3D Printing for COVID-19 Response at MIT

Purpose:

This document outlines associated risks with using 3D printing (types typically found on college campuses and in DIY makerspace) for COVID-related medical devices and personal protective equipment (PPE). This document does not provide information, guidance, or references that should be used to support 3D printing in response to COVID-19.

Synopsis:

The imminent shortage of PPE, along with the wide availability of 3D printing technologies has generated enthusiasm about the potential of 3D printing to create PPE and other medical devices. Selection of suitable manufacturing processes for PPE requires expertise in materials science and engineering, the technical aspects of PPE design, intended use and clinical context, regulatory science, and understanding of professional manufacturing at scale (not fabrication and making). *Although MIT has world-class 3D printing capabilities, these printers are best applied to show proof of concept that can be used to justify transition to a manufacturing process that delivers parts with appropriate rate/scale/safety characteristics*. To better understand how you can contribute to helping with COVID medical device/PPE efforts at MIT, please see: https://covid19.mit.edu/Update-on-efforts-to-provide-PPE-for-local-hospitals.

Practical issues with PPE and 3D printing:

At present, the shortages of PPE are primarily attributable to two factors that limit the practicability of 3D printing to the current situation:

Core issues with masks: Masks are not the problem, the availability of filter media is currently the problem. Masks without filter media do not aid in the current situation.

Capacity for masks and other high-volume PPE use: There is a lack of current manufacturing capacity to produce the volume of masks/filters/face shields/etc. required to address backlogs and daily demands for PPE. In some cases these needs are estimated to be several million per day. Effort put toward 3D printing to fill supply gaps diverts focus where effort is needed to address filter media shortages.

Risk and uncertainty with 3D printed devices and PPE:

The use of 3D printed devices and PPE in this type of situation could generate situations wherein unnecessary risk is added to an already challenging situation. It is possible to find 'solutions' that look good on paper but are unproven with respect to practicable sanitization processes that are (i) currently widely available at hospitals, (ii) compatible with 3D printed parts that can be made at scale at MIT, and (iii) able to process parts at hospitals in the volumes required. This can lead to a false sense of security where risk has actually been amplified.

Ultimately, if 3D printing is to be selected as a process for scaled manufacturing of components of PPE or devices that can be used in the medical arena, the above mentioned regulatory and sanitary aspects must be guaranteed. Many established 3D printing companies are already implementing this guidance and leveraging the appropriate supply chains, in cases where 3D printing truly makes sense and does not impart false confidence. Given the preceding, 3D printing at MIT is best applied in the way it always has been, to rapidly convert good ideas into proof of concepts.

Martin L. Culpepper, Peter H. Fisher, Elazer R. Edelman

Neil Gershenfeld, professor in media arts and sciences, and A. John Hart, professor of mechanical engineering, both offered comments during the crafting of Professor Culpepper's memo