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CODE FOR UNMANNED ROCKETS 1982

NATIONAL FIRE PROTECTION ASSOCIATION, INC.
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Code for Unmanned Rockets

NFPA 1122-1982

1982 Edition of NFPA 1122

This edition of NFPA 1122, *Code for Unmanned Rockets*, was prepared by the Committee on Pyrotechnics and acted on by the National Fire Protection Association, Inc. on November 18, 1981 at its Fall Meeting in Toronto, Ontario, Canada. It was issued by the Standards Council on December 9, 1981, with an effective date of December 29, 1981, and supersedes all previous editions.

Origin and Development of NFPA 1122

NFPA 1122 was originally prepared as a tentative code by the Committee on Pyrotechnics under the designation NFPA 41L, *Code for Model Rocketry*. It was tentatively adopted in 1967 and officially adopted by the Association in May, 1968. In November, 1976, a major revision of NFPA 41L, including its new designation as NFPA 1122L, *Code for Unmanned Rockets*, was adopted. The 1976 edition was again revised by the Committee on Pyrotechnics in 1980 to delete the "L" designation and to delete the requirements for cold propellant rocket motors which are no longer allowed. Other technical changes were made at this time and are indicated by vertical rules in the margin of the page on which they appear. This revision was adopted at the 1981 Fall Meeting.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

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Foreword

The purposes of this code are to prohibit the making and launching of dangerous homemade "rocket bombs" and to eliminate the tragic injuries and deaths which have occurred because of experiments with explosive "rocket fuels," homemade rocket motors, and unsafe launching mechanisms.

The code contains instructional guidelines and specific standards for the design, construction, limitation of charge and power, and reliability of all rocket motors manufactured for sale to the general public; for the design and construction of rockets propelled by these motors; and for the conduct of tests, launchings, and other operations involving such rockets so that hazards are minimized.

The NFPA Committee on Pyrotechnics feels that this code contains appropriate measures to safeguard this popular and growing activity. These safe model rocket activities should not be confused with the hazardous, uncontrolled operations of so-called "basement bombers" and "amateur rocketeers" who attempt to make their own propellants, rocket motors, and large metallic rocket vehicles. Model rocket activities should be allowed within the specifications of this code to safely guide our science-minded youth and citizens.

Code for Unmanned Rockets

NFPA 1122-1982

Chapter 1 General Requirements

1-1 Scope.

1-1.1 This code shall apply to the design, construction, limitation of propellant mass and power, and reliability of all rocket motors, other than fireworks rockets, produced commercially for sale to and/or use by the public for purposes of education, recreation, and sporting competition.

1-1.2 This code shall also apply to the design and construction of rocket vehicles propelled by the rocket motors specified in 1-1.1.

1-1.3 This code shall also apply to the conduct of launch operations of the rocket vehicles specified in 1-1.2.

1-1.4 This code shall not apply to the design, construction, production, manufacture, fabrication, maintenance, launching, flight, test, operation, use, or other activity in connection with a rocket or rocket motor when carried out or engaged in by:

(a) the government of the United States of America;

(b) any state or local government;

(c) any individual, firm, partnership, joint venture, corporation, or other business entity engaged, as a licensed business, in research, development, production, test, maintenance, or supply of rockets, rocket motors, rocket propellant chemicals, or rocket components or parts;

(d) any college or university.

1-1.5 This code shall not apply to the design, construction, fabrication, production, manufacture, maintenance, launching, flight, test, operation, or use of rocket-propelled model aircraft which sustain their mass against the force of gravity by aerodynamic lifting surfaces that support the aircraft during the entire duration of their flight in the air or to the rocket motors which provide the propulsion for such model aircraft.

1-1.6 This code shall not apply to model or toy rockets propelled by pressurized liquid rocket motors containing less than 250 mL (8.45 liquid oz) of water.

1-1.7 This code shall not apply to skyrockets, rockets with sticks, and other fireworks rockets as defined in Section 1-3.

1-2 Purpose.

1-2.1 The purpose of this code shall be to ensure the wide and easy availability of commercial model rocket motors that meet standards of safety and reliability, thereby ensuring that the creative and experimental urges of the public regarding rocket devices has reasonably safe outlets.

1-2.2 The purpose of this code shall also be to discourage the making and launching of homemade rockets and other rocketlike vehicles propelled or intended to be propelled by homemade rocket propulsion devices.

1-2.3 The purpose of this code shall also be to discourage experiments with explosive or highly energetic rocket propellants, construction of homemade rocket propulsion motors, and attempted launchings or operations of these homemade rocket devices, thereby minimizing tragic deaths and injuries.

1-3 Definitions. For the purposes of this code, the following terms shall be defined as stated in this section.

Aero model. A miniature, unmanned replica of a flying device and includes the category of model rocket, as defined in 1-3.5.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority having jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary

as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Cold propellant rocket motor. A rocket motor which produces force or thrust by change of state of the substance contained, i.e., not by a process involving combustion.

Hybrid rocket motor. A rocket motor in which the fuel is in a different physical state (solid, liquid, or gaseous) than the oxidizer and which derives its force or thrust from the combination thereof.

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Liquid propellant rocket motor. A rocket motor which contains a fuel and an oxidizer in liquid form or in a combined monopropellant liquid form as a single chemical and which derives its force or thrust from the combustion thereof.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Model rocket. A rocket that is propelled by a model rocket motor, that contains a device for returning it to the ground in a condition to fly again, whose structural parts are made of paper, wood, or breakable plastic and containing no substantial metal parts, except cold propellant rocket motors, and whose primary use is for purposes of education, recreation, and sporting competition.

Model rocket motor. A solid propellant, cold propellant, or pressurized liquid rocket motor that conforms to the standards for rocket motors as set forth in this code.

Pressurized liquid rocket motor. A rocket motor that derives its force or thrust from a liquid expelled from the rocket motor by pressurized gas and involving no combustion or change of state.

Production lot. A quantity of solid propellant rocket motors produced during a single work shift, on the same motor manufacturing device, using the same batch of propellant material.

Rocket. A device which ascends into the air without use of aerodynamic lifting forces acting against gravity and which is propelled by a rocket motor.

Rocket engine. (*See definition of Rocket motor.*)

Rocket motor. A device, or combination of devices, that provides the necessary force or thrust to cause a rocket to move. The force or thrust shall be created by the discharge of gas generated by combustion, decomposition, change of state, or other operation of materials contained, carried, or stored solely within said rocket motor or rocket and not dependent upon the outside environment for reaction mass.

Rocket vehicle. (*See definition of Rocket.*)

Skyrocket or rockets with sticks. Commercially manufactured fireworks rockets not intended for reuse and which have been classified as Class B or Class C fireworks in accordance with U.S. Department of Transportation regulations.[1]

Solid propellant rocket motor. A rocket motor containing a fuel and an oxidizer in solid form and which derives its force or thrust from the combustion thereof.

Steam rocket motor. A rocket motor which produces its force or thrust by means of steam carried or stored within the rocket motor or rocket vehicle or produced in the rocket motor or rocket vehicle by the heating of water therein.

Thrust augmenter. A device for increasing the force or motive power of a rocket motor by imparting a portion of the momentum of the rocket motor's exhaust jet to the surrounding environmental medium, and is considered to be part of a rocket motor when and where used.

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[1]The Department of Transportation regulations referred to are designated Code of Federal Regulations, Title 49, Part 173.

Chapter 2 Requirements for Rocket Construction and Operation

2-1 A rocket shall at all times comply with the requirements of construction and operation as set forth in Section 307; 72 Statute 749, 49 U.S. Code 1348, "Airspace Control and Facilities"; Federal Aviation Act of 1958 covering Federal Aviation Regulations, Part 101, Subpart A, pp. 101.1, (a)(3)(ii)(a) through (d), or later revisions or amendments thereto. (*See Appendix A.*)

Chapter 3 Requirements for Model Rocket Motors

3-1 Solid Propellant Rocket Motors.

3-1.1 A solid propellant rocket motor shall be a device produced by a commercial manufacturer and shall have all of the propellant preloaded into the motor casing in such a manner that they cannot be removed without destroying the motor. Delay trains and ejection charges may be included as an integral part of the motor or may be preloaded and packaged separately if (a) the auxiliary package is a single preassembled unit containing all of the remaining combustible material, and (b) the auxiliary package is so designed that an individual would have no difficulty handling and using it safely.

3-1.2 A solid propellant rocket motor casing shall be made of nonmetallic material of low thermal conductivity such that the temperature of the external surface of the motor casing cannot exceed 200°C (392°F) during or after operation.

3-1.3 A solid propellant motor casing shall be so designed and constructed that it will not fragment if it should rupture.

3-1.4 A solid propellant rocket motor shall be so designed and constructed as to be incapable of spontaneous ignition in air, in water, as a result of physical shocks, jarring, impacts, or motion under conditions that would reasonably be expected to occur during shipment, storage, and use, or when subjected to a temperature of 80°C (176°F) or less.

3-1.5 A solid propellant rocket motor shall contain not more than 62.5 g (2.2 oz) of propellant materials and shall produce less than 80 Newton-seconds (17.92 lb-sec) of total impulse with a thrust duration of not less than 50 milliseconds (0.050 sec).

3-1.6 A manufacturer of solid propellant rocket motors shall subject a random sample of 1 percent of each motor production lot to a static test which shall measure and record the rocket motor's total impulse, delay time, and action of ejection charge, if included. Solid propellant rocket motor production lots shall be corrected, destroyed or retested by the manufacturer under any of the following conditions:

(a) the total impulse of any test item departs more than 20 percent from the established mean total impulse value of the rocket motor type;

(b) the time delay of any test item departs more than 20 percent from the established mean time delay value of the rocket motor type, but in no case shall this variation exceed 3 seconds;

(c) the ejection charge, if any, of any test item does not function properly;

(d) if any test item malfunctions in any other manner that affects the safety of its shipment, storage, handling, or use. Static tests shall be conducted with the test items at ambient temperature.

For a retest, a manufacturer shall test a minimum additional 2 percent of the production lot in question. If any additional test item displays any of the abovementioned conditions, the entire production lot shall be corrected or destroyed by the manufacturer.

3-1.7 A solid propellant rocket motor type whose performance deviates from the sample test criteria and performance limits detailed above within 1 year from the date of manufacture shall be withdrawn from commercial sale and redesigned to provide reliable operation when ignited within a period of 1 year from the date of manufacture. All solid propellant rocket motors shall have imprinted upon the exterior surface of their motor casing the date of manufacture or equivalent coding.

3-1.8 A solid propellant rocket motor shall be shipped and stored with no ignition element installed that can be activated by an open flame at a temperature of less than 150°C (302°F), or by incident radio frequency radiation normally encountered in shipping, storage, handling, or use.

3-1.9 No manufacturer, distributor, or other person shall sell, offer to sell, expose for sale, or otherwise make available to the public any type of rocket motor ignition device that is intended to be initiated by a hand-held flame.

3-1.10 A solid propellant rocket motor shall be shipped and sold with complete instructions for its storage, handling, and use. These instructions shall contain a warning to read and follow all instructions carefully and to use the rocket motor only in accordance with instructions. In addition, the instructions shall contain the following information:

(a) how to safely ignite the rocket motor by electrical means;

(b) performance data on the rocket motor type to include propellant weight, total impulse, average thrust, time delay, and representative thrust-time curve;

(c) any special first aid data or action to be taken in the event of burns or oral ingestion of the propellant;

(d) proper and safe disposal of the rocket motor if it has become too old, been subjected to conditions that may impair its performance or, in the opinion of the user, may have become unsafe;

(e) any special action that must be taken to fight any fire in which stored rocket motors may be involved.

3-2 Pressurized Liquid Rocket Motors.

3-2.1 A pressurized liquid rocket motor shall be sold as a completely prefabricated, assembled device ready for the user to fill, pressurize, and use.

3-2.2 A pressurized liquid rocket motor shall use water in the liquid state or other nontoxic liquid as a propellant or reaction mass.

3-2.3 A pressurized liquid rocket motor shall be designed for an internal working pressure not greater than 7 atmospheres gage (103 psig or 7.231 Kg per cm^2) and shall be equipped with a nonadjustable, nonremovable safety valve or pressure release means that will operate when the internal pressure exceeds 10 atmospheres gage (147 psig or 10.33 Kg per cm^2). The pressurized liquid rocket motor casing shall be designed and constructed to possess a minimum burst pressure of 20 atmospheres gage (294 psig or 20.66 Kg per cm^2).

3-2.4 A pressurized liquid rocket motor shall be shipped and stored with no propellant material inside it and vented to atmospheric pressure.

3-2.5 The pressure used by a pressurized liquid rocket motor shall be either generated or produced by a pressure source such as a pump outside the rocket motor or generated by the noncombustible chemical reaction of chemicals within the rocket motor or rocket vehicle.

3-2.6 Materials used in the construction or fabrication of a pressurized liquid rocket motor shall be nonmetallic.

Chapter 4 Testing and Certification

4-1 Model rocket motor types offered for sale, exposed for sale, sold, used, or made available to the public shall be examined and tested by the authority having jurisdiction to determine whether or not they comply with the standards and requirements detailed in Chapter 3. The authority having jurisdiction shall certify as acceptable for sale and use those products that do comply. At the discretion of the authority having jurisdiction, such examination, testing, and certification may be carried out by an approved testing laboratory or an organization such as the National Association of Rocketry or its successor organization affiliated with the National Aeronautic Association (the national aeronautical club of the United States of America having jurisdiction over the sporting and competitive aspects of model rocketry as the United States representative to the Federation Aeronautique Internationale).

4-2 The authority having jurisdiction shall maintain a current and complete list of all those rocket motor types which are certified as complying with the standards and requirements detailed in Chapter 3 and shall make copies of this list available to citizens and public safety officials requesting it.

Chapter 5 Prohibited Activities and Permit Requirements

5-1 Prohibited Activities. The following activities shall be prohibited by this code:

5-1.1 The use of rocket motors for the primary purpose of producing a spectacular display of color, light, sound or any combination thereof.

Exception: This prohibition shall not be construed as prohibiting the public demonstration of model rockets as defined herein and as certified according to these regulations.

5-1.2 The use of a rocket or rocket motor as a weapon against a target.

5-1.3 The use of a rocket motor contrary to the instructions for its use and contrary to the provisions of Federal Air Regulations Part 101.1(a)(3)(ii).

5-1.4 Tampering with any rocket motor in any manner or degree which is contrary to the purpose for which said rocket motor is designed and intended to be used.

5-1.5 The sale, offering for sale, exposing for sale, or otherwise making available to the public any rocket motor that does not comply with the requirements herein and has not been certified in accordance with Chapter 4 herein.

5-1.6 The operation, discharge, or activation of a rocket motor contrary to the provisions of Federal Air Regulations.

5-1.7 The manufacture, production, fabrication, making, operation, maintenance, launch, flight, test, activation, discharge, or other experimentation with rockets or rocket motors that have not been certified in accordance with the provisions of Chapter 4 including, but not limited to, hybrid rocket motors, liquid propellant rocket motors, steam rocket motors, rocket propellant chemicals for solid, liquid, and hybrid rocket motors including monopropellants.

5-1.8 The sale, offering for sale, exposing for sale, making, or using of fuse, wick, or other ignition devices intended to be activated by a hand-held flame for the purpose of starting or igniting a rocket motor.

5-1.9 Affixing to a rocket motor a statement of compliance with the regulations or statement of certification required by Chapter 4, or statements in writing in advertising or on the package that certification according to Chapter 4 has been obtained when such certification has not been obtained, has been withdrawn, or has been denied.

5-1.10 Reloading any solid propellant rocket motor with any material, once said motor has been operated.

5-1.11 Reloading or refilling any cold propellant rocket motor with any material not specifically recommended or made available by the manufacturer.

5-1.12 Reloading, refilling or pressurizing any pressurized liquid rocket motor with any material or by any means not specifically provided or recommended by the manufacturer.

5-2 Permits. Permits shall be required for the storage of more than 100 Kg (220 lb) of solid propellant model rocket motors by a user.

Appendix A Supplementary Information

This Appendix is not a part of the requirements of this NFPA document. . . but is included for information purposes only.

A-1 Excerpt from Section 307,72 Statute 749,49 United States Code 1348, "Airspace Control and Facilities"; Federal Aviation Act of 1958 covering Federal Air Regulations, Part 101, Subpart A, Part 101.1(a)(3)(ii):

"The Part prescribes rules governing the operation in the United States of the following:. . .

(3) Any unmanned rocket except. . .
  (ii) Model rockets
    (a) Using not more than four ounces of propellant;
    (b) Using a slow-burning propellant;
    (c) Made of paper, wood, or breakable plastic, containing no substantial metal parts, and weighing not more than 16 ounces, including the propellant; and
    (d) Operated in a manner that does not create a hazard to persons, property, or other aircraft."

NOTE: By waiver letter dated December 27, 1968, the Federal Aviation Agency exempted cold propellant model rockets from the nonmetallic provisions of FAR 101(a)(3)(ii)(c) above.

A-2 Model Rocket Safety Code of the National Association of Rocketry—Hobby Industry Association of America.

Solid Propellant

1. Construction—My model rockets will be made of lightweight materials such as paper, wood, plastic, and rubber without any metal as structural parts.

2. Engines—I will use only preloaded factory-made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.

3. Recovery—I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.

4. Weight Limits—My model rockets will weigh no more than 453 grams (16 ounces) at lift-off, and the engines will contain no more than 113 grams (4 ounces) of propellant.

5. Stability—I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.

6. Launching System—The system I use to launch my model rockets must be remotely controlled and electrically operated, and will contain a switch that will return to "off" when released. I will remain at least 15 feet away from any rocket that is being launched.

7. Launch Safety—I will not let anyone approach a model rocket on a launcher until I have made sure either the safety interlock key has been removed or the battery has been disconnected from my launcher.

8. Flying Conditions—I will not launch my model rockets in high winds, near buildings, power lines, tall trees, low-flying aircraft, or under any conditions that might be dangerous to people or property.

9. Launch Area—My model rockets will always be launched from a cleared area, free of any easy-to-burn materials, and I will use only nonflammable recovery wadding in my rockets.

10. Jet Deflector—My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.

11. Launch Rod—To prevent accidental eye injury, I will always place the launcher so the end of the rod is above eye level, or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use, I will always store it so that the launch rod is not in an upright position.

12. Power Lines—I will never attempt to recover my model rocket from a power line or other dangerous place.

13. Launch Targets and Angle—I will not launch rockets so their flight path will carry them against targets on the ground, and will never use any explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.

14. Prelaunch Test—When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through prelaunch tests. I will conduct launchings of unproven designs in complete isolation.