Innovate UK Business Connect - KTP Platform (Current)
2829 Innovate UK KTP 50th Golden Awards

The University of Manchester & Arup

Application name should be the nominee name (i.e. the name of the Partnership team, project, people or person who will be the recipient of the Award).

Confidentiality Declaration	✓ I confirm all contributors to this project have provided consent for the use of the information provided in this application to be used by the organisers in any promotion of the Awards. ✓ The information provided does not include comercially sensitive content that requires approval before it is made public.
Consent	✓ I am happy for any of the information provided to be used by the organisers in any promotion of the Awards

1. Knowledge with Impact
Criteria
In this category applications should demonstrate exemplary TCS / KTP credentials, with a particular focus on evidencing the impacts made, the transformative outcomes delivered, and the exploitation potential realised.
Eligibility
To be eligible for this award, your TCS / KTP participation must have begun after 1st January 1975 and have been completed by 30 June 2025.

2. Driving Innovation for the Future
Criteria
Here we wish to showcase the most creative, innovative and market-disruptive aspects of TCS / KTP. Applicants here should be able to demonstrate and evidence the nature, novelty and scale of progressive change enabled and exploited by TCS / KTP.
Eligibility
To be eligible for this award, your TCS / KTP participation must have begun after 1st January 1975 and have been completed by 30 June 2025.

3. The Art of Successful Collaboration
Criteria
This theme exemplifies the TCS / KTP ethos, here we wish to focus on the relationship aspects of TCS / KTP and how applicants can demonstrate a depth and breadth of reach and impact that has been facilitated through people and organisations working in partnership for a common goal.

Eligibility
To be eligible for this award, your TCS / KTP participation must have begun after 1st January 1975 and have been completed by 30 June 2025.

The shortlisted finalists for each category will be invited to attend the Gold Awards Gala Dinner on Wednesday, 29th October 2025 at the Kimpton Clock Tower Hotel in Manchester.
Each shortlisted finalist will be allocated three Gold Awards Gala Dinner tickets, but will be responsible for covering their own travel and accommodation costs.

Are you applying for the Driving Innovation for the Future Category? Yes

About the Nominee(s)

Describe the People/ Partners/ Participants involved including any available TCS/ KTP project details (mention here any relevant context such as Knowledge Base and Company Partner details, main company activities, markets, locations; also consider providing turnover, profitability, and headcount numbers where possible).

> Arup is a global, multidisciplinary engineering and design consultancy working across all aspects of the built environment. With over 18,000 professionals in 96 offices across 37 countries, and projects delivered in more than 160 countries, Arup reported a global turnover of £2.2 billion last year, operating at a 2% profit margin. The firm is renowned for its "Total Architecture" philosophy, which integrates engineering, design, and sustainability to create high-quality, human-centric environments.
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> Arup has contributed to the structural design of internationally recognised landmarks including the Sydney Opera House, Beijing Olympic stadia, and the London Eye. Locally, in the context of this KTP, Arup was involved in the design of Manchester City Stadium and the University of Manchester's new Engineering Campus.
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> The project was led within Arup by the Algorithms and Numerical Analysis team, with Dr Stephen Hendry and Dr Ramaseshan Kannan. The academic team comprised Professor Françoise Tisseur and Professor Stefan Güttel from the Department of Mathematics at the University of Manchester. The KTP Associate was Dr Christopher Hickey, a Computational Scientist and now a full-time employee at Arup.

The Strategic Context

What was the strategic challenge, need or opportunity that this KTP (or formerly TCS) nomination set out to address? Please outline the key purpose/ aims/ objectives of your partnership(s) and/ or the drivers motivating the Gold Award nominee(s)

> The strategic challenge was ambitious: To radically innovate the way structural engineers design buildings like skyscrapers, bridges, and stadiums.
> A key technology in structural engineering is vibrational analysis, which enables engineers to simulate and optimise the vibration behaviour of physical structures under conditions such as earthquakes, wind, and heavy footfall. This KTP enhanced Arup's capability in that area by embedding advanced numerical algorithms, developed by the Manchester academic team, into Arup's software. Efficient and accurate numerical simulations are essential, not only for the timely project delivery at Arup, but also for the safety and sustainability of building design. Numerical errors can be catastrophic, while excessive conservatism leads to material waste and environmental impact.
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> With the construction sector being a major emitter of carbon, the KTP has helped Arup to deliver leaner designs (e.g. by reducing the thickness of steel skeletons in skyscrapers) through more accurate simulations, as well as supporting the retrofitting and reuse of existing constructions (allowing for more efficient statistical analysis). The KTP perfectly aligned with Arup's aspiration to become a world-leader in sustainable Building design.

The partnership directly supported Arup's strategic goals by enhancing its ability to simulate dynamic structural behaviour, particularly seismic performance, with greater fidelity, accuracy, and scalability. This capability is critical as Arup continues to design increasingly complex structures in a rapidly urbanising world. It also strengthens Arup's position at the forefront of the structural simulation software market.

While Arup's Algorithms and Numerical Analysis team has deep expertise in developing algorithms for its proprietary software, Oasys GSA, it lacked experience in advanced mathematical techniques such as matrix operations and complex arithmetic. The team's strengths lie in engineering, rather than the algorithmic and computational foundations required to push simulation boundaries. The KTP addressed this gap by embedding cutting-edge academic expertise into Arup's workflows.

Overview of Outcomes/ Impacts for the Beneficiaries

Please outline the key achievements for the host Organisation(s), the Knowledge Base(s) and the Associate(s). What were the evidential impacts and outcomes realised alongside any evidence of changes in operations, culture, economic/ societal/ environmental benefits etc. How was the transferred knowledge applied to optimal effect within the company/ sector context and how did the beneficiaries ensure that the legacy capabilities were fully embedded and utilised.

This KTP delivered a major innovation in structural engineering simulation through the development and full integration of MASIL (Mass Accumulating Shift and Invert Lanczos), a breakthrough algorithm now embedded in Arup's commercial software, Oasys GSA, now used globally by thousands of engineers. MASIL replaces a widely used, but mathematically flawed, industry standard, enabling faster and more accurate seismic analysis, improving productivity and reducing computational demands. MASIL is based on a fully rigorous mathematical foundation, giving its users more confidence.

The project catalysed the formation of Arup's Algorithms and Numerical Analysis team, now applying advanced computational techniques across structural, geotechnical, and crowd modelling. MASIL's improved efficiency and reliability, enables Arup's engineers to design safer, more resilient structures with reduced material use. This directly contributes to Arup's global sustainability strategy and NetZero goals.

Knowledge transfer was a key success: the Associate and academic team embedded algorithmic expertise into Arup's software development teams. Dissemination included academic papers, industry forums, and international conferences (e.g., SIAM CSE, NAFEMS).

Through this partnership, Arup has gained a lasting capability in numerical algorithm design. The Associate's work has been fully embedded within the ANA team, enhancing internal visibility and driving adoption. This positions Arup to lead in structural simulation innovation and contributes to the UK's sovereign capability in a market dominated by American and East Asian software.

The academic team—leaders in numerical analysis—brought leading-edge research into real-world application, demonstrating how collaboration between academia and industry can deliver meaningful societal impact at scale. The project has even impacted teaching, by one of the academic team members (Tisseur) using the KTP outputs as demonstrator applications in their classrooms.

WOW Factor!

What makes this nomination special in having realised its transformative innovation potential and why should it win the Driving Innovation for the Future Gold Award?

This KTP represents a paradigm shift in how engineers analyse the vibrations of structures. Traditionally, structural simulation relied on brute-force methods that were computationally intensive and often lacked precision. The development of MASIL (Mass Accumulating Shift and Invert

Lanczos) changes this fundamentally by focusing on the movement patterns most critical to design and safety, delivering both speed and accuracy, a rare and coveted combination in numerical algorithm development.

MASIL is now embedded in Arup's commercial software, Oasys GSA, used globally by thousands of engineers. Since the release of MASIL in 2022, the revenue from GSA sales has grown 45%, with internal data showing a strong uptake of the new solver options. The algorithm's success has led to new use cases, extending beyond seismic analysis, and is prompting a re-evaluation of long-standing industry standards.

The project's impact goes far beyond technical innovation. It catalysed the formation of Arup's Algorithms and Numerical Analysis team, now tackling complex problems across multiple domains. It also contributed to Arup's Net Zero strategy by enabling more efficient, resilient designs with reduced material use. It has enhanced Arup's reputation for technical excellence, helping win new work globally.

The collaboration has continued to flourish: Prof. Stefan Güttel secured a Royal Society Industry Fellowship to extend the work, and Arup's supervisor Ramaseshan Kannan was awarded a Royal Academy of Engineering Fellowship, leading to new AI products and the creation of an AI-focused team within Arup.

The Associate's journey, from theoretical research to industrial impact, has been recognised with awards and speaking engagements, showcasing the power of effective knowledge transfer and employment within Arup.

In essence, this KTP exemplifies how deep academic research, when strategically aligned with industry needs, can transform engineering practice, build lasting capability, and deliver measurable societal, environmental, and economic impact. It demonstrates a true innovation lifecycle.