the race to create a low cost ventilator system

Early on in the pandemic, many African countries had no ventilators and faced a serious shortage of medical grade oxygen, creating an ethical and logistical crisis. A fast-moving international collaboration formed to address these critical shortages. One of the businesses involved is Cambridge Precision, co-founded by Richard Hefford-Hobbs (MSt History of Design, 2017).

According to the World Health Organisation, when the Covid-19 pandemic hit there were fewer than 2,000 working ventilators to serve hundreds of millions of people in public hospitals across 41 African countries. Ten countries in Africa had none at all.

In response, in March 2020 the University of Cambridge's departments of Chemical Engineering and Biotechnology (CEB), Physics and Engineering came together with the Centre for Global Equality to found the Oxygen and Ventilator System Initiative (OVSI), led by Professor Axel Zeitler from the CEB. The urgent goal was to develop a modular, low cost yet high-quality oxygen and ventilator system, predominantly for use in under-resourced countries and institutions.

A fast moving collaboration

The collaboration moved rapidly to create agile design teams made up of staff and students from across the University and UK-based engineering companies, working directly with medics, researchers, and manufacturers based in some of the target countries. The rollcall of distinguished UK companies involved includes Cambridge Aerothermal, Interneuron, and Cambridge Global Health Partnerships, Beko, Prodrive, Immaterial, and Cambridge Precision, and they quickly formed links with other organisations outside the UK such as Defy and Denel in South Africa, the University of Nairobi (Kenya) and Bahir Dar University (Ethiopia).

Richard Hefford-Hobbs, Chairman and co-founder of Cambridge Precision, says he reacted positively the moment he heard about the collaboration. "When the opportunity arose to work with scientists, students, and public and private organisations to really make a difference and promote effective innovation that cuts through normal commercial boundaries, I knew that my team and I could make a valuable contribution."

Cambridge Precision is a highly accredited and award-winning leader in the field of precision engineering, working to translate the most complex product designs into reality. During the Covid-19 crisis it became involved in a number of urgent new projects, predominantly in the med-tech, imaging, and life sciences sectors – from helping develop new thermo-imaging technologies to designing and manufacturing sample holding trays to withstand robust centrifugal and heating processes. At the same time it has played an important role in the OVSI collaboration by driving forward the development of two key modules.

Professor Axel Zeitler explains: "The team at Cambridge

Precision Ltd have produced components from initial drawings, suggested design improvements, and worked with the engineering team to develop functional rigs and the all-important reactor, for both the OVSI Ventilator and the OVSI Oxygen Concentrator.'

Test rigs for both the ventilator and oxygen concentrator are now being operated and monitored in the UK and Africa.

The OVSI Oxygen Concentrator

Oxygen concentrators take in air and remove nitrogen, to create an oxygen-rich gas for people with low oxygen levels. The problem with most concentrators is that they are expensive and designed for operation in sterile, high-tech medical environments. The OVSI Oxygen Concentrator aims to solve this by employing a robust design and efficient chemical engineering techniques to catalyse a chemical reaction. A simple and royalty free design should enable partial build 'in country', with only critical engineered parts or chemicals needing to be imported.

The concentrator team in Cambridge is led by Dr David Fairen-Jimenez with Dr Ewa Marek from CEB, together with Mithili Sunnerson and Ben Moore, both students at the University of Cambridge, and supported by Cambridge Precision and the Centre for Global Equality. The team is working closely with engineering teams in Ethiopia and Kenya to ensure that OVSI designs are compatible with the environmental, infrastructural, and socio-economic conditions of target countries.

India's Covid-19 crisis in April and May 2021 illustrates the imperative need for oxygen supply, and the team are urgently seeking funding and support to speed up the route to full manufacture. The goal is to have a fully regulated version of the device ready for launch during 2021. Additional funding is actively being sought to broaden the device's scope from a Covid-19 response to treatment of a range of respiratory conditions, particularly those endemic in developing countries, such as childhood pneumonia.

The OVSI Ventilator

The early months of the Covid-19 crisis led to a global call for additional ventilators. The OVSI team focused on the development of a life-saving piece of equipment that could stand the rigours of intense heat, power fluctuation, transit across challenging terrain, and operation in a field hospital environment.

The OVSI ventilator is a low-cost, high-quality instrument

Richard Hefford-Hobbs: engineer, entrepreneur, philanthropist

Richard Hefford-Hobbs, BSc (Hons), MSc (Lond.), MSt (Oxon.), FRMS FIET FRSA, qualified as a graduate Manufacturing Engineer after having completed an apprenticeship in mechanical scientific instrument making. Today he is engaged in numerous commercial, educational and voluntary endeavours to promote and support manufacturing, engineering and agricultural innovation, education, and the arts.

After completing a master's degree at UCL, he went to Oxford to further read for a MSt in the History of Design, graduating in 2019.

OVSI – promoting oxygen innovations for a healthier world

The Oxygen and Ventilator System Initiative (OVSI) is an international collaboration that seeks to advance affordable, life-saving oxygen treatments. Originating from an inter-departmental initiative at the University of Cambridge, this agile not-for-profit venture has brought together engineers, scientists, medics, businesses and NGOs to design, test, share and encourage the manufacture of an open, low-cost, resilient, modular ventilation system. The group aims to increase global capacity so that effective critical care can be delivered where previously it has been unavailable.

designed for a range of end-uses from non-invasive C-PAP to ventilation required in Intensive Care Units. The prototype was developed in the Whittle Lab at the University of Cambridge and at UK motorsport pioneers Prodrive. It's currently being adapted for mass production by Defy in South Africa, where it is being submitted for emergency regulatory approval.

In the UK the OVSI team are about to issue a royalty free licence so that development partners can progress the design of this module of the oxygen and ventilation system to full manufacture, and a team at Cambridge Precision is working with an international team of students to release iterations of the design on Git-Lab.

The power of collaboration

"The OVSI collaboration has made tremendous progress over the last year,' says Professor Axel Zeitler, 'in no small part due to the support and expertise of the organisations who have contributed staff, facilities, time, and energy to the initiative."

Richard Hefford-Hobbs agrees. "The quality of collaboration from across the planet is remarkable. I am pleased to be part of the steering group and able to offer the services of Cambridge Precision to build and test components, and contribute to the overall outcome."

He notes how the urgent needs of the pandemic have led to some remarkable and positive outcomes. "My interest in design and the innovative engineering is well-documented," he says. "The importance of applying these skills to support continuous improvement is obvious, but something that really stands out, during this last, challenging year, is how invaluable collaboration can be."

This was something that Kellogg had already brought home to him. "I can say hand on heart that my time spent studying at Kellogg College reaffirmed my commitment to collaboration and gave me the freedom to explore and the confidence to innovate."

He concludes: 'Without academic and business collaborations and the sincere altruism of those in public, private, and third sector organisations, the outstanding response to this pandemic would not be possible. The long-term gains of true inter-sectorial co-operation will, I believe, help us genuinely build back better."