



# ASPC EXCHANGE PROGRAMME 2014

AMY BATHGATE

BIOMECHANICAL & VIDEO ANALYST

April – May 2014



High Performance Centre

→ Australian Institute of Sport





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## 1. INTRODUCTION

The Exchange Program promoted by the Association of Sports Performance Centre (ASPC) aims to encourage the sharing of knowledge and experiences, and the subsequent development of leaders between ASPC members. While the High Performance Centre (hpc) of the University of Pretoria in South Africa, is Southern Africa's first elite performance facility having been established in 2002, it has a well-established multidisciplinary Sport Science and Medical Unit (SSMU) which caters to both recreational and elite athletes' needs and has played a part in many success stories on the international stage. The Australian Institute for Sport (AIS), however, has been recognized the world over for being Australia's strategic high performance sport agency and is responsible and accountable for leading the delivery of Australia's international sporting since its launch in 1981. They are internationally renowned for producing world, Olympic and Paralympic champions by combining high performance expertise with world-class facilities and cutting-edge sports science/sport medicine.

The Biomechanics department at the hpc does not isolate its services or areas of interest to the distinguished field of biomechanics alone, but rather does much in the fields of Performance Analysis and Kinesiology. Biomechanics was a founding discipline when the AIS was established, and has now expanded into a broader, but more intricate department of Movement Science which includes Performance Analysis, Skill Acquisition and Aquatic Testing and Research. Because of this department in particular, the AIS was seen to be the ideal facility to visit in order to observe practices and tap into the knowledge and experiences at one of the most renown and successful elite facilities in the world, thereby developing current expertise, strategies and practices in the hpc Biomechanics department.

## 2. EXCHANGE PROGRAM SCHEDULE

### 2.1. WEEK 1

#### **XIIth International Symposium on Biomechanics & Medicine in Swimming – BMS2014**

*Monday 28 April 2014*

- Conference Registration and Welcoming
- The Leon Lewillie Memorial Lecture by Professor Joao Paulo Vilas-Boas
  - “Building up” in swimming science

*Tuesday 29 April 2014*

- Coaching Keynote by Bill Sweetenham
  - Biomechanics – Interpretation and implementation



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- Biomechanics Keynote by Frank Fish
  - Limitations on swimming speed: How can natural technologies be utilized?
- Coaching Keynote by Andrei Vorontsov
  - Sport science and medical support in preparation of elite swimmers (Russia, GBR, Sweden)
- Physiology Keynote by Professor Phillippe Hellard
  - The development of a research department in French Swimming Federation: a paradigm evolution
- Concurrent sessions of oral research presentations

*Wednesday 30 April 2014*

- Strength and Conditioning Keynote by Professor Robert Newton
  - Strength and conditioning priorities for elite swimmers
- Nutrition Keynote by Dr David Costill
  - Energy and dietary demands of pool and open water swimming
- Concurrent sessions of oral research presentations

*Thursday 1 May*

- Biomechanics Keynote by Dr Raymond Cohen
  - Computational fluid dynamics as a tool for improving stroke technique
- Social Sciences, Humanities and Pedagogics Keynote by Professor Steve Langendorfer
  - Water competence: new insights into swimming and drowning
- Concurrent sessions of oral research presentations

*Friday 2 May*

- Medicine Keynote by Professor Peter Fricker
  - Immune function and the swimmer: twenty five years of enquiry at the AIS
- Physiotherapy Keynote by Peter Blanch
  - Injury to swimmers: bad luck, bad athletes or bad management
- Concurrent sessions of oral research presentations
- Closing Ceremony and Symposium Banquet

## **2.2. WEEK 2**

### ***Movement Science & Aquatic Testing, Training & Research Unit (ATTRU) at AIS***

*Monday 5 May 2014*

- Basic introductions to the majority of staff in the Movement Science department
- Frank Fish – Keynote speaker from BMS2014
  - Presentation for AIS staff



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- Jamie Youngson – Senior Strength & Conditioning Coach
  - The applications of S&C in elite sports
  - Practical challenges
  - The relationship between S&C, coach and athlete
  - Practical sprint session – elite mogul skier
  - Practical gym session – elite swimmers
- Elite swimmers
  - Training session in pool

*Tuesday 6 May 2014*

- Jamie Youngson – Senior Strength & Conditioning Coach
  - Practical gym session – elite mogul skier
  - Practical gym session – elite swimmers
  - Basic recovery methods
  - Beliefs regarding warm-up and warm-down strategies
- David Costill – Keynote speaker from BMS2014
  - Presentation for AIS staff

*Wednesday 7 May 2014*

- David Pease – Senior Biomechanist at ATTRU
  - WetPlate testing session – elite swimmers
    - WetPlate equipment and information supplied
    - Characteristics of starts, turns, relay change-overs
    - Servicing of elite athletes using WetPlate
    - Scientist-athlete-coach relationship
- Elaine Tor – PhD Scholar at ATTRU
  - Research projects forming part of PhD
  - Insights into the underwater kicking phase of the start in freestyle
  - Key characteristics in underwater kicking phases in swimming
- Mitch Mooney – Performance Analyst
  - Practices of Performance Analysis in netball & rowing
  - Equipment, software, reports used
  - Communication with coaches/athletes
- Tamara Kefford – Performance Analyst
  - Practices in waterpolo & slalom kayaking
  - Equipment, software, logistics
  - Team projects at national events in kayaking
  - Relationship with coaches, athletes and colleagues from other institutions

*Thursday 8 May 2014*

- John Baker – Senior Biomechanist
  - Personal experiences during work with kayaking



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- Software and equipment used in department
- Cameras used in department, new cameras being ordered
- Tour of biomechanics lab and facilities
- Michael Barber – PhD Scholar
  - The use of video analysis and biomechanics in track events
  - Performance analysis at national and international track & field events
  - Key performance indicators in track and field performance analysis
  - The video system and force plates used at the AIS indoor track facility

*Friday 9 May 2014*

- Bruce Mason – Head of ATTRU
  - Performance analysis systems and their development
  - Experiences & common practices in swimming performance analysis
  - Insights, beliefs and comments on various systems and/or practices
- Elissa Phillips – Senior Biomechanist
  - Performance analysis in track and field events
  - Reports, practices and equipment used during track and field events
  - Relationship with coaches/athletes and how information is carried across
  - Relationship with colleagues at other institutions
  - Database usage to store all video and performance analysis
  - Practical session – Vicon set up and calibration for Berlei Sportsbra Testing

### **2.3. WEEK 3**

#### ***Movement Science & Aquatic Testing, Training & Research Unit (ATTRU) at AIS***

*Monday 12 May 2014*

- David Pease – Senior Biomechanist at ATTRU
  - Characteristics in unusual diving techniques – compensations, coordination, insights
- Adam Hunter – Senior Biomechanist
  - Instrumented seat for sailing
  - Instrumentation being developed for cycling analysis & bike set-ups
  - Experiences in gait analysis and injury prevention – especially in Paralympic athletes
  - Performance analysis in kayaking
- Elaine Tor – PhD Scholar at ATTRU
  - Performance analysis for Swimming Australia
  - Software, equipment and practices used
  - Database usage for all performance analysis done



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*Tuesday 13 May 2014*

- Rebecca Pahl – Post grad Scholar at ATTRU
  - Testing of newly introduced starting platform using WetPlate
  - Usage of Wetplate software & databases
  - Interaction with John Fowlie (Head Coach) on relationships/communication
- Pendar Hazrati – PhD Scholar at ATTRU
  - Testing of equipment used in measuring active and passive drag
  - Explanations of protocols and data
  - Usage in practical applications with coaches
  - Challenges with the system and its practical applications

*Wednesday 14 May 2014*

- Amy Waters – Post grad Scholar
  - Explanation of main research project
  - Validation of new Catapult's ClearSky wireless local positioning systems in track events
- Amy Lewis
  - Explanation of main research project
  - Kinematics of wheelchair racing
- Elissa Phillips & John Baker – Senior Biomechanists
  - Set up of 20 camera Vicon protocol for pilot testing
  - Investigating effects of different lever lengths and stiffness's in prosthetic blades used in track events

### **3. MAIN DISCUSSION POINTS**

#### **3.1. Application of biomechanics & servicing of elite sports/athletes**

Elite athletes/sports at the AIS are serviced by scientific staff in collaboration with the athletes'/sport's coaching staff. Between coaches and scientists areas of potential or problematic areas are identified and a plan is then designed to address or research the relevant aspects of this area of interest. Video and biomechanical services are provided real-time as far as possible and coaches are educated to understand and drive the process. Scientists work through the coaches to relay information to the athletes and almost never with athletes directly. When more advanced biomechanical tools are utilized i.e. 3D analysis, etc. computational equations are used to explore the impact of possible changes/adjustments i.e. prosthetic blade stiffness properties/length, bike set up, etc. before proposing such adjustments to the athletes/coaches. Academic research topics and results are carried over into practical outcomes as far as possible through coaches education, and these coaches then drive the integration into servicing and performance models.

Servicing is not an ad hoc option, but rather an integrated part of the athletes' overall periodization or training cycle. It is arranged as an integral part of training programs with focused outcomes, and used to answer specific



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questions, and/or to improve on specific aspects of technique/equipment/etc. Servicing is planned by coaches and with the input of all involved in the athletes' training including the S&C coach.

Most biomechanists work regularly with their relevant sporting codes, building invaluable relationships with the coaching staff and athletes alike. Performance analysis is available to all athletes at national competitions (thanks to a collaborative effort involving all institutions), as well as certain local competitions (depending on the level of competition) and at least one biomechanist/performance analyst usually accompanies teams to international training camps and/or competitions. Certain sports do not take a performance analyst with to international competitions, but rather utilize their services remotely. All sports have access to biomechanical/performance analysis services depending on their funding structures and use them in ALL environments (training/competition/international tours). Coaches see the need for the quantitative input from the scientific servicing and in turn they educate the athletes to realize and utilize this in both their training and in competition.

### **3.2. Sharing and/or storage of information**

In terms of most biomechanical services, the data and relevant video footage is supplied directly to the coach (if requested), and also immediately uploaded to a national database for the sport. Performance analysis which is available to most if not all athletes at national events as well as certain local competitions (depending on the level of competition), is made possible by a collaborative effort between all involved sporting institutions to service the otherwise unmanageable number of athletes involved quickly and efficiently. Scientific staff divide the necessary events and/or needed roles up between them, and according to a predetermined fixed protocol, service all athletes involved. Information and video is then immediately uploaded to the relevant national database. These databases are fully accessible to all national sports institutions as well as all affiliated coaches in the relevant sports. Coaches can utilize these databases at any time and usually from most locations, and compare athletes and/or performances as needed. This system also assists in the education process as coaches are then comfortable in the operation of the software used and with the information provided, making more regular servicing a more streamlined process whereby the scientific staff control the process but the coach drives the feedback with the athletes.

This database system also prevents any information disappearing or not being available when coaching staff and/or scientific staff exit the system for whatever reason, or when athletes change coaches or servicing institutions. The data is available to all, at all times, and there is no reason for an athlete/coach/scientist not to be able to access it at any given time. The transparency between institutions also allows for a collaborated effort in terms of ensuring that servicing is of the highest possible standard at all times.

### **3.3. The coach – athlete – scientist relationship**

Scientists provide servicing for athletes, but all results and analysis is provided to the coach and it is up to the coach to communicate at his/her discretion what information get relayed in feedback to the athlete. Even when weekly servicing is in place and the athletes and coaches are completely comfortable with the protocols and the scientists involved, the coach is still the key in relaying information to the athlete. In most instances, the coach will



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ask for specific information or operate the feedback equipment/software themselves as to identify specific aspects of the data they feel most relevant to the athlete involved. This is also done in various ways depending on the learning type and personality of the athlete involved i.e. athletes who are visual learners vs athletes who identify better with numbers, etc. Although the scientists will be informed of these attributes in the athletes, it is the coach's prerogative as to what information is given to the athlete and in what manner.

Coaches and scientists also communicate and work closely in the identification of possible research needed in their respective sports which could benefit performance, and the identification of performance analysis parameters and equipment. In most research projects, elite athletes are used (where possible) to ensure that the results are relevant. Coaches are, however, not supplied with all the information/data available to scientists. It is the scientists' role to filter the information in such a way as to only relay the most pertinent or important information needed in the practical training environment.

This relationship revolves around the athlete/sporting performance at the centre, but is coach driven and scientifically supported. Communication and education are key to building a relationship which is symbiotic, invaluable and integral to an athlete's development and performance planning.

### **3.4. Equipment and software used at the AIS**

Where equipment is available commercially to serve the purpose of providing the information they are seeking accurately and easily, then off the shelf products are purchased and a validation process is followed before being used practically. But when commercial products are either unavailable or not suitable for the intended tasks on hand, in house design and development of such systems are attempted by collaborating with the Research and Development Lab Technicians. Video systems are integrated and calibrated in such a way as to provide an aesthetically pleasing image, but more importantly an image which can be easily calibrated and synchronized with additional data i.e. EMG, force plate data, GPS, etc. All video is also set up in such a manner as to allow for digitization if necessary. Extensive research is done using all equipment designed and used at the AIS.

Where possible i.e. in fixed and secured training venues, certain equipment is permanently installed and made available to coaches for use during training sessions. Video equipment is often easily operated even without the presence of scientific staff for qualitative feedback with athletes in training i.e. closed circuit cameras with permanent feeds and connected display systems on poolside/courtside that are available at all times to both athletes and coaches.

## **4. CONCLUSIONS**

The AIS Movement Science department and the HPC Biomechanics department, despite obvious differences in available funding, facilities and equipment, work similarly in many aspects of their servicing to elite athletes. They also face similar challenges to a certain extent.





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Firstly, despite the extensive information available during servicing at the AIS, both departments filter the information relayed to the coach/athlete during feedback to ensure it is focused and selective in order to be addressed in training and have a direct influence performance. In many instances the HPC provides athletes/coaches with very similar information as that which the AIS supplies its athletes. The biggest difference is the full integration of the servicing into programs at the AIS, instead of the more ad hoc basis in which many SA athletes approach servicing (this is often a direct result of funding challenges). Similar strategies for building up the relationships between coaches and scientific support are also employed. The AIS unfortunately has a 21 year head start in terms of building relationships with coaches and sporting bodies, and now have the luxury of working with a great number of coaches who use scientific support as invaluable and integral segments of their performance and development plans. They do, however, still experience the challenge of working with coaches who do not “buy in” to the systems and services in place. The positive aspect of this is that South Africa is progressing rapidly in this respect and will “catch up” quickly as performances benefit from this scientific support and involvement, and relationships are developed and solidified.

Probably the greatest difference between the departments, which should be addressed by the HPC (and possibly the different SA institutions) is the use of the national databases to store and share servicing and performance analysis data. Currently there is very limited sharing of data/information, and extensive loss of data in SA. Protocols for data collection are also independent and varied. There are currently no national databases and comparisons between athletes (local or international) and/or performances are difficult if not often impossible. This is also impacted by the lack of integration of scientific support and performance analysis, in particular, into national sports programs. Invaluable data is often not collected, lost or not relayed over to athletes and/or coaches – thereby nullifying the performance influences. Communications between institutions and collaborative efforts in such a task may be beneficial for SA sport on a whole.

Moving forward, the Biomechanics department will use many of the ideas gained at the AIS to better service their athletes and develop the coach-athlete-scientist relationship to the point that these services are rooted within training cycles and competition performances. They will explore the possibilities of better data storage to eliminate loss of data and increase athlete tracking, comparisons, etc. Performance analysis was identified by most of the AIS staff in the Movement Science department as the most important service to include in elite sports programs, especially at the national and international levels, and this is something that that needs to improve in SA sport.

The take home lessons learnt during the visit to the AIS will be shared not only with colleagues within the Biomechanics department at the HPC, but also with scientists from other departments within the Sport Science and Medical Unit to ensure that all benefit and learn from this experience.