

# **The Tester's Dashboard: Release Decision Support**

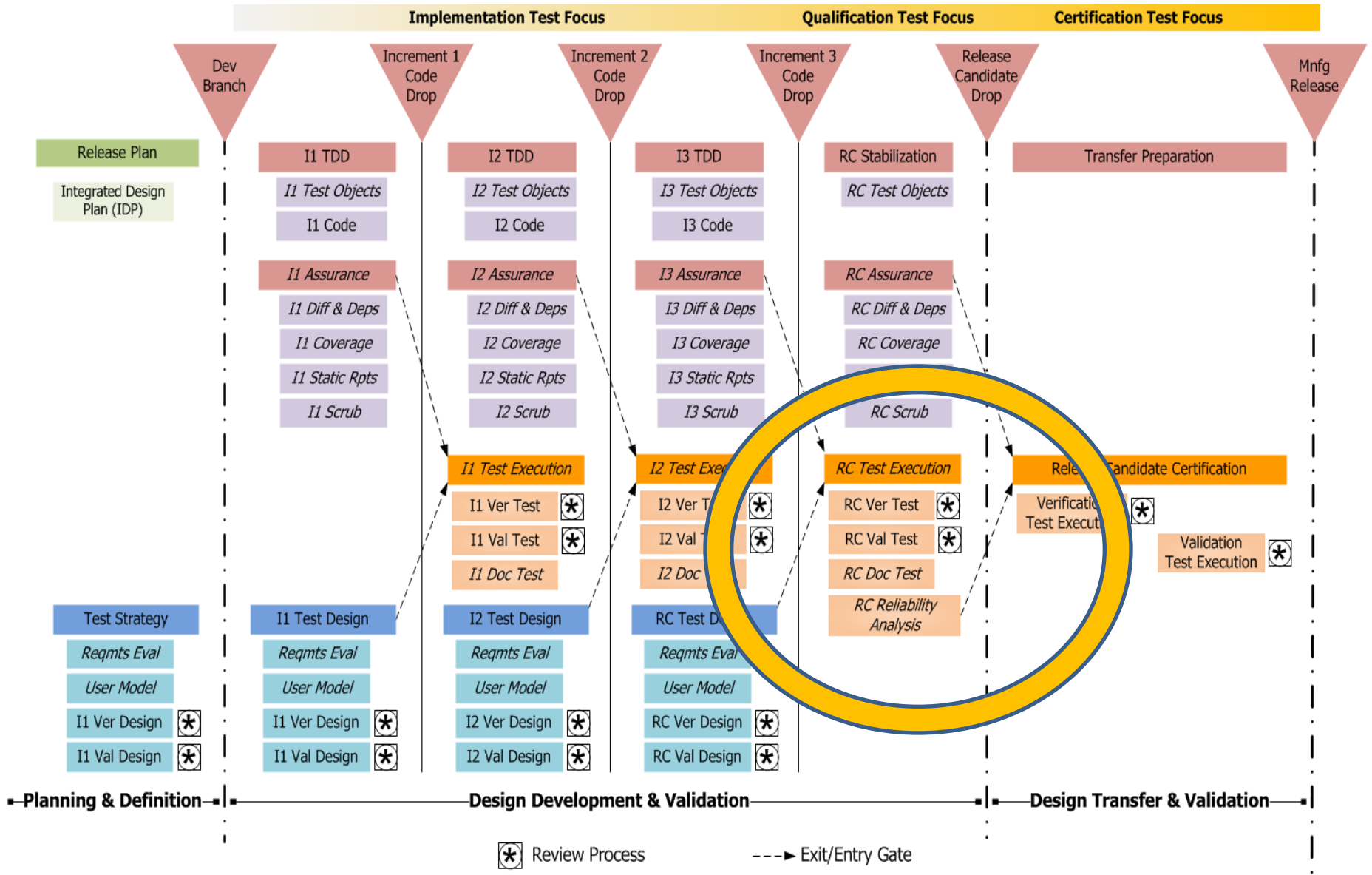
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# Overview

- Complementary metrics for release decision-support
  - Model-based testing
    - Operational profile
    - Model coverage metrics
  - Reliability Demonstration Chart
  - Relative Proximity
- Case Study
- Observations

# Release Decision Support

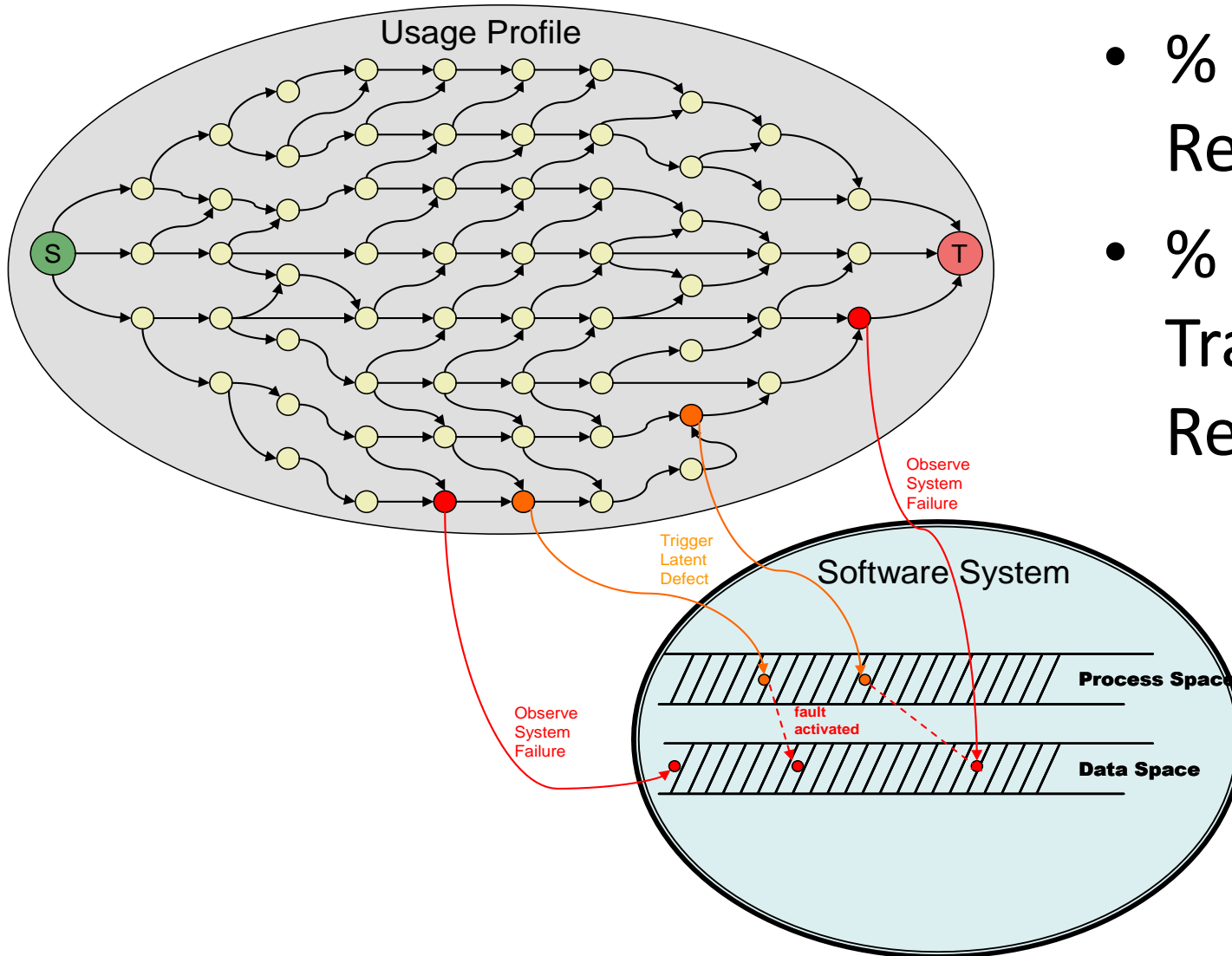




# Model-based Reliability Estimation

- Test suites must be
  - Proportional to operational profile
  - Sequentially feasible
  - Input feasible
- Approach
  - Markov model
  - Monte Carlo simulation
  - Post run analytics

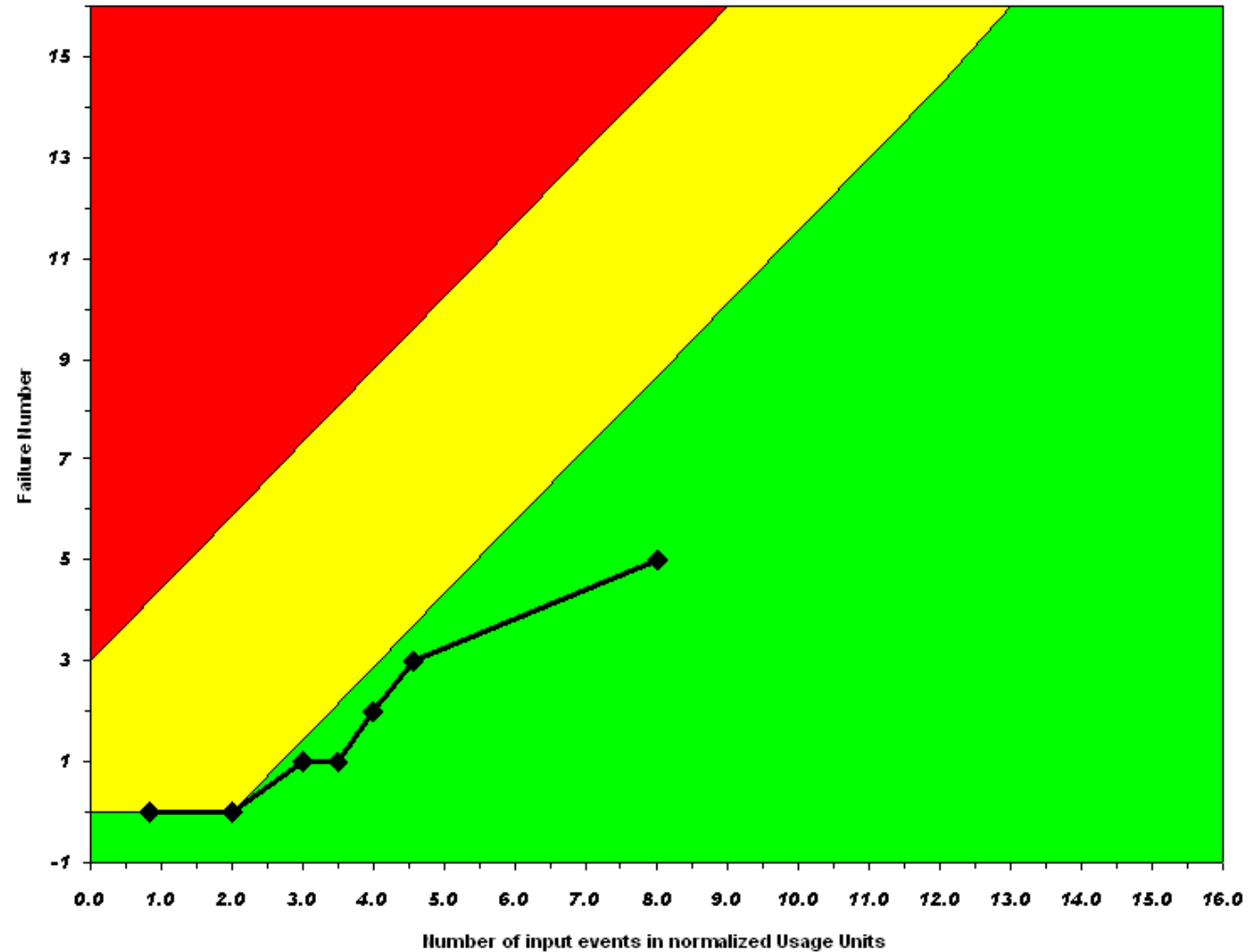
# Model Coverage Metrics



- % States Reached
- % State-Transitions Reached

# Reliability Demonstration Chart

- Sequential Sampling
- Risk-Adjusted
- Musa equations



<http://sourceforge.net/projects/rdc/>

# Relative Proximity

- Kullback-Lieber Distance
  - Information theoretic
  - Characterizes difference in variation of message population  $E$  (expected) and sample  $A$  (actual) as “relative entropy”

$$\text{KLD} = \sum A_i (\log_2 (A_i / E_i))$$

- Relative Proximity
  - KLD math doesn't work unless failures modeled (sum of the actuals must be 1.0)
  - Assume the target failure rate is aggregate
  - Allocate failure rate in proportion to each operation



# Profile Explicit Failure Modes

- Assume maximum acceptable failure rate intensity of 1 in 10,000

Operation	Mode	Standard Profile	Explicit Failure Profile	Expected Number, 10000 Tests
A	Pass	0.7	0.6993	6993
B	Pass	0.2	0.1998	1998
C	Pass	0.1	0.0999	999

# Profile Explicit Failure Modes

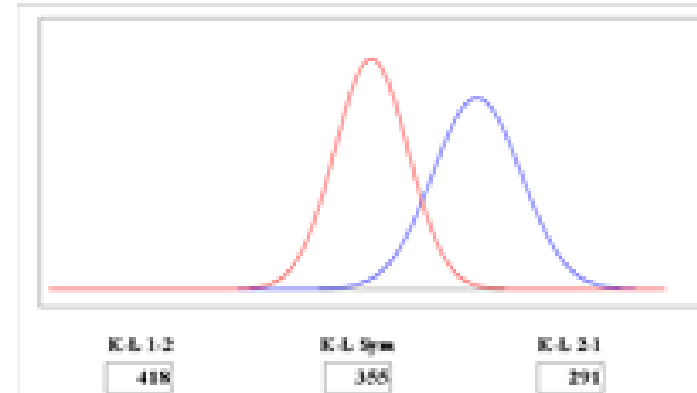
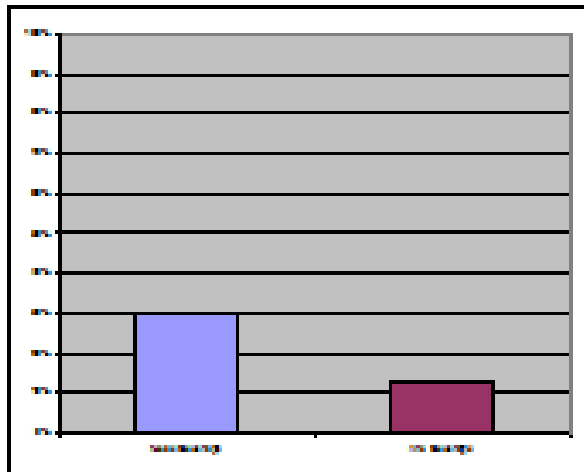
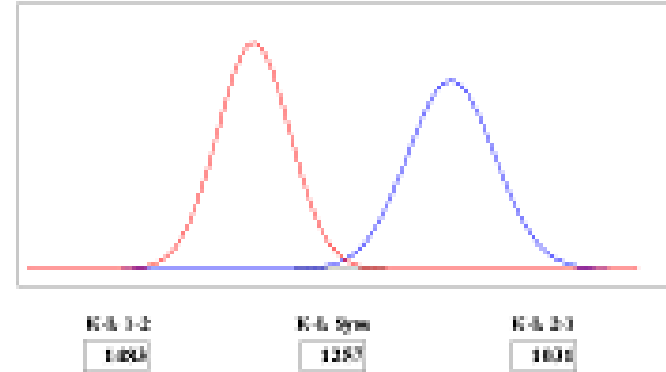
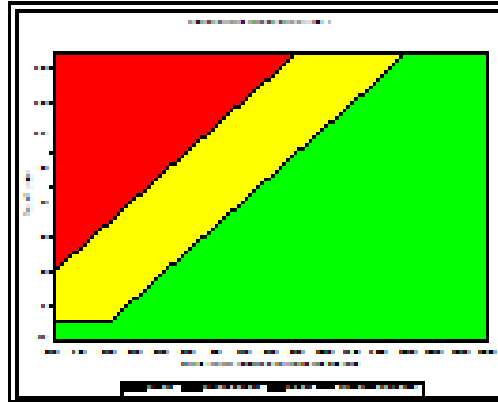
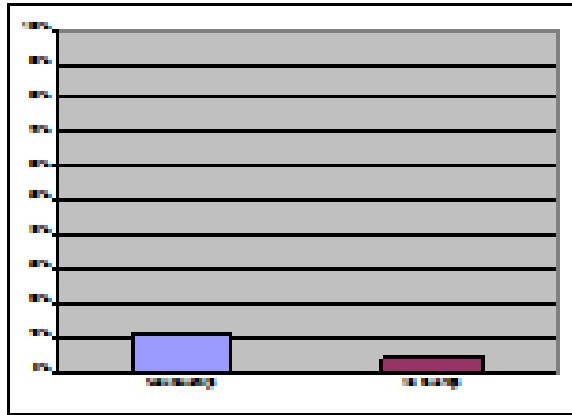
	Mode	Expected	Actual	KL Distance	Actual	KL Distance
A	Pass	6993	7000	10.104	6990	-4.327
	Fail	7	0	0.000	10	5.146
B	Pass	1998	1990	-11.518	2000	2.887
	Fail	2	10	23.219	0	0.000
C	Pass	999	980	-27.149	994	-7.195
	Fail	1	20	86.439	6	15.510
		10000	<b>10000</b>	<b>81.094</b>	<b>10000</b>	<b>12.020</b>

- Relative Proximity indicates the difference between actual and observed failure rates
- Many possible operation failure rates with better or worse fidelity
- RDC based on aggregate FIO, not sensitive to operation variance

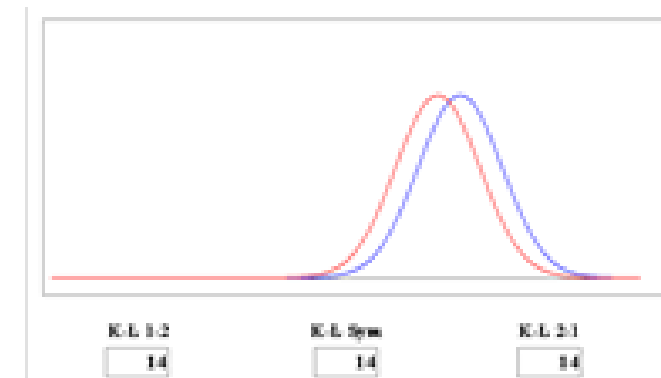
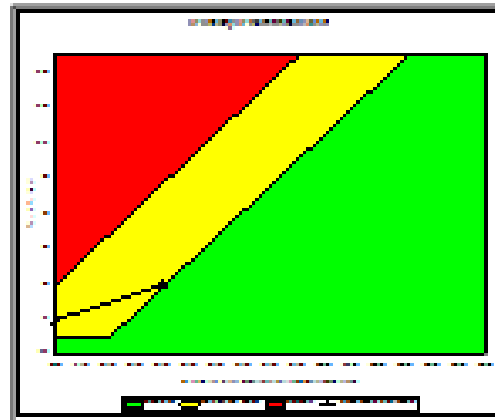
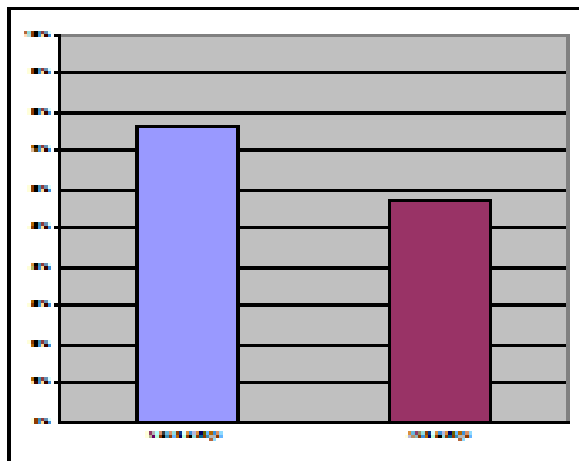
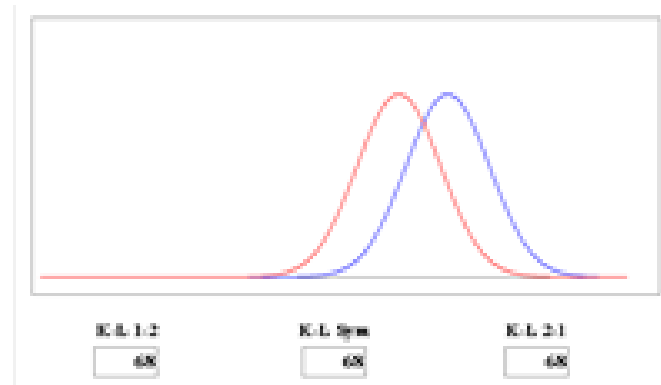
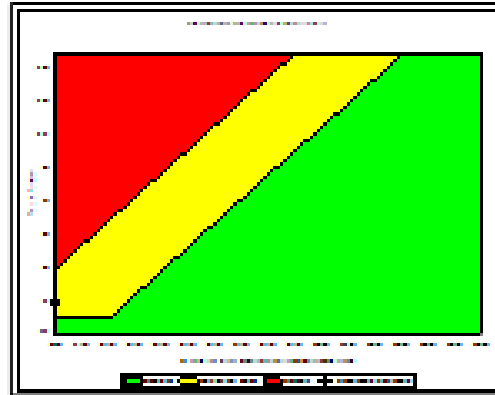
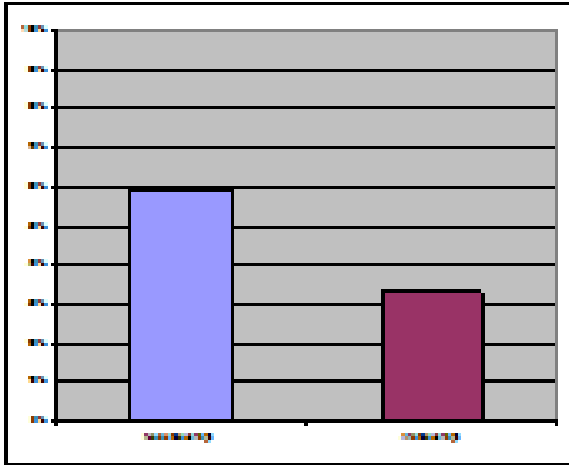
# Case Studies

- Stochastic Models
- Assumed Failure Rates
- Word Processing Application
- Ground-Based Midcourse Missile Defense

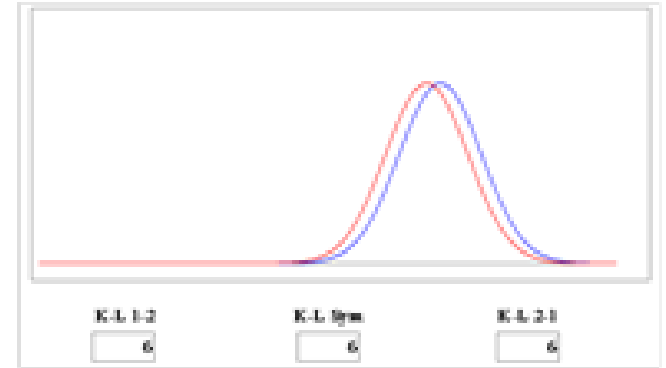
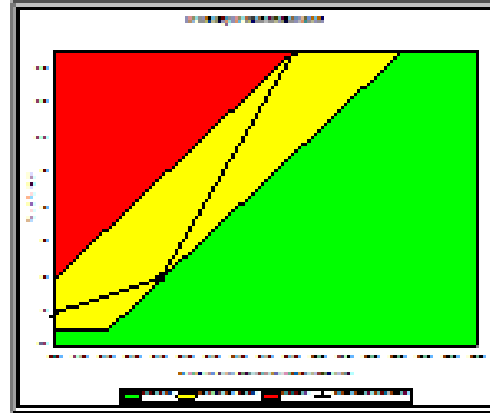
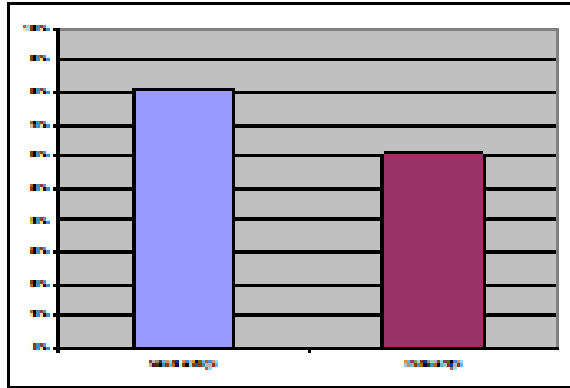
# GBMD Test Run, 0-100



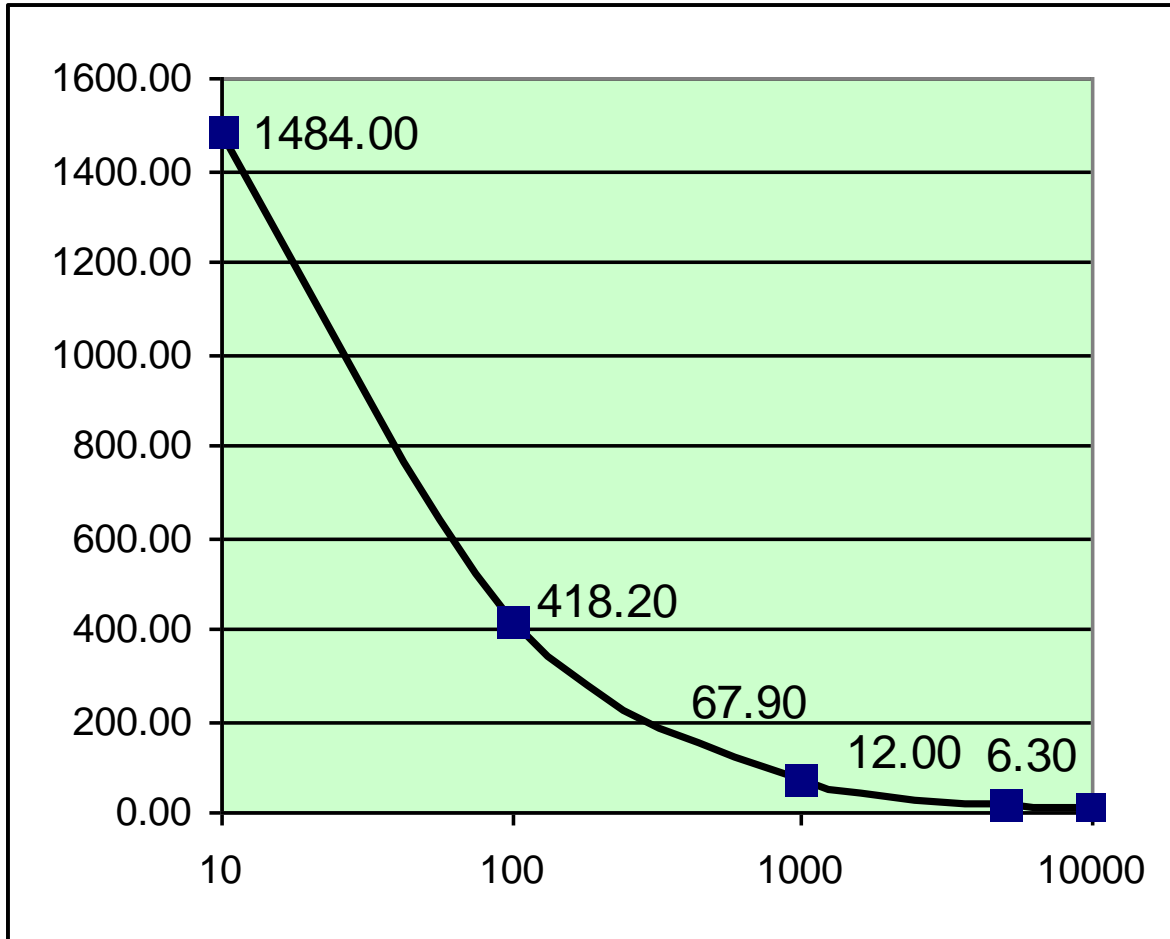
# GBMD Test Run, 1K, 5K



# GMBD Test Run, 10K



# GBMD Relative Proximity Trend



# Observations

- Model coverage indicates minimal sufficiency
  - Wouldn't release without all state-xtn pairs covered
  - Stochastic can take a long time to do this
  - Cover with N+ first
- RDC assumes “flat” profile
  - With sequential constraints, may be optimistic
  - Strength is explicit risk-adjustment
- Relative Proximity will indicate when operation-specific Failure Intensity is as expected (or not)



Q & A