

MASC

THE POWER OF TEAMWORK

BY DAVID PACCHIOLI

In early March 2020, as COVID-19 cases in the U.S. jumped into the tens of thousands, an interdisciplinary team of Penn State researchers mobilized to address critical shortages of masks, ventilators, and other personal protective equipment (PPE) available to healthcare workers.

The initiative—called Manufacturing and Sterilization for COVID-19, or MASC—began in Tim Simpson’s 3D printing class. Simpson, Paul Morrow Professor Engineering Design and Manufacturing, was looking for a way to give his students a meaningful experience in spite of the campus lockdown.

“It was going to be tough to run a hands-on lab when students weren’t allowed in the labs, so I started looking for ideas about 3D printing COVID-19 PPEs, which students could help design from their homes,” says Simpson, who is also co-director of the Center for Innovative Materials Processing through Direct Digital Deposition. “My students jumped at the opportunity.”

While his students were generating ideas, Simpson was seeing stories from around the world highlighting creative uses of 3D printing to meet the sudden demand. He started sharing these stories with colleagues, and soon a University-wide initiative was born, with volunteers signing on from the College of Engineering, the Applied Research Lab, the Center for Medical Innovation at Penn State’s College of Medicine, and the Smeal College of Business, among other units. Motivated by news headlines, neighbors’ concerns, physicians’ requests, and healthcare workers’ pleas for medical supplies, more than 380 faculty, staff, and students pitched in.

“I think it really helped a lot of us cope with the situation, to feel like there was something we could do,” says Mary Frecker, Riess Chair in Engineering, director of the Penn State Center for Biodevices, and the current co-director of MASC.

Cross-disciplinary teams formed to tackle a growing list of projects. The focus was on design and delivery of rapidly scalable solutions—prototyping and testing done at Penn State followed by transition to an industry partner to scale production and ensure regulatory compliance. Within the first week, MASC researchers created a prototype for a plastic face shield and recruited a local manufacturing company, Universal Protective Packaging, Inc., to mass-produce it. UPPI has since manufactured more than a million of the shields for Hershey Medical Center and others in need.

Meanwhile, another team designed and 3D-printed protective mask prototypes for Hershey physicians to test and provide feedback. Through connections with faculty at Penn State Behrend, the MASC team worked with Plastikos, Inc., in Erie to developing tooling for injection molding to produce the masks in high volume.

As part of the all-out effort, supply chain experts sourced a textile material for use as a mask filter and materials scientists tested it. Architects and engineers collaborated remotely to design and develop an isolation booth to protect nurses and staff working at drive-through testing sites. Costume designers from the School of Theatre patterned and sewed gowns and masks that were then packaged in Penn State’s Meat Lab before being sterilized with gamma rays at the Breazeale Nuclear Reactor.

A sterilization group evaluated techniques such as ultraviolet radiation, vaporized hydrogen peroxide, and plasma methods, and the legal and regulatory team made sure solutions conformed to frequently changing regulations.

Eight months later, with critical shortages relieved, MASC has shifted to longer-term planning.

A “solution catalogue” documents and shares nearly 20 completed projects, with technical specifications, manufacturing instructions, and industry contacts. The MASC team continues to meet weekly, Frecker says, “and part of what we do is talk with the folks at the medical center about what they see coming up that’s going to be needed.”

Simpson’s idea for his class bloomed into a total team effort that has had positive impacts all across Pennsylvania. “The story behind it all,” he says, “highlights the power of partnership at Penn State to help support the health and welfare of lives across the commonwealth.”



Dr. Neerav Goyal, a physician at Hershey Medical Center, tests a 3D-printed filtration mask prototype.

Penn State Health/Jason Plotkin (2)