Effects of aeroplane digital twins on business models

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ABSTRACT

In simple terms, a digital twin can be defined as follows: The Digital Twin is a uniquely identifiable digital representation of a physical or logical object for one or more purposes. [1] The topic of digital twins is becoming increasingly important. Not only publications (see Figure 1) on the topic but also search queries in search engines are continuously increasing. The potential of digital twins is generally considered to be very high. It is reflected in various political, scientific and economic strategies. [2], [3], [4] However, the question of financing digital twins has not yet been fully clarified. There appear to be two problems in particular:

1) The costs and benefits of digital twins can be allocated at different stakeholders.

2. the benefits of digital twins are often not realised directly in the digital twin, but in surrounding processes and often at stakeholders other than those providing the required information.

These two boundary conditions require that the development and operating costs of digital twins must be distributed among the individual market participants in proportion to the benefits. It is also to be expected that a great deal of financial effort will be required to reduce data disruptions. This requires additional standardization for digital twins in terms of linking and semantics. Examples in the industrial environment are the AAS (Asset Administration Shell) [5] or ECLASS [6]. Initial research into transferring this standard to aviation is already underway. [7]

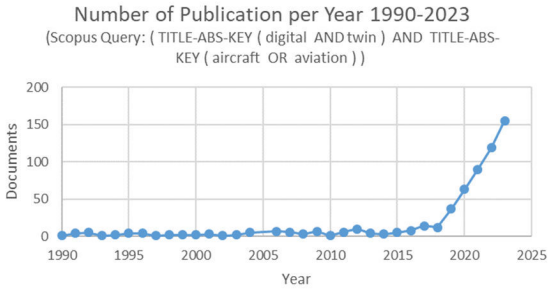

Figure 1: Number of publication

In the overall life cycle of an aircraft it passes through the basic phases of design, production, operation and utilization. Within these phases, a large number of stakeholders is involved. Digital consistency must be enabled across the stakeholders as well as across the lifecycle phases. [8]

Some of the generated data is very specific and is not required by other stakeholders to the same extent as other data. As the data market as a whole and thus also data-driven research and development are emerging, some benefits are not yet foreseeable. Currently, a lot of data, such as time series for components, is not yet available and therefore the use cases for predictive maintenance, for example, are very limited.

An important feature of digital twins will also be the feedback of data into the previous life

phases. For example, information from production and operation can be used to introduce improvements into the design. However, this feedback can also take place within a life cycle phase, for example in operation/maintenance. The repair data of a component can have an influence on future operation and repairs. Possible feedback loops are shown in Figure 2 as an example.

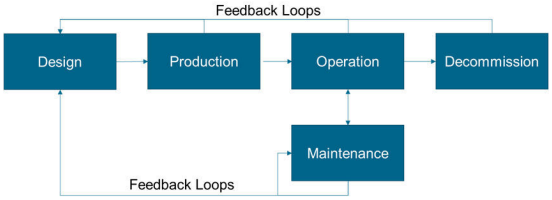

Figure 2: Feedback Loops

The potential benefits of the systems can be divided into the life cycle phases. The most diverse benefits are in the area of operations. However, this does not mean that this is where the greatest financial potential lies. Virtual design and virtual certification in particular can generate considerable benefits in the design phase. The transformation of design, testing and certification into entirely virtual processes enables the consideration of experiences from the operational phase and makes continuous product improvements more feasible.

This presentation identifies various potentials from a literature review and allocates them to the different life cycle phases. This ranges from virtual certification and digital quality assurance in production to prescriptive maintenance and digital pollutant registers in recycling. The presentation also includes new concepts as data or software as a service (DaaS/SaaS) to show potentials for new business models for aircraft digital twins.

Literature

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