



Safety Code

Introduction

This document combines and revises the Tripoli High Power Safety Code, the Tripoli Research Safety Code, rules for Model Rockets, and Radio-Controlled Rocket Boost Gliders when used at Tripoli Launches.

This document either meets or exceeds NFPA 1122 and 1127 with respect to commercial motors without forcing our members or Prefects to have a current copy of the NFPA codes.

As needed, the Tripoli Board of Directors (BoD) will announce updates that shall be considered official even before a new version is published.

1 General Conditions

1-1 Scope

- 1-1.1 This code shall govern the actions of Tripoli members at any launch.
- 1-1.2 This code shall govern the actions of all people at a Tripoli Launch.
- 1-1.3 This code does not relieve a member or a Prefecture of any legal obligations established by stricter regulations adopted by an AHJ.

1-2 Purpose

- 1-2.1 The purpose of this code is to establish guidelines for the reasonably safe operation of rockets at Tripoli Launches.

2 Legality

- 2-1 The Tripoli Rocketry Association does not represent that rocketry is legal everywhere and urges its members to become familiar with local regulations.

3 Operating Clearances

- 3-1 A Tripoli member shall fly a rocket only in compliance with the more restrictive of the following:
 - 3-1.1 Tripoli Safety Code (this document);
 - 3-1.2 The regulations controlling airspace for the country where the launch is held. For example, in the United States airspace use must comply with Federal Aviation Administration Regulations, Part 101 (Section 307, 72 Statute 749, Title 49 United

States Code, Section 1348, "Airspace Control and Facilities," Federal Aviation Act of 1958). Other countries will have their own sets of regulations;

- 3-1.3 Other applicable federal, state, and local laws, rules, regulations, statutes, and ordinances. Because of the large number of AHJs, including these would be impractical for Tripoli Rocketry Association. It is the responsibility of every Tripoli member to know and understand the local regulations.

4 Insurance

- 4-1 Tripoli insurance coverage is based on operations which follow the requirements of the Safety Code.

5 Units

- 5-1 Units of length within this document are expressed in both metric (S.I.) and English units. Although an effort has been made to maintain equivalency, the conversion is not precise. For example, the safe distance to Spectators for a Model Rocket launch is listed as 50 feet or 15 meters. Please use whichever system of measurement system is regionally used without concern that the two measurements are not equivalent. The Launch Director and RSO may always exceed the distances shown in the Safe Distance Table.

6 Access

Access at Tripoli Launches shall be limited to the following:

- 6-1 The RSO and Launch Director are authorized to further restrict access to any range area in addition to the limits listed below.
- 6-2 As a condition of being granted range access, Insured Fliers shall provide proof of membership and certification status whenever requested by Range Personnel.
- 6-3 An Adult Flyer may access the High Power Launch Area and Model Rocket Launch Area.
- 6-4 Tripoli or NAR Junior members who have completed the TMP or NAR Junior L1 process may access the High Power Launch Area under the direct supervision of an HPR Flier under the rules of the applicable program.
- 6-5 Insured fliers under 18 may conduct flights from the Model Rocket Launch Area.
- 6-6 Launch Directors and RSOs may allow uninsured persons under 18 years of age to fly Model Rockets from the Model Rocket Launch Area as part of an organized Tripoli Launch under the supervision of an Adult Flier. Parents or guardians of these uninsured persons must sign liability waivers as a condition of participation.
- 6-7 Range Personnel may access any portion of the range as directed by the Launch Director or RSO.
- 6-8 A responsible adult may be designated as Range Personnel to help a flier upon approval of the RSO.
- 6-9 Spectators may not access the High Power Launch Area or Model Rocket Launch Area.

7 General Range Operation Rules

- 7-1 Although Tripoli Launches involve several layers of safety rules which are intended to increase safety, FLIERS ARE ULTIMATELY RESPONSIBLE FOR THEIR ROCKET AND FLIGHT, including but not limited to the following:
- 7-1.1 Construction; rockets shall be built using lightweight materials, such as paper, wood, plastic, rubber, or when necessary ductile lightweight metals, and construction techniques that are suitable for the planned flight.
 - 7-1.2 Stability; the flier shall document the location of the center of pressure and be able to demonstrate the center of gravity.
 - 7-1.3 Every rocket shall include a recovery system sufficient to allow the rocket to land at a safe velocity. (See Recovery)
 - 7-1.4 The thrust-to-weight ratio of a rocket typically should be at least 5:1. However, the RSO may approve a thrust-to-weight as low as 3:1 ratio. Initial thrust-to-weight ratios lower than 3:1 may only be authorized by an RSO if an active stability system is included.
 - 7-1.5 Range Personnel designated by the RSO shall inspect all rockets flown at Tripoli Launches. Only rockets approved for flight as a result of this inspection process shall be allowed to fly. The inspection shall minimally consist of verification of the following:
 - 1 Adequate construction methods
 - 2 Positive stability or acceptable glider trim.
 - 3 Appropriate recovery system.
 - 4 Sufficient Thrust to Weight ratio (see requirement above 7-1.4).
- 7-2 While installing an igniter and at all times afterward, the rocket must remain pointed in a safe direction (away from all people.)
- 7-3 Rockets must launch from a stable platform which guides the rocket in a safe direction until it has reached the velocity necessary for stable flight.
- 7-4 Rockets shall not be intentionally launched over the flight line.
- 7-5 When needed, blast deflectors must be used to prevent damage or reduce the risk of fire.
- 7-6 Blast deflectors shall be oriented such that any ejected motor parts shall not endanger people.
- 7-7 Launch Control Systems used at Tripoli Launches shall:
- 7-7.1 Include an arming switch with a removable key or interlock, which disables the entire launch control system when removed.
 - 7-7.2 Use a momentary switch to command the rocket motor ignition.
 - 7-7.3 Only be used with rockets which they can safely and quickly ignite.

- 7-8 The motor igniter shall not be connected to the launch system until all other flight electronics are active.
- 7-9 Rockets flown at Tripoli Launches may not carry any of the following:
 - 7-9.1 Vertebrate animals
 - 7-9.2 Hazardous Payloads including those which are poisonous, flammable, incendiary, or explosive.
- 7-10 Range activity shall cease whenever a thunderstorm has been detected within ten miles (16 kilometers) of the launch site.
- 7-11 Spectators shall follow all directives by launch personnel. Failure to comply will result in being required to leave.
- 7-12 The use of alcohol or any substance that could affect judgment or response to hazardous situations is prohibited for all persons in attendance at a Tripoli Launch operation.
- 8 Launch Director and Range Safety Officer (RSO)
 - 8-1 The Launch Director or RSO may refuse to allow the launch or static testing of any rocket or rocket motor.
 - 8-2 The Launch Director or RSO may require greater safe distances than specified in the Safe Distance Table.
 - 8-3 RSO decisions pertaining to safety are final and may not be overridden by any other Range Personnel, including the Launch Director.
 - 8-4 Except for decisions pertaining to safety, Launch Director decisions are final and may not be overridden by any other Range Personnel.
 - 8-5 Launch Director and RSO duties may be combined and performed by one person. Examples of when this might be done are at very small launches or at launches where responsibilities have been designated to others and the Launch Director and RSO duties are mostly supervisory.
- 9 LCO Responsibilities
 - 9-1 The LCO shall not launch a rocket that has not been clearly announced.
 - 9-2 The announcement shall include a countdown that lasts a minimum of 5 seconds.
 - 9-3 No rockets shall launch when the sustained surface winds exceed 20 MPH (32 KPH).
 - 9-4 Rockets shall not be launched in any way that could interfere with aircraft operations.
 - 9-5 No rocket shall be intentionally launched through any altitude with greater than 50% cloud coverage.
 - 9-6 No rocket shall be intentionally launched into or through a cloud.
 - 9-7 Special LCO responsibilities exist for R/C RBG. Please refer to section 14-1

10 Motor Limitations

- 10-1 Only the following motors may be flown at Tripoli Launches:
 - 10-1.1 Certified Motors
 - 10-1.2 Research Motors
 - 10-1.3 Demonstration Motors
 - 10-1.4 Commercial Class 3 Motors
- 10-2 Decertified Motors may not be flown at a Tripoli Launch.
- 10-3 Tripoli members may not test or fly motors at a Tripoli Launch, which exceed their High Power Certification level except Certified Motors flown as a certification flight.
- 10-4 Demonstration Motors and Commercial Class 3 Motors require prior approval by the Launch Director and/or RSO before being flown or static tested at a Tripoli Launch.
- 10-5 Demonstration Motors may be flown or tested by the manufacturer, a vendor, an employee of the manufacturer, or by a flier, but may not be sold to a flier.
- 10-6 Research Motors which have been sold for a profit may not be used at a Tripoli Launch.
- 10-7 All test firings shall be done vertically or parallel to the flight line such that the axis of the motor does not point towards people.
- 10-8 Only the following types of propellants are allowed to be used in Research Motors at Tripoli launches. All other propellants are prohibited except as allowed by 10-8:
 - 10-8.1 Solid propellants as listed below.
 - 1 Composite propellants using one or more inorganic oxidizers dispersed in a carbon-based polymer binder.
 - 2 Sugar propellants using potassium nitrate as the primary oxidizer and the following sugars or sugar alcohols as primary fuel: Dextrose, Erythritol, and/or Sorbitol.
 - 10-8.2 Hybrid motors which use nitrous oxide as the oxidizer.
- 10-9 Other motor types may be allowed by the Board of Directors following review and recommendation by the Tripoli Research Committee.
- 10-10 10-10 Case Components used in Research Motors
 - 10-10.1 Metallic cases shall be made of non-ferrous ductile metals such as 6061 aluminum alloy.
 - 10-10.2 Non-metallic cases shall not be made of brittle materials which may rupture into sharp shards, such as PVC.
 - 10-10.3 Forward closures shall not be made of ferrous materials.
 - 10-10.4 Minor components such as snap rings, nozzle washers, rear closures, and seal disks may be made of ferrous materials.

10-10.5 Nozzles for Sugar Motors may be made of steel as long as the throat of the nozzle is recessed within the case.

11 Recovery

- 11-1 A rocket shall be launched only if it has a recovery system designed to return all parts of the rocket to the ground safely and at a landing speed not to exceed 35 feet/second (11 meters/second). Higher landing speeds may be approved by the BoD before the flight.
- 11-2 Rockets that employ passive recovery (e.g. tumble recovery, aero-braking) need not employ an active recovery system.
- 11-3 Only fire resistant wadding may be used.
- 11-4 No attempts shall be made to retrieve a rocket from a power line.
- 11-5 No attempt should be made to catch a rocket.
- 11-6 Any rocket with a total installed impulse exceeding 2560 Ns must have an electronically controlled recovery system which does not rely upon the motor to eject the recovery system.

12 Model Rocket Rules

- 12-1 A Model Rocket may not be launched more than 30° from vertical.
- 12-2 Only Model Rocket Motors shall be flown from the Model Rocket Launch Area. Model Rocket Motors may be flown from the High Power Launch Area.
- 12-3 The minimum distance to Range Personnel when Model Rockets are launched shall be 30 feet.
- 12-4 The minimum distance to any Spectator when Model Rockets are launched shall be 50 feet.
- 12-5 Model Rocket Drag Races
 - 12-5.1 Whenever ten or more Model Rockets are included in a Drag Race, use a Safe Distance equal to 1½ times the highest anticipated altitude.

13 High Power and Class 3 Rules

- 13-1 Except for certification flights, all flights and static motor tests conducted at a Tripoli Launch shall be conducted within the flier's current certification level.
- 13-2 Certification flights may only be made using Certified High Power Motors.
- 13-3 High Power Rocket Motors and Class 3 Rocket Motors may only be flown from the High Power Launch Area.
- 13-4 Only Tripoli members who are Certified Level 2 or higher may fly or test motors that are not certified.
- 13-5 All flights that may exceed 100,000ft AGL or are FAA Class 3 shall be submitted to the Class 3 Review Committee for analysis before being allowed to fly at a Tripoli Launch.

- 13-6 A High Power Rocket must be launched no more than 20° from vertical.
- 13-7 Igniters shall not be installed in High Power Rocket Motors except at the pad or at special preparation area away from all uninvolved people.
- 13-8 Electronic recovery or devices shall remain inhibited until the rocket has been raised to launch position but before the launch igniter is connected to the launch control system.
- 13-9 Staging devices, if any, shall be armed after recovery devices but before the launch igniter is connected to the launch system.
- 13-10 Where possible, igniters must be removed and all sources of ignition must be disarmed before lowering a rocket from launch position.
- 13-11 A mercury switch or roller switch shall not trigger the ignition of a rocket motor.
- 13-12 All High Power Rockets shall be flown from the distances set forth in the Safe Distance Table.
- 13-13 High Power Drag Races
 - 13-13.1 When three or more High Power Rockets are included in a Drag Race, the safe distance used shall be determined by summing the total impulse of all installed motors in the Drag Race and then adhering to the complex rocket safe distance for that total impulse.
 - 13-13.2 During a Drag Race, all people who are on the range shall pause and watch the Drag Race until the participating rockets are confirmed to pose no hazard.
- 13-14 Flammable Material Distances
 - 13-14.1 Smoking or vaping is prohibited within 25 feet (8 meters) of any pyrotechnic material or solid propellant.
 - 13-14.2 The area around each launch pad must be cleared of flammable materials to the following radius. For sparkies increase distance by 50%:
 - 1 Up to J impulse: 25 feet/7.5 meters
 - 2 K impulse: 37.5 feet/11.5 meters
 - 3 L impulse: 50 feet/15 meters
 - 4 M-O impulse: 62.5 feet/19 meters
- 13-15 The Launch Director or RSO may allow range safety personnel to be half the distance specified by the Safe Distance Table (13-17) below only when necessary for safe range operations. This only applies to actual range safety personnel necessary for safe range operation, not Spectators or photographers.

13-16 Launch Site Criteria

13-16.1 The minimum distance from a launch site to any person or property not associated with the operation must be the greater of the following:

- 1 Not less than one-quarter the maximum expected altitude, or
- 2 457 meters (1,500 ft.).

13-17 Safe Distance Table

Safe Distance Table

Motor Designation	Total Installed Impulse Newton-seconds		Single Motor		Complex	
			feet	meters	feet	meters
A-G	0.01	160	50	15	50	15
A-G Class 1 HP*	0.01	160	100	30	200	60
H-J	160.01	1,280	100	30	200	60
K	1,280.01	2,560	200	60	300	90
L	2,560.01	5,120	300	90	500	150
M	5,120.01	10,240	500	150	1,000	300
N	10,240.01	20,480	1,000	300	1,500	460
O	20,480.01	40,960	1,500	460	2,000	610
P-T	40,960.01	889,600	2,000	610	2,500	760

*Class 1 High Power are motors which fall into the Class 1 impulse range, but are regulated as High Power motors because they have greater than 80 Newtons average thrust, contain metal particles to make them sparkies, or contain more than 125 grams of propellant.

14 Radio-Control Boost Rocket Glider Rules (R/C RBG)

14-1 Before launch, the pilot and LCO shall have the following coordinated responsibilities:

- 14-1.1 The pilot shall verify that the glider's radio system is configured and functioning correctly before signaling the LCO that the R/C RBG is ready to launch.
- 14-1.2 The LCO will coordinate with the pilot when to launch the model, remaining alert to possible hold calls from the pilot.

14-1.3 Pilots may launch their models with their own launch controller if the LCO allows.

14-2 Radio Control.

14-2.1 Fliers may only use radio equipment and frequencies approved for radio control of flying models by the agency with regulatory approval of radio frequency usage (i.e., FCC in the United States).

14-2.2 Before every flight, fliers shall check the equipment used for radio control for interference and test to ensure proper operation.

14-2.3 If necessary, each flier shall be responsible for frequency coordination with other fliers at the site.

14-3 R/C RBG Flight Operations

14-3.1 Gliders shall be properly trimmed for safe rocket boost operations.

14-3.2 Gliders shall be safe and controllable for glide operations

14-3.3 Test or first flights of an R/C RBG shall be launched at least 100 feet farther than required by the safe distance table for the installed total impulse.

14-3.4 All flights shall avoid overflying the Spectator Area.

14-3.5 In the event of an apparent failure to ignite, the pilot should remain alert and ready to control the R/C RBG until the possibility of a hang-fire has been cleared, any air start electronics have been disarmed, and the ignition system has been disabled.

14-3.6 A flier may air-start a motor attached to an R/C RBG to climb or accelerate without diving under the following conditions:

- 1 The R/C RBG must be gliding stably,
- 2 The onboard R/C ignition system is designed not to be triggered accidentally,
- 3 The onboard R/C ignition system is not armed until the model is on the pad with the radio system turned on and proper operation is verified,
- 4 The proposed airstart was reviewed and approved by the RSO prior to launch,
- 5 The model heading is not toward Spectators, and
- 6 The model is at least 100 feet above the launch site.

14-3.7 An R/C RBG may not be launched at an angle exceeding 30° from vertical except an R/C RBG capable of having its flight path safely controlled during rocket boost may be launched at angles up to 45° from vertical.

14-3.8 All R/C RBG flights must be launched parallel to or away from the flight line.

15 Definitions

For the purposes of this code, the following terms shall be defined as stated in this section. Words or phrases which have been defined will appear in italics within the code requirements.

Adult Flier: An Insured Flier who is 18 years old or older.

AHJ: Authority Having Jurisdiction – a legal term referring to an entity which has authority to enforce specific rules or regulations such as FAA, a Fire Marshall, or a Sheriff's Department.

Amateur Rocket: As defined in 14 CFR Part 1, section 1.1, an Amateur Rocket is defined as an unmanned rocket that:

1. Is propelled by a motor or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less; and
2. Cannot reach an altitude greater than 150 kilometers (93.2 statute miles) above the earth's surface.

Certified Motor: A motor which has been certified by TMT or a motor certification organization officially recognized by TMT. Only High Power Rocket Motors or Model Rocket Motors are certified.

Class 3 Rocket: Also referred to as an Advanced High Power rocket by FAR 101.23, a Class 3 Rocket is one which contains a motor or combination of motors having a combined total impulse greater than 40,960 Newton-seconds of impulse but less than 889,600 Newton-seconds.

Class 3 Rocket Motor: A rocket motor which has a total impulse greater than 40,960 Newton-seconds but less than 889,600 Newton-seconds.

Commercial Class 3 Motor: Commercial product of a Recognized Manufacturer.

Complex Rocket: A rocket containing multiple rocket motors.

Composite Rocket Motor: A Solid Propellant containing an oxidizer and a fuel consisting of a polymer binder with other additives such as metal particles, opacifiers, and catalysts.

Decertified Motor: A rocket motor which was certified by TMT or one of the organizations officially recognized by TMT, but which has had its certification revoked for some safety related cause.

Demonstration Motor: An Uncertified Motor which is under development as a Model Rocket Motor or High Power Rocket Motor or a Commercial Class 3 Motor which is a commercial product that falls outside the scope of NFPA 1125. Demonstration motors must be manufactured by a TMT recognized rocket motor manufacturer.

Drag Race: The intentional launching of multiple rockets at the same time.

High Power Certification: A process established by Tripoli or a rocketry organization recognized by Tripoli to approve an adult to fly High Power Rockets and Class 3 Rockets.

High Power Certified (Certified): A person who has successfully completed High Power Certification is Certified.

High Power Rocket: Also referred to as a Class 2 rocket by FAR 101.22, a High Power Rocket is an Amateur Rocket other than a Model Rocket that contains a motor or motors having a combined total impulse of 40,960 Newton-seconds or less.

High Power Rocket Flier (HPR Flier): An Adult Flier who is Certified to fly High Power Rockets.

High Power Launch Area: A restricted access location on the range where High Power Rockets are finally prepared, armed, and launched.

High Power Rocket Motor: A motor which meets any of the following criteria:

1. Exceeds 80 Newtons average thrust, or
2. An impulse greater than 160 Newton-seconds up to 40,960 Newton-seconds (upper limit of an O motor), or
3. Which has had metal particles added to intentionally create a shower of sparks effect.

Hybrid Motor: A special type of High Power Rocket Motor which combines liquid nitrous oxide with solid fuel to provide thrust.

Insured Flier: A flier at a Tripoli Launch who is covered by an insurance policy that is acceptable to Tripoli. Note: Associate and Honorary classes of Tripoli membership do not include insurance.

Launch Control Officer (LCO): A Certified flier who operates the launch control system and has immediate responsibility for launch safety. The LCO reports to the Launch Director.

Launch Director (LD): The person who has overall administrative responsibility for the launch.

Model Rocket: Also referred to as a Class 1 rocket by FAR 101.22, a Model Rocket is an Amateur Rocket that:

1. Uses no more than 125 grams (4.4 ounces) of propellant;
2. Uses a slow-burning propellant;
3. Is made of paper, wood, or breakable plastic;
4. Contains no substantial metal parts; and
5. Weighs no more than 1,500 grams (53 ounces), including the propellant.

Model Rocket Flier: A person who is only authorized to fly Model Rockets.

Model Rocket Launch Area: A restricted access location where Model Rockets are launched.

Model Rocket Motor: A Certified Motor meeting the following limitation:

1. Average thrust must not exceed 80 Newtons,
2. Impulse must be G or less,
3. Not a sparky, and
4. Contains 125 grams or less of propellant.

Special Note for Tripoli Launches: Because the current FAA definition of a Model Rocket is based on propellant weight rather than impulse, it's possible to have a Class 1 rocket ("Model Rocket") that contains a High Power Rocket Motor, an H motor with less than 125 grams of propellant. That does not mean it may be flown from the Model Rocket Launch Area. Any

rocket which contains a High Power Rocket Motor must be launched from the High Power Launch Area according to the High Power Safe Distances. Such a rocket would still require at least an L1 certification.

Primary: More than 50% by weight of the specific chemical component (fuel or oxidizer); it does not refer to the percentage of the ingredient within the overall formula.

Radio-Controlled (R/C) Rocket Boosted Glider (RBG): A rocket boosted model capable of gliding flight and equipped with a radio control system capable of controlling the direction of flight during glide and, optionally, boost.

Range Personnel: Persons who are approved by the Launch Director to help with launch operations. Membership in Tripoli is recommended, but not required.

Range Safety Officer (RSO): The person who has overall authority to ensure range safety. This person shall be currently Certified at least to Level 2.

Recognized Manufacturer: A commercial rocket motor manufacturer which is currently recognized by TMT.

Research Motor: A Rocket Motor made by a Tripoli member or team of Tripoli members or a Certified Motor which has been intentionally modified by a Tripoli member or team of Tripoli members for their own use at a Tripoli launch.

Rocket: A device which is propelled by the thrust generated by a rocket motor.

Solid Propellant: A propellant consisting of oxidizer and fuel which are mixed and processed to form solid grains.

Spectator: A nonparticipant whose primary purpose is to observe a rocket launch.

Spectator Area: The range areas established by the Launch Director or RSO where Spectators are authorized to observe the preparation and launching of rockets.

Sugar Rocket Motor: A solid propellant containing potassium nitrate as the oxidizer, and a sugar or a derivative of sugar as the fuel.

Tripoli (TRA): Tripoli Rocketry Association, Inc.

Tripoli Launch: A Tripoli Launch is one which complies with all of the following requirements:

1. The Launch Director and RSO are members of Tripoli in good standing who are Certified L2 or higher.
2. Follows the Tripoli Safety Code.
3. Complies with all AHJ requirements, such as FAA waiver, BLM rules, etc.
4. Landowner permission has been formally established, such as the Landowner Authorization Form or similar.

Tripoli Mentoring Program (TMP): A program that permits Tripoli Junior members limited access to fly High Power Rockets under the direct supervision of a Tripoli HPR Flier.

Tripoli Motor Testing (TMT): The Tripoli committee tests and certifies commercial motors for NFPA 1125 compliance.

Uncertified Motor: A motor that has not been certified by TMT or a motor certification organization officially recognized by TMT.

16 Referenced Publications

The following documents or portions thereof are referenced within this code or establish requirements recognized by AHJs.

16-1 Government Publications. Available online or from Superintendent of Documents, GPO.gov.

16-1.1 Federal Aviation Administration Regulations, from the Code of Federal Regulations.
<https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-101>

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