



Canadian Association of Rocketry
Association canadienne de fuséonautique

High Power Rocketry Level 1 – 3 Certification Program

CAR/ACF High Power Rocketry Level 1 – 3 Certification Program

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Revision History:

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Apr 13, 2005 – Ian Stephens, reformat and reword
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Jan 26, 2017 – David Buhler, updated CAR/ACF address
March 19, 2017 -David Buhler. Updated CAR/ACF, certification time period
June 17, 2022 David Buhler Corrected L3 Certification Information

Overview

The CAR/ACF HPR Level 1 – 3 Certification Program exists to allow rocketry enthusiasts access to rocket motors more powerful than those available to model rocketry. High Power Rocket motors of H impulse (160.01 N-sec impulse) to O impulse (40,960 N-sec impulse) are regulated by the Canadian Government and users of these motors must satisfy Transport Canada and Natural Resources Canada – Explosives Regulatory Division that they are aware of the regulations regarding the safe and legal use of these motors in high power rockets.

The HPR Level 1 – 3 Certification Program for high power rocketry consists of three progressive levels:

- Level 1 allows the purchase and use of H impulse class solid rocket motors.
- Level 2 allows the purchase and use of I impulse class solid rocket motors.
- Level 3 allows the purchase and use of J, K and L impulse class solid rocket motors.

The CAR/ACF HPR Certification Program also includes Level 4, which allows the purchase and use of M, N and O impulse class solid rocket motors. The process for Level 4 is much more rigorous than Levels 1 – 3, having written design reviews, documentation and supervised construction reviews/inspections followed by a witnessed certification flight. Level 4 Certification is covered in the companion document *CAR/ACF High Power Rocketry Level 4 Certification Program*.

The CAR/ACF HPR Level 1 – 3 Certification Program has been open to Junior CAR/ACF Members for years, with those aged 14 – 16 able to certify at CAR/ACF Level 1 and 2, and those aged 16 – 18 can also certify at CAR/ACF Level 3. See more information on Junior HPR Level 1 – 3 Certification later in this document.

CAR/ACF has a reciprocal agreement with Tripoli Rocketry Association (TRA) and the National Association of Rocketry (NAR) in the USA with respect to mutual recognition of certification levels at sanctioned launches. See more information on TRA and NAR Reciprocal Agreements later in this document.

High power certification is intended to provide a measure of the rocketry enthusiast's competence to avoid gross violations of safe rocket operation. The program is not foolproof. A single demonstration of a rocketry enthusiasts' skills does not guarantee consistent safe performance. The certification program does not replace the application of safe handling practices and common sense, nor does it replace compliance with local, NRCan (Natural Resources Canada) and TC (Transport Canada) federal regulations.

Use the **HPR Level 1 – 3 Certification Form**, available for download from CARWeb, at www.canadianrocketry.org, or from your local club's CAR/ACF Liaison, or write to CAR/ACF HQ to have one mailed to you.

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Minimum Requirements

The basic requirements for CAR/ACF High Power Certification are:

- that the applicant must be a minimum of 18 years old at the time of certification. A driver's license or a birth certificate is an acceptable proof of age. (See Junior HPR Level 1 – 3 Certification Program for the exception.)
- that the applicant must be a member in good standing with the Canadian Association of Rocketry (CAR/ACF) at the time of certification. Evidence of CAR/ACF membership will be requested prior to the certification attempt. Acceptable evidence of membership includes the CAR/ACF membership card, a canceled check indicating payment of membership fees, or participation in a CAR/ACF event where membership status is verified and indicated on the event materials.
- that the motor used for certification attempts must be currently certified by the CAR/ACF Motor Certification Committee, National Association of Rocketry (NAR) or Tripoli Motor Testing AND be accepted by NRCan or covered under a general importation permit issued by NRCan.
- that the certification flight be made at a CAR/ACF sanctioned launch event held with the appropriate Transport Canada Launch Approval.
- that a hybrid rocket motor not be used for a certification flight unless the applicant holds a CAR/ACF Hybrid Endorsement (or equivalent approved by the CAR/ACF BoD).
- that certification attempts must be witnessed in person by the certification team. Video recordings of a certification flight are not acceptable

Certification Teams

The Certification Team consists of two individuals who are senior members (over the age of 18) in good standing in the CAR/ACF. The certification team members must be unrelated to the applicant. Members of other rocketry organizations, unless they are also members of the CAR/ACF, cannot participate on a certification team.

At least one of the member of the Certification Team must be already certified to a level equal to the certification level being attempted by the applicant, for example, a team member must be certified at Level 1 to judge the applicant's Level 1 certification attempt.

Level 1 certifications may be administered by a single CAR/ACF Level 2 certified individual. The two certified individuals' requirement is waived in this case.

Certification attempts must be witnessed in person by the certification team. Video recordings of a certification flight are not acceptable.

Certification Process and Documentation

This section describes the process and documents required for the applicant to certify at HPR Levels 1 – 3.

Certification may only be accomplished at a CAR/ACF sanctioned launch where a valid Rocket (High Power) Launch Authorization issued by Transport Canada. All conditions and restrictions imposed by TC must be satisfied and followed. The exception to this is the written test portion of the Level 1 Certification which can be held anywhere convenient to the applicant and the person authorized by CAR/ACF to administer the test prior to the certification flight. For more information on the written test see the section on Level 1 Certification Requirements.

The applicant must complete the CAR/ACF High Power Certification Application prior to his certification attempt. If Level 2 certification is desired the applicant must provide proof of previous Level 1 certification, likewise for Level 3, the applicant must provide proof of Level 2 Certification. Proof of previous certification includes a copy of the high power certification affidavit or a CAR/ACF membership card showing the Level 1 certification level.

The applicant's rocket will be subjected to a safety inspection by a qualified Rocket Inspector prior to flight. The safety inspection checklist should accompany the CAR/ACF High Power Certification Application. During the safety inspection the applicant will be expected to orally answer technical questions related to the safety and construction of the rocket. The questions may include (but are not limited to) identification of the rocket's center of gravity and center of

pressure, methods used to determine model stability, and interpretation of the rocket motor's designation. The Rocket Inspector will initial the form indicating approval to continue with the launch.

The applicant will fly their rocket. The flight must be witnessed by the Certification Team members. Stability, deployment of the recovery system, and safe recovery should be considered when evaluating safety of the flight. Rockets experiencing a catastrophic failure of either the airframe, rocket motor and/or recovery system (e.g. shock cord separation) will not be considered as having a successful qualifying flight.

The model must be returned to the Certification Team after flight and be inspected to verify motor retention and for evidence of flight induced damage. The Certification Team will sign the Certification Form indicating that a safe flight was made and that the post flight inspection was satisfactory.

The Certification Form and HPR Level 1 written tests (if applicable) is normally returned to the applicant after the flight. The Certification Form and \$5 Processing Fee may be given to the Launch Organizer or other CAR/ACF representative to be sent to CAR/ACF Headquarters as a group. Otherwise the applicant would be responsible for forwarding the Certification Form to CAR/ACF Headquarters. Once sent to CAR/ACF Headquarters, the Certification form is not returned to the applicant, instead it is retained on record at CAR/ACF Headquarters. Unless a 2-part Certification Form is used, the applicant will have to make their own copy if they wish to have a copy themselves.

A new CAR/ACF membership card will be issued showing the certification level upon receipt of the certification paperwork.

The card is recognized as proof of the certification level.

Falsification of data or statements by the certifying individual will result in revocation of the CAR/ACF HPR Certification and membership in CAR/ACF. Falsification of data or statements by the Certification Team, e.g. failure to secure a Transport Canada launch authorization, can result in revocation of the team members CAR/ACF memberships.

HPR Level 1 Certification Requirements

Certification at Level 1 permits single or multiple motor rocket flights with motors having from 160.01 Newton seconds impulse to a maximum total impulse of 320.00 Newton seconds (**H** impulse class).

The applicant passes the CAR/ACF Level 1 Knowledge Test and must demonstrate their ability to build and safely fly a rocket containing one H impulse class motor. Cluster or staged models may not be used for certification flights. Only single use or reloadable solid rocket motors that are certified by TRA, CAR/ACF or NAR are permitted. A hybrid rocket motor may not be used for a Level 1 Certification flight. The applicant must assemble the reloadable motor, if used, in the presence of a Certification Team member.

A written examination is required to demonstrate knowledge of the regulations and laws pertaining to high power rocketry in Canada as well as questions concerning basic rocket technical knowledge, e.g. center of pressure and center of gravity relationships. The *CAR/ACF Level 1 Knowledge Test* will contain 50 questions in the multiple choice and fill in the blanks format.

- The questions will come from a 48 question pool.
- Twenty-five of the questions will be related to Transport Canada Regulations, the applicant must answer all the Transport Canada questions correctly (passing grade is 100%).
- The balance of the questions have a passing grade of 75%.
- The test may be taken only once in a 30 day period.
- The test must be completed prior to the flight attempt.
- Tests will be graded before a certification attempt.
- The written test will not have to be repeated if the flight attempt is completed within 1 year of taking the written test.

The *CAR/ACF Level 1 Knowledge Test* will typically be administered by a CAR/ACF Liaison or Regional Director.

HPR Level 2 Certification Requirements

Certification at Level 2 permits single or multiple motor rocket flights with motors having from 320.01 Newton seconds impulse to a maximum total impulse of 640.00 Newton seconds (**I** impulse class).

The applicant must demonstrate the ability to build and safely fly a rocket containing one I impulse class motor. Cluster or staged models may not be used for certification flights. Only single use or reloadable solid rocket motors that are certified by TRA, CAR/ACF or NAR are permitted. A hybrid rocket motor may be used for a Level 2 Certification flight if the applicant has a CAR/ACF Hybrid Endorsement (or waiver from CAR/ACF HQ, which must be requested prior to the certification flight). The applicant must assemble the reloadable motor, if used, in the presence of a Certification Team member.

HPR Level 3 Certification Requirements

Certification at Level 3 permits single or multiple motor rocket flights with motors having from 640.01 Newton seconds impulse to a maximum total impulse of 5,120.00 Newton seconds (**J - L** impulse class).

The applicant must demonstrate the ability to build and safely fly a rocket containing one J-L impulse class motor. Cluster or staged models may not be used for certification flights. Only single use or reloadable solid rocket motors that are certified by TRA, CAR/ACF or NAR are permitted. A hybrid rocket motor may be used for a Level 3 Certification flight if the applicant has a CAR/ACF Hybrid Endorsement (or waiver from CAR/ACF HQ, which must be requested prior to the certification flight). The applicant must assemble the reloadable motor, if used, in the presence of a Certification Team member.

Typically, the applicant would certify at Level 3 using a **J** class motor and work up in power with experience. Although not required by CAR/ACF HPR Level 1 – 3 Certification Program, CAR/ACF strongly recommend this approach.

Junior HPR Level 1 – 3 Certification

The HPR Level 1 – 3 Certification Program requires the demonstration of skills and knowledge in three areas:

- 1.Theory and knowledge,
- 2.Construction skills,
- 3.Motor handling, assembly, and use.

Junior members can participate under the first two activities, but NRCAN-ERD regulations prohibit minors from using explosives, including solid rocket motors, hybrid rocket motors, black powder and e-matches. The Junior HPR Certification Program tests the first two areas in the same manner that senior certifications are done: the *CAR/ACF Level 1 Knowledge Test* for the first and airframe examination and RI / Certification Team questioning on the second.

The junior applicant needs to be sponsored by a senior member holding a certification of at least the same level as that being attempted by the applicant. The sponsor must be clearly aware and accept that they are assuming full responsibility and liability for the flight as if it were their own.

The certification steps are:

- the Junior applicant writes the *CAR/ACF Level 1 Knowledge Test*,
- the Junior applicant builds and prepares the airframe themselves,
- the Senior Sponsoring member must prepare and install the rocket motor,
- the Junior applicant and the Senior Sponsor take the rocket to the RI for inspection, same as for the Senior certification.
- the RI examines the rocket and questions the Junior applicant,
- the flight test is conducted same as senior certification.

The age restrictions for a Junior applicant are:

- Level 1 – minimum age 14 (birthday prior to flight test)
- Level 2 – minimum age 14 (birthday prior to flight test)
- Level 3 – minimum age 16 (birthday prior to flight test)

When the Junior member turns 18, they must re-fly 1 rocket at the HIGHEST certification level achieved, selecting, building and installing the motor themselves, and if this flight is successful then they are given full certification at this level as a Senior CAR/ACF member.

Membership Lapse or Expiration

Members **do not lose their certifications levels** if they do not renew their memberships.

Canadian Association of Rocketry / Association canadienne de fuséonautique reserves the right to charge missed membership fees, charge an administration fee, and or to have other action taken as the Board sees fit.

Canadian Association of Rocketry / Association canadienne de fuséonautique reserves the right to change this policy without notice.

TRA and NAR Reciprocal Agreements

CAR/ACF has reciprocal agreements with the two major Rocketry Associations in the US, the Tripoli Rocketry Association and the National Association of Rocketry. A few years ago, it was recognized that there are many rocketry enthusiasts in Canada that fly in the US and many US fliers that fly in Canada. To reduce confusion and clarify who can fly what at each organization's launches, CAR/ACF entered into a reciprocal agreement similar to that between NAR and TRA. What this means is that Tripoli and NAR HPR Certifications will be honoured at CAR/ACF Launches. Tripoli and NAR members must show evidence of their Certification level and membership prior to launching and they may fly to their current certification level, but not beyond.

It is possible for TRA and NAR members in Canada to "grandfather" into CAR/ACF with their TRA/NAR HPR Level certification. To do so, the TRA member must:

- join CAR/ACF by submitting a membership application and appropriate membership fee,
- provide evidence of existing TRA certification Level,
- and complete the *CAR/ACF Level 1 Knowledge Test*