4-30-2014

Volume 49 - Issue 24a - Wednesday, April 30, 2014

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The Rose Thorn

Design Team Spotlight

Rose-Hulman Institute of Technology • thorn.rose-hulman.edu • Wednesday, April 30, 2014 • Special Issue

The Human Powered Vehicle and concrete canoe build on past experience.

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Design/Build/Fly soars over the competition.

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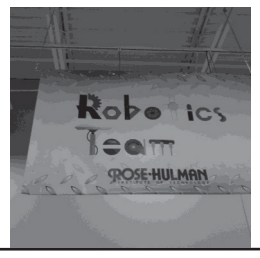

Engineering students applying their multidisciplinary knowledge to a common goal.

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RHEV

Bethany Martin • editor in chief

Rose-Hulman Efficient Vehicles (RHEV) is a club team that has been designing, building and competing with high-efficiency vehicles for almost ten years. The team has regularly placed in the top 15 in the Shell Eco-Marathon contest in Houston, Texas since 2007.

The event's goal is to be the team with the vehicle that goes the furthest using the least amount of energy. The team also competes in the Society of Automotive Engineers (SAE) Supermileage competition at the Eaton Proving Grounds in Marshall, Michigan each year.

The team's record mileage is 1972.3 miles per gallon of gasoline at Rockingham Speedway in Corby, England. This record was achieved in 2007. The team recently returned from the 2014 Eco-Marathon and placed fourth in the alternative fuel prototypes category.

The Rose-Hulman Efficient Vehicle in action

Courtesy of RHEV

The vehicle must pass a technical inspection before the vehicle is allowed to practice and compete. Some of these restrictions include having a floor to protect the driver from the ground while driving; the driver may not have access to the wheels and must wear a five point harness. The vehicle itself must have a firewall, roll cage, on-board fire extinguisher, and horn for passing other competitors. In past years open topped vehicles have been allowed, but in 2015 the rules will change and the entire vehicle must be covered. The vehicle must be capable of protecting a driver in the event of a collision or rollover. The vehicle cannot have appendages that change due to wind while the vehicle is in motion. The vehicle must have a constant shape and cannot have external additions that are harmful to other competitors.

The RHEV interim advisor, Dr. Ashley Bernal, says that she enjoys, "seeing them learn and help other teams." Dr. Bernal went on to describe how the team would often give out extra harnesses and lend tools to competitors. She said that she was proud of her students because, "not all teams are like that."

GPE

Bethany Martin • editor in chief

Rose-Hulman Grand Prix Engineering (RoseGPE) is a team that designs and builds competitive formula style race cars to perform in a worldwide competition called Formula SAE (Society of Automotive Engineers) series. The vehicle is totally by designed Rose-Hulman students. The focus of the club is to create a finished product using, "robust engineering, ... simulation software, and testing to validate design decisions," says RoseGPE President Brandon Hasenour.

> The team was founded in 2009 and has since competed twice.

They are represented by their advisor Dr. Daniel Kawano. Dr. Kawano says that, "it is always a great pleasure watching the team take... a concept in CAD and have that materialize into a car running under its own power." Even though they often run into major failures during the manufacturing and testing phases, Dr. Kawano is, "always impressed with the students' motivation to overcome these challenges."

The goals of the organization are to "develop undergraduate engineering students into critically thinking, experienced, and confident engineers... to then gain leadership and management experience as upperclassmen" as well as, "to achieve the highest possible score at competition through allocating time and effort in the areas with the greatest reward," says Hasenour.

The team was founded in 2009 and has since competed twice. The first time in 2011, they finished 55th out of 98 teams. The second time they improved remarkably, moving up to 15th out of 105 teams. This year the team plans to

> The second time they competed they moved up remarkably.

compete in Michigan; May 14th through the 17th.

Next year the team plans to use the same Honda CBR600f4i engine as with their previous cars, but they will be constructing a new suspension design and frame to make way for the new ten inch wheels that are taking the place of the old 13 inch wheels. The team hopes to test down force and turning grip of the aerodynamic wings next summer.

This team is sure to make a splash in the formula racing community in the future.

Concrete Canoe at Great Lakes competition

Bethany Martin • editor in chief

Several Rose-Hulman students recently participated in the American Society of Civil Engineers (ASCE) Great Lakes Conference at the University of Illinois. Among the participating teams were Concrete Canoe and Steel Bridge

Concrete Canoe is a relatively young design team for Rose-Hulman as it was reestablished only four years ago. The team has had its ups and downs in recent years, having only been able to compete twice in its new existence. One year the team was unable to compete due to the cold weather and safety issues.

The Concrete Canoe design team has room to improve. They have placed low in recent years, but they have pinpointed their faults. Junior Civil Engineering student Jacob Gould says, "The reason we did so poorly [was] because of attention to detail." He added that this year they, "had a better overall product compared to years past, but the minor details proved to be costly."

Next year the team plans to rethink their design and overall team structure. They hope to have three or four different focus teams working on different aspects of the canoe. The plan is to incorporate an external mold that the concrete is molded inside to aid in smoothness, strength, overall shape, and aesthetics. The new mold will take more time initially, but will pay off in the long run. They will save money and time when they reuse the new mold. They plan to change the composition of the concrete to make it more workable and rethink the reinforcement inside the canoe itself to improve the durability and competitiveness. This team is one to watch for continued improvement.

> "This team is one to watch for continued improvement.

A BLIP ON THE RADAR

HPV team sees small dent in monumental number of victories

Katrina Brandenburg • editor in chief

The Human Powered Vehicle (HPV) team has been building streamlined and recumbent bicycles since its founding in 2005. Over the years it has been highly successful, winning for the first time at both annual competitions, East and West, in 2008 with a bicycle named Infinity and continuing that success at all except three competitions since then. In 2011 the team even hosted the competition for the eastern coast at the Indianapolis Motor Speedway.

This academic year members of the team traveled to India where they volunteered at a newly founded human powered vehicle competition there. They also placed second at East competition and first place overall for the West competition.

The four components of an HPV competition are design, innovation, speed, and endurance. These components of extend the competition beyond racing bicycles to include a 30-page report and an oral presentation for the design portion. A smaller report, an innovative manufacturing or vehicular feature, and a demonstration are required for the innovation portion of the competition.

The sprint tournament is either a top speed competition or a drag race. The endurance competition pushes both bicycle and rider to the limits; it is a 2.5 hour race on a circuitous path.

The bike that can be given credit for this year's successes is a delta-style tilting tricycle, Namazu. It has two rear wheels, which can be locked upright or allowed to tilt with the vehicle, to allow the tricycle great stability at low speeds or performance and handling at high speeds. It won the design portion of both competitions. Other placements this year were second in innovation at East, first in innovation at West, third in men's speed at West, and the team spirit award at West.

Namazu, the vehicle for this year's competitions.

Courtesy of Human Powered Vehicle

The Rose Thorn interviewed the team's project manager and president, Ben Griffith. Ben is a member of the class of 2015 and pursues a degree in mechanical engineering. He will also compliment his major with a minor in robotics.

Thorn: Could you share some brief information about your role on the team?

Griffith: Unlike what one would expect, my job isn't to be the technical leader of the team. My role is keeping the team organized and motivated, creating a project schedule and trying to keep us on it, and taking care of any necessary bureaucracy. My biggest responsibility is understanding the strengths of all the team members.

Thorn: How about some background information? General information about what you do.

Griffith: The team builds a new streamlined and recumbent bicycle each year. Recumbent means that the rider sits in a laid back position, which gives better power output and makes it easier to create a streamlined fairing that fits around the rider. The vehicle has to be designed to balance raw speed with practical considerations such as turning and fitting multiple riders.

Thorn: What is the plan for the team next year?

Griffith: We'll be having officer elections soon and then start planning for next year. The competition has been undergoing a series of changes to greater emphasize practicality and innovation, so we'll have to take all of that into account when we start our design again.

Thorn: Who is your advisor now? What role does he play in your organization? In the program overall?

Griffith: Dr. Moorhead has been with the team for years, and he races his own recumbent bicycle. His experience with the competition and fluid dynamics make him a great technical resource, and he's always available to help us navigate the bureaucracy and provide advice. This year he stepped up to be the new head of the HPVC planning committee... With Dr. Moorhead running the competitions Dr. McSweeney has joined our team. As a cyclist, he brings real world experience and perspective from someone who could commute on a vehicle like ours.

Design/Build/Fly Team Accomplishes Great Success in the 2014 DBF Competition

Interview

Dr. Calvin Lui
Design/Build/Fly faculty advisor

Dr. Calvin Lui, Associate Professor of Mechanical Engineering, has served as the advisor of DBF since its establishment eight years ago.

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Thorn: In your opinion, which years had the most successful teams?

Dr. Lui: As far as testing is concerned, 2011 and 2014 were the most successful years because we had a lot of tests and refinement before the competition. The two planes finished all the missions in the ways we designed them.

I always told the team that success is not only measured by ranking in the competition. If our plane performs everything we promise to deliver, I would call it a success.

Thorn: What is your role as the advisor for the DBF team?

Dr. Lui: Starting in the fall, I meet with the team every week. The team members regularly share their new ideas and update me on where they stand on the design path. I may challenge them with questions which they may have overlooked. But, the design is totally their own. On the logistics side, I need to ensure safety, spending within budget and provide critique on their design report. As our design matures, I like to push the performance of our plane to its limits. Our team responded well this year. We sat down and brainstormed all potential weight savings that could be done, then evaluated their merits by the possible additional points we could gain. We ended up with a lighter and faster plane at the end!

Thorn: Can you comment on this year's success?

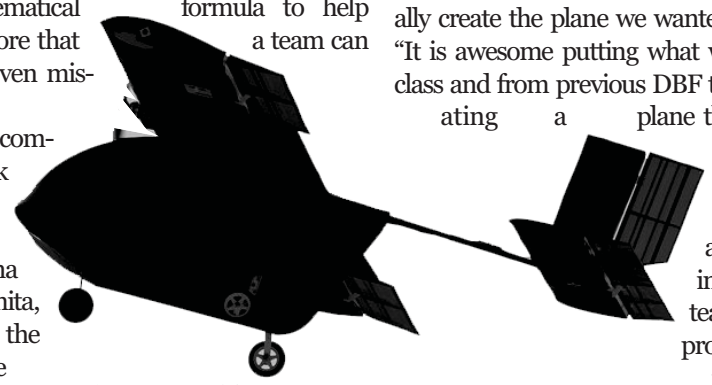
Dr. Lui: Our team was motivated to compete this year. Our airplane was light and fast. It is capable of reaching a top speed of 35 mph. Our dual-propeller system was well-tested and reliable. The plane had a built-up structure wrapped in a monokote layer and carbon fiber that provided the needed strength but saved on weight. The down side was that if it was impacted severely, the structure could be destroyed. Every single detail counts. This year, the team took time to cut down unnecessary material on the plane making it competitive. The team ranked 13th out of 80.

Thorn: What is the most fun part of the competition?

Dr. Lui: The mission requirement for each year is so different, usually the strategy from previous year is not reusable. That's the fun part, the team needs to make a new design every year. Witnessing how the team matures over the years is rewarding!

Elena Chong • news editor

Every year, the Rose-Hulman Design/Build/Fly (DBF) team competes in the national DBF competition sponsored by the American Institute of Aeronautics and Astronautics (AIAA). The purpose of this competition is to build an airplane that can take off, fly, and land safely by remote control. Participant's planes are evaluated in three different flight missions. The challenge of each mission changes from year to year and the details are provided in the competition rules that are published every August. Usually, they provide a mathematical formula to help determine the score that a team can obtain for any given mission.



Black Widow, the 2014 airplane designed by the DBF team

Courtesy of the Design/Build/Fly team

The 2014 DBF competition took place on the weekend of April 11-13 at Cessna East Field in Wichita, Kansas. This was the 18th year of the competition. The competition started with the Taxi Mission, which required the plane to taxi on a simulated rough surface. Flight Mission One was a ferry flight. The plane had to fly as many laps as possible under four minutes. Flight Mission Two was a maximum load mission. The team had to carry as many cargo-blocks as possible for three laps. Flight Mission Three, the last mission, was an emergency medical mission. The plane had to carry a fixed payload on a timed three-lap flight.

Since the establishment of the Rose-Hulman DBF team in 2007, it has been open for all students. However, because of the massive time commitment, a mechanical engineering senior capstone design project group was implemented within the team in 2008. The five senior mechanical engineering students who majorly contributed to this year's airplane are Craig Godbey, Zach Ernst, Kristin Uuk, Richard Neal, and Joshua Yoder.

The Rose-Hulman DBF team built their plane based on the mathematical formulas provided in the rules. This year, their airplane is a light (4.2 lbs) and fast machine that is capable of reaching a speed of 35 mph. The team calls their plane Black Widow, because of its color and design. "[In] DBF, we were able to use the equations and methods we learned to actually create the plane we wanted," Zach Ernst states. "It is awesome putting what we have learned from class and from previous DBF teams into play in creating a plane that can actually complete the missions at our competition this year," Kristen Uuk adds. One significant improvement that the team made was to improve the propulsion of their plane. Dr. Calvin Lui, advisor of the DBF team, said the success of the team in this year's competition was due to the dedication of the team members. They studied and researched different motor and propeller combinations that optimized their chances of accomplishing and scoring on each mission. Over the past years, propulsion or the power management has been the biggest challenge, and this year, they were able to improve the plane's propulsion capability.

During the competition, the Rose-Hulman DBF team managed to make five full laps, 2500 feet each, in four minutes. They were just two seconds short from completing the sixth lap. The plane is capable of carrying two pounds of payload in a sustained flight configuration. Craig Godbey says, "This year we have figured out the methods to solve the problems that we have faced in the past, leaving the team in a better position for the years to come." The team ranked 13th out of 80 teams, which include teams from MIT, UCLA, Georgia Tech, Cornell, and international teams from Turkey, Israel, Korea, Thailand, and many more.

The mechanical engineering student members that went to competition are seniors: Craig Godbey, Zach Ernst, Kristin Uuk, Richard Neal, Joshua Yoder, sophomores: Mike Cirocco, Kane Weinberg, and Nick Wilkowski, the team pilot Tyler Collins from ISU, and team advisor Dr. Calvin Lui.

Courtesy of the Design/Build/Fly team

Rose-Hulman Robotics

Morgan Escalera • business manager

Rose Hulman is home to some of the finest engineers in the country, and many of those engineers enjoy extracurricular activities specializing in their professional interests.

Rose's robotics teams are a prime example of the drive to experience engineering related activities outside of the classroom. According to their advisor Dr. Mutchler, robotics makes students become better engineers, teaching them skills like team work and real world problem solving. It attracts a wide variety of students from different disciplines who wish to improve their machining, CAD programming, and software design skills. While this program is relatively new, Dr. Mutchler is confident that they will only get better with each passing year as they continue to practice and become more accustomed to the competition process.

The Rose-Hulman Robotics Team

Courtesy of the Rose-Hulman Robotics team

> "These challenges encourage students to become well-rounded engineers.

The Rose Hulman Robotics group is divided into four subgroups, each of which has their own officer who comes to meetings. These subgroups include the Marine Advanced Technology Education (MATE) program, International Ground Vehicle Competition (IGVC), and Combat Robotics.

MATE is an underwater and aerial program that was established in 2010. The machines are also characterized as remotely operated vehicles (ROV). The MATE competition changes each year. This requires team members to come up with original designs each season to accomplish the given task. The machine must complete a timed pool mission and be accompanied by a poster and technical report. The team is also required give a presentation to a panel of distinguished engineers in an evaluation. These challenges encourage students to become well-rounded engineers.

Over all, the robotics teams have 40 active members with some more joining intermittently.

IGVC

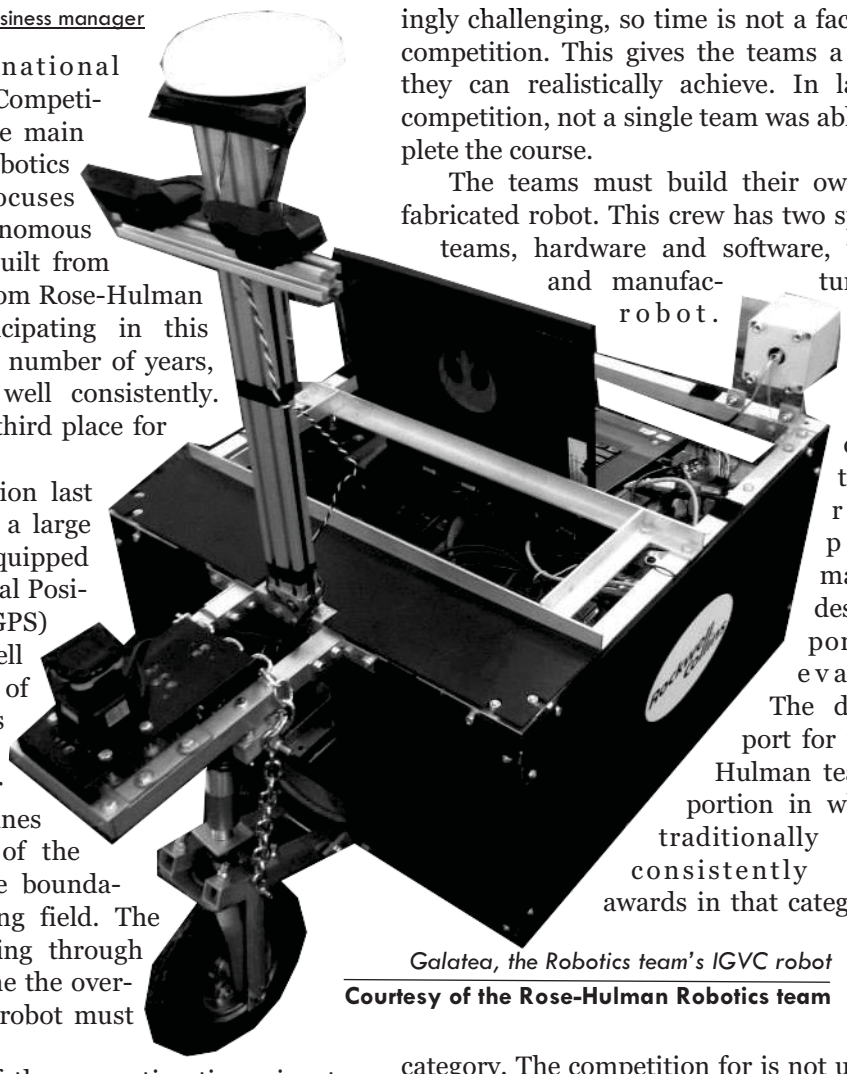
Morgan Escalera • business manager

The International Ground Vehicle Competition (IGVC) is the main stalwart of the Robotics team, and focuses mainly on autonomous robots that are built from scratch. Teams from Rose-Hulman have been participating in this competition for a number of years, and have done well consistently. They took home third place for design last year.

The competition last year consisted of a large grassy field equipped with various Global Positioning System (GPS) waypoints, as well as a multitude of obstacles; such as barrels, trash cans, and other debris. White lines on the grounds of the field serve as the boundaries to the playing field. The white lines snaking through the field determine the overall path that the robot must travel.

The object of the competi- tion is to touch all of the waypoints and get to the finish line. The contest is notorious for being exceedingly challenging, so time is not a factor in the competition. This gives the teams a goal that they can realistically achieve. In last year's competition, not a single team was able to complete the course.

The teams must build their own custom fabricated robot. This crew has two specialized teams, hardware and software, to design and manufacture their robot. During the contest and after its completion, the robot's performance and design report are evaluated. The design report for the Rose-Hulman team is the portion in which they traditionally succeed, consistently winning awards in that category. They often still do well in the performance category. The competition for is not until June, but the team is optimistic, especially because more can be accomplished on the software side of the project.



Galatea, the Robotics team's IGVC robot

Courtesy of the Rose-Hulman Robotics team

Combat Robotics

Morgan Escalera • business manager

Combat Robotics is the most popular section of the Robotics team. Even though it is in its first year, it has earned several awards and inspired a renewed interest in the field of robotics.

The team divided their efforts into two weight classes for the competition this year. The Combat Crew created a 15 pound fighting robot as well as three individual three pound fighting robots. The competition sets two robots against each other in an arena. Points are awarded for design, aggression, control of the opposing robot, and damage to the other robot. The arena for this competition is a large circle of concrete, enclosed in a dome of Plexiglas to ensure safety for the operators. The weapons used in the competition are varied, but can be classified in two major categories. Wedge bots use their sloped appendages to push opposing robots around the arena and flip them over. Spinners use vertical elements, usually a rod, to hit the other robot on its underbelly in order to turn it over.

> "The future looks bright for the Combat Robotics crew.

The main focus of the teams is to get the opposing robot upside down. Once a robot is flipped over it is essentially out of the game. These robots usually employ heavy shields to protect the electronics and controls. If those essentials get hit, it could destroy the robot. Because the focus is on flipping the opponent over, some robots, including one of the Rose-Hulman robots, employ a plate of metal that is kept low to the ground. This plate makes wedges and spinners less effective.

Maneuverability is also important for this competition. This keeps the offensive edge of your machine against the weak edge of the opponent's. The Rose-Hulman Combat Robotics team was focused on maneuverability rather than defense and did well in the competition. Their 15-pound fighting robot was awarded the second place out of 43 participants. In the three pound class, their three robots placed third, seventh, and eighth place.

In the future the team is hopeful they will do even better and compete in more than one competition per year. The future looks bright for the Combat Robotics crew.