

## A **SUCCESS** STORY

### **ADDITIVE MANUFACTURING** FOR HIGH-PERFORMANCE THERMOPLASTIC COMPOSITE PARTS

Current commercial 3D printing technologies present several major limitations: they are generally closed source, thus restricting the choice of often proprietary and costly materials, they limit control over the manufacturing parameters, and they produce parts with a performance level that does not always meet industrial requirements. Furthermore, their production cycles are not suited to large-scale manufacturing.

To overcome these technological challenges, a research group led by Dr. Mihaela Mihai of the NRC, in collaboration with Prof. Daniel Therriault's group at Polytechnique Montréal, joined forces with industrial partners working across the entire value chain (Alstom, AON3D, Cancarb, Dyze Design, eLab Extrusion, Felix Compounds, Hutchinson, Hydro-Québec, OCX Services, Safran Tech, Solaxis Ingéniosité Manufacturière, and Technosub) to develop an open-source 3D printing technology that provides greater flexibility in material choice and process control precision. The technology includes the formulation of materials specifically adapted to process-related requirements and high-performance applications, notably in the transportation sector. The project also sought to develop advanced systems capable of printing high-melting-point thermoplastics, combining multiple materials simultaneously, and using conventional pellets while integrating real-time monitoring for the construction of parts. The effort also called upon process modelling and numerical simulation to help optimize process control and industrial performance.

This project has significantly advanced additive manufacturing by developing innovative thermoplastic composites specifically designed for 3D printing. The integration of a radiation heating system optimizes interlayer adhesion, thereby improving the quality and robustness of printed parts. Printing process modelling, combined with real-time monitoring via infrared camera and optical coherence tomography, offers precise process control. The materials developed stand out with the integration of reinforcements and additives and include an ecological component through practical recycling and reuse demonstrations via fused filament fabrication (FFF). In total, nine innovative technologies and eight new products have been developed, which helps improve the FFF process significantly while paving the way for higher-performance industrial applications.

 *This collaboration was very educational. It helped us accelerate the development of 3D parts by improving our understanding of the various issues discussed during the project.*

*We were able to benefit from some of the project's outcomes while building essential links with partners and researchers in the 3D printing field. Over the years, we have developed an exceptional relationship with Mihaela and her team. PRIMA's ability to connect companies and research centres while providing structural support for innovation projects helped us extend our reach and accelerate our growth.*



**- Mathieu Paré,**  
Director of Innovations,  
Technosub

# A **SUCCESS** STORY

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From an economic perspective, this project opens new markets and creates promising business opportunities in the rapidly expanding 3D printing sector. The development of innovative products and adapted modelling tools strengthened the competitiveness of those involved. In addition, the design of new parts for the transportation sector illustrates the technology's concrete industrial potential and its capacity for integration into strategic sectors. These advances will help stimulate both local and international markets while fostering the creation of specialized jobs and supporting the growth of innovative companies within the advanced materials value chain.

Finally, the project significantly improved the technical skills of the teams involved, spurring the transfer of knowledge and the professional development of personnel. This enhanced expertise has helped solidify the partners' position in a competitive and constantly evolving technological environment while promoting a culture of collaborative and sustainable innovation within organizations.



#### SECTORS

Transport,  
Additive Manufacturing



#### APPLICATIONS

vehicle parts  
and tools



#### TRL

Start 3, End 5



#### DURATION

36 months  
(2021-2024)



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