Advanced manufacturing boosts global competitiveness of aeronautics and defence sectors

The Aerospace Industry Support Initiative (AISI) is fulfilling its mandate to assist in improving the global competitiveness of the local aeronautics, space and defence sectors. Advanced manufacturing, specifically, holds good potential for AISI industry partner Denel Aerostructures as a game changer to promote the aerospace industry.

The AISI is an initiative of the Department of Trade and Industry (the dti) and is hosted and managed by the Council for Scientific and Industrial Research.

Marié Botha, AISI Manager, says, “The AISI takes its strategic direction from government’s objectives with a specific emphasis on industrialisation of technology. South African industry is encouraged to advance niche capabilities and technologies through industrialisation. Our projects and contribution to the aerospace and advanced manufacturing industries cover a broad spectrum – from process design of continuous fibre-reinforced thermoplastic joining methods to process design of titanium fluid-cell forming, and the design and testing of high strength aerospace materials.”

The following project is of particular interest in the partnership with Denel Aerostructures.

Feasibility of Natural Fibres in Aerospace Structures

South Africa’s local composite market has yet to make a significant impact in the global market. However, aircraft interiors are one area where natural fibres may be employed in composites as they offer a good strength-to-weight ratio. This, together with the growing popularity of green technologies and the need to reduce manufacturing costs, contributes to natural fibres being seen as a substitute for synthetic glass fibres.

With the support of the AISI, Denel Aerostructures is taking natural fibres from a pilot study into a production environment. The feasibility of using natural fibre composites in aerospace interiors is assessed and, where possible, the emphasis is on locally manufactured natural fibres.

Alcino Cardoso, Chief Engineer at Denel Aerostructures, says, “The aerospace market is still one of the most promising markets when it comes to composites. Due to fluctuations in oil prices and the risk of future shortages, aerospace manufacturers are turning to alternative materials to build lighter aircraft that are reliable and environmentally friendly.”

Natural fibres are already successfully used in the automotive and other commercial applications. The aerospace industry has taken an interest in natural fibres, but to be accepted, the fibres must meet stringent safety, quality and certification requirements. Flax is the most researched natural fibre, and, Cardoso continues, “shows the greatest promise to be accepted as a structural fibre for aerospace structures”.

Part of the feasibility study aims to identify its reliability and repeatability (i.e. as a natural fibre, are its strength properties the same from harvest to harvest); how its strength properties behave under hot/wet environments; and what its flame, smoke, toxicity and heat release properties are.

Cardoso explains, “Flax fibres are currently included in various aerospace development programmes worldwide and show superior specific substance and strength to the synthetic glass fibre. Also of special interest is its excellent dampening and acoustic properties. Passenger safety regulations are extremely strict. Flax fibres have inherent safety advantages that make them suitable for aircraft interiors, such as doors for baggage components, interior liners, and cabin floors. However, due to the stringent aircraft testing requirements, they will probably only find their way into aircraft structures by 2020.”

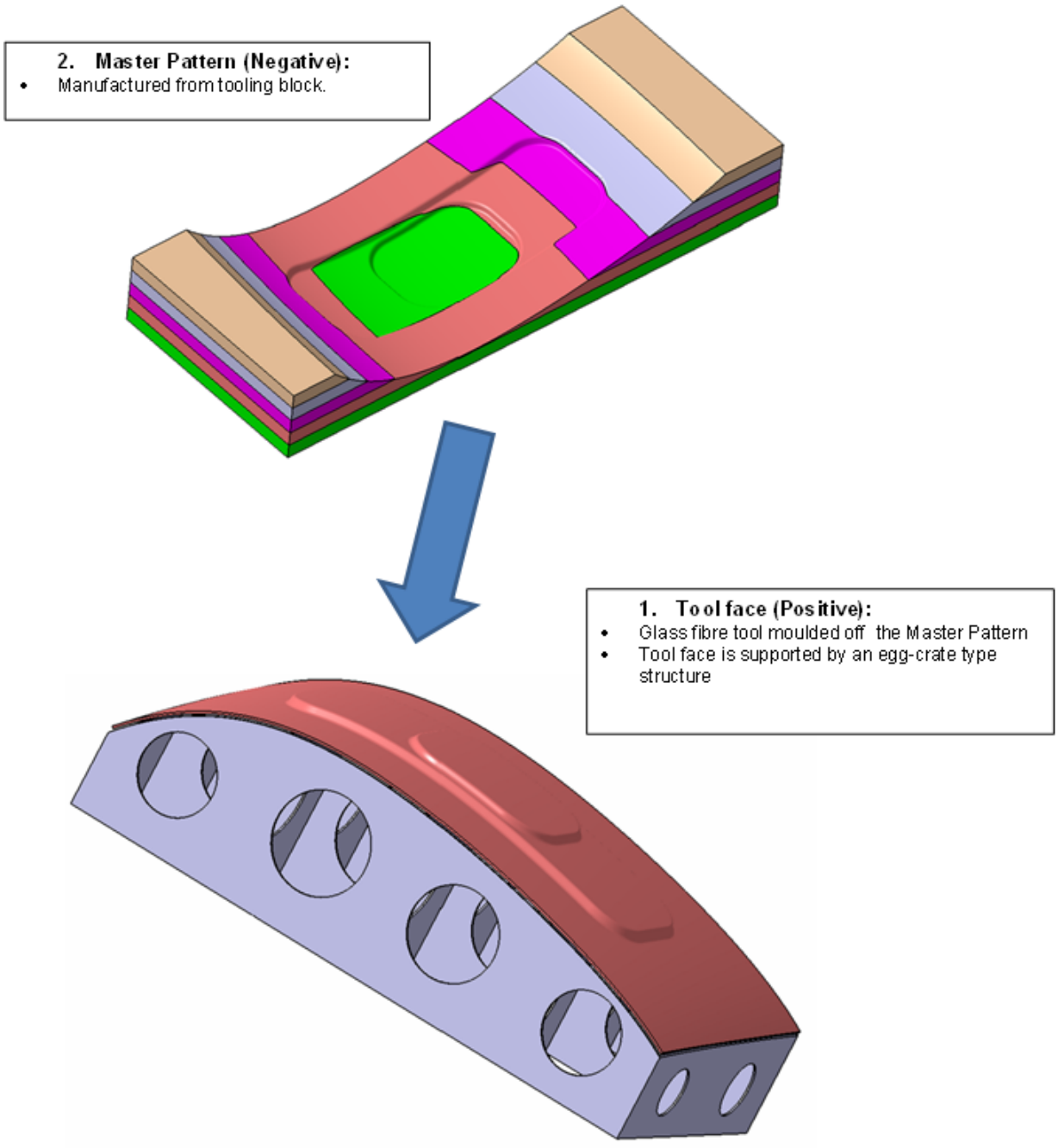
Currently, Denel Aerostructures, with the support of the AISI, is characterising the material properties of an epoxy resin/flax fibre composite laminate with the purpose of using this material in the interior liners of the new regional aircraft developed under the SARA programme. Various test coupons are currently being tested and an interior liner will be manufactured this year from locally developed flax fibre fabrics.

Cardoso says they have been able to develop globally comparable natural flax fibre fabrics in about a third of the expected timeframe. “A further spin-off has been indications from the local market to collaborate on developing carbon fibre fabrics, a synthetic fibre widely used on aerospace structures.

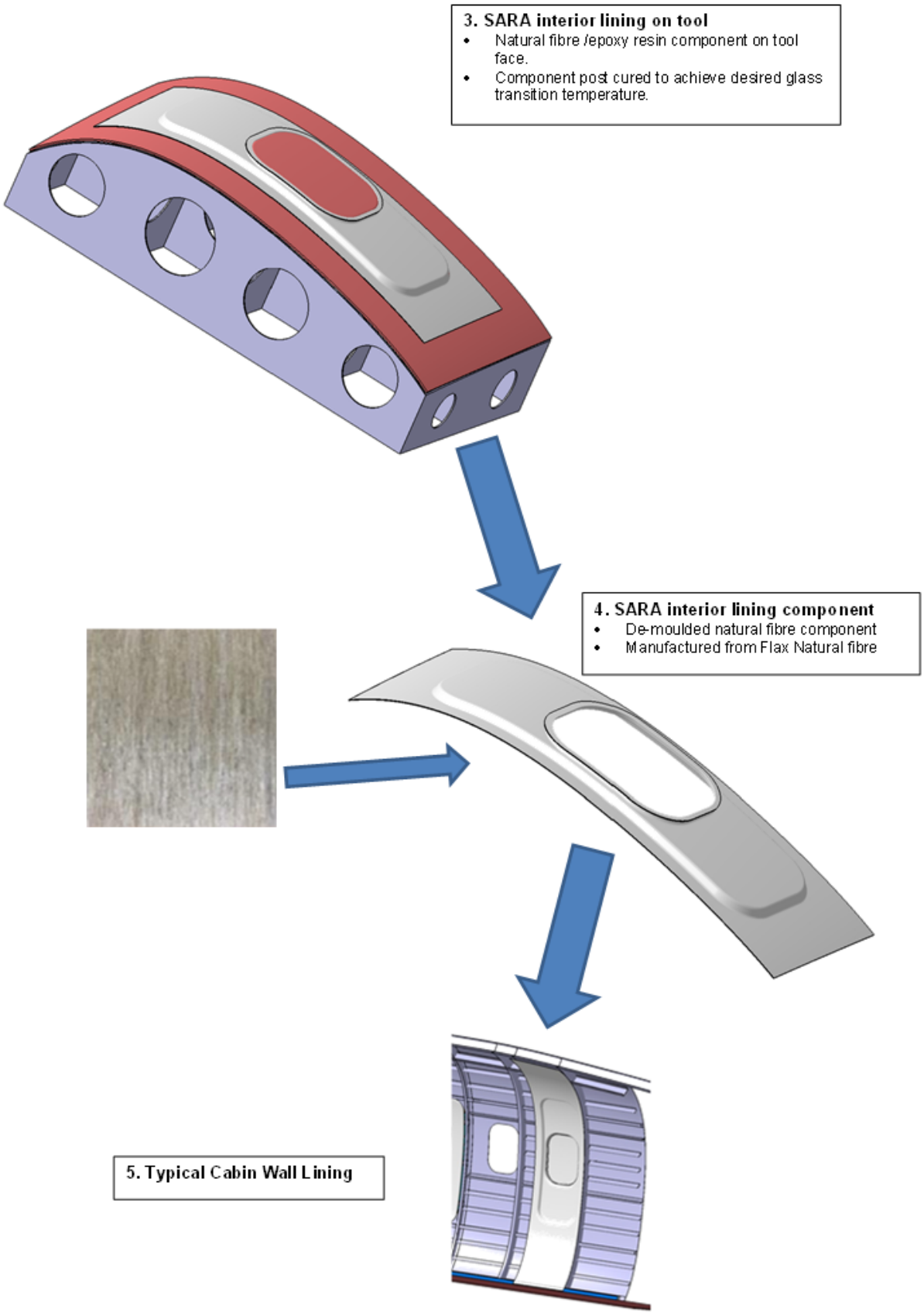
“From a local perspective, we can activate the natural fibres value chain, break into the lucrative global composites market and create much-needed jobs,” he concludes.

The capability developed within this project is linked to the use of natural fibres in the development of the South African Regional Aircraft (SARA), by Denel Aerostructures.

The support of the AISI has made it possible for Denel Aerostructures to make gains in terms of advanced manufacturing. Botha says, “This is in line with our vision and mission, which is to make the South African aerospace industry globally competitive.”



Master pattern and tool design for the SARA interior lining



Typical SARA interior lining manufactured from Natural Fibres