The 1999 ASAE/CSAE-SCGR Annual International Meeting will be held in Toronto, Ontario Canada from July 18-21, 1999.

The Department of Agricultural Engineering would like to invite all alumni attending the conference to attend an Alumni Reception being held Monday, July 19, 1999 in the Dominion North in the Sheraton Centre Toronto Hotel. The reception will be from 8:30 p.m. to 10:00 p.m. There will be a cash bar and snacks will be provided.

While you are visiting with old friends and making new acquaintances, browse through our history book, “Agricultural Engineering on the Prairie, Illinois Style.” The book covers 75 years of the department’s history and copies will be available for purchase at a cost of $20.

So mark your calendar! Come and enjoy a night of reminiscing and just plain old good visitin’ with friends old and new! See you on July 19!
Greetings … Another academic year has passed very rapidly and this newsletter highlights some of our activities and accomplishments. I believe you will agree that we continue to have outstanding faculty, staff and students.

The retirements of Carroll Goering and John Siemens have caused me to experience nostalgia regarding the department. With the exception of Kent Mitchell, every other member of the department has retired or left since I came to the University of Illinois in 1973. These were my mentors and the people that established the fine reputation that we enjoy. As we close out the century, we are also closing out a unique era of our department history. We look forward to the new century with optimism with a new generation of faculty and staff that will set a new benchmark of accomplishments that we cannot yet even visualize.

Please drop a note or e-mail to let us know about the events in your life. Your colleagues always enjoy reading our alumni news section.

Loren E. Bode
Head of Department

The Department has recently launched an effort to establish off-road equipment mechatronics programs and a mechatronic systems laboratory is under development as part of this effort. Midwest Technologies, Inc. of Illinois (MidTech), has donated $100,000 to support the development of the Bruce Cowgur Midtech Mechatronic Systems Laboratory in memory of the late Mr. Bruce Cowgur, founder of the company. This laboratory will consist of facilities to support electrohydraulics, mechatronic systems integration and mobile infotronics teaching and research activities in the department.

Mechatronics is the study of a type of novel machinery – machinery with a “brain”. Such machinery is integrated with mechanical parts, electrical components and microprocessors. The word “mechatronics” itself is an integration of “mechanics” and “electronics”. The major difference between conventional machinery with electronic components and mechatronic machinery is that the former adds electronic components, while the latter integrates electronic components.

Adding some electronics to a machine means adding additional functions, and integrating electronics means furnishing extended capability to the machinery (Fig. 1). An example of applying mechatronics technology to off-road vehicles is the HEUI fuel system for diesel engines. In conventional diesel engines, a mechanical governor is used to control the engine speed. Such a governor is made up of a mechanical centrifugal flyweight mechanism to sense the speed variation, and regulate fuel delivery to the engine via a mechanical fuel distribution pump and mechanical fuel injectors. It requires a complicated mechanism and numerous parts to accomplish the basic desired function. It results in not only high cost, but also low reliability. Recent advances in mechatronics made it possible to replace the governor with an electronic speed sensor with a hydraulically-actuated electronically-controlled unit injector fuel system.

For more information, contact:
Dr. Qin Zhang
Dept. of Agricultural Engineering
1304 W. Pennsylvania Ave., Rm. 360
Urbana, IL 61801
217.333.9419
217.244.0323 fax
qzhang@age.uiuc.edu
On March 25, 1999 Loren Bode, along with the faculty and staff, welcomed Lorennie Bateman to the department with a reception to acknowledge the generous contribution made by H. Paul and Lorennie Bateman. As many of you are aware, Paul passed away on August 2, 1997.

John Siemens, Professor Emeritus in the Off-Road Equipment Engineering Section, provided a presentation on Professor Bateman’s career and his interest in the Agricultural Engineering Research Farm.

It was Paul’s wish that the gift be used for research at the Agricultural Engineering Research Farm. His interest and long-term professional career became focused on field experiments when he assumed responsibility for the farm in 1950. From then until his retirement in 1968 he conducted experiments on tillage and planting methods. After retirement from the University, Professor Bateman’s interests in farm machinery continued. He and Lorennie spent many tedious hours in fields planted to corn measuring seed planting depth and spacing.

Another gift to the College of ACES provides annual funding to support two Bateman Congeniality Awards and one or more JBT Scholarships to outstanding entering freshmen.

After a Certificate of Appreciation was presented to Lorennie, Roscoe Pershing and Don Hunt gave special remarks.

Again, the department wishes to extend its gratitude for the generous and thoughtful gifts given by H. Paul and Lorennie Bateman. Thank you!
Retirement of Dr. Carroll E. Goering

Dr. Carroll Eugene Goering, Professor of Agricultural Engineering at the University of Illinois at Urbana-Champaign, retired on May 20, 1999. Dr. Goering was a Design Engineer at International Harvester Company from 1959 to 1961 and Professor of Agricultural Engineering at the University of Missouri from 1965 to 1977 and the University of Illinois from 1978 to 1999. Carroll earned his BSAE from the University of Nebraska and his MS and Ph.D. degrees from Iowa State University.

Carroll was born in Platte Center, Nebraska. After completing his BSAE degree in 1959, Carroll worked for International Harvester Company until 1961 and then returned to Iowa State University to earn his Masters and Ph.D. degrees in Agricultural Engineering.

At the University of Illinois Dr. Goering conducted research on the design, construction and operating principles of farm equipment and made significant contributions in several areas.

Vehicle Automation
Carroll worked on vehicle guidance at the University of Missouri. The research was ahead of its time and did not have the advantage of the global positioning system to provide guidance signals. Nevertheless, the research had an impact in that ASAE initiated the Agricultural Automation Committee which continues to function today.

Chemical Application Technology
Also, at the University of Missouri, Carroll conducted research on pesticide application technology. In 1975, he reported on a sprayer in which the chemical concentrate is stored separately from the water carrier and mixed on the go. Fifteen years later, such sprayers came into commercial use. While on sabbatical leave at the University of Illinois, Goering worked with Professor Jack Butler on techniques for measuring drift from a sprayer. Drawing on the research, Goering led the effort to develop the ASAE Standard entitled “Test procedure for measuring deposits and airborne spray from ground swath sprayers”.

Engines and Alternative Fuels
Soon after joining the faculty at the University of Illinois, Goering initiated research programs on engines and alternative fuels. The focus of the research was on finding alternative fuels for compression-ignition engines. He developed a procedure for measuring engine cylinder pressures and to infer the rate of energy release from fuels. His publication on the procedure won an ASAE outstanding paper award. Goering helped the University of Natal in South Africa establish a similar procedure. In the early 1980s, Goering and his students devised laboratory procedures for transforming soybean oil into its methyl ester, i.e., they produced and tested methyl soyate. Ten years later, a National Biodiesel Board was formed to promote methyl soyate.

Education
During his career, Goering has advised and taught hundreds of undergraduate students and served as advisor to more than forty graduate students.

These students are now engineers at Caterpillar, Cummins, Case IH, John Deere, and numerous other companies. Goering wrote a textbook, Engine and Tractor Power, which is now in its third edition and has become one of the best sellers in the ASAE textbook series. It has been translated into Arabic for use in Saudi Arabia.

American Society of Agricultural Engineering

Goering has been very active in ASAE. He has repeatedly served as Chairperson of technical committees. Twice, he has served as Chairman of the Power and Machinery Division. As Division Chairperson, Goering nurtured the establishment of a continuing series of Agricultural Equipment Technology Conferences (AETC). Goering served on the ASAE Board of Directors during a crucial time, i.e., when a re-structuring of the society was being planned as a means to reverse declining membership. He served on a subcommittee which wrote a revised constitution and bylaws for ASAE.

Recognitions
In 1970, Carroll was awarded a distinguished service award by the University of Missouri. In 1986, the College of Engineering at the University of Illinois awarded Goering the prestigious Everitt Award for excellence in undergraduate teaching. In five consecutive years, engineering students chose Goering as an outstanding...
Dr. John Cornelius Siemens, Professor of Agricultural Engineering at the University of Illinois at Urbana-Champaign, retired on December 31, 1998, after a 40-year career at the University of Illinois and at Cornell University. John earned his BSAE degree at the University of California at Berkeley and Davis, his MS in Agricultural Engineering at the University of Illinois, and his Ph.D. in Civil Engineering at the University of Illinois. During his Ph.D. studies, he served as an instructor in Agricultural Engineering and did research in soil mechanics. As part of his Ph.D. research, John designed and built the first indoor soil bin at the University of Illinois.

John was born in Shafter, California. He grew up in Lancaster, California with three brothers and one sister on an alfalfa/ dairy farm. For summer work during his college career, he contracted to haul the hay produced on a 640-acre farm. He, a brother and a friend won the hauling contest at the Antelope Valley Fair in 1956. They loaded and unloaded four tons of hay (64 bales) in 6 minutes and 32 seconds.

John attended Antelope Valley Junior College for one year before enrolling in Agricultural Engineering at the University of California at Davis. At Davis, John played football for the Aggies and on one occasion was selected “player of the week.”

After completing his Ph.D. degree in 1963, John accepted a position as Assistant Professor of Agricultural Engineering at Cornell University. In 1968, he returned to the University of Illinois as Associate Professor of Agricultural Engineering. In 1976, he was promoted to full professor.

As a graduate student, John worked with Professor Jay Weber on two major projects. One was modeling tillage tools, using the soil bin that John designed and constructed. The other was on farm tractor maintenance. John and Professor Weber conducted some of the earliest research on the use of dry-type air cleaners on farm tractors. Prior to that time, only oil-bath air cleaners were used.

In 1967, when Professor Wendell Bowers left Illinois to take an extension position at Oklahoma State University, a replacement was needed. According to Dr. Frank Lanham, Head of Agricultural Engineering, “To fill a gap is an assignment of real magnitude...In casting about for a replacement for Professor Bowers, one man in the United States immediately stands out - Dr. John C. Siemens of Cornell University.” John accepted the offer to return to Illinois. John’s new assignment was Extension Specialist in Field Power and Machinery. Based on his strong research record, John was also granted an appointment to the Graduate Faculty. In later years, John became Extension Program Leader for all extension activities in Agricultural Engineering.

At Illinois, John quickly established cooperative research efforts with other departments. In 1968, Extension Agronomist Ellery Knake wrote to Dr. Lanham to laud John’s outstanding cooperative work on the development of a new “waterless sprayer”. This was only the first of many such letters from Agronomy faculty lauding John’s outstanding cooperation.

In 1970, John accepted a Residency in Engineering Practice sponsored by the American Society for Engineering Education to spend a year with Deere & Company at Moline, Illinois. During the year with Deere & Company, he worked on the evaluation of tillage systems for corn and soybean production and a computer program to select the optimum machinery set for a farm. This highly successful year marked the beginning of several cooperative ventures between Dr. Siemens and Deere & Company.

In 1975-1976, John was granted a sabbatical leave to study at the Division of Agricultural Engineering, Department of Agricultural Technical Services, Pretoria, South Africa. His specific assignment was to evaluate and study field machinery selection methods used for corn production in South Africa. This leave launched John on another of his major career interests, machinery management. John later had other overseas assignments, including a 1977 consultancy to study soybean production potential in Iraq and studies in Yugoslavia and Jamaica.

At the University of Illinois, John has made major research contributions in two main areas, conservation
tillage and machinery management. In the 1970s, with financial support from Deere & Company, John and Professor Oeschwald from the UIUC Agronomy Department launched a massive tillage research project that ultimately led to the nationwide acceptance of conservation tillage and the virtual retirement of the moldboard plow. John’s tillage research was widely publicized. His national reputation led to his selection in 1993 as senior author of a Soil Management textbook published by Deere & Company.

Working with a series of graduate students, John developed machinery selection software for guiding farmers in selecting optimum sets of machinery for their farm operations. Manufacturers also use the software in deciding upon types and sizes of machinery to manufacture. Based on his outstanding expertise in machinery management, John was selected to teach Technical Systems Management (TSM) 221, the farm machinery management course. He continued to teach the course until his retirement.

Two major awards have recognized John’s outstanding accomplishments. In 1993, he received the Senior Faculty Award for Excellence in Extension, from the College of Agriculture. At the 1999 ASAE meeting in Toronto, he will receive the John Deere Gold Medal Award, one of the highest honors granted by ASAE. It is ironic that the John Deere Gold Medal Award was named for John Deere, the inventor of the steel moldboard plow and that John Siemens won the award on the basis of his conservation tillage research, which essentially retired the moldboard plow.

John readily admits that he was very lucky to have met Jean Elsesser. They were married in 1961. They have three sons, three daughter-in-laws, and one grandchild. They are expecting a second grandchild.

In retirement, John and Jean look forward to new ventures. So far John is not doing very well at the new ventures. This past winter he has made presentations at several Pesticide Application Training Sessions and is revising a textbook on Farm Machinery Management for Deere & Company. He hopes for more golf soon!

Dr. Carroll E. Goering
continues on page 9

undergraduate advisor in engineering. On 22 occasions, students at the University of Illinois have placed Goering on the list of teachers ranked as excellent in their courses. From the Agricultural Engineering Department, Goering received the teaching excellence award in 1985, 1994 and 1995. The College of Agricultural, Consumer and Environmental Sciences chose Goering to receive the Senior Award for Excellence in Teaching in 1994. In 1996, the College awarded Goering the Funk Award for distinguished service to agriculture. The Funk Award is named for the Funk family, owners of the Funk Seed Corn Company. In 1996, ASAE president George Kriz awarded Goering a presidential citation for work on revising the ASAE constitution and bylaws. In 1998 Goering was elected an ASAE Fellow.

Carroll and Carol Ann Goering raised three children. Laurie is a foreign correspondent for the Chicago Tribune; she currently lives in Rio de Janeiro and covers South America. Dan is an aeronautical engineer with Boeing in Seattle. Sara recently completed her Ph.D. in Philosophy and has accepted a faculty position with California State University at Long Beach.

Did you know?

The Fallow Furrow Award was started in the Department of Agricultural Engineering when Kent Mitchell forgot to attend a class he was teaching in 1975! Since that time, the current holder of the award has accepted nominations for worthy recipients to receive it at the next spring banquet; with few exceptions it has been given annually since that time.

Dr. Goering has been the recipient of the award once and Dr. Siemens has received the award twice.

Check out page 9 to see who received the award this year!
EOH/AOH Open House Displays - March 1999

Development of a Multi-Point Sampler for Air Sampling - Xinlei Wang
Automotive Navigation of Agricultural Vehicles - Eric Benson, Matt Laydon, Honghu Qiu
Safe Use of Generators - Mark Fudge

Alteration of SCS-CN Method to Predict Tile Flow - Yongping Yuan, Thomas Wilckman
Novel Sensors for Crop Health Measurement - Curtis Cornell

Smart Sprayer - Lie Tang, Brian Steward, Charles Kammin, Haibo Yao
E/H Steering System Simulator - Honghu Qiu

OxyDiesel Fuel for a Cleaner World - Mike Membza, Adam Cransay, Kenneth Wanning, Nathan Kress, Ruth Bork
Information Management Technology for Information Agriculture - Qin Zhang

Modified Dry Grind Ethanol: Same Grade Quality with Lower Cost - Jenny Wahjudi, Malcolm Speller
Evaluation of Tri-R Robotic Driver Guiding a Tractor in a Corn Field - Dale Johnson

Edible Explosions - Popcorn and Its Science - Yu Tian, Yolanda Lopez, Anna Cathcart
Alpha Epsilon Delta Chapter - Jeff Zuercher

Wet Milling of Corn with Lactic Acid - Ping Yang, John Bower
Variable Rate Slurry Applicator - Al Guativa, Jeff Dauderman, Brian Petelin, Luke Tomsha

Corn Yield Prediction with an Artificial Neural Network - Jing Liu, Lisa Foster
Department of Agricultural Engineering Information Table - Dini Reid, Richard Cooke

Wireless Tractor Communication - Eric Viall, Jeff Will, Joe Bartoli
Open House Coordinators - Randy Fonner, Steve Fard

Young Scholars Program Summer Project - Marguerite Tan
Open House Helpers - Anne Batchelor, Kelly Thop, Larry Pruitt, Dennis Mohr

The Sky is Falling – Save Your Soil - Paul Miller, Chris Harbut
Illini Ag Mech Club - Chris Kallal

Wireless Video Systems for Mobile Equipment - David Konnker
The 1999 ASAE/CSAE-SCGR Annual International meeting will be held July 18-21, 1999 in Toronto, Ontario, Canada. Four members of our department will receive special recognition this summer.

John C. Siemens (Professor Emeritus, Off-Road Equipment Engineering Division) won one of ASAE’s most prestigious awards – the John Deere Gold Medal. It is ironic that John’s outstanding tillage research, which basically retired the moldboard plow, won him the award named for the person who invented the steel moldboard plow. Regardless, John is clearly deserving of the award.

Loren E. Bode (Head of the Department) has been elected to the ASAE Board of Trustees. Marvin R. Paulsen (Division Leader, Food and Bioprocess Engineering) has been elected to the nominating committee for Food and Process Engineering. John F. Reid (Professor, Off-Road Equipment Engineering Division) has been elected to the nominating committee for Power and Machinery.

The Incomplete List of Teachers Ranked as Excellent by their Students for Spring 1999 has been released. Congratulations to: Philip Buriak, Leslie L. Christianson, Carroll E. Goering, Michael C. Hirschi, Nathan Marsh (TA), Gerald L. Riskowski, and Brian Steward (TA).

At the Spring Banquet held April 18, 1999, Brian L. Steward was presented the Teaching Excellence Award for graduate assistant teaching and Yuanhui Zhang, Associate Professor in the Bioenvironmental Engineering Division was presented a Teaching Excellence Award for his outstanding contributions to the teaching programs in the department.

And on a lighter note, Yuanhui also received the Fallow Furrow Award—he received two notices, written in Dutch, that turned out to be a ticket violation while he was in Holland. He ignored the first one, but had the second one translated - he paid the ticket.

The award remains in the possession of the Bioenvironmental Engineering Division for another year – as Ted Funk received the award last year!

On a more personal and happy note …

John F. Reid, Professor/Off-Road Equipment Engineering Division and Dini M. Voss, Assistant to the Head, were united in marriage on March 13, 1999 in Champaign, Illinois. Congratulations and best wishes to Dini and John as they embark upon their new life together!
Paul W. Benson, Lecturer, Technical Systems Management, was honored at the Funk Awards Banquet on April 20. Paul was the recipient of the Professional Staff Award for Excellence in Undergraduate Teaching. Congratulations to Paul!

Phil Buriak, Professor, Technical Systems Management (TSM) and Coordinator, TSM Program received the Campus Award for Excellence in Undergraduate Teaching. This is clearly the most prestigious teaching award presented by the University of Illinois. Phil was honored at the annual Instructional Awards Banquet held on April 26 at the Illini Union.

Phil was also awarded the College of ACES Senior Faculty Award for Excellence in Teaching. Phil was honored at the annual Paul A. Funk Awards Banquet held on April 20. Congratulations to Phil on winning these two awards!

Collins Award for Innovative Teaching

W. Leighton Collins was a faculty member in the College of Engineering from 1929 to 1965 and former executive director of the American Society of Engineering Education (ASEE). He was a pioneer and leader in ASEE and helped shape engineering instruction in the United States. This award recognizes outstanding development or use of new and innovative teaching methods.

Dr. Qin Zhang received the award at the 35th College of Engineering Honor Awards Convocation held Friday, April 16, 1999.

Qin Zhang, Assistant Professor of Agricultural Engineering, teaches one of the most challenging and important courses in the department, AgE 311, Instrumentation and Measurements. It is challenging: the technology covered in the course changes quickly because of rapid advances in computing and instrumentation technology. It is important because students must understand the material and will use the computerized instrumentation technology in their engineering careers. Zhang redesigned AgE 311 to emphasize active learning and professional communications. He designed challenging real-life problems for the class discussion and homework. Students are expected to work in teams and use knowledge learned in other classes and from peers and additional technical material to solve problems. To promote professional communications, students work on a group laboratory project to identify a problem, design and build a complete measurement system, perform engineering measurements, and communicate the results professionally. Zhang’s teaching philosophy encompasses active learning and communications to improve engineering education.
J. Kent Mitchell, Professor in the Soil and Water Division, was on sabbatical leave from August 21, 1998 through January 5, 1999. Three months of leave were spent as a Visiting Professor in the Department of Hydraulic Structures, Faculty of Land Reclamation and Environmental Engineering, Warsaw Agricultural University (WAU), Warsaw, Poland.

He spent the time with Dr. Kazimierz Banasik, who was a visiting faculty member in the Soil and Water Division from August 1997 to June 1998. Dr. Banasik is involved in the hydrology of agricultural watersheds, rivers and reservoirs, and investigations and physical modeling of hydraulic structures. Kent obtained several helpful ideas and techniques to use with water quality research being conducted in the Little Vermillion River Watershed (LVR). He began a study to define runoff Curve Number (SCS - Runoff Model) for the LVR as well as the Zagozdzonka watershed. Additionally, he and Dr. Banasik outlined the course of a study to determine lag times for the monitored areas of the two watersheds. Hopefully, these studies will continue cooperatively in the future.

He attended several meetings and/or trips having to do with the TEMPUS Joint European Project, “Education in Environmental Engineering for Central Poland,” which has a research component, as well as, the teaching direction. Dr. Banasik is the leader of this project aimed at providing exchange opportunities between WAU and the Radom Private College of Environmental Protection, Radom, Poland, students and students at other cooperative institutions and at developing a teaching and research program at Radom College.

Kent chaired a technical session and presented a paper at the 3rd International Conference on Hydrosience and Engineering in Cottbus, Germany and chaired a technical session and presented a paper at the Conference on Environmental and Technical Problems of Water Management for Sustainable Development at WAU. This paper was published in the Bulletin of the Polish Academy of Sciences.

One of the most memorable activities of his sabbatical was when he presented the lecture entitled, “Agricultural Land Use and Water Quality” for the Inauguration Ceremonies for the Inter Faculty Program of Environmental Studies at WAU and for the Radom College. This ceremony is for new students that are in the Environmental Studies program.

Although not part of the official activities of an engineering sabbatical, Kent and Marlene were able to visit several cultural and historic sites: Royal Palace, Old Town, Lazienki Park, Curie Museum, many cathedrals and Cemetery Powazkowski on All-Saints Day in Warsaw; Zelazowa Wola; Panorama Radarwicka, Wroclaw; Zakopane; Cracow; and Auschwitz-Birkenau in Poland; Praha Castle and Old Town Praha, Czech Republic; Olympic Park and Old Town, Munich, Germany; Neuschwanstein Castle, Germany; Old Town, Innsbruck, Austria; Old Town, Vienna, Austria; and Berlin Dom and Central Berlin, Germany. They also attended several concerts at Cathedrals, the National Philharmonic Hall, and the Rose Garden in Lazienki Park; and an opera, operetta, and ballet at the National Opera Hall.
Loren Bode (Head), Eric Benson, Keli Christopher, and William Northcott (left to right) were honored at the Graduate Fellow Recognition Program held November 5, 1998. Also recognized, but not pictured, was Ana Maria Garcia. The Illinois Chapter of GAMMA SIGMA DELTA, the Honor Society of Agriculture, and the College of ACES sponsored the program.

During the past year the following alumni and friends have donated money to the department. These funds are used to help provide scholarships to deserving students, defray travel costs to professional meetings and support student projects for our open houses each spring. Some donations have been specifically designated to one of several special funds in our department.

For more information on donor opportunities, please contact the department at (217) 333-3570.

Mr. and Mrs. A. Richard Ayers
Mr. Paul G. Boland
Mr. Dana and Ms. Elizabeth Christensen
Mr. David A. Cornwell
Mr. and Mrs. Roger W. Curry
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Mr. William L. Schubert
Mr. and Mrs. Gene C. Shove
Dr. and Mrs. David W. Smith
Mr. and Mrs. Roger M. Smith
Mr. and Mrs. Daniel L. Smith
Dr. Roger R. Yoerger

Keli Christopher, graduate student in Soil and Water, won first place in the 1999 Minorities in Agriculture, Natural Resources and Related Science graduate student poster competition. She also was elected as the national MANRRS grad student parliamentarian. Congratulations Keli!

If you are interested in purchasing our history book, "Agricultural Engineering on the Prairie Illinois Style," please send your check in the amount of $25.00 and payable to the University of Illinois to:

Agricultural Engineering History Book
Attention: Mary Beth Munhall
1304 West Pennsylvania Avenue
Urbana, IL 61801

Don't miss the boat, order your history book today!
Using NIT To Measure Extractable Starch
Dr. Marvin R. Paulsen, Professor, Department of Agricultural Engineering

Corn can be grown for many reasons but in the end it is grown for its starch. However, not all starch contained in corn can be extracted. At best 90+ % can be extracted but the amount recovered depends on drying conditions, hybrid and environmental growing conditions. Drs. Marvin Paulsen and Steven Mbuvi are heading the effort to utilize Near Infrared Transmittance (NIT) and Near Infrared Reflectance (NIR) to measure extractable starch in corn. For several years, Dr. Steven Eckhoff’s laboratory in Agricultural Engineering headed by Armgard Haken and assisted by Yuxian Niu and Sara Chaney have been measuring extractable starch using the 100-g wet milling procedure that takes three days to complete one sample. A new test method is being correlated to those results which uses near infrared light to predict the same thing but in about 2 minutes.

About 16% of the corn grown in the US and about one-third of the corn grown in Illinois is used for wet milling. Wet milling is the process used to chemically and mechanically break corn kernels apart into starch (66%), protein {gluten feed (25%) and gluten meal (5%)}, and corn oil (4%). Depending on the specific wet miller, starch may be converted into fructose, ethanol, or left as starch, which may be used for food, pharmaceutical or industrial uses. Wet milling is a growing segment of the corn market and corn with high extractable starch has an increased value of around 4 to 6 cents per bu for each 1 % point increase in extractable starch. Presently we see extractable starch range from about 54 to 71% dry basis. The low percentages come from corn dried with drying air in excess of 100ºC. However, drying temperatures of 100ºC are commonly used in the grain industry because drying efficiency for a dryer with a given airflow increases as drying temperatures increase. Thus, elevator managers are left in a quandary of whether to run their dryers at a high temperature to maximize fuel efficiency or to sacrifice fuel efficiency to improve starch extractability. This research is important because it can provide elevator managers and purchasers of corn for wet milling a tool for making these decisions.

Over 800 samples have been tested over the past two years for use in developing the calibration for predicting extractable starch using NIT. Theoretically we should be able to predict within 1.3 times the laboratory standard error for the 100-g wet milling test, or with a standard error of prediction of about +/- 1 % point of starch. Presently we have an error of about 1.3% points, but we look for this to improve as samples are added that cover the upper and lower ranges more fully. We are also developing a similar calibration for a NIR instrument and some of that work is being done by Ms. Binying Ye, a Ph.D. graduate student in the department.

Extractable starch is greatly affected by varieties and we are finding different varieties are affected differently by drying temperatures. The project was initially funded by CFAR (Council for Food and Agricultural Research) as seed money which has since been further funded by Optimum Quality Grains, LLC.

For more information contact:
Dr. Marvin Paulsen
Agricultural Engineering Dept.
1304 W. Pennsylvania Ave., Rm. 360
Urbana, IL  61801
217-333-7926 phone
217.244-0323 fax
E-mail: mrp@age.uiuc.edu

Infratec 1229 NIT instrument used for scanning Corn samples for extractable starch.
Introduction

The modeling of flow and transport in many watersheds in Illinois is complicated by the widespread use of subsurface drainage systems. Typically, these systems drain small depressional areas and consist of a few tile lines placed at irregular angles and spacings. Many of these systems were installed 50-100 years ago and their locations are not known. Most existing watershed-scale models do not include the effects of subsurface drainage systems, while subsurface drainage models tend to focus on single fields. However, drains are important, if often overlooked, modifiers of flood peaks and water quality in rivers, ditches and streams.

Researchers in the Soil and Water Section of the Agricultural Engineering Department are in the process of developing comprehensive watershed-scale models that incorporate the effects that portion of subsurface flow that is intercepted by artificial tile drains and transported directly to outlet channels. In this article, some of the research being conducted is described. This includes the use of infrared aerial photography to create a GIS layer for subsurface drains, and the development of a tile flow component for a watershed-scale flood flow model.

Mapping Subsurface Drainage Systems

One of the first steps in the modeling of flow and transport in tile-drained watersheds is to map the subsurface drainage systems and store this information as a geographic information system (GIS) layer.

The drain (tile) mapping procedure developed in the Agricultural Engineering Department is based on the fact that the soil over efficiently draining tile lines dries faster than the soil at other locations in the field, and has higher reflectance in the infrared region of the radiation spectrum. Reflectance in the infrared (IR) range of the radiation spectrum is very sensitive to soil moisture content. Variations in soil moisture and plant vigor show up as variations in near IR (0.7 - 1.3 µm) and mid IR (1.3 - 3 µm) reflectance. Some of the factors affecting soil surface reflectance include soil moisture content, soil texture (proportion of sand, silt and clay), surface roughness, the presence of iron oxide, and organic matter content. Soil moisture content is strongly related to soil texture. Coarse, sandy soils are well drained, resulting in low moisture content and relatively high reflectance, while poorly drained fine textured soils will generally have lower reflectance. Visual similarity of reflectance can be encountered in soils with different moisture content depending on the combination of the other factors that affect reflectance. However, this problem can be overcome by computer-assisted digital image analysis, particularly by separating out the effects of variations in soil type and ground elevation.

During the period immediately following the spring thaw, tiles start to flow and moisture differences on soil surfaces can be detected in the infrared spectral range. The best photographs can be acquired on a cloud-free day, two or three days after a rainfall event that exceeds 5 cm (2 inches). However, it is rarely cloud-free in the first few days after a suitable rainfall event, as solar heating of the moist soil surfaces produces overcast skies. Typically, there are no more than two or three times each year when the conditions are suitable for producing the required CIR photographs.

After the color infrared photographs are obtained, they are scanned into digital form and geometrically corrected based on ground control points from 1:24,000 topographic maps. They are then overlain by soil, elevation, administrative boundaries, and surface drainage maps to facilitate easier delineation of tile lines. The resulting tile map for a section of the Little Vermilion River watershed is shown in Figure 1. Many of the patterns observed in this subwatershed are also observed in most of the watersheds in Central Illinois:

1. Most of the drainage systems are irregular, that is, the drains are not laid out according to a pattern, nor are they equally spaced. Almost all existing drainage equations presuppose the existence of equally-spaced drains and, therefore, have to be modified if they are to be applied to Illinois.

2. There is a strong correlation between soil type and subsurface drainage density. Most of the drains are associated with Drummer Silty Clay Loam, one of the most productive soils in Illinois.
3. A small percentage of the subsurface drains cross the boundary of the watershed, a predictable phenomenon in flat watersheds. However, for the most part, the boundaries of the surface and subsurface watersheds coincide.

A Flood-flow Model for Tile-drained Watersheds
A knowledge of the extent of subsurface drainage networks in a watershed can lead to the development of comprehensive models that combine surface runoff and tile flow. In one such model being developed and tested, a GIS-based interface is used to link the flood-flow model HEC-1 with RAPIDFLOW, a drain flow routine based on the deZeeuw and Helinga fluctuating watertable equation.

The graphical user interface developed for use with the comprehensive hydrologic model is interactive. It supports and runs (processes) the combined model (HEC-1 and RAPIDFLOW) and displays the output in multiple windows on a single platform PC. RAPIDFLOW is embedded within the interface, whereas HEC-1 is run externally. HEC-1 is used to calculate infiltration based on the Green-Ampt infiltration equation. This infiltration is used in RAPIDFLOW to calculate the fluctuating water table depth and the volume of water drained. Using Arc/Info, a buffer region is created around each tile line, representing an effective drainage region that is drained by that tile. The interface program estimates the buffered area, which is then treated as a subsurface watershed. The subsurface watershed area is the portion of the subwatershed contributing to tile flow. HEC-1 then treats the hourly tile flow predicted by RAPIDFLOW as the rainfall input for a totally impervious pseudo watershed equal in area to the surface subwatershed. The resulting hydrograph is routed using the same procedure used for the surface subwatersheds. A flow chart of the linkages between HEC-1 and RAPIDFLOW is shown in Figure 2.

The application of the combined HEC-1/ RAPIDFLOW model to a rainfall event in the East Embarrass subwatershed that occurred in July, 1998, demonstrates the benefit of the added drainflow component. The total rainfall depth was 7.8 cm over three days, but conditions were such that the traditional HEC-1 model did not indicate any storm flow. The infiltrated water was then used as input for RAPIDFLOW, run with the set of input parameters shown in Table 1.

These parameters were not calibrated for the simulation, the values being based on soil type and common drainage practices in the watershed. The effective drain spacing is a concept introduced to get around the fact that the drains in the watershed are not parallel. That value used was based on calibration done in another watershed for random drains in Drummer soil.

A comparison of simulated and observed flows is given in Figure 3. The patterns in the two flow series are similar, particularly in the times at which the peak flows occurred. The model overpredicted the peak flow by close to 20%. The major discrepancy is in the shape of the recession limbs of the two hydrographs. This may be due to the fact that the deZeeuw and Helinga equation is based on the existence of parallel drains. A new and more appropriate fluctuating water table equation that is not predicated on the existence of parallel drains is being tested. It is expected that when this equation is incorporated into RAPIDFLOW, a better fit will be produced. In any event, however, even in its present state, the combined model provides more accurate results than the existing version of HEC-1.

The work described above is just a small part of the research effort to characterize the hydrology of tile-drained watersheds. Other projects include the development of drainage equations for irregular systems, the development of a modified curve number model for drain flow, and the use of GIS tools to transform field-scale models into watershed scale models. Much of this research puts the department at the forefront of work in subsurface drainage, particularly in watersheds with irregular drainage systems.

<table>
<thead>
<tr>
<th>Hydraulic Conductivity</th>
<th>4 cm</th>
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<tbody>
<tr>
<td>Drainable pore space</td>
<td>0.05 m³/m³</td>
</tr>
<tr>
<td>Initial watertable depth above tile drain</td>
<td>0.2 m</td>
</tr>
<tr>
<td>Effective drain spacing</td>
<td>30 m</td>
</tr>
<tr>
<td>Depth of impermeable layer from tile drain</td>
<td>1 m</td>
</tr>
</tbody>
</table>

Table 1. Input RAPIDFLOW parameters for sample application
Figure 1. Layout of drainage tile in the Upper Little Vermilion River Watershed

Figure 2. Flow chart for combined model

Figure 3. Simulated and observed hydrographs for example model application

For more information contact:
Dr. Richard Cooke
Agricultural Engineering Department
1304 W. Pennsylvania Ave., Rm. 332
Urbana, IL 61801

217.333.0944 phone
217.244.0323 fax
E-mail: r-cooke@uiuc.edu
Robert R. Rowe (BS ’49) moved to Mars, Pennsylvania (25 miles north of Pittsburgh) about five years ago. After 30 years of singing in the church choir, he joined the “Notables,” a local Barbershop Chorus and he is learning to play the organ for a change of pace. Robert enjoyed the visit from Wayne and Mary Anne Maley last fall and the Christmas letters from Bob Tweady and S.S. DeForest. Old friends are always welcome if you are traveling his way. He is only five minutes from the Pennsylvania Turnpike and Interstate 79.

Allen R. Rider (Ph.D., ’73) assumed the duties of Vice President, North American Commercial Operations on January 1, 1999. Dr. Rider continues to maintain his position as President, New Holland North America. New Holland is a world leader in the design and manufacture of a full line of agricultural and construction equipment, and offers a rapidly expanding line of financial services in many of its markets. The Company and its joint venture partners operate through a global network of over 6,000 dealers and distributors. Consolidated net revenues exceeded $6 billion in 1997. Congratulations!

Dorland W. Smith (BS ’58) and his wife, Marilyn, celebrated their 40th anniversary during the 1998 Thanksgiving holiday. Mr. Smith retired after the first of the year from Menard Electric Cooperative where he was general manager.

Michael F. Walter (MS ’70/BS ’68) sent us an update on his family. They are becoming a family of Ag Engineers. His oldest son Todd, his wife Christa and his oldest daughter’s husband, Jay, all have BS degrees from Ag and Biological Engineering at Cornell. Six of his children have left home leaving only Mahama, who is a freshman in high school. Dianne works full-time plus about 50 percent more as a volunteer 4-H leader and with a couple of committees on special education.

Erin (Shaw) Cartland (MS ’94/BS ’92) recently sent an e-mail updating us on the happenings in her life. In 1997 she and her husband, Clayton, were in a severe car accident in Cabo San Lucas, Mexico and had to be air-ambulanced to La Jolla, California for treatment. Thankfully, everything is ok now, except Erin has permanent hardware in her left leg - airports just love her! Erin is working for Electronic Data Systems in Ames and working on her MBA Saturdays and evenings at Iowa State.

Michael G. Curl (BS ’98) married Kimberly Kraemer on August 1, 1998. Michael is a design engineer with the transmission unit of Caterpillar, Inc. in East Peoria. The couple reside in Peoria, Illinois.

Varghese M. Kurien (MS ’95) started a new job with Dames & Moore in Rolling Meadows, Illinois in December of 1998. Dames & Moore is an environmental consulting firm. Congratulations Varghese!

Andrew M. Riggins (BS ’96) transferred to the John Deere Company – Minneapolis Branch in October 1998. He is a Territory Aftermarket Manager for Southeast Minnesota. Andy and his wife, Holly, reside in Rochester, Minnesota.

Curtis Ritter (MS ’97/BS ’93) is employed with Detroit Diesel Corporation in Detroit, Michigan and reports that he has been
involved with lots of interesting projects. Curt also reports that he and his wife, Mary, have a happy healthy 11-month old son, James. Congratulations Curt on the new member of your family!

**Timothy T. Schaberg** (BS '96) is now working in Peoria, Illinois for Komatsu as a hydraulic engineer. His responsibilities include the hydraulic systems, cylinders and suspensions that go into large dump trucks.

**Gary D. Uken** (BS '90) and his wife, Janet are the proud parents of Ethan Noyes, born August 19, 1998. Gary is a project engineer with Caterpillar in DeKalb, Illinois. Ethan was named after Noyes Lab where Gary and Janet first met while taking Chem 101 at UIUC. Congratulations!

**Corey R. Weddle** (BS '96) recently assumed the position of Project Manager for the Desktop Software Group at Ag. Leader Technology in Ames, Iowa. Congratulations Corey!

**Yanling Zhao** (Ph.D. '98) accepted a position as Hydrogeologist with the South Florida Water Management District in December 1998.

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**Condolences**

The Department of Agricultural Engineering faculty, staff and students wish to extend their condolences and sympathy to the families and friends on the deaths of four of our alumni -

**Max D. Albin** (BS '51) passed away January 4, 1999 in Urbana, Illinois. Mr. Albin was the director of product engineering at Flo-Con Systems, Champaign, for 12 years. He was also a member of the Registered Professional Engineers.

**Randall L. Beasley** (BS '48) passed away on December 30, 1998 in Springfield, Illinois. He was an engineer with Coles/ Moultrie Electric Cooperative from 1948 until his retirement in 1988.

**Christopher J. Crowell** (MS '95/ BS '94) passed away on December 20, 1998 in Peoria, Illinois. He was a test engineer in the engine division at Caterpillar Inc.’s Tech Center since 1995. Christopher was a Jonathan Baldwin Turner scholar and was named outstanding freshman of the year. He received the John Deere Scholarship Award for outstanding senior in the College of Agricultural, Consumer and Environmental Sciences (ACES). He volunteered for Big Brothers, Big Sisters and at OSF Saint Francis Cancer Care Unit.

**Dean L. Searls** (BS '37) passed away quite suddenly on January 21, 1999 at the age of 84. Dean was former manager of Adams Electrical Cooperative and an External Adviser to the department for two terms. He was formerly of Camp Point and more recently of Westview.

The department would also like to express our sympathy to **Maurice L. Burgener** (MS '49/ BS '48), **David B. Burgener** (BS '73) and the entire Burgener family on the tragic death of their granddaughter and daughter, Kristy. Kristy died of an advanced form of Kidney cancer that remained hidden without symptoms until four weeks prior to her death. The family is setting up a scholarship fund to remember Kristy, her desire to help others, and to do her best at whatever task she undertook. Those persons desiring to contribute to that fund should send checks made payable to:

St. Peter’s Church  
125 West Church Street  
Elmhurst, IL 60126  
Please note on the check “Kristy Scholarship”

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Moving???? Don’t forget to write!
Jeffrey P. Ehrhardt will have his name inscribed on the Bronze Tablet that hangs in the Main Library Building. The Bronze Tablet is recognition of continuous high academic achievement and is the campus-wide highest academic honor. Jeff received this recognition because he had a minimum 3.5 cumulative grade-point average for all work taken preceding fall semester and he also ranked, on the basis of his cumulative grade-point average, in the top three percent of the students in the college graduating class. Congratulations Jeff!

Jeffrey A. Duncan was inducted into the Phi Kappa Phi, an Academic Honorary Fraternity.

Jason O’Connor is the recipient of the Hebert Hoemann Memorial Scholarship. The scholarship was presented at the Grain & Feed Association of Illinois Annual Convention and Trade Show held February 14-16, 1999 in St. Louis, Missouri.

Armando Najero has been selected to be a participant in the Fiat Worldwide Management Training Program. He is only one of four U.S. participants. This is a wonderful opportunity for Armando.

Sheila Sahu received the Anderson Outstading Student Certificate at a dinner held on February 15 at the Urbana Holiday Inn. Sheila received the certificate for her GPA and strong leadership activities.

Amanda M. Peters of Rantoul, Illinois, was honored as a recipient of the Jonathan Baldwin Turner (JBT) Agricultural Scholarship during a December 4th banquet held at the Illini Union on the University of Illinois Urbana-Champaign campus. Amanda is majoring in agricultural engineering and plans to specialize in food and bioprocess engineering. The Faculty of the Department of Agricultural Engineering funds Amanda’s scholarship.

Amanda M. Peters and Loren E. Bode

ASAE Student Club and Ag. Mech Club Spring Banquet

April 18, 1999 was the date for the combined ASAE Student Club and Ag. Mech Club spring banquet. The following students were recipients of our department awards this year.

Bateman Congeniality - AGE
Bateman Congeniality - TSM
Frank W. Bauling Memorial
K.J.T Ekblaw Scholarship
Espy Prize for Exemplary Service
John Deere Dealership Mgt. Program Scholarship
John Deere Foundation
E.W. Lehman - AGE
E.W. Lehman - TSM
Bernard C. Mathews/ Mathews Company Scholar
Jonathan Pierce Memorial
TSM Outstanding Senior
J.A. Weber Memorial

Congratulations to all of the award recipients!
LET US KNOW ...  ALUMNI INFORMATION SHEET

Name: _______________________________ Year Graduated: _____________________

Home Address: ____________________________________________________________

City, State, Zip: ___________________________________________________________

Business Title/ Profession: ________________________________________________

Company/ Institution: ____________________________ Phone: ____________________

E-mail Address: ________________________________

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