

ISBS 2018 Auckland Conference

SPRINZ-HPSNZ-AUT Millennium Applied Programme

Wednesday 12th September 2:00-7:30

Schedule

- 2:00-2:30 Bus AUT City to AUT Millennium - arrive at the pool.
- 2:30-3:00 **Welcome** to the AUT Millennium precinct by Mike Stanley, Martin Dowson and Barry Wilson at the Sir Owen Glenn Aquatics Centre. Award given to Sir Graeme Avery in absentia by Professor Young-Hoo. (30 minutes)
- 3:00-3:30 Joshua McGeown explains the “balloons” and movements to the sessions, then delegates follow the ISBS conference assistants to the first applied choice session via the AUT Millennium **tour** (30 minutes)
- 3:30-4:15 **Applied session 1** (45 minutes)
- 4:15-4:30 Move to next choice session (15 minutes)
- 4:30-5:15 **Applied session 2** (45 minutes)
- 5:15-5:30 Move to Finish Line (15 minutes)
- 5:30-6:00 **Sir Graeme Avery Event** wine & cheese, meet athletes, coaches, sport scientists (30 minutes)
- 6:00-6:30 ISBS 2018 Conference **award presentation** to Sir Graeme Avery (30 minutes)
- 6:30-7:00 Continued wine & cheese & networking (30 minutes)
- 7:00-7:15 Move to buses (15 minutes)
- 7:30-7:45 Bus AUT Millennium to AUT City



An interactive afternoon of sessions delivered by High Performance Sport New Zealand (HPSNZ) and AUT SPRINZ Biomechanists, Performance Analysts and other biomechanics relevant sport facing practitioners. The 11 sessions are at AUT Millennium (AUTM), which is a satellite site of AUT University and the Auckland training hub for many HPSNZ supported sports such as athletics, sailing, and swimming. These sports and others (cycling, rowing, snow sports etc.) will be represented in the line-up. The applied sessions involve practical demonstrations of aspects of analysis and/or tools used to deliver in the field to directly positively impact athletes performances on the world stage. Following these engaging sessions there will be tasting of New Zealand wine, allowing for further discussion and networking. Sir Graeme Avery will be acknowledged for his contribution to sport science.



Applied session information and presenters

Presentation Title	Location	Lead Presenter	Presentation description
Paralympic Swimming Technique Analysis & Technology Development	AUTM Sir Owen Glenn Aquatics Centre	Jodi Cossor and Matt Ingram	A demonstration of a multidisciplinary approach driven by biomechanical analysis for Paralympic swimmers. Dr Jodi Cossor and Matt Ingram will show contrasting approaches to technique optimisation for individual abilities and opportunities.
Rowing Stroke Analysis	AUTM Sir Owen Glenn Aquatics Centre	Justin Evans and Sarah-Kate Millar	A practical session delivered by Justin Evans and Dr Sarah-Kate Millar assessing the athletes rowing stroke to assist the coach on technical changes. This session will demonstrate various rowing traits and how the biomechanist and coach can work together to optimise boat speed.
Integration Of Biomechanics In The Coaching Of Elite Throwers	AUTM Sports Hall Ground Level - Track side by roller door	Mike Schofield and Kim Hébert-Losier	This session looks at shotput and the evidence based approach to coaching. The session will be delivered by Mike Schofield and Dr Kim Hébert-Losier who work alongside Athletics NZ coaches to develop understanding of performance in a new and refreshing light. Industry partner: Qualysis, University of Waikato.
Biomechanics Related to Athlete Development	AUTM Sports Hall Ground Level - Long jump pit area	Craig Harrison and John Cronin	Dr Craig Harrison and Professor John Cronin will provide examples from the AUTM Athlete Development programme.
Sprint & Strength Biomechanics	AUTM Sports Hall Ground Level - Sprint lanes next to HPSNZ zone	Kim Simperingham and Jamie Douglas	Kim Simperingham who works with high performance rugby athletes will outline sprinting mechanics in practice.
Sports Medicine & Biomechanics	AUTM Large seminar room Level 2	Bruce Hamilton, Fiona Mather, Justin Ralph and Rone Thompson	Dr Bruce Hamilton, Fiona Mather, Justin Ralph and Rone Thompson will demonstrate the approach of HPSNZ and Cycling NZ performance health teams in the use of some specific tools for prevention of injury and optimisation of performance.
Integration between inertial sensors & motion capture – running & basketball	SPRINZ SKIPP Clinic Level 1	Kelly Sheerin, Thor Besier and Denny Wells	Kelly Sheerin and Associate Professor Thor Besier will provide examples of using IMU and motion capture methods for running and basketball biomechanics research, education and service.
Cycling Biomechanics - Forces & Physiology	SPRINZ Endurance Performance Clinic Level 1	Rodrigo Bini and Andrew Kilding	Dr Rodrigo Bini & Associate Prof Andrew Kilding will show how linking of biomechanics and physiology improves injury prevention and performance enhancement.
The Impact of Innovation on Biomechanics	AUTM Small seminar room Level 2	Robert Tang, Andre de Jong, and Farhan Tinwala	Robert Tang, Andre de Jong and Farhan Tinwala discuss select projects developed by Goldmine, HPSNZ's in-house engineering team, and how these innovations have enabled unprecedented levels of biomechanics feedback.
Wearable Technology in Snow Sports Load Monitoring	SPRINZ S&C Lab Clinic Level 1	Cameron Ross and Paul McAlpine	Cameron Ross demonstrates the technology being used at the Snow Sports NZ training centre in Cadrona to enhance load monitoring of athletes. This application allows greater insight into training performances and biomechanical loads than has been previously possible in the training environment.



Jodi started her career under the guidance of Dr Bruce Mason at the Australian Institute of Sport where she worked for five years predominantly with the Swimming and Water polo teams. In 2002 she moved to England to be the first biomechanist to be employed by British Swimming. During this time, Jodi introduced competition analysis to determine race strategies that could then be practiced within the daily training environment. Whilst working for British Swimming Jodi completed her PhD on the use of technology to improve the performance of starts and turns in swimming. After three Olympic cycles Jodi moved to New Zealand in 2013 where she is currently a Senior Biomechanist for the Swimming and Paralympic Swimming teams.



PARALYMPIC SWIMMING TECHNIQUE ANALYSIS AND TECHNOLOGY DEVELOPMENT

Jodi Cossor¹ and Matthew Ingram^{1,2}

High Performance Sport New Zealand, Auckland, New Zealand¹
University of Canterbury, Christchurch, New Zealand²

A demonstration of a multidisciplinary approach driven by biomechanical analysis for Paralympic swimmers. Dr Jodi Cossor and Matt Ingram will show contrasting approaches to technique optimisation for individual abilities and opportunities.

Key words: Paralympic swimming, innovation, performance gains

INTRODUCTION: Working with Paralympic athletes provides the opportunity to be more creative when providing biomechanical support within the daily training environment (DTE). Two swimmers may be in the same classification at a competition but present completely different physical attributes. An athlete missing part of an arm will need to have a stronger kick than an athlete missing part of a leg, while fatigue in brain injured athletes impacts their performance towards the end of a race. These unique differences were identified by Fulton et al. (2009) when examining performance improvements at competitions between 2004 and 2006. It is therefore important to enhance the strengths and minimise the weaknesses of the individuals to a greater extent when compared with able bodied swimmers. Dingley et. al (2014) highlighted the significance of these differences when examining the start phases of Paralympic swimmers.

This demonstration will display the current technology used when working with our Paralympic swimmers as well as changes that can be made through the utilisation of immediate feedback within the session (Burkett, 2010). Support within the DTE involves the integration of the biomechanist, physiotherapist and strength coach for optimal performance gains. Recent innovation projects have included the automatic tracking of the swimmer along the length of the pool to produce real time stroke and velocity parameters, as well as the development of training aids for hand and leg amputees.

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- Burkett, B. (2010). Technology in Paralympic sport: performance enhancement or essential for performance? *British Journal of Sports Medicine*, 44(3), 215-220.

ACKNOWLEDGEMENT: The authors wish to acknowledge the support of Roly Crichton, Simon Mayne and Gary Francis in allowing us to test this technology with their swimmers, as well as the input from the swimmers that ensured that the systems can add value to their performance. Special thanks also goes to the Gold Mine team whose expertise created the hardware and software components that make this technology functional within a high performance environment.



After completing a BSc in Physics followed by a MSc in Sports Science, Justin commenced work with Cycling New Zealand for the Rio Olympic cycle as a performance scientist. In 2017 Justin was employed by High Performance Sport NZ to support Rowing NZ in both biomechanics and physiology. This work includes monitoring each training session for all athletes through the use of heart rate and boat/stroke measurements. Justin's work with the rowers has involved collaboration with the Goldmine team to enhance real time feedback tools for both the coaches and athletes.



ROWING STROKE ANALYSIS

Justin Evans¹ and Sarah-Kate Millar²

High Performance Sport New Zealand, Auckland, New Zealand¹
Auckland University of Technology, Auckland, New Zealand²

A practical session delivered by Justin Evans and Dr Sarah Kate Millar assessing the rowing stroke to assist the coach on technical changes. This session will demonstrate various rowing traits and how biomechanists and coaches can work together to optimise boat speed.

Key words: rowing, technique

INTRODUCTION: The rowing stroke is technically quite complex since it uses nearly all the muscles of the human body, requires complex coordination of the rower's movements and increases in complexity as the number of rowers in a boat increases. There are two main environments where rowers train in order to enhance performance; on the water and on a rowing machine. This presentation will look at the similarities and differences between these two environments and considerations for testing. This demonstration will display tools and feedback methods used when working with coaches and athletes to assist in technique changes as well as examine the differences in on water rowing and rowing ergometers and how we need to think carefully about the appropriateness this training modality.

ACKNOWLEDGEMENT: The authors wish to acknowledge rowers and coaches who have supplied data presented and helped on the day with the presentation.





As an athlete Mike started out as an elite golfer and then onto Olympic weightlifting which sparked an interest in power based sports. Blending the two passions Mike moved onto a masters in rotational power development and starting working as a strength and conditioning coach for throwers, golfers and weightlifters. Following the completion of a masters and still having some unanswered questions Mike moved through to a PhD in throwing biomechanics, strength and conditioning and how to blend the two under the supervision of Prof. John Cronin, Dr Kim Hébert-Losier and Dr Angus Ross. Currently Mike is mid-way through his PhD Mike and works with elite throwers as an applied biomechanist, strength and conditioning coach and coach.



Dr Kim Hébert-Losier is Senior Lecturer at the University of Waikato and lead biomechanics researcher at the UoW Adams Centre for High Performance in Tauranga. Kim is an expert Qualisys user that specialises in capturing 3D motion in field environments. She has acquired extensive overseas experience working as a physiotherapist or researcher in Canada, New Zealand, Sweden, USA, and Malaysia. She has worked across a range of sports and alongside recreational to Olympic athletes and World Champions.

INTEGRATION OF BIOMECHANICS IN THE COACHING OF ELITE THROWERS

Mike Schofield^{1,2,3} and Kim Hébert-Losier⁴

High Performance Sport New Zealand, Auckland, New Zealand¹

Sports Performance Research Institute New Zealand, AUT University, Auckland, New Zealand²

Athletics New Zealand, Auckland, New Zealand³

University of Waikato, Tauranga, New Zealand⁴

Mike Schofield and Dr Kim Hébert-Losier will provide a live demonstration of how technology is being used to analyse athletic throws biomechanics inside and outside of the laboratory. Most importantly, the topic of how biomechanics can be integrated in promoting evidence-based coaching practices and athlete management will be discussed.

Key words: athletics, biomechanics, performance, throws

INTRODUCTION: In high performance sport, coaches and athletes are constantly seeking for performance improvement through marginal gains. The field of biomechanics plays a central role in a high-performance sport setting, particularly in sports where slight changes in technique can substantially affect outcomes. Traditional analyses of athletes are conducted in laboratory environments, but technology advancement make it feasible to collect high-quality data in the field, increasing the ecological validity of information. In athletic throwing events such as discus, hammer, and shot put, projectile motion laws govern performance. Therefore, coaching practices on the field and in the gym seek to enhance release parameters (i.e., velocity, height, and angle). Detailed biomechanical analyses of athletes' throwing performance are often undertaken, but can provide a myriad of information that raise several questions from a practical perspective. How to best optimise use of equipment to inform practice? What data are relevant? What aspects need to be considered in interpreting data? How can the knowledge gained be used to increase performance? Can biomechanics integrate coaches, athletes, medical staff, performance analysts, and strength and conditioning coaches more to address performance in a more holistic approach?

ACKNOWLEDGEMENT: The authors would like to acknowledge Qualisys AB for their support, and for providing state-of-the-art motion capture solutions that can be used by athletes, athletic trainers, clinicians, and researchers alike to advance in the fields of sports performance, injury prevention, and rehabilitation.



Dr Craig Harrison helps youth athletes develop the foundations of physical and mental performance. Focusing his time in two key areas, Craig is the Director of Athlete Development at AUT Millennium, an evidenced-informed non-sport-specific development programme for youth athletes aged 8-17 years. Craig is also a Research Fellow at the Sports Performance Research Institute New Zealand (SPRINZ) at AUT University, where he leads the Youth Athlete Development postgraduate



research group. Craig has worked with parents, coaches, teachers and administrators to help youth athletes reach their sporting best across New Zealand for over 15 years.

A YOUNG FOOTBALLER'S JOURNEY: THE IMPORTANCE OF ATHLETIC MOVEMENT

Craig Harrison

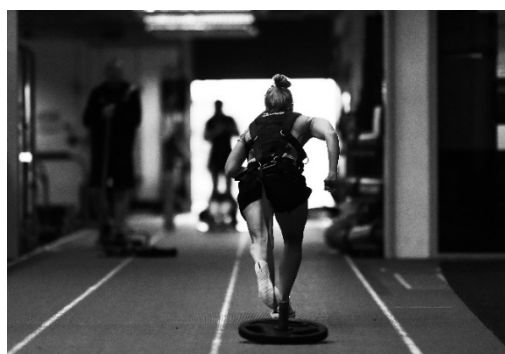
Sports Performance Research Institute New Zealand, AUT University, Auckland, New Zealand

Dr Craig Harrison will provide examples from the AUTM Athlete Development programme to outline the importance of athletic development.

Key words: youth, athletic, movement, injury

INTRODUCTION: Anna joined Athlete Development (AD) aged 10, passionate about the game of football and looking for new opportunities to develop her game. Six years later, and with her first national team cap under her belt, she transitioned into the high-performance system. This applied session is about that journey. Specifically, Craig Harrison will present the key principles of the AD programme, an evidence-informed, non-sport-specific development programme for youth athletes in New Zealand, and how they are applied to develop the foundations of athletic movement and prevent injury.

ACKNOWLEDGEMENT: The author wishes to acknowledge Mike Stanley and Professor John Cronin for their steadfast support of the Athlete Development programme. Special thanks also goes to the entire AD coaching team for their hard work, creative thinking and willingness to play the long game.





Kim Simperingham is the S&C Manager at the HPSNZ National Training Centre (Auckland) and works with the NZL Sailing team and the All Blacks rugby team. Kim has nearly 20 years of experience as a Strength and Conditioning coach supporting a wide range of sports. Kim was formerly head of S&C for Auckland Rugby, NZ Blacks Ferns and Kintetsu Rugby (Japan). Kim is a PhD candidate at AUT University and his research interests include enhancing sprint performance in team sport athletes; the effect of wearable resistance on sport training and performance; and acute enhancement of power performance.

athletes; the effect of wearable resistance on sport training and performance; and acute enhancement of power performance.



SPRINTING AND STRENGTH BIOMECHANICS

Kim Simperingham^{1,2} and Jamie Douglas^{1,2}

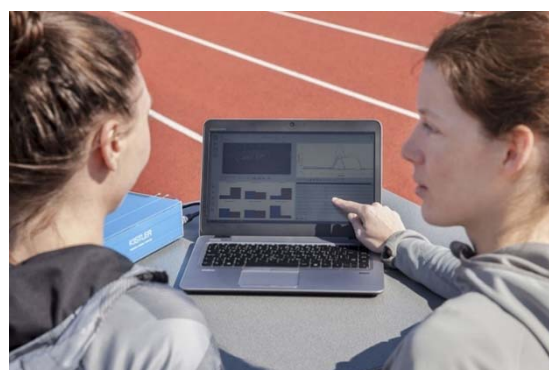
Sports Performance Research Institute New Zealand, AUT University, Auckland, New Zealand¹

High Performance Sport New Zealand, Auckland, New Zealand²

A demonstration of a custom-built eccentric loading device for sprint training. Kistler representatives will present the new KiSprint system.

Key words: Paralympic swimming, innovation, performance gains

INTRODUCTION: Kim will discuss the multi-disciplinary approach to providing applied research and athlete support in NZ, and specifically how AUT researchers have investigated the impact of wearable resistance training on running, jumping and sprint training. Jamie Douglas is an AUT/HPSNZ PhD scholar whose research has been directed by the experimental and anecdotal evidence indicating the efficacy of eccentric training methods in enhancing sprint performance. A custom-built eccentric loading device will be demonstrated. The application of this device in athletic preparation will also be discussed. Finally, Kistler representatives will present the new KiSprint system. KiSprint is a comprehensive system to analyze, compare and improve sprint starts; incorporating force measurement, high-speed video capturing, speed measurement and software. Scientists, coaches or athletes get reliable parameters immediately after the trial. An elite NZ sprinter will complete some sprint starts during the demonstration.



KISTLER
measure. analyze. innovate.



Bruce has been the Director of the Performance Health team based at the National Training Centre in Auckland since 2013. He is also the Head of Sports Medicine for the NZ Olympic Committee and the Medical Director of Canoe Racing NZ and is a practicing Sports Physician who recently completed his Doctorate in Sports Medicine. Past roles include Sports Physician for the Australian Institute of Sport, Medical Coordinator for Athletics Australia, Team Doctor for Triathlon Australia, Regional Lead Physician for the English Institute of Sport and Chief Medical Officer for UK Athletics. Before moving back to his country of birth, Bruce worked for three years at the purpose built facility of Aspetar, Qatar Orthopaedic and Sports Medicine Hospital as the Chief of Sports Medicine.



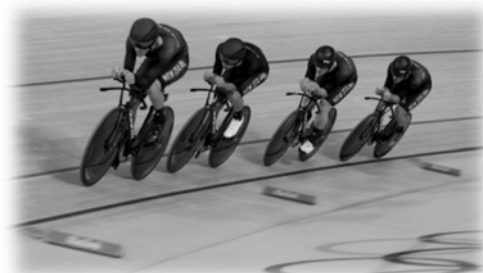
Roné is currently Regional Lead for Waikato region for High Performance Sport New Zealand. Before joining HPSNZ she was based in the UK and worked within the English Institute of Sport and British Athletics as a performance therapist from 2002-2013. Her journey includes being on the medical team for Beijing, London and Rio Olympics, as well as numerous major championship events. She is currently working at Avantidrome in Cambridge in assisting athletes to achieve their 2020 Tokyo Olympic goals.



Justin Ralph has a BHSc (physiotherapy) and PgDip HSc (musculoskeletal physiotherapy). Justin is a performance physiotherapist with High Performance Sport New Zealand working with Cycling New Zealand based in Cambridge. He has previously worked with Para-cycling New Zealand from 2011-2016 including the London and Rio Paralympic Games. Part of Justin's role working with Cycling New Zealand's elite athletes is to help optimize the athlete bicycle interface aiming to influence injury prevention and enhance performance.



Fiona Mather has an extensive track record working in elite sporting environments, and has had the privilege of experiencing numerous Olympic and Commonwealth Games cycles supporting athletes within the UK sporting system and in her current position as Head of Performance Therapies at High Performance Sport New Zealand.



Injury, Performance and Saddle Pressure Analysis in Elite Cycling

Bruce Hamilton¹, Fiona Mather¹, Justin Ralph² and Rone Thompson²

High Performance Sport New Zealand, Auckland, New Zealand¹
High Performance Sport New Zealand & Cycling NZ, Cambridge, New Zealand²

A demonstration of how saddle pressure analysis is utilised in elite cycling to influence injury and performance outcomes.

Key words: Elite cycling, injury prevention, performance

INTRODUCTION: Power, endurance and aerodynamics are key elements of cycling performance. Epidemiological evidence of injury and illness prevalence in elite cycling is surprisingly limited, but both acute and overuse injuries and illness may impact upon performance. However, it is generally recognised that the interface between the athlete and the bicycle influences the ability of athletes to produce power, sustain an effective aerodynamic position, and the risk of sustaining an overuse injury – this forms the theoretical basis of the “bicycle fit” process. The use of pressure mapping on the bicycle provides an additional means of assessing the effectiveness of the athlete: bicycle interface. This interactive demonstration will present the approach of the HPSNZ and Cycling NZ Performance Health team to utilising bicycle saddle pressure analysis, in the prevention of injury and optimisation of performance.

ACKNOWLEDGEMENT: The authors wish to acknowledge the support of Cycling New Zealand in facilitating this presentation.





Kelly is a registered Physiotherapist and Biomechanist who leads the AUT Millennium Sports Performance Clinics. He has a clinical interest and expertise in running injuries and biomechanics. Kelly has a Masters degree in musculoskeletal physiotherapy, including research in 3D running biomechanics. He is currently completing his PhD in the area of real-time feedback in runners at risk of tibial stress fracture, and his work has been published in a number of leading international journals. Kelly also teaches anatomy and biomechanics within the School of Sport and Recreation at AUT University, and has presented at national and international conferences.



INTEGRATION BETWEEN INERTIAL SENSORS AND MOTION CAPTURE

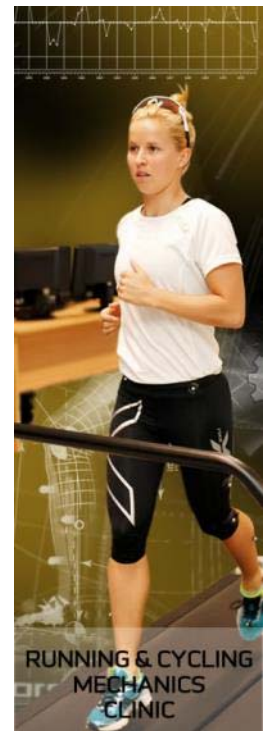
Kelly Sheerin¹, Thor Besier^{1,2} and Denny Wells^{1,3}

Sports Performance Research Institute New Zealand, AUT University, Auckland, New Zealand ¹
 Auckland Bioengineering Institute & Department of Engineering Science, University of Auckland,
 New Zealand ²
 Logemas, Queensland, Australia ³

Kelly Sheerin, Thor Besier and Denny Wells will provide a demonstration of an integrated inertial sensor and marker-based optical motion capture solution.

Key words: Inertial measurement unit, IMU, wearable sensors, lower limb load

INTRODUCTION: Improvements in sensor technology, wireless transmission and data analysis techniques, has enabled the development of wearable sensors capable of measuring real-time, meaningful information in a range of settings (Norris, Anderson, & Kenny, 2014). Compared to traditional motion capture systems, wearable sensors are low cost and require less expertise to operate, enabling a broad range new clinical and sport applications (Piwek, Ellis, Andrews, & Joinson, 2016). Most importantly, wearable sensors are also enabling measurement outside of the laboratory, providing new opportunities and insight for biomechanics research and application. Translation of findings from laboratory-based interventions to the real world is often cited as a limitation of biomechanics research (Sinclair, Hobbs, Protheroe, Edmunson, & Greenhalgh, 2013). We are now in a much better place to bridge this gap and this demonstration will highlight some recent applications of real-world measurement and monitoring using inertial sensors and optical motion capture. The integration and synchronisation of inertial measurement units (IMUs) with optical motion capture provides interesting opportunities to augment the reconstruction of human motion and overcome some of the limitations of IMU-based measurement, such as drift and global positioning. Direct measurement of acceleration at distal limb segments using IMUs also provides a useful 'surrogate' of impact load, which can be used for long-term monitoring and real-time feedback. This demonstration will detail the different modelling approaches that we are using as well as the technology that makes this integration possible.



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ACKNOWLEDGEMENT: We acknowledge the support of the Sports Performance Research Institute of New Zealand (SPRINZ), Logemas, and VICON-iMeasureU, for making this demonstration possible.



Rodrigo Bini, PhD, is a Lecturer in Exercise and Sports Biomechanics at La Trobe University – Bendigo Campus in Australia. Currently, Rodrigo is an associate Editor of the *Journal of Science and Cycling*. He also is a member of the Editorial Board of the *Sports Biomechanics* journal, the *Journal of Sports Sciences*, the *European Journal of Sport Science*, and the journal *Medicine*. Rodrigo is also one of the editors and authors of many chapter on the book “*Biomechanics of Cycling*”, published in 2014. Rodrigo has published over 60 articles, the majority involving studies on sports biomechanics. Rodrigo’s PhD work helped the development of procedures for the SPRINZ

Cycling Mechanics Clinic and the Endurance Performance Clinic. See details on Rodrigo via:

<http://www.gepecbrasil.com/>

<http://sites.google.com/site/binirodrigo/> - CV Articles

<https://scholars.latrobe.edu.au/display/rbini>



Andrew Kilding is an Associate Professor in sport and exercise physiology at SPRINZ, AUT University. Andrew teaches and supervises postgraduate students in a range of sport and exercise science papers at AUT. He has a wide range of research interests but the majority of his research focusses on strategies to enhance aerobic responses, adaptations and performance in endurance athletes. Andrew has published almost 100 scientific articles and is an Associate Editor for the *Journal of Science and Medicine in Sport*. He has provided applied physiology support to a range of athletes and has been involved in athlete preparation prior to Olympic Games. Andrew was recently appointed Head of Performance Physiology at High Performance Sport New Zealand.



CYCLING BIOMECHANICS – FORCES AND PHYSIOLOGY

Rodrigo Bini^{1,2} and Andrew Kilding²

¹La Trobe Rural Health School, La Trobe University, Bendigo, Australia;

²Sports Performance Research Institute New Zealand, AUT University, Auckland, NZ

The purposes of this applied session are to provide a brief introduction on how pedalling style/technique can influence energy cost and joint loads, and then to perform a laboratorial based assessment (i.e. cycle ergometer) illustrating how changes from pushing to pulling technique could affect pedal forces and oxygen cost. A background of optimal vs. feasible pedalling forces will be introduced to provide the basic understanding for outcomes from the practical assessment. After that, one trained cyclist will be assessed on a cycle ergometer whilst forces applied to the pedals and oxygen uptake are measured. This session will demonstrate how pedalling technique can affect energy cost, particularly when involving increased pulling actions at the recovery phase of the crank cycle (1, 2). We expect to show that cycling efficiency is largely affected by the choice made by each cyclist in terms of muscle recruitment.

KEY WORDS: pedalling technique, energy cost, cycling efficiency.

References:

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Robert's career in high performance sport began in 2009 with the design and development of a novel real-time biomechanics feedback device for Rowing NZ. He joined HPSNZ as an Electronics Engineer in 2011 and later became a Senior Electronics Engineer. From 2015, he has led the electronics and hardware design at Goldmine, HPSNZ's in-house engineering team. Robert has played a pivotal role the design and development of advanced training equipment used by many New Zealand Olympic athletes, such as the data logging systems used by Cycling NZ,



Canoe NZ, and Rowing NZ. He holds a BEng and a MEng, both from the University of Canterbury.

CUTTING EDGE SPORTS TECHNOLOGY AT HPSNZ

Robert Tang¹, Andre de Jong¹, Farhan Tinwala^{1,2}, Sean Zhou¹ and Stafford Murray¹

**High Performance Sport New Zealand, Auckland, New Zealand¹
Auckland University of Technology, Auckland, New Zealand²**

Robert Tang, Andre de Jong and Sean Zhou discuss select projects developed by Goldmine, HPSNZ's in-house engineering team, and how these innovations have enabled unprecedented levels of biomechanics feedback.

KEYWORDS: Sports technology, innovation

INTRODUCTION: When deployed correctly innovation has a demonstrable impact in high performance sport (de Koning, 2010; Jones, 2010). Winning margins in sports are constantly decreasing, with often only fractions of a second discriminating between finishing places. Consequently, there has been a movement internationally for high performance sport practitioners and scientists to create novel technological solutions to provide them and their athletes with a competitive edge (Haake, 2009). With an increasing number of high performance athletes and a growing need for technological interventions (Elmer et al., 2012) how does an organisation such as HP High Performance Sport New Zealand, with finite budgets and resources, prioritise bespoke innovation projects? (Ringuet et al., 2014).

This presentation will provide insight into High Performance Sport New Zealand's innovation system and processes. We cover how innovation projects are created and the decision-making process leading to project selection. We also discuss how the innovation process itself is refined, to ensure that subsequent approved projects make a meaningful and measurable performance impact. Finally, this presentation will cover a range of successful projects that have resulted from the innovation process. Successful projects to be discussed include an indoor marker less tracking system for shotput, an eccentric training cycling ergometer, and an automated video tracking system for swimmers.

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ACKNOWLEDGEMENT: The authors wish to acknowledge the financial support provided by Sir Stephen Tindall to High Performance Sport New Zealand's innovation programme. This support has been instrumental to the success of our innovation programme and many of the medal winning performances achieved by New Zealand Olympic athletes.



Cameron Ross started out as a snowboard coach and instructor where he identified a gap in knowledge in the training environment of snowboard athletes. Returning to study, Cameron did a Masters with the Olympic Winter Institute Australia and the University of Canberra, researching landing stabilization in elite ski and snowboard athletes. Cameron then embarked on an integrated PhD both providing performance analysis for Snow Sports New Zealand (SSNZ) park and pipe athletes and completing a PhD where he developed an automated 'on-snow' athlete load monitoring system. In collaboration with High Performance Sport New Zealand, a functioning athlete tracking system specific to snowboard slopestyle athletes, is now incorporated into the daily training environment of SSNZ snowboard slopestyle athletes.



Between 2000 and 2009 Paul McAlpine completed his MSc and PhD at Auckland University with a focus on injury mechanics in Snowboarding through on-snow force measurement and motion analysis. Throughout this period of time Paul also developed and tested footwear as a contractor with private companies. He provided 3D motion capture and analysis for the NZ Cricket fast bowler screening assessments before moving to Adelaide in 2010. Paul was the Biomechanist for the South Australian Institute of Sport supporting a range of sports including Rowing, Kayak, Swimming, Water polo, Hockey and Cycling. In 2013 Paul and his wife Laura moved back to NZ to support athletes over 3 Olympic cycles in both summer and winter Games. Paul is a Senior Biomechanist for HPSNZ and is the primary service provider for Kayak Sprint and Snow Sports New Zealand whilst supervising PhD candidate Cameron Ross.

WEARABLE TECHNOLOGY IN SNOW SPORTS LOAD MONITORING

Cameron Ross^{1,2,3} and Paul McAlpine^{1,2}

High Performance Sport New Zealand, Auckland, New Zealand¹

Snow Sports New Zealand²

University of Otago, Physical Education, Sport and Exercise Sciences³

Key words: Load monitoring, Inertial measuring unit (IMU), Snow sports, sensors

Introduction: Snowboard slopestyle involves athletes riding down a man-made course made of snow that has jumps and rail features where athletes combine technical tricks and skilful riding. Recently we have seen these sports transition from recreational pastimes to elite professional sports, where athletes represent their countries and form part of high performance programmes.

There is a paucity of research of the 'on snow' training environment of snowboard slopestyle. Common training descriptors such as volume, intensity and overall training load cannot be used for on-snow training, as there is no comprehensive athlete tracking system or on-snow load monitoring tool currently available. As a high performance program there was a need to development a snow sport-specific athlete tracking system, to in-form on the crucial aspect of 'on-snow' training which would be included in the already established 'off-snow' athlete monitoring system. To achieve this, athlete tracking technologies were identified and validated for their use in identifying and measuring sport specific movement patterns and internal and external load metrics. Collected load monitoring data was then delivered back to the program (coaches, athletes and support staff) to give insight into on-snow training and demonstrate the capability and usefulness of the tracking systems.

The applied session will delve into the identification of specific training variables extracted, current technologies available, how we go about collecting 'on-snow' data, the pros and cons of monitoring snowboard slopestyle athletes and how the program as a whole can use the data.





Simon and his wife Dani immigrated to NZ in 2013 in order to commence his role as a Senior Performance and Technique analyst with sailing. Since then he has become the head of the PTA discipline within HPSNZ. After graduating from Southampton University with a MEng in Mechanical Engineering, Simon worked briefly for the Jordan Formula 1 team as a vehicle dynamicist before joining the engine development team at Ford Motor Company for 5 years. Simon then returned to his passion of sailing, working with the British Sailing team for 2 Olympic cycles including the highly successful 2012 Olympic Games. The New Zealand sailing



team have benefited from this experience with Simon and Ben Day analysing race data on international events, enhancing boat and sail technology, as well as introducing new technology for coaches to provide real time feedback to their athletes.

Martin Dowson – High Performance Sport New Zealand



Martin is the General Manager Athlete Performance Support at High Performance Sport New Zealand. Martin has more than 25 years' experience in providing or managing the support to high performance athletes. He has worked with athletes in New Zealand, England and Japan as a sports scientist and strength and conditioning coach, was a Senior Lecturer in Sports Science at Auckland University of Technology, and from 2005 developed and led the Performance Services team at the New Zealand Academy of Sport, the forerunner to HPSNZ.

AUT Adjunct Professor Barry Wilson

Professor Barry Wilson is an Adjunct Professor with SPRINZ at Auckland University of Technology. As a teacher and researcher in biomechanics I have had appointments at the University of Queensland in Australia, and at University of Otago, in Dunedin, New Zealand. As a researcher, I have been involved in sports performance and injury prevention at all levels of sport. However, my greatest opportunity for applied sport science has been as Consultant Sports Biomechanist at the Malaysian Institute of Sport, Kuala Lumpur, both part-time and full-time over a period of 12 years. This work was largely in directing a biomechanics programme and developing local staff skills for delivering sport science to coaches and athletes. Throughout my career I have maintained a close association with multiple sports as athlete, coach and sport scientist. I remain "somewhat driven" to getting "Science into Sport, and Sport into Science".



Barry will be talking about:

1. National and International graduate students, scholarship support and the scope of their work.
2. SPRINZ research groups including: Technology, Sports Kinesiology and Injury Prevention, Strength and Conditioning.
3. SPRINZ staff's association with HPSNZ sports e.g. Associate Professor Andrew Kilding, Head of Performance Physiology for Tokyo Olympics; Jamie Douglas, Performance Scientist Cycling

Mike Stanley - AUT Millennium Chief Executive & NZ Olympic Committee President



Mike has been Chief Executive of AUTM since 2003. He is President/Chairman of the NZOC and has served on the board of the NZOC since 2004. Mike is a board member of High Performance Sport New Zealand. Mike has been a competitor, coach, commentator and an administrator for rowing. He became a New Zealand rowing representative in 1976, and was a member of the NZ rowing eight which won back-to-back world championship in 1982 and 1983 and finished fourth in that event at the 1984 Los Angeles Olympic Games. Mike was inducted into the Sports Hall of Fame in 1995 and shared the NZ Sportsman of the Year trophy with the world champion crew of 1982. From 1994 to 2003, Mike was Chief Executive of Rowing New Zealand.

AUT Millennium Tour Information

Your tour guides

Josh McGeown, Enora Le Flao, Dustin Oranchuk, Erika Ikeda, Jono Neville, Aaron Uthoff, Andrew Pichardo, Farhan Tinwala, Shelley Diewald, Renata Bastos Gottgroy, Jessica Yeoman, Casey Watkins, Eric Harbour, Anja Zoellner, Alyssa Joy Spence, Victor Lopez Jr, Albert Chang.

AUT Millennium history

- A charitable trust established to help New Zealanders live longer and healthier lives, and to enjoy and excel in sport through the provision of world-class facilities, services, research and education.
- Founded in 2002 as Millennium Institute of Sport and Health (MISH) by Sir Stephen Tindall and Sir Graeme Avery as a premium health and fitness facility for both athletes and the public alike.
- Partnered with AUT University in 2009, forming AUT Millennium, to expand research and education in the sporting sector.

AUT Millennium general information

- 800,000+ facility visits per year from adults and children
- \$17,000 in expenses against \$19,200 in income per day
- 155 staff members
- Seven business units:

- Gym
- Aquatics
- School and Holiday Programmes
- Accommodation

- Conference
- Clinics
- Athlete Development

Four Foundation Clubs:

- Bays Athletics
- North Harbour Water Polo
- North Shore Swimming
- NorthSport Olympic Weightlifting

21 Tenants:

- Aktive Auckland
- Ascot Radiology
- Athletics New Zealand
- The Avery Foundation
- Bays Athletics
- Canoe Racing New Zealand
- Constellation Community Trust
- Feetness Podiatry
- HealthZone Medical
- HealthZone Physiotherapy
- High Performance Sport New Zealand
- Little French Cafe
- North Harbour Water Polo
- North Shore Swimming
- North Sport Olympic Weightlifting
- New Zealand Water Polo
- Orthosports
- Paralympic Swimming New Zealand
- Swimming New Zealand
- Tennis New Zealand
- Wholefoods Cafe



Public gym

- Home to over 2,300 “Everyday Champions”, our qualified instructors and personal trainers provide a positive and supportive environment for members to achieve their health, fitness and nutritional goals.

Outdoor track & field

- Free public track
- 60,000 users per year
- 8x 400m lanes
- Double-ended track (international standard)
- 2x jump pits
- High jump
- Double-ended pole vault (international standard)
- Throwing nets (shot put, discus, hammer)
- Sports field (rugby, soccer)
- Bays Athletics
- Athletics NZ
- Gym members
- Accommodation guests



Sports hall

- Large indoor sporting area
- Hosts a variety of sporting disciplines

PowerZone

- NorthSport Olympic Weightlifting/North Harbour Rugby weights area

High Performance Sport New Zealand

- Offices and gym
- Carded athlete-only gym

Rock wall

- 7m at highest
- 11 climbs
- Bouldering room
- Used for School/Holiday programmes and conference groups

Bays Athletics

- Club gym area
- Indoor long jump pit
- 60m sprint track (plus 10m outdoor deceleration)
- Only international standard indoor pole vault in the southern hemisphere

Community programs

Athlete Development

- Science-based, non-sport specific training academy for athletic and mental development
- Children aged between 8-18 years old of all ability levels
- 3x training sessions per week
- Authoritative coaching – demanding yet responsive to the athletes
- Essential movement patterns and correct technique
- Blogs, vlogs, seminars and workshops available

Schools programme

- Each year, approximately 11,000 young people aged 5-18 years old participate in activities including Learn to swim, Water Safety, Waterwise training days, Education Outside the Classroom, flippa ball and rock climbing during the school term.

Holiday programme

36th Conference of the International Society of Biomechanics in Sports, Auckland, New Zealand, September 10-14, 2018

- A programme designed to challenge, reward and inspire confidence in children aged between 5-13 years old through a range of on- and off-site activities during the school holidays.

Swim school

- Gold Standard and Swimming NZ accredited Swim School, and past winner of NZSCTA Swim School of the year, is one of largest on the North Shore with over 2,500 students enrolled, and caters to over 10,000 users annually.
- Offers 600 total lessons per week in both the Sir Owen G Glenn National Aquatic Centre and AUT

Sir Own G Glenn National Aquatic Centre

- Opened in 2015, New Zealand's premiere aquatics facility has a 50m Olympic-standard and 25m swimming pools used by the local community, members, high performance athletes and international competitions.
- While home to High Performance Swimming, North Shore Swimming Club, North Harbour Water Polo and Paralympic Swimming New Zealand, the NAC also hosts swimming lessons, public lap swimming, school swimming sports, club events and community classes (Adult Swim Squad and Deep Water Running).
- The \$26 million centre, which was partially public-funded for public lane availability, seats up to 1,100 people and hosts about eight major events per year, including up to 700 athletes and 200 managers and coaches.
- 50m Olympic-standard pool: 51.5m x 25m, 1.5m moveable bulkhead, 1.2m – 2m drop-off, 27 degrees (international-standard), 10 x 50m lanes, Starting blocks, scoreboard, water polo nets, kayaks, training aids, 2.4 million litres of water, 3.5 hours to recirculate water, 4x underwater viewing windows, Video analysis training equipment.
- Toddler pool: 10m x 5m, 0.8m deep, 32 degrees, 2x 10m lanes, Filtered and recirculated every 1.5 hours, Lessons for all ages

Research-Education-Service Clinics

Sports Performance Research New Zealand (SPRINZ) Clinic

- With 16 university academics and over 90 Masters and PhD students, this highly-skilled and knowledgeable team offers a range of services based on scientific research:
 - Running gait analysis
 - Injury rehabilitation
 - Strength improvement
 - Power and cardio fitness
 - Heat acclimatisation
 - Body composition
 - Physiological endurance assessment
 - Strength and conditioning assessment



Human Potential Clinic

- The evidence-based exercise assessments and prescriptions are open to the general public and help to bridge the gap between the medical and fitness industries.
- Catering to a wide variety of medical conditions and risk factors, including high blood pressure, diabetes, cardiovascular disease and cancer, the HPC provides the individualised tests and programmes, including: comprehensive prevention, treatment and management, and progressive self-management and long-term changes in health behaviours.

Accommodation

- Host to a number of local, national and international groups for Auckland events, training camps or conferences held at AUT Millennium, including:
 - Wheel Blacks
 - Silver Ferns
 - Wales Weightlifting
 - Chinese Rugby training squad
 - Canterbury Basketball

Conference

- Three modern and stylish rooms available for public hire for corporate training days, events and much more!
- With views of the track, Rangitoto and Hauraki Gulf, lunchtime team-building activities available in the Gym, pool, track and rock climbing wall, and full-licensed catering options, AUT Millennium Conference caters for all guests' needs.
- Olympic Room: up to 50 people
- Commonwealth Room: up to 80 people
- Finish Line: up to 250 people

