Aerospace & Defence Qualification Process Impacts on Ability to Substitute Cr(VI) Substances

Aerospace and Defence (A&D) products operate and carry people in extreme environments over extended timeframes, while having to fulfil extremely challenging technical, reliability, and safety requirements. To ensure the safety and reliability of aerospace products, comprehensive airworthiness regulations have been in place globally for decades. **These regulations require a systematic and rigorous framework to be in place to qualify all materials and processes to meet stringent safety requirements that are subject to independent certification and approval through EASA and other agencies requirements.** Air, ground and sea-based defence systems, and also space systems, are subject to similar rigorous qualification requirements. Changes to A&D hardware offer unique challenges that are not seen in other industries.

The A&D companies that design and integrate the products (e.g. aircraft, engines, radar systems, missiles), are each responsible for their own product qualification, validation and certification, according to airworthiness regulations or defence/space customer requirements. Within a single A&D company, even seemingly 'similar' components or hardware used in different systems/models have unique design parameters and performance requirements, driven by the system-level requirements of the final delivered product. **A&D products cannot be placed on the market without going through this demanding process irrespective of any REACH legislation.** The same rigorous process is in place to approve materials used for the repair and maintenance of these products. Figure 1 illustrates the process required in the A&D industry when substituting a material.

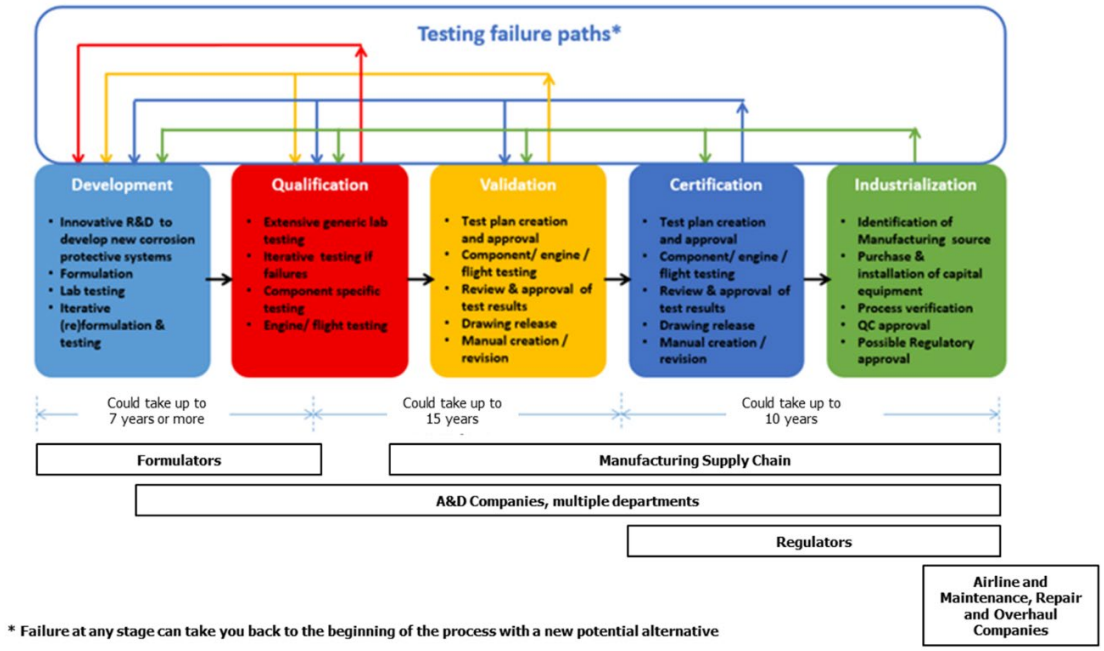

Figure 1: Illustration of the development, qualification, validation, certification and industrialisation process required in the aerospace industry

Whilst a formulator may introduce an alternative into their products, there are many discrete activities required to introduce an alternative candidate into A&D hardware. The testing and qualification criteria is dictated with due regard to the design and performance requirements of each component and system. An example suite of tests for primers may include enhanced corrosion, fatigue, chemical resistance, erosion, repair and manufacturing trials, engine and/or flight tests. Once a candidate technology has reached a sufficient level of maturity, then integration into products is permitted. Industrialisation is an extensive step-by-step methodology followed in order to implement a qualified material or process throughout the manufacturing, supply chain and maintenance operations, leading to the final certification of the A&D product. This includes re-negotiation with suppliers, investment in process implementation and final audit in order to qualify the processor to the qualified process. An individual component may become part of multiple

subsystems and systems, each imposing its own design requirements and challenges**. Thus, successful substitution for one component in a given subsystem does not imply that it is suitable for use in a different subsystem. Each individual subsystem and system must be assessed and validated independently.**

Formulators are responsible for developing and performing the preliminary assessment of any candidate alternative's viability. However, **only the original design owner can determine when a candidate alternative is fully qualified and/or validated and therefore meets both airworthiness and comparable performance requirements for each of their A&D applications independently.**

The A&D industry has long recognized the risks associated with Cr(VI) and the necessity of implementing the use of alternatives. Significant efforts have been expended by the A&D industry over several decades to develop and implement alternatives. A&D companies have rigorous processes in place requiring extensive documentation, reviews, and approvals to justify use of Cr(VI) in new designs or changes to existing designs. Once a new validated, certified and approved alternative is incorporated into a design, adherence to the new design becomes a contractual and regulatory requirement.

Despite these efforts, there remain many applications for which no suitable alternative can be implemented. Recognizing that there are many different uses of Cr(VI) and that each must be assessed individually, to date there is no universal replacement for any of these coatings and surface treatments for A&D uses. For many A&D products it may not be feasible to make certain changes due to the complexity of ensuring that no negative impacts are introduced into proven designs. The complex relationship between each component (in aerospace and defence systems) and its performance requirements within its own unique design parameters requires certification of each substitution individually (see Figure 2). Qualification in one particular application does not guarantee that use in another application is qualified. Every application must be individually assessed to determine that requirements are met. This process must be independently replicated across all A&D products by each A&D company. A&D products (e.g. a specific aircraft model) may be in service for 30-50 years (even longer in defense uses), requiring maintenance, repair and spare parts over their entire service lives. Any changes to these parts or processes must be fully validated and certified to ensure safety and performance are not compromised.

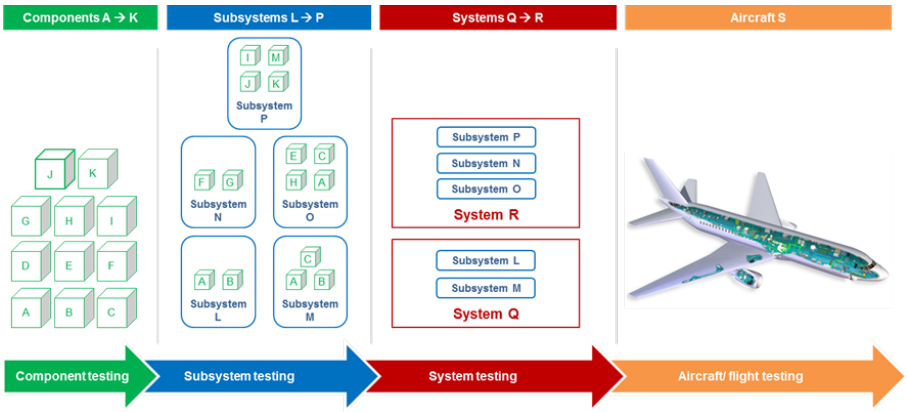

Figure 2: Systems assessment and validation overview

The industry was diligently pursuing alternatives prior the passage of the REACH regulation, and will continue to do so regardless of the details of any particular Authorisation decisions.