Webinar Summary – Reducing Test Burden Without Sacrificing Confidence: Bayesian Reliability Testing in Practice

Presented by: **Pankaj Shrivastava** - 29th October 2026

The webinar explains how Bayesian methods can improve reliability demonstration testing (RDT) by combining relevant historical evidence with new test results. Its objective is to help practitioners allocate testing resources more efficiently without compromising the physical requirements of testing or the confidence of the demonstration.

The speaker describes a prior distribution as a representation of uncertainty before new results are collected - not a predetermined conclusion. Bayesian RDT depends on historical data being relevant, traceable, defensible, and comparable to the product and test conditions under consideration. The webinar mentions beta distributions and cumulative binomial algorithms for modelling, alongside prior qualification and sensitivity analysis. It also discusses zero-failure demonstration plans.

In the Product E example, traceable in-house reliability data supported a reduction in required test units from 42 to 9, approximately 79%. The potential benefit is greatest when the prior evidence strongly supports the specific reliability target. However, Bayesian analysis does not eliminate the need for adequate test duration or override product physics; it can reduce sample size, not make testing unnecessary.

The main recommendation is to use Bayesian methods to make sound existing evidence more informative. They are not a shortcut for weak data or an incorrect model, and practitioners should validate the relevance and strength of the prior evidence before relying on it.

Key Takeaways:

- Bayesian approach can cut required test units from 42 to 9 when prior evidence is strong and target reliability aligns with the prior mean (≈ 97.01 %).
- Sample size reduction diminishes as the target reliability moves further above the prior mean; for higher targets (e.g., 99.12 %) the benefit drops to ~28 %.
- Prior distribution must be qualified: comparable products, evidence quality, and variance are critical; a wide prior weakens its influence.
- Zero-failure outcome is assumed in the sample size calculation; any observed failure requires re-analysis and may invalidate the zero-failure conclusion.
- Test duration is independent of Bayesian analysis; it remains governed by mission requirements and stress conditions.
- Weighting of comparable products was set equal in this example; alternative weighting could be based on variance or evidence quality but would need expert input.
- Beta distribution is used for both prior and posterior; no chi-square or Y-base methods were employed.
- Activation energy for the module was conservatively taken as 0.8 eV, though literature values range from 0.7 to 1.2 eV depending on packaging.
- AI tools are not currently used to identify priors; subject-matter expertise drives prior selection.

If you are a SaRS Member and would like to watch the recording of the webinar, please click here.