Neural Ecosystem with Tata Consultancy Services Enables Next-Generation Aerospace Manufacturing

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Keywords

Aerospace & Defense Industry, Neural Manufacturing, Digital Transformation, Artificial Intelligence, IoT, Augmented Reality, Ecosystems

Summary

Recently, Dr. Sandeep Muju, Head of Aerospace and Defense Global Practice, and Anand Pradhan, Head of Strategy & Business Development, Aerospace and Process Manufacturing at Tata Consultancy Services (TCS) briefed ARC on their thought leadership framework for next generation aerospace manufacturing. TCS is transforming the aerospace and defense (A&D) industry with neural ecosystems providing information exchange and interoperability. The IT/OT systems in A&D firms have historically been fragmented and the company believes a neural aerospace enterprise brings the next generation of manufacturing capabilities and connectivity.

Digital transformation will replace fragmented systems with intelligent connected end-to-end interoperability, enabling next generation manufacturing among aerospace and defense companies.

TCS has previously defined a set of imperatives in the context of *Business 4.0 in the New Normal* (post COVID) and aligns with the Industry 4.0 initiative. Business 4.0™ is a TCS thought leadership framework augmented with a new business lifecycle predicated on purpose-driven, adaptable, and resilient business transformation. Extending this thinking to the manufacturing customer, TCS articulates the future to be Neural. It defines "neural manufacturing" as an intensely networked set of partners aligned to a common purpose, where the value chains are responsive, adaptive, and personalized with intelligence built on the edge of the networks. The aerospace and defense industry is positioned well to benefit from the neural manufacturing ecosystem of the future.

TCS Is Entrenched Across the Aerospace Value Chain

TCS has had a strong industry presence in aerospace for over 30 years. The company has provided integrated engineering, manufacturing, enterprise, IT innovation, digital transformation, IT and Business process services to several civil & defense aircraft and rotorcraft companies with a large number of dedicated global delivery centers.

The aerospace manufacturing ecosystem is an integrated mix of industry players spread across airlines, aircraft manufacturers, airports, air traffic management, regulators, ground support, and an extended network of tiered suppliers. Legacy operational technologies were not designed to be connected, and therefore work mostly in their own silos. Conversely, a neural aerospace enterprise is a highly networked ecosystem boasting the following attributes:

- Connected: Integrated representation of assets with digital thread towards a networked, connected, secure, and interoperable format.

- Automated: Robots, cobots (collaborative robots), and automated assembly and parts manufacturing; parts traceability and genealogy – autonomous track and trace.

- Adaptive: Managing parts supply/demand disruptions with supply chain digital thread and 3D printing to create an intelligent factory – connected and adaptive assets and platforms.

- Personalized: Additive manufacturing for in-demand and personalized fulfillment of printable spares and materials; immersive aircraft simulation and modeling.

- Cognitive: Cognitive data visualization for critical aircraft decision-making; Cognitive production control systems; machine vision applications in safety and aircraft inspection.

- Resilient: Prognostic fault prediction and maintenance; blockchain for resilient supply network and counterfeit detection.

- Intelligent: Prescriptive and prognostic insight generation from assets network; Intelligent planning and scheduling; AI-based generative design and engineering of aircraft parts.

Interconnected Neural Manufacturing in the Aerospace Industry - Source: TCS

TCS Is a Driver of the Smart Neural Factory

The smart factory self-optimizes performance across a broader network to achieve efficiency, precision, and agility. At the center, a cognitive command center receives demand and supply data from external and internal sources. The system combines inputs from various enterprise systems including ERP, CRM, SCM, MES, PLM along with internet of things, augmented and virtual reality and artificial intelligence data.

Data from engine manufacturing, fuselage wings, avionics, and other product subsystems along with specific supply chain and worker data is aggregated into the central control systems where artificial intelligence is deployed for visualization and decision-making purposes. Prescriptive decisions for health monitoring, fault prediction and prevention, and production performance results in resource optimization.

Neural Dimensions Drive the Future Aerospace Ecosystem

The neural aerospace ecosystem of the future can be represented by three interconnected dimensions building on Industry 4.0 foundational technologies:

1) Internal Dimension: A connected internal ecosystem with cognitive computing architecture – this dimension intelligently connects a company's internal smart assets and platforms powered by IoT and automated production and processes with human-machine interaction.

2) Network dimension: A cognitive supply network -- the application of cognitive technologies such as artificial intelligence, natural language processing, computer vision, and robotics in supply chain allows the entire network to think and interact over the cloud. End-to-end visibility of the supply network can be achieved by coupling connected networks with IoT for increased automated communication and digital twin technologies, simulating multiple scenarios and failure prediction including the extended supply network.

Aerospace and defense companies can now adopt emerging technologies to benefit from technology led business innovation and competitiveness.

3) External Dimension: A connected external ecosystem – efficient and seamless integration of the internal network and external dimension. External Dimension includes the digital aftermarket and MRO network, neural unified air traffic management, flight safety, smart governance, and connected sustainable environments across the A&D industry ecosystem.

Conclusion

TCS has successfully demonstrated the benefits of neural ecosystems in aerospace through multiple case studies. Aerospace companies have implemented IoT, cloud, analytics, and augmented reality to achieve end to end visibility, quality, and productivity improvements during the manufacturing process. Additionally, TCS is actively participating in developing data monetization approaches for aerospace companies.

Aerospace and defense manufacturers across the value chain can now use this architecture to develop and implement digital strategies by migrating to a neural aerospace ecosystem. These organizations will be well equipped to build a resilient ecosystem of value chain partners and suppliers.

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