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Short Communication

# Process Development and Configuration Management for Aerospace Projects

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## Abstract

The advancement of computational technology and the use of embedded software have made the systems more complex and highly integrated this due to the large number of functionalities delivered and their applications in the most diverse areas, which includes: control aerospace vehicles such as satellites, rockets, aircraft, telemetry and remote control, etc. On the other hand, this complexity demands a robust development process, in which it is essential to version the work products and, especially, to control the changes in these products. In this way, investing and maintaining efficient configuration management should contribute to a successful and less error prone project, both in the phases of the development cycle and throughout the manufacturing process. Therefore, considering this context, I will present some steps to maintain an effective control of the configuration of a complex project, based on a method applied in the aerospace industry, which establishes key activities for the control of artifact baselines, requirements management, maintaining the product structure and delivering software releases and hardware versions. Digital technologies are radically transforming project delivery, breaking the mould of 1960s approaches to enable more rapid and agile forms of organizing. Yet the use of large digital data-sets also requires new forms of control. This study compares the leading practices of managing change in digitally-enabled projects in Airbus, CERN and Crossrail. The paper concludes by considering the implications for managing digitally-enabled projects. There is little literature on the use of Configuration Management (CM) in the Aviation Industry. However, it can be very useful today, where complexity to manufacture aircraft is increasing, and application of CM is very suitable. The pieces of the aircraft are produced in different countries, even the same parts are assembled in different countries and factories. Designs with different materials, and products increasingly lightweight, enhanced the complexity. In addition customers request very different versions of the same model, which are changing over years. The two most important objectives of the CM are to guarantee that there is compliance between the products and services that have been delivered to the customer, and to support the process of application for individual certificate of airworthiness, while optimized business performances are taken into account. The main objective of the study is how the CM is implemented in the aviation industry with an immediate applicability. CM is a discipline that arises from the need to ensure control in the complex process of relationships. CM is well suited to solving complex problems, like in aircraft industry. Its application allows the reduction of periods of integration and design, so that reduce delivery time to customers. As we enter an era of 'big data', asset information is becoming a deliverable of complex projects. Prior research suggests digital technologies enable rapid, flexible forms of project organizing. This research analyses practices of managing change in Airbus, CERN and Crossrail, through desk-based review, interviews, visits and a cross-case workshop. These organizations deliver complex projects, rely on digital technologies to manage large data-sets; and use configuration management, a systems engineering approach with mid-20th century origins, to establish and maintain integrity. In them, configuration management has become more, rather than less, important. Asset information is structured, with change managed through digital systems, using relatively hierarchical, asynchronous and sequential processes. The paper contributes by uncovering limits to flexibility in complex projects where integrity is important. Challenges of managing change are discussed, considering the evolving nature of configuration management; potential use of analytics on complex projects; and implications for research and practice. In particular, design activities are investigated as a crucial context for technology implementation and process optimization in the aerospace industry. Based on a four-year collaboration with a leading company, the article shows the development of new processes and software tools which reduced sensibly the time and cost for designing key parts of aircraft engines, with indirect benefits on product quality. The paper can be a proof-of-concept for similar implementations in complex engineering sectors as the study combines discussion of technical aspects of modelling with strategic issues related to design and NPD performance. It is mainly a question of processes and way of working. For maximum business benefit, its implementation requires a strong sponsorship at top level, and discipline throughout the organizations, in order to define and fully apply common processes and common methods, supported by common tools. The Digital Mock-up (DMU) becomes the heart of the product information. It is created with the support of Computer Aided Design (CAD) and is managed by a Product Data Management (PDM) system that also supports the industrial drawing release process and configuration management. Practical operations in concurrent engineering lead to significant business benefits, which can be measured in terms of lead-time and reduction of effort in development. These benefits have now been made visible for the development of the A340- 500 and A340-600, and for the A380. As a vision, Airbus expects further integration steps in the design office technology, targeting a Virtual Aircraft, with stronger links between Systems Engineering (including Architectural Design and Requirement Based Engineering), Design to Decision Objectives around the DMU, and supported by the PDM.

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