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DIGITAL TRANSFORMS PHYSICAL

# AIRCRAFT: BUSINESS CHALLENGES AND KEY QUESTIONS

WHITEPAPER

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## PTC

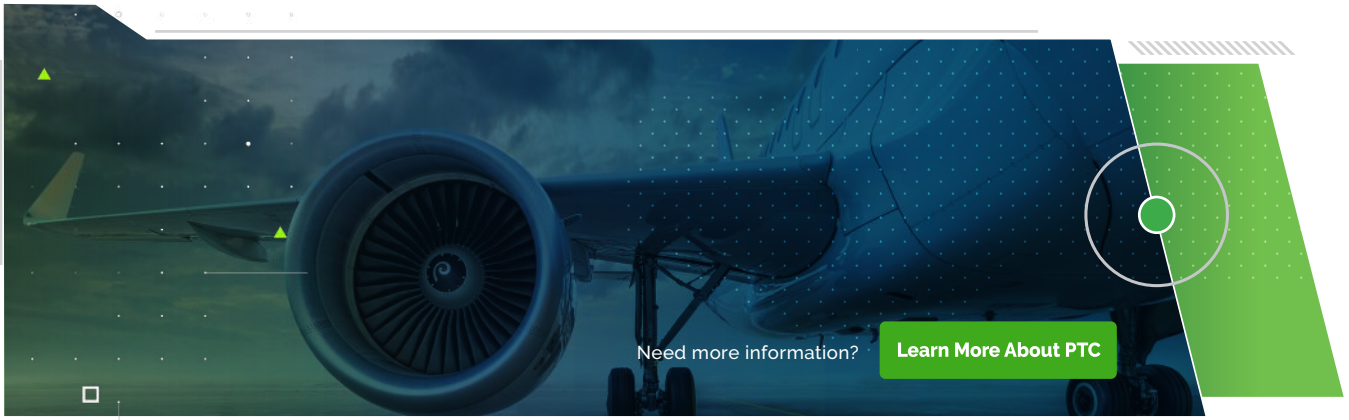
For the past several years, technology for supersonic passenger jets and eVTOL has been in a quiet state of development. But as these firms move from design to testing and production, the market wave they will generate will be broadly felt. Whether in the traditional commercial/military market or with new capabilities on the horizon, the airframe players who successfully balance risk with innovation will emerge as leaders in this new reality.

At PTC, we view industry and government stakeholders in FA&D as being in the same boat. The near-term challenges may be different, but longer term, they're identical...mission success within budget. Since 1985, the most powerful firms in global A&D have partnered with PTC to establish and maintain a winning advantage. The U.S. government also works closely with PTC on priorities that range from managing acquisition programs and tracking how fleets are configured, to synchronizing maintenance with technology insertion and strategic planning, all within the supply-chain operations reference, or "SCOR," framework. PTC has the system-wide insight,  proven technology and best practices to help the aircraft business lower risk while connecting the present to the future.

## BUSINESS CHALLENGE: INGESTING CONTRACTOR DATA FOR DIGITAL TWINS

The fundamental challenge of any government program manager is effectively acquiring/using product data from the contractor community.

- Our vision is to have a digital twin top down for all fleet assets, including everything that has a product model associated with it – weapons systems to the power plant and everything in between. Do we have a means for models and drawings to be loaded into an interface and unpacked automatically into the respective product structure to support each individual system?
- The aircraft OEM view of the product is significantly different than the aviator's view. How can we pull data from industry, ingest it into the product structure, then push it to the fleet in the context it needs? Can this flow be bi-directional, so we are constantly enriching the digital twin with fresh data?
- How can we enable contractors to either populate data directly through CDRL packages or with staged deliveries?
- Can we source CAD data from different vendor formats without needing to convert it (STEP, PLCS DEX, DEX1, UGNX, Catia, Creo, etc)? Would achieving neutrality on tools help to accelerate our goals for the program?




## BUSINESS CHALLENGE: OPERATIONS UTILIZING AR

If a government program manager acquires product models from industry, he/she can use them in multiple new ways.

- If we can use CAD data as the basis of creating an AR experience, could we make interactive job performance aids, training guides or maintenance instructions for diagnosing/repairing issues?
- Could AR capabilities help us to additively manufacture a part while in theater in order to complete the mission?
- Could we capture field experiences using AR to report back specific issues to our industry partners?

## BUSINESS CHALLENGE: MANAGING CLOUD ENVIRONMENTS

With cloud platforms being adopted at an ever-increasing rate, the task of choosing a path forward is daunting for government and industry stakeholders.

- Do we have the needed expertise on staff to complete a cloud deployment for product data in the program?
- The accreditations seem especially convoluted. Can we accelerate our program goals by choosing a partner who already has a FedRAMP/DISA Authorized IL-5 cloud environment in active use by the DoD?
- Can a chosen partner supply us with the expertise to layer on top of those accreditations in order to obtain an ATO for our specific program(s)?
- Will this environment connect to several DoD networks, such that anyone with a CAC card and proper credentials can access it?

# BUSINESS CHALLENGE: PRODUCT DEVELOPMENT IN CLOUD

There are several problems plaguing product development currently. Modern design teams are spread out, geographically or functionally, which has the potential to cause delays and confusion. Outsourcing is another issue, in which multiple people work on the same task but across different companies and organizations, again causing issues. Velocity is another issue, in an age in which people don't want Gannt chart-driven workflows anymore. Onshape, by PTC, is currently the only software capability that was born in the cloud to directly address these issues. Eventually, capabilities for CAD, PLM, SPM, IIoT and AR will all be accessed through cloud environments like Onshape.

- Our complex program schedule is getting bogged down with shockingly 'simple' things like user code mismatches, upgrade delays, and problems sharing data. Is there a way to manage this complexity in a more effective way?
- Could we accelerate our program goals by putting the CAD system itself in the cloud, and not just the CAD data?
- Would doing so help us to eliminate confusion caused by new releases? Could we get all our users on the same upgrade simultaneously, doing so every few weeks vs. once per year?

## BUSINESS CHALLENGE: ACCELERATING FUEL-EFFICIENT AIRFRAME DEVELOPMENT WITH ADDITIVE MANUFACTURING

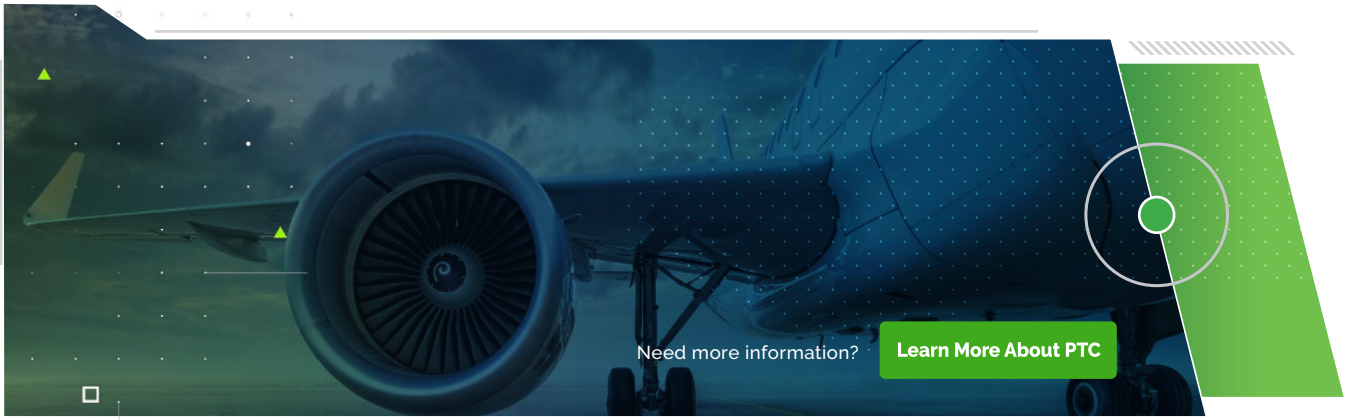
In the additive realm for the airframe business, the focus isn't just on lowering cost through fewer component parts and reduced weight. Smart players are cutting product development times by up to 40% and manufacturing times by 80%. That is a transformational breakaway advantage. And the stretch goal on the horizon is to additively manufacture electronics and structures fully integrated in one metal print.

- To lower risk and shorten product development/certification times for new fuel-efficient platforms, how can our program managers have full confidence that what they are printing reflects the finalized design, its proper version, orientation, and inspection history?
- How will capabilities like topology optimization and real-time simulation inside CAD fundamentally change our pivot speed to embracing additive?
- Have I tapped into my supply chain to utilize existing CAPEX in additive vs. capitalizing it alone?
- How will additive manufacturing help achieve greater effectiveness and versatility of airframe assembly and production operations?

## BUSINESS CHALLENGE: INNOVATION IN AIRFRAME PRODUCT DEVELOPMENT

Given the constant requirements for safety and fuel efficiency in airframe product development, emerging capabilities in the CAD domain for real time simulation, topology optimization, and FEA integration will aid in the transition to new structures and composites. PLM offers a means to improve development processes across mechanical, structural, and electrical systems as well as environmental testing. IoT/AR are already ushering in major changes in smart manufacturing and the maintenance of aircraft. Each one of these areas can be a fundamental platform for innovation.

- Is my team designing this airframe with modularity in mind to accommodate evolving customer requirements across both civil and military portfolios?
- Will that modularity enable us to repurpose engineering artifacts from our current focus to broader marketplace needs?
- What is the optimal variation of composites that will enable customer and mission success?




## BUSINESS CHALLENGE: EXTENDED AIRFRAME SERVICE LIFE

Today's aircraft designs will have much longer expected service lives than those of just a few years ago. A longer product lifecycle will naturally mean modularity to pivot to rapidly changing market conditions.

- Do we have a clear understanding and a practical CONOPS for how historical flight loads are impacting structural integrity?
- For current programs, how we can we manage component upgrades in the most efficient way?
- How can we increase mission readiness by implementing a comprehensive service parts forecasting strategy at the program level?

## BUSINESS CHALLENGE: DIGITAL ENGINEERING POLICY

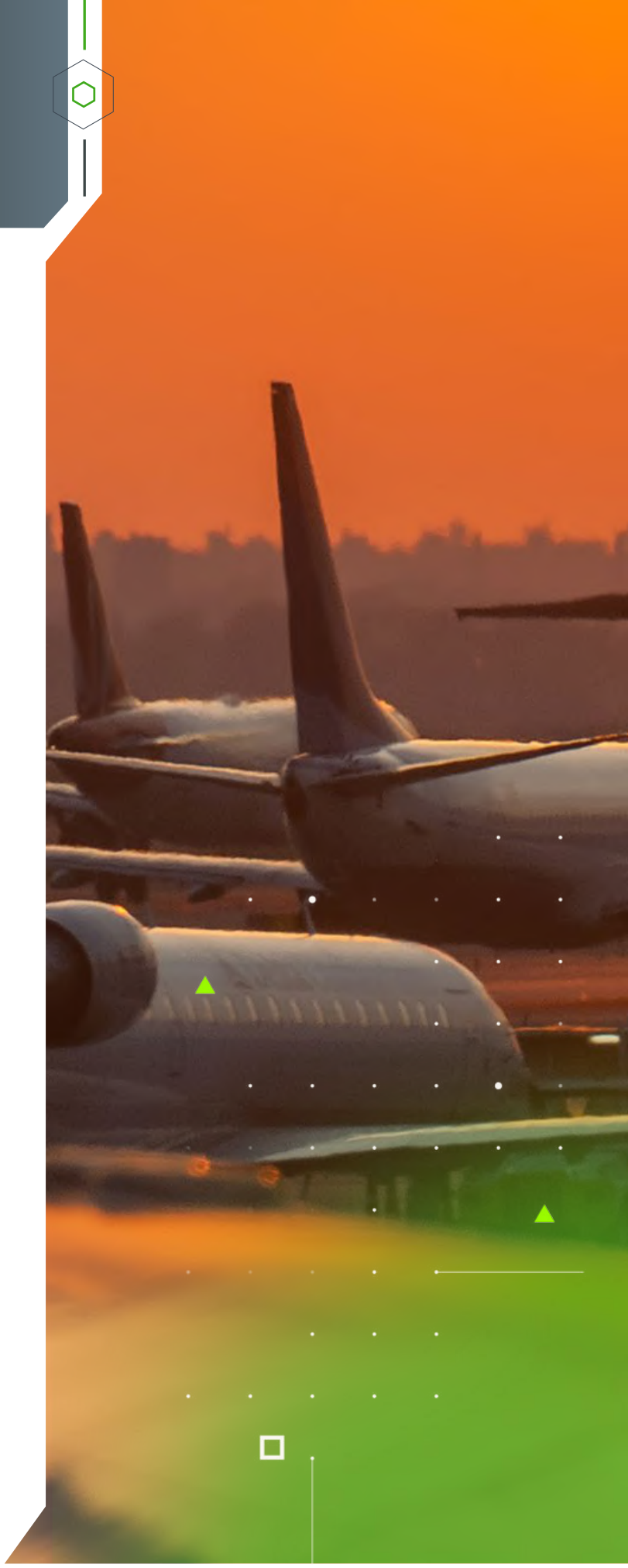
The Department Defense Digital Engineering Strategy requires the use of digital models to inform program decision making as well as a single 'authoritative source of truth' to sync documents and engineering artifacts to digital models for improved collaboration across government and industry. PLM will be the centerpiece of this strategy and will have a profound impact on the way space systems data is organized. What will that mean for DoD aircraft acquisition and sustainment?

- In the lead up to SSR, PDR and CDR, could our Digital Engineering collaboration processes with other services on joint programs be optimized?
- Could an MBE approach to product data quicken the process for RCAs after an airframe failure based on intuitive, model-based views into key component data and processes?
- How are we truly enabling MBE for air vehicle design collaboration across geographically dispersed teams?

# BUSINESS CHALLENGE: INNOVATION VS. ACCOUNTABILITY

With greater military aircraft program funding comes more accountability across the board – both inside government as well as with the OEMs directly.

- While delivering on contractual requirements, how can we break the mold of the traditional financial model for a military aircraft program and put investment dollars to work in anticipation of new capabilities that government customers will need?
- In what ways, can we accelerate air worthiness certification by linking requirements to the sequencing of business process?
- With IoT and AR, how can we smartly build out multiple, simultaneous pilot programs securely, fail the non-performing ones quickly, and scale what is working across multiple OODA loops?
- How can we update digital airframe mock-ups across multiple design suppliers?



# BUSINESS CHALLENGE: WIN PROGRAMS

As airline utilization rates and U.S. defense spending have both increased, many programs that have been in limbo for years are suddenly in play. Successful bidders will need to not only develop a compelling capability but also communicate that in a meaningful way to the customer. Having an excellent command of product data is a necessary for accomplishing this.

- How can we quickly repurpose the same airframe and associated artifacts to other emerging civil or military programs that are on the horizon?
- How can we demonstrate the impact that real time aerodynamic modeling will have on our ability to quickly roll out new product features; both now and in the coming decades of the program's life?
- Should we stand up a PLM capability on a program specific basis to enable a quick pivot to whatever system the end customer uses? Could this itself be a win theme.

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