CURRICULUM VITA
Dr. Brian L. Steward
Associate Professor
Agricultural and Biosystems Engineering
214D Davidson Hall
Iowa State University

Education

South Dakota State University	Electrical Engineering	B.S., 1989
South Dakota State University	Electrical Engineering	M.S., 1994
University of Illinois Urbana-Champaign	Agricultural Engineering	Ph.D., 1999

Academic Experience

- 7/05 – present Associate Professor, 60% Teaching / 30% Research / 10% Service Appointment, Iowa State University, Ames, IA
- 7/03 – present Human Computer Interaction Graduate Program Faculty, Iowa State University, Ames, IA
- 8/00 – present Graduate Program in Sustainable Agriculture Faculty, Iowa State University, Ames, IA
- 11/09-8/10 Fulbright Visiting Professor, Departamento de Engenharia Agrícola, Universidade Federal de Viçosa, Viçosa, Minas Gerias, Brasil.
- 8/99 – 6/05 Assistant Professor, 50 % Teaching / 50 % Research Appointment, Iowa State University, Ames, IA
- 7/98 – 7/99 Research Assistant, University of Illinois, Urbana, IL
- 8/95 – 6/98 USDA Fellow, University of Illinois, Urbana, IL
- 9/94 – 7/95 Foreign Expert, Changsha Electric Power Univ., Changsha, P. R. China
- 9/92 – 8/93 NASA Fellow, South Dakota State University, Brookings, SD
- 9/91 – 5/93 Teaching Assistant, South Dakota State University, Brookings, SD

Industrial and Other Non-Academic Experience

- 10/89 – 7/94 Design Engineer, Raven Industries, Sioux Falls, SD
- 5/89 – 8/89 Intern, Missouri Basin Municipal Power Agency, Sioux Falls, SD

Honors and Awards

Personal Awards

- ASABE Honorable Mention Paper Award for the *Transactions of the ASABE* journal article published in 2010 authored by S. Abd Aziz, **B. L. Steward** and M. Karkee entitled, "Using spatial uncertainty of prior measurements to design adaptive sampling of elevation data." (top 5% of all ASABE journal articles published in 2010). 8/8/2011
- ISU College of Agricultural and Life Sciences Outstanding Achievement in International Agriculture Award, Presented at the CALS Spring University Convocation 2/7/2011
- ISU Louis Thompson Distinguished Undergraduate Teacher Award, Presented at the ISU Fall University Convocation 9/20/2010
- Fulbright Scholarship Grant for Research and Lecturing at the Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brasil 3/4/2009
- ISU College of Engineering Superior Engineering Teacher Award, Presented at the ISU College of Engineering Fall Convocation 8/27/2008
- ISU Engineering Student Council Leadership Award for significant and lasting contributions to the success of Iowa State Engineering Students 1/29/2007

- US Environmental Projection Agency Honorable Mention P3 award, Chris Deal, Jason Haegele, Marisol Martinez, **Brian Steward**, faculty adviser, and Evan Visser, Iowa State University and Caio Alves, Delly Oliveira, faculty adviser, and Rowena Vieira Federal University of Vicosa. Honorable Mention for the quality of their design and proposal, *Renewable Resources To Power A University – A Model For Regional Sustainable Development,* for the Environmental Protection Agency's 2006 P3 Program -- People, Prosperity, and the Planet." — 5/10/2006
- Jack Everly Journal Award, North American Colleges and Teachers of Agriculture (NACTA), **Brian Steward**, Steve Mickelson, and Tom Brumm. "Formative and Summative Assessment Techniques for Continuous Agricultural Technology Classroom Improvement." Presented at the 51st Annual Conference of NACTA, Wooster, OH. — 6/17/2005
- Young Engineer of the Year, Iowa Section of the ASAE. — 4/7/2005
- Select Paper Award of the Information and Electrical Technologies Division of the American Society of Agricultural Engineers, Dev Shrestha and **Brian Steward**. "An Object-Oriented Architecture for Field Data Acquisition, Processing and Information Extraction," Presented at the 2003 American Society of Agricultural Engineers Annual Meeting, Las Vegas, NV. — 7/27-30/ 2003
- Best Paper Award of the Biological and Agricultural Engineering Division of the American Society for Engineering Education. Steve Mickelson, Tom Brumm, Larry Hanneman, and **Brian Steward**. "Using Engineering Competency Feedback to Assess Agricultural Engineering Curriculum," Presented at the 2003 American Society for Engineering Education Annual Conference & Exposition, Nashville, TN. — 6/22-25/ 2003
- Advisor Recognition Award as faculty advisor of the Nepal Student Association, ISU Student Activities Center. — 4/23/2003
- Newcomer of the Year, Iowa Section of the ASAE. — 3/11/2003
- Exceptional Student Support Recognition, Iowa State University. — 4/7/2002
- Teaching Excellence List, University of Illinois. — Spring 1999
- Teaching Excellence Award, Department of Agricultural Engineering, University of Illinois. — 4/19/1999
- First Place Cutting Edge Award for research presentation, College of Engineering, University of Illinois. — 3/1999

Awards of Graduate Student Advisees

- Served as faculty advisor to Simon Nielsen, who received the ISU Graduate Student Research Excellence Award, Graduate College, Iowa State University, — 7/2011
- Served as faculty advisor to Simon Nielsen, who received the Howard P. Johnson award for outstanding MS student of the year, Agricultural and Biosystems Engineering Department, Iowa State University. — 5/2011
- Served as faculty advisor to Manoj Karkee, who received the ISU Graduate Student Research Excellence Award, Graduate College, Iowa State University, and International Leadership award, Iowa State University. — Fall 2009
- Served as faculty advisor to Manoj Karkee, who received the Rev. P.T. Taiganides award for outstanding PhD student of the year, Agricultural and Biosystems Engineering Department, Iowa State University. — 5/2009
- Served as faculty advisor to Kelly Thorp, who received the Rev. P.T. Taiganides award for outstanding PhD student of the year, Agricultural and Biosystems Engineering Department, Iowa State University. — 4/29/2006
- Served as faculty advisor to Kelly Thorp, who received the ASABE Mid-Central Graduate Student of the Year Award, Manhattan, Kansas. — 4/1/2006
- Served as faculty advisor to Dev Shrestha, who was a finalist in the 2004 ASAE Graduate Student Research Award paper competition, for the paper, *Automatic Corn Population Measurement Using Machine Vision*, 2004 American Society — 8/4/2004

of Agricultural Engineers Annual Meeting, Ottawa, Canda.

- Served as faculty advisor to Dev Shrestha, who received the Rev. P.T. Taiganides award for outstanding PhD student of the year, Agricultural and Biosystems Engineering Department, Iowa State University. 5/7/2004
- Served as faculty advisor to Mark Westphalen, who received the Howard P. Johnson award for outstanding MS student of the year, Agricultural and Biosystems Engineering Department, Iowa State University. 5/7/2004
- Served as faculty advisor to Dev Shrestha, who received the ISU Graduate Student Teaching Excellence Award, Graduate College, Iowa State University, and International Leadership award, Iowa State University. Spring 2003
- Served as faculty advisor to Mitch Miller, who received the Howard P. Johnson award for outstanding MS student of the year, Agricultural and Biosystems Engineering Department, Iowa State University. 5/2002
- Served as faculty advisor to Mitch Miller, who received the ISU Graduate Student Teaching Excellence Award, Graduate College, Iowa State University. Fall 2001

Academic Areas of Specialization

- Teaching program in the areas of fluid power, dynamic systems modeling, simulation and controls, sustainable engineering, and computational intelligence.
- Research program in the areas of dynamic systems and sensing for agriculture and biosystems, precision agriculture, and field automation and mechatronics at the interface of machine and environment.
- International programs in Brazil. Leading student exchange programs with Federal University of Viçosa, Viçosa, Minas Gerais, Brazil, Federal University of Campina Grande, Paraiba, Brazil, and Study abroad trip to Brazil. Leadership of International Programming efforts within the ABE Department.

Professional Affiliations

- American Society of Agricultural and Biological Engineers (1995 – present)
- American Society for Engineering Education (1999 – 2009)
- Engineers for a Sustainable World (2004 – 2008)
- Licensed as Professional Engineer in Iowa (2008; Lic. #18674)
- Alpha Epsilon, Honor Society of Agricultural, Food, and Biological Engineering, 1998
- Eta Kappa Nu, National Electrical and Computer Engineering Honor Society, 11/13/1987
- Phi Kappa Phi, Honor Society, 11/24/1996
- Tau Beta Pi, Engineering Honor Society, 3/18/1988

Professional Committees

American Society of Agricultural and Biological Engineers:

- IET-01 - Information and Electrical Technologies Division Executive Committee (secretary, 2007; vice and program chair, 2008; chair 2009; past chair 2010)
- IET-02 – Information and Electrical Technologies Division Steering Committee (2002 – 2010)
- IET-04 – Information and Electrical Technologies Division Publications Review and Paper Award Committee (2005 – present)
- IET-07 – Forward Planning and Structure Committee (chair, 2010)
- IET-217 – Computational Methods, Simulations, and Applications (2011-present)
- IET-254 - Emerging Information Systems (2001-present; secretary, 2003; vice chair, 2004; chair, 2005)
- IET-312 - Machine Vision (1998 –present; secretary, 2000; vice chair, 2001; chair, 2002; past chair, 2003)
- IET-318 - Mechatronics and Biorobotics (2000-present)
- PM-54 - Precision Agriculture (2001-2010;2011)
- Iowa Section Awards Committee (2001, 2004)
- Iowa Section Vice Chair Publicity (2001- 2003)

National Fluid Power Association

- Education/Industry Summit Task Force (2004)

Fourth IFAC International Workshop on Bio-Robotics, Information Technology, and Intelligent Control for Bioproduction Systems (Bio-Robotics IV)
- National Organizing Committee (2009)

Department Committees
- Coordinator of ISU-UFV (Brazil) Exchange Program (2008 – present)
- Space Committee (2006—2009, 2011-present)
- International Programs committee (2006 – 2009, 2010; chair, 2007; chair, 2010-present)
- Building Committee (2011-present)
- Manufacturing Faculty Position Search committee (2011)
- Promotion and Tenure committee (2002-2003,2008-2009,2010-2011)
- Awards Committee (2008 – 2009)
- Teaching Lab Coordinator Search committee (2008-2009)
- Advanced Machinery Engineering Focus Group Coordinator (2006 – 2009)
- Chair Advisory Council (2006 – 2009)
- Bioproduction/Biomanufacturing Faculty Position Search committee (chair, 2006-2007)
- AE Graduate Programs Committee (2005 – 2007)
- International and Diversity committee (2004 – 2006)
- ABE Technology (AST and ITEC) Curriculum committee (2004 – 2006)
- Co-Coordinator of ISU-UFV (Brazil) Exchange Program (2003 – 2007)
- Advanced Machinery Engineering Faculty Position Search committee (2003 – 2004)
- Career Guidance and Advising committee (2002 - 2006)
- Biological Systems Engineering committee (2002 - 2006)
- AST Curriculum committee (2002 - 2004)
- Career Guidance committee (2001 - 2002)
- Advising committee (1999-2002)
- AE Curriculum committee (1999-2002)

College Committees
- ISU College of Engineering International Programs Advisory Committee (2005 – 2008; 2010-present)
- ISU College of Agriculture International Agriculture Secondary Major Supervisory Committee (2006 – 2009)

University Service
- ISU Study Abroad and Exchange Committee (2007-2009)
- Engineers for a Sustainable World, ISU Chapter, Faculty Advisor (2004-2009)
- Nepal Student Association, Faculty Advisor (2001-2009)
- ISU Graduate Program in Sustainable Agriculture Coordinating Committee (2006 – 2008)
- ISU Sustainability Policy Task Force (2006)

Editorial Service
- Associate Editor, Revista Engenharia na Agricultura (2009-present)
- Associate Editor, Transactions of ASABE, Applied Engineering in Agriculture (2005-present)
- ASABE Resource Magazine Board (P-513; 2004-present)

Technical Reviewer
- Transactions of the American Society of Agricultural and Biological Engineers
- ASAE annual meeting IET paper award review committee, 2002, 2004, 2007, 2008, 2009, 2010
- Applied Engineering in Agriculture

- ASME Journal of Dynamic Systems, Measurement, and Control
- Automation Technology for Off-Road Equipment Conference Scientific Review Committee
- Proceedings of American Control Conference
- University of Idaho Experiment Station
- ASME International Mechanical Engineering Congress and Exposition (IMECE)
- Biosystems Engineering
- Canadian Biosystems Engineering
- Computers and Electronics in Agriculture
- CRC Press
- Elsevier
- HortTechnology, American Society for Horticultural Science
- ISU PSI Grants Program
- John Wiley and Sons
- Journal of Food Engineering
- Proceedings of the Sixth International Conference on Precision Agriculture
- Republic of Georgia National Science Foundation
- BARD Grants Program
- Cambridge University Press
- International Journal of Agricultural Engineering
- Oxford University Press
- Journal of Professional Issues in Engineering Education and Practice
- Pedosphere

International Experience

- Hosted ISU visit by Dr. Delly Oliveira Filho and Dr. Olga Moraes Toledo, Federal University of Viçosa, Viçosa, Brazil to for seminars and dialogue about mutual interests. — 1/24-27/2012
- Travelled to Brazil for exchange student interview and selection process at Federal University of Campina Grande, Piraiba and Federal University of Viçosa, Minas Gerias. — 11/1-12/2011
- Invited to China Agricultural University, Beijing, PR China, to lecture and interact with graduate students and meet researchers and representatives in the agricultural machinery industry. — 9/16-23/2011
- Travelled to Brazil for exchange student interview and selection process at Federal University of Campina Grande, Piraiba and Federal University of Viçosa, Minas Gerias. — 11/28-12/7/2010
- Travelled to Brazil to participate for meeting at AGCO and Deere, Porto Alegre, RS regarding international internships and participate in FIPSE/CAPES Directors Meeting, Florianópolis, SC. — 9/20-26/2010
- Organized an International Symposium entitled *Training Engineers Across The Americas To Solve Global Challenges* held at *IX Congreso Latinoamericano y del Caribe de Ingeniería Agrícola - CLIA 2010* and *XXXIX Congresso Brasileiro de Engenharia Agrícola - CONBEA 2010,* Vitória, Espirito Santo, Brasil. — 7/25-26/2010
- Organized and led Study Abroad Course and Trip to Brazil with 18 students from Iowa State University and the University of Kentucky. Theme: Agricultural technology development and adoption as affected by production scale. — 5/9-23/2010
- Spent nine months in Brazil funded by a Fulbright Scholar Grant for Research and Lecturing at the Universidade Federal de Viçosa, Viçosa, Minas Gerias, Brasil — 11/1/2009-8/9/2010
- Travelled to China to for invited presentations and visit to Nanjing Forestry University, Nanjing. — 9/2009
- Travelled to Brazil to participate in final defense as a member of MS. thesis examining committee of Evan Visser at Federal University of Viçosa (UFV), Viçosa, Brazil. — 12/2008
- Hosted ISU visit by Dr. Wathney Hermsdorff and Mr. Alberto Viera, Federal — 4/20-25/2008

University of Viçosa, Viçosa, Brazil to for presentation and dialogue about mutual interests.

- Led team of two ISU undergraduate engineering students to Federal University of Viçosa (UFV), Viçosa, Brazil to learn about renewable energy developments and collaborate with UFV students on EPA P3 project. 3/8-15/2008
- Travelled to China to present paper at the *5th International Symposium on Fluid Power Transmission and Control* in Beidaihe, visited China Agricultural University and Zhejiang University to develop network with colleagues and present my work. Visited Sauer-Danfoss plant in Shanghai. 5/29–6/13/2007
- Hosted ISU visit by Dr. Luciano Baiao, Federal University of Viçosa, Viçosa, Brazil to discuss mutual research interests and the ISU-UFV student exchange program. 4/4-5/2007
- Traveled with ISU ABE team (K. Leibold, K. Arora, H.M. Hanna) to India for visits at Punjab Agricultural University, TIDC India, Tractors and Farm Equipment Limited (TAFE; Massey-Ferguson licensee), John Deere India, and Sauer-Danfoss India to learn about the agricultural machinery industry in India. Presented a paper and attended the International Conference on 21st Century Challenges to Sustainable Agri-Food Systems: Biotechnology, Environment, Nutrition, Trade and Policy, Bangalore, India. 3/9-21/2007
- Hosted ISU visit by Ms. Juliana Biruel, Federal University of Vicosa, Vicosa, Brazil to attend ESW National Conference, learn about renewable energy research, and investigate opportunities for collaboration and graduate studies. 9/20-10/5/2006
- Led team of five ISU undergraduate Engineers for a Sustainable World students to Federal University of Viçosa (UFV), Viçosa, Brazil to learn about renewable energy developments and collaborate with UFV students on EPA P3 project. 3/8-15/2006
- Hosted ISU visit by Dr. Delly Oliveira, Federal University of Vicosa, Vicosa, Brazil to present a lecture to ISU chapter of Engineers for a Sustainable World and meet with students working on Sustainable Engineering and International Development course (AE/CE/EE/ME 388x) course projects. 10/10-13/2005
- Hosted ISU visit by Dr. Levi Kasisira, Federal University of Vicosa, Vicosa, Brazil to present a lecture to ISU chapter of Engineers for a Sustainable World and meet with students working on Sustainable Engineering and International Development course (AE/CE/EE/ME 388x) course projects. 10/10-13/2005
- Hosted ISU visit by Mr. Denis Boisgontier and Mr. Julien Orensanz, Novel Information Technologies group, Arvalis Institut du Vegetal, Boigneville, France. 7/23/2004
- Visited Wageningen University, Wageningen, The Netherlands, Farm Technology Group and Agrotechnology and Food Innovations group to present research and discuss mutual research interests. (J. Muller, L. Tang, J.-W. Hofstee, D. Kurstjens, G. van Straten, D. Goense) 6/14/2004
- Traveled with ISU College of Engineering IMPACT team to Denmark for site visits of current undergraduate student exchange partner, Odense University College of Engineering, Odense, Denmark; industrial partner, Sauer-Danfoss, Nordborg, Denmark, for discussions of mutual research interests; and Aalborg University, Aalborg, Denmark, to meet with potential collaborators (Drs. H. J. Anderson, A. P. Ravn, K. Nielsen, J. Bendtsen, J. Pederson, T. Anderson) and explore potential for student exchange. 6/8-11/2004
- Visited the Royal Danish Agricultural and Veterinary University (KVL), Taastrup, Denmark, Agrotechnology Group, to present research and discuss mutual research interests in precision agriculture and agricultural robotics (S. Blackmore, S. Fantos, H.-W. Griepenstrog, D. Wulfsohn). 6/7/2004
- Visited the Federal University of Campina Grande, Campina Grande, Brazil to establish partnership in within the FIPSE educational consortium and explore potential for undergraduate and graduate student exchange. 3/22-24/2004
- Visited the Federal University of Viçosa, in Viçosa, MG, Brazil for student exchange site visit to recruit students for exchange and make student exchange arrangements, to present research and discuss research collaboration and 3/16-19/2004

exchange of students.

- PI on ISU Council for International Programs Grant funded for development of student exchange in Brazil. 7/1/2003-6/30/2004
- Co-PI on U.S. Department of Education FIPSE grant funded to establish educational consortium with University of Kentucky, Federal University of Vicosa, Federal University of Lavras, Federal University of Campina Grande, and University of Sao Paulo in Piracicaba, in Brazil with the purpose of establishing undergraduate student exchange and faculty research collaborations. 9/4/2003-present
- Co-Hosted with Dr. Vijay Vittal, ECpE, Dr. Delly Oliveira at ISU for one year faculty sabbatical and initiated research collaborations on mechatronics for energy optimization. Dr. Oliveira is a member of the Agricultural Engineering faculty at Federal University Viçosa, Brazil. 8/15/2003-7/30/2004
- Hosted visit by Prof. Simon Blackmore, Danish Veterinary and Agricultural University (KVL), Dr. Jose Molin, University of Sao Paulo and Mr. Leandro Gimenez, ABC Foundation, Castro, Brazil. 7/22/2002
- Visited Embrapa Corn and Sorghum Research Station, Sete Lagoas, Brazil to present research. 3/20/2002
- Visited the Federal University of Viçosa, in Viçosa, MG, Brazil to present research and discuss research collaboration and exchange of students. Made contact with Drs. Francisco Pinto, Daniel Queiroz, Delly Oliveira. 3/17-19/2002
- Presented paper at the World Congress on Computers in Agriculture and Natural Resources, Foz do Iguacu, Brazil. 3/13-15/2002
- Hosted ISU visit of Dr. Harold Ortwig, Professor Mechanical Engineering/Fluid Power Trier University of Applied Sciences, Germany. 4/7/2000
- Spent year in the People's Republic of China working as a foreign expert at the Changsha Electric Power University, Changsha, Hunan. Taught undergraduate courses in the areas of English composition, reading and American culture. 8/94-7/95

SCHOLARLY ACTIVITIES

Grants and Contracts

55 Projects Funded ($3,301,874 Total; $860,267 on 23 projects as PI)

Principal Investigator

Project Title:	Dielectric Spectroscopic Sensor Development for Hydraulic Fluid Contaminant Detection
Name of Grantor:	National Fluid Power Association
Cooperating Faculty:	**B. L. Steward** and S. J. Birrell
Grant Amount:	**$74,995**
Effective Dates:	January 1, 2012 – December 31, 2012
Steward's Role:	PI; wrote proposal and will lead research team

Project Title:	Food, Fiber, and Energy Production: Developing an International Undergraduate Engineering Curriculum
Name of Grantor:	US Dept of Ed. FIPSE/ Brazil CAPES
Cooperating Faculty:	T. S. Stombaugh, **B. L. Steward**, S. R. Workman, T. J. Brumm, M. J. Darr
Grant Amount:	**$297,730**
Effective Dates:	Oct 1, 2009 – Sept. 30, 2012
Steward's Role:	Principal Investigator on ISU sub-contract; ISU coordinator of the exchange program; Developed study abroad program and international internships program.

Project Title:	Developing a Physical Modeling Framework for Bioenergy Systems

Name of Grantor:	Fulbright Scholar Program
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**$17,000**
Effective Dates:	March 1, 2010 – June 30, 2010
Steward's Role:	Wrote proposal and lived in Brasil as a visiting scholar in the Agricultural Engineering Department at the Federal University of Viçosa, Minas Gerias teaching, lecturing, and doing research.

Project Title:	Small-scale Fuel Alcohol Production to Meet University Vehicle Fuel Needs and Promote Regional Sustainable Development
Name of Grantor:	EPA P3 Grants Program
Cooperating Faculty:	**B. L. Steward,** T. J. Brumm, D. Oliveira, W. Hermsdorf, J. S. Silva
Grant Amount:	**$ 13,536**
Effective Dates:	September 1, 2007 – August 31, 2008
Steward's Role:	Principal Investigator; formed student team and led team in development of final report and presentation at the P3 competition in Washington, DC. Developed and led investigative trip of with three team members to Brazil.

Project Title:	Supporting Travel to India
Name of Grantor:	ISU Foreign Travel Grants Program
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**~$ 1,104**
Effective Dates:	March 9, 2007 – March 21, 2007
Steward's Role:	Principal Investigator; Traveled to India to visit agricultural universities, agricultural machinery manufacturers, and present paper at international conference.

Project Title:	Project Development for Sustainable Engineering Course
Name of Grantor:	Iowa DNR
Cooperating Faculty:	**B. L. Steward** and S.-K. Ong
Grant Amount:	**$ 11,900**
Effective Dates:	February 15, 2006 – August 31, 2006
Steward's Role:	Principal Investigator; Wrote proposal and led course development

Project Title:	Sencer Summer Institute Full Team Application
Name of Grantor:	National Center for Science and Civic Engagement (NSF-subcontract)
Cooperating Faculty:	**B. L. Steward,** S. K. Mickelson, and S.-K. Ong
Grant Amount:	**$ 2,800**
Effective Dates:	August 1, 2005 – August 31, 2007
Steward's Role:	Principal Investigator; wrote proposal and attended SENCER meeting in San Jose with other team members.

Project Title:	Renewable Resources To Power A University – A Model For Regional Sustainable Development
Name of Grantor:	US EPA P3 Awards Program
Cooperating Faculty:	**B. L. Steward,** S.-K. Ong, and D. Oliveira
Grant Amount:	**$ 14,681**
Effective Dates:	September 1, 2005 – August 31, 2006
Steward's Role:	Principal Investigator; formed student team and led team to development of final report and presentation at the P3 competition in Washington, DC. Developed and led investigative trip with six team members to Brazil.

Project Title:	Using Topographic Information for Improved Vehicle Navigation Control
Name of Grantor:	Deere & Company
Cooperating Faculty:	**B. L. Steward,** L. Tang
Grant Amount:	**$61,463**
Effective Dates:	January 1, 2005 – December 31, 2005

Steward's Role:	Principal Investigator; wrote proposal and led research team to accomplish research objectives

Project Title:	Real-Time Machine Vision Early Stage Corn Population and Spacing Estimation
Name of Grantor:	Pioneer Hi-Bred International, Inc./ CATD
Cooperating Faculty:	**B. L. Steward**, S. J. Birrell, G. Manimaran
Grant Amount:	**$48,285**
Effective Dates:	May 15, 2004 - December 31, 2004
Steward's Role:	Principal Investigator; wrote proposal and led research team who collaboratively accomplished research objectives.

Project Title:	Enhancing Fluid Power Learning Through Animation and Visualization
Name of Grantor:	National Fluid Power Association
Cooperating Faculty:	**B. L. Steward,** T. J. Brumm
Grant Amount:	**$4,960**
Effective Dates:	January 1, 2004 – December 31, 2004
Steward's Role:	Principal Investigator; wrote proposal and recruited and hired Flash programmer to develop the animation software; currently collaborating with programmer in the development of the animations.

Project Title:	Development and Use of Digital Elevation Models (DEMs) to Aid Vehicle Navigation and Control
Name of Grantor:	Deere & Company
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**$52,668**
Effective Dates:	Nov 1, 2003 – October 31, 2004
Steward's Role:	Principal Investigator; wrote proposal and led research team who collaboratively accomplished research objectives.

Project Title:	Understanding Brazilian Agriculture and Culture: An Exchange of Students and Ideas
Name of Grantor:	ISU Council on International Programs
Cooperating Faculty:	**B. L. Steward**, H. Xin, and S. Taylor
Grant Amount:	**$6,000**
Effective Dates:	July 1, 2003 – June 30, 2004
Steward's Role:	Principal Investigator; wrote proposal and provided co-leadership (with Dr. Xin) to ISU team in developing student exchange and FIPSE proposal; visited the Federal University of Campina Grande, Campina Grande, Brazil explore potential for undergraduate and graduate student exchange; and visited the Federal University of Vicosa, in Vicosa, MG, Brazil for student exchange site visit to recruit students for exchange and make student exchange arrangements, to present research and discuss research collaboration and exchange of students.

Project Title:	Controller Area Network (CAN) for Fluid Power Lab Experiments
Name of Grantor:	National Fluid Power Association
Cooperating Faculty:	**B. L. Steward,** S. J. Birrell
Grant Amount:	**$4,456**
Effective Dates:	July 1, 2003 – June 30, 2004
Steward's Role:	Principal Investigator; wrote proposal and recruited ABE senior design team for the project.

Project Title:	Development of ESCOPE for Seed Production Fields
Name of Grantor:	Pioneer Hi-Bred International, Inc./ CATD
Cooperating Faculty:	**B. L. Steward**, S. J. Birrell
Grant Amount:	**$43,800**
Effective Dates:	May 15, 2003 - December 31, 2003

Steward's Role:	Principal Investigator; wrote proposal and led research team who collaboratively accomplished research objectives.

Project Title:	Genetic Programming-Based Spectral Processing With Range Operators
Name of Grantor:	ISU Special Research Initiation Grant
Cooperating Faculty:	**B. L. Steward,** D. A. Ashlock
Grant Amount:	**$13,983**
Effective Dates:	Jan 1, 2003 – Dec 31, 2003
Steward's Role:	Principal Investigator; wrote proposal and led research team and conducted 85% of the research.

Project Title:	Fluid Power-based Autonomous Agricultural Vehicle
Name of Grantor:	National Fluid Power Association
Cooperating Faculty:	**B. L. Steward,** S. J. Birrell
Grant Amount:	**$4,300**
Effective Dates:	Jan. 1, 2003 – December 31, 2003
Steward's Role:	Principal Investigator; wrote proposal and recruited and co-advised ABE senior design team who designed and built prototype vehicle.

Project Title:	Development and Evaluation of Active Rear Wheel Steering System
Name of Grantor:	Deere & Company
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**$70,770**
Effective Dates:	Nov 1, 2002 – April 30, 2004
Steward's Role:	Principal Investigator; wrote proposal and led research team of graduate and undergraduate students who collaboratively accomplished research objectives.

Project Title:	Hydromechanical Transmission Trainer Development
Name of Grantor:	National Fluid Power Association
Cooperating Faculty:	**B. L. Steward,** S. J. Birrell
Grant Amount:	**$4,795**
Effective Dates:	July 1, 2002 – June 30, 2003
Steward's Role:	Principal Investigator; wrote proposal and recruited and co-advised ABE senior design team and subsequent students who designed and built trainer.

Project Title:	Travel to Brazil
Name of Grantor:	Iowa State University International Travel Grant
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**$1,036**
Effective Dates:	March 12, 2002 – March 22, 2002
Steward's Role:	Principal Investigator; traveled to World Congress on Computers in Agriculture and Natural Resources, Foz do Iguacu, Brazil to present paper, to the Federal University of Vicosa, in Vicosa, MG, Brazil to present research and discuss research collaboration and exchange of students, and to Embrapa Corn and Sorghum Research Station, Sete Lagoas, Brazil to present research.

Project Title:	Early Growth Stage Corn Plant Population and Distribution Sensing Technology Development
Name of Grantor:	Pioneer Hi-Bred International, Inc./ CATD
Cooperating Faculty:	**B. L. Steward**, S. J. Birrell
Grant Amount:	**$43,800**
Effective Dates:	Jan. 31, 2002 - December 31, 2002
Steward's Role:	Principal Investigator; wrote proposal and led research team who collaboratively accomplished research objectives.

Project Title:	Stereo Machine Vision for In-situ Crop Growth Measurement
Name of Grantor:	Iowa State University University Research Grant
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**$17,655**
Effective Dates:	July 1, 2001 – June 30, 2002
Steward's Role:	Principal Investigator, wrote proposal and led research team of graduate and undergraduate students who collaboratively accomplished research objectives.

Project Title:	Development and Evaluation of Multi-mode Four-wheel Electrohydraulic Steering System on a Sprayer Vehicle.
Name of Grantor:	Deere & Company
Cooperating Faculty:	**B. L. Steward**
Grant Amount:	**$48,550**
Effective Dates:	January 1, 2001 - June 30, 2002
Steward's Role:	Principal Investigator, wrote proposal and led research team of graduate and undergraduate students who collaboratively accomplished research objectives.

Co-Principal Investigator

Project Title:	Development of P. A. Harvester
Name of Grantor:	Kemin Ind.
Cooperating Faculty:	S. J. Birrell and **B. L. Steward**
Grant Amount:	**$432,588**
Effective Dates:	January 1, 2011 – December 31, 2012
Steward's Role:	CO- Principal Investigator; consulted with the PI and project team.

Project Title:	High-speed planting effects
Name of Grantor:	Successful Farming
Cooperating Faculty:	H. Mark Hanna, R. Elmore, and **B. L. Steward**
Grant Amount:	**$ 16,995**
Effective Dates:	February 1, 2011 – January 31, 2012
Steward's Role:	CO- Principal Investigator; consulted with PI and project team.

Project Title:	Drying corn cobs and corn stover in and Advanced Trailers peanut drying trailer
Name of Grantor:	Apt Advanced Trailer
Cooperating Faculty:	C. J. Bern, **B. L. Steward**, and T. J. Brumm
Grant Amount:	**$20,711**
Effective Dates:	October 31, 2009 – September 30, 2010
Steward's Role:	Co-Principal Investigator; served on the POS committee of the graduate student who carried out the work on this project.

Project Title:	FPGAs for Real Time Continuous Systems Simulation
Name of Grantor:	ISU ICube Institute
Cooperating Faculty:	J. Zambreno, **B. L. Steward**, and A. K. Kelkar
Grant Amount:	**$5,000**
Effective Dates:	January 1, 2010 – June 30, 2010
Steward's Role:	Co-Principal Investigator; developed hydraulic steering valve model used simulated on the FPGA.

Project Title:	Real-time Active Droplet Size and Drift Control System
Name of Grantor:	AGCO Corp.
Cooperating Faculty:	H. M. Hanna, **B. L. Steward**, and M. J. Darr
Grant Amount:	**$118,550**
Effective Dates:	May 18, 2009 – May 17, 2011
Steward's Role:	Co-Principal Investigator; editorial support on proposal and served as thesis advisor for student working on the project.

Project Title:	An Automated Mechanical Intra-row Weed Removal System for Vegetable Crops
Name of Grantor:	Leopold Center for Sustainable Agriculture
Cooperating Faculty:	L. Tang and **B. L. Steward**
Grant Amount:	**$54,666**
Effective Dates:	Feb. 1, 2009 – January 31, 2011
Steward's Role:	Co-Principal Investigator; editorial support on proposal and served as thesis advisor for one student working on the project.

Project Title:	Laboratory Support for New Course in Microcontroller Systems and Vehicle Communication
Name of Grantor:	ISU COE Tuition Surcharge Funds
Cooperating Faculty:	M. J. Darr, **B. L. Steward**, and S. J. Birrell
Grant Amount:	**$38,400**
Effective Dates:	July 1, 2008 – June 30, 2009
Steward's Role:	Co-Principal Investigator; assisted Darr with proposal

Project Title:	Collaborative Proposal: Technical Staff Member to Support Student Design Projects, Student Machine Shop, and Manufacturing Systems Laboratory in the Agricultural and Biosystems Engineering and Mechanical Engineering Departments
Name of Grantor:	ISU COE Tution Surcharge Funds
Cooperating Faculty:	**B. L. Steward**, J. Heise, J. Wickert, and R. Kanwar
Grant Amount:	**$187,264**
Effective Dates:	July 1, 2009 – June 30, 2011
Steward's Role:	Co-Principal Investigator; wrote initial proposal draft and served on search committee for the staff member.

Project Title:	Computer Interfacing Hardware for Fluid Power Lab
Name of Grantor:	ISU CAC Funds
Cooperating Faculty:	M. J. Darr and **B. L. Steward**
Grant Amount:	**$9,900**
Effective Dates:	July 1, 2008 – June 30, 2009
Steward's Role:	Co-Principal Investigator; assisted Darr with proposal and hardware specifications.

Project Title:	Field Prototype to Measure Force and Stalk Vibration During Simulated Root Breaking
Name of Grantor:	Pioneer Hi-Bred International, Inc.
Cooperating Faculty:	J. A. Mann III, R. Raman, **B. L. Steward**
Grant Amount:	**$19,033**
Effective Dates:	March 1, 2008 – December 31, 2008
Steward's Role:	Co-Principal Investigator; consulted with project team

Project Title:	Development of Variable Rate Stover Collection for Single Pass Biomass Harvester
Name of Grantor:	Deere and Co.
Cooperating Faculty:	S. J. Birrell and **B. L. Steward**
Grant Amount:	**$ 262,539**
Effective Dates:	May 20, 2008 – May 20, 2012
Steward's Role:	Co- Principal Investigator; assisted project team, co-supervised staff member working on the project, major editorial support on papers resulting from the research.

Project Title:	Case-Based Computerized Assessment of Cultural Adaptability in ISU Students
Name of Grantor:	ISU Council on International Programs
Cooperating Faculty:	A. Bhandari, A. L. Kaleita, N. Keren, and **B. L. Steward**

Grant Amount: **$5,000**
Effective Dates: July 1, 2008 – June 30, 2009
Steward's Role: Co-Principal Investigator; editorial effort on proposal, assisted with the project team by giving input into the cases.

Project Title: Enhancing Realism and Flexibility of VR-Based Real-Time Dynamic Simulation Framework with Operator and Hardware in-the-loop Interface
Name of Grantor: Deere & Company
Cooperating Faculty: A. G. Kelkar, **B. L. Steward**
Grant Amount: **$330,542**
Effective Dates: January 1, 2008 – December 31, 2010
Steward's Role: Co-Principal Investigator; co-wrote proposal and co-led the research team. Major editorial effort in for journal articles resulting from the project research results, major effort in writing final report.

Project Title: Development of International-Agriculture Case Studies
Name of Grantor: ISU Council on International Programs
Cooperating Faculty: A. L. Kalieta, S. Mickelson, **B. L. Steward**, T. J. Brumm
Grant Amount: **$6,375**
Effective Dates: January 1, 2006 – June 30, 2006
Steward's Role: Co-Principal Investigator; editorial effort on proposal, assisted with the project team.

Project Title: Multifrequency Dielectric Sensing For Hydraulic Fluid Condition
Name of Grantor: National Fluid Power Association
Cooperating Faculty: S.J. Birrell, **B. L. Steward**
Grant Amount: **$146,809**
Effective Dates: September 1, 2005 – August 31, 2007
Steward's Role: Co-Principal Investigator; co-wrote the proposal, guided graduate students who were working on the project, substantial editorial effort on papers and posters arising from the project. Presented work at an international conference.

Project Title: Design Pneumatic Systems for Robotic Arable Farming
Name of Grantor: National Fluid Power Association
Cooperating Faculty: L. Tang, **B. L. Steward**
Grant Amount: **$4,800**
Effective Dates: September 1, 2005 – June 30, 2006
Steward's Role: Co-Principal Investigator; edited proposal

Project Title: Downpressure Effects On Planter Performance
Name of Grantor: Duello Ag Group
Cooperating Faculty: H. M. Hanna, **B. L. Steward**
Grant Amount: **$16,792**
Effective Dates: April 14, 2005 – March 31, 2006
Steward's Role: Co-Principal Investigator; provide assistance to the research team and edited papers resulting from the research.

Project Title: Real-time Control of Machines and Simulation of JD AutoTrac in VR
Name of Grantor: Deere & Company
Cooperating Faculty: A. G. Kelkar, **B. L. Steward**
Grant Amount: **$435,889**
Effective Dates: January 1, 2005 – December 31, 2007
Steward's Role: Co-Principal Investigator; co-wrote proposal and co-led the research team. Major effort in writing final report and software manual.

Project Title:	Effects of Planter Speed and Row Unit on Early Corn Growth
Name of Grantor:	CNH Global America LLC
Cooperating Faculty:	H. M. Hanna, **B. L. Steward**
Grant Amount:	**$4,734**
Effective Dates:	March 1, 2004 – Feb. 28, 2005
Steward's Role:	Co-Principal Investigator; played a supporting role on the project team.

Project Title:	Application of Hyperspectral Imaging for Remote Sensing of Maize Pollen Release: Year II
Name of Grantor:	Iowa Space Grant Consortium (NASA)
Cooperating Faculty:	M. E. Westgate, J. Hatfield, **B. L. Steward**
Grant Amount:	**$29,700 (Year II) $79,200 entire project**
Effective Dates:	Feb. 1, 2004 – Jan. 31, 2005
Steward's Role:	Co-Principal Investigator; providing analysis of the spectral data acquired through the project.

Project Title:	Feedback-Based Real-Time Scheduling in Autonomous Vehicle Systems
Name of Grantor:	ISU ICUBE
Cooperating Faculty:	G. Manimaran, **B. L. Steward**
Grant Amount:	**$7,000**
Effective Dates:	January 1, 2004 – May 15, 2004
Steward's Role:	Co-Principal Investigator; provided expertise and guidance on the application of real-time scheduling to machine vision-based field variability sensing systems and autonomous vehicle systems.

Project Title:	Biosystems and Agricultural Engineering Training – Consortium for Sustainable Plant and Animal Production Systems
Name of Grantor:	US-Brazil Higher Education Consortia Program,US Department of Education (sub-contract from University of Kentucky)
Cooperating Faculty:	H. Xin and **B. L. Steward**
Grant Amount:	**$89,109**
Effective Dates:	Sept 1, 2003 – August 30, 2007
Steward's Role:	Co-Principal Investigator; wrote proposal and provided co-leadership (with Dr. Xin) to ISU team in developing student exchanges and educational consortium.

Project Title:	A Micro-Electro-Mechanical Systems-Based Soil Analysis System
Name of Grantor:	Iowa State University Carver Trust
Cooperating Faculty:	S. J. Birrell, S. C. Chen, **B. L. Steward**
Grant Amount:	**$22,000**
Effective Dates:	April 15, 2000 - July 31, 2001
Steward's Role:	Co-Principal Investigator; played supporting role on the project team.

Collaborator

Project Title:	Low-cost, Sustainable Solutions in International Distance Education
Name of Grantor:	ISU Council for International Programs
Cooperating Faculty:	S. K. Mickelson, **B. L. Steward,** J. Monahan, G. Chighladze, A. L. Kaleita, A. Maney, and L. Zachary
Grant Amount:	**$11,500**
Effective Dates:	January 1, 2007 – June 30, 2007
Steward's Role:	Collaborator; mentored a project team in sustainable engineering and international development class that investigated sustainable solutions for distance education in Georgia

Project Title:	International Agriculture Case Studies for Enhancement of Undergraduate Competency in Cultural Adaptability
Name of Grantor:	ISU Miller Faculty Fellowship Program
Cooperating Faculty:	A. L. Kalieta, S. Mickelson, **B. L. Steward**,
Grant Amount:	**$23,621**
Effective Dates:	August 1, 2006 – July 30, 2007
Steward's Role:	Collaborator; edited proposal and collaborated with the project team.

Project Title:	Useful and Effective Evaluation and Review of Instruction
Name of Grantor:	ISU Miller Faculty Fellowship Program
Cooperating Faculty:	T. J. Brumm, B. Licklider, **B. L. Steward**, S. Freeman, and S. Mickelson
Grant Amount:	**$23,566**
Effective Dates:	August 1, 2005 – July 30, 2006
Steward's Role:	Collaborator; project idea grew out of my SOTL work with classroom assessment and two journal articles

Project Title:	Sustainable Engineering and International Development Course
Name of Grantor:	ISU Miller Faculty Fellowship Program
Cooperating Faculty:	S.-K. Ong, K. Bryden, **B. L. Steward**, and G. Sheble
Grant Amount:	**$24,905**
Effective Dates:	August 1, 2005 – July 30, 2006
Steward's Role:	Collaborator; co-led course development and co-taught course

Project Title:	Faculty Assessment of Competency-Based Learning and Electronic Portfolios
Name of Grantor:	ISU Miller Faculty Fellowship Program
Cooperating Faculty:	T. J. Brumm, S.K. Mickelson, **B. L. Steward**, L. Hanneman, M. Huba
Grant Amount:	**$20,146**
Effective Dates:	July 1, 2004 – June 30, 2005
Steward's Role:	Collaborator; playing an active role with the project team.

Project Title:	Developing and Assessing Desired Student Outcomes Using ePortfolios: a Comprehensive Transformation of the ABE Undergraduate Curricula
Name of Grantor:	ISU Miller Faculty Fellowship Program
Cooperating Faculty:	T. J. Brumm, S.K. Mickelson, **B. L. Steward**, et al.
Grant Amount:	**$23,073**
Effective Dates:	July 1, 2003 – June 30, 2004
Steward's Role:	Collaborator; played a role in writing the proposal and an active role with the project team.

Project Title:	Proposal for CTE Departmental Teaching and Learning Grant
Name of Grantor:	ISU Center for Teaching Excellence
Cooperating Faculty:	T. J. Brumm, **B. L. Steward**, S.K. Mickelson
Grant Amount:	**$900**
Effective Dates:	Feb. 1, 2003 – June 20, 2003
Steward's Role:	Cooperating Faculty member; helped write proposal.

Project Title:	Biosafety Institute for Genetically Modified Agricultural Products (BIGMAP)
Name of Grantor:	ISU New Initiatives
Cooperating Faculty:	M. Misra, et al. (including **B. L. Steward**)
Steward's Role:	Cooperating Faculty

Project Title:	icube@isu: Information Infrastructure Institute (I^3)
Name of Grantor:	ISU New Initiatives
Cooperating Faculty:	A. K. Somani, et al. (including **B. L. Steward**)
Steward's Role:	Cooperating Faculty

Pending ($8,051,058)

Project Title:	Shielding Cucurbit Crops for Resilient Agroecosystems
Name of Grantor:	USDA-NIFA Specialty Crop Research Initiative
Cooperating Faculty:	M. Gleason, and 8 CoPIs including **B. L. Steward**
Grant Amount:	**$3,043,575**
Effective Dates:	Jan. 1, 2013 – Dec.31, 2015
Steward's Role:	Co-Principal Investigator

Project Title:	A Systems Approach to Automating Intra-row Weed Control in Vegetable Crops
Name of Grantor:	USDA-NIFA Specialty Crop Research Initiative
Cooperating Faculty:	D. Slaughter et. al. including L. Tang, **B. L. Steward**
Grant Amount:	**$3,900,000**
Effective Dates:	Sept. 1, 2012 – Aug. 31, 2016
Steward's Role:	Co-Principal Investigator

Project Title:	High-throughput Plant Discrimination, Localization, and End-effector Actuation for In-situ Automated Intra-Row Mechanical Weed Control Systems for Vegetable Crops
Name of Grantor:	NSF-National Robotics Initiative
Cooperating Faculty:	L. Tang, **B. L. Steward,** K. Delate
Grant Amount:	**$973,364**
Effective Dates:	August 1, 2012 – July. 31, 2016
Steward's Role:	Co-Principal Investigator

Project Title:	Development of an improved heat exchanger for anhydrous ammonia flow control
Name of Grantor:	Raven Industries Inc.
Cooperating Faculty:	H. M. Hanna and **B. L. Steward**
Grant Amount:	**$134,119**
Effective Dates:	June 1, 2012 – May 31, 2014
Steward's Role:	Co-Principal Investigator

Gifts ($758,580 + ~$92,000 In-Kind Equipment)

Project Title:	Embedded controllers and associated hardware for Fluid Power Laboratory
Name of Grantor:	Sauer Danfoss
Cooperating Faculty:	**B. L. Steward**, and M.J. Darr
Grant Amount:	**~$55,000**
Steward's Role:	Wrote gift request proposal and presented to representatives from Sauer-Danfoss

Project Title:	Developing a Fluid and Hybrid Power Control and Transmission Laboratory
Name of Grantor:	Sauer Danfoss
Cooperating Faculty:	**B. L. Steward**, S.J. Birrell, and R. Kanwar
Grant Amount:	**$256,580**
Steward's Role:	Wrote proposal and presented to representatives from Sauer-Danfoss

Description:	Sauer-Danfoss Plus1 Controllers and development systems
Name of Grantor:	Sauer-Danfoss
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-Kind: Six controllers, breakout boards, and GUIDE software**
Steward's Role:	Assisted in development effort collaborating with Michael Gandrud, Lynn Jansen, and Chad Daniel at Sauer-Danfoss.

Description:	Caterpillar Mechatronics lab in Hoover Hall
Name of Grantor:	Caterpillar Corp.
Cooperating Faculty:	G. R. Luecke and **B. L. Steward**
Gift Amount:	**$200,000**
Steward's Role:	Assisted in development effort, traveled with ISU COE team to Caterpillar Plant and Technical Center, Peoria, IL, on 6/29/2000, helped develop vision for the lab, and served as faculty technical contact for Caterpillar Mechatronics Lab opening on 10/30/2003.

Description:	Mechatronics Trainers for Caterpillar Mechatronics lab in Hoover Hall
Name of Grantor:	Caterpillar Corp.
Cooperating Faculty:	G. R. Luecke and **B. L. Steward**
Gift Amount:	**$250,000**
Steward's Role:	Assisted in development effort, traveled with ISU COE team to Caterpillar Plant and Technical Center, Peoria, IL, on 6/29/2000, served as faculty technical contact for Caterpillar Mechatronics Lab opening on 10/30/2003, and designed mechatronic trainers in collaboration with Caterpillar engineers.

Description:	Position Sensing Hydraulic Cylinders for Electrohydraulic Trainers
Name of Grantor:	Caterpillar Corp.
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-kind: hydraulic cylinders (~ $ 6,000)**
Steward's Role:	Developed initial contact with Jim Waters and made gift request.

Description:	Hydraulic Accumulators for Electrohydraulic Trainers
Name of Grantor:	Parker Hydraulics
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-kind: hydraulic accumulators and brackets (~ $500)**
Steward's Role:	Developed initial contact with Paul Sakowicz and made gift request.

Description:	Hoses and Fittings for Electrohydraulic Trainers
Name of Grantor:	Gates Corp.
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-kind: Hoses, fittings, and quick-disconnects (~$5,000)**
Steward's Role:	Developed initial contact with Pat Lee and made gift request.

Description:	Hydraulic Cylinders for Electrohydraulic Trainers
Name of Grantor:	Vermeer Manufacturing Co.
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-kind: hydraulic cylinders (~$5,000)**
Steward's Role:	Developed initial contact with Brad Nelson and made gift request.

Description:	Hydraulic Cylinders for Electrohydraulic Trainers
Name of Grantor:	Prince Hydraulics
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-kind: hydraulic cylinders (~$500)**
Steward's Role:	Developed initial contact with Jim Walker and made gift request.

Description:	Hydraulic Components for Electrohydraulic Trainers
Name of Grantor:	Sauer-Danfoss
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**In-kind: hydraulic components and engineering time (~$20,000)**
Steward's Role:	Developed initial specifications based on pedagogical objectives; Designed electrohydraulic trainers in collaboration with M. Gandrud and L. Jansen, Sauer-Danfoss, Ames.

Description:	Mechatronics Research
Name of Grantor:	Deere and Co.
Cooperating Faculty:	**B. L. Steward**
Gift Amount:	**$6,000**
Steward's Role:	Made contact with Dr. Shufeng Han, John Deere AMS and arranged for gift as the start of longer term collaborations.

Description:	Electrohydraulic Trainers
Name of Grantor:	John Deere Foundation
Cooperating Faculty:	**B. L. Steward,** S. W. Melvin, W. DeVries, D. Householder
Gift Amount:	**$46,000**
Steward's Role:	Provided leadership and vision in the development of a Fluid Power Lab in Davidson Hall; Designed electrohydraulic trainers in collaboration with M. Gandrud and L. Jansen, Sauer-Danfoss, Ames.

Peer-Reviewed Articles

*MS, Ph.D., Post Doc, or Research Scientist supervised by Steward.

Peer-Reviewed Journal Articles

1. Karkee, M., R. P. McNaull, S. J. Birrell, and **B. L. Steward.** 2012. Agricultural Biomass Removal Rate Estimation for Real-time Optimization of Single Pass Crop Grain and Biomass Harvesting System. *Transactions of the ASABE.* To appear.

   Role: Steward co-supervised Karkee and provided substantial editorial support to this paper.

   Significance: First paper documenting the development of a control system algorithm for varying the rate of corn stover collected in the field based on soil erosion control criteria.

2. Karkee, M. and **B. L. Steward.** 2011. Parameter estimation and validation of a tractor and single axle towed implement dynamic system model. *Computers and Electronics in Agriculture* 77(2): 135-146. doi:10.1016/j.compag.2011.04.005.

   Role: Steward supervised Karkee's graduate work, provided guidance in research problem formation, data collection, analysis, specifically providing mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

   Significance: A major issue in model based design is using experimental data to identify models or model parameters. Developing models and estimating model parameters for a tractor and implement system is important for rapid development and improvement of precision implement guidance systems. This paper documents successful estimation of tire-soil interaction parameters from measurements acquired through vehicle posture sensors. To our knowledge, this is the first time that this technique has been demonstrated for agricultural vehicles.

3. Visser, E. M., D. Oliveira Filho, M. A. Martins, **B. L. Steward.** 2011. Bioethanol Production Potential from Brazilian Biodiesel Co-products. *Biomass and Bioenergy* 35(1): 489-494.

   Role: Lead author, Visser, was the first ISU student to participate in the exchange program with the Federal University of Viçosa (UFV) in Brazil. Steward mentored Visser from the time that he first went to Brazil on the exchange until when Visser was member of an EPA P3 team that Steward led. Steward served on Visser's graduate examination committee at UFV where he completed his MS degree. Steward provided extensive editorial and technical support to this paper. Contribution: 20%

   Significance: One major problem facing the commercial production of cellulosic ethanol is the challenge of economically harvesting and transporting sufficient amounts of biomass as a feedstock at biorefinery plant scales. Oil extraction for biodiesel production yields large quantities of biomass co-products which in many cases may be sufficient to produce enough ethanol to meet the alcohol demands of the transesterification process. All crops studied were capable of producing enough ethanol for biodiesel production. This paper is significant because it provides evidence for the feasibility of this type of closed loop biodiesel production system.

4. Bhandari, A., S. K. Ong, and **B. L. Steward.** 2011. Student learning in a multidisciplinary sustainable engineering course. *Journal of Professional Issues in Engineering Education and Practice.* 137(2):86-93. DOI: 10.1061/(ASCE)EI.1943-5541.0000055.

   Role: Steward played a major leadership role in developing and teaching this course. He wrote an earlier conference paper which was used in the initial draft phases of this paper and provided editorial support. Contribution: 15%

   Significance: The question of how to help engineering students learn sustainability concepts and use sustainability analysis tools in their profession is non-trivial. The challenge comes from the abstract nature of sustainability concepts and the necessity to operate on a system level where undergraduate students are unaccustomed to working. This paper describes the approach that we took with the development of this course. Thirteen out of 18 students surveyed (72%) agreed that their ability to consider techno-economic, environmental, and social aspects of sustainability was improved as a result of the course. An improved student understanding of aspects of sustainability and its measures was also evident in student project reports.

5. Karkee, M., **B. L. Steward,** A. G. Kelkar, and Z. T. Kemp II**.** 2011. Modeling and Real-time Simulation Architectures for Virtual Prototyping of Off-Road Vehicles. *Virtual Reality* 15(1):83-96. DOI: 10.1007/s10055-009-0150-1.

   Role: Steward was a CO-PI on the project and supervised Karkee as a graduate student and assistant scientist, specifically providing mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

Significance: This paper presented both a dynamic systems modeling architecture as well as a simulation architecture for virtual prototyping of agricultural machine systems. This architecture enables testing of virtual prototypes of the vehicle systems in real-time and of the functionality of newly developed controller software and hardware. Potential impacts include faster development cycles of improved automation technology in off-road vehicle systems.

6. Karkee, M. and **B. L. Steward.** 2010. Study of the Open and Closed Loop Characteristics of a Tractor and a Single Axle Towed Implement System. *Journal of Terramechanics* 47(6): 379–393. DOI: 10.1016/j.jterra.2010.05.005.

   Role: Steward supervised Karkee's graduate work, provided guidance in research problem formation, data collection, analysis, specifically providing mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

   Significance: The paper addressed the open question of how much model fidelity was needed to capture the dynamics of a tractor/implement steering system to accurately represent system dynamic behavior. Open loop analysis of the kinematic and dynamic models revealed that the higher order dynamics captured by the tractor and implement dynamic model had an impact on simulated responses at higher operating velocities and on higher input frequencies. The open and closed loop response analysis performed in this work provided an understanding about the system at various forward velocities, which will help in the design and development of efficient and robust tractor and towed implement guidance controllers.

7. Karkee, M., and **B. L. Steward**. 2010. Local and Global Sensitivity Analysis of a Tractor and Single Axle Grain Cart Dynamic System Model. *Biosystems Engineering* 106(4): 352-366.

   Role: Steward supervised Karkee's graduate work, provided guidance in research problem formation, data collection, analysis, specifically providing mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

   Significance: Sensitivity analysis was used to identify the effect of system parameter uncertainty/ variation on tractor/cart steering system responses and to identify the most critical parameters of the system model. The system was most sensitive to the tire cornering stiffness parameters and least sensitive to the implement inertial parameters. These results are significant because, to our knowledge, they are the first results providing guidance to automatic guidance designers and test engineers about parameter sensitivity.

8. Aziz, S. A., **B. L. Steward** and M. Karkee. 2010. Using spatial uncertainty of prior measurements to design targeted sampling of elevation data. Transactions of the ASABE 53(2): 349-357.

   Role: Steward supervised Aziz's graduate work, provided guidance in research problem formation, data collection, analysis, specifically providing mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

   Significance: The paper won a 2011 ASABE Honorable Mention Paper Award. Field sampling can be a major expense for planning within-field management in precision agriculture. This work investigated an efficient sampling strategy that addressed knowledge gaps, rather than exhaustively collect redundant data. The results indicated that spatial uncertainty models used in an adaptive sampling design can help reduce sampling cost while maintaining measurement accuracy. The method was general, not limited to elevation data, and could be extended to other spatially variable field data.

9. Hanna, H. M. H., **B. L. Steward**, and L. Aldinger. 2010. Soil loading effects of planter depth-gauge wheels on early corn growth. *Applied Engineering in Agriculture* 26(4):551-556.

Role: Steward was a CO-PI on the project and was involved in consultations throughout project. Provided editorial support for this paper. Contribution: 20%

Significance: Study showed soil loading had an effect on corn plant emergence rate and seed depth. No evidence of soil loading effect on seed spacing, final stand, growth or extended leaf height. Results have been used frequently with producer audiences in extension education venues.

10. S. A. Aziz. **B. L. Steward**, L. Tang, and M. Karkee. 2009. Utilizing repeated GPS measurement from field operations for development of agricultural field DEM. Transactions of ASABE. 52(4): 1057-1067.

    Role: Steward provided mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

    Significance: Topographic data collected using RTK-DGPS-equipped farm vehicles during field operations could add additional benefits to the original capital investment in the equipment through the development of high-accuracy field DEMs. This paper presented two methods for developing low cost, high accuracy DEMs from repeated GPS surveys obtained during typical field operations. Using the methods documented in the paper, two years of GPS surveys of elevation data from field operations could reduce elevation error by 50% in field DEMs.

11. Karkee, M., **B. L. Steward**, L. Tang, and S. A. Aziz. 2009. Quantifying sub-pixel signature of paddy rice field using an artificial neural network. *Computers and Electronics in Agriculture.* 65: 65-76.

    Role: The research behind this paper came from a course project in AE 503, which Steward co-taught. Steward provided mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

    Significance: This paper demonstrates a new sub-pixel approach for estimating the emergence date and cropping system land use for paddy rice in remotely sensed imagery. The ANN-based approach was computationally very efficient and thus practical to apply to satellite imagery consisting of millions of pixels. Potential impacts include improved water resources planning and irrigation system design on regional scales leading to improved water use efficiency.

12. Karkee, M., **B. L. Steward**, and S. A. Aziz. 2008. Improving Quality of Public Domain Digital Elevation Models through Data Fusion. *Biosystems Engineering.* 101(3): 293–305.

    Role: Steward provided mentoring and editorial support throughout the publication process for this paper. Contribution: 40%

    Significance: This paper presented a method for dramatically increasing the accuracy, a 42% reduction in RMSE, of two publically available DEMs through data fusion. The approach showed promise for improving DEM accuracy and completeness while maintaining the highest resolution of the input DEMs, thus increasing the reliability and applicability of public domain DEMs produced by Optical and Radar remote sensing technologies.

13. Khot, L., L. Tang, **B.L. Steward**, S. Han. 2008. Sensor Fusion for Improving Roll and Pitch Estimation for an Agricultural Sprayer Vehicle. *Biosystems Engineering* 101(2008): 13-20.

    Role: Steward was a member of Knot's POS committee and provided guidance and editorial support to this paper. Data was collected by Steward's research group and under Steward's supervision. Contribution: 10%

    Significance: While most sensor fusion work uses trial and error estimates of Kalman Filter parameters, this paper documented the use of a noise model for systematic parameter estimation. The fusion algorithm was shown to be effective in improving attitude estimate of the self-propelled

agricultural sprayer, which can be extended to facilitate the automatic control of the implements that interact with the soil surface on an undulating topographic surface.

14. Thorp, K.R., **B.L. Steward**, A.L. Kaleita, and W.D. Batchelor. 2008. Using aerial hyperspectral remote sensing imagery to estimate corn plant stand density. *Transactions of the ASABE.* 51(1):311-320.

    Role: Steward supervised Thorp's graduate work, provided guidance in data collection, analysis, and paper development. Contribution: 25%

    Significance: This paper was the first to document a correlation between hyperspectral remote sensing imagery and corn plant population. Corn plant stand density is important for optimizing crop yield, and this work showed that remote sensing can be used to estimate corn plant stand density at mid-season.

15. Kaleita, A. L., **B. L. Steward**, R. P. Ewing, D. A. Ashlock, M. E. Westgate, and J. L. Hatfield. 2006. Novel analysis of hyperspectral reflectance data for detecting onset of pollen shed in maize. *Transactions of the ASAE.* 49(6): 1947−1954.

    Role: Steward wrote much of the software, did much of the data analysis for this paper. Contribution: 20%

    Significance: Knowledge of pollen shed dynamics in and around seed production fields is critical for ensuring a high yield of genetically pure corn seed. Changes in canopy reflectance using hyperspectral reflectance have been associated with tassel emergence, which is known to precede pollen shed in a predictable manner. This paper showed that corn plants can be classified by tassel occurrence and anthesis phonological stages using hyperspectral canopy reflectance data, and thus provides a means for estimating pollen shed dynamics in the field.

16. Thorp, K.R.*****, W.D. Batchelor, J.O. Paz, **B. L. Steward**, and P. C. Caragea. 2006. Methodology to link production and environmental risks of precision nitrogen management strategies in corn. *Agricultural Systems.* 89(2-3): 272-298.

    Role: Steward supervised Thorp's graduate work and was involved in the revision of this paper. Contribution: 10%

    Significance: This paper presents a methodology for developing variable rate nitrogen prescriptions that balance production and environmental effects based on crop growth models and historical weather data.

17. Brumm, T. J., S. K. Mickelson, **B. L. Steward** and A. L. Kaleita-Forbes. 2006. Competency-based outcomes assessment for agricultural engineering programs. *International Journal of Engineering Education.* 22(6): 1163-1172.

    Role: Steward played a supporting role in the development of the outcomes assessment program in the ISU ABE department which is described in this paper. Contribution: 10%

    Significance: This paper documents the comprehensive efforts of the ISU ABE department to address the ABET 2000 assessment criteria through the use of the OPAL web-based assessment system, ePortfolio, and competency-based learning approach to curricular reform. To our knowledge, no other engineering department has moved to this level of innovation in addressing student outcomes.

18. **Steward, B. L.**, S. K. Mickelson, and T. J. Brumm. 2005. Continuous engineering course improvement through synergistic use of multiple assessment. *International Journal of Engineering Education.* 21(2): 277-287.

Role: Steward did majority of data collection, analysis, writing, and revision. Contribution: 85%

Significance: This paper documents an assessment effort to better understand student perceptions of their learning and the instructional methods used in the agricultural engineering classroom. This paper addresses an open, relevant issue in engineering education, i. e., how to change classroom instruction to achieve learning objectives, which tends to be neglected with current emphases on curricular assessment.

19. Shrestha, D. S.***** and **B. L. Steward.** 2005. Shape and size analysis of corn plant canopies for plant population and spacing sensing. *Applied Engineering in Agriculture.* 21(2): 295-303.

    Role: Steward supervised Shrestha's research and provided substantial effort in the analysis, writing, and revision of this manuscript. Contribution: 40%

    Significance: Part of the challenge, and thus the novelty of this paper, of developing a reliable corn plant population measurement system is finding features from highly irregular and variable vegetation objects to classify corn plants and weeds. This paper addresses this problem through the use of a chain code-based algorithm.

20. Westphalen, M. L.*****, **B.L. Steward**, and S.F. Han. 2004. Topographic mapping through measurement of vehicle attitude and elevation. *Transactions of ASAE* 47(5): 1841-1849.

    Role: Steward supervised Westphalen's research and provided the majority of the effort in revising the paper. Contribution: 60%

    Significance: This paper is the first in the literature to investigate the inclusion of vehicle attitude measurements, along with location measurements, on the accuracy of digital elevation models (DEM) developed from vehicle-based measurements. Results showed that including such measurements can improve DEM accuracy in conditions similar to those encountered during typical field operations.

21. Shrestha, D. S.*****, **B. L. Steward,** and S. J. Birrell. 2004. Image processing algorithms for early stage maize plant detection. *Biosystems Engineering* 89(2): 119-129.

    Role: Steward supervised Shrestha's research and provided a substantial effort in writing the paper. Contribution: 40%

    Significance: The paper documented the performance of a corn plant population sensing system. The modified Otsu's method was developed for thresholding plant region feature space for plant recognition and singulation.

22. **Steward, B. L.**, S. K. Mickelson, and T. J. Brumm. 2004. Formative and summative assessment techniques for continuous agricultural technology classroom improvement. *NACTA Journal.* 48(2): 33-41.

    Role: Steward did majority of data collection, analysis, writing, and revision. Contribution: 85%

    Significance: This paper documents the synergistic effect of using multiple classroom assessment in the agricultural technology classroom in understanding student learning styles and perceptions of instructional methods. Topic is of great relevance with the current emphases on active learning approaches.

23. Miller, M. A.,*** B. L. Steward**, and M. L. Westphalen.***** 2004. Effects of multi-mode four-wheel steering on sprayer machine performance. *Transactions of the ASAE* 47(2): 385-395.

    Role: Steward supervised the research of graduate students Miller and Westphalen, performed analysis, and wrote majority of the revision. Contribution: 60%

Significance: This paper documents the development of a test methodology for understanding how four-wheel steering impacts field performance of self-propelled sprayers. This paper addresses a current, relevant question of agricultural machinery manufacturers who are trying to decide if they should enter the four-wheel steering market.

24. **Steward, B. L.**, L. F. Tian, D. Nettleton, and L. Tang. 2004. Reduced-dimension clustering for vegetation segmentation. *Transactions of the ASAE* 47(2): 609-616.

    Role: Steward developed the algorithm, did analysis, and wrote paper. Initial paper was part of Steward's PhD dissertation, but substantial additional work was done at ISU. Contribution: 90%

    Significance: This paper addresses the challenge presented by outdoor lighting conditions to machine vision systems. A novel technique, reduced-dimension clustering, was developed for dividing the color space in a way that vegetation can be more robustly segmented from background in field images.

25. Shrestha, D. S.***** and **B. L. Steward.** 2003. Automatic corn plant population measurement using machine vision. *Transactions of the ASAE* 46(2): 559–565.

    Role: Steward supervised Shrestha's research and provided a major effort in writing, analysis, and revision of this paper. Contribution: 40%

    Significance: This paper documents the first development and performance analysis of a video-based corn plant sensing system in the peer-reviewed literature. The fundamental techniques described in the paper have potential for broader crop field sensing.

26. Tang, L., L.F. Tian, and **B. L. Steward.** 2003. Texture-based real-time broadleaf and grass classification for selective weed control. *Transactions of the ASAE* 46(4): 1247–1254.

    Role: Steward played a major role in the revision of this manuscript. Contribution: 25%

    Significance: The classification of weed plants into species classes is an open area for innovation. This paper describes a novel approach to this problem using Gabor wavelets for feature extraction and an artificial neural network for classification. This approach, modeled after the human vision system, showed very good performance.

27. **Steward**, **B. L.,** L. F. Tian, and Tang L. 2002. Distance-based control system for machine vision-based selective spraying. *Transactions of the ASAE* 45(5): 1255-1262.

    Role: Steward did the majority of the research, analysis, and writing of this paper. Contribution: 95%

    Significance: A viable selective spraying system demands that herbicide be applied with high spatial accuracy relative to the location of detected weed plants or patches. This paper describes the development of a methodology and performance analysis of the methodology for machine vision-based selective spraying.

28. **Steward, B. L.** and D. S. Humburg. 2000. Modeling the Raven SCS-700 chemical injection system with carrier control. *Transactions of the ASAE* 43(2): 231-245.

    Role: Steward did the majority of the research, analysis, and writing of this paper. Contribution: 85%

    Significance: This is the first paper to model and simulate chemical concentration transients in direct chemical injection systems and estimate their effect on application error.

29. Tang, L., L. F. Tian, and **B. L. Steward**. 2000. Supervised color image segmentation by genetic algorithm for real-time weed sensing in outdoor lighting conditions. *Transactions of the ASAE* 43(4): 1019-1027.

    Role: Steward provided the initial core idea underlying the research reported in this paper and provided substantial effort in revising the manuscript. Contribution: 15%

    Significance: The paper, documenting an early use of a genetic algorithm in a remote sensing application, has provided motivation for subsequent work in our research group as well as work by others. It opened a window to the possibility of using evolutionary computational techniques for remote sensing data discovery – in this case, for HSI color space for segmentation.

30. Tang, L., L. F. Tian, and **B. L. Steward.** 2000. Machine vision-based high-resolution weed mapping and patch-sprayer performance simulation. *SAE Transactions - Journal of Commercial Vehicles* 108(2): 317-326.

    Role: Steward played a role in the writing of the paper. The research described in the paper was done using the equipment and techniques developed by Steward. Contribution: 15%

    Significance: This paper documents some of the earliest work in using video to capture field variability. Much of our subsequent work was developed based on the foundation described in this paper.

31. **Steward, B. L**. and L. F. Tian. 1999. Machine vision weed density estimation for real-time outdoor lighting conditions. *Transactions of the ASAE* 42(6): 1897-1909.

    Role: Steward did the data collection, algorithm development, analysis, and the majority of the writing of this paper. Contribution: 95%

    Significance: This paper documents an approach and performance of a weed density estimation algorithm for real-time outdoor lighting conditions. This paper addresses a challenging estimation problem which must be solved to make viable local-sensor based variable rate application.

Peer-Reviewed Journal Articles Under Review

1. Aziz, S. A., **B. L. Steward.** A. L. Kaleita, and M. Karkee. In review. Assessing the effects of DEM error uncertainty on soil loss estimation in agricultural fields. *Transactions of the ASABE.*

Peer-Reviewed Conference Proceedings

1. Santos, E. S., P. C. Corrêa, **B. L. Steward,** and D. M. Queiroz. 2011. Object-oriented model of fixed-bed drying of coffee berries. In *Proc. of 10th International Conference on Modeling and Applied Simulation,* Sept. 12-14, 2011, Rome, Italy.

    Role: Steward taught the object-oriented modeling techniques to lead author, Santos, at the Federal University of Viçosa, as a visiting Fulbright scholar and currently serves as Santos' co-advisor for his MS degree program. This work started as a course project in the course that Steward taught. Steward provided extensive editorial support to this paper. Contribution: 15%

    Significance: To our knowledge, this is the first time that an object-oriented model of a drying system has been developed using the Modelica simulation language. Modelica will enable the development of models of greater fidelity with ease and flexibility needed to answer more complex system problems encountered in agricultural engineering systems.

2. Karkee, M.*, M. Monga, **B. L. Steward**, J. Zambreno, A. G. Kelkar. 2010. Real-time Simulation and Visualization Architecture with Field Programmable Gate Array (FPGA) Simulator. In *Proc. of the*

ASME 2010 World Conference on Innovative Virtual Reality (WINVR2010), May 12-14, 2010, Ames, Iowa, USA.

Role: Steward supervised Karkee's graduate work, provided guidance in simulation architecture development and design, model development, and specifically provided mentoring and editorial support throughout the publication process for this paper. Contribution: 15%

Significance: This paper documents the first time, to our knowledge, our project in which field programmable gate arrays was used to simulate the continuous-time system dynamics of off-road vehicle systems.

3. S. A. Aziz, **B. L. Steward**, and S. J. Birrell. 2007. Dielectric spectroscopy of hydraulic fluid for contamination detection. In *Proc. of ISFP'2007: 5th International Symposium on Fluid Power Transmission and Control*, Beidaihe, China, June 6-8.

   Role: Steward supervised Aziz' work and assisted in the development of the paper. Contribution: 35%

   Significance: This paper documents the potential of using dielectric spectroscopic measurements of hydraulic fluids and predict the water contamination level in the fluid.

4. Brumm, T.J., S.K. Mickelson, **B.L. Steward**, A.L. Kaleita-Forbes and C.J. Bern. 2005. ABET is Coming! Getting Faculty Involved. In *Proceedings of the Annual Meeting of the American Society for Engineering Education*, Portland, OR, June.

   Role: Steward collaborated on the development of the continuous improvement process developed by the ABE department. Contribution: 5%

   Significance: The paper summarizes the efforts within the ABE department to involve faculty in ABET accreditation, important for on-going accreditation. The methods discussed are being successfully implemented and can be used by other engineering departments in their accreditation processes.

5. **Steward, B. L.**, R. P. Ewing, D. A. Ashlock, A. L. Kaleita, and S. M. Shaner. 2004. Range operator enabled genetic algorithms for hyperspectral analysis. In *Intelligent Engineering Systems Through Artificial Neural Networks: Smart Engineering Systems Design: Neural Networks, Fuzzy Logic, Evolutionary Programming, Complex Systems and Artificial Life*, Vol. 14. eds. C. H. Dagli, A. L. Buczak, D. L. Enke, M. J. Embrechts, and O. Ersoy, 295-300. New York. ASME Press.

   Role: Steward provided leadership to this research team, drafted the paper, and did most of the analysis. Contribution: 65%

   Significance: This paper presents the first results from the range-operator enabled genetic algorithm for hyperspectral analysis. This algorithm searches the space of spectral ranges and operators that provide the best features for spectral calibration models for physical features of interest. Little has been done to bring the power of evolutionary computation to spectroscopy and remote sensing. This paper represents our move into this gap.

6. Suzhen L., G. Manimaran, **B. L. Steward.** 2004. Feedback-based Real-time Scheduling in Autonomous Vehicle Systems. *Proceedings of the 10th IEEE Real-Time Technology and Applications Symposium (RTAS).* Le Royal Meridien, King Edward, Toronto, Canada. 25-28 May.

   Role: Steward provided expertise for the agricultural vehicle-based sensing system which served as the application platform for real-time scheduling algorithms developed in this research. He also helped in the paper revision process. Contribution: 15%

   Significance: Real-time scheduling provides a way for optimizing computational resources required for real-time vehicle based sensing. This paper introduces a real-time methodology achieved by

changing the vehicle mobility characteristics, builds on Steward's prior work, and provides an enabling technology needed for vehicle-based machine vision agricultural field sensing. To the best of our knowledge, this is the first work on feedback-based adaptive scheduling of real-time tasks in autonomous vehicle systems.

7. Mickelson, S. K., Brumm, T. J., Hanneman, L., and **B. L. Steward**. 2003. Using Engineering Competency Feedback to Assess Agricultural Engineering Curriculum. In *Proceedings of the Annual Meeting of the American Society for Engineering Education*, Knoxville, TN: ASEE.

   Role: Steward played a supporting role in writing this paper and collaborated with this group in the development of a competency-based learning curriculum in the ABE department. Contribution: 10%

   Significance: This paper was awarded the 2003 Best Paper Award of the Biological and Agricultural Engineering Division of ASEE. The ABE assessment program uses workplace competencies for outcomes assessment in response to the ABET 2000 criteria. Competencies were directly measured by key action in the engineering internship workplace through Development Dimensions International (DDI) OPAL on-line assessment program. A focus group was used to clarify quantitative results. This curriculum assessment approach is novel, and is being looked to as an example by other programs.

8. Shrestha, D. S.*****, **B. L. Steward,** and T. C. Kaspar. 2002. Determination of early stage corn plant height using stereo-vision. Proceedings of the 6th Int'l. Conf. on Precision Agriculture, eds. P.C. Robert, R. H. Rust and W. E. Larson, Madison WI: ASA- CSSA-SSSA.

   Role: Steward wrote the proposal supporting this work, supervised Shrestha's research, and provided a substantial effort in writing, editing, and revising the paper. Contribution: 45%

   Significance: Estimating crop plant growth parameters may be a means for characterizing crop nutrient response across a landscape. In this paper, we introduced a stereo-vision system for estimating crop height and showed estimation results.

9. Miller, M. A.***** and **B. L. Steward.** 2002. Control and Evaluation Methods for Multi-Mode Steering. *Proc. of Automation Technology for Off-road Equipment Conference,* ed. Q. Zhang., 357-366. Chicago, IL, 26-27 July.

   Role: Steward supervised the research of Miller, performed analysis, assisted in the writing of the paper, and played a major role in editing and revising of the paper. Contribution: 45%

   Significance: This paper documents the development of a test methodology for understanding how four-wheel steering impacts field performance of self-propelled sprayers. This paper addresses a current, relevant question of agricultural machinery manufacturers who are trying to decide if they should enter the four-wheel steering market. This paper was later revised and expanded to form a journal article.

10. Shrestha, D. S.*****, **B. L. Steward,** and E. Bartlett. 2001. Segmentation of plant from background using neural network approach. *Proc. of Artificial Neural Networks in Engineering Conference (ANNIE 2001)* eds. C. H. Dagli et al., 903-908. St. Louis, MO, 4-7 Nov.

    Role: Steward supervised the research of Shrestha, assisted in writing the paper, and played a major role in editing and revising of the paper. Contribution: 45%

    Significance: This paper describes the use of an artificial neural network to adjust the segmentation parameters for segmenting plants from background in color field images under changing lighting conditions. Robustness to changing lighting conditions is a current limitation to the use of machine vision for agricultural field sensing.

11. Tang, L., L. F. Tian, and **B. L. Steward**. 1999. Machine vision-based high-resolution weed mapping and patch-sprayer performance simulation. In *SAE SP-1417, Agricultural Machinery, Tires, Tracks, and Traction*, 126-135. Warrendale, PA: SAE.

    Role: Steward played a role in writing the paper. The research described in the paper was done using the equipment and techniques developed by Steward. Contribution: 25%

    Significance: This paper documents some of the earliest work in using video to capture field variability. Much of our future work was developed based on the foundation described in this paper. This paper was included in the SAE 1999 Transactions Journal of Commercial Vehicles. The SAE Transactions are composed of the best technical literature published by SAE each year as judged by a panel of qualified technical experts.

Other Publications

*MS, Ph.D., Post Doc, or Research Scientist supervised by Steward.

Conference Proceedings

1. Hanna, H. M., J. Kruckeberg, M. Darr, and **B. L. Steward.** 2009. Nozzle and droplet size effects on pesticide performance and drift. In *Proc. of 21st Annual Integrated Crop Management Conference*, December 2 and 3, Iowa State University, Ames, IA, pp. 49-52.

2. **Steward, B. L.,** S.-K. Ong, and K. M. Bryden 2007. Sustainable Engineering Education for Agri-Food Systems Development. In *Proc. of International Conference on 21st Century Challenges to Sustainable Agri-food Systems*. Bangalore, India, March 15-17.

3. Aziz, S. A.., **B. L. Steward**, L. Tang, M. Karkee. 2006. Multiple GPS Measurements for Digital Elevation Model. Proc. of the Computers in Agriculture and Natural Resources, 4th World Congress Conference. *ASABE Paper No. 701P0606.* St. Joseph, Mich.: ASABE.

4. Aziz, S. A., **B. L. Steward**, L. Tang, and M. Karkee. 2006. Multiple gps measurements for digital elevation model. 2006. Proceedings of the 8th Int'l. Conf. on Precision Agriculture, eds. R. H. Rust and W. E. Larson, Madison WI: ASA- CSSA-SSSA.

5. Haegele, J., **B. L. Steward**, E. Visser, M. Martinez, C. Deal, D. Oliveira, C. Marcos, A. Delboni, R. Vieira, and F. Carneiro. 2006. Modeling a renewable energy system to meet university energy needs and promote regional sustainable development. *Proc. of the 4th International Conference on Environmental Management for Sustainable Universities (EMSU).* Stevens Point, Wisconsin, USA, June 26-30.

6. Thorp, K. R.*****, W. D. Batchelor, J. O. Paz, and **B. L. Steward.** 2004. Estimating yield and environmental risks associated with variable rate nitrogen management for corn using Apollo. Proceedings of the 7th Int'l. Conf. on Precision Agriculture, eds. R. H. Rust and W. E. Larson, Madison WI: ASA- CSSA-SSSA.

7. **Steward, B. L.,** T. J. Brumm, S. K. Mickelson. 2003. Understanding patterns in student learning styles to guide curriculum innovation. In *Proceedings of the 2003 ASEE North Midwest Regional Conference,* Ames, IA: ASEE.

8. Shrestha, D. S.***** and **B. L. Steward.** 2002. Early growth stage corn plant population measurement using neural network approach. *Proc. of World Congress of Computers in Agriculture and Natural Resources*, eds. F. Zazueta and J. Xin, 8-14. Iguaçu Falls, Brazil, 13-15 Mar.

9. **Steward, B. L.** 1999. Weed Sensing - Where are we? In *Proceedings of the 11th Annual Integrated Crop Management Conference*, 193-205. Ames, IA: Iowa State University.

10. **Steward, B. L.** and J.W. Hummel. 1999. Soybean moisture content measurement based on impact force parameters. Proceedings of the 4rd Int'l. Conf. on Precision Agriculture, eds. P.C. Robert, R. H. Rust and W. E. Larson, 1241-51, Madison WI: ASA- CSSA-SSSA.

11. **Steward, B. L.** and L. F. Tian. 1998. Real-time weed detection in outdoor field conditions. In *Proceeding of SPIE 3543, Precision Agriculture and Biological Quality*, eds. G. E. Meyer and J. A. DeShazer, 266-278. Bellingham, Wash.: SPIE.

Professional Society Conference Papers

1. Nielsen, S. L., M. Karkee, and **B. L. Steward.** 2011. Methodology to perform identifiability analysis for off-road vehicle tire-soil parameter estimation. *ASABE Paper No. 1111526.* St. Joseph, Mich.: ASABE.

2. Xu, L. M. Yang. and **B. L. Steward.** 2011. System of Field Operations for Double-Cropped Paddy Rice Production Mechanization in South China. *ASABE Paper No. 1111647.* St. Joseph, Mich.: ASABE.

3. Karkee, M., R. P. McNaull, S. J. Birrell, **B. L. Steward.** 2010. Agricultural biomass removal rate estimation for real-time optimization of single pass crop grain and biomass harvesting system. *ASABE Paper No. 1009973.* St. Joseph, Mich.: ASABE.

4. Kruckeberg, J. P., H. M. Hanna, M. J. Darr, **B. L. Steward.** 2010. An interactive spray drift simulator. *ASABE Paper No. 1008842.* St. Joseph, Mich.: ASABE.

5. Karkee, M. and **B. L. Steward** 2009. Parameter sensitivity analysis of a tractor and single axle grain cart dynamic system model. *ASABE Paper No. 097295.* St. Joseph, Mich.: ASABE.

6. Karkee, M. and **B. L. Steward** 2008. Open and closed loop system characteristics of a tractor and an implement dynamic model. *ASABE Paper No. 084761.* St. Joseph, Mich.: ASABE.

7. H M. Hanna, **B. L. Steward**, and L. Aldinger. 2008. Soil loading effects of planter depth-gauge wheels on early corn growth. *ASABE Paper No. 083968.* St. Joseph, Mich.: ASABE.

8. S. Abd Aziz and **B. L. Steward.** 2008. Targeted sampling of elevation data based on spatial uncertainty of prior measurements. *ASABE Paper No. 084826.* St. Joseph, Mich.: ASABE.

9. Kaleita, A. L., S. K. Mickelson, **B. L. Steward,** and T. J. Brumm. 2007. International agriculture case studies for enhancement of undergraduate competency in cultural adaptability. *ASABE Paper No. 078015.* St. Joseph, Mich.: ASABE.

10. S. A. Aziz and **B. L. Steward.** 2007. Development of agricultural field DEM using repeated GPS measurements from field operations: effects of sampling intensity and pattern. *ASABE Paper No. 071089.* St. Joseph, Mich.: ASABE.

11. Karkee, M., **B. L. Steward**, and S. A. Aziz. 2007. Distributed virtual reality simulation assisted steering controller design for off road vehicle and implement tracking. *ASABE Paper No. 073006.* St. Joseph, Mich.: ASABE.

12. Thorp, K.R., **B.L. Steward**, A.L. Kaleita, and W.D. Batchelor. 2006. Using Aerial Hyperspectral Remote Sensing Imagery to Estimate Corn Plant Stand Density. *ASABE Paper No. 063015.* St. Joseph, Mich.: ASABE.

13. Khot, L. R., L. Tang, **B. L Steward**, and S. Han. 2006. Sensor Fusion for Roll and Pitch Estimation Improvement of an Agricultural Sprayer Vehicle. *ASABE Paper No. 0631159.* St. Joseph, Mich.: ASABE.

19. Karkee, M., **B. L. Steward**, L. Tang. 2006. Neural Approach of Sub-pixel Rice Landuse Classification for Optimized Irrigation Scheduling. *ASABE Paper No. 062124.* St. Joseph, Mich.: ASABE.

20. Karkee, M., Kusanagi, M., and **B. L. Steward.** 2006. Fusion of Optical and InSAR DEMs: Improving the Quality of Free Data. *ASABE Paper No. 061172.* St. Joseph, Mich.: ASABE.

21. Kaleita, A. L., **B. L. Steward**, R. P. Ewing, and D. A. Ashlock. 2005. Genetic algorithms for Hyperspectral Range and Operator Selection. *ASAE Paper No. 053063.* St. Joseph, Mich.: ASABE.

22. **Steward, B. L.**, T. J. Brumm, and S. K. Mickelson. 2004. Formative and Summative Assessment in Agricultural Engineering and Technology Courses. *ASAE Paper No. 048032.* St. Joseph, Mich.: ASABE.

23. Abd Aziz, S.*****, **B. L. Steward,** S. J. Birrell, D. S. Shrestha*****, and T. C. Kaspar. 2004. Ultrasonic Sensing for Corn Plant Canopy Characterization. *ASAE Paper No. 041120.* St. Joseph, Mich.: ASABE.

24. Li, B.*****, **B. L. Steward,** S. Han. 2004. Agricultural vehicle posture estimation using dual DGPS receivers and a Kalman filter. *ASAE Paper No. 041058.* St. Joseph, Mich.: ASABE.

25. Li, B.*****, **B. L. Steward,** S. Han. 2004. Integration of digital elevation models with vehicle dynamics for vehicle pitch and roll angle estimation. *ASAE Paper No. 041057.* St. Joseph, Mich.: ASABE.

26. Shrestha D. S.,*** B. L. Steward,** B. Li*****, and K. R. Thorp*****. 2004. A rapid video frame correspondence algorithm using a Kalman filter. *ASAE Paper No. 043058.* St. Joseph, Mich.: ASABE.

27. Li, B.*****, **B. L. Steward,** S. Han. 2004. Attitude estimates of an agricultural vehicle operated on slopes – static study. *ASAE Paper No. MC04 - 102.* St. Joseph, Mich.: ASABE.

28. Shrestha, D. S.,***** and **B. L. Steward,** 2003. An object-oriented architecture for field data acquisition, Processing and Information Extraction. *ASAE Paper No. 033089.* St. Joseph, Mich.: ASABE.

29. Stevermer, S. W.,*** B. L. Steward,** R. P. Cogdill, and C. R. Hurburgh. 2003. Automated sorting and single kernel analysis by near-infrared hyperspectral imaging. *ASAE Paper No. 036159.* St. Joseph, Mich.: ASABE.

30. Westphalen, M. L.,*** B. L. Steward,** and S. Han. 2003. Topographic mapping through measurement of vehicle attitude. *ASAE Paper No. 031008.* St. Joseph, Mich.: ASABE.

31. Shrestha, D. S.,*** B. L. Steward,** S. J. Birrell, and T. C. Kaspar. 2002. Corn Plant Height Estimation Using Two Sensing Systems. *ASAE Paper No. 021197.* St. Joseph, Mich.: ASABE.

32. Shrestha, D. S.,***** and **B. L. Steward.** 2001. Automatic corn plant population measurement using machine vision. *ASAE Paper No. 011067.* St. Joseph, Mich.: ASABE.

33. Humburg, D. S., **B. L. Steward,** X. Chen. 2001. Control simulation and modeling of a PWM sprayer system in variable rate chemical application. ASAE Paper No. 013034. St. Joseph, Mich.: ASABE.

34. Tang, L., L. Tian, and **B. L. Steward**. 2000. Development of a low-cost machine vision system for selective sprayer. ASAE Paper No. 003064, St. Joseph, Mich.: ASABE.

35. **Steward, B. L**., L. F. Tian, and L. Tang. 2000. Real distance control for real-time machine vision-based precision farming. ASAE Paper No. 00AETC107, St. Joseph, Mich.: ASABE.

36. **Steward, B. L**., L. F. Tian, and L. Tang. 1999. Detection of outdoor lighting variability for machine vision-based precision agriculture. ASAE Paper No. 99-3032, St. Joseph, Mich.: ASABE.

37. Tang, L., L. F. Tian, **B. L. Steward,** J. F. Reid. 1999. Texture-based weed classification using Gabor wavelets and neural network for real-time selective herbicide application. ASAE Paper No. 99-3036, St. Joseph, Mich.: ASABE.

38. Yao, H., L. F. Tian, L. Tang, and **B. L. Steward**. 1999. Smart sprayer performance simulation. ASAE Paper No. 99-1103, St. Joseph, Mich.: ASABE.

39. **Steward, B. L**. and L. F. Tian. 1998. Real-time machine vision weed-sensing. ASAE Paper No. 98-3033. ASAE, St. Joseph, Mich.: ASABE.

Abstracts and Posters

1. Hall, S. J. and **B. L. Steward**. 2011. Calibration of a First Principles Loss Model for a Hydrostatic Pump. National Fluid Power Association Industry and Economic Outlook Conference, Schaumburg, IL. August 15-17.

2. **Steward, B. L.** and Birrell, S. J. 2011 Dielectric Spectroscopic Sensor Development for Hydraulic Fluid Contaminant Detection. National Fluid Power Association Industry and Economic Outlook Conference, Schaumburg, IL. August 15-17.

3. Ahmad, M. T., L. Tang, and **B. L. Steward.** 2011. Development of a Mechanical Intra-Row Weeding Actuation System for Organic Vegetables. ASABE Annual International Meeting, Louisville, KY. August 7-10.

4. Kruckeberg, J. P., H. M. Hanna, **B. L. Steward,** and M. J. Darr. 2011. Influence of Dynamic Weather Conditions on Spray Drift. ASABE Annual International Meeting, Louisville, KY. August 7-10.

5. Xu, L., M. Yang, L. Snell, and **B.L. Steward**. 2011. Determining Machinery Requirements for Double-cropped Paddy Rice Production in South China Based on Monte Carlo Simulation. ASABE Annual International Meeting, Louisville, KY. August 7-10.

6. Bhandari, A., N. Keren, A. L. Kaleita, **B. L. Steward**, S. K. Ong, 2009. Developing cultural adaptability through international service learning. 12th Annual Colloquium on International Engineering Education, Ames, IA. October 22-25.

7. Aziz, S. A., M. Karkee, **B. L. Steward**, S. J. Birrell, and S. L. Nielsen. 2009. Dielectric Sensing for Detecting Water, Metal and Dust Contamination in Hydraulic Fluids. NFPA Industry and Economic Outlook Conference, Wheeling, IL, August 18-19.

8. Bhandari, A., N. Keren, A. L. Kaleita, **B. L. Steward,** S. K. Ong. 2009. Developing Cultural Adaptability through International Service Learning. Poster at the Association of Environmental Engineering and Science Professors Conference, Iowa City, IA, July 27-28.

9. Kaleita, A. L., A. Bhandari, **B. L. Steward**, and N. Keren. 2009. Assessing Cultural Adaptability with Scenario-Based Decision Games. International Annual Meeting of ASABE, Reno, NV, June 21-24.

10. Abd Aziz, S., **B. L. Steward,** S. J. Birrell. 2009. Multifrequency dielectric sensing for hydraulic fluid contamination detection. NFPA Fall Conference, Wheeling, IL.

11. Birrell, S. J., and **B. L. Steward.** 2005. Multifrequency dielectric sensing for hydraulic fluid condition. NFPA Fall Conference, Pittsburgh, PA.

12. **Steward, B. L.**, L. Tang, S. J. Birrell, and A. Van De Walle. 2005. Development of a fluid-powered autonomous agricultural vehicle. NFPA Fall Conference, Pittsburgh, PA.

13. K. W. Romans, S. J. Birrell, **B. L. Steward**, and A. Van De Walle. 2005. Modeling and characterizing a low power hydromechanical transmission. NFPA Fall Conference, Pittsburgh, PA.

14. Romans, K. W., S. J. Birrell, and **B. L. Steward.** 2004. Modeling and characterizing a low power hydromechanical transmission. NFPA Educator/Industry Summit, Scottsdale, AZ, September 30-October 1.

15. Brumm, T. J., S. K. Mickelson, **B. L. Steward,** and A. L. Kaleita. 2004. Work place competency-based outcomes assessment for agricultural engineering and agriculture technology programs. *ASAE Paper No. 048033.* St. Joseph, Mich.: ASABE.

16. Brumm, T. J., S. K. Mickelson, **B. L. Steward,** and A. P. Ellertson. 2004. Learning communities to improve retention and bring meaning to first-year students in agricultural engineering and agricultural technology programs. *ASAE Paper No. 048034.* St. Joseph, Mich.: ASABE.

17. Lo, Y.-C., **B. L. Steward.,** B. Li*****, and T. Shepherd. 2004. Estimation of off-road vehicle attitude using DEM and a single GPS measurement. PWSE Summer Internship Poster Presentation and Reception. Iowa State University, Ames, Iowa, July 23.

18. Brumm, T.J., A. Ellertson, S.K. Mickelson and **B.L. Steward**. 2004. Implementing electronic portfolios for program assessment and student learning. Annual Meeting of the American Society for Engineering Education, Salt Lake City, UT, June 20-23.

19. Suzhen L., G. Manimaran, **B. L. Steward.** 2003**.** Feedback-based adaptive scheduling in real-time systems, JV Atanasoff Syposium. Iowa State University, Ames, Iowa, October 30 - November 1.

20. **Steward, B. L.,** T. J. Brumm, S. K. Mickelson. 2003. Summative and formative assessment of learning and instruction in Fluid Power courses. NFPA Educator/Industry Summit, Indianapolis, IN, October 24-25.

21. Shrestha, D. S.***** and **B. L. Steward.** 2002. Automatic corn plant population measurement using machine vision. Poster presented at *AETC 2002,* Kansas City, MO, February 21-22.

22. **Steward, B. L.**, L. F. Tian, and L. Tang. 1999. Image segmentation for real-time outdoor machine vision weed detection. Poster presented at *AETC 1999,* Louisville, KY, February 7-10.

23. Tang, L., L. F. Tian, and **Steward, B. L.** 1999. Machine vision weed mapping and criteria analysis for selective herbicide application. Poster presented at *AETC 1999,* Louisville, KY, February 7-10.

24. **Steward, B. L.**, L. F. Tian, L. Tang, and J. F. Reid. 1998. Real-time weed infestation detection system for precision sprayers. Poster presented at *AETC 1998,* Louisville, KY, February.

Final Reports

1. A. Kelkar, **B. L. Steward**, Z. Kemp, K. Kappagantula, M. Karkee. *Development of VR-based Prototyping Architecture for Real-time Control of Machines in Virtual Environment with Operator-Interface.* Final Project to Deere and Company. May 2008. 41 pp.

2. **B. L. Steward,** T. J. Brumm, D. Oliveira, W. Hermsdorf, J. S. Silva and S. J. Birrell. *Small-scale Ethanol Production to Meet Liquid Fuel Needs and Promote Regional Sustainable Development.* Phase I Final Report to US EPA. March 2008. 20 pp.

3. **B. L. Steward.** SENCER Final Report. July 2007. 13 pp.

4. **B. L. Steward,** L. Tang, S. A. Aziz, J. A. Bosserd, M. Karkee, and L. Knot. *Using Topographic Information for Improved Vehicle Navigation Control.* Final Report to John Deere Agricultural Management Solutions. July 2007. 111 pp.

5. **B. L. Steward,** T. J. Brumm, D. Oliveira, W. Hermsdorf, J. S. Silva. *Renewable Resources To Power A University – A Model For Regional Sustainable Development.* Phase I Final Report to US EPA. April 2006. 20 pp.

6. **B. L. Steward,** *Brazil Project Report.* Report to Iowa Department of Natural Resources. April 2006. 14 pp.

7. **Steward, B. L.** and M. L. Westphalen*****. *Development and Evaluation of an Active Rear Wheel Steering System.* Final Report to John Deere Des Moines Works – Sprayer Products. January 2006. 53 pp.

8. **Steward, B. L.** *Real-Time Machine Vision Early Stage Corn Population and Spacing Estimation.* Final Report to Pioneer Hi-Bred International Inc and Institute for Physical Research and Technology (IPRT) Company Assistance. August 2005. 36 pp.

9. **Steward, B. L.** *Development and Use of Digital Elevation Models (DEMs) to Aid Vehicle Navigation and Control.* Final Report to John Deere Ag Management Solutions. February 2005. 46 pp.

10. **Steward, B. L.,** S. Birrell, D. S. Shrestha*****, C. Van Wyngarden, E. Stephan, N. A. Krueger. *Early Growth Stage Corn Plant Population Distribution Sensing Technology Development.* Final Report to Pioneer Hi-Bred International Inc and Center for Applied Technology and Development. March 12, 2003. 26 pp.

11. **Steward, B. L.**, S. J. Birrell, T. C. Kaspar, D. S. Shrestha*****. *Stereo Machine Vision for In-situ Crop Growth Measurement*. Final Report to ISU University Research Grants Program. November 1, 2002. 9 pp.

12. **Steward, B. L.,** M. L. Westphalen*****, and M. A. Miller*****. *Development and Evaluation of Multi-Mode Four-wheel Electrohydraulic Steering System on a Sprayer Vehicle.* Final Report to John Deere Des Moines Works – Sprayer Products. July 2002. 20 pp.

Software Manuals

1. A. Kelkar, **B. L. Steward**, Z. Kemp, K. Kappagantula, M. Karkee. *Development of VR-based Prototyping Architecture for Real-time Control of Machines in Virtual Environment with Operator-Interface.* Software Manual to Deere and Company. May 2008. 111 pp.

Book Chapters

1. Karkee, M., **B. L. Steward**, and J. P. Kruckeberg. In Preparation. Automation of Chemical Application Systems. In *Agricultural Automation: Fundamentals and Practices.* CRC Press: Boca Raton, Florida, USA.

Technical Society Periodical

1. Christianson, L., A. Bhandari, and **B. L. Steward.** 2008. Embracing sustainable development as a profession. *Resource* 15(7): 21-23.

Invited Presentations

International

1. **Steward, B. L.** 2011. Iowa State University and the Agricultural and Biosystems Engineering Department. Invited Presentation at *International Workshop – Networking among International Universities and Opportunities to Collaborating Researchers on Joint Projects,* Federal University of Viçosa, Viçosa, MG, Brazil, November 8.

2. **Steward, B. L.** 2011. Modeling, Controls, and Simulation for Agricultural Automation. Invited Presentation at Beijing Kingpeng International Hi-Tech Corporation of Beijing Agricultural Machinery Institute, Beijing, PR China, September 16.

3. **Steward, B. L.** 2011. Publishing in International Journals: 12 Keys to Success. Invited Presentation at Agricultural Mechanization Policy Research Group, College of Engineering. China Agricultural University, Beijing, PR China, September 17.

4. **Steward, B. L.** 2011. Controls for Agricultural Automation: Emerging Role of Modeling and Simulation. Invited Presentation at College of Engineering. China Agricultural University, Beijing, PR China, September 19.

5. **Steward, B. L.** 2011. The Development of Controls into Precision Agriculture and Agricultural Automation and Agricultural Mechanization in the USA. Invited Presentation at the Chinese Academy of Agricultural Mechanizations Sciences (CAAMS), Beijing, PR China, September 20.

6. **Steward, B. L.** 2011. The Development of Controls into Precision Agriculture and Agricultural Automation and Agricultural Mechanization in the USA. Invited Presentation at the China Agricultural Machinery Testing Center (CAMTC), Beijing, PR China, September 21.

7. **Steward, B. L.** 2011. Agricultural Mechanization in the USA and the Role of Agricultural Engineering at Iowa State University. Invited Presentation at College of Engineering. China Agricultural University, Beijing, PR China, September 21.

8. **Steward, B. L.** 2011. The Development of Controls into Precision Agriculture and Agricultural Automation and Agricultural Mechanization in the USA. Invited Presentation at Tianjin Agricultural Machinery Extension Center, Tianjin, PR China, September 22.

9. **Steward, B. L.** 2011. Precision Agriculture and Agricultural Automation in the USA. Invited Presentation at National Key Laboratory of Modern Precision Agriculture System Integration Research, China Agricultural University, Beijing, PR China, September 23.

10. Stombaugh, T., R. Gates. S. Workman. **B. L. Steward,** and G. Ferraz. 2010. Lessons Learned From Seven Years Of An International Exchange Program. Invited Panel Discussion at International Symposium *Training Engineers Across The Americas To Solve Global Problems,* Vitória, Espirito Santo, Brasil, July 26.

11. **Steward, B. L.** 2010. Modeling and Controls for Agricultural Automation. Invited Presentation at Universidade Federal de Lavras, Lavras, Minas Gerais, Brazil, sponsored by Brazilian Fulbright Commission, June 29.

12. **Steward, B. L.** 2010. Publishing in International Journals: 12 Keys to Success. Invited Presentation at Universidade Federal de Lavras, Lavras, Minas Gerais, Brazil, sponsored by Brazilian Fulbright Commission, June 17.

13. **Steward, B. L.** 2010. Modeling and Controls for Agricultural Automation. Invited Presentation at Universidade Federal de Viçosa, Departamento de Engenharia Agrícola, Departmental Seminar, June 1.

14. **Steward, B. L.** 2010. Publishing in International Journals: 12 Keys to Success. Invited Presentation at Universidade Federal de Viçosa, Departamento de Engenharia Agrícola, Departmental Seminar, June 17.

15. **Steward, B. L.** 2010. Modeling and Simulation Technology for Agricultural Automation. Invited Presentation at Universidade Federal de Campina Grande, Campina Grande, Paraiba, Brazil, sponsored by Brazilian Fulbright Commission, April 27.

16. **Steward, B. L.** 2010. Automação nas Máquinas Agrícolas: Para Projetando um Mundo Sustentável. Invited Presentation at Universidade Federal de Viçosa, Departamento Engenharia Agrícola, VIII Semana Acadêmica, March 18.

17. **Steward, B. L.** 2010. Advances in Modeling and Simulation Technology for Agricultural Machine Automation. Invited Presentation at Universidade Federal de Grande Dourados, Dourados, Mato Grasso do Sul, Brazil, sponsored by Brazilian Fulbright Commission, March 2.

18. **Steward, B. L.** 2009. Advanced Machinery Engineering and Manufacturing Systems Focus in Agricultural and Biosystems Engineering. Invited Presentation at Nanjing Forestry University, Nanjing, PR China, September 10.

19. **Steward, B. L.** 2009. Virtual Prototyping and Real-Time Simulation for Automatic Guidance. Invited Presentation at Nanjing Forestry University, Nanjing, PR China, September 10.

20. **Steward, B. L.** 2007. Biorenewables Production: A New Need for Precision Agriculture Technologies. Invited Presentation at China Agricultural University, Beijing, PR China, June 4.

21. **Steward, B. L.** 2007. Precision Agriculture Technologies for Biorenewables Production. Invited Presentation at Zhejiang University, Hangzhou, PR China, June 11.

22. **Steward, B. L.** 2006. Mechatronics Research Lab. Invited Presentation at Dept of Agricultural Engineering, Federal University of Vicosa, Viscosa, Brazil, March 14.

23. **Steward, B. L.** 2006. RESASI Model Overview. Invited Presentation at Dept of Agricultural Engineering, Federal University of Vicosa, Viscosa, Brazil, March 10.

24. **Steward, B. L.** 2004. Information Technology in Agriculture: Sensing in 2+n Dimensions. Invited Presentation at Sub-department of Agricultural Engineering and Physics, Agrotechnology and Food Sciences Group, Wageningen University, Wageningen, Netherlands, June 14.

25. **Steward, B. L.** 2004. AgriBioSensing in Two + n Dimensions. Invited Presentation at Dept of Agricultural Sciences, Environment, Resources, and Technology Section (Agrotechnology), The Royal Veterinary and Agricultural University (KVL), Taastrup, Denmark, June 7.

26. **Steward, B. L.** 2004. Precision Agriculture and Mechatronics: Information Technology in Agriculture and Agricultural Equipment. Invited Presentation at Dept of Agricultural Engineering, Federal University of Vicosa, Vicosa, Brazil, March 19.

27. **Steward, B. L.** 2002. Sensing and control for precision agriculture. Invited Presentation at Embrapa Corn and Sorgum Research Station, Sete Lagoas, Brazil, March 19.

28. **Steward, B. L.** 2002. Sensing and control for precision agriculture. Invited Presentation at Federal University of Vicosa, Vicosa, Brazil, March 18.

Others

1. **Steward, B. L.** 2011. Brazil. Invited Presentation at ISU Alpha Epsilon Initiation Banquet, Ames, IA, 26 April.

2. **Steward, B. L.** and S. L. Nielsen. 2010. Enhancing Realism and Flexibility of VR-Based Real-time Dynamic Simulation Framework with Operator and Hardware in-the-loop Interface. John Deere Enterprise Electronics Conference. Waterloo, Iowa. September 28.

3. **Steward, B. L.** and W. Meier. 2008. Lessons Learned from the Sustainable Development Course at Iowa State. Engineers for a Sustainable World National Conference, San Francisco, Calif. 8 February.

4. **Steward, B.L.** 2007. Sustainable Engineering and International Development Course at Iowa State University. Sustainability Educators Roundtable. Drake University. 14 August.

5. **Steward, B.L.** 2006. Developing a Sustainability Mind-set in Engineering Students. Engineers for a Sustainable World National Conference, Iowa City, Iowa, 28-30 Sept.

6. **Steward, B.L.** 2006. ISU- ESW Projects: Brazil: Modeling a Renewable Energy System to Meet University Energy Needs and Promote Regional Sustainable Development, Engineers for a Sustainable World National Conference, Iowa City, Iowa, 28-30 Sept.

7. **Steward, B. L.** 2003. Precision Agriculture: Could Information Technology in Agriculture Lead to Greater Sustainability? Invited Presentation to ISU SUS AG 610, Society and Technology in Sustainable Food Systems, Ames, IA, 20 Feb.

8. Determan, A., R. Freeman, M. Niesen, **Steward, B. L.** 2003. Beyond the B. S. to what degree are you willing to go? Panel Discussion sponsored by ISU Engineering Graduate Programs, Ames, IA, 27 Jan.

9. Mickelson, S. K., **B. L. Steward,** A. Meyer, A. Willey. 2002. Student development and the curriculum improvement process. Panel Discussion for the ISU College of Engineering Internship Employer Advisory Board, Ames, IA, 23 Sept.

10. **Steward, B. L.**, M. L. Westphalen, and M. A. Miller. 2002. Impact of four wheel steering on sprayer vehicle performance. Invited Presentation at John Deere Des Moines Works Engineering Luncheon, Ankeny, IA, 17 May.

11. **Steward, B. L.**, M. L. Westphalen, and M. A. Miller. 2002. Impact of a multi-mode four wheel EH steering system on sprayer vehicle performance. Invited Presentation at 17th Annual Agricultural Machinery Conference, Cedar Rapids, IA, 6-8 May.

12. **Steward, B. L.** 2000. China – The Middle Kingdom. Invited Presentation at ISU Alpha Epsilon Initiation Banquet, Ames, IA, 25 April.

Thesis and Dissertation

1. **Steward, B.L.** 1999. Sensing and control for real-time machine vision selective herbicide application under outdoor field conditions. Ph.D Dissertation, Agricultural Engineering Department, University of Illinois, Urbana-Champaign, IL. 61801. 171 pages.

2. **Steward, B.L.** 1994. Modeling and simulation of a chemical injection system. M.S. Thesis, Electrical Engineering Department, South Dakota State University, Brookings, SD. 57007. 163 pages.

TEACHING ACTIVITIES

Courses Taught at Iowa State University (1999-present)

Positions: Assistant Professor (1999-2005)
Associate Professor (2005-present)

Courses Taught

Course Number	Course Title	Semester	Number of Students	Instructor's Rating (out of 5)	Program Average
AE/CE/EE/ME 388x	Sustainable Engineering and International Development (3 credits)	F 05 F 06 F 07 F 08 F 10 F11	26 31 17 13 25 32	NA** 3.29 4.13 4.29 3.58 4.00	NA NA NA NA NA NA
AE 406/506	Computational Intelligence for Agricultural and Biological Systems (3 credits)	F 05 F 06	5 12	4.80 Old 4.15 New 3.80	4.27 Old 4.00 New 3.92
AE/ME 413	Practical Fluid Power Circuits (1 credit)	F 99 F 00 F 01 F 02 F 03 F 04	11 18 25 28 22 33	4.22 3.54 4.08 4.32 4.39 4.20	4.36 4.37 4.24 4.43 4.16 4.01
AE/ME 413	Fluid Power Engineering (3 credits)	F 05 F 06 F 07 F 08 F 10 F 11	28 19 32 36 35 52	4.70 Old 3.94 New 3.75 4.27 4.00 4.09 4.00	4.27 Old 4.00 New 3.92 4.18 3.99 3.94 3.84
AE 447	Power and Control Hydraulics (2 credits)	F 99 F 00 F 01 F 02 F 03 F 04	13 18 15 25 17 34	4.16 3.63 3.67 4.09 4.33 4.28	4.36 4.37 4.24 4.43 4.16 4.01
AE 490P	Independent Study (variable credits)	S 01 S 03 S 03 S 04 S 05 F 05 SS 07 F 08 S 09 S 11 F 11	1 2 2 3 2 2 1 1 1 1 1 for 3 cr.	NA NA NA NA NA NA NA NA NA NA NA	NA NA NA NA NA NA NA NA NA NA NA
AE/BSE/TSM 496	ABE Travel Course to Brazil	S 10 -1 cr SS 10 R	10 18	NA NA	NA NA

Course Number	Course Title	Semester	Number of Students	Instructor's Rating (out of 5)	Program Average
	(variable credits	F 10 -2 cr	10	NA	NA
AE 503	Modeling and	S 01	9	4.43	4.32
	Controls for	S 02	11	4.36	4.27
	Agricultural	S 03	6	4.60	4.42
AE 403/503	Systems (3	S 05	14	4.67	4.18
	credits)	S 07	19	4.57	3.89
		S 09	17	4.88	4.01
		S 11	24	4.50	4.28
AE 590M/P	Independent Study	F 00	1	NA	NA
	(variable credits)	S 06	1	NA	NA
		S 07	1	NA	NA
		F 07	2	NA	NA
		S 08	3	NA	NA
		S 11	1	NA	NA
		F11	1 for 3 cr.	NA	NA
AE 699P	Research	SS 00	1	NA	NA
	(variable credits)	SS 01	2	NA	NA
		F 01	2	NA	NA
		S 02	1	NA	NA
		SS 02	2	NA	NA
		F 02	2	NA	NA
		S 03	3	NA	NA
		SS 03	5	NA	NA
		F 03	4	NA	NA
		S 04	2	NA	NA
		SS 04	1	NA	NA
		F 04	2	NA	NA
		S 05	4	NA	NA
		SS 05	1	NA	NA
		F 05	3	NA	NA
		S 06	4	NA	NA
		SS 06	3	NA	NA
		F 06	3	NA	NA
		S 07	4	NA	NA
		SS 07	3	NA	NA
		F 07	3	NA	NA
		S 08	2	NA	NA
		SS 08	2	NA	NA
		F 08	2	NA	NA
		S 09	1	NA	NA
		SS 09	1	NA	NA
		F 09	1	NA	NA
		S 10	2	NA	NA
		SS 10	2	NA	NA
		F 10	2	NA	NA
		S 11	2	NA	NA
AST 290M	Independent Study Machine Systems (variable credits)	F 99	1	NA	NA
AST 490 M	Independent Study Machine Systems (variable credits)	S 05	1	NA	NA

Course Number	Course Title	Semester	Number of Students	Instructor's Rating (out of 5)	Program Average
AST 337	Fluid Power Systems for Agriculture (2 credits)	S 01 S 02 S 03 S 04 S 05	28 28 27 38 30	3.96 4.17 4.23 4.11 4.47	4.32 4.27 4.12 4.07 4.18
AST 337	Fluid Power Systems for Agriculture (3 credits)	S 06	25	Old 4.76 New 4.23	Old 4.26 New 3.96
TSM 337	Fluid Power Technology (3 credits)	S 07 S 08 S 09 S 11 S 12	29 45 31 54 50	4.35 3.90 4.06 4.40 NA	3.89 4.01 4.01 3.73 NA
INTST 490	International Studies Independent Study	F 06	1	NA	NA
ITEC 699	Research (variable credits)	S 05 F 05 S 06 SS 06	1 1 1 1	NA NA NA NA	NA NA NA NA

** NA - not applicable or available

Mentored Independent Study Projects

1. AST 290M, Adam Rahe, Gear Pump and Maxxum Hydraulic System, Fall 1999.
2. AE 590M, Jason Eubanks, A Comparative Study of Load-sensing Hydraulics using SIMULINK and Experimental Data. Fall 2000.
3. AE 490P, Kevin McNutt. High Speed Variable Flow Hydraulic Valve. Spring 2001.
4. AE 490P, Ryan Head, Fluid Power-based Autonomous Agricultural Vehicle. Spring 2003.
5. AE 490P, Mark Reth, Hydromechanical Transmission Trainer, Spring 2003.
6. AE 490P, Patrick Reaver and Kurt Romans, Hydromechanical Transmission Trainer, Spring 2004.
7. AE 490P, Abdul Qazi, NIR Imaging Single Kernel Analyzer, Spring 2004.
8. AE 490M, Adam Vandewalle, Operation of Hydromechanical Transmission Test Stand, Spring 2005.
9. AE 490M, Joel Werling, Fluid Power Training, Spring 2005.
10. AST 490M, Andrew Swope, Organization of an Auto-Steering Field Day, Spring 2005.
11. AE 490M, Andre Delboni, Fluid Power Sensing and Control Systems, Fall 2005.
12. AE 590P, James Bosserd, SimMechanics Model Development for Autonomous Vehicle, Spring 2006.
13. INTST 490, Katherine Edwards, British and American Evangelical Responses to Environmental Issues, Fall 2006.
14. AE 490P, Joshua Youngblut, Hydraulics, Spring 2007.
15. AE 590P, Mark Kasia, Feasibility Study to Determine Efficient Methods to Transport Corn Stover to Biorefinery Plants, Spring 2007.
16. AE 490P, Landon Aldinger, Fluid Power and Electrohydraulics, Summer 2007.
17. AE 490/590P, John Maher and Rob Franz, Sauer Plus 1 and System Dynamics, Fall 2007.
18. AE 590P, Jonathan Roth, Jeremiah Johnson, and Jian Jin, Sauer Plus 1 and System Dynamics, Spring 2008.
19. AE 490, Logan Handshaker, Fall 2008.
20. AE 490, Joey Boyer, Development of electrohydraulic circuits and controls. Spring 2008.
21. AE 490P, Travis Ohms. Measuring temperature of hydraulic test stand through the integration of microcontroller system. Spring 2011.
22. AE 590P, Andrew Peterson, High efficiency sprayer evaluation. Spring 2011.
23. AE 490P, Wyatt Hall, Fluid power modeling, simulation, and controls. Fall 2011.

24. AE 590P, Eric Anderson, Developing advanced fluid power course work. Fall 2011.

Mentored Senior Capstone Projects

1. Carl Christensen. High Speed Hydraulic Valve. Fall 2000.
2. David Geiger, William Ollinger, and Michael Schechinger. Mower Conditioner Hydraulic Suspension System. Fall 2001 - Spring 2002.
3. Amber Hasche and Noah Forlines. Hydromechanical Transmission Trainer. Fall 2002 - Spring 2003.
4. Alan Meyer, Dave Baitinger, and Amy Dee Schlechte. Fluid Power-based Autonomous Agricultural Vehicle. Spring 2003.
5. Alan Meyer and Dave Baitinger. Fluid Power-based Autonomous Agricultural Vehicle. Fall 2003.
6. James Hamil, Justin Hegland, Heather Miskell, and Sandra Wenke. Hydraulic System Design for Utility Vehicle. Fall 2004/Spring 2005.
7. Shawn Entriken, Todd Kruse, Stu Anfinson, and Jon Sievers. Automatic Guidance of a Fluid Power-based Autonomous Agricultural Vehicle. Fall 2004/Spring 2005.
8. Jason Haegele, Renewable Energy at Federal University of Vicosa. Fall 2005 and Spring 2006.
9. JD Greiner and Brandon Reis. Oil Degradation Test Stand. Fall 2005 and Spring 2006.
10. Brian Fager. Animal-Drawn No-till Planter. Fall 2005.
11. Micah Van Mersbergen and Joseph Ruhland. Design of Lamb Slaughtering Equipment. Fall 2006 and Spring 2007.
12. Logan Handshaker, Craig Evans, and Neil Heithoff, Hydraulically Controlled Plant Check Line Spool. Spring and Fall 2008.
13. Jeff Beaman, Ryan Collins, Hayden Hedge, and Saul Ceballos, Hydraulically Controlled Planter Metering Unit. Fall 2008 and Spring 2009.
14. Mark Krause, Matt McCollum, Derrick Keibler. Reconfigurable Communication Link Between FASTER and RTSim. Spring and Fall 2009.
15. Cory Mielk, Adam Cole, Lucas Sohm, and Shawn Brown. Mower Disc Wear Testing. Fall 2010 and Spring 2011.
16. Kyley Swanson, Tyler Holst, Mitch Giesking, and Zachary Preston. Hydraulic Trainer Modification. Spring and Fall 2011.

Curriculum Development

- Developed and taught distance education course AE 403/503. Spring 2007, 2009, and 2011.
- Co-Developed Computational Intelligence for Agricultural and Biological Systems, AE 406/506. Fall 2005.
- Co-Developed Sustainable Engineering and International Development Course, AE/CE/EE/ME 388x, in collaboration with Dr. Say Kee Ong, and Dr. Mark Bryden. Fall 2005.
- Developed and used draft text “Application of Hydraulic Power” (310 pp.) for AE 413.
- Developed Lab Manuals for AE 413 and TSM 337 with more than 100 pp each.
- Developed course notes for AE 403/503.
- Developed course notes for TSM 337 which includes 650 PowerPoint slides.
- Implemented use of WebCT across all courses taught.
- Developed Study Abroad course to Brazil. 2010.

Lab Development

- Led development effort the named Sauer-Danfoss Fluid Power Laboratory with a $256,580 gift and ~$55,000 in-kind donations.
- Led development effort for the ISU Fluid Power Laboratory to which $171,537 in internal ($125,537) and external ($46,000) funds, plus in-kind equipment gifts ($37,000), have been applied.
- Designed fluid power trainers in collaboration with Mike Gandrud and Lynn Jansen, Sauer Danfoss.
- Co-led, with Greg Luecke, ME, development and design effort of CAT Mechatronics Lab, Hoover Hall resulting in donations of $200,000 for lab and $250,000 for equipment.

Courses Taught at Universidade Federal de Viçosa (2010)

Position: Visiting Fulbright Professor

Courses Taught

Course Number/Credits	Course Title	Semester	Number of Students	Instructor's Rating (out of 5)
ENG 796 - 3 credits	Problemas Especiais III (Modelagem e Simulação de Sistemas Dinâmicos Agrícolas)	1° 2010	6	NA

Courses Taught at the University of Illinois (1998)

Position: Graduate Research Assistant, Ph.D. Student

Courses Taught

Course Number/Credits	Course Title	Semester	Number of Students	Instructor's Rating (out of 5)
TSM 381 - 1 credit	Electrical and Microcomputer Controls for Agriculture Lab	F 1998	19	4.5

Curriculum Development

- Integrated the use of LabView into the lab for TSM 381. Developed a lecture entitled "An Introduction to LabView." Advised students on the use of LabView for term design projects.

Courses Taught at the Changsha Electric Power University (1994-1995)

Position: Foreign Expert

Courses Taught

While at Changsha Electric Power University, Changsha, Hunan, People's Republic of China, I taught 14 contact hours per week in the English Department in both fall and spring semesters. Classes taught were English Composition, Newspaper Reading, and American Culture and Society.

Courses Taught at the South Dakota State University (1991-1993)

Position: Teaching Assistant

Courses Taught

Course Number/Credits	Course Title	Semester
EE 434 - 1 credit	Energy Conversion Lab	F 1991; F 1992
EE 384 - 1 credit	Microprocessor Systems Design Lab	S 1992
EE 303 - 1 credit	Basic Electrical Engineering II Lab	S 1993

ACADEMIC ADVISING

Iowa State University (1999-present)

Undergraduate Advising at Iowa State University (1999 - present)

Academic Year	Number of Advisees	Dr. Steward's Rating (out of 5)	Number of students rating Steward	Average of all ABE Advisors (out of 5)	Number of students rating ABE advisors
Fall 1999 Spring 2000	20	4.29 3.33	7 3	4.18 3.81	73 58
2000 - 2001	15	4.14	7	4.15	127
2001 - 2002	21	4.00	1	4.53	51
2002 - 2003	22	4.17	6	4.29	203
2003 - 2004	23	3.86	14	4.06	186
2004 - 2005	20	4.18	11	4.30	334
2005 - 2006	22	3.47	15	4.21	323
2006 - 2007	20	3.58	12	4.29	281
2007 - 2008	14*	NA	NA	NA	NA
Means	**19.8**	**3.47**	**TOTAL: 76**	**4.20**	**TOTAL: 1636**

*In 2008, the ABE department shifted to a professional advising model and thus faculty shifted from advising to a mentoring role.

Graduate Student Advising at Iowa State University (2000-present)

Served as major professor for the following students:

No.	Name	Degree	Current Employment
1	Mitchell A. Miller	M.S. Awarded 12/2001	Processing Systems Engineer, Yoplait, Reed City, MI
2	Sheldon Stevermer	M.S. Awarded 12/03	Design Engineer, AGCO, Jackson, MN
3	Dev S. Shrestha	Ph.D. Awarded 5/2004	Assistant Professor, University of Idaho, Moscow, ID
4	Mark L. Westphalen	M.S. Awarded 5/2004	Senior Associate Engineer, Caterpillar Tech Center, Mossville, IL
5	Samsuzana Abd Aziz	M.S. Awarded 12/2004 Ph.D. Awarded 12/2008	Lecturer, Univ. Putra Malaysia, Serdang, Malaysia
6	Suzhen Lin	Ph.D. Awarded 2005	Software Engineer, Teradata
7	Kelly Thorp*	Ph.D. Awarded 5/2006	Research Agricultural Engineer, USDA-ARS U.S. Arid-Land Agricultural Research Center Maricopa, AZ
8	Bo Li	M.S. began 6/2003	Withdrew
9	Michael Gandrud	M.S. began 5/2004	Test Engineer, Sauer-Danfoss, Ames, IA
10	Natthapongs Voraphani	Ph.D. Awarded 12/2007	Bangkok, Thailand
11	Dan Zurmuehlen	M.S. began 9/2004	Withdrew
12	James Bosserd	M.S. Awarded 5/2007	Design Engineer, John Deere Product Engineering Center, Waterloo, IA
13	Manoj Karkee	Ph.D. Awarded 12/2009	Assistant Professor, Washington State University, Prosser, WA
14	Sam Hall	M.S. began 8/2007	Manufacturing Technology Development Engineer, Sauer-Danfoss, Ames, IA
15	Dan O'Brian	Ph.D began 8/2008	Wells Fargo, Des Moines, IA
16	Joe Craig*	M.S. Awarded 12/2011	Design Engineer, Brand Hydraulics, Lincoln,

No.	Name	Degree	Current Employment
			NE
17	Doug Wibholm	M.S. began 8/2009	Quality Engineer, John Deere Des Moines Works, Ankeny, IA.
18	Mohd Taufik Ahmad	M.S. began 8/2009	Research Officer, Mechanization and Automation Research Center, Malaysian Agricultural Research & Development Institute (MARDI), Serdang, Malaysia
19	Simon Nielsen	M.S. awarded 8/2011	Systems Engineer, Sauer-Danfoss, Ames, IA.
20	Rob Demuth	M.S. began 8/2009	Almon Technical Publications
21	Andrew Peterson	M.S. awarded 5/2011	Professional Golf Tour
21	John Kruckeberg	M.S. awarded 5/2011	Research Engineer, ABE Dept.
22	Emilio de Souza Santos**	M.S. awarded 2011 (at Federal University of Vicosa)	CODEVASF, Brasilia, Brazil
23	Jeff Adams	M.S. began 8/2010	Technical Author, John Deere IVS
24	Gustavo Guethi Manhani**	M.S. awarded 2011 (at Federal University of Vicosa)	NA
25	J. Wyatt Hall	M.S. began 8/2011	Assistantship, ABE Department
26	Safal Kshetri	Ph.D. began 1/2012	Assistantship, ABE Department

*Co-major Professor
** Co-advisor

Served on graduate program of study committee for the following students:

No.	Name	Degree	Major
1	Yueming Jiang	M.S. awarded (2000)	Computer Engineering
2	Jason Eubanks	M.S. awarded (2000)	Agricultural Engineering
3	Mike Brand	M.S. awarded (2002)	Agricultural Engineering
4	William VandeHaar	M.S. awarded (2002)	Mechanical Engineering
5	K.C. Tiew	M.S. awarded (2002)	Computer Engineering
6	Saadettin Yildirim	Ph.D. awarded (2003)	Agricultural Engineering
7	Lance Juffer	M.S. awarded (2003)	Computer Engineering
8	Yang Xu	M.S. awarded (2003)	Mechanical Engineering
9	Roger Fales	Ph.D. awarded (2004)	Mechanical Engineering
10	Eric Baack	M.S. awarded (2004)	Mechanical Engineering
11	Doug Blum	M.S. awarded (2004)	Mechanical Engineering
12	Chengming He	Ph.D. awarded (2007)	Computer Engineering
13	Chad Spencer	M.S.	Mechanical Engineering
14	Joshua Engelbrecht	M.S. awarded (2007)	Mechanical Engineering
15	Ryan Benning	M.S. awarded (2005)	Agricultural Engineering
16	Chris Metschke	M.S. awarded (2007)	Mechanical Engineering
17	Dan Robinson	Ph.D.	Mechanical Engineering
18	Steve Crow	M.S.	Mechanical Engineering
19	Kurt Romans	M.S. awarded (2005)	Agricultural Engineering
20	Imad Abbadi	M.S. awarded (2005)	Electrical Engineering
21	Dan Frohberg	M.S. awarded (2005)	Agricultural Engineering
22	Brad Dilts	M.S. awarded (2005)	Agricultural Engineering
23	Scott Evans	M.S. awarded (2006)	Mechanical Engineering
24	Zachery Kemp	Ph.D.	Mechanical Engineering
25	Dongheng Li	M.S. awarded (2006)	Human and Computer Interaction
26	Mark Dilts	M.S. awarded (2007)	Agricultural Engineering

No.	Name	Degree	Major
27	Lav Knot	M.S. awarded (2006)	Agricultural Engineering
28	Ivan Ramler	Ph.D. awarded (2008)	Statistics
29	Jesse Lane	M.S.	Human and Computer Interaction
30	Travis Auderer	M.E. awarded (2007)	Systems Engineering
31	Benoit Inge	Ph.D. awarded (2009)	Industrial and Agricultural Technology
32	Lingyuan Yang	Ph.D. awarded (2010)	Agricultural Engineering
33	James Hershberger	M.S. awarded (2008)	Agricultural Engineering
34	Peter Swanson	M.S. awarded (2007)	Mechanical Engineering
35	Robert Penn Taylor	M.S. awarded (2008)	Mechanical Engineering
36	Joe Dunlay	M.S. awarded (2009)	Mechanical Engineering
37	Evan Visser	M.S. (at Federal University of Vicosa, awarded 2008)	Agricultural Engineering
38	Xuyong Tu	Ph.D.	Agricultural Engineering
39	Jian Jin	Ph.D. awarded (2009)	Agricultural Engineering
40	John Henscheid	M.S. awarded (2011)	Industrial and Agricultural Technology
41	Rob Franz	M.S. awarded (2009)	Agricultural Engineering
42	Lloyd Snell	M.S. awarded (2008) Ph.D.	Agricultural Engineering
43	Ali Yakubu	M.S. awarded (2009) Ph.D.	Industrial and Agricultural Technology
44	Lidia Esteve Agelet	Ph.D. awarded (2011)	Agricultural Engineering
45	Chad Daniel	M.S. awarded (2010)	Mechanical Engineering
46	Robert McNaull	M. S. awarded (2010)	Agricultural Engineering
47	Jeremiah Johnson	M. S. awarded (2010)	Agricultural Engineering
48	Madhu Monga	M. S. awarded (2010)	Computer Engineering
49	Punit Tulpule	Ph.D.	Mechanical Engineering
50	Jonathan Roth	M. S. awarded (2010)	Agricultural Engineering
51	Jofran Luiz De Oliveira	M.S. (at Federal University of Vicosa, awarded 2010)	Agricultural Engineering
52	Olga Toledo	Ph.D. (at Federal University of Vicosa, awarded 2010)	Agricultural Engineering
53	Curtis P Thoreson	M.S. awarded (2011)	Agricultural Engineering
54	Ahmad Bujan	M.S. awarded (2011)	Agricultural Engineering
55	Jeff Zimmerman	M.S. awarded (2011)	Agricultural Engineering
56	Eric Anderson	Ph.D.	Mechanical Engineering
57	Andy Jennett	M. S. awarded (2012)	Agricultural Engineering
58	Ben Potter	M. S.	Agricultural Engineering
59	John Gaard	M. S.	Agricultural Engineering
60	Alex Nykamp	M. S.	Agricultural Engineering
61	Kevin Peyton	M. S.	Agricultural Engineering

Undergraduate Research and Teaching Assistants Supervised

No.	Undergraduate Student Name	Major	Semesters
1	Rudy Ask	Agricultural Engineering	S01

No.	Undergraduate Student Name	Major	Semesters
2	Matt Brummett	Agricultural Engineering	SS01, F01
3	Brian Crawford	Computer Engineering	SS01
4	Eric Stephen	Computer Engineering	F01, S02, SS02, F02
5	Ben Weatherman	Computer Engineering	F01
6	Cory Van Wyngarden	Computer Engineering	S02, F02
7	Walter Hayden	Computer Science	SS02, F02
8	Nicholas Krueger	Agricultural Engineering	SS02, F02, F03, S04
9	Brian Thorp	Computer Engineering	F02, S03
10	Michael Collins	Computer Engineering	SS03, F03, S04, SS04, F04
11	Sandra Wenke	Agricultural Engineering	SS03, S04, SS04, F04
12	Abdul Qazi	Computer Engineering	SS03, F03
13	Eric Jacobson	Agricultural Engineering	F03
14	Tim Shepherd	Agricultural Engineering	F03, S04, SS04, F04
15	Steve Shaner	Computer Engineering	F03, S04
16	Gerry Pickett	Computer Science	S04
17	Pat Reaver	Agricultural Engineering	S04
18	Siddharth Singvi	Industrial and Manufacturing Systems Engineering	SS04
19	Yin-Cheung (Miranda) Lo	Computer Engineering	SS04, F04
20	Will Pohlman	Business	SS04, F04
21	Carl Carlson	Computer Engineering	F04
22	Kinsey Olsen	Mechanical Engineering	F04,SS05
23	Kar Bo (Janice) Wong	Computer Engineering	F04,S05,SS05,S05
24	Neal Buchmeyer	Computer Engineering	SS05, F05
25	David Suh	Agricultural Systems Technology	SS05, F05
26	Chontichar (April) Shinatrakool	Computer Science	F05, S06
27	Eduardo Maeda	Agricultural Engineering	F05
28	Andre Delboni	Agricultural Engineering	F05
29	Brandon Fisher	Agricultural Engineering	F06
30	Micah Van Mersbergen	Agricultural Engineering	S07
31	Jonathan Roth	Agricultural Engineering	F07
32	Ryan Zenisek	Agricultural Engineering	S08
33	Adam Cole	Agricultural Systems Technology	S09
34	Tyler Romoser	Agricultural Systems Technology	F10
35	Tyler Sikora	Agricultural Engineering	S11
36	Kent Recker	Agricultural Engineering	S11
37	Adam Schilling	Industrial Technology	S12

Visiting Scholars Hosting/Advising at Iowa State University:

No.	Name	Duration	Institution
1	Ms. Minli Yang	April 2011 – May 2011	China Agricultural University, Beijing, PR China
2	Ms. LiJun Xu	Sept. 2010 – Sept. 2011	China Agricultural University, Beijing, PR China
3	Dr. Delly Oliveira	August 2003–August 2004	Federal University Viçosa, Brazil

Short Courses

1. **Steward, B. L.** 2011. Introduction to Fluid Power – Hydraulics. One and a half day short course, Raven Industries Inc. Sioux Falls, South Dakota. March 10-11. 18 participants.

2. **Steward, B. L.** 2011. Introduction to Fluid Power Technology– Hydraulics. One and a half day short course, Raven Industries Inc. Sioux Falls, South Dakota. June 20-21. 19 participants.

3. **Steward, B. L.** 2011. Introduction to Fluid Power Technology– Hydraulics. One and a half day short course, Raven Industries Inc. Sioux Falls, South Dakota. July 11-12. 13 participants.

Outreach Activities

1. Steward, S.T., Paskach, J. , **Steward, B. L.,** Paskach, T. J. et. al. 2011. Robots Basic Workshop. Edwards Elementary School, Ames, Iowa. Feb. - April. ~20 participants.

2. Steward, S.T., Paskach, J. , **Steward, B. L.,** Paskach, T. J. et. al. 2012. Robots Basic and Plus Workshop. Edwards Elementary School, Ames, Iowa. Jan. - March. ~10 participants.

Professional Development

- Sauer-Danfoss Plus+1 Developer Training, Ames, IA. 12/19-22/2011
- HYSAN Version 9 Training, Ames, IA 9/1/2011
- National Fluid Power Association Industry and Economic Outlook Conference, Schaumburg, IL. 8/15-17/2011
- Annual International Meeting of the American Society of Agricultural and Biological Engineers, Louisville, KY. 8/7-10/2011
- FIPSE/CAPES Directors Meeting, Florianópolis, SC, Brazil. 9/22-25/2010
- ISU Faculty Professional Development Assignment in at a Fulbright Visiting Professor in Departamento de Engenharia Agrícola, Universidade Federal de Viçosa, Viçosa, Brazil 11/1/2009-6/30/2010
- IX Congreso Latinoamericano y del Caribe de Ingeniería Agrícola - CLIA 2010 and XXXIX Congresso Brasileiro de Engenharia Agrícola - CONBEA 2010, Vitória, Espirito Santo, Brasil. 7/25-29/2010
- National Fluid Power Association, 6th Educator/Industry Summit, Wheeling, IL 8/18-19/2009
- Annual International Meeting of the American Society of Agricultural and Biological Engineers, Reno, NV 6/22-24/2009
- HYSAN Version 8.1 Training, Ames, IA 5/19/2009
- Annual International Meeting of the American Society of Agricultural and Biological Engineers, Providence, RI 6/30-7/2/2008
- National Sustainable Design Expo, Washington, DC 4/20-22/2008
- Engineers for a Sustainable World National Conference, San Francisco, Calif. 2/7-8/2008
- ASABE Professional Engineering Exam Webinar 8/15-10/23/2007
- HYSAN Version 7 Training, Ames, IA 7/16/2007
- Annual International Meeting of the American Society of Agricultural and Biological Engineers, Minneapolis, MN 6/18-20/2007
- Fifth International Symposium on Fluid Power Transmission and Control, BeiDaiHe, China 6/6-8/2007
- International Conference on 21st Century Challenges to Sustainable Agri-Food Systems: Biotechnology, Environment, Nutrition, Trade and Policy, Bangalore, India 3/15-17/2007
- Business Engineering Sustainability: NSF Planning Workshop, College Park, Maryland. 2/16-17/2007
- Engineers for a Sustainable World National Conference, Iowa City, Iowa 9/28-29/2006

- HYSAN Version 7 Training, Ames, IA 8/14/2006
- Engineering in Transition Workshop, Center for Sustainable Engineering, Carnegie-Mellon University, Pittsburgh, PA 7/17-19/2006
- Annual International Meeting of the American Society of Agricultural and Biological Engineers, Portland, OR 7/9-12/2006
- National Sustainable Design Expo, Washington, DC 5/9-10/2006
- Agricultural Machinery Conference, Cedar Rapids, IA 5/2/2006
- National Fluid Power Association Fall Conference, Pittsburgh, PA 10/20-21/2005
- ISU CELT Teaching & Learning Circle: Civic Engagement and Learning: The SENCER Model 9/26, 10/3,17/2005
- Science Education for New Civic Engagements and Responsibilities (SENCER) Summer Institute, Santa Clara, CA 8/5-9/2005
- Annual International Meeting of the American Society of Agricultural Engineers, Tampa, FL 7/17-20/2005
- Agricultural Equipment Technology Conference, Louisville, KY 2/13-15/2005
- Smart Engineering System Design (ANNIE 2004) Conference. St. Louis, MO 11/8-9/2004
- National Fluid Power Association Educator/Industry Summit. Scottsdale, AZ 9/30-10/1/2004
- Annual International Meeting of the American Society of Agricultural Engineers, Ottawa, ON 8/2-4/2004
- National Fluid Power Association Educator/Industry Summit, Indianapolis, IN 10/24-25/2003
- Annual International Meeting of the American Society of Agricultural Engineers, Las Vegas, NV 7/28-30/2003
- ISU Learning Community Discussion Group, Ames, IA 11/13/2002
- Use of DDI Opal Software Workshop, Engineering Career Services, ISU, Ames, IA 11/22/2002
- National Custom Applicators Expo. Ankeny, IA. 8/27/2002
- Farm Progress Show. Alleman, IA 9/25/2002
- Annual International Meeting of the American Society of Agricultural Engineers, Chicago, IL 7/28-31/2002
- Automation Technology for Off-Road Equipment Conference, Chicago, IL 7/26-27/2002
- 6th International Conference on Precision Agriculture. Bloomington, MN 7/14-17/2002
- Agricultural Machinery Conference, Cedar Rapids, IA 5/7/2002
- The World Congress of Computers in Agriculture and Natural Resources, Iguaçu Falls, Brazil 3/13 -15/2002
- Agricultural Equipment Technology Conference, Kansas City, MO 2/21-22/2002
- Discussion on SOTL (Scholarship of Teaching and Learning), Center for Teaching Excellence, ISU, Ames, IA 4/4/2001
- National Fluid Power Association Educators' Summit. Cleveland, OH 10/18-19/2001
- Using Assessment Effectively Workshop, Center for Teaching Excellence, ISU, Ames, IA 10/4,11/1/2001
- Annual International Meeting of the American Society of Agricultural Engineers, Sacramento, CA 7/29-8/1/2001
- East Asian Bioproduction Engineering Forum. Sacramento, CA 7/29/2001
- Agricultural Equipment Technology Conference, Louisville, KY 2/12-13/2001
- 5th International Conference on Precision Agriculture. Bloomington, MN 7/17/2000
- Annual International Meeting of the American Society of Agricultural Engineers, Milwaukee, WI 7/10-12/2000
- Grant Writers' Workshop, Agricultural Experiment Station, ISU, Ames, IA 6/2000-11/2000
- Agricultural Machinery Conference, Cedar Rapids, IA 5/2/2000
- International Fluid Power Exposition, Chicago, IL 4/4-6/2000
- Teaching Portfolio Workshop, Center for Teaching Excellence, ISU, Ames, IA 3/6,22/2000
- Agricultural Equipment Technology Conference, Kansas City, MO 2/23-25/2000
- Ag Comm Communication across curriculum workshop, College of Agriculture, ISU, Ames, IA 9/21/1999

- Challenge Project LEAR/N Group, College of Agriculture, ISU, Ames, IA 8/1999-5/2000
- College Teaching Seminar, ISU, Ames, IA 8/18-19/1999
- Annual International Meeting of the American Society of Agricultural Engineers, Toronto, ON 7/18-22/1999
- Agricultural Equipment Technology Conference, Louisville, KY 2/8-9/1999
- Photonics East Conference, SPIE, International Society for Optical Engineering, Boston, MA 11/1-5/1998
- 4th International Conference on Precision Agriculture, St. Paul, MN 7/19-22/1998
- Annual International Meeting of the American Society of Agricultural Engineers, Orlando, FL 7/11-16/1998
- Agricultural Equipment Technology Conference, Louisville, KY 2/1998
- Annual International Meeting of the American Society of Agricultural Engineers, Minneapolis, MN 8/10-14/1997
- Engineering Education Scholars Program sponsored by NSF, University of Wisconsin-Madison, Madison, WI 7/6-12/1997
- Graduate Student Writing Across The Curriculum Seminar, University of Illinois at Urbana-Champaign, Champaign, IL 8/28-29/1996