

## Introduction

### Plans for urban air mobility

The UK Research Institute (UKRI) Future Flight Vision and Roadmap sees Unmanned Aerial Vehicles or drones undertaking deliveries across sectors and advanced air mobility using vertical take off and landing, providing for short passenger journeys across urban areas by 2030.

The European Union Aviation Safety Agency (EASA) expect urban air mobility to become a reality within the next few years.

Achieving acceptance is on the 'to-do' list of both EASA and the UKRI.

Our research focuses on the use of drones in logistics. We have identified deficiencies in how public involvement in debates has taken place so far:

- Surveys and polls have focused on levels of support for drone use cases.
- Questions have prompted responses on prevailing areas of concern.
- Studies aim to understand how to achieve acceptance rather than exploring acceptability.

There is a call to move towards a model of engagement which enables public dialogue to shape transport futures (see for example Stilgoe and Cohen 2021).

Through the development of a survey tool employing Virtual Reality (VR), we have sought to make steps towards this aim.

## Using Virtual Reality

### Engaging the disengaged

The use of drones in logistics is not a prominent issue in the public's consciousness.

In the UK, drone trials have limited visibility with a focus on medical use cases and deliveries to island communities.

Longer term aspirations for commercial drone deliveries have received little media attention.

### Using VR to bring logistics drones to familiar places

Using VR can overcome the problem of asking about future forms of mobility that do not exist yet in the real-world (Farooq et al 2018).

The main VR theory is presence theory. 'Presence' gives the feeling of being there or losing oneself and includes physical, spatial, or environmental presence (Fox et al 2009).

Here we use VR to bring drones to the space where participants are present giving people an opportunity to see and hear the logistics drones in a familiar setting.

The VR experience was designed to represent drones flying on fixed routes as this is anticipated as the early-stage deployment. The VR audio-visual representation can be transposed onto a variety of settings and therefore can be used anywhere.

## Capturing complex viewpoints

### From polls to focus groups: the middle ground

Polls and surveys can gather responses from diverse audiences but reliance on closed questions make it difficult to avoid prompting certain answers and may characterise the public as having simplistic viewpoints. Focus groups offer an opportunity to explore an issue in detail but have limited reach.



In the absence of current real world examples in the UK, the use of drones in logistics has limited significance for the public, therefore introductory information needs to be provided. Here VR is used to provide an introductory impression before the completion of a survey.

The survey uses open questions to avoid prompting, with checklists to allow participants to indicate the relative acceptability of drone overflights in terms of frequency and context.



1. Event stand set up in town and city centres, contains VR equipment and tablet computers

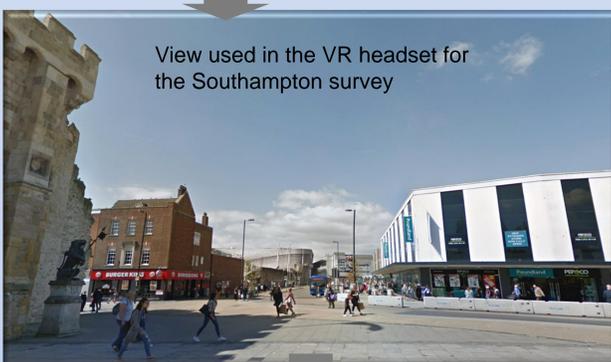
2. Passers-by invited to take part on a 'next to pass' basis and offered a £5 voucher

3. Participant consents to take part and is asked to carefully read the introductory text

4. Participant watches the three minute video using the VR headset. Video shows the following message before displaying the scene immediately outside of the event stand:



*"In the headset you will see delivery drones fly past 6 times at varied altitudes. There are two types of drones illustrated. The flight frequency is for illustration only and does not reflect foreseeable real-world use"*



View used in the VR headset for the Southampton survey

5. Participant completes survey (typically taking 10-15 minutes). The survey includes a mix of open questions and checklists. Researchers help participants complete the survey if required (e.g. if participant is dyslexic). Final sample size: 241

## Survey Design

### Initial thoughts about delivery drones

Q1) What are your initial comments on the use of drones for making deliveries?

*"They are noisy and I think also expensive but I also think it could be efficient and a good way to get things delivered."*

### Where should delivery drones fly?

Drones like those you have just seen in the Virtual Reality headset could be used in the future to make regular deliveries in the UK. Early-stage delivery services would operate along fixed flight paths using pre-determined landing sites.

Q2) Which settings do you think it would be appropriate for delivery drones to fly over?

*Tick the frequency option you feel is most appropriate for each setting.*

	No drones flying over	No more than four drone flights a day	A drone flying over every hour	A drone flying over every 30 minutes	A drone flying over every 15 minutes
Over an area of housing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Over a town or city centre	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Over an industrial area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Over an urban park	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Over my home	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(Q3) Checklist repeated for medical use case)

Q4) Delivery drones navigate by GPS and can fly just as well at night. What are your thoughts on delivery drones operating at night?

*"If something could be done about the noise it should be fine but if not it could cause noise complaints."*

Q5) What feedback would you give to those responsible for developing regulation?

*"Make sure it does not have any impact on customer privacy and on the environment. Also maybe do something about the noisiness of the device."*

Q6) What additional information would you like to help you develop your viewpoint on this??

*"If drones were to be used for delivery it should stay professional so not for any form of personal use and hopefully one day it shall be automatic so privacy shall remain."*

## Summary Points

- The VR provided participants with an idea of how logistics drones might look and sound in the absence of direct experience
- The VR helped participants focus on the use-case scenario being considered avoiding conflation with more familiar uses
- The use of a familiar setting combined with the checklist approach helped to make it relevant to participants
- Using open questions avoided prompting on specific issues and concerns and allowed complex viewpoints to be recorded
- The ordering of the questions avoided socially desirable responses associated with medical use cases
- The survey format allowed for wider participation with the incentive helping to overcome low interest amongst some groups

