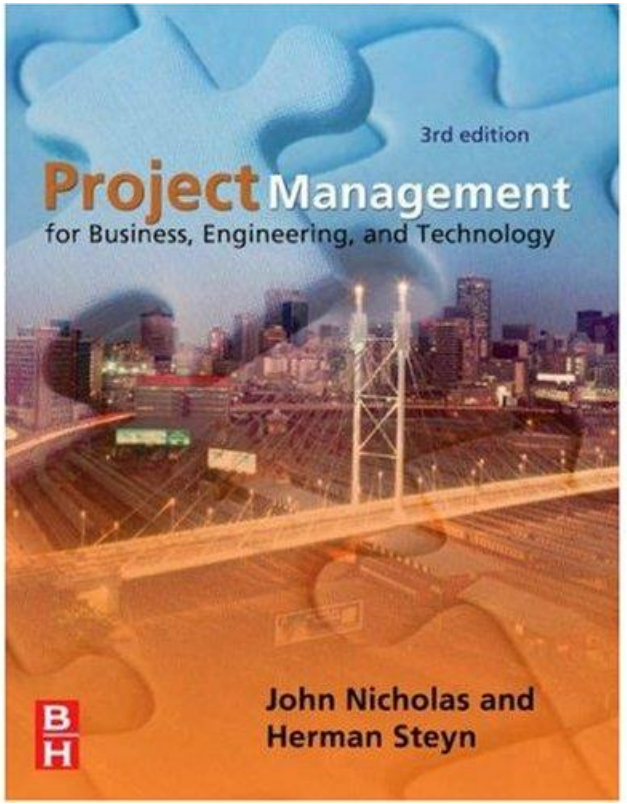
Chapter 4
Project and Systems Definition

Project Management for Business, Engineering, and Technology



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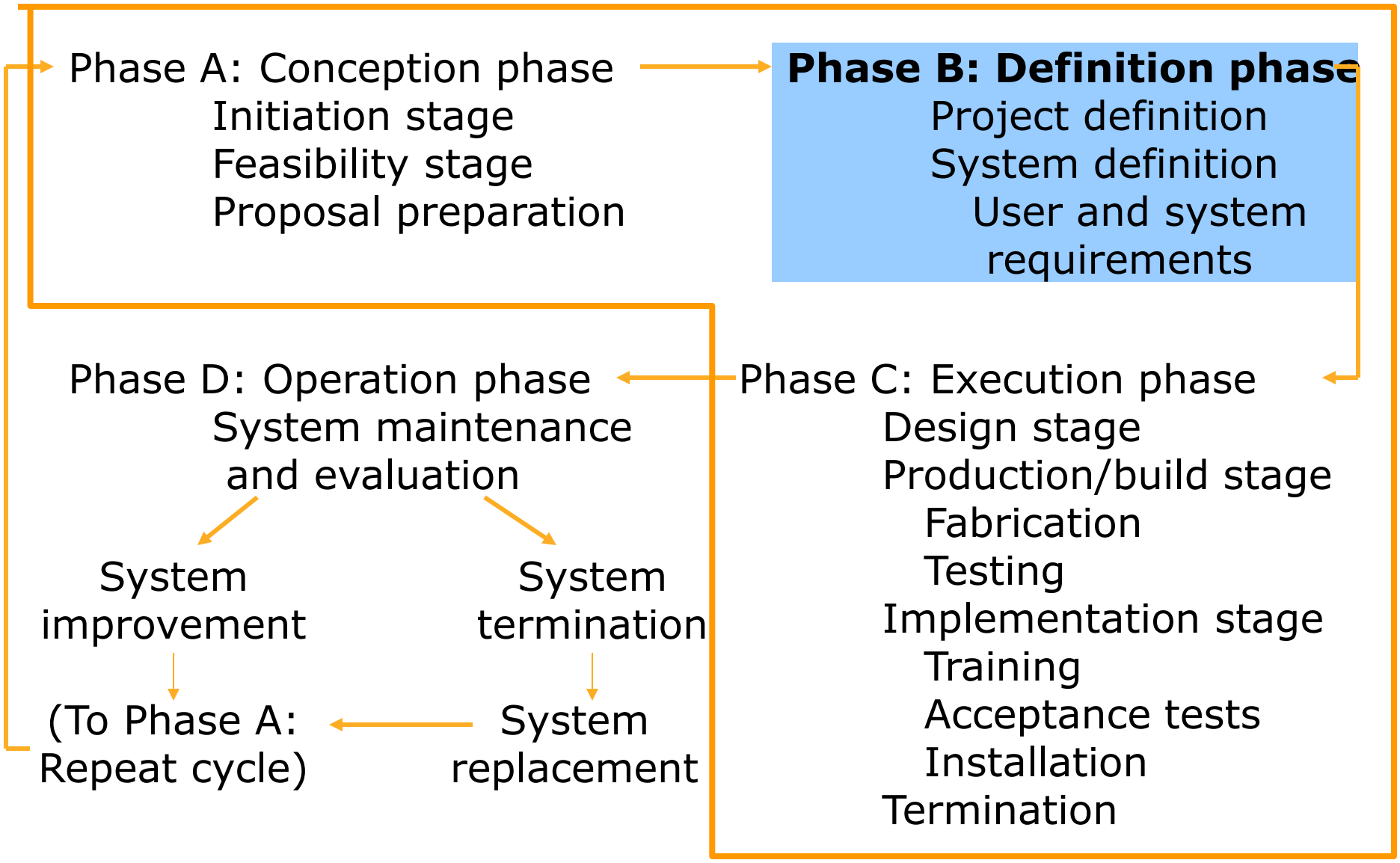
Project Life Cycle



Phase B: Definition

- Assume upon entering this stage
  - project has been approved and funded.

- Also, assume these exist
  - An SOW in RFP and proposal
  - Initial list of user requirements
  - A “rudimentary” project plan, as necessary for specifying technical content, time, and price in the proposal
  - Contract with SOW (“CSOW)

Phase B: Definition (cont'd)

- Principle tasks during Phase B

  (not necessarily in this order)

  - Organize project team: hold "kickoff"
  - Clarify in detail user requirements
  - Prepare detailed system requirements
  - Prepare project master plan
  - Review requirements and plan with customer

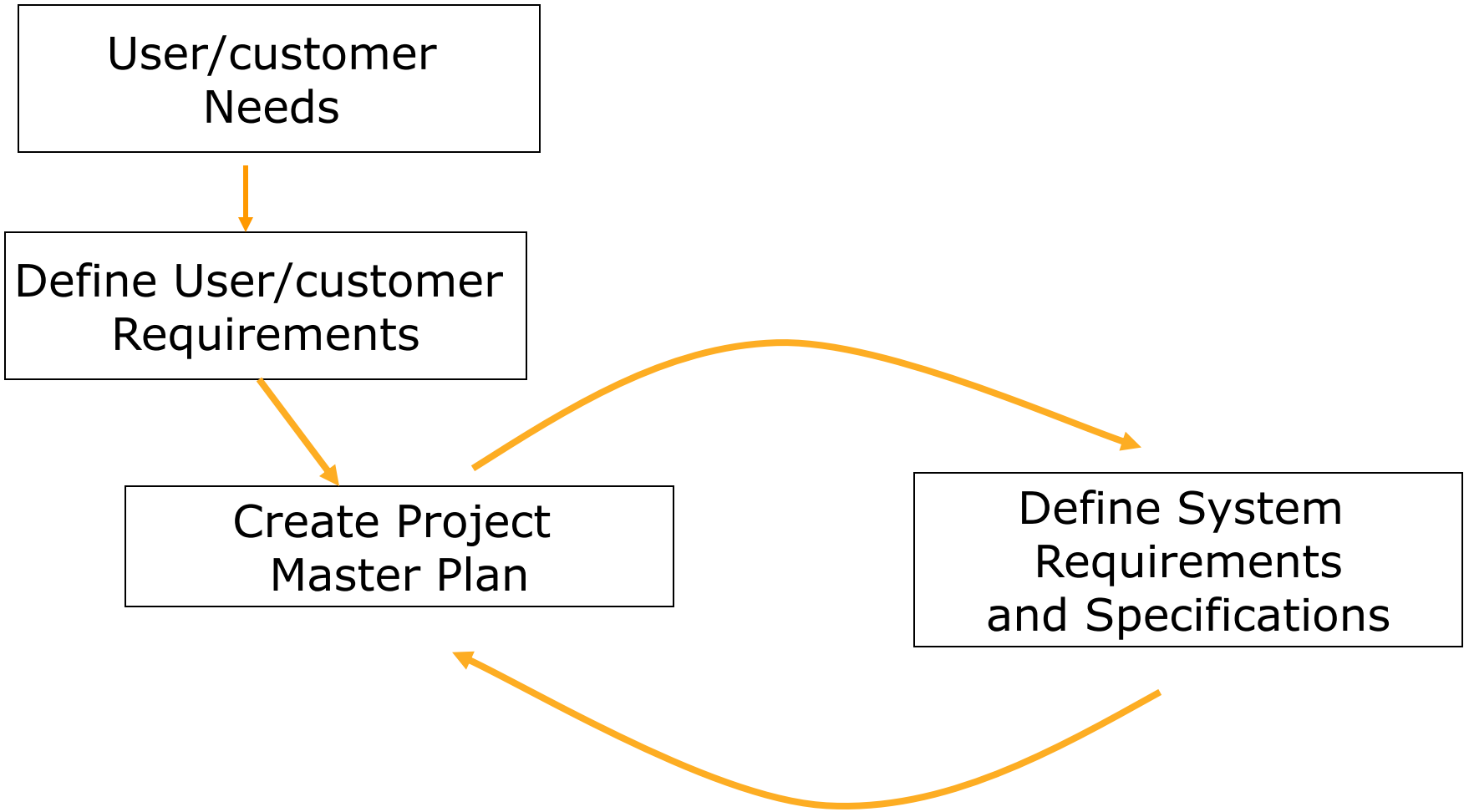
Phase B: Definition Tasks

- In little projects, Phase B is short since
  - much definition already happened in proposal preparation
- In big projects, Phase B can be lengthy
  - sometimes taking years

Project Kickoff Meeting

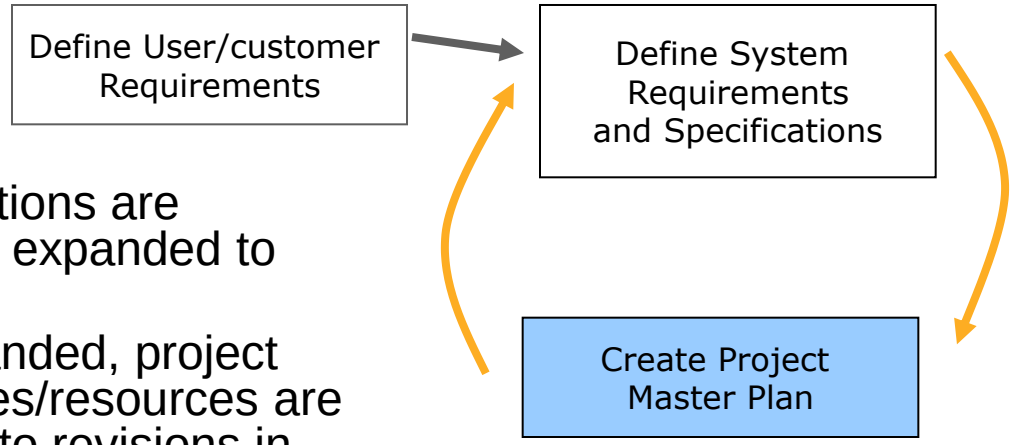
- The first formal meeting of the project team members and key stakeholders.
- A formal presentation with a question-and-answer period at the end.
- The project manager plans and runs the meeting.
- Runs 1.5-2 hours
- Purpose is to announce the project
  - communicate what the project is about
  - develop common expectations
  - generate enthusiasm and commitment to project goals and deliverables.
- Covers
  - who is the project manager
  - project SOW, goals, and deliverables
  - proposed project plan—budget, schedule, main work packages
  - constraints and risks
  - customers and other key stakeholders, their needs and requirements
  - project organization structure and key team members
  - immediate next steps.
- Held for every project and every major effort associated with the project

Phase B: Primary Definition Tasks



Project Definition

- During Definition, the project master plan and end-item requirements and specifications are defined.
- The system requirements and specification address “what” the end-item of the project must do.
- The project master plan describes “how” project will deliver end-item that meets system requirements and specifications
- Iterative process
  - Details of the specifications are defined; master plan is expanded to reflect details
  - As master plan is expanded, project constraints/opportunities/resources are identified, which leads to revisions in specifications



Project Definition = Project Planning

Project Definition

- What goes into a project plan?

Ask:

- What?
- How?
- Who?
- When?
- How long?
- Where?
- How much?
- How well?

Project Definition = Project Planning

- Proposal addressed these questions, but usually not in much detail.

Project Master Plan

- **Project master plan** addresses these questions to the satisfaction of project core team (people who will do work)
- Addresses all matters about project in sufficient detail for managers to organize and direct work to meet performance, cost, and time targets and for team to begin work
- Level of detail in the master plan far exceeds level in the proposal

Common Elements of Project Master Plan

1. What? Scope Statement, Charter, or SOW
2. What? Detailed requirements
3. How? Detailed work definition (WBS or PBS and work package/work task details)
4. Who? Responsibility for work tasks
5. What? Detailed schedules with milestones
6. How much? Project budget and cost accounts

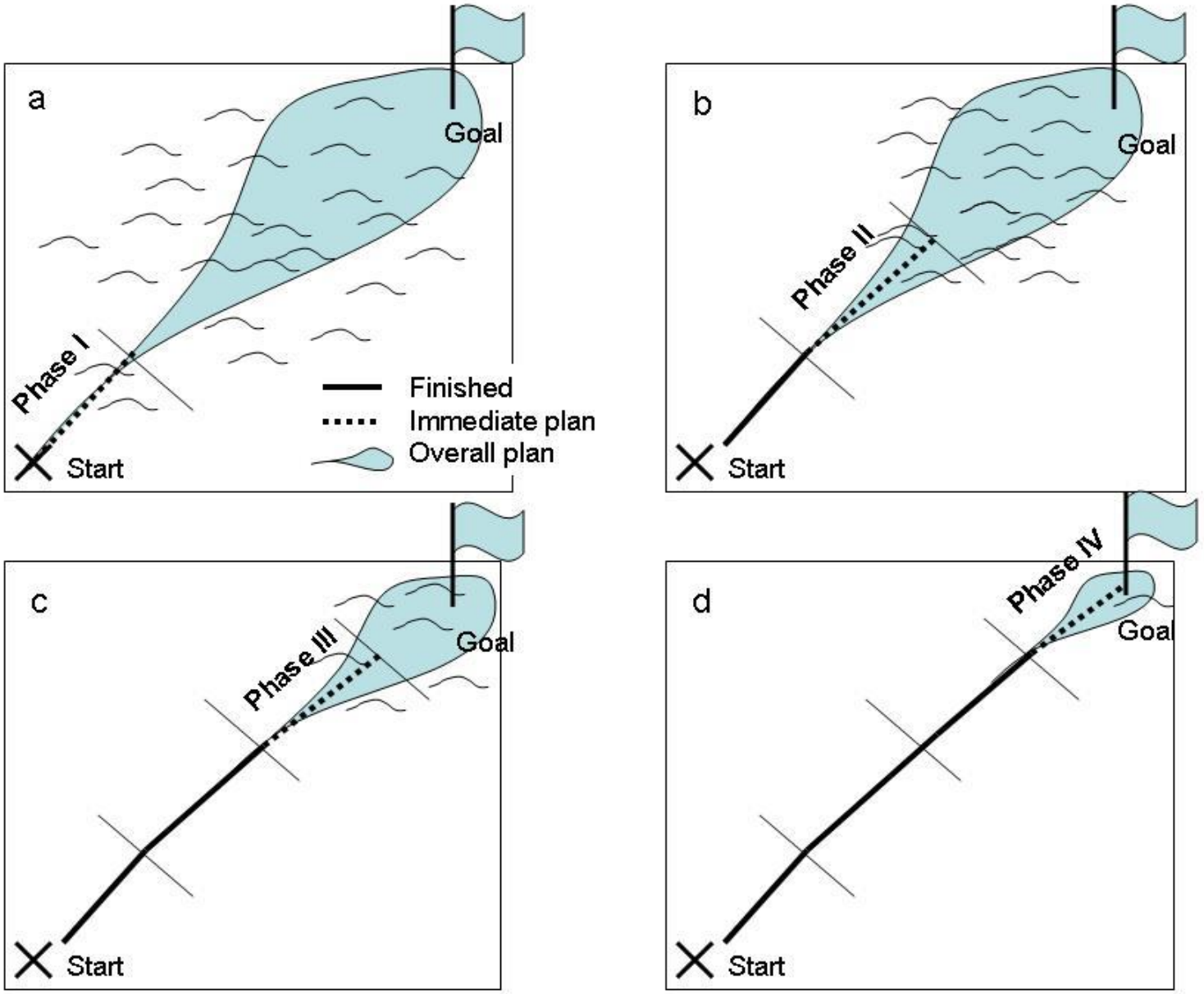
Common Elements of Project Plan (cont'd)

7. What if? Risk plan
8. How well, what, how? Performance tracking and control
9. Other elements of the plan, as needed for, e.g.
    - Work review and testing
    - Quality control
    - Documentation Implementation
    - Communication/meetings
    - Procurement
    - Contracting and contract administration

Phased Project Planning

- At the start of the project, often there are too many unknowns, so the plan must be developed in phases
- The initial plan is somewhat rough though adequate to
  - estimate project resources, time, and cost
  - explain all this to the customer
- As the project progresses,
  - the unknowns decrease
  - details of the plan are filled in
  - a more-detailed plan is created for *the next most immediate phase* of the project
- As project moves through the successive phases and stages, detailed plans are prepared with more-specific deliverables and schedules.

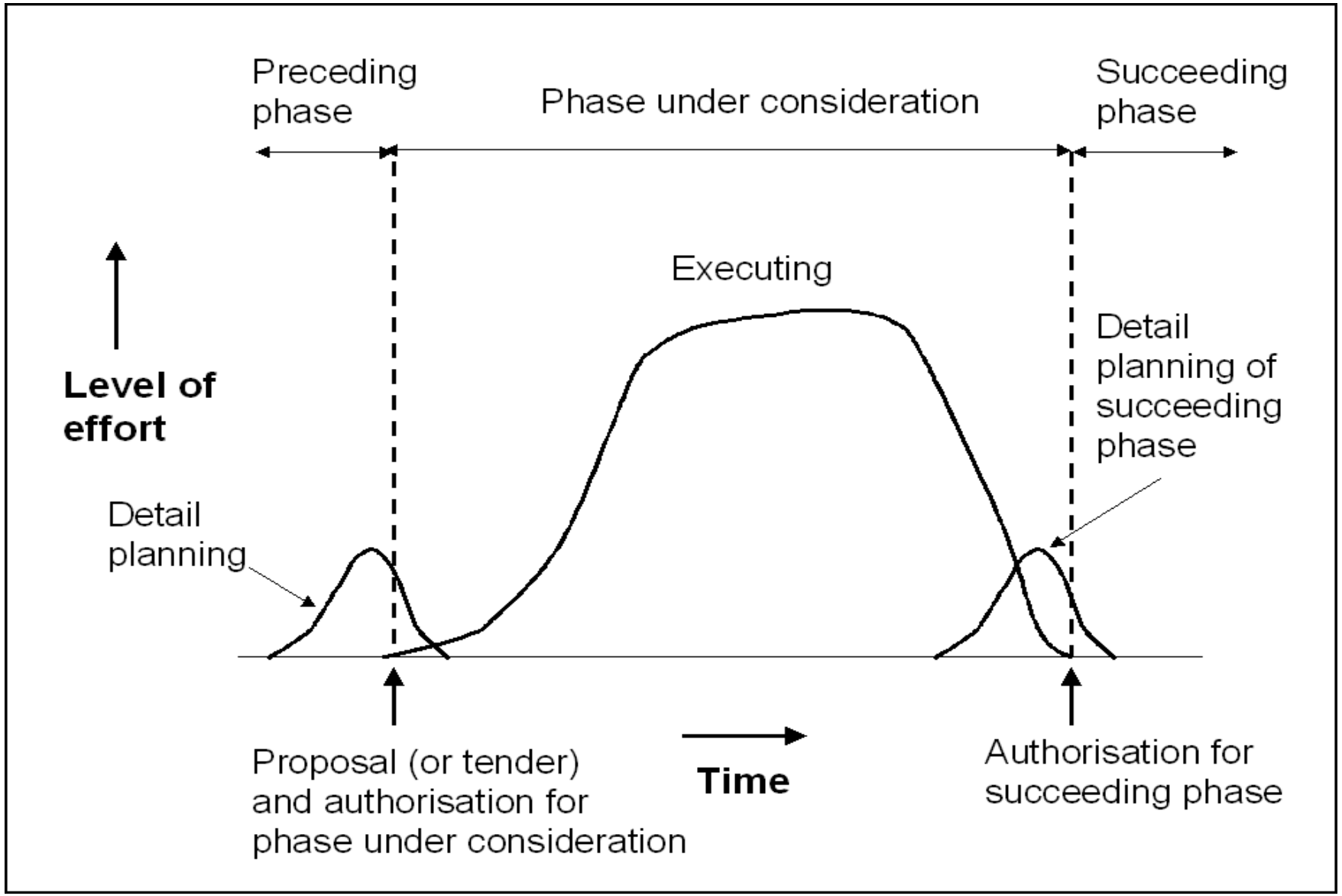
Phased Project Planning



Phased Project Planning

- Sometimes each phase concludes with a *milestone*
  - The customer or management review the deliverables and project performance
  - If satisfied, they approve the deliverables and pay for work done thus far.
- They also review the detailed plan for the next phase,
  - If satisfied they authorize the next phase.
- Authorization to begin the next phase represents a commitment by the customer and management to support the phase
- If the project has to be terminated, it is terminated at the end of a phase.

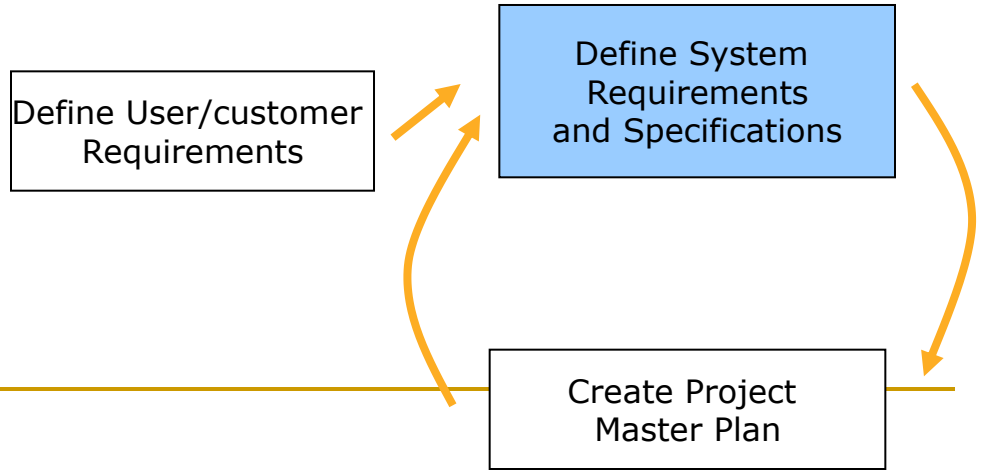
Phased Project Planning



System Definition

- System requirements and specifications elaborate in detail on the technical performance of end-item
- Tell designers and builders what project end-item (deliverable) must be and do
- Are a translation of user requirements into technical requirements
- Users are ignorant of most

  system requirements



Requirements Definition is Important!

- *Project failure often stems from ambiguous or incomplete requirements*
- Example: “I want this room painted blue.”?

  This statement is ambiguous and incomplete.

  - Doesn’t say what *type* of blue or *how much* of room to paint.

  Must specify exact color (paint spec. #) and exact part of room (e.g., “only walls”)

Requirements Definition is Important!

- Without clear requirements, contractor
  - Cannot know “what” is wanted
  - Hence, cannot know how to provide it
  - Hence, cannot define the necessary project work (“how” the project must be done)

Requirements Definition (cont'd)

- Most customers are somewhat unclear as to what their requirements are.
- Role of PM is to work with customer/user to clearly define requirements. This is a contractor responsibility since the project must fulfill customer's requirements.

Requirements Definition (cont'd)

- Requirements are
  - the "whats" that the project seeks to provide
  - the basis for project planning
  - the basis for determining project completion
  - define the contractor's obligation to customer
  - a principle cause of project cost and schedule overruns
- Despite their importance, good requirements are not necessarily easy to create

Problems with Requirements Definition

1. Incorrect Requirements: Wrong Needs
   ("Needs" = user's/customer's problem)
   - Incorrect Definition of Needs
   - Shifting or Vagueness of Needs
   - Needs of Wrong User
   - Conflicting Needs of Multiple Users
   - Distortions of Needs by Experts

Problems with Requirements Definition (cont'd)

2. Imprecise or Ambiguous Requirements (Subject to Multiple Interpretations)
   - Human Language
   - Deliberate Imprecision for Flexibility
   - Nebulous Projects
   - User's Lack of Expertise
   - Project Planner's Oversight

Problems with Requirements Definition (cont'd)

3. Shifting Requirements
   - User's Change of Mind
   - Insurmountable Obstacles
   - New Opportunities
   - Seeking Perfection

4. Over-Specification of Requirements
   - Initiative Discouraged
   - Requirements Ignored
   - Insufficient Information

Problems with Requirements Definition (cont'd)

5. Under-Specification of Requirements
   - Chaotic project planning resulting in cost and schedule overruns

Guidelines for Defining User Requirements

1. State each requirement clearly; have both user and project staff sign-off on it
2. Assume if a requirement can be misinterpreted, it will be misinterpreted
3. Accept that changes to project are inevitable and things will not go precisely as planned

Guidelines for Defining User Requirements (cont'd)

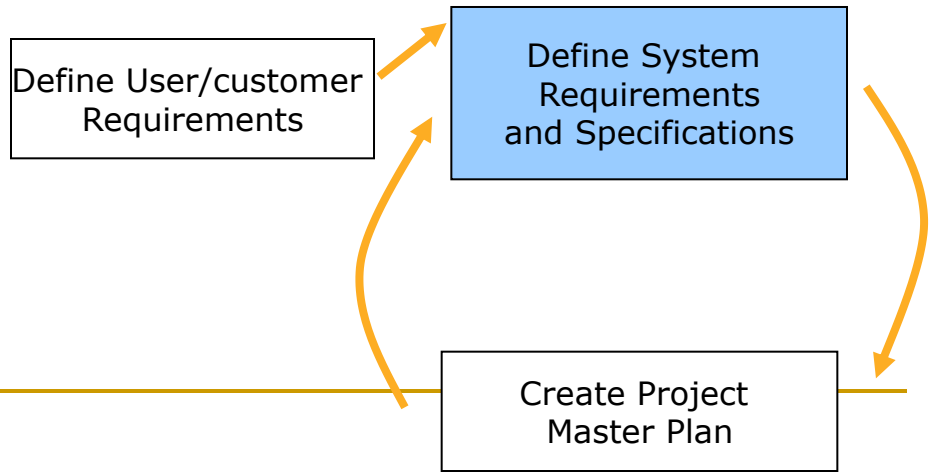
4. Include pictures, graphs, models, and other non-verbal exhibits in requirements formulation
5. Carefully monitor *changes* to requirements once project has begun
6. Educate both user and project staff about problems associated with specifying requirements

System Requirements Definition

- System requirements and specifications are a translation of user requirements into technical requirements
- They elaborate in detail on the technical performance of end-item
- They tell designers and builders what project end-item (deliverable) must be and do
- Often, users are ignorant

  of system requirements

  (in most cases, that's okay)



Requirements Definition, example

Customer/user need

Reusable three-person space vehicle that can be launched twice within two weeks

Requirements Definition

Customer/user need

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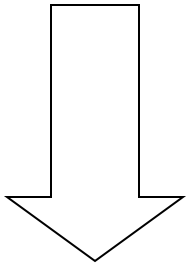

Customer/user objectives and constraints

- Win X-Prize ($10 M)
- Develop technology upon which to build a entire system to carry paying passengers into space.
- Develop vehicle that will be FAA certified.

Requirements Definition

Customer/user need

Reusable three-person space vehicle that can be launched twice within two weeks

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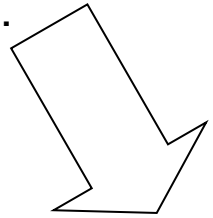

Customer/user requirements, examples

1.0 Climb to 100 km.
2.0 Comfortable, enjoyable flight
3.0 Capable of 2-week turnaround
etc.

Requirements Definition

Customer/user requirements, examples

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- These requirements must be translated into ***system requirements***
- ***System requirements*** are the technical requirements
- They tell the project team *what* the end-item system *must do*
- A ***functional requirement*** is a kind of system requirement
  - It specifies the functions the end-item system must perform to meet the user requirements
  - Associated with functional requirements are ***performance requirements*** that specify the required level of performance

Requirements Definition

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System requirements, examples

- **functional**
- **performance**
- **verification**

1.0 Climb to 100 km.
1.1 Function: Engine generates enough thrust
Performance: 73,500 kN (16,523 lbf).
Verification: simulation; mockup tests; ground tests of ignition, ramp up, steady state, shut down

2.0 Comfortable, enjoyable flight
2.1 Function: Cabin temperature at comfortable level
Performance: 75-85 degrees F
Verification: ground tests, extreme environment chamber; flight tests

3.0 2-week turnaround
3.1 Function: Refueling takes less than 2 weeks
Performance: Actual refueling procedure should take 3 days max
Verification: simulated refueling procedure; refueling tests, etc.

Requirements Definition
Requirements Priority and Margin

Each requirement should have a specified priority and margin.

Priority Level

- The relative importance of the requirement
- In case multiple requirements conflict the priority level determines which can be bent and which not.

Margin

- The amount by which the requirement can vary.
  For example, “max temperature 85 degrees F ; margin 2 degrees ” says that, if necessary, max temperature can be exceeded by up to 2 degrees.

Requirements Definition

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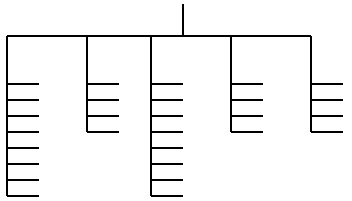
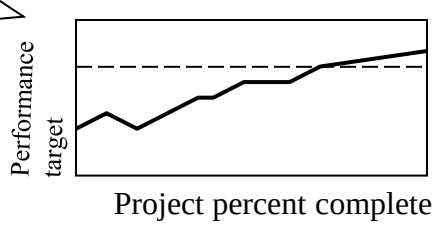
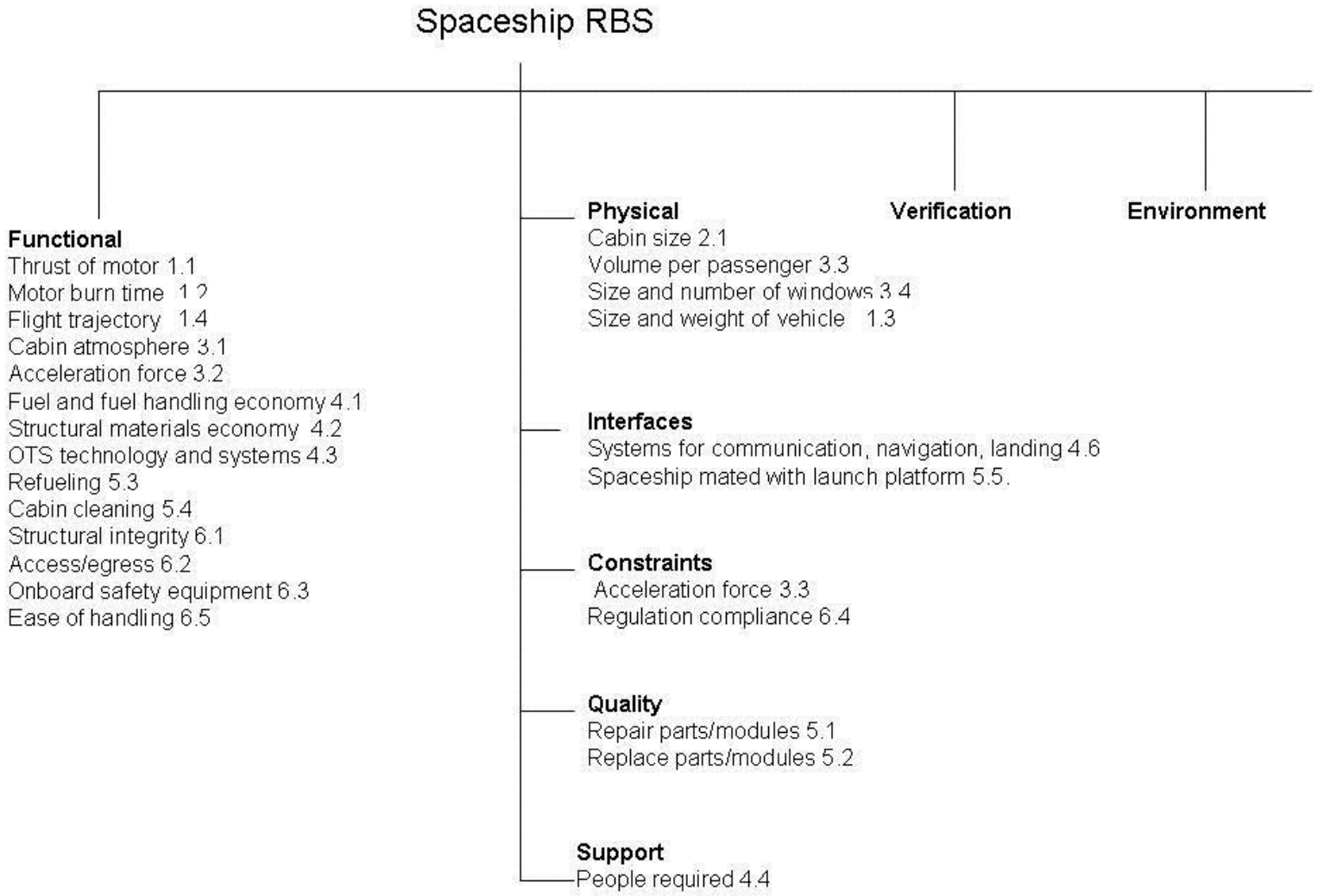
Requirements Breakdown Structure



Technical Performance Measurements



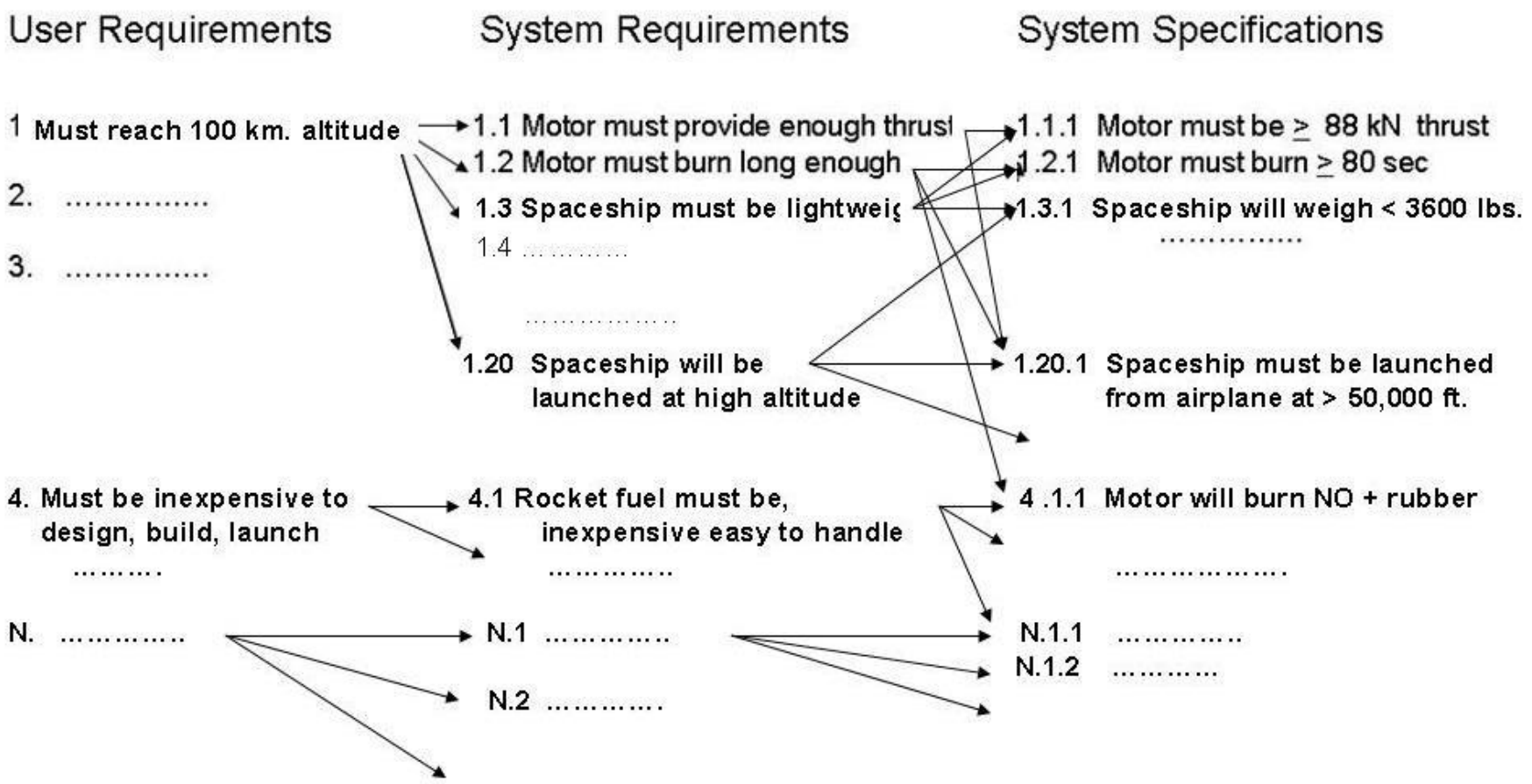
Requirements Breakdown Structure



Shows functional and other requirements sorted into logical groups.

System Specifications

- Define in more detail the system requirements.
  - Example shows system specifications derived from system requirements, which are derived from user requirements.



System Specifications

- Guide actual project work; are written by and for project specialists—systems analysts, programmers, engineers, product and process designers, consultants, etc.
- Address all areas of the project—design, fabrication, installation, operation, and maintenance.
- Enable ***traceability***
  - Throughout the systems development cycle numerous changes and tradeoffs will be made to requirements and specifications
  - Tracing the impact of changes in some specifications and requirements to others is called “traceability.”
  - Traceability involves keeping track of specifications, tying them to physical components, tracing their impacts, and *controlling* changes so requirements are met and do not conflict.
  - Managing traceability is called *configuration management* and *change control*.

Need: Reusable three-person space vehicle that can be launched twice within two weeks

Deliverable: Burt Rutan's SpaceshipOne, 2004

Project and System Definition

How do you keep everyone in the project focused on those requirements?

How do you develop a project plan that will be able to account for those requirements?

- A: make the system and project definition a *team effort*
  - incorporate the perspectives of everyone with a stake in the project
    - customers, suppliers, functional areas such as engineering, marketing, manufacturing, customer service, and purchasing, and users and operators.
- The more these individuals and groups have a hand in defining requirements and the plan, better the system requirements will account for their needs throughout the systems life cycle
- Common team approaches in Definition are ***Concurrent Engineering*** (chapter 13) and ***QFD***.