

# **Robert Hall**

specialty: Maintenance Engineering; Mining Equipment Design & Automation

Associate Professor

## **Direct Contact Information**

Rm: 511 Frank Forward

Tel.: 604 822 0066

Fax: 604 822 5599

robhall@mining.ubc.ca

## **Additional Responsibilities**

Associate Dean Engineering Students

Director

Mine Automation / Environmental Simulation Laboratory (MAESL)

## **Biography**

Mining was certainly never an initial choice. It just happened in the course of perusing other things. I started out life in rural New Brunswick and left school early to work in the food processing industry. After a few years I pursued an undergraduate degree in mechanical engineering at the University of New Brunswick. After getting my degree I spent four years in the steel construction industry working around Ontario and a brief stint in Regina. Having received an NSERC grant at the end of my undergrad degree (which I deferred) I decided to pursue a masters degree before it expired. The NSERC grant allowed me the option of selecting both the university and the degree of my choice. In the end I chose Queen's mechanical engineering and went to work on a mining engineering project in Chile.

As a result of this experience I chose to get a Ph.D. in mining engineering with an emphasis on mechanical applications. I saw that the global aspect of mining would

provide the best opportunity for new research and travel. In addition, there are more challenges in the mining industry than in any other engineering discipline. During my Ph.D. I was able to do contract research with Inco in Sudbury and Syncrude in Fort McMurray.

My experience in Fort McMurray and Sudbury led me to specialize in mining equipment design and control because mining has the biggest and most technically advanced equipment in the world. A good example of this is the 797 caterpillar haul truck. At 350 tons haul capacity, it can carry a fully loaded 747 jet, including passengers and fuel.

Based on my experiences in university, choosing academia over higher-paying industrial opportunities was, for me, an easy choice. I could see that an academic career path would offer flexibility in lifestyle and research as well as on-going learning opportunities. I enjoy teaching as it provides with an opportunity to positively influence students to excel not only in their engineering studies, but in life as well.

A major portion of life outside work is taken up with sports and personal development. I'm active in all kinds of sports, but most particularly in Ironman triathlons, for which I've traveled across Canada, and in 2003, Australia. I also enjoy spending time with family and friends.

### **Research Interests**

- Mine Automation
- Equipment Maintenance and reliability
- Wear and material
- Crushing and plant optimization

## **REFEREED PUBLICATIONS**

### **Journal Articles**

18. Gosal, A.S., Owen, W. S., Daneshmend, L.K. and Hall R. A., Hydraulic Power Sharing On a Hydrostatic Transmission for a Load-Haul-Dump for Underground Mines Accepted for Publication in Mining Technology: IMM Transactions Section A March 2007

17. Aman C, Poole G., Dunbar, W., Maijer. D. Taghipour, F. and Berube, P. Student learning teams: Viewpoints of team members, teachers and an observer accepted for publication in March 2007 Journal of Engineering Education, A Journal of the Higher Education Academy Engineering Subject Centre
16. Rosario, P.P., Hall, R.A. and Maijer, D. M., 2006 Integration of Gyratory Crusher Liner Wear and Operational Performance for Better Crusher Management Canadian Mining & Metallurgical Institute Bulletin June 2006
15. Ebrahimi , A., Hall, R.A. and Morin, M., 2005 The Evaluation of Equipment Size Effects on Open Pit Mining International Journal of Surface Mining, Reclamation and Environment, Vol 19, No. 1, 41-56
14. Rosario, P.P., Hall, R.A. and Maijer, D. M., 2004 Optimization of Primary Gyratory Crushing at Highland Valley Copper: in Minerals Engineering.
13. Rosario, P.P., Hall, R.A. and Maijer, D. M., 2004 Improved Gyratory Crushing Operation by the Assessment of Liner Wear and Mantle Profile Redesign: Minerals Engineering
12. Kocsis, C., Hardcastle, S. and Hall, R.A., 2004. The Integration of Mine Simulation and Ventilation Simulation to develop a 'Life-Cycle' Mine Ventilation System. Technical note to published in Transactions of the Society of Mining Engineering (Volume 316). (originally referred conference paper 6)
11. Zhou, J., Hall R.A and Rosario, P.P, 2003. The Application of Neural Networks on Mine Equipment Data Analysis. Mining Engineering Published in China in June Vol 3. 38-42
10. Ebrahimi, A., Hall, R.A. and Blackwell. G., 2003. Sizing Equipment for Open Pit Mining - Identifying and Quantifying the Factors. Transactions of the Institution of Mining and Metallurgy, London, Section A (Mining Industry) 112: A171-A179.
9. Hall, R.A. and Daneshmend, L.K. 2003. Reliability and Maintainability Models For Mobile Underground Haulage Equipment, Canadian Mining & Metallurgical Institute Bulletin, June, 159-165.
8. Klein, B., Hall, R.A., Scoble, M. and Morin, M., 2003. Total systems approach to design for underground mine-mill integration. Canadian Mining & Metallurgical Institute Bulletin, January, 65-71.
7. Skinner, T., Hall, R.A., and Sahebkar, M., 2003. The need for technology standards for mobile equipment in the mining industry, Canadian Mining & Metallurgical Institute Bulletin, January, 52-56.
6. Meech, J.A., Scoble, M., Hall, R.A., et al., 2003. CERM3 and its contribution to providing sustainable research for the mining industry. Canadian Mining & Metallurgical Institute Bulletin, January, 72-81.
5. Hall, R.A. and Daneshmend, L.K., 2003. Reliability Modelling of Surface Mining Equipment: Data Gathering and Analysis Methodologies. International Journal of Surface Mining, Reclamation and Environment Vol. 17, No. 3, 139-155.
4. Ebrahimi, A., Hall, R.A. and Scoble, M.J., 2002. The Impact of Technology and Scale on Surface Mining Production Systems. Journal of Mines, Metals & Fuels, October- November, 371-379.
3. Hall, R.A. and Daneshmend, L.K., 2002. Evaluation of Surface Mining Equipment Reliability. Journal of Mines, Metals & Fuels, October- November, 395-400.
2. Hall, R.A., Daneshmend, L.K., Lipsett, M.G., and Wong, J., 2000. Reliability

- Analysis as a Tool for Surface Mining Equipment Evaluation and Selection. Canadian Mining & Metallurgical Institute Bulletin, 93 (1044), 78-82.
1. Hall, R.A., Knights, P.F. and Daneshmend, L.K., 2000. Pareto Analysis and Condition Based Maintenance of Underground Mining Equipment. Transactions of the Institution of Mining and Metallurgy, London, Section A (Mining Industry) 109: A14-A22.

### **Refereed Conference Proceedings**

19. Kashani, A. H, Owen, W. S., Lawrence, P. D. Hall, R.A., Real-Time Robot Joint Variable Extraction from a Laser Scanner 2007 Submitted to IEEE International Workshop on MACHINE LEARNING FOR SIGNAL PROCESSING Formerly the IEEE Workshop on Neural Networks for Signal Processing August 27-29, 2007 • Thessaloniki, Greece
18. Olsen, S.G., Daneshmend, L.K., Hall, R.A. 2006 Matching Machine Design to the Production Process: A Case Study in the Integrated Design of Mobile Equipment and Mining Methods, Proceedings of the 3rd CDEN/RCCI Conference, Toronto, Ontario, June,.
17. Zhou, J, Hall, R.A., Fowler, G., Huntingford, K., 2006. Improve off-the-road tire management through engineering analyses Proceedings of Fifteenth International Symposium on Mine Planning and Equipment Selection, Torino Italy, Sept 20-22.
16. Priyadarshi, S, Hall, R.A., Streit, L., Torjusson, G., 2006. Maintenance Analysis of Haul Trucks Proceedings of Fifteenth International Symposium on Mine Planning and Equipment Selection, Torino Italy, Sept 20-22.
15. Llewellyn, R.J., Hall, R.A., Du, J., 2006 Assessment of Materials for Gouging Abrasion Applications Proceedings of AUSTRIB2006 3 - 6 December Brisbane, Australia.
14. Rosaria, P.P., Hall, R.A. and Maijer, D.M., 2006. The Importance of Liner Geometry and Wear in Crushing. American Society of Mining Engineering Annual General Meeting, St Louis, Missouri, March 26-29, Proceedings published on CD.
13. Murphy, P., Hall, R.A. and Daneshmend, L.K., 2004 Hydrostatic Drive Optimization For Load-Haul-Dump Vehicles. Accepted for presentation and publication in the Proceedings 13th Annual Conference on Mine Planning and Equipment Selection, Wroclaw, Poland Sept 1-3.
12. Rosario, P.P, Hall, R.A., Maijer, D M., 2004 Liner Wear and Performance Investigation of Primary Gyratory Crushers. Comminution 2004, Perth, Australia, March 24-26, published on CD.
11. Kocsis, C., Hall, R.A. and Hardcastle, S., 2004. The Integration of Mine Simulation and Ventilation Simulation to develop a 'Life-Cycle' Mine Ventilation System. Society of Mining Engineering, Annual General Meeting, Denver, Colorado, February 23-25, Proceedings published on CD.
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9. Hunter, R.J., Hall, R.A. and Usher R., 2003. Musselwhite PQ Expansion Phase I Overview. Proceedings of the 16th Canadian Institute Of Mining Operators Conference, Saskatoon, October 19-22, Proceedings published on CD.
8. Kocsis, C., Hall, R.A. and Hardcastle, S., 2003. The Integration of Mine Simulation and Ventilation Simulation to develop a 'Life-Cycle' Mine Ventilation System. Proceedings of APCOM Conference, Published by the South African Institute of Mining and Metallurgy May, Proceedings published on CD.
7. Klein, B., Hall, R.A., Scoble M.J. and Dunbar, W.S., 2003. Simulation of Integrated Underground Mining-Processing. Proceedings of APCOM Conference, South African Institute of Mining and Metallurgy May, Proceedings published on CD.
6. Ebrahimi, A, Hall, R.A. and Scoble, M.J., 2003. Trends in Surface Mining Equipment and their Implications. Publication in Proceedings of the Twelfth International Symposium on Mine Planning and Equipment Selection, Kalgoorlie, Australia, April, Proceedings published on CD.
5. Ebrahimi, A., Hall, R.A. and Blackwell, G., 2003. Modelling the impact of larger equipment on open pit mining operations. American Society of Mining Engineering Annual General Meeting, Cincinnati, Ohio, February 24-26, Proceedings published on CD.
4. Hall, R.A. and Daneshmend, L.K., 2000. Evaluation of mining equipment automation including process considerations and sensitivity analysis. Ninth International Symposium on Mine Planning and Equipment Selection, Athens, Greece, Nov 6-9, 709-713.
3. Hall, R.A., Daneshmend, L.K., Baiden, G., Flynn, T. and Loney E., 1999. Investigation of Equipment Automation Using Maintenance Data Analysis, Reliability Modelling and Simulation. 5th ISMMA and Telemint I Conference, Sudbury, June 14-16, Proceedings published on CD.
2. Hall, R.A., Knights, P.F. and Daneshmend, 1999. Reliability & Maintenance of Mobile Underground Mining Equipment: a Case Study from a Chilean Gold Mine. Maintenance and Reliability. Conference (MARCON'99): "Reliability and Maintenance Initiatives for the New Millennium ", May 10-12, Gatlinburg, Tennessee : 4.01-4.15.
1. Djan-Sampson, M., Daneshmend, L.K., Hall, R.A. and Loney, E., 1998. Reliability Engineering: A Tool for Enhancing Mining Equipment Availability and Reducing Costs. Proceedings World Rock Boring Association Conference –WRBAS '98. Sept. 22-24, Sudbury: 109-115.

#### **Other contributions – industrial R&D publications**

9. Hall R.A., 2004 Comminution for Invisible Mining – Study Final Report, submitted to Placer Dome Technical Services, January, 23 pages.
8. Hall R.A., 2002. Snap Lake Diamond Project Ventilation Heating System Review, submitted to De Beers Ltd, April, 13 pages.
7. Hall, R.A., Daneshmend, L.K., and Marshall, J.A., 2000. Final Report on the Research Contract: Follow-On Reliability Analysis & Production Simulation of Diamond Drills, submitted to INCO Mines Research, Copper Cliff, ON, May, 36

- pages.
6. Hall, R.A., Daneshmend, L.K., and Marshall, J.A., 1999. "Progress Report #1 on Research Contract Follow-On Reliability Analysis & Production Simulation of Diamond Drills", submitted to INCO Mines Research, Copper Cliff, ON, July, 23 pages.
  5. Hall, R.A., Daneshmend, L.K., 1999. "Reliability & Maintenance Analysis of Surface Mining Shovels: Phase I Report", submitted to Syncrude Canada Ltd., May, 27 pages.
  4. Hall, R.A., Daneshmend, L.K., and Djan-Sampson, M., 1998. Failure Analysis, Reliability Modelling, and Simulation, Final Report on the "Reliability Analysis of Diamond Drills" Research Contract, submitted to INCO Mines Research, Copper Cliff, ON, Oct., 96 pages.
  3. Hall, R.A., and Daneshmend, L.K., 1998. Reliability Modeling and Simulation of Diamond Drill, Phase II Technical Report on the "Reliability Analysis of Diamond Drills" Research Contract, submitted to INCO Mines Research, Copper Cliff, ON, June, 15 pages.
  2. Hall, R.A., Knights, P.F., Daneshmend, L.K., 1997. Maintenance Evaluation of Mobile Equipment at El Indio Mine, submitted to Barrick Gold.
  1. Hall, R.A., Knights, P.F., Daneshmend, L.K., 1997. Evaluation of Condition Based Maintenance Practices for Mobile Equipment at El Indio Mine, submitted to Barrick Gold.

## **NON-REFEREED PUBLICATIONS**

### **Journals**

3. Hall R.A., 2004. Taking Time to Appreciate Industry. To be published in Canadian Mining & Metallurgical Institute Bulletin, May.
2. Hall, R.A., 2004. Improving Productivity without Capital Expenditure Canadian Mining & Metallurgical Institute Bulletin, January.
1. Hall, R.A., Mottola, L. 2004. Total Systems Thinking to Tackle Competitive Challenges Canadian Mining & Metallurgical Institute Bulletin, January.

### **Conferences**

13. Zhou, J., Hall R.A., Fowler, G. and Huntingford, K., 2006, "Applications of Engineering Analysis to Improve Tire Management", Proceedings of the Canadian Institute Of Mining Annual General Meeting Conference, May 14-17th Vancouver BC.
12. Olsen S.G., Daneshmend, L.K., Hall R.A., 2006, "Development of a Reef Dozer", Proceedings of the Canadian Institute Of Mining Annual General Meeting Conference, May 14-17th Vancouver BC.
11. Gosal, A., Hall, R.A., Daneshmend, L.K, Murphy, P., 2004, "Research and Development for an Ultra-Low Profile LHD" presented and published in proceedings of the Canadian Institute of Mining Annual General Meeting Conference, Edmonton, AB. May 9-May 12.

10. Rosario P.P., Hall, R.A., Maijer, D. M., 2004 “Integration of Gyratory Crusher Liner Wear and Operational Performance for Better Crusher Management” presented and published in Proceedings of the Canadian Institute Of Mining Annual General Meeting Conference, Edmonton, AB. May 9-May 12.
9. Ebrahimi, A., Hall, R.A., 2004, “The Evaluation of Equipment Size Effects on Open Pit Mining” presented and published in Proceedings of the Canadian Institute Of Mining Annual General Meeting Conference, Edmonton, AB. May 9-May 12.
8. Llewellyn R., Liang, P., Hall, R.A., and Tolfree, D., 2004, “Gouging Abrasion Resistance of Materials for Oil Sands Service” presented and published in the Proceedings of the Canadian Institute of Mining Annual General Meeting Conference. , Edmonton, AB. May 9-May 12.
7. Rosario, P.P. and Hall, R.A., 2003, “Gyratory Crushing Optimization at Primary Gyratory Crushers at Highland Valley Copper”, BC Yukon Canadian Institute of Mining Branch, Annual Meeting, November 28.
6. Murphy, P.F., Marshall, J.A., Hall, R.A., Daneshmend, L.K., and Wild, P.M., 2002, “Advanced Technologies for Mobile Underground Equipment Technology”, Proc. Canadian Institute of Mining Annual General Meeting Mining Millennium Conference, Vancouver, BC. April 28-May 1, Proceedings published on CD.
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4. Hall, R.A., Daneshmend, L.K., Baiden, G., Flynn, T. and Loney E., 2000, “Reliability Modelling and Simulation for Evaluation of Mining Equipment Automation”, Proc. 11th Canadian Institute Of Mining Maintenance Engineering and Operators’ Conference, Sudbury, May 7-10, Proceedings published on CD.
3. Hall, R.A., Daneshmend, L.K., Lipsett, M.G. and Wong, J., 2000, “Reliability Analysis as a Tool for Equipment Evaluation and Selection”, Proc. Canadian Institute of Mining Mining Millennium Conference, Toronto, Ontario. March 5-10,; Proceedings published on CD.
2. Hall, R.A. and Daneshmend, L.K., 1999, “Current Trends in Open Pit Mine Maintenance”, Proc. 14th Canadian Institute Of Mining Mine Operators Conference, Bathurst, February 21-25: 127-135.
1. Hall, R.A., Daneshmend, L.K. and Knights, P.F., 1998, “Reliability Analysis of Mobile Underground Mining Equipment: A Case Study”, Proceedings of the 10th Canadian Institute Of Mining Maintenance Engineering Conference, Maintenance/Engineering 2000 and Beyond, Saskatoon, September 13-15: Proceedings published on CD.