Dr Glen SNEDDEN

CSIR
DPSS: Aeronautic Systems
Research Group Leader

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Extraordinary Lecturer at the University of Pretoria

Member of the Aeronautical Society of South Africa (AeSSA) Council

National representative to the International Society for Air Breathing Engines

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More than 18 years of experience in research in the fields of gas turbine aerodynamics and heat transfer centred at the CSIR in Pretoria, South Africa and involving all the major Universities in South Africa. International collaborative projects have include partnerships with SNECMA, Volvo Aero (GKN Aerospace), TU Darmstadt, Avio SpA, National Research Council of Canada, US Navy, South African Air Force, Canadian Air Force and Rolls Royce Corporation and many others.

ACADEMIC AND PROFESSIONAL QUALIFICATIONS

2012
PhD
Durham University (UK) – School of Engineering and Computing Sciences
Thesis: The Application of Non-Axisymmetric Endwall Contouring in a 1½ Stage, Rotating Turbine
Supervisors: Dr G Ingram and Dr D Gregory-Smith
External Examiner: Dr Budimir Rosic

2003
BCom(Management)
University of South Africa (by correspondence)

1998
Registered Professional Engineer (PrEng):
Registration Number: 980749
Engineering Council of South Africa (ECSA)

1996
MSc (Mech Eng)
University of Natal (SA) – Department of Mechanical Engineering
Thesis: Transient Measurement of Heat Transfer in Steady State Turbine Cascades
Supervisors: Dr GDJ Smith and Prof JP Bindon
External Examiner: Prof Detlev Kröger

1993
BSc (Mech Eng) Summa Cum Laude
University of Natal (SA) – Department of Mechanical Engineering

Membership of Professional Bodies

2009 - Present
Member of ASME
Membership No.: 000100061258

2005 – Present
Member of the Aeronautical Society of South Africa (AeSSA)
Council Member for Propulsion

1994 - 2009
Associate Member of the South Africa Institution of Mechanical Engineers (SAIMechE)
Corporate member of the Turbomachinery Technogroup

Professional and Academic Experience

January 1996 – Present
CSIR (Council for Scientific and Industrial Research)
Aeronautic Systems
South Africa
Current Capacity: Principal Engineer (Since 2005)
Research Group Leader (Since 2000), Group of 13 Professionals
Contract Research Leader (Since 2003), Department of Defence and Grant projects
Technical Advisor to the Aeronautical Industry Support Initiative (AISI) of the dti (Since 2012)

Administrative Duties:

- Member of the Operations Management Committee for Aeronautics.
- Member of the Business Development Committee for Aeronautics and the wider Defence Peace Safety and Security Operating Unit.
- Member of the Human Capital Development Committee for Aeronautics.
- Member of the Research Institute Management Committee for three DoD programmes.
- Chairman of the Gas Turbine Research Steering Committee for DoD.
- Member of the DoD Computational Mechanics Steering Committee.
- Member of the Management and Operations Committees of the AISI.
- Programme Manager: Project Chevron 1. Aeronautical Technology Development at the CSIR on behalf of the DoD. Topics: Aeronautical Systems Modelling and Simulation, Wind Tunnel Technologies and Experimental Aerodynamics, Non-Destructive Testing, Store Integration and Flutter Flight Clearance, Gas Turbines. Value: +/ R30Million
- Programme manager: Project Ballast, Gas Turbine Research on behalf of DoD. Value +/-R2Million in student and project grants to 8 Universities in South Africa.

Awards:

- Joint winner of the Operating Unit Technical Excellence Assegai Award 2003 for Turbomachinery track record together with Thomas Roos and an honourable mention at the CSIR Excellence awards for the same.
- Joint winner of Operating Unit Transformation Assegai Award 2004 for the transformation of the CFD Research Group as Research Group Leader.
- Winner of the Operating Unit Best Mentor Award 2013.

Relevant Courses:
Strategic Leadership Programme (CSIR) – 2011
CSIR Mentorship Training – 2009

2000 to Present

Representing South Africa on the committee of the International Society of Air Breathing Engines (ISABE) who organize the biannual ISABE conference

2012 to Present

Extraordinary Lecturer
Aircraft Propulsion 2012 and 2013 (Postgraduate Course)
Department of Mechanical Engineering
University of Pretoria

Visiting Academic Positions

January 2013 to July 2013
Visiting Lecturer: Thermomachines
Department of Mechanical Engineering
University of Johannesburg

Areas of Research Specialisation

Fields of Expertise:
Turbine aerodynamics, Turbine cooling and heat transfer, Combustion engine thermodynamics, Turbine design, Turbine secondary system flows, Mechanical design, Computational fluid dynamics, Experimental aerodynamics and heat transfer.

Topics:

- Micro Gas Turbine Design
- Turbine Aerodynamics and Optimisation
- Turbine Secondary Flows
- Turbine Heat Transfer and Cooling Systems
- Turbine Secondary Systems
- Experimental Aerodynamics
- Computational Fluid Dynamics
- Mixed Flow Compressors
- Novel Combustor design
- Turbopump design

Teaching Development

Aeronautical Industry development in South Africa has historically been driven by Defence research, however, despite the ongoing developments in this environment, the need for international collaboration and the growth in the increasing domination of the civil market on South Africa's aeronautical industrial base requires a fundamental change in the closed approach that has been the norm in South Africa to date. South African research and development can only be made competitive through the collaboration of all elements in the value chain and by finding appropriate funding mechanisms to enhance our global offering.

Globally the large civil aircraft integrators require risk and revenue sharing partners to implies that a make to print industry will die away and therefore manufacturers have a vested interest in building the capacity to design, test and develop products and subsystems through partnerships with institutes and universities. In the defence sector internationalization is both a threat to our local industry and a huge potential market. Yet

this market can only be accessed if a full system (with support) can be offered to the client with requires deep levels of knowledge across all technologies and complete capability to develop whole systems. This again requires the efficient use of whole value chain in order to be competitive.

It is therefore imperative that Universities, Institutes and Industry, with the aid of Government, learn not to compete and duplicate, but to build the capability, nascent in South Africa, together.

Research Activities, Contracts and Scholarships

Contracts attracted during the last eight years:

Funder	Year received	Total Number of years of funding	Role	Amount (R)
EU FP6 VITAL	2006	3	Principal	1,950,165
EU FP7 FUTURE	2008	4	Principal	3,538,143
DST FP6 VITAL	2007	3	Principal	835,467
DST FP7 FUTURE	2009	3	Principal	557,669
Armscor Chevron 1 5xPDs	2006	8	Principal	195,106,708
Armscor BALLAST 2PDs	2009	5	Principal	8,598,087
dti AISI Gas Turbine Funding	2012	1	Principal	500,000
THRIP	2013	1	Principal	984,000
SRP Equipment Fund	2008	1	Principal	725,000
Armscor DOOM 4xPDs	2006	5	Principal	2,587,719
Volvo Secondment	2008	2	Principal	1,658,200
Armscor BOI	2006	3	Principal	111,445
dti AISI Type Certification	2012	1	Principal	457,886
dti AISI NDT	2012	2	Contributor	192,318
dti Gas Turbine Development	2013	1	Principal	580,000

International collaborative projects:

- Atar+ NGV upgrade programme with SNECMA

    - Responsible for delivery of heat transfer experimental results for the external surfaces of the NGV
- Klimov SMR-95 Rotor
    - Responsible for delivery of heat transfer experimental results for the internal and external surfaces of the 1st stage rotor
- Rolls-Royce T56-A15LFE
    - Rolls-Royce Corporation, CSIR DSTO and NRC in conjunction with the RAAF, USNavy, SAAF and RCAF in support of the international C-130 fleet. Activities included execution of certain aspects of the technical work (disc cavity CFD) as well as programme management of the SA activities.
- Inclusion as the 52nd partner of VITAL, a major European Union Sixth Framework research programme for environmentally friendly gas turbine engines was the first such project awarded to a South African company in the transport and aerospace sector and built on the initial work for my PhD.
- EU Framework 7 project FUTURE for the accurate modeling of flutter in gas turbine compressors with 26 other European partners.

Local contracts:
Armscor Contracts:

Chevron 1: Aeronautical technology retention based at CSIR
DOOM: Competitive fund for the recapitalization of research infrastructure
BALLAST: A Grant programme that has dispensed R8.5 Million in student grants and equipment funds to gas turbine related projects

THRIP and dti Gas Turbine projects: Multipliers to extend the goals of BALLAST and begin the industrialization process of components developed under BALLAST.

Student Research Supervision

PhD Student Supervision
Currently providing co-supervision to:

1. J Bergh (converted from MSc) started 2010
   Thesis Title: Evaluation of objective functions for the optimization of non-axisymmetric endwalls for loss reduction
   University of Cape Town
   Co-supervisors: Prof C Meyer (Stellenbosch University) and Prof D Reddy

2. B Huyssen (Since 2012)
   Thesis Title: Comparison of heat transfer to planar and non-axisymmetric, aerodynamically optimized, turbine endwalls in a cascade
   University of Pretoria (part time)
   Co-supervisors: Prof JP Meyer

MSc Student Supervision

Students Graduated

1. B Meyers
   Dissertation Title: The experimental flowfield and thermal measurements in an experimental can-type gas turbine combustor
   University of Pretoria
   Co-supervisors: Prof JP Meyer, Dr G Mahmood

Current co-supervising:

1. J Smythe (Since 2011) Dissertation under examination
   Dissertation Title: The design and analysis of a kerosene turbopump for a South African commercial launch vehicle
   University of KwaZulu Natal
   Co-Supervisors: Mr M Brooks, Dr G Smith and Prof JP Bindon

2. L Philogene (Since 2012)
   Dissertation Title: The design of a turbopump test facility for scale testing
   University of KwaZulu Natal
   Co-Supervisors: Mr M Brooks, Dr G Smith and Prof JP Bindon

3. M Richings (Since 2013)
   Dissertation Title: Numerical analysis of turbopump designs
   University of KwaZulu Natal
   Co-Supervisors: Mr M Brooks, Dr G Smith and Prof JP Bindon

4. K Mabe (Since 2013)
   Thesis Title: Development and Validation of a Methodology for Measuring Full-Field Convective Heat Transfer Coefficient Distributions using Thermochromic Liquid Crystals
   University of Pretoria
   Co-supervisors: B Huyssen and Prof JP Meyer

5. J Kruger (Starting 2014)
   Turbine endwall heat transfer measurement at different turbulence levels
   University of Pretoria
   Co-supervisors: B Huyssen

6. R Ebrahim (Starting 2014)
   Turbine endwall heat transfer measurement at different Reynolds numbers
   University of Pretoria
   Co-supervisors: B Huyssen

Undergraduate Student Project Supervision

More than 10 final year project students from local universities: university of Pretoria and Tswane University of Technology, have been co-supervised with the aim of selecting students to enter postgraduate programmes.

Publications

Peer Reviewed Journal Articles:

1. Meyers BC, Snedden GC, Meyer JP, Roos TH, Mahmood GI (2012) *Three-component particle image velocimetry in a generic can-type gas turbine combustor,* Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy 0957650912454780.

2. Mafusire C, Forbes A, Snedden G, Michaelis MM (2008) *The spinning pipe gas lens revisited* South African Journal of Science, Vol. 104, Issue 7, pp 260-264, 10 December 2008.

3. Mafusire C, Forbes A, Michaelis MM, Snedden GC (2008) *Optical aberrations in a spinning pipe gas lens* Optics Express, Vol. 16, No. 13, pp 9850-9856, 23 June 2008.

4. Mafusire C, Forbes A, Snedden G, Mahlase C, Michaelis MM (2007) *Characterisation of a spinning pipe gas lens using a Shack-Hartmann wavefront sensor*, Proceedings of SPIE, Vol. 6663(6663OH), pp 1-8, 2007.

5. Smith GDJ, Stieger RD and Snedden GC (1999) *Energy and the Environment*, Bejan A, Vadasz P and Kroger D (eds.), Kluwer Academic Publishers, ISBN 0 - 7923-5596-2, p 175-184.

Conference Articles:

1. Bergh J, Meyer C and Snedden G (2013) *Optimisation of Non-Axisymmetric Endwall Contours for the Rotor of a Low Speed 1 ½ Stage Turbine*, AfriCOMP, July 2013.

2. Dunn D, Snedden G and Von Backström, TW (2013) *An Unsteady Numerical Analysis Of A Generic Non-axisymmetric Turbine Endwall In A 1 ½ Stage Turbine Test Rig, Proceedings of IASSA 2013.*

3. Wegman E, Snedden G, Van Der Spuy SJ, F Holzinger, HP Schiffer, H Mårtensson and J Őstlund (2014) *The Development of an Air Injection System for the Forced Response Testing of Axial Compressors,* GT2013-96011, ASME IGTI 2013.

4. Dunn D, Snedden G and Von Backström, TW (2013) *Unsteady Effects Of A Generic Non-Axisymmetric Endwall Contour On The Rotor Of A 1 ½ Stage Low Speed Turbine Test Rig,* GT2013-94961 ASME IGTI 2013.

5. Smyth J, Brooks M, Bindon JP, Smith GDJ and Snedden GC (2012) *The Design of a Kerosene Turbopump for a South African Commercial Launch Vehicle,* AIAA Joint Propulsion Conference, August 2012.

6. Bergh JO, Snedden GC and Meyer C (2012) *Optimization of Non-Axisymmetric End Wall Contours for the Rotor of a Low Speed, 1 1/2 Stage Research Turbine with Unshrouded Blades,* GT2012-68569, ASME 2012.

7. Dunn, D, Snedden, G, Roos T and Hildebrandt T (2011) *Application of transition modelling in CFD for use with turbine blades*. 20th ISABE Conference, Gothenburg, Sweden, 12-16 September 2011.

8. Meyers, BC, Snedden, GC, Meyer, JP, Roos TH and Mahmood GI. (2011). *Experimental results showing the internal three-component velocity field and outlet temperature contours for a model gas turbine combustor*. International Symposium on Air Breathing Engines, Gothenburg, Sweden, September 12-16, 2011.

9. Dunn, D, Snedden, G and Von Backström, TW. (2010). *Experimental investigation into the unsteady effects on non-axisymmetric turbine endwall contouring*. 7th South African Conference on Computational and Applied Mechanics (SACAM10). Pretoria, 10-13 January 2010, pp 1-11.

10. Snedden G, Wegman E, Van Zyl L, Dunn D and Grobler J-H,(2010) An excitation System for Fan Blade Flutter Experimentation" Proceedings of IASSA 2010.

11. Snedden, G, Dunn, D, Ingram, G and Gregory-Smith, D. (2010). *Performance of a generic non-axisymmetric end wall in a single stage, rotating turbine at on and off-design conditions*. ASME Turbo Expo 2010: Power for Land, Sea and Air. Glasgow, 14-18 June 2010, pp 12.

12. Snedden, G, Dunn, D, Von Backstrom TW and Ingram G (2010). *Observations on the selection of objective function for the optimisation of turbine endwalls using computational fluid dynamics*. 7th South African Conference on Computational and Applied Mechanics (SACAM10). Pretoria, 10-13 January 2010, pp 1-15.

13. Snedden G (2009) *The future of gas turbine technology and developments in South Africa*, IASSA 2009.

14. Snedden G, Dunn D, Ingram G and Gregory-Smith D, *The Application Of Non-Axisymmetric Endwall Contouring In A Single Stage, Rotating Turbine*, In Proceedings of ASME Turbo Expo 2009, GT2009-59169, 2009.

15. Snedden G, Dunn D, Zwane N and Schipani C VITAL TTC T6.2.10: Unsteady Endwall Contouring Investigation of Turbine Endwall Contouring, VITAL Final Workshop, Budapest 2009.

16. Mafusire, C, Forbes, A, Michaelis, MM and Snedden, G. (2009). *Wave aberrations in a spinning pipe gas lens*. 7th International Workshop on Adaptive Optics for Industry and Medicine., White Lake Resort Shatura, Russia, 8-11 June 2009, pp 22.

17. G Snedden, D Dunn, TH Roos and D Gregory-Smith (2007) *Characterisation of a Refurbished 1 ½ Stage Turbine Test Rig for Flowfield Mapping behind Blading with Non-Axisymmetric Contoured Endwalls,* ISABE 2007-1363, ISBN 1-56347-931-1.

18. Snedden G, Roos T and Naidoo K (2005) *Detailed Disc Assembly Temperature Prediction: Comparison Between CFD and Simplified Engineering Methods* ISABE-2005-1130, September 2005.

19. Snedden G and Lambert T (2003) *A CFD Analysis of the impingement cooling effect of the coolant jet caused by the T56 1st stage disc metering hole*, ISABE 2003-1065, September 2003.

20. Snedden G (2003) *Quasi 3D CFD Flow Simulation of a Turbojet Disc Cavity with Conjugate Heat Transfer*, ISABE 2003-1179, September 2003.

21. Dunn D, Snedden GC, and Von Backström, TW. 2009. *Turbulence model comparisons for a low pressure 1.5 stage test turbine*. 19th Conference of the International Society for Air Breathing Engines, Montreal, Quebec, Canada, 7-11 September 2009, pp 7.

22. Meyers, BC, Snedden, GC, Meyer, JP, Roos TH and Mahmood GI. (2009). *Three-dimensional particle image velocimetry in a generic can-type gas turbine combustor*. 19th Conference of the International Society for Air Breathing Engines, Montreal, Quebec, Canada, 7-11 September 2009.

23. Mafusire C, Forbes A, Snedden G, Mahlase C, Michaelis MM (2006) *CFD Model of*

a Spinning Pipe Gas Lens, paper C21, 51st Annual Conference of the South African Institute of Physics, Cape Town, 3-7 July 2006.

24. Mafusire, C, Forbes, A, Snedden, GC, Mahlase ACK, Michaelic MM and Mathuthu MI, (2006), *Gas lensing in a heated spinning pipe*. 51st Annual Conference of the SAIP, University of the Western Cape, South Africa, 3-7 July 2006, pp 1.

25. Gazendam, A, Bosscha, P, Donovan, S, Eksteen J, Haarhof J, Horn U, Mahlase C, Matthee K, Naidoo T, Snedden G, Van Niekerk H and Vogt D. 2006. Inclusive vision ofr high performance computing at the CSIR. CSIR Research and Innovation Conference: 1st CSIR Biennial Conference, CSIR International Convention Centre Pretoria, 26-27 February 2006, pp1.

26. Scheepers G, Morris RM, Visser JA, Roos TH, Snedden GC (2006*) Experimental and Numerical Study of Near Bleed Hole Heat Transfer Enhancement in Internal Turbine Blade Cooling Channels*, SACAM 2006.

27. Steenkamp A, Snedden G, Quinn R and Tait R (2005) *Determination of the Material Properties of a Modern SLA Resin under Fatigue,* RAPDASA 2005.

28. Steenkamp A, Snedden G, Quinn R and Tait R (2005) *Secondary Loss Reduction in Modern Turbines using Endwall Profiling*, RAPDASA 2005.

29. Stieger R, Smith GDJ, Snedden G (1998) *Advances in the Measurement of Convective HeatTransfer Coefficient in Gas Turbine Applications,* Presented at the Binational Symposium on Energy Environment, ICC Centre, Durban, June 1998.

30. Kirsten T, Lippert A, Snedden G, Smith GDJ (1996) *Experimental Measurement and CFD Prediction of Heat Transfer to a Nozzle Guide Vane*, ASME Paper 96-GT-237 Presented at the 1996 ASME congress, Birmingham, UK.

Technical/Research Reports:

1. 63 Confidential Technical Reports, Client: SANDF/DoD/Armscor and Local industry

2. 20 Confidential Research Management Reports, Client: DoD/Armscor

3. 1 Confidential report to Rolls Royce Corporation, T56-A15-LFE Spacer Programme

4. 3 Deliverable and 3 Milestone Reports to VITAL FP6 European Project

5. 6 Deliverable Reports FUTURE FP7 European Project

Popular Articles:

1. Snedden G (2009) *South Africa's future role in gas turbine engines for aircraft propulsion*, World Airnews, Vol. 37, Issue No. 9, TCE Publishers.

2. Three articles for the CSIR's Sciencescope

Journal Articles under production:

1. Dunn D, Snedden G and Von Backström, TW (2013) *An Unsteady Numerical Analysis Of A Generic Non-axisymmetric Turbine Endwall In A 1 ½ Stage Turbine Test Rig,* Aerospace Journal, RAeS*.*
2. Snedden G, Dunn D, Ingram G, Bergh J and Huyssen B (2013) *Overview of UK/SA Research on Turbine Aerodynamics, Secondary Loss Mechanisms and their Alleviation*, Aerospace Journal, RAeS.
3. Snedden G, Dunn D, Ingram G (2014) The Performance of a Generic Non-axisymmetric End wall in a Single Stage, Rotating Turbine at On and Off-Design Conditions, Journal of Turbomachinery, ASME.

Conference Papers under review:

1. Dunn D, Snedden G and Von Backström, TW (2014) *Unsteady Effects of a Generic Non-Axisymmetric Rotor Endwall Contour on a 1½ Stage Turbine Test Rig at off Design Conditions,* GT2014-25524 ASME IGTI 2014.

External Examiner:

MSc and MEng Thesis Examination on multiple occasions for:

- University of Cape Town
- University of KwaZulu Natal
- Stellenbosch University

External Oral Examiner University of Pretoria Final Year Research Projects
Moderator for Final year projects, University of Johannesburg

Invited Session Chair

1. ISABE Conference since 2000
2. IASSA
3. SACAM
4. ASME IGTI 2009

Reviewer

1. ISABE Conference
2. IASSA Conference
3. SA Journal of Mechanical Engineering

4. ASME IGTI Conference

Languages

1. English: Home Language
2. Afrikaans: Fluent

Nationality

South African
ID Number 720523 5084 082

National Security Clearance Rating: Secret

References

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Department of Science and Technology
National Point of Contact: Aeronautics
Chief Director: Technology Localisation & advanced Manufacturing
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bgerryts@gmail.com