

Lower Latency, Higher Speeds: Aerospace and Defense Industry set for Transformation enabled by 5G

Abstract

Low latency, reliability, and high data transmission rates are critical for the aerospace and defense industry. With the upcoming 5G network capability promising to hugely improve the current 4G, in terms of latency, speed, and connection density, a major shake-up is in store for urban air mobility, airport operations, aircraft interiors, defense and cybersecurity. From spawning on-demand air taxi services to increasing drone use, from offering smart data-driven solutions for passenger experiences to making possible individual wearable devices transmitting soldier information for emergencies, adoption of 5G tech will reinvent the industry. Additionally, the aerospace production industries are also looking at vast enhancements stemming from 5G-enabled real-time live data collection from smart sensors and machine control systems, which will have considerable impact in industrial IoT and manufacturing efficiencies and 'factory of the future'.

Why does Aerospace & Defense need 5G Applications beyond the Current 4G?

For sleeker operations in the aerospace and defense industry, data transfer speeds need to increase, density of connectivity needs to be higher, latency needs to be lower, and energy savings need to go up. The current standard 4G offers many high-speed features, but its maximum speed is only about 100 Mbps and 1 Gbps for mobile and low-mobility communications, respectively.

Contrast that with the upcoming standard 5G. The anticipated theoretical speed of 5G connections is up to 20 Gbps per second, about 10 to 20 times the speed of the current 4G. Equally important is the latency improvement from 50 milli second with 4G to a theoretical 1 milli second for 5G, an improvement of nearly 50 times.

Though these advantages come with some caution from aviation safety perspectives, 5G holds special significance for the aerospace and defense industry. It is likely to improve:

- Urban air mobility
- Airport operations
- Aircraft interiors
- Defense and cybersecurity

It can also facilitate better technology adoption in areas such as:

- Industrial IoT and industrial automation
- Industrial robotics
- Immersive technology
- Predictive artificial intelligence
- Connected shop floor

How 5G will play out in Aerospace and Defense Industry

Urban air mobility business models

Urban air mobility (UAM) transportation solutions are expected to become available by 2025. From the technology-readiness perspective, maturity in advanced electric propulsion, autonomous flight and 5G communication networks will be key to the growth in speed of the UAM mobility market.

direct, air-to-ground communications (DA2GC) system designed to connect aircraft network infrastructure to the ground cellular network. This will provide passengers with broadband services and cellular coverage from gate to gate, without losing connectivity.

Defence, military and cybersecurity

A 5G-enabled, viable soldier-level scenario would be a smart wearable device to detect physical condition, facilitate primary care for wounded limb, inject shots or send emergency alert to medical teams.

Simultaneously, 5G will create a complex jamming and communications environment for military communications. These will also support a massive number of connected devices, enable huge bandwidth increase and create a next-generation threat landscape with new security challenges.

Offering huge benefits, like enhanced speed and performance, lower latency, and better efficiency, this will also come with risks. Too many devices, elevated virtualization and cloud use will lead to more 5G security threats and a multifaceted attack surface. To realize a healthy communications future, laser focus is required on 5G security.

5G Networked Production

Fraunhofer Institute for Production Technology (IPT), Ericsson and GF Machining Solutions² collaborated to develop the 'network monitoring system', a 5G solution for managing manufacturing processes addressing extreme vibration challenges (disrupt dimensional consistency at high volumes, not accepted by the aerospace industry's high precision requirements) of high-speed milling machines. Future manufacturing challenges are evolving and will soon exceed capabilities of today's production systems.

5G Smart sensor technology

Problem:

Typically, the milling process for new blisk geometry has a trial-and-error approach, which comes with long lead-times, dependence on milling operator experience, high cost and long duration.

Solution:

Real-time live data collection from smart sensors and machine control systems becomes important. In combination with

workpiece simulations, this data gives an insight into the point of origin of vibration. These together provide accurate control strategy.

5G for production

Problem:

Time, reliability and high data transmission rates are critical for complex product manufacturing, process control of wireless closed-loop control systems and high-precision process monitoring.

Solution:

Low latency and high speeds of 5G technology have the potential for providing a reliable wireless solution for connected applications for logistics or tracking.

5G Technology Impact

On industrial IoT and manufacturing efficiencies

While most technologies being discussed may already be in use, 5G will make them better. Coupled with Business 4.0™-based models, 5G will vastly improve industrial production systems.

Estimates say that 5G can support a connected density of one million devices per sq.km., enabling IoT to further merge with manufacturing³. IoT plays a crucial role where data from sensors, tags, reader etc. is collected, stored (in cloud) and analyzed in real-time to draw insights and predict status for proactive actions.

With 5G, manufacturing will see futuristic applications where connected devices will sense their environment and interact with each other for decentralized decisions. 5G will bolster self-optimization, automation, and efficiency by improved use of robotics, immersive technologies like AR/VR/MR, greater predictive artificial intelligence (AI), and production monitoring. It will enable remote operations in real time.

On Factory of the Future

Factory of Future is an integration of Cyber Physical Systems in production and logistics combined with IoT for industrial processes and ICT technologies. New areas and emerging technologies like Robots, Additive Manufacturing, sensors, advanced and exotic materials, AGVs ... all contribute to provide increased flexibility and better efficiency of the assembly line. These technologies once integrated and connected in a smart way provide data to extract insights.

About The Authors

Bhaskar Sharma

Bhaskar is the marketing head with the ANP ISU of Manufacturing Business Unit at TCS. He also has expertise in the aero industry and is an SME for the segment. He has around 24 years of experience in business and program management across engineering design, digital and IT services and mechatronic test solutions. His experience encompasses diverse industry sectors including aero and defense, automotive, marine, home appliances and industrial. Bhaskar holds a bachelor's degree in electronics engineering.

Sandeep (Sandy) Muju

*Aerospace & Defense Advisor
Manufacturing BG*

Sandeep is aerospace and defense (A&D) industry advisor with the manufacturing business unit at TCS. He has more than 25 years of experience across A&D, highly engineered/manufactured products and technology services organizations.

Contact

Visit the [Manufacturing](#) page on www.tcs.com

Email: anp.marketing@tcs.com

Subscribe to TCS White Papers

TCS.com RSS: http://www.tcs.com/rss_feeds/Pages/feed.aspx?f=w

Feedburner: <http://feeds2.feedburner.com/tcswhitepapers>

About Tata Consultancy Services Ltd (TCS)

Tata Consultancy Services is an IT services, consulting and business solutions organization that delivers real results to global business, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT-enabled, infrastructure, engineering and assurance services. This is delivered through its unique Global Network Delivery Model™, recognized as the benchmark of excellence in software development. A part of the Tata Group, India's largest industrial conglomerate, TCS has a global footprint and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

For more information, visit us at www.tcs.com