

Tripoli Rocketry Association Safe Launch Practices – November 2020

Note: The enclosed guidance is condensed and simplified information from NFPA 1127 and the Tripoli Safety Codes. The complete Tripoli policies are available at www.Tripoli.org.

I. All Launches:

- A. Must comply with United States Code 1348, "Airspace Control and Facilities", Federal Aviation Act of 1958 and other applicable federal, state, and local laws, rules, regulations, statutes, and ordinances.
- B. A person shall fly a rocket only if it has been inspected and approved for flight during safety check-in. The flier shall document of the location of the center of pressure and be able to demonstrate the center of gravity of the rocket if requested at safety check-in.
- C. The member shall provide proof of membership and certification status by presenting their membership card during flier registration or during safety check-in as necessary.
- D. A single stage rocket predicted to fly in excess of 75,000 feet AGL or a multiple stage rocket predicted to fly in in excess of 50,000 feet AGL require review and approval in accordance with current Tripoli policies.
- E. Recovery.
 1. Fly a rocket only if it contains a recovery system that will return all parts of it safely to the ground so that it may be flown again.
 2. Install only flame-resistant recovery wadding if wadding is required by the design of the rocket.
 3. Do not attempt to catch a rocket as it approaches the ground.
 4. Do not attempt to retrieve a rocket from a power line or other place that would be hazardous to people attempting to recover it.
- F. Payloads
 1. Do not install or incorporate in a rocket a payload that is intended to be flammable, explosive, or cause harm.
 2. Do not fly a vertebrate animal in a rocket.
- G. Weight Limits
 1. NFPA 1127 requires that the maximum lift-off weight of a rocket shall not exceed one-third (1/3) of the average thrust on the motor(s) intended to be ignited at launch. In most cases, Tripoli recommends that the weight not exceed one-fifth (1/5) of the initial thrust for those motors ignited at launch.
- H. Launching Devices
 1. Launch from a stable device that provides rigid guidance until the rocket has reached a speed adequate to ensure a safe flight path.
 2. Incorporate a jet/blast deflector device if necessary to prevent the rocket motor exhaust from impinging directly on flammable materials.
- I. Ignition Systems
 1. Use an ignition system that is remotely controlled, electrically operated, and contains a launching switch that will return to "off" when released.
 2. The ignition system shall contain a removable safety interlock device in series with the launch switch.
 3. The launch system and igniter combination shall be designed, installed, and operated so the liftoff of the rocket shall occur as quickly as possible after actuation of the launch system. If the rocket is propelled by a cluster of rocket motors designed to be ignited simultaneously, install an ignition scheme that has either been previously tested or has a demonstrated capability of igniting all rocket motors intended for launch ignition within one second following ignition system activation.
 4. A rocket motor shall not be ignited by a mercury switch or roller switch.
- J. Install an ignition device in a high power rocket motor only at the launch pad or in a special preparation area a safe distance away from uninvolved parties.
- K. Launch Operations
 1. Do not launch with surface winds greater than 20 mph (32 km/h) or launch a rocket at an angle more than 20 degrees from vertical.
 2. Do not ignite and launch a rocket horizontally, at a target, in a manner that is hazardous to aircraft, or so the rocket's flight path goes into clouds or beyond the boundaries of the flying field (launch site).
 3. A rocket shall be pointed away from the spectator area and other groups of people during and after installation of the ignition device(s).
 4. Take any photos prior to arming any energetics.
 5. Firing circuits and onboard energetics shall be inhibited until the rocket is in the launching position.
 6. Fully arm recovery systems before inserting igniters into any motors.
 - i. When firing circuits for pyrotechnic components are armed, no person shall be allowed at the pad area except those required for safely arming/disarming.
 - ii. Do not approach a rocket that has misfired until the RSO/LCO/LD has given permission.
 - iii. Always remove igniters from motors before disarming electronics.
 7. Firing circuits and onboard energetics shall be inhibited prior to removing the rocket from the launching position.
 8. Conduct a five second countdown prior to each flight that is audible throughout the launching, spectator, and parking areas.
 9. All flights shall be within a flier's certification level, except certification attempts.
 10. The RSO/LCO may refuse to allow the launch or static testing of any rocket motor or rocket that they deem to be unsafe.

Tripoli Rocketry Association Safe Launch Practices – November 2020

II. Commercial Launches

- A. Use only certified rocket motors.
- B. Do not dismantle, reload, or alter a disposable or expendable rocket motor, nor alter the components of a reloadable rocket motor or use the contents of a reloadable rocket motor reloading kit for a purpose other than that specified by the manufacture in the rocket motor or reloading kit instructions.
- C. Do not install a rocket motor or combination of rocket motors that will produce more than 40,960 N-s of total impulse.
- D. Rockets with more than 2560 N-s of total impulse must use electronically actuated recovery mechanisms.
- E. When more than 10 model rockets are being launched simultaneously, the minimum spectator distance shall be set to 1.5 times the highest altitude expected to be reached by any of the rockets.
- F. When three or more rockets (at least one high power) are launched simultaneously, the minimum distance for all involved rockets shall be the lesser of:
 - 1. The complex distance for the total installed impulse. (refer to table V. Distance Tables)
 - 2. 2000 ft (610 M)
 - 3. 1.5 times the highest altitude expected to be achieved by any of the rockets.
- G. When more than one high power rocket is being launched simultaneously, a minimum of 10 ft (3M) shall exist between each rocket involved.

III. Research Launches

- A. Exclusions / Prohibitions (may be waived on a case by case basis by the BOD):
 - 1. Uncertified black powder-based research motors are prohibited. (including as a composite ingredient, regardless of binder and/or formulation modifications)
 - 2. Uncertified liquid rocket motors, with the exception of nitrous-oxide hybrid rocket motors, are prohibited.
 - 3. So called double-based, triple-based, and micro-grain propellants (including zinc/sulfur propellants) are prohibited.
 - 4. Cases (including hybrid cylinders), front and rear closures, and nozzles shall not be fabricated of steel or other frangible materials (e.g. PVC).
 - 5. Research motors shall not be used for certification flights.
- B. All flights and static tests that use research motors shall be conducted by Tripoli members who are Tripoli certified level 2 or higher.
- C. A rocket with more than 40,960 N-s of total impulse requires review and approval by the TRA Class 3 Committee.
- D. Rockets that employ passive recovery (e.g. tumble recovery, aero-braking) need not employ an electronically actuated recovery system.
- E. Each rocket participating in a mass launch (more than 3 rockets simultaneously) shall be at least the safe distance for that rocket's total installed impulse. (If the Mass Launch includes a NAR only participant, this section does not apply. The requirements of II.E, II.F .and II. G. above would apply)
- F. Launch Directors have the authority to restrict participation and access at Research Launches in **addition** to the allowances below.

IV. Participation / Access

Individual Description	Commercial Launch		Research Launch	
	Model Rocket Area	High Power Area	Model Rocket Area	High Power Area
Tripoli Senior Member	Participate	Participate	Participate	Participate
Adult Members of the National Association of Rocketry (NAR only) flying in the US or Canada	Participate	Participate	Commercial Motors	Commercial Motors
Tripoli Junior members that have completed the Tripoli Mentoring Program training	Supervised*	Supervised	Supervised*	Supervised
Non Tripoli members age 18 and over that are students of an accredited educational institution	Supervised*	Supervised	Supervised*	Supervised
Non-member Volunteers (only if approved by Prefect, RSO, or Launch Director)	Range Duty	Range Duty	Range Duty	Range Duty
Children younger than 18 years of age	Supervised*	No	Supervised*	No
Invited guests of fliers	Supervised	No	Supervised	No
Spectator (Non-invited guest)	No	No	No	No

Note – Supervised* means a single Adult Flier can provide direct supervision of up to 5 of the identified individuals.

Note – Supervised means a single HPR Flier can provide direct supervision of up to 5 of the identified individuals.

Tripoli Rocketry Association Safe Launch Practices – November 2020

V. Distance Tables

Rocket's Total Installed Impulse, Newton Seconds (N-s)	Motor type	Minimum Clear Distance				Minimum Launch Site Dimensions (diameter or shortest dimension), feet (The larger of 1/2 of the waived altitude or)		Minimum Safe Distance, Commercial Launch				Minimum Safe Distance, Research Launch			
		Regular		Sparky				Non-Complex		Complex		Non-Complex		Complex	
		ft	m	ft	m			ft	m	ft	m	ft	M	ft	m
0.01 to 160.00	A-G*							30	9	30	9	50	15	50	15
160.01 to 320	H	50	15	75	23	1,500	457	100	30	200	61	200	61	250	76
320.1 to 640.00	I	50	15	75	23	1,500	457	100	30	200	61	200	61	250	76
640.01 to 1280.00	J	50	15	75	23	1,500	457	100	30	200	61	200	61	250	76
1,280.01 to 2,560	K	75	23	113	36	1,500	457	200	61	300	91	250	76	350	96
2,560.01 to 5,120	L	100	30	150	45	1,500	457	300	91	500	152	300	91	500	152
5,120.01 to 10,240	M	125	38	200	61	1,500	457	500	152	1,000	305	500	152	1,000	305
10,240.01 to 20,480	N	125	38	200	61	2,000	610	1,000	305	1,500	457	1,000	305	1,500	457
20,480.01 to 40,960	O	125	38	200	61	3,000	915	1,500	457	2,000	610	1,500	457	2,000	610
40,960.01 to 890,000	P-T	125	38	200	61	3,000	915	N/A		N/A		2,000	610	2,500	762

*Distances for commercial Model Rocket Motors. High Power 'F' and 'G' Motors (exceeding the limits in the definition of Model Rocket Motor) shall be flown at the 'H' distance.