Aviation Safety Plan Template

INSTRUCTIONS

1. The following document provides an example to facilitate the development of a project-specific Aviation Safety Plan (ASP). The ASP is the official, guiding document and must reflect the mission, risks, etc, of the project. As such, it is an internally and externally auditable document. The Project Lead, who may also be the PI and/or RPIC, is responsible for its content and implementation.
2. The document highlights the areas that need to be customized per the project parameters. Areas that are not highlighted are standard language that may be edited freely to reflect the project specifics.
3. All documents referred to in the Attachments section of this document should be uploaded to the attachments section of the WPC Activity.
4. The Description of Work in the WPC Activity should be synced to this ASP; however, the Description of Work in the WPC Activity does not need to be as comprehensive as this ASP and can refer to the attachment for the full version.
5. If minor changes to the ASP are required (e.g., updating equipment, adding/deleting crew names, documentation of a new COA, etc.), they may be made without reauthorization of the Activity. Major changes to the ASP (e.g., scope of work, location, mission, risk, etc.) are required, the WPC Activity must be reviewed and reauthorized. Contact the APOC for guidance.
6. ***This is an example, not a template***. The owner of the document must create content that reflects project specifics. Click on the template link provided above to develop a project-specific ASP. Red font **Note** comments provide additional points that must be addressed by the creator.

LBNL Aviation Safety Plan (ASP) for UAS (Unmanned Aircraft System) Flights

Project: Title and related information

Work Planning & Control Activity: Alphanumeric identifier

Summary

Location: Insert location(s) where flight operations will be conducted. This may involve generalizing, but it is important to provide sufficient specificity (i.e., "various locations involving…", "urban areas in proximity to…", etc.) to describe the basics.

COA: The Blanket Area UAS Class G COA (DOE) in effect as of publication of this example is dated 2019-AHQ-907-COA-REVISED. It is subject to change. Contact the APOC for the current version. **NOTE**: Include the current COA as an attachment to the WPC Activity.

UAS: Drone make/model; drone serial number.

ASP Dates: Date-to-date (time span, not to exceed one year). **NOTE:** The ASP must be revised any time there is a material change in the activity. The Activity must be reviewed annually.

Overview

Project Principal Investigator: PI name, division/organization/ LBNL

Point of Contact for aircraft Activities: Name and LBNL email address

Project: Name of project

Sponsor Program Manager: Name of sponsor

Project goal: Describe project goal

Key instrumentation: Describe the instruments (payload), if applicable.

Aircraft platforms: Describe the UAS(s) to be deployed

Location of planned flights: Describe the locations of flights

Dates of planned flights: Provide a date range, e.g., September 1, 2019 – 30 September 2020

Current status of Certificate of Authorization: The Blanket Area UAS Class G COA (DOE) in effect as of publication of this example Policy is dated 2019-AHQ-907-COA-REVISED. It is subject to change. Contact the APOC for the current version. **NOTE**: Check to ensure you have the most current version.

LBNL Approvals: Approved by DOE Bay Area Site Office (BASO) Aviation Safety Officer (ASO) in coordination with the LBNL Aviation Point of Contact (LBNL APOC). This Activity is addressed as Work Planning and Control Activity XX-0000.

Aviation Safety Plan Outline

1. Introduction
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1. Introduction

NOTE: Provide sufficient detail in this section to inform the reader about the purpose, equipment, detectors, etc. Make sure it reflects your equipment and operating conditions.

NOTE: This is an example of an Aviation Safety Plan. Areas that will need to be project-specific are highlighted throughout.

The project team will deploy a small unmanned aircraft system (UAS) during research activities. A (insert drone make/model number) will be used. The UAS platform will be

equipped with a XXXX used to detect YYYY. The YYYY is detected and used to quantify ZZZZ. Data collected during flights will be used for development and improvement of real-time software and algorithms for data mapping and localization.

1.1 Regulations and Requirements

UAS flights and related activities will be conducted in accordance with DOE Order 440.2C, LBNL Aviation Safety Policy, relevant parts of Title 14 of the Code of Federal Regulations (Federal Aviation Administration, 14 CFR), and all specific regulations of another sovereign airspace authority when the mission is outside of the United States.

Note: This blanket COA is not valid nor can it be used outside the United States. For foreign missions, the local/country rules will apply.

UAS flights will be conducted under the Blanket Area UAS Class G COA (DOE) 2019-AHQ-907-COA. **NOTE:** This is subject to change. Check with the Aviation Point of Contact to ensure the current COA is included.

Flight operations will be conducted exclusively in Class G airspace. Flight operations conducted under this Plan will typically be limited to 400 ft AGL, but the current COA accommodates up to 1200 ft. AGL.

The UAS used in this project is considered an Approved Unmanned Aircraft System per the manufacturer's airworthiness statement. Airworthiness is maintained by Remote Pilot in Command (RPIC) by inspection prior to and after each flight.

The aircraft employed in this project has/have been registered with the FAA.

2. Aircraft Requirements

2.1 Aircraft

Only one UAS will be operated by each operator (e.g. Remote Pilot in Command ("Pilot") or designee under direct supervision of the pilot) at any given time at a given site. UAS deployed for this project is an LBNL-owned (insert drone make/model number). Additional

UAS may be acquired through LBNL and will be subject to the same requirements as included in this Aviation Safety Plan.

The (insert drone make/model number) utilizes the following features (per the manufacturer).

- AES-256 Encryption. Per the manufacturer, The AES-256 encryption keeps data transmission secure.
- Obstacle Avoidance. The drone is equipped with an onboard system employing front, bottom and upper sensors that detect and aids in avoiding obstacles while enabling precision hovering.
- Anti-collision Beacon. The drone is equipped with latest generation top and bottom anti-collision beacons for visibility at night or in lowlight conditions.
    - Note: While paragraph G of the DOE Blanket COA, allows UAS operations to be conducted at night, this project will not involve night or impaired visibility flights.
- DJI AirSense. This drone has a built-in ADS-B receiver, called DJI AirSense. This technology enhances airspace safety by automatically providing the operator with real-time information about nearby airplanes and helicopters.
- Note: There is a recognized potential for data gathered by a DJI drone to be transferred to unauthorized collection points if the drone is connected to the internet for update/file download. Precautions will be taken to prevent unauthorized collection of data.

2.2 Operator

All DOE/LBNL-owned UAS will be operated by trained LBNL UAS pilots who have been certified as FAA Remote Pilots under Part 107 or by personnel under the direct supervision of the FAA-certified RPIC. The RPIC operating or supervising UAS' under this project must hold a FAA Remote Pilot Certificate and be prepared to produce it if requested. In addition, while there is no requirement for medical certification, any certified pilot or observer on this project will self-certify that they are capable of performing the job safely.

All FAA Remote Pilot Certificates are included in Attachment 1. This attachment will be updated as additional operators receive their FAA certificates.

2.3 Airworthiness review and approval

An Airworthiness Certificate (AC) is not required by the FAA for small UAS operating under Part 107. However, it is required by the DOE. The AC(s) for the drone(s) must be kept with the UAS kit. It should also be included in the attachments and is an attachment to the WPC Activity.

> *Note: Except for small unmanned aircraft operating under 14 CFR part 107 or a part 107 waiver, a civil UAS cannot conduct air commerce in the National Airspace System unless there is an appropriate and valid airworthiness certificate issued for that UAS. U.S. registration is a prerequisite for the issuance of an airworthiness certificate.*

2.4 Crew size and composition

The project team/operations crew for all UAS flights comprises a minimum two-person ground crew: a Pilot and Airspace Observer. Neither the Pilot nor the Observer is allowed to serve both functions at the same time. All RPICs and Observers must meet training requirements specified by DOE HQ OAM and the DOE Blanket COA. RPIC qualification will be documented in the UAS Notification to DOE HQ OAM Senior Aviation Manager.

Name	Crew Function
Name (LBNL)	Pilot/Payload Specialist/Airspace Observer
Name (LBNL)	Airspace Observer
Name (LBNL)	Payload Specialist/Airspace Observer

This ASP and the Work Planning and Control Activity (**XX-0000**) will be updated whenever there is a material change in crew status or certification.

3. Equipment Description

3.1 Airframe and Payload

The (make/model number) UAS (shown in Fig. 1) is battery powered and equipped with visual camera (i.e., brand name), which is a high-resolution camera (20.8 Mega Pixels) that can be used in still (capturing static pictures) or video mode. This system has also been paired with a (make/model number) camera, which is a high definition (640 × 512 resolution) thermal camera that has an infrared sensor, which can spot pixel temperature with a relatively good precision. Ground controllers are systems developed by the manufacturer (i.e., make/model number). Per the manufacturer data and the position are encrypted and are not automatically transferred to the manufacturer

Figure 1: (drone make/model number)

NOTE: Include a statement attesting to the fact that data or position information cannot be transmitted by the UAS. This is a DOE requirement.

3.2 Launch

UAS launch standard procedures are as follows:

- Physically inspect UAS to ensure airworthiness
- Select an open area clear of immediate obstacles
- Clear the area of personnel except crew.
- Pilot and Observer scan the area and sky to confirm takeoff conditions are clear. Personnel are kept at least 30 feet from spinning rotors during takeoff/landing.

- Check mounting provision for tightness and security of all components that are removable for transporting to and from the flying site.
- Check the payload to ensure that it is securely mounted onto the UAS.
- Controller is checked and turned on.
- UAS is placed on the ground and powered on.
- Controller displays aircraft telemetry. Pilot confirms battery voltages and signal strength of GPS.
- Pilot and Observer recheck immediate area and sky.
- If clear for takeoff, Pilot announces "Takeoff" and engages UAS motors.
- Pilot brings aircraft into a stable hover approximately 6' off the ground and reconfirms all flight controls, battery voltages, and data-link signal strength.
- Pilot and Observer fly the mission.
- During flight, Pilot and Observer continue to scan the sky and immediate area and note any personnel, aircraft, aircraft obstacles, or weather that could pose a safety hazard. Pilot constantly scans telemetry data from the aircraft monitoring battery voltages, RF signal quality, altitude, and GPS data.
- The UAS will be operated in return-to-home mode, where it returns to a home location in case the connection link with the remote control is lost.
- Flight time will be logged for future activity reporting using the HQ OAM supplemented form (sample attached). Data will be reported monthly to OAM, irrespective of whether flights have been conducted. Data reporting will be coordinated with the LBNL Aviation Safety Point of Contact.

NOTE: a model checklist is included in the Aviation Safety Policy and should be applied here. It is recommended that it be included as an attachment to the ASP if it or a modified version will be used.

3.3 See and Avoid

The Pilot will maintain a visual line-of-sight with the UAS at all times. As per FAA requirements, visual line-of-sight is unaided. The Observer will also constantly maintain line-of-sight with the aircraft and warn the Pilot to avoid any condition that would place the aircraft out of line-of-sight, as well as warn of any aircraft in the region of flight. The Observer will also guide the Pilot in preventing collision.

4. Communications

Ground controllers used for each UAS comply with part 15 of the FCC Rules. The DJI Matrice 210 V2 controller communicates on either a 5.725 to 5.825 GHz or 2.400 to 2.483 GHz frequency.

Maximum transmission distance, free of interference, for the DJI Matrice 210 V2 controller complies with the FCC (5 miles) and CE (3.1 miles) rules.

Communication between the Pilot and Observer consists of direct verbal communication when both are co-located. If it becomes necessary for the Observer to move away from the Pilot, cell phone communication will immediately be initiated to maintain contact. At remote sites, coverage will be confirmed prior to flying. When cell communication is not effective, an equivalent method for communication between pilot and observers will be established (portable radio, satellite phone, etc.).

5. Mission Description

5.1 Pre-Operation Briefings

Operations team briefings will be held before and after flights to ensure that all team members are aware of safety requirements, flight plan and procedures, and general operations.

Prior to flight, the operations team will review the following:

- Weather, including wind conditions
- Altitudes and flight path
- Mission overview, including handoff and recovery procedures
- Frequencies to be used
- Flight time limitations, including battery charge requirements
- Contingency procedures to include lost link, divert, and flight termination
- Any hazards unique to the flight being flown, including issues and/or special provisions related to proximity to the public.

NOTE: a model checklist is included in the Aviation Safety Policy and should be applied here. It is recommended that it be included as an attachment to the ASP if it or a modified version will be used.

5.2 Crew Special Requirements

Crew special requirements include special responsibilities and required safety training or information briefings as follows.

All team members:

- Must have a working knowledge of this Aviation Safety Plan.
- Must understand and comply with the stipulations set forth in the governing Work Planning & Control Activity **(XX-0000)**.
- Formally accept the Work Planning and Control Activity controls profile prior to participating in flight operations.
- Must conform to all LBNL WPC Activity requirements, whether participating in flight operations or data collection.
- Implement hazard controls according to site risks and identified controls.
- Comply with local site rules and regulations.

In addition to general team member requirements:

Pilot in Command:

- Responsible for overseeing all UAS operation and flights, and serves as the authority on takeoff, landing, and flight termination.

Observer(s):

- Responsible for maintaining a direct line-of-sight with the UAS and assisting the Pilot with UAS operations. The Observer role is essential to ensure safe UAS operation and will remain focused on the flight and alert to changing operating conditions. Manned aircraft always have the right of way.

5.3 Debriefing

After the flight, operations team will debrief to review the following:

- Areas that were successful and areas that need improvement for all phases of the operation, including:
  - Planning
  - Preparation
  - Takeoff
  - Mission
  - Landing
- Items to consider for modification or improvement
- Equipment assessment
- Procedures assessment
- Internal and external coordination issues
- Data collection and management

NOTE: a model checklist is included in the Aviation Safety Policy (Appendix H) and should be applied here. It is recommended that a checklist specific to flight operations covered by the ASP be included as an attachment to the ASP.

6. Hazard Risk Assessment

Hazards in this section will be discussed and assessed in accordance with the Risk Analysis Chart. The process for making the Hazard Risk Assessment is included in Appendix B of this document. Each risk will be assigned a Risk Analysis Chart (RAC) code of I through IV based on the likelihood and consequence of an occurrence and the RAC chart (see Table 2).

6.1 Air Traffic

The operations site may vary. FAA Part 107 regulations will be observed with respect to flight operation proximity to controlled air space.

The LBNL Remote Pilot in Command has the responsibility to verify the following:

- Notification of local Air Traffic Control Center, if applicable per Part 107.
- Confirmation that a NOTAM will be issued for the planned operating period (as applicable and depending on location of flight operations).
- Local host coordination has been made, approved, and scheduled, if applicable.
- Defined communications and equipment are operable.
- The observer is properly equipped and briefed on role and responsibilities.
- Established procedures are followed if a local Search and Rescue (SAR) effort is in conflict or there is unplanned air traffic observed.

The closest regional airport at each location will be identified to account for any potential air traffic risk issues. However, mission plans will always ensure that the UAS will remain within Class G airspace, thereby making the risk of UAS and commercial aircraft collision negligible. Flights under this Work Planning and Control Activity won't exceed 400 feet AGL.

If there is any doubt regarding the proximity of flight operations to a regional airport or airfield, the local Air Traffic Control center will be contacted and advised of planned flight operations in advance to ensure compliance with FAA regulations.

Summary - Air Traffic Risk Issues (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

6.2 Aircraft Hazards

The primary hazards posed by the UAS may include collision with a person on the ground, a building, or power lines. Where applicable, the project team will work with the location facilities management/owner/etc. to define the flight zone to mitigate risk to uninvolved personnel at the host location and nearby power lines.

Flights will primarily be conducted in an open field with no ground obstructions. However, several flights may be conducted around a building. When flying around buildings, an adequate and safe standoff distance from the building will be established. Flight plans will

be tailored towards the hazards associated with the open field or research building during pre-flight briefings with the project team and the host location POC.

Where flight operations will take place in close proximity to buildings or other inhabited areas, controls will be established to ensure that contact with the UAS and personnel or buildings will not occur.

Summary - Aircraft Hazards (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

6.3 Ground Obstructions

Primary hazards for ground obstructions may include other people, trees, or buildings. The project team will work with host location Point of Contact (POC) to mitigate ground obstruction risks as stated in 6.2.

Ground Obstruction Risks (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

6.4 Physiology

Team members will wear the proper PPE and will be briefed on the appropriate clothing to wear to mitigate the effects of temperature and weather changes.
Physiology Risks (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

6.5 Mission Profiles

Planning

Initial mission briefing will typically take place at LBNL prior to departure for the operational location.

Setup

Setup will occur at the flight location. No specific safety equipment is required, and all participating team members from LBNL will, as applicable, adhere to host location safety requirements, as well as the requirements specified in the LBNL WPC Activity **(XX-0000)**. This includes ensuring that the flight area has been cleared of non-participating personnel and clearly marking off the flight area to ensure that non-participating personnel conducting business at or in close proximity to the site are aware of ongoing flight activities.

Under no circumstances will flight operations be conducted over any personnel who are not part of the aircraft operation unless those people are in a covered structure strong enough to provide substantial protection from the UAS if it were to hit the structure.

There is no significant physiology risk as assessed above.

Startup

Initial flight preparations will be reviewed in-depth at the operational site again by all flight team members, including the flight plan, hazards, safety requirements, and personnel roles.

Weather conditions will be reassessed prior to and during each flight at the site to determine whether conditions pose a hazard to flight operations.

Takeoff

UAS take-off procedures as outlined in Section 3.2 Launch Procedures will be followed. An additional sweep of the flight area will be conducted shortly prior to takeoff to ensure that the area is clear.

Pilot will verbally alert every one of the launch prior to takeoff, and ensure that the Observer is in position and ready. Under no circumstance will a flight be initiated without cross-check by the Pilot and the Observer.

Initial Climb

The UAS will ascend in Class G airspace to as high as (specify XXX feet) above ground level, and not further than visual line of sight. No specific safety equipment is required.

Cruise

Upon reaching an initial altitude, the UAS will fly following pre-defined pattern (e.g., grid, circular, polygon) around the test building, depending on the building geometry. All activities for a given flight will be included in the flight plan and discussed in the pre-flight briefing with team members.

Summary - Mission Profile Risks (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Isert

6.6 Potential Inflight Hazards

Cruise Hazards

The likelihood of a mid-air collision with piloted aircraft or other UAS is extremely improbable due to the very low flight height < XXX ft and slow flight speed (X ft/s), long distance (more than 5 miles) from the nearest regional airport, and careful coordination with host location officials to ensure no overlap with other researchers in the designed test site. As such, the likelihood of catastrophic consequences, such as building damage, environmental impact, serious injury or fatality, is negligible.

Unplanned Egress from Airspace

An unplanned egress from airspace could result from winds higher than the airspeed blowing the UAS off course. To mitigate any risks, wind and other weather conditions will be assessed on-site during the setup and pre-flight debriefing, and UAS flight plans will be canceled in the event of strong winds. The flight path area will be designed to account for potential winds blowing the UAS off-course by at least 30 feet horizontally to avoid risks involving ground obstructions. The threshold wind speed at which flights will be stopped is 10 m/sec. The flight operations team will constantly monitor changing wind speeds using a digital anemometer. Wind speed is checked prior to initial flight, and flight plans are shifted or canceled dependent upon wind conditions.

Summary - Inflight Hazards (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

Collision with Surface Infrastructure

The risk of collision with surface infrastructures will be assessed based on two types of flight plans: open field and building.

> Open Field: The risk of collision with structures or personnel during test open field flights is low, as all flight operations will be conducted in a large, open field.
>
> Buildings: During measurement flights around buildings, the risk of collision with a structure or personnel is slightly higher than the risk in the test field due to proximity of the flight path to the building (The closest distance will be 13-16 feet). However, as the UAS will remain within the line of sight and flying slowly the entire time, the consequences of collision with the building or personnel will be negligible.

The potential for light damage to UAS craft exists during all flight operations.

Practice flights may be conducted in open fields or in proximity to buildings. Practice flights will be treated the same as operational research flights in all respects, as outlined in the

sections above. The proximity of the UAS to personnel, buildings, and other structures will always be given prime consideration before initiating flight operations.

Summary - Risk of Collision with a Structure in Test Field (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

Summary - Risk of Collision with a Structure during Research Flights (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

Landing

An open area by the test site will be designated for takeoff and landing. Prior to landing, the Pilot will communicate intent to land to the Observer, who will ensure that the landing area and flight path are clear for landing. The Pilot and Observer will also communicate to any participating personnel of the intent to land the UAS and clear the area. The Pilot and Observer will confirm approach and flight path and scan the area again to ensure it is clear. The Pilot will clearly announce "landing," and reduce the aircraft altitude and speed for landing. The UAS will transition from flight to hover over the target landing spot and land. Motors and transmitters will be turned off, and batteries will be removed.

Summary - Landing Risks (per Attachment 4, Table 1 and 2):

Likelihood: Insert
Consequence: Insert
RAC: Insert

7. Emergency Reporting and Contacts

In the event of an emergency requiring FAA notification, such as a collision with a building or personnel, LBNL personnel will immediately communicate the situation to the designated on-site LBNL representative (i.e., the Pilot in Command) and to the on-site location host POC, as applicable. The LBNL representative will serve as a point of contact with the local host location's representative and the LBNL Aviation Point of Contact (who will notify the BASO Aviation Safety Officer, as warranted) to communicate detailed information about the incident. While highly unlikely, any potential impact of an emergency on civil air operations will be communicated to the local Air Traffic Control center as soon as possible, but no later than 6 hours following the event.

Per Section (your section), any injury, damage to property, impact on environment, or damage to the UAS must be reported to the Aviation Point of Contact by email as soon as possible.

Under no circumstances will a RPIC or Airspace Observer attempt to catch a UAS as it descends. This introduces the potential for a serious injury. Neither the value of the UAS nor that of its payload are a consideration.

This project may, in part or for the duration of its authorization, be subject to COVID-19 exposure controls. All work will be conducted in accordance with Chapter 46 of the LBNL Health and Safety Manual. In the event pandemic and/or operating conditions change, the project will comply with any restrictions arising from those changes, including but not limited to travel restrictions, quarantine requirements, and personal protection. All personnel will confirm health status via the LBNL COVID-19 Symptom Check on a weekly basis. It is the responsibility of the PI and RPIC(s) to ensure all crew members understand these requirements and comply accordingly. In the event host or local exposure prevention requirements are more rigorous than those of LBNL, then the host or local exposure prevention requirements will be followed.

The (drone make/model number) is also equipped with an emergency failsafe function to mitigate any risks associated with loss of signal between the transmitter and UAS. The Return to Home function is illustrated below, and the Record Home Point function will be included as part of pre-flight preparations before each flight involving the UAS make/model).

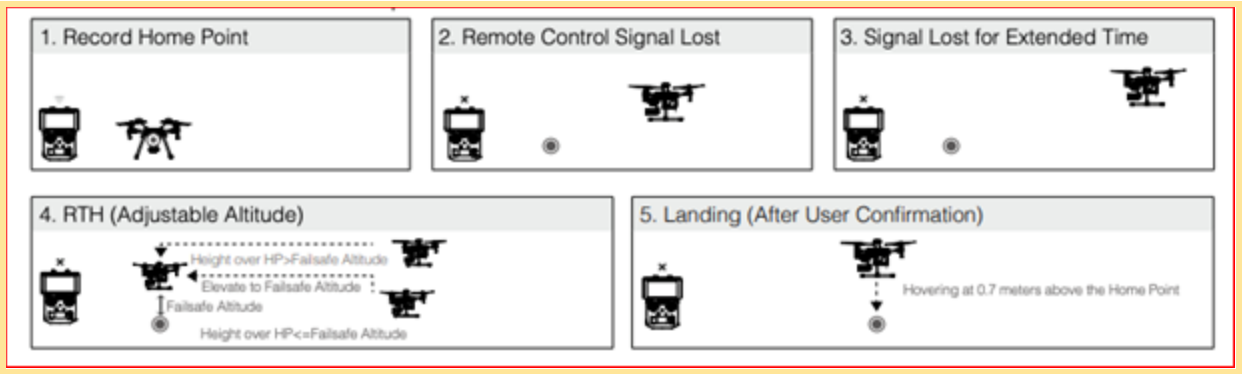

Figure 2: (insert drone make/model) Failsafe Return to Home Illustration

8. Responsibilities

(Insert name) will be responsible for coordinating Work Planning & Control Activity changes – including changes to the Aviation Safety Plan and related documents – with the LBNL Aviation Point of Contact.

As applicable, the PI will coordinate with local officials to ensure all safety procedures and flight operation information have been communicated to participating personnel. LBNL and DOE requirements will always be observed. In the event that research operations are conducted outside the United States, local in country UAS requirements will also be followed.

The LBNL Pilot in Command at any time during the project will be responsible for piloting the UAS following FAA regulations, obtaining weather reports, and conducting briefings. The flight crew (pilot(s) and observer(s)) must read and follow any additional site-specific documents, the approved version of this safety plan, and other field safety requirements for the host location and the LBNL WPC Activity.

9. Qualitative Risk Assessment

Given the experience and training of LBNL UAS pilots, the short flight times, the low flight speed, low flight height, and the restricted nature of host locations (as applicable, the overall probability of an incident is rated as "XXXXX". Given the established controls for operating near buildings, the lack of air traffic, and the distance from the nearest regional

airport (more than 5 miles), as well as the low cost and frangible nature of the UAS, the severity of an incident is rated as "XXXX." Each individual risk has been assessed utilizing the risk assessment model in Table 1 and 2, and each area has been determined to be a RAC X or Y. This overall mission is therefore conservatively rated: RAC XXX - XXX Risk.

10.Approvals

I certify all information contained in this document is correct to the best of my knowledge and that it has been uploaded to the WPC Activity.

Date: XX/XX/XXXX (you may insert a copy of your signature)

_____

Signature of LBNL Requesting Authority/PI

Name: XXXX
Division: XXXX
Subdivision: XXXX
Lawrence Berkeley National
Berkeley, CA 94720
Phone number: XXX-XXXX

Aviation Safety Plan -- Attachments

Attachment 1. FAA Remote Pilot's License Certificates

Insert name(s) and certificate(s) here. Also attach to the WPC Activity.

Attachment 2. Certificate of Registration

Insert photo of certificate here. Also attach to the WPC Activity.

Attachment 3. Unmanned Aircraft Systems Risk Analysis Metrics

Risk analysis considers the severity of a mishap and the likelihood that an incident will occur. The combination of severity and likelihood results in a "Risk Analysis Code" (RAC). The RAC helps identify the risk of flight operations and the required safety oversight, and ensures that missions are reviewed and approved at management levels appropriate to mission risks. In developing the risk scenarios consider the following:

1. What is the UAS required to do?
2. What is the environment in which the UAS and ground support component is working?
3. What are the hazards in the entire system, and how could they impact the flight and mission?

It is helpful in risk analysis to develop risk statements in the "If/Then" format: If (this failure, mishap, or event occurs), Then (this worst case consequence that could occur). For example, "If GPS signal/navigation is lost during flight, then the UAS may crash into an existing infrastructure. A risk statement leads to estimating the likelihood that the risk will occur and identifying the control that prevents the risk from occurring or the mitigation that eliminates or reduces the consequence. Engineered controls are preferable to administrative controls (e.g., procedures, training). For the example cited, a control that would eliminate the consequence would be a lost link application in the UAS on-board controller that caused the UAS to fly in a loiter pattern at its last position until the GPS signal/navigation is restored or until manual control over the UAS is established.

Mishap Severity

Mishap severity is an assessment of the consequences of the most credible mishap that could be caused by a specific hazard. Mishap severity is a categorization that provides a qualitative measure of the most credible mishap resulting from flight crew error, environmental conditions, design inadequacies, procedural deficiencies, or UAS or component failure or malfunction. Rationale for the selection of hazards and the associated most credible mishap should be documented in the risk analysis section of the ASP. Definitions for mishap severity appear in Table 1 below.

Mishap Likelihood

Mishap likelihood is the assessment of the frequency that a mishap will occur during the planned duration of the UAS mission. Likelihood can be derived from historical data, or, for new UAS missions (e.g., a new UAS, ground station, instrument payload), from extrapolation of similar operations. Rationale for assigning mishap likelihood should be documented in the risk analysis in Section 9 of this Aviation Safety Plan. Definitions for mishap likelihood appear in Table 1 below.

Table 1: Severity of Consequences and Likelihood of Occurrence - Definitions

Severity of Consequences			**Likelihood of Occurrence**		
Severity Level	Definition	Value	Likelihood Level	Definition	Value
Catastrophic	Equipment destroyed, multiple deaths.	5	Frequent	Likely to occur many times	5
Hazardous	Large reduction in safety margins, physical distress, or a workload such that crewmembers cannot be relied upon to perform their tasks accurately or completely. Serious injury or death. Major equipment damage.	4	Occasional	Likely to occur sometimes	4
Major	Significant reduction in safety margins, reduction in the ability of crewmembers to cope with adverse operating conditions as a result of an increase in workload, or as result of conditions impairing their efficiency. Serious incident. Injury to persons.	3	Remote	Unlikely, but possible to occur	3
Minor	Nuisance. Operating limitations. Use of emergency procedures. Minor incident.	2	Improbable	Very unlikely to occur	2
Negligible	Little consequence.	1	Extremely Improbable	Almost inconceivable that the event will occur	1

Table 2: Risk Analysis Chart

Risk Likelihood		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Unacceptable (Red). Where combinations of severity and likelihood cause risk to fall into the red area, the risk would be assessed as unacceptable and further work would be required to design an intervention to eliminate that associated hazard or to control the factors that lead to higher risk likelihood or severity.

Acceptable (Green). Where the assessed risk falls into the green area, it may be accepted without further action. The objective in risk management should always be to reduce risk to as low as practicable regardless of whether or not the assessment shows that it can be accepted as is.

Acceptable with Mitigation (Yellow). Where the risk assessment falls into the yellow area, the risk may be accepted under defined conditions of mitigation. An example of this situation would be an assessment of the impact of an sUAS operation near a school yard. Scheduling the operation to take place when school is not in session could be one mitigation to prevent undue risk to the children that study and play there. Another mitigation could be restricting people from the area of operations by placing cones or security personnel to prevent unauthorized access during the sUAS flight operation.

(also attach the risk analysis metrics to the WPC Activity)

Attachment 4. Current Certificate of Waiver or Authorization (COA)

(also attach the CURRENT COA to the WPC Activity)

Attachment 5. Current Airworthiness Declaration

(also attach to the WPC Activity)

6. Notification to HQ OAM Senior Aviation Manager (Form 19)

(also attach to the WPC Activity)