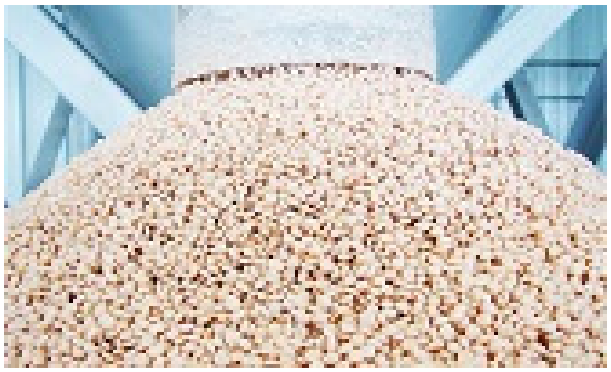
MARCH 2019

POLYTECHNIC RESEARCH AND ENGAGEMENT NEWS

In this Newsletter:

Bulk Solids Innovation Center Studies Pneumatic Flow of Wheat



Pneumatic conveying systems, which move bulk materials with the use of air, can be found any location where large amounts of loose substances are moved, stored or handled. This includes food processing plants, grain facilities, chemical/petroleum manufacturers and all types of factories. In the Midwest, they are essential for the movement of wheat, corn soybeans and milo into and out of grain elevators, trucks and rail cars.

However, these systems are not perfect, so the Bulk Solids Innovation Center (BSIC) has been working with Tech 4 Imaging to find solutions to challenges that grain elevators face as they construct new storage and processing facilities, which may include bins of up to 1 million bushels capacity. One such problem is the movement of white wheat, a premium commodity that is in high demand from national and international consumers.

First is the challenge of accurately monitoring the flow of solid material in a pneumatic line. Current methods rely on weighing the amount of material as it arrives in a bin, calculating the flow rate and then adjusting the feeder valve. Although it works, eventually, it relies on trial and error and must be re-calibrated for each different material - a time consuming process! However, the BSIC has recently completed a series of tests on an adjustable flow rate meter that can be used to set and maintain a highly accurate flow rate throughout the system. According to Dr. John Lawrence, BSIC Executive Director, this new technology will increase efficiency, reduce costs and improve industry outputs.

Next is the challenge of finding the most effective method to move wheat kernels without breaking them or producing highly explosive grain dust in the elevators. The BSIC explored both dilute phase conveying (low pressure, high velocity) and dense phase conveying (high pressure, low velocity). When the data were collected, it was found that dense phase conveying produced less dust and less breakage. Moreover, this method uses no moving parts, unlike the dilute phase which has metal screws and bearings that can potentially produce sparks that ignite air-borne grain dust.

However, elevator operators must weigh the cost of installation for dense phase conveying systems, which be up to 5 times that of dilute phase. Even though the operating costs of both systems are comparable, current low grain prices may be a significant factor in the decision-making process for grain food manufacturers and elevator operators. The availability of up-to-date and accurate information from the BSIC is a huge public benefit for businesses that must make difficult economic and safety decisions.

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KSU Polytechnic Global Aviation Initiative

In November 2016, Polytechnic received a charge from the president's office which originated with the previous president, Kirk Schulz; identify what we do best and work to make it world class. This quest was undertaken by President Meyers when he took office. It was clear to many that Polytechnic already has many strengths in the fields of manned and unmanned aviation, but how to build Polytechnic into a world-wide educational destination isn't as obvious. A national search for information was started.

First, Polytechnic contacted the corporate executives of about 35 global aviation companies, airports, trade organizations and the like and asked them, "What are the issues that keep you up at night?" The information they shared identified some possible opportunities, and some needs that have not yet been addressed.

Next, with financial support from the City of Salina, Salina Chamber of Commerce, Economic Development Organization, The Salina Airport Authority and others, a consultant was hired. The consultant looked at global trends, local resources, and campus strengths and recommended that Polytechnic focus on public safety for UAS (unmanned aerial systems), and on manned aviation with both a short-term and a long-term focus. In the short term the main focus is to help industry solve the significant talent shortage that has recently emerged in the aviation industry in many key technical areas. In the longer term the focus is on establishing a leadership position in aeronautical education through innovative approaches to training, research that drives economic innovation, and thought leadership.

An internal study group is currently working to identify specific short and long-term goals for the college, and set up a step-by-step plan to move in the direction of increased global competitiveness and a more streamlined structure. The committee members are dedicated to finding ways to increase the synergy between engineering and aviation for more robust student learning. This will lead to long-term sustainability both in the industry and on our campus, better use of resources and increased opportunities for growth.

At this point in time the president and most of his cabinet members have been briefed on the results of our planning process and we are awaiting feedback from university leadership as to which of those directions they would like to see us move forward with. We've been told to expect a formal response sometime in May after the leadership cabinet has had a chance to fully deliberate.

For more information about this exciting project, contact Dr. R. Kurt Barnhart, Associate Dean of Research and Engagement at kurtb@ksu.edu

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Dr. Joseph Studies Electric Vehicle Charging Practices

Dr. Siny Joseph, Associate Professor of Economics at KSU Polytechnic, was one of the authors on a study that explores the cost of charging electric vehicles, both to the power generating organization and the customer. The study was published in The Institution of Engineering and Technology Journal in November 2018.

According to the study, the increasing numbers of electric vehicles (EV) are putting a strain on the electric distribution system's transformers. Researchers have found that the vehicle's high-power charging demand wears out the transformers more quickly than normal, especially if vehicles are charged when the overall demand for electricity is high. Using variable pricing, day-ahead scheduling, customer satisfaction, and transformer loss data, the authors have identified a possible algorithm to maximize benefits to both the electric distribution system and electric vehicle owners.

The authors looked at "neighborhoods" of electric vehicles, treating each neighborhood as a virtual power plant (VPP) with a finite amount of energy available. They postulated that some consumers would be willing to schedule their charging a day in advance, at a time set by the power distributor. These consumers would benefit from paying a lower price per unit of power used, and the distributor would benefit from being able to manage the loads on their transformers.

However, other customers who are not as willing to wait would pay a premium price for their power in exchange for being able to charge their vehicles at an unscheduled time. These customers would benefit by being able to charge their vehicles whenever they wished, and the power distributor would have sufficient income to replace transformers worn out more quickly by high-power charging when the overall electric demand is also high.

The authors conclude that a price-based EV charging scheme raises the potential of a better understanding of consumer behavior. It also ensures that cost of unplanned charging and the increased equipment wear is borne by those specific EV owners and others will not be affected.

The article is available online at 10.1049/iet-gtd.2018.5754
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National Institute of Justice Funds KSU Polytechnic Award to Evaluate Remote Sensing Technologies for Forensic Crime Scene Reconstruction

The Applied Aviation Research Center (AARC) on Kansas State University's Polytechnic Camp us is working with law enforcement partners to evaluate small unmanned aircraft (sUAS or drone) remote sensing technologies to reconstruct crime scenes.

Under the grant, sponsored by the National Institute of Justice, the AARC is collaborating with the Kansas Bureau of Investigation, the Riley County Police Department, and the Kansas City Missouri Police Department to evaluate sUAS remote sensing technology and compare it to the conventional methods that use ground-based LiDAR systems for crime scene reconstruction.

The study will be conducted at multiple test locations during day and night conditions. Using quantitative and qualitative metrics, the team will evaluate each technology and will produce a journal article detailing the equipment, methods, and results of the research. The information gathered may impact up to 3000 law enforcement agencies and other organizations.

Funding for this research, titled "Evaluation of Terrestrial Laser Scanning and Aerial Remote Sensing with sUAS for Forensic Crime Scene Reconstruction" comes from a seven-month, $91,416 grant from the Department of Justice, National Institute of Justice, Research and Development in Forensic Science for Criminal Justice Purposes program. According to Kurt J. Carraway, the AARC's UAS Executive Director, the strong relationships that AARC has built with multiple law enforcement agencies over the past several years are an essential component of the study.

This project will explore the benefits and compromises of using remote sensing technologies to produce precise reconstructions of outdoor terrain and features. M. Wade Cherms, Riley County Police Department Crime Scene Investigator, says "with continued research in forensic documentation, identification, processing and reconstruction, the application of UAS operations has the possibility to positively impact and support public safety agencies in many facets of crime scene. Conducting trials and testing could impact investigations from scene to courtroom by knowing what works in certain applications indicated through the collection of data."

"Terrestrial laser scanning is an instrumental tool in accurately depicting various crime scenes for use in court," said Assistant Special Agent in Charge Robert Jacobs, who oversees the Kansas Bureau of Investigation's Crime Scene Response Team. "TLS is extremely helpful, but we're interested in seeing how the aerial data compares. The aerial perspective has strong potential

to provide more details in some instances and may be a quicker and less complex approach to collecting the data."

To learn more about this research and other training opportunities and services offered by Kansas State Polytechnic's Applied Aviation Research Center, contact Kurt Carraway at 785-833-2152 or kcarraway@k-state.edu.

This project was supported by Award No. 2018-R2-CX-0031, awarded by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The opinions, findings, and conclusions or recommendations expressed in this publication/program/exhibition are those of the author(s) and do not necessarily reflect those of the Department of Justice.
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