SPEED Exhibition Description

In science, speed is a ratio: distance over time. When combined with human ambition, speed becomes much more. What is fast? From where does speed arise? What are the impediments to speed? Are there barriers, and if so, how can they be overcome? What happens when speed disappears?

Throughout the exploration, we return always to the human face of speed, finding inspiration from the worlds of sport, entertainment, and cutting-edge research. Who are these people, testing their own abilities and the limits of technology, to re-define again and again that simple relationship of distance and time?

Exhibits in *SPEED* are straightforward and authentic. Each has at its heart the physical reality of speed, and illuminates directly at least one of several speed-related concepts such as acceleration, horsepower, or friction.

The environmental design emphasizes energy and motion. Forms and colors are inspired by Japanese anime techniques. Large anime characters dominate the visual field, and serve as larger-than-life illustrations of the speed stories we tell. Exhibit components are exposed, materials are industrial, machined metals and graphics dominate. Exhibits economize both space and material, presenting only that which is needed.

Interpretive signs are integrated into the architecture of *SPEED*. Bold and splashy, they too draw their inspiration from Japanese anime. This form allows, and in fact encourages, a concentration of words, pictures, and mathematical expressions. Always in these signs we tell our stories with a direct, unsentimental voice, allowing the passion, heroism, and often oddball humor of the tales themselves to shine through.

Push!

Here we explore the sources of speed. Where does speed come from? How do you get going fast, and how do you keep it up? What do we mean by acceleration, g-force, and thrust?

Major Story

Coaster Wars	Modern roller coasters push to the very edges of human endurance. New coaster designs stretch further the existing records for height, acceleration, and speed. Modern coasters have become so complex that they demand advanced technology just to keep the cars from leaving the track and the occupants from passing out.

Interactives

Ski Simulator	Guests climb into a pair for a virtual simulation of an downhill race. Fed by gravity and human pushing power, a skier can obtain amazingly *high speeds and accelerations*.
Build a Coaster	Guests dream up and build their own roller coasters out of modular parts. The sections are straight, looped or curved steel rails and the cars are ball bearings. The simplicity of the materials allows for a wide variety of designs, including looping coasters, spirals, multiple hills, etc. *The relationships between height, acceleration, and velocity are explored.*
Horsepower Bike	Guests measure their ability to produce horsepower by pedaling a stationary bicycle. A clever arrangement of gears and chains results in a rapidly rotating final gear. The final gear speeds up and slows down as the horsepower supplied the human "engine" waxes and wanes. Both the gear rotation rate and the horsepower are displayed on large LED screens. Accompanying graphics explore *the mathematics of horsepower, and relate this important concept to speed*.

Stop!

The causes and consequences of rapid deceleration are the topic here. What happens when speed vanishes? What does it mean to say that stopping is really accelerating?

Major Story

John Paul Stapp	In 1954, Air Force Colonel John Paul Stapp survived a rapid deceleration totaling 45 g's in a controlled experiment to determine how best to protect pilots and others from the detrimental effects of crashes. Stapp was the chief researcher in the experiments, but he refused to subject anyone else to the gut-wrenching experimental rocket sled known as "Sonic Wind". Stapp's speed of 632 mph was achieved in a leisurely 5 seconds, but was reduced to zero in only 1.4 seconds and resulted in bruises over most of the colonel's body, including on the inside of his eyelids.

Interactives

Penny Stopper	Guests inject their coin into a stream of high-velocity air. The air stream catches the coin and smashes it against a wall. The altered coin is then returned to its owner. An accompanying slow-motion video shows the effects of *instantaneous deceleration*.
Train Game (Stop That Train)	A passenger train computer simulation challenges guests to accelerate to cruising speed, and then decelerate at the proper rate to reach the station safely and on schedule. *Speed as a ratio of distance over time is a crucial element.*
Crash Test (Art of Stop)	Guests slow down and speed up video footage of speed-induced crashes. A few frames of each movie will contain graphic call-outs describing the *effects of instantaneous deceleration*, pointing out the first signs of trouble.
Hit the Wall	Guests hear audio interviews with race car drivers sharing their experiences and answering the question, *"how does it feel to hit a wall?"*
Stop-Motion Animation	Stop-motion techniques mimic real motion best when the animator understands the simple *relationship between distance (how much should the prop move?) and time (what is the frame rate?)*.

Go!

In Go! we investigate speed as a quantity. What is speed and how do we achieve it? What are the features that enhance or retard speed? What are the mathematical relations that govern the concept of going fast?

Major Story

Firehawk 600	In a move unprecedented in major American motor sports, CART (Championship Auto Racing Teams) in April 2001 postponed indefinitely a scheduled race on the Texas Motor Speedway. Why? The track was too fast.

Interactives

Gravity Race (Build Your Own Car)	Guests build cars out of a bin of Lego parts. Choices about weight distribution and tire size make a big difference later when the cars race against others on a track. *The effect of vehicle design on performance is the focus.*
Carvolution	Using buttons and a monitor, guests flip through images of ninety years of Indianapolis 500 winners, showing how car designs, and consequently car speeds, have changed over time. Graphics give information about *technological innovations that affected the look of the cars over time.*
Finger Speed	Guests push a button as fast as they possibly can for five seconds. A computer readout records the number of pushes to and displays high scores. Guests *compare the speed of their moving fingers* against one another.
Sounds of Speed	Guests are prompted to make several Speed-related sound effects, which are then inserted into an animated short or slide show. *Many of the prompts will reference speed concept such as the Doppler Effect and the sonic boom.*
Travel Sim	Guests plan a trip around the world. First a year is chosen from a list of possibilities. Next, guests choose from the available modes of travel in the different eras. If multiple trips are completed, guests may *compare their average and top speeds for each trip they take.*
Vehicle Designer	This computer activity encourages guests to choose engines, wheels, and body types to create their own vehicle. *Supporting graphics describe how vehicle design impacts performance.*

Drag!

Despite Newton's Laws, common experience shows that things slow down. Here we find out why. What are the various impediments to speed, both on solid ground and in the air?

Major Story

Race Around the World	Racing in the around-the-world endurance race known as the Vendee Globe Challenge, 24-year-old Ellen MacArthur finished second, becoming the youngest person ever to circumnavigate the Earth alone. The course of the race took MacArthur and the other competitors from France across the equator and through the Great Southern Ocean, under the world's three great capes, and then back up through the Atlantic to finish in France again, three or more months later. To finish the race at all is an accomplishment, as most competitors are forced out by bad weather or mechanical failure. More than one racer has died in the attempt.

Interactives

Turbulence Tank	Guests manipulate various vehicle-shaped objects within a moving fluid. The shapes are moved with magnets, and can face the flow at various angles. Each shape responds differently to the fluid, and in turn *creates either smooth (efficient) or turbulent (inefficient) flow within the fluid itself*.
Drag Race (Spin Your Wheels)	Guests compete to get a vehicle across a slippery surface in the shortest possible time. The start of the race is the key. How fast can you turn your wheels without losing contact with the surface (in other words, slipping)? The successful racer will have discovered that *static friction (from non-slipping wheels) is much more efficient than sliding friction at moving a car forward*.
Fluid Diving (Viscosity Race)	Guests rotate a wheel housing three tubes filled with different viscous liquids. Within each tube is a PowerPuff Girl that falls through the liquid after being released from a magnetic bond at the top. *The PowerPuff Girl in the least viscous fluid reaches the bottom first, while the others trail behind*.

Zoom!

Strange things happen at extremely high speeds, things that always surprise us and that sometimes seem to fly in the face of common sense. Just how fast is sound, and what exactly is a sonic boom? And why is the speed of light called the ultimate barrier?

Major Story

Cheryl Stearns - Spacediver	American aviator and skydiver Cheryl Stearns will attempt to break a long-standing altitude record for skydiving. Stearns will jump from a balloon 130,000 feet above the surface of the Earth. In the process, Stearns will attempt to become the first human to break the sound barrier without the aid of a vehicle.

Interactives

Relatively Speaking	Guests explore, at their own pace, the shocking fact that every one of us is always moving at the speed of light. We achieve this remarkable speed not in normal space, but in four-dimensional space-time. This fact and many others all arise from a single, simple discovery: *the speed of light is always the same, no matter where the light comes from or who does the measuring*.
Infinity Mirror	Guests manipulate two parallel mirrors to create a seemingly infinite set of images regressing to the vanishing point. But are there an infinite number of images? A bit of thinking about the *finite speed of light* reveals that the answer is no.
Shout Tube	Five hundred and sixty four feet and six inches of coiled pipe is placed between the guest's mouth and ear. Speaking into one end of the pipe causes a delayed signal to reach the other. *Sound travels through air at around 700 feet a second, resulting in a delay of (1/2 second).*
Speed of Thought	Green lights flash randomly in a circle preparing guests for the unknown moment when the light will suddenly turn red, starting the clock. How quickly can the guest respond, press a button and stop the clock? *The speed of thought, though very fast, is significantly slower than the speed of light.*