



Space Systems: Business Challenges and Key Questions

WHITE PAPER



A 21st century space race is upon us. The stakes couldn't be higher as the future of a multi-planetary human civilization hangs in the balance. On the military side, Space Force has now been stood up with capabilities for operations, acquisition and training. And in the private sector, 2020 has proven the long-term viability of commercial space partnership with NASA. Today's ISS resupplies, satellite payload deliveries and rover missions will usher in tomorrow's micro satellite constellations, space tourism, ZERO G manufacturing, and a human footprint on Mars. The cost of launch will be dramatically reduced with reusable vehicles, new composites and 3D printing. Former competitors have suddenly become collaborators, and the fine line between industry and government has been forever blurred. Welcome to the new space race.

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 space sector lower risk while connecting the present to the future.

Business Challenge: Commercial Space Becomes Viable – Two high profile launches in 2020 helped solidify the long term viability of commercial partnership with the government for human spaceflight.

- As industry and NASA maintain existing programs and get new programs off the ground, how is it possible to ensure a single source of truth for product data across the lifecycle?

- Do we have a clear understanding and a practical CONOPS for how flight loads are impacting structural integrity on reusable launch vehicles?
- Is my team designing this launch vehicle with modularity in mind to accommodate evolving government customer requirements?

Business Challenge: Space Force Activated – Space Force has now been stood up with capabilities for operations, acquisition and training in Vandenberg, Los Angeles and Peterson, respectively. Its YoY budget is increasing dramatically with thousands of new personnel. PLM offers a means to improve development processes across mechanical, structural, and electrical systems as well as environmental testing.

- Once we get past the strategy behind Digital Transformation, how should we actually implement it in a way that accelerates the mission of USSF?
- Historically, the Air Force has not utilized PLM capabilities in space acquisition. Should we consider a pilot capability on for 1-2 programs?
- Are our spacecraft designs bi-directionally reflecting changes in requirements?

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 OEM view of the product is significantly different than the operator's view. How can we pull data from industry, ingest it into the product structure, then push it to the field 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 Gantt 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: 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. The individual departments have followed suit with their own digital engineering efforts. PLM will be the centerpiece of this strategy and will have a profound impact on the way space systems data is organized.

- 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 a launch failure based on intuitive, model-based views into key component data and processes?
- How are we truly enabling MBE for space vehicle/launch vehicle design collaboration across geographically dispersed teams?

Business Challenge: Lowering Cost of Launch with Additive Manufacturing – In the additive realm for the space 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%. Whether your 'competition' is another company or an entire nation state, 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. Beyond that, think of how additive manufacturing will impact Deep Space exploration on the moon or asteroids?

- To lower risk and shorten product development and certification times, 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?



Business Challenge: Knowledge Retention – In NASA alone, as early as 5 years ago, people of retirement age outnumbered those aged 35 and under by 3:1. A similar problem is happening in the IT functions of the DoD. This creates a major knowledge retention issue for space systems development and operation in the U.S. and globally.

- How can we leverage PLM and CAD technology platforms to accelerate knowledge management (KM) plans?
- Do we have an adequate repository of testing data and associated processes such that the knowledge from those tests is transferrable to new employees?
- Are we utilizing AR platforms for game-ified personnel training experiences?

Business Challenge: Innovation vs. Accountability – With greater funding comes more accountability across the board – both inside government itself and in the industrial contractor base.

- While delivering on contractual requirements, how can we break the mold of the traditional financial model and put investment dollars to work in anticipation of new capabilities the government will clearly need?
- 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?

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