

**Research
Graduate Studies
International Programs**

**Progress Report
for
Fiscal Year 2006 and 2007**

Montana Tech
The University of Montana

January 29, 2008

Annual Progress Report

Research, Graduate Studies, and International Programs

Fiscal Years 2006 and 2007

I. Introduction

In this report we provide an assessment of the activities of the three offices under the supervision of the Associate Vice Chancellor for Academic Affairs and Research. These include the Office of Research, the Graduate School, and The Office of International Programs. In FY2001 we developed standardized metrics to view performance trends in these three areas. In this current report we provide new information for FY2006 and FY2007, and compare these results to historical data from FY2000 to the present for most categories.

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II. Office of Research

Research Success

The volume of research performed on the Montana Tech campus can be measured by four different but related metrics.

- The first measure is the total new grant funding received in a given fiscal year. This measures the grant writing success of the faculty during the current and preceding years. Figure 1 shows the trends for the last eight years. Since FY2004 awards have shown a steady increase from \$5,000,000 per year to over \$9,000,000 in FY2007.

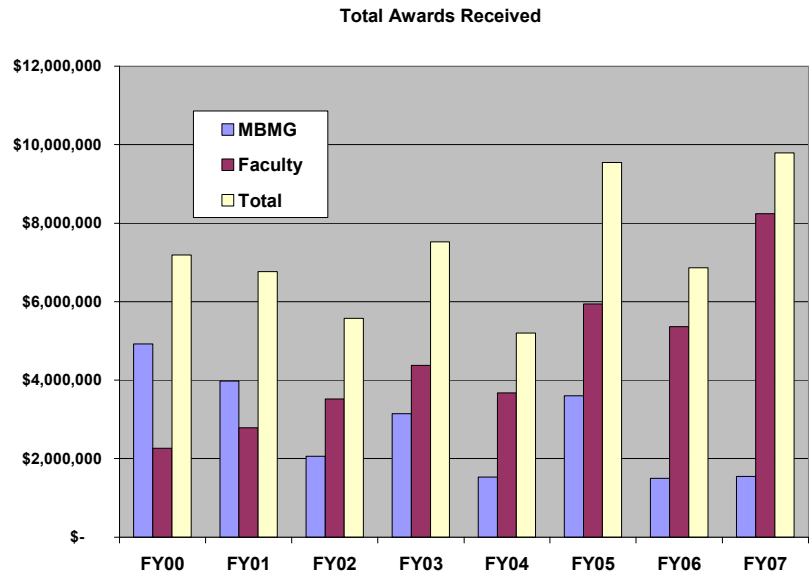


Figure 1: Total Awards Received FY2003 – FY2007

- The second measure of research productivity is more directly related to the research activity of a given year. This metric tracks the actual expenses incurred by the faculty, staff, and students for research related activities and charged to our external sponsors. As shown in Figure 2, expenditures have been nearly constant over the last five years, ranging between \$7M and \$8M.

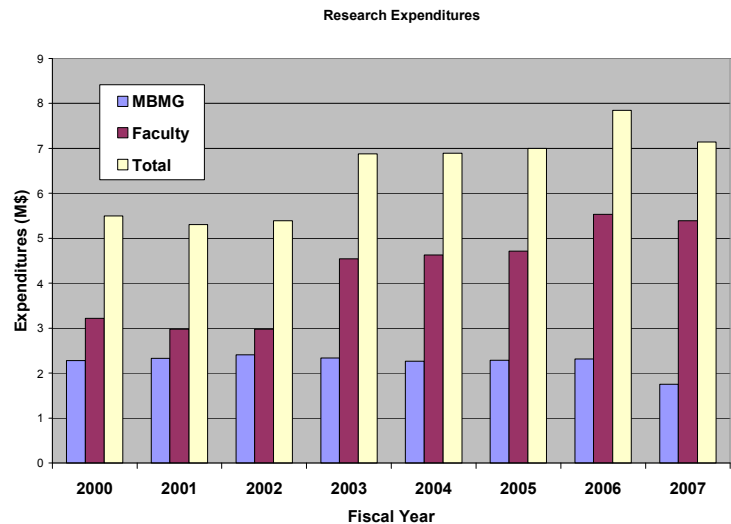


Figure 2: Research Expenditures FY2003 – 2007

- The third measure of research productivity is the success rate of our grant submissions. Figure 3 compares the grant writing activity and success rates for the Fiscal Years 2002 through 2007. The value of submitted grants is shown for each year. Also shown are the data for funded, pending and denied proposals at the time of printing (January, 2008) for all Fiscal Years. Typically the success rate will increase slightly into the second year after submittal as agencies make final decisions on submitted proposals. Submitted values are used for the categories of Submitted, Pending and Denied. Primary Amount Awarded values are used for the Funded category. Appendix A is a summary of Proposals Submitted for FY 2007 sorted by Principal Investigator. Although the number of proposals funded has been variable, the average value of the submitted proposals has shown a continual increase during the last six years

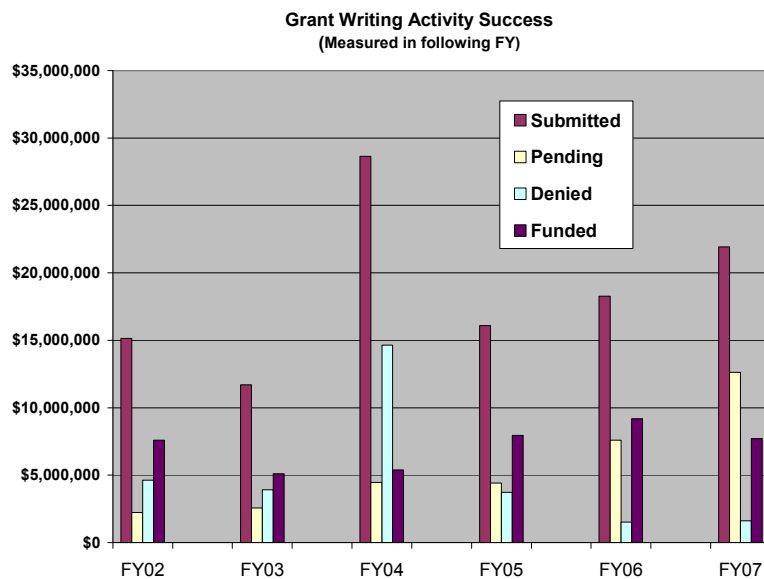


Figure 3: Grant Writing Activity for Fiscal Years 2002 to 2007

- The final metric that we track is the number of Montana Tech employees involved in research. Figure 4 shows the number of faculty and MBMG who have been involved in research funded by grants active in the fiscal year noted. Principal investigators and co-principal investigators are added for the total participant counts.

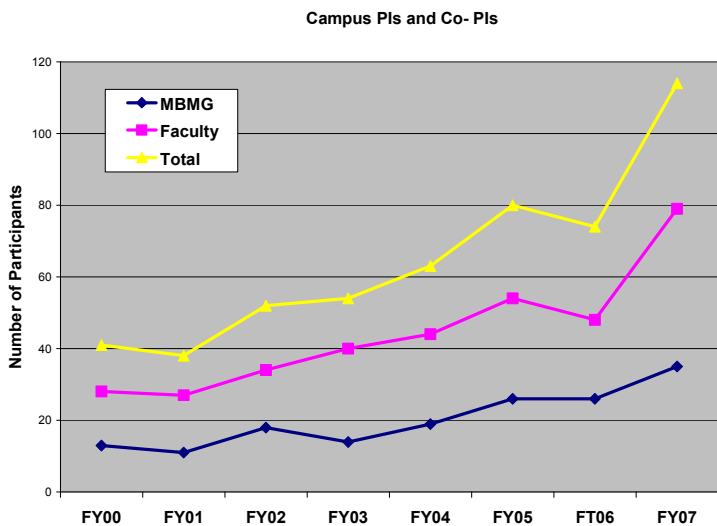


Figure 4: Campus Involvement in Research

Indirect Cost Returns

The Indirect Costs (IDC) are assessed to each grant or contract at a rate of 44% of the sum of salaries and fringe. The research uses of these funds include project reinvestments, matching requirements, and direct returns to Deans, Departments, and Principal Investigators. Figure 5 shows the historical value of these returns over the last five years. Total returns have been in the range of 45% to 55% over the period.

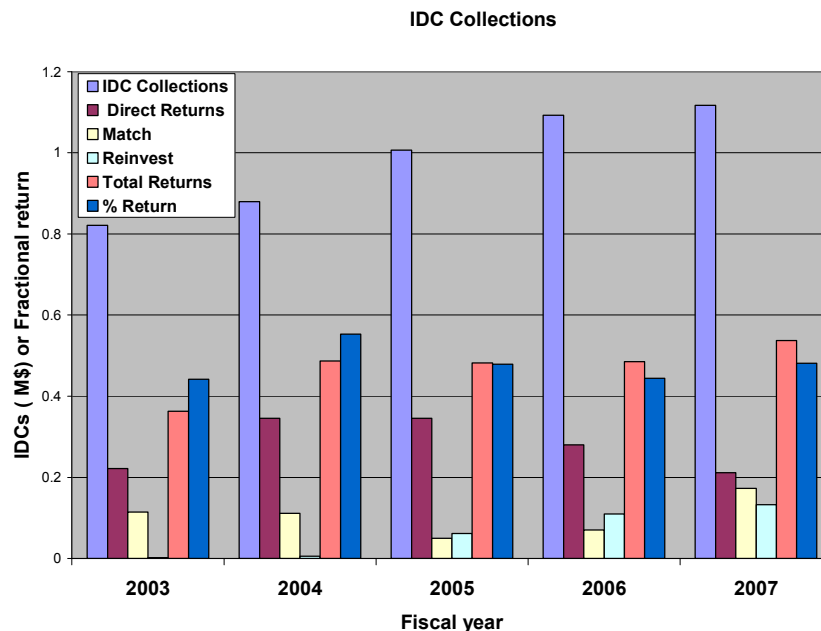


Figure 5: IDC Returns to Departments and Faculty

Scholarly Publications

The campus has no central collection point for the scholarly works produced by our faculty and staff. The Office of Research compiles a self-reported list of faculty and staff publications associated with the research and scholarship of the campus and posts them on the Office of Research home page. Included in Appendix B is the list of publications for the 2006 calendar year as reported by each faculty and staff member by December of 2006.

Industrial Collaborations

Collaboration with industrial partners is an important element of the support provided by the campus to existing and new businesses in Montana. These collaborations take various forms. These include developing marketable intellectual property, collaborative research and technology development ventures, and serving as a resource to regional businesses and industries. The information collected by the Office of Research provides specific information on the second form of interaction, funded collaborations. A list of these collaborations for FY 2006 and FY 2007 is provided in Appendix C.

Patent Disclosures, Filings and Awards

Over the last several years the campus has begun a program to educate the faculty on their rights and opportunities with respect to intellectual property. In Appendix D we summarize the patent activity of the last two years, including invention disclosures, patent applications and patent awards.

Undergraduate Research Program

The Undergraduate Research Program (URP) is now in its twelfth year of operation. Our major sponsor is the National Science Foundation (NSF) through the EPSCoR program. The NSF has renewed this grant for an additional three years in FY2007 and will supply \$450,000 over the three year period. Efforts are underway to expand the program and to increase the student stipends. Figures 6 and 7 show the history of student participation in the program in the funding history. Note that in 2007, recruitment efforts were reduced pending the renewal of the NSF sponsorship.

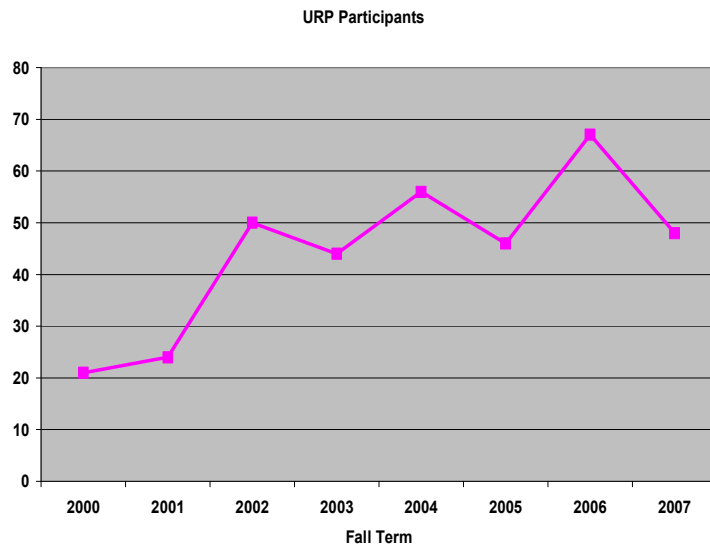


Figure 6: Undergraduate Research Program Participation

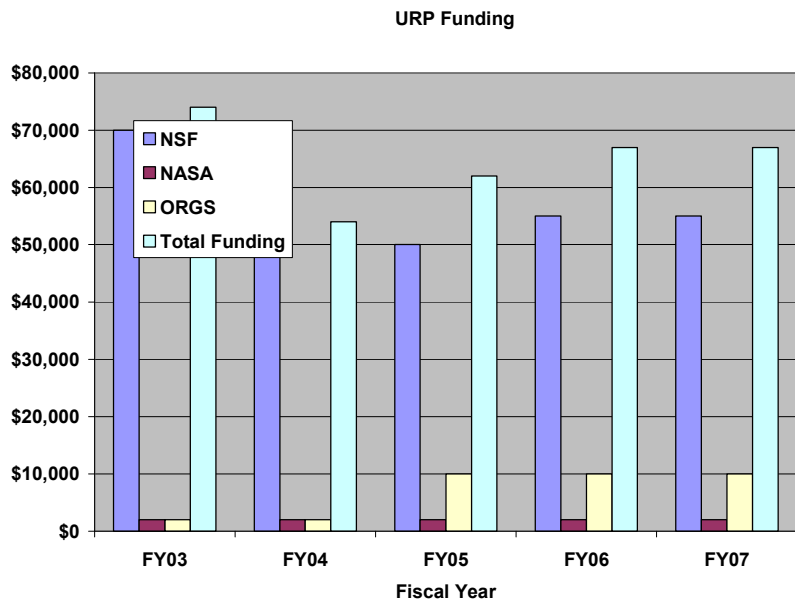


Figure 7: Undergraduate Research Program Funding

III. Office of Graduate Studies

In this section we examine trends in graduate enrollment and student financial support at Montana Tech.

Enrollment

From FY 2006 to FY 2007 Graduate Student enrollment increased slightly to 108 students. Given the declining number of Montana Students and the robust engineering job market, the fact that we grew slightly is considered a positive result. Figure 8 shows the overall enrollment trends for the last eight years. The graduate student population has been remarkably constant over the period at about 5% of our undergraduate population.

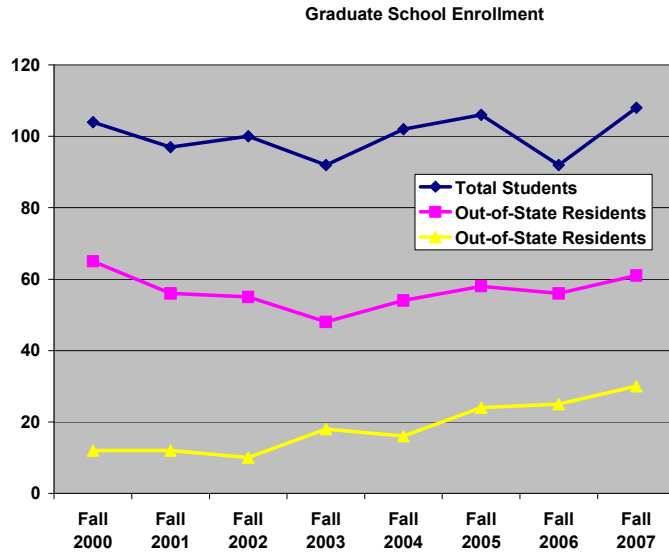


Figure 8: Graduate School Enrollment

Figure 9 shows data for some of our selected programs and student populations. The Fifth Year Masters of Science program shows no clear growth, while International student population continues to recover in the post-9/11 environment. Another very interesting trend is the dramatic growth behavior in on-line students, driven by the Masters in Project Engineering and Industrial Hygiene. Thirty percent of our students in FY2007 were virtual students.

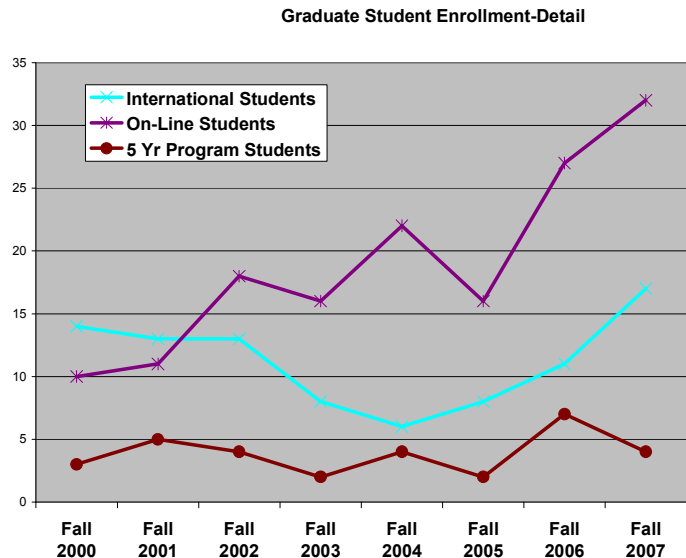


Figure 9: Graduate School Enrollment, Selected Programs

Student Preparation

We are continuing to monitor the level of preparation of incoming students. This is a complex issue to fully define. One simple measure that we have been tracking is the GPA and GRE scores of our incoming first year graduate students. In Figure 10, the GRE scores of the incoming graduate student class are shown for the past eight years. We are now seeing a definite decline in these scores in our newly admitted student body.

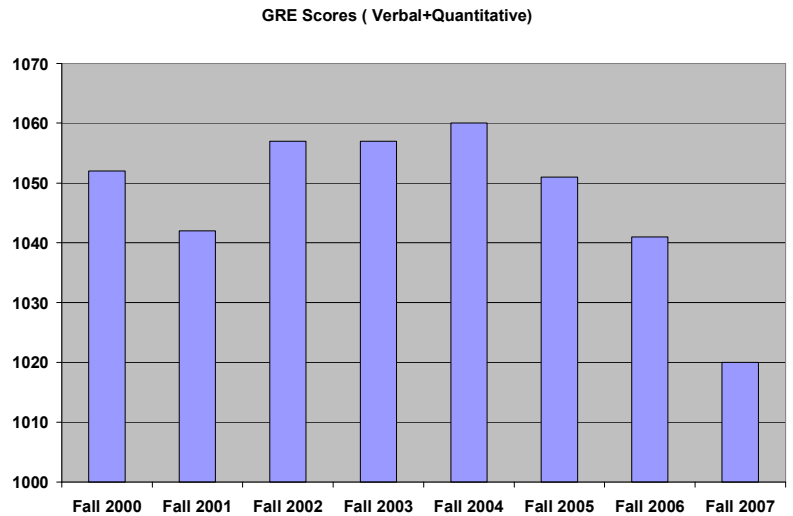


Figure 10: GRE Scores for new Graduate Students

Figure 11 shows that same historical data range for the undergraduate GPA of the incoming graduate school class. We are seeing a recovery of the GPA after the 9/11 drop and an overall increase from earlier in the decade.

The net result of both of these metrics is somewhat confusing and can lead to questions about the reliability of these two techniques for measuring academic preparation.

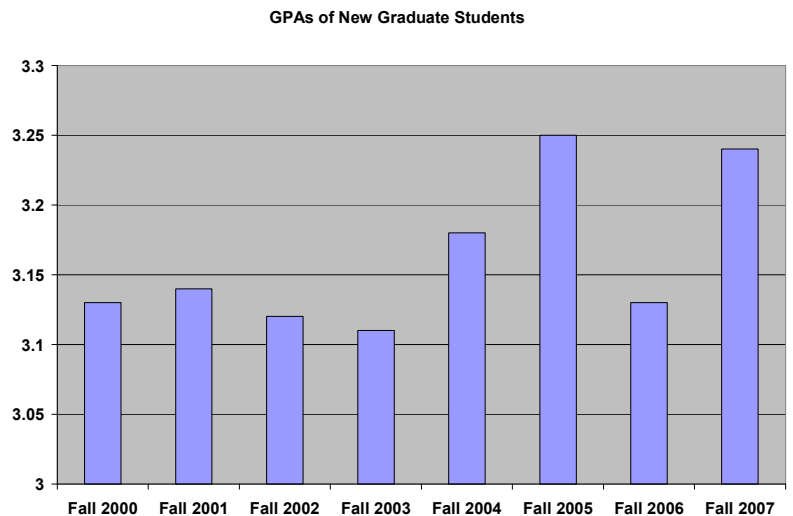


Figure 11: GPA of Incoming Graduate Students

Student Support

One final metric from the Graduate School of particular interest to students is the level of financial support they and their peers receive. In 2007 the graduate students received \$689,462 of total support, with the major portion coming from tuition waivers. Figure 12 shows a summary of all support funds available. Figure 13 shows a histogram of the financial support (from all sources, GTA, GRA, and fee waivers) received by our graduate students in 2006 and 2007. Over 80% of eligible students received some form of financial support.

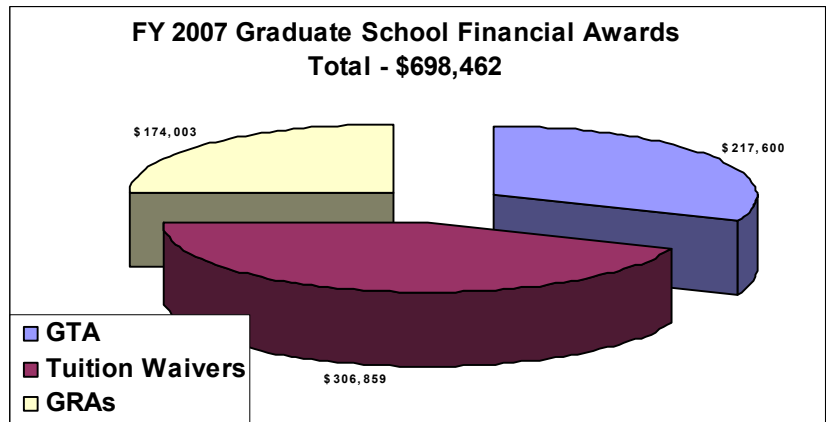


Figure 12: Total Graduate Student funding available

Of particular interest to the Research Office is the amount of graduate student support provided by grants and contracts. In the last two years these sources provided an average of \$55,000 per year in direct tuition support. In addition these sources provided an average of \$175,000 in GRA support. The average GRA support to each student in AY05/06 was \$4,700 increasing to \$7,055 in AY06/07. The distribution of all support provided to graduate students is shown in Figure 13.

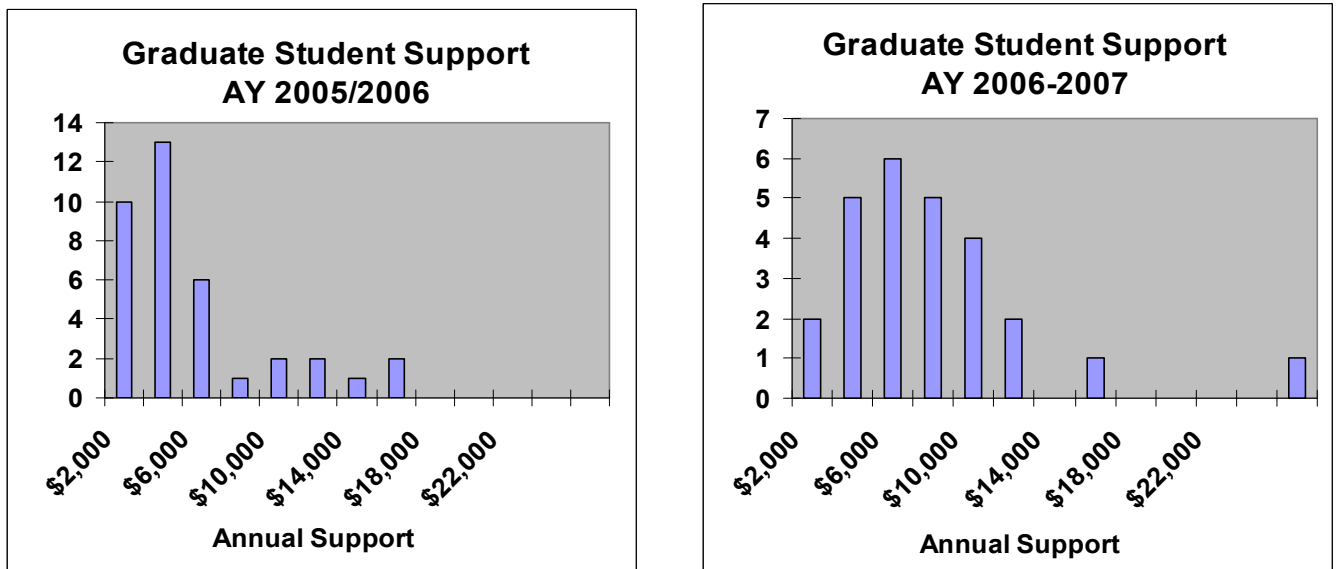


Figure 13: Graduate Student Support

IV. Office of International Programs

The Office of International Programs has worked with five self-selected academic departments to strengthen our research exchange programs with partners around the world. Participating academic departments include Metallurgical and Materials Engineering, Geophysical Engineering, Environmental Engineering, Geological Engineering, and Biological Sciences.

International Visits

The international exchange program at Montana Tech has three components.

- The campus hosts international visitors to our campus. Appendix E summarizes our hosted visitors in FY2006 and FY2007.
- Montana Tech supports visits by our faculty to foreign institutions and research sites. Appendix F lists the details of these visits for FY2006 and FY2007.
- Montana Tech operates a “Thesis Abroad” program for Montana Tech graduate students. Appendix G summarizes the students who participated in this program in FY2006 and FY2007.

All of these initiatives are supported by a grant from the Bureau of Citizens and Cultural Exchanges of the U.S. Department of State. This grant will conclude in February of 2008 and efforts are now underway to seek additional funding for the program and to incorporate the Graduate Student Thesis Abroad program into the funding base of our ongoing research programs.

APPENDICES

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| Appendix B: | List of Publications for CY 2006 |
| Appendix C: | Industrial Collaborations |
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APPENDIX A
Summary of FY 2006 and 2007 Proposals Submitted

FY 2006

| Principal Investigator | DEPARTMENT | Number of Proposals Submitted FY06 | Total Value |
|------------------------|--|------------------------------------|-------------|
| Abdo, G | Montana Bureau of Mines and Geology | 2 | \$35,000 |
| Anderson, C | Center for Advanced Mineral and Metallurgical Processing | 2 | \$1,225,568 |
| Berg, R | Montana Bureau of Mines and Geology | 1 | \$73,394 |
| Coe, D | Chemistry | 1 | \$487,550 |
| Conrad, P | Mining | 1 | \$203,714 |
| Donovan, R | General Engineering | 3 | \$100,000 |
| Douglass, R | Biology | 5 | \$689,209 |
| Duaime, T | Montana Bureau of Mines and Geology | 3 | \$166,382 |
| Ehresman, J | General Engineering | 2 | \$15,000 |
| Elliott, C | Technical Outreach | 3 | \$328,631 |
| Figueira, J | Research | 2 | \$904,738 |
| Gammons, C | Geological Engineering | 5 | \$418,574 |
| Ganesan, K | Environmental Engineering | 2 | \$155,715 |
| Ganesan, P | Environmental Engineering | 1 | \$493,222 |
| Gerbrandt, B | General Engineering | 1 | \$31,968 |
| Hargrave, P | Montana Bureau of Mines and Geology | 1 | \$27,000 |
| Heath, L | Petroleum Engineering | 1 | \$50,000 |
| Hilbert, L | College of Technology | 1 | \$89,951 |
| Hoffman, T | Petroleum Engineering | 2 | \$77,906 |
| Horton, M | Learning Center/COT | 1 | \$35,000 |
| Icopini, G | Montana Bureau of Mines and Geology | 2 | \$213,967 |
| Jensen, R. | Safety, Health and Industrial Hygiene | 1 | \$60,050 |
| Kankelborg, A | Technical Outreach | 1 | \$23,837 |
| Kasinath, R | Environmental Engineering | 2 | \$876,000 |
| Krstulich, J | Center for Advanced Mineral and Metallurgical Processing | 1 | \$758,564 |
| Kuenzi, A | Biology | 1 | \$180,252 |
| Lopez, D | Montana Bureau of Mines and Geology | 1 | \$162,954 |
| Luft, S | Trades & Technical/COT | 1 | \$327,681 |
| MacLaughlin, M | Geological Engineering | 1 | \$199,742 |
| Madigan, B | General Engineering | 2 | \$104,800 |

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|-----------------------|---|---|---------------------|
| Mellott, K | Technical Outreach Services for Communities Program and Technical Assistance to Brownfields Program | 3 | \$137,912 |
| Metesh, J | Montana Bureau of Mines and Geology | 2 | \$161,491 |
| Miller, K | Montana Bureau of Mines and Geology | 1 | \$15,000 |
| Miranda, P | Center for Advanced Mineral and Metallurgical Processing | 1 | \$144,637 |
| Morrison, J | General Engineering | 1 | \$180,000 |
| Munday, P | Professional and Technical Communications | 2 | \$4,999,995 |
| North-Abbott, M | Petroleum Engineering | 1 | \$287,830 |
| Olson, J | Montana Bureau of Mines and Geology | 1 | \$100,000 |
| Parker, S | Chemistry | 2 | \$84,638 |
| Patton, T | Montana Bureau of Mines and Geology | 2 | \$19,850 |
| Pedulla, M | Biology | 2 | \$109,000 |
| Peterson-Elakovich, D | Learning Center/COT | 2 | \$315,527 |
| Peterson, H | Environmental Engineering | 1 | \$20,000 |
| Peterson, M | Mine Waste Technology Program | 2 | \$220,980 |
| Porter, K | Montana Bureau of Mines and Geology | 1 | \$122,037 |
| Reiten, J | Montana Bureau of Mines and Geology | 3 | \$23,000 |
| Spear, T | Safety, Health and Industrial Hygiene | 1 | \$49,581 |
| Stickney, M | Montana Bureau of Mines and Geology | 2 | \$116,764 |
| Stierle, A | Chemistry | 1 | \$207,450 |
| Trudnowski, D | General Engineering | 1 | \$180,000 |
| Tucci, N | Montana Bureau of Mines and Geology | 1 | \$16,271 |
| Twidwell, L | Metallurgical and Mineral Processing Engineering | 1 | \$50,000 |
| Van Daveer, K | Nursing | 2 | \$72,867 |
| Verlanic, A | Technical Outreach | 5 | \$548,990 |
| Weight, W | Geological Engineering | 3 | \$150,540 |
| Wheaton, J | Montana Bureau of Mines and Geology | 6 | \$396,309 |
| Young, C | Metallurgical and Mineral Processing Engineering | 1 | \$2,000 |
| Zhou, X | Geophysical Engineering | 4 | \$398,037 |
| | | | \$17,647,075 |

APPENDIX A
Summary of FY 2006 and 2007 Proposals Submitted

FY 2007

| Principal Investigator | DEPARTMENT | Number of Proposals Submitted FY07 | Total Value |
|------------------------|---|------------------------------------|-------------|
| Anderson, C | Center for Advanced Mineral and Metallurgical Processing | 5 | \$6,085,124 |
| Apple, M | Biology | 1 | \$3,665 |
| Coe, D | College of Math & Science | 1 | \$593,450 |
| Conrad, P | Mining | 1 | \$45,759 |
| Delaney, P | Montana Bureau of Mines and Geology | 1 | \$10,000 |
| Donovan, R | General Engineering | 2 | \$279,963 |
| Douglass, R | Biology | 2 | \$748,528 |
| Drury, W | Environmental Engineering | 1 | \$110,449 |
| Duaine, T | Montana Bureau of Mines and Geology | 6 | \$471,819 |
| Elliott, C | Technical Outreach | 1 | \$6,000 |
| Figueira, J | Research | 2 | \$254,814 |
| Gammons, C | Geological Engineering | 3 | \$163,776 |
| Ganesan, K | Environmental Engineering | 1 | \$213,278 |
| Gleason, B | General Engineering | 2 | \$656,222 |
| Hargrave, P | Montana Bureau of Mines and Geology | 1 | \$15,000 |
| Hart, J | Safety, Health and Industrial Hygiene | 1 | \$38,500 |
| Icopini, G | Montana Bureau of Mines and Geology | 1 | \$699,907 |
| Jensen, R | Safety, Health and Industrial Hygiene | 1 | \$60,050 |
| Kankelborg, A | Technical Outreach | 3 | \$134,146 |
| Kasinath, R | Environmental Engineering | 1 | \$631,889 |
| Link, C | Geophysical Engineering | 1 | \$195,300 |
| Madigan, B | General Engineering | 1 | \$100,000 |
| Madison, J | Montana Bureau of Mines and Geology | 3 | \$111,904 |
| McGrath, S | Montana Bureau of Mines and Geology | 1 | \$3,540 |
| McIntosh, A | Nursing | 2 | \$446,776 |
| Mellott, K | Technical Outreach Services for Communities Program and Technical Assistance to Brownfields Program | 1 | \$43,250 |
| Metesh, J | Montana Bureau of Mines and Geology | 6 | \$707,035 |

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|-----------------------|--|---|---------------------|
| Miranda, P | Center for Advanced Mineral and Metallurgical Processing | 2 | \$184,360 |
| Munday, P | Professional and Technical Communications | 1 | \$183,517 |
| Parker, S | Chemistry | 4 | \$491,456 |
| Patton, T | Montana Bureau of Mines and Geology | 5 | \$128,360 |
| Pedulla, M | Biology | 1 | \$15,000 |
| Peterson-Elakovich, D | Learning Center/COT | 1 | \$123,161 |
| Peterson, H | Environmental Engineering | 1 | \$500,000 |
| Peterson, M | Mine Waste Technology Program | 2 | \$172,000 |
| Reiten, J | Montana Bureau of Mines and Geology | 4 | \$247,781 |
| Spear, T | Safety, Health and Industrial Hygiene | 1 | \$38,500 |
| Speece, M | Geophysical Engineering | 6 | \$603,540 |
| Stickney, M | Montana Bureau of Mines and Geology | 2 | \$56,250 |
| Stierle, A | Chemistry | 1 | \$200,000 |
| Trudnowski, D | General Engineering | 3 | \$83,150 |
| Verlanic, A | Technical Outreach | 3 | \$3,151,532 |
| Vincent, M | Technical Outreach | 1 | \$27,996 |
| Weight, W | Geological Engineering | 1 | \$11,344 |
| Wheaton, J | Montana Bureau of Mines and Geology | 9 | \$764,097 |
| Young, C | Metallurgical and Mineral Processing Engineering | 4 | \$520,577 |
| Young, M | Nursing | 1 | \$150,000 |
| Zhou, X | Geophysical Engineering | 2 | \$787,769 |
| | | | \$21,270,534 |

APPENDIX B

List of Publications for CY 2006

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|---|
| <p>Amtmann, J., Amtmann, K. 2006. Fit To Respond: Strength Training for EMS Professionals. Journal of Emergency Medical Services. Vol. 31, No. 7, pp. 52-56.</p> |
| <p>Amtmann, K.—Amtmann, J., Amtmann, K. 2006. Fit To Respond: Strength Training for EMS Professionals. Journal of Emergency Medical Services. Vol. 31, No. 7, pp. 52-56.</p> |
| <p>Anderson, C.G. and L.G. Twidwell, The Control of Iron and Arsenic in the Treatment of Gold Bearing Enargite Concentrates, Proceedings Iron Control in Hydrometallurgy, CIM, Montreal, 2006.</p> |
| <p>Apple, M., Fontenla, S., Fernandez, N., and C. Ezcurra. 2006. "Mycorrhizal symbioses above treeline in the Patagonian Andes of Argentina at Cerro Chaluaco: A Potential GLORIA site." MTNCLIM 2006, sponsored by the Consortium for Integrated Climate Research on Western Mountains (CIRMOUNT) (http://www.fs.fed.us/psw/cirmount/), Timberline, Mt. Hood, Oregon. http://www.fs.fed.us/psw/mtnclim/.</p> |
| <p>Bardsley, S.M. The Effects of Respirator Wear on Heart Rate and Blood Pressure During Moderate Steady-state Work. Proceedings of the 3rd Annual Regional National Occupational Research Agenda (NORA) Young/New Investigators Symposium, April 2005, Salt Lake City, pp.1-10,. The Rocky Mountain Center for Occupational and Environmental Health, University of Utah, 2006.</p> |
| <p>Berg, R.B.—Berger, A. L., and Berg, R.B., 2006, The Silver Bow sapphire occurrence, Montana: Evidence for a volcanic bedrock source for Montana's alluvial sapphire deposits: Economic Geology, v. 101, p. 679 – 684.</p> |
| <p>Berg, R.B.—Twidwell, L.G., Gammons, C.H., Young, C.A., and Berg, R.B., 2006, Summary of deepwater sediment/pore water characterization for the metal-laden Berkeley Pit Lake, Butte, Montana: Mine Water and the Environment, V. 25, no. 2, p. 86-92.</p> |
| <p>Berg, R.B., and Cooney, C.F., 2006, The importance of surface features and adhering material in deciphering the geologic history of alluvial sapphires – An example from western Montana [abs.] Gems and Gemology, v. 42, no. 3, p. 145.</p> |
| <p>Berg, R.B., 2006, Geologic map of the Upper Clark Fork Valley between Bearmouth and Missoula, southwestern Montana: Montana Bureau of Mines and Geology Open-file Report MBMG 535, 17-p. text, map scale 1:50,000.</p> |
| <p>Cameron, D.; Willett, M.; Hammer, L., "Distribution of Organic Carbon in the Berkeley Pit Lake, Butte, Montana," Mine Water and the Environment, 2006, 25(2), 93-99.</p> |
| <p>Douglass, R.J.—Calisher CH, K D Wagoner, BR Amman, JJ Root, RJ Douglass, AJ Kuenzi, KD Abbott, C Parmenter, TL Yates, TG Ksiazek, BJ Beaty, and JN. Mills, 2006. Demographic Factors Associated with Prevalence of Antibody to Sin Nombre Virus in Deer Mice in the Western United States. J. Wildlife Diseases 42:813-818.</p> |
| <p>Douglass, RJ, CH. Calisher, KD Wagoner and JN. Mills, 2006. Sin Nombre virus infection of deer mice in Montana: characteristics of newly infected mice, Incidence, and temporal pattern of infection. J. Wildlife Diseases (in press).</p> |
| <p>Douglass, RJ, WJ Semmens, SJ Matock-Cooley and AJ Kuenzi, 2006. Deer mouse movements in peridomestic and sylvan setting in relation to Sin Nombre virus antibody prevalence. J. Wildlife Diseases (in press)</p> |
| <p>Duaine, T.E.—Gammons, C. H. and Duaine T. E. (2006) Long-term changes in the geochemistry and limnology of the Berkeley pit-lake, Butte, Montana. Mine Water and the Environment 25(2), 76-85.</p> |
| <p>Duaine, T.E.—Gammons, C. H., Metesh J. J. and Duaine T. E. (2006) An overview of the mining history and geology of Butte, Montana. Mine Water and the Environment 25(2), 70-75.</p> |
| <p>Duaine, T.E.—Gammons, C.H. and Duaine T.E. (2006) Geochemistry and stable isotopes of acid mine drainage from abandoned coal mines in the Belt-Stockett area, Montana. Proc. 28th Annual Conf. of the National Assoc. of Abandoned Mine Land Programs (NAAML), Billings, MT, Sept. 2006, Paper 16, 14 pp.</p> |
| <p>Duaine, T.E.—Gammons, C. H., Duaine T. E., Parker S. R., Grant T. R. and Botsford W. S. (2006) Geochemistry and hydrogeology of acid mine drainage in the Great Falls- Lewistown Coal Field, Montana. Proc. 7th International Conf. on Acid Rock Drainage, St. Louis, MO, March, 2006, p. 630-647.</p> |
| <p>Gammons, C. H., Poulson S. R., Pellicori D. A., Roesler A., Reed P. J., Petrescu E. M. (2006) The hydrogen and oxygen isotopic composition of precipitation, evaporated mine water, and river water in Montana, USA. Journal of Hydrology 328, 319-330.</p> |
| <p>Gammons, C. H.—Shope C. L., Xie Y., and Gammons C. H. (2006) The influence of hydrous Mn-Zn oxides on diel cycling of Zn in an alkaline stream draining abandoned mine lands. Applied Geochemistry 21, 476-491.</p> |
| <p>Gammons, C. H.—Wood S. A., Gammons C. H., and Parker S. R. (2006) The behavior of REE in naturally and anthropogenically acidified waters. Journal of Alloys and Compounds 418, 161-165.</p> |

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| <p>Gammons, C. H., Slotton D.G., Gerbrandt B., Weight W., Young C. A., McNearny R. L., Cámac E., Calderon R. and Tapia H. (2006) Mercury concentrations in fish, water, and stream sediment in the Rio Ramis-Lake Titicaca watershed, Peru. <i>Science of the Total Environment</i>, 368 (2-3), 637-648.</p> |
| <p>Gammons, C. H. and Madison J. P. (2006) Contaminated alluvial groundwater in the Butte Summit Valley. <i>Mine Water and the Environment</i> 25(2), 124-129.</p> |
| <p>Gammons, C. H. and Duaiame T. E. (2006) Long-term changes in the geochemistry and limnology of the Berkeley pit-lake, Butte, Montana. <i>Mine Water and the Environment</i> 25(2), 76-85.</p> |
| <p>Gammons, C. H., Metesh J. J. and Duaiame T. E. (2006) An overview of the mining history and geology of Butte, Montana. <i>Mine Water and the Environment</i> 25(2), 70-75.</p> |
| <p>Gammons, C. H., Metesh J. J., and Snyder, D. M. (2006) A survey of the geochemistry of flooded mine shaft water in the Butte District, Montana. <i>Mine Water and the Environment</i> 25(2), 100-107.</p> |
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| <p>Zhou, X. and S. Li, “Detection of coastal region sea ice decay from orthorectified RADARSAT-1 ScanSAR imagery: A case study of Bering Strait and Norton Sound, Alaska” . The 9th Bi-Annual Circumpolar Remote Sensing Symposium, Seward, Alaska. May 15-19, 2006.</p> |
| <p>Zhou, X. —Wang, X., Xie, H., Guan, H., Zhou, X., "Different responses of MODIS-derived NDVI to root-zone soil moisture in semi-arid and humid regions", <i>Journal of Hydrology</i>, doi: 10.1016/j.jhydrol.2007.03.022, in press.</p> |

APPENDIX C Industrial Collaborations

July 2005 through June 2006

| PI (Co-PI) Name | Dept | Title of Project | Primary (Secondary) Funding Source | Total Project Awarded |
|--------------------|------|--|--|-----------------------------|
| Anderson, C | CAMP | Thermodynamic & Kinetic Autoclave Model Development | Optima Powerware | \$32,824 |
| Anderson, C | CAMP | Mineral Sample Testing, Tampakan Project Task III Testing | Indophil Resources | \$16,607 |
| Anderson, C | CAMP | NSC Sulfur Formation Optimization and Alkaline Sulfide Gold Testing | Barrick Gold Corp. | \$10,500 |
| Anderson, C | CAMP | NSC Oxidative Pressure Leaching of Marca Punta Copper Concentrates | Sociedad Minera El Brocal | \$17,965 |
| Anderson, C | CAMP | Peruvian Silver Project | Pan American Corp. | \$42,633 |
| Anderson, C | CAMP | MLA Sampling Analysis, Catalyst Analysis Samples, Slag Granulation, Sample Testing Project, Lab Analysis Consulting Expenses | Stillwater Mining Company | \$15,600 |
| Anderson, C | CAMP | Concrete Upgrade Optimization Work | Elkhorn Goldfields | \$15,140 |
| Anderson, C | CAMP | Lab Analysis Consulting Expenses | Tiffany & Co. | \$7,430 |
| Anderson, C | CAMP | Diagnostic Leaching, Locked Cycle Leach & EW Testing Work, Gold Leaching Test Work | Straits Resources | \$55,838 |
| Anderson, C | CAMP | Indian Springs Tungsten Project - Technical Services Performed by CAMP | Galway Resources | \$5,879 |
| Anderson, C | CAMP | Bond Work Index & Relative Abrasion Tests | Great Western Minerals Group | \$53,136 |
| Anderson, C | CAMP | Indian Springs Tungsten Property, Nevada Met Data Review | Galway Resources | \$5,640 |
| Anderson, C | CAMP | Cerro de Pasco Silver Resource Characterization and Process Development | Pan American Silver Corporation | \$31,475 |
| Anderson, C | CAMP | Thermodynamic and Kinetic Autoclave Model Development | Optima Powerware Inc. | \$26,842 |
| Anderson, C | CAMP | Technical Assistance for Laboratory Samples, Methods and Equipment | Tiffany & Company | \$5,727 |
| Anderson, C | CAMP | Technical Assistance for Proposed Zinc and Precious Metals Recovery | Terry Sozanski | \$10,900 |

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|--------------------------|----------|---|--|------------------|
| Anderson, C | CAMP | Technical Assistance for the Indian Springs Tungsten Property, Nevada Metallurgical Data Review | Galway Resources | \$5,640 |
| Anderson, C | CAMP | Technical Assistance for Pyrometallurgical Fume and Particulate Control | Allied Precious Metals Recycling Company, Inc. | \$12,780 |
| Anderson, C | CAMP | Continuation of Crosscutting Technology Development of CAST | CAST(Stillwater Mining Company) | \$73,318 |
| Donovan, R | GEN ENGR | Interagency Agreement for Development of Forge Affiliate Program in High Schools | GOED | \$25,000 |
| Donovan, R | GEN ENGR | Distributed Ad-Hoc Intelligent Sensor Intrusion Detection System | G-5 Technologies | \$99,903 |
| Gammons, C | GEOL | Vertical Gradients in Biogeochemistry of Flooded Mine Shafts in the Butte, Montana Flooded Mine Complex | MWTP(EPA)(DOE)(MSE) | \$50,000 |
| Gerbrandt, G (Sawyer, P) | ENVE | Revegetation Monitoring for Montana Resources Inc. - Continuation of RC #494 | Montana Resources | \$22,256 |
| Patton, P | MINING | Judith Basin Coal Project - MOU - Pace Financial Network - Necessary Core Data Attributes from 30 Client Coreholes | Pace Financial Network | \$13,152 |
| Peterson, M | MWTP | Mine Waste Training and Education-FY06 | EPA(DOE)(MSE) | \$136,355 |
| Peterson, M | MWTP | MWTP Project Management - FY06 | EPA(DOE)(MSE) | \$84,625 |
| Porter, K | MBMG | Husky Energy Geologic Field Course | Husky Energy | \$6,150 |
| Twidwell, L | MET | Influence of Anions on the Removal of Arsenic by Co-precipitation and Long-Term Stability of Ferrihydrite and Modified Ferrihydrite | MWTP(MSE) | \$50,000 |
| Verlanic, A | OUTREACH | RYO Correctional Facility - Technical Outreach | RYO Correctional Facility | \$1,325 |
| | | | | \$934,640 |

APPENDIX C Industrial Collaborations

July 2006 through June 2007

| PI (Co-PI) Name | Dept | Title of Project | Primary (Secondary) Funding Source | Total Project Awarded |
|-------------------------------|----------|---|--|-----------------------------|
| Abdo, G | MBMG | Water Balance Monitoring Project | Big Hole Watershed Committee | \$10,000 |
| Anderson, C | CAMP | Technical Assistance - Samuel Engineering | Samuel Engineering | \$17,740 |
| Anderson, C | CAMP | Stillwater Partnership Mod. 1 | Stillwater Mine | \$65,000 |
| Anderson, C | CAMP | Yetter & Warren LLP Expert Witness Technical Assistance | Yetter & Warden | \$3,104 |
| Anderson, C (Dakubo, F) | CAMP | Phase I. and Phase II. Evaluation of M-I SWACO Ore | Robert Bailey | \$60,240 |
| Anderson, C (Krstulich, J) | CAMP | Technical Assistance for Preliminary Design of a Silicon Recycling Facility | MERDI & Headquarters | \$3,000 |
| Anderson, C (Miranda, P) | CAMP | Technical Assistance for Treatment of Belmont Mine Water for Irrigation Purposes - | MSE | \$14,780 |
| Conrad, P | MIN | Determine the Correlation Between Rock Moved and Steel Consumed for Ground Engaging Tools | Newmont USA Limited | \$45,759 |
| Duaime, T | MBMG | MSE-Belmont Mine Test | MSE | \$10,963 |
| Gammons, C | GEOL | Biogeochemistry of Flooded Mine Shafts | MWTP(MSE) | \$50,000 |
| Hoffman, T | PET | History Matching Naturally Fractured Reservoirs - Consulting Agreement | Chevron Energy | \$42,906 |
| Gerbrandt, B (Sawyer, P) | GEN ENGR | Revegetation Monitoring at East Dump | Montana Resources | \$31,969 |
| Kankelborg, A | OUTREACH | Community Partners Americorps Program 2006-2007 | Montana Office of Community Service | \$500 |
| Madigan, B | GEN ENGR | Support Activities for Resodyn SBIR N05-120 Phase I Navy Project: Evaluation of Fastener Hold Cold-Work | Resodyn | \$4,800 |
| Miller, K (McDonald, C) | MBMG | Irrigation Methods; Pesticide Transport to Groundwater: Greenfields Bench, Teton County, MT/Industry Match | American Cianamide (DOA) | \$15,000 |

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|------------------------|-------|---|---------------------------------------|------------------|
| Patton, T | MBMG | MOU - Gallatin Valley Monitoring Wells | Gallatin Local Water Quality District | \$24,896 |
| Peterson, M | MWTP | Project Management Funding for MWTP - FY07 | MSE | \$71,810 |
| Peterson, M | MWTP | MWTP Training and Education Funding - FY07 | MSE | \$100,190 |
| Spear, T | SH/IH | Sampling Strategy for Silicon Exposure | ASIMI | \$7,000 |
| Spear, T (Hart, J) | SH/IH | Subcontract Agreement - NCAT Montana Asbestos Safe Weatherization Demonstration Project - Phase I | NCAT | \$77,000 |
| Twidwell, L | MET | Influence of Anions on the Removal of Arsenic by Co-precipitation and Long-Term Stability of Ferrihydrite and Modified Ferrihydrite | MWTP(MSE) | \$50,000 |
| Weight, W | GEOL | Prescribed Fire in Riparian Zones Affected by Conifer Expansion | NRI(USU) | \$76,626 |
| Weight, W (Gammons, C) | GEOL | Radionuclides in Mine-impacted Waters Within the Boulder Batholith | MWTP | \$68,330 |
| | | | | \$851,613 |

APPENDIX D PATENT APPLICATIONS AND PATENT AWARDS

| Description / Patent No. | File Date | Patent Name | Inventor's / Co-Inventor Name(s) | Inventor's / Co-Inventor's Affiliation |
|--|------------|---|--|--|
| Disclosures in Process | | | | |
| Disclosure received | 12/5/2007 | Control of Tool Normal Stress During Friction Stir Welding | R. Bruce Madigan | Montana Tech |
| | | | Thomas Lienert | Los Alamos National Lab |
| Provisional Patents | | | | |
| Provisional Patent UMT - 111P Serial No. 60/637,969 (filed 12-20-04) and UMT - 111CP Serial No. 60/724,631 (filed 10-7-05) | 12/20/2004 | Battery Impedance Identification via Simultaneous Synchronous Detection | Dr. John Morrison | Montana Tech |
| Patents Applied for by Montana Tech | | | | |
| UMT-111CXC1 Serial No. 11/313,546 | 12/20/2005 | Battery Impedance Identification Via Simultaneous Synchronous Detection | Dr. John Morrison | Montana Tech |
| Patents Issued | | | | |
| Patent No. 10/840,442 Company: PFM | 5/6/2004 | Rapidly Deployable Three Dimensional Seismic Recording System | Dr. Curtis Link & Dr. Marvin Speece | Montana Tech |
| Patent No. 7,314,507 | 1/1/2008 | Apparatus & Method for Removing Mercury Vapor from a Gas Station | Dr. Kumar Ganesan | Montana Tech |
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| Disclosures/Patents Abandoned | | | | |
|--|-----------|--|---|--------------|
| ABANDONED--5/2005 | 2/18/2005 | Meth Lab Detection System | Dr. John Morrison, Mr. Bruce Madigan, and Dr. Richard Johnson | Montana Tech |
| ABANDONED--5/2007 Provisional Patent MTT-103P Serial No. 60/814,374; (filed 6-14-06) | 6/14/2006 | Copper Molybdenum Alloy with High Conductivity | Kevin Jaansalu, Courtney Young, plus 8 students | Montana Tech |
| ABANDONED--6/5/07 Provisional Patent MTT-104-P Serial No. (60/812,019); (filed 6-7-06) | 6/7/2006 | Effect of Pressure on Flootation Performance | Dr. Courtney Young | Montana Tech |
| ABANDONED--7-16-07 Provisional Patent MTT-105P Serial No. 60/831,520; (filed 6-17-06) | 6/17/2006 | Real-Time Synchronized Grid Frequency Sensor | Dan Trudnowski, John Morrison, and 2 students | Montana Tech |

APPENDIX E

International Visitors FY2006 and FY2007

| International Campus Visitors To Montana Tech FY06 & FY07 | | | | | | |
|--|---------------|--|-------------|---------------|--|---|
| | Date of Visit | | | Date of Visit | Agenda | Campus |
| Name | Arrival | Institution | Citizenship | Departure | Purpose | Host |
| Margaret Fong, Ambassador | 5/31/2007 | Director-General of the Hong Kong Economic & Trade Office | Japan | 5/31/2007 | Exploring opportunities for economic exchange with focus on Clean Energy and Beef | Mike Johnson, Butte Economic Development Center and other Butte Representatives |
| Professor Okura Takahiko | 1/9/2007 | Venture Business Laboratory, National University Corporation, Akita University | Japan | 1/11/2007 | Discussions concerning common research areas. | Larry Twidwell, Courtney Young, Joseph Figueira, Chancellor Frank Gilmore |
| Student, Flavia Mazzini | 5/2/2007 | Universidad Nacional Del Comahue, Bariloche, Argentina | Argentina | 10/2/2007 | Undergraduate Research, Senior Thesis, Hantavirus Project | Rick Douglass, Amy Kuenzi |
| Dr. Mark Talesnick | 9/4/2006 | Technion, Haifa | Israel | 9/12/2006 | Assist with lab testing for NSF Large Voids Project and present at Graduate Seminar Series. Future Research Collaboration. | Dr. Mary MacLaughlin |
| Kurt Moeller | 8/15/2006 | Kjtech, University of Queensland, Australia | Australia | 8/25/2006 | Work with MLA | Corby Anderson |

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|---|-----------|--|-----------|-----------|--|---|
| Ravden Vold, Ambassador | 6/22/2006 | Mongolia | Mongolia | 6/26/2006 | Seeking trade options with particular interest in copper mining and environmental impacts of mining. | Senator Conrad Burns, Chancellor Frank Gilmore |
| Dr. Greg Hope | 5/10/2006 | Griffith University, Brisbane, Queensland, Australia | Australia | 5/17/2006 | Metallurgical Research - Exploring Possibilities | Courtney Young |
| Dr. Ying Gu | 5/1/2006 | JK Tech, University of Queensland, Australia | Australia | 5/19/2006 | Mineral Research | Chris Gammons |
| Ambassador Naser M.Y. Al Belooshi | 3/31/2006 | Bahrain | Bahrain | 4/1/2006 | Attend Economic Development Summit held at Montana Tech | Senator Baucus, Chancellor Frank Gilmore |
| Ambassador Zhou Wenzhong | 3/31/2006 | China | China | 4/1/2006 | Attend Economic Development Summit held at Montana Tech | Senator Baucus, Chancellor Frank Gilmore |
| Ambassador Sudjadnan Parnohadiningrat | 3/31/2006 | Indonesia | Indonesia | 4/1/2006 | Attend Economic Development Summit held at Montana Tech | Senator Baucus, Chancellor Frank Gilmore |
| Ambassador Lee Taesik | 3/31/2006 | Korea | Korean | 4/1/2006 | Attend Economic Development Summit held at Montana Tech | Senator Baucus, Chancellor Frank Gilmore |
| Ambassador Frederico A. Humbert | 3/31/2006 | Panama | Panama | 4/1/2006 | Attend Economic Development Summit held at Montana Tech | Senator Baucus, Chancellor Frank Gilmore |
| Professor Gerard T. Wrixon, President, University College Cork | 9/5/2005 | University College Cork, Cork, Ireland | Ireland | 9/5/2005 | Exchange | Joe Figueira, Corby Anderson, Chancellor Gilmore |

APPENDIX F

International Collaborations FY2006 and FY2007

| Montana Tech Faculty & Student International Travel/Exchange | | | | | |
|---|-------------------------------|-------------|--|------------------------------------|---|
| Department | Date of Arrival | Institution | Country | Agenda / Purpose | |
| Metallurgical & Materials Engineering | Metallurgy, Student, Nick Gow | 6/29/2007 | Griffith University | Australia | Research |
| Metallurgical & Materials Engineering | Student, Katie Schumacher | 6/1/2007 | University of Alberta | Canada | Research Project - "To investigate the incorporation of refractory materials in copper-based systems for use as wear-resistant coatings and free-machining alloys." |
| Environmental Engineering | Student, Kim Draperly | 5/20/07 | Universidad Nacional del Comahue | San Carlos de Bariloche, Argentina | Thesis Abroad |
| Chemistry | Douglas Cameron | 5/14/2007 | University College, Cork, Ireland/University of Aberdeen, Aberdeen, Scotland | Ireland, Scotland | Develop research and educational contacts. Follow-up trip to trip made by Joe Figueira in 2005. |
| Geophysical Engineering | Student, Christopher Crowell | 2/2/2007 | James Cook University, Cairns | Australia | Behanna Creek project, Study of Groundwater flow, under Professor Paul Nelson |
| CAMP | Corby Anderson | 1/23/2007 | CMP Annual Meeting, Ottawa | Canada | Attend CMP Meeting. |
| Professional and Technical Communication | Bill Macgregor | 1/3/2007 | UMaT | Ghana | Present a Technical Communication Workshop and to discuss course structure for a UMaT program. |
| CAMP | Corby Anderson | 1/9/2007 | Sydney, Brisbane & Christchurch | Australia | Meet with Straits Resources, Client of CAMP |

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|---------------------------------------|---|-------------|---|-----------|---|
| Metallurgical & Materials Engineering | Larry Twidwell | 10/8/2006 | Akita University | Japan | Discussions re: potential student and faculty exchanges; work w/ doctorate students; Assist in development of a research program dealing with recycling and metals recovery processing. |
| Environmental Engineering | Kumar Ganesan | 1/2/2006 | IIT Chennai and Biomedical Institute in Trivandrum India Chennai | India | Strengthen existing collaborative working relationship. |
| Metallurgical & Materials Engineering | Larry Twidwell | 10/1/2006 | Metallurgical Society, Montreal | Canada | Attend "Iron Hydrometallurgy" at 36th Annual Meeting, Metallurgical Society and meet with Dr. George Demopoulos, re: exchange students. |
| Environmental Engineering | Kumar Ganesan | 8/6/2006 | Queens College, London | England | Attend Conference and Collaborative Research |
| Geophysical Engineering | Curtis Link | 7/6/2006 | University of Queensland | Australia | Exchange Visit |
| Engineering Science | Dan Trudnowski | 6/19/2006 | IEEE Power Engineering Systems, Montreal | Canada | Attend and present paper at Conference. |
| Geological Engineering/ Chemistry | Chris Gammons, Steve Parker | 6/2/2006 | Professor Ricardo Amils, Sevilla | Spain | Collaboration with Professor Amils and sampling of Rio Tinto and Rio Odiel |
| Geological Engineering | Students, Bethany Erfourth and Cindy Wright | 6/1/2006 | East Asia Pacific, Funded by NSF EAPSI | Asia | East Asia Pacific Student Internship |
| Environmental Engineering | Student of Holly Peterson, George Mwaniki | Summer 2006 | University of Nairobi | Africa | Continuing Holly Peterson's research in the content of metals that are threatening to human blood by testing hair samples of pets that are in close contact with humans. |
| Geological | Mary MacLaughlin | 5/28/2006 | Glasgow University | Scotland | Continued discussions regarding DDA research. Taught short course. |
| Counseling/ Programming | Margie Pascoe | 5/21/2006 | NAFSA Annual Conference, Montreal, Quebec | Canada | Obtain training to assist foreign scholars, faculty and students studying/working abroad and overall exchange opportunities. |
| CAMP | Corby Anderson, John Krstulich | 5/19/2006 | Titan Interstate Association International Conference, Moscow | Russia | Attend Conference. |
| Geological Engineering | Mary MacLaughlin | 5/11/2006 | Glasgow University | Scotland | Continued discussions regarding DDA research. |

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| Metallurgical & Materials Engineering | Courtney Young | 5/2/2006 | University of San Marcos, Lima, Peru | Peru | Speak at the 7th International Gold Symposium. Title of Paper - Cyanide Stewardship - Recycling vs. Destruction |
| Biology | Grant Mitman | 4/15/2006 | Universidad del Comahue, Bariloche | South America | Natural Acid Lake sampling and visit University to establish student exchange arrangements. |
| Research | Joe Figueira | 4/2/2006 | JK Institute, Brisbane; University of Queensland, Brisbane; James Cook University, Cairns; University of New South Wales, Sydney | Australia | Exchange Visit |
| Liberal Studies | Robert Ziegler | 3/29/2006 | Conference of Society of Diz-neuviemistes at the University of Edinburgh | Scotland | Present Paper "Meanings of Pleasure in Mirbeau's Le Journal d'une femme de chambre" |
| Research/CAMP | Joe Figueira, Corby Anderson | 3/21/2006 | AMIRA International, Toronto, Canada | Canada | Attend AMIRA International Meeting |
| Professional and Technical Communication | Henrietta Shirk | 3/19/2006 | Trinity College, Oxford University, Oxford, UK | United Kingdom | Present paper entitled "Women's 'Place' in the Gender Digital Divide: Confronting Rhetorical Boundaries in the Cyberspace Landscape" |
| Geophysical Engineering | Curtis Link | 3/9/2006 | James Cook University, Cairns | Australia | Foreign exchange visit to do collaborative research and teaching. |
| Biology | Martha Apple | 3/7/2006 | Universidad del Comahue, Bariloche | Argentina | Work with Dr. Sonia Fontenal and graduate student, Natalia Fernandez and Dr. Cecilia Ezcurra on Mycorrhizae of Andean Plants. |
| Environmental Engineering | Kumar Ganesan | 2/2/2006 | Neerul Islam College of Engineering/Nanyang Technological University | India/Singapore | Execute Memorandum of Understanding in India and develop collaboration in biomedical engineering research at Nanyang. |
| Environmental Engineering | Kumar Ganesan | 1/2/2006 | NI Engineering College, Trivandrum, India | India | To Develop and Sign Memorandum of Understanding |
| Mining Engineering | Phil Patton, John Brower | 11/1/2005 | University Seminar | Guatemala | Present Two Day Seminar sponsored by Glamis Gold Mining Company's "Exploradora Montana" |
| Research | Joe Figueira | 10/13/2005 | University College Cork, Shannon, Ireland | Ireland | Exchange Visit |
| CAMP | Corby Anderson | 7/5/2005 | University College Cork, Ireland, Glasgow, Scotland & Shannon, Ireland | Ireland/Scotland | Meet with President Wrixon, the Chemistry Department, and Tyndall National Institute. Meet with Chemical Engineering personnel. |

APPENDIX G

International Exchange Program

| Graduate Student Participants -Thesis Abroad Program | | | | | |
|---|-----------------------------------|-----------------|--|------------------------------------|--|
| Department | Name | Date of Arrival | Institution | Country | Agenda / Purpose |
| Metallurgical & Materials Engineering | Nick Gow | 6/29/2007 | Griffith University | Australia | Recovery of Gold from Thiosulphate Leach Liquor Using Activated Carbon |
| Metallurgical & Materials Engineering | Katie Schumacher | 6/1/2007 | University of Alberta | Canada | To investigate the incorporation of refractory materials in copper-based systems for use as wear-resistant coatings and free-machining alloys. |
| Environmental Engineering | Kim Draperly | 5/20/07 | Universidad Nacional del Comahue | San Carlos de Bariloche, Argentina | Treatability of Soluble Selenium in Two Naturally Occurring Springs and One Collection System in German Gulch Montana |
| Geophysical Engineering | Christopher Crowell | 2/2/2007 | James Cook University, Cairns | Australia | Behanna Creek Project - Study of Groundwater Flow, under Professor Paul Nelson, JCU |
| Geological Engineering | Bethany Erfourth and Cindy Wright | 6/1/2006 | East Asia Pacific, Funded by NSF EAPSI | Asia | East Asia Pacific Student Internship |
| Environmental Engineering | George Mwaniki | Summer 2006 | University of Nairobi | Africa | Continuing Holly Peterson's research in the content of metals that are threatening to human blood by testing hair samples of pets that are in close contact with humans. |