COLORADO
Center of Excellence for Advanced Technology Aerial Firefighting
Division of Fire Prevention & Control

**Prime-Minute PGSU Validation**
Summary Report

Who: Prime-Minute Incorporated and DFPC-CoE
What: Validation Event
When: August 31 through September 4, 2026
Where: High-Lonesome Ranch, Mitchell Parcel (Loma, CO)
Why: To validate the functionality of Prime-Minute Inc.'s Precision Guided Suppression Unit (PGSU) and determine next steps in the Operational Test and Evaluation (OT&E) Process.

**Validation Objectives**:

1. Reduce safety standoff distance ring(s) to an acceptable size for future OT&E use. (Metric-Safety)
2. Confirm Density Altitude's effects on the PGSU. (Metric-Precision)
3. Analyze consistency in Precision and Water Deployment (Metric-Precision).
4. Confirm Emergency Abort System Reliability. (Metric-Safety)

This was the second precision related drop testing conducted in the US (Pendleton, OR, 27-30 JUL 26). The "Safety Ring" for testing was necessarily oversized and should only be reduced through repeated accuracy. Oregon Testing yielded promising results in precision, but that was very close to Sea Level (1,400' MSL) and it was hypothesized that higher Density Altitude (DA)would cause the PGSU to fly differently. Though not a primary metric in the Precision testing, water deployment is analyzed on every drop to establish parameters for Suppression testing in Phase 2 and 3. Finally, confirmation of DA's effects on the Emergency Abort System and confirm the newly incorporated Audible Alarm functionality.

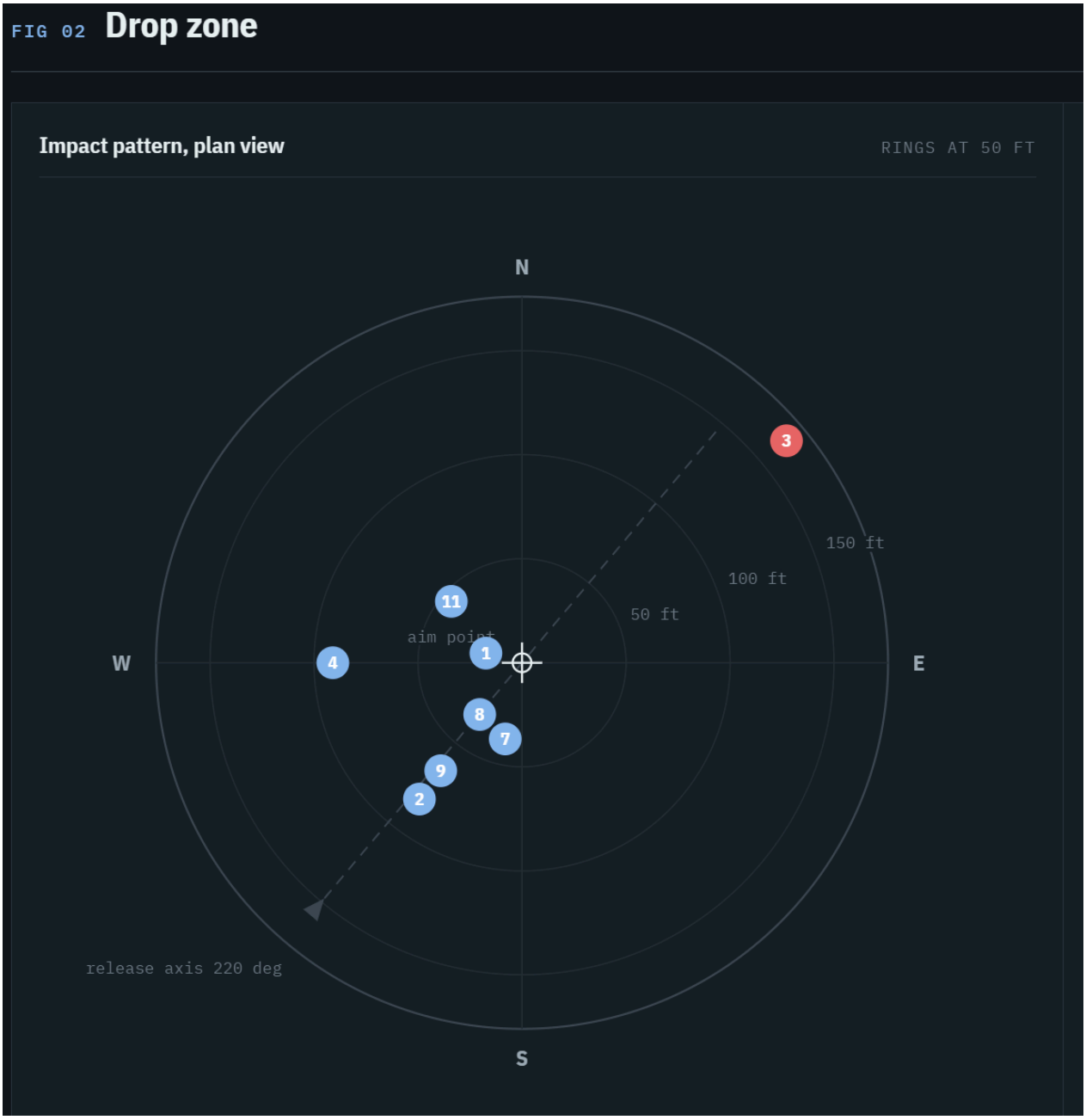
Note: Density Altitude is Pressure Altitude corrected for non-standard Temperature. Higher DAs, like those found in Colorado, affect Aerodynamics and Terminal Velocity Speeds.

**Test Parameters:**
The PGSUs dropped were a mix of US and Israel manufactured, "80%" solutions. The difference being the nose-nozzles have not been incorporated (Phase 2, where we start measuring Suppression). To make up for the difference in weight and Center of Gravity, steel plates are bolted inside the nose of the PGSU to simulate the water that will be used in those nozzles in the future, so the PGSU flies realistically. The other difference for OT&E Activity PGSUs, is the Parachute portion of the Emergency Abort is not incorporated; that system is safety critical and therefore a one-time use feature.

**Summary Results:**
Day 1: 2 PGSUs (Precision) and 1 PGSU Emergency Abort Confirmation.
Day 2: 2 PGSUs (Precision)
Day 3: 5 PGSUs (Precision)

-Closest PGSU to center = 18 feet, farthest = 91 feet
MEDIAN DISTANCE for the entire event = 45 feet

*Polar Plots of actual impacts (excluding Emergency Abort, GNSS Failure, and one structural aileron failure (still under investigation). -Courtesy PMI.*



-The Emergency Abort continues to work as designed, and higher DA had a marginal effect on the parachute drop speed (+/-1.5 m/s). The Audible Alarm was heard from over 1 KM (3,280') away; plenty of time at that drop speed to bring potential people on the ground's attention skyward.

-Density Altitude did influence the PGSU, and the Flight Controller was programmed to make corrections earlier, to allow for desired aerodynamic effects.

1. DA increase means less air density, which means it takes longer to get to Terminal Velocity (Vt) Speed, and the Flight Controller must program against that longer acceleration.

2. Higher DA proved harder for the PGSU to reach Nadir at around 300 feet Above Ground Level (AGL). Nadir ensures the PGSU is perpendicular to the Earth's Surface, and ensures an accurate, repeatable water deployment ring.

Note: High DA may require the incorporation of some sort of Speed Brake system to get the PGSU to Nadir, in addition to the existing airfoil capabilities.

3. DA is something that can be programmed against. Between drop days 2 & 3, they went from a margin of error of about 63' to approximately 45'.

**Other Lessons Learned:**

-GPS Failure. During Day 3's first drop, the aircraft, Drone, and PGSU all lost GPS signal as the PGSU left the aircraft. Even though the PGSU was not under guidance, and didn't have the parachute system, the flight control system did what it was supposed to do (fix the ailerons to achieve nose-down). When the PGSU received GPS signal from the Ground Based system we had projected at the target area, it deployed its water and stayed within 700ft of the 3400ft safety perimeter.

Note: We received a notification days later by email from the UT State Forester's Office that Wildland Aircraft were also having complete GNSS Failures over the previous days/weeks, potentially due to unannounced GPS "Jamming" testing.

-Manufacturing tolerances are different between US and Israel built PGSUs. This manifested in leaking water around welds requiring repair, and overall weakness in the body when the Inflators pressurize the water. This prevents the PGSU from being able to create a large "water cloud" as pressure breaks portions of the welds, and is allowed to escape anywhere but through the nozzles. It also prevents predicable crumple zones from functioning correctly, and leads to a debris field.

*-Proper Crumple Zone and improper water deployment cloud. (Courtesy CoE and PMI)*


-Debris fields are larger if the PGSU does not reach Nadir, and exacerbated in “80%” PGSUs due to physics. The weight of the steel plates in the nose, used to make up for the lack of nose-nozzles for now, “sticks” in the ground and the body is flung in the direction of impact. If the PGSU lands with any angular momentum, the remaining body parts are flung in the direction of impact.

**Recommendation:**
-Reduce the Area of Restricted Clearance (ARC) and establish interim “Danger Ring” around the target area that is based on actual physical properties. Continue to refine this ring by analyzing repeated accuracy in Phase 2-3. This will feed future “minimum stand-off distances” for operational use.

-Precision is the ability to get to the target; we must get there first before we can analyze Suppression. The current 45’ “margin-of-error” with a 35’ radius (70’ diameter) water deployment ring is accurate enough to move forward with Phase 2: Scheduled Fire. It is a larger deviation from lower DA, but learning is taking place. Keep in mind these drops are occurring from an altitude of 4,400’ to 6,000’ AGL. That’s over a mile high in most cases; proof of an understanding of physical laws and their impacts on the PGSU.

*-Side-by-side PGSU thermal and visual water deployment (at 74/110 gallons). (Courtesy CoE & PMI)*

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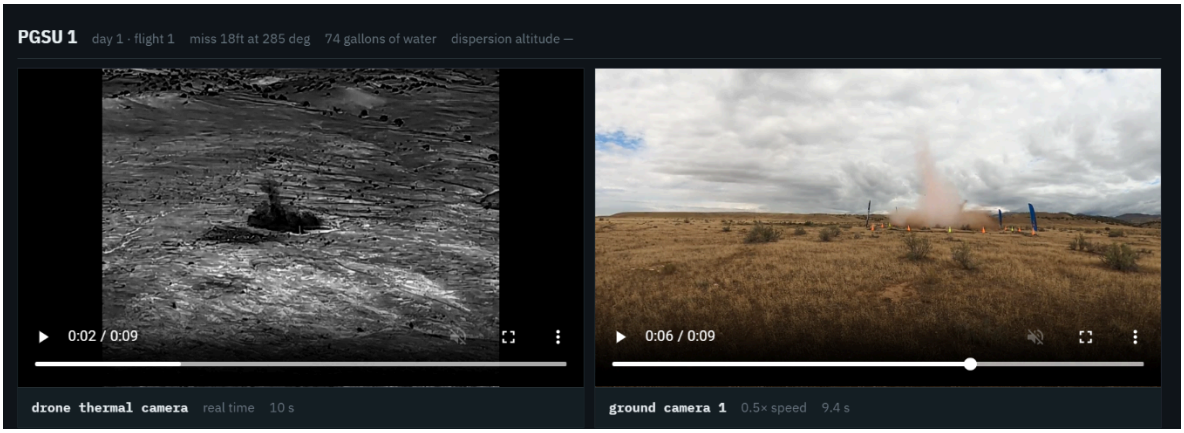


Recommend incorporating nose-nozzles, removing steel ballast plates, and continuing OT&E Activity centered around determining Suppression. Point of Contact for this summary can be reached at Anthony.somogyi@state.co.us.

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