

Playing safe

In the modern world we are constantly being told how people are suffering from higher stress levels than ever before. With financial, career, and personal worries weighing heavy on today's society, people are constantly seeking new ways to wind down and forget their problems. Add to this the fact that most jobs nowadays are office-based and it comes as no real surprise that the popularity of high impact, extreme, contact sports has never been greater.

Long gone are the days when ladies wore long skirts to play tennis or a nice round of golf was enough to relieve the stresses of the day. In today's world people seek an outlet for their problems, aggression, and even anger on the sports court or field. Although this may be good for their mental well-being, there is only so much impact that the human body can physically withstand and, as a result, there is a greater demand for personal protective equipment (PPE) than ever before.

The worldwide sports industry now faces new challenges with PPE. Athletes are becoming physically stronger, faster and more skilled within their sports. Technology is rapidly developing, enabling athletes to strike balls and pucks harder, and tackle each other with greater force. PPE must develop at the same rate otherwise people at the sharp end (i.e. the people participating in these sports) are being placed at greater risk of injury. This, coupled with the fact that we live in an ever-increasing claim culture, means that the demands placed on PPE are higher than ever before.

In response to this demand, a team at the Ergonomic and Safety Institute (ESRI) at Loughborough University in the UK, in collaboration with PSO3 Ltd, has undertaken a project to assess the PPE available in the sports industry and in other areas, using hockey as a case study.

Background to the project

The project was set up to investigate personal protective equipment in the sports industry and began in July 2005. The application being investigated is field hockey, yet the output is envisaged to be applicable across the sport sector and non-sport sectors. The research is of high significance through its ability to capitalise on key potential synergies between ESRI, Sports Technology and PSO3 Ltd.

Throughout the course of the project materials from all industry sectors (sport & non-sport) will be assessed and reviewed. By doing this it is



The forms of hockey may vary, but protection is vital on any surface.

hoped to deduce the factors that currently drive the use of particular protective materials within the sports industry, whether that be that it is the economic forces of the sport or the user's needs that drive the material design?

The aim is to draw on knowledge and understanding obtained from comparative sports to hockey such as cricket, ice hockey and lacrosse and to use this information to further advance material development in hockey. Whilst achieving this goal it is hoped that it will be possible to transfer knowledge and understanding back into the other comparative sports.

The same approach to knowledge transfer is envisaged for other non-sport industries with the intention that this collection of knowledge will benefit both the sport and non-sport industry sectors.

The Project Overview and significance

The leisure industry made £4,319 million in 2002 from sales of sports goods in the UK. With equipment in sport accounting for 25% of this revenue, there is a huge market for furthering the equipment available to both recreational and professional athletes. Hockey is just one of these markets within the industry and is particularly demanding from a PPE perspective due to the high mobility of the participants and the potential for impact injuries caused by stick or ball.

The advancement of technology of PPE in

Project goals

Increase the effectiveness of hockey PPE to users at the sharp end.

- *Identify opportunities for the transfer of knowledge between different industry sectors.*
- *Develop new PPE Human Factors knowledge and tools within a new application domain.*

Aims & measurable objectives

The focus of this proposal is to understand how enhanced design of hockey PPE can increase the performance and comfort of the end-user at a recreational and professional level both in terms of hockey, but also for participation in other sports and non-sport sectors.

Specifically, the aims of this project are to:

- *Identify where there are user and technological opportunities and barriers to develop more effective hockey PPE.*
- *Identify a range of possible future materials and design specifications that can be implemented to improve PPE.*
- *Identify the opportunities for knowledge transfer between hockey, other sports, and other non-sport sectors.*

The success of the project will be judged according to three key objectives:

- *The identification of commercially relevant opportunities for the design and manufacture of enhanced PPE.*
- *The realisation of future research collaboration with the IMCRC and interested commercial partners.*
- *The publishing of at least two academic conference and one academic journal papers from research undertaken in this project.*

sports such as hockey will enable a more efficient customisation of equipment. It is envisaged that this will provide the catalyst needed within many sports to provide the ultimate in safety, without compromising the comfort, agility, or speed of the individual. It will advance the injury prevention components of the sport and consequently reduce the cost to society, industry and the individual by decreasing the likelihood of personal injury.

Through the innovation of UK hockey equipment, this project aims to increase the demand for nationally produced protective equipment. A key feature of this proposal is the opportunity to apply the concepts and methods arising from the transfer of knowledge from multiple industry sectors to one another, and hence increasing the potential of many PPE industries. The project will result in an improved understanding of material properties in the UK, and an increased facility for high performance safety equipment across both leisure and construction industries.

Further opportunities for the facilitating of the transfer of knowledge will also be explored. For example, both cricket and field hockey require leg guards, yet this transfer of knowledge across sports has only just begun emerging. Again, this awareness will be compared with the information available by other, more technologically advanced sectors, for example examining the application of bullet proof materials in the forces for the development of protection against sports balls at high speeds.

Everyone's a winner

If the research project yields positive results and is successful, it could lead to a number of advances for several groups. There will be a better understanding of the potential for developing novel and innovative hockey PPE based on a user-orientated perspective. This is a positive result for both the player and the manufacturers. Players will enjoy a higher level of protection and will thus suffer fewer injuries, and the manufacturers will be able to offer improved, more advanced products.

The collaboration between different research groups within the Loughborough IMCRC and the commercial partners involved in the project will generate pump-priming opportunities for further basic and applied research into this area and many others.

Furthermore, the hockey industry will benefit by uniquely realising fuller returns on investments in PPE through the dissemination of the project results via the mechanisms for knowledge transfer set up within the project. The project will provide SMEs with the opportunity to maximise financial return based on advanced research. And finally, other major industry sectors will benefit from the knowledge gained in the project via the opportunity to transfer knowledge. All in all the results could benefit a wide ranging group of consumers, developers and manufacturers. 



*Courtesy of ESRI.
Elements of protective
research*

The players

ESRI

ESRI was formed on August 1, 2002 from the Research Institute for Consumer Ergonomics (RICE) and HUSAT Research Institute, two groups with reputations for applied research stretching back more than 30 years. In 2005 ESRI incorporated the Applied Vision Research Institute (AVRI). Its mission is the application of research based knowledge to solve real world problems and the study of real world problems to advance understanding.

ESRI comprises three research centres which are dedicated to vehicle safety, applied ergonomics and human vision. The Institute has over 65 members of staff and an annual research income of some £2.5million making it one of the largest sources of independent vehicle safety and human factors expertise.

It is a fully participating member of the Faculty of Science but maintains strong links with a wide range of research groups and departments throughout the university. Although our primary focus is applied research projects undertaken for external partners and sponsors, its ESRI has a strong commitment to undergraduate teaching and student supervision. ESRI provides specialist modules to an increasing number of undergraduate and post-graduate programmes and provides an opportunity for students to complete projects in association with ESRI's research programme. ESRI has a growing community of PhD.

Sport Technology

The Sports Technology Research Group within the Wolfson School of Mechanical & Manufacturing Engineering at Loughborough University has been active since 1986 and has developed an international reputation in the design, simulation, testing and manufacture of sports equipment. Our research has studied the engineering of a vast range of equipment - boots, bats, clubs and rackets, balls and shuttlecocks - in a wide range of sports - badminton, tennis, cricket, golf, hockey, rugby and soccer - under play and simulation conditions.

The Sports Technology Research Group is the largest research group in sports technology in the UK. It has established relationships with sports scientists, psychologists, bio-mechanists and human biologists within the university. It has experience in testing with elite sports athletes and our research knowledge spans many other sports.

Loughborough's continuing sports engineering research activity is supported by major international equipment companies, UK sports goods SME's, individual sports governing bodies and leading science and engineering technology suppliers. The total funding received for sports engineering related research over the last five years is approaching £2.9 million (sports engineering specific £1.65 million, sports science £575k, dynamic/optical instrumentation £690k) with over £1.5 million current. For these projects nearly a quarter of the funding was attracted from the sports industries concerned, and over a quarter from the sports councils and governing bodies.

PSO3 Ltd

PSO3 Ltd was set up in 2004 as multi function consultancy. Grahame Mansell-Grace is the managing director and he has over 20 years' experience of learning and development within companies across industries. He has taken this work into sport as well and has worked at developing the way in which coaches behave away from the specific skills, thinking how those skills can be maintained and developed by looking elsewhere for solutions.

As an international hockey coach having worked with England, Wales and the USA he has involvement with all levels of sport and this has led to an interest in enabling sportsmen and women to use their equipment more appropriately. It was often found that ill fitting equipment - due to size and materials - also increased the dangers of high impact sports. The desire to improve the skills of individuals has led to a relationship with ESRI to look at key enablers which will mean that individuals of all standards, ages, gender etc. will be able to perform in a safe secure environment as they advance those skills.