High Altitude Class 3 Filing
Mines Rocket Club

Document prepared by Tom Powell, with information furnished by:

- Will Swegles,
- Ashle Jantzen,
- Caleb Mark,
- Andrew Wu

No certificate may be issued unless a completed application form has been received (14 C.F.R. 91. 101. and 105).

US Department of Transportation
Federal Aviation Administration

APPLICATION FOR CERTIFICATE OF WAIVER OR AUTHORIZATION

From Approved: O.M.B. No.2120-0027 08/31/2019

APPLICANTS - DO NOT USE THESE SPACES

Region	Date

Action
☐ Approved ☐ Disapproved – *"Explain under "Remarks"*

Signature of authorized FAA representative

INSTRUCTIONS

Submit this application in triplicate (3) to any FAA Flight Standards district office.

Applicants requesting a Certificate of Waiver or Authorization for an aviation event must complete all the applicable items on this form and attach a properly marked 7.5 series Topographic Quadrangle Map(s), published by the U.S. Geological Survey (scale 1:24,000), of the proposed operating area. The map(s) must include scale depictions of the flightlines, showlines, race courses, and the location of the air event control point, Police dispatch, ambulance, and fire fighting equipment. The applicant may also wish to submit photographs and scale diagrams as supplemental material to assist in the FAA's evaluation of a particular site. Application for a Certificate of Waiver or Authorization must be submitted 45 days prior to the requested date of the event.

Applicants requesting a Certificate of Waiver or Authorization for activities other than an aviation event will complete items 1 through 10 only and the certification, item 17, on the reverse.

1. Name of organization	2. Name of responsible person
Tripoli Rocketry Association	

3. Permanent mailing address	House number and street or route number	City	State and ZIP code	Telephone No.
	16500 South Golden Road	Golden	CO 80401	

4. State whether the applicant or any of its principal officers/owners has an application for waiver pending at any other office of the FAA.

No members of the applying organization or group have pending wavier applications at any other FAA office.

5. State whether the applicant or any of its principal officers owners has ever had its application for waiver denied, or whether the FAA has ever withdrawn a waiver from the applicant or any of its principal officers/owners.

No members of the applying organization have had waviers denied or withdrawn.

6. FAR section and number to be waived

14CFR101.26(b)6

7. Detailed description of proposed operation *(Attach supplement if needed)*

Launching of Class 3 unmanned rocket into controlled airspace.
Operations to be performed during concurrent Northern Colorado Rocketry launch at their North Site in the Pawnee National Grassland.
NCR Event organizers requested for launch duty administration.
Refer to attached supplemental information for operational parameters.

8. Area of operation *(Location, altitudes, etc.)*

NCR Pawnee North Site, Co Rd 45, Nunn, CO 80648. 40° 53.134'N, 104° 38.322'W EL1665m/5462.6ft MSL

9a. Beginning *(Date and hour)*	b. Ending *(Date and hour)*

10. Aircraft make and model (a)	Pilot's Name (b)	Certificate number and rating (c)	Home address (Street, City, State) (d)

▶ ***ITEMS 11 THROUGH 16 TO BE FILLED OUT FOR AIR SHOW/AIR RACE WAIVER REQUESTS ONLY.***

11. The air event will be sponsored by:

12. Permanent mailing address	House number and street or route number	City	State and ZIP code	Telephone No.

13. Policing *(Describe provisions to be made for policing the event.)*

14. Emergency facilities *(Mark all that will be available at time and place of air event.)*

☐ Physician ☐ Fire truck ☐ Other - Specify _____

☐ Ambulance ☐ Crash wagon _____

15. Air Traffic control *(Describe method of controlling traffic, including provision for arrival and departure of scheduled aircraft.)*

16. Schedule of Events *(include arrival and departure of scheduled aircraft and other periods the airport maybe open.)*

Hour (a)	Date (b)	Event (c)

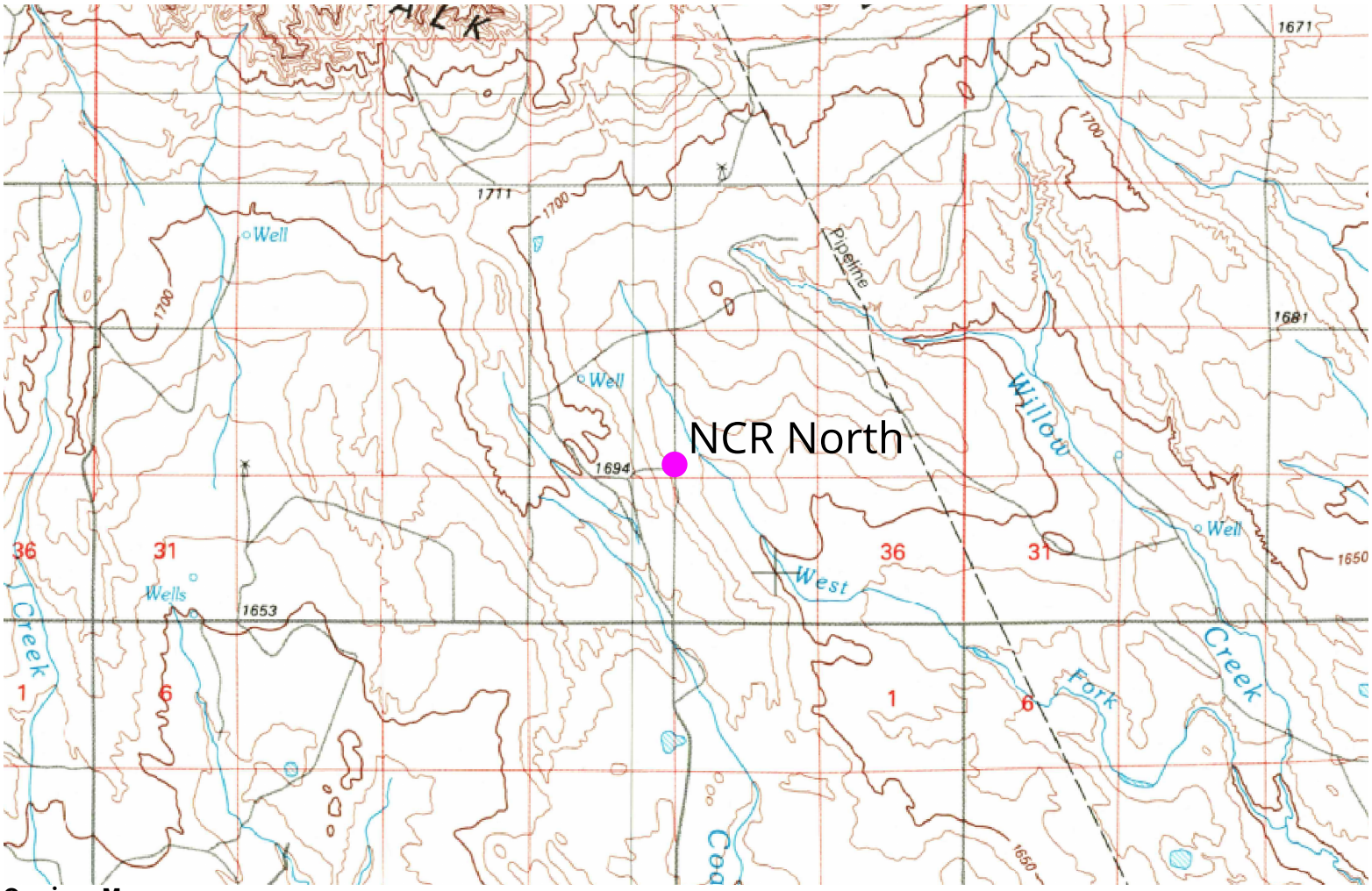
If sufficient space is not available, the entire schedule of events may be submitted on separate sheets, in the order and manner indicated above.

Please Read > The undersigned applicant accepts full responsibility for the strict observance of the terms of the Certificate of Waiver or Authorization, and understands that the authorization contained in such certificate will be strictly limited to the above described operation.

17. Certification - I CERTIFY that the foregoing statements are true.

Date	Signature of Applicant

Remarks

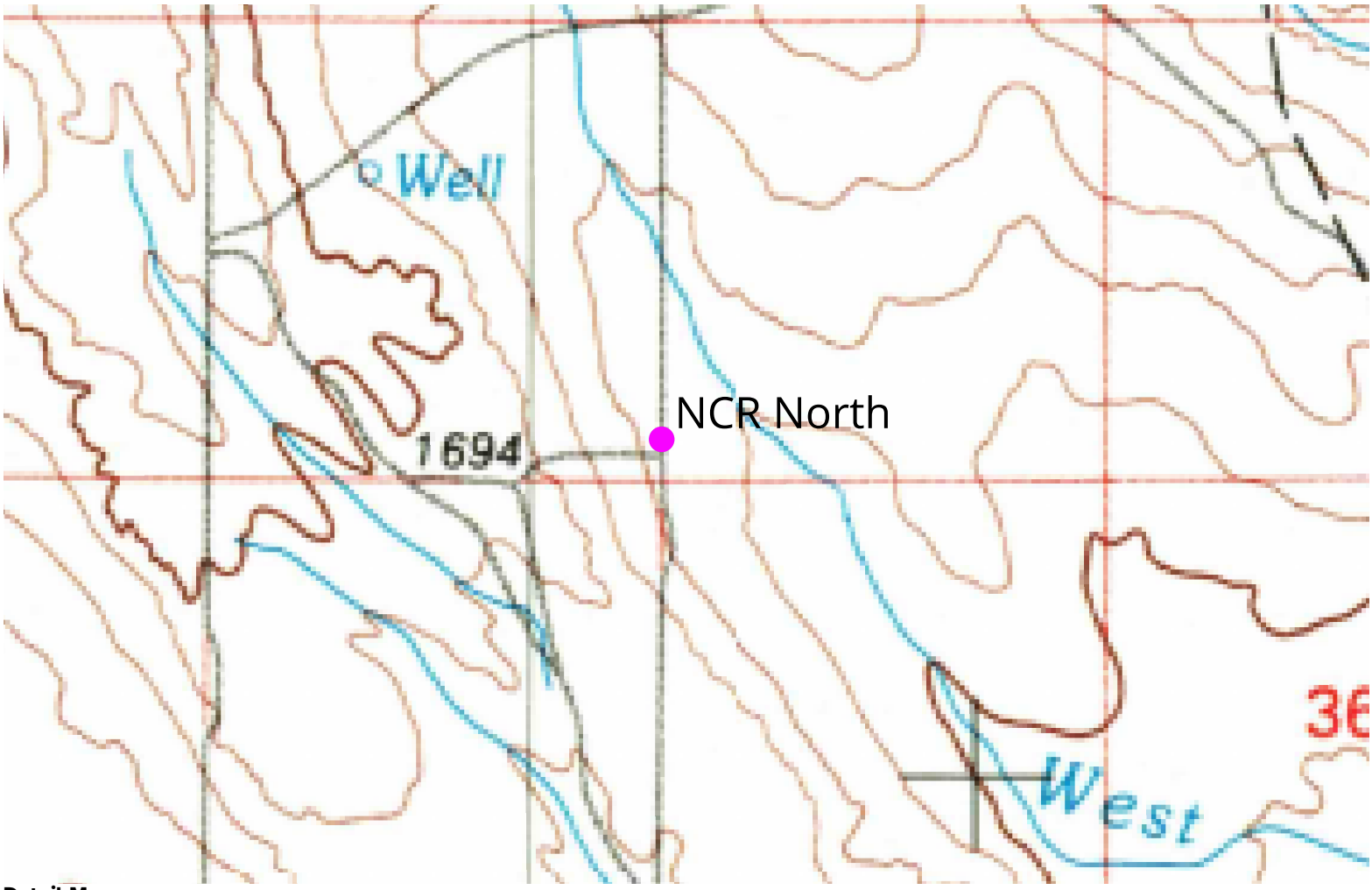


Overivew Map

1 0 1 2 NM

Subregion of USGS Eaton, CO 1:100,000 Topographical Map. Map prepared by T. POWELL on 2024-06-25

1:75,000



Detail Map

0 0.25 0.5 NM

Subregion of USGS Eaton, CO 1:100,000 Topographical Map. Map prepared by T. POWELL on 2024-06-25

1:24,000

Supplemental Information for Item 5, FAA Form 7711-2

1 Description of Systems

1.1 Lower Stage (Booster)

1.1.1 Propulsion

(a) Ammonium Perchlorate Composite Propellant (APCP); 80% solids, 10% Aluminum.

(b) [ ] inches of characterized propellant in [ ] diameter [ ] type grains; phenolic liner, epoxy bonded grains, assembled per OEM instructions.

(c) Characteristics

Table 1: Motor Characteristics, generated with BurnSim version [ ].

Kn: [ ]	Max Pc [ ]	Volumetric Loading: [ ]
Web: [ ]	Burn Time [ ]	Propellant Length: [ ]
Mass: [ ]	Motor Class [ ]	Delivered Isp: [ ]

(d) Motor is [ ] long, [ ] diameter, [ ] wall drawn over mandrel (DOM) tubing, OEM supplied composite nozzle with steel retention cap. The motor is retained into the airframe using head end motor retention, no loading from recovery systems is placed on the retainer-motor interface.

1.1.2 Airframe

(a) Nominal outer body tube diameter of [ ] in, length of [ ] in.

(b) Internal motor retention bulkhead FDM printed from polycarbonate.

(c) Fins constructed from milled & routed [ ] plate.

(d) Fillets made with Smooth-On MT-13 pre-thickened epoxy.

(e) Fin can received [ ] layers of [ ] layup, with alternating weave directions.

1.1.3 Avionics

(a) Motor is ignitied by ground launch control box.

(b) Altus Metrum TeleMetrum (GPS, Barometric, Accelerometer)

(1) Drives stage separation charge.

(2) Drives lower stage recovery deployment charge.

(c) Jolly Logic Chute Release

(1) Ejected by recovery deployment charge with both drogue and main parachutes.

(2) Releases main parachute at [ ] feet AGL.

1.1.4 Recovery

(a) [ ] inch drogue parachute. [ ] feet per second descent rate.

(b) [ ] inch main parachute. [ ] feet per second descent rate.

1.2 Upper Stage (Sustainer)

1.2.1 Propulsion

(a) Ammonium Perchlorate Composite Propellant (APCP); 80% solids, 10% Aluminum.

(b) [ ] inches of characterized propellant in [ ] diameter [ ] type grains; phenolic liner, epoxy bonded grains, assembled per OEM instructions.

(c) Characteristics

Table 2: Motor Characteristics, generated with BurnSim version [ ].

Kn: [ ]	Max Pc [ ]	Volumetric Loading: [ ]
Web: [ ]	Burn Time [ ]	Propellant Length: [ ]
Mass: [ ]	Motor Class [ ]	Delivered Isp: [ ]

(d) Motor is [ ] long, [ ] diameter, [ ] wall drawn over mandrel (DOM) tubing, OEM supplied composite nozzle with steel retention cap. The motor is retained into the airframe using head end motor retention, no loading from recovery systems is placed on the retainer-motor interface.

1.2.2 Airframe

(a) Nominal outer body tube diameter of [ ] in, length of [ ] in.

(b) Internal motor retention bulkhead FDM printed from polycarbonate.

(c) Fins constructed from milled & routed [ ] plate.

(d) Fillets made with Smooth-On MT-13 pre-thickened epoxy.

(e) Fin can received [ ] layers of [ ] layup, with alternating weave directions.

1.2.3 Avionics

(a) Motor is ignitied by ground launch control box.

(b) Altus Metrum TeleMetrum (GPS, Barometric, Accelerometer)

(1) Drives stage separation charge.

(2) Drives lower stage recovery deployment charge.

(c) Jolly Logic Chute Release

(1) Ejected by recovery deployment charge with both drogue and main parachutes.

(2) Releases main parachute at [ ] feet AGL.

1.2.4 Recovery

(a) [ ] inch drogue parachute. [ ] feet per second descent rate.

(b) [ ] inch main parachute. [ ] feet per second descent rate.

2 Operational Properties

2.1 Site Properties

Table 3: Launch Site Parameters

Tower Height	[ ] in
Launch Site Altitude	5462.6 ft MSL
Estimated Landing Site Altitude	5400 ft MSL
Site Longitude	104° 38.322’ W
Site Latitude	40° 53.134’ N
Typical Site Temperature	[ ]
Typical Site Pressure	[ ]

2.2 Maximum Altitude and Maximum Range

2.2.1 Methods

Highest altitude and maximum range simulations were attained using RASAero version [ ] aerodynamic performance data. Wind data was collated from observations recorded at the Eaton, CO[1] weather

[1] EATON 4.3 ENE, CO US

station. Resultant collated data was provided to RS-Pro version [ ].

Table 4: Maximum altitude and range.

Wind State	Launch Orientation	Booster Altitude	Sustainer Altitude	Booster Range	Sustainer Range
No Wind					
Typ. 08:00 Winds					
Typ. 12:00 Winds					
Typ. 16:00 Winds					

2.3 Static Stability Characteristics

Mach Number	C.P. (in)	Stability/Static Margin (calibers)
0.10		
1.0		
2.0		
[ ] (Max + 5%)		

2.4 Dynamic Stability Characteristics

2.5 Mass & Thrust Characteristics

2.6 C_p, C_n, and Drag Characteristics

2.7 C_p, C_g, and Mass Characteristics

2.8 Recovery Dispersion Characteristics

For each of the wind states defined in table 4, recovery dispersion calculations were run.

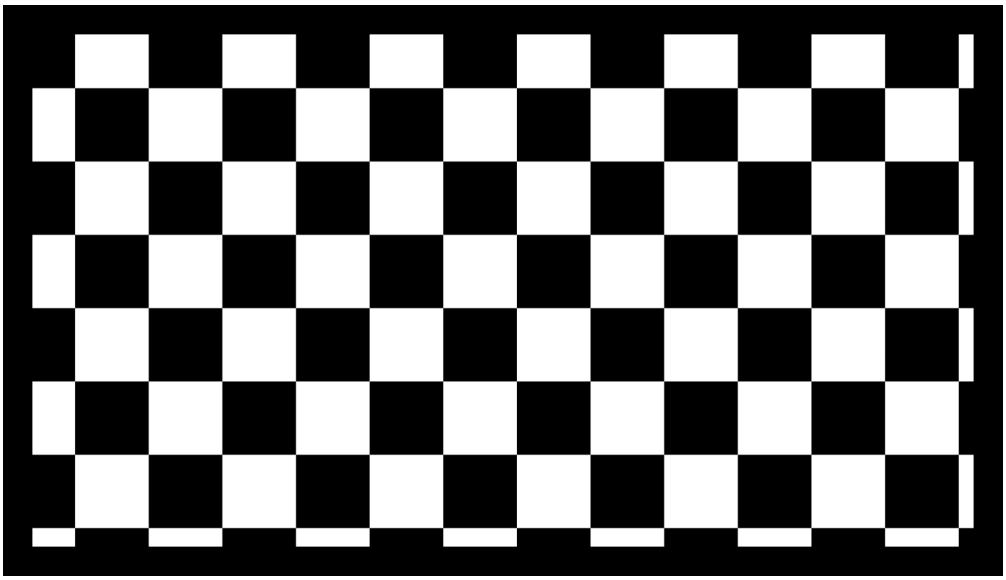


Figure 1: Dynamic stability properties of the system.

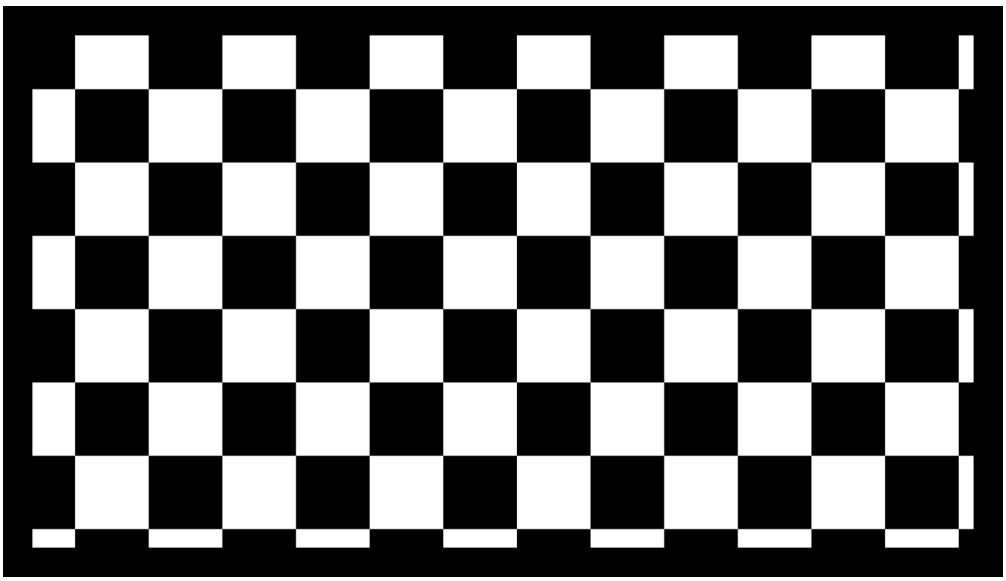


Figure 2: Mass and thrust properties of the system.

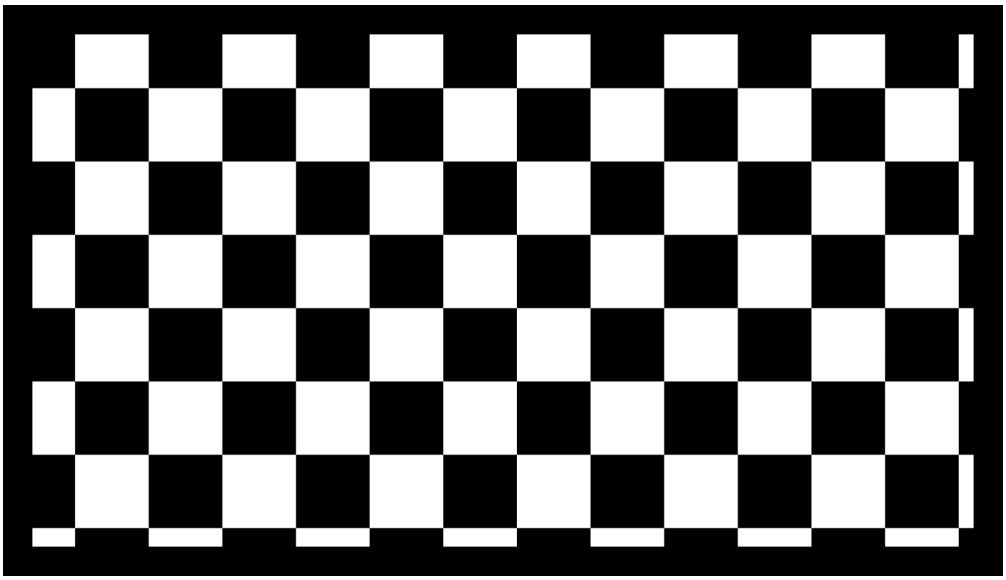


Figure 3: Aerodynamic properties of the system.

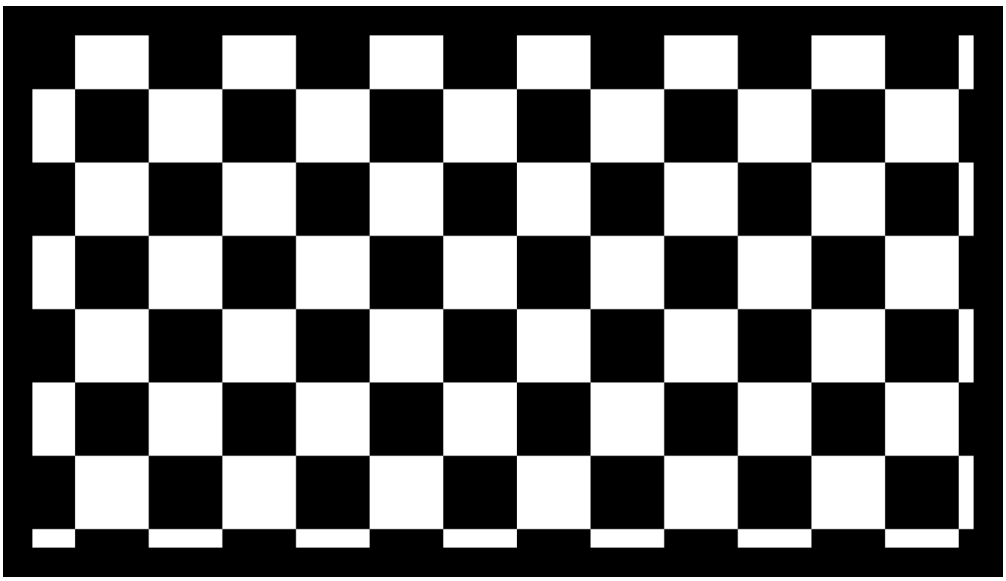


Figure 4: Continued aerodynamic properties of the system.

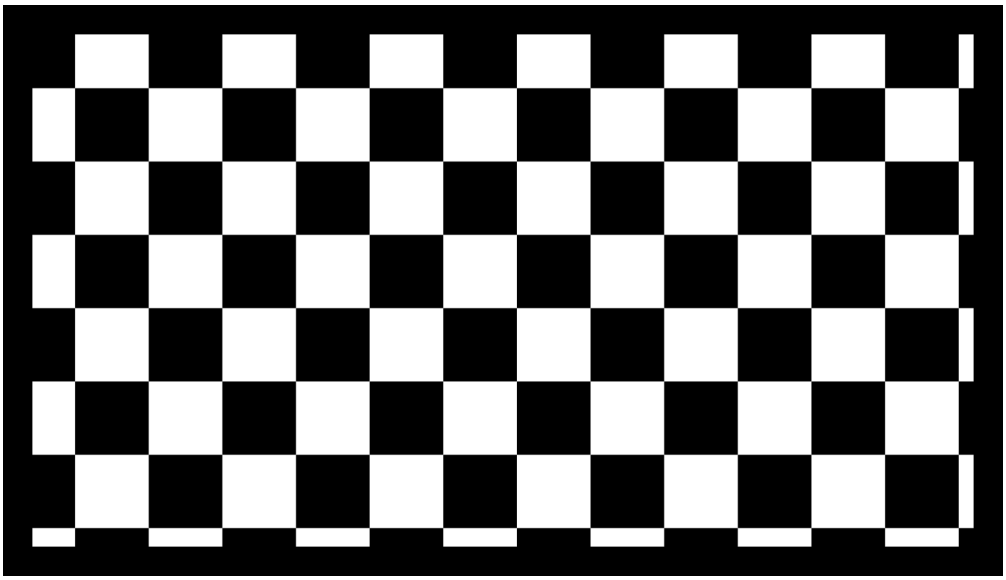


Figure 5: Recovery dispersion with no wind.

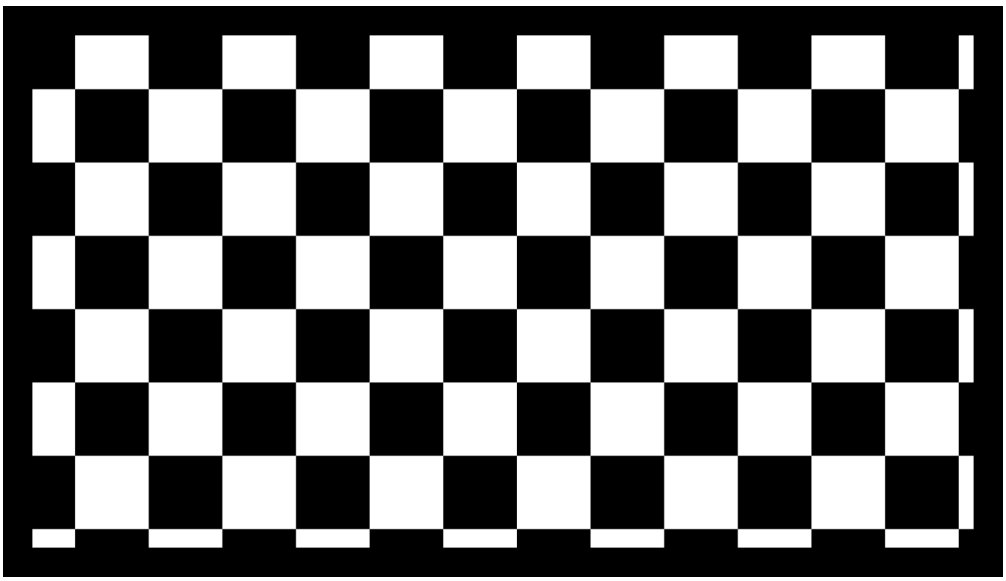


Figure 6: Recovery dispersion with wind typical to 08:00 on the site.

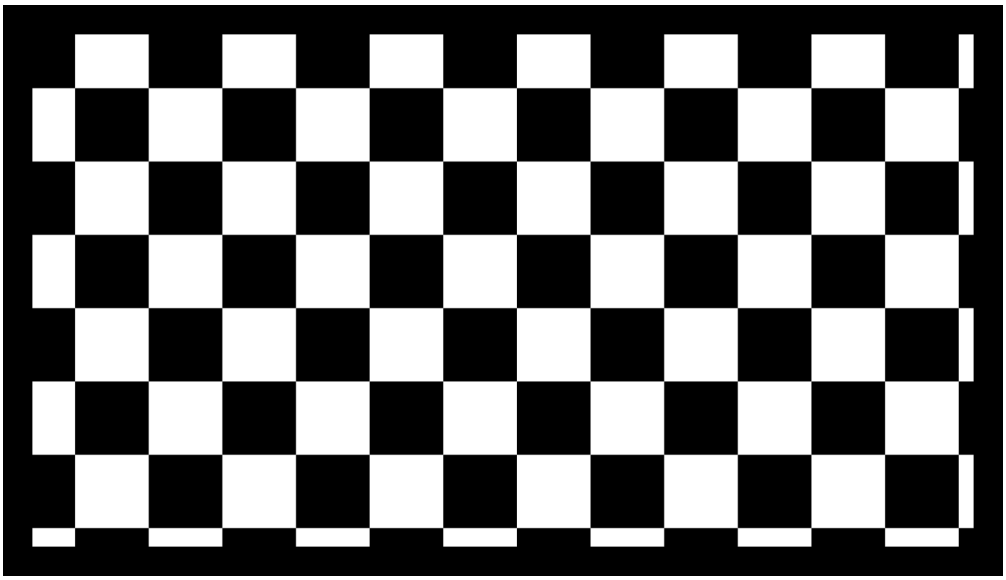


Figure 7: Recovery dispersion with wind typical to 12:00 on the site.

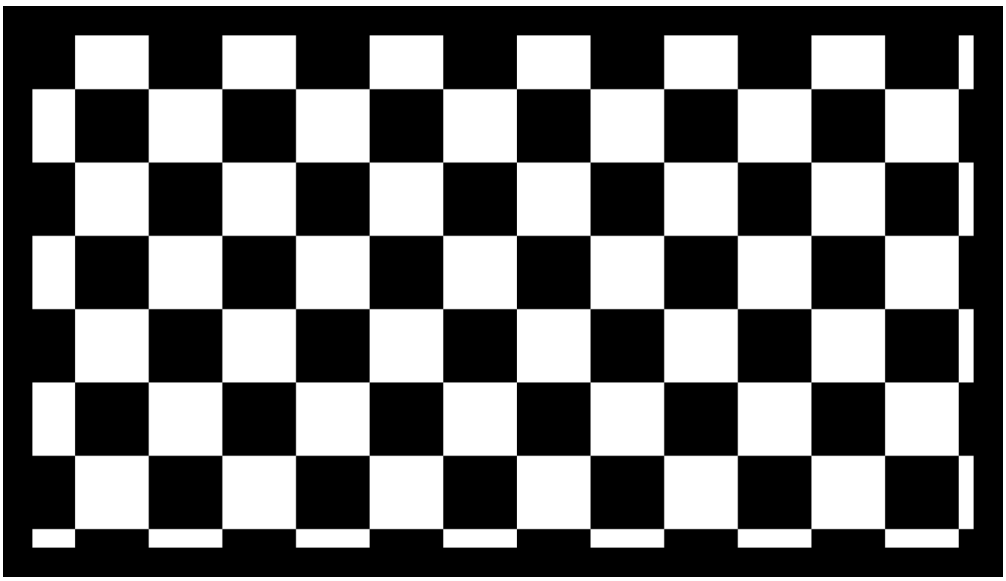


Figure 8: Recovery dispersion with wind typical to 16:00 on the site.

2.8.1 No Wind

2.8.2 Typ. 08:00 Winds

2.8.3 Typ. 12:00 Winds

2.8.4 Typ. 16:00 Winds

2.8.5 1-σ RS-Pro Uncertainties

Table 5: RS-Pro mass property uncertainty

Mass		%
Moments of Inertia		
Center of Gravity		

Mass Properties

Table 6: RS-Pro aerodynamics uncertainty

C_a		%
C_n		%
CP		cal %
Fin Cant		°

Aerodynamics

Table 7: Rs-Pro Propulsion uncertainty

Total Impulse		%
Propellant		%
Thrust Axis		°

Propulsion

Table 8: RS-Pro wind uncertainty

Direction		°
Velocity		fps

Wind

Table 9: RS-Pro launch rail uncertainty

Azimuth	°
Elevation	°

Launch Rail

Table 10: RS-Pro failure likelihood factors.

Ignition	%
C.A.T.O.	%
Deployment	%
Chute Failure	%

Failure Likelihood

3 Supporting Systems

3.1 Radio Communication

To facilitate prompt and resilient communication while on site and performing recovery operations, 10-watt 2-meter band HAM radios will be used. All radios will be operated by persons licensed per 47 CFR 97.503(a). All radios may be operated in a mode to comply with 47 CFR 95.531 through 47 CFR 95.587 for use on FRS channels.

The telemetry enabled systems onboard the rocket operate on the 70-centimeter HAM band. These signals will be received by two offsite 5-element Yagi-Uda antennas with a gain of 6 dbi. Each will be equipped with appropriate computer hardware to interpret the signals.

4 Safety Procedures

(a) Range safety, pre-, during- and post-launch checklists will be used.

(b) Event operators will be alerted to all actions.

(c) The team will communicate readiness to launch to the Launch Control Officer, who will provide setup instructions and decide the order of launches.

(d) The Launch Control Officer will alert event attendees via a public address system.