

CURRICULUM VITAE

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ROBERT T. PACK

Associate Professor (with tenure), Department of Civil and Environmental Engineering
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EDUCATION

B.Sc. (Engineering Geology) 1980, Brigham Young University
M.A.Sc. (Geological Engineering) 1982, University of British Columbia
Ph.D. (Civil Engineering) 1985, Utah State University

WORK EXPERIENCE

2006 to present Associate Professor, Civil and Environmental Engineering Department, Utah State University and Senior Engineer, USU Space Dynamics Laboratory

Engineering, research and teaching encompassing the fields of geomatics, remote sensor systems engineering and applications, terrain analysis and target detection, earth surface processes. He currently works with building a new lidar remote sensing instrument designed for detailed 3D imaging of the natural landscape.

2006 to present Director, USTAR Directed Energy Sensors Technology team, Utah State University
Leads a team of six faculty and twenty-five graduate students in the pursuit of commercialization and contract opportunities for lidar/lidar systems at the Space Dynamics Laboratory.

2005 to present Adjunct Research Associate Professor, Mechanical and Aerospace Engineering Department, Utah State University.

Engineering, research and teaching in encompassing opto-mechanical design and remote sensor systems engineering.

2003 to present Director, Utah Center for Advanced Imaging LADAR, Utah State University
Leads a team of five faculty and twelve graduate students in the pursuit of commercialization and contract opportunities for three dimensional imaging lidar.

2003 to present Research Associate Professor, Electrical and Computer Engineering Department, Utah State University.

Engineering, research and teaching in encompassing opto-electronic design and remote sensor systems engineering.

1998 to present Principal, Lidar Pacific Corporation

Founded Lidar Pacific Corporation for the purpose of developing a unique technology that fuses digital imagery with lidar data in real-time. Under his leadership, this sweat-equity company is now working with the Space Dynamic Laboratory in developing this technology for U.S. defense applications.

1998 to 2006 Research Associate Professor (Term Appointment), Civil and Environmental Engineering Department, Utah State University

Engineering, research and teaching encompassing the fields of geomatics, remote sensor systems engineering and applications, terrain analysis and target detection, earth surface processes. He currently works with building a new lidar remote sensing instrument designed for detailed 3D imaging of the natural landscape.

1996 to 1998 Adjunct Associate Professor, Utah State University

Initiated and completed two Canadian-funded research projects associated with landslide risk assessment, sediment routing, in-lake sediment dating, and GIS software development. With the assistance of programmers, designed the SINMAP GIS-based software application for landslide hazard mapping that is now used world-wide.

1988 to 2000 Project Engineer and President, Terratech Consulting Ltd.

Geotechnical engineer and engineering geologist specializing in the use of remote sensing techniques for geologic hazards evaluation and risk assessment. Under his direction, over two million hectares of landslide hazard mapping has been completed in British Columbia. As a computer programmer, he has developed software related to geotechnical analysis, analytic photogrammetry, and geographic information systems. He started the company in 1988, managed it for 10 years, and then sold-out to his partners in 2000.

1985 - 1988 Project Engineer and Engineering Geologist, Thurber Consultants Ltd.

Apprentice engineer providing geological engineering consulting services throughout western Canada. His experience included large corridor studies for major highways and mining roads, landslide risk analysis, foundation design, and rock quarry evaluation. He has completed computer programming for automation of large soil testing laboratory and slope stability analysis.

Current Professional Licenses:

Professional Engineer (**PEng**) - Province of British Columbia

Professional Geoscientist (**PGeo**) – Province of British Columbia

Professional Engineer (**PE**) - State of Washington

Professional Engineer (**PE**) - State of Utah

Professional Society Membership

Member, American Society for Photogrammetry and Remote Sensing

Member, Optical Society of America

PUBLICATIONS

Patents

Pack, R.T. and Pack, F.B., 2003. 3D Multispectral Lidar. U.S. Patent No. 6,664,529.

Pack, R.T. and Budge, S.E. 2005. System and Method for Improving Lidar Data Fidelity Using Pixel-Aligned Lidar/Electro-Optic Data. U.S. Patent No. 7,417,717.

Books

Pack, R.T. 1998. Road Construction Techniques for Potentially Unstable Terrain. RRET Course Manual
Published by British Columbia Institute of Technology, Burnaby, B.C. 230p.

Book Chapters

Pack, R.T. 2005. Application of Remote Sensing Methods. Chapter 11 in Debris Flows and Debris Avalanches – A Practically Oriented Overview of the State-of-the-Art, M. Jakob and O. Hungr Editors, Praxis Publishing House, Chichester, UK. p.275-289.

Journal Articles

Blonquist, K. and Pack, R.T. 2010. Bundle adjustment for the orthogonal projection with inner constraints. Journal of the International Society for Photogrammetry and Remote Sensing. Submitted.

Blonquist, K. and Pack, R.T. 2010. Orthogonal photogrammetric solutions without a-priori camera and target knowledge. Journal of the International Society for Photogrammetry and Remote Sensing. Submitted.

Blonquist, K. and Pack, R.T. 2010. Method for parameter initialization that improves the robustness of perspective photogrammetric solutions to near-orthographic image geometries. Journal of the International Society for Photogrammetry and Remote Sensing. Submitted.

R. Kayen, R.T. Pack, J. Bay, S. Sugimoto, H. Tanaka. 2006. Terrestrial-LIDAR visualization of surface and structural deformations of the 2004 Niigata Ken Chuetsu, Japan Earthquake. Earthquake Spectra J., v.22, n.S1, p. S147-S162.

Luce, C.H., Tarboton, D.G., Istanbuluoglu, E. and Pack, R.T. 2005. Reply to Comment by Johathan J. Rhodes on “modeling and interactions between forest vegetation, disturbances, and sediment yields”. Journal of Geophysical Research, v.110, n.F01013, doi:10.1029/2004JF000279.

Istanbuluoglu, E., Tarboton, D.G., Pack, R.T. and Luce, C.H. 2004. Modeling of the interactions between forest vegetation, disturbances, and sediment yields. Journal of Geophysical Research, v. 109. n.F1, F01009 10.1029/2003JF000041 19 February 2004.

Istanbuluoglu, E., Tarboton, D.G., Pack, R.T., Luce, C. 2003. A sediment transport model for incision of gullies on steep topography. Water Resources Research, v.39, n.4, p.1103.

Istanbuluoglu, E., Tarboton, D.G., Pack, R.T., Luce, C. 2002. A probabilistic approach for channel initiation. Water Resources Research, v.38, n.12, p.1325.

Clarke, G.K.C., Mathews, W.H., and Pack, R.T. 1984. Outburst floods from Glacial Lake Missoula. Quaternary Research, v.22, p.289-299.

Peterson, S.M. and Pack, R.T. 1982. Paleoenvironments of the Upper Jurassic Summerville Formation near Capitol Reef National Park, Utah. BYU Geology Studies, v.29, pt.2, p.13-26.

Refereed Conference Papers

Pack, R.T., Swasey, J., Fullmer, R.R., Budge, S.E., Israelsen, P., Petersen, B. and Cook, T.D. 2009. Eye-safe lidar test-bed with coaxial color imager. SPIE Defense and Security Symposium, Orlando, Florida.

Neilsen, K., Budge, S.E., Pack, R.T., Fullmer, R.R., and Cook, T.D. 2008. Design and validation of the eye-safe lidar test-bed (ELT) using the LadarSIM system simulator. SPIE Defense and Security Symposium, Orlando FL., March 17-21.

- Mamanakis, M.T., Fullmer, R.R., Pack, R.T. and Budge, S. 2008. Active and attentive LADAR scanning for automatic target recognition. SPIE Defense and Security Symposium, Orlando FL., March 17-21.
- Boldt, B.M., Budge, S.E., Pack, R.T. and Israelsen P.D. 2007. A handheld texel camera for acquiring near-instantaneous 3D images. In Proc. Asilomar Conf. on Signals, Systems, and Computers, Nov. 2007.
- Pack, R.T., Cook, D. and Petersen, B. 2007. Eye-safe LADAR test-bed (ELT) for enhanced data collection in support of ATR development. SENSIAC Military Sensing Symposium, Sponsored by Georgia Institute of Technology, Atlanta, GA. October 2007.
- Pack, R.T., Farnsworth, C.B. and Leonard, B.D. 2007. Development of a rockfall hazard rating system for the State of Utah. In: Proceedings of the First North American Landslide Conference, Vail, Colorado, June 2007.
- Fenton, R.C., Fullmer, R.R. and Pack, R.T. 2007. Simulation tests of a lidar-based spacecraft pose determination algorithm. SPIE Defense and Security Symposium, Orlando FL., March 26-30.
- Leishman, B., Budge, S. and Pack, R.T. 2007. A validation procedure for a ladar system radiometric simulation model. SPIE Defense and Security Symposium, Orlando FL., March 26-30.
- Pack, R.T., Saunders, D., Fullmer, R. and Budge, S. 2006. The simulation of automatic ladar sensor control during flight operations using USU LadarSIM Software. SPIE Defense and Security Symposium, Orlando FL., March 27-31.
- Omer, D., Call, B., Pack, R.T. and Fullmer, R. 2006. Generic simulation of multi-element ladar scanner kinematics in USU LadarSIM. SPIE Defense and Security Symposium, Orlando FL., March 27-31.
- Budge, S., Leishman, B. and Pack, R.T. 2006. Simulation and modeling of return waveforms from a ladar beam footprint in USU LadarSIM. SPIE Defense and Security Symposium, Orlando FL., March 27-31.
- Kayen, R., Collins, B.D, Bawden, G. and Pack, R.T. 2006. Earthquake deformation analysis using terrestrial scanning laser-lidar technology. 8th U.S. National Conference on Earthquake Engineering, paper NCEE-1587, April 18-22, 2006.
- Pack, R.T, Israelsen, P. and Sealy, K. 2005. A co-boresighted synchronized ladar/EO imager for creating 3D images of dynamic scenes. SPIE Defense and Security Symposium, Orlando FL. March 28-April 1.
- Fenton, R.C., Fullmer, R.R. and Pack, R.T. 2005. Design of lidar-based sensors and algorithms for determining the relative motion of an impaired spacecraft. SPIE Defense and Security Symposium, Orlando FL. March 28-April 1.
- Steinberg, A. and Pack, R.T. 2003. Real-Time Detection, Registration and Recognition using Pixel-Level Fusion of Active/Passive Imagery. Proc. VIIth Digital Image Computing: Techniques and Applications, Sun C., Talbot H., Ourselin S. and Adriaansen T. (Eds.), 10-12 Dec. Sydney, Australia.

Fullmer, R., Patterson, P., and Pack, R.T. 2003. "The Conceptual Design of the Guidance, Navigation and Control System for a Maintenance and Repair Spacecraft", AAS/AIAA 2003 Astrodynamics Specialist Conference, Aug. 3-7, Big Sky, MT.

Pack, R.T. and Steinberg, Alan N., 2003. Real-time composite feature extraction and visualization using pixel-level fusion of active/passive data. Sixth International Conference on Information Fusion, Cairns, Queensland, Australia, July, 2003.

Pack, R.T. and Steinberg, A. 2002. Pixel-level fusion of active/passive data for real-time composite feature extraction and visualization. Invited Paper at NATO Research and Technology Agency Workshop IST-036/RWS-005, Massive Military Data Fusion and Visualization: Users Talk With Developers, Norwegian Defense Logistics and Management College, Halden, Norway, 10-13 September 2002. (invited)

Anderson, L.R., Bowles, D.S., Pack, R.T. and Keaton, J.R. 1996. A risk-based method for landslide mitigation. In: Proceedings of the 7th International Symposium on Landslides, Trondheim, Norway.

Pack, R.T., Morgan, G.C. and Anderson, L.R. 1987. Philosophy of landslide risk evaluation and acceptance. In: Reliability and Risk Analysis in Civil Engineering, Proceedings of ICASP5, the Fifth International Conference on Applications of Statistics and Probability in Soil and Structural Engineering, Vancouver, B.C. May 25-29, 1987, p. 946-952.

Pack, R.T., Keaton, J.R., Jeppson, R.W. and Anderson, L.R. (1984). The 1983 Utah landslide disaster. In: Proceedings of the 4th International Symposium on Landslides, Toronto, Canada, p. 693-698.

Reviewed Research Reports

Pack, R.T., Boie, K., Mather, S. and Farrell, J. 2006. UDOT rockfall hazard rating system: Final Report and User's Manual. UDOT Research & Development Report No. UT-06.03, January 2006.

Pack, R.T., Fullmer, R., Peterson, B. Henry, R., Ashby, S., and Saunders, D. 2004. USU LADAR SIM Release 2.0. Published report submitted to the Cruise Missile Real-Time Retargeting Program, Naval Air Warfare Center Weapons Division, China Lake, CA.

Pack, R.T., Fullmer, R., Peterson, B. and Henry, R. 2003. USU LADAR SIM Release 1.1. Published report submitted to the Cruise Missile Real-Time Retargeting Program, Naval Air Warfare Center Weapons Division, China Lake, CA.

Pack, R.T. and Boie, K. 2002. Utah rockfall hazards inventory, phase I. Utah Department of Transportation, Research Division, Research Report UT-03.01.

Pack, R.T., Fullmer, R., Peterson, B. and Henry, R. 2002. USU LADAR SIM Release 1.0. Submitted to the Cruise Missile Real-Time Retargeting Program, Naval Air Warfare Center Weapons Division, China Lake, CA.

Lindeburgh, S.B., Pack, R.T. and Schwab, J.W. 1982. Slope stability and forest land management: a selected annotated bibliography. B.C. Ministry of Forests Internal Research Report 84005-PR, 72p.

Conference Papers

- Pack, R.T., Israelsen, P., Petersen, B., Christensen, R., and Crum, G. 2008. Use of USU's new full-waveform airborne lidar in the topographic mapping of a landslide area near Logan, Utah. 42nd Annual Symposium on Engineering Geology and Geotechnical Engineering, Boise, Idaho.
- Buhler, R., Pack, R.T., Bay, J., Chaiprakaikeow, S. 2008. Logan Bluff landslide slope monitoring program – preliminary results. 42nd Annual Symposium on Engineering Geology and Geotechnical Engineering, Boise, Idaho.
- Pack, R.T. and Farnsworth, C. 2006. Rockfall hazard analysis in Utah. 40th Annual Symposium on Engineering Geology and Geotechnical Engineering, Logan, Utah.
- Pack, R.T. 2006. Use of Lidar in the Precise Measurement of Landslide Morphometry. 40th Annual Symposium on Engineering Geology and Geotechnical Engineering, Logan, Utah.
- Mather, S. and Pack, R.T. 2004. Comparison and application of rockfall hazard classification systems in the State of Utah. 38th Annual Symposium on Engineering Geology and Geotechnical Engineering, Reno, Nevada.
- Boie, K. and Pack, R.T. 2004. Practical application of the NYDOT rockfall hazard system to selected remediation sites in Utah. 38th Annual Symposium on Engineering Geology and Geotechnical Engineering, Reno, Nevada.
- Pack, R.T. 2003. Engineering geologic mapping using 3D imaging technology. 37th Annual Symposium on Engineering Geology and Geotechnical Engineering, Boise, Idaho.
- Pack, R.T., Boie, K. and Farnsworth, C. 2003. Utah DOT rockfall hazards inventory – Phase I. 37th Annual Symposium on Engineering Geology and Geotechnical Engineering, Boise, Idaho.
- Istanbulluoglu, E., Tarboton, D.G., Pack, R.T. and Luce, C. 2001. A probabilistic approach for channel initiation. Presentation given at Colorado State University, Hydrology Days. March 2001.
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 2001. Assessing terrain stability in a GIS using SINMAP. 15th Annual Conference on Geographic Information Systems, February 19-22, 2001, Vancouver, B.C., Canada
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1999. GIS-based landslide susceptibility mapping with SINMAP. Proceedings of the 34th Symposium on Engineering Geology and Geotechnical Engineering, Logan, Utah, April 28-30, 1999.
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1999. GIS-based landslide susceptibility mapping with SINMAP. 42nd Annual Meeting of the Association of Engineering Geologists, Salt Lake City, Utah, September 26-29, 1999..
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1998. The SINMAP approach to terrain stability mapping. In: 8th Congress of the International Association of Engineering Geology, Vancouver B.C. September 1998.
- Pack, R.T. 1997. New developments in terrain stability mapping in B.C. In: Proceedings of the 11th Vancouver Geotechnical Society Symposium. May 30, 1997, Vancouver, B.C.

- Pack, R.T. 1995. Statistically-based terrain stability mapping methodology for the Kamloops Forest Region, British Columbia. In: Proceedings of the 48th Canadian Geotechnical Conference, Canadian Geotechnical Society, Vancouver, B.C., p.617-624.
- Anderson, L.R., and Pack, R.T. 1992. A risk-based method for alternative selection to mitigate landslide risks. In: Proceedings of the CCNAA-AIT Joint Seminar on Prediction and Damage Mitigation of Meteorologically Induced Natural Disasters, National Taiwan University, May 21-24, 1992.
- Pack, R.T., Haigh, T.R. and Kerr, J.R. 1991. Geogrid reinforced retaining wall with Lock-Block Facing. In: 6th Annual Vancouver Geotechnical Society Symposium, Geosynthetics: Design and Performance, Vancouver, B.C., Canada.
- Pack, R.T. and Morgan, G.C. 1988. The evaluation and acceptance of risk in geotechnical engineering. In: Proceeding of a Symposium on Risk and Liability in Geotechnical Engineering, Vancouver Geotechnical Society, May 27, 1988.
- Pack, R.T. 1984. Multivariate analysis of landslide-related variables in Davis County, Utah. In: Proceedings of the Specialty Conference on the Delineation of Landslide, Flash Flood and Debris Flow Hazards in Utah, June 14-15, 1984, Logan, Utah, p. 50-65.
- Pack, R.T. and Anderson, L.R. 1984. Reconnaissance aerial photography used in immediate landslide and debris flow hazard identification - the Utah experience. GSA Abstracts with Programs, v.16, n.6, p.616.
- Pack, R.T. 1984. Debris flow initiation in Davis County, Utah, during the spring snow melt period of 1983. In: Proceedings of the 21st Annual Engineering Geology and Soils Engineering Symposium, Moscow, Idaho, April 5-6, 1984.

Major Research Reports

- Pack, R.T. 2002. Cruise Missile Real-Time Retargeting (CMRTR) DASSL Build 4 Report. Naval Air Warfare Center, China Lake, California, October 30. (not for public release).
- Pack, R. T., Wilkerson, T.D., Crowther, B., Pack, F.B., McKay, J., Moody, S. and Tarboton, D.G. 1999. The Lidar Orthoimaging System (LOIS). Internal Research and Development Report to the Space Dynamics Laboratory, 29p.
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1999. SINMAP - A Stability Index Approach to Terrain Stability Hazard Mapping, User's Manual. Produced in ArcView Avenue and C++ for Forest Renewal B.C. under Research Contract No: PA97537-ORE.
- Pack, R.T. 1999. Physical operability mapping and stability index mapping, lower Sukunka TU. Research Report prepared for Canadian Forest Products, Chetwynd Division through Terratech Consulting Ltd., 17p.
- Pack, R.T. and VanBuskirk, C.D. 1998. Comparison of alternative terrain stability mapping methods in a portion of TFL 48. Research Report prepared for Canadian Forest Products, Chetwynd Division through Terratech Consulting Ltd., 26p.

Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1998. Improvement of terrain stability classification methods using a DEM-derived stability index. Final Report to Forest Renewal B.C. under Research Contract No: PA97537-ORE

Pack, R.T. and Gubala, C.P. 1997. Assessment of Relative Sedimentation Impacts, Trout Lake Basin, B.C. Final Report to Forest Renewal B.C. under Research Contract No: KB96041-RE through Terratech Consulting Ltd. 67p.

Pack, R.T. 1994. Inventory of forest landslide occurrences in the Kamloops Forest Region. Final Report to B.C. Ministry of Forests, Kamloops Forest Region through Terratech Consulting Ltd..

Published Software

Pack, R.T., Tarboton, D.G. and Goodwin, C.N., Prasad, A. 2005. SINMAP for ArcGIS - A Stability Index Approach to Terrain Stability Hazard Mapping, User's Manual. Produced in VBA for ArcGIS and C++ under funding by the USDA. Forest Service.

Pack, R.T., Fullmer, R., Peterson, B. Henry, R., Ashby, S., and Saunders, D. 2003. USU LADAR SIM Release 2.0. Submitted to the Cruise Missile Real-Time Retargeting Program, Naval Air Warfare Center Weapons Division, China Lake, CA.

Pack, R.T., Fullmer, R., Peterson, B. and Henry, R. 2003. USU LADAR SIM Release 1.1. Submitted to the Cruise Missile Real-Time Retargeting Program, Naval Air Warfare Center Weapons Division, China Lake, CA.

Pack, R.T., Fullmer, R., Peterson, B. and Henry, R. 2002. USU LADAR SIM Release 1.0. Submitted to the Cruise Missile Real-Time Retargeting Program, Naval Air Warfare Center Weapons Division, China Lake, CA.

Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1999. SINMAP - A Stability Index Approach to Terrain Stability Hazard Mapping, User's Manual. Produced in ArcView Avenue and C++ for Forest Renewal B.C. under Research Contract No: PA97537-ORE. (has averaged 3 downloads/day for 7 years)

Pack, R.T. 1996. TIN-Slope. Software developed by Terratech Consulting Ltd. for manipulating triangulated irregular networks in topographic analysis. Developed in Delphi for the HPGL/2 plotter language.

Technical Presentations

Pack, R.T. 2002. Introduction to USU lidar capabilities to Battelle at the Pacific Northwest National Laboratory, Richland, WA, October 31, 2002.

Pack, R.T. 2001. An approach to the real-time 3D georectification of imagery. 2001. Presentation to the Conference of the American Society for Photogrammetry and Remote Sensing, St. Louis, Mo., April 23-27, 2001.

Pack, R.T. 2001. Imaging lidar development at USU Space Dynamics Laboratory. Presentation to the 15th Annual Conference on Geographic Information Systems, February 19-22, 2001, Vancouver B.C. Canada.

- Pack, R.T. 2001. Debris flow hazard reduction. Presentation given to the Geologic Hazards of Utah Conference, Salt Lake City, Utah, April 13, 2001.
- Pack, R.T. 2001. Imaging Lidar Development at USU Space Dynamics Laboratory, Briefing to Navy Surface Warfare Center Weapons Division, China Lake, California, March 21, 2001.
- Pack, R.T. 2000. 3DML - Three-dimensional Multispectral Lidar. Briefing to Defense Advanced Research Projects Agency (DARPA), November 21, 2000, Washington, D.C.
- Pack, R.T. 2000. 3DML - Three-dimensional Multispectral Lidar. Briefing to the Naval Surface Warfare Center, Dahlgren, Virginia, November 21, 2000.
- Pack, R.T. 2000. An introduction of the lidar orthoimaging system at USU Space Dynamics Laboratory. Presentation given to the ASPRS Intermountain Region Fall Technical Meeting, North Logan, Utah, September 29, 2000.
- Pack, R.T. 2000. Overview of the Lidar Orthoimaging System. Briefing to NASA Jet Propulsion Laboratory, Pasadena California, May 3, 2000.
- Pack, R.T. 2000. Overview of the Lidar Orthoimaging System. Briefing to Office of Naval Research, April 14, 2000.
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1999. GIS-based landslide stability mapping with SINMAP. Presentation given to the Annual Conference of the Association of Engineering Geologists, Salt Lake City, Utah, September 27, 1999.
- Pack, R.T. 1999. Overview of the Lidar Orthoimaging System. Briefing to Air Force Research Laboratory, Albuquerque, New Mexico, July 14, 1999.
- Pack, R.T. 1999. LIDAR, a new tool for debris flood/flow hazard analysis. Presentation at the Annual Conference of the Utah Floodplain Management Association, October 28-29, 1999, Utah State University, Logan, Utah.
- Pack, R.T. 1998. A tool for delineating landslide prone terrain. Presentation at the Annual Conference of the Utah Floodplain Management Association, Cedar City, Utah, October 29, 1998.
- Pack, R.T., Tarboton, D.G. and Goodwin, C.N. 1998. The SINMAP approach to terrain stability mapping. Presentation given to the U.S. Forest Service, Boise Idaho, September 26, 1998.
- Pack, R.T. 1998. Desktop GIS tools - shovels and freight trains. Presentation given to the Utah Floodplain Managers Association Conference, Ogden, Utah, July 15, 1998.

Research Reports

- Quantifying the Exposure of Streams to Sediment Inputs from Managed Forests, A Risk-Based Approach. Funded under the USDA National Research Initiative, Washington, D.C.
- Wind Lidar Data Processing for NASA Goddard Space Flight Center. Research is under a cooperative agreement with USU.

Development of a computer simulator for the Three-Dimensional Multispectral Lidar. Internal Research and Development Project at USU Space Dynamics Laboratory.

Design of debris control structures for the River Valley Ranch, Carbondale, Colorado. Funded through URS Corporations, Salt Lake City, Utah.

A study of Alpine City debris flow in the aftermath of the 2000 fires. Research is in partnership with URS Corporation, Salt Lake City, Utah.

An analysis of Physical Operability for Logging Operations based on Stability Index. Research for Canadian Forest Products, Chetwynd, B.C.

Comparison of SINDEXTM and Terrain-Based Terrain Stability Mapping in the Foster and Canoe Creek watersheds, Robson Valley, B.C. Research for the Prince George Region of the B.C. Forest Service.

Landslide and Terrain Attribute Study in the Nelson Forest Region. FRBC Award KB97202-0RE1.

Inventory and Geotechnical Engineering Assessment of Bridge River Ash in the Lillooet and Squamish Forest Districts. FRBC Award No. T097179-7RE.

SPECIFIC WORK EXPERIENCE

During the course of his 25 year professional career, he has completed well over 300 projects as the primary technical investigator/engineer. Projects in which his technical contribution exceeded 75% of the project work are summarized below.

1 – Lidar Systems Engineering

As a systems engineer for the Space Dynamics Laboratory, he lead the design an airborne remote sensor that can collect three-dimensional digital imagery in real time. He has been responsible for specifying and integrating a lidar transceivers, scanners, optics, electronics, and strap-down GPS/INS systems; has completed a system design a space-based lidar tracking and rendezvous system; is working with the Naval Air Warfare Center on lidar seeker head technology for cruise missiles; and has lead efforts in GPS/INS Kalman filter design for precision sensor platform stabilization

2 - Analytic Photogrammetry & Aerial Surveying

In 1998 established the geomatics laboratory at the USU Department of Civil and Environmental Engineering with 30 workstations for instruction in engineering GIS and remote sensing (including photogrammetry). He presently works with Z/I Imaging, PCI Geomatics and ERDAS softcopy photogrammetry systems within this lab. His experience also includes the use of ISM Softcopy and Zeiss Analytical stereoplotters. As president of Terratech Consulting Ltd., lead aerial mapping projects for engineering clients throughout southern British Columbia. He provided the technical expertise for designing and planning all aspects of each aerial survey project including: target layout, survey control, aerial photography acquisition, aerial triangulation, block adjustment, analytic stereoplotter setup and map data acquisition. He provided technical training and support to several stereoplotter operators throughout this period. Over a dozen large projects involving several hundreds of thousands of dollars have been completed under his direction.

3 - Geographic Information Systems Development

He is conversant with ESRI and Intergraph mapping products along with add-on GIS products for AutoCAD and MicroStation. In 1995, he programmed a proprietary slope mapping algorithm designed specifically for watershed mapping. This algorithm has now been applied to over 200 map sheets comprising several million hectares across B.C. for half a dozen clients. In 1998 he led a team that completed the SINMAP ArcView Extension that is now being used world-wide for terrain stability mapping. He is conversant in the AutoLisp programming language for AutoCAD. He has programmed several in-house programs for: automatic borehole log production; transfer of survey data directly from a total station data collector to AutoCAD, automatic retaining wall design function, and more.

4 – Landslide and Debris Flow Evaluations

He has completed over 100 projects related to debris flows, debris avalanches, rockfall, rockslides, earthflows, snow avalanches, and other steep slope processes. Much of this work has been related to the research and development of techniques for controlling these hazards including the design of deflection berms, debris basins, stabilizing earthworks, retaining walls, check dams, and others. Some typical projects include:

- Evaluation of debris flow risk in the aftermath of the June 1990 Falls Creek Debris flows near Mable Lake, B.C. B.C. Provincial Emergency Program.
- Debris flow evaluation and debris basin design at Kendry Creek, 1994. - B.C. Ministry of Forests and Provincial Emergency Program.
- Dozens of slope stability assessments associated with logging road construction in severe terrain by various forest companies including: Tolko Industries, Pope & Talbot, Downie Street Sawmills, Weyerhaeuser Canada, Slocan Forest Products, Bell Pole Co., Evans Forest Products, and Riverside Forest Products, Ainsworth Lumber, Galloway Lumber, Aspen Planners, Interfor, and Federated Cooperatives.
- Inventory of over 1000 landslide sites across the Kamloops Forest Region for the B.C. Ministry of Forests.
- Evaluation of the August 1991 Bear Creek debris flow in Seton Portage for the B.C. Ministry of Environment.
- Debris torrent evaluation of Disbrow Creek on the Squamish highway for B.C. Ministry of Transportation and Highways.
- Evaluation of debris torrent hazards along the Trans-Canada Highway between Sicamous and Revelstoke, B.C. for Ministry of Transportation and Highways.

5 - Hydrologic Studies

- Hydrogeologic and geotechnical design of rapid infiltration (RI) basins in Sicamous, Montrose, Rossland, Fruitvale, and Nakusp.
- Septage pit design in Sicamous.
- Hydrocarbon groundwater contamination study - Nelson public works yard.
- Hydrogeologic evaluation of the proposed expansion of the Nanaimo Landfill Site, Nanaimo, B.C.
- Numerous septic field designs.
- Detailed hydrogeologic analysis and groundwater modeling of potential severe seepage along a proposed through-cut of the Trans-Canada Highway, near Salmon Arm, B.C.
- Six detailed hydrogeologic analyses used in rapid infiltration basin design.
- Geomorphic and topographic analysis used in predicting surface drainage characteristics during heavy storms throughout the Municipality of Peachland, B.C.
- Tyndall Road drainage plan developed in conjunction with Urban Systems Ltd., Kelowna, B.C.
- Numerous drainage studies for small land-owners.

- Designed and oversaw fabrication of specialized equipment for installing standpipe piezometers on steep slopes in remote areas by hand. This design has been incorporated for special use by the B.C. Ministry of Transportation and Highways.
- Formed liaison with Western Profile Instrumentation (Terratech Western Profile Consultants Ltd.) and participated in hydrologic and geotechnical instrumentation monitoring program for several large dams and landslides including Revelstoke Dam, Mica Dam, Downie Slide, and Dutchman's Ridge Slide.
- Hydrologic and geotechnical analysis and design of large breakwaters and boat basins at Sidney, Royston, Comox, and Campbell River, B.C. for Public Works Canada, 1986-8.

6 - Environmental Risk Analysis

- Geotechnical risk assessments of landslide hazards in forested watersheds across British Columbia. Several dozen projects have been completed to date.
- Developed an environmental risk-related decision-making framework for use in forest development approvals by B.C. government forest regulators.
- Risk analyst for the proposed 600 km long Pacific Rim Liquid Natural Gas Pipeline in central B.C.
- Geotechnical risk assessment of critical river crossings on the Athabasca oil and gas pipelines for Syncrude Canada.
- Evaluation of debris flow hazards on Deadman Creek in relation to potential risks imposed on the right abutment of the Revelstoke Dam for B.C. Hydro.

7 - Engineering Geologic Studies

- Engineering geologic mapping of terrain stability hazards for use in forest development throughout British Columbia - over 2 million hectares personally mapped or reviewed for fourteen separate clients.
- Official reviewer of proposed B.C. provincial standards for Terrain Stability Mapping.
- Reconnaissance-level geology and terrain analysis for the proposed Peachland-O'Keefe 60 kilometer long highway corridor for B.C. Ministry of Transportation and Highways.
- Detailed terrain analysis for proposed 100 kilometer long Mount Klappan Mining Road - Gulf Canada
- Terrain analysis and gravel search for the construction of a 110 km access road to the Mt. Klappan Coal Mine in northwestern B.C.
- Gravel pit evaluations including lithological analysis and quality testing for various Municipalities and private owners.
- Oversaw quality control testing and volume surveying for five gravel crushing operations of the B.C. Ministry of Highways.
- Engineering geologic evaluation of rock and soil conditions associated with a small hydro dam, 600m long rock tunnel and 8 MW power house site for the Akolkolex Power Company, Revelstoke, B.C.

8 - Steep Slope Engineering

- Detailed two- and three-dimensional stability and risk analysis of the Mara Rock Slide above Highway 97 near Sicamous, B.C.
- Engineering design of deep anchors for bridge abutments and piers cantilevered on a rock cliff above the Incomappleux River, B.C.
- Rock scaling program design - City of Nelson.
- Numerous rockfall protection designs for various clients.
- Evaluation of the effects of a rock blast on a nearby hot spring for B.C. Ministry of Environment, Nelson, B.C.

- Design of the largest (at the time) geogrid-reinforced, concrete block faced wall in British Columbia - near Princeton, B.C. for the B.C. Ministry of Highways.
- Geotechnical Design of a 550 m long by 10 m high soil nailed retaining wall on the Trans-Canada Highway in Kamloops, B.C. for the B.C. Ministry of Transportation and Highways.
- Design of at least twenty five other retaining walls along streets and highways throughout British Columbia.
- Project engineer for the design of approximately 10 km of highway through massive landslide terrain at the Beatton River near Fort St. John, B.C.
- Soils evaluation for the realignment of the Trans Canada Highway west of Kamloops B.C. for Ministry of Transportation and Highways.
- Detailed analysis of the stress-strain behavior of a new embankment on the Trans-Canada Highway near Kamloops, B.C.
- Slope stability analysis (including 3-D analysis) and stabilization design of at least 20 other problem embankments across B.C.

9 - Multivariate Statistical Research

He has completed several specialized research projects dealing with the multivariate analysis of landscape and geologic variables including:

- Statistical sampling design and multivariate statistical analysis of factors affecting “Visually Effective Green-Up” of clear-cut areas within a forest. Results of this multi-year study were used in developing provincial guidelines for preserving forest aesthetics.
- Review and revision of B.C. standard statistical methodology used in sampling and analyzing detrimental soil disturbance in forest clear-cut areas.
- Statistical sampling design and multivariate statistical analysis of factors related to landslide occurrences along logging roads throughout the Kamloops Forest Region. The results of this multi-year study were used in developing a terrain stability hazard mapping methodology as well as road stability assessment methodology.

10 - Geotechnical Engineering

- Designed the underpinning and jacking of the Nelson Public Works Building using over 60 deep friction piles.
- Designed deep pile foundations for ten major highway bridge abutments.
- High-risk emergency shoring and permanent repair of the major water supply line to the City of Nelson that was almost destroyed by a debris slide. Stabilization and repairs involved very difficult steep access and helicopter support.
- Geotechnical investigations and recommendations for nine large sewer construction projects in southern B.C.
- Bridge abutment design for twelve highway bridges for the B.C. Ministry of Highways. Experience with a variety of foundations including churn-drilled piles and special protection from debris flow and debris flow impacts.
- Liquefaction potential analysis for breakwater foundations in Comox, Royston, and Campbell River harbors.
- Numerous seismic slope stability analyses in slope stabilization projects.
- Rock foundation design for the Cantel cellular tower on Bastion Mountain near Salmon Arm, B.C.
- Foundation settlement analysis for the Vancouver Island Regional Correctional Centre for B.C. Building Corporation.
- Over forty miscellaneous shallow foundation investigations and designs for buildings and houses.

ACADEMIC AWARDS

- Utah State University Technology Entrepreneur of the Year, 2006.
- Phi Kappa Phi Honor Society for Ph.D. work at Utah State University, 1985.
- Recipient of Graduate Research in Engineering and Technology Award, Science Council of British Columbia, 1981.
- Sigma Gamma Epsilon Geology Honor Society in Geology, 1980.
- Max Prescott Distinguished Alumni Award, Brigham Young University, 1980.
- Educational Expeditions International (EEI) National Scholarship in Archeology, 1974.

PROFESSIONAL SERVICE

- President, Utah/Idaho Region of the American Society for Photogrammetry and Remote Sensing, 2001 to 2002.
- Member of the Board of Directors of the Forest Engineering Institute of British Columbia. 1996-7.
- Member and Chairman of the Joint Practices Board of the Association of Professional Engineers and Geoscientists of British Columbia and the Association of British Columbia Forest Professionals, 1995-2000.
- Member of the Association of Professional Engineers and Geoscientists of British Columbia / Applied Science Technologists of British Columbia Joint Practice Board, 1995.
- Chairman, Vancouver Island Geotechnical Society, 1986-8.
- Geological Society of America Representative to the ASCE-GSA-AEG Joint Committee on Engineering Geology, 1985-91.