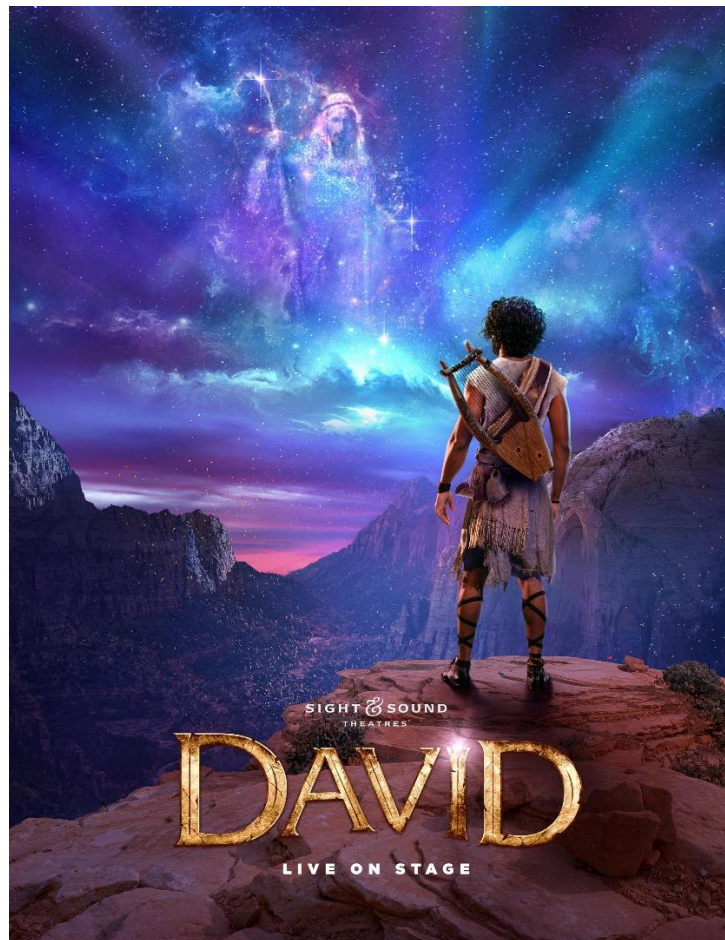


Robotics in Theatre Productions

Career Readiness Online Challenge

by Micah, Elijah, and Ruth



727H Home-Field Advantage

Magnus Robotics

Harrisburg, PA, USA

The company our team has chosen to write about is Sight & Sound Theatres. Sight & Sound, which is headquartered in Lancaster, PA, puts on live theatre performances from the Bible. We chose them because they regularly use robotics and animatronics as parts of their productions.

In producing their 2022 production, *David*, the engineers there undertook their biggest animatronic set piece they'd ever built, a robotic Goliath. At 14 feet tall, Goliath is one massive feat of engineering. It has joints to turn its neck, nod its head, move its arms, and turn at the waist. It is attached to a pole that can move up, down, forward, and backward to make it look like it is walking. The robot uses a total of 25 pneumatic cylinders, 2 hydraulic cylinders, and an electric motor to power all of its joints.

In June, our robotics club, Magnus Robotics, was given an opportunity to take a tour of Sight & Sound's facilities. Ben Kauffman, the Mechanical/Structural Designer, and Bill Platt, the Automation & Effects Manager, walked us through their use of the design process, specifically the robot

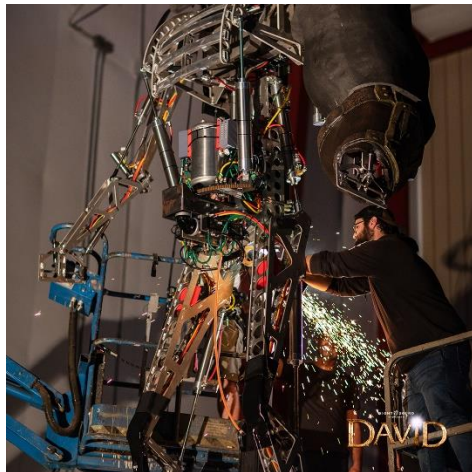


The behind-the-scenes tour

Goliath. They gave us a demonstration of what Goliath could do. It was pretty incredible. Our team was also able to set up a follow-up video call with Ben, Bill, and Jess Flitcraft, the Animatronics Specialist, to get a more in-depth understanding of their design process. We visited Sight & Sound's website and watched some of their videos to learn even more, specifically their documentary, "David: A Giant Project." To view that video scan this QR code.



When it was decided that the 2022 production would be David, artists drew up the concept art for the different sets. The teams got together and immediately knew that one of the biggest challenges would be designing and building Goliath. The engineers were asked if they thought that building a robotic Goliath was even feasible. After some discussion, they settled on what seemed like a fairly reasonable solution. The idea was handed over to Ben Kauffman, who set to work designing the individual parts using a CAD program called SolidWorks. One major thing he had to take into account when designing Goliath, was that it needed to be as light as possible while at the same time being very sturdy. Since they didn't have a lot of extra time or money, he had to be fairly confident that all the components would work the first time. Just to be sure, several critical parts like the head and an arm, were prototyped to make sure that they would definitely work. After about half a year of designing, Ben got



Building Goliath

together with the rest of his team to

collaborate. The finished designs were sent over to the building department. After the components were built, they were fitted together and tested. Anything that didn't work like it was supposed to was tweaked until it worked correctly. After everyone was satisfied with the way Goliath was operating, he was sent to the paint & decor department to be finished.



Ben Kauffman working on Goliath

Sight & Sound's use of the design process has its similarities and differences to how we use it in the VEX IQ Competition. First off, they use it on a much larger scale than we do. It took their engineers about two years and \$250,000 to complete Goliath. Since that's all the time and money they had, they didn't have the opportunity to try several different designs. We, on the other hand, can design and build

robots fairly quickly. This is mostly due to the fact that we have small pieces that easily snap together and pull apart. One similarity is that we both document our design process. For us, that's compiling an engineering notebook, but for Sight & Sound, that's making detailed drawings and CAD models. We also both program our robots to complete a sequence of events autonomously.

Participation in VEX Robotics has taught us to work together and collaborate as a team. It has also taught us aspects such as time management and perseverance. Each of these things helps prepare us for future STEM careers. While talking with the engineers at Sight & Sound, they gave us two pieces of advice: communicate with your team members and don't be afraid to try something new.

On October 26, we were given the opportunity to go and watch the actual production of David! We were able to see the robot Goliath in action as they used it in the show. It was incredible!



Micah, Ruth, Elijah, and sister Rachel at David production

Resources

1. Behind-the-scenes tour of Sight & Sound Theatres in Lancaster, Pa on June 6, 2022, with Ben Kauffman, Mechanical/Structural Designer, and Bill Platt, Automation & Effects Manager
2. Video call on November 30, 2022, with Sight & Sound engineers Ben Kauffman, Bill Platt, and Jess Flitcraft, Animatronics Specialist
3. “David: A Giant Project,” <https://www.sight-sound.tv/david/videos/david-a-giant-project>