(2) to down-weight only slightly, or not at all, those failures that are random in nature, that can still occur in replacement components, or that occur only once in 100 or several hundred launches in components that have not yet failed.

No matter what technique is employed, filtering is at best a compromise. The perfect filter would somehow down-weight to some extent or entirely those failures that have been "fixed" or made less likely, without down-weighting those random failures with unknown causes. The filters considered in this study have no such capabilities; they produce a result based solely on the launch sequence, and where in the sequence failures have occurred.

In predicting vehicle failure probabilities from empirical data, large representative samples are essential for a good estimate, and the more reliable the vehicle, the greater the need for a large sample. For example, if some characteristic exists in exactly 1% of a population, the probability is 0.37 that it will not appear in a random sample of 100, and 0.61 that it will not appear if the sample size is 50. If the characteristic exists in 2% of the population, it fails to appear about 36% of the time in a random sample of 50.

For reasons presented above, the data samples for Atlas, Delta, and Titan have been made as large as possible consistent with the notion of representative configurations, as set forth in Ref. [4]. In RTI's judgment, the value of F that best weights the performance data is 0.98, although a value anywhere in the interval 0.97 to 0.99 cannot be ruled out. For consistency in data weighting, the same values of F have been used for all vehicle programs. The differences in predicted failure probability that result from these three F's are illustrated in Figure 4 for Atlas. The plots show the inverse relationship between filter volatility and the value of F. For F = 0.97 vis-à-vis larger values, it can be seen that the filtered failure probability jumps higher with each failure and drops at a faster rate with each successful launch that follows.