CASE STUDY

Proving Reliability Growth in Mission-Critical Defense Systems with ReliaSoft

Our customer is a world leader in the design, development, and manufacturing of advanced combat, missile, rocket, and sensor systems for the U.S. military, its allies, and NASA.

The division that HBK worked with is responsible for some of the most sophisticated and critical defense technologies in the world, where performance and reliability are paramount. The mission-critical nature of these products means that failure is not an option, and demonstrating system reliability is a key contractual and ethical obligation.

Challenge

Our Defense Contractor customer faced the immense challenge of ensuring and demonstrating the reliability of complex, repairable combat systems throughout a rigorous development and testing lifecycle, meeting stringent military standards.

Solution

By implementing HBK's ReliaSoft Weibull++ and its Reliability Growth module, our customer analyzed component life data and applied Crow-AMSAA models to track and forecast reliability improvements for repairable systems during developmental testing.

Result

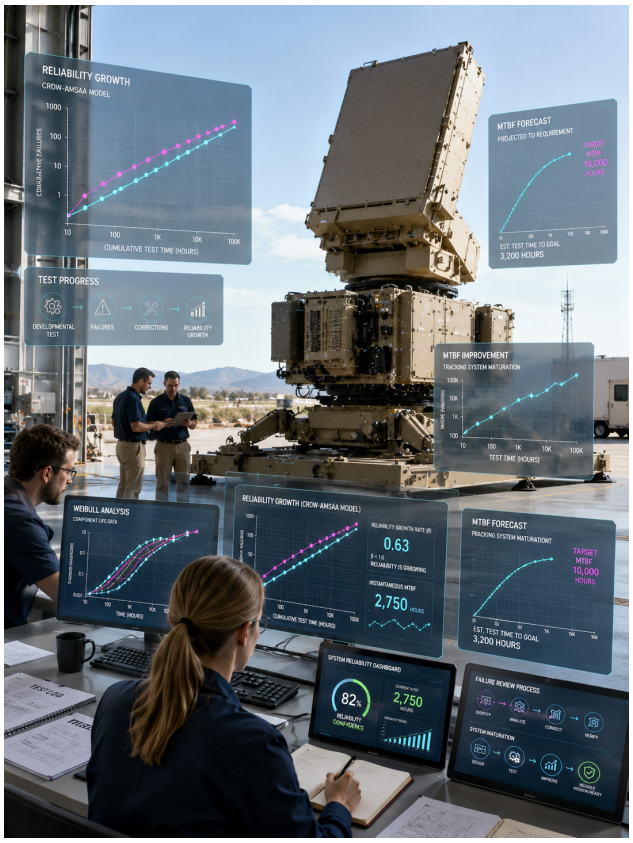
This provided quantifiable proof of reliability growth to meet contractual requirements, optimized system maintenance strategies, reduced lifecycle costs by 15%, and ultimately ensured higher mission success rates for critical defense and aerospace systems.

The Challenge

The systems developed by our Defense customer, such as advanced missile launchers, radar systems, and fire control units, are inherently complex and designed to be repaired and maintained over a long service life. The primary challenge is not just designing for initial reliability, but proving that the system's reliability improves - or "grows" - throughout the intensive developmental testing (DT) and operational testing (OT) phases.

During this process, failures are expected, identified, and corrected through design modifications. The challenge is to have a standardized way to scientifically model this improvement to:

- Quantify the current reliability of the system at any point in testing.
- Forecast if the system is on track to meet its final reliability requirement or Mean Time Between Failures (MTBF) goal.
- Provide objective, data-driven evidence to the customer (e.g., the U.S. Army, Air Force, or Navy) that the system is maturing as expected.
- Make informed decisions on when to stop testing and whether further design improvements are necessary.



The Solution

To meet this challenge, our customer deployed a sophisticated reliability engineering program centered on HBK's ReliaSoft software suite, focusing on two key areas for their repairable systems.

- **Component-Level Analysis with Weibull++**: At the component level, engineers used our software to perform life data analysis on critical parts. By analyzing test data, they characterized the failure patterns and lifetime distributions of individual components. This is foundational for building reliable systems from the ground up and informs the initial design.
- **System-Level Reliability Growth Analysis (RGA) with the Crow-AMSAA Model**: This is the core of the solution for the overall system. As our customer's integrated system went through developmental testing, every failure event and its cumulative operational time was recorded. This data gets fed into the RGA module and using the Crow-AMSAA (NHPP) model, which is specifically designed for tracking reliability improvement in repairable systems, their engineers accomplished:

1. **Model the Growth**: The model plots the cumulative failures versus cumulative test time. The slope of this line on a log-log plot indicates the rate of reliability growth. A slope (beta value) less than 1 signifies that failures are becoming less frequent over time, meaning reliability is growing.
2. **Track MTBF Improvement**: The software calculates the instantaneous MTBF of the system at any given point, showing how effective design fixes had been.
3. **Forecast Future Reliability**: team members projected the number of test hours required to achieve the final, contractual MTBF goal. This allowed program managers to assess if the testing schedule and budget were sufficient.

Results & Impact

Our Defense customer's decision to standardize their reliability process by implementing HBK's ReliaSoft suite provided measurable benefits crucial for their continued success.

- **Objective Evidence of Performance**: The Crow-AMSAA analysis provided clear, graphical, and statistical reports that demonstrated reliability growth. This was critical for passing major program milestones and gaining customer acceptance.
- **Informed Programmatic Decisions**: By forecasting the required test time to meet reliability goals, program managers made data-driven decisions about resource allocation, schedule adjustments, and risk management.
- **Optimized System Design**: The model helped the customer determine that the reliability growth rate was sufficient. If the growth is flat-lining below the requirement, it signals that more impactful design changes were needed to address systemic failure modes. This identification resulted in reducing life cycle costs by 15%.
- **Enhanced Mission Readiness**: Ultimately, this rigorous, quantitative approach to reliability ensured that the systems delivered to warfighters are not only functional but are proven to be durable and dependable under operational stress, directly contributing to mission success and safety.

Conclusion

In the high-stakes world of advanced defense systems, it is often said that data is the life blood of the kill chain. But if the complex, repairable systems generating that data are not dependable, the entire chain is compromised from the start. The ability to scientifically track, model, and forecast system reliability is therefore not just a contractual obligation, but a strategic imperative. By leveraging powerful tools like HBK's ReliaSoft Weibull++ and its specialized Reliability Growth module with the Crow-AMSAA model, Defense Contractors can ensure the integrity of that life blood. They move beyond simply fixing failures to managing the very process of improvement, delivering systems with proven reliability that meet the uncompromising demands of modern warfare.