Can drones become a realistic freight mode to assist in medical logistics?

Experiences from the NHS Covid-19 drone trial with St Marys Hospital on the Isle of Wight

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The pressure from a ‘good news’ story

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Technology

Coronavirus: Drones to deliver NHS supplies to Isle of Wight

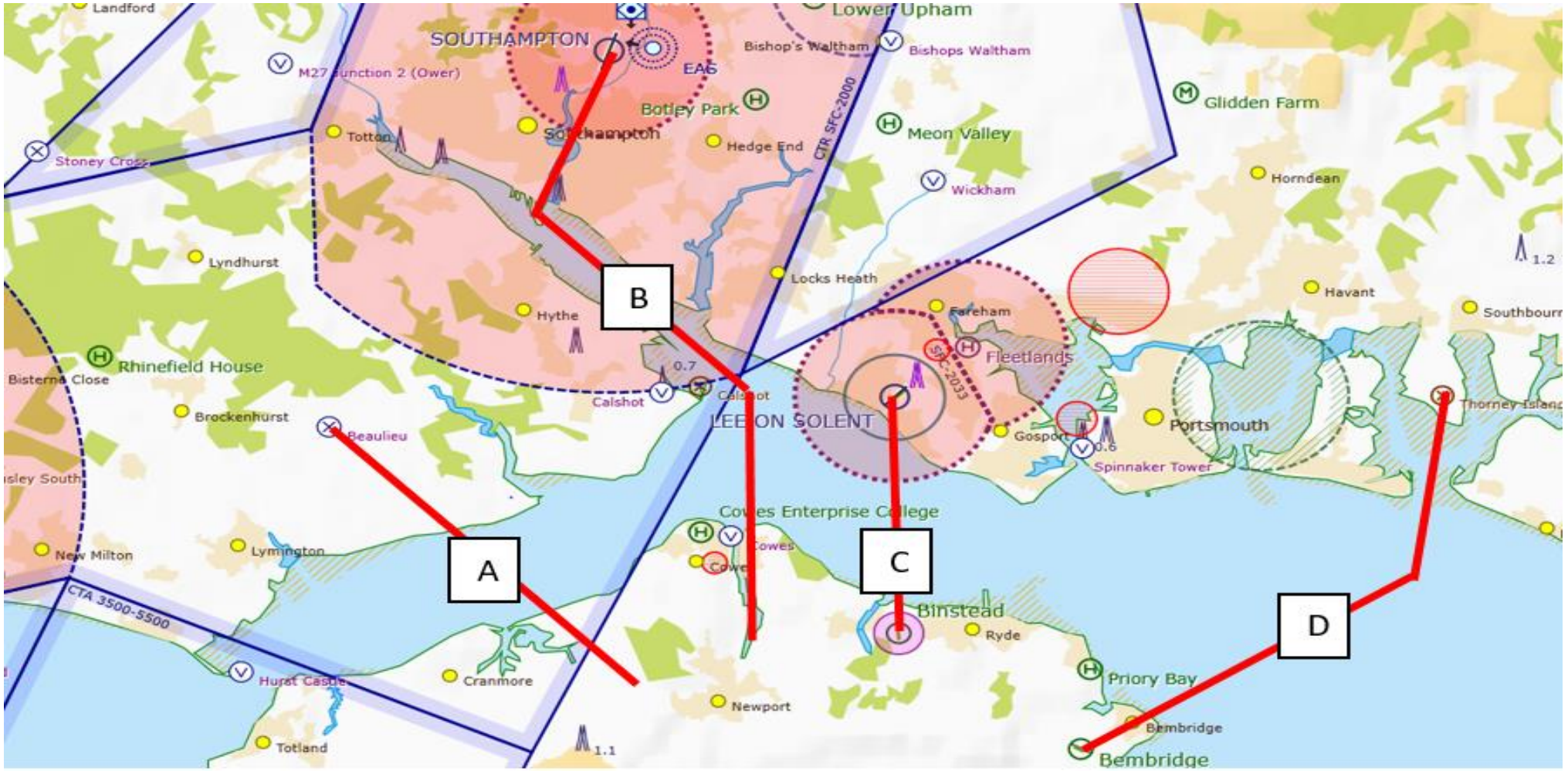
24 April 2020 Share

Coronavirus pandemic

The Windracers Ultra drone can carry 100kg

Drones will be used to carry medical supplies from Hampshire to the Isle of Wight, the government has announced.

The Route


Landford
SOUTHAMPTON
M27 Junction 2 (Ower)
EAG
Botley Park
Totton
Hedge End
Bishop's Waltham
Bishops Waltham
Lower Upham
Meon Valley
Glidden Farm
Wickham
Horndean
Stoney Cross
Lyndhurst
Hythe
Locks Heath
Fareham
Havant
Southbourn
Rhinefield House
Bisterne Close
Brockenhurst
Beaulieu
Calshot
Fleetlands
LEE-ON-SOLENT
Gosport
Portsmouth
Spinnaker Tower
Thorney Island
Cowes Enterprise College
Cowes
New Milton
Lymington
Binstead
Ryde
Priory Bay
Bembridge
Hurst Castle
Cranmore
Newport
Totland
CTA 3500-5500
CTR SFC-2000
A
B
C
D

The Ultra AAV

Performance

Fuel Capacity: 33L

Fuel Burn: ~10L/hr

Cruise: 115km/h

Endurance: 3hrs

Range (aircraft): 300km

Communications Range (est.): 160km

Empty Weight: 295kg

Useful Payload (est): 20-25kg

Take-off/landing: ~200m

Operational constraints: 20knts cross wind, gusting 30knts

The Ultra AAV – Payload bay

First load for St Marys, IOW

What is the real NHS ‘need’ going forward?

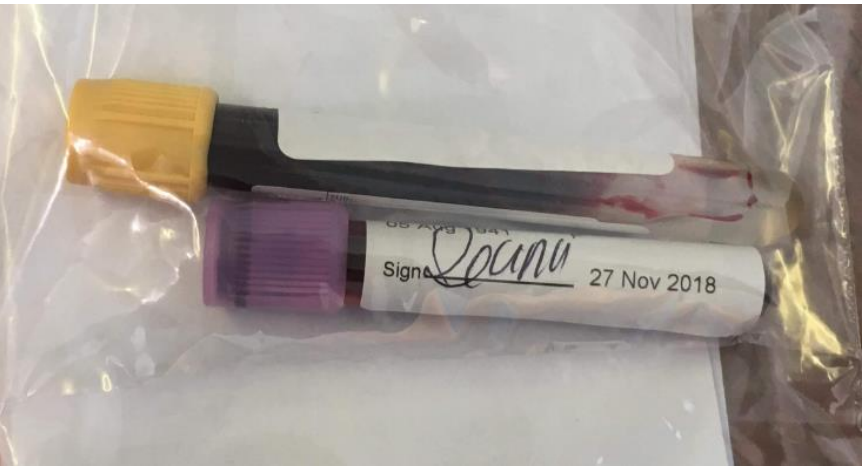
Small consignment dangerous goods movements

- Patient diagnostic samples
- Aseptic medicines
- Emergency blood movements
- Remote community monitoring care

- Small drones – point-to-point (hospital to hospital helipads; pharmacy to hospital)

Patient diagnostic samples

Blood Related	Body Tissue	Faeces	General Fluid	General Sample	General Swab	Sexual Health	Urine
Blood	Duodenal biopsy	Faeces	Cerebrospinal fluid	Calculus	Ear swab	Cervical swab	Catheter Urine
Plasma	Gastric biopsy		Fluid	Gallbladder	Eye swab	Endocervical swab	Midstream urine
	Isolate		Knee aspirate	Hair	Groin swab	High Vaginal Swab	Urine
	Paraffin embedded		Saliva	Miscellaneous	Mouth swab	Low vaginal swab	
	Skin biopsy NOS		Sputum	Miscellaneous spec	Nose and Throat swab	Penile Swab	
	Tissue		Synovial fluid	Nail clippings	Nose swab	Semen, Infertility	
				Skin scrapings	Perineal swab	Semen,Post Vasectomy	
					Pernasal swab	Urethral swab	
					Pharyngeal swab	Vaginal swab	
					Pus	Vulval swab	
					Pus swab	Vulvo-vaginal swab	
					RECTAL SWAB		
					Sacral swab		
					Skin swab		

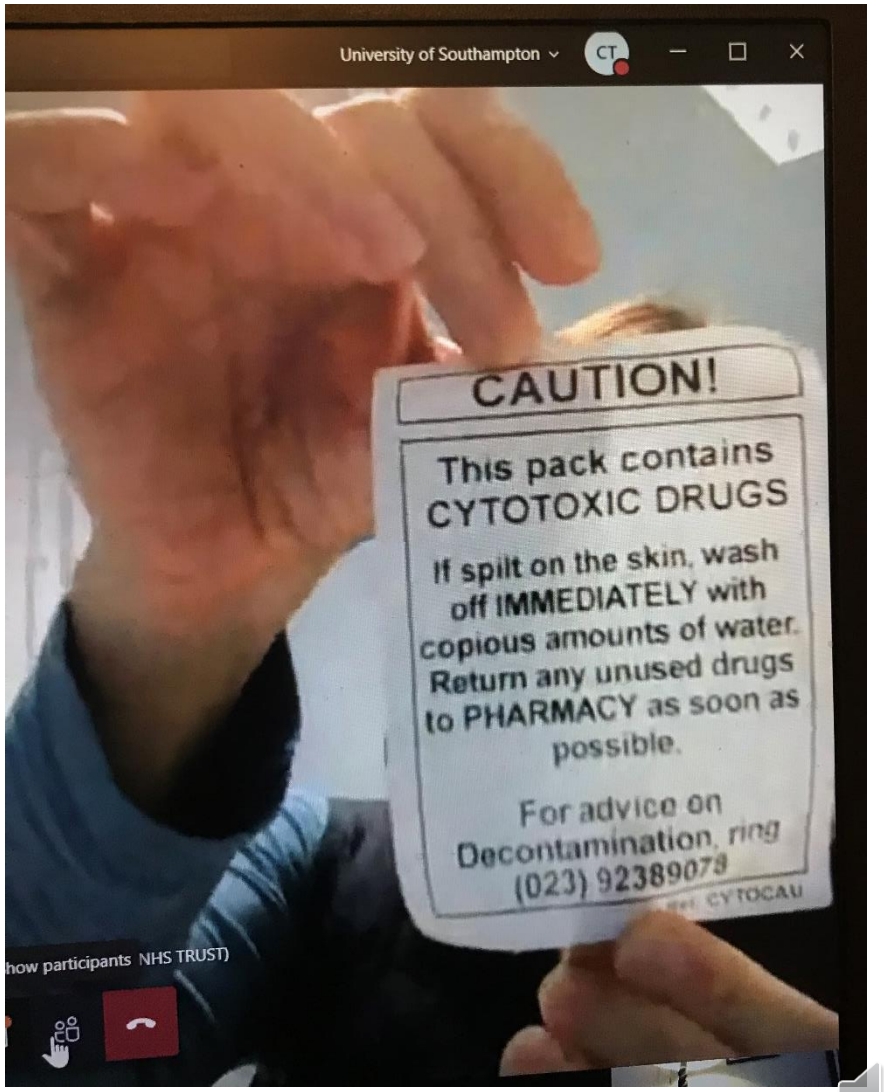


Blood

- Not classed as DG if for transfusion
- Often travels ‘unaccompanied’ on ferry

Chemotherapy drugs

- UN1851, 3248, and 3249.
- Also known as cytotoxic drugs
- Drugs are carried in their individual canisters/tubes/vials.
- Can have shelf life of 4 hours (e.g. Vidaza for Leukaemia)



Patient monitoring

Remote community oximetry monitoring care

- Self monitoring at home to spot early deterioration
- Scope for AAVs to deliver kit and link patient to practitioner

https://www.designboom.com/wp-content/uploads/2017/06/flypulse-defibrillator-drone-designboom-06-14-2017-fullheader.jpg

https://5.imimg.com/data5/EX/FF/MY-49373564/simply-go-portable-oxygen-concentrator-500x500.jpg

Key lessons learned from IOW Covid-19 trial

1) **Most drones currently unsuitable for specimen movement**

- Platforms built, looking for a ‘problem’
- PI650 packaging regs dictates carriage requirements
- EASA regs likely to dictate a ‘crash protective container’ for AAVs

2) **Dangerous Goods approval key for movement of NHS loads**

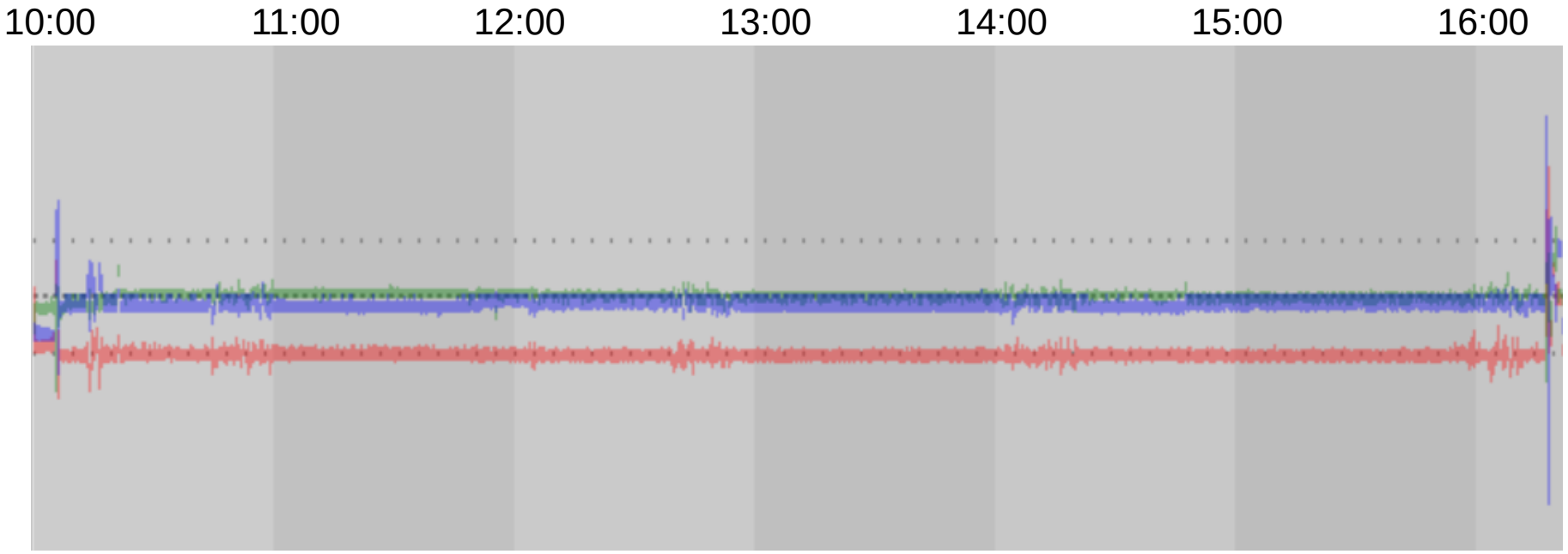
- No AAV has yet been given DG approval by the CAA
- DG carriage by air regs have never been applied to drones before
- Members of AAV team need DG training
- MHRA stipulate strict requirements for carriage (min/max temps)
- Aseptic medicines and blood may be adversely affected by different vibration frequencies.

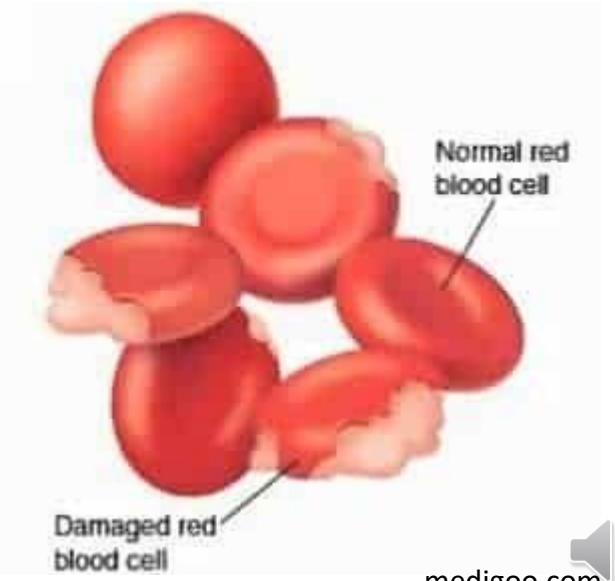
Vibration – Blood Stocks

- Mock stocks placed into an NHSBT standard blood stock carrier with cooling blocks
- Axivity AX3 Vibration Sensor placed amongst the stocks, measuring 3-axes at 1600Hz

- Vibrations measured during the mock ‘overland’ run were not significant
- In blood, vibration may cause Haemolysis
- In chemotherapy drugs, vibration may initiate the breakdown of the chemicals

Axivity.com

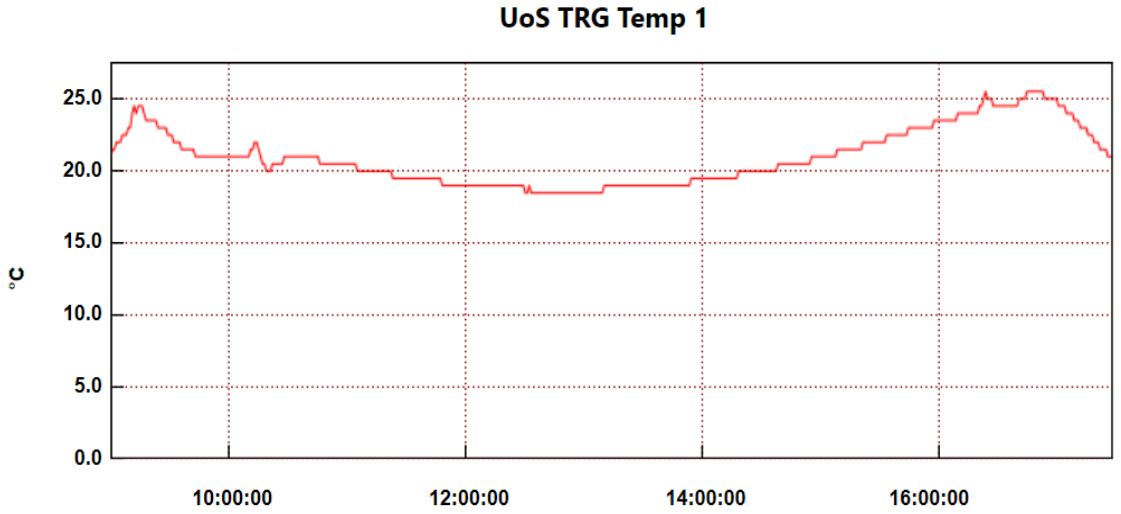




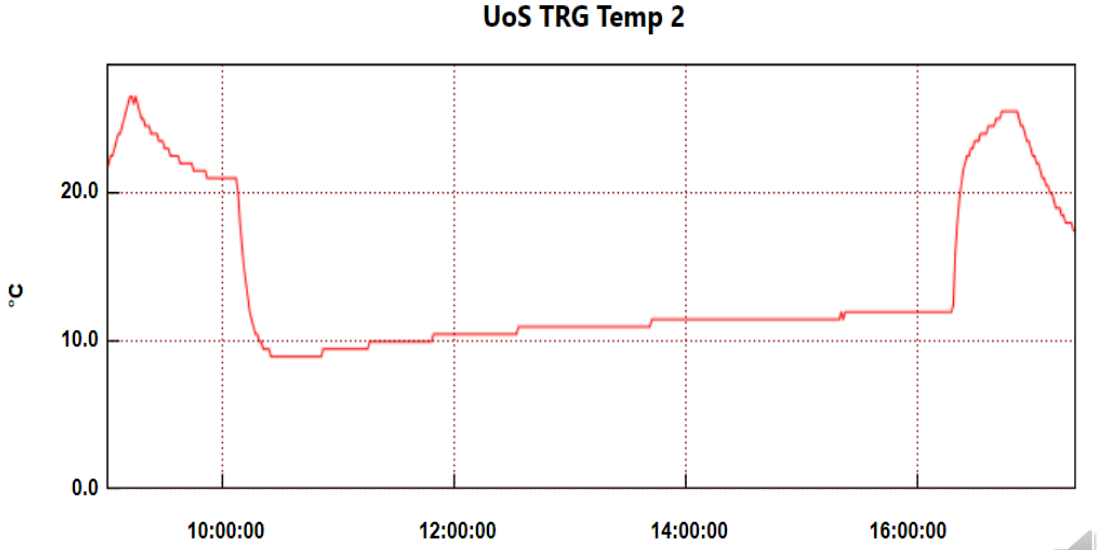
medigoo.com

Temperature – Blood Stocks/Specimens

- Mock specimens placed into an insulated ‘Versapak’ (compliant specimen carrier) with a single cooling block
- Temperature sensor placed amongst the samples, measuring once per minute
- Ambient temperature was maintained during the journey



- Mock stocks placed into an NHSBT standard blood stock carrier with cooling blocks
- Temperature sensor placed amongst the stocks, measuring once per minute
- Chilled temperature was fairly well maintained though NHSBT spec blocs would have ensured this



Key lessons going forward

AAV design considerations for NHS medical logistics

- VTOL AAVs for point-to-point logistics
- Automated pickup system where the AAV can pick up a pre-packed cargo box that has been set out in a specific place by the staff and return automatically
- AAV needs to be fully automated with control (if required) coming from a central air traffic control centre
- Understanding human factors issues is key to enabling safe autopilot-safety pilot handovers
- Packages may well have to be placed in a detachable cargo hold which will have to meet ESAS destruction tests