Reliability Growth Planning JMP Addin

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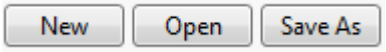
1. Introduction

This addin implements three planning models, suggested by MIL-HDBK-189C. We document some details here to help users to verify our implementation.

All user interfaces have three buttons: 

. The button "New" resets the contents to the factory default. The button "Open" allows one to open a JSL file. The button "Save As" allows one to save the current work to a JSL file.

2. AMSAA Crow Planning Model

The mathematical expression for the MTBF is

$$M(t) = \begin{cases} M_I, & t \le t_1 \\ M_I \left(\frac{t}{t_1}\right)^{\alpha} (1-\alpha)^{-1}, & t > t_1 \end{cases}$$

where M_I is the Initial MTBF, t_1 is the Initial Test Time, α is the Growth Rate. Also one may be interested in the Total Test Time (T), and the Tinal MTBF achieved at that time, $M(T)$.

The addin allows one to calculate one of the quantities above, while other quantities are given. The graphical interface allows one to quickly approach the desired curve.

3. System Level Planning Model (SPLAN)

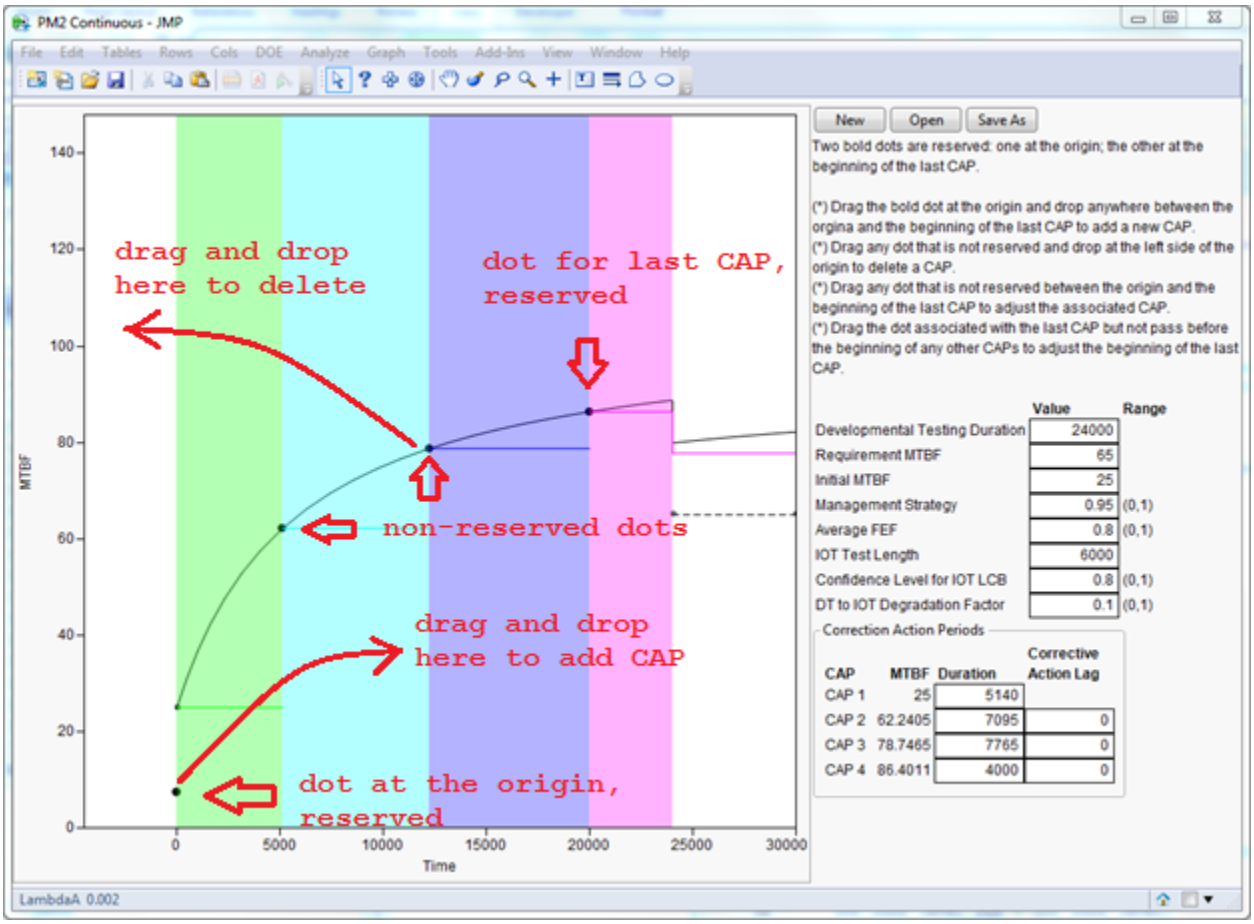
The mathematical expression for the MTBF is the same as one in the previous section. For a specified confidence level, this module calculates the ratio of the Final MTBF to the TR, the Expected No. of Failures, and the probability of acceptance (Prob(Accept)), given $M(T)$, $N(T)$, TR, and α, where $N(T)$ is the expected number of failures at T and TR is the technical requirement. The calculation is conducted by interpolation using the tables in AMSAA TR-652.

4. Projection Methodology (PM2) – Continuous

The mathematical expression for the MTBF is

$$M(t) = \begin{cases} \dfrac{1}{\lambda_A + (1-\mu_d)\cdot\left[\lambda_B - \dfrac{\lambda_B}{1+\beta\cdot t}\right] + \dfrac{\lambda_B}{1+\beta\cdot t}}, & t \le T \\ \dfrac{1-d}{\lambda_A + (1-\mu_d)\cdot\left[\lambda_B - \dfrac{\lambda_B}{1+\beta\cdot t}\right] + \dfrac{\lambda_B}{1+\beta\cdot t}}, & t > T \end{cases}$$

where d is the degradation factor due to transition from a development test (DT) to an operational test (OT) environment, μ_d is the average fix effectiveness factor (FEF), λ_A, λ_B, and β are all calculated according to MIL-HDBK-189C. The user interface also allows one to construct correction action periods (CAPs); see a screenshot on the next page. A detailed reference is AMSAA TR-2006-9.

The interface provides one with maximum flexibility to construct CAPs. By default, there are at least two CAPs. The black dots at the origin and the beginning of the last CAP are reserved. The MTBF associated with the last CAP has to achieve a certain value to demonstrate achieved MTBF with some confidence. That MTBF is determined by the Required MTBF, IOT (Initial Operational Test) Length, Confidence Level for IOT LCB (lower confidence bound), DT to IOT Degradation Factor, and the Corrective Action Lag associated with that CAP. That MTBF further determines the smooth ideal growth curve. Other CAP steps are only determined by the start of corresponding CAP and its Corrective Action Lag, which can be added by dragging the black dot at the origin and

drop anywhere between the origin and the beginning of the last CAP. One can drag and drop any non-reserved dot to the region to the left of the origin to delete the associated CAP.