You said it's rough out there

What we have done to toughen up Venue

Everyone we talk to says, "Hey, our department is pretty rough on our gear." So we put extra effort into making Venue™ rugged.

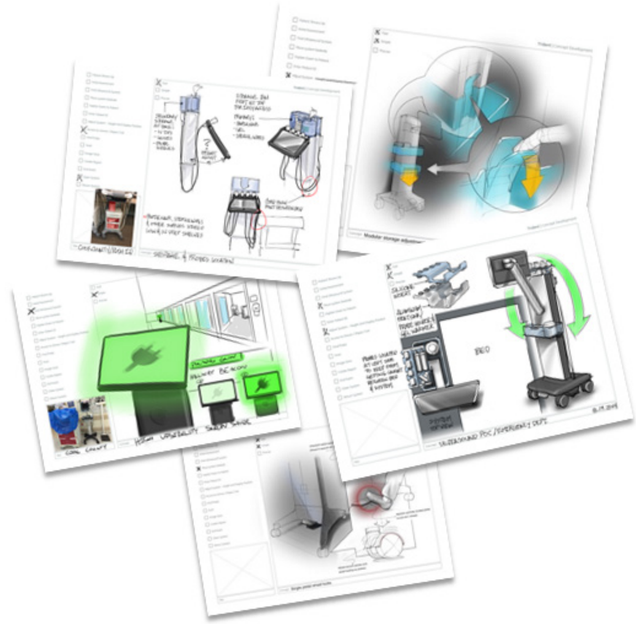
This paper shows you the reliability and durability testing we do to make sure that Venue is reliable in your hands.

Like brakes and steering wheels.

Yeah, we get it. Ruggedness on the frontlines of critical medical care is as important as brakes and steering wheels. From the earliest design, we started with this as a foundational concept.

Some of the early design concepts (pictured at the right) survived to the final design. Some didn't. But to make it from concept to clinic meant that the design, casters to cockpit, had to meet rigorous standards for reliability and durability.

Here is some of what we did to pressure-test that design:



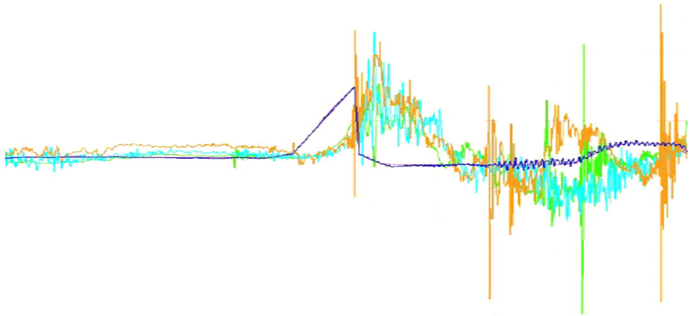
Shake it up and bring the data.

The picture at the right is one of the test models of Venue on a shaker table. If you follow the bundle of red wires (look for the Axis X label and the piece of tape just below that to find the wire), you'll find accelerometers that we placed throughout the system as we shook it.

When we shook the bottom of the system, we could see how the impact was transmitted to other parts of the system and how they responded.

The accelerometers recorded the impact and gave us data like the chart below the photo. The dark blue line represents the shock from the table, and the colored lines represent the movement based on sensors placed on Venue in several locations.

We used this data to make design improvements, including things like where to reinforce portions of the mechanical design, whether to add brackets to secure connectors, and whether to move the center of gravity.



The graph above represents the motion of several parts of the system when it is shaken in a test environment. The blue line is the table motion, the other lines represent motion of the system components.

Crash it.

In another test, we crash the system into a plywood wall at three meters per second. We use this data in a similar way, looking for the mechanical limits of the design and any potential opportunities to reinforce system durability.

Bake it.

Alex, one of our validation engineers, stands in front of a massive oven we use to test the system in a range between 0°C and 70°C. And while it's baking, the validation team is running the system software continously to look for changes in system behavior.

We run temperature testing like this on the component, subsytem, and whole system level. It helps us to find weak spots, to test air flow design in the system, and to help us to make a trade-off between fan speed (and noise) and system cooling.

And run it.

Throughout many of these tests, we're continously running the system software and monitoring it for expected behavior. Three months at 50˚C is the baseline, but our continuous improvement culture means this is on-going.

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Imagination at work

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