

VERTIPORTS

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A clean slate

Will vertiports simply replicate the environmental errors made by airports, or will stakeholders capitalise on the chances presented by this fledgling sector?

Tara Craig reports

Aviation gets a bad press when it comes to the environment, and it's not just a case of fuel. Anyone living near an airport will testify to the traffic problems, while a walk through the average terminal prompts all sorts of eco concerns, from the omnipresent concrete to the food waste and seemingly never-ending mounds of packaging generated by retail outlets.

However, vertiports, above all, are new and thus in a position to not only avoid the environmental faux pas of the traditional airport but to take a step further, establishing best practices that will in time find their way back to conventional terminals. Here, a group of vertiport stakeholders explain how.

Material matters

When it comes to building anything sustainably, materials are the first thing to consider. Paul Hermans, aviation business leader at global engineering consultancy Arup, sees the smaller scale of vertiports as an advantage. He told *Airports International*: "Vertiports can lend themselves to the application of novel and/or less conventional materials such as bio-composites, or to the application of recycled building materials in the structure or cladding."

Hermans adds that the location of a vertiport – for instance on the roof of an existing building – may mean that lightweight materials are beneficial not just in terms of their lower carbon impact but their actual weight, too. Aluminium is already frequently used in helidecks, he explained, and is endlessly recyclable, while (hybrid) timber construction is increasingly common in airports. Hermans also noted that vertiports will involve shorter passenger dwell time than is the case with conventional airports, thus requiring less thermal insulation: "Reduced thermal requirements open a wider range of possibilities for using recycled materials, as thermal performance is one of the driving factors for [façade] materials to be replaced in existing building stock."

Chicago-headquartered eVertiSky specialises in developing eco-sustainable infrastructure for eVTOLs – electric vertical take-off and landing aircraft. Chief executive officer Sandra Formenton explained how, led by head of architecture and design Giancarlo Zema, the company uses biomimicry and sustainable materials such as photovoltaic materials and eco-concrete, which can recharge using solar energy. "We also utilise recyclable glass, wood, self-shading windows, energy-efficient

building materials, insulation and efficient HVAC [heating, ventilation and air conditioning] systems. Our approach integrates sustainable energy sources like sunlight, wind and water conservation to create advanced, eco-friendly infrastructure," Formenton added.

Arup's Hermans also recommends the use of 'material passports' during the construction phase, to ensure that all materials – whether base materials or full elements such as façade systems or partition walls – can be recycled or reused at the end of the vertiport's life.

His sentiments are echoed by Darryn Holder, head of planning & partnerships at Urban-Air Port (UAP). He explained how components used in his company's Air-One Coventry – the world's first fully operational Urban-Air Port for drones and eVTOLs – are being used in other UAP infrastructure while other components such as structure have been sold for re-use in other new construction.

Addison Ferrell is director of Skyports Infrastructure, which designs, builds and operates take-off and landing infrastructure for air taxis. He told *Airports International* that his team will always look to recycle materials and concrete, adding that in many instances vertiports won't require deep foundations that call for huge amounts of



Left: Joby Aviation and Skyports Infrastructure are to build a Living Lab passenger terminal where they can test eVTOL passenger technologies and procedures Skyports Infrastructure and Joby Aviation

concrete and steel. “We will also always endeavour to use materials that can be recycled in the future and this is part of the ongoing discussions we have with architects, infrastructure developers and construction companies,” he said.

Joined-up thinking

The scale of vertiports also means they are especially well suited to a modular design and off-site construction methods, leading to less waste, a reduction in construction time and less need to transport unwieldy materials or construction equipment. Skyports, Ferrell confirmed, will use off-site prefabricated and precast elements where appropriate to deliver buildings of high quality within tight timeframes and with minimal waste. “Depending upon local vernacular, we may also utilise modular construction, structurally insulated panels or cross-laminated timber,” he added.

UAP has moved away from conventional construction, Holder explained, to deliver ‘infrastructure as a product’. “Full fabrication [of the vertiport infrastructure] takes place in controlled factory environments, allowing efficient use of sustainably sourced energy, minimising waste and re-cycling off-cuts/excess material,” he said.

Holder added: “Our system is designed as a kit of parts, allowing our infrastructure to be scalable, providing for growth in response to the maturing of the AAM [advanced air mobility] market while providing a cost-effective market entry point.

“As well as being quick to install, it is fully demountable, so can be re-deployed elsewhere, either as a functioning vertiport, or in 30 years’ time the individual standardised components may enjoy another life in a different piece of infrastructure. UAP prioritises direct re-use of building structure and component wherever possible. Standardised structural elements and buildings components are used throughout to maximise future utility. This approach has already been demonstrated with Air-One Coventry.

“Our system requires a very short time on site for installation and we continue to invest in R&D around innovative



Designed by the architecture firm Giancarlo Zema Design Group for eVertiSky, Hamamelis is an innovative solar-powered vertiport eVertiSky



The new vertiport was inspired by the tapered fruit of the Hamamelis, a plant of Chinese origin capable of launching its seeds remotely eVertiSky

installation techniques. Our vertiport design lends itself to self-erection at least in part, with the lifting system that acts as our Vertical Airfield providing an elevated take-off and landing platform. This minimised the need for heavy lifting equipment which makes on-site construction more streamlined.”

Arup’s Hermans also stresses the need to future-proof vertiports. Not only should they be built with intermodal transportation in mind, but thought should be given to how AAM will develop – and the size of the aircraft using the facilities in the years to come.

Charging infrastructure

The most obvious environmental benefit of the AAM sector is of course its fuel, with the bulk of today’s prototypes being eVTOLS. Both electric and battery charging facilities can be expected at

vertiports from the get-go, while some particularly forward-looking developers are also already considering how they might accommodate hydrogen-powered aircraft. For example, eVertiSky, when undertaking feasibility studies for potential vertiports, assesses energy consumption to determine the charging infrastructure needed. “Our facilities include dedicated charging stations equipped with advanced technology and high-power capabilities for fast and efficient charging of electric aircraft,” Formenton told *Airports International*.

UAP has gone one step further, developing on-site generation capabilities and on-site energy storage to balance demand peaks. “We are also developing our infrastructure to help reduce the demands on aircraft batteries,” explained Holder. “Through our infrastructure we remove the requirement for aircraft →



Top: Hamamelis will be operated by Walle Mobility, and will offer the first Italian air-taxi service for the transport of people and goods eVertiSky

Above left: According to Firstco, the typical vertiport will rely on remote control and monitoring of its systems from a centralised operations room that supervises multiple vertiports, as shown here Firstco

Above right: A UAP proposal for Norrköping Airport in Sweden involved utilising a location on the airside/landside boundary to maximise potential for connectivity Urban-Air Port

taxiing and minimise the needs for tugging/ pushback. We move aircraft into position using the infrastructure itself through our lifting system and can then recapture much of that energy through regen [regenerative] drives. It's a marginal gains approach. If we can provide even small reductions, it has the potential to offer huge benefits, whether that be in reducing charging demand or extending route distances." UAP is also looking into solutions that will enable electric vehicle and aircraft batteries to be reused.

Meanwhile, London-based systems engineering specialist Firstco believes

power management needs to be addressed at all levels of the AAM ecosystem, with the input of everyone from eVTOL manufacturers to battery/ charging infrastructure OEMs and vertiport operators. Its Vertiport Management System (VMS) has been designed to facilitate the optimisation of power usage during operations by understanding key factors such as the real-time status of an eVTOL's batteries, the scheduled dwell time between landing and take-off, and the availability of charging infrastructure at each vertiport. The VMS will also gauge the maximum power supply

permitted at a vertiport, and undertake real-time spot pricing for charging where the destination vertiport has greater charging capacity, enabling the infrastructure to work within a network.

Learning from airports

Asked what learnings from airports sustainability initiatives Arup will bring to vertiports, Paul Hermans pointed to carbon reduction, in terms of both construction and operations. He explained how Arup developed an energy management control system for San Francisco International Airport, featuring advanced controls, metres and integrated networking data. It also incorporated high-performance energy efficiency strategies in all new construction, recovering and reusing energy within the terminal complex with a heat recovery chiller plant, generating and storing renewable energy on site with distributed energy resources (solar power and battery storage). “Core elements from these strategies developed for campus sites can be adapted to vertiport developments, which can vastly improve operational performance of buildings,” he added.

It's not just in materials or construction that airports can inform vertiport developers, stressed Formenton of eVertiSky. Inspired by airports' sustainability initiatives, she said: “We consider advancements in reducing light pollution, improving indoor air quality, minimising the use of toxic substances, implementing biophilic design principles, and mitigating heat island effects. By leveraging these learnings, we strengthen the sustainability credentials of our vertiports.”

UAP's Holder expects the current trend for electrification of airport ground operation vehicles and equipment to extend into the vertiports sector. “We anticipate that programmes such as the ACI airport carbon accreditation might expand to include vertiports, and to meet highest environmental quality accreditation, BREEAM/ LEED [Building Research Establishment Environmental Assessment Method/ Leadership in Energy and Environmental Design] or an equivalent will also feature,” he told *Airports International*.

Integration with green transport

Those of an eco-friendly frame of mind may well be horrified at the prospect of yet more air transport. However,



Arup worked with Volocopter to deliver a robust, globally applicable vertiport concept suitable for densely populated urban areas *Volocopter*

vertiports' size and the speed and ease with which they can be built mean they are ideal as components in a broader transportation network. Build a vertiport next to a station, and passengers may have the option of travelling there by train, bus, bicycle or even on foot. Developers predict a transportation future where taking an eVTOL from a vertiport is as easy – and natural – as catching a bus.

For Firstco, it is crucial that vertiport networks are integrated into the existing

feeds to and from multiple sources such as real-time rail timetables or highway congestion data, the VMS can help predict how this will affect the vertiport, enabling operators to react accordingly.

Multimodal integration is at the core of Skyports Infrastructure's vertiport site selection process – the company actively seeks sites next to railway stations and other transport connections, according to director Ferrell. He said: “We will endeavour to provide not just vertiport infrastructure, but also the supporting transit infrastructure that will enable people to make more sustainable choices wherever possible. The infrastructure we're building is designed to serve the industry as it expands, so we must take account of the long-term sustainability trends and objectives of each of the cities and markets we work within.

“Our Dubai vertiport design, which we are developing with the Roads and Transport Authority of Dubai, is a great example of the push for multi-modal integration. Our DXB site integrates directly with the city's metro. Further, it is built upon a multistorey car park, which is equipped for electric vehicle charging and will favour ‘green’ transport methods.”

Urban-Air Port considers full vertiport integration with existing transport hubs essential to the overall AAM proposition. Determining location of vertiports will be key, but the UK firm has also come up with an app intended to encourage responsible travel planning with onward connections – including incentives for ride-sharing. Urban-Air Choice App will enable travellers to plan their journey, book their travel and seamlessly ➔



transportation system, rather than placed alongside them. Typical passenger journeys must be studied and understood to help identify optimal vertiport locations and how they interface with local existing transport infrastructure. Firstco's VMS has been designed to integrate with other transport infrastructure, enabling the vertiport network to become part of a wider multimodal transport system. Using data



Arup provided aviation planning services for the VoloPort vertiports
Volocopter



UAP has developed not only charging infrastructure, but on-site generation capabilities and on-site energy storage
Urban-Air Port



Urban-Air Port founder Ricky Sandhu described the opening of Air-One as “a momentous moment – the starting gun for a new age of transport”
Urban-Air Port

integrate with other forms of transport. “For example, someone could rent an e-scooter, travel to an Urban-Air Port, take an air taxi across a city, order a coffee en route and have it waiting at an Urban-Air Café at their destination, all controlled from the palm of their hand,” Holder explained.

Where eVertiSky is concerned, the focus is on “local intramodal and multimodal linkages [that] enhance accessibility and promote a genuinely eco-friendly means of transportation”, according to Sandra Formenton. She added that this approach minimises the need for long, carbon-intensive ground journeys and contributes to the overall sustainability of the transportation network. “Vertiports play a central role in various activities,

including passenger transport and cargo delivery. Passengers travelling by rail can conveniently connect to vertiport flights for shorter regional trips, while local businesses can utilise vertiports for last-mile delivery, such as transporting pizzas or delivering utility equipment to field personnel.

“Through our UAM Feasibility Study, we identify potential vertiport locations and routes that align with these modalities, promoting seamless connectivity and easy transfers between different modes of sustainable transportation. By integrating with existing ‘green’ transportation elements, we create a cohesive transit scheme that aligns with the transportation needs of tomorrow,” she said.

Skyports Infrastructure’s Addison Ferrell is convinced vertiports are the key to multimodal transport. “We believe that vertiports can act as urban mobility hubs in a way that airports do not,” he told *Airports International*.

Focus on footprints

Any new construction has the potential to cause concern among environmentalists, city planners and residents, but as Arup’s Paul Hermans pointed out, vertiports’ smaller scale lends itself to their integration into existing facilities.

Smaller vertiports can be developed on building rooftops, with the smallest accommodated on high-rise buildings, and larger vertiports fitting onto, for example, car parking garages – as long



Foster + Partners' provisional concept design for a Skyports Infrastructure vertiport terminal next to Dubai International Airport
Skyports Infrastructure



Arup's modular, scalable and demountable vertiport design concept uses prefabricated materials and can be installed on sites as small as 625m²
Volocopter

as there is sufficient structural capacity in the building's original design. "We supported Volocopter in developing a highly compact concept that could fit on top of high-rise buildings which generally have a smaller footprint," he said, adding that unallocated land on existing general aviation airfields provides further opportunities for larger vertiports.

eVertiSky aims to minimise the environmental impact of vertiport construction by integrating into urban environments, repurposing existing structures or working with underutilised facilities. "By avoiding the need to build on greenbelt land, we preserve natural areas and reduce carbon-intensive ground journeys

typically associated with travelling to and from airports," CEO Formenton said.

UAP's very first vertiport concept, dating back to 2017, focused on repurposing existing infrastructure assets – for example, rooftops of existing buildings or utilising a location on the airside/landside boundary to maximise potential for connectivity. Urban-Air Port has also proposed that Washington Metropolitan Airport Authority utilises hardstanding areas – both landside and airside for locations at Dulles International and Ronald Reagan Washington National Airport – including tops of terminal buildings, multistorey car parks and ground car parking areas, which will see reduced demand for parking following the introduction of Metro rail connections.

Green technology

Vertiports are all about speed and ease for passengers – not only getting them quickly from point A to point B, but ensuring they are not left twiddling their thumbs before their flight, or stuck in a security queue. This is where technology comes in.

According to Sandra Formenton, eVertiSky vertiports will feature a standardised range of app-enabled services, thus reducing the need for paper tickets or boarding passes.

Skyports too is harnessing biometrics, with ticketless passenger verification and validation. Passengers will be expected ➔



**We will always
endeavour to use
materials that can be
recycled in the future**

*Addison Ferrell, Skyports
Infrastructure*





The VoloPort interior design practices circular economy, with products made from recycled ocean plastic and leather made from mango peel *Volocopter*

to use their mobile devices for access to vertiports, the company reported. “Skyports will also leverage video and sensor data insights to streamline vertiport operations by monitoring and tracking KPIs, thus enabling real-time data-led feedback rather than a paper-based monitoring system,” Addison Ferrell added.

The use of apps by no means signals an end to conventional terminal equipment – but vertiports developers are looking at making the latter more environmentally friendly. Arup’s Paul Hermans explained: “Equipment such as screens, kiosks, lighting etc can be designed to automatically power down when the vertiport is not in use. This can be done according to movement of people in the building and can be planned to match the flight schedule. Low power devices can be used to drive the screens, for instance a Raspberry Pi rather than a PC.”

Looking forward

However green their tech may be, there is one key element of vertiport uptake that requires attention from stakeholders – people. As Hermans concluded: “To be genuinely sustainable and make the most of this new form of urban transportation, vertiport developments should consider societal acceptance from the outset, bring

wider social benefit and address equity, accessibility, noise and visual clutter.”

For those outside the aviation sector, vertiports are at such an early stage of development that it’s only natural the focus is on the aircraft. They’re sleek, futuristic and would not look out of place in the cartoons many of us grew up watching. But design fans and environmentalists should find much to encourage them in the work going into vertiport structures. The corporate

world – not least anything aviation-related – is often accused of ‘greenwashing’, paying lip service to the environment through cleverly packaged initiatives with little real benefit. But in the case of vertiports, it is evident sustainability has been a key requirement from the outset, and what is especially pleasing is the seemingly never-ending stream of clever ideas and technology being harnessed for the greater good, both of our planet and would-be eVTOL passengers. **AI**



Designed by Giancarlo Zema, the headquarters of the Levi-Montalcini Foundation is dedicated to study of the work of Nobel Prize winner Rita Levi-Montalcini. Its roof will be home to a small vertiport *eVertiSky*