Agricultural Engineering Student Projects Focus on Practical Solutions  
by Bruce Erickson

A low-cost secondary containment system for mini-bulks. A sprayer for your ATV. A blower to keep the feederhouse clean on a combine. A way to evenly apply pesticides to grain going into a bin. These were just four of the ten Agricultural Systems Management senior capstone projects displayed at Purdue University last week.

“My goal was to develop something that had utility for a farmer,” said Ross Chapman, regarding the feederhouse debris cleaning system he and colleagues developed. “Compared to older models, the feederhouses on later, bigger models are wide, allowing plant residues build up—the accumulation blocks your view, and it becomes a safety hazard. Anyone who has ever worked around a combine knows how slick those surfaces can become.”

**Feederhouse Debris Cleaner.** Chapman and classmates tried three different fan systems—ones that could be powered mechanically, hydraulically, and electrically. Each engaged with the header control, and was designed to withstand the tough environment that would be present at the interface of the combine and the header. The electric fan option, moving 400 cubic feet of air per minute proved to be the least expensive with materials costing less than $200, and was adaptable to multiple makes and models of combines. There were complications with rigging up the mechanical and hydraulic options, with parts pricing in the $500 range.

**Pesticide Containment.** This team was charged with designing an inexpensive structure to contain an accidental spill from a mini-bulk pesticide container. Commercial containment tanks are available but can run $1,000 or more. In the future, secondary containment structures may be mandatory equipment for certain pesticides.

The design specifications were that the containment structure must be made from readily-available materials, be portable, have the capacity to hold 700 gallons of a potentially corrosive liquid, and a life span of at least ten years. Designs using grain bin rings, hay rings, metal stock tanks, and wooden boxes made of 4 x 4’s and plywood all proved quite workable. But all of these systems depended on a chemical-resistant 36 mil polypropylene liner costing $350 to $450, making the overall cost prohibitive. If a cheaper liner were available, all but the bin ring design could be built for less than $500.
Utility Sprayer. Revamping a sprayer to be mounted into a John Deere gator was the goal of this team. The group started with a three-point, PTO driven sprayer with manual controls to one that could be easily moved into and out of a gator, for maximum utility.

The finished sprayer unit was wired through the cigarette adapter and featured a 5 GPM, 45 PSI 12-volt pump, ten-foot boom and a 50-foot retractable hose and gun on a reel. Other features included a spray monitor with pressure control, solenoid controlled valves for the boom and spray gun, and quick and easy cleanout.

Grain Pesticide Applicator. Pesticides applied to grain going into a bin are often treated with a single nozzle mounted above the auger hopper, often resulting in poor distribution on the grain. The purpose of this project was to convert a rotary screen grain cleaner into a rotating pesticide applicator, in hopes of converting potentially unused equipment into an inexpensive way to evenly apply pesticides.

The original screen enclosure of the grain cleaner was replaced with a Plexiglas enclosure for observation, but sheet metal could be used as well. Nozzles were selected to apply a rate in step with the rate of grain flow into the cleaner, and then videos were taken to see how grain flowed through the cleaner. A variable rate controller was tested to adjust rates for variances in grain input.

After the judges left and the ballots were counted, the team with the utility sprayer had won. According to Gaines Miles, Professor of Agricultural and Biological Engineering and advisor to these students, “this was an especially hard-working group—and resulted in some of the most innovative projects that we have ever had.” Other projects included a convenient trailer for ATVs, the relative precision and accuracy of GPS receivers, and a sweet corn harvesting system.

Team Members and Sponsors of Featured Projects:
(Click on links below to see the actual posters as presented.)

- [Feederhouse Debris Cleaner](#) sponsored by Chapman Farms. Ross Chapman, Brad Craycraft, and Joe Riner
- [Low Cost On-Farm Containment for Pesticide Storage](#) Sponsored by Dow AgroSciences. Andrew Cook, Jeremy Peacock, and Lance Setterdahl
- [Post-Harvest Pesticide Applicator](#) Josh Schmidt and Josh Martin
- [Utility Sprayer: Updating, Rebuilding, and Adapting Project](#) sponsored by Monsanto. Dan Murphy, Sam Nesbitt, David Ferguson, and Andy Marchese