

Research at a Glance

# Technical Brief

## Principal Investigator

Anil Agrawal, Ph.D., PE,  
Professor of Civil Engineering,  
The City College of CUNY



## NJDOT UAS/Drone Procedures Manual and Best Practices for Use in New Jersey

### Research Problem Statement

Recent advances in Unmanned Aircraft Systems (UAS) technologies have tremendous potential of improving the reliability and efficiency of inspections of transportation infrastructures, such as bridges, highways, railroads, construction projects, high mast light poles, etc. Two major challenges in the adoption of UAS operations for NJDOT transportation infrastructures are: regulatory compliance with the FAA regulated airspaces, and the absence of comprehensive operational procedures and guidelines for performing the UAS missions.

### Research Objectives

The main objectives of this research were to investigate the local laws, statues and conditions affecting the NJDOT's UAS operations, and develop comprehensive procedures for the use of UAS by a public agency, such as NJDOT for their inspection, operation, and management activities. These UAS procedures comply with current Federal regulations and include appropriate forms to maintain documentation and ensure FAA compliance. The outcomes of this research are presented as two separate sections in this report. The first section addresses the existing laws and practices for UAS operations in the State of New Jersey. The second section discusses NJDOT's unique safety and risk management concerns and fully integrates them with established best UAS procedures for use by NJDOT. These procedures cover all aspects of UAS operations conducted on behalf of NJDOT, whether it is by public employees, a consulting firm, or a contract with a commercial UAS vendor.

### Methodology

This research began reviewing the available NJDOT's documents that might be related to UAS operations such as Aircraft Accident Procedures Manual. The NJDOT internal organizational chart and potential UAS activities were reviewed. Later, a detailed literature review was performed to investigate other States and countries procedures and regulation for UAS mission in infrastructure projects. A series of discussion meetings were held with experts in aeronautical area to develop risk management system for NJDOT UAS operations.

**Research Project Manager**

Stefanie Potapa, Bureau of Research, NJDOT

**Results**

The outcomes of this research are presented in the form of Unmanned Aircraft Systems Flight Operations Manual (UASFOM). This UASFOM provides guidance for NJDOT personnel, employees, consultants, and contractors in the performance of UAS Operations. This manual has been developed with a strong emphasis on continuously demonstrating a high level of safety standards in daily flight operations, while meeting performance targets. The UASFOM includes the procedures to address the privacy concerns of citizens and documents state laws and regulations relevant to New Jersey UAS operations. It also contains the NJDOT safety management system (SMS) and risk assessment approach, the customized three-phase NJDOT UAS training program, and all pre-, during, and post-flight operational issues. Additionally, all the required forms, checklists, and flight supporting documents are provided in this manual.

Furthermore, a night-time operation training video was prepared to train NJDOT’s crew members prior to conducting night operations to recognize and overcome visual illusions caused by darkness and understand physiological conditions that may degrade night vision.

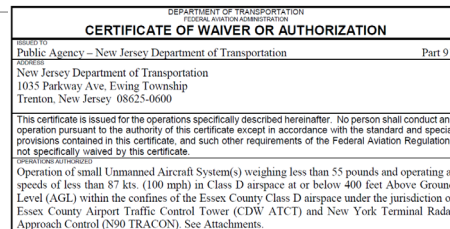
Seven requests for Certificates of Authorization (COA) have been obtained from the Federal Aviation Administration (FAA) for NJDOT operations that deviate from Part 107 regulations. Out of these, six COAs are for public airports of New Jersey State and one for an airport with common airspace with the State of Pennsylvania.

Form DA-66 (09/19)

**NJDOT UAS In-Flight Emergency Checklist**



<b>Lost Link [1]</b>	<ul style="list-style-type: none"> <li>Put the UAS in "Return-to-Home" mode</li> <li>Try to regain the UAS control through the remote controller (for example the ATTI-mode switch on DJI Controller). If the control regained, land immediately</li> <li><i>If the aircraft is away from the project site</i></li> <li>Follow the procedure for "Fly-away Emergency"</li> <li><i>If the aircraft remains within the project site</i></li> <li>Warn nearby people of an emergency landing</li> <li>Continue to issue the "Return-to-Home" command</li> <li>Wait until the battery is discharged and the aircraft auto lands or crashes.</li> <li>Notify the NJDOT Bureau of Aeronautics.</li> </ul>
<b>Total Loss of Power [2]</b>	<p style="text-align: center;"><u>Before Impact</u></p> <ul style="list-style-type: none"> <li>Identify emergency landing or ditch area</li> <li>Try to restore power and regain control of the aircraft</li> <li>Warn nearby people of crash landing by shouting a warning</li> <li>Immediately land or ditch the aircraft, if full or partial power regain</li> <li>Maintain visual contact with the aircraft</li> <li>Prepare to take post-crash action</li> </ul> <p style="text-align: center;"><u>After Impact</u></p> <ul style="list-style-type: none"> <li>Contact 911 if the landing location endangers life or property</li> <li>Send the command to power off the aircraft</li> <li>Power off the control and communication systems</li> <li>If the aircraft is in hazardous location, wait for emergency respond</li> <li>Check the aircraft for fire</li> <li>Notify the NJDOT Bureau of Aeronautics</li> </ul>
<b>Airspace Intrusion</b>	<ul style="list-style-type: none"> <li>Alert the RPIC of position and heading of the encroaching aircraft.</li> <li>Monitor the position and heading of the encroaching aircraft.</li> <li>Take evasive actions if a collision imminent.</li> <li>Land the aircraft immediately and wait for safer situation if there is any risk of collision.</li> <li>Suspend the operation. Do not resume flight operation until the encroachment has ended.</li> </ul>



This brief summarizes NJ-2021-00x, "NJDOT UAS/Drone Procedures Manual and Best Practices for Use in New Jersey", produced through the New Jersey Department of Transportation Bureau of Research, 1035 Parkway Avenue, P.O. Box 600, Ewing, NJ 08625 in cooperation with the U.S. Department of Transportation Federal Highway Administration.