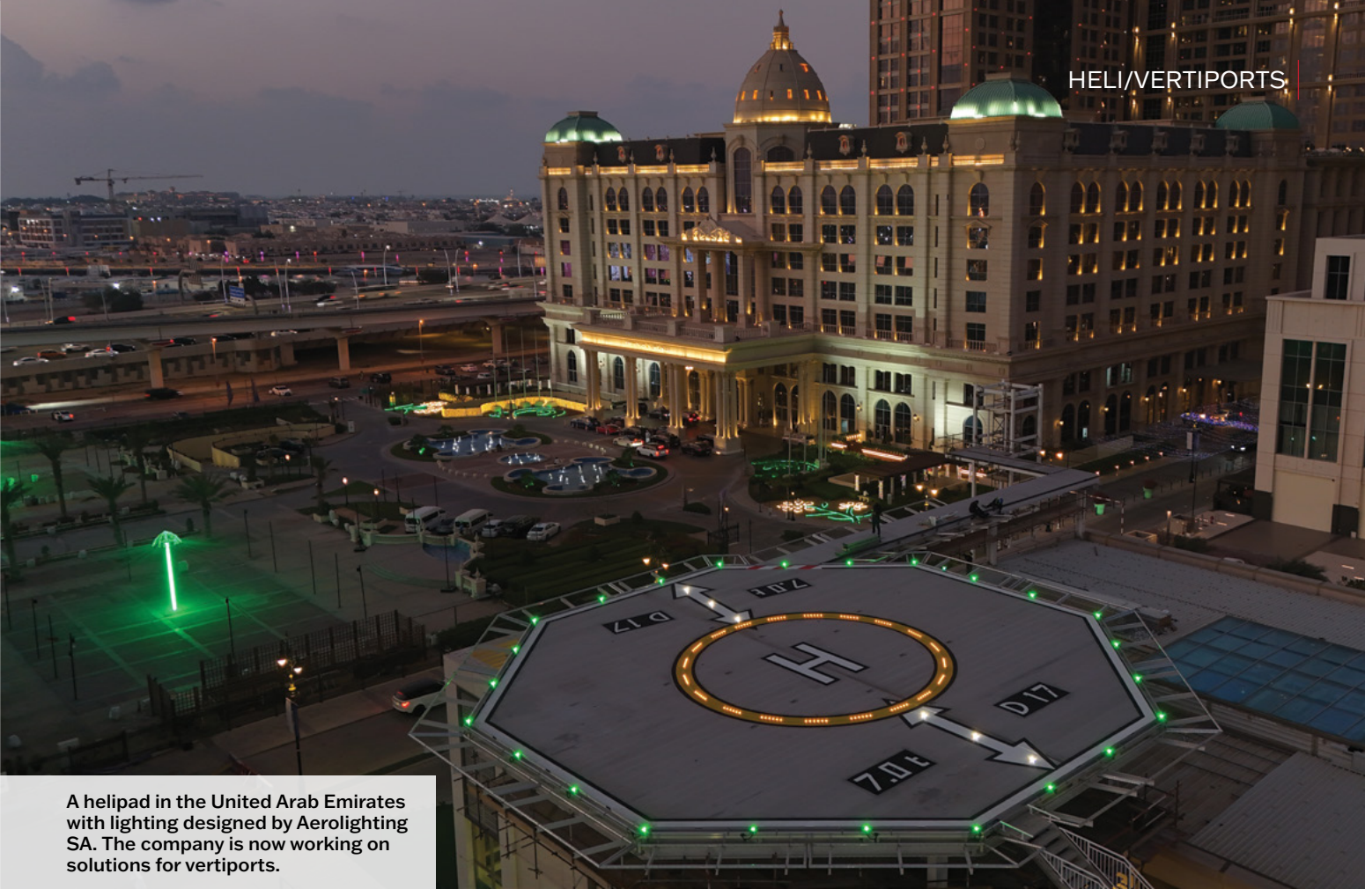

A helipad in the United Arab Emirates with lighting designed by Aerolighting SA. The company is now working on solutions for vertiports.

Wheels within wheels

Heliports are crucial infrastructure for the helicopter industry, while vertiports are a growing focus for the nascent advanced air mobility (AAM) sector. How has the development process advanced over the years for both types of facility, and how could things progress in the coming years? Gerrard Cowan polls the experts.

Even with the advantages of VTOL, heliports remain crucial infrastructure, while vertiports are a growing focus for the burgeoning AAM sector. How has the development process advanced over the years for both types of facility, and how might things progress in the coming years?

Rex J Alexander is President and Executive Director of consultancy Five-Alpha LLC and Infrastructure Advisor to the Vertical Flight Society (VFS).

He has worked on heliport and vertiport infrastructure in a variety of roles for over 30 years, including serving as Head of Aviation Infrastructure at Uber Technologies and as a co-founder of HeliExperts International LLC, which specialises in heliport development and related services.

There are a range of initial questions for potential clients, Alexander says, some of which are more obvious than others.

First, it is important to define the purpose of the heliport, and the activities it is expected to support – whether tours, corporate operations, hospital patient support, defence operations, personal/private operations, public transportation, etc.

Second, it is vital to determine the largest and heaviest helicopter that the heliport will be expected to support in the next 20 to 30 years.

"Many people design their heliport to the helicopter they are currently operating, which is a mistake," Alexander says. "You have to consider the potential of upgrading to a new aircraft in the future or your facility may be obsolete when that occurs."

Next, they must consider where they

want to put the heliport and whether it will be at ground level or on a rooftop because, as Alexander notes, there is a "big difference in price and complexity".

After this, they should consider whether they envision one or more landing sites and whether they want any parking positions. Additionally, they should consider if they want to add any amenities, such as a hangar, or a fuel system.

It is important to consider the municipality that has oversight of the land where they expect to site the heliport.

Alexander says the client's relationship with the planning and zoning division, as well as the local community, will be important.

He also makes a point of asking: "Do they know of anyone who they expect might come out in opposition to a heliport at their site?"

Planning considerations

Alexander carries out a range of research prior to making a site visit, considering aspects such as the type of airspace the site is located in or under; any other infrastructure nearby, such as other heliports or airports and the type of airspace they have, VFR or IFR; and the regulations the state (in the US) has regarding heliports, as well as the local municipality.

He also reaches out to the relevant aviation authority that has oversight of the area – in the US, the FAA regional Airports District Office or ADO, and the local Flight Standards District Office or FSDO. The preparation phase will also consider the local historical prevailing winds for the area.

> *"You have to consider the potential of upgrading to a new aircraft in the future or your facility may be obsolete when that occurs."*
>
> Rex J Alexander, President and Executive Director, Five-Alpha LLC

The process then moves on to an on-site visit, which validates the information collected during the preparation phase and accounts for obstructions such as buildings, power lines, antennas and light poles.

Alexander uses this time to validate the necessary ground space and airspace to support the identified design helicopter and operations.

He says: "This is also a good opportunity to interview the proponent's administrative staff to get an idea of what they envision for their master plan for the site over the next 30-plus years to ensure viability and longevity of whatever we plan to build. While on site, I will also try to set up a meeting with the local fire marshal to get a feel for any concerns they may have that we will need to address."

There are a wide range of factors to analyse, Alexander notes. He says he is "adamant about having two approach departure paths for any heliport or vertiport for safety purposes", even though this isn't a regulatory requirement.

Urban environments can present unique challenges due to the turbulence generated by the surrounding architecture.

"For this reason," Alexander says, "we often conduct wind tunnel testing and/or CFD [computation fluid dynamics] analysis for sites. We investigate downstream turbulence generated by the wind from all 360 degrees of the site as it is acted upon by both the terrain and any current or future surrounding architecture."

Noise is a consideration regardless of the location, so "we go out of our way to ensure that the approach and departure paths into and out of a heliport or vertiport do not overfly residential areas to the extent feasible".

Alexander also points to the impact from downwash and outwash, which is a particular concern for ground-based heliports.

"I have personally witnessed downwash from helicopters weighing in the neighbourhood of 5,000 to 7,000 pounds knock people over, lift full sheets of plywood 20 to 30 feet into the air, break off the doors of nearby aircraft, and send dozens of shopping carts across parking lots at a high rate of speed."

For Alexander, this equates to an untenable degree of hidden liability for owners and operators.

Skyports Infrastructure has worked on both vertiports and heliports. Image: Skyports

Predictable and preventable

Raymond A Syms is a co-founder of HeliExperts International and has

worked in heliport developments for more than 45 years, as well as working as a pilot for military, general and commercial aviation.

He echoes Alexander's emphasis on the need for preparation work, adding that it is vital "to be as conscious as possible of the community and regulatory approval from the beginning, before you even report to the client on the options they have".

It's also important to look more broadly at an area's history with helicopters – whether they have had a bad experience, for instance – and consider how this may impact the process.

Pointing to advancements in the heliport design process, Syms says HeliExperts International today produces a LIDAR model of the entire available site that can be used to design a virtual layout and which can easily be updated in response to evolving needs.

He notes that the vast majority of heliport accidents "were both predictable and preventable, related to design and operational deficiencies".

Five-phase plan

BATT Suisse works on heliport and vertiport design through two main pillars: consulting and design work and developing technical systems like navigation aids and lighting.

The company works with a range of partners in bidding for heliport and vertiport development work.

Björn Abel, BATT Suisse's Managing Partner, says the design project is driven by three main factors: safety and compliance; financial and operational efficiency; and sustainability and environmental impact.

He emphasises the importance of securing early involvement from the local aviation authority, any affected stakeholders and, if necessary, the local air navigation service provider (ANSP).

The company then works through a five-phase plan.

Phase one is the customer requirements analysis, considering costs, expected land use, etc. Phase two focuses more on the details of legal compliance.

In the third phase, the focus is on the tendering approach, where "we support the client preparing the tender" in different areas of work.

In phase four, BATT Suisse supports the party in detailing its proposals and winning approval, before finally moving on to the execution in phase five.

"The build project is usually finalised once the authorisation process has been successfully completed, and the necessary documents are issued," Abel says. "If the client or the operator in charge demands, we provide after-sales service, recurring inspections and audits."

Suitable sites

Damian Kysely is Head of Infrastructure, EMEA at Skyports Infrastructure, which has worked on both vertiports and heliports and has a particular focus on developing the infrastructure needed for advanced air mobility (AAM) and eVTOLs.

"I would say nine out of 10 sites that we look at are not suitable," he says. "We really have to go through a lot of sites to get one that comes out as suitable, where we can design the facility with the required capacity that we want and close to the demand that we're targeting."

He adds that such sites must have permits from authorities and be "economically feasible, so that the construction costs are not astronomically high, which allows us to sustain the business model for the industry".

Kysely says there has been a lot of progress on the regulatory side in defining the regulations and specifications needed for vertiports.

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> Damian Kysely, Head of Infrastructure, EMEA, Skyports Infrastructure

Much of this has been borrowed from heliports because there are some similarities involved.

"There are some significant differences," he notes. "Whether it's because of the propulsion, or the flight profile performance, or the firefighting requirements. But at the end of the day, they need a certain amount of space to land. They need the airspace to be designed and protected in such a way that allows them to fly in and out safely and efficiently. They need firefighting provisions, albeit specific to the type of the aircraft, and they need a terminal which processes passengers. So the elements are very similar."

Alexander says the biggest initial difference between vertiports and heliports relates to fire safety standards for vertiports, which will require the inclusion of high voltage electrical power and charging systems.

He notes that for the AAM business models to work, vertiports will require the integration of charging systems, electrical protection and safety for high voltage, lithium-ion battery storage, lithium-ion battery fire suppression, and electric storage system (ESS) integration.

"I believe at the end of the day the geometry of both the heliport and vertiport are going to be closely aligned, with the potential for a few differences. Those differences will primarily be driven by aircraft capabilities and performance."

Key infrastructure

From an infrastructure perspective, an eVTOL should be able to land at any vertiport, airport or heliport, says Tony LaCorte, Director of External Affairs and Communications at Textron eAviation, developer of the Nexus eVTOL.

He notes that the latter's 50-foot wingspan takes existing heliport design criteria and rotorcraft performance into account.

"One key consideration is that eVTOLs will require ground infrastructure to include multimodal charging capability. Commonality of this charging infrastructure is something Textron eAviation is continuing to monitor – and will take engagement and consensus from regulatory agencies, local power companies and industry to create economically viable solutions."

For a heliport or vertiport to effectively support eVTOL operations, other key infrastructure and service components must be in place, such as on-site maintenance and aircraft sustainment capabilities, replacement battery storage systems, and data and communications infrastructure to support flight management and aircraft sustainment.

LaCorte says that planning for and improving infrastructure is one of the main priorities for the industry at present.

"Airspace infrastructure needs to develop further in order to make more efficient use of our airspace. Reshaping the US National Airspace System (NAS) to include evolving the infrastructure that would accommodate new entrants such as eVTOLs could have a significant impact on reducing fuel usage and overall carbon footprint."

Terry Miyauchi, Key Segment Specialist, HEMS at Bell Helicopters,

Lighting built to last

Julien Borcard, Managing Director of Aerolighting SA, says his company has long focused on heliports, though we are still at the early days of developing lighting solutions for vertiports.

In particular, vertiport infrastructure will grow as a focus for future development on both the technical and regulatory sides.

Borcard says his company has several key priorities when it develops lighting installations at heliports and vertiports.

First, it is vital to manufacture high-quality lighting systems that are designed to last.

While this may seem obvious, Borcard notes that for heliports and vertiports maintenance operations are rare and mostly reactive.

He says: "The lights must not only comply with standards and be waterproof during their certification and installation, but must also remain so for over 15 years with almost no maintenance."

Secondly, Borcard points out that the pilot's human eye does not respond in the same way as a UAV's optical sensor.

It is therefore necessary to have the two technologies working together. This must be done without one technology causing inconvenience to the other.

Thirdly, Borcard acknowledges the growing co-existence of helicopters and UAVs.

This has seen Aerolighting develop a system known as HeliTracker that in turn enables the heliport lighting system to automatically activate upon the approach of an aircraft, without pilot intervention.

Borcard says: "As part of a research project, we also integrated a similar system used by some UAVs, called FLARM, into our system. The idea is to visually inform the pilot during the final approach phase of the presence of another type of aircraft in the area."

notes that the bulk of the world's vertical lift aircraft land off site, without the benefit of an improved heliport/vertiport.

However, the advancement of today's air mobility efforts have created new challenges in urban settings – and the obvious solution according to Miyauchi is developing "up".

There are many baseline factors to ensure the landing area is free of hazards and has obstacle-free approach and departure paths, while noise and downwash impact are also critical factors.

Miyauchi says: "While elevating the heliports/vertiports from ground level to rooftop minimises or alleviates many of these factors, maximum aircraft weights then need to be factored in.

"For example, how heavy an aircraft can the rooftop system accommodate? How many aircraft can the size accommodate?

"Other factors include power grid support and the vertiport/heliport's impact to the building. This alone might require a redesign or rework of building systems."

Developed by Textron eAviation, the Nexus eVTOL's 50-foot wingspan takes account of existing heliport design criteria and rotorcraft performance. Image: Textron eAviation

Location specific

There are a wide range of specific technical considerations that are relevant to heliports and vertiports, depending on their location.

For example, Mike Wilson, founder of Wilson Consultants, points to potential challenges around density altitude, typically defined as pressure altitude corrected for nonstandard temperature.

This can impact helicopters, Wilson notes, because the engine develops less horsepower or thrust, depending on engine type.

"The rotors produce less lift because the air is thinner," he says.

In cases of high-density altitude, helicopters may need to reduce weight – carrying fewer passengers, fuel or luggage while remaining within the parameters of the helicopter.

Wilson Consultants produces Density Altitude Displays (DADs) to inform pilots and ground crew of the local density altitude.

While the company has so far focused on the airport space, Wilson says he sees strong potential in the heliport and vertiport market in the future.

Vaisala provides weather sensing and data solutions to traditional heliport operations, and has participated in numerous research and demonstration projects for vertiports in Europe and North America over the past five years.

Fernando Trolia Slamic, the company's Director – Strategy and Business Development for Weather and Environment, says it is critical to understand the impact of predominant seasonal microclimates, the topography of the terrain and the patterns of human activities.

"Parameters such as wind gusts and vortices, seasonal risks of icing, and precipitation patterns and types are among the most impactful aspects to consider from a site characterisation perspective, as well as in real time during operations."

Looking ahead, Slamic says Vaisala foresees a blurring between heliport and vertiport typologies across urban areas in the coming years.

He says the company expects to see existing heliport sites being repurposed for drones and eVTOLS, particularly those dedicated to emergency and health care services.

Subsequently, more diverse types of vertiports will likely come into play, with smaller and more modular footprints – for parcel delivery, for example.

"Technological developments in digital design and construction, as well as increasing demand for vertiports, are likely to drive the evolution of heliport and vertiport development," says Slamic.

"Innovations in weather intelligence and AAM technologies will also significantly shape future developments as the industry matures." ■

"One key consideration is that eVTOLs will require ground infrastructure to include multimodal charging capability. Commonality of this charging infrastructure is something Textron eAviation is continuing to monitor."

Tony LaCorte, Director of External Affairs and Communications, Textron eAviation