Sloan Career Cornerstone Center

Profiles of Mechanical Engineers

Alex Burkat, P.E.

Principal Mechanical Engineer
Walt Disney Imagineering
Glendale, CA

Education:
MS, Mechanical Engineering, Ohio State University
Honors Diploma, Moscow Automobile & Road Construction Institute (mechanical design, automotive & transportation equipment)

Job Description:
Principal Mechanical Engineer, designing rides and equipment for Disney theme parks, and evaluating and making improvements in existing rides and facilities.

Advice to Students:
"Go into engineering only if you really have a calling to be an engineer -- if you like to build things, if you get real satisfaction of seeing something built from your idea, or built by your own hands. If you are that kind of person, I think engineering is right for you."

Comments:
Alex started his career working on automotive, mining, and robotics equipment -- but the same basic skills and knowledge apply to his work on roller coasters.

Video Transcript 1:
"I'm a mechanical engineer working for Walt Disney Imagineering in Glendale, California. And my title is principal mechanical engineer. What my job is, to design rides, rides for Disney theme parks and equip them for these rides, rides and attractions. I worked on many rides and attractions. One of the first rides I worked on was Splash Mountain at Disneyland. It was just finished at the time I was hired and I was drafted to work on this ride, to debug it, and to improve certain components and add certain features to it. I had to take quite a bit of data on the Space Mountain at Disneyland, which is a roller coaster. To take this data, we had a three axis accelerometer at strategic points in the vehicle and we had a small computer take the data. I had to ride the roller coaster all night, which is fun when you do it, it's fun when you do it once or twice but all night, it's a little bit tough."

Video Transcript 2:
"I think this job brings a lot of satisfaction. And the most satisfaction I get when I go to the park, either Disneyland or in Florida and I see people using rides and going on rides I worked

on, and you can see happy faces. And some-times I take my kids to Disneyland and we go on one attraction or the other. And they know that I worked on it and I did this or that, and it's very satisfying to see your things actually built and working."

Interview:

Q: Tell us who you are, who you work for, and what your job title is.

Burkatt: OK. My name is Alex Burkatt. I'm a mechanical engineer working for Walt Disney Imagineering in Glendale, California. And my title is principal mechanical engineer.

Q: And what's involved in being a principal mechanical engineer?

Burkatt: What my job is, is to design rides and attractions for Disney theme parks and equip the parks for these rides and attractions.

Q: Tell us about some of the rides and attractions that you built.

Burkatt: I worked on many rides and attractions. One of the first rides I worked on was Splash Mountain at Disneyland. It was just finished at the time I was hired and I was drafted to work on this ride, to debug it, improve certain components, and add certain features to it. So it was very good experience, my first experience with Disney. And what was very helpful, I worked in a park environment and I learned to appreciate that environment and the interaction between the maintenance people, operations, and guests.

Q: And so what was involved in working with the Splash Mountain, the testing of these things? Was it fun?

Burkatt: It was fun. It was very challenging, very interesting, because I never worked on anything like that. It's a water ride. So you have boats -- we call them “logs” -- which go up the mountain, up to the very top. They drive there by conveyor, with guests in them and then you float them in a flume and eventually the boat goes down. There are several drops and one -- we call it “Big Drop” -- is pretty big. So, the first time you go there, you're very high at the top of the mountain. You can see the whole park and then you go down. So, what we had to do, we had to improve the capacity of the ride and there were a few things we needed to improve. That basically was my first job with Disney. I had some small jobs, and after that, I worked on redesigning the seat-belt mechanism for simulator rides. Talking about simulator rides -- basically what it is, it's a flight simulator adapted to an amusement park environment. You can find them at Disneyland, and at Disney World in Florida and in France. Common names for them are “Space Mode” and “Space Starters.” Also a similar seat-belt mechanism is used on “Indiana Jones.” We had an existing mechanism at the time and it was working, but not exactly satisfactorily. So the decision was made to redesign it, and make sure it fit into existing constraints and the existing packaging. So I worked on it for about a year, because we had to outfit all our simulators, which are quite a few, all over the world. I made designs and built prototypes. We installed prototypes at Disneyland and at Disney World in Florida, did extensive testing to make sure that it was working quietly, and debugged it. It eventually went into production and we installed them on all our simulators. And so, we think it is very satisfactory and I have a patent on this mechanism.

Q: What's involved in getting a patent?

Burkatt: When you work for a company like Disney, it's relatively easy. You have your design. Then you make a description of this design and the company applies for a patent. So it's done through the company, which kind of shields you from all this paperwork which is really extensive, and it takes about two years.

Q: Well, how does it feel to have a patent?

Burkatt: Satisfactory, yes. It means you designed something and it's yours. And another thing, you go to the park and you see people using it and you know it's your design so it's very gratifying.

Q: Tell me about the testing -- you have other patents, I think?

Burkatt: Yes, I have another patent and it's a continuing process. We're working on designing a restraint mechanism for roller-coaster rides. Existing roller-coaster restraints are built on the principle of "one size fits all." And it's not very comfortable for everybody, because you have small kids and old people and people of different sizes who wants to ride the ride. And when you have very rigid, very fixed restraints, to restrain all of them, it's not always very comfortable. And you have restrictions on people's sizes. Because eventually, you come to the point where you cannot fit small kids, and even those who are allowed to ride the ride according to their body physics. So what we're trying to do, we're trying to design a new generation of restraints which will allow people to ride roller-coaster rides more comfortably, and accommodate people of all sizes.

Q: Say something about the experience of what you told me before about Splash Mountain and riding with the computer all night.

Burkatt: When you work on rides, there are several things involved. You design new things. You have to work on existing things. You have to make additions and improvements. So in our case, data composition is very important. I had to take quite a bit of data on the Space Mountain at Disneyland, which is a roller coaster. And the way to take this data, we had three accelerometers at strategic points in the vehicle and we had a small computer take the data. And I had to ride the roller coaster all night, which is fun when you do it once or twice, but all night, it's a little bit tough.

Q: What was it like when you finally got off? You literally rode it all night?

Burkatt: For several hours, yes. I was riding and comparing data, putting accelerometers in different places, collecting more data and riding and riding. When it was over, I had had enough of roller coasters.

Q: Where did you start your education? Tell us about that progression from when you first went to university and how you got into the U.S. and then from then on.

Burkatt: I was born in Russia, in Moscow, and it's where I went to college and got my Bachelor's degree in mechanical engineering. I worked for a couple of years and then immigrated to the United States. I worked here for a couple of years and I felt like I would like to get more education, more knowledge, more background, and I went to Ohio State University at Columbus, Ohio to graduate school and graduated in '87 with a Master of Science degree. And I got two jobs here in California. I had another job, a previous job, before I began working for Disney. And since then, I got my P.E. license, Professional Engineer license, and I attended quite a few classes and seminars. Basically, every year I make sure I can attend either a class or a training seminar to keep up to speed.

Q: Tell us about the different jobs that you've had, how you got them, what the engineering was like, what the lifestyle was like compared to what you have now.

Burkatt: I worked in different fields of engineering – automotive, and mining equipment, and robotics, and finally here at Disney. The difference is, at Disney it's not an automotive company or aerospace company. It's not a company dedicated exactly to technology or exactly to industry. So here you have a mixture of talents, a mixture of cultures and it's very interesting. It gives you very good exposure and a very wide field of view of all aspects of life and it's still a very, very demanding place for engineers, all kind of engineers -- mechanical, electrical, and software engineers. I would say it's at least as challenging as any other place, because here we are dealing with people, ordinary people. You are not dealing with people who are trained to fly airplanes, fighter jets or other equipment. You're dealing with everybody, with everybody in the street. People go to Disney parks and they want to ride the rides so you have to make sure that the rides you design, rides you work on, are safe and enjoyable.

Q: Tell us about some of the "G-loads" of one design and one experience.

Burkatt: There are several loads, several G-forces, considered safe. For example, when you ride a roller coaster and you come to the station where you load and unload the vehicle, usually the G-force is half a G. And there is a difference between lateral forces and site forces you can experience. So when we design a roller coaster, a lot of attention is given to ergonomics and human factors -- how a body reacts to different loads and what kind of seat you have to support human bodies. And again, we're dealing with all kinds of people, all sizes, and you have to make sure that the seat you design is very comfortable to whoever sits in this seat. It has to be comfortable to get in the vehicle and out of the vehicle. And also you need to do it fast, because we want to have as many people ride the ride, in a given time, as possible because nobody appreciates having to stay in long lines.

Q: There's a wide variety of things one could do as a mechanical engineer. You might want to say something about your initial training and maybe -- I didn't catch if you actually worked in missiles or not --but give us some connection with missiles and then ending up at this stage anyway at Disney.

Burkatt: When I studied in Russia for mechanical engineering, we were taught to design mobile equipment for missile systems. Vehicles -- big heavy vehicles -- which transport missiles and load, unload them, and carry them to the launch pad. Then I worked in the automotive industry, which is quite different, and a coal-mining equipment company. Then in robotics. And in many of these fields we were mostly doing mechanical design. It was good

high-level mechanical design that was more or less specialized. Here, at Disney you have to do all kinds of mechanical design. It's mechanical design. You also to deal with hydraulics and pneumatics. One of my latest projects, I had to learn very quickly to design parts using composites, very sophisticated composites, similar to what you use in the aerospace industry. Our applications are very demanding. Our equipment works in parks ten hours a day, 365 days a year, and we cannot afford any failures.

Q: Tell me what a typical day is like, the kind of people you're working with, and talking with. What's life like as a Disney engineer?

Burkatt: Actually as an engineer, you do not spend 100% of your time with your calculator or your computer doing hard engineering. You have to deal a lot with people. So usually my day starts, I come and I check my E-mail and check for any voice messages. And then during the day when you work on your projects, you have to deal with the parks because you need to vector into your design their requirements and their desires. You work with creative people who conceive the idea of the ride, of the new attraction or refurbished attraction, what it's supposed to do, what it's supposed to look like and how it's supposed to feel. You deal with those people who make sure that people can get in and out of the ride fast enough and comfortable. You deal with maintenance people. You are dealing with many other engineers. So you have a whole variety of people who you have to deal with. You often have to deal with manufacturing. We have our own manufacturing facilities, and we deal with outside vendors. So what's involved here? Contracts and finance and scheduling, you have to do all these things. We have people who actually do this but you also have to have your say, have your involvement into it and your input.

Q: Talk about what it's like in doing the engineering behind a creative idea, an idea that comes from the creative department. How does that work?

Burkatt: I can give an example -- my last project. We have an existing ride we would like to refurbish, make more interesting, and more exciting. So the creative people had an idea and then they asked us, “How can we implement this idea?” So we begin looking on different design concepts, how we can implement them, what would be their impact on existing parks, and how expensive it's going to be, because we also work within certain budgets. And we tried different concepts, three or four different concepts, until we finally came up with an idea, all of us -- the whole creative team, engineers and artists and people from the park --and we came up with the idea we all liked. We engineers think it's feasible, and you can build it, you can do it -- and the creative people think it's fun and you can build a ride and tell a story around it. So this process usually evolves. It starts with the creative people considering the idea of the ride and then the engineers coming on board and helping them to make it real.

Q: Tell me about the satisfaction. What do you most enjoy about your job?

Burkatt: I think this job brings a lot of satisfaction. And the most satisfaction I get is when I go to the park -- either Disneyland or in Florida -- and I see people using rides and going on rides I worked on. And you can see happy faces. And sometimes I take my kids to Disneyland and we go on one attraction or the other. And they know that I worked on it and I did this or that, and it's very satisfying to see your things actually built and working.

Q: How about the lifestyle? You mentioned that you have two kids and a wife. Tell us about what life is like as a husband, father, parent and mechanical engineer.

Burkatt: This job is not eight to five. Sometimes you have to go to Disneyland and do some testing or some work at night. But the point is, if you like what you're doing you don't mind. Of course, you mind having to do it every day all the time, but you do it and it's part of the job. And I don't mind it.

Q: Tell me about some of the things that aren't so much fun. What are the challenges, what are the things that have you pull your hair out, even though you do have quite a bit of hair remaining.

Burkatt: Well, of course, as I said, it's a fun job, it's a very interesting job, but also you have to do a lot of routine things. You have to do certain paperwork, you have to put together spreadsheets and schedules. And the most unpleasant thing is that sometimes you do something or you didn't do something, and it doesn't work exactly to your satisfaction. It can be very frustrating if you can't find the right solution right away, but in general I think it's a very satisfying job. I've been with Walt Disney Imagineering for over seven years and I'm very happy here. And the name of the company is very interesting. It's “Imagineering,” which is the marriage of two words, “imagination” and “engineering”. And when you put it together you get Disneyland.

Q: How about the transition to the U.S.? Tell us about the challenges of coming to the U.S., coming to university here in the U.S.

Burkatt: I didn't have much problem with the language, though I still speak with a heavy accent. I didn't have problems, because I learned English when I was back in Russia. So I came here, and basically it took me a couple weeks to understand people and hoping people understand me. The transition was, from my point of view, very painless, very easy, because what I found out was that people in this country are extremely friendly, extremely helpful. And it's a very, very pleasant experience. The same with my first job and with my second job. When I went to college, it was very different. In Russia, colleges are more specialized. They are dedicated to certain fields. You go to college and you study basically only aerospace or you study only the automotive field. Here it's much more general, so you get more varieties, and there are many more resources at the universities here, many more resources available to students. Labs are excellent. Computer equipment. And I liked it very much. The two years I was in college were very, very pleasant. It wasn't easy, it was tough. Because what I did, I quit my job and I went full time. Ohio State University graduate school only has classes during the daytime, so you cannot work and study at the same time, it's almost impossible. But it was an incentive for me to do it faster and I completed my course in a little bit less than two years.

Q: That's for the Master's?

Burkatt: Yeah.

Q: Why did you decide to study for a Master's?

Burkatt: I felt that I had to get my education. I wanted to learn more and it's what I did. I went to graduate school, I learned more. I think, to a certain degree, I felt gaps in my education. But also, it helped me and taught me to study by myself. So right now, if I need to learn something, I don't necessarily go to college and take a course; I can buy several books and read them and hopefully get some software and practice and learn.

Q: You've had quite a few transitions in life. What were some of the major transitions, what were some of the influencing factors that caused the changes? One big change was going to engineering school in the first place. Of course, another big change was the different companies you worked for in Russia and those changed one to another. Then, from Russia to here was a change. Talk about some of the changes and what influenced them.

Burkatt: When I was in Russia, in my day, you didn't have much choice there. When I was a kid, I always wanted to study math and be a mathematician. But I couldn't and that's why I went to engineering school. And after engineering school, you didn't have much choice. You go to a place of work where you are sent to work and you have to work there for a certain period of time. And I did. I worked for about three years. But I didn't like the political system there. I always disliked it. That was one of the reasons I came here. And I worked in several companies in the United States. First when I came, I got almost the first job which was offered to me. And two weeks later, I was offered another job, an even better one. So I worked there for several years, then another company -- at that time, it was the early eighties. Many companies were going “belly up,” and I found another job. And I felt, at that time that I needed a little bit more education, a little bit more knowledge to advance in engineering. And this is how I made a decision to go to graduate school.

Q: How did you find those jobs?

Burkatt: Through newspapers, through friends. I think if you're an engineer and you have a good, solid background and like what you're doing, you always can find a job. I can also talk about my P.E. license.

Q: Yeah, please.

Burkatt: When I was living in Columbus, Ohio, I decided to get my Professional Engineering license. And I was working at the time and I know that many people, to get training for that exam, go to courses. Instead, I choose to go to the library, I got a bunch of books, studied and passed it the first time I took it. So I'm a Registered Professional Engineer.

Q: Tell me about what advice you would have for a student, either a freshman or sophomore student. They're at the beginning of their engineering undergraduate program. What advice can you tell them that they don't learn in school?

Burkatt: I think you should go into engineering only if you really have a calling to be an engineer -- if you like to build things, if you get real satisfaction of seeing something built from your idea, or built by your own hands. If you are that kind of person, I think engineering is right

for you. It's a very demanding field and unfortunately, it's not a very glorified field. But people who are working in these areas -- engineers and scientists -- they can appreciate and understand the importance of what we're doing, and that the progress of the world is based on engineering and technical progress mainly.

Q: Can you say something about, from your perspective, about what professionalism is? And also, any connections in your background with professional societies and what that's gained you?

Burkatt: I'm a member of ASME. I get ASME publications about conferences and seminars and classes. I get a lot of trade magazines. And I'm always trying to keep on top of the information. And we have a lot of information. So I'm trying to read magazines such as Design News, Mechanical Engineering, Machine Design, Hydraulics & Pneumatics, Composites and many, many others. It's difficult to find time to do all these things but if you want to be a good engineer, an up-to-date engineer and not an obsolete engineer, it's what you have to do. Also, there are a lot of engineering tools. We have computers, we have different software packages to do dynamic analysis and stress analysis and simulation -- computer simulation -- and you have to learn new packages and be able to use all these wonderful tools we have available.

Q: The next time I'm riding on Space Mountain, what should I remember?

Burkatt: If you ride on Space Mountain, if you haven't ridden it for a while and if you ride it this time, what we did was one of the latest projects I worked on. We added on-board audio. So it's not just a simple roller coaster you ride for feel. You still do, but you have a sound. And when you ride the roller coaster with a sound, and it's wonderful music especially written for this ride, it enhances your experience tremendously. It's like a new ride.

Q: What else should I remember if I'm riding Space Mountain?

Burkatt: Remember that I rode it at night without any sound, with a computer and an accelerometer for a few hours.

Q: Good. Thank you. I appreciate that.

Burkatt: Thanks.