

Part 1: Mission Parameters & Assessment

Section 1 – Mission Information

- **Project Name:** Atlantic Cape Baseball Field Multispectral Survey
- **Mission Date/Time:** Target Solar Noon (approx. 11:30 AM – 1:30 PM) for optimal lighting.
- **Objective:** Collect calibrated multispectral and thermal data suitable for vegetation analysis and environmental assessment of the baseball field turf.
- **Pilot in Command / Visual Observer:** Dan Devlin / Dennis
- **Mission Area:** Atlantic Cape Community College Baseball Field, 5100 Black Horse Pike, Mays Landing, NJ.
- **Expected Deliverables:** Calibrated Reflectance Orthomosaic, NDVI Map, Thermal Map, Vegetation Health Assessment.

Section 2 – Site Assessment

- **Surface/Vegetation:** Primarily managed turf grass with dirt infields.
- **Obstacles:** Tall stadium lights, perimeter fencing, bleachers, and nearby utility poles/trees along the perimeter.
- **Environmental/Shadow Concerns:** Shadowing from stadium lights and nearby trees can severely impact reflectance data; flights must occur when the sun is highest to minimize this.



Section 3 – Environmental Conditions Assessment

- **Solar Angle & Time:** Must collect within 2 hours of solar noon.
- **Cloud Cover:** Clear skies or high, consistent overcast are acceptable. Rapidly changing, patchy clouds are unacceptable as they disrupt radiometric calibration.
- **Wind:** Must be under 15 mph to prevent vegetation movement (which ruins image alignment).

Section 4 – Hazard Identification and Risk Assessment

Hazard	Likelihood	Severity	Risk Level	Mitigation Strategy
Bird Strikes	Medium	High	Medium	Maintain visual line of sight; yield to wildlife.
Stadium Lights/Poles	Low	High	Medium	Set minimum flight altitude at least 50ft above the highest obstacle.
Changing Illumination	High	Low	Medium	Utilize DLS2 sensor; pause flight if heavy, patchy clouds roll in.
Pedestrian Interference	Medium	Medium	Medium	Establish a clear perimeter and launch/recovery zone away from walkways.

Part 2: Flight & Sensor Planning

Section 5 – Flight Planning Parameters

- **Flight Altitude:** 250 feet (balances high-resolution Ground Sample Distance with efficient coverage).
- **Front Overlap:** 80% (multispectral requires higher overlap than standard RGB for photogrammetry).
- **Side Overlap:** 75%
- **Flight Speed:** 5 m/s (ensures crisp images without motion blur).
- **Flight Pattern:** Crosshatch or standard lawnmower pattern.
- **Ground Sample Distance (GSD):** 0.7 in/px
- **Number of Flight Lines:** 7
- **Estimated Flight Duration:** Dependent on Draganfly takeoff and speed.
- **Estimated Number of Images:** 111
- **Coverage Area:** 10.46 acres
- **Approximate flight time:** 8 minutes

Section 6 – Reflectance Calibration Plan

- **Pre-flight:** Capture an image of the calibrated reflectance panel in clear, unshadowed light before takeoff. Hold the drone level over the panel.
- **During Flight:** The Downwelling Light Sensor (DLS2) will continuously measure ambient light to compensate for minor environmental changes.
- **Post-flight:** A second reflectance panel image will be captured immediately upon landing to bookend the dataset.

Section 7 – Altum-PT Sensor Utilization Plan

- **Blue/Green/Red Bands:** Used for standard visible spectrum mapping and baseline color assessment.
- **Red Edge Band:** Highly sensitive to early plant stress; detects turf issues before they are visible to the naked eye.
- **Near Infrared (NIR) Band:** Crucial for calculating vegetation vigor and calculating the NDVI index.
- **Thermal Sensor:** Measures emitted heat to identify water stress, irrigation leaks, or drainage issues on the field.
- **Panchromatic Sensor:** Provides a high-resolution base layer to sharpen the spatial detail of the multispectral bands (pan-sharpening).

Part 3: Operations & Logistics

Section 8 – Equipment List

- Drone platform Draganfly (compatible with Altum-PT)

- MicaSense Altum-PT Sensor & DLS2 module
- Calibrated Reflectance Panel
- Spare drone batteries and controller
- High-speed SD cards (formatted)
- Anemometer (for wind checks)

Section 9 – Weather Requirements

- **Wind:** < 15 mph.
- **Precipitation:** Zero. Vegetation must be dry (wet leaves alter reflectance).
- **Kp Index:** < 4 (ensures stable GPS).

Section 10 – Go/No-Go Decision Matrix

- **GO:** Wind < 15mph, dry turf, steady lighting, airspace clear, equipment fully functional.
- **NO-GO:** Patchy clouds causing rapid shadow changes, wind > 15mph, wet field conditions, sensor calibration failure.

Section 11 – Quality Assurance Checklist

- [] Sensor lenses clean and dust-free.
- [] DLS2 top sensor is completely unobstructed.
- [] Reflectance panel captured with no shadows (including the operator's).
- [] SD card confirmed to be capturing all bands (check sample shot).

Part 4: Deliverables

Section 12 – Analytical Products Plan

- **Reflectance Orthomosaic:** A geometrically corrected, calibrated map representing true ground reflectance, used as the base layer.
- **NDVI Map:** Generated using the NIR and Red bands to evaluate the biological vigor and health of the baseball field turf.
- **Thermal Map:** Highlights temperature anomalies to pinpoint areas that are under- or over-watered.
- **Vegetation Health Assessment:** A final summary report combining NDVI and thermal data to advise groundkeepers on targeted maintenance.

Section 13 – Mission Summary: This mission leverages the Altum-PT to move beyond standard visual inspection of the Atlantic Cape baseball field. By strictly controlling environmental variables, utilizing high-overlap flight parameters, and executing precise radiometric calibration, we will generate a scientifically valid dataset. This data will allow facilities management to perform targeted, precision turf maintenance, optimize water use, and catch stress factors early.

Reflection:

Developing this multispectral mission plan for the Atlantic Cape Community College Baseball Field highlighted the stark contrast between traditional RGB photography and scientific data collection. The biggest difference I found is that RGB mission planning prioritizes visual aesthetics and broad coverage, while multispectral planning focuses on quantitative measurement and data consistency. An RGB camera captures what the human eye sees and often tolerates minor changes in exposure or lighting. In contrast, the MicaSense Altum-PT acts as a scientific instrument measuring specific bands of reflected energy and emitted thermal heat to detect invisible conditions like vegetation stress or moisture levels. This requires much more rigorous planning, including higher image overlap and strict adherence to standardized procedures.

Central to this scientific approach is radiometric calibration. Calibration is what transforms a simple photograph into a reliable, repeatable measurement. By capturing images of a calibrated reflectance panel before and after the flight and using the Downwelling Light Sensor (DLS2) to track ambient light changes during the mission, we convert raw pixel brightness into true ground reflectance. Without this precise calibration, you can't accurately compare NDVI data from one week to the next, because variations would reflect lighting changes rather than actual biological changes in the turf.

Environmental conditions strongly influence data quality, making strict Go/No-Go decision-making vital. Factors like solar angle, cloud cover, and wind can severely compromise a multispectral dataset. For example, wind moves vegetation, disrupting the photogrammetric alignment process. Patchy clouds or long shadows from the stadium lights reduce the reflected energy reaching the sensor, skewing spectral signatures. Therefore, the most important factors for successful multispectral data collection are environmental consistency, meticulous pre-flight planning, and executing the mission near solar noon to minimize shadowing.

The primary challenge I encountered while creating this mission plan was balancing the Altum-PT sensor's technical demands with the site's physical realities. Designing a flight plan that maintained the high overlap (80% front / 75% side) required for multispectral photogrammetry while ensuring a safe altitude above stadium lights required careful calculation. Additionally, structuring the calibration workflow to account for the DLS2 and reflectance panels added logistical complexity that doesn't exist in standard RGB flights. Ultimately, this project reinforced that successful multispectral remote sensing comes from disciplined, proactive planning rather than simply flying a drone.