

Rainmaker Petition for Amendment

Document ID: FAA-2025-1630, Exemption No.-25287

Effective Date: 19 MAR 2026

RAINMAKER



1. Petitioner Contact Information

- Company: Rainmaker Technology Corporation
- Primary Contact: Samuel Kim, Director of Regulatory and Compliance
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2. Background and Operational History

Since being granted Exemption No. 25287, Rainmaker Technology Corporation has safely and successfully conducted precipitation enhancement operations utilizing the Rainmaker Elijah Quadcopter Series. Operating under this exemption, Rainmaker has supported state government contracts in coordination with research entities, executing vital cloud seeding sorties to combat drought conditions. To date, Rainmaker has conducted 245 mishap free hours spanning over 1,252 flights carrying two flares with zero safety incidents. The Elijah platform is a highly capable multi-rotor sUAS with a maximum flight time of 90 minutes and an integrated Parachute Recovery System (PRS), ensuring reliable performance during these complex environmental missions.

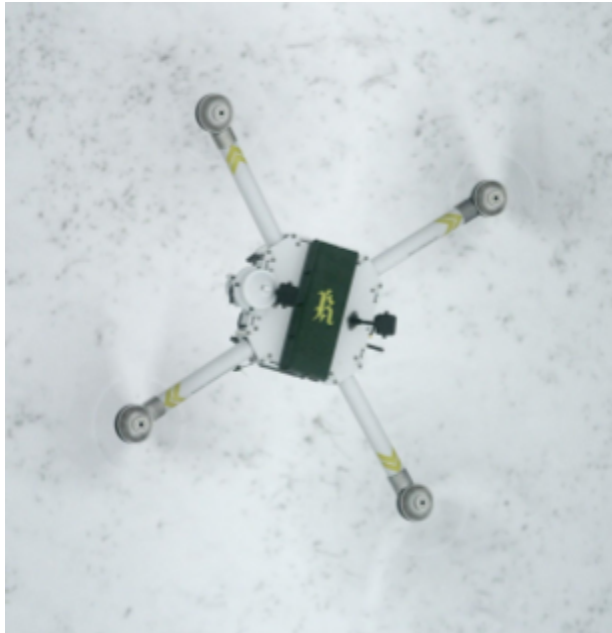
The proposed increase in payload capacity for flare operations is made possible by the advancement of capabilities of the Elijah platform. To reflect these operational improvements, the Petitioner requests updates to the following conditions:

- **Maximum Takeoff Weight (MTOW):** An increase from the currently approved 50 lbs to up to 55 lbs.
- **Maximum Flight Time:** An increase from the currently evaluated 60 minutes to 90 minutes.
- **Maximum Altitude:** An increase from the currently evaluated 15,000 feet MSL to 20,000 feet MSL.

sUAS type	Multi-rotor quadcopter
Battery	Lithium-ion battery
Maximum flight time	90 minutes
Maximum speed	35 mph
Maximum altitude	20,000 feet MSL
Dimensions (LxWxH, inches)	32" x 32" x 6.5"



Total aircraft weight (payload included)	50 lbs
Anti-collision lighting	2 strobe, flashing, FAA approved



1. **What kind of UAS will you use to fly the operations requested in this application? For example: multi-rotor, fixed wing, hybrid (both multi-rotor and fixed wing), single rotor, lighter than air, etc.**
 - Rainmaker Elijah Quadcopter Series
2. **What is your UAS's power or energy source in flight?**
 - Lithium-ion battery powered
 - Four brushless heavy-lift motors
 - KDEDirect - 8218XF-120
 - 120Kv, 110 A continuous current
 - Eight carbon-fiber, Atomic-6 dynamically balanced propeller blades
 - 30.75" x 11" 100% in-fill carbon-fiber layup
 - 200W embedded heater element
3. **What is your UAS's maximum flight time (in minutes), range (in feet), and speed (in miles per hour)?**
 - Maximum flight time: 90 minutes
 - Maximum range (altitude): 20,000 feet MSL
 - Maximum speed: 35 mph



4. **How big is the aircraft (length/width/height in inches)?**
 - 32" x 32" x 6.5"
5. **How do you ensure the aircraft only flies where it is directed (i.e. ensure containment)?**
For example: geo-fencing, tether, etc.
 - Containment is ensured through geofencing boundaries and autopilot flight paths that utilize air radios and two onboard GPS modules.
 - Flight management and autopilot is managed via PX4 flight control software.
6. **What kind of termination system, if any, does the UAS have? For example immediate flight termination switch.**
 - The UAS is pre-programmed to execute a safe landing at a predetermined landing site in the event of a triggered contingency procedure (ex. Lost link scenario or degraded subsystems).
 - The system's termination system is initiated by either an autonomous response or induced by the RPIC.
 - Initiation of the termination system will cut power to the motors and engage the Parachute Recovery System.
 - Live positioning data is passed to the GCS and corroborated with Seraph's estimated PRS trajectory based on atmospheric readings.

3. Description of the Proposed Amendment

The Petitioner requests an amendment to allow the carriage of up to six (6) pyrotechnic devices as described in the references, implemented via a two-phase rollout to ensure a conservative approach to safety.

- Phase 1 (4 Flares): Petitioner will conduct a minimum of 50 successful operational flights with 4 flares, demonstrating flawless system integration and zero safety anomalies, before progressing to Phase 2.
- Phase 2 (6 Flares): Upon successful completion of the Phase 1 criteria, Petitioner will transition to Phase 2 conducting operational flights with 6 flares.
- Requested Change to Conditions & Limitations: Petitioner requests C&L 6 ,7, and 8 to be read as follows:
 - Conditions & Limitations 6 and 8: Amend "Waiver No. 107W-2025-00728, or subsequent version," to "Waiver No. 107W-2025-04440A, or subsequent version,"
 - Conditions & Limitations 7: Amend "In addition, no more than two flares per aircraft and no more than 50 grams (g) of explosive material per flare are authorized." to "In addition, no more than six flares per aircraft and no more than 50 grams (g) of explosive material per flare are authorized."



4. Granting the Amendment is in the Public Interest

Used in aerial cloud seeding, flares help to enhance wintertime snowpack that feeds critical infrastructure (hydropower, agricultural irrigation, other industrial uses) and ensures a reliable supply of drinking water for municipalities.

- Flares are used critically in precipitation enhancement projects across the American West, currently helping communities in the Colorado River Basin, Rio Grande basin, and other key watersheds to build resilience against water scarcity and drought.
- State entities contract this technology to help revitalize critical water infrastructure.
- Each additional flare (triggered sequentially) adds an additional 5-7 minutes of dispersal time directly resulting in major precipitation enhancement effects over targeted areas.

5. The Amendment Provides an Equivalent Level of Safety

Increasing the pyrotechnic payload to a maximum of six flares will provide a level of safety equal to that provided by the current exemption. In order to justify this increased payload, Rainmaker has conducted thorough testing through simulation, ground, and tethered operations to ensure that all associated risks are fully mitigated prior to live implementation.

- **Weight, Balance, and Performance:** Each additional flare adds approximately 280 grams to the Elijah platform accounting for a total of 3.7 pounds for 6 flares. The weight of all Rainmaker payloads are accounted for in remaining compliant under Part 107. The total Takeoff Weight is still well within Rainmaker's specified Max Takeoff Weight (MTOW) which is restricted by the regulatory confinements of 55 pounds. The additional weight of these flares have a negligible impact on battery life and flight time capability.
- **Mounting and Structural Integrity:** Flares are inserted into an aluminum Flare Holder Assembly and secured with a vibration resistant clevis pin. The Flare Holder Assembly is secured to the landing leg with a close-fitting shaft collar with two M4 button head set screws to arrest all degrees of freedom. A pocketed, aluminum tube shroud is slid over the flare to safely contain any debris produced as the flare burns while still allowing airflow to the flare.
- **Ignition System and EMI Mitigation:** The flare system is treated as a payload which includes a dedicated Flare Controller Board that receives command signals from the on board flight computer. The flight computer sends a CAN protocol message to the Flare Controller Board, which then charges a capacitor bank to reliably ignite the flares. The Flare Controller Board also handles telemetry monitoring and feedback on ignition. The system is decoupled from critical flight control logic and the hardware controlling overall vehicle stability. The platform's resistance to EMI from the flares payload is thoroughly tested on the ground and on the Rainmaker Vertical Test Stand (VTS) prior to live flights.



6. Summary for the Federal Register

Docket No.: FAA-2025-1630. **Petitioner:** Rainmaker Technology Corporation. **Section(s) of 14 CFR Affected:** § 107.36. **Description of Relief Sought:** Rainmaker Technology Corporation is seeking an amendment to Exemption No. 25287 to allow for the carriage of up to six (6) pyrotechnic devices (flares) on the Rainmaker Elijah Quadcopter Series small unmanned aircraft system (sUAS) for precipitation enhancement operations. The petitioner proposes a data-driven, two-phase rollout, beginning with four (4) flares and progressing to six (6) flares after successfully completing 50 operational flights with zero safety anomalies.

7. Conclusion

Rainmaker Technology Corporation's proposed amendment to Exemption No. 25287 represents a measured, rigorously tested expansion of our proven precipitation enhancement operations. The data-driven, two-phase approach to increasing our pyrotechnic payload ensures that an equivalent level of safety is maintained throughout all flight profiles. Given the pressing need to combat drought and protect critical watersheds in the American West, this amendment will provide a vital tool to efficiently scale our operations in the public interest. We respectfully request the FAA's review and approval of this petition.

Respectfully submitted,

Samuel Kim

Rainmaker Technology Corporation

Director of Regulatory and Compliance



Appendix A: Rainmaker Operator's Handbook - Page 38



Operator's Knowledge Handbook

the Engineers' responsibility to expand the flight envelope and reduce limitations, it is the responsibility of the Field Operator to know these limitations and respect them. PUSHING LIMITATIONS **WILL** BREAK AIRCRAFT! Hence the name '*limitation*'!

Section 3: Aerosol Dispersion Methods

The most critical component of Rainmaker's aircraft is the dispersion of aerosols, as it is essential for the successful execution of our objective: inducing precipitation. Several methods exist for dispersing Ice Nucleating Particles (INPs), though the most prevalent involve flares and the Aerosol Dispersion System (ADS). Historically, two types of flares have been utilized; however, Rainmaker primarily utilizes a proprietary, internally developed device referred to as the ADS.

3.1 Silver iodide Safety & Handling

Silver iodide (AgI) is not an extremely caustic chemical; however, caution should be exercised during handling. AgI is classified as a skin and eye irritant, and prolonged, extreme exposure may result in argyria, characterized by the discolouration of the skin. Furthermore, silver iodide poses an extreme hazard to aquatic life and must be managed in accordance with regulations regarding proximity to fresh water. The following safety and handling procedures are provided and must be strictly adhered to:

Safety

1. In the event of inhalation, immediately seek fresh air.
2. In the event of skin contact, remove all contaminated clothing and thoroughly rinse the affected skin area with water.
3. In the event of eye contact, remove contact lenses, if applicable, and irrigate the eyes with water for a duration of 15 minutes.

Handling

- Prevent contact with bare skin by utilizing rubber or latex gloves.
- Dispersal or aerosolization within confined spaces is prohibited.
- A face mask must be worn in conditions where inadvertent inhalation is unavoidable.
- Any spilled AgI must be promptly wiped up and appropriately discarded.
- When operating outdoors, handling must occur over a covered surface to preclude



Appendix B: Rainmaker Operator's Handbook - Page 39



Operator's Knowledge Handbook

accidental spillage onto the ground.

3.2 Flare Safety and Handling

Rainmaker utilizes two primary types of pyrotechnic devices for cloud seeding operations: Zeus (Burn-in-Place/BIP) and Ikarus (Ejectable) flares. Both devices contain hazardous chemical compositions, including ammonium perchlorate and silver iodide, which require strict adherence to safety protocols to prevent accidental ignition, injury, or environmental contamination.

All operators must be familiar with the specific Safety Data Sheet (SDS) for each flare type prior to handling:

- **Zeus (BIP):** Refer to [SDS Version 5.1](#) (UN #: UN0432)
- **Ikarus (Ejectable):** Refer to [SDS Version 5.2](#) (UN #: UN0431)

The relief granted from 14 CFR § 107.36 is limited to the use of burn-in-place (BIP) and ejectable flares as described in the Hazardous Materials Regulations (HMR) [49 CFR Parts 171-180](#), with the following classifications:

- UN0431 Articles, pyrotechnic for technical purposes, 1.4G (Ikarus)
- UN0432 Articles, pyrotechnic for technical purposes, 1.4S (Zeus)

3.2.1 Hazards and Safety Precautions

General Safety Rules:

- **No Smoking:** Smoking is strictly prohibited within 50 feet of any flare or storage area.
- **Ignition Sources:** Keep flares away from open flames, heat surfaces, sparks, and hot environments.
- **Static Electricity:** Protect against electrostatic charges. Operators should ground themselves before handling flares to prevent static discharge.
- **Impact and Friction:** Do not subject flares to grinding, shock, friction, or impact (e.g., dropping).
- **Personal Protective Equipment (PPE):** Wear protective gloves and eye protection when handling flares to prevent skin contact or eye irritation.

3.2.2 Storage Procedures

Flares must be stored in accordance with local regulations and the specific environmental conditions outlined in the SDS.



Appendix C: Rainmaker Operator's Handbook - Page 40



Operator's Knowledge Handbook

- **Inventory Storage:** Active inventory is stored in the designated warehouse storage space. This space is climate-controlled to protect flares from heat and direct sunlight and is equipped with automatic, heat-activated sprinklers.
- **Rejection Storage:** Any flare deemed unsafe or rejected must be immediately moved to the designated outdoor fire-safe storage container. This container is also equipped with automatic, heat-activated sprinklers.
- **Transport:** Flares must always be transported in sealed, drop-proof containers that prevent movement and friction.

3.2.3 Inspection and Rejection Criteria

Prior to every operation, the Field Operations Specialist (FOS) or RPIC must inspect every flare before it is removed from its transport container.

Rejection Criteria: A flare must be rejected if it exhibits any of the following:

- **Expiration:** The current date is past the expiration date printed on the flare.
- **Visible Damage:** Cracks, dents, or deformation of the casing.
- **Moisture Damage:** Signs of water intrusion, swelling, or corrosion on contacts.
- **Improper Storage:** If the flare was found outside of a sealed, drop-proof container or exposed to extreme heat.

Rejection Workflow:

1. **Identify:** Mark the flare as "REJECTED."
2. **Isolate:** Do not attempt to repair or use the flare.
3. **Secure:** Immediately transfer the rejected flare to the outdoor fire-safe storage container.
4. **Log:** Record the rejection in the inventory log, noting the flare type and reason for rejection.

3.2.4 Loading and Arming Procedures

To minimize risk, flares are to be mounted and armed only when the aircraft is ready for immediate launch.

1. **Preparation:** Ensure the aircraft is powered off and the flight battery is disconnected. Verify the aircraft is on a stable, outdoor surface. Never mount or arm flares indoors or in a confined space.
2. **Mounting:**
 - **Zeus (BIP):** Secure the flare into the bracket using the M8 x 30mm socket head cap screws. Ensure the clamping bracket is tight and the flare cannot shift.



Appendix D: Rainmaker Operator's Handbook - Page 41



Operator's Knowledge Handbook

- Ikarus (Ejectable): Load into the dispenser mechanism, ensuring the orientation matches the ejection feed path.
- 3. Arming: Connect the ignition wiring to the firing circuit/PDB. Ensure distinct "click" or secure connection of wires.
- 4. Final Check: Verify no wires are pinched and the payload is secure. Once armed, all personnel must remain clear of the flare's discharge path.

3.2.5 Disposal Procedures

Proper disposal is critical to prevent environmental contamination and fire hazards.

- Used Flares (Spent):
 - Ensure the flare is fully extinguished and cool to the touch before handling.
 - Verify that no unburnt pyrotechnic material remains.
 - Dispose of the spent casing/debris in accordance with local environmental regulations, ensuring no materials enter water courses or sewage systems.
- Rejected/Unused Flares:
 - Rejected flares stored in the outdoor fire-safe container will not be disposed of in general waste.
 - Contracted Disposal: A local flare disposal company is contracted by Rainmaker respective to each operation's geographic location in the country. The Director of Field Operations or the site lead will contact the disposal company on an as-needed basis to schedule a pickup of the contents of the outdoor fire-safe container. Flare and flare component waste shall not be mailed for disposal.



Appendix E: Rainmaker Operations Manual - Page 17



Unmanned Operations Manual

secured. A mandatory postflight brief will be conducted to discuss the mission's outcome, identify any issues or lessons learned, and provide feedback for the SMS. At the conclusion of a mission, operators are required to complete the "Operators Debrief Survey" for the purpose of tracking and resolving equipment issues and refinement of operating procedures.

2.5 Special Operations

2.5.1 Carriage of Hazardous Materials

The carriage of materials classified as hazardous by the Department of Transportation (DOT) under 49 CFR is strictly prohibited during Part 107 operations unless authorized by exemption.

Rainmaker has obtained authorization to conduct cloud seeding operations with burn-in-place (BIP) or ejectable flares in accordance with an exemption from § 107.36: Exemption No. 25287, Regulatory Docket No. FAA-2025-1630.

Once the sUA is at the targeted altitude and the meteorological conditions are present, the RPIC will actuate the flares via the ground control system. An onboard camera system will verify the successful employment of the flare and will also verify it is completely done operating to ensure safe conditions prior to the descent of the sUA.

In the event the sUA makes an emergency landing and/or uncommanded landing prior to the full extinguishment of the flares, fire extinguishment equipment will be present and used by the ground crew for all flare operations. Due to the lack of extensive, horizontal travel the CONOPS utilizes, the ground crew will be able to expeditiously meet the sUA as soon as it lands in a controlled or uncontrolled manner.

In accordance with the Rainmaker Operator's Knowledge Handbook, the Director of Field Operations is ultimately responsible for the following:

- **Handling & Safety:** Ensuring all personnel strictly adhere to safety protocols, such as using personal protective equipment (gloves, face masks) when handling hazardous materials.
- **Loading & Arming:** Overseeing procedures for the safe mounting and arming of burn-in-place (BIP) and ejectable flares, ensuring they are mounted only just prior to use and never in confined spaces.



Appendix F: Rainmaker Operations Manual - Page 18



Unmanned Operations Manual

- Rejection Criteria: Ensuring crews are trained to inspect and reject any pyrotechnic devices that show visible damage, are expired, or have not been stored in sealed, drop-proof containers.
- Disposal & Environmental Protection: Enforcing proper disposal protocols and ensuring that selected flares utilize short burn times to ensure they are fully extinguished and cold prior to reaching the ground.

2.5.2 Operation of Multiple sUAs

Contingent on waiver approval for § 107.35 Operation of Multiple Small Unmanned Aircraft, Field Teams are authorized to conduct flights where a single operator controls multiple sUAs simultaneously.

2.5.3 Remote Operations

Field Teams are authorized to conduct remote operations if specified in the 107 waiver they intend to operate within.

2.5.4 Weather Balloon Operations

Special consideration and extra precaution must be taken when operating with regard to weather balloons and radiosondes. Each and every Rainmaker site uses compressed hydrogen gas to fill the balloons. Hydrogen gas is extremely flammable and explosive. To ensure the safety of all personnel (operator or visitor), the following are prohibited actions during weather balloon operations:

- Ignition or use of any lighting/heating element or source of heat within 50 feet of a hydrogen cylinder. Examples of lighting/heating elements are:
 - Cigarette lighters
 - Powered vehicles
 - Diesel heater
 - Gas generator
- Smoking within 50 feet of a hydrogen cylinder

In addition, it should be noted that:

- During the winter static electricity may build up. This charge is enough to cause the hydrogen to react. Please discharge before using the hydrogen.
 - To discharge: Before touching the cylinder, touch a grounded metal object (like a pipe or vehicle chassis) with a key, coin, or your knuckles to safely discharge any



Appendix G: C&L 9 Approval - AFS-752



Fowler, Ryan P (FAA)

to me ▾

12:38 PM (4 minutes ago)



Mr. Kim,

The FAA has reviewed the manual(s) submitted by Rainmaker Technology Corporation per Condition and Limitation #9 of Exemption No. 25287 and determined that the Operator's Knowledge Handbook and Unmanned Operations Manual satisfy 49 CFR § 175.9(b)(6)(ii). This email constitutes the FAA's written approval. Rainmaker may now begin operations under Exemption No. 25287, provided it complies fully with all other Conditions and Limitations, associated waivers, and relevant Federal Aviation Regulations. Please retain this email as proof of compliance with Condition and Limitation #9.

Very respectfully,



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