WHITE PAPER

Next Generation Test & Evaluation

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The Time Is Now for Aerospace and Defense Companies to Cut Test & Evaluation Waste and Embrace Digital

The introductions of new capabilities within the Aerospace and Defense (A&D) industry notoriously experience significant deployment delays. And with increasing complexity and sub-system integration across hardware and software, these delays are only getting longer. Companies with innovative, advanced aircraft designs will eventually lose their competitive advantage if they continue to experience schedule delays and thus are unable to bring their products to market on time.

Approximately 70% of A&D capabilities under development are currently being delayed, at an average of about one year. Nearly half of that time is attributed to test and evaluation (T&E), with the most significant delays occurring from the time a production decision is made to initial deployment. Not only are new A&D capabilities frequently delayed, but they also take nearly two times longer to field than comparable capabilities in other industries.

The solution is to improve T&E by implementing a digital-first T&E approach for both design optimization and early deficiency detection—as evidenced by businesses across industries that have implemented a digital-first T&E approach typically realizing cost savings of 20%–30%.

Exhibit 1 - A&D are not only fielding capabilities ~1 year later than planned, but taking ~2x longer than corporate leaders are

Source: DOD Selected Acquisition Reports released in FY 2023, expert interviews, BCG analysis

With the demand for faster delivery as a requirement for A&D programs increasing, combined with greater costs associated with T&E, original equipment manufacturers (OEMs) that can deliver faster will have a competitive advantage.

1. When compared against the programs’ planned schedule.
2. Milestone C to IOC
Greater integration of the ever-growing number of hardware and software subcomponents continues to increase test complexity for most industries. In response, industry leaders have adapted their T&E from that of a sequential, physical test-dependent process to a digital-first one. Traditional T&E may have worked for mechanical hardware, but late-stage redesign and re-engineering of complex capabilities now drives cost increases and additional delays in fielding capabilities. Digital tools are most beneficial in the earlier stages of design and development, unlocking significant savings later.

Industry Leaders Have Realized Significant Cost Savings by Adapting a Digital-First T&E Approach

Industry leaders are rapidly delivering new capabilities to drive early discovery and dynamic re-planning by leveraging digital T&E for prototype selection, partnering with the right vendors to optimize production, testing their products’ digital twins before fully building out, and more to promote early discovery. These leaders have demonstrated their ability to reduce schedules for individual test events by 70%, condensing overall program test schedules by 20%–30%. In this new process, approximately 25% of physical testing is migrated to digital environments—and there is strong potential to migrate more tests to digital as digital precision increases over time. Several A&D companies have already invested in digital T&E.

Digital tools are typically applied against the following scenarios:

1. Delivering Against Dynamic Requirements. Increase strategic testing to assess the plethora of configurations and scenarios for critical components, particularly those in which late-stage deficiencies have consistently been identified in the past
2. Reducing High Development Costs. Eliminate costly prototyping and physical test setups, particularly those with the longest lead times
3. Identifying Probable Failure Risks. Improve accuracy of risk assessments by simulating probable failure points to identify any required supplemental physical testing
4. Integrating Software-Centric Design. Confirm compatibility of software and hardware integration before physical components are fully built

Digital tools are most beneficial in the earlier stages of design and development, unlocking significant savings later.

Exhibit 2 - IG realized significant schedule savings using digital-first T&E; high potential for A&D given comparable testing

Exhibit 3 - Digital-first T&E pushes test left with early discovery and iteration, reducing demand for long physical test and risks to delays

Industry Leaders Have Realized Significant Cost Savings by Adapting a Digital-First T&E Approach
A&D Companies Have Already Started to Invest in Digital T&E Tools, But Unmet Preconditions Prevent Them From Fully Realizing Potential

Several A&D companies have already invested in digital T&E tools, yet most fail to realize full benefits from them. Digital tools require a large up-front investment and continuous resourcing to improve models and simulations. If the tools are not properly leveraged, what should be an accelerated schedule can easily become an unused, expensive burden to maintain. We have identified five preconditions OEMs must meet prior to unlocking digital’s full potential in order to accelerate the T&E process.

1. Select optimal use case. Companies often build a digital tool without first assessing the greatest areas of need, or invest in digital tools for tests that either are in low demand or are quick/inexpensive to execute in a physical environment. Companies must assess both test pain points and the maturity of their digital tool sets, and their leaders must establish a digital strategy that defines their specific areas of focus (e.g., late deficiency identification, cost management, etc.).

2. Start small and scale. Many teams are eager to build digital twins/models for the most complex systems of systems but have not yet fully assessed the required fidelity and feasibility. Companies should instead start with quick-win investments in areas with strong digital potential; for example, start with a model for static test (e.g., stress deformation) rather than a more complicated dynamic test. Once companies identify where they have the greatest data fidelity, they can then increase digital test points or scale to more complicated models.

3. Be comfortable with a certain amount of risk. Test teams often fail to assess the level of precision needed to satisfy each test point, assuming digital is not a viable option. These teams need to define the risk tolerance for each test point during the planning phase and push to adopt digital wherever models meet the standard.

4. Embrace a digital culture. Many test engineers are more comfortable with traditional T&E approaches, as they lack few incentives to increase adoption of digital. Corporate leaders must articulate a vision for digital-first T&E and create upskilling opportunities for teams—and achieve benefits of having a T&E innovation champion on their teams to spearhead digital-tool adoption.

5. Encourage collaboration. Limited collaboration between vendors and customers often means stakeholders may not be granted data and process transparency, resulting in questions around the validity of results. This often leads to repeat testing, which only further brings delays to schedules. Stakeholders must define governance procedures to increase collaboration. A number of programs have had great results in co-locating teams, creating virtual test event participation opportunities, and driving joint decision-making on key inputs (e.g., model assumptions).

When adopting digital-first T&E approaches, OEMs should establish a phased approach, prioritizing the highest-value use cases with strong model maturity before standing up additional digital capabilities. This pacing realizes benefits faster, requires less up-front investment, and enables growth through continuous learning. The focus should be on programs that are early in their development life cycle, as they are more likely to achieve greater schedule improvements via early discovery from digital tools.

OEMs That Adopt Digital-First T&E Will Have a Competitive Advantage

As capabilities increase in complexity, discovering deficiencies later in the later stages of design and development has greater schedule and financial implications than ever before. Continued late delivery of capabilities can erode an OEM’s market share as well as customer confidence. By investing in digital-first T&E, OEMs will be able to differentiate themselves and carve out a competitive advantage by satisfying growing customer demand.

The value of digital-first T&E is clear. For OEMs, it’s no longer a question of why, but rather of when. And the answer to that is simple: now.
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