PRIMA

Advanced Materials Moving Forward

A **SUCCESS** STORY

DEVELOPING COMPUTER-ASSISTED DESIGN TOOLS AND INNOVATIVE MATERIALS FOR **HOCKEY HELMETS**

Each year, some 32,000 Canadians undergo severe head injuries due to sporting activities. With the aim of protecting hockey players, **Professor Yvan Petit of the École de technologie supérieure (ÉTS)**, in collaboration with two industrial partners, **CCM-Hockey Canada** and **Design Blue Ltd. (D30)**, developed a set of computer-assisted design tools, methods and advanced materials to ensure effective head protection for both amateur and professional hockey athletes. CCM's innovative new hockey helmet features a lightweight, high-performance foam mesh specifically designed to dissipate impact energy and minimize the linear and rotational acceleration of the head during impact, thus minimizing the risk of concussion.

The results of this fruitful collaboration between the industrial partners were significant. CCM-Hockey has already integrated the project's benefits into the Super Tacks X hockey helmet, which is currently available on the market. The helmet uses Nest Tech, a combination of D30 foam calibrated according to the project's specifications, along with lattice structures developed jointly with another partner. CCM-Hockey has also developed several new processes, including its proven and robust method for dynamic foam characterization, sophisticated tools that predict foam material performance in ice hockey helmets, computer-assisted design and optimization tools that combine finite element models to simulate standardized testing, advanced statistical analysis methods to optimize their use, along with new methods to identify the ideal foam characteristics of a given helmet. The collaboration also benefited Design Blue Ltd. (D30) through the dynamic characterization of its own materials, enabling the company to better understand head-related impacts and consequently improve its existing materials. The knowledge gained has been applied to head protection in other sports, including football, skiing and motorcycling, along with a range of sectors like electronics and defence.

The knowledge and technologies that resulted from this collaboration were successfully transferred to new applications to improve safety and protection across a variety of sectors.

Our collaboration with Prof. Yvan Petit helped us dynamically characterize the viscoelastic foam properties used in the construction of our hockey helmets, thus reinforcing our company's leadership when promoting safety in sports.

- **Pierre-Luc Beauchamp**,
Sr. Development Manager
H&F Protective and Goalie at
CCM Hockey Research & Development

The research group's joint expertise led to the development of a robust, dynamic foam characterization and prevention method in ice hockey helmet performance. The resulting data can be used to assess the ideal foam impact properties for a specific helmet, which will help set development targets for the next generation of smart impact materials. We are eager to introduce new impact attenuation material technologies in the field.

- **Oliver Sunnucks**,
Sr. Product Designer and Mechanical
Engineer at Design Blue ltée. – D30

SECTORS
Textile
Health
Sport

APPLICATIONS
Finite element simulation/advanced materials development

TRL
1-6

DURATION
36 months
(2019-2022)

ÉTS Le génie pour l'industrie

CCM

D3O IMPACT PROTECTION