# AVIATION CHALLENGE 3

## CALL FOR PROPOSAL

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## SUMMARY

The Aviation Challenge, a programme under the Aviation Development Fund (ADF), seeks to tap the intellectual capacities of the industry, academia and others to develop and implement innovative solutions to issues faced by Changi Airport that lack commercially-available products.

CAAS invites aviation companies and technology providers to form consortia to submit problem statements and proposed solutions under the Challenge theme. The programme will provide funding support for a prototype development phase and an implementation phase.

Selected consortia will develop the solutions with funding support from CAAS. At the end of the prototype development and demonstration, prototypes that have successfully met its design requirements or deemed to have good potential to do so, will be funded for further development and implementation by the consortium members in Changi.

The third run of the Aviation Challenge (AC3) will cover the following theme:

> **Innovation to Enable Seamless Ground Operations**

The call-for-proposal is a two-stage process. The call for Stage 1 is open from 5 July 2018 to 31 October 2018 (2359 hrs, Singapore Time).

For more information, please email *caas_ai@caas.gov.sg*.

## 1. CHALLENGES AND OPPORTUNITIES

1.1. The aviation industry in Singapore has seen robust growth in recent years and is expected to continue to do so. Changi Airport handled 373,000 flights, 62 million passengers and 2 million tonnes of cargo in 2017. Passenger and cargo volumes are expected to grow by 1.3 times by 2025. With workforce growth not expected to keep up, there will be a projected manpower shortfall of more than 6,000 workers in the coming years. In addition, the manual and physically-demanding nature of some airside operations may present challenges for an older workforce in the future.

1.2. The growth in air traffic will also place increasing demands on Changi's airside infrastructure such as aircraft stands, apron space, roadways, taxiways and runways. Aircraft stand usage will intensify, and prior to the operationalisation of Terminal 5, the use of remote bays, which by itself requires more equipment and resources, will likely also increase. These developments will contribute to tightness in airside capacity, place further strain on resources and add complexity to airside operations. Airside processes and operations must thus transform to keep up with the strong growth in air traffic.

1.3. Airport companies aim to connect passengers and cargo as seamlessly and fast as possible and it will become increasingly challenging to sustainably maintain current minimum connection times and service standards, especially during the peak periods. With corresponding surge in demand for resources during the peak periods, there are strong opportunities for resource optimisation, as well as rationalisation for non-peak periods.

1.4. While there are challenges, advances in technology have presented opportunities to overcome them and bolster Changi's competitiveness. Automation technology to address manpower-intensive and physically-demanding processes is constantly improving. Internet of Things (IoT) solutions have become more affordable and accurate, enabling the mass collection and sharing of operational data. Developments in data analytics have led to new ways to process operational logs and optimise processes, which could also lead to new capabilities and service offerings.

1.5. The upcoming Changi East expansion will almost double Changi Airport's size and increase capacity from 85 to 135 million passengers annually. Building on a greenfield site provides opportunities to rethink and redesign our airport's infrastructure, processes and operations. Given the construction timeline of Changi East and Terminal 5, the next few years would be an opportune window to test new ideas and concepts. Implementing AC3 solutions at the existing terminals would allow substantial time for these solutions to be tested and incorporated into Changi East and Terminal 5 plans.

## 2.    INNOVATION TO ENABLE SEAMLESS GROUND OPERATIONS

2.1.    AC3 offers a unique collaborative platform for end-users to partner solution providers. Companies with operations at Changi Airport can work with technology providers, academia or other partners to jointly identify problem statements, co-develop solutions and test them in an operational environment. Should the prototypes prove successful, the AC3 will also support the further refinement of solutions and implementation at Changi Airport.

2.2.    To address challenges at Changi Airport's airside, the theme of AC3 is *Innovation to Enable Seamless Ground Operations*. The scope of AC3 will cover the planning, management and operations of Changi Airport's taxiways, roadways, apron and aircraft stands (see Figure 1).



*Figure 1. Plan view of Changi Airport*

2.3.    At the apron and aircraft stands, ground operations comprise complex and overlapping operational processes that contribute to the handling of the aircraft turnaround (see Figure 2). These operations require strong command and control, and close coordination by the different airside stakeholders. There is need to foster greater collaboration between end-users and technology companies to jointly consider new approaches to address challenges and develop solutions that suit the needs of end-users, the unique operating context, or the existing infrastructure at Changi Airport.

*Figure 2. Overview of aircraft handling processes at the apron involving multiple stakeholders*

2.4.    To enhance our airside operations, three opportunity areas, namely *Automated Apron, Optimisation of Airside Capacity,* and *Data-Driven Airport* have been identified under the AC3 theme:

a.    *Automated Apron.* To ensure Changi can continue to deliver ground services and serve the growing traffic effectively with a sustainable workforce, AC3 seeks solutions that can boost manpower productivity at the airside. Today, drivers and equipment operators form a large part of the workforce at the airside. The development of autonomous vehicle driving capabilities and autonomous docking capabilities to help dock or connect various handling equipment to the aircraft, will reduce the reliance on drivers and equipment operators. Assistive technologies to automate or reduce the manual and physically-demanding nature of some airside operations can transform airside jobs to make them suitable for an ageing workforce.

With the Changi East expansion, the number of taxiways, roadways and aircraft stands will also increase. To enable the effective management and operation of a much larger airside in the future, AC3 can also support solutions to enhance the detection and rectification of surface damages, oil-spills and Foreign Object Debris (FOD).

b.    *Optimisation of Airside Capacity.* It is estimated that there are more than 700 vehicles and 5,000 non-motorised equipment on the airside today. These belong to different airport companies and service providers. As air traffic increases, the demand for such vehicles and equipment to serve the increasing number of aircraft will rise, especially during the peak hours. However, there is a limit to the extent in which the

vehicle and equipment fleet can grow as uncontrolled growth will lead to sub-optimal utilisation resources during non-peak periods. A congested airside will also slow down the movement of passengers, cargo, airside staff, vehicles and equipment, leading to delays and disruptions. AC3 can support projects that analyse the deployment of resources and types of trips made, so as to optimise them through solutions that enable demand-matching or sharing of airside resources.

At the same time, it is not possible to increase the amount of circulation and staging space at the aircraft stands. The lack of space arising from a higher number of vehicles and equipment, may slow down aircraft handling and impact safety at the stands. AC3 can support solutions that enable more efficient operational concepts, demand-matching solutions for sharing airside resources and other collaborative efforts among airport stakeholders to explore transformative solutions to mitigate airside capacity constraints.

c.      *Data-Driven Airport.* With advancements in sensor, mobile and digital technologies, the pace of data collection and digitalisation within the airport community has picked up in recent years. Camera-imaging technology has also made it possible to tap the network of airside cameras as another data source.

AC3 can support projects that leverage the rich airport data logs to generate insights for better management or predictive deployment of manpower and resources. Sector-level spill-over effects of these transformative technologies could lead to enhanced service offerings to airline customers and the creation of higher-value jobs for the airport community.

## 3.      **PROBLEM STATEMENTS AND SOLUTIONS**

3.1.    Consortia are invited to propose specific problem statements within the AC3 theme and opportunity areas identified above. Problem statements will be assessed based on how well the consortia understands and addresses the long-term challenges at Changi Airport's airside, and the potential benefits or impact from addressing that challenge. The problem statement could cut across multiple opportunity areas or focus on a single area.

3.2.    Consortia could also propose problem statements not within the three opportunity areas but are still impactful and relevant to the AC3 theme. However, the AC3 will not cover problem statements related to security processes, due to national and international aviation security considerations not within the direct control of companies with operations at Changi Airport.

3.3.    Most importantly, the AC3 seeks innovative and transformative solutions that are not commercially available or deployed at other airports today, in order to bring about the development of new capabilities for Changi Airport. The solutions should lead to transformative outcomes upon implementation, including but not limited to:

a.      New technology or capability currently not available or deployed at other airports to be implemented at Changi;

b.      Significant productivity savings or increased efficiency of operations compared to current processes;

c.      Meaningful manpower development outcomes, such as the strengthening of workers' capabilities; reduce barriers to entry; enhance career prospects; and/or share gains through wage enhancements;

d.      Enhanced airside processes and operations that optimise the deployment of vehicles and non-motorised equipment to address airside congestion issues; and

e.      Potential for local company to spin-off, or for the development of new lines of businesses for end-users/technology providers.

3.4.    Where applicable to the proposed problem statement, the proposals must also address potential operational and implementation considerations to provide CAAS with a detailed picture of the consortium's intention for implementation, including but not limited to:

a.      Timeline and scale for implementation, including plans for future scale-up in Singapore or beyond;

b.      Ease of system implementation such as integration with end-users' operations and existing systems, minimal disruption to airport operations;

c.      Alterations to current airside infrastructure or impingement on vehicle movement in the relevant operational area on the apron; and

d.      Implementation and lifecycle costs, including running and maintenance costs.

## 1.     SCOPE OF CALL-FOR-PROPOSAL

1.1     CAAS invites the submission of proposals for projects to be considered for funding under AC3 for prototype development and implementation at Changi Airport. To qualify, the proposals must detail the proposed problem statement under the AC3 theme, the design and development of a working prototype, and the implementation plans for the solution at Changi Airport.

## 2.     ELIGIBILITY

2.1     This call is open only to end-users (i.e. companies with operations at Changi), or consortia between end-users and technology providers (such as technology companies, SMEs, IHLs, RIs). This is to ensure that the development of solutions is guided by domain expertise and end-users' requirements, and that developed solutions have a ready end-user for implementation. For consortia applications, the lead applicant should be the end-user.

2.2     Foreign entities may participate as technology providers within the consortia, but only work conducted in Singapore may be funded under the programme.

2.3     Applicants must declare if they have received government funding (whether full or partial) from other sources for their proposed projects.

## 3.     APPLICATION AND EVALUATION PROCESS

3.1     Proposals are to be submitted using the prescribed **Project Proposal Form**. The proposals must demonstrate a good appreciation of the challenges faced at Changi Airport's airside and show a clear understanding of existing ground operations and strong execution capability. The proposal should also include descriptions of the identified problem statement under the AC3 theme, the proposed solution to respond to this problem statement, the developmental approach / methodology, timeline (including key milestones), project management plan and budget.

3.2     Proposal submission and evaluation will be in two stages:

a.     Stage 1: Submission of conceptual proposal with broad outlines of identified problem statement, proposed solution, timelines and initial cost estimates, for shortlisting.

b.      Stage 2: Submission of detailed proposal by shortlisted applicants, containing further details on solutions and technologies to be developed, partnership structure of consortia, prototype development plan, implementation plan and detailed breakdown of costs for final evaluation and cost qualification.

3.3      After the Call-for-Proposal is closed, Stage 1 proposals will be surfaced to a judging panel for evaluation. Shortlisted proposals will be notified, and given time to provide a detailed proposal for Stage 2 evaluation. This evaluation process may require a presentation by the applicants to the judging panel.
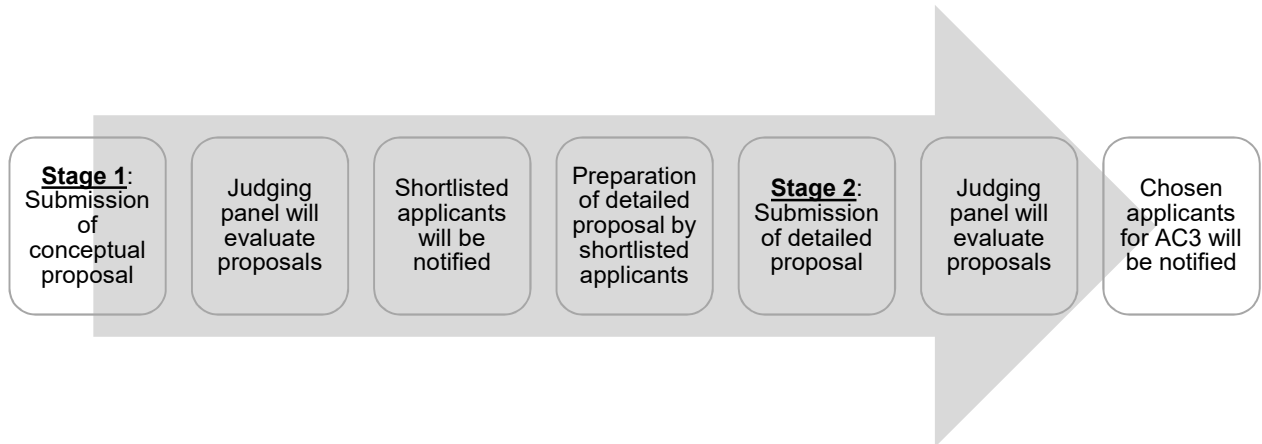


*Figure 3. AC3 submission process*

3.4      The evaluation criteria will include the following considerations:

| Category | Description |
|---|---|
| **Value to Singapore** | ▪ Suitability of problem statement<br>▪ Spillover effects and scalability to airport community<br>▪ Enhanced airside processes and operations that optimise the deployment of vehicles and equipment<br>▪ Significant productivity savings or increased efficiency of operations compared to current processes<br>▪ Meaningful manpower development outcomes: strengthen worker capabilities; reduce barriers to entry; enhance career prospects; and/or share gains through wage enhancements<br>▪ Potential for local company to spin-off, or for the development of new lines of businesses for end-users/technology providers |
| **Innovative Technologies** | ▪ New technology or capability to address current gaps that is currently not available or deployed at other airports<br>▪ Ability to meet operational, safety and business requirements |
| **Project Management** | ▪ Completeness and clarity of proposed business case, implementation plans and deliverables<br>▪ Domain experience and technical expertise of consortium<br>▪ Cost effectiveness of funding requested vs project objectives |

*Table 1: Evaluation Criteria*

## 4. PROJECT FUNDING AND KEY PERFORMANCE INDICATORS

4.1 AC3 will provide funding for up to 70% of the expenses for qualifying items during the prototype development phase and the implementation phase for projects that are successfully selected, with S$2 million and S$1 million set aside for each respective phase of each project, on the terms and conditions as stipulated in the letter of offer that will be sent to successful applicants.

4.2 Qualifying items may be classified into the following categories:

a. Purchase/Lease of Equipment and Materials
b. Lease of Intellectual Property and Software
c. Professional Services
d. Manpower
e. Others

4.3 Contributions in-kind from the lead applicant may be included in the proposed project budget for CAAS to consider whether to approve as a qualifying item.

4.4 All costs stated in the proposed budgets shall exclude any applicable Goods and Services Taxes (GST), unless the lead applicant is unable to claim such tax from the Inland Revenue Authority of Singapore.

4.5 Expenses for non-qualifying items or expenses for qualifying items incurred beyond the approved funding limit shall be borne by the applicant.

4.6 The costs incurred in preparing the project proposals shall be borne by the applicants.

4.7 Each project will be subject to a set of milestones and deliverables, mutually agreed between CAAS and the applicant prior to the award. However, each project must minimally include the following milestones with the respective potential deliverables.

| Milestone | Deliverables | Estimated Due Date from Project Commencement |
|---|---|---|
| **Prototype Development Phase** | | |
| 1. Development of solution | ▪ Confirmation of proposed concept and finalisation of design for prototype development | 3 months |
| 2. Prototype Demonstration | ▪ Demonstration of prototype for evaluation | 12 months |

| Implementation Phase | | |
|---|---|---|
| 3. Evaluation of Implementation Plans | <ul><li>Finalisation of plans for rollout and operational usage</li><li>Finalisation of timeline for manpower development outcomes</li></ul> | 15 months |
| 4. Operationalisation | <ul><li>Demonstration of implemented solution</li><li>Revised SOP</li><li>Achievement of manpower development outcomes</li></ul> | 24 months |

*Table 2: Example of Project Deliverables*

4.8     The funds will be disbursed on a reimbursement basis for expenses incurred and paid, upon the successful achievement of the milestones and the submission of supporting documents for the deliverables.

4.9     For milestone 2, CAAS will reimburse expenses incurred if there is a working prototype or solution demonstrated under realistic test conditions, even if the prototype or solution is eventually assessed to be unsuitable to proceed to the implementation phase.

4.10    Funds for the implementation phase will only be unlocked upon approval of implementation plans by CAAS at milestone 3.

4.11    All projects should be completed within 24 months from the acceptance of the offer for the funding from CAAS.


## 5.     INTELLECTUAL PROPERTY RIGHTS

5.1     Applicants are to provide details on any intellectual property rights (IPR) that could be created or that will be used in the course of the project, including ownership details of such IPR. The IPR created from the project shall be available for the end-user's unrestricted use for a reasonable period of time to allow for full and effective implementation of the project at Changi.

5.2     Each applicant (including each party within a consortia) shall grant to CAAS an irrevocable, worldwide, sub-licensable, non-exclusive, perpetual and royalty-free license to use, reproduce and/or modify all IPR created or used in the course of the Project that is or will be vested in or licensed to such applicant, for CAAS' internal and/or operational purposes.

## 6.    SUBMISSION

6.1    All proposals must be prepared in the format of the Concept Proposal Form, and must be submitted by email to *caas_ai@caas.gov.sg* on or before 31 October 2018 (2359 hrs, Singapore Time) for Stage 1 evaluation.

6.2    Only proposals that are properly completed, and submitted with relevant supporting documents attached, will be accepted for evaluation.

6.3    Proposal submission should also quote the following in the email subject line: "Submission for AC3 – *[Proposal Title]* by *[Consortium Name]*".