Keith Hippely (BS ’80 ME) has always considered himself to be a “car guy,” and figured his Mechanical Engineering design degree would be a ticket to a car company. He was right, kind of. For nearly 30 years he’s worked for Mattel and its Hot Wheels division, coming up with ideas for toy vehicles and then rolling up his sleeves to make them work.

The job is a lot of fun, he says, but also involves some serious engineering. He has racked up nearly a score of patents and helped make toys that have sold more than a million units each. People have waited in lines around the globe for some of his creations.

What are some of your favorite projects?
I work in the Hot Wheels area. As an engineer, I work on concepts for cars and I work on the mechanisms that make things work.

One of the coolest things I’ve gotten to work on recently is this line called Road Beasts. These are monster trucks that turn into monsters. Imagine a monster truck whose body lifts up on hinges at the back exposing a giant jaw inside with teeth. They were on the shelves this past summer.

They are sort of like a simpler version of Transformers. For instance, we have the ones that have opening jaws and we’ve got things like eyes that pop up in the side windows when they open their jaws so they become more animal-like. We have some that when you push down on the back the whole body hinges forward and lunges at you while the mouth opens and the tongue sticks out. We have one that’s called Sticky Tongues and when the body rises up, a giant hinged tongue comes out of the body and touches the ground. Because it’s sticky, it can pick up little things. I got to work on figuring out how to make that work; how do you make the gizmo to make that happen. Another one of them is a thing called Porcuspike. When you push down on the spoiler in the back all these spines come and stick out of the body, kind of like a porcupine.

In this line, they’ve all got little spoilers or things in the back where it’s hinged. That activates a linkage that pushes something and makes something happen. It’s a lot of fun not only to come up with the linkage, the engineering part, but it’s also fun to come up with the idea too. That’s one of the most fun parts about the job - from time to time we get to sit around in brainstorming sessions and come up with all these wild ideas.

A car that got me a lot of notoriety was this Mars Rover that we did. I got to go down to the NASA Jet Propulsion Lab (JPL) to see the actual Mars Rover when it was under construction and talk to the engineers, which was fascinating. Talk about the ultimate robotic vehicle! That particular toy, because of the success of the engineers at JPL, went on to be the must-have toy of the summer (’97). People were just lining up everywhere to get this thing. It became this phenomenon and the publicity about that was amazing.

You also worked on a version of Lightning McQueen from the movie Cars?
That has to be probably one the coolest things I ever worked on and probably the most successful. It is an animatronic, robotic toy. It’s got a rubber mouth that moves up and down while he talks. He’s got eyes in his windshield that move from side to side and up and down along with his eyebrows, kind of like in the movie. He has a little keypad on his back window and we designed what we hoped would be easy to understand keys so a kid could tell it to go right and left and to talk. When you press Go it repeats the sequence of things you just entered. For the kids who are old enough to understand it, it can teach them a little bit about programming.

We found that a lot of the younger kids couldn’t quite think that many steps ahead. What they absolutely loved to do, however, was just to press the buttons, one after another in any order and then press Go and watch it do something different every time. They would do this endlessly. When he hits a wall he stops and he says, “Ow, that hurt.” And then he backs up. And the kids will do this over and over again. They’ll bop him in the nose to make him go “Ow.”
I’d imagine there is a lot of work that went into that car to make it commercially appealing.

We worked really hard on that car. A lot of these toys are very complicated consumer devices and I don’t think people realize all the engineering that goes into making these things. We made over a million units of that car. They all had to be completely safe. They are all controlled by minicomputers and motors that make it do various things. And we’ve got to make them to sell for $35. Toys are really a challenge in that respect. It was a tremendous amount of work fitting everything in there and particularly getting the cost to where it made sense in the marketplace.

That is actually one of the hardest parts of the job, getting everything to meet cost. We have a really detailed cost system that costs every tool and every process and every decoration and operation down to a fraction of a cent. The hardest part really is figuring out just which features are the most important features. Costs are continually going up and it’s so competitive. Lightning McQueen in his first iteration was around $80. We had to put in months and months of work to figure out which features we could eliminate and how much is this part here, how much is the tooling for this part, how much does that come down to in terms of the final price of the toy.

How did you end up working for Mattel?

Mattel had a design contest at Stanford for the engineers. The idea was to come up with a toy. First prize was $3,000, which was a ton of money at the time. I said, “Wow, I have this great idea. For sure, I’m going to win.” So I worked my butt off. This was my junior year. I came up with this great idea and entered it into the contest. And I didn’t win anything. I didn’t even get an honorable mention! But about a week or so after the contest was over, I got a call from Mattel saying, hey, how would you like to come and work for us over the summer? I thought about it and it sounded like a really fun place to work and so I did. When I was here for the summer I designed a toy that ultimately they made into a product and so they offered me a full-time job when I graduated.

What were the toys you made for the contest and on your internship?

When you are playing Cowboys and Indians you can never really tell if you shot the other kid. So I thought it would be really neat—remember this is 1979—to have a ray gun where you shoot a beam of light at someone and they would have a little receiver that they would wear on a vest and when the light beam would hit it, it would beep. Then you’d know you’d hit the guy. We had a team of all these industry people who weren’t with Mattel judging these things. I guess they didn’t think it would go anywhere. But then a few years later someone came out with Laser Tag and it went on to be the number one or two toy of that year and they are still selling it today. It is one of the most popular toys of all time. Not that I’m bitter.

As a summer intern I worked on what ended up becoming a toy called the Teach and Learn Computer. Back in 1979 they didn’t have much in the way of voice chips. But this was a talking computer. It used a little disk that you’d put in that was almost exactly the same size as a CD. The computer was kind of like a notebook sized tablet and on the top it had all of these overlays. It would ask you questions and you’d press on the overlay to indicate your answer. It would know where your finger pushed and it would tell you if you were right or wrong. My invention was the electromechanical voice synthesizer that made that work. The disk wasn’t a CD, it was a tiny record. A record with grooves and a tiny little needle attached to a tiny little tone arm that pushed on a little tiny speaker cone. I figured out a way to drop the needle into the correct groove corresponding to the right answer. On the alphabet ones, for example, there are 26 grooves, one for each letter. Each groove is spirally interleaved with all the others. So there are 26 equally spaced scratches at the edge of the record and those lead into each of the 26 grooves. So all you’ve got to do is to drop the needle at the right point at the edge of the record. It had amazingly good sound at the time.

What drew you to Stanford in the first place?

I’ve always been interested in mechanical things and design. I’ve always thought it would be great to be one of those guys who created new things. I love that part of my job. It is just a good feeling to know that people are using something that you worked on. Stanford had a great engineering program and had a pretty good reputation in mechanical engineering. I was kind of intrigued by their classes, in particular Visual Thinking with Bob McKim, ME 101. I also wanted to come to California. I grew up in Delaware. It seemed like such a beautiful campus and they had a tremendous amount to offer besides engineering.

One of the most inspiring classes I took that really helped lead to my career was ME 103, Manufacturing Technology, with Professor Dave Beach. He was just a very inspirational guy. My favorite professor ever. Of all the classes that I took, that class prepared me the best to come here and do what I do because he taught me how to make things. He instilled a real love for designing, creating, and building products.