香港特別行政區政府
民航處
Civil Aviation Department
The Government of the Hong Kong Special Administrative Region

Small Unmanned Aircraft Advisory Circular No. AC-005

Date: 31 May 2022

Guidelines for Building Survey/ Inspection Operations using Small Unmanned Aircraft

1. Background

1.1 The Small Unmanned Aircraft Order ("SUA Order"), Chapter 448G of the Laws of Hong Kong, comes into operation on 1 June 2022. Under the SUA Order, small unmanned aircraft ("SUA") operations are regulated under a risk-based approach and be classified according to the weight of the SUA and the operational risk level. SUA Order is a piece of subsidiary legislation made under the Civil Aviation Ordinance that aims to provide a flexible and forward-looking regime for the regulation and development of SUA operations in Hong Kong

1.2 Given SUA's aerial accessibility and flexibility, SUA has played an increasing role in a wide range of survey-related applications, in particular, building survey/ inspection, façade inspection (or also referred as "structures" in the context of this document), roof inspection, etc. With its imaging ability, the use of SUA provides more cost-effective and safe solution when compared to traditional way involving workers to conduct manual inspection or photographing.

1.3 This Advisory Circular ("AC") aims to provide guidelines and set out some general safety requirements for building survey/ inspection using SUA in Hong Kong from the aviation safety perspective. Should such operations require the use of SUA in circumstances where the following operating requirements under the SUA Order cannot be met, a permission under section 37 of the SUA Order will be required from the Civil Aviation Department ("CAD") :

- The flying altitude of the aircraft not higher than specified flying altitude *[section 16(1)(c)]*[1];

[1] The flying altitude as specified in the Gazette Notice issued under section 17(2) of the SUA Order is 100 ft above ground level for Category A1 Aircraft and 300 ft above ground level for Category A2 Aircraft.

- The distance between the aircraft and any person who is not involved in the flight operation, measured horizontally and at any altitude, is not less than the specified distance *[section 16(1)(e)]*[2]; and
- The distance between the aircraft and any vehicle, vessel or structure that is not under the control of the remote pilot of the aircraft for the flight, measured horizontally and at any altitude, is not less than the specified distance *[section 16(1)(f)]*[3].

2. Definition

2.1 **First-person view ("FPV")** operation, which is common in building survey/ inspection, means flying with immersive FPV googles, real-time video feeds displayed on remote controller or mobile phone, etc. In a standard operation, if FPV is involved, a Visual Observer shall be deployed to maintain Visual Line of Sight with the SUA as detailed in the relevant Gazette Notice and the Safety Requirements Document ("SRD").

2.2 **"Involved Person"** means a person who takes part in or is well aware of the SUA operation, understands the risk, and is aware of the instructions and safety precautions in regard to the SUA operation. In practical terms, this means that an involved person must:

- be clearly notified about and aware of the SUA operations;
- understand the risks involved;
- have reasonable safeguards introduced for them by the venue manager or the SUA operating crew during SUA operation; and
- be expected to follow the directions and safety precautions provided.

2.3 A **vehicle** or **vessel** is considered to be "**under the control of the remote pilot**" (known as "involved" hereafter) if:

- The remote pilot shall be satisfied that a permission has been granted by appropriate persons which have an interest in the vehicle or vessel (e.g. the management party of the vehicle or vessel) for an SUA to operate within a distance less than the required lateral separation;
- Persons on board can reasonably be expected to follow directions and safety precautions for the SUA operation to avoid unplanned interactions with the SUA; and

[2] The distance as specified in the Gazette Notice issued under section 17(2) of the SUA Order is 10 m for a Category A1 Aircraft, and 10 m (with the flying speed of the aircraft not exceeding 20 km/hr) or 30 m (with the flying speed of the aircraft exceeding 20 km/hr but not exceeding 50 km/hr) for a Category A2 Aircraft.

[3] The distance as specified in the Gazette Notice issued under section 17(2) of the SUA Order is 10 m for a Category A1 Aircraft, and 10 m (with the flying speed of the aircraft not exceeding 20 km/hr) or 30 m (with the flying speed of the aircraft exceeding 20 km/hr but not exceeding 50 km/hr) for a Category A2 Aircraft.

- Persons on board should be adequately briefed or informed about the SUA operations.

2.4 A **structure** is considered to be "**under the control of the remote pilot**" (known as "involved" hereafter) if:

- The remote pilot shall be satisfied that a permission has been granted by appropriate persons which have an interest in the structure (e.g. the management party of the structure) for an SUA to operate within a distance less than the required lateral separation;
- Occupants of the structure can reasonably be expected to follow directions and safety precautions for the SUA operation to avoid unplanned interactions with the SUA; and
- Occupants of the structure should be adequately briefed or informed about the SUA operations.

2.5 **"Uninvolved Person/ Vehicle/ Vessel/ Structure"** means any person/ vehicle/ vessel/ structure other than an "involved person / vehicle/ vessel/ structure".

3. Building Survey/ Inspection under Standard Operations

3.1 Since the uses of Category A1 or Category A2 SUA for building survey/ inspection that involve operations within the applicable operating requirements are categorised as "Standard Operations", **prior permission from CAD will not be required**. A typical example of such operation is illustrated in the following paragraphs.

3.2 If a Category A1 or A2 SUA is used for building survey/ inspection, and the operations are in compliance with all applicable operating requirements at all times during the flight, such operations are regarded as Standard Operations.

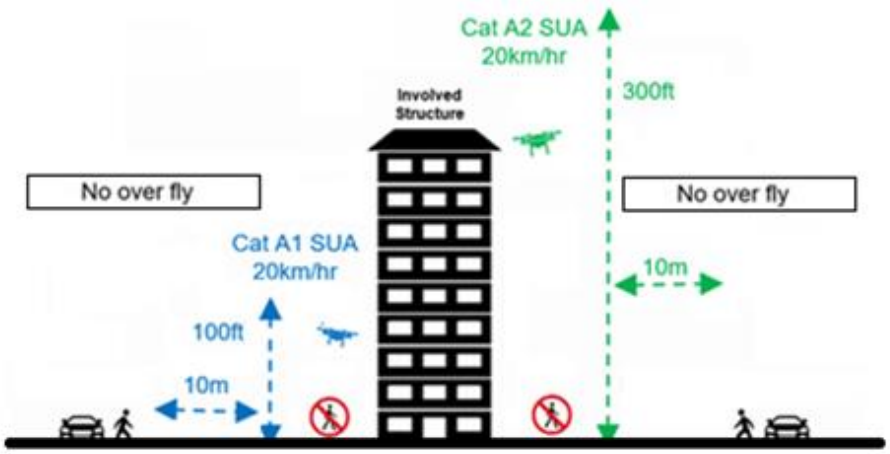

Figure 1: Building survey/ inspection under Standard Operations

3.3 All regulatory requirements (including but not limited to registration and labelling of the SUA, registration of remote pilots, equipment, insurance, etc.) applicable to SUA involved in standard operations must be met. Detailed requirements are available in the SRD.

3.4 For the avoidance of doubt, prior permission from CAD is not required if:

- ✓ SUA operations are in compliance with the applicable operating requirements**;**
- ✓ Category B SUA is not used for operation;
- ✓ No dangerous goods is carried;
- ✓ Operations are not within a Restricted Flying Zone ("RFZ"); and
- ✓ Public access to the operating site is controlled to ensure no uninvolved people, vehicles, vessels are overflown

3.5 Permission from relevant land or property owner, management, authority or agency if deemed necessary or appropriate for the intended operations is obtained.

4. Building Survey/ Inspection under Advanced Operations

4.1 To ensure aviation and public safety, operators of SUA should always endeavour to operate in compliance with all operating requirements applicable to the SUA as specified under section 15 of the SUA Order at all times during the flight. This notwithstanding, in the context of building survey/ inspection operations, the CAD notes that there are practical needs and operational circumstances at times where the stipulated operating requirements cannot be fully met, such as **flying high altitude (i.e. above 300 ft AGL)** or **flying over uninvolved people/ structures**. Under these circumstances, a permission will be required for the SUA operator to conduct **advanced operations**.

4.2 The ensuing paragraphs in this AC provide to applicants who wish to apply for a permission from the CAD to conduct the building survey/ inspection operations within Hong Kong that involve advanced operations. Depending on the practical needs and operational circumstances, different types of advanced operations may be involved.

4.3 Applicants and operators of SUA should read this AC in conjunction with other safety guidelines and documents published by the CAD, including but not limited to the SRD and the relevant AC(s) before making the application and conducting building survey/ inspection involving advanced operations.

4.4 Unless otherwise advised or specified in the permission, all regulatory and safety requirements as stipulated in the SUA Order and documents published by the CAD shall continue to apply.

4.5 The additional safety requirements for obtaining the permission are set out in the following paragraphs of this AC.

5. Equipment Requirements

5.1 The SUA shall be equipped with the necessary safety system capable of performing the functions specified in section 13 of the SUA Order, i.e. flight log and geo-awareness functions.

5.2 Applicant is required to propose **additional safety system or equipment** demonstrating enhanced safety assurance for sustained flight over uninvolved people, vehicles, vessels or structures, for example, using **lightweight SUA** (i.e. Category A1 SUA).

Note: "Sustained flight" does not include a brief, one-time transiting over the uninvolved people, vehicles, vessels or structures, where the transit is merely incidental to a point-to-point operation unrelated to the people or property being flown over.

5.3 The SUA to be used for advanced operations of building survey/ inspection shall also be equipped with **appropriate navigation lighting**[4] . The lighting must be **visible** to the remote pilot at all times during the flight and it must be **sufficient for the remote pilots to determine the orientation and direction of the SUA visually**.

5.4 Installation of **rotor blade guard** is required to avoid collision while manoeuvring the SUA in close proximity of building or structure. **Obstacle avoidance** is also recommended to further mitigate the risk of collision.

5.5 **Strobe** or **anti-collision light system** is also recommended for use in building survey /inspection.

5.6 **Geo-fence** and **altitude limiting functions** shall be equipped and in use during operations to cage the SUA in manoeuvring within a pre-defined flight volume. **Real Time Kinematic (RTK) positioning system** is recommended.

5.7 **Appropriate ground station** or **remote controller software** shall also be in place to assist the remote pilot in identifying the SUA's position in real time.

5.8 **Anemometer** to monitor wind gust at high altitude shall be equipped for monitoring the change in wind speed and direction as flying altitude elevates.

5.9 Before take-off and during the flight, the SUA must achieve a positive satellite lock. Where the manufacturer does not specify the number of satellites to gain lock, the SUA shall not fly with less than 7 satellites positively acquired.

[4] Usually red lights on forward rotor arms and green lights on rear rotor arms, or red lights on left wing and green lights on right wing

5.10 All personnel and crew members including the remote pilot involved in the building survey/ inspection are recommended to be provided with appropriate personal protective equipment (PPE) (e.g. reflective apparel, safety vests, etc.)

6. Personnel Requirements

6.1 The remote pilot for the flight shall hold a valid remote pilot registration and be assigned with an Advanced Rating.

6.2 Other than the remote pilot, to provide additional safety and observation support, sufficient supporting crew shall be made available for the SUA operations for the purpose of building survey/ inspection to assist the remote pilot in monitoring the remote controller or assess the SUA's position.

6.3 Effective audio communication must be maintained between the supporting crew and the remote pilot at all times during the flight.

7. Operating Requirements

7.1 The operation area/ path must be carefully chosen with sufficient lateral separation from uninvolved people, structures, vehicles or vessels.

7.2 Saved for Paragraph 7.1 above, with Hong Kong being a densely populated cosmopolitan, certain building survey/ inspection may unavoidably involve flying over uninvolved people, vehicles, vessels or structures. If such overflying is unavoidable or or sufficient lateral separation cannot be kept, the access to the site(s) of such operations shall be controlled. Effective communication shall be in place so that any uninvolved person or the appropriate persons of the uninvolved vehicles, vessels or structures located within such site(s) is aware that an SUA may fly over them or their vehicles, vessels or structures. Unless with additional safety system or equipment accepted by the CAD as specified in Paragraph 5.2, the remote pilot **shall not maintain sustained flight** over any uninvolved people, vehicles, vessels or structures, and shall reduce as much as possible the time of overflying. **Overflying of highway, railway, or any strategic route shall be avoided**.

7.3 Notice to public for notifying SUA operation shall be in place. Placement of safety cones, warning signage are recommended to signify that an SUA operations in the vicinity is in progress. This will enhance the awareness of the SUA location.

7.4 The flying speed of the SUA shall **not exceed 20 km/hr**.

7.5 The remote pilot shall take into consideration the intended operation altitude and the obstructions that may come into sight, so as to ensure **visual line of sight (VLOS) will be maintained** with the SUA at all times. If a Visual Observer ("VO") is deployed to assist the remote pilot in keeping the SUA in VLOS and safely conducting the flight by unaided visual observation of the SUA when FPV operation is involved, relevant requirements, including timely and effective communication between the remote pilot and the VO, shall be fulfilled. Details of VLOS requirements can be found in Chapter 7 of the SRD.

7.6 The SUA shall not be operated within an RFZ or carry any dangerous goods during flight, unless a relevant permission has been separately obtained.

7.7 The remote pilot shall comply with all other applicable operating requirements to the SUA, i.e. operating the SUA only in daylight hours, maintaining VLOS in a specified way, not carrying any person or animal during flight, nothing being dropped from the aircraft, the remote pilot operating no more than one SUA at the same time and the dimension of SUA not exceeding 1m during flight (except that longest distance between any two rotor blade tips can be up to 1.2 m). More information about the requirements is available in the SRD published by the CAD.

7.8 Applications may be made for any one or more than one specific type of advanced operations; but in any one flight, only one type of advanced operations should be involved, unless otherwise specified by the CAD in the permission concerned.

7.9 If all necessary safety requirements are met and mitigation measures are in place for the advanced operations, to enable the beneficial use of SUA for high-rise building survey/ inspection, the CAD may consider allowing an SUA to be operated within a pre-defined flight volume in which **the SUA will not fly higher than 100 ft above the highest fixed point of, and horizontally farther than 30 m from the subject structure**. An illustration of the pre-defined flight volume is in Figure 2.

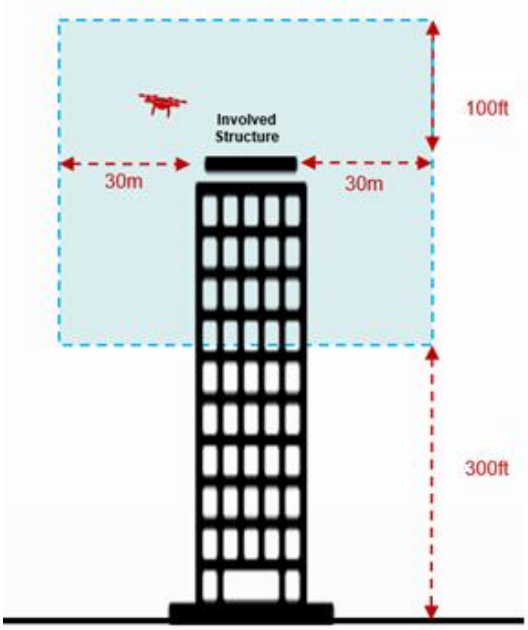

Figure 2: The pre-defined flight volume for high-altitude building survey/ inspection

8. Others

8.1 The remote pilot, responsible person of SUA or any other person who knowingly causes or permits the aircraft to be operated for the flight should take note that apart from the SUA Order, other regulations, bylaws, requirements, etc. may also govern the usage of SUA. Applicable rules shall be observed and permission from relevant land or property owner, management, authority or agency shall be obtained if deemed necessary or appropriate for the intended operations.

9. Application

9.1 Applicants may apply to the CAD for permission to conduct advanced SUA operations for building survey/ inspection following the requirements set out in AC-002.

9.2 Apart from the requirements prescribed in the AC No. AC-002, an applicant shall also include the following information/ document specific to building survey/ inspection operation as part of the application:

a) An Operations Manual including (See **Appendix A** for details):

- Duties and responsibilities of all crew member(s) including remote pilot and supporting crew;
- Description of the building survey/ inspection and the procedures to ensure safe operation;
- General and emergency procedure to conduct the building survey/ inspection safely, including flight checks to be carried out and communication

protocols between the remote pilot and other flight crew;

- Description of qualifications requirements to ensure competency and currency for all personnel involved in the intended operations, including the supporting crew; and

b) A risk assessment identifying hazards specific to building survey/ inspection and the corresponding risk mitigation measures (See **Appendix B** for details)

9.3 Dependent on the risks and complexity of the proposed operation, the CAD may require a flight demonstration to be performed to assess the applicant's capabilities and safety of the proposed operation.

10. Enquiries

10.1 This AC will be subject to review and update from time to time in the light of the advancement of technology and increasing popular use of SUA in different professional applications. It should also be noted that the safety requirements provided above are not meant to be exhaustive. It shall be the responsibility of the SUA responsible person and remote pilots to comply with all applicable regulatory requirements, put in place appropriate safety precautions and risk mitigating measures for the subject SUA operation, as well as to follow the requirements and guidelines set out by any property owner and/or manager to ensure the safe operation of SUA at all times.

10.2 This AC should be read in conjunction with the SUA Order, SRD and other SUA related documents published by the CAD.

10.3 For enquiries, please contact the Unmanned Aircraft Office of the CAD at sua@cad.gov.hk.

11 Notes

11.1 This AC supersedes the version dated 18 March 2022.

Appendix A – Operations Manual for Building Survey/ Inspection involving Advanced Small Unmanned Aircraft Operations

The applicant may make reference to the sample of Operations Manual and incorporate into the manual specific descriptions/ policies/ procedures applicable to Building Survey/ Inspection to address any concerns and issues arose. While the following are not intended to be exhaustive or prescriptive, the applicant should give similar considerations in the Operations Manual.

A. Responsibilities and Duties

- The duties and responsibilities of the Remote Pilot and other crew shall be detailed in the Operations Manual, including but not restricted to:

  Remote Pilot

  a) Conduct SUA flight in accordance with the procedures set out in the Operations Manual;
  b) Ensure the overall safety of the SUA operation on-site;
  c) Confirm the Supporting Crew maintains currency of his/ her training and is physically fit to carry out duties as a Supporting Crew;
  d) Brief and debrief all members of the flight team and associated staff and ensure they are aware of their responsibilities and tasks for the particular SUA operation;
  e) Conduct risk assessment to identify any hazard for the operation and determine risk mitigating measures to be implemented;
  f) Conduct site and flight safety assessment to determine if the prevailing conditions are suitable for SUA operations and complete the associated forms;
  g) Work out the flight details including flight time, flight duration, take-off and landing area, flight path, position of Supporting Crew etc. and execute accordingly;
  h) Perform pre-flight check to ensure the SUA and the safety equipment are in good condition and functioning properly prior to take-off or launching;
  i) Halt or cancel SUA operation if, at any time, the safety of persons or property on ground or in the air is in jeopardy, or if there is a failure to comply with the provisions of permission issued by the CAD; and
  j) Ensure that all logs and records in relation to the operations are properly completed and signed.

  Visual Observer (if available)

  a) Maintain direct, unaided (other than corrective lenses) visual contact with the SUA to know the SUA location, determine the SUA's attitude, altitude and direction of flight, observe the airspace for other air traffic or hazards and determine if the SUA become a hazard to any other aircraft, person or property;
  b) Communicate continuously and effectively with the Remote Pilot and provide sufficient collision avoidance information to the Remote Pilot; and

c) Inform the Remote Pilot when the SUA is approaching its maximum operating range limits.

Supporting Crew

a) Keep the Remote Pilot updated constantly on an independent monitor on flight parameters of the SUA including battery level and satellites tracked;
b) Assist in ensuring the operation is executed according to plan such as flight path followed and image captured;
c) Maintain constant visual lookout for any uninvolved people, vehicles, vessels or structures within or getting close to the minimum lateral separation required; and
d) Alert the Remote Pilot in case of any emergencies such as battery level and satellites tracked reaching the minimum level for safe operation.

B. Qualification Requirements

- The crew shall be competent for the operations to be conducted. He/ she is required to complete satisfactorily training and assessment relevant to the duties and responsibilities and maintain currency by test flights, training flights and/ or actual SUA operations. The training programme for the crew shall be documented in the operations manual.

- All training records shall be properly kept and updated by the SUA Operator, and shall be made available in a legible format to the CAD upon request.

C. Equipment Requirements

- The following equipment shall be in use for building survey/inspection:
    a) Lightweight SUA (i.e. Category A1 SUA) will be used for sustained flight over uninvolved people, vehicles, vessels or structures;
    b) Appropriate navigation lighting which shall be visible to the remote pilot at all times during the flight and it must be sufficient for the remote pilots to determine the orientation and direction of the SUA visually;
    c) Strobe or anti-collision light system will be used for operations if necessary;
    d) Rotor blade guard to avoid collision while manoeuvring the SUA in close proximity of building or structure;
    e) Obstacle avoidance function to further mitigate the risk of collision;
    f) Geo-fence and altitude limiting functions for SUA to operate within the pre-defined flight volume using Real Time Kinematic (RTK) positioning system;
    g) Appropriate ground station or remote controller software to assist the remote pilot in identifying the SUA's position in real time; and
    h) Anemometer to monitor wind gust.

D. Communications

- The Remote Pilot shall consider adequate means of communication between crew members and any other relevant people when conducting operations, including any procedures that need to be implemented. The Remote Pilot should also consider back up communication methods in case the primary means of communication fails.

- Communication protocols between the Remote Pilot and Supporting Crew to communicate collision avoidance information and corresponding commands.

E. On-site Procedures and Pre-flight Checks

- Before the operation, the Remote Pilot shall conduct comprehensive flight planning (including daylight reconnaissance and site safety assessment) prior to the operation to ensure compliance with all applicable statutory requirements, e.g. obtain permission from the appropriate persons of the building, establish communication protocol with the occupants of the building (if any), carefully choose the flight path to avoid overflying highway, railway or strategic route, appropriately position himself to maintain VLOS with the aircraft, determine the geo-fenced area and altitude limits, and confirm that the operation will be not be within a restricted flying zone, etc. Any hazards, restrictions and obstacles shall be identified, addressed and recorded.

- The remote pilot shall brief the all crew members participating in the operation, especially the Supporting Crew, to ensure they are fully aware of their responsibilities and the operational task.

F. Flight Procedures

- The access to the site(s) of such operations shall be controlled. Clear warning signs, cones and/or safety tape shall be used to indicate SUA operations in progress. Extra crew may be deployed to advise the public of the dangers of entering the operating area for sites with potential public access.

- Any uninvolved person or appropriate persons of the uninvolved vehicles, vessels or structures located within such site(s) must be aware that an SUA may fly over them or their vehicles, vessels or structures. Such overflying time shall be reduced as much as possible. Overflying of highway, railway or strategic route shall be avoided.

- The take-off and landing (including recovery landing) points shall be equipped with adequate lighting to provide clear visual reference, and also allow the Remote Pilot to visually see and avoid hazards and obstacles on the ground to facilitate safe take-off and landing of the SUA.

- At all times during the flight, the following requirements shall be met:

    a) The flying altitude is not higher than 100 ft vertically from the highest fixed point of the subject structure;
    b) The horizontal distances between SUA and the involved building is not more than 30 m; and
    c) The flying speed of the SUA does not exceed 20 km/hr.

- The Supporting Crew shall keep the Remote Pilot updated constantly on an independent monitor on flight parameters of the SUA including battery level and satellites tracked.

- The navigation lighting (usually red lights on forward rotor arms and green lights on rear rotor arms) of the SUA must be visible to the Remote Pilot at all times during the flight for visual determination of SUA orientation and direction.

- If the Remote Pilot fails to visually determine the orientation and direction of the SUA, or the SUA becomes a hazard to any other aircraft, person or property, the Remote Pilot shall immediately respond in accordance with established emergency procedures to ensure the safety of operation. The relevant emergency procedures shall be documented in the operations manual.

G. Emergency Procedures

- The Remote Pilot shall determine suitable responses and fail-safe mechanism for emergency during operation, e.g. loss of command and control link, loss of navigation lighting and loss of GPS signal.

    a) If the aircraft will return to the 'home' position and land automatically, considerations shall be given to possible flight path in accordance with the daylight reconnaissance, site and flight safety assessment conducted prior to the operation, such that, when such function is activated, the aircraft will not collide with obstacles. The altitude for such function shall also be deliberated for obstacle clearance and avoiding collision risk with other aircraft, in any case not above 300 ft AGL.
    b) The Remote Pilot (or with the Supporting Crew's assistance) shall also closely monitor the telemetry data against possible signal interference, and determine suitable response to ensure that the aircraft remains under control and that fail-safe mechanism will not be undermined.

Appendix B – Safety Risk Assessment for Building Survey/ Inspection involving Advanced Small Unmanned Aircraft Operations

The applicant shall identify risks specific to the proposed SUA building survey/ inspection and propose effective risk mitigation measures so that the risks are mitigated to an acceptable level. A template of risk assessment is available in the sample of Operations Manual. The following is an example of safety risk assessment for building survey/ inspection and some anticipated risks to be addressed. Applicant should note that the list is not exhaustive. Any other risks associated with the proposed operation shall be identified and addressed.

Risk No.	Identified Hazard	Associated Risk (What & How)	Existing Mitigation	Current Risk Rating	Further Mitigation	Revised Risk Rating
1.	*Unexpected obstacles protruding from the building which hinders VLOS*	*SUA may collide with the building/ obstacles*	*Supporting Crew is appropriately positioned to monitor the SUA and the surrounding environment from another angle, while communicating closely with the Remote Pilot*	*4C*	*Only SUA with functioning obstacle avoidance feature will be used for operation.*	*1C*
2.	*SUA may fly higher than 100 feet above and farther than 100 feet away from the building*					
3.	*Remote pilot's vision might be impaired by the environment, e.g. glare, reflection*					
4.	*Difficult for the SUA to hold its position due to deteriorated GPS signal*					
5.	*High gust at high altitude*					

– END –