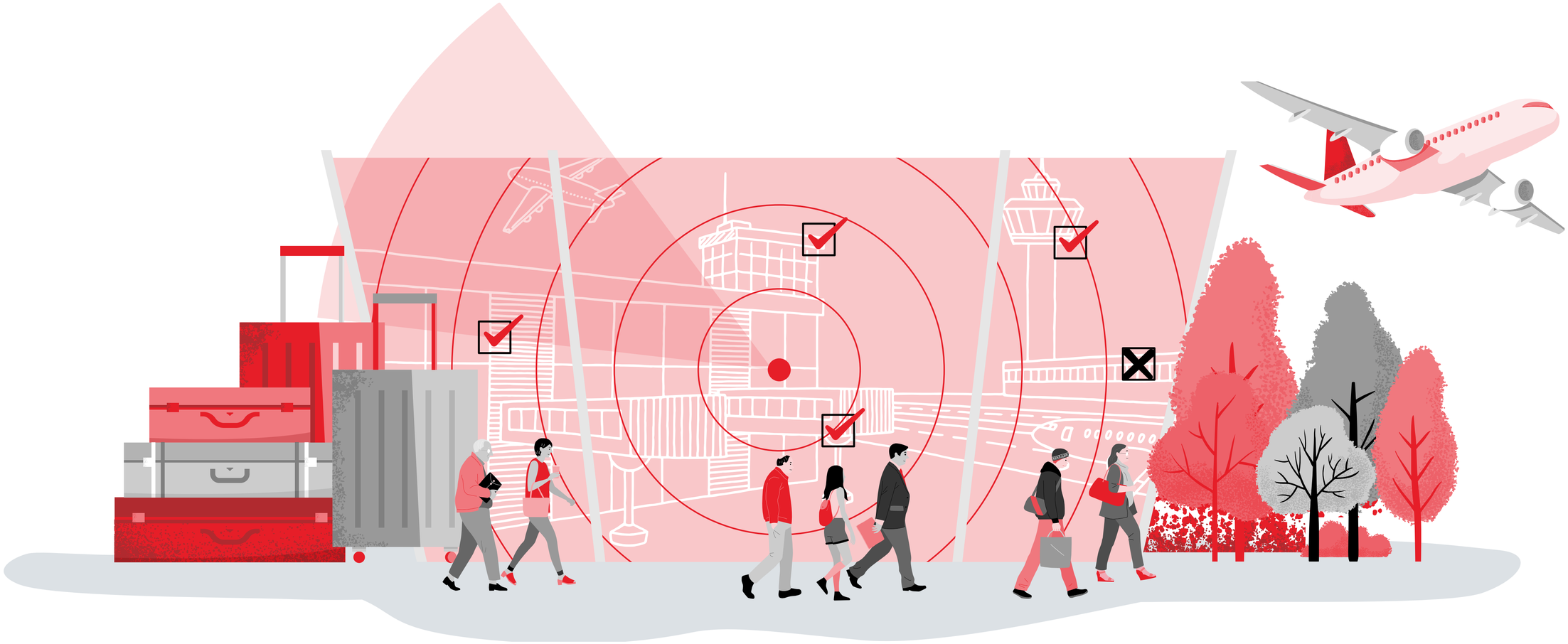
ARUP

Aviation

Global experts, local solutions



ARUP

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Our aviation business

Aviation businesses must balance demand and global growth with the need to decarbonise, become more energy and operationally efficient and address climate change. Arup helps clients across the industry to understand how to make their operations and services more sustainable, efficient and resilient, designing for lower energy use and operating costs at the same time. We are working with our aviation clients to help them rethink their business models and operations to maximise social value, ensure supply chains are resilient, develop circular business models, reduce emissions, generate electricity, harvest water and eliminate waste.

Arup is the creative force behind many of the world's most innovative and sustainable building, transport and civil engineering projects and design technologies. We offer a broad range of professional services that combine to make a real difference to our clients and the communities in which we work.

We have advised the majority of the world's leading airports and are recognised globally as a leader in airport masterplanning, delivering airport terminal and support facility designs and specialist aviation services.

We support operators, owners, investors and users to develop safe, secure and sustainable solutions that deliver customer service excellence on a sound commercial basis. We add value to our clients' business through close stakeholder collaboration and draw on in-depth knowledge to deliver robust, resilient and efficient solutions.

Arup has been involved in aviation development for over 70 years, with experience gained through a wide range of assignments at more than 100 airports worldwide. Dedicated to sustainable development, the firm is a collective of 16,000 planners, designers, engineers and business advisors working across 140 countries. Founded to be both humane and excellent, we collaborate with our clients and partners using imagination, technology and rigour to shape a better world. Through strong internal networks we benchmark and share the learning from our global aviation and other sector experience to deliver better solutions for our clients by balancing the needs of people, processes, technology and environment.

Jenny Buckley
Global Aviation Business Leader
e: aviation@arup.com

Arup in aviation

We have been involved in aviation development for more than 70 years, with experience gained through a wide range of assignments at more than 100 airports worldwide. We have advised the majority of the world's leading airports and are recognized globally as a leader in airport masterplanning, delivering airport terminal and support facility designs, and specialist aviation services.

We support funders, owners, operators and users to develop safe, secure, resilient and sustainable solutions that deliver customer service excellence on a sound commercial basis. We add value to our clients' business through close collaboration with the client team and stakeholders, and drawing on in-depth knowledge to deliver robust, resilient and efficient solutions.

Assignments in airports worldwide

Our international presence enables us to apply our global expertise to meet the particular local requirements of projects.

* UK: ABZ, BHX, BRS, CBG, CWL, MME, EMA, EDI, LGW, GLA, LHR, LPL, LGY, MAN, NCL, NQY, NWI, PZH, SEN, STN

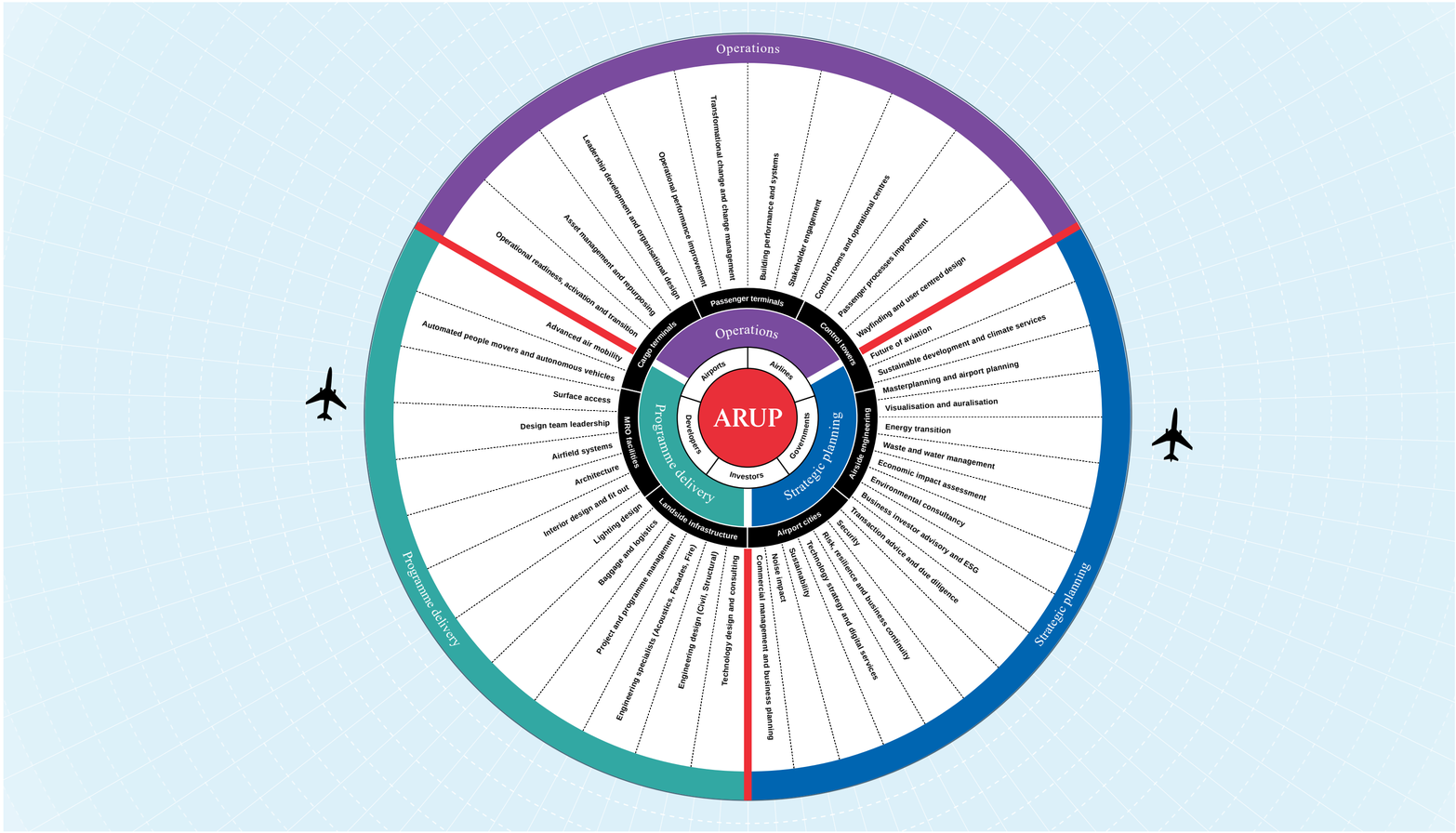
** Ireland: ORK, DUB, SNN

Aviation services

We have the breadth of skills covering the whole lifecycle of aviation projects that can respond to the challenges of the aviation industry: strategic and commercial planning, technical design and project delivery; operational and implementation management skills. Our international presence enables us to apply our global expertise to meet the particular local requirements of projects of any scale ranging from many of the world's largest international hubs to award winning smaller regional airports.

At Arup, airport planners, designers and business consultants work in conjunction with our experts in other disciplines including fire safety, vibrations and acoustics, baggage, security, energy, waste, geotechnics, tunnels, environmental engineering, economic planning, contracting and project management, and transport planning.

Our projects cover airport strategic and masterplanning, traffic demand analysis and the programming, planning and design of passenger terminals; cargo terminals; airside infrastructure; landside infrastructure; control towers and control rooms; maintenance repair and overhaul facilities; utilities; airport cities and urban development.



How we can help

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A better future

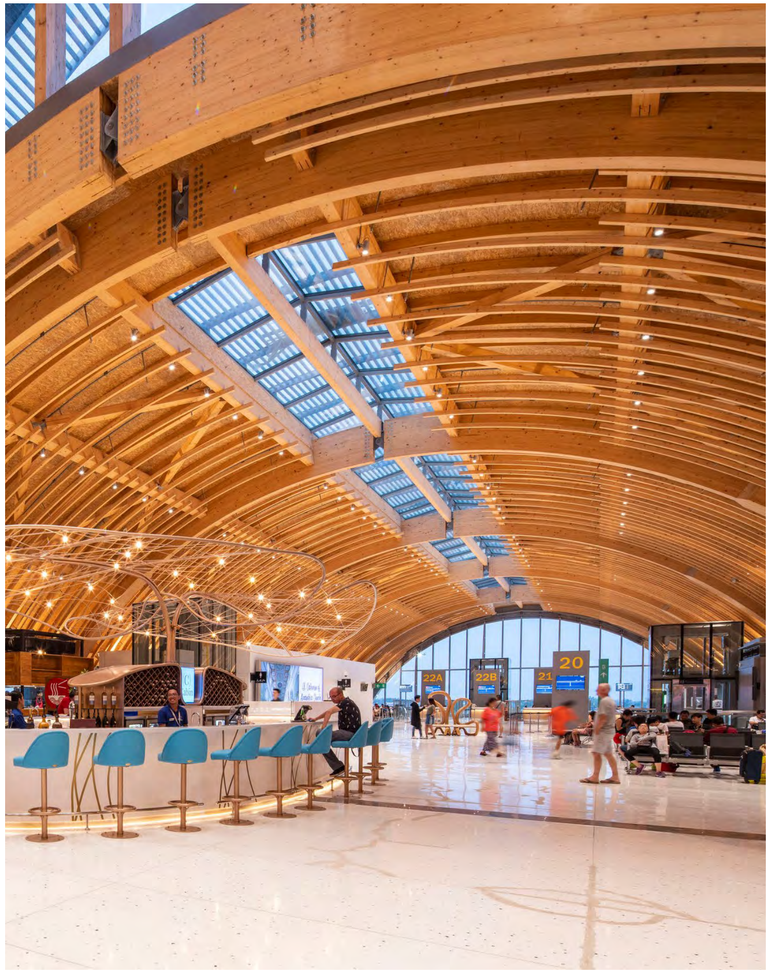
At Arup, we believe that sustainability is about more than just reducing carbon emissions. As experts in the field of transport infrastructure, we recognize that airports have a unique opportunity to take action and adopt low-emission strategies, optimize energy and resource use, and drive socially valuable outcomes for local communities. We help clients in the aviation sector to develop integrated approaches to these opportunities, incorporating circular economy principles as they build new capacity and pioneer the use of electric vehicles and decarbonization strategies within their campuses.

We understand that the way we plan, design, build, and live in our cities and buildings has important implications for our health and wellbeing. That's why we believe that airports have a significant role to play in shaping a region's economy, employment, transport system, and environment. Through effective masterplanning and design processes, we can use airports as catalysts for sustainable change and leverage their commitments to influence wider regional planning.

Airports are major employers, but the sustainable airport can play a larger role in the community than merely providing jobs. As focus points for a range of technical, engineering and service skills, they have an opportunity to become a hub for local skills, offering apprenticeships, and reaching out to communities that lack traditional educational advantages.

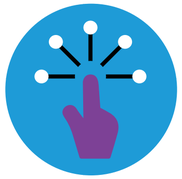
The time for airports to act is now, and at Arup, we're helping owners and operators to lead the way in sustainable aviation. We are at the forefront of developing best practice in building design, construction, maintenance, and refurbishment for both new and existing airports. We are also exploring and preparing the infrastructure needed to support alternative aviation fuels, electric vehicles, and surface access.

Airports have a fantastic opportunity to lead on sustainability, pioneer progressive economic measures and practices, and ensure that the industry is an active participant in the shift to a net zero economy. Ultimately, once the world's airports are more vocal about their net zero commitments, and making progress on a path to sustainable aviation, they will strengthen their social license to operate. This won't just be to the benefit of the industry but will strengthen the cities and communities they serve.



Mactan Cebu International Airport Terminal 2

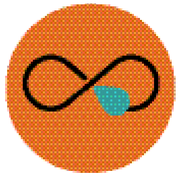
Approach to aviation



Digital

Digital technology plays a vital role in aviation and in Arup's aviation projects, permeating every aspect of airport design and operation. As a transformational tool, digital technology enables Arup to create smarter, more efficient airports that improve the passenger and employee experience. By utilizing digital tools such as data analytics, simulation, and automation, Arup can optimize energy consumption, reduce waste, and improve critical systems to create more sustainable and resilient airports.

Together we create new value for our aviation clients, solving complex challenges using advanced data analytics, modelling, and knowledge of the latest technologies and standards.



Climate and sustainability

At Arup, we are always looking to minimize environmental impact whilst continuing to provide opportunities for socioeconomic growth for generations to come. For aviation, there are two clear priorities –the shift to sustainable aviation fuels, a transition that's a work in progress, and second, the need to develop sustainable airports.

From wealth to employment to cultural exchange, airports have always made a considerable contribution to both national economy and surrounding communities, but that role is likely to come under renewed scrutiny as sustainable development continues to reframe the opinions of governments, regulators, investors and the travelling public. The sustainable airport is something that we can achieve right now maximizing the use of cutting-edge technologies, utilizing digital solutions, and prioritizing local communities, passengers, and employees.

Passenger experience

To gain an edge in global aviation, airports must design their infrastructure and facilities around the changing needs of passengers. This includes utilizing technology to improve the overall passenger experience, as we have seen in the past five years. The goal should be to reduce stress for passengers from the beginning of their journey to the moment their plane takes off. Each touchpoint in this journey provides an opportunity to drive satisfaction, reduce stress, and increase efficiency.

To achieve the optimal passenger and customer experience, it is crucial to understand the passenger's journey and focus on every interaction along the way. Successful deployment of services, such as wayfinding and content strategy, route planning, and environmental design, can empower passengers to make better decisions about their journey and ultimately improve their satisfaction with the airport.

Facilities and infrastructure

ARUP

Facilities and infrastructure

Air traffic control towers (ATC)

The Air Traffic Control (ATC) tower is a relatively small but vital part of the airport infrastructure. It provides the means by which the safe and efficient movements of aircraft on the ground and in the air are coordinated and as such the resilience of the tower systems and building structure is of the highest priority.

The technology used for ATC is developing rapidly with the introduction of new camera and radar technologies. Flexibility to adapt ATC to embrace these technologies is an important aspect of our tower design and planning. The Arup design team call upon many of their specialists to assess factors such as; control cab sightlines, glare, environmental comfort, acoustics, fire safety, system resilience, façade design and structural damping and dynamics.

Apart from the technical requirements of airport operation the control tower is also a central landmark on the airport and its architectural form is often used as a symbol or icon to represent the airport. This can be clearly seen in the many towers Arup have designed worldwide.

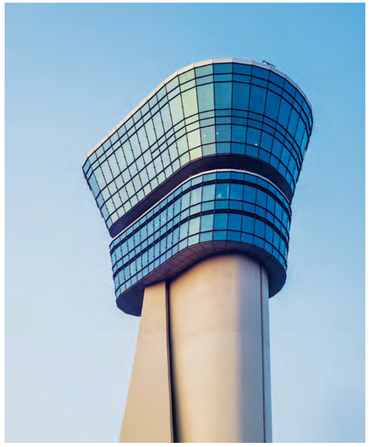
Working closely with the airport operator, air traffic control authority, contractors and other professionals, Arup bring their very wide range of technical skills to ensure the control tower achieves all the requirements of a world class tower design.

Selected projects

– Birmingham International Airport, UK
– Cancun International Airport, Mexico
– Chhatrapati Shivaji International Airport, Mumbai, India
– Dublin Airport, Ireland
– Edinburgh Airport, UK
– IGIA Delhi Airport, India
– KAIA Jeddah Airport, Saudi Arabia
– London Heathrow Airport, UK
– Newcastle International Airport, UK
– Rajiv Gandhi International Airport, Hyderabad, India
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Sydney Airport, Australia

London Heathrow required a new tower to be constructed amidst the aircraft stands and taxiways serving Terminal 3. Arup worked with the construction contractors to design a unique tower that could prefabricated off-site and safely jacked up to its full 87m height and which allowed airside operations to continue uninterrupted.

London Heathrow Airport, UK
© LHR Airports Limited



Chhatrapati Shivaji International Airport, Mumbai, India

Facilities and infrastructure

Airline lounges

Airline lounges can offer passengers a place of reprieve from the inherent chaos of travel. They are essential to an enhanced passenger experience. Arup has extensive experience supporting airline and terminal owner/operators in the planning and design of passenger lounges. These lounges incorporate various amenities including restaurant and bar space, lounge areas, bathrooms including showers, family areas, private VIP spaces, and outdoor/roof top spaces. Recently, Arup and our collaborators have taken an active role in planning not only the amenities and services for our client's lounges, but also to collaborate in developing a vision and roadmap for the customer experience. As airlines continue competing for high value customers, we are finding that these design considerations continue to become more valuable during the planning and design stages. These projects are delivered in highly secure areas, so design decisions and phasing need to take this challenge into consideration.

Selected projects

– Alaska Airlines Flagship Lounge, Sea-Tac, Seattle, USA

– Delta's Premium Lounge, Terminal 4, JFK International Airport, New York, USA

– Delta SkyClub and Sky Deck Concourse B, Terminal 4, JFK International Airport, New York, USA

– Etihad Lounge, Terminal 4, JFK International Airport, New York, USA

– JFK IAT Airline Lounge Concepts, New York, USA

– JFK IAT American Express Centurian Lounge, JFK International Airport, New York, USA

– LAX Etihad Lounge, Los Angeles, USA

– Swissair First & Business Class Lounge, Terminal 4, JFK International Airport, New York, USA

– Turkish Airlines Lounge, New Istanbul International Airport, Istanbul, Türkiye

Arup served as the Prime Consultant to Delta in their development of a 36,000 ft^2 Premium Lounge for JFK Airport Terminal 4. The addition of the Delta Premium Lounge will provide a dedicated check-in facility, security checkpoint, premium ground experience, and lounge for their customers. It will be the first instance of this service offering within Delta's network.

Premium Delta Lounge, JFK International Airport, New York, USA
© Gensler

Facilities and infrastructure

Airport cities

Airports are increasingly being seen as business destinations and as economic generators for the local and regional areas around them. We see office blocks, hotels, convention centers, medical facilities, free trade zones and entertainment areas being developed within or just beyond the airport perimeter.

Our expertise in the built environment enables us to deliver a total package for these airport city developments:

– Smart, sustainable city development

– Integrated transport planning

– Infrastructure improvement

– Economic planning

– Large scale urban planning.

These development planning skills, combined with our global aviation experience, enable us to create integrated solutions that align airport operational and commercial development objectives.

We have developed the “Smart, Green & Resilient” concept for our planning work on airport cities: a synthesized approach to energy, water, waste, communication, transport and building development. We place particular attention on mitigating carbon use through improved public transport and multi-modal transportation links. We have also developed sophisticated acoustics consulting to provide appropriate zoning pathways around the airport.

Selected projects

– Auckland Airport Business District, New Zealand

– Barcelona-El Prat Airport Real Estate Masterplan, Spain

– Beijing New Airport City, China

– Bologna Airport, Italy

– Hamad International Airport, Doha, Qatar

– Hong Kong International Airport North Commercial District Masterplanning

– Malaga, Valencia, Palma de Mallorca and Sevilla Airports, Spain

– Manchester Airport City Enterprise Zone, UK

– Mexico City International Airport, Mexico

– Sabiha Gökçen International Airport Techno-Park, Istanbul, Türkiye

– Taiwan Taoyuan Aerotropolis

– Venice Airport, Italy

– Warsaw Chopin Airport City, Poland

As General Consultant for the Taoyuan Aerotropolis Project, covering an area of 6,845 hectares, we advised on all aspects of the Aerotropolis including: masterplanning and urban design; sustainability, landscape and environmental planning; economic and financial advice; transport planning and public engagement.

Taoyuan Aerotropolis, Taiwan
© Taoyuan County Government

Facilities and infrastructure

Airport masterplanning

We provide an integrated approach to total airport development-enabling clients to achieve an appropriate balance between their commercial, operational, social and environmental objectives. Our work with airports, operators and developers, investors, airlines and regulators includes the development of both long-term strategic masterplans and mid-term capital investment plans for both regulated and non-regulated airport assets.

Working in collaboration with our clients' own teams and key external stakeholders, we draw together an appropriate combination of our own experts and other professionals to suit the particular needs of the airport development.

Arup is actively supporting our aviation clients and helping to accelerate their transition to a more resilient, sustainable, lower carbon future. This requires shaping aviation development at the outset through the masterplanning process, including pathways to decarbonisation; more efficient landside, terminal and airfield arrangements; sustainable aviation fuels, including hydrogen and electric; mitigation of noise and local emissions; sustainable surface access; economic, employment and social value strategies; climate change resilience and adaptation; environmental impact including water, biodiversity, plants and habitats; as well as green and blue infrastructure.

Selected projects

– Auckland International Airport, New Zealand
– Barcelona Airport, Spain
– Berlin Brandenburg Airport, Germany
– Copenhagen International Airport, Denmark
– Galeão-Antonio Carlos Jobim International Airport, Rio de Janeiro, Brazil
– Istanbul New Airport, Türkiye
– Kunming Xiaoshao International Airport, China
– London Gatwick Airport, UK
– London Heathrow Airport, UK
– London Luton Airport, UK
– Newark Airport Vision Plan, Newark Liberty International Airport, New Jersey, USA
– Mexico City International Airport
– Montréal Airports System, Canada
– Queenstown Airport, New Zealand
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Solidarity Transport Hub, Poland
– Townsville Airport, Australia
– Western Sydney Airport, Australia

"By selecting internationally renowned firms Arup and SOM to oversee the Newark Vision Plan, the Port Authority has demonstrated its intent to help Newark Liberty reach its maximum potential for the benefit of all New Jersey residents and visitors."

Phil Murphy, New Jersey Governor

Newark Vision Plan, Newark Liberty International Airport, New Jersey, USA

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Facilities and infrastructure

Airside engineering

Our team of experts ensure the delivery of safe, flexible, efficient, and easily maintainable airside facilities through a rigorous integrated total engineering process. Our teams bring a detailed understanding of international aviation standards, together with the lifecycles of equipment, aircraft, and built infrastructure. An essential element of our design is to ensure that all our projects meet the highest levels of environmental protection and sustainability.

Being a global practice, with local delivery, we provide a unique offering of knowledge of international best practice and local regulatory regimes and operational environments, thus delivering optimum value to our clients.

We look to reduce environmental impact through efficient use of materials and drawing on circular economy principles. For existing airfield pavements, Arup can identify a range of remediation solutions to optimise the re-use of existing materials and suit the future needs of the airport.

The extensive use of BIM in our designs enables us to successfully coordinate elements such as geometry, pavements, drainage and earthworks to deliver a more efficient construction package and contribute to future client maintenance strategies.

Selected projects

– Billy Bishop Toronto City Airport, Canada
– Brisbane Airport, Australia
– Cancun International Airport, Mexico
– Changi International Airport, Singapore
– Dublin Airport North Runway, Ireland
– Exuma International Airport, Bahamas
– Edinburgh International Airport, UK
– Glasgow Airport Taxiway Yankee, UK
– JFK International Airport, New York, USA
– Leeds Bradford Airport, UK
– London City Airport, UK
– London Gatwick Airport Pier 1, UK
– London Luton Airport, UK
– RAF Scampton, Marham and Waddington, UK
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Terminal 4, London Heathrow Airport, UK
– Toronto Pearson International Airport, Canada
– Wick Airport, UK
– Zagreb International Airport, Croatia

Arup works proactively with clients to address the challenge of optimizing airport use within the constraints imposed by airside capacity, whether in the design of new airports or the upgrading of existing facilities, notably to meet the needs of larger aircraft.

Terminal 4 Gate Modifications, JFK International Airport, New York, USA

Facilities and infrastructure

Automated people movers (APM)

We are a world leader in the planning and design of passenger transport systems and have experience of the development of innovative Automated People Mover (APM) and Personal Rapid Transit (PRT) systems for airports and other major infrastructure developments.

Our specialist skills in railway and system engineering, depot design, airport planning, urban and transportation planning, fire engineering, acoustic and vibration design, environmental impact assessment and communications enable us to provide a holistic approach to the solution of each project.

We provide specialized APM services covering all stages of projects including master planning, feasibility study, reference design, specification and procurement, construction supervision, testing and commissioning, and reliability monitoring after opening.

Our service ensures that client needs are met to cost and time and add value through technical excellence, innovation and efficient organization.

Selected projects

– Zayed International Airport, Abu Dhabi, UAE
– Beijing Capital International Airport, China
– Brisbane International Airport Domestic Terminal, Australia
– Cable Drawn System, Birmingham International Airport, UK
– Dubai International Airport and Dubai New Airport, UAE
– New Istanbul Airport, Türkiye
– Los Angeles International Airport, USA
– Luton DART, London Luton Airport, UK
– Personal Rapid Transit System, London Heathrow Airport, UK
– San Jose Automated Transit Network Feasibility, USA
– Sao Paolo Airport, Brazil
– Sky Plaza, Terminal 2, Hong Kong International Airport
– Suvarnabhumi International Airport, Bangkok, Thailand
– Terminal 2 and 5, Changi Airport, Singapore
– Third Runway Concourse, Hong Kong International Airport
– Toronto Pearson International Airport, Canada
– Midfield Concourse, Hong Kong International Airport
– Montréal-Pierre Elliott Trudeau International Airport, Canada
– Venice Marco Polo Airport, Italy

HKIA Midfield Concourse Project involved APM system expansion and upgrade. The original fixed block signaling system was upgraded to a Communication Based Train Control system, requiring a progressive system overlay to avoid disruption of the existing operations. This was the first airport APM system overlay project in the world.

Hong Kong International Airport

Facilities and infrastructure

Aviation support facilities

We have over 60 years' experience in the planning and design of aviation support facilities. Commencing with military aircraft hangars, our services now cover every aspect of the sophisticated demands of airlines and airport operators, meeting the most stringent safety and operational standards.

For airport operators we provide rapid and economic design of hangars, from simple single span structures to complex, highly serviced maintenance buildings for the largest Boeing and Airbus aircraft in production.

For major world airlines we have collaborated in the designs of some of the world's most sophisticated aircraft maintenance, training and test facilities.

We have taken the lead role in the planning and design of technically advanced air cargo handling facilities, together with the provision of all ancillary requirements including fire stations, flight kitchens and GSE maintenance buildings.

Selected projects

– 48-Bay Fast Jet Maintenance Facility, RAF St Athan, UK

– A330 Maintenance Hangar, RAF Brize Norton, UK

– Air Traffic Control Tower, London Heathrow Airport, UK

– British Airways Engineering Wales, Bay 2 Flexible Wide-Body Bay

– British Airways Engineering Wales,
Relocation of Avionics and Interiors Engineering

– British Airways Heavy Maintenance Hangar,
Cardiff International Airport, UK

– British Airways World Cargo Center, London Heathrow Airport, UK

– Central Utility Plant, Los Angeles International Airport, USA

– Customs and Border Protection Facility, Terminal 5i,
JFK International Airport, New York, USA

– Flight Catering Facility, Hamad International Airport, Doha, Qatar

– HACTL Super Terminal 1, Hong Kong International Airport

– Korean Air Cargo Terminal, JFK International Airport,
New York, USA

– Lufthansa Catering Facility, Hong Kong International Airport

We created a digital version of the bay through a 3D LIDAR scan, which reduced the number of site visits needed, supporting health and safety in a sensitive working environment, and reducing the impact on the live hangar bays. Through the scan, we traced existing services and confirmed structural record information with a high degree of accuracy, feeding this into the complex MEP design.

London Heathrow Airport, UK

ARUP

Facilities and infrastructure

Baggage handling systems

We provide an independent and integrated service for the development of airport automation solutions for baggage and cargo handling.

We support clients from master planning over options development, to implementation and operational handover from small regional airports to large international hubs.

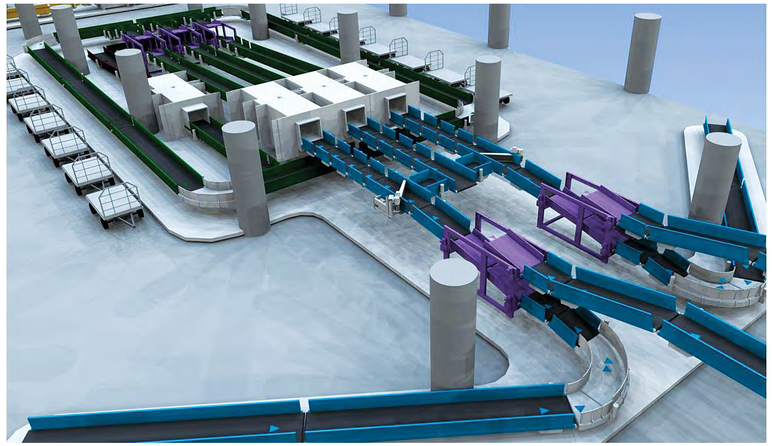
Baggage handling is central to the success and efficiency of airport operations. With a team of experts drawn from airlines, airports and system suppliers, we are able to provide an independent and pragmatic approach to planning, design and implementation of systems and operations. We are uniquely able to develop solutions, fully integrated and coordinated with passenger processes and IT systems with terminal and airside infrastructure, be they for new facilitates or upgrades of existing installations.

We have practical experience of the application of both established and emerging technologies such as AGVs, robots, and RFID, and operational processes, like compressed and batch build, and remote check in and bag delivery. We also help clients maximise the benefits of digitisation to reduce cost and carbon emissions.

Selected projects

– Chopin Airport, Warsaw, Poland
– HBS replacement, Dublin Airport, Ireland
– HBS replacement/several, London Heathrow Airport, UK
– HBS replacement, Manchester Airport, UK
– Hong Kong International Airport
– John Lennon Airport, Liverpool, UK
– Kuwait International Airport
– LAX T9 BHS Masterplan, Los Angeles, USA
– Melbourne Airport, Australia
– Perth Airport, Australia
– Rajiv Gandhi International Airport, Hyderabad, India
– Sabiha Gökçen Expansion, Istanbul, Türkiye
– Seattle-Tacoma International Airport, Seattle, USA
– Solidarity Transport Hub Masterplan, Warsaw, Poland
– Terminal 1 Extension, Bangalore International Airport, India
– Terminal 2, Antalya Airport, Türkiye
– Terminal 2, Dublin Airport, Ireland
– Transfer Operations, Zayed International Airport, Abu Dhabi, UAE

Arup’s team of experts have experience in all aspects of airport baggage, from planning and design to implementation and operational efficiency improvements. We have a proven track record of delivering successful projects for airports of all sizes, and we are committed to helping our clients achieve their goals.



Midfield Terminal, Hong Kong International Airport

Facilities and infrastructure

Cargo handling facilities

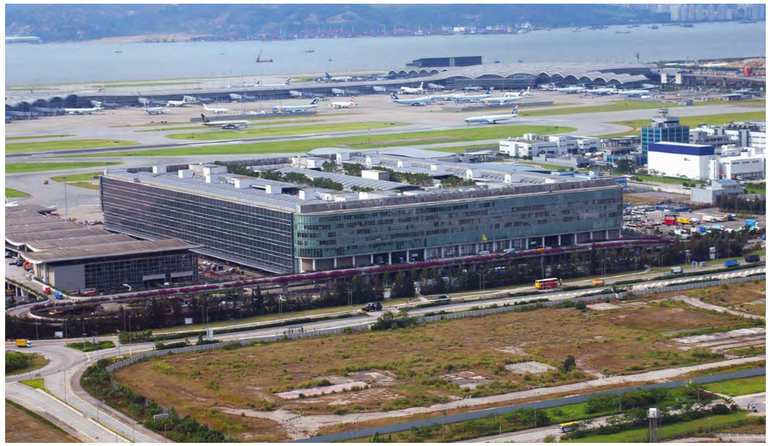
We provide a comprehensive range of consulting services for the development and enhancement of cargo handling facilities, systems and operations. Our work with a wide range of stakeholders in the air cargo industry–including airport authorities, airlines, cargo handlers and developers–involves both the implementation of new terminals and the improvement of existing operations. We are focused on the development of efficient and effective operational processes and supporting infrastructure to minimize costs and optimize service levels.

Our specific knowledge of air cargo is complemented by wider experience within the logistics and distribution sector worldwide–providing an unrivalled understanding of the business drivers for the cargo industry and of the regulatory context for global shipment of goods. Access to the wider Arup experience in the road, rail and sea transport sectors also provides us with a unique insight into the planning of multi-modal infrastructure and operations.

Selected projects

– British Airways World Cargo Center, London Heathrow Airport, UK
– Cargo Strategy for Aena main cargo airports,
  – Adolfo Suárez Madrid–Barajas Airport, Madrid, Spain
  – Barcelona-El Prat Airport, Barcelona, Spain
  – Vitoria Airport, Vitoria, Spain
– Cargo Terminal, Aeroporto Leonardo da Vinci, Fiumicino, Italy
– Container Handling and Storage Facility, Terminal 5, London Heathrow Airport, UK
– Freight access strategy, London Heathrow Airport, UK
– HACTL Super Terminal 1 Air Cargo Terminal, Hong Kong International Airport
– Parcelforce UK and International Hubs, Coventry, UK
– Portland International Airport, US
– Zaragoza Airport, Zaragoza, Spain Solidarity Transport Hub Masterplan, Poland

Arup can deliver efficient and effective airport cargo handling solutions that minimize costs and optimize service levels. We combine our specific knowledge of air cargo with our wider experience in logistics and distribution to provide our clients with the best possible service.



HACTL Super Terminal 1, Hong Kong International Airport

Facilities and infrastructure

Control rooms and operations centers

The market is increasingly looking at digitalisation of airport assets and operations driven operational excellence and enabled by digital transformation. The impact of this is felt strongly in next generation of airport control rooms where digital tools such as AI and ML combined with new data driven processes, data insights and automation is driving a revolution in operations.

Across the major aviation process areas such as passenger, security, landside operations, airside and ground handling , logistics and baggage we are seeing a move by airport operators towards more multi-function collaborative decision making.

This is enabled by digital solutions that enable information sharing, better situational awareness at both strategic and tactical levels. New more content rich communications and collaboration tools are allowing virtualised control room structures to be created where the traditional control room operator can work seamlessley with a more mobile and distributed workforce, providing a more co-ordinated customer service and greater impact towards operational response.

Through our global experience across key disciplines covering people factors, digital technology, aviation processes and designing operational environments, we take a holistic view working with airport operators to create such environments for driving operational excellence and flexibility.

Selected projects

– Baggage Handling Control Rooms Consolidation, London Heathrow Airport, UK

– Confidential Airport Client APOC Location Security Advisory, UK

– Delta Airport Control Centers, LaGuardia Airport, New York, USA

– Delta Airport Control Centers, Los Angeles International Airport, USA

– Terminal Service Center, London Heathrow Airport, UK

– Dubai Baggage Handling control rooms consolidation, UAE

– Edinburgh Control Tower, Scotland, UK

– Heathrow APOC, UK

– National Air Traffic Services, UK

– Swissport Operational Control Center, London Gatwick Airport, UK

Dubai Airport (DXB) was undergoing a major expansion of their baggage systems at Terminal 1 and Terminal 3. Arup led the development of the business case for an integrated control room involving multi-stakeholder engagement. Once approved, we went on to identify suitable location for the control room, created the project mandate, prepared user and systems requirements to support its implementation.

Heathrow Baggage Handling, London Heathrow Airport, UK

Facilities and infrastructure

Hangars – maintenance, repairs and overhaul

We have extensive international experience in the planning, design and commissioning of aircraft maintenance and painting hangars, for a wide range of civil and military aircraft. These vary from complex heavy maintenance facilities able to accommodate a range of both wide and narrow bodied aircraft, to facilities specifically designed for an operator's fleet.

Working closely with the client's management team we develop innovative integrated solutions which meet both the current operational needs and provide flexibility for future changes in the industry, all contained within strict budgetary control.

Selected projects

– 48-Bay Fast Jet Maintenance Facility, RAF St Athan, Wales, UK

– Aircraft Maintenance Hangars, Hamad International Airport, Doha, Qatar

– British Airways A380 Hangar, London Heathrow Airport, UK

– British Airways Engineering Wales, Three-bay Wide Bodied Deep Maintenance Facility

– British Airways Maintenance Base Wide Body Hangars, London Heathrow Airport, UK

– Cargolifter Airship Hangar, Brand, Germany

– Double-Bay A330 Maintenance Hangar, RAF Brize Norton, UK

– Double-Bay Wide Bodied Maintenance Facility, Prague Airport, Czech Republic

– GAMCO Double-Bay Multi Stand Aircraft Hangar, Zayed International Airport, Abu Dhabi, UAE

– Korean Air Hangar, JFK International Airport, New York, USA

– Lufthansa, Shannon Airport, Co Clare, Ireland

– MRO Industry Report for Ireland and Czech Republic

– New Service Hangar Refurbishment, London Heathrow Airport, UK

– Turkish Airlines Multi-Bay Heavy Maintenance Center, Sabiha Gökçen International Airport, Istanbul, Türkiye

"The result of your team's effort has been to create the best aircraft maintenance facility in the world. In addition, Arup continue to support British Airways Maintenance Cardiff with solutions that complement the original design that improve organisational flexibility and overall productivity improvements."

British Airways Maintenance, Cardiff International Airport, Wales, UK

A380 Hangar, London Heathrow Airport, UK

Facilities and infrastructure

International passenger terminals

We bring our global expertise and understanding of the aviation industry to the planning, design and upgrading of international passenger terminals. Working closely with our clients and architectural partners, we provide total technical, management and financial planning services, to create passenger terminals which meet the most stringent operating criteria while providing iconic statements as international gateways.

Our understanding of the rapidly changing security, environmental and business demands on operators and airlines, enables us to develop designs which are flexible but keep within strict financial constraints.

Sustainability is a key criterion in our designs, resulting in low carbon footprint and energy efficient buildings and supporting terminals which meet the most stringent operating criteria while sustainable business and operating plans.

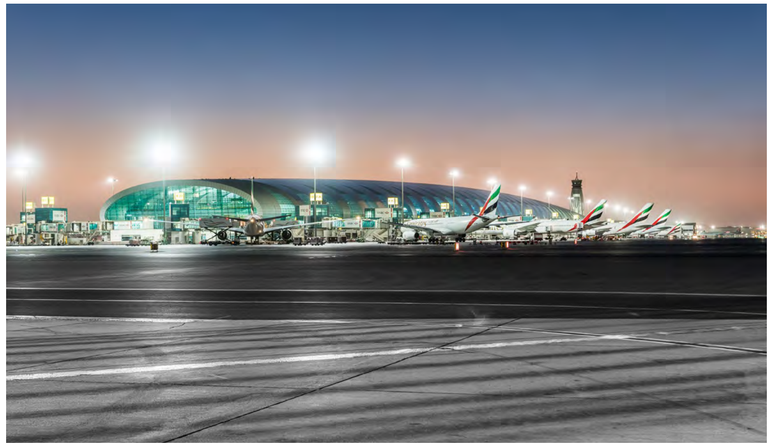
Our objective is to address client aspirations for their terminals, meeting current demands while providing capacity and flexibility for future growth.

Selected projects

– Brisbane Airport, Australia
– International Departures Expansion, Perth Airport, Australia
– JetBlue Terminal 5i Expansion, JFK International Airport, New York, USA
– Kunming Xiaoshao International Airport, China
– Lima Airport, Peru
– Montréal-Trudeau International Airport, Canada
– New Midfield Concourse, Hong Kong International Airport
– Rajiv Gandhi International Airport, Hyderabad, India
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Terminal 1 and New Midfield Terminal, Zayed International Airport, Abu Dhabi, UAE
– Terminal 1 Extension, Kempegowda International Airport, Bangalore, India
– Terminal 4, JFK International Airport, New York, USA
– Terminal 2, Dublin Airport, Ireland
– Terminal 2, Kuwait International Airport
– Terminal 3, Beijing Capital International Airport, China
– Terminal 5, London Heathrow Airport, UK
– Terminal A+, Frankfurt Airport, Germany
– Toronto Pearson International Airport, Canada
– Zurich Airport, Switzerland

“Historically, Arup has provided us with valuable strategic advice on new paradigms with regards to planning for mega airports and future technologies as well as operational process improvements for handling aircraft, passengers, baggage, employees and external stakeholders. We appreciate the fact that Arup can provide us with leading specialists from around the world and deliver the services locally through a very capable team of project managers and engineers from their Dubai office.”

Paul Griffiths Chief Executive Officer, Dubai Airports



Dubai International Airport, UAE

Facilities and infrastructure

Landside infrastructure

Customer experience with the landside infrastructure as the gateway forms a first impression of the airport when passengers arrive and serves as a reminder when they leave. It is an opportunity to present the very best of what they can expect elsewhere in the facility. Directions, available capacity, and wayfinding are the key features we believe that define a lasting positive impression.

We also seek to incorporate provision for future growth and embed responsible environmental principles that address not only the materiality of the construction process but also address adjacent community needs for mutual economic prosperity and reduced environmental impact.

A key challenge that airports face is providing customer focused and sustainable surface access. This is often a significant capital investment which is seen as a necessary, but unwelcome expense. Arup seeks to engage airport owners and operators on the most appropriate and cost effective solutions for access. Exploring all available modes of transport and strategies for optimizing the use of various modes as appropriate is an underlying tenet of this approach to capitalize on this investment. Development and integration of efficient transport systems is a core part of the success of our projects. Arup's specialists in rail, highway, metro, light rail, bus, car parking, pedestrian movement and urban planning bring a long track record of innovative solutions and ground access transport excellence. These skills are underpinned by our global leadership in Planning, Design and Project Management skills targeted as solving some of the most difficult problems our clients experience.

Selected projects

– Ground Transport Center and Approach Roads, Hong Kong International Airport

– Istanbul New Airport, Türkiye

– Kunming Xiaoshao International Airport, China

– Manchester Airport, UK

– Melbourne Airport, Australia

– Multi-Level Car Park, Brisbane Airport, Australia

– Quadrant Four Roadways, JFK International Airport, New York, USA

– Surface Access Study, Birmingham International Airport, UK

– Surface Access Study, East Midlands Airport, Castle Donington, UK

– Surface Access Study, Leeds Bradford International Airport, UK

– Terminal 2, Dublin Airport, Ireland

– Terminal 5, London Heathrow Airport, UK

– Traffic Management Study, Cairo International Airport, Egypt

– VISSIM Model, Newark Liberty International Airport, New Jersey, USA

– Warsaw Chopin Airport, Poland

At Newark Liberty International Airport, we developed a plan to optimize transportation network companies (TNC) pick-up while maintaining the efficiency of the road network and the use of curbside space. We conducted a global best-practice study to identify effective and unique TNC pick-up concepts that meet the needs of both drivers and passengers while minimizing impacts to other modes.

Newark Liberty International Airport, New Jersey, USA
© PANYNJ

Facilities and infrastructure

Multimodal connections – multimodal transportation hubs

As key nodes and access points to global transportation networks, airports connect countries and regions, generating opportunity for trade, growth and collaboration and providing access to education, healthcare and employment. Often operating 24 hours per day, airports can provide multi-modal connectivity which can benefit not only passengers and employees but also local communities and businesses.

With expertise across all transport modes, we recognise that the integration of transport systems at and with airports is critical in enabling the efficient and sustainable movement of people and goods, minimising congestion and maximising the realisation of benefits across cities and regions.

With an increasing need to decarbonise and with our clients seeking improved environmental outcomes, our work prioritises sustainable, high-capacity public transport modes, often brought together at multi-modal transport hub, with healthy, active travel choices also provided, in particular for airport employees.

Selected projects

– Calgary Airport Rail Link, Canada
– Hong Kong International Airport
– Istanbul New Airport, Türkiye
– London Gatwick Airport, UK
– London Heathrow Airport, UK
– Luton DART, London Luton Airport, UK
– Shenzhen Airport East Integrated Transport Hub, China
– Solidarity Transport Hub, Poland
– Western Sydney Airport, Australia

We design well-planned transport interchanges and hubs, which enable seamless connectivity between different transport modes, allowing intuitive and straight-forward airport access and interchange between ground transport modes.

Sky Plaza, Terminal 2, Hong Kong International Airport

Facilities and infrastructure

Regional/domestic passenger terminals

We have extensive experience in the provision of a broad spectrum of aviation facilities. We understand how the markets and traffic profiles at regional airports differ from those at larger hubs and what impact this has on business models, commercial imperatives, infrastructure provision and capital expenditure requirements. We recognize the particular demands that low-cost carriers can place on regional airports and how planning and designing for these demands need to be balanced with the requirements of other users where necessary.

Whether upgrading existing facilities or providing new ones, we pay particular attention to long-term flexibility and systems adaptability, enabling airports to respond efficiently and cost effectively to changes in market drivers.

By applying sustainability principles, we also help operators address the challenges that come from infrastructure provision while at the same time maintaining the local environmental and social structure.

In addition, our understanding and experience of airport operating practices is invaluable in allowing us to deliver projects in the live operating environment.

Selected projects

– Alicante and Menorca Airports, Spain
– Billund Airport, Denmark
– Bristol Airport, UK
– Copernicus Airport, Wroclaw, Poland
– Durham Tees Valley Airport, Darlington, UK
– Gold Coast Airport, Queensland, Australia
– Heydar Aliyev International Airport, Baku, Azerbaijan
– Leeds and Bradford International Airport, UK
– Logan International Airport, Boston, USA
– Long Beach Airport, California, USA
– Ottawa MacDonald-Cartier International Airport, Canada
– Québec City, Jean Lesage International Airport, Canada
– Riga International Airport, Latvia
– St John's International Airport, Newfoundland, Canada
– Terminal 2, Raleigh-Durham International Airport, Morrisville, USA
– Terminal Core Redevelopment, Portland International Airport, Portland, USA
– Townsville Airport, Queensland, Australia

"Arup has been a trusted business partner of JetBlue Airways for the past decade. They have been actively involved with most of our growth plans, which entails large development projects as well as smaller expansion assignments. The Arup professionals have a complete understanding of our business and fully integrate with our in-house team."

Richard J. Smyth, (Formerly) VP, Corporate Real Estate,
JetBlue Airways Corp

JetBlue Terminal 5, JFK International Airport, New York, USA
© Nic Lehoux/Gensler

ARUP

Facilities and infrastructure

Test and training facilities

We work with airlines, operators and manufacturers on the design of complex facilities required for the full power testing of engines, external running tests of aircraft and flight simulator test cells. Achieving the exacting performance criteria that are demanded for these facilities requires the integration and input of specialist designers working within the framework of the facility design.

We are unique in having within our organization risk analysts, specialist acoustic engineers, fire engineers, vibration engineers, building environment control engineers and information technology specialists who work with the designated design team to ensure that the facility meets the performance criteria and operational readiness.

Our global experience in the design of airports, airport facilities and aircraft maintenance facilities enables us to advise clients on the most appropriate form and location of their test or training facility to meet both operational and business efficiency.

Selected projects

– Acoustic Baffle, British Airways Ground Running Facility, Cardiff International Airport, UK

– British Airways Heathrow Maintenance Base, A380 Engine Ground Run Pen Facilities

– British Airways Maintenance Base Heathrow Airport–Flight Simulator Hall, UK

– Cathay Pacific Flight Training Center, Hong Kong International Airport

– Dragon Airlines Headquarters, Hong Kong International Airport

– GE90 Aircraft Engine Test Cell Facility, Nantgarw, Wales, UK

– Korean Air Engine Maintenance Facility

– Turkish Airlines Heavy Maintenance Center, Sabiha Gökçen International Airport, Istanbul, Türkiye

– Virgin Blue Simulator Building, Brisbane Airport, Australia

British Airways Engine Ground Run Pens–The Arup design met stringent planning constraints, safeguarded BA's future interests at the airport and were delivered without compromising BA's operational requirements.

Virgin Blue Simulator Building, Brisbane, Queensland, Australia

Planning

Planning

Airfield planning

Our airside planners can plan and design the full gamut of airside infrastructure arrangements including runways, taxiways, aprons, and aircraft parking positions in line with applicable regulations as well as safety and operational requirements.

We work closely with architects, engineers, airlines and contractors to ensure designs are compliant and all operational constraints are adhered to, while also optimising efficiency and capacity.

Our work includes detailed stand planning and design including aircraft stand systems infrastructure and equipment ground services (e.g. power, water, air conditioning, fuel), aircraft guidance and signage, and communication and control systems design and implementation to meet safety and operational requirements and optimize turnaround times.

We can also advise on aircraft stand systems (i.e., Passenger Boarding Bridges, Visual Docking Guidance Systems, including specifications and drawings tailored to airport requirements.

Selected projects

– Airfield Lighting Systems Rehabilitation, Toronto Pearson International Airport, Canada

– Dublin Airport North Runway, Ireland

– Harvey Milk Terminal–Boarding Area B, San Francisco International Airport, USA

– Istanbul 3rd Airport–Specialist Services, Türkiye

– JFK Runway 13L-31R Rehabilitation Planning, JFK International Airport, New York, USA

– London Gatwick Airport South Terminal and Pier 1 Stands, UK

– Terminal 1 Redevelopment, Newark Liberty International Airport, New Jersey, USA

“Arup brought a global perspective on best practices to their work, which is particularly appreciated given that Toronto Pearson is North America’s most internationally connected airport. [Arup’s] report charts a path forward over the next 20 years for a world-class airfield electrical system that is consistent with Toronto Pearson’s goal to be the best airport in the world.”

Todd Ernst, Director of Aviation Infrastructure, Energy and Environment at the Greater Toronto Airports Authority

Toronto Pearson International Airport, Canada

Planning

Airline migration planning

The migration of a stakeholder's operation is a complex planning exercise. Specifically, the strategy for moving airlines needs to be carefully developed and managed to ensure a seamless transition that assures business continuity and with as little impact to the traveling public as possible.

We have led and supported a number of airline moves programs; ranging from the overnight migration of airlines to a new common use terminal, to the relocation of multiple airlines to a different airport to alleviate capacity constraints.

We have extensive experience of working with airlines, airport operators and third parties to develop the optimal, risk balanced move plan, which aligns with the stakeholders' operational requirements. We are able to integrate complex migration plans and define the critical path activities for the chosen move date.

We add value by deploying the appropriate individuals to support the client's project teams, with a breadth of experience garnered from over 15 years in operational readiness and airport transfer programs.

Selected projects

– Delta LAX Modernization Project, Los Angeles International Airport, USA

– Relocation to Dedicated Terminal 3, Dubai International Airport, UAE

– Relocation, New Common Use Terminal 2, Chhatrapati Shivaji International Airport, Mumbai, India

– Relocation, New Common Use Terminal 2, London Heathrow Airport, UK

– Temporary Relocation to Dubai World Central, Al Maktoum International Airport, UAE

"Thank you for everything you did to get us through this week's move. This first project phase was seen as a huge success by Delta, LAWA, and many others and a lot of that is because of you."

Mark Pearson, Delta Airlines, VP Corporate Real Estate

Delta LAX Sky Way, Los Angeles International Airport, USA

Planning

Airport planning

Our airport planners work with clients to respond to today's demands and to anticipate and plan for future needs. We develop creative planning and operational solutions that balance traffic growth, evolving airline strategy and commercial demands with changing regulatory policy and competing land use, sustainability and environmental requirements. We provide the professional skills needed to define the strategic, development, business and operational requirements for new airport facilities, as well as optimising the capacity and value of existing assets.

We employ a highly analytical approach to problem definition and solution development, based on an in-depth understanding of airport and airline operations and an appreciation of airports as commercial businesses and public assets. We deliver pragmatic solutions, directed to achieving projects that are affordable, buildable, operationally efficient and which minimize impact on the environment.

Whether working for small regional airports or the world's largest hubs, we apply the same high caliber of analysis, creativity and strategic thinking, focused on understanding and serving our clients' needs.

Selected projects

– Air New Zealand Domestic Terminal Pathways, New Zealand

– Frankfurt Airport Vision 2020, Germany

– Hamad International Airport, Doha, Qatar

– JetBlue Terminal 5 and 5i, JFK International Airport, New York, USA

– London Heathrow and Gatwick Airports, UK

– New Terminal Development Plan, Toronto Pearson International Airport, Canada

– Riga International Airport, Riga, Latvia

– Seattle-Tacoma International Airport Internal Arrivals Facility, Washington, USA

– Terminal 1 and New Midfield Terminal, Zayed International Airport, Abu Dhabi, UAE

– Terminal 2, Dublin Airport, Ireland

– Terminal 4, Delta Airlines, JFK International Airport, New York, USA

– Townsville Airport, Australia

– Venice Marco Polo Airport, Italy

"At JFK, Boston and other key airports, Arup has consistently embraced our objective of an efficient and competitive hub. Their innovative airside and terminal planning has helped us turn an idea into a reality."

Richard J. Smyth, Jet Blue Vice-President, Corporate Real Estate

JetBlue Terminal 5, JFK International Airport, New York, USA

Planning

Business investment advisory

Infrastructure investors and lenders in their airport investments need to understand the challenges to operate and expand an airport business. The current digitalization and climate change challenges are eminently technical challenges that add to the complexity of the airport business plan.

An Airport Business Plan needs to combine commercial expertise as well as technical expertise and incorporate sustainability and digital innovations. It is critical to weight adequately the different factors specifically for each case.

Arup has a team that is specialist in the work of due diligence for infrastructure and integrates the aviation expertise available across Arup aviation, which makes our expertise unique in the agile combination of all the expertise required for a solid investment and responsible tailored case to the specific context for the airport and the owner/operator.

Selected projects

– Affordability of London Luton Airport Expansion Plan, UK
– Athens Airport Business Plan Due Diligence Report, Greece
– Brussels Airport Technical Due Diligence, Belgium
– Business & Financial Review of Avinor, Norway
– Eskilstuna Airport privatization feasibility study, Sweden
– Hobart Airport Technical Due Diligence, Australia
– JFK T1 Airport Technical Due Diligence, USA
– OMA Airports Technical Due Diligence, Mexico
– Review of Business Plan of Vienna Group, Austria
– Sabiha Gökçen International Airport Technical Due Diligence, Istanbul, Türkiye
– Sofia Airport Technical Due Diligence, Bulgaria
– Unilode Business Technical Due Diligence, Switzerland

Arup's business investment advisory team advises lenders, sponsors and public authorities on infrastructure projects worldwide.

By translating technical and commercial issues into financial analysis, we enable our clients to fully evaluate investment opportunities, creating a competitive edge for investors or delivery certainty for asset owners.

Kansai and Osaka International Airports Privatisation, Osaka, Japan
© Payless images

ARUP

Planning

Data and analytics

Airports are dynamic infrastructure under constant change. The natural evolution of air traffic characteristics such as changes in destinations, airlines and aircraft types have to be adopted in parallel to upgrading existing infrastructure and preparing roadmaps to meet future forecast requirements.

Thanks to our broad experience in airport capacity planning and dynamic simulation and our digital data driven advisory services we support airport operators in their digital transformation.

Our ambition is to transform the way airport planning analyses are carried out and support airport operators or investors become more data led in their decision making. By automating and optimizing aviation planning tasks and exploiting the vast amounts of data airports have, we aim to facilitate the monitoring of traffic and identification of capacity and investment triggers of the airfield, terminal and surface access infrastructure. The benefits of embracing automation and data are clear: faster and more efficient analyses; greater robustness for validating assumptions and inputs; ability to answer more and different type of questions; and greater flexibility and agility to adapt to changes.

Selected projects

– Arup Airport Demand Analyser (ADA)

– Arup Emissions Analyser (AEA)

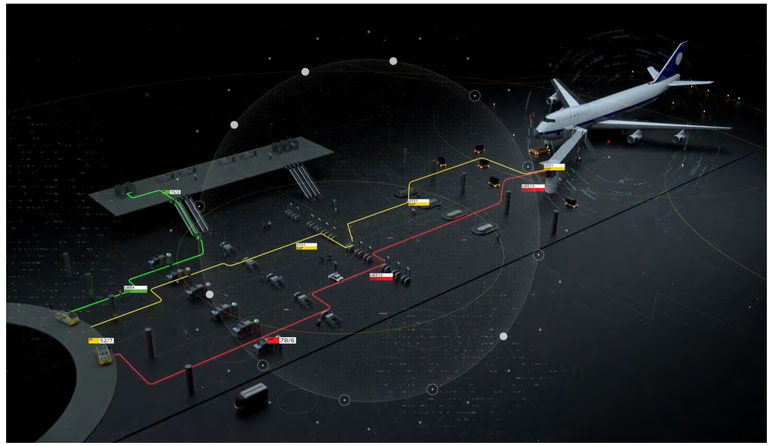
– Arup Surface Access Analyser (ASA)

– Capacity/Demand data-driven tool for Aena Airport Planning Department

– Flight schedule rolling hour analyser

– London Heathrow Capacity Planning Transformation

By combining our expert knowledge in airport capacity planning and simulation with our digital and data analytics expertise we efficiently respond to airport planning analytical and automation challenges with bespoke data driven digital solutions.



The future ready airport
Data analytics in real-time.

Planning

Economic and community impact planning

Our economic and planning specialists have substantial experience in assessing the social and economic impact of airport development, and how the potential positive effects can be maximized. We also have experience in understanding how airport development fits with local, regional and national planning policy and strategies and how this can best be communicated to stakeholders and the general public.

Through integration with other technical disciplines within Arup, we are able to provide a transparent, yet analytical and robust assessment, at a range of spatial levels.

Airports have varied and complex impact on their surroundings. They are a major direct employer, with often significant (on and off-site) indirect employment through contracted and supplier organizations. In turn this workforce presents additional economic growth as purchasers of goods and services (induced benefits). In addition, airports provide connectivity for businesses attracted by the prospect of airport service (catalytic employment).

We can devise planning frameworks to provide capacity for these impacts and deliver solutions that are sensitive to both local communities and wider political and societal objectives.

Selected projects

– Current Operation and Relocation Scenarios, Cambridge City Airport, UK

– Economic Impact of Expansion, Norwich International Airport, UK

– Future of Air Transport in Scotland, for the UK Government

– Land-use and Capacity Studies, Edinburgh & Glasgow Airports, UK

– Land-use and Urbanization Study, London Heathrow Airport, UK

– PANYNJ Newark Liberty International Airport Vision Plan, New Jersey, USA

– Proposed Airport Economic Study, Cliffe Marshes, Kent, UK

– Sabiha Gökçen International Airport, Istanbul, Türkiye

– Socio-Economic Impact, London Southend Airport, UK

– Warsaw Chopin Airport, Poland

The airport terminal is designed to save lives and property…we are confident the design will safeguard a major financial investment and preserve an international transportation system so that it may continue functioning if an earthquake strikes.

Sabiha Gökçen International Airport, Istanbul, Türkiye

Planning

Modelling and simulation

We employ a highly analytical and multidisciplinary approach to find solutions that holistically meet the needs of owners, passengers, airlines and all other stakeholders. Our analytical tools range from simple spreadsheets and aircraft gating tools, to complex baggage, airfield and passenger flow simulation models. We adopt and integrate the tools necessary to meet the needs of each project and problem. Our ability to develop realistic and well calibrated future planning schedules provides a key underpinning to most of our analytical work. When coupled with good data, whether drawn from our experience of many airports, or collected locally, we are able to provide a well-integrated understanding of airport system performance.

We rely on simulations of passenger and baggage movement and processes to provide in depth understanding of a facility's performance. We carry out airfield simulation modeling to assess airfield performance and capacity. Simulations allow us to identify system interdependencies, weaknesses, and resilience and can inform improvements to both physical planning and operational processes. We are able to optimize capacity and sometimes delay capital investment by simple measures to make better use of current facilities and systems.

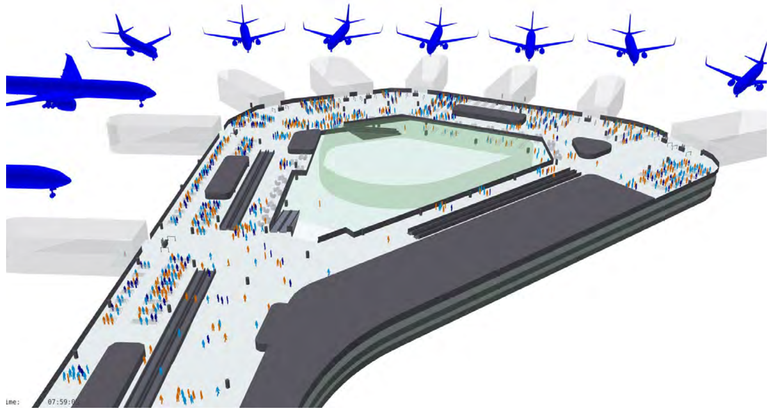
We have developed expertise in a wide range of simulation tools and methods and have found simulation to be a practical tool for providing valuable input to the dynamic planning and design process. We utilize a variety of advanced simulation software based on the application requirements and the client's preferences, including Simio, CAST Terminal, CAST Aircraft, MassMotion, and VISSIM.

Selected projects

– Zayed International Airport and Dubai International Airports, UAE
– Beijing Daxing International Airport, China
– Boston Logan International Airport, USA
– Changi Airport, Singapore
– Fiumicino Airport, Italy
– George Bush Intercontinental Airport, Houston, USA
– Hamad International Airport, Doha, Qatar
– Incheon International Airport, South Korea
– Istanbul New Airport, Türkiye
– JFK, LaGuardia, and Newark Liberty International Airports, USA
– Los Angeles International Airport, USA
– London Heathrow and Gatwick Airports, UK
– Mexico City International Airport, Mexico
– Montréal-Trudeau International Airport, Canada
– Portland International Airport, USA
– Rio de Janeiro Jobim International Airport, Brazil
– San Francisco International Airport, USA
– Seattle Tacoma International Airport, USA
– Taipei Taoyuan International Airport, Taiwan
– Toronto Pearson International Airport, Canada
– Warsaw Chopin Airport, Poland

"[Arup's] quality of the work is such that we are unlikely to see other examples of this in Italy or in Europe […] These simulations much better than other contents available, demonstrates complex conditions; these simulations are direct and clear in showing that there are many assumptions; this is not just capex, its also procedures and ORAT; these materials are useful and relevant."

Aeroporti di Roma



Terminal 2 Expansion, Incheon International Airport, Seoul, Korea

Planning

Operational planning

A Concept of Operations (ConOps) is a strategic and tactical document that outlines the operational and logistics concept design from the end user's perspective. It defines the operation's characteristics, base specifications, and requirements for those involved in delivering and using the operation. The development of a CONOPS helps airports meet performance expectations by creating efficient supply chain and logistics solutions. These solutions guide operations while incorporating innovative, cost-effective approaches that yield positive social, financial, and sustainable outcomes.

ConOps can apply to new airport facilities or related buildings, as well as planned changes in existing, live operations. We facilitate early engagement with key stakeholders, including those using new terminal buildings or other operational spaces (such as control rooms or reconfigured passenger areas), to ensure the solution effectively meets end users' needs. Collaborative workshops play a crucial role in achieving agreement on design objectives. These workshops can range from high-level concept development discussions to focused design sessions that inform detailed planning. We work with clients to define Operating Principles, considering all user types, processes, systems/ technology, and people perspectives.

Operating Principles and a ConOps supports the development of the 'Basis of Design' and informs the development of more detailed operating procedures, and provides the basis for resource and training requirements. In addition to this it informs the development of Total Cost of Ownership, considering the whole life cycle costing, CAPEX, operating costs, projected renewals and asset replacements.

Selected projects

– Alaska Airlines, Seattle–Tacoma International Airport, USA

– Combined Baggage Control Room, Dubai International Airport, UAE

– Gold Coast Airport Concept of Operations and Operational Readiness, Queensland, Australia

– LAWA, Terminal 9 Concept Design, Los Angeles International Airport, USA

– New Istanbul Airport Operational Study for Tender, Turkey

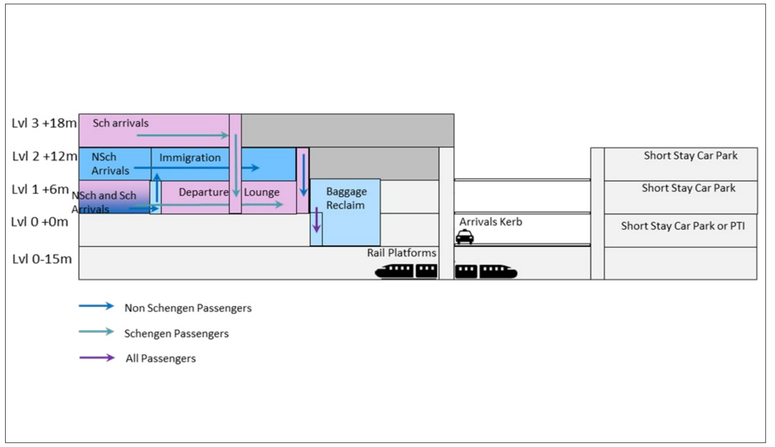
– Newcastle Airport Expansion, New South Wales, Australia

– Terminal 3, Phoenix Sky Harbor International Airport, USA

– Solidarity Transport Hub, Warsaw, Poland

– Western Sydney Airport, Australia

Development of a Concept of Operations in line with the outline airport masterplan is a fundamental piece of work that will influence effective design from the beginning and enable world class operation of the new facility.



Level changes for arriving passengers travelling to baggage reclaim
Click image to enlarge. Click enlarged to close.

Planning

Passenger terminal planning

Our integrated holistic approach provides a unique service to clients in the planning of airport passenger terminals. Passenger terminals are where airport performance is perhaps most visible and where the competing demands of passengers, airlines, the operator and a range of other stakeholders need to be properly addressed and effectively balanced.

We have an acute understanding of this balance and are particularly skilled at helping our clients define their overall strategic development objectives and their aspirations for passenger experience, operational efficiency, commercial performance and environmental and sustainability performance.

Our planning skills center on how capacity responds to demand, how passenger, baggage and vehicle flows are optimized, how the terminal interacts operationally with the airside and landside systems and how disruption to existing operations can be minimized.

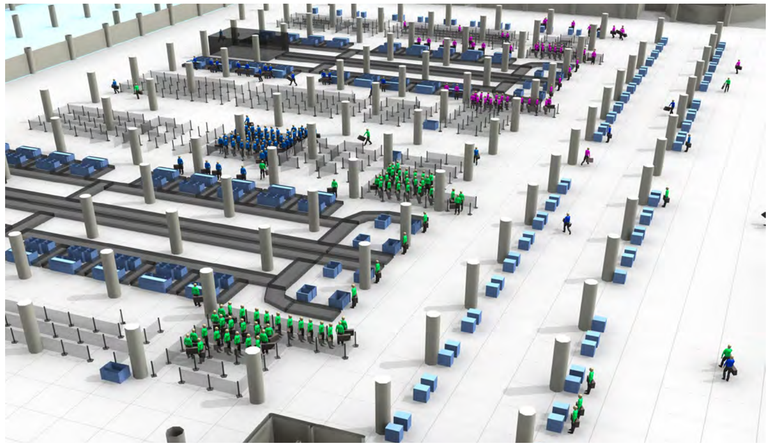
Our comprehensive planning expertise is complemented by our design capability, which covers the full range of services, including net zero terminal expansion and retrofit, to help us successfully deliver terminal projects tailored precisely to client needs.

Selected projects

– Copenhagen International Airport, Denmark
– Delta LAX Modernization Project, Los Angeles International Airport, USA
– Development Plan, Montréal-Trudeau International Airport, Canada
– JetBlue Terminal Development, JFK International Airport, New York, USA
– Melbourne Airport, Australia
– Midfield Terminal, OR Tambo International Airport, Johannesburg, South Africa
– New Lisbon Airport, Portugal
– New Terminal Development Plan, Toronto Pearson International Airport, Canada
– Q6 Strategy, London Heathrow Airport, UK
– Riga International Airport, Latvia
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Terminal 2, Dublin Airport, Ireland
– Terminal 4, JKF International Airport, New York, USA
– Terminal Core Redevelopment, Portland International Airport, USA
– Terminal Expansion, Venice International Airport, Italy
– Vienna International Airport, Austria
– Western Sydney Airport, Australia

“I can attest that Arup handled the demanding end-user needs and tight budget/schedule with success. They spend the necessary time to understand not only our standards but our desired as they relate to these projects and have exhibited the necessary nimbleness to respond to our shifting needs.”

Pierre St-Onge, Project Management Director, Aéroports de Montréal



Aéroports de Montréal, Pierre Elliot Trudeau Airport, Montréal, Canada

Planning

Security and risk

Our aviation security consulting service comprises a wide spectrum of skills that build on our broad airport, built environment and regulatory experience. We deliver risk-based solutions, which reflect a full understanding of aviation and operational security and the safety requirements of airports in a constantly changing regulatory environment. We provide strategic, design and operational services for regulators, individual operations, terminals and complete airports.

Arup boasts an extensive range of security specialists will work with you independently to understand your project in depth, your needs and your security requirements. The team at Arup includes some of the most experienced security professionals in the country including those trained by CPNI, with backgrounds from government, police and industry.

Our experts have the knowledge to tailor aviation security strategy based on ICAO, ECAC, TSA and individual authority standards and have extensive experience in embedding security culture and a management framework into organisations including the development of Security Management Systems (SeMS).

Our services include Personnel, Physical and Cyber Security consultancy, Blast Analysis, Hostile Vehicle Mitigation (HVM) assessments, Checkpoint modelling, Threat and Vulnerability Assessments (TVRA), and the development of Security Management Systems (SeMS), Security Principles of Design (SPoD) and Statement of Needs for Operational Requirements (OR).

Selected projects

– Zayed International Airport, Abu Dhabi, UAE
– Changi Airport Masterplan, Singapore
– Delta JFK-IAT Redevelopment, Terminal 4, JFK International Airport, New York, USA
– DGCA Safety and Security Review, Kuwait
– Federal Department of Infrastructure and Regional Development, Australia
– Heathrow Expansion, London Heathrow Airport, UK
– Istanbul New Airport, Türkiye
– JetBlue Terminal 5 and 5i, JFK International Airport, New York, USA
– Midfield Concourse Development, Hong Kong International Airport
– New International Arrivals Facility, Seattle-Tacoma International Airport, USA
– Solidary Transport Hub, Warsaw Airport Masterplan, Poland
– Terminal 2, Dublin Airport, Ireland
– Toronto Pearson International Airport, Canada

We recognise the need to develop a robust security framework to monitor, manage and record all aspects of security requirements, advice and implementation to provide full accountability and to meet the needs of both the client's security governance and the country's regulators.

Beijing Capital International Airport, China
© Frank P Palmer

Planning

Surface access

Surface access is a focal point of Arup's global expertise in aviation and transportation planning. We deliver analysis, strategies and designs that help airports to unlock landside capacity, enable growth within environmental limits, and enhance the travel experience of airport passengers, staff, and goods.

We are committed to facilitating sustainable journeys to and from airports across all modes and optimising the lifespan and efficiency of the landside infrastructure that supports surface access. The landside infrastructure forms the primary physical interface between the core aviation functions of the airport and the surrounding communities and commercial developments. The successful development of this infrastructure will ensure efficient and sustainable surface access, promote local economic development, and help to minimise the impact of airport operations on local communities.

Selected projects

– Delta JFK IAT Redevelopment, JFK International Airport, USA

– Delta Sky Way at LAX, Los Angeles International Airport, USA

– Forrestfield Airport Link, Perth Airport, Australia

– Greater Toronto Airports Authority,
Ground Transportation Center, Toronto, Canada

– Landside Infrastructure Feasibility, Melbourne Airport, Australia

– Landside Roadways, Newark Liberty
International Airport, New Jersey, USA

– London Gatwick Airport, UK

– London Heathrow Airport, UK

– Luton DART (Direct Air-Rail Transit), London Luton Airport, UK

– Masterplanning, Western Sydney Airport, Australia

– Solidarity Transport Hub, Warsaw Airport, Poland

"Arup worked collaboratively with us to deliver novel insights into our surface access operations by using modern data sources and cutting edge data science techniques."

Timothy Wells, Surface Access Travel & Policy Lead, Heathrow Airport Limited

Southern Rail Access to London Heathrow Airport, UK
©Adambro

Planning

Technology strategy and planning

Our Digital Design and Advisory practice offers consulting services to solve complex technology related challenges across the business and project lifecycle from strategy to design and into operations. We are uniquely placed through our strong domain knowledge in key market sectors and deep understanding of the aviation business, the physical and virtual environment in which it works and the technology trends and the challenges that exist.

Our independence allows us to look for the most appropriate technology solution from improving security, reliability, operational efficiency and the passenger experience to generating revenue and reducing whole lifecycle costs. Our global experience allows us to develop innovative technical design and management services through cross market and cross country lessons learnt and detailed knowledge of the most challenging problems facing the industry.

We understand that the deployment of a solution will only be successful if the business it is deployed in understands the benefits gained and is engaged and bought into the process. Our knowledge and skills in integrating the people who use the solutions, the processes they follow and the technology deployed in the physical or virtual environment sets us apart from many of our competitors.

Selected projects

– Changi Airport, Singapore

– Dubai International Airport, UAE

– Duschanbe Airport, Tajikistan

– Geneva Airport, Switzerland

– Hamad International Airport, Doha, Qatar

– London Heathrow Airport, UK

– Mumbai Terminal 2, India

– Muscat and Salah Airports, Oman

– National Air Traffic Services, UK

– Saudi Arabia Aviation IT

– Terminal 4, JFK International Airport, New York, USA

With its state-of-the-art integrated technology, and Arup's deeply integrated role with Delta, the new Terminal C brings the airport experience, operations and climate impact mitigation into the highest of 21st century standards, helping to define the future of air travel.

Delta Sky Way, LaGuardia Airport, New York, USA

Design and construction

ARUP

Design and construction

Acoustic design of airport facilities

We have experience in the acoustic design of airport facilities around the world. This includes the design of terminal buildings, control towers, transport interchanges, below and above ground rail facilities, workshops, visual control rooms, interview facilities and passenger lounge facilities.

Understanding the needs of the users is central to our acoustic design philosophy. This allows us to set realistic and pragmatic design criteria, which achieves appropriate acoustic control within budgetary and legislative constraints. We are world leaders in the field of auralization which allows clients to experience acoustic conditions during the design process. This allows an understanding of the acoustic issues first hand by listening in our specialist SoundLab facilities.

We deliver risk-based solutions, which reflect a full understanding of aviation and operational security and the safety requirements of airports, which respond to a dynamic regulatory and operational environment.

Selected projects

– Jewel Changi Airport, Singapore
– Baggage Reclaim Hall Expansion, Terminal 4, London Heathrow Airport, UK
– Delta JFK-IAT Redevelopment, Terminal 4, JFK International Airport, New York, USA
– Hong Kong International Airport
– Kansai International Airport, Osaka, Japan
– Kuwait International Airport Midfield Terminal
– Zayed International Airport, Abu Dhabi, UAE
– Noise Strategy and Management Plan, Auckland Airport, New Zealand
– Terminal 1, Manchester Airport, UK
– Terminal 2, Dublin Airport, Ireland
– Terminal 3, Beijing Capital International Airport, China
– Terminal 5 and Control Tower, London Heathrow Airport, UK
– Toronto Pearson International Airport, Canada
– Washington Dulles International Airport, USA
– Zurich Airport, Switzerland

At Jewel Changi Airport, we developed acoustic treatments that complemented the iconic design, studied waterfall mock-ups and predicted effects of noise from various sources on operations and activities within the space to enhance visitors' comfort and safety. Arup assisted in assessing sound levels of the Rain Vortex, including real-time measurements during mock-ups.

Jewel Changi Airport, Singapore

ARUP

Design and construction

Airfield ground lighting and aircraft parking aids

Our airfield ground lighting experts have worldwide experience in the assessment and design of airfield lighting systems for both civil and military airports. Through our international experience our designers are fully conversant with the National and International standards which govern the design of ground lighting systems for all airport types wherever located.

Aeronautical ground lighting is defined as ‘any light specially provided as an aid to air navigation, other than a light displayed on an aircraft’. The challenge is to meet the ever increasing aircraft speeds and the global increase in air traffic with secure and safe systems.

With integrated design and by developing analytical and simulation models, our experts meet these challenges by producing tailored designs for new airports or the upgrading of existing facilities so as to minimize disruption to the existing airport operations.

In cooperation with our civil, pavement and aircraft support engineering experts we also offer an integrated service for airside and aircraft stand infrastructure.

Selected projects

– Athens International Airport, Greece
– Birmingham International Airport, UK
– Edinburgh Airport Stand Lighting, UK
– High Intensity Approach Lighting, Sydney Airport, Australia
– Leeds Bradford International Airport, UK
– London Luton Airport, UK
– Runway Approach, RAF Scampton, UK
– Runway/Taxiway Rehabilitation work, Toronto Pearson International Airport, Canada
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Southside Apron Works, Newcastle International Airport, UK
– Taxiway lighting and control for Changi T5 Apron, Changi Airport, Singapore
– Taxiway Lighting, London Heathrow Airport, UK
– Taxiway and Stand Lighting, London Gatwick Airport, UK
– Taxiway works, RAF Marham, UK
– Terminal 2, Dublin Airport, Ireland
– Western Taxiway Repair, RAF Waddington, UK

Airfield lighting control systems have advanced to the point of being controlled through an Advanced Surface Movement Guidance System that enables routing, illuminated guidance, and GPS surveillance of the aircraft. Only lights for a short distance in front of the aircraft are illuminated and distinguished as the aircraft moves over them. Thereby optimizing taxi routes and reducing CO2.

Sydney Airport, Australia

ARUP

Design and construction

Building engineering – MEP

At Arup we understand how successful airports fundamentally operate and how to navigate the diverse complexities and competing issues that our clients face. We understand what it takes to design and deliver complex sustainable, scalable aviation projects of national importance. We have a deep appreciation of the importance of robust and best value MEP design and are experienced in conveying complex MEP strategies to the wide range of stakeholders involved in aviation projects.

We work closely with our clients to establish the optimum solutions for smooth building operation. Our broad range of in-house disciplines gives us an unrivalled insight into successful management of interfaces across systems such as Baggage handling, IT, Security & Operations, and future FM activities to facilitate seamless operational readiness.

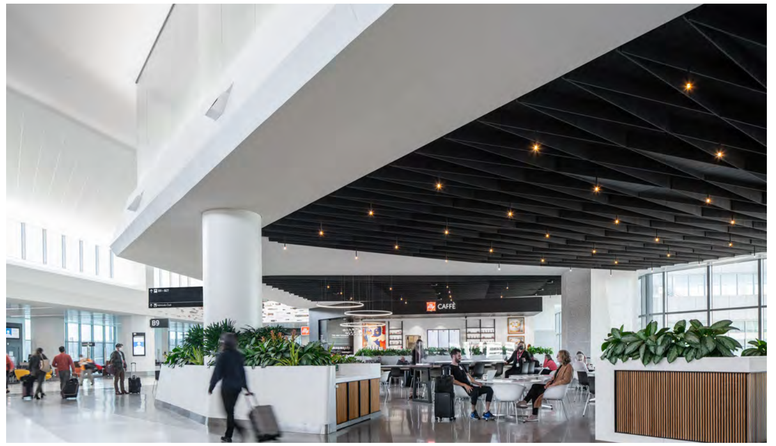
The optimum design of Mechanical, Electrical and Public Health (MEP) systems is fundamental to the successful operation of airport buildings, most especially in terms of low energy and reliable operation. However, they also need to be highly adaptable so that they can accommodate change and be readily maintainable within very short periods of downtime.

Sustainability is at the heart of everything we do, and we take pride in producing efficient and elegant designs which are futureproofed for expansion. With sustainability, decarbonisation, and circular economy principles in mind, we realise that the design and construction stage is only the early phase of an extended lifecycle, and we consider how these decisions can have a profound impact on performance and costs for the lifetime of the building and beyond.

Selected projects

– Changi Airport Group–Terminal 5 Master Building Consultancy, Singapore
– Delta JFK T4 Redevelopment Phase 3–Design, New York, USA
– Delta T2 and T3 Modernization, Los Angeles International Airport, USA
– GTAA Terminal 1–New Concourse and Processor Design Consultant Services, Toronto, Canada
– Heathrow–Terminal 5 Plus, London Heathrow Airport, UK
– Houston Airport System, United Airlines Terminal B, Houston, USA
– ITT T2 Connection, Changi Airport, Singapore
– JFK T4 Concourse Emirates Lounge and Retail Expansion, New York, USA
– Massport C to B Connector, Boston, USA
– Midfield Terminal Complex, Zayed International Airport, Abu Dhabi, UAE
– Seatac International Arrivals Facility, Seattle, USA
– SFO Terminal 1 Redevelopment, San Francisco, USA
– Terminal Area Plan, O'Hare International Airport, Chicago, USA
– Terminal 1 Redevelopment–Deconstruction, Newark Liberty International Airport, New Jersey, USA
– Terminal 2, Bangalore International Airport, India
– Terminal 3, Lhasa Gonggar Airport, Tibet
– Terminal 3, Taoyuan International Airport, Taiwan

From the start of the design, Arup identified two critical areas for reducing energy consumption: the heating and cooling systems, and the baggage handling system. Altogether, Harvey Milk Terminal 1's sustainable design measures helped to achieve over 40% energy savings, ultimately allowing Boarding Area B to achieve LEED v4/4.1 BD+C New Construction Platinum certification, the first airport terminal in the world to do so.



Harvey Milk Terminal 1, San Francisco International Airport, USA
© Jason O'Rear

ARUP

Future of aviation

Building performance and systems

Our experts advise airport operators on how to provide the best possible environment for the users of their buildings and facilities, by designing and improving operational efficiency of their building, plant and associated systems.

We achieve this through a soft landings process. Early design stage involvement ensures operational outcomes are clearly defined and checked throughout the design, construction and handover process. This is followed by a strategy to optimize building performance post project completion through aftercare, seasonal commissioning and Post Occupancy Evaluation; thereby maximizing the return on our client's investments.

We provide our clients with a complete multi-disciplinary service in a single team, including M&E, control systems, commissioning, facilities management, carbon consulting and occupant evaluation (health, wellbeing and productivity).

In existing facilities we carry out site-wide surveys, feasibility reports and implementation works, which offer clients a full solution for evaluation and improvement of their airport facilities.

Selected projects

– Controls Optimization and Energy Reduction, Terminal 3, London Heathrow Airport, UK

– HACTL Super Terminal 1, Hong Kong International Airport

– Terminal 2, Dublin Airport, Ireland

– Terminal 3, Beijing Capital International Airport, China

– Terminal 5, London Heathrow Airport, UK

Terminal 3 at Beijing Airport is also one of the world's more environmentally sustainable airport terminal buildings, designed to respond to Beijing's cold winters and hot summers. Its soaring, aerodynamic roof uses skylights to make the most of the sun's heat and light, bathing passengers in shades of red and gold as they move through the lofty building.

Terminal 3, Beijing Capital International Airport, China
© Zhou Ruogu Architecture Photography

ARUP

Design and construction

Civil engineering

Arup's strength is in the breadth of services it can provide. Arup can provide civil engineering support to assist the airport with any technically challenging or specialist work. This includes pavements, drainage, geometry, earthworks, AGL, utilities, signs/markings, expert witness, and design coordination.

Our highly capable and experienced team of engineers and specialists, all of whom are experts in their field and have a wealth of aviation experience and understand the complexities around working in an airside environment. We work closely with project stakeholders to ensure connectivity and visibility across all workstreams, interfaces and disciplines, as well as the safe planning and delivery of projects while minimising impact on airfield operations.

Our expertise spreads across all stages of a project, from inception to delivery on site. Our knowledge of design standards across the globe allows us to bring best international practice at a local level and identify opportunities for value engineering early in the design process.

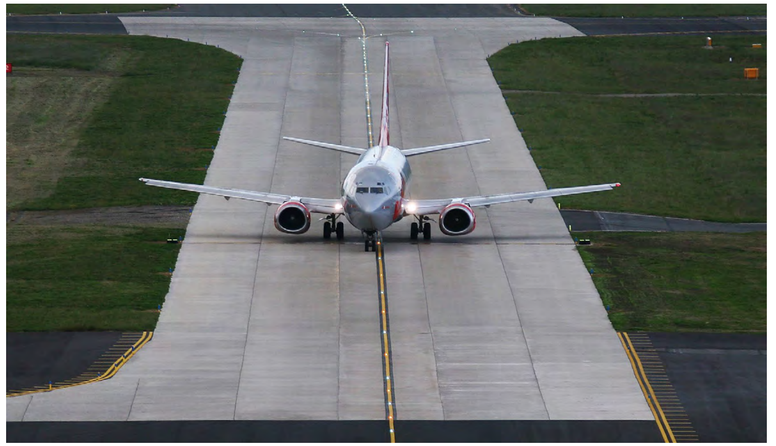
As part of the civil engineering input, Arup will provide sustainable design solutions, embracing Circular Economy to minimise both embodied carbon, material usage and waste impacts through considering re-use and recycling at every stage.

Arup can provide site support during construction works. This includes supporting the quality control process as well as commissioning of an asset.

Selected projects

– Billy Bishop Toronto City Airport, Canada
– Brisbane Airport, Australia
– Cancun International Airport, Mexico
– Changi Airport, Singapore
– Dublin Airport North Runway, Ireland
– Edinburgh International Airport, UK
– Exuma International Airport, Bahamas
– Glasgow Airport Taxiway Yankee, UK
– JFK International Airport, New York, USA
– Leeds Bradford International Airport, UK
– London City Airport, UK
– London Gatwick Airport Pier 1, UK
– London Luton Airport, UK
– RAF Scampton, Marham and Waddington, UK
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Terminal 4, London Heathrow Airport, UK
– Toronto Pearson International Airport, Canada
– Wick Airport, UK
– Zagreb International Airport, Croatia

Arup draw on in-depth knowledge and experience of airport infrastructure, to deliver value for money for clients. On every project, Arup seek to deliver robust, resilient, and integrated designs, bringing an innovative approach to project delivery by utilising modern construction delivery tools and techniques.



Leeds Bradford International Airport, UK

Design and construction

Design team leadership

The design of airport facilities requires the intellectual input and integration of many distinct planning and design disciplines and technical specialists. With our breadth of aviation experience and capability, together with our inherent multidisciplinary design approach, we are well suited to take on the design team leadership role for airport projects.

Our design team leaders direct, channel and focus the creative force of all design disciplines to successfully deliver the project. We act as lead consultant, taking projects from inception to completion. We employ sub-consultants to work with us and to deliver integrated design solutions; key to this is creating a synergetic design team where all disciplines work together, shoulder-to-shoulder.

While the design team leader role does not take away from the individual designers' responsibility to create and document the design, it does provide oversight, leadership and a point of focus for the wider team and the client. The role allows for big picture knowledge and awareness across the full length and breadth of disciplines involved in a project, as well as the ability to drill down to specific challenges and pull in different disciplines to define options and create solutions.

Effective design team leadership is intrinsic to the successful delivery of complex airport projects, from inception through to completion.

Selected projects

– Delta Sky Way, Terminals 2 and 3, Los Angeles International Airport, USA
– Delta Terminal 4 Redevelopment Phases 1, 2, 2.5, and 3, JFK International Airport, New York, USA
– Development Strategy, London Heathrow Airport, UK
– Istanbul New Airport, Türkiye
– JetBlue Terminal 5, JFK International Airport, New York, USA
– Midfield Terminal, OR Tambo International Airport, Johannesburg, South Africa
– Q6 Program Design, London Heathrow Airport, UK
– Terminal 2, Dublin Airport, Ireland
– Terminal 4 IAT redevelopment, expansion, and transformation, JFK International Airport, New York, USA
– Terminal 5, London Heathrow Airport, UK

Arup utilize a wide breadth of aviation experience and capability to provide design team leadership on complex airport projects.

This role provides oversight, leadership and a focal point for both the design team and the client, allowing for challenges to be addressed holistically and creative solutions brought to the forefront of design excellence.

JetBlue Terminal 5, JFK International Airport, New York, USA
© Nic Lehoux/Gensler

Design and construction

Fire safety

Our international team of specialists have provided fire safety consulting on a global basis for over 30 years. We uniquely understand design, construction, operational readiness, handover and operation.

The adoption of traditional prescriptive design measures to airport facilities, given their scale and functional design requirements, can be prohibitive in terms of aesthetic flair, innovation, cost and operational constraints. Airport terminals need a holistic fire engineering strategy that facilitates security requirements, passenger segregation and business continuity measures while maintaining acceptable levels of life safety.

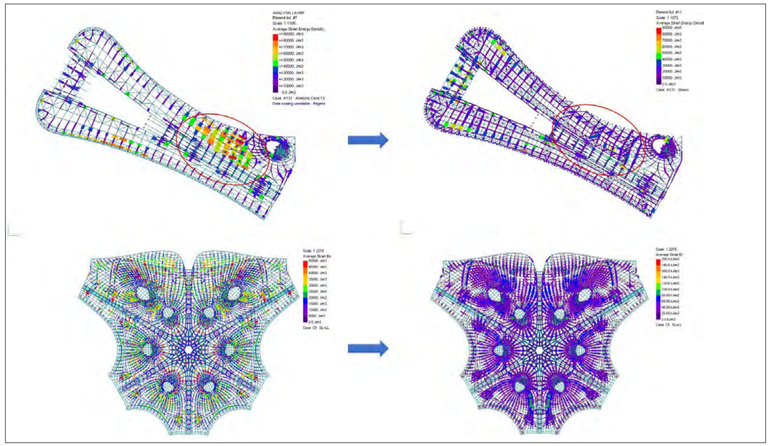
Our integrated project design teams use advanced analytical and simulation techniques, balanced with practical understanding of user experience, local codes and requirements, to develop innovative fire safety solutions. We achieve functional and architectural objectives while significantly reducing capital costs, lowering business and operational risks and improving life safety and security.

Communication and liaison between operational and design teams is fundamental to ensuring the design responds to specific operational needs. This engagement should occur at inception, through design, construction and handover.

Selected projects

– Barcelona International Airport, Spain
– Beijing Daxing International Airport, China
– Dallas Fort Worth International Airport, USA
– Delta JFK-IAT Redevelopment, Terminal 4, JFK International Airport, New York, USA
– Domestic Terminal Expansion, Brisbane Airport, Australia
– Fire strategy and statutory approvals, Zayed International Airport, Abu Dhabi, UAE
– HACTL Cargo Handling Facility, Hong Kong International Airport
– Hong Kong International Airport
– King Abdulaziz International Airport, Jeddah, Saudi Arabia
– Kuala Lumpur International Airport, Selangor, Malaysia
– Kunming Xiaoshao International Airport, China
– Phase 2, Pudong International Airport, Shanghai, China
– Rajiv Gandhi International Airport, Hyderabad, India
– Schiphol Airport, Amsterdam, Netherlands
– Terminal 1 Arrivals and Departures Extension, Perth Airport, Australia
– Terminal 2, Dublin Airport, Ireland
– Terminal 3, Beijing Capital International Airport, China
– Terminal 3, Shenzhen Bao'an International Airport, China
– Terminal 5, London Heathrow Airport, UK

At Beijing Daxing International Airport Arup's fire engineers took a performance-based design approach and adopted a series of fire protection strategies, including smoke curtains, fire shutters and fire separation bands to prevent the spread of fire and smoke from one fire control zone to another, replacing traditional solid walls that affect passenger circulation. High risk areas are fully contained with fire resistant construction.



Fire Engineering, Beijing Daxing International Airport, China

ARUP

Design and construction

Lighting

In skilled hands, lighting becomes the fourth dimension of architecture, integrating and enhancing passenger experience. We offer a comprehensive lighting design service, from initial strategic advice and concept development through to construction documents, on-site support and procurement advisory services for all markets worldwide.

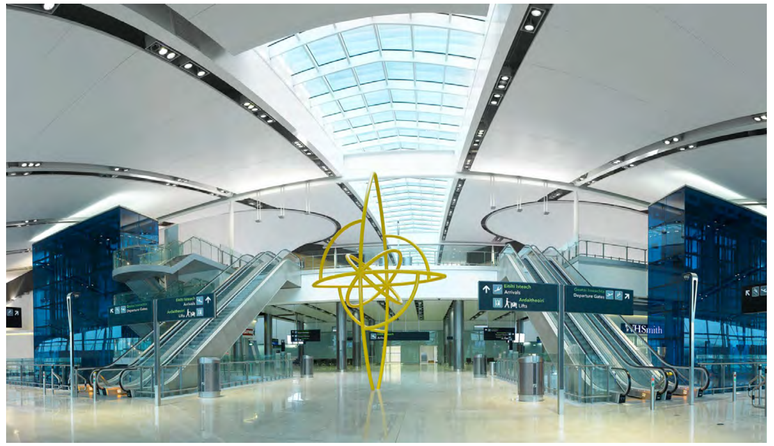
The creation of authentic, memorable experiences through light can be the most powerful and cost-effective tool to establish a top position in the passengers' mindset. Lighting defines the experience and environment through which the staff and passengers will move, whether they are at the start or the end of their journey, passing through retail areas, or going to work.

Engaging our strategic lighting approach prior to any airport expansion or refurbishment program ensures a sustainable outcome. Our designers have extensive skills and experience in providing an integrated daylight and architectural lighting solutions that ensure visual comfort for passengers and airport operation staff, as well as complying to environmental requirements while in keeping with the architectural vision of the terminal and its interiors.

Selected projects

– Beijing Capital International Airport, China
– Edinburgh Airport, UK
– Heydar Aliyev International Airport, Baku, Azerbaijan
– Kansai International Airport Terminal Building, Osaka, Japan
– Midfield Terminal Building, Zayed International Airport, Abu Dhabi, UAE
– Midfield Terminal Complex, Hong Kong International Airport
– Northern Runway, London Gatwick Airport, UK
– Raleigh-Durham Airport Terminal C, North Carolina, USA
– Sabiha Gökçen International Airport, Istanbul, Türkiye
– Sacramento International Airport, California, USA
– Terminal 4, JFK International Airport, New York, USA
– Taoyuan International Airport, Taiwan
– Terminal 2, Kuwait International Airport
– Terminal 2, Dublin Airport, Ireland
– Terminal 4, Adolfo Suárez Madrid-Barajas Airport, Spain

Arup designed and developed a unique high-performance LED downlight with super low glare optics for the Hong Kong International Airport Midfield Concourse project. It was developed to meet the specific requirements within the client brief, a result of our unique combination of creativity, technical knowledge, and product design know how.



Dublin Airport, Ireland
© Ian Bruce Photography

Design and construction

Passenger processing systems

Now more than ever, our clients seek solutions to enhance the processes and provide a quick and efficiency journey to improve customer experience. In many cases the challenges are focused on the introduction of new passenger processing procedures designed to cut queuing time and increase passengers time to enjoy the commercial areas. Our airport specialists have significant expertise in assessing how changes in passenger processing impact the business operations of airports, airlines and control authorities and how new technologies best support these process changes.

We support our clients in understanding different passenger profiles, their needs and challenges while travelling. We adopt a holistic view by considering the needs and requirements of staff as their interactions with technology also impact passengers processing. We work with our clients to determine how passenger facing technology can be used to maximize non-aeronautical revenues and ease passenger stress to improve their experience.

We understand the challenges faced by airport operators, airlines and control authorities regarding the use of new technologies throughout the passenger journey and are able to respond to these with real experience from some of the world's leading airports.

Selected projects

– Dubai World Central, Al Maktoum International Airport, UAE

– Hamad International Airport, Doha, Qatar

– JetBlue Terminal 5, JFK International Airport, New York, USA

– London Heathrow Airport, UK

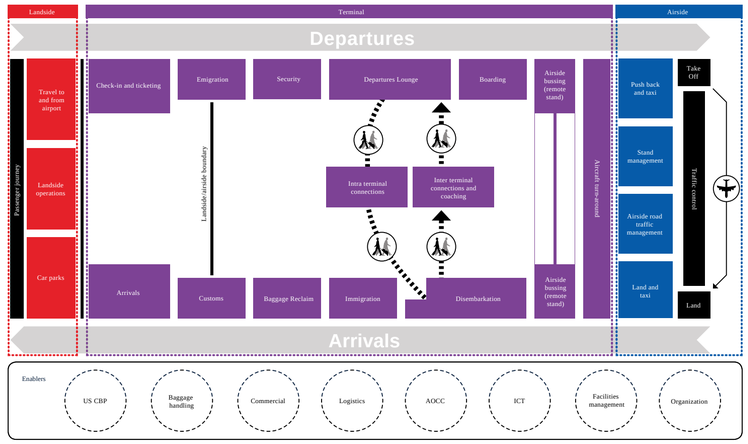
– Terminal 2, Dublin Airport, Ireland

– Terminal 3, McCarran International Airport, Las Vegas, USA

– Terminal 5, London Heathrow Airport, UK

– Toronto Pearson International Airport, Canada

Arup has developed Human Factors Framework for analysis of security operation. We provide innovative analysis of assets that considers not only the physical layout but the holistic interactions of people, technology and equipment. Clients can use the outputs to target resources accordingly to deliver cost-effective solutions.



Airport process diagram
Click image to enlarge. Click enlarged to close.

ARUP

Design and construction

Program and project management

We provide a full lifecycle range of program and project management services for capital development, asset management, due-diligence and business transformation within the aviation sector.

We have cross sector experience of managing complex programs along with in-depth aviation sector knowledge. This combination helps our clients to implement and activate airport projects innovatively and safely–to budget, on schedule and to a high standard –without disruption to operations. Program and project management teams can also harness other areas of expertise within Arup to maximise project benefits and outcomesvin noise, sustainability and carbon reduction as well as engineering and operational disciplines, for example.

Our aviation project management experience includes refurbishment of live facilities, development of new terminals and infrastructure, airline relocations, operational readiness, masterplan capital expenditure advice and business restructuring.

Selected projects

– Airline Relocation Program, London Heathrow Airport, UK
– Belfast Airport, UK
– Birmingham International Airport, UK
– Bristol Airport, UK
– Bologna Guglielmo Marconi Airport, Italy
– Istanbul New Airport, Türkiye
– JetBlue Terminal 5, JFK International Airport, New York, USA
– OR Tambo International Airport, Johannesburg, South Africa
– Q6 Baggage Program, London Heathrow Airport, UK
– Q6 Passenger Experience Program, London Heathrow Airport, UK
– Terminal 2, Dublin Airport, Ireland
– Terminal 2 ORAT, London Heathrow Airport, UK

Working closely with Heathrow we developed and implemented a comprehensive, automated requirements and assumptions management process to inform and refine early scope designs. This included all stakeholder groups' views, including airlines, and allowed for significantly faster and simpler project delivery and governance at later project stages.

Dublin Airport, Ireland
© Ian Bruce Photography

Design and construction

Stakeholder engagement

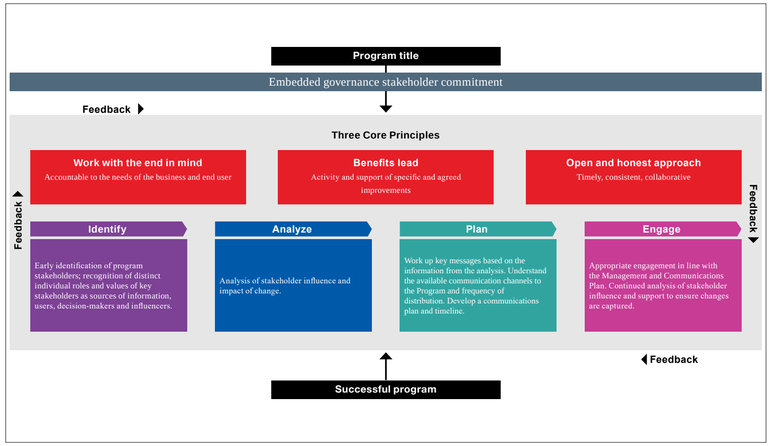
Effective stakeholder engagement is crucial for the success of any complex program or project. Without it, there can be no common agreement, ownership or support so there is real benefit in knowing that everyone involved in or impacted by an airport or terminal development is being represented at all stages.

We understand the complexity of stakeholders within an airport community and recognize the importance of identifying and engaging them early in a collaborative and cooperative relationship. With their needs established from the outset and aligned with business objectives, the net benefits include more effective and lasting decision making; greater mitigation of risk; alignment and motivation of all parties involved; and on time delivery of project goals. This also makes it much easier to identify and overcome challenges and adapt to opportunities related to the vision and goals of the project as and when they arise.

Selected projects

– Chhatrapati Shivaji International Airport, Mumbai, India
– Dublin Airport, Ireland
– Generation 2 Second Runway Project EIA, London Stansted Airport, UK
– Istanbul New Airport, Türkiye
– London Heathrow Airport, UK
– PANYNJ EWR Vision Plan, Newark Liberty International Airport, New Jersey, USA

Participation by all stakeholders involved in, or affected by, an airport or terminal development at all stages of delivery offers real benefits. Arup identifies and engages stakeholders early to ensure that needs are established from inception.



Stakeholder engagement process
Click image to enlarge. Click enlarged to close.

Design and construction

Structural engineering

Arup structural engineers are proud to be involved in many of the great airport buildings of today. These projects benefit from our skill and knowledge, from our collaborative problem solving and from the collective experience of our many colleagues across the globe.

Our engineers are motivated by the need to bring delight to the travelling public and to bring efficiency and profitability to the airport operator team through our contribution the building design.

We know that the construction process must be deliverable and reliable so we tailor our designs to suit construction processes available to the site team.

We are acutely aware of cost. A successful project is one that is inexpensive to deliver.

We are passionate about minimising the embodied carbon impact of the buildings we design. Smart structural design can have a major impact on the amount of steel and concrete used, and thus on the greenhouse gas emissions during manufacture and construction.

Most of all, however, our structural engineers love to work collaboratively with the project team, shaping a better airport building together.

Selected projects

– Control Tower, Chhatrapati Shivaji Maharaj International Airport, Mumbai, India

– Direct Air Rail Transport, London Luton Airport, UK

– Harvey Milk Terminal 1, San Francisco International Airport, USA

– Long Thanh International Airport terminal, Vietnam

– Mactan-Cebu International Airport, Philippines

– Midfield terminal, Zayed International Airport, Abu Dhabi, UAE

– New Terminal C, LaGuardia Airport, New York, USA

– Roof steel optimisation, Beijing New International Airport, China

– Terminal 2, Kuwait International Airport, Kuwait.

– Terminal 2, Dublin Airport, Ireland

– Visual Control Tower, Dublin Airport, Ireland

– Terminal 3, Kotoka International Airport, Accra, Ghana

– Terminal 3, Lhasa Gonggar Airport, Tibet

– Terminal 3, Taoyuan International Airport, Taiwan

– Terminal 5 and Air traffic Control Tower, London Heathrow Airport, UK

– Terminal 5, Changi Airport, Singapore

– Terminal Redevelopment, George Bush Intercontinental Airport, Houston, USA

The structural timber roof of the new Terminal 2 at Mactan Cebu Airport exudes a spatial elegance and earthy material warmth so unlike most other international airports. The Philippines is one of the world's major earthquake zones, and the roof must withstand typhoon winds of up to 200kph, even so, it is one of the largest supporting structures in the world made entirely from glue laminated timber. This not only gives it a delightfully low embodied carbon impact, but it was also less costly than the initial steel roof design.

Terminal 2, Mactan Cebu Airport, Philippines
© Marcel Lam Photography

ARUP

Design and construction

User centered design

User Centered Design is a holistic design approach rooted in collaboration, innovation, and empathy. It brings the people lens to the core of the design process with the aim of elevating the human experience of the entire airport community while addressing the project's strategic goals. We do this by gaining a thorough understanding of people's needs and expectations, we think end-to-end considering the full arc of the user journey and develop designs for a multiplicity of front of house and back of house diverse audiences.

By looking at the interactions between people, places and technology we help clients understand people, frame new strategies and create meaningful and integrated experiences for their users. Ultimately, user centered design is about bringing in empathy to understanding how human emotions impact the quality of experience which shapes the outcomes of our design work. This includes everything from processes and procedures to terminal design and communications. It reflects a hospitality mindset with a welcoming and caring attitude to strive to constantly improve the overall experience. The core methodology is an evidence-based and iterative ideation process including robust user research, co-creation approaches with project stakeholders and piloting of ideas before implementation.

Planning strategically to deliver integrated enhanced experiences in airports helps organisations thrive as industry leaders and build competitive advantage with the opportunity to be ranked by SKYTRAX or ACI. Infrastructure improvements and technocentric approaches alone will not guarantee an iconic experience if human needs are not addressed, while building an actionable understanding of the users will provide an essential basis for designing places that are desirable and well used.

Selected projects

– London Gatwick Airport, UK

– London Heathrow Airport, UK

– Toronto Pearson International Airport, Canada

"How might we shift from exploring airport elements of in isolated working groups to a unified vision of what STH will actually 'feel' like with customer needs central to all decisions?"

Solidary Transport Hub Client Challenge

Human centered design

Click image to enlarge. Click enlarged to close.

Design and construction

Wayfinding and signage

Our wayfinding services form an integral part of the ‘airport experience’ adapting to the architectural environment and contributing towards providing a positive impression of the airport, enhancing the passenger experience, and improving both operational efficiency and commercial opportunities. Our integrated team specializes in wayfinding and signage systems for complex environments, where a large number of people circulate.

We take a holistic and user-centric approach to ensure that the wayfinding systems are intuitive and meet the needs of various types of users including passengers and operators in most efficient and effective way. We have global experience in the design of both fixed and dynamic signage systems for large multi-modal transport interchanges, providing specialist design services tailored to meet the stringent demands of these complex passenger terminals. We create wayfinding strategies to support overall concept of operations for the new facilities.

Our innovative use of 3D modeling technologies during the design process allows a scheme to be rigorously tested while plans are still ‘on the drawing board.’ This approach dramatically improves design coordination, minimizes expensive and time consuming iterative design change and provides confidence for the client that any proposed design will work in practice.

Selected projects

– Design Manual, Copenhagen Metro, Cityringen, Denmark

– Design Manual, Deployment Schedule and 3D Maps, Aeroporto Leonardo da Vinci, Fiumicino, Rome, Italy

– Design Manual, Dublin Airport, Ireland

– Design Manual, Hong Kong International Airport

– Flight Information Display Screen Review, London Heathrow Airport

– Schiphol Airport Amsterdam, Netherlands

Arup conducted the feasibility study and proposed changes to Flight Information Displays Enhancements (FIDs) in Heathrow Terminal 4. Drawing upon skills such as cognitive psychology and physical signage design, we developed recommendations to improve wayfinding, signage, visibility of FIDs, and overall customer experience.

Dublin Airport, Ireland
© Ian Bruce Photography

Operations and management

ARUP

Operations and management

Airport logistics

Airports are unique environments capable of generating goods-in and waste out volumes like small cities, which need to seamlessly integrate with the flow of passengers. The diverse network of businesses include retail, food & beverage, office, hotel, cleaning & maintenance, cargo, catering, MRO and public services.

We possess one of the largest and most experienced airport facilities planning, design and logistics practices in the world. The movement of goods, materials and equipment within and around the passenger terminal is fundamental to effective terminal operations and to the passenger experience. We develop efficient and effective logistics strategies for retail, servicing, trolleys and ground support equipment, which inform the planning, design and operation of airport infrastructure.

We provide a sustainable goods in and waste out logistics design, analysis and optimisation for existing and future airports. Early involvement in design stages ensures optimised logistics operations, enhanced efficiency, resilience and growth strategies and increases opportunities for carbon reduction.

Selected projects

– Zayed International Airport, Abu Dhabi, UAE
– Beijing Capital International Airport, China
– Cargo Handling and security, Rome Airport, Italy
– Changi Airport, Singapore
– Consolidation Center Study, Montréal-Trudeau International Airport, Canada
– Dublin Airport, Ireland
– Istanbul New Airport, Türkiye
– Kuwait International Airport
– London Heathrow Airport, UK
– New Lisbon International Airport, Portugal
– New Terminal Logistics Strategy, JFK International Airport, New York, USA
– Perth Airport, Australia
– Solidarity Transport Hub, Warsaw, Poland

Arup is a leading provider of sustainable logistics solutions for airports. We have the experience and expertise to help you design, build, and operate efficient and effective logistics systems that support the safe and timely movement of goods, materials, and equipment. We offer a comprehensive range of services, from design and engineering to construction and commissioning, and we are committed to providing innovative and sustainable solutions.

JFK International Airport, New York, USA
© Eduard Heuber

ARUP

Operations and management

Asset management

As a trusted adviser and respected provider of aviation design services, our service portfolio includes strategic asset management consulting. Our specialists propose robust and reliable asset management solutions essential for long-term business stability, preservation and resilience. Whole life considerations of critical assets will ensure they meet the needs of the business and be capable of leaving a lasting legacy.

We advise on line of site from organizational objectives and business drivers, through to priorities for capital expenditure, operations and maintenance. We provide tailored rewards and enhancement programs with the aim of optimizing the performance of aviation assets.

We engage with specialist sub-consultants and through effective integration and team working, we have a proven commitment to deliver the best product possible for our clients.

Arup has developed global capability in asset management to help our clients achieve organisational goals. We provide either individual or integrated services to meet the business needs.

Selected projects

– Brisbane Airport, Australia

– Brize Norton, UK

– Dubai World Central, Al Maktoum International Airport, UAE

– London Heathrow Airport, UK

– Los Angeles International Airport, USA

– Terminal 2, Dublin Airport, Ireland

We assist our clients to make informed decisions in line with their business objectives, linking the top-level drivers with Asset Management activities as they are carried out on the ground. This “line of sight” enables the management of assets to be optimised over the entire asset life cycle based on informed decisions and to ensure the tools are in place to implement these decisions–all within a strategic business framework and best practice asset management principles.

Terminal 5, London Heathrow Airport, UK

Operations and management

Leadership and team development

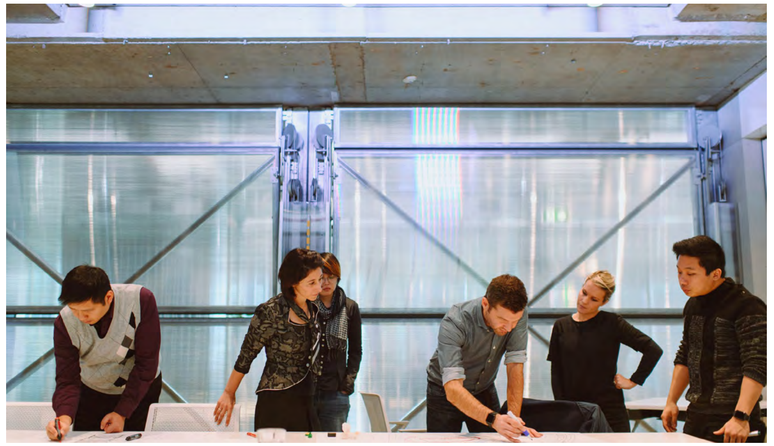
Leadership is a key determinant of organizational performance and managing change. Investing in developing effective leaders results in financial success and widespread improvements in morale and motivation. Effective leadership is pivotal for communicating business vision, improving safety culture, working with diverse stakeholder groups, enabling key decision-making, mapping strategic benefits, and navigating through political sensitivities.

Our approach focuses on a leader's sense of meaning and identity as the key source from which they operate. Our chartered occupational psychologists design world-class leadership programs that take leaders on a journey of discovery, delivering a more profound impact than merely providing tools and techniques. We seek to understand the context in which leaders work and equip them with the relevant skills and strategies to reach their full potential at an individual, team, organization and system-wide level.

Selected projects

– Dubai Airports, UAE
– General Medical Council, UK
– London Heathrow Airport, UK
– National Health Service, UK
– Terminal 2, Dublin Airport, Ireland

Typically, a new airport or terminal will have around 30 to 50 new systems which presents a significant challenge. Arup provides a comprehensive set of services to ensure the organisation, and the individuals within it, are completely familiar with these by Airport Opening Day.



Designers at Work, Sydney, Australia

ARUP

Operations and management

Operational performance improvement

Detailed, holistic understanding of a business is essential to successful, sustained performance improvement. This embraces each component of an organization's operations, physical assets and culture. Our operations consultants ensure that these components work together to support organizational goals.

We provide operations consulting services to support airlines and airport operators in the planning, implementation and ongoing improvement of their business operations. We help our clients to establish and deliver sustainable business improvement through a combination of specific aviation sector experience in operations management and performance improvement with wider cross-industry expertise of best practice for operations strategy and change management.

Our operations consulting expertise complements the wider Arup activities in planning and implementation of airport infrastructure and technical systems.

Selected projects

– Terminal 2, Chhatrapati Shivaji International Airport, Mumbai, India

– Terminal 2, Dublin Airport, Ireland

– Terminal 2, London Heathrow Airport, UK

– Terminal 3, Dubai International Airport, UAE

The operational demands of Terminal 2 were such that several innovative and novel concepts had to be developed to facilitate a robust and secure working environment. The master plan for Terminal 2 established high level design aspirations and principles with the aim of delivering visual coherence and establishing the most effective use of all the facilities for passengers and staff alike and delivering a high quality environment that respects and elevates the public realm.

Terminal 2, Dublin Airport, Ireland

Operations and management

Operational readiness, activation and transition (ORAT)

Airports are under increasing pressures to enhance passenger, visitor and staff experience; become operationally more efficient and effective; generate revenues from technology services; effectively integrate technology into capital programs; successfully bring terminals and airports into operation; and provide sustainable technology solutions. The process of taking a new building and turning it into a fully functioning airport from day one needs to be carefully and sensitively managed.

Achieving success in these projects relies on meticulous planning, coordination, and a deep understanding of the essentials involved. Operational Readiness, Activation, and Transition (ORAT) is pivotal to ensuring a seamless transition from design to full-scale operations. Traditionally, ORAT was seen as a process to be initiated closer to the opening date, focusing on fine tuning systems and staff training. However, a paradigm shift is underway, one that acknowledges the importance of starting ORAT early in as the design phase. Although ORAT requires a number of familiar elements–such as stakeholder engagement, change management and governance–the way in which these interact during an airport or terminal opening is completely unique and can pose a significant challenge.

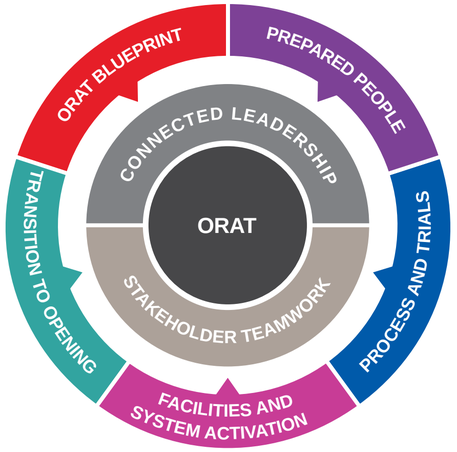
We combine our understanding of the built environment, with the operational needs of an airport, our in depth technical knowledge and our people and process specialists to provide a globally experienced team that mitigates client risk to provide a successful opening day of a new facility.

Selected projects

– Aéroports de Montréal, Canada
– Delta Air Lines, Los Angeles International Airport, USA
– Houston Airport System, United Airlines Terminal B, Houston, USA
– JetBlue Terminal 5 and 5i, JFK International Airport, New York, USA
– JFK International Airport, New York, USA
– LaGuardia Airport, New York, USA
– Luton, St. Martin
– PDXNext Western Expansion, Portland International Airport, USA
– Portland International Airport, USA
– Port of Portland and Landside Program, Portland International Airport, USA
– Southern Terminal Expansion, Gold Coast Airport, Australia
– Terminal 2, Chhatrapati Shivaji International Airport, Mumbai, India
– Terminal 2, London Heathrow Airport, UK
– Terminal 2, Perth Airport, Australia
– Terminal 1 Domestic, Perth Airport, Australia
– Terminal 3, Dubai International Airport, UAE
– Terminal Redevelopment Program, George Bush Intercontinental Airport, Houston, USA
– Toronto Pearson International Airport, Canada

"Arup continues to deliver exceptional service for Delta–now in the field of operational readiness–by providing the organization, attention to detail and professionalism necessary to coordinate with both the construction and the operations teams to ensure a successful transition from construction of the first new LaGuardia concourse into an operational environment."

Ryan Marzullo, Managing Director of New York Design and Construction, Delta Air Lines



ORAT Wheel

Operations and management

Organizational design

We use a human-centered approach to define, design, build and test a future state organization that align capabilities, organization structures, roles and responsibilities. Our practical and collaborative operating model and organizational design approach is focused on co-designing and developing fit-for-purpose operating models and organizational structures to deliver on strategic and operational objectives.

Using our proven framework and methodology we co-define, design and develop a blueprint for how client organizations should operate across a number of layers to maximize clarity, purpose, accountability, direction and internal consistency. We further equip organizations to effectively deliver strategy through their people by developing organizational design that is fit for the future and unique to their context.

We support clients across a range of strategic imperatives, increasingly this has included driving sustainability and decarbonization outcomes through a review of organizational readiness to deliver the desired change. We apply the same approach and human-centered design principles to our tailored sustainability readiness framework, the ‘SustainAbility Accelerator’. We review and enhance the current operating model and organization so that sustainability is integrated across all levels of decision making. This enables the development of a robust organizational design that fits with the airports wider operating model and delivers the target strategy for a high performing organization.

Selected projects

– Chhatrapati Shivaji International Airport, Mumbai, India

– Dubai Airports, UAE

– London Heathrow Airport, UK

As part of this engagement our team are providing assurance of data sets, developing a series of trajectories for future risk appraisal and undertaking cost benefit analyses of various mitigation interventions. The suite of interventions target the airport’s scope 1, 2 and 3 emission streams an are phased to support delivery of a science based decarbonisation trajectory.

Five Strategic challenges

Our work responds to five strategic challenges in the built environment.
Click image to enlarge. Click enlarged to close.

ARUP

Operations and management

Transformational change and change management

Change is inevitable. Organizations are required to continually transform, adapt and be agile in increasingly competitive market conditions. What lies at the heart of successful, sustainable change is a fundamental shift in people's attitudes and behaviors. We believe that change in any area is best managed, implemented and sustained through people. We support our clients to proactively manage every aspect of transformation, from articulating a vision for the future and then putting the right foundations in place to mitigate risk and plan, deliver and embed lasting and sustainable change.

Our change management experts and organizational psychologists work in partnership with clients to understand the business drivers, and to ensure that people are aligned with the strategy and direction of the organization, work collaboratively, engage effectively with stakeholders and deliver authentic and compelling communication to facilitate change.

We adopt a holistic approach to change which combines a deep understanding of client needs and aspirations, the change process and the range of 'levers' that can be pulled to support organizations, teams and individuals to deliver pragmatic yet sustainable results. Our approach is underpinned by engagement and co-creation; 'winning hearts and minds' and has three key stages: Defining the future vision 'to be' and assessing the 'as is' state; developing a bespoke plan to bridge the gaps; and engaging stakeholders to lead, own and embed change.

Selected projects

– Chhatrapati Shivaji International Airport, Mumbai, India
– Delta Airlines, LaGuardia Airport, New York, USA
– Dubai Airports, UAE
– T2 Operational Readiness, Activation and Transition, Mumbai Airport, India
– T2 Operational Readiness & Airport Transition, London Heathrow Airport, UK
– T4 Departures Transformation, JFK International Airport, New York, USA

Arup led the entire operational readiness, activation and transition (ORAT) process at Mumbai Airport's new Terminal 2. Training and familiarisation ensured all staff knew where to go, what to do and how things work. And trials demonstrated that the people, processes, facilities and systems were ready for live operations.

T2, Mumbai International Airport, India

Future of aviation

Future of aviation

Advanced air mobility

Arup offers a wide range of services covering the whole lifecycle of AAM projects that can respond to the challenges in this emerging aviation sector.

Our international presence enables us to apply our global expertise to meet the local requirements of projects of any scale ranging from vertiport designs to targeted acoustic studies. We have been involved in aviation development for more than 70 years, with experience gained through a wide range of assignments at more than 100 airports and heliports worldwide. Our integrated planning services help architects, planners and urban designers develop more accessible, sustainable, efficient cities. Our integrated approach puts people first and guides decision making to optimize human experiences in our projects. Our extensive experience in aviation and integrated planning across multiple engineering and specialist disciplines directly translates to the AAM market.

We provide the following services for AAM projects: Vertiport siting and planning, vertiport building design, new construction or retrofit of existing buildings, noise exposure analyses, UAM integration into the overall transport network, community acceptance strategies, regulatory strategies, threat, vulnerability and risk assessments (TVRA) for facilities relating to UAS, planning and design of Counter UAS (C-UAS) systems for greenfield solutions and adding capability to existing security infrastructure, auralizations for stakeholder and community engagement, and assessment of wind conditions.

Selected projects

– Auralizing future flight, Acoustics

– Aviation and UAM/UAS Optioneering noise analysis tools, Acoustics

– Urban-Air Port, Coventry, UK

– Hospital helipad at the new National Pediatric Hospital Dublin, Ireland

– ICAO Aviation study, Acoustics

– Los Angeles Department of Transportation– Urban air mobility policy framework, Los Angeles, USA

– Matternet drone station, Switzerland

– NASA UAM Human response study framework

– NASA Urban Mobility Noise Working Group, Research and Thought Leadership

– Roter downwash and aeronautics

– “Sky Tower” vertiport concept design Uber Elevate Summit, 2018 & 2019

– Sounds of the future city Cooper Hewitt, Smithsonian Design Museum, New York, USA

– Stakeholder engagement through auralization, Acoustics

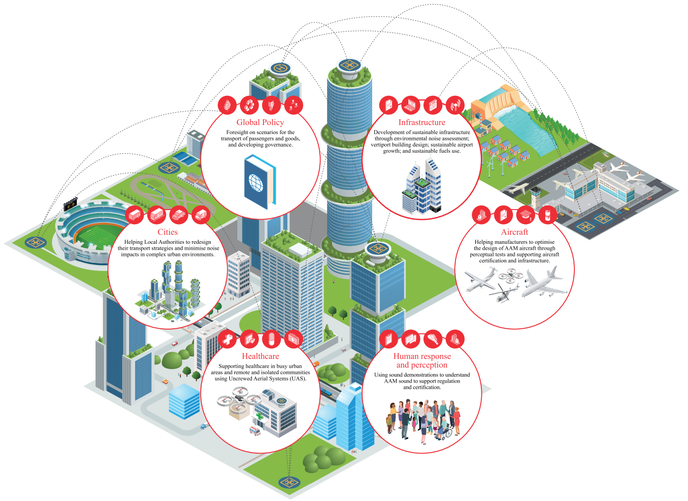
– Transportation Research Board UAM workshop, Research and Thought Leadership, Washington, DC, USA

– UAS Threats and opportunities in nuclear facilities

– Urban microclimate study, Wind and aeronautics

– Urban wind site selection, Wind and aeronautics

In collaboration with the Los Angeles Department of Transportation (LADOT), Arup developed the first ever policy framework for urban air mobility in the City of Los Angeles. This framework will help progress operator requirements for urban air mobility vehicles, outline strategic land use planning to determine the impact the vehicles will have on their surroundings, and engage stakeholders using visualization and auralization tools.



Advanced air mobility

Future of aviation

Alternate/sustainable energy

There is tension between choosing energy security and the cost to do so. The massive scaling up of sustainable/renewable energy production and new fuels before aircraft technology is proven have created regulatory, infrastructure, logistical and technological uncertainties. Airports need to know what infrastructure is needed and by when to enable future fuels to reduce the risk of investment.

Airlines need to commit to the new fuels and technology, although an airport's ability to influence this is limited. We have an opportunity to secure permission for aviation to grow/avoid stranded assets; to provide investment, jobs, and skills arising from new fuels; to develop new business models possible through radically different energy supply chains; and for airports to become energy hubs.

We can help in a number of areas: through assessment of current/ planned aircraft route network: baseline climate impact of current operations, applicability of new fuels/ aircraft types to address market sectors, and estimation of the resulting climate benefits; through operations impact assessment to support transition to SAF (sustainable aviation fuel), battery electric, and/or hydrogen; through market assessment of SAF availability and supply chain; through regional energy demand assessments; through multi-factor impact assessment: noise, environment, air quality; through potential to retrofit Hydrogen fuelling infrastructure; through future proof apron and support facilities to account for phased transition into hydrogen use, distribution and potentially production; through mapping of network of airports with hydrogen infrastructure to become viable.

Selected projects

– AAAE Sustainable Aviation Fuel White Paper

– Hydrogen in Aviation end to end supply chain study, Aerospace Technology Institute, UK

– Hydrogen demand report for aviation in South Wales and South West England

– Hydrogen derived fuels for aviation & maritime, Opportunity Green, UK Urban Air Mobility, Volocopter, Electric Aviation, Germany

– Hydrogen study for London Gatwick Airport

– Pilot Hydrogen Hubs for trialling advanced aviation in New Zealand, New Zealand's Ministry of Business, Innovation and Employment

– San Diego County Airports Sustainability Management Plan

– Study on the societal acceptance of Urban Air Mobility in Europe, European Union Aviation Safety Agency

"We have a high regard for the performance and professionalism of Arup."

Henry James, Net Zero Portfolio Manager, Wales & West Utilities

Hydrogen demand report for aviation in South Wales and South West England
© Scharfsinn86

Future of aviation

Climate risk and resilience

The aviation sector already experiences impacts from flooding, sea level rise, increased rainfall, storms and high temperatures, both in the air and on the ground. These risks, which manifest as disruption, delay, increased maintenance, reduced asset lifetimes, and related safety and cost concerns, are projected to increase in future with climate change.

Our work supports airport and other transport infrastructure clients to characterise the climate-related vulnerabilities they may have. We access reliable and reputable climate change projections data using in-house tools to assess climate hazards now and in the future.

We combine asset and hazard information using latest data science and geospatial visualisation. We provide insights from scenario-based analysis and our digital products enable clients to interrogate assessment results tailored to need and objectives. We assemble multi-discipline teams to support you in effective management of physical climate risk, from policy and corporate strategy to infrastructure planning and design.

Aside from bespoke commissions, our services can be included in Environmental Impact Assessments (EIA), or within ESG and corporate reporting (e.g. aligned to Task Force on Climate-related Financial Disclosure, TCFD).

Selected projects

– Vancouver International Airport After Action Review, Canada

– 35+ EIA (airport expansion), London Stansted Airport, UK

– Central Utility Plant resilience, Los Angeles International Airport, USA

– Civil engineering and resilient design for Northern American airports including JFK, LaGuardia, Toronto Pearsons, Seattle, Portland

– Climate Change Adaptation and Resilience Reporting, London Heathrow Airport, UK

– Climate Change Risk Assessment and Adaptation Plan, Liverpool John Lennon Airport, UK

– Expansion EIA, London Luton Airport UK

– Heathrow Expansion EIA DCO, London Heathrow Airport, UK

– Northern Runway Project Environmental Impact Assessment (EIA), Climate Resilience Assessment for Development Consent Order (DCO), London Gatwick Airport, UK

– Terminal 1 drainage system performance under climate change scenarios using WeatherShift, San Francisco International Airport, USA

– TCFD and climate change risk assessment, London Luton Airport ,UK

– US Sustainability Guidelines, Los Angeles International Airport, USA

Gatwick Airport want to use the existing standby runway and infrastructure to increase capacity. We undertook the climate change technical assessments required for the UK planning process. Gatwick's commitment to further enhancement of existing adaptation means that no significant risks from future climate change were identified in the resilience and in-combination impact assessments.

London Gatwick Airport Bridge, UK

Future of aviation

Climate and sustainability

The challenges facing the aviation sector are clear: meeting the rising demand for travel, developing airports and airline operations on a global scale while addressing carbon emissions and effects of and on climate change. The pressures for competition and economically viable operations are also acute: differentiation and a superb passenger experience are key to ensuring long-term prosperity and growth, requiring solutions that are environmentally-sound and grounded in economic realities.

We have the global experience and expertise to help airport operators and airlines balance the key elements of sustainable development at a corporate, project development and operational level. We bring the best of global experience to develop holistic, innovative and sustainable solutions for the aviation sector.

Our objective and pragmatic approach to sustainability adds value in many ways. This includes reputational management and delivery of cost-effective option analyses, design and operational parameters that contribute to and enhance environmentally and socially sustainable development.

Selected projects

– AAAE Sustainable Aviation Fuel White Paper
– Decarbonising Heat Strategy, London Gatwick Airport, UK
– Harvey Milk Terminal 1, San Francisco International Airport, USA
– Kuwait International Airport
– Melbourne Airport, Australia
– Mexico City International Airport
– New Midfield Concourse, Hong Kong International Airport
– Noise Management Strategy, Auckland Airport, New Zealand
– Portland International Airport, USA
– San Diego County Regional Airport Authority, USA
– San Diego County Airports Sustainability Management Plan
– Terminal 2, Dublin Airport, Ireland
– Terminal 3, Shenzhen Bo'an International Airport, China
– Terminals 3, 4 and 5 Q6 Study, London Heathrow Airport, UK
– Zero Net Energy Plan, San Francisco International Airport, USA

"SFO was the first airport in the world to achieve a certified Zero Net Energy facility, and we are focused on attaining this goal for our entire campus. Our Zero Net Energy Plan is our roadmap to accomplish this bold initiative, guiding and informing our actions as we push the envelope for what is possible in airport sustainability."

Ivar C. Satero, Airport Director, SFO

Terminal Core, Portland International Airport, USA
© ZGF Architects LLP

Future of aviation

Decarbonization

Many governments have committed to limiting global warming and need to reduce carbon emissions to achieve net zero. The aviation ecosystem must decarbonise, although it is expensive and a complex pathway to do so. It will only retain its licence to operate through a shared commitment from key stakeholders to implement net zero. There is a need to identify, develop and integrate sustainable energy into current operating procedures, adhere to ambitious local, state, national, international and industry targets.

There are a number of interventions Arup can help to deliver across scopes of carbon emissions. In Scope 1 (direct fuel use/on-site combustion): carbon and energy reduction targets; hydrogen fuels. In Scope 2 (indirect fuel use/electricity consumption): optimise building orientation; local energy generation from renewables (solar, wind, biomass); energy storage and recovery and thermal comfort; fossil-free and net-zero for all new buildings, infrastructure and systems; renewable energy procurement. In Scope 3 (beyond an airport's direct sphere of control): lifecycle cost assessment of projects, lifecycle specifications and lifecycle carbon accounting; prioritization of public transit to reduce vehicle emissions; optimise airfield layout and effectiveness to minimise travel distances–stacking of aircraft, taxi-ing of aircraft and GSE equipment; reduce waste/improve recycling.

Selected projects

– Bristol Airport Decarbonisation Study, UK

– Environmental Sustainability Plan, Dubai Airports, UAE

– Green Controlled Growth, London Luton Airport, UK

– Halifax Airport Carbon Management Plan, Canada

– Montréal Airports Energy Master Plan and Carbon Neutrality Roadmap, Canada

– Zero Net Energy Plan, San Francisco International Airport, USA

Combining our airport operations and buildings knowledge with our energy skills, we are able to develop a large scale carbon neutral energy plan.

IAT eGSE, JFK International Airport, New York, USA

ARUP

Future of aviation

Digital

We provide comprehensive strategic advice on the role of digital technology in the aviation sector, incorporating both organisational transformation and placemaking. Our approach puts staff and passengers at the centre of the design process, while maintaining focus on the business benefits.

Our Digital Aviation Advisory team brings together Arup's traditional planning, engineering, design and advisory strengths with advanced digital expertise in enterprise architecture, modelling, data analytics, and user–centered design. Together we create new value for our aviation clients, solving complex challenges using advanced data analytics, modelling, and knowledge of the latest technologies and standards.

We chart a strategic course for CIOs and digital departments to achieve their goals through the complex landscape of suppliers, technologies, trends and legislation. Our work on standards and industry bodies such as AAAE, ACI's ACRIS program and the World Airport IT Standing Committee ensure that we keep at the forefront of industry thinking.

Selected projects

– AAAE, Intelligent Apron programme

– ACI ACRIS, Virtual AODB data standards

– Baggage operation model, London Heathrow Airport, UK

– Data management strategy, Hong Kong International Airport

– Digital Masterplanning–expansion program, London Heathrow Airport, UK

– Operationalization–Green airside vehicles, Dubai International Airport, UAE

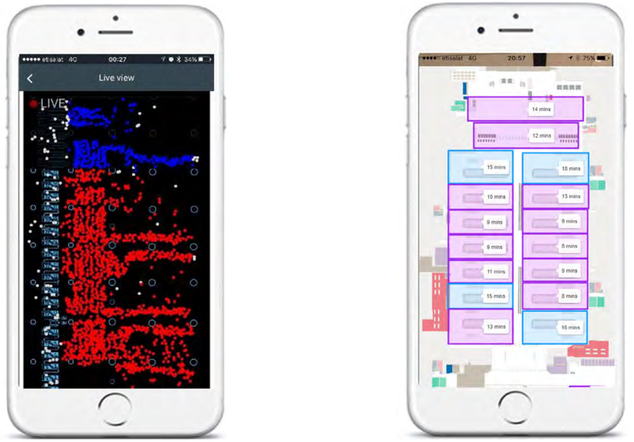
– Systems integration, Schiphol Airport, UK

– Technology integration & management, Navi Mumbai International Airport, India

– WAITSC, Twin Transition sustainability programme

– Warsaw Solidarity Transport Hub, Masterplan digital strategy and Innovation analysis

Dubai International Airport were looking to reduce queue times and improve passenger experience. We helped deliver their strategic vision and our solution was a sophisticated combination of technology and infrastructure. Upon the operation, the end result was a 50% reduction in average queue time within the terminal.



Data analytics
Technology and infrastructure solution.

Future of aviation

Energy management

We have an abundance of detailed design experience gathered from major airport developments around the world. As part of our work we have been collecting measured airport data of both utilities consumption and from energy sub metering systems from our projects.

This detailed experience, backed up by extensive hard data, enables us to understand in detail how energy is actually consumed within an airport development and to establish realistic energy models and utilities requirements for new projects going forward.

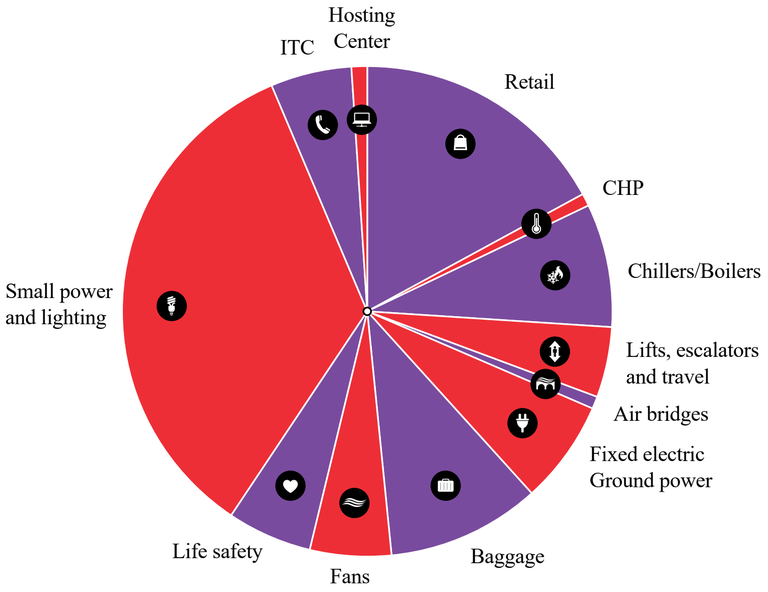
Our experience in the design and operation of airports enables us to challenge wasteful and conservative approaches and offer quantified savings based on specific change proposals. Costly and wasteful overdesign can be common place in airport developments as a result from the application of inappropriate local design codes, a lack of understanding of the diversities that can and should be applied to the various different airport systems or inadequate understanding of the technologies and opportunities generally.

Basing our design on sound, appropriate and added value assumptions, we use this wealth of data and knowledge to offer our clients new and better services.

Selected projects

– Dublin Airport, Ireland
– Halifax Airport Carbon Management Plan, Halifax, Canada
– Istanbul New Airport, Türkiye
– Landmark Aviation Fixed Base Operations, San Diego International Airport, USA
– London Heathrow Airport, UK
– Los Angeles World Airports Sustainability Masterplanning and Design and Construction Handbook Policy, Los Angeles, USA
– Manchester Airport City, UK
– Massport Energy Efficiency Initiatives, Boston, USA
– Montréal Airports Energy Master Plan and Carbon Neutrality Roadmap, Montréal, Canada
– SFO International Airport, Zero Net Energy Plan, San Francisco, USA

Arup delivered a comprehensive Energy Master Plan and Carbon Neutrality Roadmap for Montréal Airports, outlining the pathway towards net zero carbon by 2050 for all scope 1 and 2 emissions while adapting to growth, increasing resiliency, and reducing total cost of ownership.



Power consumption profile/by system

Future of aviation

Environmental, social and health assessment

We are a leading provider of comprehensive environmental consulting services to the global aviation industry. Airport development projects are routinely subject to close scrutiny by statutory authorities, local communities and other stakeholders due to potential environmental concerns.

We are leaders in innovative cost-effective environmental design, assessment and mitigation. Our specialists drive the planning and engagement with statutory bodies and community consultation using our leading edge tools to interpret and communicate complex principles to a non-technical audience.

We have proven capability and experience to help airport operators, airlines and other stakeholders through the planning, design, construction and operation of new airports, airport cities, surface access and the management of existing facilities.

We have extensive capability in Air Quality, Biodiversity, Carbon and Climate Resilience, Health Assessment, Cultural Heritage, Landscape Design, Noise, Resource and Waste Management, and Water Resources. A key strength is in 3D visual modelling, animation and digital presentation of technical data and EIA documentation to aid community and stakeholder consultation and decision makers.

Selected projects

– Air Quality Studies, Runway 3 EIA/HIA, Hong Kong International Airport

– Aircraft Noise Simulation, Hyatt Aerocity, New Delhi, India

– Airport Optimization EIA, London Luton Airport, UK

– Airport Sustainability Practices Research for TRB, USA

– Environmental & Climate Strategies, Melbourne Airport, Australia

– Environmental Due Diligence, Kuwait International Airport

– Environmental Due Diligence, Osaka and Kansai Airports, Japan

– Environmental, Land Use and Capacity Studies EIA, Glasgow and Edinburgh Airports, UK

– Generation 2 Second Runway Project EIA, London Stansted Airport, UK

– Runway 3 Project EIA Studies, London Heathrow Airport, UK

– New Parallel Runway EIA, Brisbane Airport, Australia

– North Terminal Extension EIA, London Gatwick Airport, UK

– Qantas 3-Bay A380 Maintenance Hanger EIA, Sydney Airport, Australia

– Sustainability Appraisal of Masterplan, Leeds-Bradford International Airport, UK

– Terminal 2 EIA, Dublin Airport, Ireland

At London Luton, we are making the best use of the existing runway at London Luton Airport to accommodate passenger growth. We are leading the multiorganisational environmental workstream supporting Luton Rising, the owners of London Luton Airport, in their application for Development Consent Order to expand the airport from the currently permitted capacity of 18mppa to 32mppa.

London Luton Airport, UK

Future of aviation

ICT infrastructure and digital advice

Our Digital and Information and Communications Technology (ICT) consultants provide a fully integrated service to meet the business and technical needs of airports and airlines. Our team brings together Arup's traditional planning, engineering, design and advisory strengths with advanced digital expertise in enterprise architecture, modelling, data analytics, and user-centred design.

We understand the business, operational, and transformational change challenges associated with major construction programs which enables us to undertake an holistic approach to the design, technical assurance and integration of complex technologies into airport facilities.

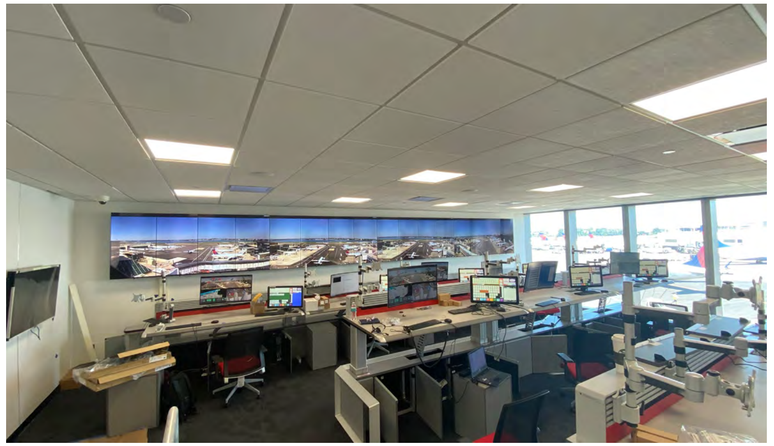
We understand the supplier market and can help airport operators through the process of designing and specifying aviation specific technology including operational data platforms, check-in and security systems. We optimize the use of boarding gates, air bridges and airside facilities.

Our network and communications experts are trusted by some of the largest airports in the world to set and enforce the IT infrastructure standards for the biggest capital projects.

Selected projects

– Delta Terminal C, LaGuardia Airport, New York, USA
– Delta Terminal 4, JFK International Airport, New York, USA
– Hamad International Airport, Doha, Qatar
– ITC Masterplan, Zayed International Airport, Abu Dhabi, UAE
– JetBlue Terminal 5, JFK International Airport, New York, USA
– Julius Nyerere International Airport, Dar es Salaam, Tanzania
– Sky Plaza, Terminal 2, Hong Kong International Airport
– System Integrator Pier and Terminal, Schiphol Airport, Amsterdam, Netherlands
– Terminal 1-8, Los Angeles International Airport, USA
– Terminal 2, Dublin Airport, Ireland
– Terminal 2, Mumbai International Airport Limited, India
– Terminal 2, Terminal 5, expansion, London Heathrow Airport, UK
– Terminal 3, Beijing Capital International Airport, China
– Terminal 3, Dubai International Airport, UAE
– Terminal 3, McCarran International Airport, Las Vegas, USA
– Toronto Pearson International Airport, Canada

For Schiphol's new Pier and Terminal projects, Arup act as the eyes and ears of the capital program ensuring the on-time delivery of all 200+ systems. Our expertise has included checking and developing the requirements, assuring the design from a systems perspective, managing the integration, and tracking the verification and validation.



Delta Sky Way, LaGuardia Airport, New York, USA

Future of aviation

Nature recovery

As large-scale human-centric infrastructure, airports are often seen as in conflict with nature, but they certainly do not have to be sterile locations devoid of all biodiversity. Of course, risks such as bird strike need to be carefully managed but biodiversity can be about so much more than this in terms of a broader regeneration of the natural environment in which airports operate.

Many airports are located in sensitive and high value biodiversity locations, surrounded by land that is designated for its national or international conservation importance (for example, the Rio Formosa wetlands around Faro airport, in Portugal). This should be seen as a key opportunity for aviation to contribute through the further protection, regeneration and enhancement of these critical, often threatened, resources, globally, and to address the positive social responsibilities of airports and aviation organisations.

Accelerating efforts to achieve increasingly ambitious sustainability targets relating to climate and nature requires considerable capital input. Green finance is perhaps one way for the aviation sector to start to secure this capital if they can demonstrate real commitment to and alignment with global targets, including those seeking to halt and reverse biodiversity loss. It may therefore pay to prioritise these actions and transition to a position among the world's most environmentally friendly airports.

Selected projects

– Design and planting advice for adjacent creek restoration, to minimise risk of bird/bat collision, Brisbane Airport, Australia

– Development of strategy and principles for biodiversity in relation to proposed runway expansion, Barcelona Airport, Spain

– Ecological surveys and HRA Screening, Inverness Airport, UK

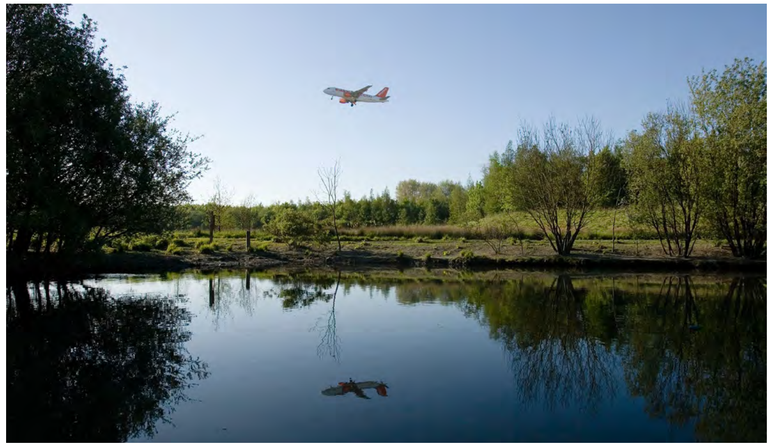
– Expansion Project–freshwater ecology, geomorphology and fisheries input to the EIA and Water Framework Directive (WFD) Assessment, London Heathrow Airport, UK

– Full package of ecological survey, design and consenting services for DCO, London Luton Airport, UK

– Habitat survey and strategic advice for masterplan, Weston Airport, County Kildare, UK

– Input to sustainability strategy, London Gatwick Airport, UK

We focus our efforts on measures to avoid, protect and enhance existing biodiversity resources and features. Furthermore, we identify and develop strategies to proactively manage biodiversity risk while maximising positive outcomes for nature on the ground.



London Gatwick Airport Environmental Impact Assessment

Future of aviation

Noise impact

Aviation growth creates pressure to expand existing facilities and to build new airports. There is therefore a need to quantify potential environmental impacts, in particular assessing changes to the noise environment in the vicinity of airports and aircraft routes.

Our wide experience in the environmental assessment of aviation noise, combined with the use of internationally accepted noise prediction models, enables us to assess impacts at both local and regional levels.

We consider all sources of aviation noise and demonstrate how these will change the pattern of local noise exposure. This includes the taxiing and flight noise of aircraft operations, the sources of ground power to aircraft and changes to the traffic patterns within the airport boundaries and surrounding infrastructure. Consideration is also given to surface access noise by way of road traffic and railway noise. These effects are categorized and weighed against the effects of other environmental as well as operational and financial factors.

We use sophisticated GIS techniques to present and analyze noise exposure information which can be coordinated with web-based consultation exercises. We can also employ Arup Soundlab and other auralization techniques to present combined video and audio demonstration to stakeholders and the general public.

Selected projects

– A380 Ground Running Pens Relocation, London Heathrow Airport, UK

– Airport Masterplanning and Noise Contours, Hobart International Airport, Australia

– British Airways Ground Running Facility, Cardiff International Airport, UK

– Glasgow City Heliport Relocation, UK

– Impact of Runway Extension, Birmingham International Airport, UK

– New Terminal EIA, Cambridge City Airport, UK

– Virtual Reality Soundbooths, London Heathrow Airport, UK

“I think the Soundbooths have been a really popular addition to the consultations that have been ongoing now for about a year because they take a very complicated topic and give a real reference point for the conversations that we have with members of the public.”

Emma Gilthorpe, Executive Director for Expansion, Heathrow, speaking to BBC Radio Berkshire

Sound Demonstration, London Heathrow Airport, UK

Future of aviation

Passenger experience

Air travel can be frustrating and stressful experience for some passengers. The journey to the airport, within the premises and once they leave them, passengers face several touchpoints and areas where stress levels can rise. More crowding, increased waiting Wtime and an increase demand on facilities might impact passengers overall experience.

It's key to understand the overall passenger experience and every interaction a passenger has along the way. Each touchpoint provides an opportunity to drive satisfaction and all moments should be orchestrated to align with the brand.

Successful deployment of services empowers the passenger to make better decisions about their journey. Arup has experience leading wayfinding and content strategy, route planning, information and environmental graphic design. This can be improved with tailored passenger-focused digital services that connect them to the amenities, information and support they require. This includes wifi connectivity, tailored passenger information services, self-service amenities and frictionless transfers between terminal zones.

Selected projects

– Changi Airport, Singapore

– Delta Sky Way, LaGuardia Airport, New York, USA

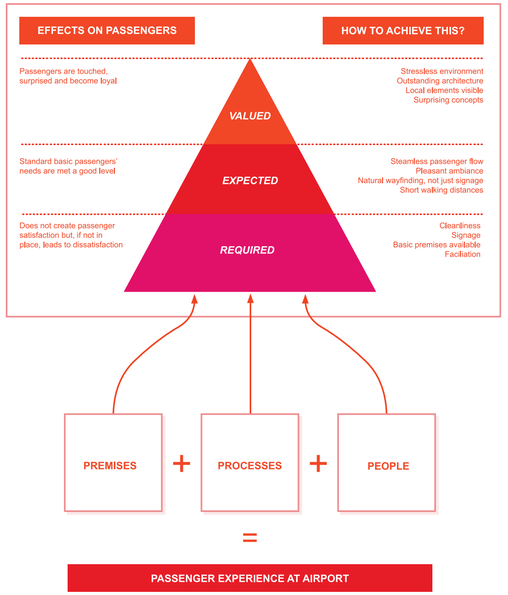
– Hong Kong International Airport

– JFK New Terminal One, Art & Branding, JFK International Airport, New York, USA

– PANYNJ EWR Vision Plan, Newark Liberty International Airport, New Jersey, USA

– Warsaw Chopin Airport, Poland

Passenger experience should span across all touchpoints and be integrated with other airport service design/ops efforts.



The passenger journey

Click image to enlarge. Click enlarged to close.

Future of aviation

Resource and waste management

We provide advice and undertake studies on best practice resource and waste management for a wide range of developments. Waste can have a significant impact on the construction and operational costs of an airport development. Our services cover all stages of a project from early feasibility studies, strategy formulation, planning application stage, environmental assessment and permitting, construction, operation and decommissioning.

Our services include predicting resource use and waste generation, advising on segregation and the space requirements for storage, and identifying recovery and disposal options. We carry out waste management audits and prepare plans for construction and demolition projects, and for the operation of commercial and residential developments and airline waste disposal.

Selected projects

– Airport Expansions, Cambodia

– Data and policy scan for potential sustainable aviation fuel, South-East Queensland, Australia

– Energy from Waste Feasibility, Australia Pacific Airports (Melbourne) Pty Ltd, Melbourne Airport, Australia

– Environmental Impact Analysis, London Stansted Airport, UK

– Gold Coast Airport Terminal Expansion, Westpac, Australia

– Infrastructure Assessment and Options Report, Man Aung Island Eco Tourism Development

– Landside Masterplan, Mumbai International Airport, India

– Packaging Data Submission Review and Support, British Airways, UK

– Terminal 2, Dublin Airport, Ireland

– Waste Analysis and Options Appraisal, London Heathrow Airport, UK

– Waste to Energy Feasibility, Hong Kong International Airport

– Waste Flow Map, London Gatwick Airport, UK

– Waste Management Strategy and Plan, Multiplex, Western Sydney Airport, Australia

Arup has the capability to inform waste management systems to be employed at airports throughout the design process while managing the challenges of the aviation industry such as complicated logistical problems, security zones and access navigation and biosecurity risks. While managing these challenges Arup waste experts can successfully balance the drivers of resource recovery and landfill diversion while future proofing the operation of an airport through consideration of future volumes and expansions.

London Gatwick Airport, UK

ARUP

Contact:

Global Aviation Leaders

e: aviation@arup.com

www.arup.com

Jenny Buckley
Global Aviation

Tom Kennedy
Americas

Joseph Sweet
Australasia

Jin Fan
East Asia

Conor Hoey
Europe

Alan Newbold
UK, India, Middle East and Africa