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## Shape memory polymer S-shaped mandrel for composite air duct manufacturing

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**Abstract:** The work describes a new concept of shape memory polymer (SMP) mandrel to manufacture a complex shaped filament wound carbon composite air duct. The mandrel is designed, fabricated and tested to verify the shape recovery and extraction characteristics for the manufacturing of the composite structure. A finite Element model is developed to predict the shape recovery and overall deformation behavior due to the combination of pressure and temperature profiles used during the molding. The agreement between the deformations predicted by the Finite Element model and the ones measured on the SMP demonstrator are good, and show the feasibility of the smart material mandrel to be used in the production of composite structures with complex and ducted forms. A demonstrator of a PAN-carbon/epoxy filament wound composite air duct is manufactured, and the capability of the SMP mandrel verified through a hot gun extraction process.

**Keywords:** shape memory polymer, composites manufacturing, air duct, carbon filament wound molding, Finite Elements, viscoelasticity

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