

Assoc. Prof. Stefan B. Williams

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1. Background Information

a. Education

1998 – 2001 University of Sydney Sydney, NSW
PhD in Field Robotics (School of Aerospace, Mechanical and Mechatronic Engineering)

- Thesis entitled “*Efficient Solutions to Autonomous Mapping and Navigation Problems*” investigates computational efficiency in the Simultaneous Localisation and Mapping problem

1992 – 1997 University of Waterloo Waterloo, ON
Bachelor of Honours Systems Design Engineering

- Member of Dean's list, graduating with first class honours
- Option in Management Sciences

b. Scholarships, Awards, Prizes

2010 Faculty of Engineering AMME Outstanding Teaching Award

- Awarded Outstanding Teaching Award for the School of Aerospace, Mechanical and Mechatronic Engineering.

2005 NSW Young Tall Poppies Science Award

- The Tall Poppy Campaign was established by the Australian Institute of Political Science to promote awareness of Australia's intellectual achievements among the Australian public. This award recognises the achievements of outstanding young researchers in the sciences.

1998 – 2001 University of Sydney Sydney, NSW

- International Postgraduate Research Scholarship, 1998-2001
- International Postgraduate Award, 1998-2001
- Department of Mechanical Engineering Overseas Conference Travel Grant, 2000
- Postgraduate Research Support Scheme, 2001

1992 – 1997 University of Waterloo Waterloo, ON

- Member of Dean's list, graduating with first class honours
- Awarded Undergraduate Research Assistantship and Faculty of Engineering Upper Year Scholarship

c. Research Grants and Contracts

July 2010 – June 2013 Australian Research Council Super Science Fellowship
Machine Assisted, Multi-scale Spatial and Temporal Observation and Modelling of Marine Benthic Habitats

- (S. Williams, M. Byrne, W. Figuera, N. Barrett) Principle CI in project examining techniques for extracting information from large volumes of image and associated data collected by Autonomous Underwater Vehicle systems

Jan. 2010 – Dec 2014 Australian Research Council Discovery Grant

Cost-effective Autonomous Technologies for Long Term Monitoring of Marine Protected Areas

- (O. Pizarro, S. Williams, M. Jakuba, R. Eustice, L. Whitcomb) CI in project developing algorithms and methods for long term monitoring of marine protected areas

- Jan. 2010 – Dec 2012 Australian Research Council Linkage Grant
Autonomous Repeatable Surveys for Long Term Monitoring of Marine Habitats
- (S. Williams, O. Pizarro, M. Jakuba) Principle CI in project developing algorithms for repeated surveys of marine habitats
- Jan. 2008 – Dec 2010 Australian Research Council Discovery Grant
Autonomous Exploration and Characterization of Benthic Habitats Linked to Oceanographic Processes
- (S. Williams) Principle CI in project developing algorithms and methods capable of producing detailed spatio-temporal reconstructions of natural marine environments using data collected by a survey capable AUV
- Sept. 2007 – Oct. 2007 Marine National Facility Ship Time
Evolution of drowned shelf edge reefs in the GBR: Implications for understanding abrupt climate change, coral reef response and modern deep water benthic habitats
- (J. Webster, R. Beaman, P. Davies and S. Williams) Three week Southern Surveyor Ship Time awarded to study drowned reefs along the Great Barrier Reef
- July 2007 – June 2009 National Collaborative Infrastructure Scheme
Integrated Marine Observing System (IMOS) AUV Facility
- (S. Williams and O. Pizarro) Establishment of AUV facility providing access to high resolution imaging AUV
- May 2007 Australian Institute for Marine Science Ship Time
Biodiversity Assessment off Ningaloo Reef System, WA
- (M. Rees, S. Williams, O. Pizarro) Ten days ship time document biodiversity off the Ningaloo Reef System, WA
- Jan. 2005 – Dec. 2007 Australian Research Council Discovery Grant
Decision making and mission planning for Unmanned Underwater Vehicles
- (S. Williams and A. Blair) Principle CI in project investigating explore the unique requirements for coordinated navigation and control of AUV systems
- June 2004 – June 2007 Australian Research Council Linkage Grant
Environment modelling of Great Barrier Reef habitats using Autonomous Transect Surveying
- (S. Williams and A. Salih) Principle CI in project developing algorithms and methods suitable for modeling unstructured, reef environments using data collected by an autonomous robotic system capable of surveying the Great Barrier Reef
- July. 2003 – July 2006 Australian Research Council Linkage Grant
Fish-Bird: Autonomous Interactions in a Contemporary Arts Setting
- (M. Velonaki, D. Rye, S. Scheduling, S. Williams) CI in project exploring autokinesis and the behavioural patterns that evolve between people and autokinetic machines
- Dec. 2002 – present Australian Research Council Centre of Excellence
ARC Centre of Excellence for Autonomous Systems
- Named researcher in the ARC Centre of Excellence for Autonomous Systems

Other Grants: University, state government, etc.

- Faculty of Engineering Major Equipment Grant (2009) with Dr. Oscar Pizarro and Dr. Michael Jakuba, Hybrid gliding AUV
- Sesqui Major Equipment Grant (2007) with Prof. Peter Davies and Prof Maria Byrne
- Sesqui Research and Development Grant (2005) with Dr. Maria Byrne (CHS USyd) - Autonomous Modelling of Sediment Dynamics
- Sesqui Major Equipment Grant (2004) – Purchase of a deepwater capable Unmanned Underwater Vehicle from Woods Hole Oceanographic Institution
- Sesqui Research and Development Grant (2004) – Demonstration of Terrain Aided Navigation

- Sept. 2008 – Jan. 2010 *Australian Hydrographic Office* Sydney, NSW
Research Project
- Project examining the development of littoral surveying tools
- April. 2004 – Oct. 2008 *Commonwealth of Australia* Sydney, NSW
System Development
- Defence Science and Technology Organization/CSI WA - Development of the next generation of Rover target training vehicle
- Feb. 2003 – May 2004 *Patrick Technology* Sydney, NSW
Consultant
- Consulting services relating to the automation of port facilities
- Nov. 2001 – Feb. 2002 *Seabed Mapping Intl. Ltd.* Nelson, NZ
Consultant
- Feasibility analysis of a proposed tracking system for a towed, submerged body
- June 1999 – June 2000 *Marine Platforms Division, DSTO* Melbourne, VIC
Consultant
- Provided navigation, software and hardware consulting services related to the development of next generation Autonomous Underwater Vehicle (AUV) design undertaken by Defence Science and Technology Organisation (DSTO)

4. Teaching Experience

- Ten years teaching experience
- Units of study include
 - AMME 3500 System Dynamics and Control
 - AMME 4101/2 Thesis
 - MTRX 1701 Introduction to Mechatronic Engineering
 - MTRX 4700 Experimental Robotics
- Student supervision including
 - 12 PhD students (4 completions)
 - 3 Masters student (3 completion)
 - 40+ Undergraduate thesis students

5. Research Interests

- Simultaneous Localisation and Mapping
- Autonomous Underwater Vehicles
- Navigation and control for autonomous systems
- Estimation theoretic data fusion
- Sensor management
- Vision, laser and sonar based terrain-aided navigation
- Artificial intelligence

6. Services

- a. Reviewer for Professional Journals
- IEEE Transactions on Robotics
 - Robotics Society of Japan's Advanced Robotics
 - Journal of Field Robotics
 - International Journal of Robotics Research
 - IEEE Journal of Oceanic Engineering

- b. Reviewer for Professional Conferences
 - Robotics Science and Systems
 - International Symposium on Robotics Research
 - Field and Service Robotics
 - IEEE International Conference on Robotics and Automation
 - IEEE/RSJ International Conference on Intelligent Robots and Systems
- c. Conference Organizing Committee
 - Robotics Science and Systems, 2010 and 2011
 - IEEE International Conference on Robotics and Automation 2011
 - IEEE Oceans Sydney 2010
 - New Constellations: Art, Science and Society, 2006
- d. Conference Program Committee
 - IEEE International Conference on Robotics and Automation, 2011
 - IEEE/RSJ International Conference on Intelligent Robots and Systems, 2006
 - Australasian Conference on Robotics and Automation, 2005-2010

7. Publications (Last 5 years)

Book

1. S.B. Williams, *Efficient Solutions to Autonomous Mapping and Navigation Problems*, VDM Verlag, Germany, 2009

Book Chapters

2. S.B. Williams, O. Pizarro, I. Mahon and M. Johnson-Roberson, "Simultaneous Localisation and Mapping and Dense Stereoscopic Seafloor Reconstruction using an AUV", in G. Pappas, V. Kumar and O. Khatib, *Springer Tracts in Advanced Robotics*, Vol. 54, pages 407-416, 2008
3. A. Brooks, T. Kaupp, A. Makarenko, S.B. Williams and A. Oreback, "Orca: A Component Model and Repository.", In *Principles and Practice of Software Development in Robotics*, Springer, pages 231-251, 2006
4. S.B. Williams, I. Mahon, "Terrain Aided Localisation and Mapping for Marine Environments", in M. Ang and O. Khatib, editors, *Springer Tracts in Advanced Robotics*, Vol. 21, pages 111 - 120, 2006
5. A. Brooks, A. Makarenko, T. Kaupp, S. Williams, and H. Durrant-Whyte. "Implementation of an indoor active sensor network". In M. Ang and O. Khatib, editors, *Springer Tracts in Advanced Robotics*, Vol. 21, pages 397-406. Springer, 2006.

Papers - International Refereed Journals

6. T.C.L. Bridge, T.J. Done, A. Friedman, R.J. Beaman, S.B. Williams, O. Pizarro and J.M. Webster, "Variability in mesophotic coral reef communities along the Great Barrier Reef, Australia", *Marine Ecology Progress Series*, accepted 21/01/2011
7. S. Barkby, S.B. Williams, O. Pizarro and M. Jakuba, "A Featureless Approach to Efficient Bathymetric SLAM using Distributed Particle Mapping", *Journal of Field Robotics*, 28(1):19-39, 2011
8. T. Bridge, T. Done, R. Beaman, A. Friedman, S.B. Williams, O. Pizarro and J. Webster, "Topography, substratum and benthic macrofaunal relationships on a tropical mesophotic shelf margin, Great Barrier Reef, Australia", *Coral Reefs* 30: 143-153, 2011
9. P. Rigby, S.B. Williams and O. Pizarro, "Towards Adaptive Benthic Habitat Mapping using Gaussian Process Classification", *Journal of Field Robotics*, 27(6), pages 741-758, 2010

10. S.B. Williams, O. Pizarro, J. Webster, R. Beaman, I. Mahon, M. Johnson-Roberson and T. Bridge, "AUV-assisted surveying of drowned reefs on the shelf edge of the Great Barrier Reef, Australia", *Journal of Field Robotics*, vol. 27(5), 2010, pp. 675-697
11. M. Johnson-Roberson, O. Pizarro, S.B. Williams, "Generation and Visualization of Large Scale 3D Reconstructions from Underwater Robotic Surveys", *Journal of Field Robotics*, Vol. 27(1), Pages 21 – 51, 2010
12. D. Steinberg, A. Bender, A. Friedman, M. Jakuba, O. Pizarro and S.B. Williams, "Toward Selection of a Propulsion Method for a Long Range Benthic Imaging AUV", *Marine Technology Society Journal*, 44(2), Pages 46-55, 2010
13. I. Mahon, S.B. Williams, O. Pizarro and M. Johnson-Roberson, "Efficient View-Based SLAM Using Visual Loop Closures", *Robotics, IEEE Transactions on*, 24(5):1002-1014, 2008
14. J. Webster, R. Beaman, T. Bridge, P. Davies, M. Byrne, S.B. Williams, P. Manning, O. Pizarro, K. Thornborough, A.A. Thomas, and S. Tudhope, S. "From corals to canyons: The great barrier reef margin". *EOS, Transactions American Geophysical Union*, 89(24):217–218, 2008
15. A. Brooks, A. Makarenko, S.B. Williams, and H.F. Durrant-Whyte, "Parametric POMDPs for Planning in Continuous State Spaces", *Robotics and Autonomous Systems*, 2006

Papers - International Refereed Conferences

16. D. Steinberg, S.B. Williams, O. Pizarro and M. Jakuba, "Towards autonomous habitat classification using Gaussian Mixture Models", *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 4424-4431, 2010
17. D. Steinberg, O. Pizarro, S.B. Williams & M.V. Jakuba. "Dirichlet process mixture models for autonomous habitat classification". *Proceedings of IEEE Oceans 2010*, Sydney, Australia
18. A. Friedman, O. Pizarro & S.B. Williams. "Rugosity, slope and aspect from bathymetric Stereo image reconstructions". *Proceedings of IEEE Oceans 2010*, Sydney, Australia
19. L. Medagoda, M.V. Jakuba, O. Pizarro & S.B. Williams. "Water column current profile aided localisation for autonomous underwater vehicles". *Proceedings of IEEE Oceans 2010*, Sydney, Australia
20. M. Jakuba, O. Pizarro & S.B. Williams. "High resolution, consistent navigation and 3D optical reconstructions from AUVs using magnetic compasses and pressure-based depth sensors". *Proceedings of IEEE Oceans 2010*, Sydney, Australia
21. N. Barrett, J. Seiler, T. Anderson, S.B. Williams, S. Nichol & N. Hill. "Using an autonomous underwater vehicle to inform management of biodiversity in shelf waters". *Proceedings of IEEE Oceans 2010*, Sydney, Australia
22. S.B. Williams, O. Pizarro, M. Jakuba, I.J. Mahon, S.D. Ling, and C.R. Johnson, 'Repeated AUV Surveying of Urchin Barrens in North Eastern Tasmania', In *Proc. 2010 IEEE International Conference on Robotics and Automation*, pp. 293-299
23. D. Rao and S.B. Williams, 'Large-scale path planning for underwater gliders in ocean currents', *Proc. 2009 Australasian Conf. on Robotics and Automation (ACRA)*, 8 pp., Sydney, Australia, 2-4 December
24. S.A. Barkby, S.B. Williams, O. Pizarro and M. Jakuba, 'An efficient approach to bathymetric SLAM', *Proc. IEEE/RSJ Int. Conf. on Intelligent Robots and Systems, (IROS 2009)*, pp. 2525-2530, St Louis, USA, 11-15 October.
25. S.A. Barkby, S.B. Williams, O. Pizarro and M. Jakuba, 'Incorporating prior bathymetric maps with distributed particle bathymetric SLAM for improved AUV navigation and mapping', *Proc. OCEANS 2009 MTS/IEEE Biloxi Conf. & Exhibition*, 7 pp., Biloxi, USA, 26-29 October.
26. S.B. Williams, O. Pizarro, M. Jakuba, N. Barrett, "AUV Benthic Habitat Mapping in South Eastern Tasmania", *The 7th International Conference on Field and Service Robotics*, 2009

27. M. Johnson-Roberson, O.R. Pizarro, and S.B. Williams, 'Towards large scale optical and acoustic sensor integration for visualization,' *Proc. Oceans 2009 IEEE Bremen*, 4 pp., Bremen, Germany, 11-14 May.
28. O.R. Pizarro, S.B. Williams, and J. Colquhoun, 'Topic-based habitat classification using visual data', *Proc. Oceans 2009 IEEE Bremen*, 8 pp., Bremen, Germany, 11-14 May
29. S.B. Williams, O. Pizarro, M. How, D. Mercer, G. Powell, J. Marshall and R. Hanlon, "Surveying Nocturnal Cuttlefish Camouflage Behaviour using an AUV", *IEEE International Conference on Robotics and Automation*, pages 214-219, 2009
30. S.B. Williams, O. Pizarro, J. Webster, R. Beaman, M. Johnson-Roberson, I. Mahon and T. Bridge, "AUV-assisted Surveying of Relic Reef Sites", *Proc. Of the MTS/IEEE Oceans*, Quebec, Canada, Sept. 2008
31. O. Pizarro, J. Colquhoun, P. Rigby, M. Johnson-Roberson and S.B. Williams, "Towards Imagebased Marine Habitat Classification", *Proc. Of the MTS/IEEE Oceans*, Quebec, Canada, Sept. 2008
32. S.B. Williams, O. Pizarro, I. Mahon and M. Johnson-Roberson, "Simultaneous Localisation and Mapping and Dense Stereoscopic Seafloor Reconstruction using an AUV", *Proc. of the International Symposium on Experimental Robotics*, Athens, Greece 2008
33. A. Brooks and S.B. Williams "A Monte Carlo Update for Parametric POMDPs", *Proceedings of the International Symposium on Robotics Research*, Hiroshima, Japan, 2007
34. P. Rigby, O. Pizarro, S.B. Williams and J. Colquhoun, "Effective Benthic Surveying with Autonomous Underwater Vehicles", *Proceedings of the MTS/IEEE Oceans Conference*, Vancouver, 2007
35. M. Johnson-Roberson, S. Kumar, O. Pizarro and S.B. Williams, "Stereoscopic imaging for coral segmentation and classification", *Proceedings of the MTS/IEEE Oceans Conference*, Boston, 2006
36. P. Rigby, O. Pizarro, and S.B. Williams, "Towards Geo-Referenced AUV Navigation Through Fusion of USBL and DVL Measurements", *Proceedings of the MTS/IEEE Oceans Conference*, Boston, 2006.
37. S.B. Williams, O. Pizarro, I. Mahon, P. Rigby, M. Johnson-Roberson, and M. Rees, "Autonomous Underwater Vehicle Surveying on the North West Continental Shelf of Australia", *Proceedings of the Australian Marine Science Association Conference*, Cairns, 2006
38. M. Johnson-Roberson, S. Kumar, and S.B. Williams, "Segmentation and Classification of Coral for Oceanographic Surveys: A Semi-Supervised Machine Learning Approach", *Proceedings of the IEEE Oceans Conference*, Singapore, 2006
39. S. Williams, O. Pizarro, I. Mahon, P. Rigby, M. Johnson-Roberson, "Marine Robotic Systems at the ARC Centre of Excellence for Autonomous Systems", *Proceedings of the PACIFIC 2006 International Maritime Conference*, 2006

Other publications

40. T. Bridge, P. Bongaerts, N. Englebort, E. Sampayo, T. Ridgway, M. Rodriguez-Lanetty, S.B. Williams, O. Pizarro, J. Webster, J. and O. Hoegh-Guldberg, "Scleractinian Corals and their associated Symbiodinium on Mesophotic Coral Ecosystems of the Great Barrier Reef", Poster at International Coral Reef Symposium, Florida, USA, July, 2008
41. S.B. Williams, O. Pizarro, I. Mahon, M. Johnson-Roberson, and P. Rigby, "The IMOS AUV Facility", Australian Marine Science Association Conference, Christchurch, New Zealand 2008
42. S.B. Williams, O. Pizarro, I. Mahon, M. Johnson-Roberson, P. Rigby and S. Barkby, "Advances in Autonomous Benthic Surveying and Characterization of Benthic Habitats", Ocean Sciences 2008 Meeting, Orlando, Florida, 2008
43. M. Johnson-Roberson, O. Pizarro, S.B. Williams and M. Rees, "Identifying novel benthic habitats in high resolution AUV imagery", Australian Marine Science Association Conference, Melbourne, Australia 2007

44. P. Rigby, O. Pizarro and S.B.Williams, "Improved AUV navigation through multi-sensor data fusion", *Sea Technology*, 48(3), pages 15-22, March 2007
45. S.B. Willams, O. Pizarro, I. Mahon, P. Rigby, M. Johnson-Roberson, and M. Rees, "Autonomous Underwater Vehicle Surveying on the North West Continental Shelf of Australia", Australian Marine Science Association Conference, Cairns, Australia 2006
46. O. Pizarro, S.B.Willams, I. Mahon, P. Rigby, M. Johnson-Roberson and C. Roux, "Advances in Underwater Surveying and Modelling from Robotic Vehicles on the Great Barrier Reef", Ocean Sciences 2006 Meeting, Honolulu, Hawaii, 2006
47. S.B. Williams, O. Pizarro, I. Mahon, P. Rigby, M. Johnson-Roberson, "Marine Robotic Systems at the ARC Centre of Excellence for Autonomous Systems", Proc. of the PACIFIC 2006 International Maritime Conference, Sydney, 2006

8. References

- Available on Request