

Cost Impact of Reliability and Acceptance Criteria

Sam Mason
Alliant Techsystems



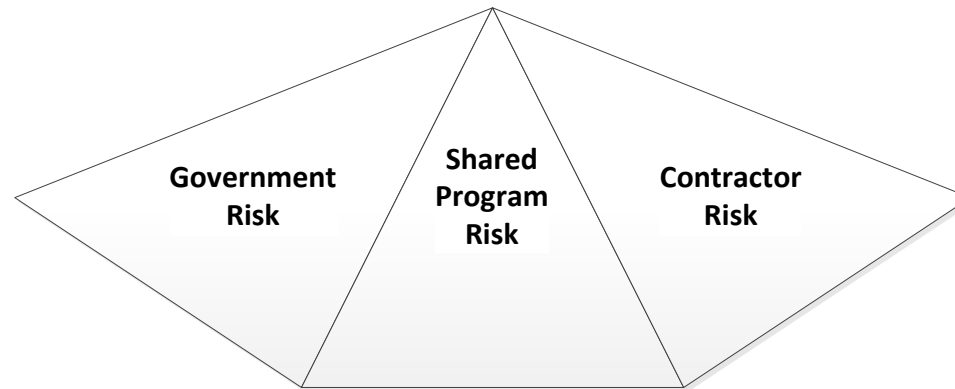
Why is this important?



- Programs in the defense industry are constantly challenged to execute high quality product at low cost. It is more imperative than ever to try to reduce cost on these programs.
- This presentation discusses one potential way to reduce the cost of program reliability.
- This can be achieved through a discussion on program reliability requirements and the test criteria used to verify the requirements.

- To discuss the process and methodology used to assign Lot Acceptance Testing (LAT) criteria against design reliability requirements.
 - Acquisition policy often sets contractor reliability requirements in a way that misses an opportunity to communicate with production groups and program stakeholders on how to prove verification during production.
 - Government risk of accepting unreliable product misses an opportunity to discuss considerations with program stakeholders on overall program cost and schedule impact.

Total Risk Space



Government Risk

- Determine Minimum Acceptable Reliability
- Set contract required reliability to meet goal with given budget and schedule

Shared Program Risk

- Trade space between reliability, cost, and risk level to execute the program successfully.

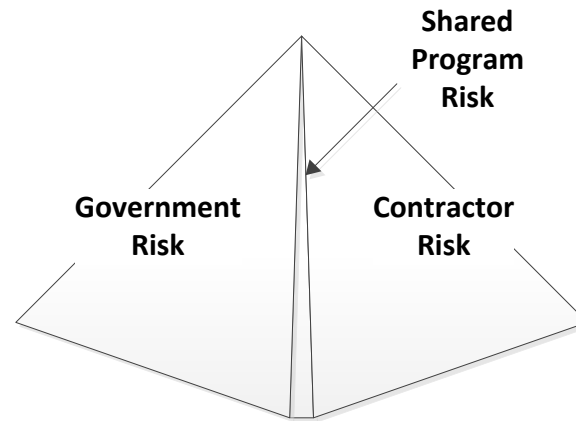
Contractor Risk

- Design product to required reliability
- Verify reliability to the minimum acceptable within program budget and schedule

- This describes whether program will be able to successfully meet and verify the required product reliability.
- The shared program risk space represents the trade space between:
 - Reliability requirement
 - Minimum acceptable reliability
 - Government risk
 - Contractor risk
 - Cost
 - Schedule

These factors are all related – one cannot be changed without impacting another

Total Risk Space



Government Risk

- Set contract required reliability as minimum acceptable

Shared Program Risk

- Very limited trade space between reliability, cost, and risk level

Contractor Risk

- Design and verify product to required reliability
- Cost and/or schedule impact due to failed lots which may be good

What is the cost of this?



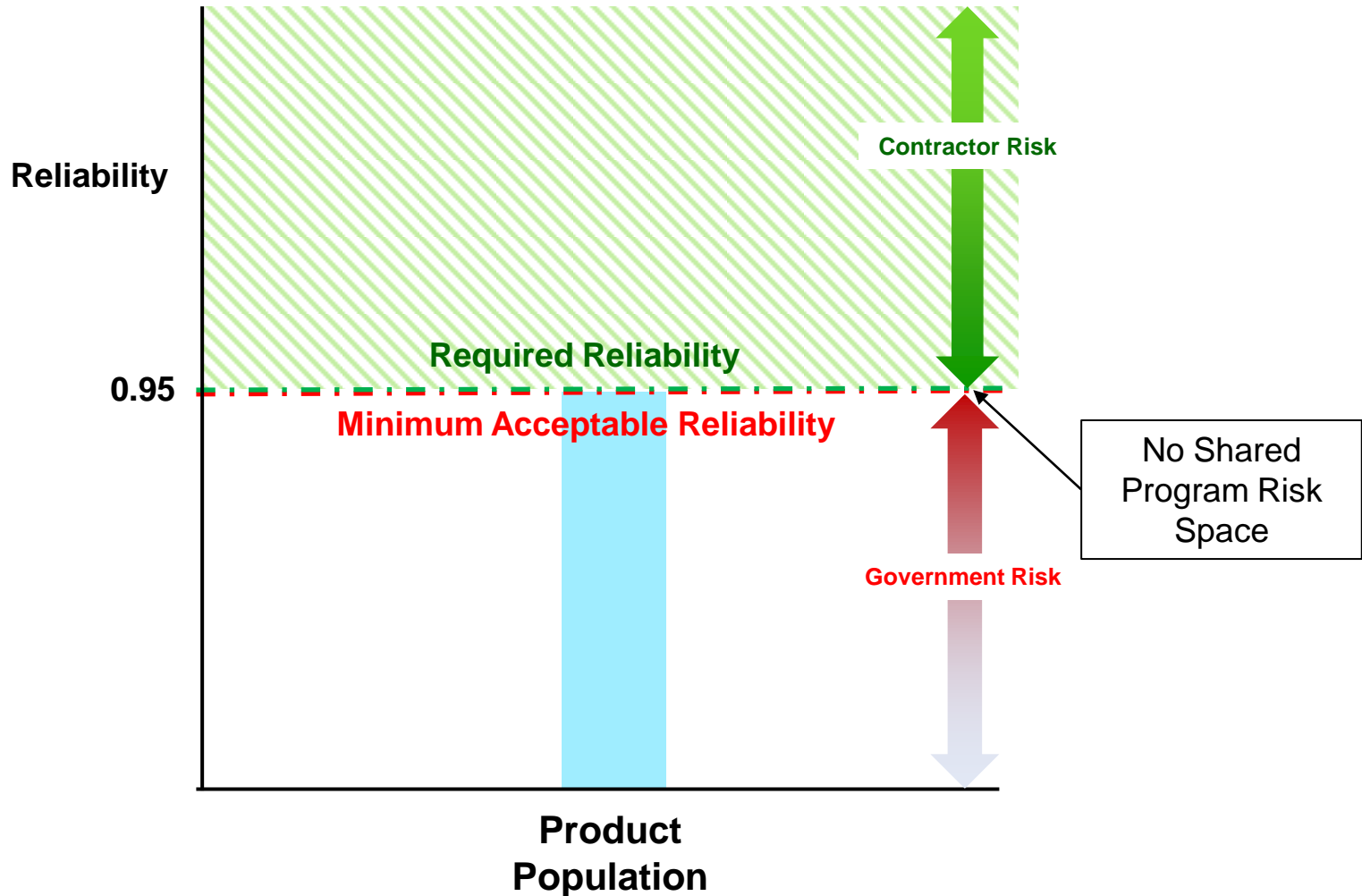
Example Program *



- High-volume, medium cost ammunition
 - Required Reliability: 0.95
 - Minimum Acceptable Reliability: 0.95

 - Total Volume to Produce: 10 million rounds
 - Average Unit Production Cost: \$10
 - Total Contract Value: **\$100 million**

Ammunition produced at requirement



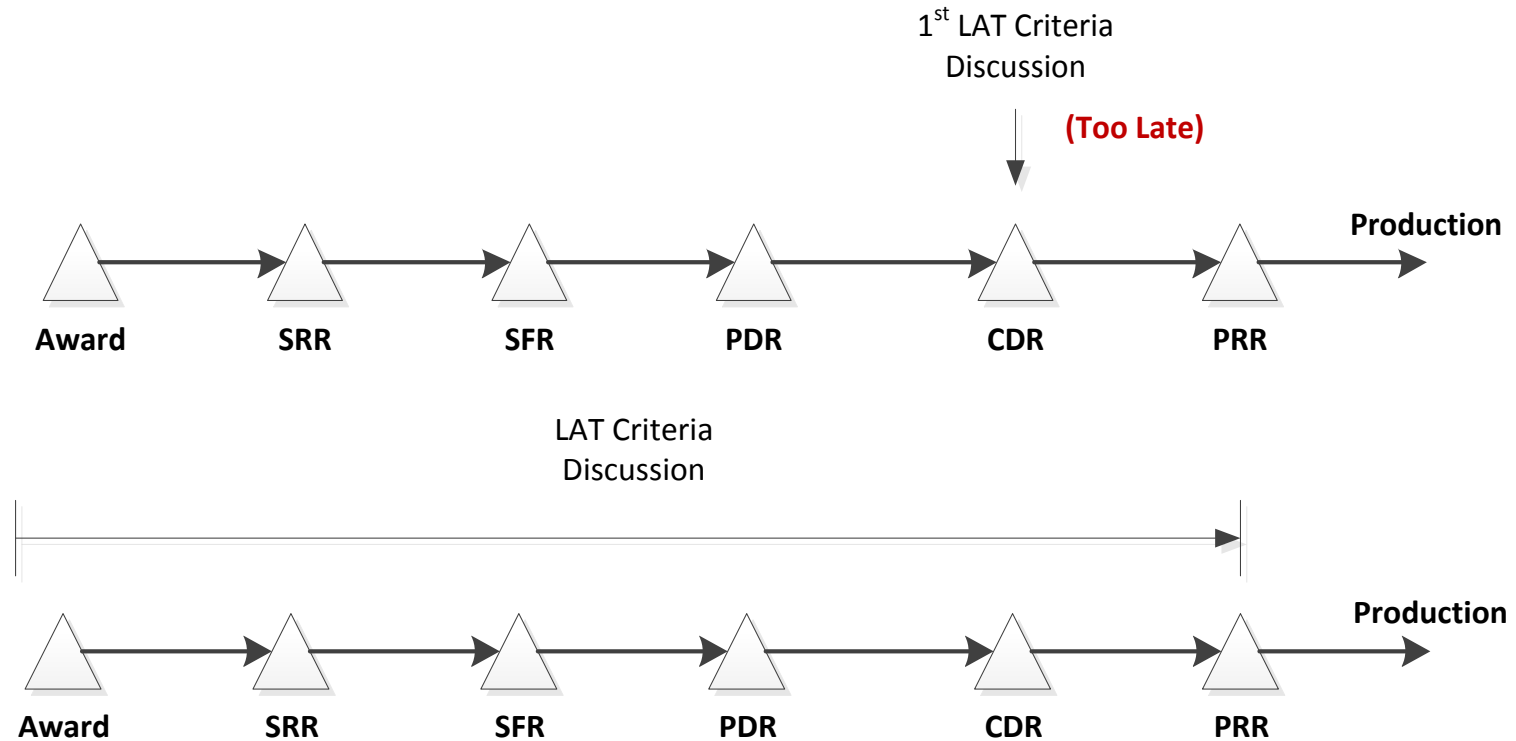
*Government issues a 0.95 reliability requirement
Contractor builds product to 0.95 reliability*

- No real viable LAT criteria:
 - Very high Government risk (>50%)
 - High production cost due to scrap (>\$1.60 AUPC increase)
- Total Contract Value: **\$100 million**
- Total Cost to Test: **\$16+ million**
- Government risk level is so high that it doesn't say anything meaningful about the 0.95 reliability requirement

High LAT cost does not even satisfy verification of the reliability requirement

What can be done to improve on this?

- Establish the shared program risk space as early in the program as possible.



LAT criteria can begin before contract award and continue through PRR as the program evolves.

What can be done to improve on this?

- Ask the right questions during the LAT criteria trade study:
 - What is the minimum reliability the Government will accept?
 - What is the maximum risk level the Government is willing to accept?
 - What is the maximum the Government is willing to pay for acceptance testing?
 - What target reliability does the contractor actually need to build to?



- ATK has developed a tool that runs thousands of binomial calculations given the shared program risk space inputs and produces a list of possible LAT conditions that meet the criteria:
 - Reliability requirement
 - Minimum acceptable reliability
 - Government risk
 - Contractor risk
 - Cost
 - Schedule

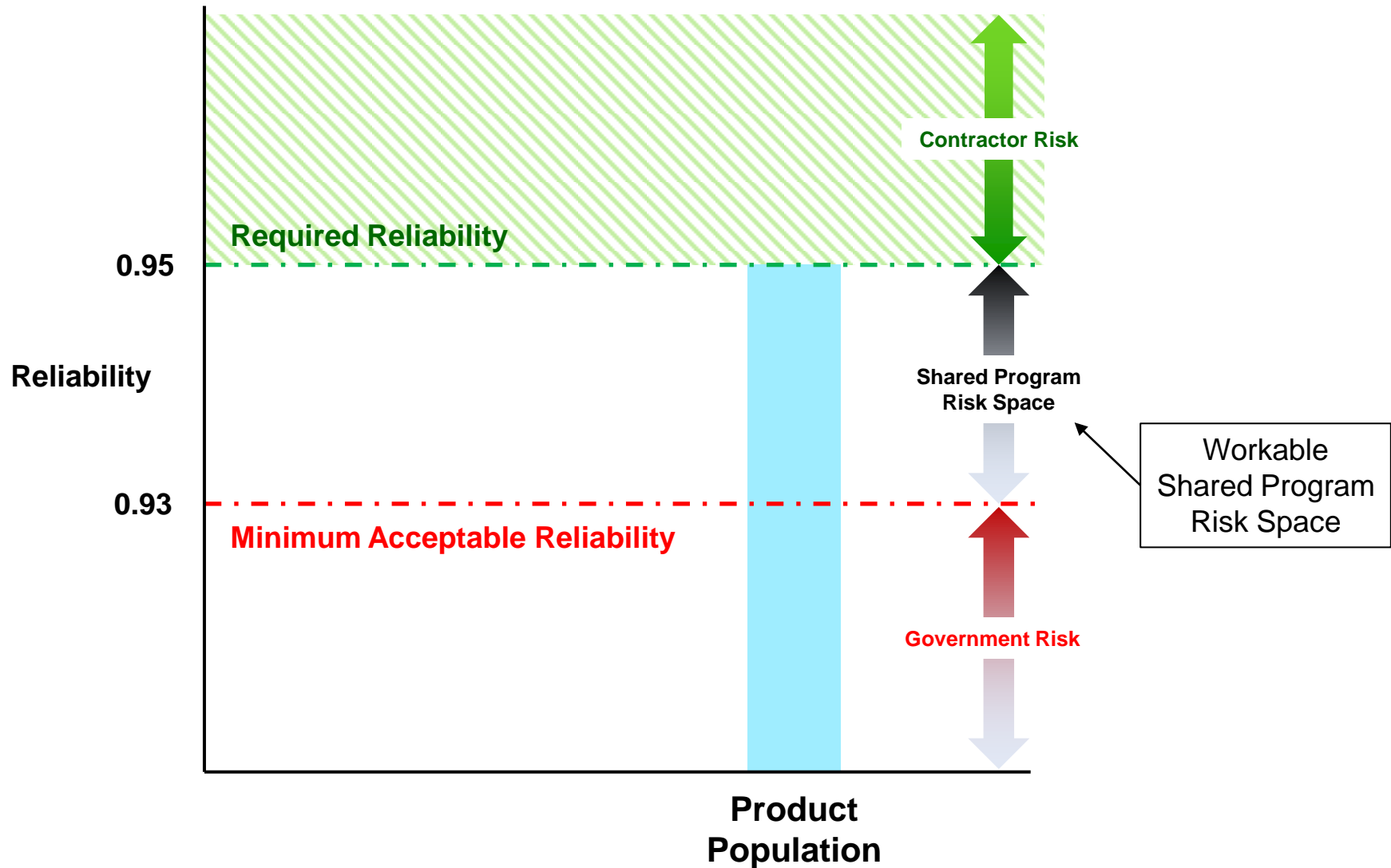
$$\sum_{k=n-f}^n \left(\frac{n!}{k! (n-k)!} \right) p^k (1-p)^{n-k}$$

Same Example Program *



- High-volume, medium cost ammunition
 - Required Reliability: 0.95
 - Minimum Acceptable Reliability: **0.93** ↓
 - Total Volume to Produce: 10 million rounds
 - Average Unit Production Cost: \$10
 - Total Contract Value: \$100 million

Ammunition produced at requirement



*Government willing to accept a 0.93 reliability requirement
Contractor builds a product to 0.95 reliability*

- With the larger Program Shared Risk Space:
 - Normal range of Government risk level (10-20%)
 - Lower production cost due to scrap (\$0.02 AUPC increase)
 - Negotiable LAT sample size (500 to 1000 rounds)
 - Negotiable hardware cost (~\$5,000 to \$10,000)
- Total Contract Value: **\$100 million**
- Total Cost to Test: **\$300k (50x cost reduction)**
- Government risk within more realistic range to detect unreliable product entry into the field.

LAT at this cost provides verification of the reliability requirement

- Total Contract Value: **\$100 million**
- Total Cost to Test: **\$300k**

- A decrease in Government risk by 5%:
 - Increases cost by **\$120k**
- An increase in minimum acceptable reliability to 0.94:
 - Increases cost by **\$3 million**
 - Increases Government risk by **13%**

- Is it worth it? What is important on this particular program?

Programs can evaluate real and costly trade-offs in risk

- We have an opportunity here and now to embrace an idea that provides more value to both the warfighter and the taxpayer.
- Current requirement flow in acquisition policy could remain unchanged to preserve continuity in the bid and review process
- Post-Award Programs could elect to review using this approach to define a best value proposition for all stakeholders



Contact Info:

- Samuel Mason
- 763-744-5214
- Alliant Techsystems (ATK)
- Sam.mason@atk.com