New material *for inline skating wheels*

This paper introduces my thesis project in the frame of the international postgraduate programme *Master in Sport Administration & Technology (MSA)* at Lausanne.

About the author: David Lenoir is currently student at the *Master of Advanced Studies in Sport Administration & Technology (MSA)*.

David Lenoir is founder and organizer of the Urban Contest, the international roller & skating contest, Lausanne, Consultant R&D for Rossignol inline skates and inline skate expert-instructor of the Swiss Skating Federation (SRV).

About the MSA and the AiSTS: The MSA is run by the International Academy of Sports Sciences & Technology (AiSTS) on behalf of the Swiss Federal Institute of Technology (EPFL), the Universities of Lausanne and Geneva and the Swiss Graduate School of Public Administration (IDHEAP).

AiSTS is a multidisciplinary centre of excellence created by above institutions with the International Olympic Committee (IOC).

The MSA program consists of developing a trans-disciplinary approach that will help solving the more and more complex issues faced today by administrations and industries related to the sport domain. The first part of the program (from January to June and September) includes 500 hours of courses for acquiring in-depth scientific knowledge applied to sport in the fields of technologies, medicine, health, management, economics and sociology, combined with "on-the-field" experiences with professionals. The second part of the program (from July to August and from October to December) requires the student to perform a practical internship and a thesis project.

As a consultant in the skating sporting goods industry since ten years, I took the opportunity to conduct a project related with my daily work and offering the unique opportunity of working with world leaders in material sciences.

The choice of working on the wheels was based on the recent and short history of inline skating. This sport, rediscovered in the late eighties have been booming during the nineties, establishing itself worldwide, and generating a huge interest in the winter hardware sporting good industry, looking for diversification and summer business. The skates have been considerably improved until the end of the nineties, but since 1993, (introduction of big sized core made of hard component), the wheel itself did not show any radical improvement. Since this time, all the wheels are built in the same way, with a hard polymer core supporting the bearings and responsible for the geometrical stability, surrounded by a soft PU bandage, providing the grip on the floor and the damping of vibrations. All the attempts to build wheels in another way have been disasters, and the two main brands Hyper and Kryptonics have never been challenged. This technical difficulty and the supremacy of two major brands have been pushing the business close to a monopole situation, especially after the fusion of those two brands in a single entity, the Bravo-corporation. This group is still producing the two brands in three main plants, based in USA Italy and Thailand.

The goal of the thesis project is to determine the key properties of the wheels, to explain why it is so difficult to technically challenge the actual monopole and to determine what are the key factors determining the quality of a wheel. This work can be seen as researching the elements enabling further wheels improvements, and explaining the failure of all the attempts of changing the materials or the way of construction.

The project is realised in collaboration with the Laboratory of Composite and Polymer Technology (LTC) at EPFL (Swiss Federal Institute of Technology), the host of the International Academy of Sports Sciences & Technology (AiSTS). The LTC laboratory is directed by Prof. Månson, scientific coordinator of the partnership between EPFL and Alinghi (the '03 America's Cup winner). LTC collaborators work on material tailoring and processing for novel applications of polymers and composites in automotive, electronics, biomedical and sport. They collaborated for example with the Alinghi's design team on the optimisation of composite materials and processes.

The thesis will focus on the material analysis by applying rheological methods. The main task will be to compare the mechanical properties of the complete wheel with the properties of the PU material itself, in order to determine the influence of it on the final product, and to identify if the core is or not playing a role in the final performance. The PU materials will be tested by DMA (dynamic material analysis), and will provide the following data on the material: storage modulus, loss modulus and their ratio known as "tand". Those data are the base of visco-elastic analysis, and should help to determine the physical properties of each PU compound used in regular production.

The other part of the data will be provided by measuring efficiency and vibration transmission on the complete wheel, thanks to specifically designed tests developed for this mean.

All those measures should enable me to determine the absorbing capabilities of a wheel, and how this is related to the efficiency of the final product. Abnormalities in the relation will help to understand the role of the core, and finally to estimate the pertinence of various project to produce wheels with other material and /or other constructions.

A marketing approach will then be applied to develop the final solutions by taking into account the consumer benefits of this new kind of product in order to establish a big enough "reason to change". This "reason to change" can be of at least three different types: increased performances, increased comfort or ease to use or cheaper price for equivalent performances. This kind of analysis and the technical demonstration of feasibility will be the base of success of any new process, providing the main motivation for the investors.

For anybody interested in this topic or wanting to test his products within my procedure, please feel free to contact me at *blackman@vtx.ch* or *www.aists.org* for info on AiSTS and the MSA programme.

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msa@aists.org / phone ++4121 693 8593

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