How It Can Benefit You:

A variety of program planning decisions are based on analyses that depend on reliability predictions. For example, warranty costs and pricing depend on many factors, one of which is how often the product will fail. Failure modes, effects and criticality analysis (FMECA) results can have a significant impact on safety, logistics and maintenance issues, and many of these applications use reliability predictions as inputs. Also, there are numerous techniques for quantifying criticality, but they all depend on the failure rates derived from reliability predictions. Much of logistics planning analysis is ultimately based on reliability prediction, in the form of spare parts lists, maintenance planning budgets and staffing, etc. All of these tasks can be traced to predictions/estimates of failure rates. Finally, maintenance procedures, test programs, and built-in-test (BIT) requirements are based on reliability predictions that show the distribution of part, component, product, and/or system failures.

Deterministic predictions provide the most benefit to a part or component designer, who can use them to help "build in" resistance to the known failure mechanism in a specific end-use application environment. Statistical (i.e., empirical) predictions are of most benefit to systems engineers and logistics planners, who are faced with a plethora of use factors which tend to be highly variable, typically impossible to control, and have a potentially significant, but perhaps unknown, effect on product/system reliability (e.g., the influence of human elements and/or the impact of manufacturing processes on inherent reliability).

Whether derived by deterministic or statistical methods, prediction estimates are only a benchmark, with a variety of uses and limitations. A prediction can be compared to customer requirements to evaluate the ability of a product to meet stated or implied needs. If it doesn't, the prediction can highlight opportunities for design improvement. It can also be compared to test results to determine product maturity, or to field results of similar systems to compare the new product's reliability against older or competing hardware or software. Predictions are not, however, a guarantee that a predicted reliability will actually be realized in its operational application. Only measured use data can provide a level of confidence that a predicted reliability has been achieved.
Reliability Modeling and Prediction

RAC Capability:

RAC engineers are experienced in all methods of performing reliability predictions, and with the software tools available. RAC also maintains a web site that provides a description of the many commercial R&M software tools available. We can easily tailor the method to meet customer needs and can provide guidance in the use of alternate prediction methods, their advantages and disadvantages, and the benefits and limitations of reliability predictions in general.

RAC can perform finite element analysis (FEA) to determine stresses in electronic and mechanical structures. This information is essential to the accuracy of deterministic prediction models. For statistical reliability predictions based on historical data, RAC engineers have direct access to the failure rate databases resident at RAC. RAC engineers have developed general and customized reliability prediction models for both military and commercial customers.

The RAC staff has the expertise to provide assistance in meeting design goals, achieving component or part derating levels, resolving environmental concerns, and identifying controlling reliability critical items. They can assist you in analyzing prediction results so that they can be used to rank design problems and assess trade study results. Beginning with the initial design concept, RAC engineers can assist you in evaluating alternative design approaches, redesigns, and corrective action approaches. Each prediction will provide a better estimate of product reliability as more detailed information about the design becomes available. RAC support can provide benefits later in the product/system life cycle through the evaluation of stress and life-limiting constraints.

RAC’s experience includes support for US Air Force, Navy and Army programs, as well as industrial customers. For example, RAC was used by the US Naval Air Engineering Center to create a Navy standard on reliability prediction, by the automotive industry to create a reliability prediction methodology for automobiles, and by other customers in commercial airline, consumer appliance, electronics and composite materials markets to create customized prediction models appropriate for their specific needs.

Finally, RAC engineers have authored documents that both support and complement the currently available military and commercial prediction techniques. They have published numerous databooks addressing part reliability data, failure mode and mechanism distributions for electronic and mechanical parts, and component failure rates resulting from non-operating periods.

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