

OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
Technical Centre, Opposite Safdarjung Airport
New Delhi – 110003

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**INVITATION FOR EXPRESSION OF INTEREST (EOI) FOR
CONDUCTING EXPERIMENTAL BEYOND VISUAL LINE OF
SIGHT (BVLOS) OPERATIONS OF REMOTELY PILOTED
AIRCRAFT (RPA)**

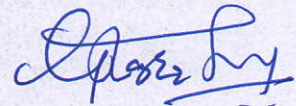
Directorate General of Civil Aviation (DGCA), Ministry of Civil Aviation, invites Expression of Interest (EOI) from Consortia of Experts for conducting experimental Beyond Visual Line Of Sight (BVLOS) operations of Remotely Piloted Aircraft (RPA) in India, leading to submission of Proof of Concept (POC) for safe BVLOS operations.

Interested Organizations involved in, or capable of, undertaking this task may submit a detailed proposal to Shri Hillol Biswas, Director (Aircraft Engineering), Office of Director General of Civil Aviation, Opp. Safdarjung Airport, Aurobindo Marg, New Delhi-110001 in a sealed envelope clearly marked "EOI for Selection of Consortium for Experimental BVLOS RPAS Operations".

The experimental BVLOS operations followed by submission of POC should be completed before DGCA issues any regulations for BVLOS operations.

Objective, scope of work and other requirements of the experimental BVLOS operations have been laid down in enclosed Annexure. The same can also be downloaded from DGCA's website <http://dgca.nic.in>.

DGCA will have the right to reject any or all EOIs, received in response to this invitation, and its decision in this regard shall be final and binding.



(G. Rajasekar)
Joint DGCA

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ANNEXURE-1

EXPERIMENTAL BEYOND VISUAL LINE OF SIGHT (BVLOS) OPERATIONS OF REMOTELY PILOTED AIRCRAFT SYSTEM (RPAS)

1. INTRODUCTION

- 1.1 Unmanned Aircraft Systems (UAS), commonly known as “drones”, have traditionally been used for military applications. However, in past few years, world has witnessed tremendous growth in commercial applications of UAS. The opportunities for UAS operations, particularly at low altitudes, are spread across a plethora of sectors including inspections and monitoring, surveying and mapping, filming and photography, precision agriculture, delivery, search and rescue, disaster relief, public safety, etc. However, the true economic and social potential of the UAS technology can be harnessed by enabling Beyond Visual Line Of Sight (BVLOS) operations.
- 1.2 Remotely piloted aircraft (RPA) is an unmanned aircraft, which is piloted from a remote pilot station. A remotely piloted aircraft, its associated remote pilot station(s), command and control links and any other components forms a Remotely Piloted Aircraft System (RPAS).

2. OBJECTIVE

- 2.1 The objective of the proposed experimental BVLOS operations shall be to conduct experimental BVLOS operations of Remotely Piloted Aircraft Systems (RPAS) in controlled conditions within identified and segregated low altitude Indian territorial airspace for a period of at least 2 months, collect evidence, prepare safety case and submit Proof of Concept (POC) to DGCA.

3. SCOPE

- 3.1 Scope of the experimental BVLOS operation include BVLOS RPAS operation, UAS Traffic Management (UTM) system deployment, supplementary services for UTM (3D maps, weather data, surveillance and telemetry data of manned and unmanned aircraft, population data etc.), collection and analysis of data, preparation of safety case and submission of Proof of Concept (POC) to DGCA.

4. FORMING OF CONSORTIUM

- 4.1 The proposed experimental BVLOS RPAS operation should be conducted by team of expert agencies and services providers, known as Consortium.

- 4.2 The BVLOS experiments are expected to pave the way for creation of evidence-based regulatory requirements to enable commercial BVLOS operations in near future. **In order to expedite achieving this objective, it is intended to approve simultaneous BVLOS RPAS experiments across the country to be carried out by multiple Consortia.**
- 4.3 Each Consortium should, as a minimum, consist of RPAS Operator(s), UTM Operator, Supplementary Service Providers and Agencies for Data Acquisition, Data Analysis, Safety Case development and preparation of POC. Table 1 gives an indicative list of Consortium Partners and their roles. The Consortium may comprise of additional partners or partners discharging multiple roles.
- 4.4 Each Consortium shall be led by a Project Coordinator, who must be an Indian citizen and must have at least 2 (two) years' experience in RPAS operations as a drone pilot or manufacturer or operator. Appropriate additional weightage will be assigned to the proposer having national/ international experience in the relevant aviation sector or to have key personnel who have worked on such national/ international projects on its roles as part of the Consortium. In case of foreign participation in the consortium, existing FDI rules in India shall apply.
- 4.5 The Project Coordinator, on behalf of the Consortium, should submit a proposal for conducting experimental BVLOS RPAS operations, to DGCA, for assessment and approval. The proposal should also contain proof of qualification and experience of members and partner companies of the Consortium. The proposal should also contain an undertaking executed by the partners forming the Consortium on their roles and responsibilities in the proposed experimental BVLOS operation.
- 4.6 **The proposal submitted to DGCA should also contain an application for seeking exemption from proviso of CAR Section 3 Series X Part I. The application should include detailed justification and filled and signed format as per CAR Section 1, Series B, Part III.**
- 4.7 The proposals submitted to DGCA will be evaluated by an Expert Committee known as BVLOS Experiment Assessment and Monitoring (BEAM) Committee constituted by Ministry of Civil Aviation (MoCA). BEAM Committee, after evaluation of the proposals may accept or reject the proposals or demand amendments in the proposal before acceptance.
- 4.8 Conducting experimental BVLOS operation will be on no-payment basis, which means that entire expense of conducting the experiment will be borne by the Consortia. MoCA/DGCA may provide appropriate weightage to those parties who have participated and successfully completed BVLOS Experiments, on non-exclusive basis, as and when Request for Proposals (RFP) for commercial BVLOS operations are invited.

Table-1 Consortium Partners and their Roles

CONSORTIUM PARTNER	ROLE
Project Coordinator	Represents the consortium of experts. He/She will be the single point of contact representing each consortium and will be responsible for achieving the milestones laid out in the proposal.
UAS Operator	Operate UAS and comply with all the safety standards and risk mitigation strategy for UAS operations
UTM Service Provider	Provide UTM services including situational awareness to UAS operators and coordination with ATC
Supplementary Service Providers (SSP)	Provide 3D maps, weather data, surveillance and telemetry data of manned and unmanned aircraft, population data etc.
Agencies for Data Acquisition & Analysis	Collect, collate and analyse data
SMS Expert	Preparation of safety case and proof of concept

5. REQUIREMENTS, PROCESSES AND TIMELINES

- 5.1 Identification of Test Airspace
 - 5.1.1 Experimental BVLOS operations should be conducted in low traffic density, uncontrolled (Class G) airspaces below 400 ft AGL, preferably in sparsely populated areas to reduce the risk of collateral damage.
 - 5.1.2 An airspace of size 20 sq.km (2.5 X 2.5 NM), extending from ground to 400 ft AGL may be identified by Consortia for the experiment. However, airspace of larger volume may be assigned to Consortia, depending on the use case selected for the experiments. Sufficient safety buffer airspace may be added to the identified test airspace. Such airspaces may be identified by different Consortia, in consultation with Executive Director (Airspace Management), Airports Authority of India (AAI), prior to submission of their proposal in response to the EOI.
 - 5.1.3 Airspace identified for the experiment should be suitable for testing all aspects of localised BVLOS operations.
 - 5.1.4 Identified airspace should be a GREEN Zone under Digital Sky, i.e. clear of all RED Zones and where requirement of ATC clearance does not exist.

However, Consortia may request for approval of airspaces in YELLOW Zones for experimental BVLOS operations in metropolitan areas.

5.2 Operating Environment

- 5.2.1 Operations may be as VFR or IFR flights, but VMC should prevail at take-off and landing areas.
- 5.2.2 Weather limitations stipulated by UAS manufacturer should be complied with.
- 5.2.3 Sorties may be conducted during day only. On successful completion of day experiments for at least 1 month, night operations may be considered for approval by DGCA. Only IFR operations shall be permitted during night.
- 5.2.4 UAS launch and recovery areas should be identified along with alternate sites.
- 5.2.5 Remote Pilot should hold a valid manned aircraft pilot license (at least PPL) and should be authorised to operate experimental BVLOS flights by DGCA.
- 5.2.6 Safe VLOS track record of the UAS operator and the remote pilot is a prerequisite for conducting experimental BVLOS operations.
- 5.2.7 Flight Plan should be filed for each sortie of experimental BVLOS flight. Energy reserve of 15% of flight time should be provisioned for.
- 5.2.8 Clearance should be obtained from concerned ATC unit before commencement of experimental flights. Completion of each sortie should also be informed to ATC.
- 5.2.9 Each Consortium should establish mobile or stationary Control Rooms covering both launching and landing areas of RPAS. The control rooms should be accessible to authorised personnel for monitoring and regulating BVLOS experimental operations if required.
- 5.2.10 Each BVLOS experiment should be monitored by a team of authorised personnel, on behalf of BEAM Committee, which should include an AAI ATC officer and IAF Air Defence Officer. The presence of AAI/IAF officers should be mandatory for a period of 5 days at the start of the experiment, which, can then be reduced to random inspections.
- 5.2.11 Principle of non-exclusivity will be followed while approving BVLOS experiments. This means that no consortium will have exclusive right to conduct BVLOS experiments in a particular airspace bubble assigned to them. If there are more than one consortia applying for conducting experiments in the same general airspace, experiments should be conducted on time-sharing basis.

5.3 Basic Requirements of Test RPAS

- 5.3.1 The RPAS used for BVLOS experimental flights should have as a minimum, the following capabilities:

- a. Micro and Small RPAS only permitted
- b. Capability for autonomous operations
- c. Sufficient endurance for long range operations
- d. Capability to withstand adverse weather
- e. Capability to transmit identity and live trajectory information
- f. Carriage of barometric sensor on board
- g. Geo-fencing, Return Home and Automatic Flight Termination capabilities
- h. Digital Sky No Permission No Take-off (NPNT) compliance
- i. Conspicuous with bright colours and flashing strobe lights
- j. 360 degrees collision avoidance system to avoid terrain and obstacles
- k. Detect & Avoid System (DAA) to detect and avoid manned and unmanned aircraft
- l. Display for Remote Pilot to provide live trajectory, manned aircraft information, DAA information and FPV, with visual / audio alerts

5.4 Basic Requirements of UTM Systems

- 5.4.1 Consortia should establish basic UAS Traffic Management (UTM) infrastructure for experimental BVLOS operations.
- 5.4.2 UTM Unit should provide population data, terrain and obstacle data, manned and unmanned traffic data, meteorological data, NOTAM information pertaining to the airspace and GNSS serviceability information to participating unmanned aircraft.
- 5.4.3 UTM Unit will be manned by trained and qualified personnel employed by the Consortia.
- 5.4.4 UTM Unit shall interact with concerned ATC and AFMLU units, as and when required. Facility for two-way voice communication between Remote Pilot, UTM Unit and concerned ATC unit is mandatory. However, communication between Remote Pilot Station and ATC units should NOT be carried out through VHF frequencies used by manned aircraft.

5.5 Development of Testing Procedure and Coordination Procedures

- 5.5.1 As part of the response to the EOI, Consortia is required to submit detailed procedures for conducting experimental BVLOS operations, along with an undertaking that the experiment will not in any manner affect safety of manned aircraft operations.
- 5.5.2 Prior to commencement of experimental flights, each Consortium should develop Standard Operating Procedures (SOP) for coordinating with ATC in normal and abnormal situations such as C2 lost link.

5.5.3 Prior to commencement of experimental flights, each Consortium should conduct hazard identification and risk management (HIRM) workshop involving all stakeholders. Experimental BVLOS operations should be attempted only after all risks are brought within acceptable level of safety. Globally accepted methods of HIRM should be employed (e.g. JARUS SORA methodology). Such exercise may be conducted by different Consortia together or separately, in the presence of stakeholders including DGCA, AAI and aircraft operators.

5.6 Obtaining Approval from DGCA for Experimental BVLOS Operation

5.6.1 Consortia should submit detailed testing procedures, coordination procedures with ATC and HIRM report to DGCA for permission for commencement of experimental BVLOS operations. The BEAM Committee, on examination of the proposal, may recommend to DGCA for approval of the proposal, along with recommended amendments, if any.

5.6.2 DGCA shall issue written approval based on the recommendation of the BEAM Committee, with operating conditions and limitations to each Consortium including the maximum time allotted for completion of the experiment. Further, in case of any extension required the same will be decided on recommendation by the BEAM Committee based on the progress report and justification provided by the Consortium.

5.7 Analysis of Data, Preparation of Safety Case and Submission of Proof of Concept (POC)

5.7.1 Consortia should have the capability to acquire data from their experiment and analyse it. They should submit the safety case (as part of POC) to DGCA for acceptance. The safety case should be based on direct evidence from quantitative and qualitative safety analyses. The assessment must prove that BVLOS operations have an equivalent level of safety to that of manned aviation, implying that BVLOS RPAS operations pose no greater risk of injury or damage to persons or property on the ground, or other airspace users than manned aviation operations.

5.7.2 It is expected that the number of iterations required to establish safety of BVLOS operations will be significantly high. **As a minimum, each consortium should complete 100 hours of experimental BVLOS flight before submission of Proof of Concept for approval.**

5.7.3 Parameters for testing of experimental BVLOS operation should include, but not limited to:

- a) Track-keeping and altitude keeping abilities of UAS
- b) DAA and Collision Avoidance capabilities of UAS
- c) GNSS coverage and impact of GNSS failure on BVLOS operation
- d) Impact of C2 link failure and C2 link interference with ATC systems

- e) Impact of BVLOS operation on manned aircraft operations
 - f) Assessment of potential collateral damage on uninvolved persons and property
 - g) Assessment of vertical and horizontal separation standards required for safe operation of multiple BVLOS aircraft
 - h) Safety of operations in below VMC environment and during night
 - i) Effectiveness of UTM systems and their interfaces with ATM Systems
 - j) Quality and effectiveness of 3D maps
 - k) Safety aspects of "No Camera" operation of RPAS
 - l) Procedures for safe carriage of payload
- 5.7.4 Post experimental operations, Consortia should submit Proof of Concept (POC) for approval of BVLOS operations to DGCA, along with the safety case report.
- 5.7.5 The POC should be commensurate with the scope of operations. It is expected that the level of documentation and justification required to get acceptance will be commensurate with the level of complexity of the proposed operation.
- 5.7.6 The safety case submitted to DGCA should explicitly state the assumptions and limitations of the experiment. An analysis must be presented on possible complications if such future commercial BVLOS operations were approved. This report must include a list of possible human as well as technical failures that put the operation at risk. It must also mention risk mitigating measures, if any.
- 5.7.7 The BEAM Committee on comprehensive evaluation of the POCs submitted by participating Consortia will submit its recommendations to DGCA.
- 5.8 Insurance and Liability for Collateral Damage
- 5.8.1 Each Consortium shall ensure that the RPAS Operator should be insured for any accidents leading to injury / death of uninvolved persons or damage of property. DGCA will not be liable for any injury/death of any person of consortium or any damage to the property of consortium and the same is the liability of consortium
- 5.8.2 DGCA shall not be held liable for any loss or damage to any entity whatsoever, caused/resulted during the conduct of such trials. Further, the Consortium shall indemnify DGCA from any loss on account of any claim by third party (including but not limited to cost of litigation etc) which may arise due to any act/omission of the Consortium during the conduct of such trials.
- 5.9 Timelines
- 5.9.1 Broad timelines for achieving the milestones are given in Table-2.

Table-2 Timelines

Sl. No:	Milestone	Responsibility	PDC
1	Notice inviting EOI published by DGCA	DGCA	
2	Submission of Proposal by Consortia for conducting experimental BVLOS operations	Project Coordinator(s) on behalf of Consortia	T
3	Evaluation of the proposal submitted by Consortia followed by approval by DGCA for conducting the experiments	BEAM Committee and DGCA	T + 1 month
4	Preparatory work for conducting experimental BVLOS operations	Project Coordinator(s) on behalf of Consortia	T + 3 months
5	Conduct of experimental BVLOS operations and data acquisition	Project Coordinator(s) on behalf of Consortia	T + 5 months
6	Data analysis and Submission of Safety Case & Proof of Concept	Project Coordinator(s) on behalf of Consortia	T + 6 months

6. RIGHT TO TERMINATE THE PROCESS

- 6.1 DGCA may terminate the EOI process at any time and without assigning any reason. DGCA makes no commitments, express or implied, that this process will result in a business transaction with anyone.

7. QUERIES AND CLARIFICATIONS

- 7.1 Any queries and clarifications may be addressed to:

Shri Hillol Biswas, Director (Aircraft Engineering)
 Directorate General of Civil Aviation
 Opposite Safdarjung Airport
 New Delhi-110003
 Email id: hbiswas.dgca@nic.in
