

An aerial photograph of a United Airlines airplane on a runway. The plane is white with blue accents and the word "UNITED" is visible on the fuselage. The runway is paved with light-colored concrete and has yellow and black markings. A large teal circular graphic is overlaid on the image, framing the text.

AECOM

from Landside to Airside

SPECIALIST SKILLS ACROSS THE AVIATION LIFECYCLE

Delivering a better world

FOREWORD

Airports and connecting transportation networks are vital to the continued growth and economic prosperity of cities, regions and countries.

With demand for air travel set to double over the coming two decades, airports around the world need to modernise and expand to be ready.

Today, the aviation industry faces some tough challenges. Infrastructure is not being built fast enough and, as demand grows, the lack of supply is causing problems.

AECOM is a global provider of technical services to airport owners, investors, airlines and aviation clients — leading and supporting programs for airports of all sizes and forms.

Our expertise spans a broad range of facilities, including passenger and cargo terminals, runways, taxiways and

aprons, aircraft hangars, infrastructure, and support facilities. Our services are demonstrated through the success of airport terminal, airside and landside projects around the world.

Building on our global network of expertise and local knowledge, our multidisciplinary, skilled professionals are experienced in delivering integrated, collaborative aviation solutions across projects and continents, from finance and analysis to design, masterplanning, program management, and construction services.

By combining our unrivalled expertise and reach, we are built to support the world's most complex aviation programs to help airports meet passenger demand, drive economic growth, and build legacies for future generations.

Read on to learn more about some of our headline projects.

WE'RE DIFFERENT

We're a 56,000-strong global team, with over 1,000 aviation professionals, with skills across the entire aviation lifecycle. We're able to offer an unrivalled interconnected set of global skills and expertise, and are equipped to deliver a wide range of aviation services. This includes specialised support to create the innovative solutions required to tackle present and future challenges.

One global team

With a single global aviation team, and experience working at over 150 airports, we can easily transfer people and knowledge to tackle our client's multiple challenges. This enables us to select the best people for the job from a pool of industry experts. Whether a project calls for waste management and materials reuse, pavement design or strategic masterplanning, our agile team of global aviation professionals can quickly mobilise to pool their collective industry intelligence — boosting creativity, coordination and productivity.



SPECIALIST SKILLS FROM LANDSIDE TO AIRSIDE

Our broad expertise spans the entire aviation lifecycle — from architecture and baggage, to ORAT and sustainability — allowing us to bring unique, joined-up solutions to landside, terminal, and airside projects.

Some of our specialist aviation services include:



- Masterplanning
- Terminal design
- Program management
- Construction management
- Airfield infrastructure
- Digital delivery
- Baggage handling
- ORAT
- Sustainability and resilience
- Environmental services
- PFAS management
- Cost management
- Surface access
- Fuelling systems
- Process and automation
- Acoustics and aircraft noise
- Feasibility and business case
- Connected and automated vehicles

DELIVERING THE LARGEST, MOST COMPLEX PROJECTS

We're built to support the most complex expansion programs, delivering integrated solutions in finance, planning, design, program management, and construction. This includes projects such as the new North Terminal at Louis Armstrong New Orleans International Airport (page 18) and the new Jorge Chavez International Airport in Lima, Peru (page 15).

WORLD CLASS DESIGN THAT WORKS FOR ALL STAKEHOLDERS

We plan and design all types of airport infrastructure and facilities, working together with stakeholders to create seamless passenger experiences from check-in to take off. Our world class terminal designs always consider the specific operational needs of the ultimate user, while providing airport owners with flexible, multi-use facilities.

UNLOCKING EFFICIENCIES THROUGH INNOVATION

Using new technologies to improve delivery and drive efficiencies, we're pushing the industry forward through the creative use of digital tools and innovative thinking. This includes using digital delivery methods (page 26) and lean construction techniques (page 50) on major airport projects.



MASTERPLANNING

SUSTAINABLE PLACES FOR PEOPLE

We focus on the complex interaction between aircraft, passengers and environment to prepare masterplans that cater for future growth in a flexible way and deliver on the client's business, operational and commercial plans.

We recognise that the masterplan is not an academic exercise in engineering. It is a living document 'born' from the business plan that it supports, presenting a coherent set of agreed principles, by which future development will be brought forward, within an accepted and rational business environment. Prior to considering a masterplan, therefore, we believe it is essential to understand the business drivers.

Our experience includes working closely with the many organisations involved in planning an airport: regulators, government bodies and border authorities, airport operators, aviation agencies, airlines, contractors and investors.

- Architecture
- Multidisciplinary design
- Site selection and evaluation
- Airspace analysis
- Land-use planning
- Masterplanning
- Capacity analysis
- Airfield simulation
- Airfield design
- Passenger terminal simulation

- Functional design of passenger and cargo terminals
- Landside simulation
- Surface access design
- Design of support systems
- Investment planning
- Planning application advice
- Environmental impact assessment
- Economic impact assessment

CASE STUDY

HKG

HONG KONG INTERNATIONAL AIRPORT – MASTERPLAN 2030 STUDY

Hong Kong

Delivering a 20-year blueprint to meet the long-term needs of Hong Kong, we led the Hong Kong International Airport Masterplan 2030 study – helping strengthen the airport’s position as a major international and regional hub.

Hong Kong International Airport (HKIA) creates huge economic value for the region. When the masterplan project was conceived, Hong Kong’s aviation industry generated (HK)\$78 billion in value-added, comprising 4.6 percent of the country’s GDP. The masterplan aimed to enable HKIA to continue

to grow without constraints and maintain its competitiveness among neighbouring airports.

As lead consultant for the study, we provided a comprehensive assessment of the airport’s operational requirements up to 2030 and beyond. The masterplan was based on adding a third parallel runway and a 50-gate, wide-bodied remote satellite concourse, situated on a 650-hectare reclamation to the north of the existing airport island.

Conducting a detailed analysis of the terminal area, we assessed how to convert the existing Terminal 2 departures building into a full 50 million passenger departures and arrivals terminal. This represented a major revision of previous planning ideas as previous masterplanning had only considered a duel parallel runway configuration.



CASE STUDY

FCO

ROME-FIUMICINO INTERNATIONAL AIRPORT

Rome, Italy

We were commissioned to develop a masterplan for the North Terminal at Fiumicino Airport. The masterplan project focused on addressing Fiumicino Airport’s immediate capacity constraints as well as developing a long-term strategic vision for the airport’s future development — with an ambition to increase annual passenger-handling capacity from 35 million to over 100

million in 2044. The recommended solution included the creation of a new terminal and associated infrastructure.

Building on this, AECOM, together with GMW Mimarlik architects, conducted a feasibility study for Aeroporti di Roma (AdR). The study included: a terminal planning exercise and assessment of the access roads, curbside, Ground Transportation Centre (GTC), rail/metro/ APM terminal interface, and apron requirements. We also established a capex programme according to the AdR regulatory framework agreement, and produced a comprehensive set of tendering documents to manage the tender process, in line with EU and Italian competitive tender rules.

TERMINAL DESIGN

TRANSFORMING PASSENGER EXPERIENCES

From concept to construction, our expert team of aviation planners and economists, terminal building, design architects, airport engineers, modelers and other specialists take an integrated and comprehensive approach to the planning and design of new and existing passenger terminals and airport infrastructure.

An elevated passenger experience enhances the terminal's functional areas by increasing checkpoint throughputs and raising post-security dwell times. In an age of multiple travel options, a premium passenger experience becomes the differentiator. We're experienced in developing concepts for terminal layout and function. We look to combine functional concerns with aspirational opportunities to create spaces that transform passenger experiences.

- Passenger terminal planning
- Architecture
- Structural engineering
- Sustainability
- Passenger simulation modelling
- Wayfinding and ergonomics
- Aviation systems planning
- Baggage handling systems design

- Blast
- Computational fluid dynamics
- Explosion detection systems
- Façade
- Fire strategy
- Mechanical and electrical design
- Quality and service delivery
- Security

CASE STUDY

HKG

HONG KONG INTERNATIONAL AIRPORT – TERMINAL 2 EXPANSION AND THIRD RUNWAY CONCOURSE

Hong Kong

As part of the HK\$141.5 billion strategy to expand Hong Kong International Airport's (HKIA) existing two-runway system into a Three-Runway System, we're delivering two transformational projects that will allow the airport to meet future air traffic demand and provide world-class passenger experiences.

Terminal 2 Expansion

As lead consultant and project manager, we are providing a range of services, including planning strategy, architectural design and engineering for HKIA's Terminal 2 (T2) Expansion. We are upgrading T2 to provide arrivals, departures and complete passenger services.

Doubling the size of the existing building and increasing its passenger handling capacity to 50 million passengers per annum ultimately, the enhanced terminal will include outstanding architectural design to facilitate a simple and efficient flow of passengers and baggage. New features include a meet-and-greet area and baggage reclaim hall, expanded security and immigration facilities, and additional check-in counters. A new Automated People Mover Interchange Station (AIS) will connect T2 with the airport's other concourses and transportation hubs.

We have planned the phased construction to minimise disruption to the airport's current and future operations. The design minimises land use, while meeting all of Airport Authority Hong Kong's functional, operational, and maintenance requirements.

The design includes maximum flexibility for future changes in space utilization, functional requirements and further expansion.

Third Runway Concourse

As part of the Three-Runway System project, we are also lead consultant and Project Manager for the detailed design and construction phase design services for the new Third Runway Concourse — delivering an innovative design and a great passenger experience, with latest technology and sustainable credentials.

The Y-shaped concourse will initially have a floor area of approximately 280,000m², with extensive building services and airport systems, and high-quality finishes. Alongside our project partners, we are researching and conducting benchmarking studies to identify future trends in technology and airport systems, retail and advertising, to ensure an innovative, exciting and enjoyable passenger experience.

Sustainability is a key focus, with passive and smart engineering to reduce energy consumption. A central landscaped courtyard will offer a tranquil setting for relaxation and enjoyment for passengers waiting in the departures concourse.

Construction is expected to be completed in 2024.



Terminal 2 expansion

Third runway concourse

CASE STUDY

KWI

KUWAIT INTERNATIONAL AIRPORT, SUPPORT TERMINAL/T4

Kuwait City, Kuwait

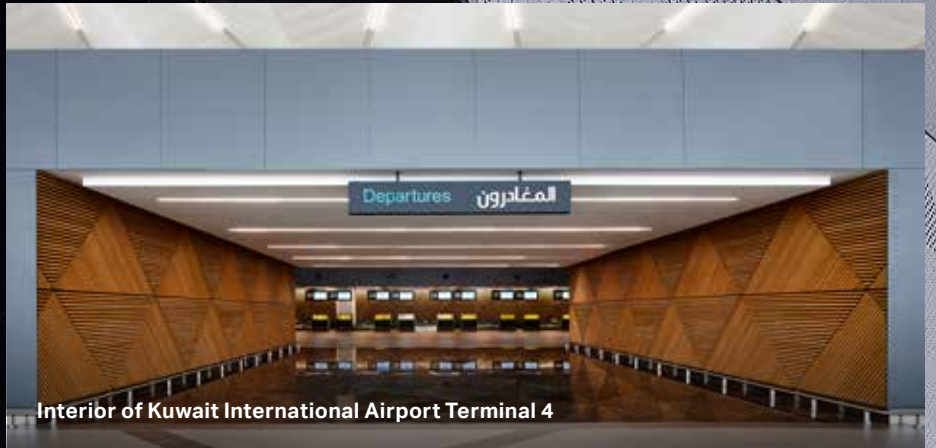
The Directorate General of Civil Aviation (DGCA) commissioned a separate support passenger terminal building, Terminal 4 (T4), to generate an additional handling capacity of 4.5 million passengers per year and support the current Terminal Building, Terminal 1 (T1). T4's systems are currently operating and fully integrated with the rest of the airport's facilities.

We provided full detailed design services for the development, beginning with a value engineering study to assess the optimum size of the terminal facility and the preparation of a strategic brief incorporating all of the stakeholder requirements, including operators' input and buildability issues, as well as assisting the contractor Cengiz during the construction process. The study concluded with a set of employer's requirements that formed the approved concept design for the whole development, as well as meeting the minimum technical requirements of the main contract between Cengiz Insaat and the Kuwait Airport Authority.

The scope of the project works includes: a terminal building (approx. 55,000 m²); a new passenger car park with 650 slots; a connecting pedestrian bridge from the existing car park to the terminal building (approx. 2,400 m²); a satellite building (approx. 1,400 m²); all associated access roads, landscape, and utilities with ancillary buildings; a line maintenance building; a bus operating centre; and cabin maintenance (around 2,400 m²).

Terminal 4 was opened on August 2018 for all Kuwait Airways operations. In addition, in the future, it will be possible for other airlines to be accommodated in this building to provide an effective link between T4, T1 and the future Terminal 2.





Interior of Kuwait International Airport Terminal 4



DELIVERING AIRPORT INFRASTRUCTURE FOR THE FUTURE

Rapid technological advancements, conflicting stakeholder demands and limited capital expenditure makes it difficult to plan, design and build airport infrastructure that will meet future needs. AECOM's Global Director of Aviation **Dwight Pullen** discusses how optimum planning, flexible designs and embracing technological innovations can help deliver the airports of tomorrow.



A viation is one of the world's fastest-evolving industries. Technology has and will continue to have a major influence on airport operations at an accelerating pace. From improving passenger processing, check-in to take-off, to facility management, all advancements aim to maximize the use of existing assets and improve customer experience.

The anticipated changes are numerous and will influence how passenger terminal buildings and airfields are used. Terminal processors will be able to accommodate far more people through one-step self check-in while similar changes will be seen for immigration and emigration and security checkpoints. Technology will enable terminal concourses to change from single-purpose to multi-purpose areas, with holdrooms and concession areas merging to improve passenger experiences, breaking down the boundary of the traditional departure lounge and spreading it out across the concourse. Airfield aprons and stands will be used differently due to the advent of higher functioning passenger boarding bridges and ground support equipment (GSE). We are already seeing the use of driverless pushback tugs and the prevalent use of electric GSE, and may even see self-push back aircrafts using electric power in the not-too-distant future. Further advances

in aircraft technologies will speed up airfield operations with the need for shorter take-offs and landings. While advances in air traffic control will allow more efficient use of airspace and contribute to a more holistic use of assets.

The pace of change while challenging provides opportunities to learn from the past and better plan and design infrastructure and facilities for future needs. For example, significant investment was made by airports to accommodate the Airbus A380 aircraft which is now on the way to extinction. However, aircraft manufacturers are now more aware of the capital investment airports must make to accommodate new products and are working to minimize the impacts. The folding wing provision of the new Boeing 777X aircraft is an example of this where the aircraft wingspan in the folded position is similar to the legacy 777 so that it can be parked in the same apron envelop.

A key challenge facing the aviation industry is anticipating future technologies and operational modes, so that we can deliver infrastructure today that meets the needs of users in the future. On the next page we look at three important factors in delivering for the long-term which can help overcome this uncertainty.



A KEY CHALLENGE FACING THE AVIATION INDUSTRY IS ANTICIPATING FUTURE TECHNOLOGIES AND OPERATIONAL MODES, SO THAT WE CAN DELIVER INFRASTRUCTURE TODAY THAT MEETS THE NEEDS OF USERS IN THE FUTURE.



Concept design of the new Jorge Chavez International Airport, Lima, Peru

DELIVERING BALANCED SOLUTIONS

Technological advancements are influencing how facilities are used and how airlines and airports work together to optimize operations. Airlines are continuously looking for ways to optimize their network planning by fine-tuning fleet selection and the number of turnarounds needed at each gate. With so many stakeholders involved in most airport projects — and often with competing interests — it's clearly a challenge to deliver balanced and functional designs as there will always be diverging interests in how space is used.

Planning and design of terminals should consider the ultimate user's specific operational needs while providing the owners with a flexible facility. Sustainability and whole lifetime cost are also important factors for delivering balanced solutions. At AECOM, we use a combination of our experience (from working at over 150 airports), wide ranging technical skills, practical technologies, creative use of space, and sustainable design, to deliver solutions that work for both our clients and stakeholders — and which always focus on delivering outstanding passenger experiences.

Furthermore, our experiences working for both airlines and airport owners/operators affords us a unique understanding of airline and owner interests and how to align the design to address both sides.

Our design of the new 260,000 square meter terminal at Jorge Chávez International Airport (NewLIM) in Lima, Peru provides the greatest flexibility to the owner, airlines and regulatory agencies in the way the airfield, gates, security, check-in, concession, and baggage reclaim can be operated. Certain gates are designed for both international and domestic use allowing the owner to accommodate the various demand peaks with less terminal space. We used the same approach for the baggage claim hall by planning a certain number of claim devices to flex for both international and domestic use with smart barriers to address the security requirements. The baggage sortation area was also designed to allow for the unique operational protocols used by the many airlines that will be using the facility. These measures and more resulted in a facility that is efficient in size, can accommodate short term capacity needs, and is designed for future expansion with minimum disruption.

DESIGNING WITH FUTURE EXPANSION IN MIND

To overcome the uncertainty of future technologies and airport operational methods, it is prudent to plan and design infrastructure that won't require significant and costly changes down the line. To do so, we must plan and design airports in a way that anticipates the need for further increases to capacity.

The NewLIM project is designed with a phase 2 expansion in mind. The configuration of Phase 1 will efficiently accommodate future terminal concourse expansion by the strategic location of the concession core, airline services, measures taken to reduce walking distances, and most importantly how the terminal's gates will be used. In addition, the airfield design was similarly optimized in Phase 1 to accommodate the additional Phase 2 traffic with only minor changes. The terminal processor, claim hall, and baggage screening/sortation systems are configured to easily accommodate the Phase 2 passenger demand through a combination of added footprint and anticipated technology.

USING INNOVATIVE TECHNOLOGIES TO IMPROVE PLANNING, DESIGN AND DELIVERY

Another significant challenge, particularly in developed countries, is that airports undertaking large upgrade programs are constrained by both space and available capital expenditure. Optimizing the use of technology to maximize the capacity of existing facilities is therefore clearly of great value.

We are embracing new technologies and digital tools at all stages of the aviation project lifecycle to improve the efficiency and effectiveness of planning and delivery of projects.

To help airports optimize investments, improve efficiency, and reduce operational costs, we've developed a state-of-the-art digital platform, that uses cutting edge technology and data

analytics, to predict terminal processes and performance. The platform can help with facility requirement planning, layout verification, identification of bottlenecks, capacity limit assessments, Level-of-Service assessments, and operational optimization. The tool allows airports to analyse alternative layouts and operational strategies, create three-dimensional simulation environments with realistic passenger flow behaviour, and deliver time efficient modelling.

Building Information Modelling (BIM) is now a common design platform that is used in most airport projects, whether brownfield or greenfield. We are working with several large airports developing digital twins of their facilities which will be used for their planned modifications and expansions. While

the initial investment is significant, digital twins can provide a real value added as the model can also be used for asset management and operations and maintenance purposes.

New technologies are also helping airports achieve excellence in project delivery. We've developed our own advanced information management platform for Operational, Readiness, Activation and Transitional (ORAT) that helps deliver successful airport openings. Our tool — called OREx (Operational Readiness Excellence) — helps manage the transition of projects, services, and facilities by allowing a user to track critical issues and overall progress throughout the ORAT process, eliminating the numerous common risks associated with openings.



OUR DESIGN OF THE NEW 260,000 SQUARE METER
TERMINAL AT JORGE CHÁVEZ INTERNATIONAL AIRPORT
IN LIMA, PERU PROVIDES THE GREATEST FLEXIBILITY TO
THE OWNER, AIRLINES AND REGULATORY AGENCIES

150

AECOM
have worked
at over 150
airports

NEWLIM: JORGE CHÁVEZ INTERNATIONAL AIRPORT

Lima, Peru

Helping deliver a massive expansion spanning seven million square meters, we are lead designer for Lima's new Jorge Chávez International Airport – a transformational upgrade that will help Peru meet future passenger demand and drive economic growth to become one of the most important airports in South America.

Jorge Chávez International Airport is the most important airport in Peru, operating most international and domestic flights in the country, while also an important connection hub for South America. The airport currently has one runway and one

terminal, but with recent growth in traffic, and demand for air travel expected to increase over the next two decades, a significant upgrade was necessary to ensure the airport continues to support Peru's economic growth.

The new Jorge Chávez International Airport is essentially a brand-new airport in its entirety and will see the construction of a second 3,480-meter long runway, as well as new taxiway system, control tower, airfield lighting vault and other support facilities. Additionally, a new 50-gate terminal will be built, with a planned expansion to accommodate a total of 61 gates, to support almost 40 million annual passengers after opening, while all new landside road infrastructure will improve surface access.

Working with Lima Airport Partners S.R.L. (LAP), our global team of experts from South America, Europe and the US are combining to deliver a range of solutions including masterplanning, all architectural works, landscape design, and design of MEP systems for the whole development – an area covering over seven million square meters.

The design of the new 260,000 square meter passenger terminal draws on Peru's landscape and climate, featuring a roof designed to maximise the amount of natural light entering the centre of the building. Our role also includes design of a new baggage handling system, and all ancillary buildings and airside and landside developments, including the new control tower.

PROGRAM MANAGEMENT

DELIVERING THE MOST COMPLEX EXPANSIONS

As an industry leader in program management services for large capital programs, we oversee activities ranging from planning, coordination, scheduling and cost control, to design, construction and commissioning.

Large programs require the management, coordination and integration of multiple, concurrent assignments. From concept through completion, we provide necessary technical and administrative services to help our clients meet their program objectives. We act as an extension of our clients' staff, protecting their interests as our own.

Program planning and management

**Master scheduling/
schedule analysis**

Master budget development

Design management

Cost management

Delivery and contracting strategies

Cost estimating

Change order management

Value engineering

Commissioning

**Facility condition/
lifecycle assessments**

CASE STUDY

LHR

HEATHROW AIRPORT FUTURE TERMINAL 2 PROGRAM

London, UK

We are lead designer for Heathrow Airport's Future Terminal 2 — a major program that will modernize infrastructure and install a new state-of-the-art baggage handling system to transform passenger experiences at Europe's busiest airport.

Opened in 2014, London Heathrow Airport's Terminal 2 (T2) is currently supported by an ageing baggage system at the now closed Terminal 1. Anticipating a surge in passenger numbers over the next decades, the Future T2 program forms part of Heathrow's wider expansion strategy and will create a new advanced baggage system within the existing T2 site, providing fast and efficient baggage handling while building capacity for future growth.

Involved since inception, we have delivered design and project management services to progress the program through the optioneering phase. We assessed 50 options for how to integrate a new baggage system into a heavily constrained live site — amongst existing buildings, infrastructure and services — without disrupting operations and passengers.

Our solution will clear existing infrastructure so that a 280m x 130m x 30m deep excavation site can be built to install a new £900m advanced baggage system. The option received buy-in from all Heathrow executive teams and 19 airline stakeholders.

Working collaboratively with Heathrow as one single team, we are focussed on finding the best and most innovative solutions to deliver this complex multifaceted program. This has involved drawing on AECOM's wide-ranging specialist skills in project management, structural engineering, architecture, lean construction, tunnelling, digital delivery, design for manufacturing and assembly (DfMA), visualisation technology, process automation, and more.



CASE STUDY

LTN

LONDON LUTON AIRPORT – FUTURE LuToN

Luton, UK

As Technical Advisor for London Luton Airport's FutureLuToN expansion strategy, we are providing multi-disciplinary services to help the airport make best use of its existing runway, including PMO, airfield design and construction services.

London Luton Airport Ltd is preparing to submit a Development Consent Order (DCO) planning application to increase the permitted capacity of the airport from 18 million passengers per annum to 32 million by 2039.

In our role as Technical Advisor we are supporting London Luton Airport Ltd. to plan and design a new terminal, rail link, airside infrastructure, road network improvements, business park and country park. Significantly, the project includes an earthworks shift of around five million cubic metres and complex construction phasing requirements.

The wide range of multidisciplinary services we're delivering includes master planning, PMO, airfield design, surface access modelling, architecture, environmental services, construction services and more.

It is expected that the DCO application to the UK government will be submitted to the Planning Inspectorate in mid-2020.



CONSTRUCTION MANAGEMENT

BUILDING CAPACITY

We offer world-class construction management services led by AECOM Hunt and AECOM Tishman, building some of the most innovative and impressive aviation facilities.

Our aviation experience includes a wide range of project types – from brand new terminals, to new baggage handling systems and other interior modernizations, to tenant fit-outs and everything in between. While these projects are often multi-phased and require a great deal of coordination with multiple parties, our construction services team has risen to the challenge every time. In fact, we have over 70 aviation projects in our portfolio, 67% of which have been for repeat clients.

Planning and scheduling

Site logistics

Cost estimating

Cost models

Document review

Scope refinement

Value engineering

Constructability and coordination reviews

Lifecycle studies

Procurement

Community outreach

Subcontracting

Construction

Construction administration

Commissioning

Cost control and accounting

Safety

Quality control

CASE STUDY

MSY

LOUIS ARMSTRONG NEW ORLEANS INTERNATIONAL AIRPORT – NORTH TERMINAL

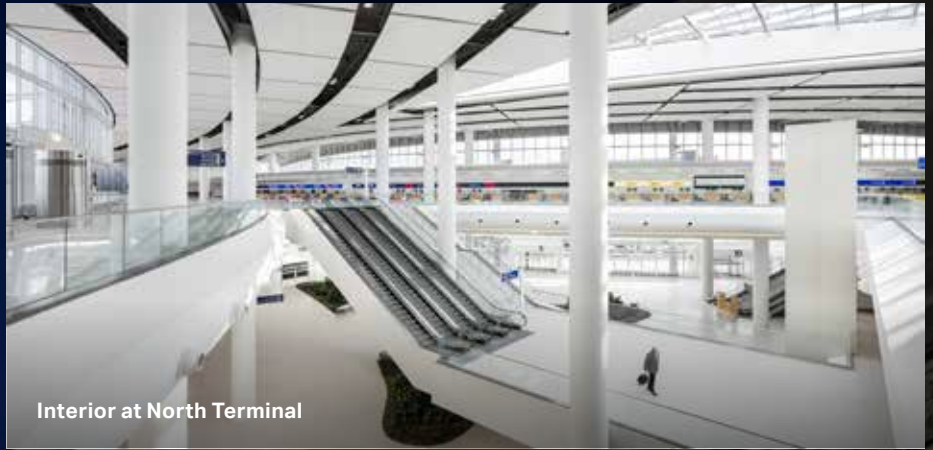
New Orleans, US

Working as part of a joint venture, AECOM Hunt served as construction manager for the new North Terminal at Louis Armstrong New Orleans International Airport — a nearly \$1 billion project.

Collaborating with local contractors Gibbs Construction, Boh Bros and Metro Site Services, we delivered this major new terminal which completely replaces the aging terminals to the south side of the runway.

Spread across three concourses, the new 35-gate modern terminal is just under 1,000,000 square foot and includes a parking garage, surface parking, airline ticket offices, and ticketing hall. The terminal was designed with an ease of use customer experience in mind, featuring centralized local restaurants and retail shops, a new consolidated security checkpoint, an open concept design, and a new inbound and outbound in-line baggage system.

Open to passengers in 2019, the North Terminal became the first new terminal constructed in the United States since the Col. H. Weir Cook Terminal at Indianapolis International Airport was completed in 2008 — also built by AECOM Hunt.



Interior at North Terminal



Gate at North Terminal

CASE STUDY

IND

INDIANAPOLIS INTERNATIONAL AIRPORT – THE COL. H. WEIR COOK TERMINAL

Indianapolis, US

AECOM Hunt performed Construction Manager — Agent services for the new 1,275,000 square foot midfield terminal and airside development. The project included a terminal building, two concourses housing 40 gates, airside apron, roadways, utilities, baggage handling system, security screening,

restaurants and retail space. In addition, a 22" thick apron of 518,000 square yards and under pavement hydrant fueling system.

The airport also included a new air traffic control tower and administration building completed prior to the new terminal. Both the tower and new terminal presented the challenge of working between active runways and meeting FAA requirements for airport access and crane usage. By utilizing land already owned by the Airport Authority and implementing numerous energy saving features, the airport achieved LEED Certified status by the US Green Building Council.



CASE STUDY

AUH

ABU DHABI INTERNATIONAL AIRPORT, MIDFIELD TERMINAL

Abu Dhabi, UAE

We are providing the construction management services to deliver this Midfield Terminal Building's (MTB) unique architectural features and optimised form. The building will help increase capacity and operational efficiency to process 30 million passengers per annum and 65 aircrafts, including multiple Airbus A380s.

The passenger facilities will also include more than 27,500 m² of airline hospitality lounges, a transit hotel, and heritage and culture museum in addition to the 11 subprojects that make up the Midfield Terminal Complex (MTC), involving car parks, landside and airside roads and ancillary buildings.

As the Construction Management Agent for the complex, we cover a wide range of responsibilities from construction activities, commissioning and Operational Readiness and Airport Transfer (ORAT) to regulatory compliance and managing project constraints, and stakeholder and client expectations. Subsequently, the MTB project management plan (PMP) has been specifically developed and tailored for other airport construction projects, and the Project Controls Management (PCM) is part of the PMP. Our ambition is to build on the project controls schema and solutions that the team have developed during this programme, to advance industry best practice.





CASE STUDY

ATL

HARTSFIELD-JACKSON ATLANTA INTERNATIONAL AIRPORT – MAYNARD H. JACKSON JR. INTERNATIONAL TERMINAL

Atlanta, US

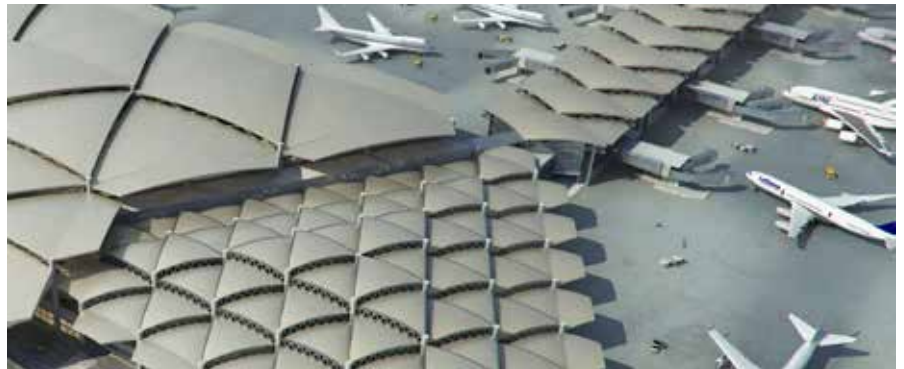
AECOM Hunt served as Construction Manager, in a joint venture with Holder Construction Company, Manhattan Construction Company, and C.D. Moody Construction Company, Inc., for the Maynard H. Jackson Jr. International Terminal project.

The City of Atlanta and the Hartsfield-Jackson Atlanta International Airport developed the capital improvement program, which included the new international terminal, in order to handle future travel demands. The terminal was built to be able to accommodate the expected surge of international travellers and has allowed Atlanta to become a major gateway to the rest of the world.



The new 1,430,000 square foot international terminal includes 12 new gates, custom offices, APM station, baggage handling system, two parking structures, elevated roadways and an APM train/utility connector to the existing Concourse E. It also included renovations to Concourse E.

The terminal includes state-of-the-art equipment and top-of-the-line security systems. Additionally, it has been designed with an emphasis on sustainability. Water and energy conservation, indoor air quality, and carbon footprint reduction were all important elements when constructing this airport, allowing it to receive LEED Gold Certification.



CASE STUDY

RUH

KING KHALID INTERNATIONAL AIRPORT

Riyadh, Saudi Arabia

Leading a joint venture, we were appointed to deliver the redevelopment and expansion of King Khaled International Airport (KKIA) in Riyadh, Saudi Arabia. The five-year, US\$72m contract is intended to help the airport

reach a future capacity of 30 million passengers per year. The project is part of a program led by Saudi Arabia's General Authority of Civil Aviation to transform KKIA into a new commercial airport that meets industry-leading standards.

We are providing program support in addition to project and construction management services, such as administration, project planning, design and construction management, as well as information and data management.

BAGGAGE HANDLING

HIGH SPEED BAGGAGE SYSTEMS

As leaders in planning, design and engineering for baggage handling and security screening systems, our professionals include mechanical, electrical, facilities, computer controls and security experts from the aviation, airline and baggage industries.

Efficient baggage handling is critical to timely aviation operations. To meet airports' needs, Baggage handling systems (BHS) and checked baggage inspection systems (CBIS) must not only handle today's passenger traffic, but also assure operational performance over the airport's lifecycle. We offer an integrated approach to systems' engineering, design, construction and implementation and we assist our clients at every project stage.

BHS masterplans

Peer reviews

Concept development and planning

Contract documents' development

Transportation Security

**Administration (TSA)
submittal process**

Tender reviews/recommendations

Commissioning and testing

**Program and construction
management**

**System start-up support
and evaluation**

**Design-build planning and
fully integrated delivery**

Energy consumption assessments

Safety and operational audits

CASE STUDY

LIM

NEWLIM: JORGE CHÁVEZ INTERNATIONAL AIRPORT

Lima, Peru

As part of the new terminal design for the new Jorge Chavez International Airport, we are developing the concept and the design for an all new baggage screening and handling system (BHS). The project includes a complete inbound and outbound BHS system. The screening system is being designed in accordance with ECAC Standard 3 protocols and will feature high speed EDS machines. The outbound sortation system includes options for mechanical make up units as well as static chute options. The design will handle the baggage demand for the initial 50-gate facility and will make provisions to accommodate the demand for the future expansion of the terminal to 61 gates.

CASE STUDY

PHL

PHILADELPHIA INTERNATIONAL AIRPORT, SECTOR 23 CHECKED BAGGAGE INSPECTION SYSTEM

Pennsylvania, US

We provided planning, design and construction administration services for this US\$40 million project, which involved the expansion and upgrade of an existing outdated CBIS with a state-of-the-art automated system. The project included the design of a two-storey building addition (10,000 square-feet) to house the new screening system and baggage make-

up operations. The structural design comprised steel framing, concrete pile foundations, masonry and metal panel exterior walls, and a custom ramp system for TSA robot bomb retrieval.

Our project management responsibilities included managing the design work across all disciplines, coordinating with the TSA, meeting with the client, organising design submissions, assisting with the bidding process, attending weekly construction progress meetings, reviewing responses to RFIs and contractors' submissions, overseeing and making site visits, supplying inspectors for certain aspects of construction, and helping the DOA to review contractors' solutions for non-conformance issues, as well as supplying additional support under our on-call PM/CM contract.



CASE STUDY

MIA

MIAMI INTERNATIONAL AIRPORT, AUTOMATED BAGGAGE HANDLING/IN- LINE SCREENING SYSTEM

Florida, US

We were contracted by American Airlines to plan, programme, and produce bid documents for the new BHS followed by coordination and management of the actual vendor design/installation and

commissioning phases. The provisions for the demolition and removal of American Airlines and associated Miami International Airport baggage/ screening systems had to be phased in several stages to allow the airline and its code share partners to maintain their daily operations with little or no disruption. In addition, we managed and coordinated the layout and operational logistics and requirements of the 100 per cent in-line baggage screening system with TSA and airport officials relative to the mandated integration of the multi-level baggage screening operation.

ORAT

TRANSITIONING FROM DELIVERY TO OPERATIONS

Our ORAT approach reduces overall time to market and ensures a predictable and sustainable outcome with effective and efficient operations. We have a successful track record of delivering large-scale projects while providing a safe, sustainable, and smooth transition from project completion through to facility operations.

Our approach focuses on two key themes: creating the 'environment for success' – through connected leadership and governance, and creating the 'structure for success' – by adopting a proven ORAT framework and approach. Our experience is drawn from airport projects from around the world, including North America, Middle East and Asia.

ORAT is a recognised and proven approach that integrates the operational goals of an airport operator and its stakeholders into a single program to seamlessly transition new products, services and facilities from project delivery into operations. ORAT combines project delivery and operational readiness activities into one plan that ensures that an airport can maximize its potential and return of investment from day one.

Operational planning
Operational readiness
Activation
Trials
Transition
Governance
Business continuity



CASE STUDY

JED

KING ABDULAZIZ INTERNATIONAL AIRPORT – NEW TERMINAL 1

Jeddah, Kingdom of Saudi Arabia

To support a successful opening at Saudi Arabia's largest and busiest airport, we are working with the General Authority of Civil Aviation (GACA) to provide ORAT and operational support services for the New Terminal 1 at King Abdulaziz International Airport.

The mega project consists of a new 810,000 square meter terminal building that will serve 30 million passengers per year. The terminal includes an advanced baggage handling system, over 28,000 square meters of retail / food and beverage space, and an advanced airport people mover system.

We've delivered ORAT and operational support services between construction completion and operations to provide a successful transfer in flight operations and activation of airport terminal facilities.

We have implemented a holistic ORAT approach within the new terminal which includes working closely with the client and the many stakeholders to assure the readiness and functionality of all facilities, infrastructure and systems, along with a focused approach on human resources such as familiarization and training of staff, and the overall identification of manpower requirements and planning.



CASE STUDY

SFO

SAN FRANCISCO INTERNATIONAL AIRPORT – HARVEY MILK TERMINAL 1

San Francisco, US

The \$2.4 billion Harvey Milk Terminal 1 project consists of a new check-in hall, Boarding Area B (BAB) supporting 25 gates, a new consolidated security checkpoint and baggage handling system. Construction is divided into two projects: BAB and Harvey Milk Terminal 1 Center (T1C). This is an operating terminal with construction being performed in phases, while maintaining flight operations.

As Construction Manager for T1C, we're working in conjunction with the project team, and have created

a manual that defines the steps and processes to perform commissioning and ORAT. The manual will act as a guidance document for use on current and future projects at SFO to create an exceptional project outcome.

We developed a structured process with documented planning, governance, resolution structure, goals, metrics and reporting to ensure a successful terminal opening. An important factor of our success was the Stakeholder Engagement Process (SEP) groups which were made up of key airport stakeholders with vested interests in particular systems or operations. Working collaboratively with design builders and SEPs, we had 36 systems for which we coordinated the operational planning, training, familiarization, operational readiness trials and post-opening issue resolution.

SOLUTION

OPERATIONAL READINESS EXCELLENCE

Worldwide

Operational Readiness Excellence (OREx) is our advanced information management for ORAT. OREx was developed collaboratively by AECOM to leverage our decades of experience to provide an effective management tool for ORAT. It is a comprehensive approach that focuses on delivering assets from construction and the activities required for an operational

facility. OREx is easily tailored to the specific project needs of an airport owner or operator.

Key features:

- Increase accountability
- Efficiently utilise work breakdown structure to manage large and complex projects
- Track critical issues and overall progress
- Monitor actual versus scheduled performance
- Identify change events and integrate into project

DIGITAL DELIVERY

A SINGLE SOURCE OF TRUTH

We're embracing the recent advances in technology to create new ways to optimize the delivery of airport projects, and increase productivity and create efficiencies throughout the design and construction process. By rethinking technology's role in how we design, build and operate, we are unlocking the best outcomes for our clients — better quality, greater reliability, faster delivery and the highest safety standards.

It's no secret that the infrastructure industry is changing. The impact of technological advancements in recent years has been nothing short of transformative. With a widening infrastructure gap and productivity at a low, digital transformation is being hailed as the key to unlocking the power of integrated delivery, and accelerating the progress of critical infrastructure that is essential to economic growth.

As well as combining the best digital tools for construction and manufacturing with new visualisation techniques, while harnessing the power of data — we're also embracing new construction techniques that are changing the way we build. Technologies and processes such as manufacturing of sub-assemblies, volumetric construction and robotics have the potential to fundamentally transform how airports are designed and built — and we deliver a full breadth of Design for Manufacturing and Assembly (DfMA) solutions, from digital libraries to modular construction, to workflow development and site intelligence.

BIM strategy services

Model authoring and management

Information management

Digital asset management

Digital estate solutions

Digital libraries

Modular construction

Workflow development

Site intelligence

Design for manufacturing and assembly

CASE STUDY

DEN

DENVER INTERNATIONAL AIRPORT, BIM+GIS

Colorado, US

We provide quality assurance (QA) services for BIM implementation on multiple programs at Denver International Airport. We are currently providing full-time, on-site QA for the major capital improvement programme, comprising the hotel and transit centre, as well as all landside and airside civil infrastructure projects.

During the past five years, we have provided BIM services on eight runway and apron improvement projects.

The primary goal of our BIM model was to ensure accessibility for all design partners and stakeholders. With

such a large site and complex central model, the site plans and models were distributed on tablet devices to limit paper plans and store new content centrally. The airport's BIM-based asset management solution is available to view on mobile devices.

QR codes can be scanned to find out more information on a particular asset, and BIM has become the primary tool set for new and ongoing projects at DEN. The model will be used for maintaining the critical assets and mechanical, electrical, plumbing and security systems that run the airport. The process is about creating a detailed intelligent model that informs all ongoing actions, and not on creating visualisations. While this major expansion illustrated the full scope of a BIM project with transition to operations, DEN has also been using this approach to capture information in other parts of the airport on smaller projects.

Although currently there isn't a highly detailed as-built model for the whole facility, the airport does have an overall skeletal model — which can be expanded with details from each project as they become available.

One key benefit is the capability to do detailed feasibility studies using the model. It is possible to quickly design and scope a new element, based on a detailed model of what is currently there. If the project is approved, then the early conceptual feasibility work helps to jumpstart the design. Having the model to do the study eliminates the need to survey and measure and capture what's there. Being able to avoid lengthy and expensive consultant time on feasibility studies adds up to big savings long term. In addition, while harder to quantify, the time saved and safety gains achieved through not having workers walking across an active job site are also positive factors.

SOLUTION

DIGITAL WORKFLOW

We know that getting things right from the start makes all the difference. Our dedicated Digital Project Delivery teams support projects from mobilization to completion, ensuring our clients benefit from digital best practice, workflow establishment, management, execution and governance throughout.

Through our Digital Healthy Start program we ensure projects are set

up to take advantage of the best available digital tools from the start. These include:

- **Project Playbook:** Providing project teams across our global business with a centralized location to easily access global and regional best practices, standards, processes, procedures and templates.
- **Information management:** Integrating people, data and processes through the project lifecycle and providing secure sharing and storage of project information to enable effective collaboration.

- **Productivity-enhancing tools:** Collaboration and productivity tools such as Autodesk BIM 360, Dynamo scripts, design anomaly detection through our self-developed AI and machine learning plug-in and model checking dashboards through our ALytics Model Intelligence software.

A digital workflow ensures all asset data is captured effectively during the design phase and can be used beyond — a "running current" of clear and consistent information for stakeholders through all stages of building and operating an asset.

CASE STUDY

BWI

BALTIMORE/ WASHINGTON INTERNATIONAL AIRPORT, CONNECTOR AND SECURITY CHECKPOINT

Maryland, US

We are the prime consultant in a multidisciplinary team, working on the multi-phased, multitask terminal expansion program at Baltimore-Washington International Airport (BWI).

Working in an operational airport environment, we are directly responsible for project management, architectural design and engineering services. The project required an accelerated design schedule, with multiple design packages to be completed within 12 months.

To meet our client's expedited schedule, the project team established processes to ensure efficient and consistent communication

and collaboration across the multidisciplinary team. AECOM's use of a robust building information model (AutoCAD Revit) was combined with weekly in-house design progress meetings and scrum sessions to secure results.

We secured consensus among the many project stakeholders for a unified vision for this program under schedule constraints. The AECOM team utilised LIDAR survey technology to document the extensive existing condition interfaces and BIM modelling to develop the project in 3D to solicit stakeholder input and promote rigorous coordination across the different disciplines.



CASE STUDY

MEL

MELBOURNE AIRPORT – DIGITAL DELIVERY

Melbourne, Australia

Using digital technology to help manage, operate and maintain assets more efficiently, we're collaborating with Melbourne Airport on its digital transformation journey to improve the use of data and information across projects — including helping to create a digital twin of the airport.

Melbourne Airport's operator, Australia Pacific Airports Corporation (APAC), is embarking on a technology-driven transformation path that will see new digital technologies being implemented such as Geographic Information Systems (GIS) and Building Information Modelling (BIM).

Our critical role involves providing strategic and technical resources to support the digital program and the adoption of these new technologies. Engaging with the airport's Capital Delivery Project Management team, we're developing the BIM delivery process in our role as on-site manager of the common data environment. As part of this, we're helping build a digital twin — a complete digital representation of the airport — to improve knowledge sharing and support data-driven asset management.

Our dedicated on-site team are also developing an immersive studio to bring capital projects to life through augmented and virtual reality technology, allowing potential issues to be identified at an earlier stage of a project to save time and money.

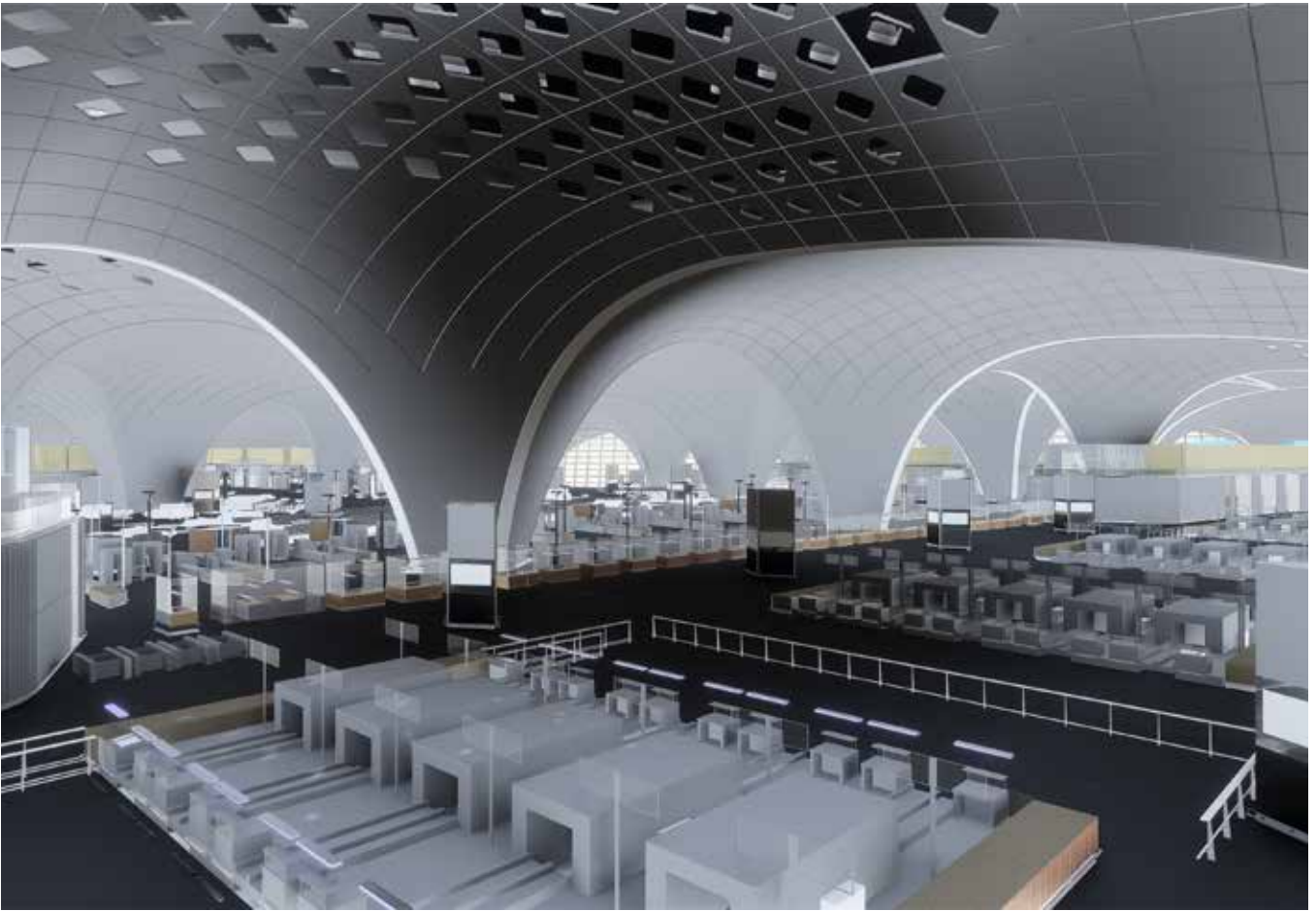
SOLUTION

MULTIDISCIPLINARY DIGITAL LIBRARIES AND DFMA

With standard design components that can be used on multiple projects, our fabrication-ready digital libraries are streamlining project delivery.

Our digital library approach eliminates costly re-work by capturing design decisions in construction-ready "mini-models", providing consistency from one project to the next and dramatically reducing the time needed to design a building. Residual decisions can be built into configurators enabling client choice on individual projects.

The use of digital libraries continues to create efficiencies in the construction phase. Standardized components, specifications and tutorials stored within the model help speed up construction and procurement and, where required, facilitate Design for Manufacture and Assembly, modular and off-site construction.



CASE STUDY

KIA

KUWAIT INTERNATIONAL AIRPORT, TERMINAL 2

Kuwait City, Kuwait

We're supporting the delivery of a new 750,000m² passenger terminal at Kuwait International Airport — a major project which will help establish Kuwait as a new regional hub in the gulf. In our role as BIM manager, we created the project's BIM standards and ongoing BIM strategy, and delivered specific quality assurance and quality control BIM tools.

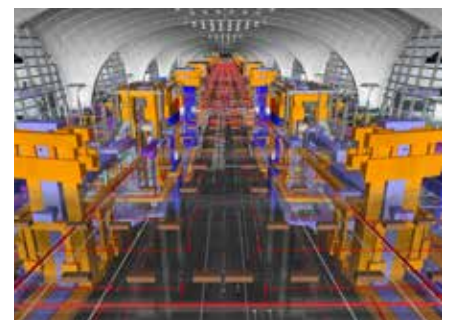
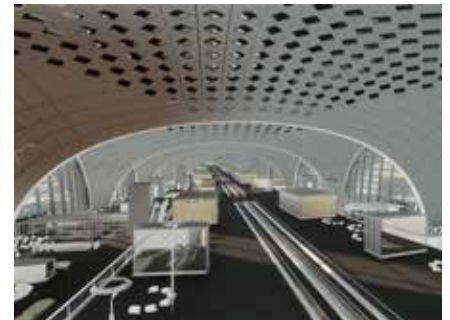
We helped manage a complex and large model for 3D coordination, construction sequence (4D), quantification (5D) and lifecycle management (6D). The scale and complexity of the project means we are managing over 800 different BIM models.

The team used commercial BIM tools like Autodesk Revit, Autodesk Navisworks and Civil3D, but the ambitious scope required the

development of specific additional processes. The BIM processes needed to allow the global project team to collect, view and modify hundreds of complex models. We used programming software such as Revit API, Dynamo, C#, C++ and Python to help them develop bespoke software to help them tackle their specific project challenges.

One of the new creations was a tool that could check that all the models complied with the BIM common standard. This enabled the team to analyse thousands of values coming from all the project's models in a few hours. After dropping this data into a database, we could provide the client and our designers complete reports about BIM quality, progress, and project health.

By developing in-house plug-ins, scripts and applying latest collaborative cloud software, we enhanced communication between different teams and disciplines. These solutions also anticipate potential issues and offer solutions, optimising and saving costs and time during the construction process.



AIRFIELD INFRASTRUCTURE

SEAMLESS SOLUTIONS

We recognize that asset replacement is not always the ideal solution, and work closely with clients to understand their underlying business needs. This helps us ensure that our physical solutions reflect the objectives and constraints of the business. We are also able to offer clients access to all the engineering disciplines they need within a one-stop-shop consultancy, guaranteeing a seamless engineering approach.

Our holistic service seeks to optimise short-term investment — maximising operational efficiency and whole-life cost — and to minimise the environmental impact of construction and operation.

Our pavements team is a global centre of excellence, operating a cradle-to-grave service. This comprises the whole lifecycle of pavement infrastructure from designing new pavements, specifying the materials, testing during construction for quality, surveying and monitoring existing pavements to assess performance, asset management, deterioration modelling, treatment prioritisation and, finally, research and development to update/rewrite the design standards.

Our Airfield Ground Lighting (AGL) team has been working on a variety of intelligent lighting systems that make the visual guiding process easier, improving situational awareness by switching lights on and off according to information shared by airfield surveillance and aircraft tracking systems. This enables optimised aircraft routing to and from gates, more efficient traffic flow, and increased safety.

AIRFIELD AND CIVIL ENGINEERING

Aprons, runways, taxiways and landside infrastructure

Airfield special systems

Soil investigations, and pavement design and engineering

Drainage-system design and engineering

Preparation of tender documents

Contract management

PAVEMENTS

Consultancy and design

Materials specification and design standards

Construction management and operations

Support from our independent in-house laboratory

AIRFIELD GROUND LIGHTING

Fixed ground power

Apron floodlighting

Hydrant fuel mains

Hydrant fire mains

Airbridges

CASE STUDY

BHX BIRMINGHAM AIRPORT

Birmingham, UK

We have been advising Birmingham Airport since the 1980s, covering the feasibility, planning and engineering of the runway extension that opened in 2014. The extension of the runway created a Take Off Run Available (TORA), exceeding 3000 m in the principal direction of operation and the associated infrastructure. This comprised a 550 m extension of the runway and the diversion of the A45 Coventry Road and complex utilities diversion. The scheme also involved full resurfacing of the existing runway, new instrument landing system equipment, new AGL, amended threshold position and approach lighting.

We prepared the detailed planning application; assisted during the planning determination process following their submission; developed a phased solution to enable the scheme to be funded and approved by the Airport Board and produced the works information for a design and construct contract.

The team worked with the airport to develop the appropriate constraints for the design and construct contract, balancing the contractor's need for reasonable possession and the client's need to maintain operations. The contract was tendered using a competitive dialogue process. As part of this, we helped in the administration of the tender process, attended mid-tender interviews and evaluated the technical aspects of the submitted tenders. During the construction phase, we provided technical advice to the employer, project manager and supervisor.

SOLUTION

PACING THE WAY – FRENCH AIRFIELD ASPHALT

Our material and research team investigated the use of French airfield asphalt (Béton Bitumineux pour Chaussées Aéronautiques — BBA) surfacing and High Modulus Base (Enrobé à Module Elevé 2 — EME2) and introduced them to UK airfields. Since their introduction

by AECOM, these materials have been used at eight UK airports and successfully demonstrated environmental, performance and financial benefits. BBA asphalt, can be laid at thicknesses 15 per cent less than Marshall Asphalt while providing equivalent strength, using less aggregate and exhibiting greater sustainability. Shorter construction timeframes also results in reduced fuel consumption and carbon emissions.



CASE STUDY

RUH KING KHALID INTERNATIONAL AIRPORT, AGL UPGRADE

Riyadh, Saudi Arabia

AECOM is the design reviewer for the new AGLCMS, to upgrade AGL, at King Khalid International Airport. The system is being developed to achieve "Follow the Greens" capability and the potential for future automated routing.

SOLUTION

TEMPERATURE RESISTANT CONCRETE

We developed a high-temperature resistant concrete to cope with F35B Lightning II aircraft that are capable of vertical landing, resulting in surface temperatures of 482°C. The team developed a UK specification with UK/EU aggregates.

SOLUTION

DESIGN STANDARDS

We develop and contribute to design standards around the world, such as the independent review of the American Association of State Highway and Transportation Officials' (AASHTO) new Mechanistic-Empirical Pavement Design Guide and Software, Concrete Society's Technical Report 66 and Britpave airfield guidance notes.

SUSTAINABILITY AND RESILIENCE

DRIVING INDUSTRY LEADERSHIP

We've delivered industry-defining sustainability projects across the aviation sector, from small, regional and general aviation airports to the world's largest airports.

The aviation industry is increasingly incorporating sustainability and resilience planning as an operational imperative. With global air travel continuing to grow, airports find themselves at the nexus of many challenging aspects of sustainability today.

This includes operating critical infrastructure and adapting to energy, water and climate change constraints, implementing comprehensive resource efficiency programs, aligning capital programs with green building best practices, and working with airlines and other business partners to reduce greenhouse gases and resource use.

Airports and other infrastructure owners/operators are also increasingly seeking to understand their exposure to climate-related physical and transition risks and ensure they contribute to the broader resilience of the regions they serve.

In 2018, Airports Council International called for airports to act to prepare their infrastructure and operations for the physical impacts of climate change. This resolution was in recognition of the increasing risk to many low-lying airports that are susceptible to the impacts of sea level rise and increasing rainfall intensities under climate change.

As an established aviation and sustainability consulting and implementation firm, our experts assist with every aspect of sustainability and resilience. We offer advisory and implementation services to help airports establish and advance their sustainability programs and initiatives and better understand and plan for climate-related physical and transition risks and opportunities.

ASSESSMENT AND ADVISORY

- Sustainability program development and advisory
- Sustainability reporting and communications
- Climate change risk assessment and advisory
- TCFD climate change scenario analysis
- Climate adaptation and resilience planning
- Vulnerability analysis and studies for future climate scenarios

- Organizational, executive and stakeholder engagement
- Integrated airport master plans
- Sustainability management plans
- Greenhouse gas (GHG) emission inventory / carbon accounting
- Airport carbon accreditation
- Green procurement and tenant programs
- Planning

MANAGEMENT AND IMPLEMENTATION

- Environmental / energy management system (ems / enms)
- Energy planning, auditing, and performance contracting
- Renewable energy planning and implementation
- Materials management and circular economy
- Water management and efficiency
- Green building design, consulting, certification and administration
- Extension of staff services



CASE STUDY

SAN

SAN DIEGO INTERNATIONAL AIRPORT GREEN BUILD

San Diego, US

As program manager for the largest expansion project in San Diego International Airport's history, we helped deliver a new terminal expansion and served as the design architect and engineer for several significant landside improvements that were part of the Green Build program.

We led the overall sustainability initiative that led to the first Leadership and Environmental Design (LEED) Platinum airport terminal in the world. Through the integration of various strategies from advanced

Baggage Handling System controls to energy efficiency measures, and on-site renewables, the award-winning program created a new benchmark for the sustainable airport.

The landside improvement project achieved LEED Gold certification and included a variety of sustainable design and construction principles, including naturally ventilated check-in pavilions, stormwater management/low impact development strategies, and a comprehensive procurement and waste management program.

By adopting an integrated, whole-program sustainability strategy, our team identified and leveraged synergies between the various components of the Green Build program and created a smart, operationally-aligned sustainability strategy.

CASE STUDY

LOS ANGELES WORLD AIRPORTS – SUSTAINABILITY ACTION PLAN

Los Angeles, US

We developed the Sustainability Action Plan for Los Angeles World Airports, which covers the following primary areas of sustainability for their airport: energy, air quality and greenhouse gases, natural resources, noise, water, and waste.

The first phase of work included a review of existing plans, evaluation of baseline conditions, and data quality. Subsequent work included the development of performance targets, goals, implementation strategies, and a monitoring framework for each focus area.

We crafted goals and identified actions for the SAP to ensure alignment with the recent update of the City of Los Angeles Sustainability Plan. A scorecard was also developed that compiled the actions along with progress tracker and benchmarking information against other leading

airports. The project also included stakeholder mapping and engagement as well as supporting LAWA in internal and external communications.

We plan and developed content for informational boards. The final deliverable, which is publicly available on the LAWA website, is a visually engaging strategic action plan that organizes and optimizes LAWA's sustainability actions and plans to achieve performance gains for the sustainability program. The SAP is also being used to organize and implement LAWA's carbon management efforts under ACA.

CASE STUDY

SYD

SYDNEY AIRPORT, GREEN STAR COMMUNITIES RATING MASTER PLAN

Sydney, Australia

As a trusted advisor, we have worked closely with Sydney Airport to develop the Sydney Airport 2039 Master Plan. Works included embedding sustainability in to planning and design through an integrated and innovative approach to cater for future expansion and airport needs in alignment with the Sydney Airport Sustainability Principles and Green Building Council Australia's (GBCA) Green Star-Communities rating. Through this work, the Airport was awarded a 4 Star Green Star-Communities rating, one of the first airports in Australia to do so. We also continue to support the airport in the analysis and reporting

of Scope 3 emissions to maintain its Airport Carbon Accreditation (ACA) Level 3 status.

Additionally, we supported SYD in climate resilience, providing advisory support to identify a pathway to strengthen the Airport's approach to climate change risk management, including trigger points to embed climate resilience in decision-making and assist the airport in its climate-related financial disclosures (i.e., through Task Force on Climate-Related Financial Disclosures, or TCFD). We also continue to support the airport in the analysis and reporting of Scope 3 emissions to maintain its ACA Level 3 status.

CASE STUDY

DTW

DETROIT METRO AIRPORT

Detroit, US

We worked with Wayne County Airport Authority to support DTW achieve Level 3 "Optimization" certification under the ACA program. The project included the development of a comprehensive Scope 3 greenhouse gas inventory, which included onsite survey work to improve the accuracy of the Scope 3 emissions. After developing a data collection protocol, we managed onsite data collection surveys, including GSE operating time, gate power utilization, and a traffic survey at terminals that included vehicle classification count, time spent at the curb, and idling.

We also projected Scope 3 GHG emissions (as well as Scope 1 and 2) to reflect future conditions in years 2020, 2030, and 2050. Finally, we worked with WCAA staff to review all documentation, including the Stakeholder Engagement Plan, to ensure ACA Level 3 requirements were met and responded to all questions raised by the auditor during the third-party verification audit.



CASE STUDY

HILLSBOROUGH COUNTY AVIATION AUTHORITY – AIRPORT CARBON ACCREDITATION (ACA) AND CARBON MANAGEMENT

Tampa, US

For over three years, we have built up Hillsborough County Aviation Authority's (HCAA) carbon and sustainability program — helping Tampa International Airport achieve

Level 1 and Level 2 ACA certification and re-certification and supported HCAA's three General Aviation (GA) airports to achieve Level 1, with one airport achieving Level 2 certification.

We developed comprehensive greenhouse gas inventories and updates for all airports, including verifying compliance with ACA requirements, developing a Carbon Management Plan for the airports, completing certification activities, and facilitating and managing the administrative and verification components of the certification process.

Our work functioned as full out-sourcing of the ACA and carbon management effort for all HCAA's airports. We managed all documentation and procedures required to achieve certification and worked with ACA administrators to ensure documentation was received in time for certification — often under a compressed schedule and either at or under budget. As a result of this work, HCAA is positioned to achieve advanced levels of carbon management and disclosure in the coming years.



CASE STUDY

OAK OAKLAND INTERNATIONAL AIRPORT

Oakland, US

Working with the Port of Oakland, we helped conduct a vulnerability assessment, prepare environmental documents for government compliance, develop improvement strategies, and design improvements for the existing airfield perimeter dyke

at Oakland International Airport for both seismic and flood conditions.

The objectives of the perimeter dyke project were to: perform a vulnerability assessment of the dyke to consider the threats posed by seismic events and climate change such as flood and sea level rise (SLR); develop improvement strategies to upgrade the perimeter dyke system to strengthen its seismic performance and secure FEMA certification of the dyke for a 100-year flood; and prepare conceptual designs and estimate the cost to upgrade the perimeter dyke.

After a successful first phase, we also produced environmental documents (and an initial study / mitigated negative declaration to comply with the California Environmental Quality Act), as well as plans, specifications and estimates for the construction of the proposed improvements. We developed and evaluated 10 alternatives with conceptual designs and cost estimates prepared for the three identified as most favourable. Modelling and analysis were performed to demonstrate the effectiveness of the improvement concepts in reducing the seismic and climate change risks.



THE AVIATION INDUSTRY AND CLIMATE CHANGE – A BALANCING ACT

The aviation sector's contribution to global warming is increasingly in the spotlight. But with most of the industry's carbon emissions associated with aircraft activity, **Robert Spencer** and **Craig Riley**, sustainability leaders in the UK and US respectively, asks what can airports really do to make a meaningful dent in the sector's CO₂ emissions?

Despite heightened public attention on climate change issues, demand for air travel continues and global aviation traffic is predicted to grow significantly over the next two decades, particularly in the developing world. To meet such demand will necessitate an increase in capacity and there are major airport expansion projects planned or in progress across the world. To avoid catastrophic consequences from climate change, significant effort to reduce emissions from all sectors, including aviation, is required over the next ten years. While new technologies and developments in aircraft design are likely to make the biggest contribution to reducing emissions, most are still years from deployment. The sector must, therefore, accelerate efforts in areas that can have an impact now; and the design and operation of new and existing airports can play a big role.

PHYSICAL AND TRANSITION RISKS

Airports can build resilience by better understanding and planning for climate-related physical and transition risks. Consideration of these risk factors is often driven at Board level by assessing the recommendations from the Task Force for Climate Related Financial Disclosures (TCFD) which is placing a stronger emphasis on how organisations such as airports understand and respond to the transition to a low carbon economy.

Transition risks represent a material gap for many and have the potential to expose airports to increased pressure from investors, along with a range of issues related to legal liability, policy changes, market and technology shifts, and reputational damage.

We're helping the industry address these challenges. In 2019, alongside global law firm Baker McKenzie and environmental consultants Ndevr Environmental, we released 'Climate Change Risk and Opportunities: A Decision-makers' Practical Guide to Disclosure', a discussion paper on how business leaders can meet their legal obligations to assess and disclose the financial risks and opportunities linked to climate change.

TOWARDS NET ZERO

In June 2018, the Airports Council International (ACI) Europe, which represents more than 500 airports across Europe, committed to net zero carbon emissions from airport operations by 2050 at the latest. In 2020, the ACI World organization intends to establish an ambitious long-term carbon reduction goal applicable for the air transportation sector at a global level. Airports in every geography are working to manage and reduce carbon, with the industry, as a whole, organizing around a common carbon management and reporting platform, called Airport Carbon Accreditation (ACA). Many airports have their sights set on achieving net zero and pursuing carbon neutrality through the ACA program, with some airports seeking to go beyond neutrality to achieve carbon positive facilities and influence the carbon emissions of their business partners and travelers.

Achieving net zero is an ambitious challenge that requires a re-think in the approach to designing and operating airports. Designers, architects and airport owners will need to understand the wider context and implications of their design decisions, taking into consideration the impacts new facilities, upgrades and supporting infrastructure, such as ground transportation, will have on the environment and looking at ways to optimize efficiency across all elements of a project.

DESIGNING FOR THE FUTURE

Crucially, new facilities and upgrades must be designed with the future in mind. Designers need to be adept at planning for developments that are going to change the way we use airports in the future, enabling their implementation as soon as the technology and financial resources are available. Passenger travel to and from airports by car and through other ground transportation contributes a sizeable portion of an airport's total carbon footprint, indicating a real need to facilitate and encourage more journeys by public and other sustainable transport means. With the increasing shift towards 'Mobility as a Service' (MaaS) ride-hailing apps like Uber and Lyft — which are not always the most climate-friendly option if they cause more congestion and unnecessary rides



TO AVOID CATASTROPHIC CONSEQUENCES FROM CLIMATE CHANGE, SIGNIFICANT EFFORT TO REDUCE EMISSIONS FROM ALL SECTORS, INCLUDING AVIATION, IS REQUIRED OVER THE NEXT TEN YEARS

by vehicle — car parking facilities required now might not, therefore, be needed quite so extensively in the future. Designing terminals, landside access infrastructure or other ancillary buildings to be adaptive or relocatable as user requirements change can bring greater carbon efficiency and environmental benefits as shifts in personal mobility patterns unfold.

CIRCULAR ECONOMY THINKING

Indeed, applying a wider circular economy approach to design and operations will help lower the carbon footprint of projects. However, many challenges constrain the ability to apply circular economy models to complex large scale infrastructure like airports. Greater collaboration is needed to fully embrace the circular economy in aviation, with designers, construction contractors, procurement and contract managers, and airport capital program teams working together to engage supply chains and develop a holistic approach to design and construction elements such as materials selection, water use and waste reduction. Specifying requirements and/or incentives for procurement are often among the most effective means of ensuring assets and resources are used more efficiently. These approaches send a clear signal to the market for innovation and alternative delivery models.

CARBON-OFFSETTING

Given the challenge of achieving net zero or carbon neutrality, more and more airports are turning to carbon offsetting to meet their climate targets. Over 60 airports globally have achieved carbon neutrality as reported on the ACA website. Airlines are also looking at carbon offsetting. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a global scheme for airlines, currently in pilot phase, that requires the purchase of carbon offsets to compensate for growth in CO₂ emissions. Delta Airlines made news just recently with the commitment of \$1 billion USD over the next 10 years to mitigate all emissions from its global business going forward, while EasyJet have announced similar measures and a £25 million fund to offset the emissions of their passenger air miles in the Europe, Middle East and Africa (EMEA) market.

While carbon credits purchased under CORSIA are typically generated by carbon reduction projects in developing countries, there are ongoing discussions about how airlines and airports together can influence mitigation efforts that are

more closely aligned to air travel. For example, expanding an airport's 'net zero zone' through programs that generate carbon reduction within an airport's catchment would localize carbon emissions reduction while generating potential air quality co-benefits, thus bringing the carbon impact and offset benefit closer to the community in which the airport operates.

The aviation sector is in a difficult position on climate change, with the full value chain for air travel including aircraft manufacturers, airlines, airports and ground transportation providers contributing to carbon emissions. Far-reaching carbon reduction requires radical changes to aircraft activity but is still years from fruition. Accelerating new aircraft technology and sustainable aviation fuels are clearly priorities, but airports and their business partners are on the road to making airports themselves more carbon efficient now and making a bigger impact in the short term. Taken together, these measures represent some of the major opportunities facing the aviation sector's carbon emissions challenge.



CASE STUDY

SYDNEY AIRPORT

Sydney, Australia

We worked with Sydney Airport's leadership team to develop a climate adaptation plan responding to the physical and transitional risks of climate change. This adaptation plan is based on the development of a clear set of future climate and transition scenarios and draws on leading adaptation actions being implemented by airports globally (see page 34). The plan provides a pathway to strengthen the airport's

approach to climate change risk management, including trigger points to embed climate resilience in decision-making and assist the airport in its climate-related financial disclosures through the Task Force on Climate-Related Financial Disclosures. The results of this work featured in the Sydney Airport 2019 Sustainability Report.



CASE STUDY

SAN DIEGO INTERNATIONAL AIRPORT – SUSTAINABILITY PLANS

San Diego, US

We were recently instrumental in helping San Diego International Airport (SAN) become the second airport in North America to achieve Airport Carbon Accreditation 'neutrality' through our sustainability plans. We helped develop the SAN Strategic Energy Plan (STEP) and Sustainability Management Plan (SMP), which together provide a portfolio of action plans to address the airport's primary areas of sustainability which include: carbon neutrality, sustainable energy, clean transportation, climate resilience, zero waste and biodiversity.

Our cross-functional team operationalized resource and cost-saving initiatives, allowing SAN's commitment to aggressive sustainability targets including 80% greenhouse gas emission reduction and a 67% increase in waste diversion. The STEP contains an action-focused roadmap leading to 30% energy cost reduction, 66% reduction in onsite greenhouse gases emissions, and ability to reduce reliance on grid energy by 70%. The plans serve as a model for the effective identification, management and communication of sustainability issues. Each plan sets an industry precedent, collectively establishing SAN's vision and roadmap for zero carbon, zero waste, and more resilient operations.



GIVEN THE CHALLENGE OF ACHIEVING NET ZERO OR CARBON NEUTRALITY, MORE AND MORE AIRPORTS ARE TURNING TO CARBON OFFSETTING TO MEET THEIR CLIMATE TARGETS.

ENVIRONMENTAL SERVICES

MANAGING AND REDUCING IMPACT

We work collaboratively with aviation clients and communities to solve their most complex environmental challenges from asset development to operations optimization, with a focus on restoration and reuse. We understand the pressures to reduce waste and maintain compliance with environmental regulations, while also advancing practices to reduce environmental impact. Our team has been developing innovative environmental solutions tailored to the individual needs of each project.

Environmental program management

Emergency response and planning
Stormwater pollution prevention

Site assessment and groundwater monitoring

Remediation

Emerging contaminants

Underground storage Tank (UST) and aboveground storage tank (AST) programs

Management and compliance support

Hazardous and non-hazardous waste management support

Recycling and diversion programs

Air quality permitting and compliance

Environmental health and safety

Environmental planning, permitting and impact assessment support

Environmental infrastructure design studies

Biological resource management at aviation facilities

Environmental management information systems

Green infrastructure and nature-based solutions

Topographic survey

CASE STUDY

BCN

PLAN BARCELONA- EL PRAT AIRPORT

Barcelona, Spain

As part of our support to Plan Barcelona – the Barcelona – El Prat Airport expansion scheme - we helped implement the airport's environmental management system (certified to ISO 14001), as well as delivering the coordination and integration of the various projects that make up the Plan.

Our range of services included implementing the environmental management system, as well as other environmental and social management services. These included protective, corrective and compensatory measures and habitat restoration and recovery of native flora.



CROSS-SECTOR SPOTLIGHT

WALLASEA ISLAND

Essex, UK

During the construction of London's landmark Crossrail line, more than three million tonnes of spoil was excavated from beneath the capital and shipped to Wallasea Island in the eastern Thames estuary to create Europe's largest man-made wetland. We carried out the design of the site earthworks for this ambitious conservation project, which will help to replace the marshland lost along the Essex coast. The created habitat will include salt marshes, mudflats, salt marsh pools, water creeks, lagoons, grazing marshes, seawalls and bunds.

As Wallasea Island is two metres below sea level, various embankments and earthworks are to be built around the site, using the earth excavated from Crossrail. During excavation, it became apparent that there was less waste material than anticipated. AECOM's ground engineers, working closely with the Royal Society for the Protection of Birds (RSPB), were tasked with redesigning the site earthworks, using the redesign to enhance the ecological value of the island, and provide a diverse range of new habitats while ensuring the tidal flow of water on and off the island would be managed.

CASE STUDY

LOS ANGELES WORLD AIRPORTS – ON-CALL ENVIRONMENTAL, TECHNICAL AND EXPERT CONSULTING SERVICES

Los Angeles, US

We've been providing comprehensive environmental consulting, engineering and construction services to Los Angeles World Airports (LAWA) for the past ten years, and we currently hold an on-call environmental consulting services contract.

The services we've delivered at LAWA sites include remedial site audits and facility investigations, operation and maintenance evaluations, construction oversight and management consultation services, human health and ecological risk assessments, treatability and feasibility studies, HAZMAT surveys and above/below ground storage tank compliance and removal.

PFAS MANAGEMENT

INVESTIGATION, MANAGEMENT AND REMEDIATION

AECOM is recognised as a global industry leader in PFAS management having worked on over 400 projects globally.

Per- and Poly-Fluoroalkyl Substance or 'PFAS' is an emerging contaminant and concern. A manufactured chemical component of legacy aqueous firefighting foam (AFFF) that has been used in the aviation industry for over 50 years. The release of AFFF at airports from training exercises, emergency response, and other uses has led to PFAS impacts to groundwater, surface water, soil and other environmental media.

PFAS is highly soluble, mobile and bio accumulative, which means it can travel long distances through soil and water. Long-term use of the chemical has resulted in contamination of the environment where PFAS was used. As regulations evolve around PFAS impacts airports are typically targeted by regulators due to the history of AFFF use and storage. Regulations around the use and bulk storage of AFFF are evolving rapidly requiring best management practices to track materials and limit release to the environment.

Our vision is to identify long term solutions for our clients to investigate, manage and remediate PFAS impacts. While our work includes investigation and management of PFAS, we're also developing, trialling and commercialising a world-first PFAS destruction technology, De-fluoro™. We are assisting clients globally to meet rapidly evolving regulatory compliance issues surrounding the use and storage of AFFF.

Preliminary assessment for PFAS
Remedial investigation/feasibility studies and development of treatment technologies
Risk assessment
Remediation solutions (incorporating AECOM's De-Fluoro™ destruction technology)
AFFF Best management practices
Fire training area alternative evaluations



SOLUTION

**NEW TO MARKET
DE-FLUORO™**

Worldwide

Our dedicated PFAS technology team was formed to strategically solve the challenging environmental issues that PFAS can create by developing a cost-effective, sustainable solution. The team developed a treatment technology system called de-fluoro™ - an electrochemical oxidation (EO) process that uses highly conductive, chemically-inert, low-cost proprietary electrodes to effectively degrade PFAS.

De-fluoro™ offers a complete on-site PFAS destruction solution that can be used as a coupling technology. The team are currently undertaking trials in AECOM's Newcastle office in New South Wales, using PFAS impacted wastewater from sites across Australia.

The technology will be commercialised in 2020 and potential applications include:

- Groundwater
- Industrial waste water
- Drinking water
- Investigation-derived waste water
- Liquid waste
- Surface water



CASE STUDY

**PFAS INVESTIGATIONS
– NORTH AMERICA AND
AUSTRALIA AIRPORTS**

North America and Australia

The persistent nature of PFAS has resulted in a high level of environmental regulatory scrutiny globally. We are currently undertaking PFAS investigations at numerous airports across the United States and Australia. We are leveraging experience dating back to the early 2000s in managing

PFAS impacts at defence facilities and bringing that practical experience to the civilian aviation space. Our PFAS experts are at the forefront of identifying potential PFAS source areas, evaluating risk to adjacent receptors, and formulating a pragmatic approach to site investigation. Data collected during the preliminary assessment and site investigation is used to create a robust conceptual site model to target additional investigation and treatment. If needed, our in-house treatability lab is used to evaluate site samples and remedial technologies to select the most appropriate remedy.

COST MANAGEMENT

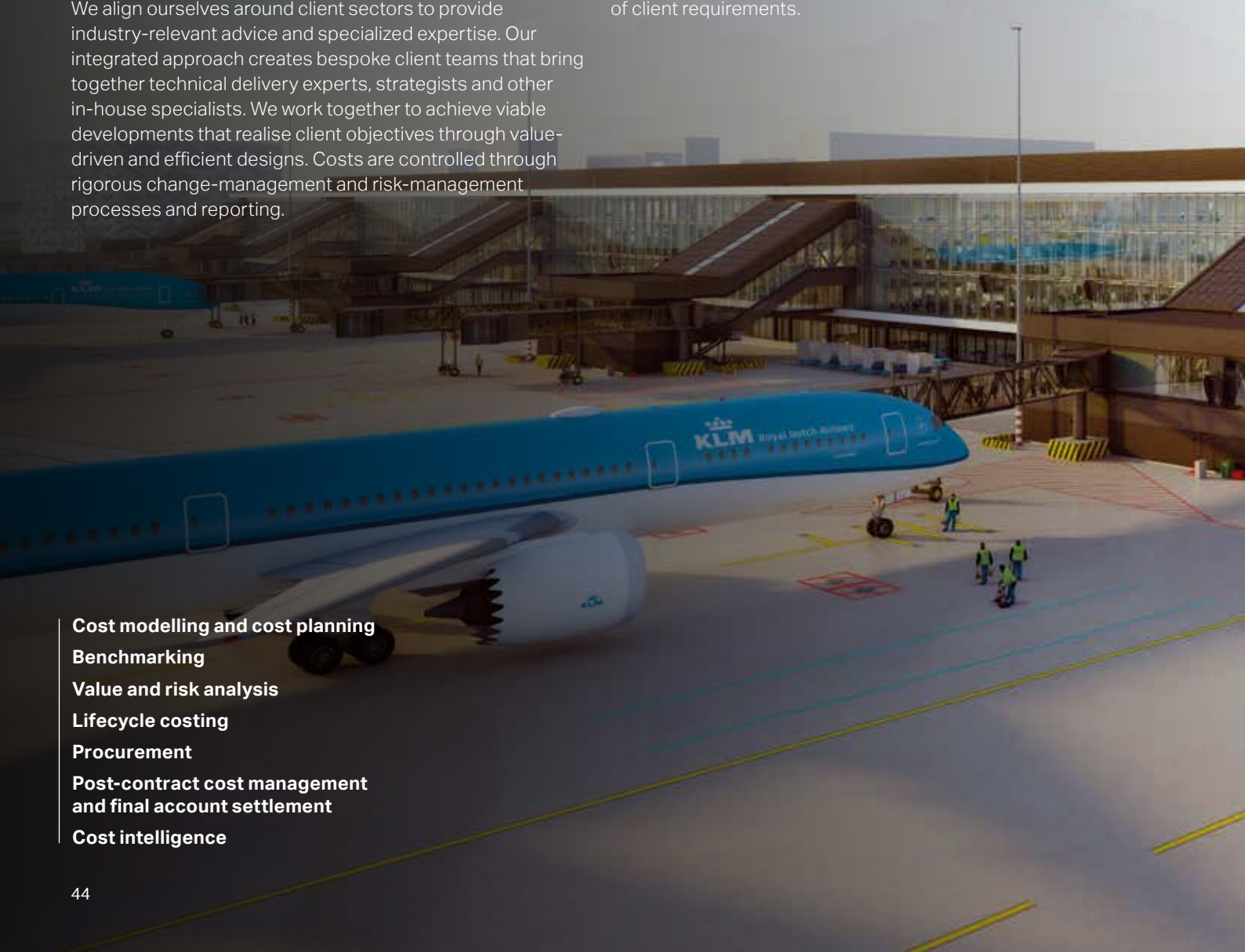
DESIGN TO BUDGET

Our cost management services provide specialized expertise across project lifecycles to reduce client risk and improve value.

We align ourselves around client sectors to provide industry-relevant advice and specialized expertise. Our integrated approach creates bespoke client teams that bring together technical delivery experts, strategists and other in-house specialists. We work together to achieve viable developments that realise client objectives through value-driven and efficient designs. Costs are controlled through rigorous change-management and risk-management processes and reporting.

We have access to unprecedented cost data on projects across a diverse range of contexts and sectors. Based on that intelligence and analysis, we have generated industry-leading, global benchmarking data sets. This means that, along with our extensive experience and specialist knowledge of end markets and building types, we can provide more accurate advice on the cost implications of client requirements.

Cost modelling and cost planning
Benchmarking
Value and risk analysis
Lifecycle costing
Procurement
Post-contract cost management and final account settlement
Cost intelligence



CASE STUDY

AMS

AMSTERDAM SCHIPHOL AIRPORT, NEW PIER DESIGN

Amsterdam, Netherlands

We helped manage the pre-tender construction cost estimate for a new pier development at Amsterdam Schiphol Airport. As part of a multidisciplinary design team, our cost managers worked with the designers, stakeholders and client team to influence and deliver a 'design to budget' capex approach. The stringent budget requirements for the project, set within a wider significant capital program, were at the outset of the project and our team worked to deliver the complex operational requirements of the facility, while adhering closely to them.

We utilized a tried-and-tested methodology to proactively drive the estimate control and management. We used project benchmarking and historic 'as built' cost data to determine how the budget related to our previous experience in the aviation sector. This includes considering specific details for the project, such as substructure and frame solutions, aspirations for envelope treatment, the desired finishes palette and the specialist systems that need to be incorporated.

To maximize our expertise and experience, we used Global Unite, AECOM's unique global cost database, which contains information from approximately 15,000 projects to benchmark a project, interrogate cost and performance criteria and review cost trends across geographies and specific workstreams, including aviation.



CASE STUDY

SIN

SINGAPORE CHANGI AIRPORT

Singapore

Singapore's Changi Airport Group is proposing to build one of the world's largest terminals, with a ground-breaking Terminal 5 complex. In addition to a terminal and concourse building equipped to facilitate 54 million passengers per annum, a significant amount of airfield development works will be required. This includes additional runway enhancement works and the construction of a new cargo complex to the north of the site.

We are providing cost estimating services for the early functional-planning stage of the project. Our work involves advising on cash flow and the implications of the overall programme of works.

We produced a comprehensive project budget and developed a work breakdown structure for the whole of the project, which enabled Changi Airport Group to make submissions to their funding parties for the initial drawdown of project expenditure. In addition to the overall detailed cost plan for the project, we have assisted the client with procurement advice, detailed quarterly cash flows and benchmarking to support the levels of expenditure being proposed.

SOLUTION

GLOBAL UNITE

Worldwide

Using the wealth of untapped data we generate worldwide to bring unique value to projects, Global Unite is AECOM's cost planning, cost control and benchmarking tool that gives our clients unparalleled access to quality global and local knowledge. The tool collects and shares project performance data from our daily quantity surveying and cost consultancy work across the whole of AECOM.

Taking knowledge from our cost planning and measurement systems, Global Unite applies data mapping rules to manage differences in geographic definitions. By creating a direct comparison of a project with global data, we can show our clients what is best practice and how their project compares.

SURFACE ACCESS

MAKING CONNECTIONS

We are leaders in the design and project management of landside infrastructure for airports. We plan and design facilities that enable infrastructure equipped for long-term sustainable growth, while also ensuring that the surrounding environment is protected.

As landside infrastructure forms the primary physical interface between the core aviation functions of an airport and its surrounding communities, we use sustainable surface access to promote local economic development and help to lower the impact of airport operations on local communities.

- Terminal curbs and forecourts
- Automated people movers
- High-speed, regional and metro-rail connections
- Public transport interchanges
- Surrounding airport-city commercial developments
- Personal rapid transit

CASE STUDY

DUB

DUBLIN INTERNATIONAL AIRPORT

Dublin, Ireland

As the main component of AECOM's input to the project's masterplan, we developed a surface access strategy that provided a detailed plan of the infrastructure required to support increased capacity at the airport. As the existing network around the airport is already heavily congested, significant infrastructure improvements were identified to help meet passenger growth forecasts.

The strategy also incorporates the proposed development of a light-rail link to the city centre. We assessed the existing surface access conditions at the airport through detailed analysis of: the existing access arrangements; the link and junction capacity, the bus interchange and parking facilities, the travel behaviour of passengers and staff and the existing freight arrangements. We undertook benchmarking of the surface access arrangements at major European airports and generated strategic transport modelling using the National Transport Authority's multi-modal Eastern Regional Model (ERM).

We produced future-year mode share projections and future-year traffic flows, and provided identification, preliminary design, phasing and costing of the road network improvements required to facilitate the estimated future-year traffic flows, as well as setting out the public transport services and infrastructure needed to support the passenger projections. Our demand-management strategy also included parking and staff mobility management.



CASE STUDY

LHR

HEATHROW AIRPORT, SURFACE ACCESS

London, UK

We supported delivery of the Heathrow Expansion Programme at Heathrow

Airport, to work towards a Development Consent Order (DCO) application for a third runway, the associated facilities and supporting infrastructure. As part of this work, we developed a new strategic highway assignment model, and are also involved in the surface access strategy and masterplan development and appraisal work.

CASE STUDY

GRR

GERALD R. FORD INTERNATIONAL AIRPORT, ACCESS CONTROL AND SECURITY SYSTEM UPGRADES

Michigan, US

At Gerald R. Ford International Airport in Grand Rapids, Michigan, AECOM was the sole provider of security masterplanning and design services for the replacement Access Control System throughout the entire airport. The project included vulnerability analysis, FAA security compliance review (CFR part 49 1542), market analysis in support of system selection, and design and construction support. The system contained about 50 card readers, which were made biometrics capable, and five perimeter gates.

Three taxiway microwave beams secure the terminal area. At the perimeter, some gates and fences were relocated to better meet Federal requirements. In addition, the CCTV system was replaced by a new digital video system. The project included an upgraded communication backbone to support these requirements, and the system uses the GSA GSIS compatible contactless smart cards. This was the first installation of such cards at an airport within the United States.

Another unusual project feature was the microwave 'security fence', which separates the air carrier operations from general aviation operations at Gerald R. Ford International Airport. This electronic fence was upgraded during the project and uses microwave beams rather than wire or chain link to deter intruders. It allows aircraft to taxi from one side of the airport to the other, but triggers an alarm to the tower when people or vehicles attempt to enter the air carrier operations area.

FUELING SYSTEMS

TAKING FLIGHT

Our aviation fuel experts have an in-depth understanding of technical and aviation regulations. We are skilled in working on airfields of all sizes and forms. We offer comprehensive in-house support for the design and construction of aviation fuelling systems and facilities.

We are adept in designing aviation offloading, storage, pumping and hydrant facilities from the ground up, as well as working on major upgrades while minimizing disruption to normal day-to-day operations. Our projects have involved the full range of investigation, design, materials, procurement and construction support services. We've been providing aircraft fuelling related services throughout the world for over three decades.

Planning, conceptual design and detailed design

Cost estimating and economic analysis

Procurement of equipment & construction material

Construction management

Operational and maintenance manuals

Environmental permitting for air emissions, storm water, and industrial waste

Spill prevention, control and counter-measure (SPCC) plans

Demolition plans and specifications

Pipeline abandonment and closure

Sustainable aviation fuel planning



CASE STUDY

BOS

LOGAN INTERNATIONAL AIRPORT

Boston, US

We provided investigation, design and construction-phase services to replace all fuelling facilities at the airport, which has totalled approximately US\$84 million. The initial award-winning US\$63-million

project was completed on time and US\$4.5 million under budget. This work included a distribution system serving all aircraft gates, a new enlarged-capacity fuel farm to replace five old ones, an operations building with sophisticated monitoring/controls, environmental safeguards, and provision for recovery/reuse of fuel. Subsequently, we performed all follow-on work to complete the fuel hydrant systems throughout the airport. The project has won multiple awards.



CASE STUDY

EXXON MOBIL

Central & South America and the Caribbean

Our on-call services required the complete range of engineering disciplines for fuel hydrant and storage systems. We provided these services continuously for 13 years, doing this work in-house. Assignments entailed planning, layout, design, permitting, materials procurement, and construction-phase services for

new and upgraded hydrant systems, fuel farms, pumps, controls, dikes, automated control and monitoring systems, and design/build control systems.

Quite often, projects were contracted with ExxonMobil, then expanded to include Shell and Texaco as a joint effort. Typically, costs ranged from US\$500,000 to US\$6 million. Work was performed at airports in Brazil, Jamaica, the Bahamas, the Dominican Republic, Aruba, El Salvador, Honduras, Nicaragua, and Chile.

CASE STUDY

MIA

MIAMI INTERNATIONAL AIRPORT

Miami, US

For over 19 years, we provided General Consulting/on-call services for all fuelling facilities. Work entailed planning, layout, design, permitting, and construction-phase services for new and upgraded fuel farm facilities, fuel

hydrant systems, and related items. Our 50+ tasks included integrating five separate storage facilities into one, upgrading many health/safety/environmental systems, designing a new air cargo fuel load rack with operations building, consolidating and upgrading the emergency fuel shut-off system, designing hydrant systems for Concourses A and G, and preparing environmental permits and a fuel system masterplan.

PROCESS AND AUTOMATION

PLANNING FOR TOMORROW

Industry is changing. Big data, automation and the growing demand for customised products mean businesses need to transform today, to keep pace with tomorrow.

With this increasingly connected, data-driven landscape comes great opportunities for better, faster and more cost-efficient processes. In response, we have developed our process-led design offer — to help our clients navigate the future, and understand how to integrate process and infrastructure (physical and digital) to create efficiencies and stay competitive. We know how important it is that investment in fixed production infrastructure is flexible and adaptable for the years ahead. From defining how a facility will be used, to developing long-term asset maintenance plans, we can provide process-led, technology-neutral advice across the project and asset lifecycle. Drawing on our global design and construction experience, we partner with our clients to understand their products and processes and create manufacturing facilities that are perfectly matched to their function.

Industrial architecture

Engineering

Construction

Lean



CASE STUDY

LHR

HEATHROW AIRPORT, AIRBRIDGE SEMI- AUTOMATED DOCKING AND UNDOCKING

London, UK

To help Heathrow Airport Limited change the use of one of its airbridges at Terminal 5 from manual to semi-automated, we identified the hazards and estimated the risks of the process to both the bridge and operators.

Through hazard identification (HAZID) workshops at the airport, with subject matter experts from Heathrow, British Airways and, airbridge manufacturer, ThyssenKrupp, we ensured that all

relevant issues and concerns were input into the process. This helped us to identify the most severe hazards, for example, the airbridge hitting a person on the apron or impacting aircraft and equipment.

We then estimated the level of risk for each hazard and assigned a score for the likelihood of occurrence, frequency of exposure, degree of possible harm and number of persons at risk. Based on this information, we were able to identify appropriate risk reduction measures for the client to implement. This included putting in place additional operator training, revising operational procedures to cover daily functional inspections, crosschecking airbridge positioning, and organising additional CCTV monitoring around aircraft bogies.



CASE STUDY

LHR

HEATHROW AIRPORT FUTURE TERMINAL 2 - LEAN

London, UK

We worked alongside Heathrow to improve its excavation process for one of Heathrow's Terminal 2 expansion projects (see page 16).

The process optimization project was delivered through a systematic implementation of lean principles to fully understand the current process, map opportunities and develop solutions. Through discrete scenario simulation and focusing on process flow and rhythm, we demonstrated a potential of 19% time and 15% cost savings for the excavation process.

ACOUSTICS AND AIRCRAFT NOISE

CONTROLLING NOISE AND VIBRATION

Our capability in acoustics ranges from environmental and building acoustics to electro-acoustics and sound system design. We have a design-led culture where creativity is supported by leading technical, research and development experience. With access to national and global specialists, we bring innovative and intelligent acoustic design solutions to high profile airport infrastructure projects.

Acoustics, and the control of noise and vibration, is a major consideration in the creation or redevelopment of airfields, airport terminals and runway extensions, and plays a key role in promoting a safe, efficient environment and passenger experience. Using sophisticated modelling techniques, we optimise acoustic performance to enhance functionality and achieve outstanding project outcomes. Our expertise includes delivering environmental acoustics design to minimize noise impacts on communities surrounding existing and proposed airports; designing cost-effective building acoustics that improve the sound insulation of airport terminals to reduce noise levels from aircraft and support services while integrating technical requirements with architectural vision; and ensuring the success of airport public address (PA) systems through combined electro-acoustics and sound system design.

Aircraft noise analysis

Aircraft noise simulation modelling

Environmental acoustics

Building acoustics

Electro-acoustics including full sound systems design and specification

Auditing and testing

Calculation and computer modelling

Review of third party design proposals and calculations

Environmental assessments of the impact from PAVA systems

Noise impact assessments

Equipment schedules

Residential sound insulation programs

Ground based multi-modal noise impact assessment and vibration analysis

CASE STUDY

STN
**LONDON STANSTED
AIRPORT, PUBLIC
ADDRESS AND
VOICE ALARM
SURVEY**

Essex, UK

Undertaking a detailed review of the combined Public Address and Voice Alarm (PAVA) systems at Stansted Airport, our electro-acoustics PAVA designers helped identify where the systems were non-compliant with relevant standards, ensuring safety by establishing the operation and condition of the installed systems.

Stansted Airport was one of the first public buildings to be installed with a Voice Alarm (VA) system. But as governing standards for the design, installation, maintenance and performance of VA systems and Sound Systems for Emergency Purposes (SSEP) had undergone numerous revisions since the initial installation, the airport's owner and operator Manchester Airport Group wanted to review the existing systems against the latest requirements and recommendations.

We carried out a desk study of available Operations and Maintenance (O&M) manuals, schematics, installation drawings and maintenance records, followed by a series of site surveys and stakeholder engagements to determine if/where equipment was no longer serviceable. We also produced a detailed summary report presenting our findings and proposed roadmaps for a phased program of renewals.

CASE STUDY

AMS
**AMSTERDAM AIRPORT
SCHIPHOL**

Amsterdam, The Netherlands

Delivering the detailed design of the full PAVA system for the new pier at Amsterdam Schiphol Airport (see page 44), our electro-acoustics specialists are designing the full system, including microphones, processing, amplification and loudspeaker layout designs, with interfacing to a number of existing systems in the main terminal building.

One of Schiphol's key requirements is to minimise spill of PA messages from gate lounges to other areas. The open nature of the pier design makes this especially challenging. Our electro-acoustics specialists are carrying out detailed modelling to predict the sound system performance in terms of speech intelligibility for comparison with the life safety requirements in relevant standards, collaborating with AECOM's architecture, telecoms, and MEP teams, as well as external acoustic and fire engineering consultants.

SOLUTION

**AECOM IMMERSIVE
SOUND STUDIO (ISS)**

Worldwide

Using new technology to simulate the sound of aircraft movements, our Immersive Sound Studio (ISS) provides industry-leading sound demonstrations to help communicate noise impacts during public consultations and aid the ongoing decision making processes with government officials, airport operators or community group leaders. When changes to an airport's local airspace operations are under consideration, ISS supports a range of innovative sound demonstration tools that allow non-technical stakeholders to understand the impact these



changes might have for them on the ground. Stakeholders can compare options to an example of the existing situation to help make a well-informed decision by using headphones, loudspeakers, touchscreen interfaces, virtual reality headsets and even iPads.

CASE STUDY

NLIA
**NEW LIBREVILLE
INTERNATIONAL
AIRPORT**

Gabon, Africa

Carrying out an environmental and social impact assessment for the new airport at Libreville in Gabon, we assessed noise and vibration impacts during the construction phase of the project, while also evaluating noise impacts during the operational phase.

Scheduled to open in 2020, the New Libreville International Airport will provide a logistical hub comprising an aerodrome and associated infrastructure. We considered a range of noise sources during the assessment including aircraft noise, ground noise at the airport, and road traffic noise on the local road network for new and existing roads. We recommended details on mitigation measures to protect local communities from significant noise impacts, including implementing an operational management plan for the airport that demonstrated how best practice would be adopted.

FEASIBILITY AND BUSINESS CASE

GETTING PROJECTS OFF THE GROUND

We support our aviation clients by providing feasibility studies, preliminary design and business case development services to help get projects off the ground.

Delivering at all stages of the decision making framework, we take funding proposals forward from the initial sifting and optioneering stage, through to determining the way forward as part of the Government's preferred approach for major investment decisions. We recognise the importance

of proportionality within the process, noting that in some instances, smaller or straightforward investments may require fewer phases, creating time and resource efficiencies by providing solutions tailored to individual project needs. Our ability to provide a wide range of services and technical support enables us to offer an integrated and holistic approach to scheme development, alongside the business case production for our clients.



Feasibility studies
Preliminary design services
Environmental services
Strategic evidence-based assessments
Qualitative and quantitative assessments

Cost benefit analysis — value for money, gross value added, and net present value
Assessment of wider impacts
External cost estimates
Cost modelling

Review of procurement routes and contractual mechanisms
Risk management workshops
End-to-end monitoring and an evaluation advice

CASE STUDY

DAVIS AERODROME

Antarctica

Completing a comprehensive siting study for a land-based airfield development program for a new airport facility in Antarctica, we're currently working with the Australian Antarctic Division (AAD) on delivering an approach to year-round aviation access to the Davis research station.

A project of unprecedented scale and complexity due to the remote location and unique environment, we've undertaken aviation planning, aircraft pavement civil engineering, aerodrome building design, and environmental services for the development of a

2700m paved runway and taken the project from initial feasibility to detailed business case submission.

Known for its unique wildlife, brave exploration expeditions and inhospitable conditions, Antarctica is a world treasure and a hub for researchers of all nations. As part of the Australian Antarctic Strategy and 20 Year Action Plan, the ADD is progressing an investigation into expanded aviation connectivity between Hobart, Tasmania and Antarctica.

Beginning the initial study in 2017, we developed several airfield layout options with different runway lengths and supporting facilities based on different aircraft types. Our team

of local and global aviation teams, including technical specialists and international subject matter experts, provided aviation infrastructure design, airspace constraints evaluation and guidance on environmental impacts.

Taking account of logistical challenges, as well as the sensitive environment and wildlife, we investigated three site options for the potential new runway, collaborating closely with AAD personnel with experience of the conditions. Having developed multi-criteria assessments for each site, we delivered a single recommended option within a tight timeframe and budget. Once the preferred site was identified, we undertook the feasibility design in conjunction with the AAD.

Visiting the site during the Antarctic summer of 2018, we helped field verify multiple runway airfield siting options and confirm optical landing systems, ground conditions, and aggregate material borrow sources, which consequently helped confirm a preferred airfield option for business case development.

We advanced a detailed business case for an airfield development plan with supporting budgetary costings for governmental approvals in 2019. We're now developing technical aspects related to the construction of a surfaced runway facility for the recommended preferred airfield site.



CASE STUDY

GLA GLASGOW AIRPORT ACCESS PROJECT

Glasgow, UK

We successfully developed the outline business case (OBC) for the £144 million Glasgow Airport Access Project — the flagship project for the £1.13 billion Glasgow City Region City Deal. This followed our involvement in preparing the initial transport appraisal — in line with Scottish Transport appraisal guidance. Transport modelling was employed to assess demand and revenue impacts. In December 2016, the Glasgow City Region Cabinet approved the OBC for further development to a full business case.



CONNECTED AND AUTOMATED VEHICLES

MAKING THE CASE FOR AUTONOMY

Airport operators are embracing smart technology more than ever and are continually developing and trialling new technologies to improve the time to travel for passengers from the minute they set off from their home until they leave the runway.

We are helping develop autonomous vehicle technology such as automated 'pods' to meet the needs of users looking for a personalised, on-demand service, supporting the end-to-end movement of people between city and campus environments.

Pods can replace the need for fixed conveyors and sorting systems at airports. The process of moving passengers through an airport needs to be secure, seamless and quick, while still offering a positive experience. Delays will occur if the baggage handling system is not sufficient no matter how efficient a passenger journey is. Enabling pods to move between fixed drop-off points to collect and offload cases would mean they can determine their own optimal route through an airport. This can provide an airport with a flexible system, operational certainty, and a reduced footprint of conveyor systems.

- Strategic planning
- Policy, regulation and standards
- Infrastructure preparedness
- Pilot / trial planning and evaluation
- Operational delivery
- Innovative business models

CASE STUDY

CAPRI

Trials across the UK

The first UK project to trial pods on public roads, Capri is an exciting new research project that is building passenger, regulatory and market confidence in autonomous pods as a practical, safe and affordable way to travel. Aiming to go further than previous pod trials, Capri is working to demonstrate a fully integrated and interactive autonomous pod service that will allow members of the public to hail a pod via an app, choose their end destination, pay and have access to relevant information and customer support.

The Capri project is awarded by The Centre for Connected and Autonomous Vehicles (CCAV), the government department set up to support the early market for Connected and Autonomous Vehicles (CAVs), and commissioned by Innovate UK, the UK's innovation agency. It is being delivered by an AECOM-led consortium comprising 19 partner organisations across the public, private and academic sectors.

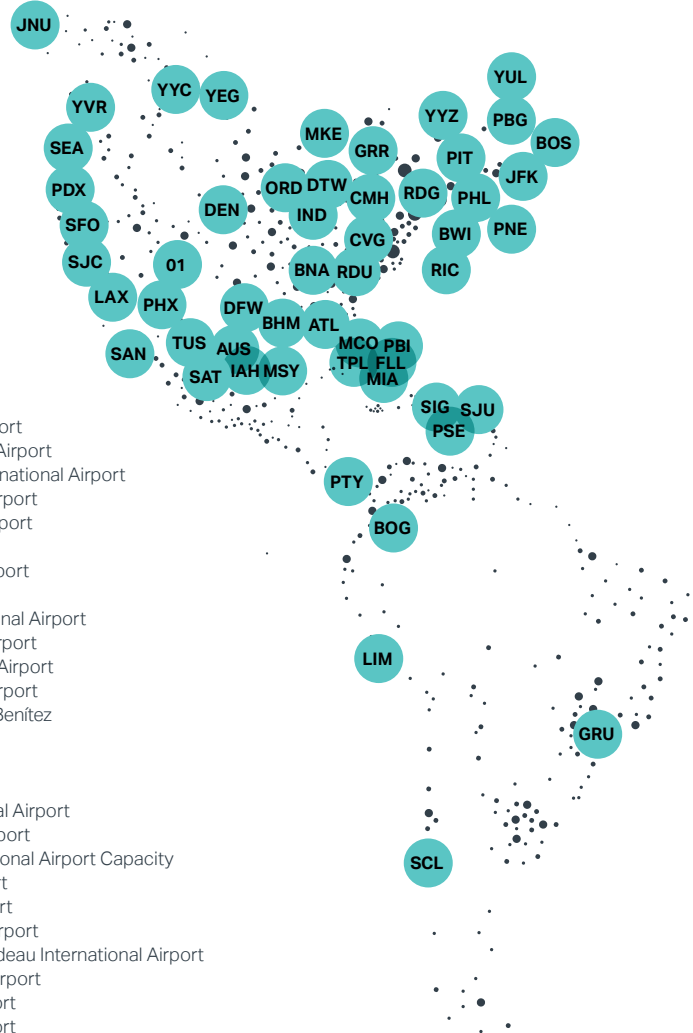
Capri won a share of the government's £100 million Intelligent Mobility Fund through the CAV2 competition. Focused on highly automated solutions with real-world benefits, the competition is looking at how autonomous vehicles will work as part of a wider transport system and the business models to enable them. All successful projects are industry-led and jointly funded by government and industry.

Driverless pods have been trialled at Filton Airfield, Bristol, as part of a pilot scheme that will pave the way for the use of connected and autonomous vehicles to move people around airports, hospitals, business parks, shopping and tourist centres.

During the two-week trial, the pods' safety critical features were assessed along with participant comfort testing. The trial will inform the pods' first public appearance later this year when they will transport members of the public around The Mall at South Gloucestershire's Cribbs Causeway retail park. The project will culminate in an on-road public trial at London's Queen Elizabeth Olympic Park, a diverse estate that includes retail, recreation, residential and business centres.



GLOBAL EXPERTISE



Americas

ATL Hartsfield–Jackson Atlanta International Airport
AUS Austin–Bergstrom International Airport
BNA Nashville International Airport
BOG El Dorado International Airport
BOS Boston Logan International Airport
BWI Baltimore Washington International Airport
BHM Birmingham–Shuttlesworth International Airport
CMH Port Columbus International Airport
CVG Cincinnati/Northern Kentucky Airport
DFW Denver International Airport
DFW Dallas/Fort Worth International Airport
DTW Detroit Metropolitan Wayne County Airport
FLL Fort Lauderdale International Airport
GRR Gerald R. Ford International Airport
GRU São Paulo–Guarulhos International Airport
IAH George Bush Intercontinental Airport
IND Indianapolis International Airport
JFK John F. Kennedy International Airport
JNU Juneau International Airport
LAX Los Angeles Airport
LIM Jorge Chávez International Airport, Lima
MCO Orlando International Airport
MIA Miami International Airport
MKE General Mitchell International Airport
MSY Louis Armstrong Airport New Orleans
ORD Chicago O'Hare International Airport
PBG Plattsburgh International Airport
PBI Palm beach International

PDX Portland International Airport
PHL Philadelphia International Airport
PHX Phoenix Sky Harbour International Airport
PIT Pittsburgh International Airport
PNE Northeast Philadelphia Airport
PSE Mercedita Airport
PTY Tocumen International Airport
RDG Reading Regional Airport
RDU Raleigh–Durham International Airport
RIC Richmond International Airport
SAT Dallas/Fort Worth International Airport
SAN San Diego International Airport
SCL Comodoro Arturo Merino Benitez International Airport
SEA Seattle–Tacoma Airport
SIG Isla Grande Airport
SFO San Francisco International Airport
SJC San Jose International Airport
SJU Luis Muñoz Marin International Airport Capacity
TPA Tampa International Airport
TUS Tucson International Airport
YEG Edmonton International Airport
YUL Montréal–Pierre Elliott Trudeau International Airport
YVR Vancouver International Airport
YYC Calgary International Airport
YYZ Toronto International Airport
01 Spaceport America

Europe and Africa

ADD Bole International Airport, Addis Ababa
AMS Amsterdam Schiphol Airport
BBK Kasane Airport, Botswana
BCN Barcelona Airport — El Prat
BHX Birmingham International Airport
BFN Bram Fischer International Airport
BKO Bamako–Sénou International Airport
CAI Cairo International Airport
CND Mihail Kogalniceanu Constanta Airport
CPT Cape Town International Airport
DKR Dakar international airport
DUB Dublin Airport
DUR King Shaka International Airport, Durban
ELS East London Airport
FAEO Ermelo Airport
FCO Rome Fiumicino Airport
FIH Kinshasa International Airport
FRW Francistown Airport

GNZ Ghanzi Airport
HRYO Gabiro Airport
IST Istanbul New Airport
LBV Libreville International Airport
LGW London Gatwick Airport, London
LHR Heathrow Airport, London
LTN London Luton Airport
MAD Madrid–Barajas Airport
MAN Manchester Airport
MJV Murcia–San Javier Airport
MUB Maun Airport
MUR Murcia–San Javier Airport
MQP Kruger Mpumalanga International Airport
NDU Rundu Airport
OLB Olbia Costa Smeralda Airport
OUA Ouagadougou Airport
PKW Selebi-Phikwe Airport
PLZ Port Elizabeth International Airport

POL Pemba Airport
PRY Wonderboom Airport
PZB Pietermaritzburg Airport
RCB Richards Bay Airport
QRW Warri Airport
SAW Sabiha Gökçen International Airport
SHO King Mswati III International Airport
SVO Sheremetyevo International Airport
SWX Shakawe Airport
SZG Salzburg Airport
VVO Vladivostok International Airport
WDH Hosea Kutako International Airport
WVB Walvis Bay Airport
06 Moron Air Base, Spain
07 Greece Independent Engineers Services
08 New Libreville Airport, Gabon
09 Air Force Base Makhado



Asia

- AKL** Auckland Airport
- AUH** Abu Dhabi International Airport
- BGL** Bengaluru International Airport, Bangalore
- BIN** Bamyan Airport
- BKK** Suvarnabhumi Airport, Bangkok
- BNE** Brisbane Airport
- BOM** Chhatrapati Shivaji International Airport, Mumbai
- BWN** Brunei International Airport
- CAN** Guangzhou Baiyun International Airport
- CHC** Christchurch International Airport
- CGK** Jakarta International Airport
- CMB** Bandaranaika International Airport
- CXI** Cassidy International Airport
- DEL** Delhi International Airport

- DOH** New Doha International Airport
- DVO** Francisco Bangoy International Airport
- DWC** Al Maktoum International Airport, Dubai
- EBL** Erbil International Airport
- ELQ** Prince Nayef bin Abdulaziz International Airport
- GUM** Antonio B. Won Pat International Airport
- HKG** Hong Kong International Airport
- HRI** Hambantota International Airport
- JED** King Abdulaziz International Airport, Jeddah
- KBL** Hamid Karzai International Airport, Kabul
- KUL** Kuala Lumpur International Airport
- KWI** Kuwait International Airport
- PER** Perth Airport
- RUH** King Khalid International Airport, Riyadh

- MAA** Chennai International Airport
- MEL** Melbourne Airport
- MNL** Ninoy Aquino International Airport
- MPH** Caticlan Airport
- NAG** Nagpur Airport
- SIN** Changi Airport, Singapore
- SPN** Saipan International Airport
- SYD** Sydney Airport
- TLV** Ben Gurion Airport, Tel Aviv
- TPE** Taiwan Taoyuan International Airport
- 02** Navi Mumbai Airport
- 03** SG Express Air Cargo Hub Development
- 04** New Xiamen International Airport
- 05** New International Airport, Manila

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical expertise and innovation, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of \$13.3 billion in fiscal year 2021. See how we are delivering sustainable legacies for generations to come at aecom.com and [@AECOM](https://twitter.com/AECOM).

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