



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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Jan 26, 2017 – David Buhler, Updated CAR/ACF address
March 19, 2017 -David Buhler, Updated CAR/ACF, certification period
June 17, 2022 - David Buhler, Corrected L3 Certification Information
December 1, 2023 – Art Mackie, New Submission process and Eligible Launches

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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 Government of Canada. Users of these motors must be aware of and comply with regulations set forth by satisfy Transport Canada and Natural Resources Canada – Explosives Regulatory Division regarding the safe and legal use of these motors.

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 is open to Junior CAR/ACF Members. Members aged 14 – 16 are eligible for CAR/ACF Level 1 and 2 certifications. Those aged 16 – 18 are eligible for CAR/ACF Level 3 certification. See more information on Junior HPR Level 1 – 3 Certification later in this document.

CAR/ACF has a reciprocal agreement with the 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.

The **HPR Level 1 – 3 Certification Form** is used to document certification flights. It is available for download from CARWeb, at www.canadianrocketry.org, or from your local club's CAR/ACF Liaison.

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 other valid government ID may be used for age verification purposes. (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 an insured launch event held with the appropriate Transport Canada Launch Approval. Certification flights can also be made outside of Canada at insured launches sanctioned by CAR/ACF recognized organizations (e.g., National Association of Rocketry, Tripoli Rocketry Association).
- that a hybrid rocket motor shall 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 will consist of two individuals 18 years of age or over, that are members in good standing of CAR/ACF or a CAR/ACF recognized organization. Currently CAR/ACF recognizes.

- The National Association of Rocketry (NAR),
- Tripoli Rocketry Association (TRA), and
- Launch Canada.

The Certification Team members must be unrelated to the applicant.

At least one member of the Certification Team must be certified to a level equal to or above the level being attempted by the applicant. For example, a least one team member must be certified at or above Level 2 to witness a Level 2 certification attempt.

Certification Team members that do not belong to CAR/ACF must provide proof of current membership and their certification level in a recognized organization. (i.e., scan or photo of organization Membership Card showing expiration date and Certification Level)

Certification Process and Documentation

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

Prior to a Level 1 Certification flight the applicant must successfully complete a High-Power Certification Exam. For more information on the written test see the section on Level 1 Certification Requirements.

Certification flights may be conducted at any insured launch where a valid Rocket (High Power) Launch Authorization has been issued by Transport Canada (TC). All conditions and restrictions imposed by TC must be satisfied and followed.

Certification flights may also be conducted outside of Canada provided that the launch is insured and has been sanctioned by a CAR/ACF recognized organization (NAR, TRA). Furthermore, the launch must be conducted in accordance with any applicable legislation in effect in the appropriate jurisdiction.

The applicant must complete the CAR/ACF High Power Certification Application prior to the certification attempt and provide proof that the previous Certification Level has been achieved. Certifications must occur in sequence with no gaps.

The applicant's rocket will be subjected to a safety inspection by a qualified Rocket Inspector prior to flight. 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 applicant will then send a scan of the completed form to:
memberships@canadianrocketry.org

Original forms should be retained by the applicant.

Once received by headquarters, the member record will be updated and a new membership card, showing the revised certification level will be available for download.

The card or card image is recognized as proof of the certification level.

Achievement Certificates are available and can be ordered on the CAR/ACF website or by contacting:
memberships@canadianrocketry.org

Falsification of data or statements by any 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 must successfully complete 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.

The 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 consist of 50 multiple choice or fill in the blank questions.

- The exam consists of two sections, Regulations and Technical Knowledge.
- The Regulations section consists of twenty-five (25) federal regulatory questions.
- Applicants must achieve a minimum score of 100% in the Regulation section.
- The Technical Knowledge section will consist of twenty-five (25) questions taken from a pool of forty-eight (48) study questions
- Applicants must achieve a minimum score of 75% in the Technical Knowledge section.
- 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 like 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 membership fee,
- supply evidence of existing TRA certification Level, and
- complete the *CAR/ACF Level 1 Knowledge Test*