

# **NORTH DAKOTA STATE UNIVERSITY**

## **Procedure for Unmanned Aircraft Flight Operations under FAA COAs**

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**9/29/2016**

**Version 3.0**

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## 1. Scope

This document provides information for NDSU faculty, staff, and students who wish to use unmanned aircraft systems for research purposes under Public Aircraft Operation COAs. A separate document is available to describe the procedures for UAS flights that can be conducted under the FAA's Small UAS Rule (14 CFR Part 107). Typically, COAs will still be necessary if utilizing a larger aircraft (> 55 lb), flying at altitudes higher than 400' AGL, or if some other requirement in Part 107 cannot be met for the research project.

## 2. Background Information

### 2.1 General Information

Unmanned aircraft may be operated (flown) outdoors under one of three categories; public, civil, and model aircraft. Additional information about these categories can be found at the following web link: <http://www.faa.gov/uas/>

**Public Operations (Governmental):** This is the category of operation by which universities and government agencies have historically conducted UAS research flight operations. A certificate of authorization (COA) must be issued by the FAA for such operations. New regulations, however, have provided a means to conduct research flights with a small UAS under a Civil Flight Operation.

**Civil Operations (Non-Governmental):** Any operation that does not meet the statutory criteria for a public aircraft operation is considered a civil aircraft operation. The FAA initially established an exemption process (referred to as a Section 333 exemption) that allowed commercial operations in low-risk, controlled environments. On August 29, 2016, the Part 107 Small UAS Rule went into effect providing a legal basis to operate under a set of qualifying conditions.

**Model Aircraft Operations:** Model aircraft operations can be conducted for hobby or recreational purposes only. In many cases the model aircraft might be physically the same or similar to those flown under Public or Civil Operations, but it is the intended use that determines the type of operation. UAS flight operations conducted for research purposes by an NDSU employee or student could not be conducted under hobbyist model aircraft rules.

**Operations Not Involving Outdoor Flights:** The use of unmanned aircraft for research activities not involving outdoor flights is not regulated by the FAA and the procedures described in this document. One example would be flying an aircraft indoors. Another example would be a non-flight research project in which the research would be conducted in the lab and is focused on the airframe components or a sensor payload. Careful consideration must still be given in either of these cases for safety, risks, and insurance aspects. The university will be developing procedures for these types of activities as well in the near future. This information will be added to the document when available.

### 2.2 UAS Public Operations at NDSU

Unmanned aircraft operations at NDSU are being conducted through the Northern Plains UAS Test Site (NP UAS TS), herein referred to as the "Test Site". The Test Site is one of six FAA designated test sites in the country. It was established under the Northern Plains Unmanned Systems Authority chaired by

North Dakota's Lt. Governor. The Test Site is a state entity reporting to this Authority and is administered through the ND Department of Commerce.

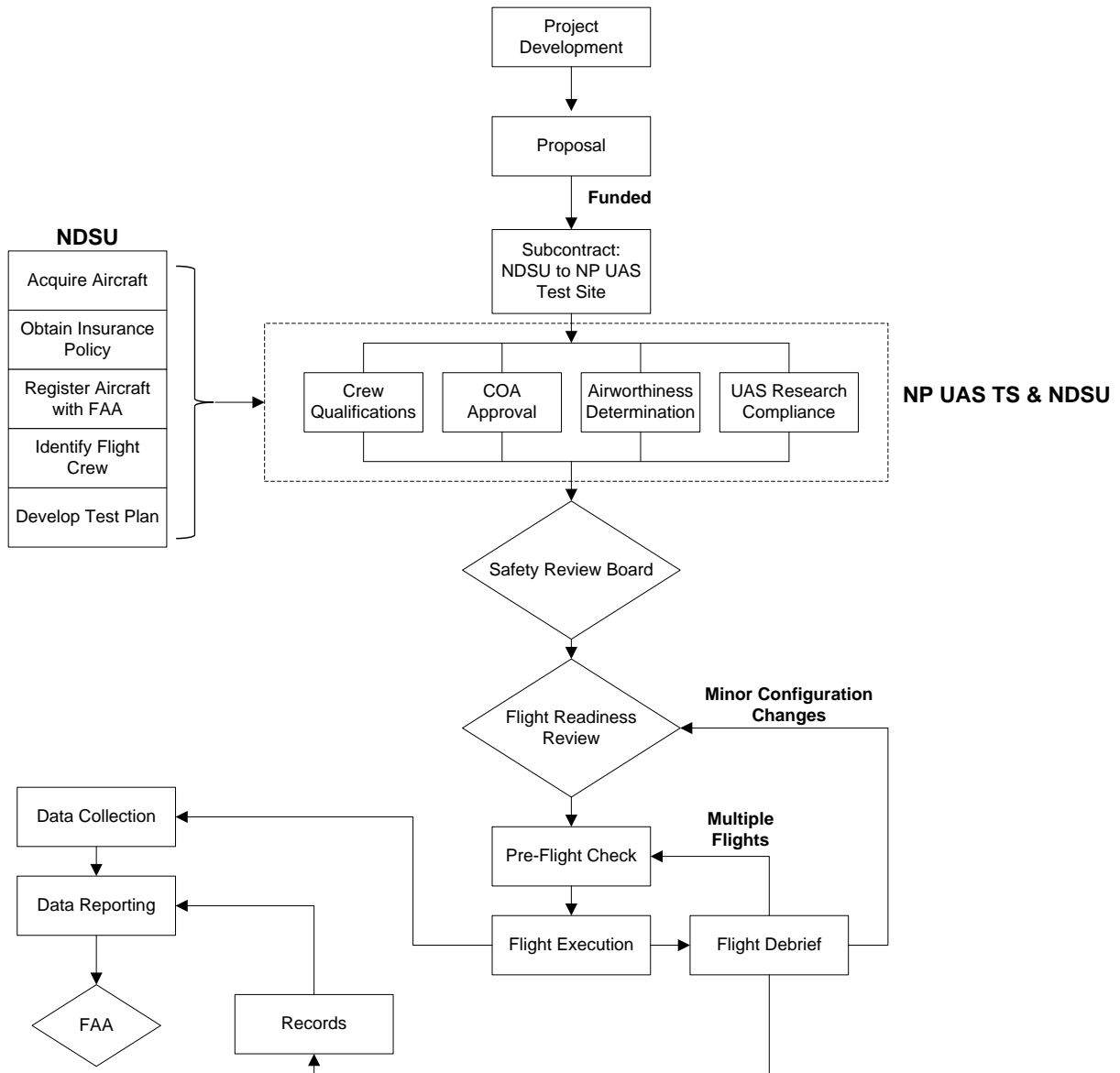
The Test Site staff members are physically located at UND's School of Aerospace Sciences. One staff member has been assigned to be a primary contact for NDSU activity and maintains a part-time presence at NDSU in the Research 2 building.

Conducting flight operations through the Test Site allows NDSU to leverage their expertise in COA applications, airworthiness determinations, flight operations, and other aspects. This provides significant benefits in time and costs. The Test Site has existing COAs that can likely cover most proposed NDSU research flights without having to obtain a new COA. Also, being one of 6 FAA designated test sites, the NP UAS TS is able to conduct operations that would not likely be approved if NDSU or another public entity was to apply for its own COAs. As one example, the Test Site has a COA that allows flights up to 1200 feet AGL (above ground level) across the entire state of North Dakota, whereas most COAs are limited to 200 or 400 feet AGL. Also, the Test Site is able to conduct flights at night and is able to gain approval to fly larger aircraft in the airspace.

### **3. Process for Unmanned Aircraft Flight Operations**

Figure 3-1 outlines the various process steps to prepare for and conduct unmanned aircraft flight operations. General information is provided in this document for overall understanding and awareness. Many of the details of this process will be very specific to the research project. The Test Site team has expertise that will help to navigate this process as efficiently as possible. They have developed many forms, checklists, and other tools to facilitate this effort.

This process flow assumes that NDSU personnel will operate the aircraft for the research project. An alternative approach is to have the Test Site provide the flight crew personnel for the research flight operations.



**Figure 3-1: Process Summary for Unmanned Aircraft Operations**

### 3.1 Project Development

Researchers should engage in discussion with the Test Site team when developing proposals that will utilize UAS. They can help develop a scope of work and budget to integrate UAS operations into a research project. The Test Site does not have funding that allows them to work directly on university research projects and therefore some funding must be budgeted for their involvement on the project. If the project involves a private sector partner and there is some element of North Dakota economic development outcome, there may be funding sources that can be applied for the costs of Test Site personnel.

Initial points of contact can be as follows:

Aaron Reinholz, NDSU Office of Research and Creative Activity  
 Research 2 Office 102E; [aaron.reinholz@ndsu.edu](mailto:aaron.reinholz@ndsu.edu) Ph. (701) 231-5338

Jakee Stoltz, NP UAS TS staff, assigned to work with NDSU  
Research 2 Office 102B; [jstoltz@aero.und.edu](mailto:jstoltz@aero.und.edu) Ph. (701) 290-5459

### **3.2 Subcontract to the Northern Plains UAS Test Site**

The NP UAS TS is the “public entity” that holds the Certificate of Authorizations required for unmanned aircraft flight operations. A subcontract must be executed between NDSU and the NP UAS TS for their support for NDSU research projects. This subcontract is coordinated through the NDSU Sponsored Programs Administration office.

### **3.3 Purchasing an Aircraft**

Before purchasing an aircraft, it is advisable to be aware of all the requirements and costs that are required to operate an unmanned aircraft. These should be factored into the research project budgets and timeline.

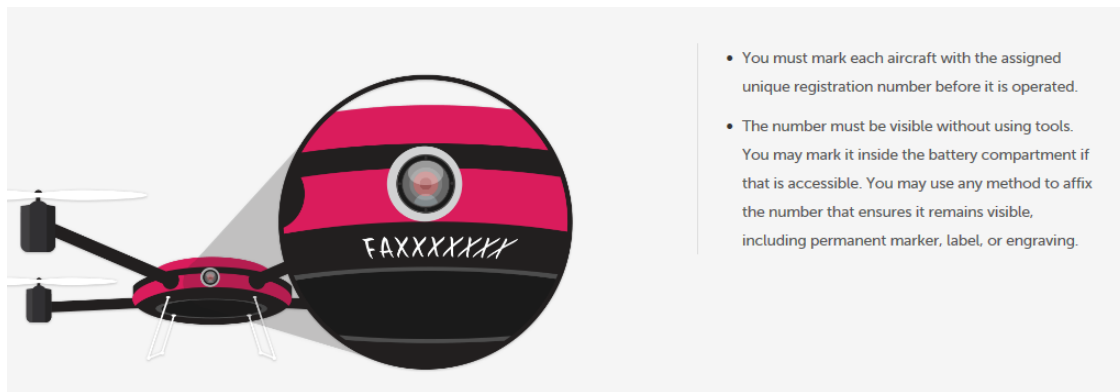
### **3.4 Aircraft Insurance**

Liability insurance must be carried for the aircraft upon purchase. The university has secured a blanket liability insurance policy under which aircraft can be added as they are acquired. The current policy costs \$425 per aircraft for 6 months of coverage. Contact Aaron Reinholz to add an aircraft to the policy. Up to this point, the research PIs have been responsible for obtaining insurance. As an example, aircraft that have been utilized by the Department of Agriculture and Biosystems Engineering have an insurance policy for \$1,000,000 liability coverage. The policy premium for one year is \$2,000 per aircraft.

With respect to damage to the aircraft from either flight activities or non-flight events, the State Fire and Tornado fund does not cover unmanned aircraft. Coverage for aircraft hull damage or loss would need to be procured separately by the researcher if desired. For many of the smaller, less expensive unmanned aircraft, researchers may choose not to obtain such coverage.

### **3.5 Aircraft Registration**

The FAA requires that each aircraft be registered and that the registration number be marked on the aircraft. This is commonly called the “N-Number” or “tail number”. The FAA has implemented a greatly simplified process to register unmanned aircraft online. This process takes only a few minutes compared to the 2-3 week (or more) paper process that was previously used. With this new process a number will be provided immediately when the registration is completed online. Please contact Aaron Reinholz if you have a new aircraft to register. The make, model, and serial number information are all that is required. After the number is obtained the aircraft must be marked. Figure 4.5-1 describes the FAA instructions for marking the unmanned aircraft.



**Figure 4.5-1: Marking Instructions for Registration Number**

### 3.6 Test Plan

Test plans are developed using an Integrated Test Team comprised of personnel from the Test Site (RDT&E, Operations, Safety) and members of the research team. Test plans start with the identification of research objectives to be accomplished with the UAS. It also includes aspects to ensure proper processes are followed, hazards are mitigated, data collection requirements are identified, flight profiles are developed to gather the required data, and other related considerations.

The test plan is then used to develop Test Cards for each individual flight. The Test Card details the flight step-by-step to ensure the Mission Commander and Flight Crew are operating the UAS correctly in order to gather the required data and meet all requirements of the research objectives.

### 3.7 Flight Crew

The flight crew consists of a pilot in command (PIC) and a visual observer (VO). Depending on the make/model of aircraft, additional flight crew may be required such as a sensor operator (SO) or external pilot (EP). For most anticipated NDSU research flight operations with a small UAS, it is likely that only a PIC and VO would be required.

The PIC is responsibility for the aircraft operation and ensuring safety of flight. The role of the visual observer is to scan the airspace for other aircraft that pose a potential conflict. The VO must work cooperatively with the PIC to ensure the aircraft is operated within visual line-of-sight at all times.

As an FAA designated test site, flight operations under the Test Site also require a Mission Commander (MC). The role of the MC is to provide oversight, ensuring all FAA regulations, Test Site Standard Operating Procedures, ISRB outcomes, and COA requirements are safely complied with. The MC is required for all flight operations and will be the liaison between the Test Site and flight crew. The MC is the final authority for daily operational approval and can suspend flight operations at any time. For initial flights the mission commander must be onsite, but once proficiency is demonstrated by the flight crew the mission commander function can be performed remotely if the flight operation is deemed to be non-complex in nature.

### 3.8 Crew Qualifications

The crew qualifications vary depending on the COA. Unfortunately, it can be quite confusing, and the subtle differences often do not make logical sense. This is the result of the evolution of the FAA’s requirements over time from one COA approval to the next. Eventually the requirements will be more uniform when the small UAS rule is finalized and published.

**Pilot in Command (PIC):**

North Dakota Statewide COA:

- Pilot Certificate Requirement

Operations without a pilot certificate (all must be met)	Medical Certificate
PIC must complete FAA private pilot ground instruction and pass the written examination - Valid for 24 calendar months	FAA Class II Medical
Operations within visual line-of-sight	
Operation during daylight hours	
Operations conducted at off-airport locations - <i>Must be a minimum of 5 NM away from any airport</i>	
Operations are conducted in a sparsely populated location	
Flight below 400’ AGL in Class G Airspace	
<b>If the above requirements above can’t be met, then an FAA Private Pilot license or greater (e.g. Commercial) is required.</b>	FAA Class II Medical

- Aircraft specific UAS training.
  - Must be trained on normal, abnormal, and emergency procedures.
  - Training by the aircraft manufacturer is highly recommended if available.
  - NP UAS TS staff can provide UAS training on some platforms.
  - Must demonstrate proficiency on the UAS through a check flight.
- Test Site Crew Resource Management Training (Test Site procedures)
  - On-line through the NP UAS TS training website.
  - Consists of a presentation and test.
  - Initial training and annual recurrent training.
- The PIC must maintain recent operational experience consisting of at a minimum three takeoffs and three landings in the specific UAS within the previous 90 days.

If you would like to check your proposed operational location to ensure it is 5 NM away from an airport, visit [www.airmap.io](http://www.airmap.io).

1. Login or create a login.
2. Search for your location in the top left
3. On the right panel, ensure the “Recreational – 5 Mile Radius” layer is selected and has a solid orange square to the left.
4. If your location is within the orange shading, it might be too close to an airport and may require the PIC to have a pilot license.

Nationwide COA:

- Pilot Certificate Requirement



200' COA	Medical Certificate
Pilot Certificate Required – Minimum Sport Pilot	PIC – Appropriate for Pilot Certificate Held <ul style="list-style-type: none"> <li>• If sport pilot – driver’s license</li> <li>• If private pilot – FAA Class III Medical</li> </ul>
400' COA	Medical Certificate
Pilot Certificate required for complex operations <ul style="list-style-type: none"> <li>• Same requirements as ND Statewide COA. See North Dakota Statewide COA PIC requirements above.</li> </ul>	FAA Class III Medical

- Platform specific UAS training.
  - Must be trained on normal, abnormal, and emergency procedures.
  - Training by the aircraft manufacturer is highly recommended if available.
  - NP UAS TS staff can provide UAS training on some platforms.
  - Must demonstrate proficiency on the UAS through a check flight.
- Test Site Crew Resource Management Training (test site procedures)
  - On-line through the NP UAS TS training website.
  - Consists of a presentation and test.
  - Initial training and annual recurrent training.
- The PIC must maintain recent operational experience consisting of at a minimum three takeoffs and three landings in the specific UAS within the previous 90 days.

**Visual Observer (VO):**

North Dakota Statewide COA and Nationwide COA:

- Medical:
  - North Dakota Statewide COA - Valid FAA Class II medical certificate.
  - Nationwide COA – Valid FAA Class III medical certificate.
- Test Site Crew Resource Management Training (test site procedures)
  - On-line through the NP UAS TS training website.
  - Consists of a presentation and test.
  - Initial training and annual recurrent training.

**3.9 FAA Certificate of Authorization (COA)**

Three options are available through the Test Site.

- 1) Nationwide COA -
  - 55 lb. aircraft or less, 400’ AGL (Above Ground Level) or less.
  - No flights allowed near airports
    - 5NM from airport with control tower
    - 3NM from airport with published instrument flight procedure approach, but no control tower
    - 2NM from airport with neither
  - New aircraft types can be added easily with local (Test Site) approval.
- 2) North Dakota Statewide COA

- Any size aircraft, 1200' AGL and below.
  - Each new aircraft type must be added to the COA by amendment (30+ day process through the FAA).
- 3) Customized Test Site COA(s) can be tailored around specific research needs

### 3.10 Airworthiness Determination

Public entities have the ability to self-certify aircraft airworthiness. The Test Site has developed an airworthiness program to establish a safe approach to evaluating UAS airworthiness. The exact process used will depend on the make and model of aircraft.

First, technical information and manuals about the aircraft must be submitted to the Test Site. This will help them determine the capability and maturity of the aircraft. The Test Site will identify any hazards associated with the aircraft and mitigate them to an appropriate level. The Test Site will then assist with initial airworthiness documentation of the aircraft. An Airworthiness Release (AWR) is filled out with technical information about the aircraft, approved payloads, weather limitations, and other general safety procedures. This AWR is then signed and submitted to the FAA as a notification.

Continued airworthiness must also be addressed. If the manufacturer of the aircraft has developed a set of procedures for continued airworthiness (inspections, maintenance procedures, etc.), those are submitted to the Test Site for review and in most cases will be used as is. If the manufacturer has not developed these procedures, the Test Site will assist in developing them.

After initial airworthiness has been completed and a continued airworthiness program set, the aircraft is considered airworthy. Before research flights occur, the aircraft must go through the Flight Readiness Phase consisting of 2 flights. The first flight, Phase I, is a short flight to demonstrate the aircraft is airworthy. The second flight, Phase II, is a longer flight that demonstrates all functions and operational criteria of the aircraft are functioning properly. Upon completion of Phase II, the aircraft is ready for operational research flights.

### 3.11 Research Compliance Committee Review

The Unmanned Aircraft Research Compliance Committee (UASRCC) considers the ethical consequences of a proposed project and will apply community standards in determining whether a research project may be approved. The UASRCC will determine whether a proposed project can be approved as described, needs modification to be approved, or will be denied.

All modifications that are required will be made by the NP UAS TS and Test Site User prior to conducting a flight. The Mission Commander will be responsible for assuring that the modifications are implemented. The UASRCC Membership consists of:

- Six appointees representing the University (UND).
- Three appointees representing emergency responders.
- Three appointees representing local government.
- Three appointees representing the community at large.

Additional information about the UASRCC including the application form required for the review can be found at the following web link:

<https://und.edu/research/resources/uas-research-compliance-committee.cfm>

### **3.12 Independent Safety Review Board (ISRB)**

The objective of the independent safety review board is to conduct an evaluation of the safety of the proposed UAS flight operation. This review takes into consideration the test plan, aircraft, airworthiness assessment, crew qualifications, emergency preparedness, location of flights, COA requirements, and other relevant information. The ISRB consists of Test Site personnel representing safety and flight operations.

### **3.13 Flight Readiness Review**

The Flight Readiness Review (FRR) is primarily intended to review and approve the Test Plan and ensure compliance with any provisions from the Safety Review Board. The FRR is conducted by a representative of the Test Site flight operations, the Mission Commander, Pilot, and any other crew members required for completion of the proposed flight operation. The FRR is completed prior to the day of flight operations.

### **3.14 Pre-Flight Check**

A pre-flight briefing is conducted by the flight crew immediately prior to flight to ensure all aspects of the flight are covered and understood by all.

### **3.15 Flight Debrief**

A post-flight debrief is conducted to discuss outcomes from the flight, issues during the flight, and potential changes for future flights.

### **3.16 Data Reporting**

The provisions of the COA require some information to be submitted to the FAA about the flights. Examples of this data are as follows:

- Registration and serial number of UAS used to conduct operations
- The number of flights conducted under this COA
- Aircraft operational hours per flight
- Ground control station operational hours in support of each flight, to include Launch and Recovery Element (LRE) operations
- Pilot duty time per flight
- Equipment malfunctions (hardware/software) affecting either the aircraft or ground control station
- Deviations from ATC instructions and/or Letters of Agreement/Procedures
- Operational/coordination issues
- The number and duration of lost link events (control, vehicle performance and health monitoring, or communications) per aircraft per flight.

The data to be reported to the FAA does not include imagery or other payload sensor data specific to an application that is being tested for the research project.

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REVISION HISTORY

- V2.0 Initial release
- V2.1 Updated section 4.8 crew qualifications to correct and clarify. Removed blank section 4.9.
- V2.2 Updated section 4.3 guidance on purchasing an aircraft. The new registration process eliminated some consideration on purchasing from international sources. Updated section 4.4 to describe a liability insurance policy the university has in place. Updated section 4.5 to describe the new online registration process the FAA has implemented.
- V3.0 Updated the procedure to include information about the new Part 107 small UAS rule. Changed the document title to reflect that it is applicable to research requiring a Public Aircraft Operation COA. Eliminated the Executive Summary section as it was very redundant with the Background Information Section. Deleted the section for alternative options for UAS as it is no longer relevant to the scope of this document.