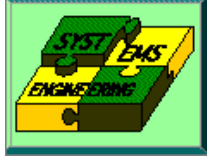
George Mason University

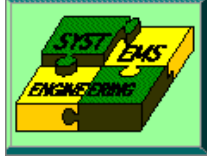


SYST 101: Intro to Systems

Lecture 23

Apr 13, 2004

C. Wells, SEOR Dept.



Announcements

Agenda

- Dr. Kathy Laskey (SEOR) on the department curriculum
- Modeling - Initial Concepts

Models Are Scalable

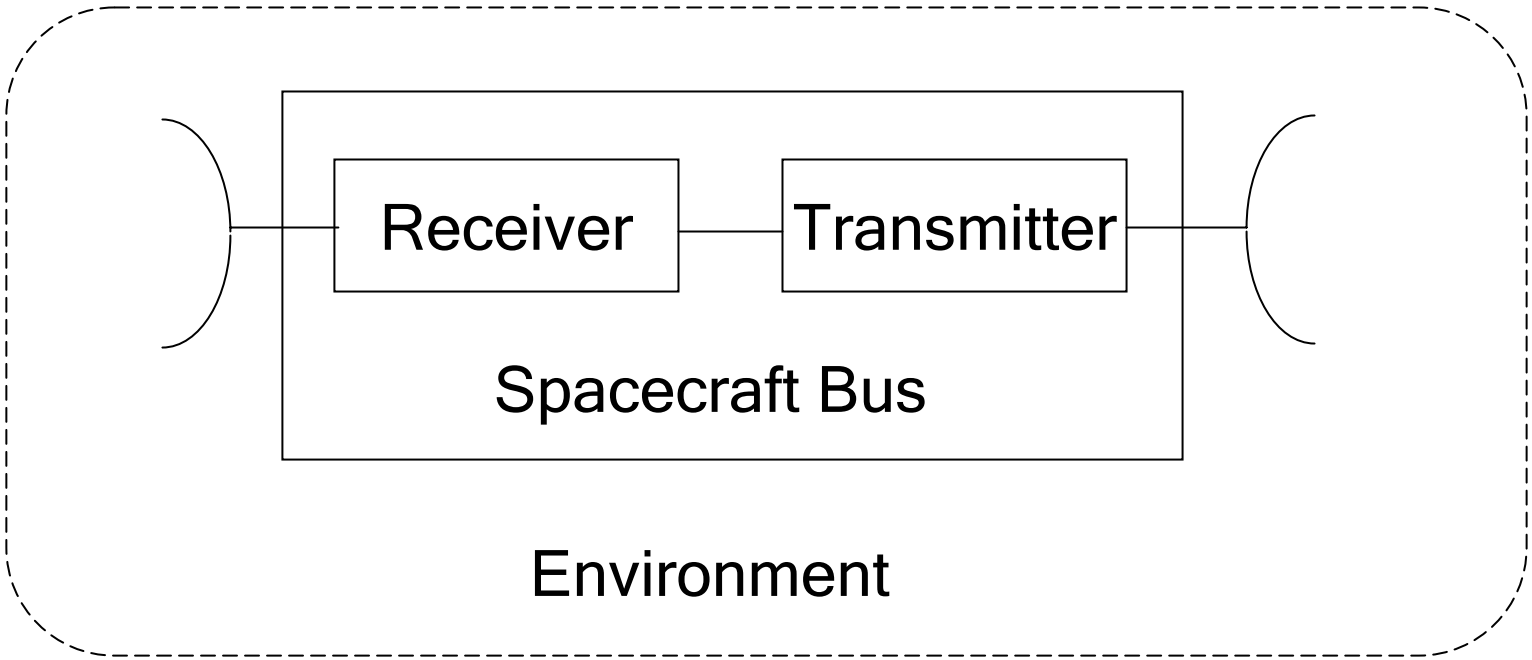
- How detailed must a model be?
  - It depends on the use
- What kind of model should be used?
  - It depends on the use
- You can do a cost/benefit analysis of the information gained (benefit) versus the type/detail of the model (cost)

Model Verification

- Models may need to be verified if their accuracy is questionable
  - Too simplified
  - Design far from the existing practice
  - Design close to failure
- The design may require Qualification if the accuracy of the model is questionable

System Design Using Models

- Design a satellite to relay communications
- Conceptual (first guess) model



Spacecraft Subsystems

- Power
  - Generation
  - Storage
- Thermal control
- Attitude control
  - Determination
  - Control
- Structures
- Propulsion
- Command and Control
- Communications
  - Transmit Antenna
  - Receive Antenna
  - Receiver
  - Transmitter
  - Command & Control

External Elements

- Orbital Dynamics
- Ground Station
  - Antennas and pointing
  - Receivers
  - Transmitters
  - Command and control
  - Networks

An N^2 Diagram

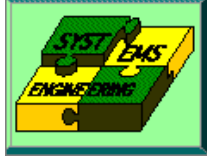
		orbital dynamics/launch	ground					power		thermal control	attitude				TT&C		comm.		
			antennas & pointing	receivers	transmitters	command & control	networks	generation	storage		determination	control	structures	propulsion	commanding	telemetry	antennas & pinting	receiver	transmitter
orbital dynamics/lanch		--	X	X	X	X	X	X		X	X	X	X	X			X	X	X
ground	antennas & pointing	X	--														X	X	X
ground	receivers	X		--													X		X
ground	transmitters	X			--												X	X	
ground	command & control					--									X	X	X	X	X
ground	networks	X					--										X	X	X
pwr.	generation	X						--	X	X	X	X	X		X	X		X	X
pwr.	storage							X	--	X		X	X		X	X	X	X	X
thermal control		X						X	X	--	X	X	X	X	X	X	X	X	X
att.	determination	X						X		X	--	X			X	X	X	X	X
att.	control	X						X	X	X	X	--	X	X	X	X	X	X	X
structures		X						X	X	X		X	--	X	X	X	X	X	X
propulstion		X								X		X	X	--	X	X			
TTC	command					X		X	X	X	X	X	X	X	--	X	X	X	X
TTC	telemetry					X		X	X	X	X	X	X	X	X	--	X	X	X
comm.	antennas & pointing	X	X	X	X	X	X		X	X	X	X	X		X	X	--	X	X
comm.	receivers	X	X		X	X	X	X	X	X	X	X	X		X	X	X	--	X
comm.	transmitters	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	--

Typical Models in SC Design

- Element performance models
- Breadboard and Brassboard models
- Black box models
- Concept demonstration models
- Launch environment models
- Finite element mechanical models
- Qualification models
- Orbital mechanics models
- Space environment models
- Propagation models

Less Technical Models

- Worker productivity
- Learning curves
- Technology maturity
- Reliability
- Parts availability
- System utilization
- Customer demand
- Regulatory environment



Assignments

- Reading
  - None today.
- Homework (due next class)
  - Give examples of 5 models to include
    - Form
    - Purpose