Sounding Rocket Design School

Module 1 of 8: Regulatory Basis of Amateur Rocketry

Background

It may seem a bit of a drag to start your journey through high power rocketry with safety rules. However, it is the excellent safety record of the hobby, more than any single factor, that has allowed for its continued existence and autonomy since the 1950’s.

Amateur rocketry is a fantastic tool to teach physics, chemistry and engineering, and indeed this is likely what attracted you to it. However, do you think if the youth of America were being seriously injured in its practice, it would be supported by parents, schools, teachers, industry sponsors and mentors? This was in fact the situation in the early 50’s - the “basement bomber” era (that sounds a lot different in the 21st century doesn’t it) - when adolescents were trying to make their own rocket fuel with predictably horrendous consequences.

Later in that decade the *National Association of Rocketry* (NAR) wrote the *Model Rocket Safety Code*, which was later enshrined as the *National Association of Fire Prevention* (NFPA) *Code 1122*. The hobby survived (arguably reasonable) calls for its abolition because it demonstrated that amateur rocketry could be made safe - while still retaining the element of adventure and thrill that attracted people to it - and that the hobby could police itself.

Rules not only protect the integrity and future existence of the hobby, but also first and foremost keep *you* safe. Rules do not act automatically though, and you are responsible for your own safety.

That means:

1. Not engaging in any rocketry activities for which you are not properly trained.
2. Understanding the rules that apply to your rocketry activities.
3. Following those rules, and not looking the other way when others do not.

As always, STOP when unsure, and do not be afraid to ask questions.

NAR Junior L1 Exam

The Junior HPR Level 1 Participation Program is a way for those younger than 18 to obtain a provisional Level 1 high power rocket (HPR) certification. There are two parts to obtaining a Jr. L1: an exam, and a standard Level 1 HPR certification flight.

Even though the exam is only needed for the Junior L1 program, the exam material is nonetheless the minimum standard of knowledge expected for anyone pursuing a L1, as such Jr. L1 exam questions will be worked into SRDS regardless if the student is required by the NAR to take the exam or not.

The exam is offered online, and consists of 25 questions. To pass, at least 22 (88%) must be answered correctly. Questions are selected from a pool, and are grouped into four sections, labelled A, B, C and D.

Jr. L1 Exam Details		
Section A	NAR Jr. HPR Level 1 Participation Program	5 Questions from Pool of 10
Section B	FAA Regulations; FAR 101 Subpart C	5 Questions from Pool of 10
Section C	NAR High Power Rocketry Safety Code	10 Questions from Pool of 20
Section D	Technical	5 Questions from Pool of 10
Total Questions		25 Questions from Pool of 50
Passing Grade	88%	Minimum 22 Correct

Notice something about the spread of questions across section topics. Only 5 questions of 50 are technical (the same number given to administrative questions concerning the Jr. L1 program itself). The rest, 15 out of 25, are on safety and regulatory topics. The importance the NAR places on knowledge of the regulatory basis of the hobby is on display here in how they chose to orient the exam.

NAR Level 2 Exam

Analogously to the Junior HPR Level 1 Participation Program, a Level 2 high power rocket certification requires both an exam and a certification flight.

The exam is offered online, and consists of 40 questions. To pass, at least 35 (87%) must be answered correctly. Questions are selected from a pool, and are grouped into four sections, labelled A, B, C and D.

Level 2 Exam Details		
Section A	Applicable Regulations (mostly NFPA 1127)	10 Questions from Pool of 22
Section B	Rocket Motor Designations	3 Questions from Pool of 9
Section C	Range and Safety Practices	24 Questions from Pool of 60
Section D	Rocket Stability	3 Questions from Pool of 9
Total Questions		40 Questions from Pool of 100
Passing Grade	87%	Minimum 35 Correct

Section A deals almost exclusively with *National Fire Prevention Association* (NFPA) *Code 1127*. This code, adopted by all authorities having jurisdiction (AHJ's) in the United States, is the enforceable law that the *NAR High Power Rocket Safety Code* is based on. You can think of the *NAR High Power Rocket Safety Code* as a summary of *NFPA 1127*.

Though not needed for SRDS-L1 or the Jr. L1 exam, the pool of Section A questions is provided below as bonus, as well as information on how to access the NFPA codes.

Material in Sections B - D will be covered in SRDS-L1 throughout the remaining modules.

Assignment

In practice, it is not realistic to memorize large tracts of regulatory information (it is also not desirable, memory can be faulty). In real life, it is important to know when, where, and how to look up the rules that affect a given rocketry activity.

The assignment for this module is to answer all of the questions from **Jr. L1-Section B** and **Jr. L1-Section C**. Instead of studying beforehand and answering the questions from memory, each question is going to tell you exactly where to look, and you are going to answer as you go. The exercise is not about getting the right answer or worrying about points, but learning how to navigate the documents that are the cornerstone of the hobby, and understanding how the answers follow from what is expressed in those documents.

Below you can find access to all of the regulatory documents referenced in those sections, as well as a "cheat-sheet" of important definitions.

Jr. L1 Section B - FAA Regulations; FAR 101 Subpart C

Jr. L1 Section C - NAR High Power Rocket Safety Code

L2 Section A - Applicable Regulations (NFPA 1127) (Bonus)

Regulations

Federal Aviation Administration (FAA) regulations (FAR) Part 101 Subpart C - “FAR Part 101 C”

Code of Federal Regulations Title 14 Aeronautics and Space (CFR 14)

- Chapter 1 - Federal Aviation Administration, Department of Transportation
    - Subchapter F - Air Traffic and General Operating Rules
        - Part 101 - Moored Balloons, Kites, Amateur Rockets, and Unmanned Free Balloons
            - Subpart C - Amateur Rockets

Access

FAR Part 101 C

Important Definitions

Amateur rocket means 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.

Class 1 - Model Rocket means 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.

Class 2 - High Power Rocket means an amateur rocket other than a model rocket that is propelled by a motor or motors having a combined total impulse of 40,960 Newton-seconds (9,208 pound-seconds) or less.

Class 3 - Advanced High-Power Rocket means an amateur rocket other than a model rocket or high-power rocket.

NFPA 1122 Code for Model Rocketry & NFPA 1127 Code for High Power Rocketry

Access

NFPA 1122 Code for Model Rocketry
NFPA 1127 Code for High Power Rocketry

Click on “View Free Access” and make an NFPA account.

Important Definitions

Installed Total Impulse: The combined total impulse of all rocket motors installed in a rocket and intended to be ignited during the launch and flight of the rocket.

Certified Motor: A commercially manufactured rocket motor that has been certified by a recognized testing organization acceptable to the authority having jurisdiction to meet the certification requirements set forth in NFPA 1125.

Model Rocket Motor: A solid propellant rocket motor that has a total impulse of no greater than 160 N-s (36 lb-s), average thrust of no greater than than 80 N (18 lbf), and that otherwise meets the other requirements set forth in NFPA 1125.

High Power Rocket Motor: A rocket motor that has no more than 40,960 N-s (9209 lb-s) of total impulse, and that does not otherwise meet all the requirements for a model rocket motor set forth in NFPA 1125.

Model Rocket: A rocket that (1) weighs no more than 1500 g (53 oz) with motors installed; and (2) is propelled by one or more model rocket motors having an installed total impulse of no more than 320 N-s (71.9 lb-s); and (3) contains no more than a total of 125 g (4.4 oz) of propellant weight.

High Power Rocket: A rocket that (1) is propelled by one or more high power rocket motors; or (2) is propelled by a combination of of model rocket motors having an installed total impulse of more than 320 N-s (71.9 lb-s); or (3) is propelled by a combination of of model rocket motors having more than a total of 125 g (4.4 oz) of propellant weight; or (4) weighs more than 1500 g (53 oz) with motor(s) installed.

National Association of Rocketry (NAR) High Power Rocket Safety Code

NFPA 1127

- NAR High Power Rocket Safety Code

Access

NAR High Power Rocket Safety Code

HPR Level 1 Procedures

Important Definitions

High Power Certification is required if a person wishes to:

1. Launch rockets containing multiple motors with a total installed impulse of 320.01 Newton-seconds or more, or
2. Launch rockets containing a single motor with a total installed impulse of 160.01 Newton-seconds or more, or
3. Launch rockets that weigh more than 53 ounces (1500 grams), or
4. Launch rockets powered by motors not classified as model rocket motors per NFPA 1122, e.g.:
    1. Average thrust in excess of 80.0 Newtons
    2. Contains in excess of 125 grams of propellant
    3. Hybrid rocket motors