

Under the Hood Final Report, 2010



Science Beyond the BoundariesSM

connecting museum educators around the world

As scientists push the boundaries of what we know, the Science Beyond the BoundariesSM network pushes museums' boundaries beyond their four walls, sharing scientific breakthroughs with millions of visitors worldwide.



In April 2010, the Saint Louis Science Center (SLSC) was chosen by the X PRIZE Foundation to create and coordinate a national education experience regarding the Progressive Insurance Automotive X PRIZE, a prize for a car that can get 100 miles per gallon. X PRIZE wanted to bring an understanding of the science and technology of the cars of the future to the public. They chose SLSC because of our Science Beyond the Boundaries network -- over 130 science centers and museums worldwide, reaching over 55 million visitors annually. In the short time between May and September 2010, members of this network came together to create programs around the country reaching over 1.3 million museum visitors. To support this collaboration, called "Under the Hood," SLSC developed and shared seven hands-on science activity carts and four 400-sq-ft exhibits. Many science center staff members were so pleased with their effectiveness that they are continuing to use the carts and exhibits well beyond the original September 2010 ending date, reaching thousands more visitors nationwide.

In addition, when the Under the Hood activity cart was displayed at the American Association of Museums conference, it generated interest from many museum staff members who were not participants in Under the Hood, but who saw, as SLSC did, that it was adaptable to cover science content on most any topic. Each drawer of the movable cart contains the supplies and instructions for a different hands-on science activity.

With mini-grants to support them, participating science centers developed programs customizing the educational themes to their audiences. The programs' names show their creativity: Crash Test Dummies, Future Car, A Little Explosive Fun, Build A Car, Inventors Workshop, Meet the TriHy, Green Design, Energy of the Future, Segways and High-Mileage Vehicles, Future Cruisin', and Maker Faire. In four years,

Science Beyond the Boundaries has grown from twelve museum members to 136 and Under the Hood is just one example of how much can be accomplished by this unusual group.



PROGRESSIVE
AUTOMOTIVE XPRIZE

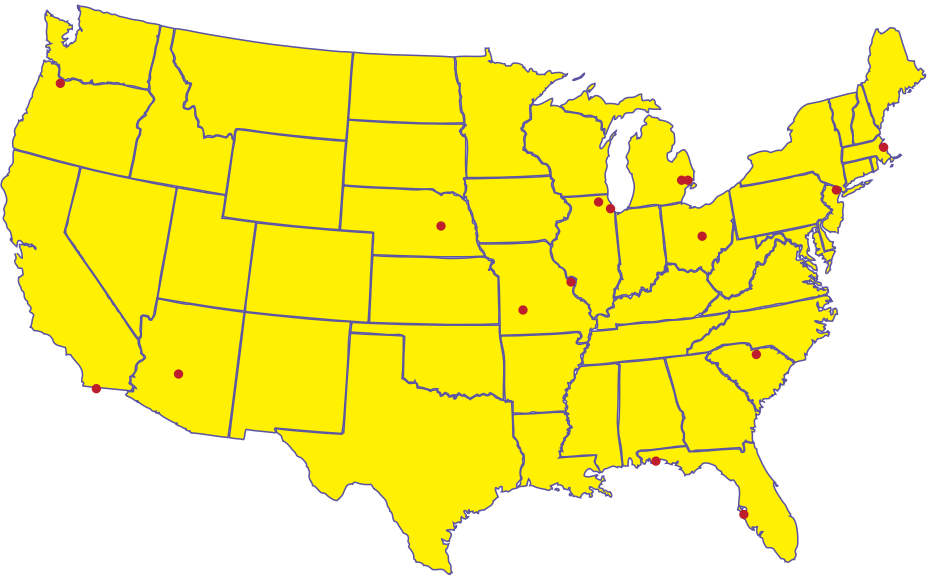


U.S. DEPARTMENT OF
ENERGY

CISCO




Under the Hood programs around the country:



The Arizona Science Center created Revved UP programs for our summer camp groups, a special family weekend and a member appreciation event. Activities included stations where guests raced solar cars, designed gear and circuits activities (Magnetic Gears Board; Snap Circuits), and built Spud Speedsters. Spud Speedsters are potatoes made into cars by pinning wheels into the sides or bottom of the potato. These were then placed on a downward sloping ramp and, three at a time, were released to see which speedster would reach the end of the track first. The speedsters were kept behind a bar which could be lowered, allowing the speedsters to simultaneously be released from the makeshift start line. At the end of the track were bumpers covered in a sliced open tennis ball to prevent the potatoes from being mashed by the metal bumpers. The more aerodynamic potatoes, or those with wheels placed to get the most traction, were often the fastest. There was also a timer display board that would record the first, second and third place potato to reach the finish line, just in case of a discrepancy.



The California Science Center used the Under the Hood demonstration cart to complement the alternative fuels, fuel cell, solar car, gears and wind tunnel exhibits in our *Creative World* gallery. Guests explored several different activities -- including making circuits, working with gears and seeing the difference between clean and dirty air filters – in small-scale interactions between individuals and groups. The cart was successfully integrated into our *Science Live!* program, our primary onsite means of expanding upon and complementing the scientific principles illustrated in our permanent exhibits.



The Center of Science and Industry (OH) (COSI) was very happy to be able to offer *Under the Hood: Automotive Science Day*. Science Days are special theme days that COSI has been hosting over the last year to provide guests the opportunity to take part in hands-on activities related to a particular science area of study or theme, and talk with practicing professionals making their careers in that area of science. As part of the program, COSI featured the Under the Hood demonstration cart in addition to partner presentations from Clean Fuels Ohio and the Center for Automotive Research from The Ohio State University. Throughout the day, guests explored ideas for alternative energies with COSI Team Members and discovered careers in new energy research and development with innovators from around Ohio.



The Detroit Science Center (MI) hosted *Future Cruisin' 2010*. The event showcased accomplishments in automotive technology and recognized independent car enthusiasts who have designed, fabricated, and successfully implemented the most advanced technology into their automobiles. Visitors were able to participate in mousetrap car races, where they learned about Newton's Laws of Motion, and tricycle races, where they used physical fitness and endurance to compete through an obstacle course. Visitors also built a marble rollercoaster, where they experimented and tested their knowledge of physics and energy. Derby car workshops and races were held for various ages, giving participants a chance to engineer their own derby car.

Discovery Center Museum (IL) conducted activities related to fuel efficiency, the use of biofuels and combustion reactions as part of several programs this summer. These included investigation of alternative fuels and how they contribute to creating super fuel-efficient vehicles for the future. We also conducted a hands-on activity using a hydrogen fuel cell to power a model vehicle, and *Corn Pops* and *A Little Explosive Fun*, live science demonstrations using ethanol and explaining its use as an alternative fuel for vehicles. For our Chem Lab Family Friday we conducted a *Flashy Chemistry Show* which was all about different types of fuel, their current uses and potential future uses.



Discovery Center of Springfield (MO) hosted a week-long focus on alternative fuels and inquiry learning experiences. First, we developed a demonstration to provide basic information about how CO₂ impacts our environment and why the need exists to begin exploring other options such as solar, hydroelectric and biofuels. Second, we encouraged visitors to practice scientific inquiry and create something new out of existing resources by visiting our *Build A Car* gallery. One gallery was transformed into a car designing area. Visitors were challenged to design a car out of recycled materials and see if it could be the fastest car of the day. Test ramps were available in the design area before coming out into the museum for actual racing.



The Discovery Museums (MA) highlighted the Automotive X PRIZE in special programs, design challenges, and at pertinent exhibits throughout the museum. *Green Design with Solar in Mind* and *Making Wheels Turn* programs were popular and engaging. Visitors raced different solar cars on tracks, inclines, and through tunnels. Visitors also built, timed, and modified LEGO® vehicles on various slopes. These engaging activities reinforced fundamental science concepts about friction, slope, and momentum, and incorporated engineering and design skills. *Meet the TriHy* highlighted a unique road-licensed vehicle and its creator, and inspired visitors young and old. Summer camp students doing final presentations for parents described the car, battery, generator, air filter, and vegetable oil tank in great detail! Visitors saw diesel combustion, oil and wax burn, and solar panels to learn how alternative sources provide energy.



The Energy of the Future: Making Things Move program was used by the **Edgerton Explorit Center (NE)** in summer educational labs in six different Nebraska communities. Students participated in activities that demonstrated and explored energy, motion and alternative energy production. The response to the lab was very positive. Kids were excited to discover how energy could be produced from familiar materials, and secondly, that energy could be used to power devices they understood.

The Emerald Coast Science Center (FL) held two events: Kid's Day on the Landing and our Summer Camp Program. During Kid's Day we set up a display about aerodynamics using a hair dryer on toy cars with pieces of notecards attached to them. Children easily saw how the different shapes affect aerodynamics and we then talked about how this would affect the amount of gas necessary to travel at a certain speed.

We also created a display board that went into greater detail so that parents had something to read while their children completed the activity. We used this demonstration with some of our summer camps, allowing children to make the same connection. We plan to continue to use this activity, as well as others from the Educator's Guide in our Family Science Night program this school year.



The Henry Ford Museum (MI) highlighted the Under the Hood exhibit as part of our first annual Maker Faire, an event created by *Make Magazine* to "celebrate arts, crafts, engineering, science projects and the Do-It-Yourself (DIY) mindset." During the event, museum presentation staff made connections

between the work highlighted in the exhibition and the creativity, ingenuity and exploration going on now in the automotive world. The exhibit was also featured in the 60th annual Old Car Festival, America's longest running antique car show.



Liberty Science Center (NJ) was one of the first science centers to join the Under the Hood national educational program when we brought a team from a local high school to a New York City press conference to talk about their Alternative Fuel Education program. We also run programs at the Under the Hood cart on the weekends. The cart is located at the entrance to our *Energy Quest* gallery. One of our interns built a great ramp for the Aerodynamics program which hooks into the side of the cart. Aerodynamics seems to be the most popular activity with Gears, Batteries and Electricity and Air Filters running close behind.



The Under the Hood program at the **Museum of Life and Science (NC)** included hands-on activities from the cart, Crash Test Dummy demonstrations, a program on alternative energy and a program on the recent oil spill. Under the Hood was featured at Engineer's Day and Child Passenger Safety Awareness Day. Two X PRIZE team finalists, Li-Ion and Edison 2, were hosted at the museum for a public viewing of their cars.

The Museum of Science and Industry, Chicago (IL) partnered with Aptera to create and deliver educational programs involving Chicago teachers, teen student interns, children from community organizations and the general public. The programs included hands-on workshops for the teachers, teen interns and community group children. Participants worked in teams to create structures (bridges and cars) based on three sets of design/engineering principles: aerodynamics, structure and load and safety. The teams competed for prizes for best performance in distance traveled, weight-bearing capacity, speed and protection of a raw egg "occupant" in their cars. An Aptera all-electric vehicle was on public display and Aptera engineers gave three presentations.



The *Fuel the Future* program at the **Museum of Science and Industry (FL)** engaged science center guests, summer campers and professional educators through Under the Hood cart demonstrations and hands-on automotive design workshops. *Fuel the Future* activities were hallmark educational experiences at our Summer Science camps: *Speed Racers* and *All-Terrain Challengers*. The *Fuel the Future* program was featured at the Hillsborough County Public Schools Secondary Science Teachers Professional Study Day, at our Homeschool Open House and at a public event for underserved audiences. Throughout the summer, we presented demonstrations regarding automotive design and alternative fuels and energy for guests of all ages.

Oregon Museum of Science and Industry staff modified our Segway demonstration to include information about the Under the Hood exhibit. Demonstrations were conducted alongside the exhibit, allowing visitors to ride the Segway and talk about different modes of transportation and their benefits and drawbacks. In addition, the opening of the country's first solar carport and electric vehicle charging station gave us an opportunity to talk about high efficiency vehicles.



At the **Saint Louis Science Center's** Opening Event, representatives from BITW Technologies (an X PRIZE team in the St. Louis area) brought their vehicle powered by vegetable oil into the Science Center, lifted up the hood and talked with delighted visitors about what was inside. We also featured our Algaepalooza table-top activities about alternative fuels. Representatives from Ranken Technical College, an automotive trade school, brought a tractor powered entirely by electricity. Our Center Stage ran interactive public presentations entitled "CO₂, Where are You?" throughout the day, introducing visitors to carbon dioxide, its relationship to automobiles and its impact on the environment.



YES (Youth Exploring Science) Teens from the Saint Louis Science Center visited community organizations' summer programs for kids and taught guided-inquiry, hands-on workshops regarding automobile design. There were ten teens, each working with a group of six kids, at each of the community locations. The kids designed their own cars that met different engineering and physics challenges and presented and demonstrated their cars at two Community Science Days, events open to the general public at the Science Center. At the second event, they taught science center visitors the same hands-on challenges that they participated in over the summer.



At the Saint Louis Science Center's Camp-In, parents and their children spent the night at the Science Center and participated in automotive-themed activities related to the X PRIZE. The Camp-In included: hands-on science activities from the Under the Hood program, an Amazing Science Demonstration, activities such as Rocket Racers and Gears tied to X PRIZE themes, additional activities from the X PRIZE Educator's Guide, fun with the Segway electric-powered vehicle, time to explore the Under the Hood exhibit, additional free time exploring the Science Center galleries, pizza dinner, snack and continental breakfast, a Planetarium Show, an OMNIMAX® film, sleeping in the Science Center galleries, and a souvenir patch.



The Saint Louis Science Center's Closing Event was held in conjunction with SciFest 2010. Inventor George Voll brought his super-efficient vehicle from BITW Technologies back to the Science Center, kids of all ages built Recycled Racers (balloon-powered cars) and also enjoyed the Under the Hood exhibit which SLSC continued to display through October 2010. Coloring sheets and stickers featuring the Under the Hood logo, the BITW car and the X PRIZE winners were enjoyed by our youngest visitors. After SciFest, we gave our exhibit to the Emerald Coast Science Center, where they will adapt it to one of their galleries.



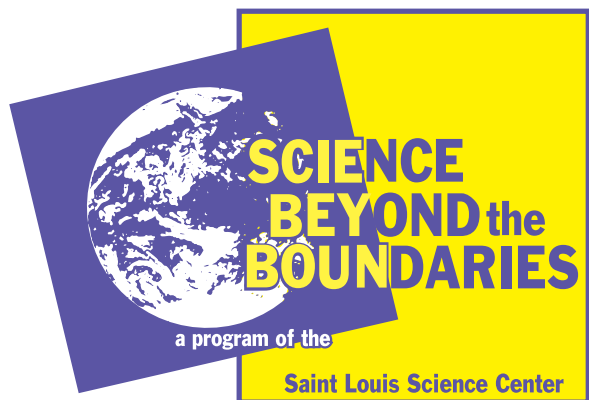
Stretching the Boundaries

The Science Beyond the Boundaries network's value in communicating breaking news in science has been recognized not just by X PRIZE but by other scientific enterprises and leaders in the scientific community such as the American Association for the Advancement of Science. In addition, our members have used the network as a dissemination component in large national grants for exhibits and educational programming and scientists who have presented at SLSC have used the network to get the word out to other museums and present elsewhere.

Science Beyond the Boundaries has a powerful impact that has been achieved with a great range of science and technology educational content. The wide reach of Under the Hood programs – 1.3 million museum visitors across the country in five months – is not limited to Automotive X PRIZE themes. Network programs are designed to provide the science content, whatever the subject matter, to support museums, large and small, in using their own staff's talents and creativity to customize programs to their audiences. Similarly, our hands-on activity cart can be used for any type of content.

Science Beyond the Boundaries is still growing. Every once in a while SLSC's Associate Director is approached by a science center CEO who says, "So, I've heard about this network. What's the application process? How do I join?" and the answer is still the same as when it started. If you would like to join, just say so. There are no obligations and no fees. All that is required is a willingness to share the best of the new frontiers of science with colleagues and visitors.

To learn more about the programs described in this report or receive complimentary copies of any of our educational materials, send an email to jjovanov@slsc.org.



PROGRESSIVE
AUTOMOTIVE X PRIZE

