The President’s

As this is my column, I am taking the liberty of a personal story for this issue.

This column is about the power of sport.

This month marks a major sporting milestone for me. In retrospect, perhaps the biggest sports milestone in my life. No, I didn’t finish another Ironman. It is even bigger than that. As of this week, I am retiring from coaching my daughter’s football (soccer for the American readers) team. I first got involved when she started playing at 5 years old, and now at her 14th birthday, the team is disbanding, as the team members all prepare for the transition into various high school sports programs. That represents 18 seasons of football (two seasons per year), (plus a few indoor winter sessions the last two years). That is a lot of time on the field with girls, who are now becoming young women.

When I first offered to help with the team, I really knew nothing of the sport, as it did not exist as a sport in the middle of America when I grew up. Through the eyes of my daughter (who has transformed nicely into a keeper/striker and a referee), and with the benefit of living in a rather international area and working fellow coaches from Switzerland, Mexico, Greece and England over the years, like millions of people around the world I’ve come to love the game. And I’ve enjoyed the opportunity to share the enjoyment of the sport with the global community as I’ve traveled and had the good fortune to attend football matches in a number of countries. Those connections, while enjoyable, are fleeting, gone as soon as the match is over.

The true power is the community that I have witnessed surrounding the team. My daughter and two others on the team have been together since the very first practice all those years ago. The current head coach’s son played on that first team (the kids played co-ed for the first three years). And as the small teams have grown to be a full 20-member squad, the new members quickly became part of the team. I often feel like we are one big family, as I’ve watched so many of these kids grow up over the years.

But it wasn’t just the kids. The parents and siblings were part of the family too. And it really was a small and very close community all these years. The parents always pitched in to bring snacks for games, food for team socials at the end of each season. But beyond that, there was the common goal of raising good kids - kids that can grow up understanding the importance of discipline, teamwork, leadership, the value of physical activity, and the value of a community.

Ironically, I don’t feel like I can take credit for any of what the kids learned over the years, as I feel that perhaps I was the one learning all those lessons on the field the same time they were. I just hope that, like the players, this coach can take those lessons to heart and apply them in all aspects of his life.
Sports Engineering Editor-in-Chief

Dr Martin Strangwood has stepped down as Editor-in-Chief, after a successful 6 years. Martin leaves the journal in the capable hands of Prof. Lloyd Smith of Washington State University. The Editorial Team recently met for a handover and strategy meeting in the Springer Offices in London. The journal is in excellent health going forward and we welcome your submissions. We also encourage members of the ISEA community to support our journal by acting as reviewers where possible.

The last six years have been an exciting period for the journal with increased competition, a change in publisher and submission for ISI rating. Despite some dips the journal has maintained a high standard at around six papers per issue. After this period of consolidation, I am pleased that the journal is continuing under Lloyd’s editorship for what I am sure will be a period of continued expansion.

-Prof. Martin Strangwood, Outgoing Editor-in-Chief

“I am honored to serve as Editor in Chief of Sports Engineering. The journal is now in its 16th year, and continues to be the primary outlet for sports engineering research. I appreciate the work of the outgoing editor, Martin Strangwood, whose work has helped maintain high standards in the journal and was instrumental in the journal’s application for ISI listing. I look forward to working with the Associate Editors, and Editorial Board to foster novel contributions and grow the readership of the Journal.”

-Prof. Lloyd Smith, Incoming Editor-in-Chief

“It was great to meet with the new editorial team on Sports Engineering and to witness the smooth handover to the new Editor-in-Chief, Professor Lloyd Smith of Washington State University. Our previous Editor-in-Chief, Dr Martin Strangwood, leaves the journal in great shape and the new EiC along with the associate editors, Drs Tom Allen and Simon Choppin, are brimming with new ideas to build on the journal’s success and how it may serve the sports engineering community in coming years. It is an exciting time right now for our journal.”

-Anthony Doyle, Senior Editor, Springer

ISEA Invited Session:

International Association of Computer Science in Sport

The 9th conference of the International Association of Computer Science in Sport (IACSS) was hosted by Marmara University, Istanbul, Turkey from the 19th to the 22nd of June. Conference Organiser Dr Hayri Ertan invited members of the ISEA to attend as part of an exchange session. Drs Lionel Manin (Institut national des sciences appliquées de Lyon), Simon Choppin (Centre for Sports Engineering Research, Sheffield Hallam University) and Kerstin Witte (Otto-von-Guericke-University Magdeburg, Germany) attended to present in a session dedicated to sensor technology. This was a great opportunity to present the aims and activities of the ISEA to a wider community. Dr Manin gave a short presentation on the ISEA while Dr Choppin promoted the upcoming conference (Sheffield, 14th – 17th July 2014) and journal.

ISEA Invited Session continued on Page 4
ISEA Invited Session Cont.

The presentations were:

**Dr Kerstin Witte**: Development and Optimization of Sport Equipment by Integration of Measuring and Information Systems

**Dr Lionel Manin**: The use of sensors to analyse and understand the dynamic behaviour of sport material/equipment

**Dr Simon Choppin**: Consumer depth sensors for sport and biomechanics analysis

The presentations received a good amount of interest from the audience. We hope to develop future collaborations between the ISEA and IACSS, especially with the upcoming conference, The Engineering of Sport 10.

Dr. Lionel Manin, Dr. Simon Choppin and Dr. Kerstin Witte

Journal Update

**Invited papers**

We have recently accepted two invited papers which are available online.


Other invited papers are in the review process.

**Special issues**

- **2013** “Winter Sports,” Peter Federolf, guest editor. Submissions are now closed.
- **2014** “Helmet Design and Impact Performance,” Anthony Bull, Peter Childs and Mazdak Ghakari, guest editors. Submissions invited from a recent “Helmet Performance and Design Conference” held at Imperial College London.
- **2015** “Associate Football,” Tom Allen and Simon Choppin, guest editors. Submissions are open, particularly those related to the 2014 World Cup. Contact the guest editors if you are interested in contributing to this issue.

We welcome comment and suggestions to any member of the editorial team

**Editor in Chief**: Lloyd Smith—lvsmith@wsu.edu
**Associate Editors**: Tom Allen—t.allen@shu.ac.uk
Simon Choppin—s.choppin@shu.ac.uk
Development of the Revised Cricket Helmet Test Standard (EN BS 7928) at the Sports Technology Institute

Ben Halkon, James Jones and Andy Harland

Protective headwear in cricket was first introduced in the 1970’s to combat the increasing level of cranial and facial injuries. Modern cricket helmets consist of three main parts; the shell and the liner work together to distribute the impact forces over a large area and the faceguard (grille) is intended to prevent ball contact with the face. Despite cricket helmets now being commonplace, injuries remain prevalent in the professional game, with almost a quarter of all cricketing injuries shown to occur to the head, often resulting in open wounds and fractures. These tend to occur in areas that wearers might expect to be protected by the faceguard. Three recent examples are shown in Figure 1.

![Figure 1: (a) An example of an injury sustained by a cricket ball penetrating the peak-faceguard gap; (b) an example of a cricket ball that has penetrated the peak-faceguard gap and (c) an example of a cricket ball impacting the faceguard, resulting in contact with the face.](image)

The majority of injuries have been attributed to the ball breaching the gap between the peak and the faceguard or the faceguard being forced onto the face, but currently neither of these eventualities are required to be tested in order to adhere to the relevant standards. Enhancing the helmet test standards to include a specific procedure that identifies whether or not the ball passes between the peak and the faceguard may lead to helmet design improvements. Experimental studies recently conducted at Loughborough University’s Sports Technology Institute (STI) ([http://sti.lboro.ac.uk/](http://sti.lboro.ac.uk/)) have supported the International Cricket Council (ICC) with the development of a proposed revised test standard (EN BS 7928 – Specification for head protectors for cricketers), scheduled for public consultation this summer, and investigated how current products fare against it.

Initial investigations determined which of three means of replicating the ball-helmet/faceguard impact would most accurately represent what is observed in the field of play. Analysis was completed to determine whether a simple test, based on an equivalent energy principle might be used to replicate peak-faceguard penetration. Two drop tests were considered, where the mass of either the replica ball or the headform on which the helmet is mounted were adjusted and dropped on the other. The speeds varied to ensure an equivalent impact energy or momentum. Neither case was found to correlate with the outcomes of testing carried out using a real ball traveling at match realistic speeds, as reported in a paper due to be presented at the 2013 IRCOBI conference at Chalmers University (Gothenburg - Sweden). It was therefore considered necessary that a projected ball penetration test be included within the standard test procedure.

Given the challenging geometry of cricket balls, in particular the seam, the performance of a synthetic training ball was assessed and found to offer a reliable, repeatable, cheap and widely available alternative to the cost and inconvenience of a real cricket ball. The nature of the collision between a cricket ball and a helmet at match speeds means that the nature of the helmet mounting becomes a secondary consideration. Comparison was undertaken between a freely suspended helmet, a helmet mounted on a freely suspended and a rigidly mounted headform and neither were shown to yield significantly different results. For this reason, the convenience and repeatability of a semi-rigidly mounted headform was used for subsequent testing.
Revised Cricket Cont.

As shown in Figure 2, once a helmet is secured to a rigidly mounted EN BS 960:2006 size J headform, a ball is projected at one of four impact locations both directly on the faceguard and at the gap between the faceguard and helmet peak. Since both the orientation of the head and the direction of the incident ball cannot be specified during play, this test is carried out both in a horizontal plane and at an angle normal to the opening between the peak and faceguard, typically involving the headform and helmet being angled backwards. These projectile tests were carried out using the STI air cannon at an impact velocity of 25-31m/s (56-69mph) for senior helmets, speeds considered comparable to fast bowlers once the ball has bounced off the wicket.

Figure 2: Examples of the different headform/helmet orientations and impact locations.

A fundamental aspect of the set-up is the definition of the ‘no contact zone’, encompassing regions such as the eye sockets, nose and mouth that should all remain free from contact by the ball or the faceguard. The no contact zone was coated in a fine powder spray which acted as a witness for any short duration contact. During development of the test, a high-speed video camera was set up to record the impact of the ball on to the helmet-headform system to determine whether or not penetration and/or facial contact occurred, but it is anticipated that such recordings will not be necessary in a final test method.

This case study is typical of the research and development activities that the Sports Technology Institute at Loughborough University is involved with. In parallel with the development of the new test standard, dissemination of new knowledge has been provided to all members of the panel, representing national and international governing bodies, professional player associations and a wide range of leading manufacturers. All the partners share a common ambition to ensure that players are afforded the highest levels of protection without compromising their comfort or ability to perform.

Sports Engineering Student Project Competition 2013

Eligibility:
This competition is open to undergraduates and postgraduates who completed their studies in 2012 or 2013 at any institution of the higher education in the world and who have undertaken an individual project on a sports engineering topic.

First stage deadline, 1 August 2013: submission of the abstract in English taken from the project report. Submissions should be sent to: motomu@mech.titech.ac.jp. All candidates will be advised of the outcomes on or about the 1 September 2013. Short listed candidates will be invited to enter the second stage.

Second stage deadline, 1 October 2013: by invitation, submission of an electronic copy of the project report in English. Submissions should be sent to: motomu@mech.titech.ac.jp. Final winners will be notified on or about the 1 November 2013.

Judging: By members of the Executive Committee of the ISEA. Judging criteria will be based on originality of the project, the quality of the work and its presentation.

Prizes: The first prize will be a certificate with a cheque for £100 and full membership of the ISEA for one year. The second prize will be a certificate and full membership of the ISEA for one year.

For further information see the ISEA website at www.sportsengineering.org or contact the organiser, Motomu Nakashima via motomu@mech.titech.ac.jp.
Sports & High Performance Materials

Dave Krzeminski

Sports materials research is expanding and progressing forward as the Sports and High Performance Materials (SHPM) program enters its 8th year at The University of Southern Mississippi (USM). This past spring, the SHPM program graduated its first female doctoral student, Olivia McNair! Dr. McNair synthesized novel, tunable materials for mouthguard applications and investigated their potential for improved impact performance. Olivia was co-advised by Dan Savin PhD (USM Assistant Professor, School of Polymers) and Trent Gould PhD, ATC (USM Associate Professor, School of Human Performance). Her successful defense brings the total number of SHPM graduate degrees to five (2 Masters, 3 Doctorate).

Additionally, Dave Krzeminski (PhD Candidate) and Nadine Lippa (PhD Candidate) each completed studies focused on the sport-specific mechanical degradation of polymeric materials. Krzeminski examined mechanical property changes induced from repetitive impact exposures and thermal annealing of helmet outer shell materials, while Lippa explored the biomechanically-driven mechanical aging of running shoe midsole foam. Each were submitted for presentation to an upcoming conference and co-authors included Dave and Nadine’s collaborative co-advisors and mentors, James Rawlins PhD (USM Associate Professor, School of Polymers), Scott Piland PhD, ATC (USM Associate Professor, School of Human Performance), and Dr. Gould. Also, Nadine’s ambitious and pioneering spirit garnered her an inaugural student representative position on the ISEA Executive Committee.

Looking ahead, expectations are high for the remainder of 2013. Jim Goetz (PhD Candidate) will utilize his ongoing research in novel, highly gas permeable, breathable polymer films to launch into human performance studies of garment and microclimate environment conditions during exercise. Jim is co-advised by Sergei Nazarenko PhD (USM Assistant Professor, School of Polymers) and Dr. Gould. Andrew Janisse (PhD Candidate) will continue to research the synthesis, engineering, and application of novel helmet inner liner foam materials for improved impact performance. Andrew is co-advised by Dr. Savin and Dr. Piland.

Following the success of SHPM’s first ISEA conference attendance in Lowell, MA, both students and faculty are eager to continue to push the field of sports materials and hopefully be rewarded with a trip in July 2014 to the University of Sheffield.
Research supporting advantageous oar selection has historically received limited attention. Kleshnev (2007) is the first, and perhaps only, to study if oar-shaft stiffness properties affect rowing biomechanics. It is said that a less stiff oar-shaft can store more elastic energy, given the larger degree of shaft flexion provided by the forces acting on the blade and handle (i.e. similar to a hockey stick). However, the energy return may be diminished. In each rowing stroke, some mechanical energy is dissipated as thermal energy that heats the oar-shaft; this is seen in elastic hysteresis and oar-shafts of different stiffness levels may have varying amounts of energy loss.

In addition, oar-shaft stiffness and length are inversely related, assuming the same material and shaft diameter. Nolte (2009) found that, since 1991, the fastest elite crews tend to use shorter oars. Since the rowing oar can be considered a Class I lever, a shorter oar (outboard) length could result in higher blade forces with the same applied handle force. However, changes to oar length, and in turn changes to oar-shaft stiffness, may produce different feedback and alter rowing technique and performance. Consequently, the following study will examine the relationship between rower’s caliber, oar-shaft stiffness, oar-shaft length and on-water rowing biomechanics.

Four scullers, two freshmen and two varsity, will be recruited from the Western University Rowing Program. Sculling is a class of rowing where the individual athlete rows with an oar (scull) on both sides of the boat simultaneously. In an attempt to mimic sport-specific intensities, participants will be tested on-water at their race pace. Starting from a zero boat velocity, participants will accelerate to their race pace and complete 20 strokes for data analysis. This protocol will be used to investigate six different combinations of oars; two oars of different stiffness levels will be adjusted and tested at three different lengths. The total oar length will be modified via changing only the outboard length while the inboard length will remain constant. The oars will come with a manufacturer set stiffness level measured by the amount of flexion exhibited at the distal end of the oar when a 10kg load is applied to that area.

A Nielsen Kellerman impeller will be used to measure boat velocity. A Powerline™ replacement oarlock with strain-gauge force transducers will be used to measure oarlock force (N) in the direction of the longitudinal axis of the boat. A potentiometer will measure oarlock angle. Previous research stands behind the validity and reliability of the Powerline™ system (Coker, Hume, & Nolte, 2008; 2009). It is expected that less stiff oar-shafts will result in greater energy loss via elastic hysteresis and therefore a slower average boat speed. In addition, shorter outboards will generate larger blade forces and thus a faster average boat speed compared to longer outboard lengths.
CALENDAR EVENTS

Coming Events for 2013

♦ The Impact of Technology on Sport
  Date: 18 - 20 September, 2013
  Congress Location: Hong Kong
  Details: http://www.apcst2013.com/

♦ icSPORTS 2013
  Date: 20 - 22 September, 2013
  Location: Vilamoura, Algarve, Portugal
  Details: http://www.icsports.org/

Coming Events for 2014

♦ The Engineering of Sport 10
  Date: 14 - 17 July, 2014
  Location: Sheffield Hallam University
  Details: http://www.shu.ac.uk/research/cser/eos10.html

CONTACT

Amanda Brothwell
International Sports Engineering Association
Centre for Sports Engineering Research
Sheffield Hallam University
A129 Collegiate Hall
Collegiate Crescent
Sheffield, S10 2BP
U.K.

Phone: +44 (0)114 225 2258
Fax: +44 (0)114 225 4356
E-mail: isea@shu.ac.uk

Join us on the web
http://www.sportsengineering.co.uk/

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INTERNATIONAL SPORTS ENGINEERING ASSOCIATION