WBS		Verify Scope Control Scope	
Time		Define Activities Sequence Activities Estimate Activity Resources Estimate Activity Durations Develop Schedule		Control Schedule	
Cost		Estimate Cost Determine Budget		Control Costs	
Quality		Plan Quality	Perform Quality Assurance	Perform Quality Control	
HR		Develop HR Plan	Acquire Project Team Develop Project Team	Manage Project Team	
Communications	Identify Communications	Plan Communications	Distribute Information	Manage Stakeholder Expectations Report Performance	
Risk		Plan Risk Management Identify Risks Perform Qualitative Risk Analysis Perform Quantitative Risk Analysis Plan Risk Responses		Monitor & Control Risks	
Procurement		Plan Procurements	Conduct Procurements	Administer Procurements	Close Procurements



# The Triple Constraint

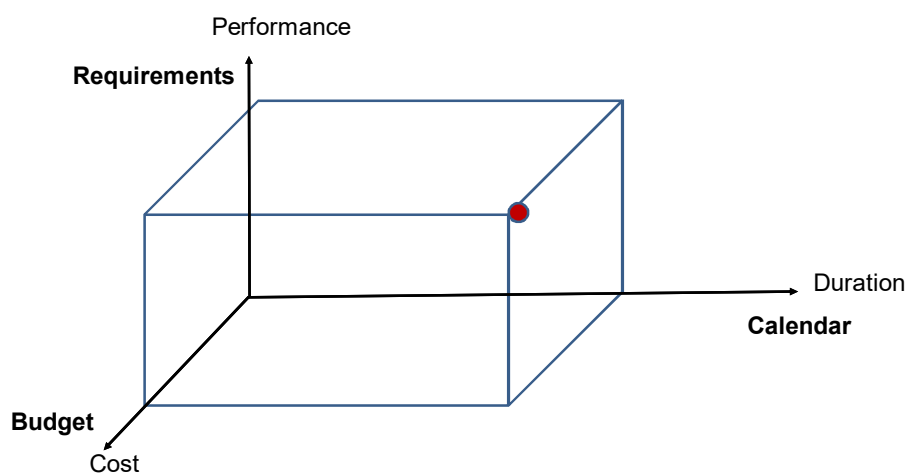
Or the iron triangle



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# The triple limit



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## Murphy's Law

- ❶ No project has ever finished on time, within budget, to requirement - yours won't be the first too
- ❶ A badly planned project will take three times longer than expected - a well planned project only twice as long as expected
- ❶ A user is somebody who tells you what they want the day you give them what they asked for
- ❶ There are no good project managers - only lucky ones



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## Bad PM Example

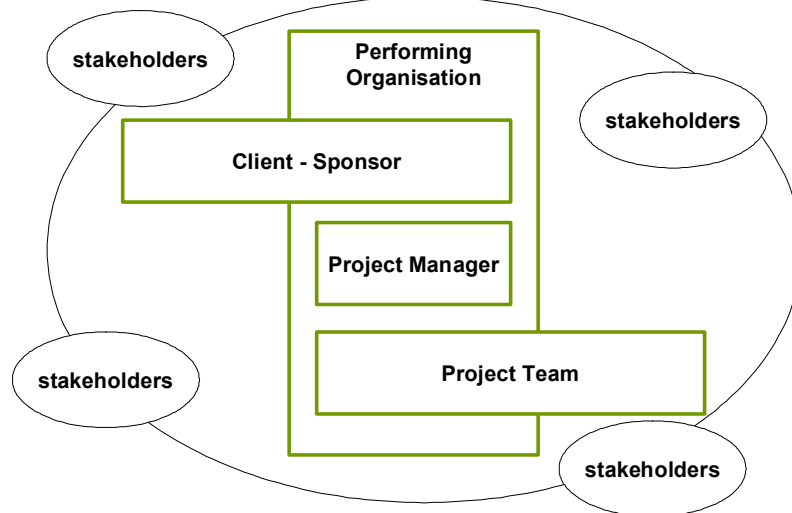
- ❶ Space Shuttle Project
- ❶ Early estimation
  - ★ Development costs: 43 Billion in 2011 USD
  - ★ Cost per flight: 9.3 Million USD
  - ★ 12 launches per year, first 1977
- ❶ Analysis
  - ★ Cost per flight: 450 Million USD
  - ★ 9 launches in 1985 and much less later, 1<sup>st</sup> 1981
- ❶ Two launch failures



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# The Big Picture



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## Stakeholders

- ❶ A person or group of people who have a vested interest in the success of a project
- ❷ Typically:
  - ★ Sponsor, Funding Body
  - ★ Customer, End User
  - ★ Suppliers, Contractors, Subcontractors
  - ★ Top Management
  - ★ Team Members, Peers
  - ★ Resource Managers, Internal Customers
  - ★ ...



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# Project Management Standards

- ❶ General Standards: i.e. [ISO 21500](#)
- ❶ There are specific standards for program management in various application areas
  - ★ Software
  - ★ Aerospace and Defense
  - ★ Space
- ❶ There are overlaps in these areas
- ❶ I will give examples from space standards: US ([NASA](#)) and European ([ECSS](#))

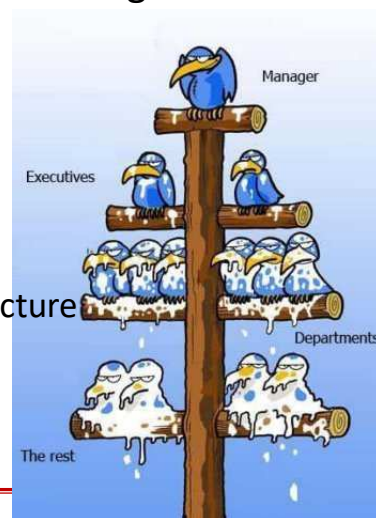


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## ECSS: Project Breakdown Structures

- ❶ A project can be broken into manageable elements in various ways:
  - ★ Function tree
  - ★ Specification tree
  - ★ **Product tree**
  - ★ **Work breakdown structure**
  - ★ Organization breakdown structure



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# Product Tree

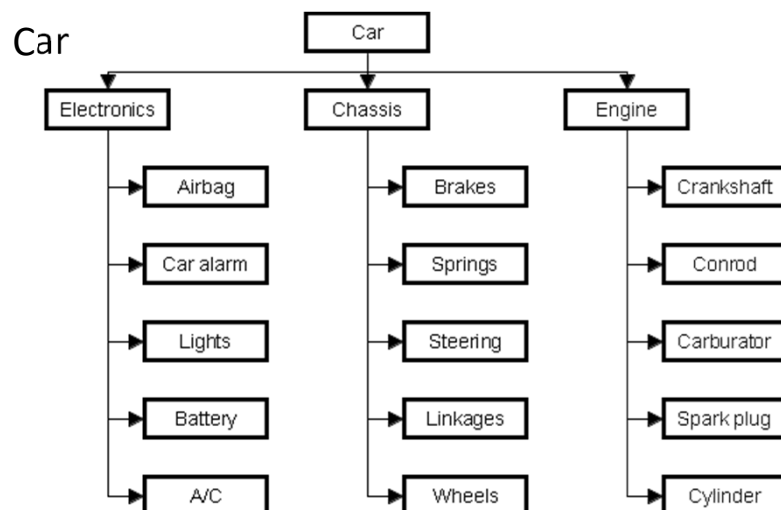
- ❶ Breakdown of the project into successive levels of hardware and software products or elements
- ❶ Related to the function tree
- ❶ Has additional elements like development models or test and integration tools
- ❶ Basis for work breakdown structure



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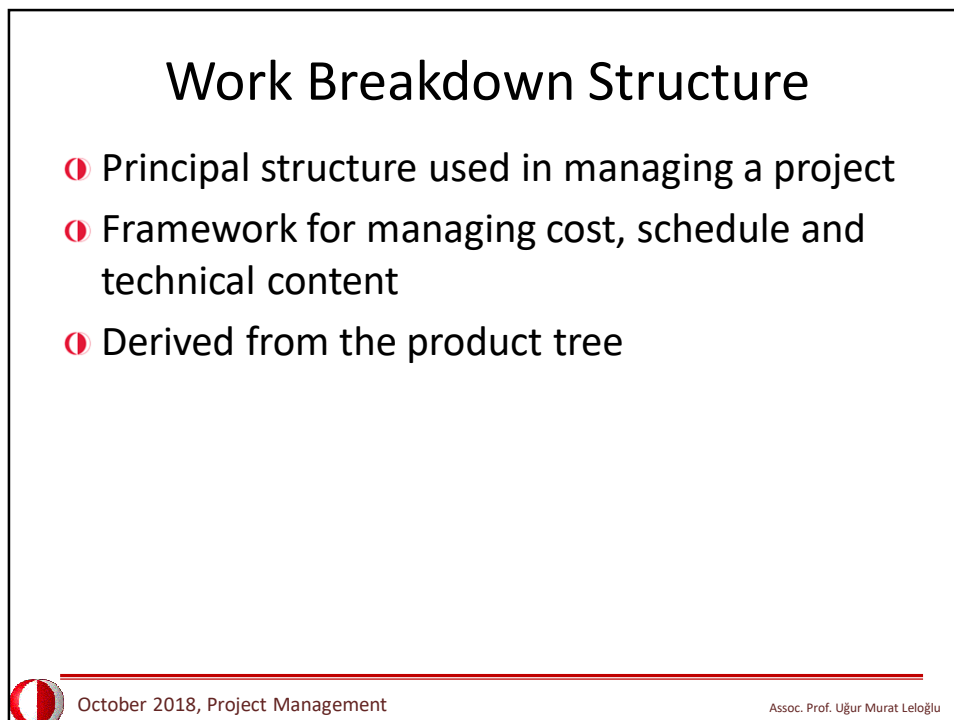
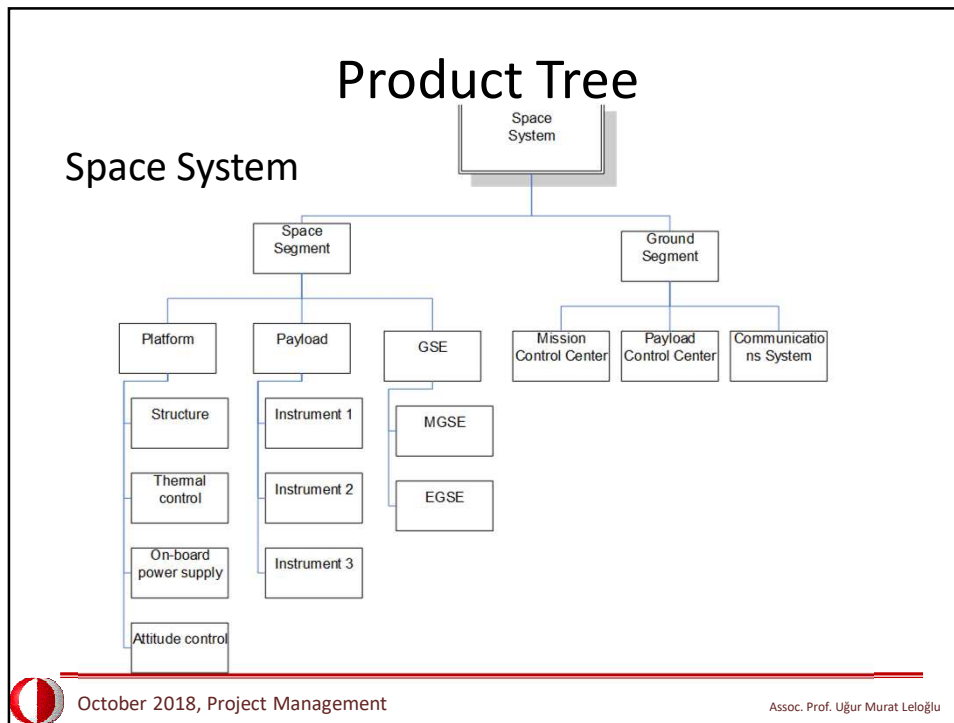
## Product Tree: Example



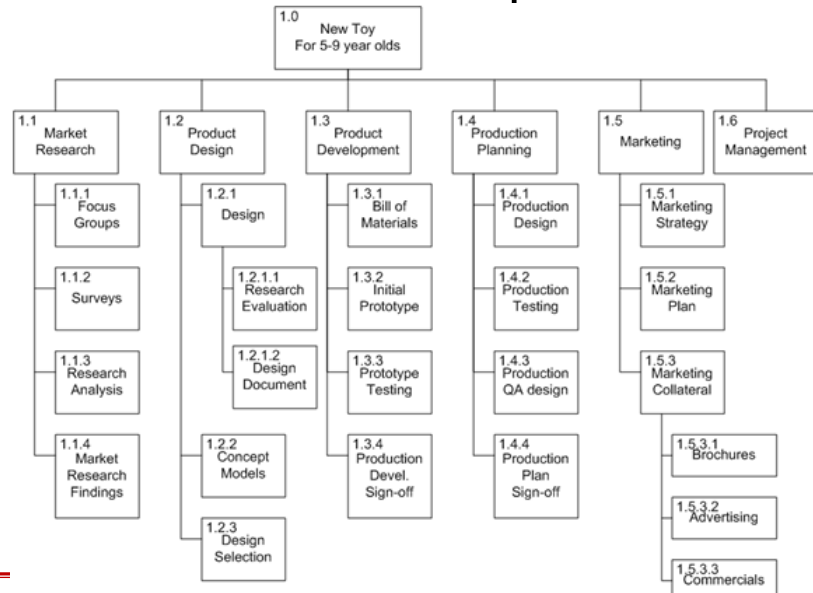
<https://whatsoftwarecando.org/juggling-trees-layout-hierarchical-information-compactly/>

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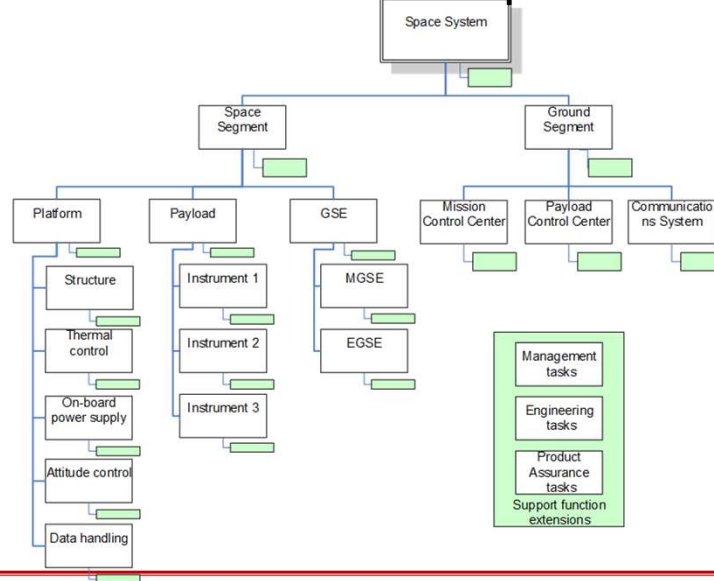
## WBS Example



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## WBS Example



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## Six levels of WBS

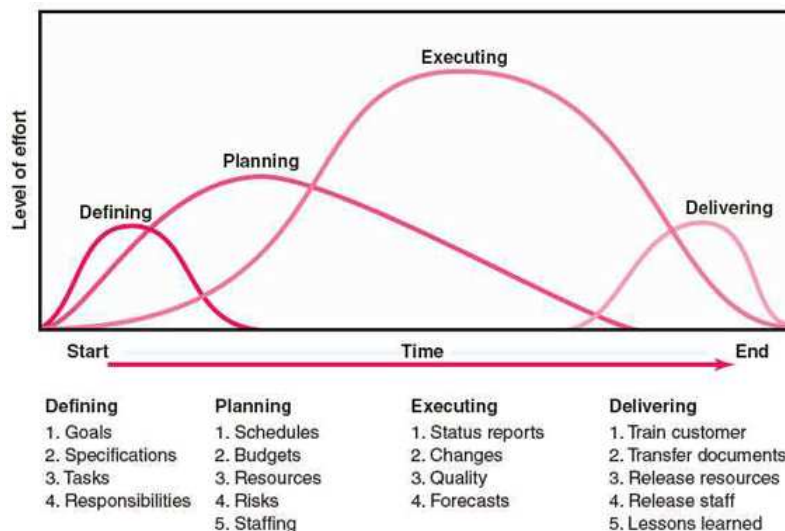
- ❶ Project
  - ★ Activity
    - Subactivity
      - Work package
        - » tasks for each team member
- ❷ Generally, cost and required time/resources are estimated at WP level and are merged to upper levels
- ❸ Multiple estimation can be compared



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## Project Phases



(Gray & Larson, 2006, p6)

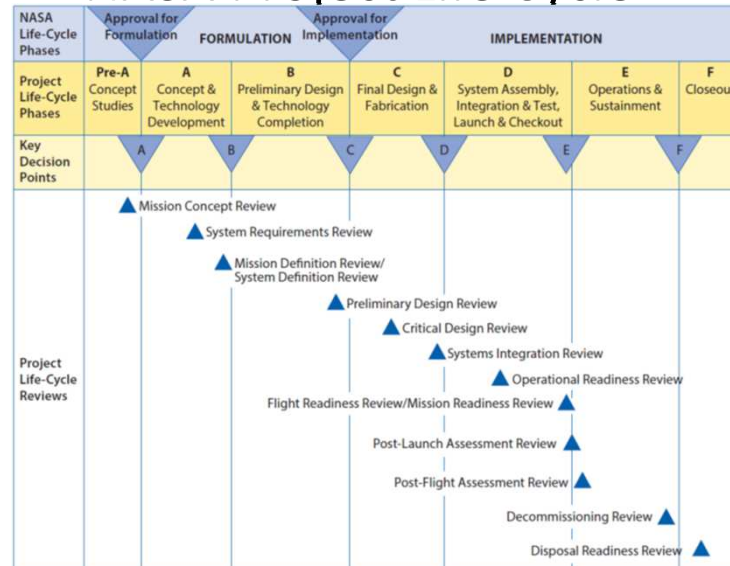


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# NASA Project Life Cycle



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[NASA Space Flight Program and Project Management Handbook](#)

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## ECSS: Project Phasing

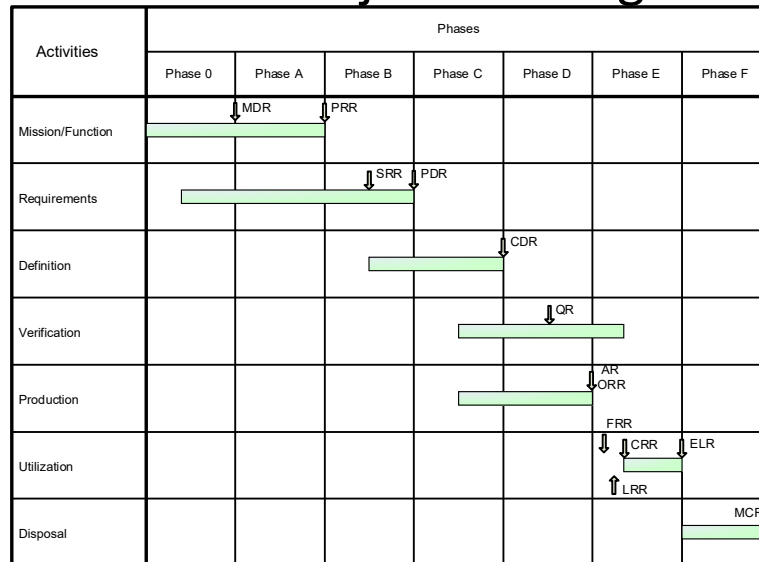
- ❶ Phase 0 - Mission analysis/needs identification
- ❷ Phase A - Feasibility
- ❸ Phase B - Preliminary Definition
- ❹ Phase C - Detailed Definition
- ❺ Phase D - Qualification and Production
- ❻ Phase E –Utilization
- ❼ Phase F – Disposal



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## ECSS: Project Phasing



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ECSS-M-ST-10C Rev. 1

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## ECSS: Project Phasing

### Phases 0, A, and B: mainly

- ★ system functional and technical requirements, identification of system concepts to comply with the mission statement
- ★ the identification of all activities and resources to be used to develop the space and ground segments of the project,
- ★ the initial assessments of technical and programmatic risk,
- ★ initiation of pre-development activities



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## ECSS: Project Phasing

### ❶ Phases C and D

- ★ all activities to be performed in order to develop and qualify the space and ground segments and their products

### ❷ Phase E

- ★ all activities to be performed in order to launch, commission, utilize, and maintain the system

### ❸ Phase F

- ★ all activities to be performed in order to safely dispose all products



## ECSS: Reviews

- ❶ Each phase ends with project review(s)
- ❷ The review confirms readiness to pass to the next phase
- ❸ (except MDR) project reviews are typically carried out by all project actors down to the lowest level supplier involved in the related phase



## ECSS: Reviews

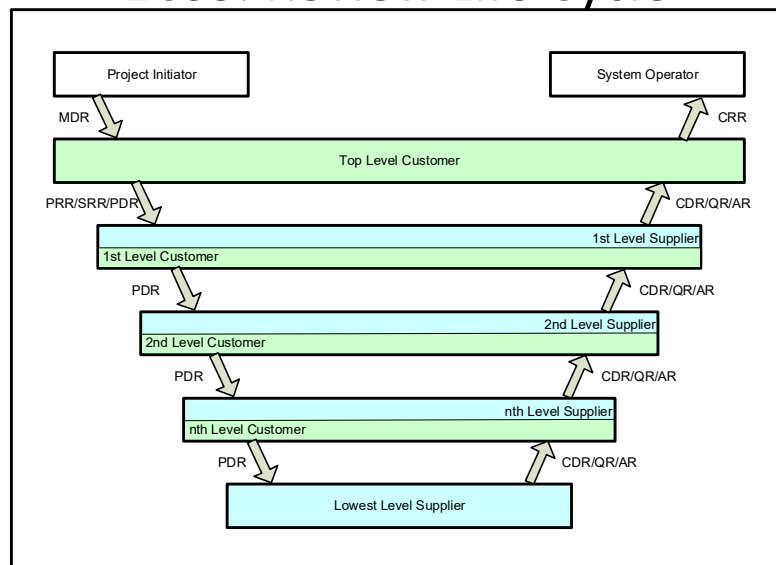
- ❶ From the PRR to the PDR, the sequence of the reviews is “top down”
- ❶ From the top level customer and his top level supplier to the lowest level
- ❶ From the CDR to the AR, “bottom up”, from the lowest level supplier and its customer up to the top level customer
- ❶ Called the “V model”
- ❶ There can be mission-specific reviews



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## ECSS: Review Life Cycle



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ECSS-M-ST-10C Rev. 1

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## ECSS: Project Phasing

- ❶ Phase 0 (Mission analysis/needs identification)
- ❶ End: The mission definition review (MDR)
- ❶ Objectives:
  - ★ the mission statement (mission needs, expected performance etc.)
  - ★ preliminary technical requirements specification
  - ★ Possible mission concepts
  - ★ preliminary assessment of programmatic aspects
  - ★ preliminary risk assessment



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## ECSS: Project Phasing

- ❶ Phase A (Feasibility)
- ❶ End: The prel. requirements review (PRR)
- ❶ Objectives:
  - ★ preliminary management, engineering and product assurance plans
  - ★ technical requirements specification
  - ★ technical and programmatic feasibility of the system concept
  - ★ Selection of system and operations concept(s) and technical solutions, (model philosophy and verification approach)



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## ECSS: Project Phasing

- ❶ Phase B (Preliminary definition)
- ❶ During: The system requirements review (SRR)
- ❶ SRR Objectives:
  - ★ updated technical requirements specifications
  - ★ Assessment of the preliminary design definition
  - ★ Assessment of the preliminary verification program



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## ECSS: Project Phasing

- ❶ Phase B (Preliminary definition)
- ❶ End: The preliminary design review (PDR)
- ❶ PDR Objectives
  - ★ the preliminary design of the selected concept and technical solutions against project and system requirements
  - ★ final management, engineering and product assurance plans
  - ★ product tree, work breakdown structure and specification tree
  - ★ the verification plan (including model philosophy)



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## ECSS: Project Phasing

- ❶ Phase C (Detailed definition)
- ❶ End: critical design review (CDR)
- ❶ CDR Objectives:
  - ★ the qualification and validation status of the critical processes and their readiness
  - ★ compatibility with external interfaces
  - ★ the final design
  - ★ assembly, integration and test planning
  - ★ flight hardware/software manufacturing, assembly and testing



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## ECSS: Project Phasing

- ❶ Phase D (Qualification and production)
- ❶ During: The qualification review (QR)
- ❶ QR Objectives:
  - ★ confirm that the design, including margins, meets the requirements
  - ★ verify the verification record is complete at all levels
  - ★ verify the acceptability of all waivers and deviations
  - ★ +



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## ECSS: Project Phasing

- ❶ Phase D (Qualification and production)
- ❷ End: The acceptance review (AR) and ORR
- ❸ AR Objectives:
  - ★ confirm product is free of workmanship errors and is ready for operations
  - ★ verify the acceptance verification record is complete at all lower levels
  - ★ verify that all deliverable products are available
  - ★ authorize delivery of the product
  - ★ release the certificate of acceptance



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## ECSS: Project Phasing

- ❶ Phase D (Qualification and production)
- ❷ End: AR and Operational Readiness Review (ORR)
- ❸ ORR Objectives:
  - ★ verify readiness of the operational procedures and their compatibility with the flight system
  - ★ verify readiness of the operations teams
  - ★ accept and release the ground segment for operations



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## ECSS: Project Phasing

- ❶ Phase E (Operations/utilization)
  - ★ Before launch: The flight readiness review (FRR)
  - ★ Just before launch: The launch readiness review (LRR)
  - ★ After commissioning: The commissioning result review (CRR)
  - ★ End: The end-of-life review (ELR)
- ❷ Phase F (Disposal)
  - ★ End: The mission close-out review (MCR)



## EE493-494 Phases

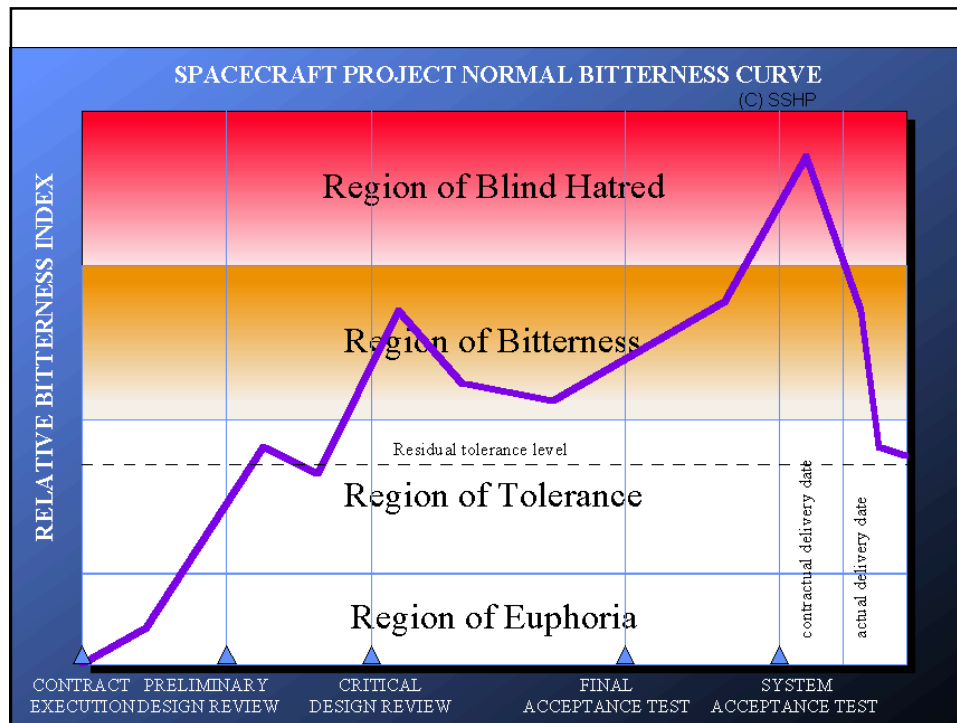
- ❶ Which phases do your milestones correspond?

You can read the [notes on technical report writing](#) before preparing your report.

- [Critical Design Review Report Evaluation Rubric](#)
- [Oral Presentation Rubric](#)
- [Proposal Report Evaluation Rubric](#)
- [Conceptual Design Report Evaluation Rubric](#)

- ❷ MDR, PRR, SRR, PDR, CDR, PR, AR, ...





## Schedule Management

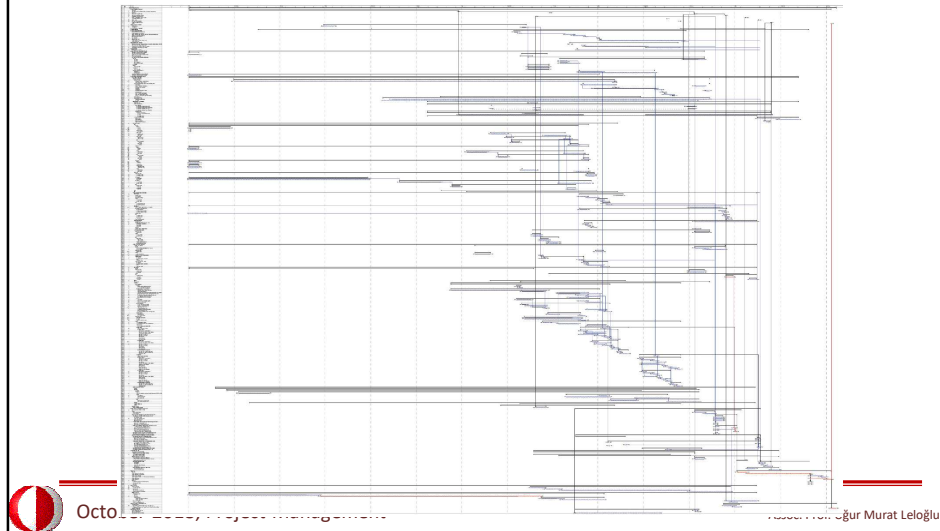
- ❶ Gantt chart: A bar chart that illustrates a project schedule
- ❷ Tasks (WBS) in the vertical axis
- ❸ Time in the horizontal axis
- ❹ Dependencies between the tasks are also shown





## Actual Project Example

- ❶ RASAT Satellite, 684 tasks spanning 5 years



## Murphy's Law

- ❶ The first 90% of the project takes 90% of the time, and the last 10% takes the other 90%
- ❶ Any project can be estimated accurately (once it's completed)
- ❶ Work expands to fill the time available

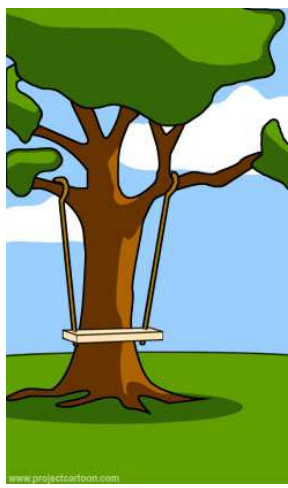


## How Projects Really Work?



www.projectcartoon.com

**How the customer explained it**



www.projectcartoon.com

**How the proj. leader understood it**



www.projectcartoon.com

**How the analyst designed it**



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## How Projects Really Work?



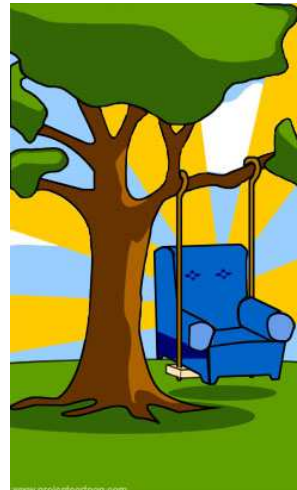
www.projectcartoon.com

**How the programmer wrote it**



www.projectcartoon.com

**What the beta testers received**



www.projectcartoon.com

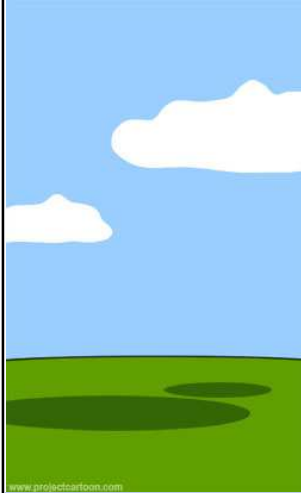
**How the business consult. described it**



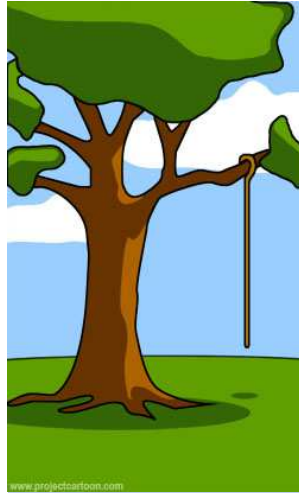
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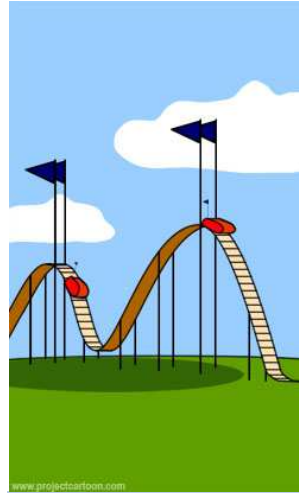
## How Projects Really Work?



**How the project was documented**



**What operations installed**



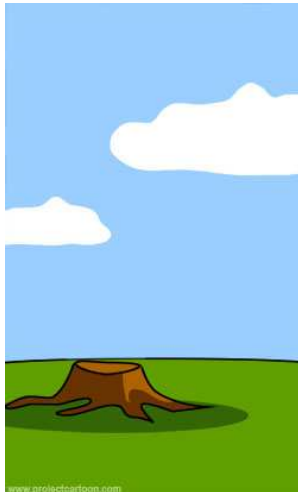
**How the customer was billed**



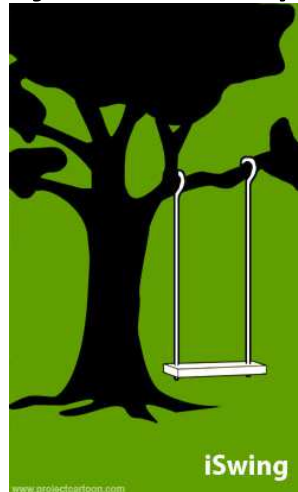
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## How Projects Really Work?



**How it was supported**



**What marketing advertized**



**What the customer really needed**



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