HypaHelm

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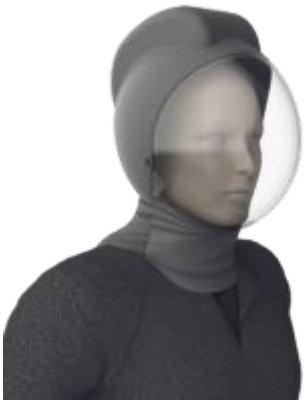
9am May 13th

Forward

Properly designed contemporary protective equipment, supplied in sufficient quantities, can provide an alternative way forward. It will save lives and facilitate rapid emergence from lockdown, irrespective of the timing of a vaccine.

Existing personal protection equipment is not fit for purpose, neither for medical use nor for the general public. If there had been effective equipment, a huge number of deaths particularly amongst medics, could have been avoided, along with the social and economic devastation of COVID-19.

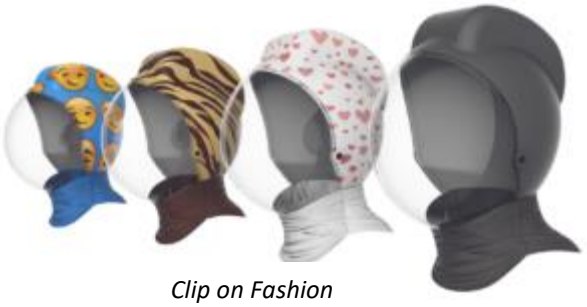


Conceptual Example of HypaHelm

Objective

After looking closely at masks and the controversy about wearing them, we initially planned to redesign them and manufacture more effective products. However, it immediately became clear that masks were only part of the problem and that the urgency and scale of the need was far beyond our resources,

Therefore, we have revised our approach. Our objective now is to be a catalyst for a much needed revolution in the design of protective equipment.



Clip on Fashion

Future

Mass manufacturing of the HypaHelm system and related items will in itself have a positive economic impact. An automated factory could probably produce half a million a day at sub £15 per unit marginal cost.

Governments will decide, but it's likely the use of HypaHelms by the public would be mandated in certain situations, such as public transport (including flights), shops, workplaces and so on, until a vaccine is widely available .

For eating and drinking establishments, there will have to be a combination of testing and individual certification for people to remove their HypaHelm. This whole process could be managed and jointly funded by the hospitality industry and their customers.

When a vaccine is developed, the HypaHelms can be put on the shelf to be available for the next pandemic.

Public Transport Example

Vision

No one on the planet should have to breath air potentially loaded with lethal viruses.

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Design Introduction

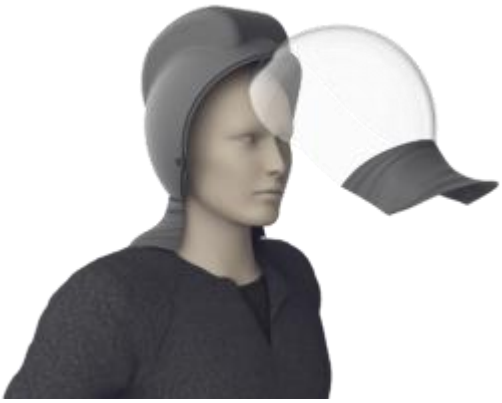
We are not trying to be prescriptive about design choices. The functional requirements we propose are a starting point for discussion and will evolve.

At this early stage, it probably doesn't make sense to specify any interoperability or performance standards. Clearly any product must perform better than existing equipment. Anyone investing in mass production should definitely take into account what standards are likely to be developed.

Time to mass manufacture is critical, so we have proposed aggressive timetables for products which don't require any fundamental research. There is no reason why design for an ICU nurse and a bus driver or commuter should be different, they all need to work and uniformity is necessary for most efficient mass production. Nevertheless, although adjustable, there will probably need to be a couple of sizes.

Design Background

The masks that are normally used by medics, KN95-FPP2-3, are basically particulate filter masks originally developed for dusty industrial applications and then more commonly used in Asia for protection against particulate pollution. The best basic face masks, which are quite difficult to breathe through and thus effectively often bypassed, are claimed to remove 99% of 300 µm particles. A dry virus is about 80 to 150 µm diameter. A bit of statistical maths suggests over 90% of virus will go straight through such a mask. Some virus may reside in larger drops of moisture before it evaporates in the air, and so a higher proportion of these may initially get trapped by the filter - but then as the moisture evaporates in the mask, what happens to the virus?



Front Opening Example

Similarly, the facemask, or the famous silk scarf, may significantly reduce the range of a moisture-laden sneeze or cough, but again – what happens to the virus if the scarf dries out?

Often, these poorly performing industrial filter masks are badly connected, if at all, to face shields or body suits. The eyes in particular remain extremely vulnerable.

There are many candidates for much more effective passive virus filters but all require assisted air flow.

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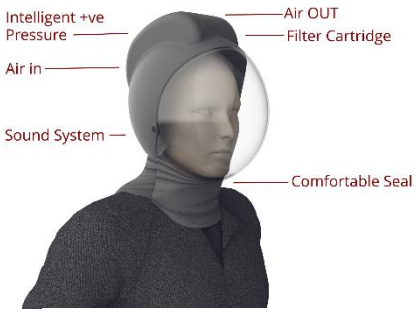
Mark One

The Mark One HypaHelm must provide effective full-face protection. Although there are multiple design challenges, it will essentially use existing technology and not require any fundamental research. Think of a Mark One as a Bluetooth headset with a super-efficient controlled fan and a few plastic bits, it's not that difficult.

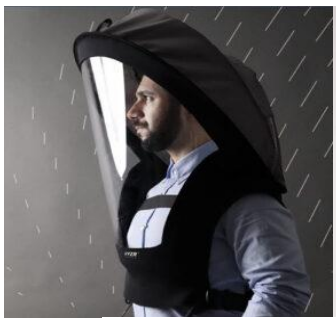
This is an outline functional specification.



Main Functions

1. Full face visibility
2. Lightweight
3. Positive regulated internal pressure
4. HEPA or similar filter cartridge,
5. Possibly reusable filter after RFID certified sterilization
6. Filter cartridge auto ejected.
7. Lithium battery powered technology built into the helmet
8. Anti-mist provision
9. Painless two-way audio with environment and for mobile phone
10. Comfortable adjustable helmet with a comfortable effective neck seal
11. Provision for drinking tube with appropriate interlock
12. Provision for hands-free safe decontamination and charging chest
13. Provision for lightweight UV transparent clip-on decorative covers and partial cultural frontal panels.
14. Suitable for immediate mass production

There are several examples of devices with similar functionality on the market from companies such as 3M or VYZR, but they are heavy expensive industrial devices that are not designed for the current mass-market virus protection requirements. There also various University projects like Southampton's which stand a much better chance of getting to market with a serious scale if there is a well-developed ecosystem



YVZR System

3M Example

University of Southampton Respirator

Mark Two

The Mark Two is generally similar to the Mark One but it incorporates a 'Kill Zone' that accomplishes the active real-time destruction of airborne viruses, whether free-floating or in moisture droplets. This may require a separate wearable bodypack initially, but eventually it should be able to be built into the HypaHelm. A version of the filter pack may still be required to pre-clean the air. There are several candidates for the Kill Zone, but they will need detailed evaluation and potentially some fundamental research.

Hotzone

An effective HypaHelm will form the core of a safe and effective integrated Hotzone system. If a Hotzone is properly safe for medics, cleaners, carers, etc, then it will also be safe for visitors to meet with their loved ones. The Hotzone system consists of:

1. A tough lightweight non-woven, moisture barrier, breathing single-use one-piece Zonesuit with one time seals. That's literally one piece made single forming action.
2. The suits need to be properly sized and have neoprene ankle, and wrist seals. In very high-risk situations it may be necessary to have a positive pressure suit with a rip alarm. Normal lightweight clothes can be worn underneath.
3. A HypaHelm.
4. A Hotzone decontamination unit (HDU). It could be a shower but there are several dry or mist decontamination units under development which will be available shortly. The user enters the HDU with the suit and HypaHelm on. There is an initial decontamination and then the suit is cut off and placed in a night safe disposer. The user still in the normal clothes, then has a further decontamination, still with the HypaHelm on. The HypaHelm is then automatically removed and placed in the decontamination chest.

Design Challenges

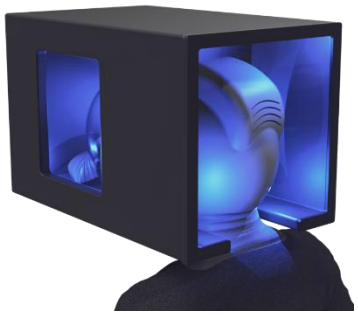
Even quickly making a Mark One HypaHelm in volume will require a herculean effort from an organisation with considerable design and manufacturing resources.

1. Initial production of a Mark One HypaHelm by the end of June 2020. Running testing and necessary approvals in parallel.
2. Developing an effective auto-off charging and decontamination chest. Testing at the end of May, production end of June.
3. Developing an effective zone suit suitable for mass production.
4. Developing an effective compatible decontamination Hotzone Decontamination Unit. Testing at the end of May, production end of July.
5. Research and development of effective 'Kill Zone' for Mark Two HypaHelm.

There are clearly some considerable challenges here, but the engineering and production resources are available globally.

Medic Example

HDU Concept



Clean-Charge-Filter Eject

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Foundation

A UK based not-for-profit Foundation has been formed. It is and will remain independent of governments. The Foundation has the following objectives:

1. Catalyse the design of vastly improved medical and public protection by creating functional specifications, reference designs, design challenges and funding original research.
2. Be a repository of donated IP. Of course, companies and individuals can register and profit from IP as normal. However, they may want to donate IP to the Foundation. The Foundation may also generate its own IP, either internally or by funded research.
3. Establish standards, tests, certification.
4. Potentially to stock emergency supplies of equipment and to distribute it. For developed countries, this would be done on a commercial basis but for other countries, the foundation may bear the cost.
5. Ensure sufficient backup stocks are generally available in developing countries.
6. Facilitate communication between commercial, academic, and other interested parties.
7. Acting as a consultant/contractor when speed is critical.

Funding and Managing Foundation

The Foundation must be independently funded to enable it to act quickly in the short term, as well as investing for the long term.

Watch this space.

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