AIRPORTS COMPANY
SOUTH AFRICA

Remotely Piloted Aircraft Systems

Scope of Work

for

Runway & Movement Area Inspection Proof of Concept Trial at OR TAMBO Airport

AIRPORTS COMPANY SOUTH AFRICA

Glossary and Abbreviations

Item	Description
ACSA	Airports Company South Africa
AEA	Association of European Airlines
AGL	Above Ground Level
AIS	Automatic Identification System
ATC	Air Traffic Controller
ATM	Air Traffic Management
ATNS	Air Traffic Navigational Services
BR	Business Requirements
C2	Command and Control
EVLOS	Extended Visual Line of Sight
FOD	Foreign Objects Debris
GCS	Ground Control Station
GIS	Geographical Information System
GPS	Global Positioning System
LOS	Line of Sight
POC	Proof of Concept
PCI	Pavement Condition Index
PMS	Pavement Management System
RF	Radio Frequency
RFP	Request for Proposals
ROC	RPAS Operational Certificate
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
RPL	RPAS Pilot License
RTK	Real-Time Kinetics
RVT	Remote Video Terminal
SACAA	South African Civil Aviation Authority
SOW	Scope of Work
UPS	Uninterruptible Power Supply.

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1 INTRODUCTION

1.1 POC OBJECTIVES

The Proof of Concept (POC) Trial at OR Tambo Airport is aimed at achieving two main objectives for Airports Company South Africa (ACSA) and these objectives are:

- To Pilot Remotely Piloted Aircraft System (RPAS) within an Aerodrome with the aim of integrated communication between RPAS and Air Traffic Management (ATM) system as well as seamless communication with controllers. In addition to this, is to make sure that all frequencies, approvals, safety management system including emergency response are exercised and evaluated for improvement and recommendation for an integrated RPAS which can be scheduled within aerodrome like manned aircrafts. These elements will be tested under restricted airspace with no scheduled flights during this POC.
- To conduct civil infrastructure Inspections for all movement areas in the airfield, i.e. taxiway, runway and aprons. The inspections will include FOD, cracks, technical civil inspections, markings, signage, electrical fittings, etc. The aim is to show the capability of RPAS system for conducting effective inspections at the airport with the aim of future adaption to utilise this technology given its various benefits like repeatability, effectiveness, and speediness of conducting inspections amongst other benefits.
- To enter into a partnership that will support ACSA to develop and implement a strategy for the introduction and management of RPAS services at ACSA sites and the effective management of RPAS activities in airport environments.

1.2 BACKGROUND

In recent years UAVs and emerging technologies such as artificial intelligence and machine learning emerged and began to transform almost every aspect of the global economy. The sub-sectors in which ACSA operates are equally affected, with new opportunities and threats emerging in many relevant economic sectors including transport, logistics, security and infrastructure management.

Taking note of these developments, ACSA intends to develop and implement a RPAS services strategy in order to identify and benefit from the new opportunities that are created by the emerging RPAS economy while also mitigating against emerging new risks and threats.

There are various risks related to the emergence of the drone economy that should be given due consideration and that may need a thoughtful response from ACSA, including in airport management, airspace management, environmental management, fire, rescue and disaster management.

Security

The use of RPAS aerial surveillance in tactical security operations is empowering security operations in new ways and changing the of security services and the structure of the security industry.

- At the same time, rapid technological advances and the wide availability of advanced RPAS technology to ordinary consumers introduces new security risk, with RPAS being increasingly used as tools in unlawful conduct.
- It is important that ACSA understands what these trends mean for its own security and how it should respond.

❑ **Airspace & Airport Management**

- With the number of professionals and consumers using drones growing exponentially, it is becoming increasingly difficult to manage the airspace around airports and to ensure that the safety and continuation of airport operations can be maintained.
- While the regulation of drones is the mandate of the CAA, it is important that ACSA considers how it can contribute to the effective management of private drone operations near airport environments.

❑ **Infrastructure Management**

- Aerial surveys and related technology tools provide opportunity for improving the quality of infrastructure management activities while at the same time reducing costs.
- ACSA is looking to understand how it can improve its management of infrastructure by employing drones and related technologies.

Challenges

❑ **Urgency**

- The exponential growth of the consumer and professional RPAS industry and its rapid encroachment in ACSA's geographical and economic spheres of operation increases the urgency of an immediate and effective response from ACSA.
- This urgency requires that the development of a RPAS strategy, testing and piloting of key recommendations be incorporated into the contracting process.

❑ **Insufficient Industry Knowledge and Expertise**

- ACSA's ability to effectively respond to the emergence of the RPAS economy is hampered by its insufficient knowledge about the drone industry and lack of practical experience in many of the relevant applications of RPAS operations and related technologies.

❑ **Complexity**

- The large scope of the RPAS economy, across many sub-sectors, including in the business and consumer environments, contribute to the high complexity of the analysis that must be undertaken as well as the nature of the response that will likely be required from ACSA.

ACSA wishes to engage the services of an RPAS Operating Entity that has experience and expertise in the infrastructure field and has the capability in the following:

- Conducting visual condition assessment of airport flexible and rigid pavements using RPAS.
- Conducting off-site analysis of condition assessments captured with RPAS.
- Adhering to various technical standards that governs visual condition assessment of Airport pavements. Linking RPAS survey results to ACSA's Geographical Information System (GIS) (data for OR TAMBO is available) and Pavement Management Systems (PMS).
- Generating pavement assessments reports signed off by relevant qualified engineers.
- Automatic infrastructure analysis for fault detection, identification, and classification. The output data shall be linked or compatible with ACSA's Pavement Deuteriation Mode.

A high-level scope of work is as follows:

- Work with ACSA to get approval to fly an RPAS inside an aerodrome within the pre-approved times.
- Provide RPAS flight demonstrations for interest groups that may include ACSA personnel, South African Civil Aviation Authority (SACAA) officials, Air Traffic Navigational Services (ATNS) personnel (especially Air Traffic Controllers (ATC)), Airline representatives, and other interested parties.
- Carry out proof of concepts flight operations to test the suitability of the RPAS and the various sensor payloads technologies.
- Analysing survey data manually and advising on the technical requirements to automate the analysis.
- Compile reports for performed surveys, including the performance of the RPAS, the findings from the analysed data, required improvements on the systems, operational issues, etc. The reports shall be supported by methodology or process followed to analyse and perform data integrity checks.
- Define an organization wide drone strategy informed by the proof of concept.
- Drafting of the RPAS economy management strategy for ACSA including recommended strategic goals, short-term and long-term priorities and programmes.
- Planning and implementation of pilot and/or proof of concept (POC) projects for approved programmes.
- Overviews of recommended strategic programmes and their scope.

Drafting of the RPAS Economy Management Strategy

- Analysis of global and SA trends in the RPAS economy and related technologies.
- Analysis of the implications for ACSA in general and its various strategic goals and areas of operations specifically.
- Recommended strategic goals in response to the emergence of the drone economy.
- Recommended short-term and long-term priorities and sequencing.
- Overviews of recommended strategic programmes and their scope.
- Implications for resource planning and technology management.
- Risk analysis.

Planning and Implementation of POC projects

- Detailed planning and project plans per approved pilot/proof of concept project, including goals, proof of concept analytical framework, implementation strategy, resourcing, budget.
- Implementation and management of approved projects.
- Interim progress reports and management presentations per project.
- Final project report and executive presentation per project.

Strategic and Technical Input

- Participation in meetings and drafting of related strategic and technical documents, as may be requested by ACSA from time to time.

1.3 Mandatory Requirements

The following mandatory requirements may be adhered to while submitting the Request for Proposals (RFP):

1) The bidder should have a valid commercial RPAS Operational Certificate registered with SACAA for the entire duration of the contract and or the POC .
2) The bidders ROC/Ops Spec shall have the following approvals; fly over people, fly over crime scene, approved to fly in FAP, FAR.
3) The bidder's ROC operational specification shall the following; day and night flights, controlled airspace, Extended Visual Line of Sight (EVLOS).

4) At least 3 years' experience as a licenced commercial drone operator.
5) Demonstrate experience in at least 3 diverse sub-sectors of the drone economy, including at least security (BVLOS) and infrastructure management.
6) Demonstrate experience with using the latest RPAS related artificial intelligence tools
7) The bidder should own at least one RPA registered under bidder's ROC.
8) The bidder shall submit registered RPLs for all pilot to partake in the POC. All Pilots, working under the authority of bidder ROC, must hold a valid RPAS Pilot License (RPL), issued by the SACAA, for the type and rating of Remotely Piloted Aircraft (RPA) being operated under the ROC.
9) The Remote Pilots shall hold a Radio Communication Licence.
10) The bidder shall submit a Safety File (including emergency management procedures).
11) The bidder shall have third-part liability insurance cover or intent in line with ACSA insurance requirements.
12) The RPAS should be equipped with an Automatic Identification System (AIS) for ATC situation awareness.
13) Attendance of compulsory briefing session.

POC Project Experience

- Demonstrate experience in participating in at least 3 (three) RPAS services-related proof of concept project.

BBBEE

- BBBEE Level 1 Status Contributor

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2 SPECIFICATIONS

The tables below list some of the Business Requirements (BR) that have been added to guide the bidder through the RFP.

BR2	RPAS TECHNICAL SPECIFICATION
BR2.1	The specification/parameters outlined in succeeding BRs represent attainable objectives for RPAS for use by the ACSA are laid out under following heads 1) The RPAS as a system 2) Physical characteristics 3) Operational Characteristics including payload 4) Portable Ground Control Station 5) Artificial Intelligence (not mandatory, but would be advantageous)
BR2.2	The performance related attributes are with reference to environmental conditions and terrain features including OR TAMBO Airport.
BR2.3	**RPAS as a system:** <u>The RPAS should consist of: -</u> **BR2.3.1.** At least two RPA. **BR2.3.2.** A Ground Control System (GCS) with an aviation approved antenna. **BR2.3.3.** Compact remote video terminal (RVT). **BR2.3.4.** Suitable launch and recovery system. **BR2.3.5.** Outdoor Sun light readable video displays. **BR2.3.6.** Complete set of payloads with each aerial vehicle. The payload should provide both day and night capabilities to the RPAS. **BR2.3.7.** Adequate spares along with the necessary storage and carriage paraphernalia. **BR2.3.8.** Rugged, Compact and lightweight packaging to enable Safe and Hassle-free transportation of within aerodrome airfield. **BR2.3.9.** The RPA shall be powered by a battery-operated system (propulsion).
BR2.4	**RPAS as a system:** <u>Programmed Flight Capability</u> **BR2.4.1.** The RPA should be able to operate successfully despite intermittent presence of in-band signals from other Radio Frequency (RF) systems.

	BR2.4.2. The RPAS should have a "Return-to-home" functionality. In case of emergency, or break in communication, the RPAS should automatically change to the "Return-to-home" route until the communication is re-established. It is recommended that multiple home locations be defined, and the RPA shall be directed to the nearby "Home" location. If possible, during return "Home" activation, the RPA shall not cross another runway and should also avoid taxiway. **BR2.4.3.** The RPAS should have the facility to launch on a pre-programmed flight. **BR2.4.4.** The RPAS should have a dynamic programming in flight functionality to provide flexibility for multi-mission planning. **BR2.4.5.** The RPAS should be able to store a minimum of 100 flight routes and each route may have minimum of 75 waypoints. **BR2.4.6.** The RPAS should have a "Manual Override" functionality or should be reconfigurable to permit overrides of a pre-programmed flight at any time during the mission. **BR2.4.7.** All data must be geo-stamped with accurate Global Positioning System (GPS) data (Real-Time Kinetic (RTK) GPS recommended). **BR2.4.8.** In case of loss, the RPAS should give a radio beacon, which would assist in its recovery.
BR2.5	**Ground Control Station (GCS)** The GCS should be based on GPS and it should be able to control all aspects of the RPAS operation like pre-flight checks, equipment self-tests, take-off/landing control of RPA and payloads. It should: **BR2.5.1.** Have advance mission planning software features. **BR2.5.2.** Provide secure communications for RPA control and tracking, sensor operation and navigation. **BR2.5.3.** Facilitate recording and replay of sensor data. **BR2.5.4.** Have suitable ports for taking data out on a network in the form of video freeze frames/video clipping. **BR2.5.5.** Have a sun readable screen for live viewing. **BR2.5.6.** Have a manual control mode/control box to cater for autopilot failure. The GCS should also contain: **BR2.5.7.** Power supply system should cater for at least five hours of continuous operation with adequate backup, i.e. Uninterrupted Power Supply (UPS). **BR2.5.8.** Manual control functionality for operating various flight control modes and payloads.

	BR2.5.9. Digital Mass storage for recording live imagery along with metadata / telemetry and still image data received from the sensors and mission flight date for post flight analysis capability. Capability should be minimum 12 hours of recording data of multiple missions in MPEG4 or any other suitable format. Data transfer of recording to be downloadable to external storage and display systems by operator. **BR2.5.10.** Compact RVT or wrist mountable video gadget. Should have ability to overlap the ground video with geo-spatial data available.
BR2.6	**Physical Characteristics:** **BR2.6.1.** The RPA should be capable of rapid deployment with a detachment not exceeding three persons. **BR2.6.2.** The RPA should have a day and night operations capability. **BR2.6.3.** The entire RPAS (RPA + Day and Night Payloads + GCS + RVT + transportation box + Launcher mechanism, if required) shall be easily transportable within an aerodrome airfield. **BR2.6.4.** The RPA plus any combination of day and night Payloads shall be a maximum of 20 kg.
BR2.7	**Operational Characteristics including payload** <u>Endurance</u> **BR2.7.1.** The RPA should have a minimum endurance of 30 minutes with the required payload, i.e. with day /night operational capability (at least mode one at a time) and thermal sensor capability. <u>Mission Range</u> **BR2.7.2.** Minimum of 2.5 km for mission range from point of launch. Note that certain airports have runways with range up to 5 km. <u>Operational Conditions</u> **BR2.7.3.** The RPAS shall be able to undertake Take-off, flight and landing in winds of up to 5m/s. **BR2.7.4.** The RPAS shall be able to provide stable images in winds of up to 5m/s. The condition means that the dada captured is still credible and useful for data analytics. **BR2.7.5.** The RPAS should have a hover, or locational loiter, functionality. <u>Standard Operating Altitude</u> **BR2.7.6.** Operational altitude shall be up to 400 feet above ground level (AGL).

Temperature

BR2.7.7. Both the operating temperature and the storage temperature shall be from minus 5 degree to 55 degrees Celsius.

Safety

BR2.7.8. The operational procedure shall cover emergency procedures within an aerodrome which may also be initiated by air traffic controller.

Maintenance

BR2.7.8. The RPAS should have its maintenance procedure, schedule and records for executed maintenance as prescribed and in line with regulations.

Training

BR2.7.10 The bidder shall recommend training requirements for ACSA resources that will participate in the trial.

BR2.7.11 The bidder shall submit a proposed induction plan for ACSA resources that will participate in the Trial.

Payload Sensors

BR2.7.12. The system must be able to identify features of interest such FODs, cracks, spalling, delamination, water, airfield markings, airfield lights, surface types, vehicles, personnel, etc).

BR2.7.13. The sensor packages must provide high-quality Imagery resolution to permit target of interest detection, classification, mapping, recognition, identification and accurate location of fixed targets of interest and movement of personnel and vehicles.

Command and Control (C2) and Data Link

BR2.7.14. The RPAS should have a suitable data uplink and telemetry and video down link with the GCS with a range of Minimum 7 km Line of Sight (LOS) (maximum runway in ACSA airports is 5 km). The data link (Uplink and downlink) should be secure with Association of European Airlines (AES) Encryption 128 bit or better and should enable automatic tracking of RPAS in flight to minimize loss of communication link.

BR2.7.15. The RPAS should be capable of providing real-time high-quality video with full flight telemetry

BR2.7.16. The RPAS should be equipped with an AIS to ensure visibility and traceability by ATC.

	BR2.7.17. The RPAS should be equipped with an infrared strobe for night operations and a beacon for recovery, i.e. other system may be suggested to assist in the recovery of lost RPAS.
BR2.8	Aerodrome Civil and Electrical Infrastructure Inspections and Data Analysis Inspections **BR2.8.1.** The RPAS should be able to survey and inspect for any FOD on the pavement, taxiway and apron surfaces. The quality of the cameras / sensors should be able to pick up a loose stone of size 10mm. Furthermore, grass length in the strip area should be measured to ensure it does not exceed 10cm above surface level, i.e. runway, and Oil / grease spillages should be detected. **BR2.8.2.** The RPAS should be able to pick up typical signs of deterioration and damage on both concrete and asphalt pavement surfaces. The defects that should be picked up include, but is not limited to: • The development of cracks, and the identification of the type of cracks and size of cracks (e.g. crocodile cracking, longitudinal and transverse cracks, block cracking, random cracks, slippage cracks, corner cracks on concrete, shrinkage cracks, i.e. 1-5 mm resolution). • Ravelling (loose stone) • Rutting or deflections • Surface texture defects, e.g. Bleeding, softening of surface, heaving, shoving, weathering, delamination, and rubber build up • Random / instantaneous defects (e.g. potholes or damage due to lightning) • Pumping on both asphalt and concrete • Edge defects (e.g. edge breaks, edge drop-off – the step from surface to adjacent ground level, grass encroaching/growing on surface) • Damage to joint sealing • Spalling and chips, at the edge or corner of concrete blocks • Difference settling on concrete pavements (e.g. faulting, warping) • Damage due to aircraft failures, i.e. impact damage on landing, etc. • Runway, taxiway and apron markings deterioration **BR2.8.3.** The RPAS should also be able to simulate approach angles of aircrafts, to measure or see the visibility of the runway markings, runway lights (i.e. PAPI and Approach lights), signage and runway navigational aids under different weather conditions.

	BR2.8.4. The RPAS should be able to survey the gradient and slopes of the runway, (both longitudinally and transverse slopes), to confirm the drainage characteristics of the runway. This should be able to be compared with the requirements of Annex 14, and to confirm whether they runway is compliant. **BR2.8.5.** The RPAS should be able to do technical structural integrity assessment of the underlying pavement layers. This is to determine / calculate the remaining pavement life on the pavement. This includes the depth of the various underlying layers, presence of water, and anything else present under the surface. **BR2.8.6**. The RPAS should be able to inspect the Aeronautical ground lighting fittings and signage for damage or malfunction. Reference should be made to the requirements of the Annex 14. <u>Data and Analysis</u> **BR2.8.7.** The data shall be packaged after Image processing, i.e. based on the mission requirements, how data was captured and on the post-processing requirements. **BR2.8.8.** For multiple sensor solution, there analysis shall include data fusion and present a holistic view of the captured scene. Furthermore, the system should be capable of tracking targets of interest over time, i.e. pavement cracks. **BR2.8.9.** The analysis shall provide insight towards Pavement Condition Index (PCI); visibility effectiveness of signage, marking and lighting; identification and severity of defects; and information/recommendations towards preventive or corrective maintenance. **BR2.8.10.** The processing output shall be overlayered on OR TAMBO Airport's GIS information.

Table 1: RPAS Tech Spec

3 DOCUMENTATION

The Service Provider is expected to produce detailed and updated documentation including but not limited to the following:

- All certificate of compliance as RPAS operator including existing operational specification.
- A draft of amended operational specification to fulfil ACSA business requirements and for submission to SACAA for approval for ACSA RPAS Pilot Trial.
- All bidder certifications shall be valid (renewed if necessary) for the entire duration of the contract, i.e. 2 years.
- Technical diagrams and deployment layouts.
- RPA and GCS Technical Specifications.
- List of modules installed and configured.
- Maintenance report template.
- Training manuals.
- Standard operating procedures.
- Standard operating manuals
- Schedule of resources to partake in this POC
- Safety Plan/File

The following project related documentation must be produced by the Service Provider during implementation of the project:

- Management Strategy
- Project Management deliverables as per ACSA Methodology.
- POC report outcomes

As part of ongoing performance management, ACSA requires that the Service Provider provides a monthly progress report in accordance with a report outline that will provided by ACSA. This report must be tabled by the Service Provider during monthly service performance assessment meetings. ACSA reserves the right to change the list reports required from the Service Provider.