

CMPE 349 Spring 2017 E.F.C. LaBerge

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Week 1

1.1

# **Requirement Documents**

- You will be (or are in the process of ) writing one
- May be combined with a system design document...
- ...the Iridium Air Interface Spec is the best example I've ever seen.
- (I'll try to get a partial copy)
- Follow the rules I gave earlier
  - Audience
  - Purpose
  - Write by Design

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### Specifications = Requirements

- In a spec or requirements document the purpose to to clearly describe what the product will do...
- ...without describing how the product will do it...
- ...unless the method is specifically determined by a stakeholder
- A good spec will let two competing teams create different, compliant designs
- Your audience is the people (engineers) who will actually design and build the equipment
- Specifications are formal writing, and have some well-established guidelines, particular about language
- Short sentences and short, well-enumerated paragraphs are normal

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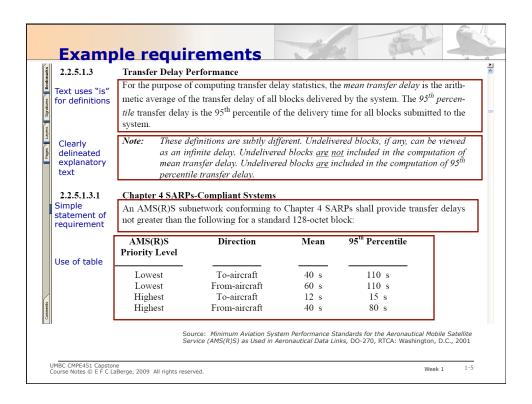
# Defining the "requirement verbs"

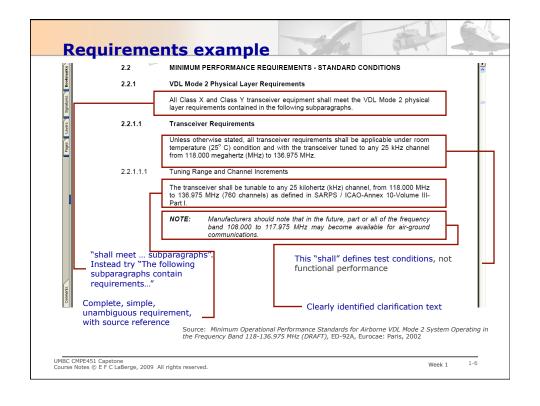
- "shall", "will", "must", "should", "may"
- Use "shall" for mandatory items that will be tested
- "Will" is frequently used to describe intent or establish context; not for requirements
- "Must" is frequently used to describe user actions, but occasionally used as a synonym for "shall"
- "Should" indicates a desired action or function or a recommended but not required attribute.
  - "Shoulds" may become requirements due to higher level documents: "shall perform all the recommended actions in document xxx".
- May is permissive, and is generally used to specifically allow certain implementation options.

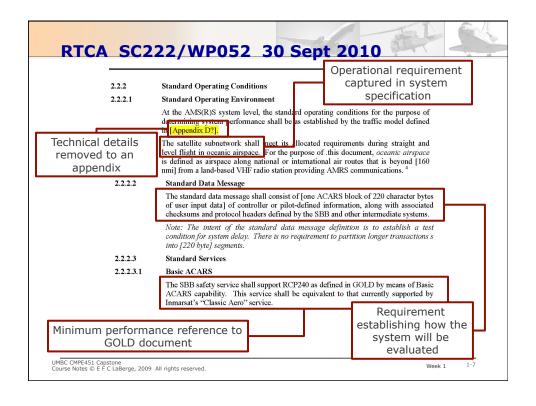
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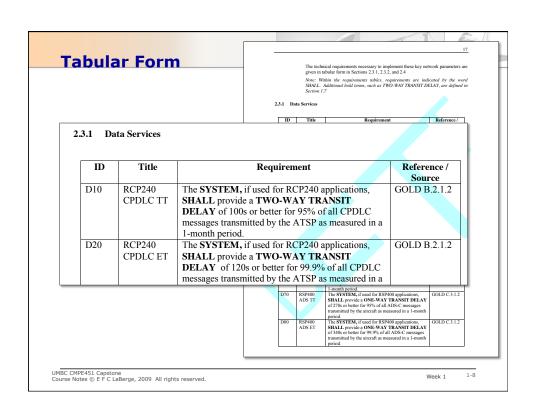
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### Functional Requirements

- What actions must your "verb phrase" perform
  - Use "shall" to denote requirements
  - Use "should" to denote desirable attributes that are optional
- Describe "what" not "how", unless "how" is absolutely essential to the function
  - Do not write the requirement to require your design...
  - ...recognize that there are other options.
    - ...shall provide Category III accuracy at all runways
    - •...shall provide lateral and vertical guidance information, basic airport data and auxiliary data when appropriate
    - ....shall include fast forward, rewind, and record functions

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## **Performance Requirements**

- How well must the function be performed?
- Performance requirements must be quantitative
  - ...shall complete processing in 1 second
  - ...shall have a vertical error of less that +/-2 ft, 95% of the time.
  - ...shall provide a probability of detection of 95% with a signal level of -105 dBm.
  - ...shall service at least 100 simultaneous users
  - ...shall operate as specified between -55 C and +70 C
- When you establish the requirement, sketch out the test method as well.
- If you can't envision a test, it isn't a requirement.

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### **Test Requirements**

- Set the conditions and procedures for testing that a requirement is met.
- Generally, test requirements are pass/fail, and are not designed to quantify performance.
- Quantifying performance falls in the realm of engineering tests, part of assuring that the design works as intended.
- ...standard test conditions shall be 70 F, no vibration, 30-50% relative humidity
- ...tests shall be conducted every ten channels across the tunable range of the radio
- ...the receiver shall meet the requirements of 2.4.1 95% of the time in a 1200 second sample.

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#### Verification

- Test: a repeatable, quantifiable measurement of some characteristic of the equipment or system, usually a performance requirement
- Demonstration: a repeatable qualitative indication that the equipment has some characteristic or performs some function
- Inspection: a repeatable qualitative, usually visual examination of the product, usually for some physical characteristic (color, texture, etc)
- Analysis: a mathematical extrapolation of system performance based on the design details which may be used to satisfy a performance requirement that requires an extremely long time to test.

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#### General outline

- Introduction, including purpose and scope, an overview of the system being specified, reference documents and a rough road map to the specification document
- A list of related specifications that will be referred to in your design: e.g. USB, Bluetooth, 802.xx, etc.
- Functional Requirements, "do this", "don't do that"
- Performance Requirements, which must contain quantifiable, testable values
- Test Requirements indicate how the device or system is to be tested and performance and functions verified.
- Design Requirement indicate specific, usually standardized process that must be employed in the design, development, assembly, and verification
- Installation Requirements (?)

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## Summary

- Follow directions
- Use the verbs
- Organize your document
- It's not a requirement if it isn't testable!
- It's not a requirement if it isn't testable!
- Requirements are what the product has to do, not how the product has to do it...
- ...unless necessary for standardization.

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