

**THE UNIVERSITY OF BRITISH COLUMBIA**  
***Curriculum Vitae for Faculty Members***

Date: May 21, 2014

1. **SURNAME:** MEECH **FIRST NAME:** JOHN  
**MIDDLE NAME(S):** ATHOL
2. **DEPARTMENT/SCHOOL:** Norman B. Keevil Institute of Mining Engineering
3. **FACULTY:** Applied Science
4. **RANK:** Professor & Director, CERM3 (Centre for Environmental Research in Minerals, Metals and Materials)

**5. POST-SECONDARY EDUCATION**

| University or Institution | Degree      | Subject Area       | Dates |
|---------------------------|-------------|--------------------|-------|
| McGill University         | B. Eng.     | Metallurgical      | 1970  |
| Queen's University        | M.Sc.(Eng.) | Mining Engineering | 1975  |
| Queen's University        | Ph.D.       | Mineral Processing | 1979  |

**Special Professional Qualifications**

Registered Professional Engineer - Professional Engineers and Geoscientists of British Columbia

**6. EMPLOYMENT RECORD**

(a) *Prior to UBC*

| University, Company or Organization  | Rank or Title                              | Dates     |
|--|--|-----------|
| Queen's University, Department of Mining Engineering,<br>Goodwin Hall, Kingston, Ontario | Associate Professor                        | 1982-1989 |
|  | Assistant Professor                        | 1979-1982 |
|  | Adjunct Professor                          | 1976-1979 |
| Roan Consolidated Mines Ltd.,<br>Concentrator, Luanshya, Zambia                          | Senior Assistant<br>Metallurgical Engineer | 1971-1973 |
|  | Assistant Metallurgical<br>Engineer        | 1970-1971 |
| Roan Consolidated Mines Ltd.,<br>Concentrator/Smelter/Refinery, Mufulira, Zambia         | Metallurgist                               | 1969      |
| Quebec Iron and Titanium Corporation,<br>Research Department, Sorel, Quebec              | Metallurgist                               | 1968      |
| Bell-Canada Limited,<br>Expo-67, Montreal, Quebec  | Pavilion Host                              | 1967      |
| Canadian Petrofina Limited,<br>Point-aux-Trembles, Quebec                                | Laboratory Sampler                         | 1966      |

(b) *At UBC*

| Rank or Title       | Dates         |
|---------------------|---------------|
| Director of CERM3   | July 26, 2000 |
| Professor           | July 1, 1998  |
| Associate Professor | 1989 to 1998  |
| Tenure              | 1989          |

7. **LEAVES OF ABSENCE:** July 1, 1996 - June 30, 1997 (Brazil, Chile, Toronto, Australia)

During my Sabbatical leave of absence, I accomplished the following:

- presented an Industrial AI Workshop at the University of Chile, Santiago, Chile (May 96)
- presented a Key Note Address at CCECE, Calgary, Alberta (June 96)
- conducted AI research at Comdale Technologies, Toronto, Ontario (July 96 - Sept. 96)
- presented a Workshop on Mineral Processing at Comdale Technologies, Toronto, Ontario (Sept. 96)
- presented a paper at SAG'96 Conference, Vancouver, BC (Oct. 96)
- presented a Key Note Address at Convergencia'96, Antofagasta, Chile (Oct. 96)
- presented an invited talk on Hg Pollution, University of Toronto, Ontario (Jan. 97)
- presented 3-week Expert Systems Workshop, CETEM R&D Centre, Rio de Janeiro, Brazil (May 97)
- prepared the Technical Program for IPMM'97, Gold Coast, Australia (Jan. - Jun. 97)
- attended IPMM'97 as Program Chairman and delivered three papers (July 97)

## 8. **TEACHING**

(a) Current teaching assignments includes:

MINE 292 Introduction to Processing      MINE 432 Robotics and Industrial Automation  
 MINE 578 Industrial Expert Systems      MINE 496 Advanced Computer Applications in Mining  
 MINE 497H Directed Studies in Autonomous Ground Vehicles

I have also taught Flotation, Unit Operations, Plant Design, Capital Cost Estimation, Precious Metals Processing, Chemistry for Mining Engineers and Engineering Report. In 1991, I assisted Dean Axel Meisen in developing a new course for First Year Engineering students APSC121 - Society and the Engineer, which introduced many social issues such as Professional Engineering Behaviour and Ethics, Sexual Harassment, Employment Equity, First-Nations issues and Safety in the Work Place. I taught this course until 1994. My Industrial Expert Systems course is popular with students from other departments. Many students have developed Expert Systems for use as teaching material in other courses (MINE292, 295, 432). In 2004-2005, I introduced a Directed Studies course in Autonomous Ground Vehicles to develop a robotic vehicle to enter the 2005 DARPA Grand Challenge in California. In 2010, I advised a group of graduate students who formed the UBC Geothermal Working Group to develop a program of study in Geothermal Energy Systems.

(b) *Courses Taught at UBC*

| Session   | Number        | Course Title                              | hours/week      | Class Size |
|-----------|---------------|---|-----------------|------------|
| 2013-2014 | MINE292       | Introduction to Mineral Processing        | 5               | 57         |
|           | MINE 497H     | Autonomous Ground Vehicles                | 3               | 1          |
|           | MINE 432      | Robotics and Industrial Automation        | 5               | 60         |
| 2012-2013 | APSC 150      | Engineering Case Studies (T1 & T2)        | 6x3 & 9x2 weeks | 620        |
|           | MINE 292      | Introduction to Mineral Processing        | 5               | 58         |
|           | MINE 497Z     | Geothermal Energy Systems                 | 3               | 2          |
|           | MINE 432      | Robotics and Industrial Automation        | 5               | 42         |
| 2011-2012 | MINE292       | Introduction to Mineral Processing        | 5               | 46         |
|           | APSC150       | Engineering Case Studies (T1 & T2)        | 6x3 & 9x2 weeks | 460        |
|           | MINE432       | Robotics and Industrial Automation        | 5               | 32         |
| 2010-2011 | MINE292       | Introduction to Mineral Processing        | 5               | 46         |
|           | APSC150       | Engineering Case Studies (T2)             | 6 for 3 weeks   | 420        |
|           | MINE497Z/590X | Introduction to Geothermal Energy Systems | 3               | 35         |
| 2009-2010 | MINE292       | Introduction to Mineral Processing        | 5               | 46         |
|           | MINE432       | Robotics and Industrial Automation        | 5               | 42         |
|           | MINE497H      | Autonomous Ground Vehicles                | 6               | 3          |
| 2008-2009 | MINE292       | Introduction to Mineral Processing        | 5               | 45         |
|           | MINE432       | Robotics and Industrial Automation        | 5               | 37         |
|           | MINE497H      | Autonomous Ground Vehicles                | 6               | 2          |
| 2007-2008 | MINE290       | Introduction to Mining and Processing     | 5               | 45         |
|           | MINE432       | Robotics and Industrial Automation        | 5               | 30         |
|           | MINE578       | Industrial Expert Systems                 | 3               | 1          |

| Session   | Number                         | Course Title                          | hours/week | Class Size |
|-----------|--------------------------------|---------------------------------------|------------|------------|
| 2006-2007 | MINE290                        | Introduction to Mining and Processing | 5          | 36         |
|           | MINE432                        | Robotics and Industrial Automation    | 5          | 26         |
|           | MINE496/578                    | Industrial Expert Systems             | 3          | 5          |
|           | MINE497H                       | Autonomous Ground Vehicles            | 6          | 3          |
| 2005-2006 | MINE290                        | Introduction to Mining and Processing | 5          | 28         |
|           | MINE432                        | Robotics and Industrial Automation    | 5          | 20         |
|           | MINE496/578                    | Industrial Expert Systems             | 3          | 11         |
|           | MINE497H                       | Autonomous Ground Vehicles            | 6          | 15         |
| 2004-2005 | MINE290                        | Introduction to Mining and Processing | 5          | 35         |
|           | MINE432                        | Robotics and Industrial Automation    | 5          | 14         |
|           | MINE497H                       | Autonomous Ground Vehicles            | 6          | 20         |
| 2003-2004 | MINE290                        | Introduction to Mining and Processing | 5          | 22         |
|           | MINE432                        | Robotics and Industrial Automation    | 5          | 17         |
|           | MINE496/578                    | Industrial Expert Systems             | 3          | 8          |
| 2002-2003 | MINE290                        | Introduction to Mining and Processing | 5          | 24         |
|           | MINE432                        | Industrial Automation                 | 5          | 4          |
| 2001-2002 | MMPE290                        | Introduction to Mining and Processing | 5          | 20         |
|           | MMPE432                        | Industrial Automation                 | 5          | 8          |
| 2000-2001 | MMPE290                        | Introduction to Mining and Processing | 5          | 8          |
|           | MMPE432                        | Mineral Process Control               | 5          | 8          |
|           | MMPE496/578                    | Industrial Expert Systems             | 4/4        | 6/4        |
| 1999-2000 | MMPE290                        | Introduction to Mining and Processing | 5          | 24         |
|           | MMPE432                        | Mineral Process Control               | 5          | 8          |
|           | MMPE496/578                    | Industrial Expert Systems             | 4/4        | 3/3        |
| 1998-99   | MMPE290                        | Introduction to Mining and Processing | 5          | 28         |
|           | MMPE431                        | Mine/Mill Feasibility Study           | 4          | 2          |
|           | MMPE432                        | Mineral Process Control               | 5          | 2          |
|           | MMPE494                        | Engineering Report                    | 3          | 14         |
|           | MMPE496/578                    | Industrial Expert Systems             | 4          | 18/4       |
| 1997-98   | MMPE290                        | Introduction to Mining and Processing | 5          | 31         |
|           | MMPE431                        | Mine/Mill Feasibility Study           | 4          | 2          |
|           | MMPE432                        | Mineral Process Control               | 5          | 14         |
|           | MMPE496/578                    | Industrial Expert Systems             | 4/4        | 18/10      |
| 1996-97   | on Sabbatical leave of absence |                                       |            |            |
| 1995-96   | MMPE290                        | Introduction to Mining and Processing | 4          | 18         |
|           | MMPE295                        | Computer Applications in MMPE         | 4          | 18         |
|           | MMPE333                        | Flotation                             | 5          | 18         |
|           | MMPE432                        | Mineral Process Control               | 5          | 8          |
|           | MMPE499/578                    | Industrial Expert Systems             | 4          | 4/8        |
| 1994-95   | MMPE290                        | Introduction to Mining and Processing | 4          | 16         |
|           | MMPE295                        | Computer Applications in MMPE         | 4          | 18         |
|           | MMPE432                        | Mineral Process Control               | 5          | 1          |
|           | MMPE499/578                    | Industrial Expert Systems             | 4/4        | 1/10       |
| 1993-94   | APSC121                        | Society and the Engineer              | 1          | 594        |
|           | MMPE295                        | Computer Applications in MMPE         | 4          | 13         |
|           | MMPE432                        | Mineral Process Control               | 5          | 8          |
|           | MMPE499/578                    | Industrial Expert Systems             | 4/4        | 1/10       |
|           | MMPE590L                       | Real-Time Intelligent Control         | 3          | 1          |
| 1992-93   | APSC121                        | Society and the Engineer              | 1          | 604        |
|           | MMPE290                        | Introduction to Mining and Processing | 4          | 16         |
|           | MMPE395                        | Computer Applications in MMPE         | 4          | 21         |
|           | MMPE432                        | Mineral Process Control               | 5          | 7          |
|           | MMPE499/578                    | Industrial Expert Systems             | 4/4        | 4/12       |
|           | MMPE590L                       | Real-Time Intelligent Control         | 3          | 1          |

| Session | Number      | Course Title                  | hours/week | Class Size |
|---------|-------------|-------------------------------|------------|------------|
| 1991-92 | APSC121     | Society and the Engineer      | 1          | 544        |
|         | MMPE395     | Computer Applications in MMPE | 4          | 14         |
|         | MMPE432     | Mineral Process Control       | 5          | 7          |
|         | MMPE499/578 | Industrial Expert Systems     | 4/4        | 4/10       |
| 1990-91 | APSC121     | Society and the Engineer      | 1          | 564        |
|         | MMPE432     | Mineral Process Control       | 5          | 9          |
|         | MMPE331     | Unit Operations I             | 6          | 18         |
|         | MMPE434     | Precious Metals Processing    | 3          | 14         |
|         | MMPE590M    | Industrial Expert Systems     | 3          | 8          |
| 1990-91 | MMPE432     | Mineral Process Control       | 5          | 5          |
|         | MMPE390     | Summer Report Writing         | 1          | 12         |
|         | MMPE360     | Capital Cost Estimation       | 3          | 12         |
|         | MMPE590M    | Industrial Expert Systems     | 3          | 8          |
| 1989-90 | MMPE432     | Mineral Process Control       | 5          | 5          |
|         | MMPE434     | Precious Metals Processing    | 3          | 14         |

## (c) Graduate Students Supervised

| Student            | Program | Dates                | Topic                                     | Co-supervisor     |
|--------------------|---------|----------------------|---|-------------------|
| Peipei Shi         | M.A.Sc. | 2013-                | Hyperaccumulation of PGMs                 |                   |
| Stephen Mak        | M.A.Sc. | 2012-                | Modeling Geothermal Resources             | E. Eberhardt      |
| Ehsan Esfahanian   | M.A.Sc. | 2012-                | European Truck Facilities and Automation  |                   |
| Sixto Aguero       | M.A.Sc. | 2012-                | Comminution Energy Efficiency             |                   |
| Juliana Parreira   | Ph.D.   | 2008-2013            | Autonomous Haulage Trucks                 |                   |
| Bahador Mousavi    | M.A.Sc. | 2009-2012            | High Impact Velocity Comminution          |                   |
| Jessica Wang       | M.A.Sc. | 2009-2012            | Copper Recovery from Tailings Dams        |                   |
| Sarah Kimball      | M.A.Sc. | 2008-2010            | Geothermal Energy in BC                   |                   |
| Nastaran Arianpoo  | M.A.Sc. | 2007-2009            | Geothermal Energy in Fort Nelson          |                   |
| Babak Khalili      | M.A.Sc. | 2007-2008            | On-line Measurement of Crusher Gap        | R. Hall           |
| Ladan Mohammadi    | Ph.D.   | 2006-2009            | Confined Space Accidents: risk assessment |                   |
| Sepehr Sedrai      | Ph.D.   | 2003-2007            | Energy Efficiency in Comminution          | D. Tromans        |
| Brennan Lang       | Ph.D.   | 2000-2005            | Design of the Millennium Plug             | R. Pakalnis       |
| Ryan Ulansky       | M.A.Sc. | 2001-2003            | Electromagnetic Hoisting                  |                   |
| Karen Wolff        | M.A.Sc. | 1998-2001            | Agglomeration of Tailing Material         |                   |
| Judita Raskaukas   | M.A.Sc. | 1997-2001            | Expert System for ARD Remediation         |                   |
| Vanessa Torres     | Ph.D.   | 1998-99              | Expert System for Gold Plant Design       | A. Chaves (USP)   |
| Ning Dai           | M.A.Sc. | 1997-99              | Acid Rock Drainage at Eskay Creek         |                   |
| Saiedeh Forouzi    | M.Eng.  | 1997-99              | Neural Network Model at Brunswick         |                   |
| Clifford Mui       | M.A.Sc. | 1993-98              | Delay Scheduling for Reheat Furnaces      | P. Barr           |
| Randy Gurton       | Ph.D.   | 1993-97              | Mechanical Signals from Concasting        | I.V.Samarasekera  |
| Kenneth Scholey    | Ph.D.   | 1991-96              | 3-D Model of Billet Reheat Furnace        | P. Barr           |
| Colleen Legzdins   | M.A.Sc. | 1993-96              | Expert System for MMC Design              | I.V. Samarasekera |
| Sunil Kumar        | Ph.D.   | 1992-96              | The 'Intelligent' Mould for Concasting    | J.K. Brimacombe   |
| Philippe Poirier   | M.A.Sc. | 1992-95              | On-line Advising System at HVC            |                   |
| Edgardo Cifuentes  | Ph.D.   | 1994-95*             | Modeling Tonnage Restrictions at HVC      | A.L. Mular        |
| Vladimir Rakocevic | M.A.Sc. | 1993-95              | Real-time Monitoring of Concasting        | I.V.S., J.K.B.    |
| Marcello Veiga     | Ph.D.   | 1993-94 <sup>+</sup> | Reducing Hg Pollution in the Amazon       |                   |
| Paul Benford       | M.A.Sc. | 1991-93              | Off-line Advising System at HVC           |                   |
| Sunil Kumar        | M.A.Sc. | 1989-91              | Diagnosing Quality Issues in Concasting   | I.V.S., J.K.B.    |
| Lester Jordon      | M.A.Sc. | 1988-90              | Adaptive Fuzzy Control of Crushers        |                   |

\* took over supervision of this student in Jan. 1994 from A.L. Mular

<sup>+</sup> student transferred from a Ph.D. program begun in 1990 at the University of Sao Paulo, Brazil

## At Queen's University

| Student           | Program     | Dates   | Topic                                     | Co-supervisor |
|-------------------|-------------|---------|---|---------------|
| ShangYu Wang      | M.Sc.(Eng.) | 1988-90 | Expert System for Mineral Processing      | W.T. Yen      |
| Wesley Ulan       | M.Sc.(Eng.) | 1987-89 | Gold Ore Cyanidation Studies              | W.T. Yen      |
| Donald Hyma       | M.Sc.(Eng.) | 1985-87 | Sands/Slimes Processing at QCM            |               |
| Gregory Baiden    | M.Sc.(Eng.) | 1984-86 | Simulating the Mine/Mill Interface        |               |
| Chris Chapman     | M.Sc.(Eng.) | 1983-85 | Agglomeration using Iron Carbonyl         |               |
| C. Anthony Harris | M.Sc.(Eng.) | 1983-85 | Secondary Crusher Fuzzy Logic Control     |               |
| Miriam Diamond    | M.Sc.(Eng.) | 1982-84 | Environmental Studies of Kognak River     |               |
| Stuart Manktelow  | M.Sc.(Eng.) | 1982-84 | Copper Adsorption on Activated Carbon     | J.G. Paterson |
| Alistair Holden   | M.Sc.(Eng.) | 1983-84 | Regenerating Loaded Activated Carbon      |               |
| Irene Cristoveanu | M.Sc.(Eng.) | 1982-84 | Carrier Flotation of Iron Ores            |               |
| Robert J. Tucker  | M.Sc.(Eng.) | 1980-82 | Simulation of Secondary Crushing          |               |
| Joachim Bayah     | M.Sc.(Eng.) | 1979-81 | Deoxygenation of Air by Backfill Material |               |

## Member of Supervisory Committee or Comprehensive Examination Committee

| Student            | Program        | Dates   | Supervisor     |
|--------------------|----------------|---------|----------------|
| Givemore Sakuhuni  | Ph.D. (Mining) | 2011    | B. Klein       |
| Persio Rosario     | Ph.D. (Mining) | 2010    | R. Hall        |
| Shefa Seigel       | Ph.D. (Mining) | 2007    | M. Veiga       |
| Alaa Abdalla       | Ph.D. (Civil)  | 2004    | Z. Shawwash    |
| Wook Kang          | Ph.D. (Civil)  | 2004    | T. Sahid       |
| Nicolas Lauzon     | Ph.D. (Civil)  | 2001-02 | B. Lence       |
| Reza Ghodsi        | Ph.D. (Mech)   | 2001    | F. Sassani     |
| Arezou Pouria      | Ph.D. (Civil)  | 2001    | T. Froese      |
| Sanjaya de Zoysa   | Ph.D. (Civil)  | 2001    | S.O.D. Russell |
| A. Udaipurwala     | Ph.D. (Civil)  | 2000    | A.D. Russell   |
| Ziad Shawwash      | Ph.D. (Civil)  | 2000    | S.O.D. Russell |
| Khaled El Ghindy   | Ph.D. (Civil)  | 1999    | A.D. Russell   |
| Masood Khoshshaban | Ph.D. (Mech)   | 1997    | F. Sassani     |
| Yihong Zhou        | Ph.D. (Mining) | 1997    | J. Laskowski   |
| Andrew Burkhart    | Ph.D. (Mining) | 1994    | A.L. Mular     |

## University Examiner

| Student               | Program          | Date | Supervisor   |
|-----------------------|------------------|------|--------------|
| Persio Rosario        | Ph.D.            | 2010 | R. Hall      |
| Ana-Carolina da Silva | Ph.D.            | 2008 | M. Veiga     |
| Mark Ma               | Ph.D.            | 2007 | M. Pawlik    |
| Joe Hunter            | M.A.Sc. (Mining) | 2006 | R. Hall      |
| Donald Tolfree        | M.A.Sc. (Mining) | 2004 | R. Hall      |
| E. Bozorgebrahimi     | Ph.D. (Mining)   | 2004 | R. Hall      |
| Persio Rosario        | M.A.Sc. (Mining) | 2003 | R. Hall      |
| Jian Yue              | M.A.Sc (MMPE)    | 2003 | B. Klein     |
| Junqiang Fan          | Ph.D.(ELCE)      | 2003 | G. Dumont    |
| Bernhard Klein        | Ph.D. (MMPE)     | 1991 | J. Laskowski |

- (d) *Continuing Education Activities*  
 - Industrial Short Courses Presented

|           |  |  |
|-----------|--|--|
| Apr. 2002 | Research Opportunities in Mining & the Environment             | CIM/AGM, Vancouver (with CANMET)         |
| Feb. 2002 | Mining Stock Scams: How to identify, police, & eliminate them! | Vancouver, B.C. (MABC and CIM)           |
| May 2000  | Expert Systems in the Mining Industry                          | ISA-Minnesota, Eveleth, Minnesota        |
| Aug. 1999 | Fuzzy Expert Systems for Mining                                | University of Sao Paulo, Brazil          |
| Jun. 1999 | Fuzzy Expert Systems for Mining                                | University of Jujuy, Jujuy, Argentina    |
| May 1998  | Computational Intelligence for realtime systems                | University of Chile, Santiago, Chile     |
| May 1997  | Building Fuzzy Expert Systems                                  | CETEM, Rio de Janeiro, Brazil            |
| May 1996  | Knowledge Engineering for Expert Systems                       | University of Chile, Santiago, Chile     |
| Aug. 1995 | Knowledge Engineering for Expert Systems                       | ATAN, Belo Horizonte, Brazil             |
| May 1995  | Fuzzy Expert Systems   | INCO Limited, Sudbury, Ontario           |
| Dec. 1994 | Fuzzy Expert Systems   | Materials Eng., Univ. Sao Carlos, Brazil |
| May 1993  | Fuzzy Expert Systems   | IEEE Computer Society, Vancouver, BC.    |
| Jul. 1992 | Real Time Control  | Comdale Technologies, Toronto            |
| Aug. 1991 | Industrial Expert Systems                                      | Helsinki Institute of Technology         |
| May 1991  | Industrial Expert Systems                                      | CIM AGM/U.B.C.                           |
| Aug. 1989 | Expert Systems for Metallurgists                               | CIM MetSoc Conf., Halifax                |
| Apr. 1989 | Expert Systems for the Mineral Industry                        | Queen's University                       |
| Mar. 1988 | Expert Systems for the Mineral Industry                        | Queen's University                       |
| Dec. 1988 | Expert Systems for Industry                                    | Laurentian University                    |
| Nov. 1988 | Expert Systems for the Mineral Industry                        | Queen's University                       |

(e) *Visiting Lecturer (indicate university/organization and dates):*

- Oct. 2007 - BHP-Billiton Nickel West Division, Perth, Australia  
 Aug. 2002 - CSIRO Research Laboratories, Sydney, Australia  
 Aug. 2000 - Institute for Materials Research, Kawazoe Lab, Tohoku University, Sendai, Japan  
 Aug. 1999 - Mining Engineering Department, University of Sao Paulo, Sao Paulo, Brazil  
 Aug. 1999 - CVRD Research Centre, Belo Horizonte, Brazil  
 June 1999 - Mining Engineering Department, University of Jujuy, Jujuy, Argentina  
 May 1998 - Department of Mining Engineering, University of Chile, Santiago, Chile  
 May 1997 - CETEM Mineral Research Centre, Rio de Janeiro, Brazil  
 Jan. 1997 - Mining Eng. Program, University of Toronto, Toronto, Canada  
 May 1996 - Department of Electrical Engineering, University of Chile, Santiago, Chile  
 July 1995 - CETEM Mineral Research Centre, Rio de Janeiro, Brazil

**9. SCHOLARLY AND PROFESSIONAL ACTIVITIES**

(b) *Research or equivalent grants (indicate under COMP if grants were obtained competitively (C) or non-competitively (NC)) (Except where indicated, I am the principal investigator on these projects.)*

| YEAR | CONTRACTING AGENCY          | COMP    | TITLE                                    | AMOUNT (\$) |
|------|-----------------------------|---------|--|-------------|
| 2012 | G8 Funding Agencies (NSERC) | C (3yr) | PhytoCAT – Growing PGM Metals ***        | 350,000     |
| 2011 | BHP-Billiton                | NC      | Simulation of Automated Haulage Trucks   | 60,000      |
|      | TLEF/Encompass/Rockwell     | C(A)    | Process Control Simulation Laboratory    | 320,000     |
|      | UBC TLEF                    | C(A)    | Electric Car Project                     | 95,000      |
|      | UBC TLEF                    | C(A)    | Pacific Centre for Geothermal Education  | 95,000      |
|      | UBC TLEF                    | C(A)    | Thunderbots RoboCup Soccer               | 90,000      |
|      | UBC TLEF                    | C(A)    | Thunderbird Robotics                     | 65,000      |
|      | APSC PAF Fund               | C       | Thunderbird Robotics                     | 35,000      |
| 2010 | I.C.E. Fund                 | C       | Fairfield Propagators Geothermal Heating | 1,260,000   |
|      | WorkSafeBC                  | C       | Confined Space Accidents – mine sites    | 29,000      |
|      | BHP-Billiton                | NC      | Simulation of Automated Haulage Trucks   | 60,000      |
|      | UBC TLEF                    | C       | Thunderbird Robotics                     | 118,000     |
|      | APSC PAF Fund               | C       | Thunderbird Robotics                     | 28,000      |

|      |   |               |  |                       |
|------|---|---------------|--|-----------------------|
| 2009 | MITACS / Century Holdings   | C             | Geothermal Energy – District Heating   | 30,000                |
|      | BHP-Billiton  | NC            | Simulation of Automated Haulage Trucks   | 65,000                |
|      | UBC TLEF  | C             | Thunderbird Robotics   | 94,000                |
|      | APSC PAF Fund   | C             | Thunderbird Robotics   | 24,000                |
| 2008 | MITACS / CanGEA   | C             | Geothermal Energy & Spent Oil/Gas Wells  | 30,000                |
|      | BHP-Billiton  | NC            | Simulation of Automated Haulage Trucks   | 75,000                |
|      | APSC PAF Fund   | C             | Thunderbird Robotics   | 30,000                |
| 2007 | Assorted Sponsors   | NC            | The DARPA Urban Challenge  | 60,000                |
|      | Canadian Gov't. NCE Program   | C             | Centre of Excellence in Geothermal Energy  | <del>20,000,000</del> |
|      | APSC PAF Fund   | C             | Thunderbird Robotics   | 24,000                |
| 2006 | Canada Foundation for Innovation++  | C<br>No Award | Canadian Centre for Research in Sustainable Mining   | <del>10,999,997</del> |
|      | APSC PAF Fund   | C             | Thunderbird Robotics   | 22,000                |
|      | NSERC Discovery   | C             | Reducing Energy Consumption in Grinding  | 17,000                |
| 2005 | Walter Gage Fund, APSC PAF, Richmond Chrysler, Domino's, MREF, SmartWorX, CAT Signs, SICK, PNI, Tri-M Systems, Leeson-Canada, NovAtel | NC            | DARPA Grand Challenge  | 52,430                |
|      | NSERC Discovery   | C             | Reducing Energy Consumption in Grinding  | 17,000                |
| 2004 | Canada Foundation for Innovation ++   | C<br>No Award | Innovations to Meet the Challenges of Mining in the 21 <sup>st</sup> Century – the Canadian Environmental Mining Research Centre | <del>10,623,996</del> |
|      | NSERC Discovery   | C             | Reducing Energy Consumption in Grinding  | 17,000                |
| 2003 | UBC, BC Museum of Mining, SLRD, MacDonald Dev. Corp.  | NC            | Sustainable Development Design Plan for Britannia Beach  | 60,000                |
|      | NSERC Discovery   | C             | Reducing Energy Consumption in Grinding  | 17,000                |
|      | UBC, Western Economic Diversification   | NC            | Sustainable Development Design Plan for a Research Centre at Britannia Beach   | 20,000                |
| 2002 | NRCAN-CANMET  | NC            | Research in Mining & the Environment   | 25,000                |
| 2001 | US Air Force Research Labs  | NC            | Intelligent Agents for Web Sites   | 15,000                |
|      | Canada Foundation for Innovation**  | C             | Centre for Environmental Research in Minerals, Metals and Materials  | 3,268,000             |
| 2000 | US Air Force Research Labs  | NC            | Intelligent Agents for Web Sites   | 15,000                |
| 1999 | Eskay Creek Mining  | NC            | Agglomeration of Mill Tailing  | 10,000                |
|      | Eskay Creek Mining  | NC            | Acid-Rock-Drainage Characterization  | 15,000                |
| 1998 | NSERC Research  | C             | Fuzzy-Neural Expert Systems  | 19,100                |
|      | Eskay Creek Mining  | NC            | Agglomeration of Mill Tailing<br>Acid-Rock-Drainage Characterization   | 40,000<br>45,000      |
| 1997 | NSERC Research  | C             | Fuzzy-Neural Expert Systems  | 19,100                |
| 1996 | NSERC Research  | C             | Fuzzy-Neural Expert Systems  | 19,100                |
|      | NSERC(CRD)*   | NC            | Intelligent Casting/Reheat Furnace   | 182,250               |
|      | Metals Research   | NC            | Colloidal Gold Recovery at Lillooet Delta  | 133,539               |
| 1995 | NSERC Research  | C             | Fuzzy-Neural Expert Systems  | 19,100                |
|      | NSERC(CRD)*   | NC            | Intelligent Casting/Reheat Furnace   | 182,250               |
|      | Canada Manpower/CANMET  | C             | Development of A.I. Software   | 7,700                 |
|      | Teck Corporation  | NC            | Copper recovery improvements at Afton  | 10,000                |
|      | UBC Teaching/Learning <sup>+</sup>  | C             | TxDent: Expert System to Train Dentists  | 29,998                |

|                       |                              |    |   |              |
|-----------------------|------------------------------|----|---|--------------|
| 1994                  | NSERC Operating              | C  | Integration of Expert Systems & ANN     | 17,900       |
|                       | NSERC(CRD)*                  | NC | Intelligent Casting/Reheat Furnace      | 170,250      |
|                       | UBC Teaching/Learning        | C  | Undergraduate Computerized Teaching     | 26,998       |
|                       | CANMET                       | NC | Update of HyperManual on ES             | 5,000        |
| 1993                  | NSERC(CRD)*                  | NC | Intelligent Casting/Reheat Furnace      | 183,250      |
|                       | NSERC Operating              | C  | Expert Systems for the Mineral Industry | 26,900       |
|                       | Highland Valley Copper       | NC | Real-Time Advising Expert System        | 10,000       |
|                       | CANMET                       | NC | Update of HyperManual on ES             | 5,000        |
| 1992                  | NSERC (CRD) *                | NC | Intelligent Casting/Reheat Furnace      | 176,850      |
|                       | NSERC Operating              | C  | Expert Systems for the Mineral Industry | 26,900       |
|                       | Highland Valley Copper       | NC | Real-Time Flotation Control             | 12,000       |
| 1991                  | NSERC Operating              | C  | Expert Systems for the Mineral Industry | 26,900       |
|                       | DEMR/CANMET                  | NC | HyperManual on Expert Systems           | 24,000       |
|                       | Highland Valley Copper       | NC | Real-Time Flotation Control             | 9,000        |
| 1990                  | NSERC Operating              | C  | Interparticular Phenomena               | 24,000       |
|                       | UBC/NSERC Equipment          | C  | Sun SPARCStation Computer               | 11,000       |
| 1989                  | NSERC Operating              | C  | Interparticular Phenomena               | 24,000       |
|                       | International Coast Minerals | NC | Retreatment of Copper Tailing           | 10,500       |
| 1988                  | NSERC Operating              | C  | Interparticular Phenomena               | 24,000       |
|                       | Comdale Technologies         | NC | Evaluation of COMDALE/X                 | 8,000        |
|                       | Quebec-Cartier               | NC | Sand-Slime Separation Circuit           | 4,500        |
|                       | Canada Manpower              | C  | Development of AI Software              | 5,400        |
| 1987                  | Quebec-Cartier               | NC | Derrick Screening Testwork              | 4,000        |
|                       | Canada Manpower              | C  | Development of A.I. Software            | 5,400        |
|                       | NSERC Operating              | C  | Interparticular Phenomena               | 20,000       |
| 79 - 86               | Grants & Contracts           |    |   | 394,500      |
| Total for 1979-2012 = |                              |    |   | \$15,926,811 |

\*\*\* Awarded a total of \$1.4 million to UBC, University of York (UK), and Yale University (USA)

++ Applied for by J.A. Meech together with 36 other Research Scientists at UBC (funding to derive from CFI, BCKDF, BCMEMPR, UBC, and numerous mining companies)

\*\* Awarded to J.A. Meech/ M. Scoble together with 33 other Research Scientists at the University of British Columbia from 10 different departments – funding received from CFI, BCKDF, & Stewart Blusson UBC Endowment Fund..

\* Awarded to I.V. Samarasekera with J.A. Meech, P. Barr and J.K. Brimacombe as co-investigators under the NSERC Research Partnership Program.. Five Industrial Partners are involved in this work: Alta-Steel, Edmonton, Alta., Manitoba Rolling Mills, Selkirk, Man., Hatch Associates, Mississauga, Ont., Accumold, Huron Park, Ont., and Comdale Technologies Inc., Toronto, Ont.

+ Awarded to Dr. Michael MacEntee, Faculty of Dentistry in collaboration with J.A. Meech

(c) *Invited Presentations*

Sep 2013 Keynote Speaker, Mine Optimization Conference, Toronto, ON  
 Aug 2013 Keynote Speaker, IFAC-Automation, San Diego, CA  
 Nov 2012 Presentation to Ecuador Ministry of Mines, Quito, Ecuador  
 Aug 2012 Keynote Speaker – IPMM2012, Foz do Iguacu, Brazil  
 Oct 2010 Invited Talk on Thunderbird Robotics, IEEE-Vancouver Branch, BCIT, Burnaby  
 Sep 2010 Invited Talk on Thunderbird Robotics, Helsinki University of Technology, Helsinki, Finland  
 May 2008 Invited Talk on UBC Robotics Research, BHP-Billiton, Ni-West, Perth, Australia  
 Jun 2006 Keynote Speaker MPMSC (Mineral Processing Modeling, Simulation & Control) Sudbury, ON  
 Apr 2006 Invited presentation on Mining Engineering Education – SME AGM, St. Louis, Mo.  
 Mar 2006 Invited presentation on Robotics – University of Salerno, Fiscano, Italy  
 Nov 2005 Invited Speaker, BISC-05, Special Sym. on 40 Years of Fuzzy Logic, Berkeley, CA.  
 Dec 2003 Invited Speaker, 3<sup>rd</sup> FLINT Workshop – Fuzzy Logic in Biometric Applications, Berkeley, CA.



- Jun 2002 Presented talk on Britannia Mine to the Delta Rotary Club, Delta, B.C.
- Jun 2002 Invited Speaker on Britannia Mine to CSC Annual Conference at UBC, Vancouver, B.C.
- May 2002 Presented talk on Britannia Mine to the Richmond Sunrise Rotary Club, Richmond, B.C.
- Dec 2001 Invited Speaker, 7<sup>th</sup> ARD Workshop, BC Ministry of Energy and Mines, Vancouver, BC
- Nov 2001 Invited Speaker, Assoc. of Professional Engineers and Geoscientists of BC, Vancouver, B.C.
- Aug 2001 Invited Speaker, 1st FLINT Workshop – Fuzzy Logic on the Internet, Berkeley, California.
- May 2001 Invited Speaker, Integrating the Mine and Mill - Lessons from Manufacturing Southern Hemispheric Conf. on Mineral Technology - Rio de Janeiro, May 27-June 1, 2001.
- May 2001 Presented Keynote Paper, CIM/AGM, Quebec City, Quebec
- Apr 2001 CIM Distinguished Lecturer presentation to the Ottawa CIM Branch, Ottawa, Ontario.
- Mar 2001 CIM Distinguished Lecturer presentation to the Vancouver CIM Branch, Vancouver, BC.
- Feb 2001 CIM Distinguished Lecturer presentation to the Calgary CIM Branch, Calgary, Alberta.
- Nov 2000 CIM Distinguished Lecturer presentation to the Edmonton CIM Branch, Edmonton, Alberta.
- Nov 2000 CIM Distinguished Lecturer presentation to the Rocky Mountain CIM Branch, Hinton, Alberta.
- Aug 2000 Invited Keynote Speaker, Workshop on Materials Design by Computer Simulation, Sendai International Center, Tohoku University, Aug. 18-19, 2000
- Mar 2000 Integrating the Mine and Mill - Lessons from Manufacturing, Mining Millennium 2000 - CIM AGM, Toronto, March 5-10, 2000.
- Aug 1999 Integration of Intelligent Manufacturing Systems into the Mining and Metallurgical Industries, 1999 CIM Conference of Metallurgists, Quebec City, August 22-25, 1999.
- Jun 1999 Mining Engineering Curriculum Development Conference, Jujuy, Argentina, June 7-12, 1999
- Oct 1997 Predicting the Impact of Mercury Pollution with a Fuzzy Expert System  
1997 IEEE International Conference on Systems, Man and Cybernetics, October 12-15, 1997
- May 1997 Preventing Mercury Pollution in the Amazon - an expert system approach.  
Prof. Olaf Malm, Federal University of Rio de Janeiro, Rio de Janeiro, Brasil
- Jan 1997 Preventing Mercury Pollution in the Amazon - an expert system approach.  
Prof. Margarete Kalin, Mining Engineering Program, University of Toronto, Ontario
- Oct 1996 EXPOMIN-Convergencia'96, Antofagasta, Chile (Key Note Presentation)  
Organizer: Dr. Manuel Duarte, University of Chile, Oct. 6-9, 1996
- Jun 1996 Industrial Applications of Artificial Intelligence and Expert Systems (Key Note Presentation)  
Canadian Conference of Electrical and Computer Engineering, Calgary, Alberta  
Organizer: Dr. Jeff Pieper, University of Calgary
- Jul 1995 Artificial Intelligence Techniques in the Minerals and Metals Industry  
Dr. Alesandro Costa de Silva, Federal University of Fluminense, Volta Redondo, Brazil
- Jul 1995 Artificial Intelligence Techniques in the Minerals and Metals Industry  
CETEM, Rio de Janeiro, Brazil -- Organizer: Dr. Marcello Veiga
- Jul 1995 AI Applications in the Mining Industry into the 21st Century (Key Note Presentation)  
APCOM XXV Conference, Brisbane, Australia  
Organizer: Dr. Don McKee, Director, JKMRRC, Brisbane
- May 1992 Managing Uncertainty in Fuzzy Expert Systems, Uncertainty Management Workshop at AI/GI/VI'92 at UBC. Organizer: Dr. Mary Deutsch-McLeish, University of Guelph.
- Nov 1991 Leadership and Organizations. Seminar on Novel Teaching Methods.  
Organizer: Gail Riddell, Centre for Continuing Education, UBC

(d) *Other Presentations*

Numerous presentations on Mining Engineering as a Career at: Kwantlen College, Caribou College, MABC Education Committee Seminars, High Schools, Elementary Schools between 1989 and present.

(e) *Other*

**CIM Distinguished Lecture Tour**

- Apr. 2001 CERM3 and The Millennium Plug - CIM AGM, Quebec City, April 29, 2001
- Apr. 2001 CERM3 and The Millennium Plug – CIM Ottawa Branch, Apr. 20, 2001
- Mar. 2001 CERM3 and The Millennium Plug – CIM Vancouver Branch, Mar. 27, 2001

Mar. 2001 CERM3 and The Millennium Plug – CIM Calgary Branch, Mar. 27, 2001  
 Nov. 2000 Integrating the Mine and Mill - Lessons from Manufacturing – CIM Rocky Mountain Branch  
 Nov. 2000 Integrating the Mine and Mill - Lessons from Manufacturing – CIM Edmonton Branch

(f) *Conference Participation (Organizer, Keynote Speaker, etc.) (since 1989)*

|             |   |
|-------------|---|
| Sep 2013    | Keynote Speaker, Mine Optimization Symposium, Toronto, Ontario  |
| Aug 2013    | Keynote Speaker, IFAC Control, Optimiz., & Automation in MMM – San Diego, CA  |
| Oct 2012    | Keynote Speaker, AutoMine Conference – Santiago, Chile  |
| Sep 2012    | Keynote Speaker, IPMM'12, Intelli. Process. & Manuf.of Materials – Iguacu, Brazil   |
| Jun 2007    | General Chairman, IPMM'07, Intel. Process. & Manu. of Materials – Salerno, Italy  |
| Nov 2005    | Invited Speaker, BISC-05, Special Symposium on 40 Years of Fuzzy Logic in honor of Lotfi Zadeh, Berkeley, CA.   |
| Apr 2005    | Participated in Conference on European Robotics (EURON) - Brussels, Belgium   |
| Apr 2005    | Attended EURON Annual General Conference – Palermo, Italy   |
| Jul 2005    | General Chairman, IPMM'05, Intelligent Processing and Manufacturing of Materials – Monterey, California   |
| May 2003    | General Chair, IPMM'03, Intelligent Processing and Manufacturing of Materials – Sendai, Japan   |
| Jun 2002    | Invited Sessional Speaker, Chemical Soc. of Canada, – UBC, Vancouver, B.C.  |
| Jul 2001    | General Chair, IPMM-2001, Intelligent Processing and Manufacturing of Materials – Vancouver, B.C.   |
| May 2001    | Invited Keynote Speaker, 22 <sup>nd</sup> Southern Hemispheric Conference on Mineral Processing, Rio de Janeiro, Brazil.  |
| May 2001    | Presented Keynote Paper, CIM/AGM, Quebec City, Quebec   |
| Aug 2000    | Invited Keynote Speaker, International Symposium on Research and Education in the 21 <sup>st</sup> Century University, Tohoku University, Sendai, Japan, Aug. 20-25, 2000 |
| Aug 2000    | Invited Keynote Speaker, Workshop on Materials Design by Computer Simulation, Sendai International Center, Tohoku University, Aug. 18-19, 2000                            |
| Apr 2000    | Presented paper, IEEE Advanced Process Control Workshop, Vancouver, B.C.  |
| Mar 2000    | Presented Keynote Paper, CIM AGM, Mining Millennium-2000, Toronto   |
| Aug 1999    | Presented Keynote Paper, CIM Conference of Metallurgists, Quebec City.  |
| Jul 1999    | General Chair, IPMM'99, Intelli. Process.& Manuf. of Materials – Honolulu, Hawaii   |
| Jun 1999    | Session Chair - NAFIPS Conference, New York City, New York.   |
| Apr 1999    | Presented paper, IEEE Advanced Process Control Workshop, Vancouver, B.C.  |
| Apr 1998    | Session Chair - 100th AGM of CIM, Montreal, Quebec  |
| Oct 1997    | Invited Paper/Session Chair - SMC'97, Orlando, Florida  |
| Jul 1997    | Program Committee Chairman, IPMM'97, Australia (3 paper and 2 session chairs)   |
| Oct 1996    | Keynote Speaker - Workshop on AI, Convergencia'96, Antofagasta, Chile.  |
| May 1996    | Keynote Speaker - Can. Conf. on Electrical and Computer Eng., Calgary, Alta.  |
| Oct 1995    | Session Chair - IEEE, SMC Conference, Vancouver, B.C. (Presented paper)   |
| Jul 1995    | Keynote Speaker - APCOM' XXV, Brisbane, Australia (Session Chair)   |
| Aug 1995    | Session Chair - 34th Conference of Metallurgists, Vancouver, BC, 1995   |
| 1993 - 1995 | Registration Chair: 34th Conference of Metallurgists, Vancouver, BC, 1995   |
| Oct 1994    | Presented two papers - CIM District 6 AGM , Oct. 1994, Session Organizer  |
| 1992 - 1994 | Education Committee Chair - CIM District 6 AGM Committee, Oct. 1994   |
| Oct 1993    | Invited paper: Randol on Opportunities for Mining in Latin Am, Acapulco, Mex  |
| Sep 1993    | Session Chairman - 2nd IEEE Conf. on Control Applications, Vancouver, B.C.  |
| 1992 - 1993 | Member, Steering Committee - 2nd IEEE Conf. on Control Apps - Vancouver, B.C.   |
| Aug 1992    | Session Organizer and Chair - 31st Conf. of Metallurgists, Edmonton, Alta. -  |
| Feb 1992    | Invited paper - Randol Gold Forum, Vancouver, B.C.  |
| Sep 1991    | Presented paper - CAMI Conference, Vancouver, B.C. - Session Chair  |
| Aug 1991    | Invited Speaker, AI Applic. in the Metals and Minerals Industry, Helsinki Univ.   |
| May 1991    | Session Chair, AI in Mineral Industry, CIM-AGM, Vancouver, B.C.   |

|             |  |
|-------------|--|
| 1990 - 1991 | Member, CIM-AGM Organizing Committee (Audio/Visual Services)                   |
| Aug 1990    | Session Chair, Expert Systems in the Minerals Industry, CIM 29th CoM, Hamilton |
| Aug 1989    | Session Chair, Expert Systems in the Minerals Industry, CIM 28th CoM, Halifax  |

## 10. SERVICE TO THE UNIVERSITY

### (a) *Memberships in committees, including offices held and dates*

#### Service at UBC

- Founder and Leader, Thunderbird Robotics Student Club, 2004 – present
- Search Committee, Head of UBC-Mining, 2007/08
- Search Committee, two Faculty Positions, MINE, 2006
- ARTP Faculty Committee, 2003-2004
- Search Committee, two Faculty Positions, MINE, 2002
- Search Committee, Environmental Chair, MMPE, 1999
- Search Committee, Environmental Junior Chair, Geological Sciences, 1999
- Chair, Department Space Committee, 1998-2002
- Chair, Department Computing Facilities, 1997-2000
- Search Committee, Head, MMPE, 1998
- Search Committee, Head, Electrical Engineering, 1997
- Time Table Representative, 1991-95
- Chair, Faculty Curriculum Committee, 1989-94
- Associate, Centre for Metallurgical Process Engineering, 1989-present

#### Service at Queen's

- Chair, Division III School of Graduate Studies & Research, 1987-89
- Associate Chairman, Division III, 1984-87
- University Senate Budget Review Committee, 1982-88
- Chair, Graduate Studies - Mining Engineering, 1980-86
- Chair, Advisory Research Subcommittee, Division III, 1986-87
- Member, Advisory Research Subcommittee, Division III, 1984-86
- Member, University Senate Budget Review Committee, 1982-89

## 11. SERVICE TO THE COMMUNITY

### (a) *Memberships in scholarly societies, including offices held and dates*

|                |   |
|----------------|---|
| 2012 – present | - Society of Mining Engineers   |
| 2001 – 2003    | - Society of Manufacturing Engineers.   |
| 1997 – 2005    | - North American Fuzzy Information Processing Society   |
| 1997 – 2005    | - Systems, Man and Cybernetics, IEEE  |
| 1997 – 2005    | - Society for the Advancement of Material Process Engineering   |
| 1977 – 2011    | - Canadian Institute of Mining, Metallurgy and Petroleum  |
| 1974 – present | - Canadian Mineral Processors   |
| 1992 – 1999    | - The Metallurgical Society of AIME   |
| 1991 – 1999    | - Computer Society, IEEE  |
| 1989 – 1999    | - Vancouver Branch Executive of CIM<br>1989 - 1992 Education Committee<br>1993 Vice Chairman 1994 Chairman<br>1995 Past-Chairman 1996/97 Centennial Organizing Com. |

### (a) *Memberships in other societies, including offices held and dates*

Registered Professional Engineer - Professional Engineers and Geoscientists of British Columbia  
 Director, Britannia Beach Historical Society (British Columbia Museum of Mining) 2002-2005  
 President, Intelligent Processing and Manufacturing of Materials, Vancouver, B.C. 2001-2008

### (c) *Memberships in scholarly committees, including offices held and dates*

Participated in the UBC Sustainability Curriculum Initiative – 2009-2010

- (d) *Memberships in other committees, including offices held and dates*
- (e) *Editorships (list journal and dates)*  
 1989 – 2005 Member, Editorial Board – Minerals Engineering Journal
- (f) *Reviewer (journal, agency, etc. including dates)*  
 1997 Killam Award - Canada Council  
 1996 BC Science Council  
 1989 – present NSERC  
 1989 – present Minerals Engineering – Editorial Board  
 1989 – present Metallurgical Quarterly
- (g) *External examiner (indicate universities and dates)*  
 McGill University, 1988  
 University of Stellenbosch, 2000  
 University of Melbourne, 2001/2002  
 Helsinki University of Technology, 2009
- (h) *Consultant (indicate organization and dates)*  
 I practice Professional Engineering providing services in process control, plant trouble-shooting, flowsheet design, environmental issues, computer applications, flotation. Some of my clients include:
- |                                   |                                  |
|-----------------------------------|----------------------------------|
| Alcan                             | Kingston, Ontario                |
| ATAN Process Control              | Belo Horizonte, Brazil           |
| Bauer, Calder and Workman         | Washburn, North Dakota           |
| BHP-Billiton                      | Perth, Australia                 |
| Comdale Technologies Inc.         | Toronto, Ontario                 |
| Companhia Vale do Rio Doce        | Carajas, Para State, Brazil      |
| Copper Beach Estates Limited      | Britannia Beach, B.C.            |
| Cullaton Lake Goldmine            | Keewatin, North West Territories |
| Dome Gold Mines                   | Timmins, Ontario                 |
| Equity Silver Mines               | Houston, British Columbia        |
| Falconbridge Nickel               | Toronto, Ontario                 |
| Federal University of Bahia       | Salvador, Brazil                 |
| Gibraltar Mines Ltd..             | Williams Lake, B.C.              |
| Highland Valley Copper Mine       | Logan Lake, B.C.                 |
| Inco Metals Limited               | Thompson, Manitoba               |
| International Coast Minerals      | Vancouver, British Columbia      |
| Iron Ore Company of Canada        | Labrador City, Newfoundland      |
| Les Mines Selbaie                 | Joutel, Quebec                   |
| Metals Research                   | Texada Island, B.C.              |
| Ministry of the Environment       | Toronto, Ontario                 |
| Mining Engineering Resources      | Kingston, Ontario                |
| MinnovEX Technologies Inc.        | Toronto, Ontario                 |
| Mintek                            | Johannesburg, South Africa       |
| Pamiba Estates                    | Sudbury, Ontario                 |
| Quebec Cartier Mining             | Fermont, Quebec                  |
| Raytheon Corporation              | Dallas, Texas                    |
| Teck-Cominco                      | Vancouver, B.C.                  |
| Terasen Utilities Services        | Richmond, B.C.                   |
| Unipure (Europe) Inc.             | London, U.K.                     |
| Western GeoPower Corporation      | Vancouver, B.C.                  |
| Williams Lake Chamber of Commerce | Williams Lake, B.C.              |

(i) *Other service to the community*

|                |   |
|----------------|---|
| May 1, 2014    | Invited Panelist, NATO Parliamentary Assoc. discuss on Pacific Gateway Initiative |
| 2012 - present | Member of the Board of Directors, <i>Deltassist</i> , Delta, B.C.                 |
| 2007 - 2010    | Member of the Southlands Community Planning Team, Tsawwassen, B.C.                |
| 2005           | Institutional Review of the Sustainable Minerals Institute, Brisbane, Australia   |
| 2004 - present | Faculty Advisor – Thunderbird Robotics undergraduate student team                 |
| 2004           | Institutional Review of Mintek, Johannesburg, South Africa                        |
| 1998           | Evaluation Committee for BCIT Electrical Engineering Technology Degree Program    |
| 1996 - 1997    | Mineral Processing Examiner – APEGBC  |
| 1990 - 1996    | Member, BCIT Mining Technology Industrial Advisory Committee                      |
| 1989 - 1995    | Member, MABC Education Committee  |
| 1994 - 1995    | Member, MABC Mining Week Committee  |
| 1990 - 1995    | Member, Scientists in the Schools Program - Science World                         |
| 1991           | Judge, Canada-Wide Science Fair, Vancouver, B.C.                                  |
| 1990           | Judge, British Columbia Science Fair, Richmond, B.C.                              |
| 1990 - 1991    | Chairman, CCPE 1991 Syllabus Review for Mining Engineering                        |
| 1990 - 1991    | Basketball Coach - Tsawwassen Jr. Sec. and South Delta Sec. Schools               |
| 1982 - 1989    | League Convenor - Pacers Basketball Club, Kingston Ontario                        |
| 1989           | Head Coach of the Ontario AA Mini-Boys Championship Team                          |
| 1986 - 1989    | Coordinator of Special Projects, Kingston Branch of CIM                           |
| 1984 - 1986    | Treasurer, Kingston Branch of CIM   |
| 1980 - 1984    | Chair, Nominating Committee - Kingston Branch of CIM                              |
| 1982 - 1886    | Mineral Processing Examiner - APEO/APEM(Manitoba)                                 |

**12. AWARDS AND DISTINCTIONS**(a) *Awards for Teaching*(b) *Awards for Scholarship*

2004 - Best Paper Award - Geothermal Resources Council, presented at the GRC-AGM, Indian Wells, CA

2001 - Williams Prize from the Institute of Materials, UK (with Indira Samarasekera)

2000 - Distinguished Lecturer for the Canadian Institute of Mining, Metallurgy and Petroleum for 2000.

1999 - Best Paper Presentation Award - IEEE Advanced Process Control Workshop, Vancouver, B.C.

1973-1976 Noranda Research Fellowship - Noranda Research, Pointe Claire, Que.

1973-1975 W.W. King Fellowship - Queen's University School of Graduate Studies

(c) *Awards for Service*

2007 – UBC-AMS “Just Desserts” Award for the founding of Thunderbird Robotics

1992 - Fellowship of the Canadian Institute of Mining, Metallurgy and Petroleum

(for outstanding contributions to the Canadian Minerals Industry and to CIM)

**13. OTHER RELEVANT INFORMATION**

In 2004, I founded an organization at UBC called Thunderbird Robotics to engage undergraduate students in preparing an autonomous ground vehicle for the 2005 DARPA Grand Challenge which took place in the Mojave Desert. In 2007, we entered the same vehicle in the DARPA Urban Challenge which was held in Victorville, CA. Thunderbird Robotics has involved over 500 students (~70 each year) in a variety of sub-projects that include 1/10<sup>th</sup> scale robot racing cars, RoboCup soccer, the NASA Moon Excavator Centennial Competition, and the Electric Car Club. At the 2009 Robot Racing event, our team finished 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> out of 15 entries and in 2010, our team won the Grand Prize in Windsor, ON. In 2011, our group finished second. At the 2009 NASA Excavator Challenge at Ames Air Force Base in Mountainview, CA, our team finished 6<sup>th</sup> out of 24 teams. In 2007 and 2008, we developed an entry into the NASA Centennial Challenge aimed at creating a light-beam-powered space elevator. In 2010, the Electric Car Club converted a 1972 Volkswagen Beetle to all-electric and in August 2010, we drove it across Canada from Vancouver to Halifax in 14 days of driving using existing infrastructure to recharge along the way. This is the first all-electric vehicle to accomplish that feat. These projects have given

students from all engineering disciplines and from computer science hands-on learning in a team-environment. It is one of the most rewarding experiences in all my years as a university professor.

I have continued my involvement with IPMM – Intelligent Processing and Manufacturing of Materials – an organization which I founded with Tara Chandra of the University of Wollongong in Australia at IPMM'97 in Gold Coast, Australia. Membership has steadily grown to 500 members from all parts of the world. The 6<sup>th</sup> International Conference was held in Salerno, Italy in June 2007 and I acted as Co-Chair of the Technical Program. The 5<sup>th</sup> International Conference took place in Monterey, California and I acted as General Chair of the Conference and President of IPMM. In May 2003, I was Co-General Chair with Dr. Yoshiyuki Kawazoe from Tohoku University at the 4<sup>th</sup> International Conference (IPMM'03) held in Sendai, Japan. In July 2001, I was General Chair for IPMM-2001 held in Richmond, B.C. In July 1999, I was General Chair for IPMM'99 in Honolulu, Hawaii. These events each attracted between 150 and 250 delegates from over 30 countries from a wide-variety of diverse backgrounds. The 7<sup>th</sup> IPMM Conference was held in Foz do Iguacu, Brazil in August 2012 organized by the University of Sao Paulo..

In 2001, I took on the directorship of CERM3 (The Centre for Environmental Research in Minerals, Metals, and Materials. CERM3 consists of ~35 researchers across UBC from over 10 departments who are conducting collaborative studies on mining and the environment. The facilities consist of 5 interlinked laboratories and a field research station located at Britannia Mine. This station was set up to design earth plugs to seal mine tunnels that last 1000 years. The installation of this facility had the spin-off benefit of stopping all pollution into Britannia Creek and the surface waters of Howe Sound. Over 20% of copper emissions were eliminated through placement of this plug in the 2200 Level adit. Our work has helped draw a number of important collaborators to the site to transform it into a major tourist destination that will showcase Canadian Sustainable Mining practices. In November 2011, reports appeared in the Press of adult pink salmon 4 km upstream of the mouth of Britannia Creek.

My research activities have also evolved into the field of geothermal energy systems in close collaboration with Dr. Mory Ghomshei in both low- and high-temperature applications. Our work has identified a major anomaly near Fort Nelson that could be a site for an Enhanced Geothermal Energy project to support a capacity of 250 MW in perpetuity. A project to identify the potential for geothermal energy applications in British Columbia was completed in 2010. Stephen Mak is currently completing a Masters project on a permeability analysis of the Pebble Creek resource.

One of my Ph.D. graduates, Ladan Mohammadi, studied the confined space accident that occurred at the Sullivan Mine reclamation site in 2006. She identified the relationship between atmospheric temperature and pressure changes and the flow of pore gas from within the dump into a sampling shed in which four people died. She created a Fuzzy Expert System to conduct an atmospheric risk assessment at other sites to ensure that conditions which might create such danger are designed out of the reclamation plan. A hand-help version of the system is available for First Response personnel to help them decide to enter or not a confined structure.

My research is aimed at reducing the footprint of mining and processing through integrating batch processes and reducing energy use. One project developed a Magnetic Levitation Hoisting system in which ore can be loaded into vehicles at the mine face and delivered directly to the surface storage facility for processing. The integration of underground haulage and hoisting can significantly reduce costs and the size of on-surface facilities. A second project is aimed at understanding the fundamental reasons why comminution (crushing and grinding) is such an inefficient process (~1-2%). We are studying high velocity impact fracture of rocks and minerals.

Over the years, I have performed considerable research on the use of Artificial Intelligence in industry, an activity that evolved from earlier work on process control simulation models. In 1983, we reported on crushing plant models while in 1985, studies with Fuzzy Logic extracted rules-of-thumb from plant operators for supervisory control. This work resulted in the founding of Comdale Technologies (Canada) in 1986 by my former graduate student - Tony Harris. Comdale was the first company to market Expert System solutions to the mining industry. My team collaborates closely with industry and we have build over 100 systems in areas that include: Qualitative Mineralogy, Mining Method Selection, Flotation Reagent Advice, Fuzzy Logic Control, Froth Recognition (Highland Valley Copper), Steel Reheat Furnace Operations, Small Hydro Plant Site Selection, Wastewater

Process Selection, Automated Speed Zone Design, Acid Rock Drainage Sampling, Mercury in the Amazon, Continuous Casting Diagnosis and Control. Several of these systems are marketed under license from UBC:

- ARDx: An AI Approach to Designing ARD Remediation Systems
- IntelliGOLD: An Expert System to Design Gold Processing Plants
- ESMAN: A HyperManual on Expert Systems
- MMCx: An Expert System to Design Metal-Matrix Composites
- MINEX: An Expert System on Qualitative Mineralogy
- Proc/ES: Introduction to Mineral Processing
- CRAC/X: Troubleshooting Continuous Billet Casting Quality Problems
- TxDENT: A Training Tool for Dentistry Students (collaborative work with UBC Dental Clinic)

The billet quality system is used at 20 mini-steel mills around the World. We helped Highland Valley Copper to formulate a real-time advisory system for plant operators. Many industrial short courses have been presented.

Together with Dr. Marcello Veiga, I have published several papers on mercury emissions used by artisanal miners. We detailed a number of important vectors and sources of this insidious material. Our publication in *Nature* (368) 1994, was the seminal work identifying deforestation as a significant activity in dispersing mercury over wide areas in Brazil. We are examining mercury pollution from the viewpoint of reducing its impact on a local and global basis.

CERM3 commenced a number of research projects into biological solutions to environmental issues. These include: Passive treatment system design for ARD; Bioindicators of bioaccumulation; Isolation of bacteriophage for *Thiobacillus ferrooxidans*. In 2003, we build a phytoreclamation facility in Bahia, Brazil to extract gold into plants from a spent heap leach pad. This work was a collaboration between CVRD (Companhia Vale do Rio Doce) and Dr Chris Anderson from Massey University in New Zealand. We showed that certain crops can concentrate gold from 0.6 ppm in the ground to over 35 ppm (dry weight) in the plants. The process has potential to be an economically commercial process for mining or reclamation as certain other plants are known to beneficiate mercury, nickel, zinc, copper, and lead. This work has generated much interest around the world and we are now collaborating with York University in the U.K. and Yale University in the U.S. on the extraction of PGMs from waste materials that can become natural catalysts. This work was funded by the G8 Research Funding Agencies.

In 2013, Juliana Parreira completing her doctoral thesis entitled Simulation of Autonomous Haulage Truck (AHT) systems under contract with BHP-Billiton in Perth, Australia. She developed a stochastic simulation tool together with a deterministic model of haulage truck movement to characterize the changes that can be expected in Key Performance Indices (KPIs) when an AHT system replaces human drivers. The sub-models of this tool include fuel consumption, truck movement and productivity, maintenance, tire wear and tire temperature, together with an economic assessment of reduced labour costs and increased safety.

Together with Professor Marcello Veiga, I have developed a methodology to transfer the Mining Engineering curriculum at UBC to other countries looking to start-up a Mining Engineering program. The program consists of 30 courses each with 24 lectures and all necessary assignments and laboratories. We are currently creating programs in three Latin American countries and one in Asia.