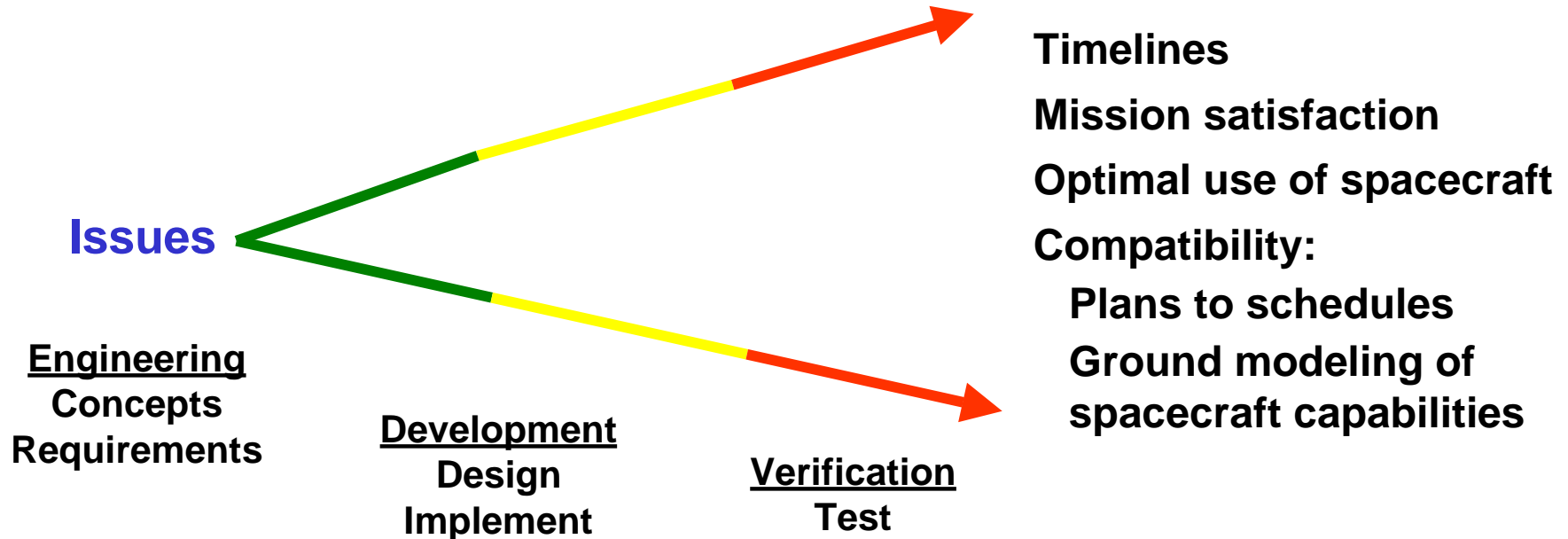




Role of Design, Design Validation, and Verification Activities in Development of Software Systems

David Kaslow
Lockheed Martin M&DS

Growth of Issues - Space/Ground S/W Systems



**Due to system size & complexity -
Issues may not surface until system integration**

Activity Interactions



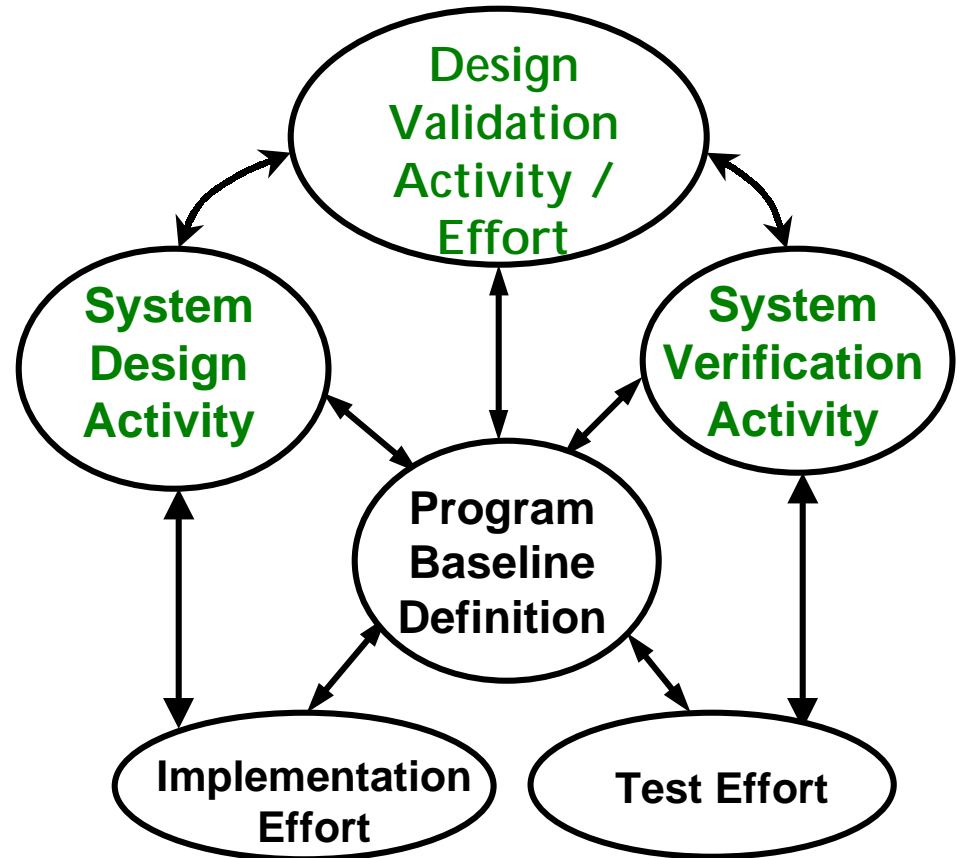
Synergistic Activities Produce

- Design that has been evaluated and approved
- System modeled & designed to meet performance requirements

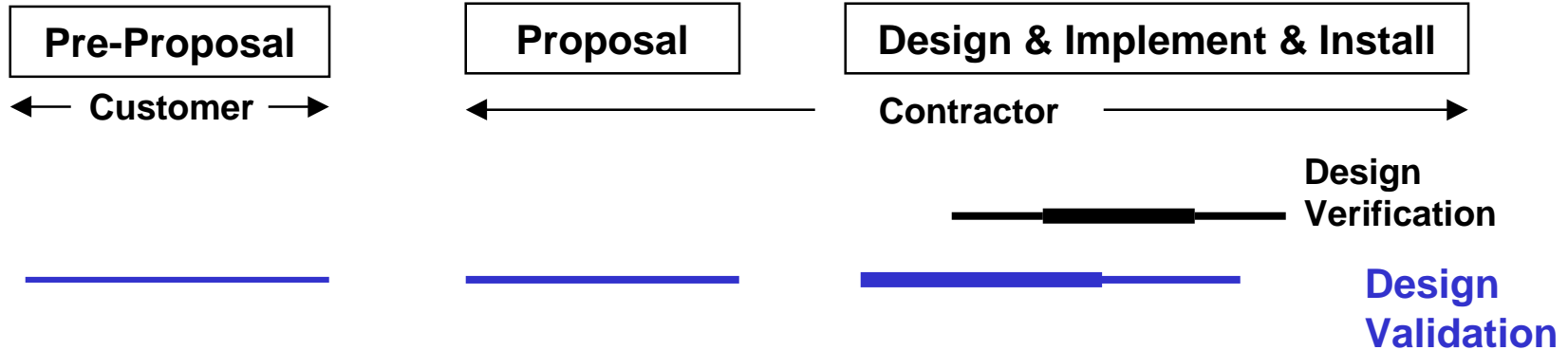
Activity: Planning & Guidance

Effort: Execution of Tasks

Doing the Right Thing is Not the Same as Doing Things Right



Design Validation Models and Prototypes



Models
 Candidate systems:
 payloads, orbits &
 scenarios

Results support
 Cost/capability trades
 Mission objective,
 concepts & rqts
 Request for proposal
 Proposal evaluation

Models
 Candidate payloads,
 orbits & scenarios

Results Support
 Cost/capability trades
 Proposal generation

Models & Prototypes
 Mission objective satisfaction
 Timeline closure
 Availability/reliability
 Planning versus scheduling
 accuracy
 Ground modeling of space
 components
 Constraint check accuracy

Validation - Timeline Satisfaction



Timeline: Generate 7-Day plan in 6 hrs. Update 3 hour portion in 5 min.

Preliminary Design
Guess-timates



Final Design
Estimates &
Measurements



Implementation
Measurements

Simple Models
e.g. Spreadsheets



Detailed Models

Mission layer
Mission architecture
Component timing
Line of code execution

Support layer
Compute, messaging &
data architecture
Processor & data transport
bandwidth & loading

Timeline problems can reside in:

Mission or service layer

Processor, database, or messaging contention

Unexpected amount or frequency of input

Validation - Mission Objective Satisfaction



Planning: 7-Day Horizon - High Value Plan - Support S/C Operations

Develop Candidate Activities

Collection based on collect requests

Collection support

Spacecraft state of health

Based On

Modeling spacecraft capabilities
and constraints

Accurate for optimizing usage

Conservative to avoid constraint
violation

Validate against spacecraft
contractor detailed models



Assembly of Plan

Select and place collection and
support activities

Based on

Maximum 'value'

Planning paradigms

Ops research techniques

Validate against scenarios

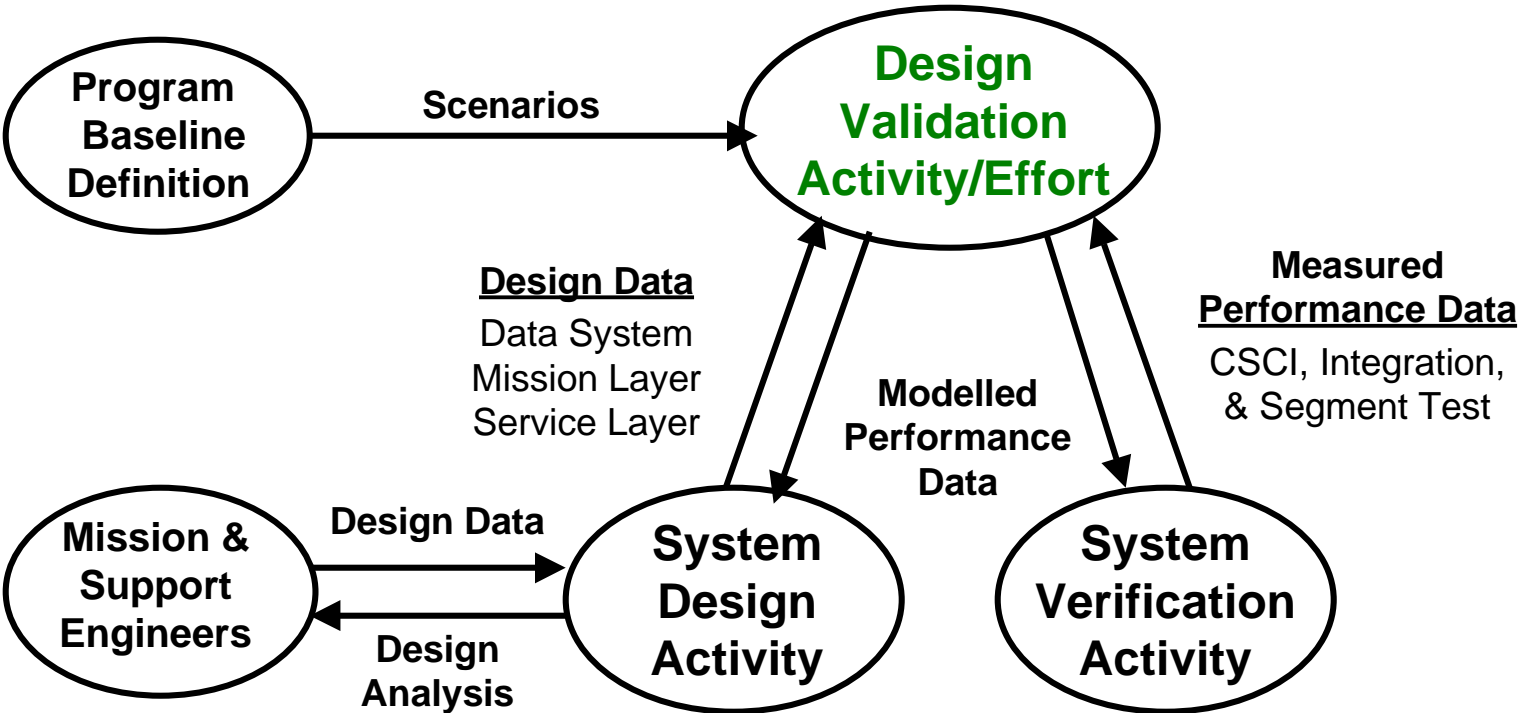
Design Validation - Interaction

Scenarios

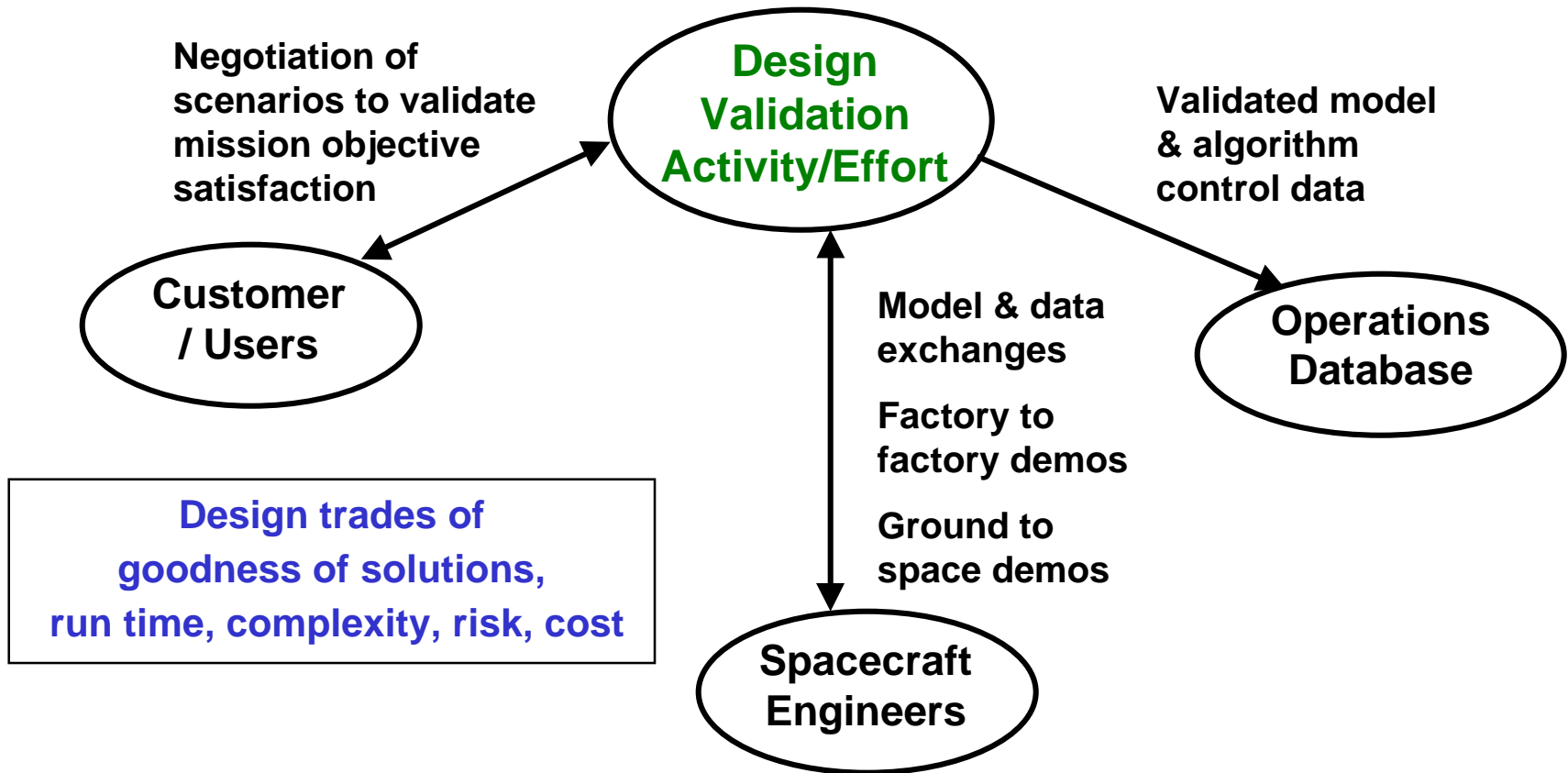
Normal/degraded/failure

Frequency & quantity of inputs, outputs

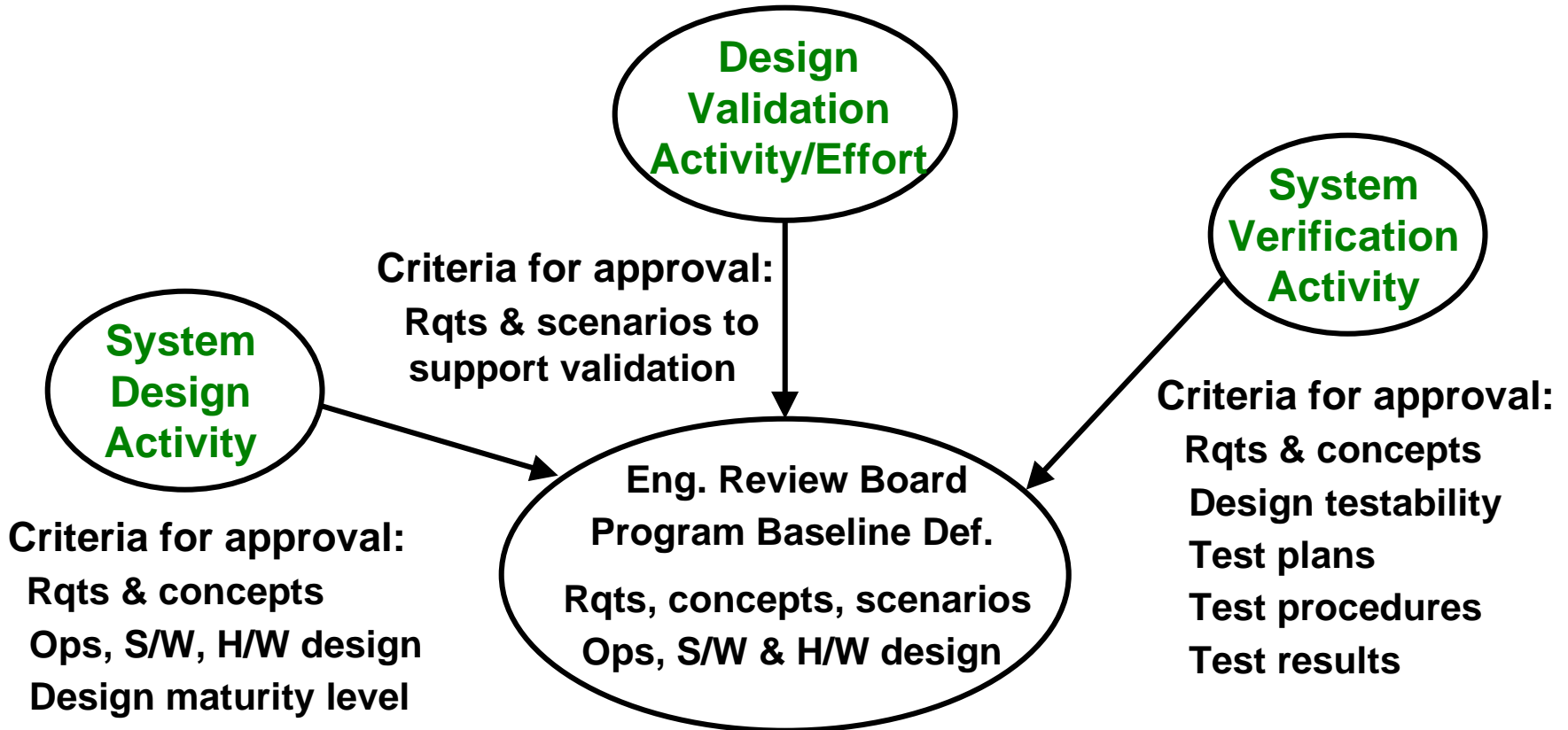
Processor & data transport bandwidths



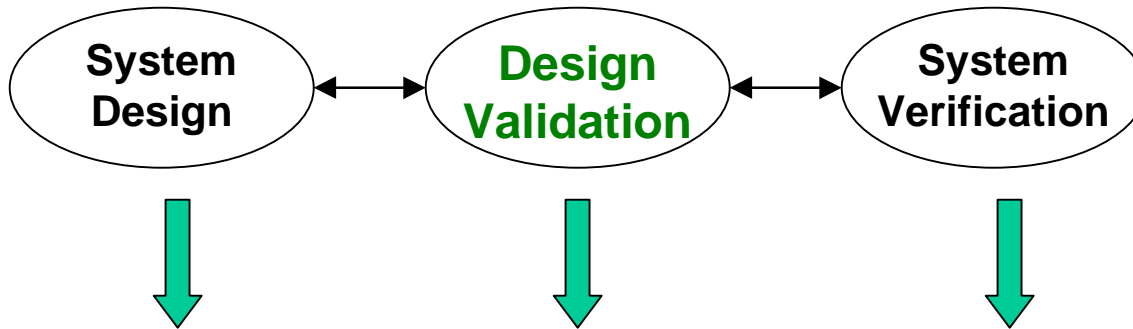
Design Validation - Interactions



Approval of Baseline



Conclusion



Design Closure • Functional Rqts + Performance Rqts + H/W & S/W Support Arch

- Early On**
Coordination of
- System Design
 - Design Validation
 - System Verification
- Will Temper**
System Issues

Issues

