From arms, planes & racing cars to ventilators: industrial conversion during the Covid-19 crisis

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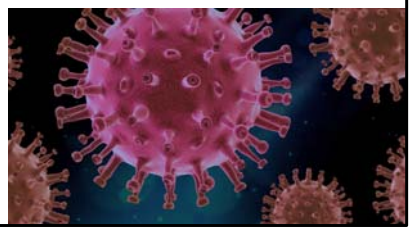
Medical emergency…

- Early March 2020…
- UK govt realises need for thousands of medical ventilators to treat Covid-19 patients – massive shortage looming
- Conference call with hundreds of senior reps from UK industry
- Twin approach
  - Scale up production of existing ventilator designs
  - Design and manufacture new devices
- Numerous industrial consortia formed



- Start of March: NHS assessment revealed only 7,400 ventilators available, but modelling suggested up to 90,000 might be needed to deal with a 'reasonable worst case scenario'
- Main source: NAO (2020). https://www.nao.org.uk/report/increasing-ventilator-capacity-in-response-to-covid-19/

[image credit: PIRO4D via Pixabay]

Ventilator consortia: NHS supply approved

Products	Companies involved
Penlon Prima EOS2	Ventilator Challenge UK/ Penlon Especially: High Value Manufacturing Catapult (govt body; lead), Ford, Airbus, Mclaren, Siemens, STI No. of companies involved: 31 No. of supporters/ suppliers: 30
ParaPac	Ventilator Challenge UK/ Smiths Medical
Zephyr Plus	Babcock/ Draeger
Nippy/ Vivo	Breas Medical
Gemini	OES Medical

Main refs:

Guardian (2020). https://www.theguardian.com/business/2020/may/04/the-inside-story-of-the-uks-nhs-coronavirus-ventilator-challenge

VCUK (2020). https://www.ventilatorchallengeuk.com/

Ventilator consortia: NHS supply *not* approved

Products	Companies involved
CoVent	Dyson; TTP
AirCare	BAE Systems
Piran Vent	Swagelok
Veloci-Vent	Cambridge Consultants; MetLase
Project BlueSky	Darwood IP; Renault; Aston Martin; Red Bull
Helix	Diamedica; Plexus
EVA	TEAM; Cogent Technology
OxVent	Oxford University; Kings College London; Smith & Nephew
inVicto	JFD
Sagentia Ventilator	Sagentia

Main ref: Guardian (2020). https://www.theguardian.com/business/2020/may/04/the-inside-story-of-the-uks-nhs-coronavirus-ventilator-challenge

Sectors represented

Sector	No of companies: Ventilator Challenge UK	No of companies: Other consortia
Medical	5	10
Automotive: Passenger cars Motor racing	 1 8	 2 1
Military technology	8	4
Aviation (civilian)	4	1
Academia/ public sector	1	2
Other	10	8

NB. Some companies categorised in more than one sector

- Using data from previous slides

Ventilator Challenge UK/ Penlon

- Straightforward modification of existing design
- Each ventilator 'not quite as complex as a car'
  - 700 individual parts; 88 suppliers
  - complex medical/ engineering certification process
- Rapid ramp-up of production
  - 1st unit produced 4 wks after govt call; 12 wks later – over 11,000 completed
  - Production volume 200x original company rate
- 4 manufacturing sites converted
  - Ford (Dagenham); Airbus (Broughton); Mclaren (Woking); STI (Hook)
  - Approx. 1,500 technical staff
  - Training at distance using 'mixed reality' headsets

VCUK (2020). https://www.ventilatorchallengeuk.com/
BSI (2020). https://www.bsigroup.com/en-GB/our-services/events/webinars/2020/building-on-the-ventilator-challenge/

[image credit: Ventilator Challenge UK]

Reasons for success

- Shared social goal
  - Specific & urgent health aim
- Existing high quality manufacturing sites & staff/ quality control standards
- Willingness to innovate rapidly
  - 'Will-do culture'
- Collaborative working
  - Close cooperation between regulators, businesses, trade unions
  - Flat management structure - 'leave your ego at the door'
  - Data sharing between all businesses/ govt - 'no data was private'
  - Simple relationship with customer, i.e. govt

- Quotes are from senior officials involved in Ventilator Challenge UK consortium – see webinar:
  BSI (2020). https://www.bsigroup.com/en-GB/our-services/events/webinars/2020/building-on-the-ventilator-challenge/
- Trade union involvement described in this article:
  Red Pepper (2020). https://www.redpepper.org.uk/swords-into-ploughshares/

[image credit: Julien Tromeur via Pixabay]

But…

- All govt's ventilator production targets missed by wide margin
- Of over 20,000 new ventilators bought, only 2,150 so far used by NHS
  - Remaining machines in Ministry of Defence storage depot
- CPAP machines more useful than ventilators
  - Production also ramped up very rapidly by UCL/ Mercedes F1 consortium
- Ventilator Challenge UK production shut down at end of contract
  - Companies returned to original activities
- Behaviour change in society – e.g. physical distancing, handwashing, face-masks, 'lockdown' – substantially reduced peak no of patients hospitalised

- Ventilator figures from mid-Sept
- CPAP - continuous positive airway pressure; less invasive machines; by early July, NHS had 27,700, including 17,800 new ones
- NAO (2020). https://www.nao.org.uk/report/increasing-ventilator-capacity-in-response-to-covid-19/
- BBC News (2020). https://www.bbc.co.uk/news/health-52087002

Lessons for tackling the climate emergency

- Early action to tackle a crisis avoids a lot of wasted effort
- Industry can innovate very rapidly for social/ environmental ends when given sufficient incentives
  - Including fossil fuel-dependent industries, e.g. aerospace, automotive
- Govt can create those incentives if political will is there
- Collaborative working can remove major obstacles
  - Involving govt, industry, trade unions, universities etc (incl. international)
- Arms conversion should be major part of climate transition
  - Arms industry has skills/ tech useful to other sectors
  - Global military spending approaching $2 trillion a year
  - International arms races tying up key industrial resources

- Global military spending in 2019: $1.9 trillion
  SIPRI (2020). https://www.sipri.org/media/press-release/2020/global-military-expenditure-sees-largest-annual-increase-decade-says-sipri-reaching-1917-billion

[image credit: Alexandra Koch]