

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



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OPERATIONAL FACTORS

June 30, 2026

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A. ACCIDENT

Location: Orlando, Florida
Date: December 21, 2024
Time: 18:30 EST
23:30 UTC
UAS/Drone: Uvify IFO

B. OPERATIONAL FACTORS GROUP

Group Chair	Kurt Gibson NTSB Washington, D.C.
Party Coordinator	Tyler Johnson SkyElements Fort Worth, Texas

C. SUMMARY

On December 21, 2024, about 1830 Eastern Standard Time (EST), multiple small, unmanned aircraft (sUA), experienced a loss of control and rapid descent while performing at a sUA light show at Lake Eola, Orlando, Florida. The swarm of sUA, Uvify IFO, were operated by Sky Elements LLC, doing business as (dba) Sky Elements Drone Shows. A minor child was impacted in the face and chest by a sUA and was seriously injured. A postaccident inspection revealed that numerous sUA impacted the ground and sustained substantial damage. The sUA light show was operating under the provisions of Title 14 Code of Federal Regulations Part 107 and a Certificate of Waiver and Authorization issued by the Federal Aviation Administration (FAA).

D. DETAILS OF THE INVESTIGATION

E. FACTUAL INFORMATION

1.0 History of Flight

The remote pilot in command (RPIC) reported that the drone show consisted of 500 sUASs that were launched from a small peninsula in the northeast corner of Lake Eola, Orlando, Florida. The RPIC reported that the setup for the show was normal and consisted of preflight checks, ensuring that the software programming

matched and was updated on all show computers, and the layout of the 500-drone grid on the ground was correct.

The RPIC reported that initially, 5 of the aircraft were not accepting the launch data. The RPIC began troubleshooting the issue and performed a soft reboot of the entire fleet. The RPIC reported that after the reboot, all of the aircraft showed ready except for two of the aircraft, which were then removed from the show. The rest of the fleet aircraft were armed, and the countdown sequence was initiated. At takeoff, it was observed that the aircraft "layers" did not lift uniformly. Further investigation revealed that the launch parameter file that contained the final flight paths had not been pushed to the aircraft and that the show center was not completely aligned with the setup grid.

A video of the drone show confirmed that the aircraft did not liftoff in uniform layers, and as they moved into position, several aircraft shifted position and altitude, which resulted in a collision with other sUASs. After the collisions occurred, several aircraft could be seen falling from the formation and impacting the ground below the drone show. One of the sUASs could be seen streaking towards the audience at a high rate of speed. The sUAS that flew towards the audience impacted a minor child in the face and chest, resulting in the child receiving serious injuries.

After the collisions, the RPIC reported that he monitored the remaining aircraft through visual observation and telemetry readings from the ground control station. The RPIC determined that due to the complexity of pausing the show and recovering the airborne aircraft, the safest course of action was for the show to proceed. The remaining aircraft completed the show and landed without further incident.

2.0 Pilot Information

2.1 Pilot's Certifications

The RPIC was issued a Remote Pilot certificate with a rating of Small Unmanned Aircraft System on 08/30/2016.

2.2 Pilot's Flight Experience

The remote PIC reported working with unmanned aircraft systems for approximately 15 to 20 years, with 10 to 15 years being commercial work with UAS. The pilot reported having about 3 years of experience working specifically with drone shows, about one year with a previous company, and about 2 years with Sky Elements. The pilot also estimated that he had completed about 300 drone shows in his career prior to the accident.

3.0 Aircraft Information

The quadcopter, sUAS, was a UVify IFO swarm light show drone. The sUAS was part of a drone light show, which contained a total of 500 similar sUASs. According to

the manufacturer, the sUAS has an approximate takeoff weight of 1,050g and is powered by a 4S LiPo battery. The sUAS had a reported top speed of 60km/h, equivalent to approximately 37.28 mph.

4.0 sUAS Control Equipment

The sUAS swarm was controlled by two laptops; the primary laptop runs the Drone Show Software (DSS) and is connected to the swarm via a Wi-Fi network. The Wi-Fi network allows for the laptop to send commands to the swarm as well as to receive feedback from the individual sUASs for any faults or errors. For the accident show, the Wi-Fi network utilized four access points that were set up around the sUASs. The second laptop was connected to the real-time kinematic (RTK) software as well as the “Red Button” software. The secondary laptop is connected to the swarm via a 915 MHz radio and is only capable of sending the RTK corrections and commands. The primary function of the Red Button software is to act as a backup in case there is a Wi-Fi network outage or interference.

On May 21, 2025, a test drone show was performed by SkyElements in Weatherford, Texas. The test show utilized the same laptops, Wi-Fi network, Wi-Fi access points, 915 MHz radio, and RTK unit that were used during the accident flight. The test show used 100 sUASs that had not been part of the accident flight. After completing the preflight checks and calibrations, the test show was activated. All of the sUASs operated normally during the initial takeoff. Shortly after takeoff, one of the sUASs, suddenly left formation while the motors made a loud buzzing sound. The sUAS’s motors can then be heard shutting off, and the sUAS then began to flip over multiple times before impacting the ground at the border of the programmed hard fence. The remaining sUASs remained in formation, and the test show continued. The remaining sUASs flew the programmed test show without any anomalies that would have precluded normal operation. The laptops, Wi-Fi network, access points, 915 MHz radio, and the RTK all operated normally during the test show.



Figure 1: Test Drone Setup



Figure 2: Show Network Switch



Figure 3: RTK Unit



Figure 4: 915 MHz Antenna

5.0 sUAS Show Initial Programming

The drone show is first programmed in Blender. The software allows the operator to create different shapes, objects, and animations for the drone show. The operator reported that the software is programmed to maintain a minimum of 2 meters between each sUAS throughout the entire show, and the operator has a standard of a maximum velocity of 4 to 5 meters per second. The operator reported that the accident drone show was programmed into Blender, with a maximum velocity for a sUAS of 4.7 meters per second and a programmed closest distance between any two sUAS of 2 meters. The software is designed to simulate the entire drone show, with each sUAS position displayed on the UI. The accident drone show was programmed in Blender, and the simulated run of the show indicated that there were no portions of the show in which the sUAS would breach the minimum 2 meters distance between each sUAS, and none of the sUAS would exceed the maximum 5 meters per second velocity limit. The produced final drone path files were additionally simulated and verified in the Drone Show Software Path Viewer, and the path files met all separation and velocity maximum parameters.

6.0 sUAS Show Site Setup and Programming

The command laptop maintained log files from the accident drone show, which the operator and the NTSB examined. The examination of the files revealed that the drone show center position was not oriented over the physical location of the sUASs. The operator reported the center of the sUAS physical location was 28.5449938997792, -81.371134865313; however, the RPIC had programmed and uploaded to the sUASs position to be 28.5449583471286, -81.3711627772998. This equated to a deviation of approximately 16.5 ft between the physical show center and the RPIC-programmed show center. The operator reported that this shift also moved the show closer to where the spectators would be located. Additionally, the log files showed only 498 sUAS were selected for the show location, meaning two of the sUAS were programmed with a different show center location than the rest of the sUAS. The data further showed that all 500 sUAS were launched for the show.

According to the operator, it was critical that the RPIC positioned the show center correctly over the center of the starting grid, as the software used algorithms to assign the correct path to the correct drone based on this position. The operator reported that when the position is not accurate, the software will map incorrect drones to the flight paths, which could result in collisions during takeoff and during the move to position. The software allowed the RPIC to view and confirm the correct position on a 2D map. Additionally, the software allowed the RPIC to view the flight paths in a 3-dimensional map to verify that the paths are accurate and that there are no crossing paths between the sUASs.

Further review of the show location data revealed that the drone show heading was different than what the show was initially programmed to be. The operator reported that the RPIC was provided a show heading of 121.3°; however, the data log revealed that the show was set to be 114.6°. The deviation in show heading resulted in the flight position being off by about 60 ft from the planned position. The heading adjustment moved the show even closer to the expected location of the spectators.

The drone show software had options to adjust the geofences around the drone show. The software had two different geofences. The soft geofence is the first geofence, which is set to send a sUAS back to its home point to land. The hard geofence is the second geofence and is programmed to disarm the sUAS's motors immediately upon reaching the geofence. Both of these geofences required the sUAS to have GPS positioning to determine where the programmed geofences are. According to the operator, at the time of the accident, the policy for margin between the two geofences was 1 meter (about 3.28 ft); however, the data showed that the RPIC had the geofence margin set to 5 meters (16.4 ft). According to the operator, the 5-meter geofence margin used to be the standard; however, on December 9, 2024 (12 days before the accident), the policy had been changed to adjust the geofence margin to 1 meter. The operator further reported that it was up to RPIC to update the command laptops with the new margin default setting as they were being used for shows. The operator also stated, that it was up to the RPIC to "draw" the geofences around the show, and that it was policy to put the fences as close to the

edges of the show as possible. A review of the data revealed that the geofences were drawn in several locations farther from the edge of the show than the operator stated would be normal. The resulting geofences were near where the spectators were expected to be stationed.

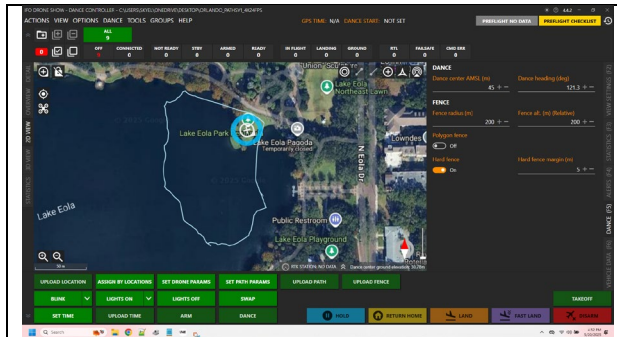


Figure 5: Drone show as designed (except for hard fence margin)

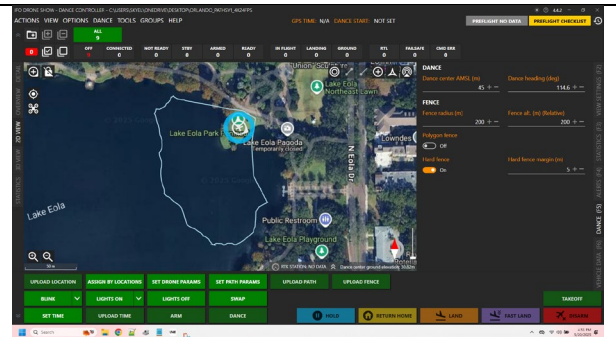


Figure 6: Drone show as flown

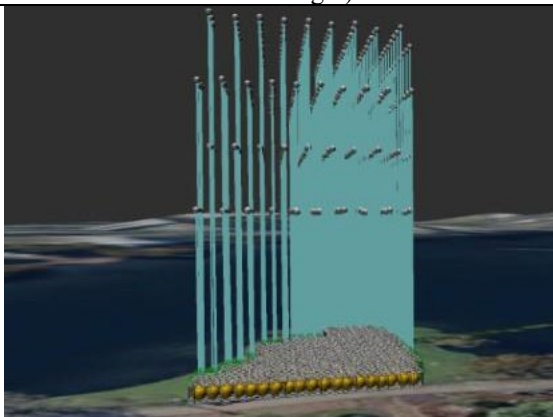


Figure 6: Drone show as designed with no crossing paths

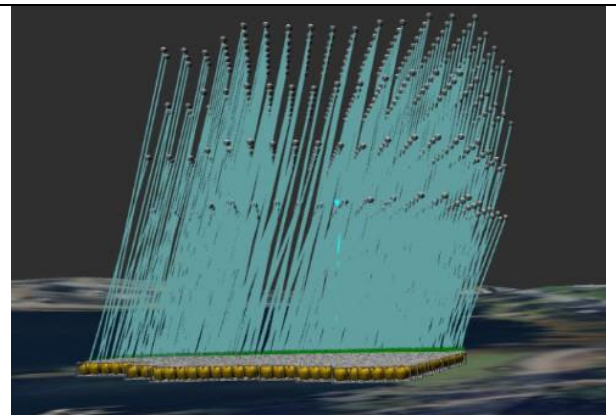


Figure 7: Drone show as flown with crossing paths

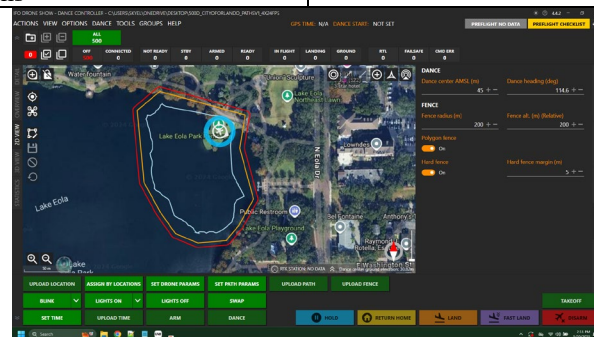


Figure 8: Drone show as flown with soft and hard fences shown

7.0 Organizational and Management Information

As a result of this accident, Sky Elements made several changes to their operating procedures:

1. A policy was put in place to have no less than two Part 107 sUAS pilots for every drone show.
2. The policy was changed to switch from digital checklists, to paper checklists which are required to be signed by both sUAS pilots and copies sent to management.
3. The policy was changed for the show setup to add an additional 2 hours of setup time.
4. A policy was implemented that the show must be ready 15 minutes prior to the show start, and if it is not, the show start will be pushed back another 15 minutes.
5. After setting the grid and preparing for the show, the pilots will be required to contact SkyElements' support for any show headings that deviates more than 1 degree from the estimated show heading sent with the show file. The pilots would require authorization from support to deviate from the initial heading.
6. SkyElements' updated the operation handbook for procedures when an accident occurs.
7. The safety buffer was adjusted for 155 ft between the edge of the hard geofence and the spectators.
8. Software enhancements that provided additional safety protections by preventing RPICs from modifying critical flight parameters, embedding show coordinates directly within the show file, and restricting access to those coordinates. Additional safeguards included the implementation of a third, path-based geofence and an Extended Kalman Filter failsafe that automatically disarms the sUA when activated.

8.0 Meteorological Information

The closest weather reporting station to the accident was approximately 2 statute miles east, at the Orlando Municipal Airport (ORL), Orlando, FL. At 18:53 EST, the weather at ORL was reported to be the following: wind from 30° at 6 knots, visibility was 10 statute miles, the skies were clear, the temperature was 12°C, the dew point was 6°C, and the altimeter setting was 30.15 inHg.

Submitted by:

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