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Ground Vehicles: Business Challenges and Key Questions

WHITE PAPER

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The safest bet is to keep moving. No industry knows this more than Ground Defense. Over the last 100+ years of mechanized warfare, an impulse to innovate has often made the difference between mission success and failure. This is true today with tanks, personnel carriers, infantry fighting vehicles, MRAPs and related C4I systems. The adoption of new materials for armor and the fuel efficiency of hybrid engines are also key factors in the market. But with the recent emphasis on overseas drawdowns, competition for long term contracts in the military ground vehicle market will be intensifying.

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 ground vehicles sector 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 vehicle 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 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: 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 is the centerpiece of this strategy and will have a profound impact on the way ground vehicle systems data is organized and distributed.

- In the lead up to SSR. PDR, 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 vehicle failure based on intuitive, model-based views into key component data and processes?
- How are we truly enabling MBE for ground vehicle design collaboration across geographically dispersed teams?
- Are our vehicle designs bi-directionally reflecting changes in requirements?

Business Challenge: Innovation in Product Development – Given the constant requirements of survivability and lethality in ground vehicle 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 ground vehicles. Each one of these areas can be a fundamental platform for innovation.

- Are we designing this ground vehicle program for modularity in a cohesive way, across armor, drivetrain, and suspension domains?
- Are we taking a holistic view toward survivability vs. focusing only on armor?
- What is the optimal variation of new composites or other armor materials that will enable maximum occupant safety and mobility?

Business Challenge: Extended Ground Vehicle Service Life – Even though military vehicles are getting lighter and more mobile, today's designs will have much longer expected service lives than those of just a few years ago. A longer product lifecycle will mean modularity to pivot missions to the evolving threat landscape and lower cost maintenance.

- Is my team designing this vehicle with modularity in mind to accommodate evolving customer requirements for infantry, command and control and ISR missions?
- For current programs, how we can we manage component upgrades for capabilities like fire control, automation and power generation?
- How can we increase mission readiness by implementing a comprehensive service parts forecasting capability at the program level?

Business Challenge: Knowledge Retention – The U.S. DoD and industrial contractor base is still suffering from the effects of a workforce nearing retirement age. This creates a major knowledge retention continuity issue for ground vehicle systems development and operation in the U.S. and globally.

- Do we have an adequate, trackable repository of vehicle testing data and associated processes such that the knowledge from those tests is transferrable to new employees?
- How can we leverage PLM and CAD technology systems to accelerate our existing plans for knowledge management (KM)? Could we use AR technology to quicken training time for maintainers?
- As we proceed through tech development, how can we track different prototype data for ballistic protection, system performance, reliability and maintainability?

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 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?
- How can we apply a suspension system designed for Formula 1 racing to a military ground vehicle to improve agility on the battlefield? Could this be a win theme?

Business Challenge: Additive Manufacturing for Ground Vehicle Components – In the additive realm for the ground vehicle business, smart players in industry are cutting product development times by up to 40% and manufacturing times by 80%. On the government side, forward deployed rapid fabrication labs (R-FABs) focus on keeping readiness rates for tanks and unmanned ground systems at levels just high enough to accomplish the mission. Printing to repair damaged turbines on tanks has been one of hundreds of recent use cases. Back in the depots in CONUS, the DoD will ultimately treat its large-scale metal 3D printers similar to a 'fleet' unto itself, each with its own tail number specific configuration. Whether your 'competition' is another company or an entire nation state, these are transformational breakaway advantages. 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 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?
- As a defense contractor, how will we change from a spares business into simply monetizing product data that enables the DoD to additively print our spares designs?

Business Challenge: Government Program Management – There aren't many new ground vehicle program starts in the DoD and NATO militaries. Instead the focus is to keep the programs that are already in flight upgraded and running efficiently.

- As programs like JLTV program mature, how is it possible to ensure a single source of truth for product data between government and industry across the lifecycle?
- How can we enable platoon leaders to make more decisions about where to place vehicles based on strategy and less on vehicle constraints?
- What is our most optimal means to track vehicle payload configurations across different upgrade prototypes?
- How can we track cost impact of engineering changes on a per vehicle basis, then across the entire fleet as they are configuration managed in the field?
- What is the most optimal way to quickly develop new vehicle product variants for U.S. allies in NATO?

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