



## Developing a Pre-flight Safety Plan for UAV/UAS Operations for Cornell Cooperative Extension

### Background

Use of unmanned aerial vehicles (UAV, a.k.a. drones) or unmanned aerial systems (UAS; refers to UAV with a payload such as cameras) is increasing in research and Extension applications, such as monitoring of crops, soil status, and forest extent and composition. There are advantages to the use of UAS for these purposes, and operation of UAVs can be very attractive in and of itself. People flying recreational UAVs or model airplanes transition easily into flying UAVs for academic and commercial applications, but may not have a clear understanding of the physical and legal risks associated with the activity. It is important to recognize the purpose of rules and regulations regarding operation of UAVs.



Figure 1: DJI Matrice 100 quadcopter on launch pad

The Federal Aviation Agency (FAA) has been developing and modifying rules and regulations for UAV and model airplane flight for several years, attempting to integrate these vehicles into US airspace safely. These rules and regulations can be found at:

[https://www.faa.gov/uas/resources/uas\\_regulations\\_policy/](https://www.faa.gov/uas/resources/uas_regulations_policy/)

Ground school classes for UAV operations will address safety and risk issues for flight in general, and are required for UAV pilot certification. See:

[https://www.faa.gov/uas/resources/uas\\_regulations\\_policy/](https://www.faa.gov/uas/resources/uas_regulations_policy/)

for more information on flying under the Small Unmanned Aerial System Rule.

The FAA has a training and notification service specifically for UAS operators. The website is <https://www.faasafety.gov/> and the figure below is an example of a safety notice. Other notices announce webinars or point to materials and courses that will help the pilot address safety issues and decrease risk.

#### FAA Safety Team | Safer Skies Through Education

##### VIP Movement Notification - Fort Drum, NY

Notice Number: NOTC7955

August 13, 2018

Fort Drum, NY

10NMR/30NMR - 17,999 MSL

Specific instructions and restrictions are available at <http://tfr.faa.gov> once the NOTAM has been issued.

\*Depicted TFR data may not be a complete listing. Pilots should not use the information on this website for flight planning purposes. For the latest information, call your local Flight Service Station at 1-800-WX-BRIEF.

*This notice is being sent to you because you selected "Selected ATC Notices" in your preferences on FAA Safety.gov. If you wish to adjust your selections, log into <https://www.faasafety.gov/Users/pub/preferences.aspx> where you can update your preferences.*

*Invite a fellow pilot to the next WINGS Safety Seminar in your area.*

Each vehicle or platform has its own recommendations and guidance for safe operation of the equipment, including weight restrictions, battery limitations, and take-off and landing procedures. Vendors generally provide information on safe operations of their equipment, and FAA regulations provide flight-planning guidance.

This document provides some guidance for developing a risk management plan for a particular flight with a UAS. *It does not substitute for pilot certification, adherence to FAA rules and regulations, or knowledge of individual platform capacities and limitations.*

The purpose of the flight also is beyond this document. However, preparation should include defining the problem or question, choosing the most effective sensor and platform package (UAS) to support the work, data collection, and a plan for securing the data before leaving the field site.

Figure 2: A timely notice from FAASafety.gov, a service specifically addressing UAS skills and activity.

## Pre-flight Planning

Each flight in each location should have a pre-flight plan fully developed and conveyed to all relevant parties before the first flight, in order to reduce and manage risk and improve efficiency.

Development of a pre-flight plan will require at least one site visit prior to flying, and discussions with all involved parties, including the landowner and others who may be working at the site at the same time as the flight occurs.



Figure 3: Panoramic view of some of hazards at field site.

### Cornell Risk Management and Insurance:

In the case of Cornell University and Cornell Cooperative Extension (CCE), Cornell Risk or the relevant insurance providers should review the project and planned flight(s). P.W. Woods and CCE Administration should be consulted about any CCE-sponsored flights. Certificates of insurance may be required of outside contractors, such as pilots.

Please see <https://www.risk.cornell.edu/forms-documents/risk-guidance/drones-guidelines/> for Cornell University policies. The site states:

“Risk Management and Insurance must approve all UAV operations at the University and for University-related business purposes. Please complete the [UAV Flight Request Form](#) and submit it to [Risk\\_mgmt@cornell.edu](mailto:Risk_mgmt@cornell.edu). Please also complete an [Event Registration Form](#) prior to the operation. We will respond to your request and provide guidance as soon as possible.”

### Elements of a Pre-flight Plan:

Sources for the following information, such as the aeronautical sectional chart, are discussed later in this document. A pre-flight plan should include:

- Site map
- Identification of ownership, including formal permission to conduct flight(s), and contact information
- Identification of all participants, including pilot, observers, and other field staff; and contact information
- Location of closest assistance in case of emergency
- Plans for emergency response
- Location of site within greater landscape, including:
  - Confirmation (in the form of a map) that controlled airspaces are outside of a 5-mile radius of the site
  - Characteristics of site, such as size, topography, land use, and access
- Identification of potential obstacles or hazards in the vicinity of the site, such as power lines, trees, nesting towers, silos, and other buildings



Figure 4: Person at bottom of pole gives sense of height of potential obstacle.



Figure 5: Potential obstacle can also act as a ground control point. This osprey nest tower that is just off planned flight lines was located with GPS.

- Notification procedures (landowner, other relevant entities, and participants in the flight) for flight times, cancellations, accidents, etc.
- Inventory of safety devices, such as hard hats, safety vests, and communication devices
- General flight plan

### Steps:

- 1) Get permission from landowner to fly
  - a. This includes publically-owned land
  - b. Landowner should be given an idea of the number of site visits and flights
  - c. Project manager should discuss with the landowner how intrusive the project might be, including any ground control or instrumentation left in place and access to site
  - d. Landowner should be notified prior to every site visit

A slide titled "Pre-Flight Package" from VG (Unmanned Experts). The slide lists the contents of a pre-flight survey and flight plan. The logo for VG and Unmanned Experts is in the top right corner. The text "PRE-SITE SURVEYS" and "PROPRIETARY" is at the bottom left, and a page number "2" is at the bottom right.

- Field site
- Sectional Chart
- Local Area, Topography and Site Hazards
- Area Notes, Contact, Comms
- Safe Operations Assessment Form & Emergency Procedures
- CU Flight Plan
- Pilot Quals and Aircraft Information

Figure 6: Contents of a Pre-flight Survey & Flight Plan, 24 July, 2017

- 2) Create a team list, including pilot, observers, others who may have roles such as collecting ground data and samples
  - a. Be sure to have contact and emergency information for each team member

POC	Position/Title	Cell	e-mail
Ed Freston FRE	CU Field Supervisor	333-390-9893	efreston@unmannedexperts.com
Debi Greenbaum GRA	CU PI	807-962-2328	debi@unmanned.edu
Tom Beach BAU	RIT RPIC	260-238-2863	tom@rit.edu
Nora Raqueno RAQ	RIT VO	260-275-7576	nora@rit.edu
Paul Trachnowski	CU Farm Supervisor	212-221-1212	ptrach@unmanned.edu
Yannick L'Ecuyer	VG Principal	212-221-1889	yl@unmanned.com

- Two teams will be active, the CU team of FRE & GRA, taking soil and spectral samples, and the RIT flying team of BAU & RAQ
- Walkie-talkies will be available for inter-team communications, with cell phones for backup and external comms.
  - 3G cell reception seems to be good. 4G isn't
  - Walkie-talkie channel 1 will be used

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Figure 7: List of team members, roles, and contact information.

- 3) Get map(s) of the project area
  - a. Identify project site on maps
  - b. Identify controlled airspaces and distance from project site
    - i. Flying a UAV within 5-mile radius of a controlled airspace requires additional procedures

Aeronautical sectional charts will identify airports and controlled airspace. See: [https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/productcatalog/vfrcharts/sectional/](https://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/vfrcharts/sectional/) to download charts. The FAA provides a guide to reading sectional charts at: [https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/digital\\_products/aero\\_guide/media/editions/cug-complete.pdf](https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/aero_guide/media/editions/cug-complete.pdf).

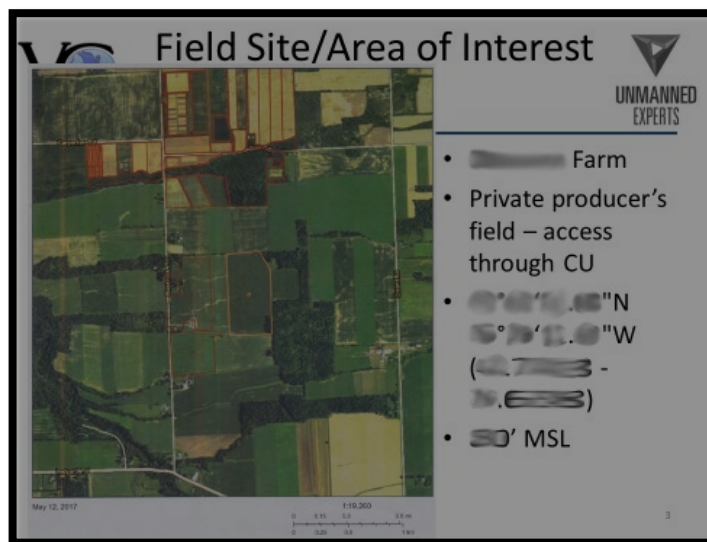


Figure 8: Land use of field site and surrounding area, with latitude/longitude and elevation information, obtained from Google Earth.

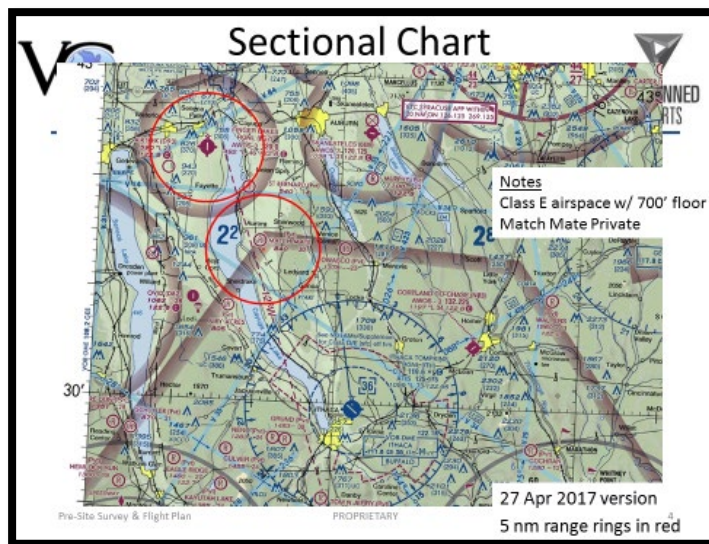


Figure 9: Aeronautical sectional chart obtained from the FAA.

- 4) Visit the site
  - a. Determine access to the site, including to a launch site
  - b. Look for potential obstacles and hazards, not limited to power lines, communications towers, nesting towers, silos, farm buildings, and trees/woods
  - c. Look for potential other activity: to the extent possible, plan on avoiding flying over farm activities, recreational activities, roads, homes and businesses, and other features and activities that are not part of the project
  - d. Look for potential hazards and observation vantage points
  - e. Locate a launch site

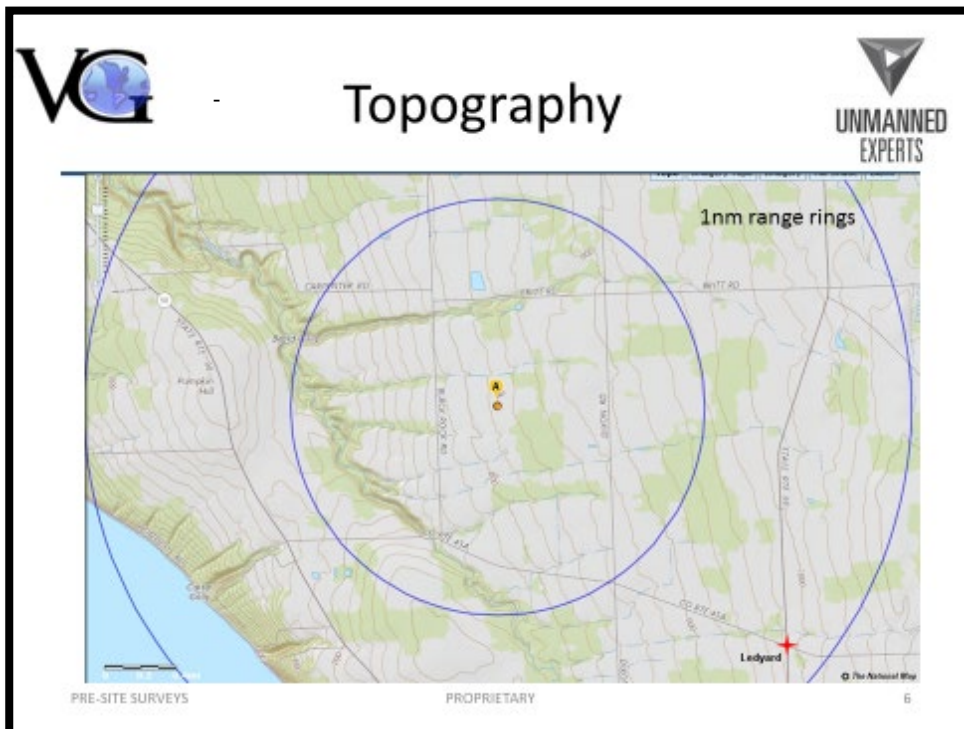


Figure 10: Topographic map (7.5 minute quadrangle) obtained from the US Geological Survey (<https://www.usgs.gov/products/maps/topo-maps>). Map scale is 1:24000 (1 inch on map equals 24,000 inches or 2,000 feet on the ground). Distance from field site is delineated in one nautical mile increments.

Figure 11: Color-coded assessment of hazards in the proposed flying area. Red would indicate that a flight should not be undertaken in that area.

	Status	Comments
Airspace	Yellow	Class E from 700' AGL
ATC	Green	ITH 119.6, Manager [unclear]
Terrain	Green	Sloping 3% grade
Hazards	Yellow	Mud, powerlines, private airport
Restrictions	Grey	Unknown
Sensitivities	Grey	Unknown
RF Issues	Yellow	Power lines
People	Green	Residences and farm buildings nearby; possibly other research activities
Livestock	Grey	Unknown
Rights of Way	Green	Private landowner, access through CU POC at Cornell Musgrave Farm, at the farm office. See slide
Cordons	Grey	Unknown
Permissions	Green	Coordinated through CU,
Mitigation	Green	Onsite visit scheduled to set up ground control prior to flying

Color key	Status
Red	No-go
Yellow	Caution
Green	Go
Grey	Unknown

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5) Notification procedures:

- a. Develop contact lists and procedures for notifying all relevant participants of flight times, cancellations and other changes in plans, and accidents
- b. Include nearest first aid facility, beyond first aid equipment in the field
- c. Provide all the notification procedures and information to all concerned parties
- d. Weather should be considered before every flight

**Emergency Procedures**

- Call 911
  - Address for Wayne Stroman home/shop: 1878 Blackhawk Road, Ithaca, NY
- RIT has a first aid kit – administer as appropriate
- Meet responders at the shop to direct them to the scene or transport person-in-need if safe
- Notify Paul, CU Farm Supervisor

Map showing SW Corner of the Cornfield and shop location.

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Figure 12: Site level resources for emergencies.

- 6) Inventory safety procedures and devices
  - a. Equipment should include head, eye, hand, and foot protection and first aid kit
  - b. Visual aids such as safety vests and launch pad/canvas
  - c. Procedures should include communication (radios, for example) in the field, at the site, and verbal signaling of launch and other events during the flight
- 7) General flight plan
  - a. Establish ground control points
  - b. Establish location(s) for reference panels, if collecting spectral data for analysis
  - c. While details of headings and other flight changes due to local conditions may be made just prior to launch, at least the general flight plan should be included in a pre-flight plan
  - d. Include extent of flight, general pattern, and altitude of flight

### **Post Flight**

Post flight debriefing can improve future flights, either over the same field site or over other sites. If safety devices and materials have been used, an inventory will help prepare for the next flight.

In conclusion, pre-flight safety planning can help reduce risk and prepare for emergencies. The information collected for a pre-flight safety plan is valuable for project planning in general, as well. Producing a plan will always be time well-spent.

## Pre-flight Planning Checklist

- Prepare a site map
  - Resources: Google Earth and <https://www.usgs.gov/products/maps/topo-maps>
- Identification of ownership, including formal permission to conduct flight(s), and contact information
- Identification of all participants, including pilot, observers, and other field staff; and contact information
- Location of closest assistance in case of emergency
- Plans for emergency response
- Location of site within greater landscape, including:
  - Confirmation (in the form of a map) that controlled airspaces are outside of a 5-mile radius of the site
    - Resource:  
[https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/productcatalog/vfrcharts/sectional/](https://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/vfrcharts/sectional/)
  - Characteristics of site, such as size, topography, land use, and access
- Identification of potential obstacles or hazards in the vicinity of the site, such as power lines, trees, nesting towers, silos, and other buildings

### INFORMATION RESOURCES

**Cornell University resources for Cornell Cooperative Extension:** <https://www.risk.cornell.edu/forms-documents/risk-guidance/drones-guidelines/>

**FAA resources for UAS operators:** [https://www.faa.gov/uas/resources/uas\\_regulations\\_policy/](https://www.faa.gov/uas/resources/uas_regulations_policy/) and <https://www.faasafety.gov/>

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