Does eVTOL fly in the UK?

An analysis of whether eVTOL flights are likely to replace current travel modes

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Executive summary

In this paper, we address the question of whether eVTOL (electric vertical take-off and landing) flights are likely to replace current journeys and become a mass-market solution: does eVTOL fly in the UK?

We take the socioeconomic framework from our 2023 UK Advanced Air Mobility study[1] ("AAM Paper," in collaboration with UKRI) and a year of BT's anonymised and aggregated mobile network Origin Destination (OD) travel data (our proxy for "real" journeys). We use this combination and geospatial analytics to test, route by route, whether the viable eVTOL use cases from the AAM Paper are likely to replace journeys people currently take using road or rail.

At the AAM Paper's peak eVTOL adoption rate of 5%, we do not find any routes where it is likely that eVTOL flights will replace current transport modes. This is despite our use of the optimistic AAM Paper assumptions for eVTOL operations and infrastructure and our assumption that all eVTOL implementation challenges are addressed.

If we assume a 100% eVTOL adoption rate, eVTOLs may replace current transport modes on around 200 routes. These account for only 0.05% of the total weekly person-trip volume.[2]

We conclude that eVTOLs are not likely to be a mass-market solution for passenger travel in the UK.

[1] https://www.pwc.co.uk/intelligent-digital/drones/uk-economic-aam-report-2023.pdf
[2] Refer to Appendix 1

Findings from the AAM Paper

Our 2023 paper assessed the socioeconomic viability of eVTOL use cases against current journeys such as road and rail. The approach was open book and used optimistic eVTOL model assumptions. It found that:

Short hop eVTOL journeys under 30km are not socioeconomically viable

Only two of the passenger use cases are socioeconomically viable

The contribution of eVTOL to overall travel is modest rather than transformative

We are not aware of anything in the intervening period that contradicts these findings. If anything, the market has moved closer to this view. High profile programmes have stalled or failed, certification has slipped to the right, airspace modernisation is proving challenging and high profile passenger-carrying eVTOL showcases did not happen.[3] The AAM Paper was sceptical about short hop taxis and eVTOL as a mass-market solution and only slightly more bullish on specific longer range high occupancy cases. Subsequent developments have broadly reinforced that stance.

What this paper adds

In this 2026 update, we do four things:

1. First, we apply the AAM Paper's socioeconomic viability parameters to the 2023 BT Origin Destination data. We use origin and destination coordinates and AAM Paper eVTOL parameters to compare eVTOL journey time to current journey time. We retain all routes where eVTOL is faster and current passenger-trip volumes meet the thresholds from the viable eVTOL use cases in the AAM Paper.

2. Second, we apply eVTOL adoption rates, starting with the AAM Paper's peak 2040 adoption rate of 5%, i.e. 5% of current road and rail passenger-trip volumes will switch to eVTOLs. A route is viable if the current passenger-trip volume factored by the adoption rate is greater than the eVTOL volume thresholds from the AAM Paper. We carry out various adoption sensitivities.

3. Third, we refresh our 5As eVTOL ecosystem model (Aircraft, Ancillary, Airline, Airport, Airspace) and discuss what has changed for eVTOL OEMs from 2023-2026.

4. Finally, we review and update the eVTOL implementation challenges from the AAM Paper (Perception, Infrastructure, Safety and Security, Technology, Regulation, Skills, Business Models)

[3] Refer to the AAM Ecosystem and Challenges sections below

Key findings

We find that few current journeys are likely to be replaced by eVTOLs and that eVTOL implementation is as challenging now as it was in 2023.

We consider a route viable where there is enough passenger volume using current transport modes to support the relevant eVTOL use case and where the eVTOL is at least as fast as current travel modes. This is based on BT's 2023 Origin Destination data and the socioeconomic logic from the AAM Paper.

At the AAM Paper's peak 2040 adoption assumption of 5%, we find no viable routes. One route becomes viable only at a much higher 17% adoption rate. If we apply an intentionally unrealistic 100% adoption rate as a sensitivity, 205 routes are viable. Even in that extreme case, they represent only 0.05% of total weekly person-trips.[4]

All the eVTOL implementation challenges from the AAM Paper (Perception, Infrastructure, Safety and Security, Technology, Regulation, Skills, Business Models) are present and correct in 2026.[5] Although there has been progress, many challenges look more daunting than they did in 2023.

Market implications

We analysed the market in the AAM Paper and during this work and are unable to find a compelling reason to focus on this technology as a mass market UK transport solution. The global market experience since 2023 also suggests that a cautious stance is appropriate. Several headline eVTOL OEMs have faced bankruptcy scares or severe funding stress.[6] Prototypes have suffered test failures. Regulations and associated approvals have not kept pace with OEM business plans. While most OEMs were initially funded based on mass consumer demand, some are now pivoting to the military segment. Commercial operations have begun but are limited; in one notable example eVTOL shipment numbers are being driven by a niche market (tourism)[7] rather than routine passenger demand.

The UK has invested significant policy and programme effort into a technology that appears unlikely to serve the mass travelling public. The opportunity cost risk is that funding and regulatory resource may be diverted away from proven mass passenger transport such as rail, buses, cycling and conventional electric regional aviation.

[4] Refer to Appendix 1
[5] Refer to the Challenges section below
[6] Refer to the AAM Ecosystem and Challenges sections below
[7] Refer to the Challenges section below

What this means for the UK

There is a role for eVTOL in the UK but it is narrow, geographically specific and highly contingent on other parts of the transport system. Other countries which have different infrastructure, topography and airspace may have more compelling reasons to push for eVTOLs. The case for military use of eVTOLs is not in scope for this paper.

For the UK, the practical implications are

- Treat eVTOL as a transport niche, not a backbone
- Direct government energy to a handful of routes where there are genuine time and connectivity gains and a higher likelihood of strong end client demand
- Focus on addressing eVTOL adoption challenges (perception, infrastructure, technology, safety and security, regulation, business models, skills) for the most viable routes, not all of the UK
- Be transparent about who benefits, who pays, where solutions are accessible and who is excluded
- Consider toning down any eVTOL national narratives that the numbers do not support

The AAM Paper suggested that much of the eVTOL hype did not survive contact with socioeconomic reality. In this paper, we stress-test this idea against real journeys. The conclusion is simple: even under favourable assumptions, eVTOL is unlikely to fly in the UK for mass-passenger transportation.

Definitions and paper structure

For the purposes of this paper, AAM comprises eVTOL aircraft for passenger transport. It excludes middle-mile and last-mile drones which we covered in our drone economic impact report Skies Without Limits v2.0.[8] Note that any references to the array of government initiatives to address eVTOL challenges are illustrative rather than exhaustive.

This paper starts by describing how the analysis is carried out and the implications of the findings. It then breaks down the AAM ecosystem using the 5 As model (Aircraft, Airline, Ancillary, Airport, Airspace) and offers a snapshot of eVTOL OEM progress (or otherwise) since 2023. The challenges associated with eVTOL implementation are discussed in detail (perception, infrastructure, technology, safety and security, regulation, business models, skills). Finally, the paper presents a deeper dive into the modelling approach.

[8] https://www.pwc.co.uk/intelligent-digital/drones/skies-without-limits-2022.pdf

Contents

Determining which actual journeys could be replaced by eVTOL

This analysis of UK eVTOL viability is built on two pillars.

1. The first pillar is the socioeconomic viability framework from our 2023 UK Advanced Air Mobility economic impact study,[9] referred to here as the "AAM Paper." That work defined a representative set of eVTOL use cases, compared them with existing modes of transport and assigned monetary values to time, carbon and safety alongside fares to calculate a socioeconomic cost per journey. A use case was considered as viable where the eVTOL socioeconomic cost was lower than the counterfactual (current modes of transport). The AAM Paper concluded that short hop journeys under 30 km were not attractive on this basis and that only two of the higher occupancy, longer distance passenger use cases were socioeconomically viable. Note that the analysis only considered journey types where the socioeconomic cost delta indicated that eVTOLs could replace current journeys, i.e. substitution-only, no consideration of potential new demand created by eVTOLs.
2. The second pillar is BT's Origin Destination Data[10] from 2023 which covers current modes of transport such as road and rail. This provides journey data by start and end point, derived from anonymised EE mobile network events. The BT Origin Destination data reports average person trips per day between (small) geographical areas,[11] together with an average distance and a journey time.

This paper combines those two pillars. We filter BT's Origin Destination data for distance and person-trip volume, calculate eVTOL distance and time using the models in the AAM Paper and reject routes where eVTOLs are slower than current modes of transport. Finally, we apply adoption rates which represent the percentage of the 2023 actual journeys that might be substituted by eVTOL journeys.

[9] https://www.pwc.co.uk/intelligent-digital/drones/uk-economic-aam-report-2023.pdf
[10] https://business.bt.com/iot/active-intelligence/origin-destination-insights/
[11] For example, Lower layer Super Output Areas (LSOAs) in England & Wales https://www.ons.gov.uk/methodology/geography/ukgeographies/statisticalgeographies

Socioeconomically viable use cases

In the AAM Paper we defined a range of six eVTOL use cases and tested whether each was socioeconomically attractive compared to the closest existing travel mode. As noted above, we assigned monetary values to time, accident risk and carbon emissions and combined these with fares to calculate a socioeconomic cost for each use case and its counterfactual.

Table 1 summarises the results and there are further details in the Modelling Approach section below. Three of the six use cases were socioeconomically attractive in the AAM Paper. Of these, two are passenger cases that we can meaningfully look for in the BT Origin Destination data.

Table 1

eVTOL Use Case			Counterfactual comparison	eVTOL vs Counterfactual socioeconomic cost delta
Description	**Distance**	**Profile (initial)**		
Urban Private Hire	8km	1 pilot, 1 passenger	Taxi (1 passenger)	+99%
Rural Private	28km	1 pilot, 1 passenger	Personal car (1 driver)	+151%
Rural Rideshare	60km	1 pilot, 3 passengers	3x individual car journeys	-33%
Sub-regional Shuttle	85km	1 pilot, 5 passengers	5x individual train journeys	-39%
Air Ambulance	80km		Helicopter	-38%
Cargo	75km	350kg	Van	+112%

The urban private hire, rural private and cargo cases were not attractive even after accounting for time, carbon and accident benefits which typically favour eVTOLs.

A central message from the AAM Paper was that viable eVTOL use cases in the UK need relatively high occupancy and longer distances. Short hop journeys under 30 km do not clear the bar on average and only begin to look attractive under very optimistic rideshare occupancy assumptions that are unlikely to hold at scale.

Applying viable eVTOL use case models to actual journeys

The next step is to take the viable use cases from AAM Paper out of the abstract and into the real world. We apply the AAM Paper use case parameters for the rideshare and sub-regional use cases to BT's 2023 Origin Destination "actuals" to answer a simple question: given how people actually travelled in 2023, which journeys could eVTOLs realistically replace?

BT's Origin Destination product data provides average journey data by start and end point, derived from anonymised and aggregated EE mobile network events. BT detects device "dwells," links them into journeys between consecutive dwells, aggregates journey into origin-destination pairs (routes) and then weights and validates the resulting matrices back to the whole UK population using census population estimates and comparison with the National Travel Survey benchmarks. The BT data reports average person trips per day between (small) geographical areas, together with an average distance and a journey time for each OD pair or route. We take the following steps, full details in the Modelling Approach section below.

1. Remove all routes[12] that are less than 30 km from the BT Origin Destination data for calendar 2023 (note – eVTOL distance parameters added in step 6)
2. Transform the remaining BT Origin Destination routes to weekly trip volumes between locations (unique origin-destination pairs)
3. Remove routes that have weekly volumes lower than those required to support a single eVTOL for the viable use cases in AAM Paper
   - Rideshare – minimum of 514 person-trips per week
   - Sub-regional – minimum of 421 person-trips per week
4. Add coordinates for route origin and destination small areas[13] using population-weighted centroids
5. Calculate the eVTOL distance and time for each origin-destination pair, dropping routes where the eVTOL is not faster than the current mode
6. Apply guardrails such as minimum and maximum eVTOL distance (5 km and 180 km respectively) and minimum current journey speed
7. Combine close destination coordinates with the same origin into "super-hubs"
8. Apply adoption rates which represent the percentage of the 2023 actual trips that might be substituted by eVTOL trips, starting with the AAM Paper's 2040 peak adoption of 5%. Routes are viable if, after being factored by adoption rate, they meet the route volume floors in step 3 above.

[12] We use "route" interchangeably with "origin-destination pair" and "OD pair." "Journey" describes a passenger trip on a route (from origin to destination)
[13] For example, Lower layer Super Output Areas (LSOAs) in England & Wales

Findings – No viable routes

In the AAM Paper, peak adoption was 5% of candidate routes by 2040. This was the "top" of the S-curve of adoption. When we apply a 5% adoption factor to the potentially viable eVTOL routes, none of them meet the weekly person-trip volume floor (step 3 above), even though this was the peak 2040 adoption rate from the AAM Paper. One route meets the volume floor requirements at 17% adoption rate. Figure 1 below visualises a random sample of 25,000 routes from the BT Origin Destination data where average current mode distance is at least 30 km (and origin and destination are different zones) per step 1 of the modelling approach. Separately (right), it visualises the routes that are above the volume floor when various adoption rates are applied. At 100% adoption, there are 205 viable eVTOL routes.

As a sensitivity, we repeat the analysis using a lower volume floor of 250 person trips per week, materially below the 421 and 514 trip floors required to align to the AAM Paper's use case operating assumptions. With the 250 floor there were zero viable routes at 5% adoption, 212 at 50% adoption and 944 at 100% adoption. Note that this was only a theoretical exercise and that the socioeconomic costs would be higher with this floor assumption, making it even less likely that passengers would choose eVTOLs over current modes.

In summary, we find no viable routes when we apply the 2040 5% peak adoption from the AAM Paper. This is despite the extremely optimistic and favourable to eVTOL assumptions embedded in the AAM Paper, refer to the Optimistic eVTOL Assumptions and Interpretation section below.

Figure 1: Random 25K sample of all BT Origin Destination (left) and viable routes under various adoption rates.[14]

Indicative visualisation of all routes >30km

Visualisation of viable routes at various adoption rates

[14] Maps were generated using kepler.gl (open-source) with Mapbox basemap tiles. Basemap © Mapbox © OpenStreetMap contributors

Optimistic eVTOL assumptions and interpretation

With a 100% adoption rate and a slew of very optimistic eVTOL and vertiport assumptions, we find that we have around 200 viable routes. These account for only about 0.05% of all 2023 person trips in the BT Origin Destination data, see Appendix 1. eVTOL is not mass market.

There are several reasons to view the resulting "viable" eVTOL journeys as an optimistic upper bound rather than a forecast:

Operations

- We assume an effective 13 hour operating day per aircraft, after applying weather and utilisation discounts from the AAM Paper analysis to an 18 hour operating window
- We assume that demand is evenly distributed over a week
- We assume no deadheading and perfectly balanced two-way demand on each route
- We assume average occupancies of around three passengers per flight for rideshare and five for sub-regional shuttles, consistent with the use cases in the AAM Paper, and that these can be achieved in practice, along with the weekly person-trip volumes they imply (514 and 421 respectively)
- We use fewer operational days than assumed in the AAM Paper. Were we to use the operational days in the AAM Paper, volume floors would increase by c.15%, giving fewer viable routes at 100% adoption. Refer to the Modelling Approach section.

Vertiports

- We treat population-weighted centroids as proxies for optimally sited vertiports. In reality, suitable sites will be constrained by many factors including planning, noise and airspace
- The assumed 0.5 km walk to and from the vertiport is short and does not reflect locations where last-mile access would be more complex

Adoption

- The analysis identifies OD pairs where an eVTOL service could in principle be faster than current journeys and where underlying demand is large enough to support regular services. It does not assume that all or even most journeys on those routes will switch.
- In the 2023 AAM Paper, uptake over time is governed by an S-curve adoption profile and by explicit limits on share of journeys that switch (5% substitution by 2040). As noted above, if we apply this 2040 substitution rate to these 2023 figures, there are no viable routes. Accordingly, we have assumed an unrealistic figure of 100% adoption when identifying the routes that are most promising.

Costs	• The underlying AAM cost model already treats eVTOL operating costs in a cautious manner when comparing to ground modes, so finding a route "viable" in this sense is non-trivial. However, cost estimates for future aircraft are uncertain and actual fares will depend on business models and financing. For example, the paper assumes that eVTOL capital costs are £3m for 4-5 seat eVTOLs used in the rideshare use case which we understand is at the lower end of typical market expectations.
eVTOL implementation challenges	• We assume that all relevant eVTOL adoption challenges are addressed, refer to the Challenges section below where we discuss potential issues with perception, infrastructure, safety and security, technology, regulation, skills and business models

Model implications

In the AAM Paper, we noted that longer distance, higher occupancy viable use cases had the potential to deliver notable socioeconomic savings. We suggested a focus on identifying the longer distance, higher occupancy and niche use cases which delivered compelling societal and/ or connectivity benefits and delivering these in the first instance.

To date, we have not seen this kind of route-by-route screening applied in UK eVTOL initiatives. They have, understandably, moved ahead on the basis of high-level market studies and industry narratives.[15 16 17 18] That said, some government-funded studies are sceptical about AAM[19] with eVTOL "Commuter Shuttle" marked as "Not thought viable before 2050" and even eSTOL "Regional Passenger Transport" considered "not mass transit" and "too niche."

In this paper, our analysis indicates that individuals are unlikely to choose eVTOLs over current transport modes and their evolution. This is despite what we consider to be highly optimistic assumptions in areas such as operations, vertiports, adoption rates and eVTOL capital costs. Also, as in the AAM Paper, we assume that the significant challenges associated with eVTOL implementation are addressed; this modelling assumption is as necessary as it is unrealistic.

[15] https://assets.publishing.service.gov.uk/media/6571b635049516000f49be06/advanced-air-mobility-evidence-review.pdf
[16] https://assets.publishing.service.gov.uk/media/661943b7679e9c8d921dfeeb/fof-action-plan.pdf
[17] https://www.gov.uk/government/news/over-20-million-to-help-drones-and-flying-taxis-take-to-uk-skies
[18] https://www.caa.co.uk/our-work/research-and-innovation/enabling-advanced-air-mobility (SC.VTOL Issue 2, CAP 3169, etc refer to the Regulations section below)
[19] https://iuk-business-connect.org.uk/wp-content/uploads/2025/01/Innovate-UK-Future-Flight-Challenge-Drone-and-Advanced-Air-Mobility-Regional-Use-Case-Study.pdf

The challenges are many and significant. They include perception, infrastructure, technology, safety and security, regulation, business models and skills. These are discussed in detail in the Challenges section below.

This number of eVTOL adoption challenges suggests that an effective approach would be to focus on addressing the challenges for the most viable routes; they are more likely to have genuine end-client pull and a higher chance of adoption. In other words, a better chance of getting a return on investment and moving the needle for UK transport.

Over and above the most viable routes, there is potential to deliver further benefits to society in more niche use cases such as passenger travel to UK Islands from the mainland where the socioeconomic cost penalty is offset by other societal benefits. We have not assessed these in this paper. Such routes could help to integrate communities currently cut-off or restricted by traditional transportation. We can speculate that, to succeed, such eVTOL solutions would have to be competitively priced (i.e. considering fares only, not assigning cost values to time, carbon and accident rates) and that a level of government subsidy would be required.

Accessibility is another consideration covered in several papers and articles;[20 21] the notion that eVTOLs should be accessible to all. This is a laudable goal, but we are unable to find any concrete policy on fares, siting or physical access and accessibility risks being sidelined in the drive to get eVTOLs flying.

Increasing the distance and ease of travel could allow an expansion of the commuter belt which could reduce congestion, overcrowding and increase quality of life. This potential new demand is not assessed in this paper which, as noted above, only considers substitution of existing travel modes.

It is conceivable that a premium market could develop for short flights with low occupancy, but we question whether the required infrastructure could be funded without mass-market demand. If enough vertiports are deployed to meet the demand for longer distance, higher occupancy use cases, it is possible that these could be used for premium-priced, short hop low occupancy transport in the medium term.

[20] https://futureflightsocial.ac.uk/research/title-23/ (Navigating Future Flight: Societal Principles for Drones and Advanced Air Mobility in the UK)
[21] https://www.futureairmobility.com/news/advanced-air-mobility-for-all-how-can-we-ensure-the-accessibility-of-future-flight

Infrastructure is a significant market challenge and a lack of vertiports may stifle UK eVTOL potential. If we continue to take an optimistic view and consider that all other challenges are addressed, we still need vertiports to deliver socioeconomically attractive AAM services. These vertiports are unlikely to be in the same location as the UK's c.45 certified Aerodromes[22] and c.400 GA (General Aviation) airfields.[23] Even if we assume all vertiports can be used by all eVTOLs and that technical and regulatory challenges are solved, this means finding significant quantities of real estate, often in built up areas, and obtaining planning permission from local councils. Local councils are likely to have to change their approach and capacity to keep up with the vertiport planning permission requests.

The process itself may be lengthy and not have a positive outcome, especially where cultural heritage and wildlife are involved.[24] There is also the critical impact of vertiport locations on adoption rates – this paper uses idealised vertiport locations and operational assumptions and still finds no viable routes at certain adoption rates. Move the vertiports to sub-optimal locations (as we must expect when the reality of urban planning is faced) and adoption will likely decline further. We note that this could be a different story in other countries which have different topography, fewer existing travel options and so on. The potential benefits of eVTOLs are amplified in greenfield developments where there is no existing infrastructure. We do not cover the military potential of eVTOLs in this paper.

The UK's busy airspace will become even busier over the next decades, potentially with eVTOLs and more likely with drones. On the latter, we suggested there could be more than 900,000 commercial drones in the UK by 2030, most of which will be flying BVLOS (Beyond Visual Line of Sight) and autonomously.[25] There will also be an increase in the volume of traditional commercial aviation and its green evolution, e.g. eCTOLs. This unprecedented increase in scale and complexity will predominantly manifest at low altitudes and in built up areas. Existing ATM (Air Traffic Management, manned) has to adapt and evolve to include automation (including AI) and seamlessly integrate with UTM (Unmanned Traffic Management), presenting significant challenges in areas such as technology, regulation and skills, refer to the Challenges section below. The CAA's Airspace Modernisation Strategy (AMS)[26] aims to address this challenge, amongst other things, and there is now a structured programme in place which is in the early stages of implementation.[27]

eVTOL solutions will also face stiff competition from existing transport options and other new(er) solutions including EVs, High Speed 2 and clean regional aviation. Like eVTOLs, EVs are also clean but will usually take travellers point to point, unlike vertiport travel. This is not to say that EVs solve congestion issues – compelling eVTOL solutions may still be a key part of a portfolio of measures to address congestion issues.

In conclusion, if we consider how the UK actually travels today, it is difficult to make the case for eVTOLs as a mass-transport solution. Using optimistic eVTOL model assumptions, few routes survive first contact with adoption rates and the range of eVTOL adoption challenges.

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[22] https://www.caa.co.uk/Commercial-industry/Airports/Aerodrome-licences/Certificates/UK-certificated-aerodromes
[23] https://www.gov.uk/government/publications/general-aviation-sector-and-airfields-studies
[24] https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf
[25] https://www.pwc.co.uk/intelligent-digital/drones/skies-without-limits-2022.pdf
[26] https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy/ams-governance-and-progress-reports/
[27] https://www.caa.co.uk/publication/download/25755 (CAP 3084), see also Challenges/ Airspace and Challenges/ Regulation below

AAM ecosystem

As mentioned above, for the purposes of this paper, AAM comprises electrically-powered vertical take-off and landing (eVTOL) aircraft primarily for passenger transport. It excludes middle mile and last mile cargo drones and other drone applications.

5 As model

The AAM ecosystem is complex and we have attempted to distil it into “5 As”: Aircraft, Ancillary, Airport, Airline and Airspace. While there are limitations to this approach, we believe these are outweighed by the clarity it offers.

1	**Aircraft**	Entities which design and manufacture eVTOLs and are responsible for design and manufacturing certification.
2	**Airline**	Entity that owns and operates a fleet of Aircraft to serve passengers from ticket sales through to disembarkation and/ or delivers freight. Also responsible for passenger compensation for delayed or cancelled flights, baggage issues, etc.
3	**Ancillary**	Entities which carry out MRO (Maintenance, Repair & Overhaul) servicing and associated activities on behalf of the Airline. In the AAM industry MRO may predominantly be carried out by OEMs (Original Equipment Manufacturers), see below and refer also to the Technology section.
4	**Airport**	“Vertiport” take-off and landing locations for Aircraft which include passenger processing/ security and charging facilities. We expect several tiers of vertiport, from basic take-off and landing facilities in rural locations to full-service hubs, likely to be located in cities.
5	**Airspace**	Operator and/ or provider of airspace solutions which may encompass both ATM (manned Air Traffic Management) and UTM (Unmanned Traffic Management).

eVTOL OEMs and the AAM ecosystem

In Table 2 we take the first 10 eVTOL OEMs we listed in the 2023 AAM Paper and summarise

- which parts of the 5A ecosystem they are targeting
- overall status in 2026 compared to targets set earlier (on-track, slipping, paused)
- how funding is shaping up (insolvent, restructured, stable)

Table 2

AAM Paper	Aircraft	Airline	Ancillary	Airspace	Airport	Status	Funding
Volocopter	D				P	Slipping	Restructured[28]
Joby	D	D			P[29]	Slipping[30]	Stable
Wisk (A)	D			C[31]		On-track[32]	Stable
Eve Air Mobility	D		D[33]	D[34]	P[35]	Slipping[36,37]	Stable
EHang (A)	D	D			P	On-track[38]	Stable
Lilium	D					Paused	Insolvent[39]
Vertical Aerospace	D					Slipping[40]	Restructured[41]
Archer	D	D			P[42]	Slipping[43]	Stable
Airbus	D			C		Paused[44]	Stable
Supernal	D					Paused[45]	Under review

Table 2 Key
A = Autonomous at launch: 5As: D = Direct; P = Partnering; C = Contributing
Status: Slipping = current plan more than a year later than published; On-track = within a year; Paused = activities suspended or limited

Table 2 indicates that most eVTOL players are focussed on the Aircraft space and planning to operate in the “OEM Model” which is analogous to traditional aerospace manufacturers, e.g. Vertical Aerospace. Note that, for the purposes of this paper, we have not covered Aircraft leasing companies which are active in this space, such as Avolon.

A smaller number of entities are focussed on a vertically integrated model where they will also operate as the Airline. We expect that AAM companies that plan to offer a vertically integrated solution will also offer integration with ground transport modes (multimodal) to give the passenger a one stop experience, e.g. Joby and Uber[46] (following Joby’s acquisition of Blade which underscores Joby’s Airline ambitions).[47]

[28] https://www.volocopter.com/en/newsroom/vc-reorganization-success
[29] https://ir.jobyaviation.com/news-events/press-releases/detail/167/joby-metropolis-announce-partnership-to-develop-25
[30] Refer to the Regulation section, below
[31] https://wisk.aero/newsroom/wisk-and-nasa-sign-five-year-research-partnership-to-advance-autonomous-flight
[32] https://wisk.aero/newsroom/wisk-completes-first-flight-of-generation-6-autonomous-evtol
[33] https://www.eveairmobility.com/eve-air-mobility-presents-eve-techcare-at-mro-europe/
[34] https://www.eveairmobility.com/uatm/
[35] https://www.eveairmobility.com/eve-collaborates-with-vertimob-and-prs-aeroportos-in-anacs-regulatory-sandbox/
[36] https://airportir.com/ir-pulse/eve-prepares-for-evtol-accreditation-and-flights-in-2026
[37] https://www.eveairmobility.com/eve-air-mobility-completes-successful-first-flight-of-full-scale-evtol-prototype/
[38] Refer to the Regulation section, below
[39] https://www.ainonline.com/aviation-news/futureflight/2025-02-21/lilium-closes-evtol-business-new-investment-falls-through
[40] https://www.aerospacetestinginternational.com/news/drones-air-taxis/vertical-aerospace-delays-vx4-evtol-by-two-years.html
[41] https://www.bbc.co.uk/news/articles/c0mz3p72d0wo
[42] https://investors.archer.com/news/news-details/2024/Archer-and-Falcon-Aviation-to-Jointly-Develop-Vertiport-Network-in-Dubai-and-Abu-Dhabi-for-the-Launch-of-Flying-Car-Operations-in-UAE-as-Soon-as-2025/default.aspx
[43] https://investors.archer.com/news/news-details/2024/Archer-Announces-Fourth-Quarter-and-Full-Year-2023-Results-Now-In-Final-Phase-of-Midnights-Certification-Program-as-it-Readies-for-Launch-in-2025/
[44] https://www.ainonline.com/aviation-news/futureflight/2025-01-28/airbus-pauses-plans-bring-nextgen-evtol-aircraft-market
[45] https://techcrunch.com/2025/09/07/hyundais-evtol-startup-supernal-pauses-work-following-ceo-and-cto-departures/
[46] https://www.jobyaviation.com/news/joby-brings-blade-to-uber-app
[47] https://www.jobyaviation.com/news/joby-completes-acquisition-of-blade/

Market trends since 2023 that matter for the ecosystem view

- Timelines have moved right. A growing share of OEMs are now more than a year behind the targets they stated in 2023 and/or 2024
- Funding situation is tougher but not quite indicative of the bubble bursting. Several players have restructured or paused and there have been insolvencies. Some “stable” players are narrowing scope and, in some cases, prioritising routes to revenue that do not rely on mass passenger demand in the near term, e.g. cargo
- The traditional OEM route remains prevalent but vertical integration is still on the table. However, OEMs may limit vertical integration scope in the short term to maximise their chance of delivering tangible progress on core matters such as type certification
- Very few passengers have travelled by eVTOL in the last year, certainly fewer than broadly anticipated in 2023

Overall, the eVTOL market is beset by challenges and is consolidating but there are signs of progress. We discuss the range of eVTOL implementation challenges further in the next section.

Challenges

The AAM market will not realise its potential unless multiple challenges are addressed. In the AAM Paper, we stated that these included perception, infrastructure, safety and security, technology, regulation, business models and skills. There are also associated future aviation technology developments that may impact AAM adoption such as drones and regional aviation.

Drones We expect drones to be the vanguard for much of future aviation technology. For example, ubiquitous commercial drones could pave the way for public acceptance of AAM and other pivotal future aviation technologies such as UTM. If BVLOS drone solutions and the associated UTM developments for, say, last mile delivery drones do not progress at pace, this will have an adverse impact on AAM timelines.

eRegional (commercial air travel between UK airports) We note that public acceptance, new air traffic solutions and infrastructure are not required to the same extent for clean regional aviation which is more analogous to existing regional traffic. The AAM passenger use cases which are attractive tend to feature higher occupancy and longer distances, i.e. they tend towards regional aviation. If regional solutions are available before AAM and offer similar connectivity, they may have an impact on AAM implementation timing and market share.

eHelicopter (eVTOLs as helicopter replacements) In the AAM Paper and in this analysis, we do not find a compelling case for eVTOLs as mass passenger transport. The case for eVTOLs as a direct replacement for existing helicopter missions was more convincing; the socioeconomic analysis in the AAM Paper concluded that the air ambulance use case was viable. We expect that eVTOLs as helicopter replacements, using established components such as heliports and airspace integration, will prosper. It should be noted, however, that helicopter volumes in the UK are small[48] so this is evolution rather than revolution.

[48] UK Civil Aviation Authority's aircraft register (1 Jan 2025), there are c.1,113 helicopters out of 18,707 registered civil aircraft (6%) https://www.caa.co.uk/Documents/Download/1782/3ba95a4b-fbeb-48a3-bfb0-a7442a4de3a4/110

The core challenges identified in the 2023 AAM Paper are all present and correct and some have been amplified since. Perception is still a major hurdle and awareness and acceptance lag behind industry ambition. The infrastructure bottleneck is still present and correct, vertiport planning permission remains an issue and grid capacity is increasingly problematic. There has been a huge effort applied to regulation and while it has certainly evolved, it is not yet at the maturity level required for commercial rollout. Technology is advancing overall, but regulation and integration hurdles continue to slow progress. Business models are being tested by shifting timelines and funding pressures. The skills gap is as acute as ever.

In short, there has been progress since 2023 but the fundamental barriers to scale and adoption are largely unchanged and, in some cases, more pronounced than before. The funding environment is also challenging, as touched on in the AAM Ecosystem section above.

In the sections below, we discuss each of the AAM challenges in turn.

Perception

Sounds great but not in my backyard

In the early years, AAM was usually referred to as UAM (Urban Air Mobility) and this still refers to a subset of AAM. When we think about perception, there is certainly a clue in the UAM acronym. Is it realistic to expect people who live in built up urban areas to welcome 18 hours (or more) per day of noise, visual blight and the architectural disruption that would be associated with AAM solutions? Perhaps if they offer greener, more efficient and affordable services than the alternatives.

The challenge is particularly stark when set against the rise of EVs which are not only powered by "clean" energy but require minimal infrastructural disruption, compared to AAM. EVs, whether personally owned, taxi operated or taken via a rideshare usually go directly from the starting point of the journey to the end destination, rather than requiring a journey to and from a vertiport. Our models also indicate that, for urban and rural private hire, AAM solutions are more expensive to buy than the alternatives. EVs, however, do not address congestion issues.

There are many perception studies and we considered three in the AAM Paper. The first was the 2021 study from EASA[49] which found that respondents were keen on the principle and viewed AAM as a new, attractive solution which they were ready to try. They were, however, less keen when they stopped and considered the implications and sought to limit their personal exposure to risks such as safety, noise, security and environmental impact. Concerns about cybersecurity and cultural heritage were also noted. We are not aware of any studies that contradict these 2021 findings.

80%

of the UK public have a very low awareness of "air taxis," with many having never heard of the technology or the concept of electric vertical take-off and landing (eVTOL aircraft).

The second was the DfT Attitudes Tracker (Wave 7, 2021) which indicated that, in the UK, there is a very low awareness of "air taxis" with a total of 80% of respondents who had either "heard of, know nothing about them" (19%) or "never heard of them" (61%). The comparable total figure for drones is 12%. More recent DfT work points to a similar conclusion. Technology Tracker (Wave 11, 2024)[50] and Technology Tracker Autumn Wave 2024[51] continue to treat flying taxis as a niche emerging technology with limited self-reported awareness and mixed trust. Awareness of "flying taxis" is similar and a total of 80% of respondents had either "heard of, know nothing about them" (23%) or "never heard of them" (57%). The percentage selected of the top two "prompted" advantages of flying taxis has declined: convenience/ speed down from 45% to 40% and improved connectivity from 42% to 38% from 2022 to 2023.

[49] https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf
[50] https://assets.publishing.service.gov.uk/media/66f3dc255316e21be6c4bc37/dft-tchnology-tracker-wave-11.pdf
[51] https://assets.publishing.service.gov.uk/media/682613d3c3d769b1824e6447/dft-technology-tracker-autumn-2024-wave.pdf

Finally, the AAM Paper considered our own data from a study of the UK industry's perception of drones, conducted in 2022 with BEIS (Department for Business, Energy and Industrial Strategy)[52]. This study was consistent with our 2019 survey[53] in finding that out of 15 use cases (13 drone, 2 AAM using our definitions), the two least supported were AAM, but we noted an increase in the level of support between 2019 and 2022. The least supported use case remains "flying taxis" but support has increased 9% to 45% in 2022. Similarly, drones as patient transport "air-ambulance" is second bottom of the table but has increased by 6% to 59%. This broadly aligns with the EASA study referenced above where use cases that were of benefit to the community such as air ambulances were better supported than those designed to meet individual needs.

There is certainly work to do to make the public aware of AAM and persuade them that the benefits of AAM outweigh the costs. As previously mentioned, progress within the commercial drone industry could help here. For instance, it is possible that thousands of delivery drones flying back and forth will normalise future aviation tech and pave the way for acceptance of AAM.

In the AAM Paper, we mentioned that the importance of social licence for new forms of aviation was recognised by FFC whose approach was to work with the public in the very early stages (via a £1.6m social science research programme). This ESRC-funded programme concluded in 2025 with the Navigating Future Flight report[54]. It found that support is conditional: a majority see net benefits for cargo drones (68%) and a narrower majority for eVTOLs (56%) when deployments demonstrably serve the public good, improve connectivity and public services and are credibly more sustainable than existing options. Concerns are material and persistent, particularly around affordability (78% are concerned eVTOLs will be too expensive), safety, cybersecurity, privacy, noise, visual congestion and impact. The report distils these expectations into 14 public principles and calls for regulation and independent oversight to be in place before scaled rollout, with accessibility and transparency designed in from day one.

Volocopter Paris Olympics

> "Volocopter and ADP experienced stringent opposition to their planned eVTOL flights at the Paris Olympics. For example, LeMonde quoted that eVTOLs were "an environmental aberration for the ultra-rich"[55] in an article covering the legal action taken by the City of Paris.
>
> In addition to perception issues, the planned passenger flights did not proceed due to certification delays. Flight demonstrations (without passengers) took place off-site.[56][57]"

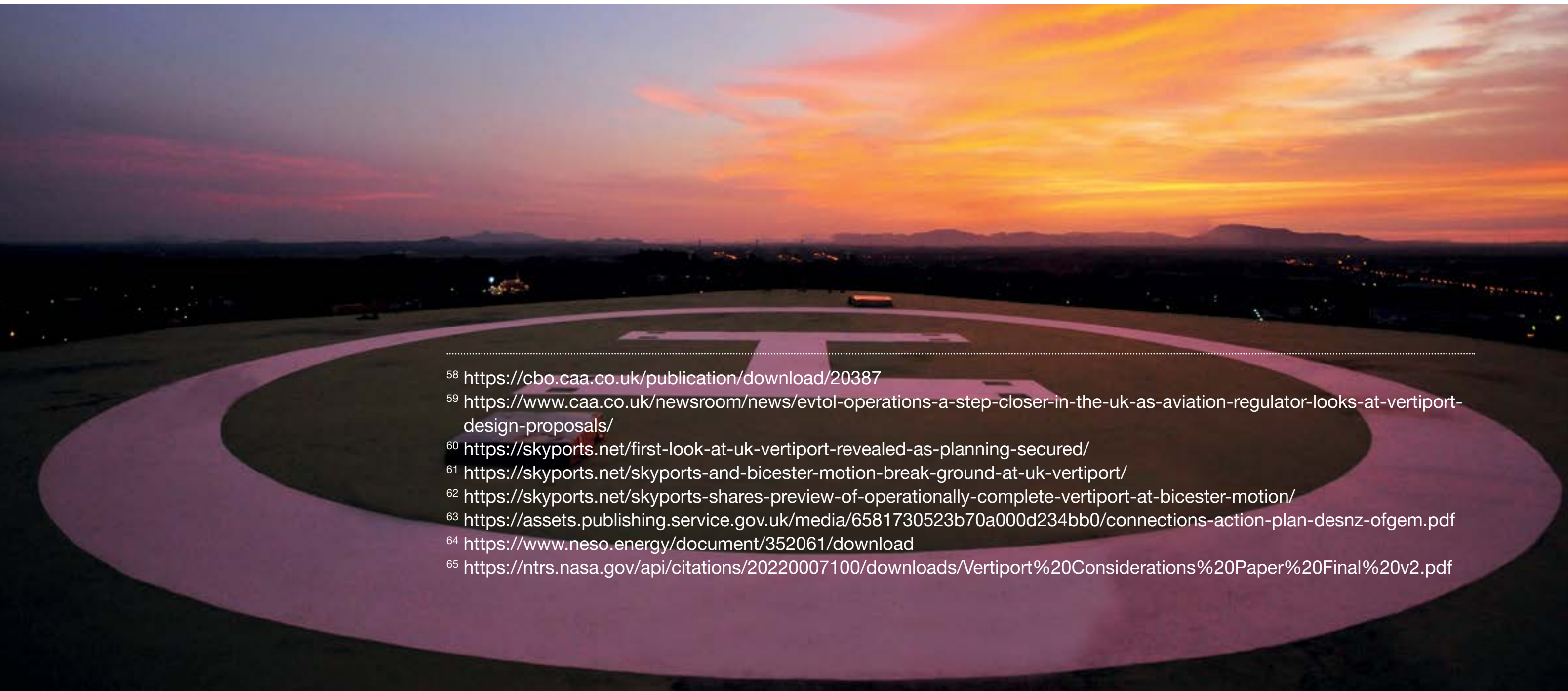
[52] https://www.pwc.co.uk/intelligent-digital/drones/building-trust-commercial-drones.pdf
[53] https://www.pwc.co.uk/issues/emerging-technologies/drones/drones-and-trust.html
[54] https://futureflightsocial.ac.uk/research/title-23/
[55] https://www.lemonde.fr/en/environment/article/2024/07/19/city-of-paris-takes-legal-action-against-flying-taxis-during-olympic-games_6690309_114.html
[56] https://www.wired.com/story/the-dream-of-flying-taxis-in-paris-failed-to-take-off/
[57] https://www.lemonde.fr/en/transport/article/2024/08/08/paris-flying-taxi-flights-scrapped-during-olympics_6711471_216.html

Infrastructure

Build it and they will come

One of the key assumptions in our modelling is that eVTOLs take off and land at vertiports and that vertiports are not a constraint. Vertiports are as critical to AAM adoption as they are fraught with practical challenges. We touch on the complexities and potential time delays associated with finding real estate and obtaining planning permission above (Model Implications) and operating vertiports for extended periods (Perception) above. Other challenges include design and compliance standards (Regulation, below) and the amount of power that will be required from the grid, assuming there are no issues with other utilities. Since 2023 the UK has started to turn vertiports from concept into something rather more concrete but there is still a long way to go. The CAA published CAP2538 on considerations for aerodromes and bespoke vertiports planning to operate VTOL aircraft[58] and has consulted on design proposals for vertiports at existing aerodromes.[59] In parallel, Skyports and partners secured planning permission for a permanent vertiport testbed at Bicester Motion in August 2024,[60] broke ground in December 2024[61] and the site is now operationally complete.[62]

These are meaningful steps but they also illustrate the long lead times for site delivery, local planning risk, grid connection constraints and the lack of a mature repeatable operating model. UK grid connection queues and reforms are a live constraint across the economy which matters for high power charging at vertiports. The UK grid connections regime is under severe strain. The DESNZ and Ofgem Connections Action Plan[63] indicates that transmission connection applications have grown approximately tenfold over five years with some customers being offered connection dates in the late 2030s. The plan also reports that the UK will struggle to meet EV infrastructure requirements without reform. NESO paused most new transmission and distribution connection applications from January 2025.[64] It seems unlikely that, against such a background, connections for a marginal technology such as eVTOLs will be prioritised. We have, of course, just skimmed the surface. Refer to Advanced Air Mobility vertiport Considerations: A List and Overview[65] for a more comprehensive, US-centric discussion which consolidates 450 vertiport considerations.



[58] https://cbo.caa.co.uk/publication/download/20387
[59] https://www.caa.co.uk/newsroom/news/evtol-operations-a-step-closer-in-the-uk-as-aviation-regulator-looks-at-vertiport-design-proposals/
[60] https://skyports.net/first-look-at-uk-vertiport-revealed-as-planning-secured/
[61] https://skyports.net/skyports-and-bicester-motion-break-ground-at-uk-vertiport/
[62] https://skyports.net/skyports-shares-preview-of-operationally-complete-vertiport-at-bicester-motion/
[63] https://assets.publishing.service.gov.uk/media/6581730523b70a000d234bb0/connections-action-plan-desnz-ofgem.pdf
[64] https://www.neso.energy/document/352061/download
[65] https://ntrs.nasa.gov/api/citations/20220007100/downloads/Vertiport%20Considerations%20Paper%20Final%20v2.pdf

In addition to vertiports, communications which are low latency, high bandwidth and have comprehensive coverage and redundancy will also be critical to eVTOLs safely navigating the skies. The communications must enable a traffic management system which seamlessly combines manned and unmanned traffic management and enables AAM to safely operate at low levels in a sky busy with drones and other air traffic. Refer to the Technology and Regulation sections below for further discussion of UTM (Unmanned Traffic Management) and its critical role in unlocking future aviation technologies such as AAM and BVLOS (Beyond Visual Line of Sight) autonomous drones.

There is also the "chicken and egg" challenge which some AAM Infrastructure players are keenly aware of. We used this Skyportz quote from December 2021 in the AAM Paper

> "Forget the hype, concept plans, and fancy designs, the reality is that there is no existing industry in vertiport infrastructure anywhere in the world as there aren't any aircraft commercially certified to use them,… Until we have the aircraft approved, there is no point in building anything as we don't yet know what the requirements will be."[66]

This is still as relevant in 2026 as it was four years ago, refer to the Regulation section below. It would be remiss of us not to mention that Skyportz entered the fabrication phase for their aircraft-agnostic Aeroberm "vertipad" prototype in November 2025.[67]

[66] https://www.futureflight.aero/news-article/2021-12-20/ground-infrastructure-experts-wrestle-vertiport-challenges
[67] https://www.ainonline.com/aviation-news/futureflight/2025-11-06/skyportz-commences-fabrication-first-vertipad-prototype

Safety and Security

Current aviation has set a high bar and the tech landscape is changing

When we think of new technology, our initial excitement may be tempered when we start to consider the risk involved. In our AAM Paper modelling, we used commercial aviation accident rates as a proxy for eVTOL rates. The logic for this is that eVTOLs will essentially go through the same rigorous certification process as current commercial aviation, see Regulation below. If one accepts this premise, eVTOL travel will be safer than, say, road travel.

Continuing with the commercial aviation theme, we find it difficult to imagine that AAM flights will have less rigorous security and passenger/ baggage screening than is currently in place for domestic air travel in the UK. To achieve the 10 mins boarding time (arrival at vertiport to take off, per the AAM Paper) we have modelled for the majority of passenger use cases, a different approach is required. Less stringent security may not be an option and new solutions will be required to automate and streamline vertiport processing, refer to the Technology/ Airport section below. That said, we note that the shortest flight in the world has no security screening which implies that different levels of screening may be possible depending on capacity and distance[68].

There are other considerations associated with an increasingly digital and automated solution such as AAM. The piloted AAM phase will feature high levels of automation which will, of course, increase when the pilot is removed and we have fully autonomous AAM. The Airspace (ATM/ UTM) automation will also be at an unprecedented level. Both AAM and Airspace automation imply a reliance on AI (albeit operationally deterministic) which will have to make many decisions per second that impact passenger safety. Accordingly, effective and holistic AI testing and certification and cybersecurity will be paramount. Since 2023 regulators have started to treat AI assurance and cybersecurity as first order safety issues rather than secondary IT risks but regulations are at an early stage, refer to the Regulation section below. The CAA published CAP3019 on AI in aviation to inform its emerging assurance approach,[69] and followed this with a strategic framework in CAP3064A.[70] In the EU, Implementing Regulation (EU) 2023/203 introduced Part IS requirements to manage information security risks with a safety impact and has applied since February 2026.[71] For eVTOL this may increase the evidence burden across aircraft systems, vertiports and airport IT, identity and payment flows and UTM and ATM integration. Cybersecurity, then, must cover the entire digital ecosystem, from the AAMs themselves to passenger processing and Airspace management. Distributed ledger technologies (DLT) such as blockchain could play a key role here, refer to the Technology/ Airspace section. Other elements of physical security will also be important, consider, for example, the “hostile vehicle mitigation” concrete bollards outside most airports.

[68] https://frequentmiler.com/flying-on-the-worlds-shortest-flight-papa-westray-to-westray-less-than-2-minutes/
[69] https://www.caa.co.uk/publication/download/22665
[70] https://www.caa.co.uk/publication/download/23437
[71] https://eur-lex.europa.eu/eli/reg_impl/2023/203/oj

Following the drone incidents at Gatwick in 2018[72], the counter-drone market was certainly buoyant and that direction of travel has continued. For example, NPCC awarded a counter drone framework worth £8m in 2023[73] and MAG initiated early market engagement in 2024 for a comprehensive drone detection systems across Manchester, Stansted and East Midlands airports[74]. The counter-AAM segment is less well defined but no less required in a world where it seems that any vehicle can be used for nefarious purposes[75]. In the 2021 EASA perception study, respondents showed a limited trust in the security and cybersecurity of AAM and noted a requirement for threat prevention steps[76]. This sentiment is echoed in the Navigating Future Flight report referenced in the Perception section above. There is also a potential blurring of lines between AAM and drones, for example, an eVTOL carrying cargo vs a cargo drone. All risk scenarios must be defined and mitigated.

[72] https://www.whatdotheyknow.com/request/gatwick_airport_drone_incident_i/response/1830098/attach/4/Official%20sensitive%20Operation%20Trebor%20Structured%20Debrief%20report%20Redacted....pdf
[73] https://www.find-tender.service.gov.uk/Notice/004116-2023
[74] https://www.find-tender.service.gov.uk/Notice/038793-2024
[75] https://www.judiciary.uk/wp-content/uploads/2019/11/London-Bridge-Borough-Market-Terror-Attack-2019-0332.pdf
[76] https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf

Technology

We will discuss Technology through the lens of the 5As model from the AAM Ecosystem section above – Aircraft, Ancillary, Airline, Airspace and Airport.

Aircraft

These exciting new eVTOL aircraft require a change in approach to design, maintenance and repair including failure modes, redundancies and contingency procedures. The high-volume production required to meet projected global demand will also test manufacturers and their supply chains.

The propulsion systems associated with eVTOLs have a level of ambition not seen before for electrically powered vehicles and there are many associated challenges. We could also argue that the sheer number of different eVTOLs being designed (c.1,000 concepts[77], significantly up from the c.300 in the AAM Paper) represents a missed opportunity for collaboration which would result in fewer designs but faster iteration and lower overall industry risk. The batteries required to power the eVTOLs are, perhaps, in a different place with the rise of EVs. Although aviation safety requirements may drive overall battery design in a different direction, the EV market is driving innovation and high-volume production of batteries. The AAM market may be able to leverage this, significantly reducing design and supply chain risk and cost compared to tech developed from scratch[78]. Related, eVTOL flight endurance (compared to conventional propulsion) is cited as a concern[79] for scenarios where holding patterns or rerouting is required due to weather and other disruptions in traffic flow and this potential issue must also be addressed. Evidence of the eVTOL propulsion system challenges can be found in the increased number of hybrid discussions, with Joby stating that they had flown 523 miles using a hydrogen-electric demonstrator.[80]

When we drafted the AAM Paper, 2024 to 2025 timelines were common for eVTOLs to be approved. At the time of writing, most leading OEMs now frame type certification and entry into service as a multi-year process extending into the second half of the 2020s. For example, in Joby's 2025 update they described flight testing and a pathway towards FAA Type Inspection Authorisation in 2026 rather than near-term commercial entry.[81] High profile insolvencies and challenges delivering such as Volocopter at the Paris Olympics are also illustrative.[82] To our knowledge, the only approved eVTOL flying commercial passenger flights is China's eHang, but their numbers are driven by tourism rather than mass transport demand (refer to the Regulation section, below).

When we think of the economics of AAM, technology that removes or reduces piloting levels is key to increasing the viability of certain use cases. There are many avionics challenges to resolve including autonomy, DAA (Detect and Avoid) and BVLOS (Beyond Visual Line of Sight). The underlying regulations are moving (see the Regulations section below) but they are still incomplete for routine low-level operations in mixed traffic.

[77] https://evtol.news/aircraft
[78] https://www.umlaut.com/uploads/documents/umlaut_Whitepaper_eVTOL.pdf
[79] https://www.caa.co.uk/data-and-publications/publications/documents/content/cap2272/
[80] https://www.jobyaviation.com/news/joby-demonstrates-potential-regional-journeys-landmark-hydrogen-electric-flight/
[81] https://www.jobyaviation.com/news/joby-flights-2025/
[82] https://www.wired.com/story/the-dream-of-flying-taxis-in-paris-failed-to-take-off/

Most regulators continue to prioritise piloted operations first with autonomy treated as a later phase because of the compounded assurance burden across DAA, software, cybersecurity and human factors.[83 84 85] Consider, for example, the interlinked challenge of Airspace and Technology/ Avionics – the AI and automated systems in the eVTOL will have to combine seamlessly with AI and automation in the UTM/ ATM to deliver a safe and efficient solution that can deal with an unprecedented level of air traffic. Accordingly, a communications backbone which is low latency, high bandwidth, high reliability and has redundancy will also be key.

If we go back to the eVTOL itself and consider the component level, eVTOL manufacturers have broadly followed an insource model (majority of components designed in-house, vertical integration e.g. Joby) or an outsource model (majority of components purchased from third parties, e.g. Vertical Aerospace). In both cases, many of the components are single-sourced and have not been produced in volume. This represents a significant technical challenge and supply chain risk. Since the 2023 paper this supply chain and industrialisation risk has been amplified by funding stress and programme churn across the sector, refer to the AAM Ecosystem section. As mentioned, some high profile European OEMs entered insolvency proceedings, likely a signal that the route from prototype to certified aircraft and scalable production is longer and more capital intensive than many early business plans assumed.

To produce the number of eVTOLs forecast, a high-volume manufacturing model is required, at a scale which is unprecedented in traditional aerospace. The required manufacturing model is more akin to the volume production of cars and we note with interest the investments of, for example, Toyota (Joby), Stellantis (Archer) and Suzuki (Skydrive),[86] refer also to the AAM Ecosystem section. The volume manufacturing model must be addressed not only to deliver the quantity and quality of units required but also to achieve an eVTOL unit cost that will make the AAM unit economics work. You will note that, in the AAM Paper we used a relatively low initial capital cost (initially £3M per eVTOL) and that we still consider this a highly optimistic assumption as mentioned in the Optimistic eVTOL Assumptions and Interpretations section above. The degree to which eVTOLs embrace Design for Manufacture (DfM) principles to hit volume and cost targets will be a key success criterion.

Vertical Aerospace

> “Vertical Aerospace’s VX4 programme illustrates both aircraft maturity and funding risk. In August 2023 a prototype was lost in testing after a propeller blade detached. The UK AAIB attributed the event to an adhesive bond failure.[87] The company then reset expectations under its Flightpath 2030 plan, pushing type certification from 2026 to 2028 and restructuring near term financing.[88]
>
> The net message for the sector is that certification and industrialisation are taking longer and costing more than early business cases assumed, requiring recapitalisations rather than a straight line to scale.”

[83] https://www.gov.uk/government/publications/future-of-flight-action-plan
[84] https://www.easa.europa.eu/en/domains/drones-air-mobility/drones-air-mobility-landscape/urban-air-mobility-uam
[85] https://www.icao.int/sites/default/files/left-menu-pdfs/UTM%20Framework%20Edition%204.pdf
[86] Note that the AAM Paper included now defunct relationships Daimler-Volocopter (Volocopter insolvency in 2024 and subsequent acquisition in March 2025 by Diamond Aircraft) and Hyundai-Supernal (Supernal paused operations in late 2025 https://startupwired.com/2025/09/08/supernal-hits-a-roadblock-hyundais-evtol-dream-faces-turbulence/)
[87] https://www.gov.uk/aaib-reports/aaib-investigation-to-va-1x-g-evtl
[88] https://www.ainonline.com/aviation-news/futureflight/2024-11-25/vertical-aerospace-set-50-million-funding-and-debt-relief

Ancillary

When we think about MRO (Maintenance, Repair and Overhaul) for AAMs it is clear that the technology and approach required to work on AAMs will differ from existing commercial aviation. There are, perhaps, three main factors at play, over and above cost pressure. These are the profile of AAM design (lower cost and lower maintenance components compared to existing commercial aviation, fewer moving parts), relatively small AAM MRO market size and OEM desire to keep IP (Intellectual Property). This is likely to result in MRO initially being carried out by OEMs and the rise of AI-powered predictive maintenance. Since 2023, the regulatory system has started to reflect this. The CAA eVTOL Delivery Model explicitly identifies continuing airworthiness, maintenance approvals and maintenance capability build as gating workstreams alongside aircraft certification and operations (2025).[89] In the UK context this also interacts with skills and training for high voltage systems and battery handling as well as the practical question of where spares, battery packs and software updates are held and released in a safety managed way.

Airline

In addition to the implementation of new passenger and baggage processing tech, airlines will face many other challenges. These include an increased level of interconnectivity with other modes of transport (mobility as a service). For example, a passenger may use the Airline's app to buy point-to-point transport which includes an AAM leg and certain airlines will wish to coordinate, say, EV taxi travel at either end in a seamless manner. Airlines will also increasingly have robotic and other automated technologies for check in, boarding, inflight service, etc. The airline role is far from established and, since 2023, it has looked more like ecosystem integrator and brand wrapper than aircraft owner and operator, with many airline and airport announcements structured as conditional partnerships and route studies that preserve option value while the sector waits for certification outcomes and fleet delivery clarity.

[89] https://www.caa.co.uk/our-work/publications/documents/content/cap3169/

Airport

There are multiple technology challenges to solve when it comes to vertiports. One of the main challenges is the ability to cope with multiple eVTOL shapes and sizes, with more than 1,000 concepts logged. Sophisticated, AI-powered planning and scheduling tech will be required to safely get the maximum vertiport utilisation, as will robotic/ automated eVTOL movement and charging and baggage handling.

As mentioned in the Safety and Security section above, to achieve the 10 minute boarding time we state in the Modelling Approach section below, new security technology will be required. This could include the use of robots for baggage handling and security. These security robots may include facial recognition cameras and the ability to remotely measure pulse rate and detect explosives without interrupting passenger flow[90]. Another example of using technology to speed up vertiport processing is biometric, DLT processing prior to passengers arriving at the airport. It is worth noting that much of this is likely to be the responsibility of the Airline, above.

As touched on in the Safety and Security section above, there is also the matter of counter drone and counter AAM; the technology required to ensure that nefarious drone or AAM use can be detected and neutralised. In the counter drone market, this often comprises RF, optical and radar-based detection systems, along with AI aircraft identification. Refer to the Infrastructure section above for further discussion on vertiport challenges.

[90] https://www.mordorintelligence.com/industry-reports/airport-robots-market

Airspace

There are a significant number of technology challenges when it comes to airspace. As mentioned in the Model Implications section, there could be up to 900,000 commercial drones in the UK by 2030.[91] Add this to the thousands of AAMs and anticipated increases in helicopters and General Aviation (GA) traffic (whether clean or not) and we have a step change in the volume of aviation traffic. This increased scale and activity will be predominantly at lower altitudes in built up areas (whether urban or rural) and, again, these are unprecedented challenges.

This increase in scale and complexity requires effective UTM and a paradigm shift in ATM. ATM must adapt and evolve to include automation (including AI) and seamless integration with UTM which, with less of the technical baggage associated with ATM, may have a smoother path to automation. Automation is key not only for safety due to the required speed of decision making but also to address the air traffic skills shortage we mention in the Skills section below.

Since we published the AAM Paper, there have been some important changes in the UTM landscape. In Europe, the regulatory concept of U-space has moved from pilot projects to clear operational requirements, providing a baseline for UTM style services in low-level airspace (albeit still with significant implementation work ahead)[92]. The UK is not bound by EU U-space rules post Brexit and our reading is that the UK is far behind many peer countries, given that it does not consider UTM foundational, nor does it have a concrete plan to implement it. We discuss this in detail in our 2024 and 2025 papers, Skies Without Limits v3.0[93] and UK Drone Regulations and Net Risk respectively.[94] See also the Regulatory section below. We also have doubts about the near-term commercial viability of UTM in the UK and globally, perhaps illustrated by pioneering UK UTM company Altitude Angel entering administration in October 2025 after leading multiple FFC-funded activities.[95] Putting the many challenges such as digital maturity and commercial viability aside, for UTM/ATM technology to succeed, seamless integration of all data feeds and digital infrastructure capable of managing the sheer volume of data (with redundancy) will be key. As mentioned in the Aircraft section above, a communications backbone which is low latency, high bandwidth, resilient and has redundancy will also have a key part to play in DAA and cybersecurity.

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[91] https://www.pwc.co.uk/issues/intelligent-digital/the-impact-of-drones-on-the-uk-economy.html
[92] https://transport.ec.europa.eu/news-events/news/new-eu-rules-dedicated-airspace-drones-enter-force-2023-01-26_en
[93] https://www.pwc.co.uk/intelligent-digital/drones/skies-without-limits-2024.pdf
[94] https://www.pwc.co.uk/intelligent-digital/drones/drone-regulations-and-net-risk.pdf
[95] https://www.commercialuavnews.com/drone-news-altitude-angel-administration-regulations

The CAA's Airspace Modernisation Strategy (AMS) aims to address the technical airspace challenges. Since 2023, the AMS has moved from strategy to a Delivery Plan and progress reporting, but the published material still signals a long, complex transition. The AMS (CAP1711)[96] and the Deployment Plan (CAP1711b)[97] set out a multi-year programme across airspace redesign, new CNS (Communications, Navigation, and Surveillance) and digitalisation. CAA progress reporting highlights that delivery is uneven and requires sustained coordination across NATS, airports and airspace change sponsors.[98] There is still a long way to go and no sign of the UK embracing UTM as foundational.

As touched on in the Safety and Security section above, it is also critical that any data exchanged, not least between UTM and ATM systems, is reliable and trusted. DLTs and AI are likely to combine to play a key role here. Nearer term, NATS OpenAir platform[99] seems likely to serve as a Common Information Service Provider capability, acting as a central point of truth for aeronautical and operational data and enabling information exchange between UTM service providers and existing ATM systems. However, OpenAir is only one building block. Where regulators have pushed for scalable BVLOS, they have treated UTM as a bundle of mandatory services, notably network identification, geo awareness, flight authorisation and traffic information, underpinned by robust common information services. Internationally, deployment is often anchored in a nationally designated or ANSP linked model rather than relying on early-stage commercial experimentation, with examples including Poland[100], Singapore[101] and Italy[102]. For the UK, the implication is that a clear "UTM first" decision and funding path may be needed if routine BVLOS is to scale beyond trials and if AAM is ever to share low-level airspace at meaningful volume.

[96] https://www.caa.co.uk/our-work/publications/documents/content/cap1711/
[97] https://www.caa.co.uk/our-work/publications/documents/content/cap1711b/
[98] https://www.caa.co.uk/our-work/publications/documents/content/cap3084/
[99] https://nats.aero/blog/2025/12/testing-our-airspace-integration-concept-new-partnership-kicks-off-a-busy-year-of-openair-development/
[100] https://www.unmannedairspace.info/uncategorized/how-poland-built-and-introduced-an-operational-integrated-national-utm-atm-system/
[101] https://www.urbanairmobilitynews.com/emerging-regulations/singapores-new-aviation-safety-plan-addresses-integration-of-utm-and-aam/
[102] https://www.sesarju.eu/sites/default/files/documents/events/DSD2025/From%20regulation%20to%20implementations%20The%20Italian%20Uspace%20experience%20novideo.pdf

Regulation

Innovation and adaptation

Regulation was a considerable challenge in 2023 and still is. The safety-first, conservative approach and rigorous regulation that has kept air travel relatively safe for decades understandably applies to this new technology. AAM is also arriving at a time when there are broader technical and operational changes that regulation must address for all commercial aviation. This includes the rise of AI across the board and the busier airspace associated with increases in commercial traffic and new drone use cases such as delivery and security.

In the 2023 AAM Paper, our view was that, although Brexit and the push to level up the UK could drive us to adopt different regulations in the UK than in Europe, this seemed unlikely. For example, in June 2022 the CAA announced that it would use the Special Conditions (SC)-VTOL certification standards developed by EASA (European Union Aviation Safety Agency) (CAP2537)[103]. We also mentioned that the UK had joined a new National Aviation Authority (NAA) network, along with Canada, United States, Australia and New Zealand.[104] The scope of this group explicitly included “air taxis.”

Since 2023, there has been much material published on AAM in the UK. In the main, it is early-stage and directional rather than definitive regulation. For example, the DfT’s Future of Flight Action Plan (March 2024)[105] sets out milestones for eVTOL delivery and CAP3169[106] (September 2025) sets out the CAA’s eVTOL delivery model and ambition to 2028. The DfT is pushing ahead with the action plan, evidence includes the creation of the Future of Flight Industry Group[107], announcements of funding[108] and analysis of future of flight scenarios.[109] CAP3186[110] (November 2025) sets out the CAA’s proposed policy approach for certifying and enabling initial eVTOL operations. The timeframe of commercial eVTOL flight by 2028 is ubiquitous.

[103] https://www.caa.co.uk/publication/download/20383/
[104] https://www.gov.uk/government/news/uk-joins-up-with-closest-allies-to-create-new-forum-to-work-together-to-tackle-aviations-biggest-challenges
[105] https://www.gov.uk/government/publications/future-of-flight-action-plan
[106] https://www.caa.co.uk/our-work/publications/documents/content/cap3169/
[107] https://www.gov.uk/government/groups/future-of-flight-industry-group
[108] https://www.gov.uk/government/news/over-20-million-to-help-drones-and-flying-taxis-take-to-uk-skies
[109] https://www.gov.uk/government/publications/future-of-flight-scenarios
[110] https://www.caa.co.uk/publication/download/26250

Intention turned into regulation in March 2024 when the CAA adopted EASA's SC-VTOL Issue 1 and associated EASA MoC (Means of Compliance) material via an Official Record Series 9 decision.[111] UK.SC.VTOL Issue 2[112] followed in June 2025, to incorporate EASA's SC-VTOL Issue 2.[113] Also in June 2025, the NAA network (UK, Australia, Canada, New Zealand and the United States) published an Advanced Air Mobility type certification roadmap intended to converge approaches and reduce duplicated effort.[114][115] In May 2026, the CAA opened a follow up to its VTOL legislation consultation, with a scope that includes eVTOLs, airworthiness, pilot licensing and flight operations regulations.[116]

Broadly, then, the CAA's published position on eVTOLs still draws heavily on the EU and the thinking of other peer countries, but some material appears more UK centric. For example, CAP 2538 (Aerodromes and vertiport considerations)[117] is more grounded in a UK-specific gap analysis against existing regulations. A significant amount of effort has been applied to establishing UK eVTOL regulations. They are at an early stage and, encouragingly, we are learning from, and collaborating with, our peers. However, we are still far from establishing the end-to-end regulatory framework required for safe eVTOL flights.

There are still a plethora of regulatory innovations and adaptations required for AAMs to take to the skies safely and these are at an early stage. This matters because the UK business case is extremely sensitive to regulatory-driven constraints on routing, noise, pilot requirements, operating minima and vertiport licensing. The key pattern since 2023 is that regulators have started to publish roadmaps and early guidance but many of the hard decisions still sit in consultation, MoC and operational trial phases rather than stable rulemaking. The timelines in the Future of Flight Action Plan still look aggressive and, perhaps, the UK government may wish to reconsider its focus on hitting these if such a focus diverts regulatory resources away from other areas which have more compelling market demand.

[111] https://www.caa.co.uk/our-work/publications/documents/content/ors9-no-0037
[112] https://regulatorylibrary.caa.co.uk/sc/Content/PDF%20Documents/UK.SC.VTOL%20Issue%202.pdf
[113] https://www.easa.europa.eu/en/document-library/product-certification-consultations/special-condition-vtol
[114] https://www.caa.co.uk/newsroom/news/groundbreaking-roadmap-for-aircraft-of-the-future-released
[115] https://www.faa.gov/air-taxis/NAA-Network-Roadmap-Advanced-AirMobility-Aircraft-Type-Certification-Edition-April2025.pdf
[116] https://consultations.caa.co.uk/portfolio-delivery/legislation-for-new-types-of-vertical-take-off-and/
[117] https://www.caa.co.uk/publication/download/20387

Regulatory innovations required for eVTOL to take off

In the AAM Paper, we listed areas where novel regulatory innovations were required for eVTOLs: type certification, operational authorisations, pilot licensing, autonomous flight, vertiports, communications networks and counter-AAM.

We contrasted these novel regulatory approaches against those more likely to mirror existing approaches: Design Organisation Authorisation (DOA), Production Organisation Authorisation (POA), Air Operator Certificate (AOC), various safety, security and environmental (including noise) regulations and passenger rights, including compensation for delayed, diverted or cancelled flights.

We continue to subscribe to the same view on regulatory innovations but would add that no NAA is attempting to create an "air taxi rulebook" from scratch for these new requirements. Rather, they are adapting existing regulations alongside the introduction of novel regulatory approaches. For example, the FAA's approach to eVTOL (included under powered-lift) rule making leverages existing aircraft and helicopter regulations and adds Part 194 which is a SFAR[118] (Special Federal Aviation Regulation), an interim regulatory approach that usually runs for 10 years or so (more below). In the UK, CAP3186[119] also signals that the CAA intends to apply existing regulatory frameworks as far as possible, while setting out where new policy will be required for novel eVTOL aircraft characteristics and operations. In the next section, we note the progress against the regulatory innovation categories we used in the AAM Paper.

[118] https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1042954
[119] https://www.caa.co.uk/publication/download/26250

Novel eVTOL regulatory requirements

eVTOL type certification

There has been visible progress on certification frameworks since 2023, but the sector is still pre-type certificate for passenger eVTOL in the main Western geographies. Per above, the UK has aligned to EASA SC VTOL and EASA continues to mature its MoC guidance. What we do not see is a full type certification programme that could underpin volume production. In general, eVTOL OEM type certification is slipping to the right, see below.

Operational permission

Since 2023 there has been progress on the operational approach in the US. This is relevant because many eVTOL OEMs are pushing for FAA approvals first. FAA final rules for integrating powered lift (including eVTOLs) were published in the Federal Register in November 2024 and establish pilot certification and operating parameters.[120] [121] Note that most of the operational requirements are based on those already established for helicopters and aircraft. In the UK, CAP3169[122] indicates that the basis for eVTOL operations will be established through staged trials and incremental rulemaking. We expect that, in the UK, operating permission will sit within the existing AOC (Air Operator Certificate, see below) framework with eVTOL additions. This is a slightly different approach to that taken by the US.

Pilot licensing

Pilot licensing has become less theoretical since 2023 as regulators work to define how eVTOLs fit within existing aeroplane and helicopter licence structures. As noted above, the FAA powered-lift final rule creates an alternate framework for powered lift pilot training and qualifications and is a pragmatic example of how regulators may phase in new licence and training constructs (see FAA references in the bullet above). In the UK, pilot licensing remains early stage. CAP3169 states that the CAA has stakeholder work groups covering pilot licensing (inter alia) and the CAA has issued a crewed VTOL licensing CAP (3005,[123] see also the consultation response[124]). The latter outlines an approach for early crewed VTOL operations which is based on existing professional pilot qualifications such as the Commercial Pilot License and the Air Transport Pilot License. A pilot licensing path for those with no previous piloting experience is noted as a future enhancement in CAP3005. The UK's membership of the NAA network perhaps implies that it will look to leverage the FAA's work in this area.

[120] https://www.faa.gov/newsroom/integration-powered-lift-pilot-certification-and-operations-miscellaneous-amendments
[121] https://www.govinfo.gov/content/pkg/FR-2024-11-21/pdf/2024-24886.pdf
[122] https://www.caa.co.uk/publication/download/25923
[123] https://www.caa.co.uk/publication/download/22363
[124] https://consultations.caa.co.uk/policy-development/licensing-pilots-of-vtol-capable-aircraft/consult_view/

Vertiports

EASA has published Prototype Technical Specifications for vertiports (2022),[125] this is guidance rather than binding regulation. The FAA has issued Engineering Brief 105a[126] on vertiport design (2024), also guidance rather than regulation. Since 2023, the UK has progressed from a general vertiport discussion to published guidance and consultation on design proposals (CAP2538).[127] This is focussed on converting existing aerodromes to vertiports but also considers the case of building vertiports from scratch. Overall, we have interim approaches rather than mature vertiport regulations. This implies that a case by case approval effort will be required and that this is likely to be subject to planning challenges for each site. We are not aware of any initiatives to change existing planning regulations to increase the likelihood of rapid approval of new vertiport sites, for example in CAP2538.

[125] https://www.easa.europa.eu/en/document-library/general-publications/prototype-technical-design-specifications-vertiports
[126] https://www.faa.gov/airports/engineering/engineering_briefs/eb_105a_vertiports
[127] https://cbo.caa.co.uk/publication/download/20387

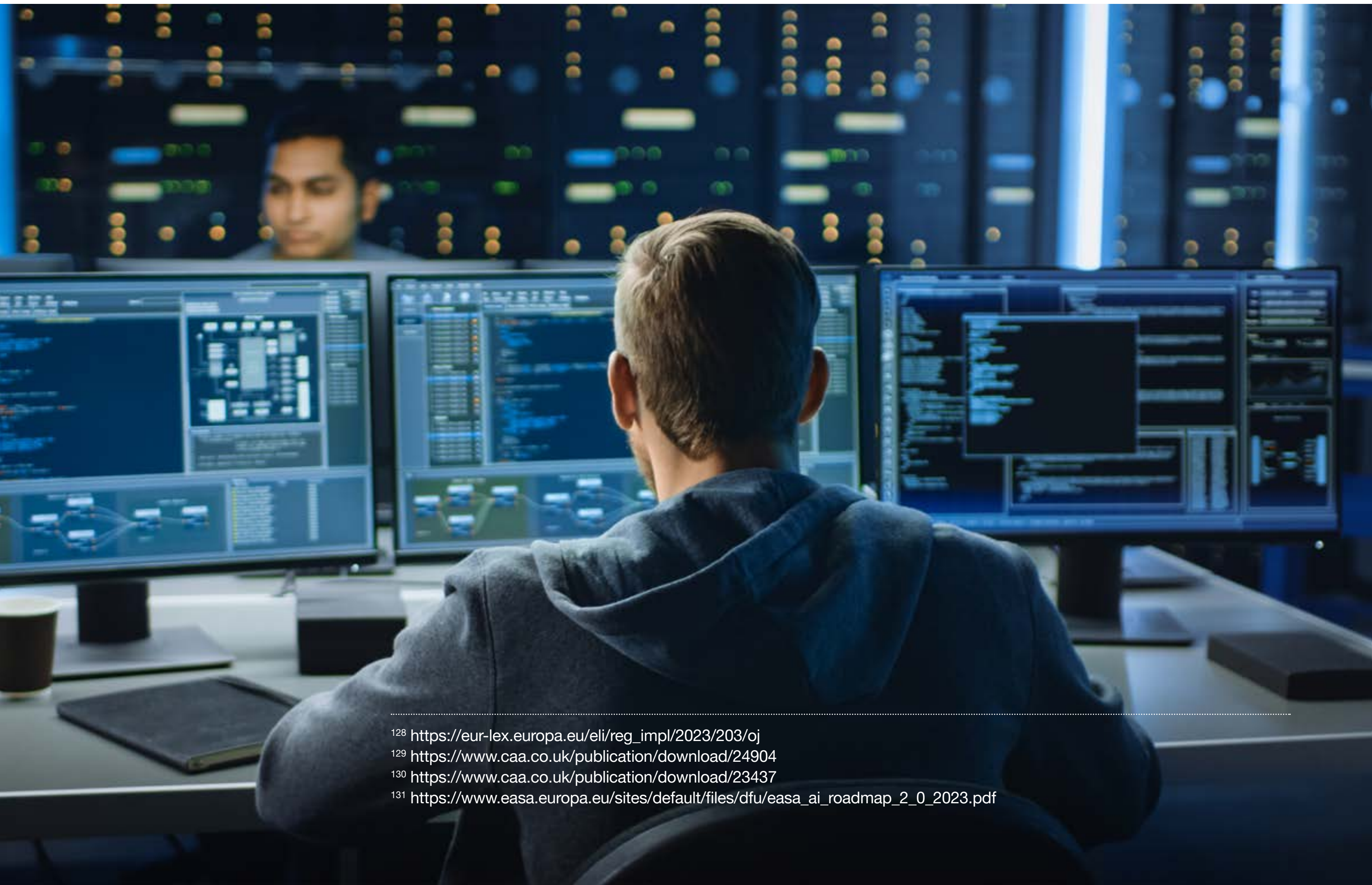
Novel future aviation regulatory requirements (including for AAM)

"Counter AAM" and cybersecurity

The regulatory bar seems to be getting higher for cybersecurity. The EU Part IS rules on information security risks with a safety impact apply from February 2026. They describe cybersecurity governance compliance requirements for incident reporting and assurance[128] and, although not directly applicable to the UK, they are likely to be influential. In the UK, the CAA has also published cybersecurity guidance within UK SORA (2025, drones) which is a concrete step towards formalising cybersecurity safety objectives (CAP3098).[129] These EASA and UK steps indicate that cybersecurity regulations will apply to eVTOLs. This suggests a higher compliance cost for eVTOL operators and vertiport developers than may have been anticipated. We find no evidence of thinking specifically on counter-AAM (covered in the Safety and Security Section above), although there is much on counter-drone and the equivalent for commercial aviation.

AI-powered autonomous flight

No definitive novel regulation in this area but we can see evidence that assurance approaches to AI are being considered, for example in UK CAP3064A[130] mentioned above. EASA's AI Roadmap 2.0 similarly frames the need for new guidance and safety cases for AI enabled functions (May 2023).[131]



[128] https://eur-lex.europa.eu/eli/reg_impl/2023/203/oj
[129] https://www.caa.co.uk/publication/download/24904
[130] https://www.caa.co.uk/publication/download/23437
[131] https://www.easa.europa.eu/sites/default/files/dfu/easa_ai_roadmap_2_0_2023.pdf

UTM and ATM (including potential AI impact)

We touch on the overall AI environment in the bullet above and will not get into the weeds of what constitutes autonomy vs AI here. Although there is at least one CAA project explicitly exploring AI for drone airspace management,[132] it is unlikely to be core in the medium term, given the stage the thinking on AI is at. Dropping AI for now and focussing on UTM regulatory progress, we can state that the UK has conducted multiple FFC-funded UTM trials.[133] [134] In 2025, a consortium led by Anra was awarded funding (Airspace Modernisation Support Fund) to demonstrate how multiple drone operators and UTM providers can share airspace safely, in support of the AMS.[135] [136] The Future of Flight BVLOS Roadmap (CAP3182)[137] states that airspace architecture proposals, providing the framework for UK integrated airspace, will be published in 2026. Further details are in the AMS Part 3 Deployment Plan (CAP1711b)[138]. UTM regulations, however, are at an early stage and the Future of Flight Action Plan still has UTM in trial mode in 2026. It may be the case that the first UTMs in the UK will not use AI, even in the operationally deterministic[139] sense, for safety critical systems. The general picture is rather more mixed. If we look at the claims of the major UTM players, AI is in evidence and it is unclear how this has influenced the approval process in other countries, if at all. There is little evidence that DLTs such as blockchain are being widely considered for UTM. There is some evidence that blockchain, for example for ATM slot swapping, is being researched in Europe.[140]

Communication networks (future aviation, general applicability)

If we take a slightly broader view than the AAM Paper and consider this category to be "digital services" which the Future of Flight Action Plan considers a fundamental building block, we can see progress but not in terms of regulations. Examples include NATS OpenAir whose consultation report considers that OpenAir is a direct response to the Action Plan's call for digital services.[141] We cover this in the Technology/ Airspace section above. Other future regulatory considerations such as bandwidth are at consultations stage.[142] If we stretch the definition, we can include BT's successful launch of the BTDroneSim in this area; it has facilitated BVLOS flights since its introduction in 2023.[143] BT are also testing 4G and 5G resilience, funded by the Airspace Modernisation Support Fund.[144]

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132 https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy-support-fund/successful-applicants/ (Advanced Drone Airspace Management – Discovery Phase sponsored by envAero)
133 https://iuk-business-connect.org.uk/projects/future-flight/skyway/
134 https://iuk-business-connect.org.uk/projects/future-flight/agile-integrated-airspace-system-alias/
135 https://www.anratechnologies.com/home/2025/05/21/uk-caa-awards-airspace-modernisation-support-fund-to-advance-shared-airspace-drone-operations-in-lancashire-uk/
136 https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy-support-fund/successful-applicants/
137 https://www.caa.co.uk/publication/download/26211
138 https://www.caa.co.uk/data-and-publications/publications/documents/content/cap1711b/
139 "operationally deterministic" here means that, under the same conditions, the same inputs generate the same outputs
140 https://sesar.eu/projects/SlotMachine
141 https://www.nats.aero/wp-content/uploads/2024/11/NATS10894_OpenAirConsultation_Phase2_Report_10.pdf
142 https://consultations.caa.co.uk/safety-and-airspace-regulation-group/ec-conops/
143 https://newsroom.bt.com/bt-connects-the-skies-with-uks-first-drone-sim/
144 https://www.caa.co.uk/commercial-industry/airspace/airspace-modernisation/airspace-modernisation-strategy-support-fund/successful-applicants/ (4G and 5G Network At-Altitude Surveys sponsored by BT Group plc)

Regulatory adaptations

We note above that the AAM Paper suggested that regulatory adaptations include:

- Design Organisation Authorisation (DOA, required to design aircraft of a given type, with defined design privileges that support certification activity)
- Production Organisation Authorisation (POA, required for producing aircraft of a given type in volume, with controlled manufacture and release)
- Air Operator Certificate (AOC required to operate an airline, refer also to "Operational Authorisation" above, with associated continuing airworthiness and approved maintenance arrangements)
- Various safety, security and environmental (including noise) regulations
- Passenger rights, including compensation for delayed, diverted or cancelled flights

AAM Ecosystem 5As: Aircraft
OEMs will typically need at least three headline approvals to sell aircraft, noting that some organisational approvals may be held by partners. This is broad brush rather than definitive.
Novel
1. Type certificate (see section above)
Adaptation
2. DOA
3. POA
AAM Ecosystem 5As: Ancillary, Airline, Airport
If the eVTOL OEMs also plan to operate as the Airline and run the Airport, they also need these headline approvals
Novel
4. Vertiport approval (see section above, likely to be a site specific package combining aerodrome licensing or certification elements and planning)
Adaptation
5. AOC, with associated airworthiness and maintenance

Regulatory status of selected OEMs

Europe

In the AAM Paper, we stated "EASA have awarded eVTOL certification pioneer Volocopter a DOA under EASA Part21J (2019) and POA under EASA Part 21G (2021) with the balance, including Type Certification, still required." We are not aware of any public confirmation that a type certificate has been granted since.

Vertical Aerospace secured the first UK DOA in 2023, expanded in 2024.[145] It does not have type certification and has moved its target certification date out to 2028[146] (in 2022, they expected to be operating by 2025).[147] This is consistent with the wider "slip to the right" sentiment expressed in other parts of this paper. However, they did achieve a significant milestone in June 2026 when they successfully completed the first piloted flight of their final full-scale prototype.[148]

[145] https://vertical-aerospace.com/wp-content/uploads/2024/07/UK-Civil-Aviation-Authority-expands-scope-of-DOA-for-Vertical-Aerospace-and-agrees-certification-co-operation-with-European-Union-Aviation-Safety-Agency-2.pdf
[146] https://vertical-aerospace.com/wp-content/uploads/2025/09/Vertical-Aerospace-Announces-Manufacturing-Facilities-and-Updates-on-Path-to-Certification-During-Capital-Markets-Day-1-1.pdf
[147] https://vertical-aerospace.com/wp-content/uploads/2023/11/Vertical-announces-further-certification-progress.pdf
[148] https://vertical-aerospace.com/wp-content/uploads/2026/06/20260609-AC3-First-Flight-Press-Release_v2.pdf

China

EHang's EH216 S has now accumulated a sequence of CAAC certifications that look structurally similar to conventional aviation, but applied to a pilotless eVTOL: Type Certificate (Oct 2023)[149], Standard Airworthiness Certificate (Dec 2023)[150] and Production Certificate (Apr 2024)[151]. In 2025, operators of the EH216 S received the first air operator certificates for human carrying pilotless eVTOL operations, including tourism and sightseeing at approved operational sites.[152] This is currently the clearest evidence of routine paying passenger operations, albeit in constrained operating contexts rather than open network transport.

United States

Joby and Archer illustrate the split between "operator certification first" and "aircraft certification still in progress".

Archer's subsidiary received an FAA Part 135 Air Carrier and Operator Certificate in June 2024,[153] allowing commercial operations with conventional aircraft while their eVTOL Midnight remains pre type certification. Archer also received an FAA Part 145 repair station certificate,[154] (2024) which is a conventional maintenance approval rather than an eVTOL specific innovation. In its Q1 2026 results, Archer stated that it had closed Phase 3 of FAA type certification and was progressing to Phase 4.[155]

Joby also has Part 135[156] (2022) and Part 145[157] (2024) and has communicated progress through the FAA's staged type certification process (stage 3 from 5, 2024).[158] In March 2026, Joby stated that their first FAA-conforming aircraft had taken flight and this was a major step in the final stage of FAA type certification.[159] It continues to target first passenger operations on a 2025 to 2026 timeframe, but the point is that the sector remains largely pre passenger eVTOL type certification in the main Western geographies.

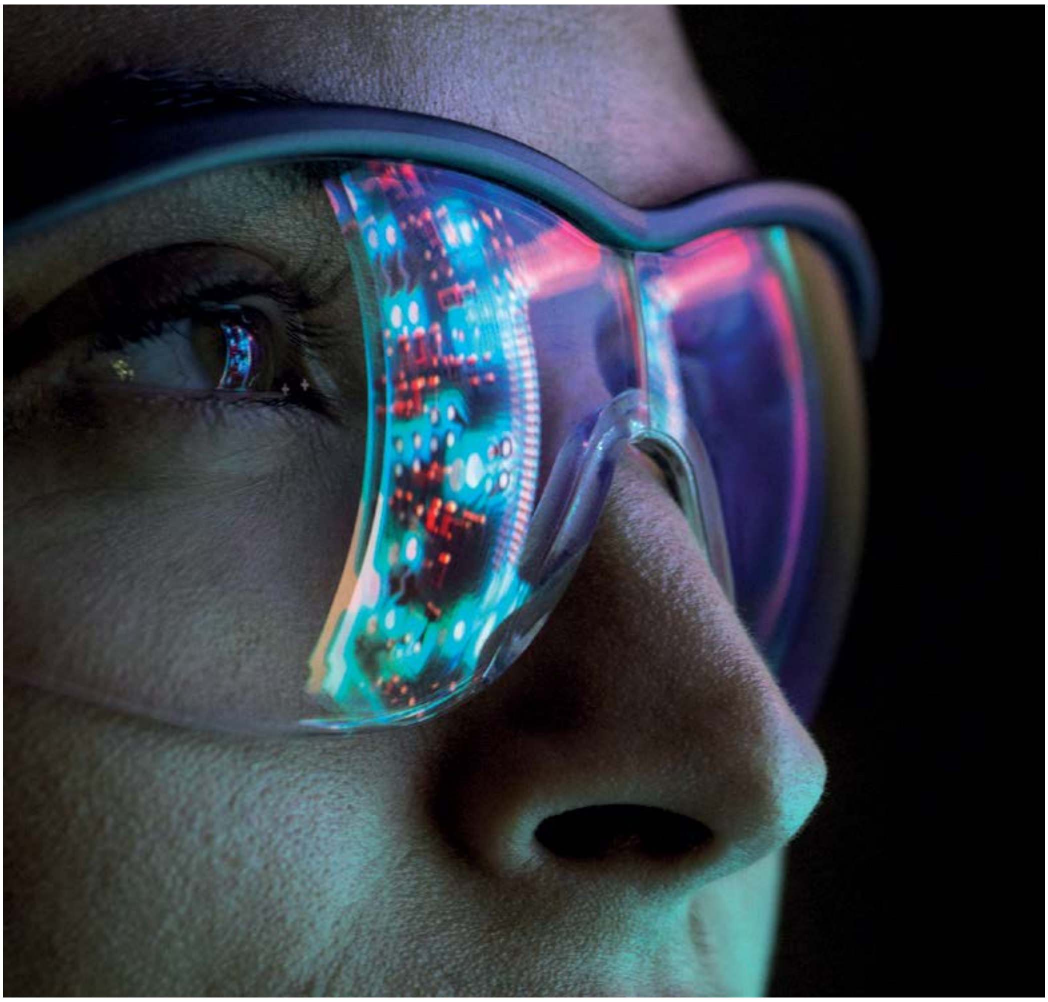
149 https://www.ehang.com/news/990.html
150 https://www.ehang.com/news/1021.html
151 https://www.ehang.com/news/1058.html
152 https://www.ehang.com/news/1196.html
153 https://investors.archer.com/news/news-details/2024/Archer-Receives-FAA-Certification-to-Begin-Operating-Commercial-Airline/default.aspx
154 https://news.archer.com/archer-receives-part-145-certification-from-the-federal-aviation-administration
155 https://investors.archer.com/news/news-details/2026/Archer-Announces-First-Quarter-2026-Results-Highlighting-Record-FAA-Certification-Progress-With-Initial-US-Operations-Expected-In-2026/
156 https://ir.jobyaviation.com/news-events/press-releases/detail/40/joby-receives-part-135-certification-from-the-faa
157 https://www.jobyaviation.com/news/joby-receives-part-145-maintenance-certificate
158 https://www.jobyaviation.com/news/joby-completes-third-stage-faa-certification-process
159 https://www.jobyaviation.com/news/joby-s-first-faa-conforming-aircraft-takes-flight

Skills

A lot has been written about the current and future skills gap in STEM and Aerospace and it was as much of an issue in 2023 as it is now. For example, the 2025 report from the National Engineering Policy Centre,[160] states that expected growth in key industries amounts to 834,000 additional personnel by 2030.

In the AAM Paper, we focussed much of the skills section on the pilot number required in the three main phases of eVTOL evolution, piloted, semi-autonomous and autonomous flight. Were eVTOL volumes to reach higher, critical-mass numbers this may still be an issue. However, with the slow progress, low volumes and conservative attitude to automation in the UK, the pilot issue will play less of a part in eVTOL adoption than we first thought.

There are, of course, many roles other than pilots. Integrating human performance into the system and paving the way to autonomy may be key. Other requirements include training standards for cabin crew (in light of increased levels of autonomy and robotics) and air traffic control (who will need to manage significantly increased traffic volume and prevalence of AI), not to mention engineers, ground site staff and security personnel etc, see Future Aviation Skills Strategy for example.[161] There is also the wider supply chain to consider, refer to the Technology/ Aircraft section above, for example.



[160] https://raeng.org.uk/news/engineers-2030-final-report-launched/
[161] https://assets.publishing.service.gov.uk/media/65379e7c1bf90d000dd844c7/dft-future-skills-strategy.pdf

In the AAM Paper, we noted that the FFC had recognised the skills issue and had opened a challenge for “Future flight: closing the skills gaps.”[162] The challenge has now closed and we understand that outcomes were delivered,[163] but this represents a micro scale. Thirteen short projects were funded. These were mainly training content and outreach, spanning local authority capability building (for example AAM4Gov), university teaching and CPD modules (Nottingham and Cranfield), practical upskilling for electric aircraft maintenance (Skyborne) and tools to improve safety case maturity for routine operations (VR based drone training and BVLOS risk quantification).[164] This is useful groundwork, but perhaps a little early, given where AAM technology currently is; the FFC initiative cannot be considered a national workforce solution for AAM.

More general aviation skills programmes such as the DfT’s Generation Aviation programme[165] and its Future aviation skills strategy work[166] are positioning the wider aviation workforce for digitalisation, automation / future technology and net zero. They include calls to modernise training routes and apprenticeship standards. The DfT programmes appear to address many of the general aviation skills challenges but it seems unlikely that skilled workers will be attracted to eVTOL in large numbers, given that it appears to be a marginal industry.

[162] https://apply-for-innovation-funding.service.gov.uk/competition/1363/overview/623bc6ff-4f6b-4e38-b077-4adb8fed6636#summary
[163] For example, https://aam4gov.com
[164] https://iuk-business-connect.org.uk/news/future-flight-challenge-closing-the-skills-gap-cohort/
[165] https://www.gov.uk/government/groups/generation-aviation-group
[166] https://www.gov.uk/government/publications/future-aviation-skills-strategy-research

Business models

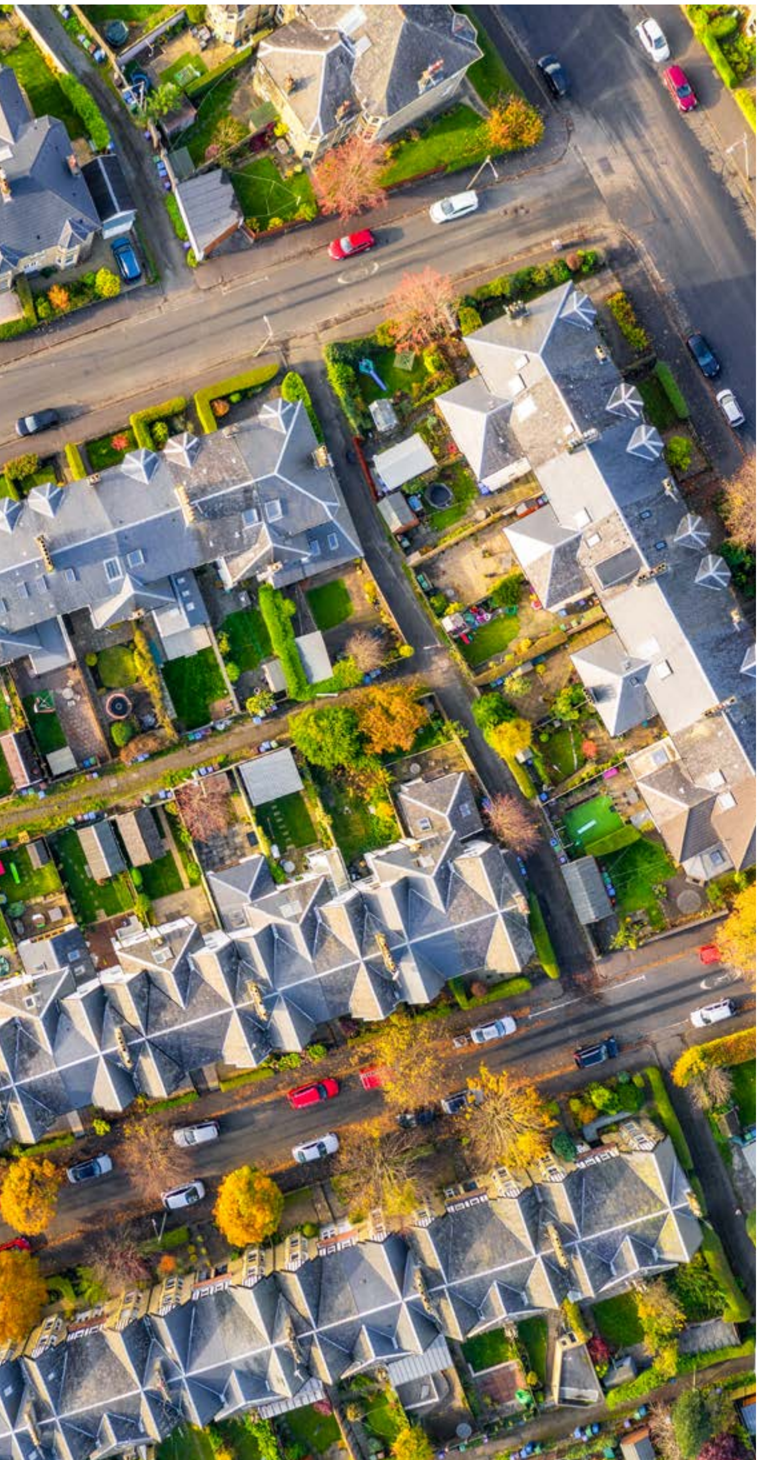
New business models are also required for AAM to flourish. While these will not necessarily be a barrier at the same level as, say, vertiports or pilot numbers, business models will need to evolve to accommodate AAM. These range from the terms and conditions / contractual framework for this new form of travel (including multimodal integration) to insurance and the UTM commercial model. The responsibilities and liabilities borne by the different parties involved will have to be understood and integrated into the ecosystem. Some of these will be regulated, for example passenger compensation and standard level of insurance, others will be driven by market forces.

At the time of writing, we are only aware of one commercial eVTOL operation carrying paying passengers, EHang in China, where CAAC (Civil Aviation Administration of China) air operator certificates currently cover low altitude tourism and urban sightseeing at approved sites.[167] EHang has also been reported as planning a Shenzhen to Hong Kong route from January 2026 with a claimed 20 minute flight and an expected fare of about 800 yuan.[168] There are two points here. First, overall eVTOL volumes remain too low for business models to be deployed and matured. Second, regarding EHang, if we look at published timings and prices, rail is similar in time and roughly ten times cheaper (second class rail fare), so we cannot draw robust business model inferences.[169]

In 2023, the legal framework for autonomous flight was being reviewed by the Law Commission in a project funded by the FFC and ESRC. They were evaluating existing legislation to identify any "blocks, gaps or uncertainties" with a view to law reforms that enable the UK to reap the benefit of advances in automation. The Law Commission completed its three-year review of aviation autonomy and published its final report and recommendations for the DfT and CAA in May 2026. The report sets out recommendations to reform UK aviation law to enable the safe introduction of highly automated and autonomous uncrewed aircraft.[170]

[167] https://www.ainonline.com/aviation-news/futureflight/2025-03-31/ehang-earns-worlds-first-evtol-air-operator-certificate/
[168] https://www.unmannedairspace.info/urban-air-mobility/first-commercial-evtol-route-announced-hong-kong-to-shenzhen/
[169] https://www.highspeed.mtr.com.hk/en/trip-planner.html?id=WEK2FUT&sortBy=SJT (time) https://www.highspeed.mtr.com.hk/en/ticket/fare.html (fares, Futian line)
[170] https://lawcom.gov.uk/publication/aviation-autonomy-final-report/

Modelling approach



This section begins by outlining our approach to modelling individual use cases from the AAM Paper. It then outlines the steps we take to combine this modelling with BT's Origin Destination product to determine whether any existing journeys were likely to be replaced with eVTOLs.

AAM Paper modelling approach:

Defines and models the cost, time, accident risk and environmental impacts of use cases. This involves disaggregating the different journey segments of each of our use cases (eVTOLs) and counterfactuals (traditional transport modes). We then develop a bottom-up model that compares key journey factors to estimate the net impact of substituting from traditional transport modes to eVTOLs.

Modelling approach in this paper:

Takes the socioeconomically viable use cases from the AAM Paper and uses BT Origin Destination data to test whether current journeys are likely to be replaced by eVTOLs. This consists of determining which routes in the BT 2023 Origin Destination data have enough volume (weekly person trips) to support the modelling in the AAM Paper.

AAM Paper – Approach to developing individual use cases

The first step in estimating the impact of eVTOLs is to understand the journeys people will use them for, and the impact that replacing current journeys with the AAM alternative has on those individuals and broader society. We used best practice WebTAG[171] and Green Book[172] guidance to inform our assumptions and analysis alongside information from DfT's National Travel Survey.[173]

Our prior Socioeconomic Study[174] of future aviation technology formed the basis for our modelling of individual use cases: we identify and estimate the key impacts of each use case, capturing private costs and benefits as well as resulting externalities (i.e. the impacts on wider society) as follows:

1. **Define the use cases and counterfactuals** to capture a selection of potential journeys that AAM technology could replace, including the different journey segments required (e.g. travelling to a vertiport). These have been selected to represent a range of different applications and types of journey that illustrate the versatility of AAM technology.
2. **Estimate annual journeys and total journeys completed per vehicle lifetime** based on assumptions around capacity, operating hours and cruising/charging speed. This allows us to estimate the capital and operational costs per journey.
3. **Estimate capital and operational costs** using market research and expert input to develop a bottom-up approach to calculate the total costs. Based upon our capacity and utilisation assumptions, we have calculated the associated cost of operating an eVTOL per journey. As outlined above, we use this with estimated journey numbers to estimate the cost attributed to each journey, i.e. the fare cost.
4. **Identify and quantify associated externalities of journeys**, that is the wider social implications of mode choice beyond the private fare and time costs to individuals. This includes the costs of accidents, CO2 emissions and references to noise pollution.

[171] Transport Analysis Guidance, DfT, November 2022, https://www.gov.uk/guidance/transport-analysis-guidance-tag
[172] The Green Book (2022), HM Treasury, November 2022, https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent/the-green-book-2020
[173] National Travel Survey (2019), DfT, August 2020, https://www.gov.uk/government/statistics/national-travel-survey-2019
[174] UKRI, Future Flight Challenge Socio-economic study, January 2021, https://www.ukri.org/wp-content/uploads/2021/01/UKRI-120121-ISCFFutureFlightChallenge-Socio-economicStudy.pdf

Table 1 summarises the results. Three of the six use cases were socioeconomically attractive in the AAM Paper. Of these, two are passenger cases that we can meaningfully look for in the BT Origin Destination data: rural rideshare and sub-regional shuttle.

Table 1

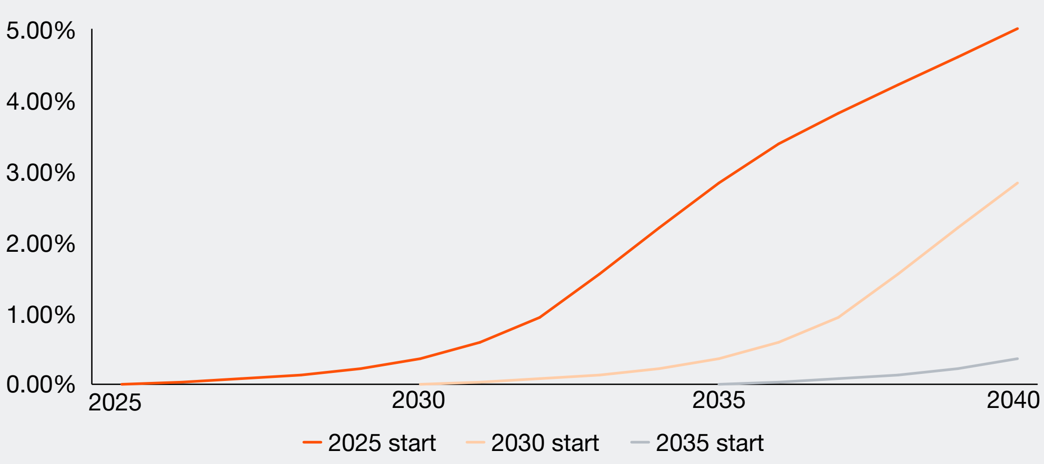
eVTOL Use Case			Counterfactual comparison	eVTOL vs Counterfactual socioeconomic cost delta	Scaled?
Description	**Distance**	**Profile (initial)**			
Urban Private Hire	8km	1 pilot, 1 passenger	Taxi (1 passenger)	+99%	No
Rural Private	28km	1 pilot, 1 passenger	Personal car (1 driver)	+151%	No
Rural Rideshare	60km	1 pilot, 3 passengers	3x individual car journeys	-33%	Yes
Sub-regional Shuttle	85km	1 pilot, 5 passengers	5x individual train journeys	-39%	Yes
Air Ambulance	80km		Helicopter	-38%	Yes
Cargo	75km	350kg	Van	+112%	No

The urban private hire, rural private and cargo cases were not attractive even after accounting for time, carbon and accident benefits.

A central message from the AAM Paper was that viable eVTOL use cases in the UK need relatively high occupancy and longer distances. Short hop journeys under 30 km do not clear the bar on average and only begin to look attractive under very optimistic rideshare occupancy assumptions that are unlikely to hold at scale.

In the scaling phase of the socioeconomic analysis in the AAM Paper, we used the adoption curves in Figure 2, with rideshare adoption peaking at 5% in 2040. We use the highest case adoption from the AAM Paper in this paper to convert the raw weekly person trip volumes per route into adopted person trip volumes, see below. We also carry out sensitivity analysis on a number of different adoption percentages.

Figure 2: AAM S-curves of adoption, capped at 5%



Use case details

This section contains the original eVTOL use case breakdown from the AAM Paper for the two socioeconomically viable use cases we cover in this paper: rideshare and sub-regional. The original batch of use cases were selected to demonstrate the range of journeys eVTOLs could service, and how different factors will influence their relative desirability. The analysis was based on averages, and will therefore not reflect the full spectrum of responses – for example, there will be individuals who are happier to spend more on fares or value time more highly which will not be reflected in central results (and vice versa). In the AAM Paper and the rideshare and sub-regional descriptions below, the counterfactual for the use cases is based on the most directly comparable and common mode of transport that is currently used to make those journeys. In this paper, the counterfactual is the “actual” travel data from BT’s Origin Destination product.

Rural rideshare

We explore the impact of consolidating three individual journeys into a single eVTOL journey. In the counterfactual, three individuals start their own separate journeys from nearby locations (for instance within the same village) and travel to the same destination, where the average journey length is 60 km. The journey distance is reduced for the use case because eVTOLs are assumed to take a more direct route compared to cars. Refer to the visual representation below.

The use case estimates the potential impacts of an eVTOL completing the same journey, however the three individual counterfactual journeys are consolidated into a single eVTOL journey with passengers needing to complete a short trip at each end of their journeys to travel to and from the vertiports. We model the costs associated with:

- Fare price
- Time cost
- Accidents
- CO_2 emissions

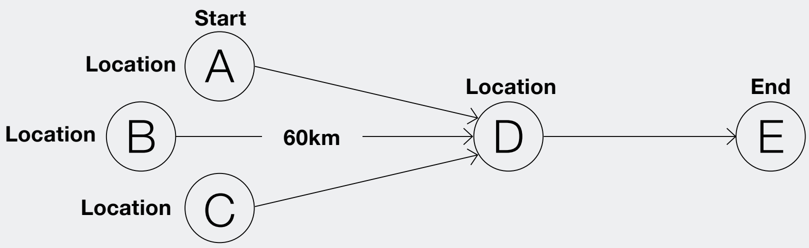
Car

1 Each individual gets into their car

2 Each individual drives from their respective starting point to the same destination, location D

3 Individuals park their car

4 Individuals travel to final destination



eVTOL

1 Each passenger books an eVTOL and walks from their starting point to a nearby vertiport[175]

2 Passengers enter the vertiport and board the waiting eVTOL

3 The eVTOL takes-off and travels from vertiport B to vertiport C

4 Passengers disembark and travel to final destination

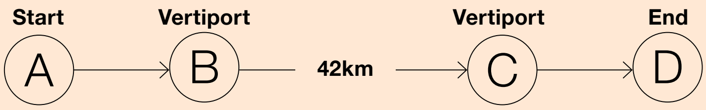
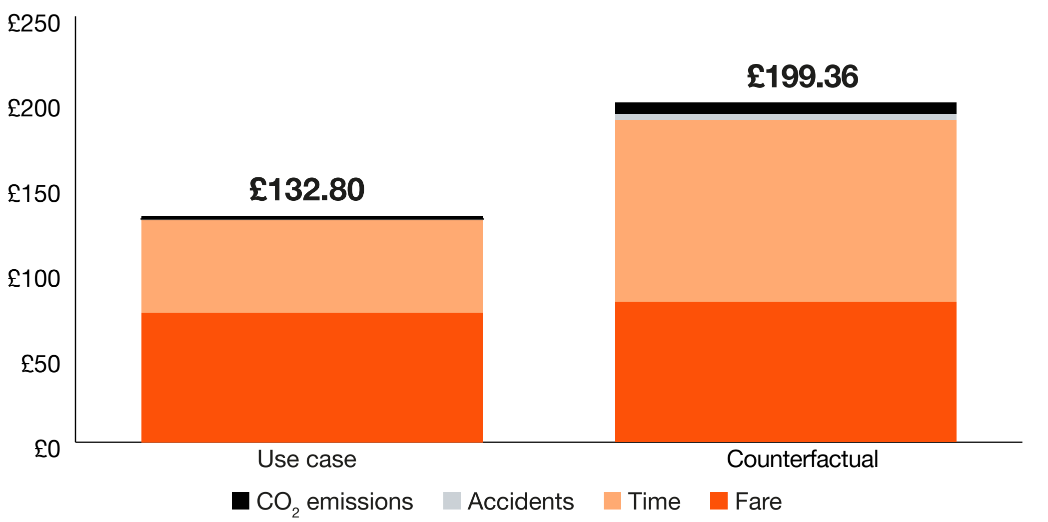


Figure 3: Rural Rideshare use case and counterfactual costs (2025)



[175] Each passenger books their own individual journey, however the eVTOL app coordinates similar rides much like current Uber rideshare technology.

Results

The results in the AAM Paper suggest that the use case will deliver significant savings across all considered timeframes and impacts, with the greatest benefit delivered through fare costs and time savings. We expect the relative benefits to increase over time, primarily due to efficiency gains from a larger eVTOL market, but also because of changes to inputs such as falling CO2 emissions attributed with electricity generation.

In 2025, use case costs were expected to be 34% lower than the counterfactual. The eVTOL fare is 8% lower than the counterfactual because the use case replaces three individual car journeys with a single eVTOL journey, meaning that even though it has a higher cost per km, the reduction in net distance travelled delivers major savings.

Time savings represent the greatest individual benefit area in this use case. Increased travel distance means that the time associated with travelling to a vertiport and boarding an eVTOL is offset by higher eVTOL travel speeds. We estimate that the eVTOLs could provide time savings of approximately 40 minutes per passenger, providing a net time savings of 120 minutes per journey with an equivalent monetary value of £51.71.

The assumed lower accident rate of eVTOL travel, benchmarked against commercial aviation, means that average cost of accidents per journey is very small compared to the counterfactual as with other use cases.

We have estimated that the use case produces about 20.5 kg less CO2 compared to the counterfactual, with a monetary value of £5.33. In this use case, there would be CO2 savings even if just one car journey were replaced with a single eVTOL journey, unlike the urban and rural private hire examples above: the longer journey length means that the net CO2 emissions per km from an eVTOL are lower than the counterfactual, a car journey.

Sub-regional shuttle

In this use case we estimate the impacts associated with a modal shift from rail travel to an eVTOL journey. The counterfactual represents five individuals travelling on the same train journey of 120 km. In the use case, these same passengers switch to a single eVTOL journey which has a lower distance due to more direct air travel. We assume that the AAM journey is shorter, due to a more direct flight path and that a larger eVTOL that is designed for longer journeys with a capacity of 12 is used. For this use case, we model the costs associated with:

- Fare price
- Time cost
- Accidents
- CO2 emissions

Counterfactual: Rail

1. Passengers travel from their respective starting locations to train station B
2. Passengers purchase train ticket (or have booked in advance) and wait for train to arrive then board
3. Train travels from point B to C
4. Passengers disembark train and leave the station
5. Passengers travel to their final destination D

Start A → Train station B — 120km → Train station C → End D

Use case: eVTOL

1. Passengers travel from their respective starting locations to the vertiport
2. Passengers purchase eVTOL ticket (or have booked in advance) and wait for eVTOL to arrive
3. Passengers enter the vertiport and board the waiting eVTOL
4. The eVTOL travels from vertiport B to vertiport C
5. Passengers disembark
6. Passengers travel to final destination D

Start A → Vertiport B — 85km → Vertiport C → End D

Results

The results in the AAM Paper show that the use case is significantly cheaper than the counterfactual, driven primarily by time savings. It is likely that the time savings will decrease slightly over time as rail travel becomes faster through investment such as HS2, although this may be offset by advances in AAM technology.

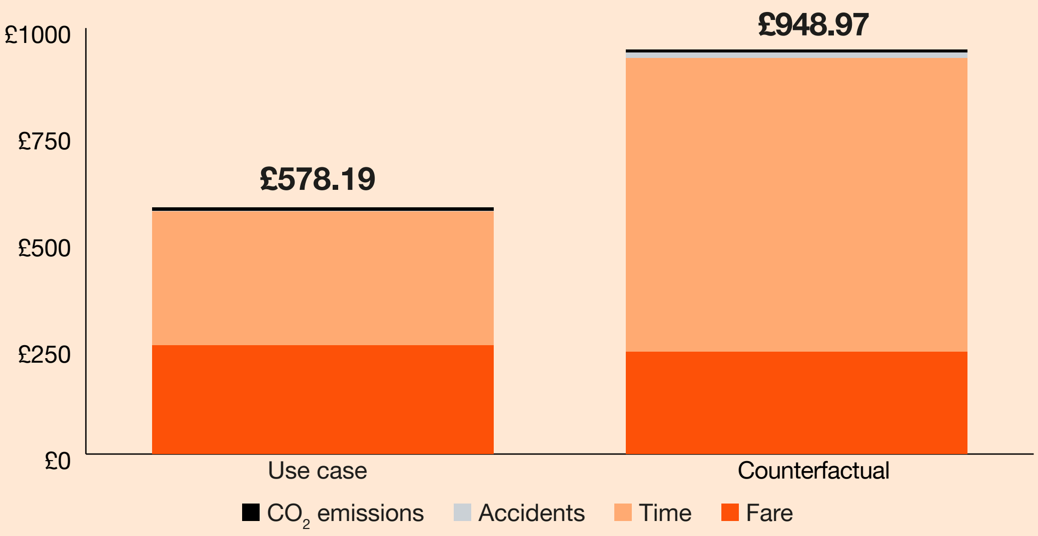
In 2025, use case costs were expected to be 39% lower than the counterfactual. Despite net benefits, the use case fare is estimated to be approximately 6% higher than the counterfactual. The eVTOL fare is modelled using the same bottom up approach as other use cases, which is primarily driven by piloting costs and eVTOL prices. The counterfactual fare cost is based on the price of an anytime day single from York to Preston, at £48.20 per person.[176]

We estimate that the door-to-door eVTOL journey is around 111 minutes quicker than the corresponding rail journey. This has an attributable monetary value of £78.77 per passenger, with a net use case value of £393.85. It is important to note, whilst eVTOLs are quicker than trains, the train also stops at multiple points throughout its journey which significantly slows it down, whereas the eVTOL will only travel between two points of a fixed route.

We have used rail data to estimate the accident cost per km of travel and compared this to the corresponding value for commercial passenger air travel. Using these values gives an average cost of accidents of £0.24 per journey in our use case and £11.82 in the counterfactual, delivering a net benefit of £11.58.

CO2 emissions are estimated to be 12% higher in the use case, equating to 3.1kg more CO2 produced as rail travel is a relatively efficient mode of transport and so more efficient in the short to medium term.

Figure 4: Sub-regional Shuttle use case counterfactual costs (2025)



[176] We recognise that it is possible to buy a cheaper ticket (e.g. using a railcard), however we chose to use this as our base case because we have not attributed any discounts for different types of fare or travel times in our use case.

Testing whether current journeys are likely to be replaced by eVTOLs

We take a substitution-led approach. We ask the question: if the socioeconomically viable eVTOL passenger use cases from the AAM Paper were up and running in 2023, on which routes would a passenger be likely to choose them?

We do not assume that eVTOL creates significant new demand. We treat BT's Origin Destination data as the counterfactual benchmark for current travel behaviour and we treat the AAM Paper's socioeconomic rideshare and sub-regional shuttle use cases as the eVTOL offer.

The pipeline below is the practical translation of that logic into a set of candidate routes. It expands on the summary in the Applying Viable eVTOL Use Case Models to Actual Journeys section above

1. **BT Origin Destination 2023 data clean**
   This dataset is built from anonymised and aggregated EE mobile network events, processed into consecutive dwells and trips, then aggregated into origin destination pairs and calibrated back to the UK population. For each origin-destination ("OD") pair, BT provides data including the origin small area (e.g. LSOA (Lower layer Super Output Area)), destination small area, average daily trip count, average travel distance and average journey duration. We remove rows where origin small area equals destination small area, where movements are effectively within zone and where distances are zero or near zero.
2. **AAM Paper short hop filter**
   A core message from the AAM Paper is that short hop passenger journeys are not socioeconomically attractive on average. We remove routes under 30 km using BT's reported average distance per OD pair. This is an observed average travel distance rather than a straight line calculation.
3. **Conversion of BT Origin Destination from daily to weekly person trips**
   BT Origin Destination contains average daily person trips for each OD pair with origin and destination small areas stated, for example LSOA in England and Wales. We aggregate all rows with the same OD pairs and convert to weekly person trips, using a 6 day week (no Sunday).

4. **Application of minimum weekly volume floors derived from the AAM Paper**
   The AAM Paper viability logic depends on aircraft utilisation and occupancy. We translate that into minimum weekly person trip volumes that a single aircraft would need to carry on a route for the AAM Paper conditions to hold.

Calculations from the AAM Paper

Hours per day

- 18 hour/ day starting operating window
- Weather (16%) and utilisation (15%) discounts give us a 12.9 hours/ day operating period

Hours per week

- Assume operations on 6 days per week, giving 77.1 effective operating hours per week per aircraft

Use case cycle times and occupancy

- Rideshare use case, around 27 minutes per trip gives around 2.2 flights per hour, average occupancy is 3 passengers
  - Floor: 514 person trips per week
- Sub-regional shuttle use case, around 55 minutes per trip gives around 1.1 flights per hour, average occupancy is 5 passengers
  - Floor: 421 person trips per week

We remove OD pairs with person trips per week below this floor.

Note that, per step 2 above, weekly person trips are aligned to the BT Origin Destination day types which include weekdays and Saturday only (no Sunday). The BT Origin Destination six day week gives us 312 days per year. The AAM Paper assumes a higher figure of 358 operational days per year and using this would increase the weekly volume floors by c.15%, resulting in fewer viable routes at 100% adoption.

5. **Addition of coordinates for origins and destinations using population weighted centroids** BT origin and destination small area zones are small statistical areas. To model an eVTOL journey we need a representative coordinate for each zone. We use population weighted centroids from the origin and destination small areas. These centroids act as a proxy for the most likely demand focal point within each zone and give us a consistent basis for calculating straight line eVTOL distance and for approximating access to a vertiport.

6. **Calculation of an eVTOL door to door time and comparison with BT Origin Destination data** For each remaining OD pair we build an end to end eVTOL journey time that can be compared to BT's average journey duration. This follows the model in the AAM Paper, by use case

- Access time from the origin centroid to a notional vertiport
- Fixed ground time for boarding and processing
- Flight time between vertiports
- Fixed ground time for disembarkation
- Egress time from the destination vertiport to the destination centroid

Access and egress are treated as a short last mile walk. We assume an average 0.5 km walk at 4.5 km per hour, which equates to around 6.7 minutes at each end. This is a simplifying assumption and we consider it favourable to eVTOL, reflecting an idealised vertiport location relative to demand.

Flight time is based on straight line distance between origin and destination centroids and the AAM Paper performance assumptions. We use an eVTOL cruise speed of 240 km per hour and add fixed time allowances for take-off and landing. We also apply an uplift to reflect that flight time is not pure cruise in a straight line for the full journey. This retains consistency with the AAM Paper use case modelling.

Ground times are use case specific

- Rideshare assumes 10 minutes boarding and 5 minutes disembarking
- Sub-regional shuttle assumes 20 minutes boarding and 10 minutes disembarking

This produces a modelled eVTOL door to door time for each OD pair that is comparable to the BT Origin Destination data. We then calculate the eVTOL time versus BT Origin Destination data as both minutes and percentage.

7. **Removal of origin destination pairs where eVTOL is not faster, apply guardrails**
   We treat time advantage as the minimum test for substitution, consistent with the AAM Paper which assigns a cost to time saved. We remove any OD pairs where the modelled eVTOL door to door time is slower than the BT Origin Destination average journey time.

We also apply practical guardrails to remove edge cases

- Minimum and maximum eVTOL straight line distance thresholds, to remove very short routes (less than 5 km) where aviation overhead dominates and very long routes outside the credible range of the modelled use cases (180 km, reflecting the net distance the eVTOL can travel)
- A minimum plausible speed check on the current journey. Where BT Origin Destination data implies an extremely low door to door speed, it may indicate that the OD definition is capturing unusual behaviour or a data artefact rather than a representative trip. These rows are excluded before ranking.

8. **Clustering of close destination points into virtual hubs to reflect vertiport catchments**
   Small area origin destination matrices can produce multiple nearby destination zones that are effectively the same destination from a vertiport planning perspective. To reduce this fragmentation, we cluster proximate destination centroids into a single virtual destination hub for each origin.

   The clustering rule is intentionally simple and linked to the access assumption above in point 6. Destinations with the same origin which are within 0.5 km of each other are treated as a single hub, on the basis that they are within the same assumed walk catchment of a vertiport. We then represent that hub with a hub centroid and hub membership list and aggregate weekly trip volumes accordingly.

9. **Application of adoption to translate candidate 2023 journeys into potential eVTOL demand and rank routes** The AAM Paper scales socioeconomically viable use cases using an S curve adoption profile that caps at 5% substitution of relevant journeys by 2040, see figure 2 above. We apply the 2040 peak substitution to the volume of the remaining OD pairs to see if the volume floor per use case (step 4) threshold is met. Adoption is the percentage of 2023 person trips on a route that might switch from road or rail to eVTOL.

When we apply the AAM Paper's peak 2040 substitution assumption of 5%, none of the candidate routes retain enough weekly volume to meet the single aircraft volume floors above. The highest volume route would require a substitution rate of 17% to meet the weekly trip floor. This is a key finding of this paper: there is not enough demand for eVTOLs to "fly" in the UK.

To understand what the best routes would be if adoption barriers were overcome, we also run a deliberately unrealistic 100% substitution sensitivity, along with 25%, 50% and 75%. We use the 100% substitution to identify routes that may be worth further consideration.

Taken together, these steps define our test of whether current journeys are likely to be replaced by eVTOLs. The approach is transparent and intentionally favourable to eVTOL in its infrastructure and operating assumptions, refer to the Optimistic eVTOL Assumptions and Interpretation section above for more discussion on this point. It is designed to answer a limited question. Where could eVTOL have a fighting chance on substitution grounds if the AAM Paper conditions held and if we ignore the practical barriers to vertiport delivery, network operations and consumer uptake that would apply in reality. Of course, we would also have to address the other challenges in the Challenges section above.

BT Origin Destination Data and sampling limits

One of the core assumptions in this paper is that we can use BT's Origin Destination data as a proxy for "actual" journeys in 2023. Note that

- BT's OD pair matrices are based on a very large but still sample-based dataset of mobile devices. They are weighted back to the population and validated against National Travel Survey benchmarks, but some biases remain, for example under-representation of underground trips and minor zonal misallocation in some rural or hilly locations
- The Origin Destination data product only reports OD pairs where the average person trip volume exceeds a disclosure threshold, so there is a long tail of rare journeys that we cannot assess

Appendix 1

Route (Origin-Destination Pairs) summary

BT Data unique OD pairs where O<>D (no distance filter)	5,618,715	
BT Data total average weekly person trips	346,202,609	
Viable unique OD pairs (excluding 15 km/h outliers)	205	<0.01%
Viable total average weekly person trips	**168,616**	**0.05%**

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The analysis set out in this report draws on third-party data sources, including BT's 2023 Origin Destination dataset. This dataset is based on anonymised and aggregated mobile network events and is subject to inherent sampling, geographic and reporting limitations as described in the paper. The findings also rely on the modelling assumptions and socioeconomic viability framework set out in PwC's 2023 UK Advanced Air Mobility report. These assumptions are used here for analytical consistency and should not be interpreted as forecasts or assurances of future outcomes.

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