UNIVERSITY OF BORDEAUX – IMS LAB

Dassault Aviation using 4.0 Technologies - France

Abstract

Founder of the digital enterprise revolution, Dassault Aviation is one of the most innovative companies in France that has made a breakthrough in Industry 4.0. Several areas of transformation have been undertaken to support the current challenges and maintain a competitive positioning. The opportunities offered by technologies will be evoked with examples revealing the overall strategy of Industry 4.0.

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Introduction

Dassault Aviation is an Aeronautical company specialized in civil and military aviation with more than 9000 employees in France and more than 8000 planes delivered in the world since 1945. 90% of the turnover is made from export. In a highly competitive, technological and innovative sector, Dassault Aviation maintains a renowned position among competitors (ten times larger). Various collaborations with universities / engineering schools are set up in: Fluid dynamics, Flight control, Acoustics, Electromagnetism, Solid mechanics and Manufacturing. It is interesting to underline the need to lead this new industrial revolution. *"Industry 4.0 is not an opportunity but a necessity*" J-L. Sailliol. Industrial CEO of Dassault Aviation, Mérignac. France.

Challenges

Faced with competitive imperatives, Dassault Aviation's strategy was to initiate in 2017 a plan over 5 years in order to undertake different areas of transformation.

> *The challenge is to support each of the suggested axes in order to progress, innovate and increase reliability at Dassault Aviation*

Culture, skills and organizations: This axis is a target that should not be overlooked. Trade knowledge, business skills are distinctive elements to be brought together in order to have fields of excellence and retain trade knowledge.

Industrial tool: Must be robust and efficient in order to improve the Time to Market

Monitoring the programs: This target is priority because better monitoring is a guarantee of reliability with understanding of risks (FMEA product, FMEA process) in order to guarantee RFT (Right First Time).

Industry 4.0 - Digital tools, process and innovation *« Industry 4.0 is the use of data and associated digital technologies, in the service of industrial control and performance* » J-L. Sailliol. Benefits from the deployment of 4.0 technologies may be expected if the organizations are already Lean. At Dassault Aviation, Lean is called “IPR” Improvement of Production Reactivity. This condition for the deployment of 4.0 is interesting to emphasize in order to avoid the pitfalls of excessive digitalization and computerization of underperforming systems. The deployment of Lean in production systems guarantees a stable and robust base that can be "fed" by quality data feedback, by smart sensor technologies used as input data for the ERP system (to propagate good information) and use MES to guarantee the traceability of operations. To support the stated challenges, technological solutions from industry 4.0 are proposed in the following section.

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How will solve the problem?

In this section, some examples are given:

• Smart sensors: In a machine shop, for example, temperature and vibration sensors make it possible to monitor them in real time in order to establish a preventive analysis of machine breakdowns. The use of smart sensors supports the ”Monitoring” pillar identified as a challenge previously. The objective is to improve the perception of the state of the system with a supply in real time and from all the available data.

Indeed, Integrating sensors into the industrial system gives the possibility of synthesizing, aggregating data in order to provide a synthetic situation to the operator.

• Augmented reality / Workstation helmets: Today, assembly instructions can be projected on operators' helmets. Previousely, it was necessary to move to the documentation station or more recently to use a tablet at the station. Today the projection of information via the helmet ensures the acquisition of technical instructions in an efficient way.

• Cobots: On the construction site of the wing boxes, cobots introduce sealing materials into a box difficult to access. This task is tedious and prone to errors. Refocusing the operator on the added value becomes imperative and possible thanks to cobots. By training operators to do well the first time and delegate repetitive automated actions to cobots represents a lever for improving working conditions. The objective is to facilitate the work and operator involvement (recognized as another pillar of the 4.0 revolution in Dassault's strategy).

• 3D printing: If an operator (in assembly line) notices a missing component, it is possible to print it in Fablab without heaviness of usual sourcing procedures. Innovation is at all levels process, material and system. 3D printing represents a real revolution inside the workstations.

Several challenges are taken up every day by many companies in order to integrate technological innovations in production systems. The main target is always to get more reliable, more communicative solutions at the cutting edge of technology.

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Monitoring assistance from data	Digital Twin	Connected man *(Digital in the service of Man)*	Automated production
• IoT, sensors (data collection, M2M communication) • Big Data consolidation and analysis • Crossing of process / product data • Predictive maintenance • Visual control (cockpits, control towers) • Process control	• Simulation of industrial processes and procedures (industrialization, ranges) * • Workshop modeling (geometry, kinematics) • Simulation of production units (creation and simulation of flows) • Simulation of overall planning • Simulation of the internal / external supply chain	• Immersive training • Mobility in the workshop • Augmented Reality (projected on plane, helmets) • Capture, sharing, knowledge networks, human connection • Optimization of gestures and postures	• Digital and autonomous logistics (transits - AGV, Automatic identification) • Robotics, cobotics * • Additive Manufacturing * • Integrated digital control • Automated control
Change management and data preparation			

Figure.1: Four prior axes at Dassault Aviation

These four points (Figure.1) are not just projects. They are actual facts in progress. *Monitoring assistance from data* is a reality today with the possibility of doing predictive maintenance. *Digital twin* allows to create a virtual plane. When Dassault Aviation initiates a new plan program to be industrialized, the digital twin makes it possible to demonstrate the aircraft's manufacturability on the first try. The digital twin is not only a digital model of the product but also of its entire environment: Company, workshops, tools, range of instructions, instruction sheets, etc.). The objective is to move from a logic of promise to a logic of proof thanks to the digital twin. *The connected man* is the best illustration thanks to the augmented reality made possible today on the assembly lines. The goal is to make free operators' hands and display the key information in real time to allow the right action to be taken, at the right time in the right place. Operators are also required to train reliable movements in order to avoid the risk of error and do RFT. The cobotic and automated production reinforce the operator who relieves himself of difficult activities, possibly automatable, in order to focus on piloting cobots. Industry 4.0 is no longer just a project but a reality with multiple technological applications already deployed in Dassault Aviation.

References

- Collected by A. Zouggar from J-L. Sailliol

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