SUMMARY OF COOLING
Requirements Analysis & Specification

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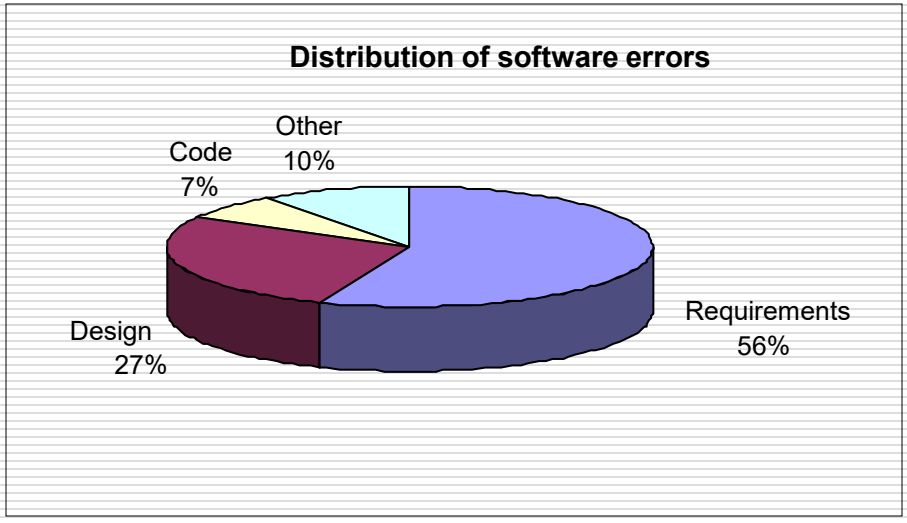
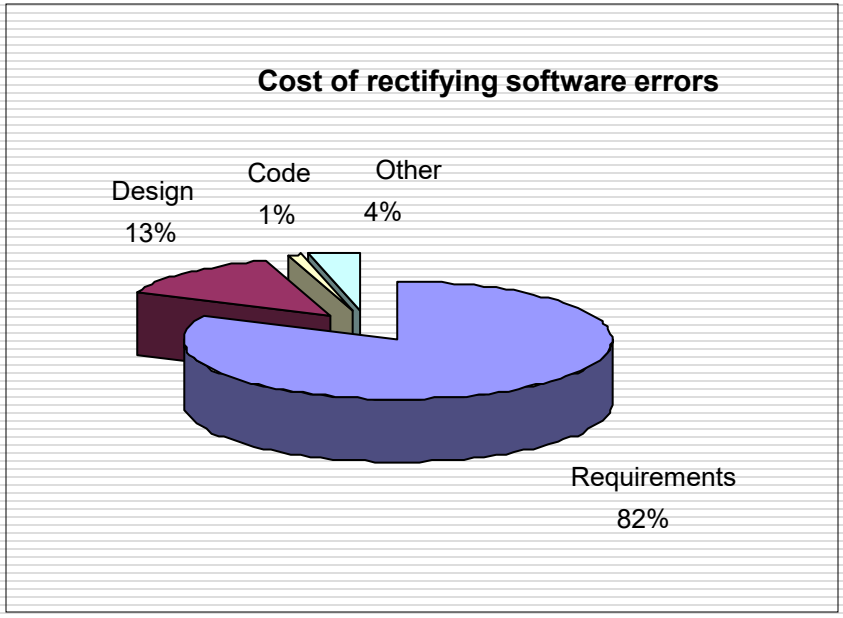
The Structure

1. Requirements Analysis & Specification
   - The important of the requirements stage
   - Making mistake
   - Practical approaches
   - Communication aspects

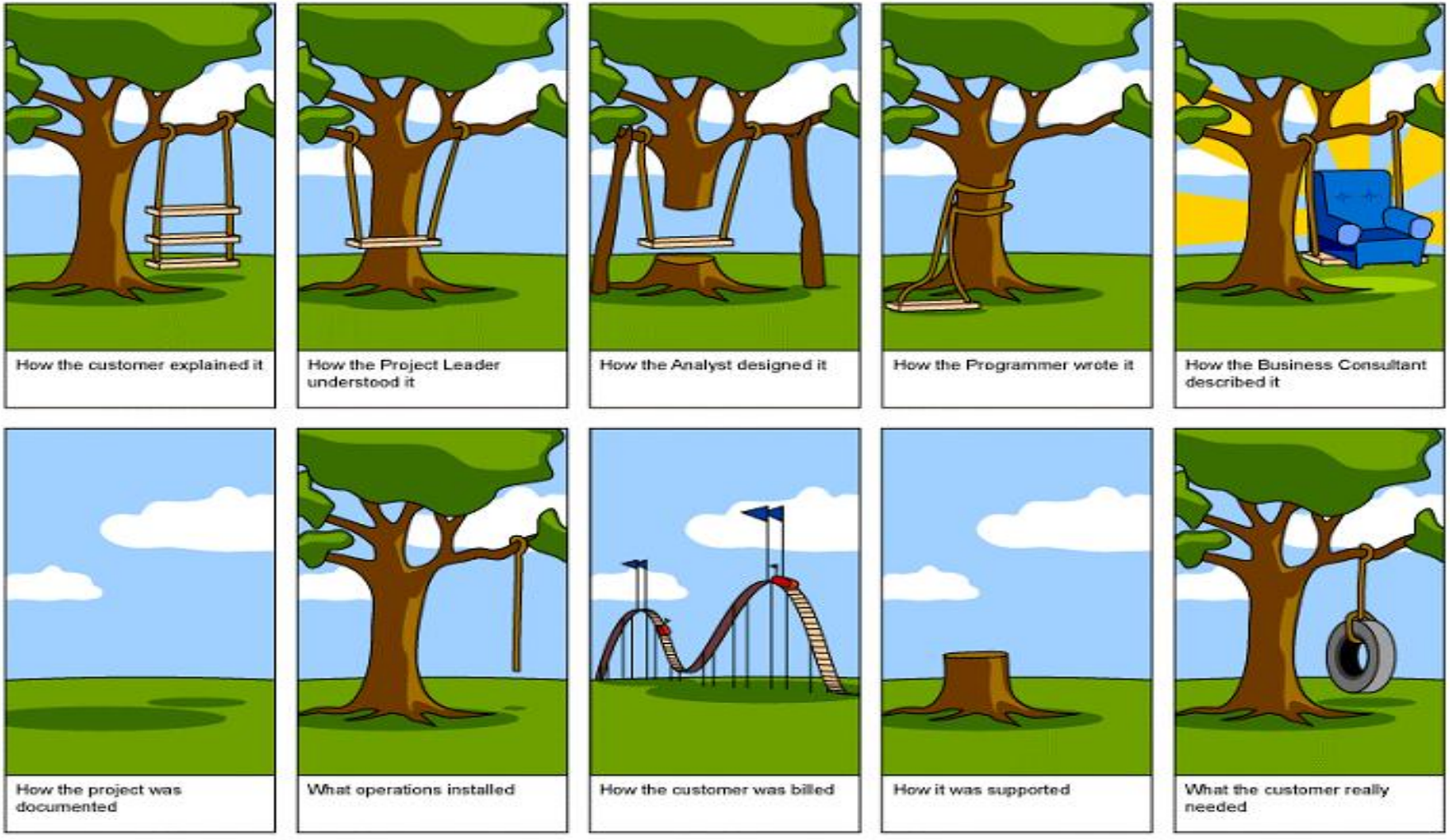
The Importance of the Requirements Stage

- Why???
  - Because they have a propound effect on the overall software error rates and productivity => related to system cost.

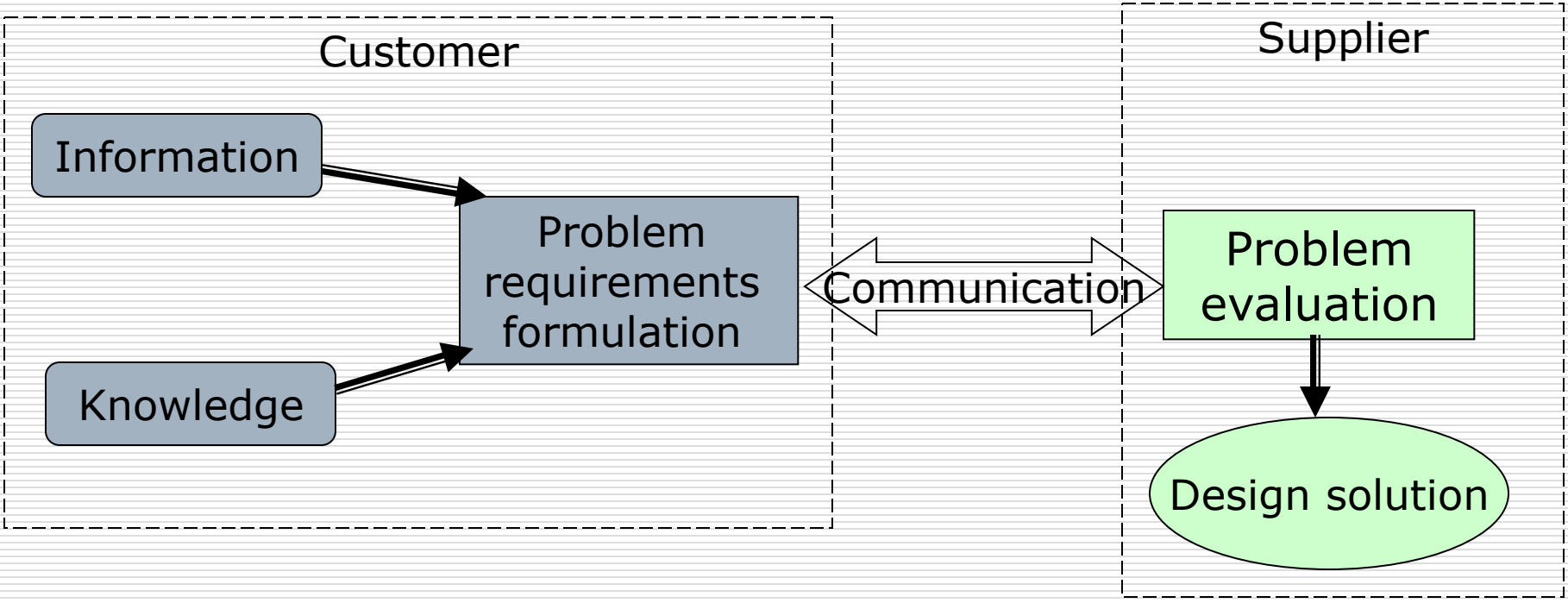




Making Mistakes

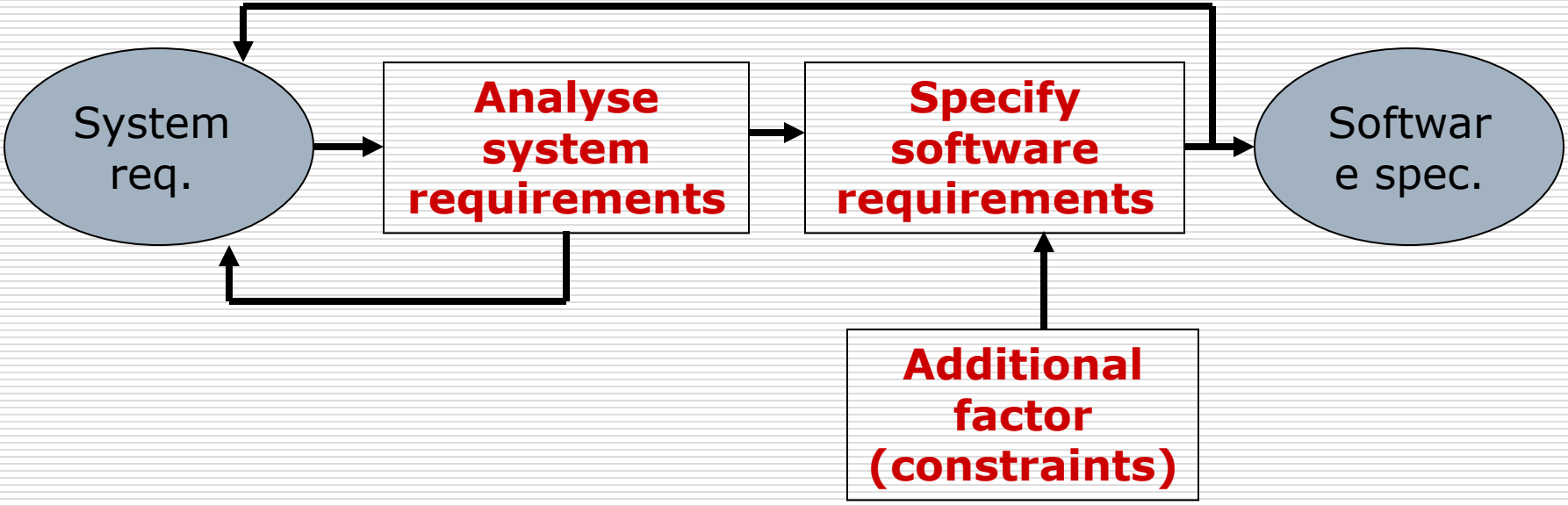


Problems in formulating specifications



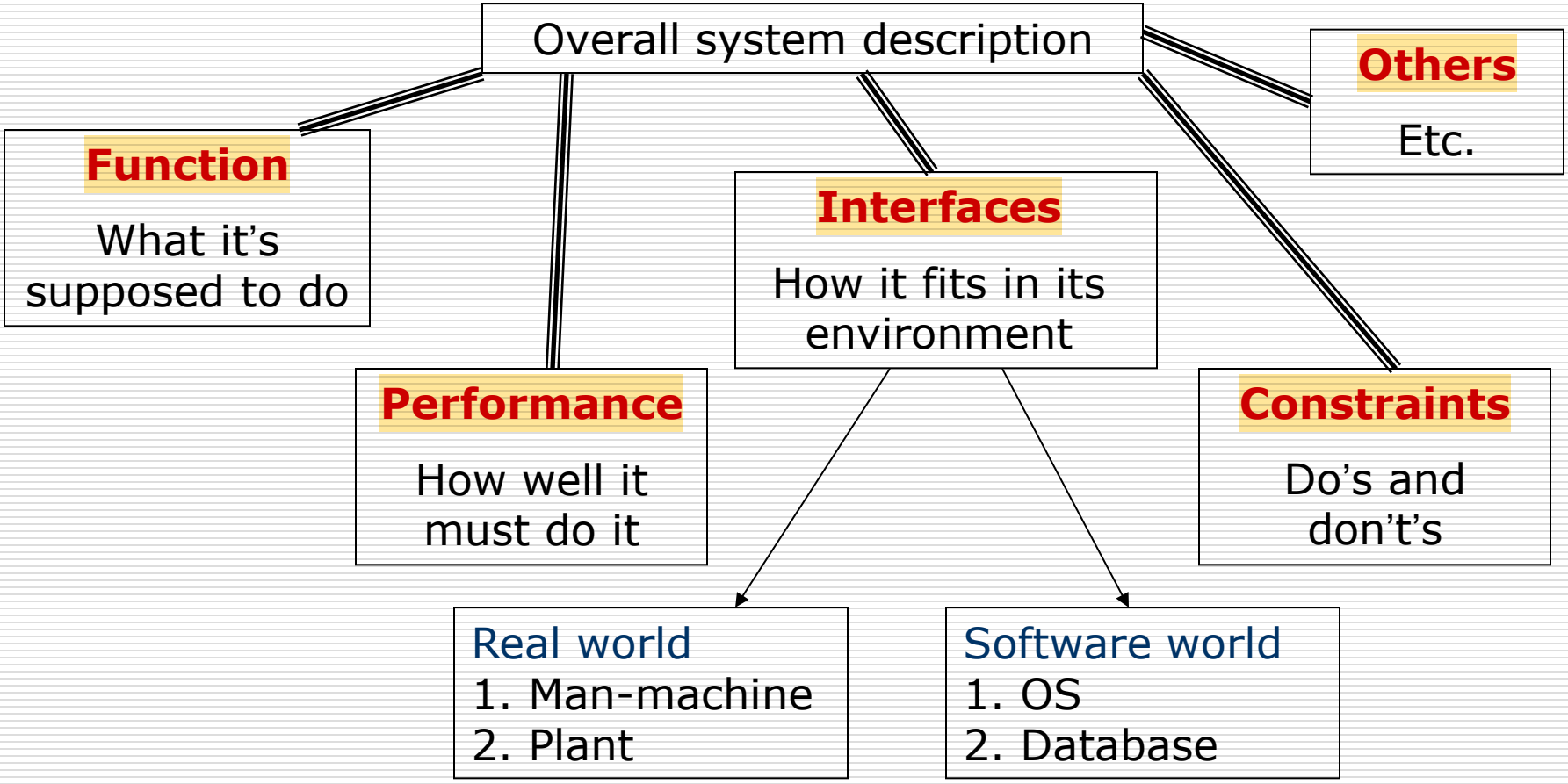
1. Problems in formulating specifications
2. Problems in communicating requirements document the requirement
3. Problems in understanding requirements

Practical approaches
The Requirement Phases



more related with non functional requirement

Practical approaches
Analysis & Specification



devices - communicate

Practical approaches
Tool Support & Automation

- Difficulty in all software development

Complexity

- To deal with the difficulty: why we have the requirement?
  1. Consistent => no mistake & conflict
  2. Correct => not wrong
  3. Complete => not omitting

- Automated tools are needed. Include in your assignment 1 report.

Functional, non-functional & development requirements

- Functional – What it does

FUNCTIONAL REQUIREMENT SPECIFICATION FOR MRCA AVIONICS:
SYSTEM: Flight Control.
SUBSYSTEM: Autopilot.

1. Process: function	The autopilot, when in hard mode, is required to control altitude to 150 metres, plus or minus 3 metres. at airspeeds up to 500 knots.
2. Inputs:	Altitude, airspeed and groundspeed. Terrain-following radar. Angle of attack. Roll, pitch and yaw gyros. Stick demand. sensors
3. Outputs:	Aileron, rudder and elevator servo commands.
4. Major error:	Loss of altitude or radar signals.
5. Exception response:	Disengage autopilot normal mode, engage emergency mode.

Functional, non-functional & development requirements

- Non-functional requirements – What it has: Attributes

NON-FUNCTIONAL REQUIREMENT SPECIFICATION FOR MRCA AVIONICS:
SYSTEM: flight Control. **SUBSYSTEM**: Autopilot.

1. PERFORMANCE:

Computation: The control algorithm is of the form
Ka[(1 +ST,)(1 +ST 2)]/[(1 +ST 3)(1 +ST.)]
Computation time: This must be achieved in 5 milliseconds.
Computation accuracy: Calculations must be accurate to within 0.01%.
Control loop update rates: 100 per second.
Variation on loop sampling time: 1 millisecond from sample to sample.
Response to loss of altitude signal: 100 microseconds maximum.
Redundancy: Quad redundant processor system.
System fault handling: Majority voting on processor outputs.
Mean Time Between Failures (MTBF) per control channel: 5000 hours.
Reliability per control channel: 99.98%.
Mean Time To Repair (MTIR) per control channel: 1 hour.
Storage capacity: 1 MByte. storage can also be performance

Functional, non-functional & development requirements

2. INTERFACES.

2.1 Interfaces - MMI.

The pilots will be able to select hard, medium or soft rides via a touch screen facility on the head down display.

2.2 Interfaces - Aircraft.

(a) Analogue input signals: These are derived from the following sources:
Altitude, airspeed and groundspeed. Terrain-following radar.
Angle of attack.
Roll. pitch and yaw gyros. Stick demand.
All are digitized using a 12 bit analogue-to-digital converter having a conversion time of 10 microseconds.
(b) Analogue output signals: These are fed to the following items:
Aileron, rudder and elevator servo controllers.
A 12 bit digital-to-analogue converter is used on the output of the controller.
(c) Avionics data bus: All state information is to be fed out onto the aircraft Mil-Std 1553 data bus.

2.3 Interfaces - Software.

operating system

The application software will be designed to interlace to the VRTX32 real-time executive.

Functional, non-functional & development requirements

- Development requirements – How it should be built

3. DESIGN CONSTRAINTS.

Programming language: Ada95. 限制条件
Operating system: VRTX32.
Avionic's data bus communication protocols: Mil-Std 1553b.
Processor type: Motorola PC604.
Maximum memory capacity (including expansion capability): 500 Kbytes.
Spare processor performance capacity on delivery: 50% min.
Documentation: JSP188.

4. OTHER CONSTRAINTS.

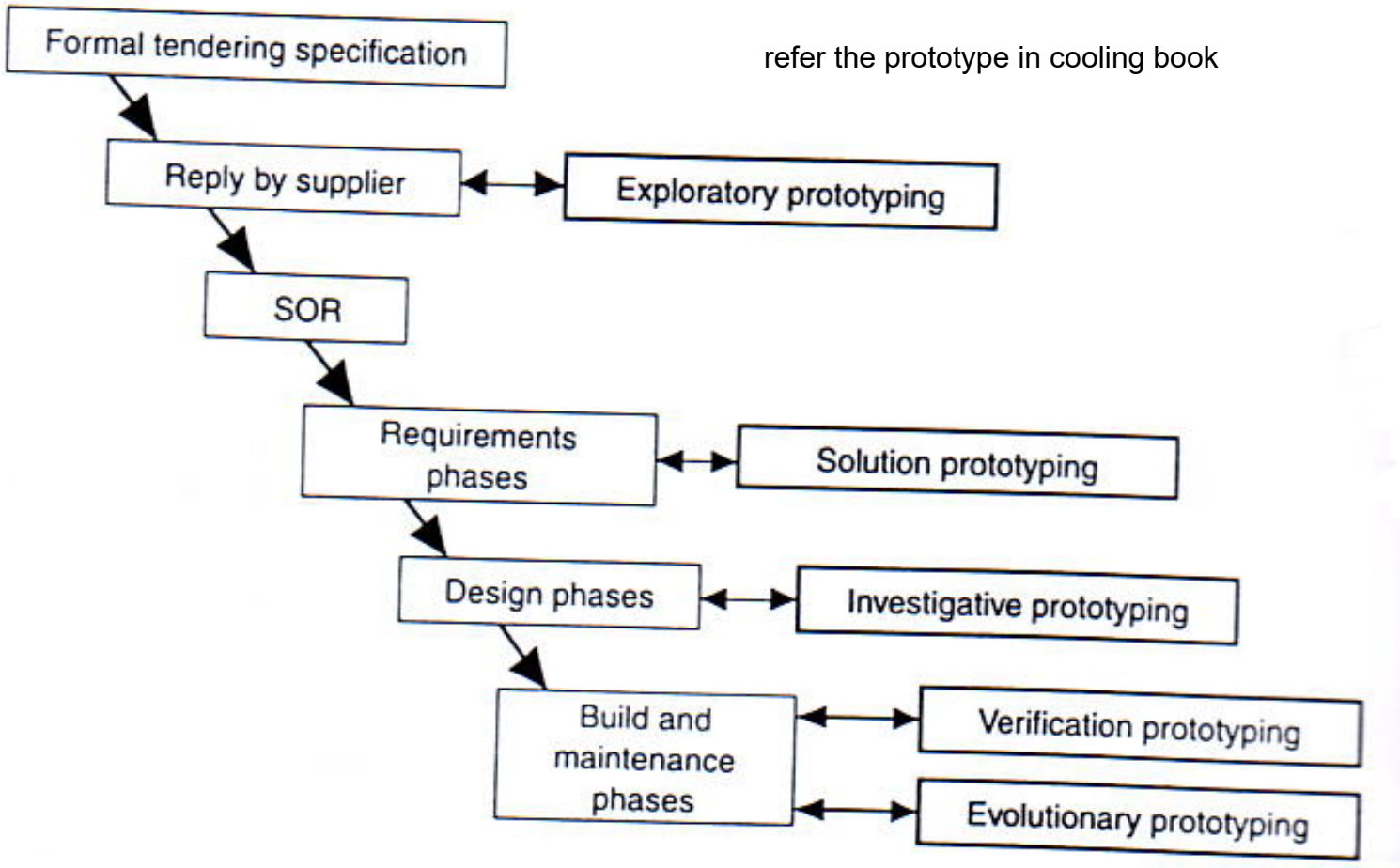
Maximum size: Half ATR case size.
Maximum weight: 10 lb.
Temperature range: -55 to + 125 degrees centigrade.
Servicing policy: Line replaceable unit.
Test: Built-in test to identify faults to unit level.

Communication Aspects
Prototyping

- In engineering a prototype – a pre-production version of a manufactured product (component, subsystem or system)

- What to evaluate during prototyping?
  1. Is the product actually feasible?
  2. Are there unforeseen high-risk technical & cost aspect?
  3. Are the design & build correct?
  4. Can it be built in a manufacturing environment?
  5. Can it be built for the right price?

Prototyping
Prototyping within the software lifecycle



refer the prototype in cooling book

Prototyping
Terminology & Types

- Software prototyping
  1. Exploratory
  2. Solution
  3. Investigative
  4. Verification
  5. Evolutionary
- Requirements prototyping
- Rapid prototyping
- Animation prototyping

get the definition from cooling book

question will be out in exam and final

SUMMARY OF COOLING
Design Concepts

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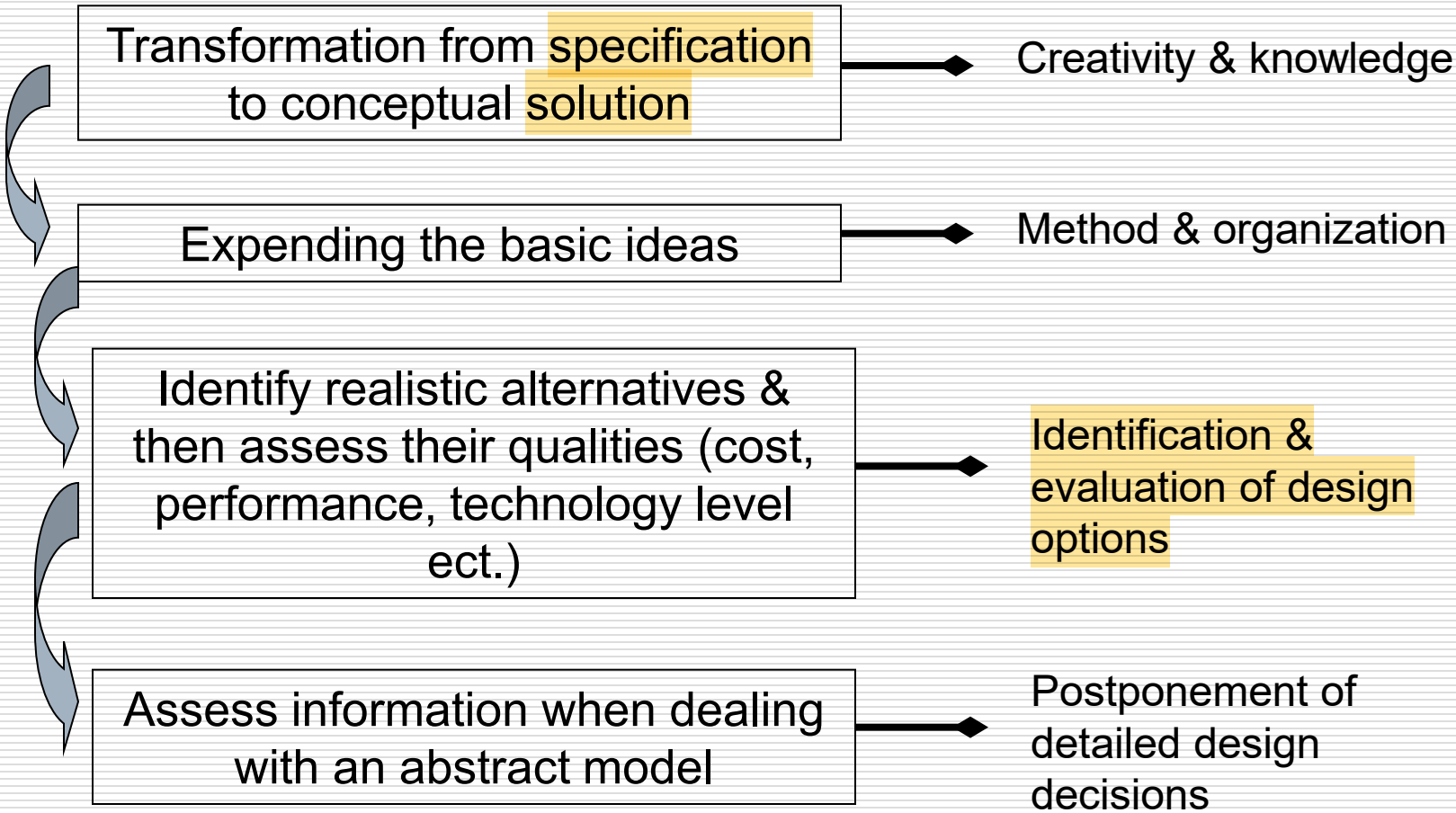
The Structure

1. Design Concept how to link it with real time system
   - Design Fundamentals
   - The elements of modular design
   - Program control structure
   - Functional structuring
   - Object-oriented design
   - Data flow design

Design fundamentals



Design fundamentals

Expend descriptive model into something specific by tackling the following factors:

1. Identify subsystems
2. Identify interface between subsystems
3. Evaluate subsystem interaction
4. Identify work-loading and allocation
5. Assess man-power req.

→ General design evolution

} evaluation of timing

Top-down & bottom-up

→ Solve the right problem

The elements of modular design

- Read text book pg. 127 – 143.

refer to cooling book

class diagram

- Important elements & building blocks of the design process
  1. Modules
  2. Coupling
  3. Cohesion (Coincidental, logical, temporal, procedural, communication, sequential, functional)
  4. Size & Complexity

structure

requirement and design

behaviour

activity diagram
sequence diagram
*how to evaluate design

- Design methodologies
  1. Functional structuring of software design
  2. Object-oriented design
  3. Data flow design

Design Methodologies
Group Investigation

1. Problem Solving 1
2. Assignment Activity

Thank You.