National Association of Rocketry
Level 3 High Power Certification Requirements

1.0 Flyer Requirements

1.1 Any individual attempting NAR Level 3 Certification must be a Level 2 high power certified NAR member in good standing.

An individual may not submit a design for a Level 3 Certification project review to the L3CC until Level 2 certification has been successfully accomplished.

2.0 Rocket Requirements

2.1 The certification rocket must be substantially built by the certifying flyer. "Substantially built" will be defined, as a minimum, as:

a) Fabrication of the engine mount with centering rings (if applicable)

b) Alignment and mounting of the individual fins (prefabricated fin canisters are specifically disallowed)

c) Installation of attachment points for the recovery system

d) Mounting and installation of airframe electronics

e) Final flight preparations including pyrotechnics installation, recovery system packing, motor assembly (as required) and motor installation

Only the builder of the rocket may use that rocket for a certification attempt. Rockets built by other than the certifying flyer are specifically disallowed. Certification rockets may be built from commercially available kits and may contain components built to the specifications of the certifying flyer but fabricated by others.

2.2 Multiple stage and clustered rockets are specifically disallowed for certification flights.

2.3 Each parachute event must be initiated by redundant control systems. Redundancy must be present in the power sources, safe and arm provisions, control logic, and output devices (e.g. bridgewires, electric matches). Redundancy is not required in the energetic materials (e.g. black powder charges), parachutes, attach points, risers, and disconnects. Models recovered by alternate methods, e.g. glide or autorotation, must be reviewed by a L3CC member on a case by case basis for recovery system design. Motor ejection charges may be used as a redundant system, but rockets depending primarily on motor ejection for any recovery event are specifically disallowed. A safe rate of decent. (20ft/ second is ***recommended***) for any component weighing in excess of eight ounces.

2.4 The capability must exist to externally disarm all pyrotechnic devices in the rocket. In this context, ‘disarm’ means the ability to physically break the connection between a pyrotechnic device and the power source to its igniter. Simply turning off the device controlling the pyrotechnic(s) is not sufficient.

2.5 The rocket must conform in all respects to any restrictions imposed by the NAR High Power

Safety Code, NFPA 1127, and the Authorities Having Jurisdiction (AHJ).

3.0 Certification Procedures

3.1 The flyer shall obtain and fill out a NAR Level 3 Certification Application (available from the NAR web site at **www.nar.org**). This form documents the certification procedure steps. The flyer shall also prepare a Certification Package as defined in these requirements.

3.2 Prior to the start of construction of the Level 3 Certification project, the flyer shall submit detailed plans for L3CC member review and approval. The purpose of the review is to ensure the rocket will be structurally and functionally adequate for the stresses encountered during launch and recovery.

The flyer shall complete the Construction Package Affidavit section of the Certification Application and obtain L3CC (Level 3 Certification Committee) member approval. The purpose of the inspection is to verify that the rocket is being constructed in a manner suitable for the stresses encountered in a Level 3 flight.

3.2.1 The flyer may invite a L3CC member to inspect the model during assembly when construction features are visible for inspection. The flyer assumes the risk, if a L3CC member has not inspected the model during construction and documentation of hidden features is not adequate, that the Rocket Construction package may not be approved.

3.2.2 The flyer shall document rocket features hidden during assembly using photographs. Digital or film technologies are permitted. An easily recognized size reference (e.g. ruler, coin) is required in the photographs (The size reference may be omitted if other photographs permit easy determination of feature sizes).

3.2.3 The approval of the Construction Package Affidavit section of the Certification Application shall be made in advance of the flight. Technical data supporting the Construction Package Affidavit approval shall be made available to the L3CC member performing the review a minimum of 5 days prior to the flight attempt.

3.3 The flyer shall complete the Recovery Package Affidavit section of the Certification Application and obtain L3CC member approval. The purpose of the inspection is to verify that the rocket recovery system is designed and constructed in a manner to:

a) Withstand the stresses encountered during recovery

b) Have a high probability of successful operation

c) Have a safe rate of decent. (20ft/ second is ***recommended***.)

Technical data supporting the Recovery Package Affidavit approval shall be made available to the L3CC member performing the review a minimum of 5 days prior to the flight attempt

3.3.1 Prior to the certification flight, the flyer shall present a Recovery Systems Package to one

L3CC member. This package shall contain the following

a) Description of the recovery system components including:
   - Drogue parachute
   - Main parachute
   - Parachute bags
   - Anchor and connecting (e.g. quicklink) hardware
   - Risers
   - Compartments, covers

b) Description of recovery initiation control components including:
   - Logic and control modules
   - Power sources
   - Safe and arm provisions
   - Output devices (e.g. flashbulbs, electric matches)
   - Schematic/wiring diagram showing the connections of the above items
   - Mounting structure/access features
   - Pyrotechnic devices (type, quantity, volume/weight of pyrotechnic materials, how was the volume/weight of pyrotechnic materials determined)

c) Description of expected descent rate with the main recovery device deployed and explanation of how the descent rate was determined, or other description explaining why the main recovery device is suitably sized for the certification rocket (manufacturer's recommendation, etc.).

d) Documentation describing how the basic functioning of the recovery electronics has been demonstrated prior to the certification flight (use of untested ejection control electronics is not permitted). This shall be accomplished by either or both of the following methods:

   - Document flight tests utilizing the recovery electronics intended for use in the Level 3 certification flight.
   - Document the ground testing of the recovery electronics.

In either case document the extent of the tested components including, recovery electronic modules, power supplies, safe and arm provisions, and bridgewire (e.g. flashbulb, electric match) type.

3.4 The flyer shall present a Certification Package prior to the certification flight. The purpose of the certification package is to present data sufficient to ascertain the flight readiness of the model.

3.4.1 The Certification Package shall contain all of the following:

a) The Construction and Recovery Systems packages

b) Calculations determining center of pressure

c) A scale drawing of the certification rocket showing major dimensions, calculated center of pressure, and the aft center of gravity limit in the Level 3 certification flight configuration. d) A description of the expected flight profile using the intended certification motor(s). This profile should include:

- Launch weight
- Estimated drag coefficient
- Velocity as the rocket leaves the launch system
- Maximum expected velocity
- Maximum expected altitude
- Maximum expected acceleration

The method (or program) used to establish the above performance parameters should be identified.

e) A pre-launch checklist covering airframe, electronics, and motor preparation.

f) A post-recovery checklist for 'safing' the rocket in case of a failure. This would include steps required for disarming pyrotechnics, removal of unfired igniters, etc.

g) A declaration of any design features designed for breakaway or easy replacement, e.g. shear pins, to minimize landing damage.

3.5 Prior to the certification flight, the flyer will present the certification rocket and Certification Package to two senior members of the NAR, who will act as Flight Witnesses, for preflight inspection. One of the Flight Witnesses shall be a member of the L3CC and the other shall be Level 2 or Level 3 certified. Both Flight Witnesses must approve the rocket for flight.

3.5.1 L3CC members that approved the Construction and /or Recovery Packages do not have to be the Flight Witnesses.

3.5.2 **Only the Flight Witnesses who performed the pre-flight inspection shall approve the flight. No other individuals shall approve the flight.**

3.6 The actual flight shall meet ALL of the following requirements:

a) The rocket shall use a motor with total impulse greater than 5120 Newton-seconds

b) The flight shall be made while a suitable FAA waiver is in effect

c) The rocket shall make a stable, safe flight. Safety includes compliance with FAA waiver limits. Models that exceed the FAA waiver altitude are, by definition, unsafe and cannot be certified.

d) The rocket shall fully deploy its recovery system. An anomalous deployment of the recovery system is not cause for flight rejection if the model descended in a safe manner. It is up to the judgement of the Flight Witnesses whether the model descended in a safe manner.

e) The rocket shall remain intact, with no separation of parts that do not deploy their own recovery device(s)

3.7 The rocket shall be returned for post-flight inspection. Models that cannot be returned for post-flight inspection, even if they are visible in a tree or power-line cannot be certified. The post flight inspection will verify that:

a) The motor casing remained within the airframe

b) The airframe is complete

c) There is no damage that would prevent an immediate re-flight of the model. It is up to the Flight Witnesses to evaluate the extent of any damage and its effect on re-flight of the model.

3.8 Upon signing the final approval on the Certification Package, the Flight Witnesses are certifying that they have reviewed the Certification Package and verified previous acceptance of the Construction and Recovery Packages. Flight Witnesses, upon signing the final approval, are certifying that the flight met all of the requirements for Level 3 certification.

3.9 Either Flight Witness may disallow the certification attempt if, in his or her opinion, it did not fully meet all of the requirements for Level 3 certification.

3.10 The flyer will remove and keep the signed, upper section of the Certification Application. This may be used as temporary proof of Level 3 certification.

3.10.1 One of the Flight Witnesses will return the completed Certification Application to NAR Headquarters.

3.10.2 The Certification Package does not have to be provided to NAR Headquarters.

3.10.3 The flyer will receive an updated NAR membership card, showing the Level 3 certification level.

4.0 Failed Certification Procedures

4.1 The procedure shall be considered failed if the failure is the result of a flight attempt that did not comply with the Level 3 requirements. Certification Package deficiencies shall be corrected prior to the flight attempt and do not constitute a failed certification procedure.

4.2 One of the Flight Witnesses shall fill out the Failed Certification Flight section on the Level 3 Certification Application. The form shall then be mailed to:

Art Upton
5944 Pembridge
Toledo, OH 43615

4.2.1 The Certification Package does not have to be provided to NAR Headquarters.

4.3 These forms will not be used to track failures by individuals. Failed certification attempts do not count against an individual. The forms will be used to track the effectiveness of the NAR Level 3 certification procedures. They will also be used to track the frequency and types of failures. This information is needed in order to improve the certification procedures over time.