

# Arizona's COVID-19 Rapid Response Initiative

## A Decentralized System to Produce and Deliver PPE & Medical Instruments

### Overview

Arizona State University (ASU) intends to operationalize a comprehensive system of production, sterilization, verification, and delivery of personal protective equipment (PPE) and medical equipment to meet the needs of Arizona's clinics and hospitals resulting from COVID-19. This effort is already underway through mobilization of the university's research labs, faculty, students, and external partners. Daily production has begun on 3D-printed face shields, testing swabs, and other PPE; however, to meet the increasing demands as a result of this crisis, a more cohesive effort is required at scale.

The proposed initiative will leverage the expertise, resources, and leadership at ASU to bring together a network of Arizona's universities, businesses, hospitals, and community contributors to scale the rapid design, development, sterilization, and delivery of critical medical equipment. This production will be achieved through the large-scale coordinated use of 3D-printers and other readily available means of manufacturing and will take advantage of both manufacturing capability decentralized throughout the state as well as centralized facilities set up across the university. ASU will focus its efforts on design, prototyping, testing, and verification of designs to meet the needs of local clinical partners. Additionally, by leveraging existing capacities - such as research facilities, faculty expertise, and students - the university can produce verified designs for manufacturing within the local business community.

A nimble supply chain will be established that leverages a network of producers, distributors, and entities who have the capability to sterilize and verify medical equipment. Key to this effort will be the creation of a software tool for the dynamic communication and management of both supply and demand, linking clinical groups to the manufacturing network. This tool will also be linked with real-time modeling efforts on-going at ASU in collaboration with ADHS and UofA, providing both manufacturers and hospitals with credible predictions of demand in the coming weeks. This effort is expected to produce over 5,000 units of equipment daily, which will help address the projected demand of Arizona's hospitals and clinics and will be nimble enough to pivot in real-time to address changes in demand.

## Desired Outcomes

- The rapid design, development, testing, verification of new models and methods to address the unique challenges presented to Arizona's hospitals by the COVID-19 pandemic.
- The procurement of materials needed to support statewide efforts to produce PPE and emergency medical devices, such as ventilators.
- The establishment of a legal framework to protect producers from liability, while allowing hospitals to leverage non-traditional, yet potentially critically needed equipment.
- The creation of an alliance network of businesses, hospitals, and universities that will have long-lasting impacts well beyond the unique challenges currently facing the state.

## Operational Units

Operational Units will be comprised of university, clinical, and business partners. These teams will be managed through an agile framework and will meet daily to coordinate efforts, share findings, and address roadblocks. ASU's departments of Corporate Engagement and Clinical Partnerships will cultivate and maintain an alliance network that will scale the personnel and efforts of the following operational units.

- **Design & Testing:** Led by hand-selected experts from ASU's Engineering and Design Schools in conjunction with multidisciplinary student teams in ASU's Luminosity Lab, this unit will coordinate the development of new device designs, as well as the verification of these models through proper testing procedures. This work will ensure that relevant manufacturable models of medical devices, such as ventilator valves, are verified prior to being distributed for production.
- **Production:** The Polytechnic School and Industrial Engineering will coordinate decentralized production across Arizona's businesses, universities, and community as well as a more concentrated activity on the ASU campus. By distributing 3D printers across distinct physical locations, scalable production can be achieved while allowing all contributors to adhere to social distancing.

- The more centralized ASU facility will be carefully organized to facilitate rapid development of designs and prototypes while maintaining safe working conditions. Technical support and comprehensive data and protocol repositories will be provided to ensure that contributors are using up-to-date and verified models and that printing procedures have the precision needed to meet quality standards.
- **Regulatory Compliance:** ASU's Office of General Council will spearhead regulatory compliance and ensure that legal considerations do not slow the agile nature of this effort. Legal waivers will be developed to allow hospitals to leverage equipment that was produced by non-traditional means, while also protecting contributors from liability. This unit will pursue pathways to leveraging currently held patents, open source designs, and new design & manufacturing opportunities presented by federal government declarations and determinations.
- **Quality Assurance:** Led by leaders from ASU Biodesign, best practices for sterilizing and verifying produced medical equipment will be established, distributed, and operationalized. Biodesign currently has the means to sterilize and verify PPE and will act as the initial hub for this effort. The Quality Assurance Unit will work to establish a network of centers across Arizona that can intake, sterilize, verify, and package produced medical equipment prior to end-user delivery.
- **Software & Logistics:** W.P. Carey School of Business experts within Supply Chain will develop a compressive process for the movement of equipment from production to assembly, sterilization, quality assurance, and delivery. This effort will ensure partnerships are formed throughout Arizona to establish, grow, and maintain a supply chain needed to meet the growing demand of hospitals. Furthermore, a team at ASU is developing a software application to facilitate and track the demand, production, and delivery of all equipment produced by this effort.
- **Procurement:** ASU will leverage its in-house procurement team to quickly acquire the material and equipment needed to support production needs. Procurement will establish small orders with various supplies throughout the world, as large batch orders are currently unavailable.

## Resources Needed for Implementation

In order for the Arizona COVID-19 Rapid Response Initiative to be implemented in a timely fashion and in a manner which operationalizes a comprehensive system to deliver PPE and medical equipment to Arizona clinics and hospitals, ASU estimates that an initial investment of Five Million Dollars will be required from state and/or other sources. This initial investment would be used to do the following:

- Specialized manufacturing equipment that is capable of producing appropriate, medical-grade solutions.
- Support for personnel to create, test, and verify parallel designs, methods, and prototypes.
- Raw materials to meet expected demand and production needs.
- Specialized testing equipment that allows for quick and effective testing and sterilization of produced equipment.
- Financial support for the delivery mechanism between contributors, sterilization centers, and hospitals.
- The development of a software system to facilitate the logistics of this effort.

## Timeline

A high-level timeline is provided to give insights to the expected weekly production of this effort. These outputs are subject to the required materials being sourced and acquired. These numbers will shift, as different needs are prioritized, and new methods are released.

### Ramp-Up Timeline

#### Week 1

- Initiative launched
- 500 Face Shields
- 500 NP Swabs
- Design and testing of novel intubation box with Banner Health
- Start of daily coordination with stakeholders
- First ventilator prototypes built and tested

#### Week 2

- 1000 Face Shields
- 2900 NP Swabs

- 300 Intubation boxes
- 5 Initial ventilator prototypes built and tested

### **Week 3**

- 2000 Face Shields
- 3800 NP Swabs
- 400 Intubation boxes
- 10-50 Initial ventilator prototypes built and tested

### **Full-Scale Achieved: Week 4 to September 2020**

- A software platform that collects the needs of Arizona's hospitals and clinics, and enables the virtual factory of production to track, meet, and deliver the required equipment and devices.
- An efficient and nimble system of new product design, development, and testing that leverages the breadth of ASU's faculty and students.
- A system of digital and physical distribution to deliver validated models, research, and materials from ASU to local businesses and manufactures across Arizona.
- A substantial increase in production achieved by leveraging the full-scale of business partners.