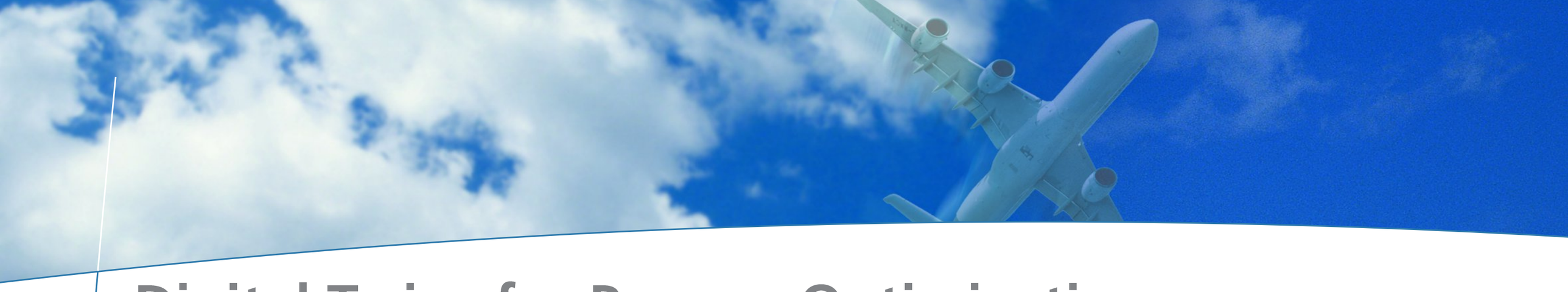
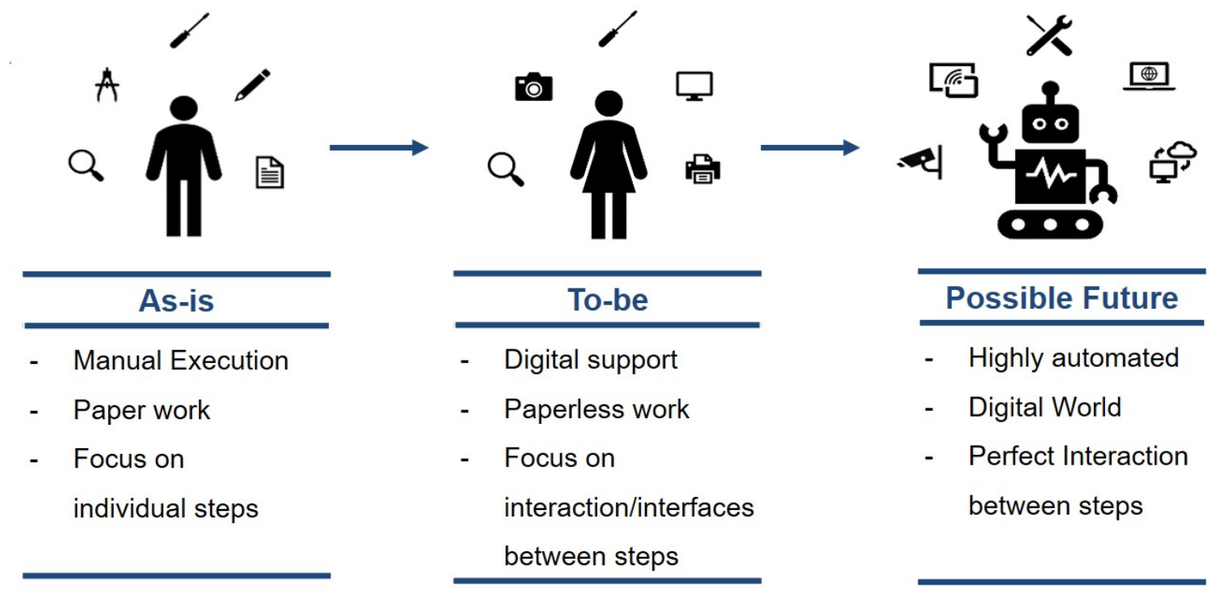


Digital Twins for Process Optimization: Digitalization of Repair Processes in Aviation

Johanna Aigner M.Sc. - johanna.aigner@dlr.de – Institute of Maintenance, Repair and Overhaul

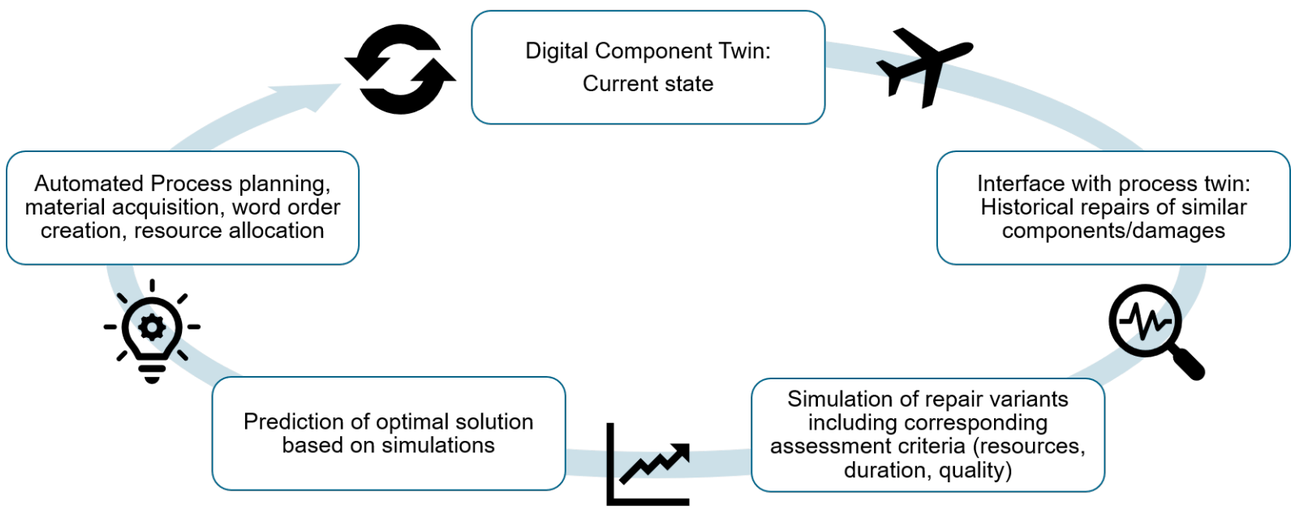
Motivation

- Ensuring the airworthiness and availability of aircraft: A complex, highly individual and manual task
- Growing fleet sizes: Demand for more efficient maintenance and repair processes
- Digital and virtual technologies: Automation of individual process steps (e.g. inspection or scarfing)
- Digital process: Integration of individual technologies in continuous chain
- Digital process twin: Interaction with digital component twin



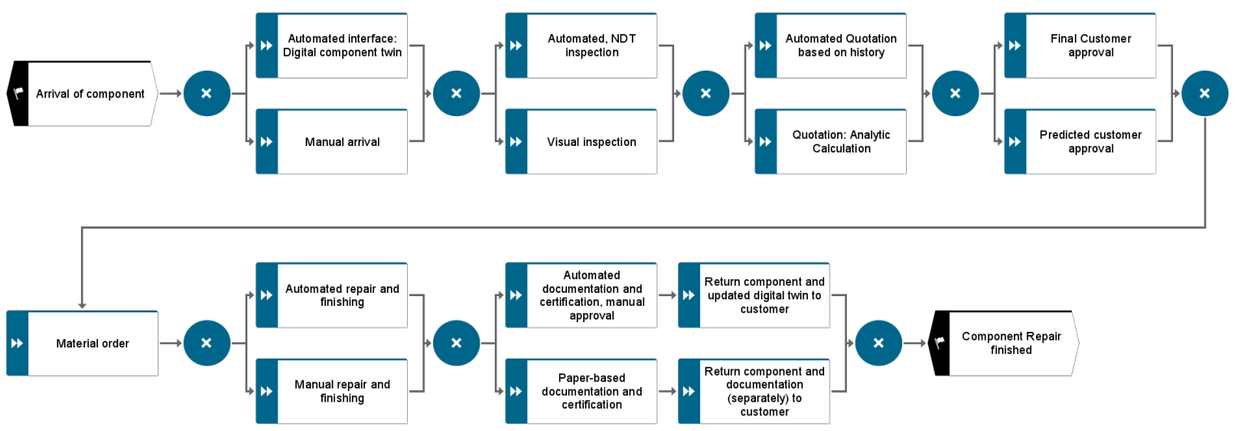
Requirements on digital process twin

- Interaction with digital component twin: Acquisition of component data, history, material properties
- Based on component state: Simulation of possible repair alternatives (via algorithms trained on historical repairs)
- Assessment of simulated scenarios (based on objective, i.e. cost-effectiveness, quality, time-saving): Prediction of optimal process flow
- According to optimum process flow: Resource planning, material acquisition, hangar planning



Digital process twin

- Database of historic repairs (including component-related data and process-related data)
- Simulation of suitable repair alternatives (including assessment-relevant information like duration, cost, ecological impact, quality and human factors)
- Optimization of various simulation alternatives to predict repair process to be chosen
- Storage of digital data along the actual repair process in order to update digital component twin and enrich digital process twin



Potentials of digitally supported repair processes

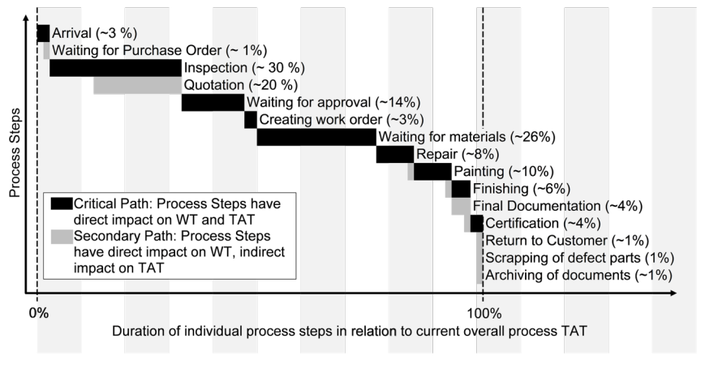


Figure: Turnaround time: Current repair process. [1]

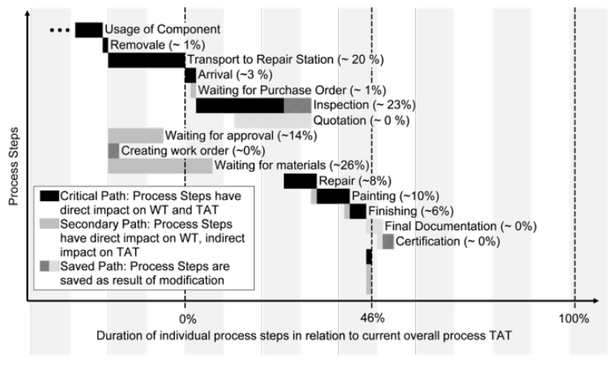


Figure: Turnaround time: Digitally supported repair process. [1]

	Process 1	Process 2	Process 3
Quality	+	-	++
Accuracy	o	o	o
Documentation	+	-	+
Robustness	- -	++	-
Damage history	+	o	o
Duration	-	+	++
Cost	+	o	-
Reliability	o	+	-

Table: Qualitative assessment of process variants.

[1] Aigner, Johanna und Meyer, Hendrik und Raddatz, Florian und Wende, Gerko (2023) Digitalization of Repair Processes in Aviation: Process Mapping, Modelling and Analysis for Composite Structures. In: Deutscher Luft- und Raumfahrtkongress 2023, Stuttgart. Deutsche Gesellschaft für Luft- und Raumfahrt - Lilienthal-Oberth e.V., Bonn, 2023. Deutscher Luft- und Raumfahrtkongress 2023, Stuttgart, 2023-09-19 - 2023-09-21, Stuttgart, Deutschland. doi: 10.25967/6100

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center