



Bits & Bytes

SUMMER 2020
Volume 1, Issue 1

Innovation Workspace Initiative

Welcome!

We are happy to have you join us for our inaugural issue of Bits & Bytes, the Innovation Workspace Initiative's newsletter. While the Innovation Workspace itself is still some ways off, we have decided to launch a newsletter to keep interested members of the community aware of the project's progress and related efforts in our community and around the world.

The Innovation Workspace Initiative (IWI) is an effort to foster a community of makers in North Iowa: by creating publicly accessible workshops in the style of a makerspace or fabrication laboratory, our goal is to assist community members in bringing their ideas to fruition. Our organization will work in parallel with school districts to provide supplemental hands-on experiences to enable students to explore their interests and broaden their understanding of science, technology, engineering, mathematics (STEM), and the skilled trades.



Interested in receiving updates and newsletters? Scan this QR code with your phone or click on this [link](#) to sign up!



Or join the conversation on our Discord Server!



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Mission:

The Innovation Workspace Initiative will be a public-private partnership to excite, educate, and inform students and the community about the skilled trades and STEM careers through project-based learning.



CREATING IN CRISIS

STEPPING UP TO ADDRESS COVID-19

COVID-19

COVID-19 has impacted nearly every aspect of daily life, directly or indirectly. The current climate has been particularly challenging for small businesses; the subsequent unpredictability has exposed weaknesses in the supply chain and caused cash flow disruptions. Locally, we have seen many creative approaches to address the current situation: working remotely, restaurants trying out new menu items through delivery-only services, grocery stores expanding into delivery services, and the John Pappajohn Entrepreneurial Center's new business helpline, established to provide guidance for local businesses seeking aid.

Around the world, creative innovators have been gaining attention for their efforts in addressing some of the most serious medical supply concerns resulting from the pandemic, including personal protective equipment (PPE) and ventilator shortages.

The Maker Movement

Over the past several decades, there has been a subculture developing in the United States and across the globe; spanning the Do-It-Yourself (DIY) and hacker cultures, this movement brings together tinkerers, technicians, artisans, programmers, and many more to create and share ideas. From this subculture has arisen the concept of makerspaces, fabrication laboratories, hackspaces, and maker faires, and this has resulted in make technologies like 3D printing becoming accessible and mainstream.



As the COVID-19 outbreak spread, this community of makers from around the world stepped up to face it. The maker movement has always believed in democratizing access to science, technology, engineering, art, and mathematics (STEAM). In the midst of a global pandemic, this philosophy resulted in a flurry of ideas and community efforts to create parts and pieces, masks and manifolds to support the doctors and nurses who rapidly found themselves on the front line. It wasn't long before news articles began appearing all over social media: manufacturers [reverse engineering ventilator valves](#) in Italy, YouTube channels posting [designs & how to's](#) on 3D printing respirators (face masks), and Facebook posts of students stepping up to [print face shield](#) components.



Image From Fast Company Article: *These Good Samaritans with a 3D printer are saving lives by making new respirator valves for free*

There has been such a surge in designs related to COVID-19 that the popular design sharing site, Thingiverse, created a new group entitled [HackThePandemic](#) and added a banner at the top of each page recommending people check out the designs they could make. Innovators worldwide have designed a multitude of experimental respirators, mask adapters, face shields, and devices for opening doors without touching the handle.

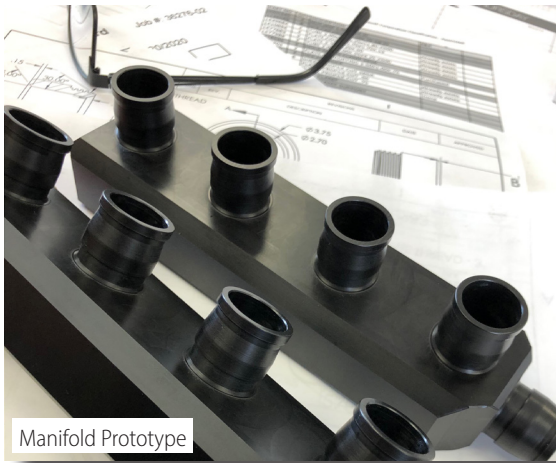


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Among the 3D printing community, designs are not only shared freely, individuals are encouraged to produce as many as possible to address the PPE shortage at large.

Among the many unsung heroes of this community response are the 3D filament providers, such as MatterHackers, who support this effort by continuing to ship filament and helping organize people who have 3D printers at their disposal. Available material and 3D printers ready to jump into action have enabled a public response to prototype and provide in ways that has never been seen before.



Manifold Prototype

MercyOne: Stepping Forward Locally

A similar rallying of resources emerged locally as members from several communities in North Iowa began reaching out to MercyOne to offer their services. It quickly became apparent it would be necessary to bring everyone together to organize the region's efforts. Two major priorities were identified: rapid manufacturing of the frames for face shields, led by

Jim Miller of [MetalCraft](#), and developing a system to extend the service of the hospital's ventilators. This second team has been headed up by Matt Koch from [Sukup Manufacturing](#) and includes physicians from [MercyOne](#), engineers from Sukup, and rapid manufacturing specialists from [Plastech Tooling](#).

Extending Resources

Within a week, the team working on the ventilators had developed a prototype manifold thanks to Plastech Tooling owner, Dean Sonquist, to split the airflow from a single ventilator to four patients. While a simple system for splitting the air was trivial, this effectively eliminated many of the clinical features of the ventilator, turning the machine into nothing more than an air pump. As the manifolds made their way to the hospital for testing, other efforts got underway to bring back some of the clinical features.

Developing Something New

Dr. William Riesen, local physician and volunteer team lead for the Mason City High School robotics team, took a slightly different approach to the problem. Inspired by a [2010 MIT paper](#), Dr. Riesen began assembling an automated system to actuate an Ambubag using the robotics team's equipment. While a modern ventilator is much more than a simple pump that blows air into the lungs, this was essentially how early ventilators began. Designed using motors with built in rotation sensors, this "robo-vent" can be adjusted for different tidal volumes, that is, the amount of air being pumped into the lungs. The apparatus uses an airflow sensor to detect when the patient is attempting to initiate a breath and delivers a controlled air pressure assist.

Robo-vent is now operational and has undergone basic

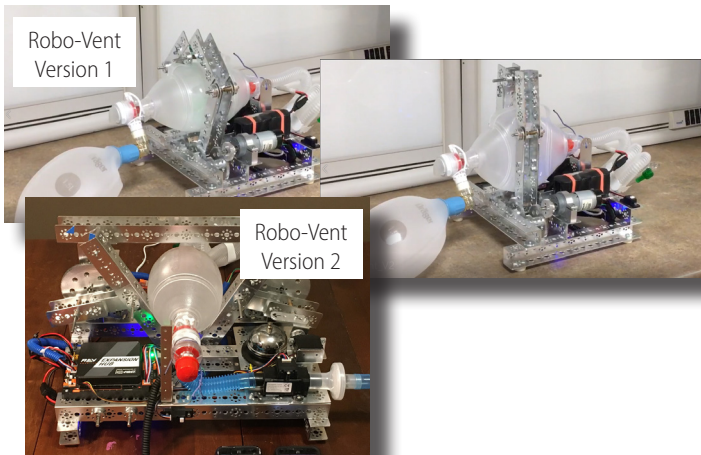


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If you would like to learn more about ventilators, how they work, and the difficulties in creating one from scratch, check out this video by [Real Engineering](#).



Building a Better Face Mask

In addition to a potential shortage of ventilators, the hospital may experience difficulties in acquiring sufficient personal protective equipment (PPE). Anthony Riesen of IWI has stepped forward to develop a 3D printed face mask to be used in the event of a



Initial Mask Prototypes



testing in a five-day run. It could now be used and replicated in an emergency. But, while high school robotics teams across the country will already have much of the equipment to produce one robo-vent, it is far from an ideal solution.

Dr. Riesen has collaborated with Matt Koch, of Sukup, to develop a version of robo-vent that could be manufactured more rapidly should North Iowa see a resurgence of the virus. Please continue to wash your hands & wear your mask to prevent this.

Interested in building a robo-vent yourself? Follow this QR code or [link](#) to get the instructions and a video of the robot in action!



scarcity in N95 face masks. By researching and trying out various respirator (face mask) designs available through the maker community, Anthony determined which designs would provide the best protection. With two FlashForge Creator Pro printers borrowed from North Iowa Area Community College, he began producing trial prints in relatively short order.



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Initial prototypes with rigid ABS plastic resulted in masks unable to form a good seal against the face, even when a layer of thin weatherstripping rubber was added around the edge. Additionally, the original filter material was not effective at blocking out the aerosolized particles used in the classic fit test at the hospital.

Troy Mingus, a respiratory therapist at MercyOne, offered a different mask. This [alternative design](#) didn't use the same bulky filter cartridge, nor did it require the use of hot glue to hold the filter in place. Additionally, it used a different type of foam weatherstripping to achieve a better seal against the face.

Mr. Mingus' mask did pass the fit test at the hospital, but there was still a concern that it would fail quickly as moisture from the wearer's breath accumulated on the filters. This prompted investigations of multi-layer filters within the original filter cartridge; an air gap between the filters would provide filtration while catching much of the moisture. At the same time, Fiberology FiberFlex 40D filament was purchased to help explore the creation of more comfortable masks that could be worn and be used over longer periods.

Chance Short from WolfWork 3D, the distributor of the FiberFlex filament, also offered suggestions regarding mixed material 3D printing. While the flexible filament makes the mask more comfortable and creates a better seal with the face, it is too pliable to create a seal with the filters. Therefore, the most successful design has been of masks with the filter portion printed with rugged ABS and the walls of the mask composed of the flexible filament. This combination should provide the best of both worlds.

A single printer will only be able to produce a couple masks a day, so how would North Iowa get the numbers needed to make a difference? Check out this video by [Smarter Every Day](#) to learn more.





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Next Level Prototyping

During preliminary testing of the flexible masks, Dr. Riesen received a special request from Bryan Williams, chief flight nurse for MercyOne Air Med: create a respirator specifically designed for helicopter personnel.

Flight nurses, like all medical personnel, are exposed to potential cases of COVID-19. However, unlike other medical personnel, flight crew members find that available N95 masks are not an ideal solution; standard N95 masks muffle the microphones the crew wears to communicate and tend to fog their visors. Mr. Williams provided a flight microphone and cable for prototyping purposes.

Previously, the respirator modifications were able to be done with minimal effort by altering the 3D printer settings; however, this new design required the original mask to be reverse engineered from the printer file, which was difficult to edit. Autodesk Fusion360, a professional computer aided design (CAD) software, proved invaluable during the reverse engineering and redesign. A rough prototype was ready for an acoustic check within days.



Prototype Acoustic Check

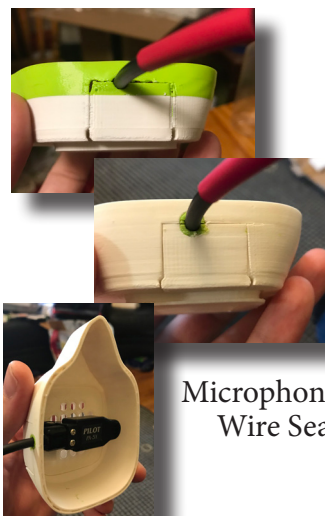
Profile View:

Path of microphone wire highlighted in yellow.



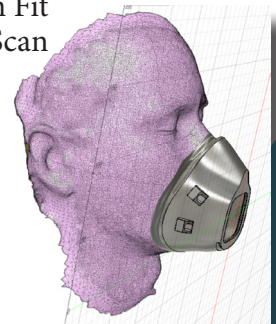
This check proved successful; the audio came through clearly and the location of the filter eliminated the issue with fogging. This allowed the design process to proceed to creating an effective seal around the microphone wire.

Finally, the masks were customized to individuals using Trnio, an iPhone app that uses photogrammetry to create 3D models from a series of pictures. This individualization of masks is being explored for all future masks, along with the possibility of automated techniques to accelerate the creation of custom masks.



Microphone Wire Seal

Custom Fit from Scan





ENTREPRENEURIAL SPOTLIGHT

ReENVISION Ag. LLC

In early October 2019, Jayson Ryner met Anthony Riesen and Tim Putnam in the Iowa Venture School program. During this crash course on entrepreneurship and business model design, Anthony and Jayson got to know each other quite well and started bouncing ideas off each other. Jayson, who is both a farmer and the choral director at NIACC, was exploring a venture geared at agricultural innovation. After the first couple weeks of Venture School, Jayson gave Anthony a call asking about 3D printers.

Several hours and calls to NIACC faculty later, Anthony was able to borrow a Flashforge Creator Pro printer to help Jayson prototype his product. They met many days over the next few weeks, discussing the required features, design specs, and trying out several early prototypes. On the final day of Venture School, Jayson was able to pitch his business idea to the panel of adjudicators with the key piece of his prototype fully functional and ready to go.

Armed with the entrepreneurial mindset gained in Venture School, Jayson was soon working on a complete prototype with additional team members with backgrounds in farming, machining, and web design. Development of the full product began, the patent process was kicked off, and the original prototype was iterated several more times as the design was update to integrate with the rest of the system.

In May of 2020, Jayson and his new company, [ReEnvision Ag.](#), were selected to participate in the Venture School Launch Day pitch competition, part of EntreFEST 2020. Out of all the teams who participated in the Iowa Venture School program across the state, twelve were selected to



compete for seed money. The first round of pitches was held on Wednesday, June 3rd, the day before the entrepreneurial festival began.

After passing this first round, Jayson progressed to the final competition where he was one of five finalists. With an updated slide deck and some further coaching from the team at NIACC's John Pappajohn Entrepreneurial Center, Jayson delivered a fantastic presentation and was able to easily answer all questions posed by the judges. ReEnvision Ag [won first place](#) in the pitch competition securing the top prize of \$10,000 in seed money and won an additional \$1,000 award for innovative technology from the Bates-Camblin Family.

“The game changed yesterday.” Jayson wrote to Anthony as they discussed the future of the company. While there is still a lot of work to do before the product is ready for market, the infusion of seed money has helped spur the venture forward.

ReEnvisvion Ag has made the leap from a home project, literally being worked on in the shed, to the kind of business venture gaining the attention of venture capitalists and angel investors. The Innovation Workspace Initiative is proud to call ReEnvision Ag our first entrepreneur helped, and we look forward to seeing where Jayson and his team go next.



COMING SOON...

THE INNOVATION WORKSPACE INITIATIVE



JPEC Tech Talk

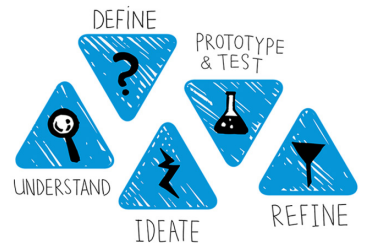
Roughly once a quarter, the John Pappajohn Entrepreneurial Center hosts a lunch-and-learn panel discussion for the community to foster discussion around a particular topic. The next talk topic is slated to be Communities of Innovation, with panelists from Fab Lab Independence Community College, Cedar Valley Makers, and Iowa State University's Center for Industrial Research and Service (CIRAS) Digital Manufacturing Lab. Following the discussion, key community members with interest in the project will be invited to join an advisory committee to help direct the initiative and make the workspace happen.

Unfortunately, due to COVID-19, this Spring's talk has been put off until the public health situation is resolved. If you are interested in being informed when the TechTalk gets rescheduled, please let us know by signing up at the link below.



Design Thinking Academy

As with any entrepreneurial endeavor, the Innovation Workspace Initiative needs to conduct a test with a minimum viable product to ensure that there is enough buy-in from the North Iowa community. For the



workspace, we have developed a camp that can be adapted to after-school sessions or a week-long day camp program to give students a taste for problem solving and product development. Based heavily on the Autodesk Design Academy course, this Design Thinking Camp will have students work together in small groups to address an issue from within the North Iowa community.

This course, designed for students entering 8th through 12th grades, will focus on each of the five stages of design thinking: Understand, Define, Ideate, Prototype & Test, and Refine, while helping participants develop soft skills such as teamwork, communication, and problem solving. Students will have access to a basic set of workspace tools and materials ranging from cardboard and duck tape, to 3D printers and Arduinos. Volunteer mentors, comprised of employees from a variety of local businesses and industries, will help guide the student projects and prompt the students to think critically about what type of careers they would like to explore in the future.

The original dates planned for the summer camp have also been disrupted by COVID-19, so please sign up at the link below if you are interested in receiving updates regarding when the camp will be conducted.



Scan this QR code with your phone or click on this [link](#) to sign up!



GET INVOLVED NOW

THE IWI DISCORD

Discord Server

The physical workspace of IWI is still a ways off, due to securing funding through partnerships and grants and, of course, COVID-19's effect on the economy. But, as the stories in this newsletter have demonstrated, this doesn't mean that innovation and community come to a standstill. Therefore we are proud to announce the launch of the Innovation Workspace Initiative's Discord Server!



For those unfamiliar with the platform, Discord is a form of social media that allows communities to customize their experience. Originally designed for gamers, Discord is built to support text, voice, and video chatting. This enables a wide spectrum of virtual events ranging from conversations about the next coolest tech, panel discussions, online presentations, and even livestreaming content.

Furthermore, each member can pick and choose which topics they are interested in without being bombarded by every conversation at once, a problem on other forms of social media.

But, most importantly, it allows you to get in on the conversations now! Whether you want to learn how we made the custom masks, are curious about the types of projects people

in North Iowa are up to, or want to discuss the finer points of modeling for 3D printing, there is a place for you in this community.

And, we want to hear your feedback! Let us know what you think about the Innovation Workspace Initiative, or if you would like to see particular equipment or tools, send us a link so we can check it out.

Sounds great, but not sure how to get started? Well, that is the easy part. Simply scan the QR Code below, or follow this [invitation link](#). If you are new to Discord, it will take you through the simple process of creating your account and then connect you to the IWI Community server. From there, we will have resources to help you get started with the community. We look forward to seeing you there!





ABOUT US

THE IWI PROJECT MANAGER

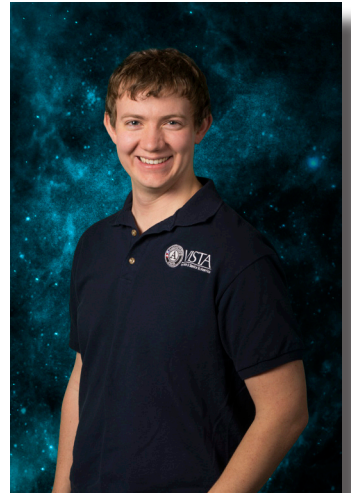
My name is Anthony Riesen, and I am the one behind this newsletter, so thank you for reading this far!

I am a Mason City native, and my journey to this project began in 2017 when I graduated with my Bachelor's in Physics from St. Olaf College and signed on to serve as the AmeriCorps Volunteer in Service to America (VISTA) at the Powell Makerspace. Over the next two years, I learned a great deal about fabrication from the members of this small makerspace in rural Powell, Wyoming, and even more about the challenges that come along with running a nonprofit. The entire two years I spent working there, I wished there had been something like the Powell Makerspace when I was in high school.

As my term of service came to an end and I returned to my hometown, I started contemplating the possibility of bringing something like the Powell Makerspace to Mason City. After convincing my parents it was a worthy project to pursue while living under their roof, my father put me in contact with Tim Putnam. From that first meeting onward, the project grew rapidly. Tim had me reach out to Jim Correll, down at Fab Lab ICC in Independence, Kansas, and before I knew it, I was on my way down to attend their community boot camp. Upon my return, Tim pushed me to envision the Innovation Workspace Initiative serving not merely Mason City, nor even just Cerro Gordo County, but the entire nine-county service area of the college. He got me signed up for the Iowa Venture School program, and soon I was driving all over the area to speak with teachers, students, business and industry leaders, and economic development directors.

These conversations were invaluable and have given me many insights into the needs of different parts of the community, but one message stayed the same wherever I went: "We love this idea. We have no idea how you are going to pull it off. We are glad you are the one exploring it." There is a lot more discovery to be done and many more questions to be answered, but the support for this project from the community has been very encouraging, and I am confident that we will make something happen. I am excited to keep moving the project forward, and would be happy to talk with you if you have any questions about the project.

Best,
Anthony Riesen
IWI Project Manager



Anthony Riesen

Innovation Workspace
Initiative

Special Project Manager

John Pappajohn
Entrepreneurial Center

North Iowa Area Community
College

E: anthony.riesen@niacc.edu

P: 641-583-5579

Special Thanks

This project is still in its infancy, but we would like to thank Tim Putnam and his team over at the NIACC John Pappajohn Entrepreneurial Center. Without their support, advice, and recommendations, this project would never have gotten this far.

We would also like to thank everyone who is doing their part to get us through COVID-19, all health care professionals serving on the front line, industry leaders who have stepped up to provide aid, including Sukup Manufacturing, MetalCraft, PlasTech Tooling, MatterHackers, WolfWorks3D, and so many more across the nation and the world.

