

**Canadian
Association of
Rocketry**

**Canada
Model Rocket
Sporting Code**

1990

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CANADA MODEL ROCKET SAFETY CODE

1. CONSTRUCTION- I will always build my model rocket using only lightweight materials such as paper, wood, plastics and rubber without any metal airframe components. My model shall include aerodynamic surfaces or a mechanism to assure a safe, stable flight.
2. ENGINES- I will use only pre-loaded, commercially available model rocket engines approved safe by Energy, Mines and Resources Canada. I will never subject these engines to excessive shock, extremes of temperature, nor will I ever attempt their reloading or alteration. I shall always employ recommended manufacturer handling and ignition procedures.
3. RECOVERY- My model rocket will always utilize a recovery system to return it safely to the ground so that my model rocket may be reflown. I shall prepare the recovery system with due care to assure that it will properly deploy.
4. WEIGHT LIMITS- My model rocket will not weigh more than 500 grams at liftoff, and the model rocket engine(s) will contain no more than 125 grams of propellant.
5. FIRING SYSTEM- I will always use a remote, electrical system to ignite the model rocket engine(s). My firing system will include an ignition switch that will return to "OFF" when released, and a safety interlock key switch to prevent accidental ignition. I will never leave the safety interlock key in my firing system between launches.
6. LAUNCH SYSTEM- My model rocket will always be launched from a stable platform having a device to initially guide its motion. My launch system will have a jet deflector to prevent the engine exhaust from directly contacting the ground, or inflammable launcher components. To protect myself and others from eye injury, I will position the launch rod or rail so that the upper end is above eye level, or else I will place a large guard on the upper end between launches. I will never place my body or hand directly over my loaded model rocket mounted on the launch system.
7. LAUNCH SITE- I will never launch my model rocket near buildings, power lines, or within 9.1 kilometers from the center of an airport. The area immediately around the launch system will be cleared of any flammable materials. I will always obtain the permission of the launch site owner prior to using the launch site for my model rocket activities.
8. LAUNCH CONDITIONS- I will never launch my model rocket in high winds, or under conditions of low visibility that may impair the observation of my model rocket in flight, or in a direction below 30 degrees from the vertical.

9. LAUNCH SAFETY- I will remain at least 5 meters away from any model rocket about to be launched. I will always announce to persons within the launch site that I am about to launch my model rocket, and I shall give a loud countdown of at least 5 seconds duration. I shall immediately remove the safety interlock key from my firing system after the launch of my model rocket.
10. MISFIRE- In the event of an ignition misfire, I shall not immediately approach my model rocket, but remove the safety interlock key and remain back for a safe period until assured that no ignition will occur.
11. ANIMAL PAYLOADS- I will never endanger live animals by launching them in my model rocket.
12. TARGETS- I will never launch my model rocket so that it will fall on or strike ground. or air targets, nor will I include any explosive or incendiary payload.
13. HAZARDOUS RECOVERY- I will never attempt to recover my model rocket from a power line, high place or other dangerous location.
14. PREFLIGHT TESTS- Whenever possible, I will, always test the stability, operation and reliability of my model rocket designs prior to flight. I will launch unproven designs in complete isolation from other persons.
15. PERSONAL CONDUCT- I will always conduct myself -in a responsible manner, conscious that the maintenance of safety for myself and others rests with my ability to design and construct sound, working models, and to enthusiastically abide by the CANADA MODEL ROCKET SAFETY CODE.

INTRODUCTION

- 1.1 The CANADA MODEL ROCKET SPORTING CODE (CMRSC) sets uniform standards for the design, construction and operation of model rockets and model rocket engines, and defines various contest rules and regulations in order that members of the Canadian Association of Rocketry (CAR) may participate in a safe hobby and challenging sport.
- 1.2 The CANADA MODEL ROCKET SPORTING CODE supports and controls all competitions sanctioned by the Canadian Association of Rocketry and all attempts to set Canadian Model Rocket Performance Records. This code does not govern model rocket sporting activities of an international or world scope. Said regulations are defined in the sporting codes of the Federation Aeronautique Internationale (FAI).
- 1.3 The CANADA MODEL ROCKET SPORTING CODE has been prepared by the CAR Contest Board which reserves the right to amend this code as and when it deems necessary. Such amendments shall only take effect when said amendments have been published by the CAR Contest Board in the official newsletter of the CAR.
- 1.4 The CANADA MODEL ROCKET SPORTING CODE contains two sections; namely SECTION A which sets standards for the construction and operation of model rockets and model rocket engines, and SECTION B which details standard competition regulations.
- 1.5 Notwithstanding the rules and regulations of Sections A and B, the CANADA MODEL ROCKET SAFETY CODE shall serve as the basis for direction and guidance in matters of general safety within the CAR.

SECTION A

2. CAR MODEL ROCKET STANDARDS

- 2.1 A "model rocket" is defined as a heavier-than-air flying rocket having a substantially non-metallic airframe, employing the reaction force of a model rocket engine as its sole source of lift, and incorporating an automatically initiated system that will assure a safe descent and model reusability.
- 2.2 The model rocket shall be constructed of wood, paper, plastic or similar lightweight materials. No substantial metal components shall be incorporated in the model rocket airframe.
- 2.3 The model rocket shall embody aerodynamic surfaces and/or a guidance system which will develop the necessary stabilizing and restoring forces to produce and maintain a safe, predictable and substantially vertical flight path. Model rockets which employ an internally or externally controlled guidance system shall incorporate sufficient inherent stability to fail safe any malfunction or disabling of the guidance system.
- 2.4 The model rocket shall incorporate a reliable and effective means, of retarding its descent so that no hazard shall be presented to 'persons or property on the ground, and to prevent model damage upon touchdown so as to enable reflight. All engine casings and/or portions of the model jettisoned from the model rocket during flight shall descend with a fully deployed streamer or parachute, or by aerodynamic surfaces, which will induce rapid tumbling or a shallow glide. Minimum loading requirements shall be five (5) square centimeters per gram for parachutes, and ten (10) square centimeters per gram for streamers.
- 2.5 A model rocket shall utilize no more than three powered stages. A "powered stage" shall be defined as a unit of the whole model rocket airframe which contains one or more model rocket engines, and which is designed to and/or actually separates as a unit in flight after the burnout of its contained engine(s). The number of powered stages used shall be assessed from the staged model configuration at the instant of its first motion on the launcher. A stage shall comply with the recovery system requirements of Rule 2.4.

- 2.6 A model rocket incorporating a self-energized firing system shall contain a safety interlock switch that will disable the firing circuit when "OFF". Activation of the firing system shall occur only immediately prior to launch. The self-energized firing system shall include a safe and reliable provision to test circuit continuity.
- 2-7 All combustible materials subject to high temperature developed by the function of any model rocket engine, burning-wick dethermalizer or other auxiliary devices operating at higher than 200 degrees Celsius shall be flame-proofed or similarly protected to prevent their ignition. Any on board device, which initiates ignition and/or employs combustion, shall be self-extinguishing upon termination of actual or intended function.
- 2.8 A model rocket shall never contain an explosive or pyrotechnic payload, nor shall it be used to launch a living animal.
- 2.9 The maximum or gross mass of a model rocket at launch shall not exceed 500 grams.
- 2.10 The model rocket shall contain no more than 125 grams of propellant grain.

CAR HODEL ROCKET ENGINE STANDARDS

- 3.1 A "model rocket engine" shall be a commercially manufactured device wherein the solid propellant grain tracking/delay train and ejection charge elements shall be preloaded and pre-assembled as an integral and discrete unit for ready and simple use.
- S.2 A model rocket engine used to provide propulsive force for a model rocket shall be of a type approved by Energy, Mines and Resources Canada, and shall be a specific engine type Contest Certified by the CAR when employed within a CAR sanctioned competition or record attempt.
- 3.3 The model rocket engine case, nozzle and internal partitions shall be solely constructed of non-metallic materials. The model rocket case shall be composed of a low thermal conductive material which will prevent the external surface of the case from exceeding 150 degrees Celsius during or after nominal engine function.
- 3.4 The model rocket engine shall be designed to offer reliable performance under nominal operating conditions. The model rocket engine casing shall not fragment during an internal overpressure state and shall dissipate the force of the overpressure along the longitudinal axis of the model rocket engine.
- 3.5 The model rocket engine shall be so designed and manufactured to be incapable of spontaneous ignition in air or water, or when subjected to shock or other motions that would be experienced during normal handling, shipment or use, or when exposed to a temperature of 80 degrees Celsius or less. No model rocket engine shall be packaged with its igniter pre-installed.
- 3.6 A model rocket engine shall contain no more than 62.5 grams of propellant grain, nor shall it generate a total impulse in excess of 80 Newton-seconds and nor shall it function with a burn duration of less than 0.05 seconds.
- 3.7 A firing model rocket engine shall not expel fragments of burning propellant grain and shall not be capable of igniting dry paper, grass or other combustible materials within a distance equal to 500 times the diameter of the nozzle throat.
- 3.8 The model rocket engine shall not be tampered with, modified or used in any manner so as to alter its dimensions, mass or its performance characteristics from those produced and/or documented by the manufacturer. Spent engine casings shall not be loaded for reuse.

- 3.9 The model rocket engine shall have plainly printed on its exterior surface:
- (a) Manufacturer's Name
 - (b) Date of manufacture
 - (e) Engine Type
 - (d) Average thrust to the nearest Newton
 - (e) Delay duration to the nearest second
- 3.10 There is no limit to the number of engines used in a model rocket, nor any restriction on the combinations and arrangements provided the sum of CAR established total impulse values of the individual model rocket engines remains within the maximum total impulse range for the event class.
- 3.11 A random sample of 1% of each model rocket engine type production run shall be subjected to quality control tests by the manufacturer to determine and record at ambient conditions:
- (a) total impulse
 - (b) maximum thrust
 - (c) burn duration
 - (d) thrust-time curve
 - (e) operation of ejection charge
- Said production run shall be destroyed or corrected by the manufacturer whenever:
- (a) the total impulse of any sampled engine varies more than $\pm 20\%$ from the manufacturer's rated total impulse;
 - (b) the delay time of any sampled engine varies more than $\pm 20\%$ from the manufacturer's rated delay time, and in no instance shall this deviation exceed three
(3) seconds;
 - (c) any sampled engine experiences during the test a nozzle or propellant ejection, casing rupture or burn through, or ejection charge failure;

(d) any sampled engine operates in a manner that would render unsafe its shipment storage, handling or use.

3.12 A random sample of each model rocket engine type production run shall be retained and stored by the manufacturer and Subjected to all tests defined in 3.11 after a period of one year from the date of manufacture. Failure to perform to said requirements shall cause withdrawal from commercial sale of that model rocket engine type until same can be qualified as herein required for minimum shelf performance life.

3.13 The manufacturer shall be responsible to supply model rocket engine instructions defining:

- (a) proper and safe handling, and ignition by electrical means;
- (b) propellant and engine mass, total impulse, average thrust, time delay, typical type thrust-time curve and maximum lift-off mass;
- (c) first aid data to treat burns and oral ingestion;
- (d) proper and safe disposal.

3.14 CAR model rocket engine classifications are as follows:

Engine Type	Total Impulse (N-S)
1/4 A	0.00 - 0.625
1/2 A	0.626 - 1.25
A	1.26 - 2.50
B	2.51 - 5.00
C	5.01 - 10.00
D	10.01 - 20.00
E	20.01 - 40.00
F	40.01 - 80.00

3.15 To be eligible for CAR Contest Certification, a model rocket engine shall:

- a) comply with all prior requirements of, Rules 3.1-3-13 except with respect to Rule 3.11, the total impulse for said engine shall not vary more than 10% from the manufacturer's rated total impulse performance when tested at a temperature of 20 degrees Celsius. The CAR reserves the right to reclassify the type of any model rocket engine from the manufacturer's declaration based on static test evaluations of total impulse as defined herein;
- b) be readily available through commercial purchase;

- c) be in current production, or otherwise, in the opinion of the CAR, to still be generally procurable. The CAR may set a definite period to limit the duration of this exemption.

SECTION B

4. CAR CONTEST RANGE STANDARDS

- 4.1 The contest range shall be at least 9.1 kilometers from the center of any airport.
- 4.2 The contest range shall have as its shortest dimension length of no less than one-third (1/3) of the expected maximum altitude capability of the model rocket(s) that will be flown. In no instance shall the contest range be smaller than 50 x 100 meter's in size.
- 4.3 The contest range shall be reasonably level offering no additional height advantage over the surrounding terrain.
- 4.4 The contest range shall not be adjacent to major highways, multi-story buildings and/or high voltage power lines. It shall be located so as not to present a hazard to persons and/or other property in the immediate vicinity.
- 4.5 The launch site shall be typically configured as in Figure 4-1:

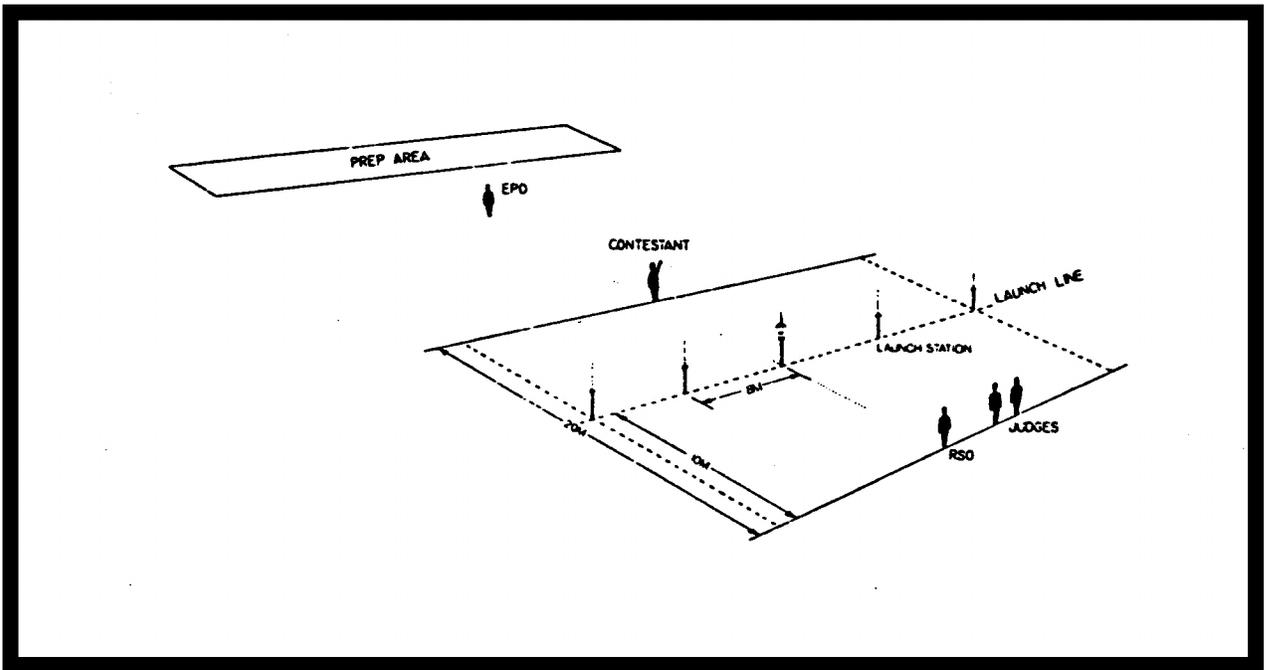


Figure 4-1: The number of Launch Stations may vary and the Launch Line may alternatively be circular in arrangement. The Judges actual position may be relocated to suit contest processing requirements. The RSO is shown at the Launch Control Station. The Launch Stations shall be identified and readily visible within the immediate Launch Site locale.

5. CAR CONTEST LAUNCH PROCEDURES

- 5.1 All operations relevant to the launch of model rockets shall be conducted and supervised by a Range Safety Officer (RSO). The authority of the RSO shall be respected at all times.
- 5.2 All model entries shall be submitted for and pass an inspection by the Entry Processing Officer (EPO) to ascertain whether @ d entries are in compliance with the event standards, and are capable of a safe and predictable flight. The inspection should include checks for gross model entry mass, engine type, attachment of the recovery system to the model, proper alignment and attachment of all fins, adequate stability margin, and other parameters deemed critical to safe operation of the model entry.
- 5.3 The model entry shall be launched from a device which will guide its vertical motion until it has attained the proper velocity for a safe and true flight trajectory. Such a device shall be sufficiently rigid to enable smooth movement of the model entry during launcher capture. The launch device shall include a blast deflector to prevent the exposure ox, the ground or the launcher itself to the exhaust jet from the model rocket engine(s).
- 5.4 The launch of the model entry shall not be assisted by the launching device wherein any velocity deviation shall result solely from the reaction force of the firing model rocket engine(s) contained within the model entry.
- 5.5 The model entry shall not be launched at any angle less than 300 from the vertical.
- 5.6 No model entry shall be launched if the ambient wind speed is greater than 35 kilometers per hour or visibility is less than 500 meters.
- 5.7 No model entry shall be launched in a manner so as to create a hazard to persons or aircraft in the vicinity of the contest range, nor shall it be launched against ground and/or air targets, nor into clouds.
- 5.8 The model rocket engine(s) shall only be ignited by a remote electrical system under the direct supervision of the Range Safety Officer. The system shall provide at least 20 watts of electrical power to each igniter for positive ignition. Said ignition system shall incorporate:

- (a) a momentary ignition switch that automatically returns to an "OFF" position when released;
- (b) a safety interlock key switch which will be "ON" only when the interlock key is engaged in the switch;
- (c) a reliable indicator of continuity within the ignition circuit.

5.9 The sequence of events preceding, initiating and including ignition shall be:

- (a) all persons shall be required to assume positions at least five (5) meters away from the Launch Station. The contestant shall stand behind his/her model with respect to an imaginary line between the Launch and Launch Control Stations (see Figure 4-1);
- (b) the RSO/Deputy shall ready a team of Judges to measure a flight, and shall advise the contestants of the availability of same;
- (a) To initiate firing, the contestant shall fully raise and extend his/her arm and provide an audible "PAD N IS GO" directed towards the Launch Control Station
(Note: .N equals equals the Launch: Station Number);
- (d) the RSO/Deputy shall advise the Judges to measure the flight of the model entry requested to be launched at Pad N ls;
- (e) the RSO/Deputy shall advise all persons in the Launch Site that a launch at Pad NLs is imminent and shall then insert the safety interlock key into the ignition system and arm the system;
- (f) the RSO/Deputy shall provide an audible countdown of at least five seconds and perform engine ignition;
- (g) once initiated by the contestant, procedures (e) and (f) may not be interrupted except by the Range Safety Officer, and then only as a response to an unsafe launch environment. When a safe launch environment is re-established, the RSO shall resume the launch at procedure (e) automatically.
- (h) If a firing model entry remains constrained on the launch device or prematurely touches down, no one shall approach said entry until the thrusting, delay and/or ejection phases of the model rocket engine(s) have ceased to function. If a misfire occurs, the Judges shall be immediately relieved to measure another flight. The contestant shall replace the igniter without removing the misfired model entry from the immediate vicinity of the Launch Station.

6. CAR CONTEST OFFICIALS

6.1 The Range Safety Officer (RSO) shall be a Senior CAR member at least 21 years of age and in good standing. Limited authority may be granted by the RSO to a Deputy who shall likewise be a Senior CAR member in good standing. Delegation of duties in this manner in no way relieves the RSO of the total responsibility for contest range control. In the event that the RSO must leave the contest range, the RSO shall transfer authority to a qualified backup RSO. Authority shall be reinstated upon the return of the primary RSO.

6.2 The Contest Director (CD), shall be a Senior CAR member in good standing. The CD for the CAR National Meet shall be at least 21 years of age and shall be appointed to said

position by the CAR Contest Board. The CD shall be responsible for general organization of the competition, applying for a CAR contest sanction, appointing the required contest officials and supervising their functions; verifying contestant CAR memberships and managing local processing of record homologation applications. The CD may function as a member of the Contest Jury (Rule 6.4), and/or as the RSO providing compliance to the requirements of Rule 6.1. The CD may appoint a Deputy to assist with the management and operation of the contest. The CD shall insure that the competition complies with the regulations and/or intent of the CANADA MODEL ROCKET SPORTING CODE.

6.3 Each event shall be scored by a team of qualified Judges (e.g. Timers, Trackers) who shall be responsible for assessing the performance/characteristics of model entries, calibrating measurement instruments, and certifying all flight/model physical data related to record homologation applications. A Judge may function as a member of the Contest Jury. At least one (1) Judge of the team shall be a Senior CAR member in good standing. All record attempts shall be measured only by Judges who shall be Senior CAR members in good standing. A Judge may compete; however, no Judge shall assess a score related to his/her model entry, nor alter or cause to have altered Competition Points awarded to his/her

model entry. One team of Judges shall be employed and dedicated to each assess Scale Points within Scale and Scale Altitude events, and R&D entries. The minimum number of Judges required per event team shall be:

EVENT	TRACKER	TIMER	PAYLOAD	SCALE	R&D	TOTAL
C1	2					2
C2, C11	2		1			3
C3,4,6,8,9,10		2				2
C5	2			2		4
C7				2		2
R&D					2	2

To facilitate homologation, it is recommended that the Judges shall be certified for technical competency to measure record attempt performances. Certification shall include the following classes:

- (a) DURATION TECHNICIAN - To receive certification, the individual must demonstrate skills of (a) accurate timing of model entry flights (b) calculation of the duration value by the standard CAR method and (c) completion of Form CC No. 802.
- (b) ALTITUDE TECHNICIAN - To receive certification, the individual must demonstrate skills of (a) calibration and accurate operation of the tracking instruments (b) calculation and closure qualification of altitude values by the standard CAR method and (a) completion of Form CC No. 802.
- (c) PAYLOAD TECHNICIAN - to receive certification, the individual must demonstrate skills of (a) calibration and accurate use of balances, vernier calipers and micrometers (b) identifying payloads and (c) completion of Form CC No. 802.

6.4 A Contest Jury (CJ) consisting of three preferably non-competing Senior CAR members in good standing shall be the final authority for the interpretation and application of the CANADA MODEL ROCKET SKORTING CODE. Unless the competition is limited to members of a single club, the contest Jury shall incorporate a maximum of two (2) members from the contest organizing club.

6.5 The Entry Processing Officer (EPO) shall be responsible for conducting those duties required to process a model entry into competition. The EPO shall process the contestant's flight card, event and safety check all model entries and process the return of model entries if and when required. The EPO shall consult with the RSO whenever a ruling is required to approve/reject a marginally safe model entry. The EPO may appoint a Deputy to assist in other than safety check operations.

- 6.6 The Data Reduction Officer (DRO) shall be responsible for the recording and reduction of all flight data. The DRO and judges should meet after the completion of any event to validate the results, and resolve discrepancies or errors. The DRO may appoint a Deputy if required to maintain processing throughput.

7. CAR SANCTIONED COMPETITION RMES

- 7.1 CAR sanctioned competitions shall be conducted in accord with the rules and regulations of the CANADA MODEL ROCKET SPORTING CODE.
- 7.2 All applications for the sanction of model rocket contests by the Canadian Association of Rocketry shall be submitted to the CAR Contest Board using a CONTEST SANCTION APPLICATION FORM (CC No. 803) available from the Contest Board. The application and sanction fee shall be transmitted at least 30 days prior to the commencement date of the contest although upon written petition and exceptional circumstances proved therein, the Contest Board may waive this requirement. All applications shall be prepared and signed by the Contest Director. The sanction fee schedule shall be:
- (a) CAR Division Organizer - \$5.00 per 10 contestants or fractions thereof;
 - (b) Open Organizer - \$7.00 per 10 contestants or fraction thereof.
- 7.3 The Meet Classes in CAR sanctioned competition shall be:
- (a) An Open Meet shall be one open to CAR members residing in a geographic region specified by the contest organizer.
 - (b) A Provincial Meet shall be one in which CAR members residing in one Province of Canada may engage in competition.
 - (c) A National Meet shall be held annually in which all members of the CAR may engage in competition. The meet shall be held on at least two (2) consecutive days. Special rules originating from and/or approved by the CAR Contest Board may apply.
 - (d) A Record Trial shall be one in which CAR members shall attempt to exceed and establish official CAR Model Rocket Performance Records. Depending on the weather and time permitting, no limits shall be placed on the number of attempts and events flown. A Record Trial window may not exceed more than fifteen (15) consecutive days in duration. All events that may be flown shall be specified on the Sanction Application Form.

- 7.4 An event or meet may be cancelled whenever the following extreme conditions occur:
- (a) Wind - continuously greater than 35 kilometers per hour.
 - (b) Storm - steady rain, hail, snow blizzard, sleet, hurricane;
 - (a) Other - flood, earthquake, less than 500 metros visibility, access to the contest range withdrawn, less than 2 contestants for the majority of scheduled events. Cancellation is not justifiable when conditions are marginal, or create only mild discomfort. The Contest Director shall consult with the contestants present regarding any cancellation action and obtain at least a two-thirds (2/3) majority vote of same to approve any event/meet cancellation. The Contest Director shall report cancellation to the Contest Board and provide a new date if the meet is to be rescheduled. The Contest Board reserves the right to request a formal sanction re-application if it feels the meet was cancelled for an invalid cause. The contest organizer is not obligated to reschedule the meet or refund any or all entry fees if the meet was cancelled for a justifiable cause. Any meet delayed by adverse conditions may be extended. Every effort shall be made to decide upon a cancellation before the commencement of any event.
- 7.5 All contest forms used during a meet with the exception of those required to process a record homologation application shall be retained by the Contest Director until termination of the calendar year. The Contest Board may inspect or claim possession of the contest forms after the completion of any meet.
- 7.6 All optional rules invoked by the Contest Director shall be defined on the Sanction Application Form and contest information materials.

8. CAR POINTS AND CHAMPIONSHIP AWARDS

- 8.1 Event Standing Points (ESP) shall be awarded to the top five (5) contestants as follows:
- 10 Points for First place in an event 6 Points for Second place in an event 4 Points for Third place in an event 2 Points for Fourth place in an event 1 Points for Fifth place in an event
- 8.2 In the event of tie for any given place within an event, each tied contestant shall receive identical respective Event Standing Points.
- 8.3 The Event Standing Points shall be multiplied by the coefficient of event difficulty, the K Factor, for that event to determine the contestant's Competition Points (CP).
- 8.4 The Competition Points for each contestant shall be summed. The sum shall be the criteria whereby contestants shall be ranked for the determination of meet standings. The meet champion for each Competition Class (Rule 9.2) shall be that contestant who has the highest number of Competition Points in his/her respective Competition Class.
- 8.5 The CAR individual member who has accumulated the largest number of Competition Points in the CAR National Meet shall be given the CAR National Championship Award in his/her respective Competition Class.
- 8.6 The CAR Division that has accumulated the highest number of Competition Points in the CAR National Meet shall be given the CAR National Division Championship Award.
- 8.7 Holders of perpetual National Championship awards shall be responsible for maintaining the award in good condition, and delivery of the award to the CAR at least fifteen (15) days prior to the Subsequent National Meet. The CAR shall maintain a registry of National championship holders.

9. CAR CONTESTANT RULES

9.1 Competition in CAR sanctioned contests is open to all CAR members. All contestants shall complete and submit a CONTEST ENTRY FORM (CC No. 801). All contestants shall present their CAR Membership Card to the Contest Director or Deputy for verification. Contestants intending to file for a World Model Rocket Performance Record shall also present their FAI Sporting License for verification.

9.2 CAR members shall compete in the following Competition Classes:

- (a) Junior - 17 years of age and under
- (b) Senior - 18 years of age and over

The Competition Class in which any CAR member shall compete shall be determined by the age of the contestant as at the first of January.

9.3 Individuals who have not received their CAR Membership Card but have applied for same shall identify the CAR Code as PENDING (abbreviation PEND) on all contest forms. Failure to subsequently inform the Contest Director of membership acceptance within thirty (30) days after the completion of the contest shall void the contestants standing achieved in the competition and all awards received shall be returned to the Contest Director.

9.4 Any non-current or non-pending member of the CAR may enter an Open CAR sanctioned meet upon holding of a CAR Contest Membership. A CAR Contest Membership may be obtained by submitting a completed membership form and prescribed fee to the Contest Director. Said Contest Member shall not be eligible to apply for and hold Canada Model Rocket Performance Records.

9.5 All competing CAR divisions in the CAR National Meet shall supply a copy of their CAR Division Charter to the Contest Director or Deputy for verification.

9.6 Due to an exceptional circumstance preventing a contestant's attendance, or a range assignment which prevents a contestant from actually flying his/her model entry, the contestant may appoint a proxy to fly the model entry. Prior to this, the contestant shall present proof to the Contest Director to substantiate the need for a proxy-flyer. The proxy shall be approved by the Contest Director, and shall be a full member of the CAR in good standing, and shall be in the same Competition Class as the contestant. A proxy shall not be appointed in C10 or Research and Development events.

10. CAR MODEL ENTRY RULES

10.1 There are eleven (11)- main classes of model entries as follows:

- C1 Altitude
- C2 Payload Altitude

- C3 Parachute Duration
- C4 Boost/Glider Duration
- C5 Scale Altitude
- C6 Streamer Duration

- C7 Scale
- C8 Rocket/Glider Duration
- C9 Helicopter Duration
- C10 Radio Control Glider Duration
- C11 Bio-Sim Altitude

Each class except C7 has been sub-classed according to engine size. Refer to rules applicable to each class.

10.2 To be eligible for competition the model entry shall be wholly constructed by the competitor. Entries obtained in essentially complete kit form from commercial manufacturers shall not be eligible for competition. Model entry materials and designs may be incorporated from any source. Model entries which are radio controlled shall be flown by the constructor-competitor.

10.3 All model entries shall have the competitors CAR Code in letters and numbers at least five (5) millimeters high displayed on its exterior surface.

10.4 Each contestant may enter up to, and including the maximum number of model entries specified for each event. A model entry may be flown in any number of events except a single flight performance may not be applied to two or more events. When the event restricts each contestant to one model entry, said entry may not be altered except for the substitution of recovery devices, engines and/or to effect repairs during the course of the event.

10.5 Immediately prior to its initial flight in an event, each model entry shall pass an inspection given by the Entry Processing Officer that will certify that the entry meets the event and safety standards as defined in the CANADA MODEL ROCKET SPORTING CODE. If an event permits multiple model entries, each contestant shall

submit all of his/her model entries for inspection together. The contestant shall present proof of model entry safety if so requested by a contest official. Any device (e.g. Piston Launcher) intended to assist the launch of the model entry shall also be submitted for and pass a safety inspection. Each model entry which passes the inspection shall be identified as complying with same. Contestants shall be required to demonstrate the operation of the radio systems for radio controlled entries.

- 10.6 The engine type, delay and manufacturer, and model entry gross weight shall be checked and recorded on the contestant's COMPETITION FLIGHT CARD (CC No. 802) prior to the flight of the entry.
- 10.7 A minimum of two (2) model entries are necessary before an event may actually be held per Competition Class.
- 10.8 The contest officials have the authority to inspect any model entry which has made an official flight. If the entry cannot be submitted with a reasonable or specified time period, that official flight shall be disqualified unless overruled by the "Hazardous Recovery" exemption of Rule 12.5.

11. CAR OFFICIAL FLIGHT RULES

- 11.1 Each model entry shall be allowed a maximum of three (3) official flights per event subject to weather conditions and event time available. No limit on the maximum number of flights shall exist for Record Trials.
- 11.2 A flight becomes official if the model entry clears the launch device or otherwise becomes airborne under its own power, and was qualified in accord with Rules 14.1.4 (e) and 14.2.6 for Altitude and Duration competition entries respectively. If a catastrophic failure occurs which in the opinion of the Judges was not caused by the improper design, construction or preparation of the model entry, the flight shall not be ruled official by option of the contestant.

12. CAR DISQUALIFICATION RULES

- 12.1 Any model entry may be disqualified by any contest official at any time when the model entry is judged not to conform to the safety and/or competition requirements of an event, Disqualification may be effected for one or more flights, or an entire event. A disqualified flight shall be scored with a value of zero.
- 12.2 Any contestant who disregards the authority of any contest official or who demonstrates a lack of respect for the standard safety rules, or who displays poor sportsmanship may be disqualified from competing in an event or entire contest.
- 12.3 Flight performance data for any disqualified model entry shall be recorded. The reason for the disqualification of the model entry should be entered on the contestant's Flight Card.
- 12.4 If a catastrophic failure occurs while in the opinion of the Judges was not caused by the improper design, construction or preparation of the model entry, the model entry shall not be disqualified. A contestant may immediately substitute another model entry for one damaged in a catastrophic failure. Substitution shall not be permitted in C5 Scale Altitude or CT Scale events if the substitute model entry cannot be judged for Scale Fidelity prior to its first flight.
- 12.5 A model entry shall not be disqualified whenever said entry is required to be returned but cannot due to its landing in a hazardous place and a contest official can verify the touch down location. This rule is not in effect for C11 competition.
- 12.6 Disqualification shall only be reversed as per rule 13.

13. CAR PROTEST AND APPEAL RULES

- 13.1 Protests shall be presented to the Contest Jury in legible writing on a COMPETITION PROTEST FORM (CC No.808) accompanied by a fee of \$2.00 within one (1) hour after the completion of event competition.
- 13.2 The Protest Form shall report in full:
- (a) the purpose of the protest;
 - (b) those officials and/or contestants involved;
 - (c) arguments and other details in support of the protest.
- 13.3 The Contest Jury shall record its ruling on the protest on the submitted Protest Form. The Contest Director shall advise the protesting contestant of the Contest Jury's decision respecting the protest. If the protest is upheld, the protest fee shall be refunded to the contestant; otherwise the protest fee shall be sent to the Contest Board accompanied by the Protest Form. The Contest Director is advised to retain a copy of the Protest Form.
- 13.4 Appeals to the decision of, the Contest Jury shall be forwarded to the Contest Board not more than two (2) days after receipt of the original protest decision. The protest fee of \$2.00 shall be returned to the contestant if the appeal is ruled in favour of the protesting contestant.

14. CAR MEASUREMENT RULES

14.1.1 All tracking instruments employed to reduce attitudes shall be of a theodolite design that:

- (a) is able to measure angles in elevation and azimuth planes with an accuracy of at least ± 0.5 degrees;
- (b) employs a sighting bar or tube having a zero power reticule system. The tube or bar shall be free to rotate in a vertical plane about a horizontal axis.
- (c) contains provisions to level the azimuth plane;
- (d) incorporates brakes on the azimuth and elevation planes to prevent any errant movement in the sighting tube/bar when released;
- (e) has coincidence in the geometric centers of the elevation circle and trunnion axes, and coincidence in the geometric centers of the azimuth plate and vertical axes;
- (f) provides perpendicularity between the trunnion and vertical axes;
- (g) has motions of one component relative to another in circular form with complete absence of slackness or back lash;
- (h) incorporates a rigid base to prevent instrument motion during normal use;

or shall be of a type approved by the CAR Contest Board.

14.1.2 Each tracking instrument of the theodolite design shall be calibrated in the field by the Judges as follows:

- (a) erect the instruments on solid ground with the vertical axis centered over the end points of the baseline;
- (b) level the instrument and transit the sighting tube/bar until the altitude circle is zeroed. Lock the motion or the elevation circle;
- (c) bisect the opposite theodolite by adjusting the level of the azimuth plate and set the azimuth dial to zero (0) degrees;

- (d) bisect some stationary object in the immediate locale of the launch site by adjusting the level of the azimuth plate;
 - (e) again bisect the other theodolite, adjusting the level of the level plate if needed. Reset the azimuth dial to zero (0) degrees if required;
 - (f) repeat (d) and (e) until each target can be bisected when the elevation circle is set to zero (0) degrees.
- 14.1.3 The model entry shall be tracked to its maximum vertical altitude. One tracking Judge (Tracker) shall be assigned to report a "STOP" to the other Judge when the model entry attains maximum apogee. Each Judge shall then immediately terminate tracking on this call. The angles of azimuth and elevation shall be read to the nearest whole degree or arc.
- 14.1.4 Tracking angular data from theodolite designs shall be reduced to an attained altitude in meters by means of the Vertical Midpoint Altitude Reduction Method (Technical Appendix - A) or other method approved by the CAR Contest Board. The official scored attained altitude shall be the computed mean of the altitudes reduced by each theodolite which close as follows:
- (a) round each theodolite altitude to nearest meter (see Technical Appendix - B);
 - (b) compute the mean of the altitudes from (a) and round to the nearest whole meter;
 - (e) if the altitudes from (a) are within the maximum percentage tolerance of the mean computed in (b), the track is closed, otherwise the track is not closed and the flight shall not be considered official unless a disqualification has occurred.
- 14.1.5 Modifications to the altitude reduction and qualification methods of 14.1.4 shall be approved by the CAR Contest Board prior to granting of a contest sanction.
- 14.2.1 All timing instruments employed to measure duration shall include the following operation standards:
- (a) able to measure duration with an accuracy of at least $\pm 0.1\%$;

- (b) shall have a resolution of at least 1/5 second;
 - (e) shall have start, stop, reset and time-out functions.
- 14.2.2 Two (2) timing instruments shall be employed to measure the duration of each flight. One timing Judge (Timer) shall each operate a single timing instrument. The Judges shall remain within a circle of ten (10) meter radius during the flight they are timing.
- 14.2.3 Duration timing shall commence at the instant of first motion of the model entry on the launch device and shall terminate whenever the maximum time is exceeded for the event, or when the model entry disappears from both of the Judge's sight, or when the model entry encounters an obstacle that ends its flight. If the model entry in flight disappears behind an obstacle or into a cloud, the Judges shall wait for ten (10) seconds, and should the model entry not reappear, timing shall terminate and the ten (10) seconds shall be subtracted from the flight time.
- 14.2.4 The official scored duration shall be the computed mean of the two times measured by each Judge, but reduced to the nearest whole number of seconds below the mean time.
- 14.2.5 Judges may employ sunglasses, corrective eyeglasses and/ or binoculars. Binoculars should have a magnification of between four (4) and eight (8). The binoculars may not be exchanged between the Judges while timing a model entry. The Judge who first uses the binoculars shall retain them to observe the entire flight. If a model entry disappears from the sight of the Judge without binoculars, the Judge shall not terminate timing but shall wait until the other Judge signals "STOP". This procedure is also in effect for the Judge with binoculars if the model entry leaves the field of view of the binoculars and if it cannot be re-sighted, but the other Judge maintains observation. If either Judge loses observation of the model entry in flight, the loss shall be immediately reported to the other.
- 14.2.6 If a timing instrument malfunctions, the flight duration shall be the time measured by the working instrument. If both timing instruments fail, the flight shall not be considered official unless a disqualification has occurred. This rule is not in effect for record attempt flights wherein both timing instruments shall be required to work without malfunction.

- 14-3.1 All weighing instruments employed to measure masses shall:
- (a) be able to measure masses with an accuracy of at least $\pm 1.0\%$.
 - (b) shall have a resolution or at least 1/10 gram;
 - (a) contain a zero adjust;
 - (d) have at least a 0-500 gram capacity.
- 14-3.2 All masses shall be expressed in grams rounded to the nearest whole gram.
- 14.3.3 The weighing instrument shall be mounted on a horizontal surface and the scale zeroed prior to use. For normal competition requirements, masses need only be verified for compliance to the event's mass range by the "GO-NO GO" test (see Technical Appendix-C). Mass measurements involved for record attempts shall be expressed as per 14-3.2. A screen is highly recommended to isolate the weighing instrument from ambient wind disturbances.
- 14.4.1 Parachute and streamer dimensions shall be measured on a flat surface using a ruler of a length greater than the largest dimension or the recovery system. Dimensions shall be rounded to the nearest whole centimeter.

15. CAR RECORD HOMOLOGATION PROCEDURES

- 15.1 Model Rocket Performance Records may be established in Canada during competitions sanctioned by the Canadian Association of Rocketry in accordance with the rules and regulations defined in the CANADA MODEL ROCKET SPORTING CODE. Record performances shall be absolute representing the best result of a single flight.
- 15.2 All attempts to set a new level of performance shall exceed the established record performance by at least one percent (1%).
- 15.3 Canada Model Rocket Performance Records may be awarded in the following events:

C1, C2, C3, C4, C5, C6, CB, C9, C10, C11
- 15.4 Canada Model Rocket Performance Records shall be established in each Competition Class.
- 15.5 The CAR Contest Board shall be the authority responsible for the homologation of Canada Model Rocket Performance Records.
- 15.6 The Record Claimant is responsible for the control and execution of the record attempt, and for supplying all documentation and fees required for record homologation and certification.
- 15.7 The CAR record homologation procedure shall be as follows;
 - 15.7.1 The Record Claimant or Contest Director shall forward to the CAR Contest Board a completed RECORD NOTIFICATION FORM (CC N. 805) within twenty-four (24) hours of the record attempt.
 - 15.7.2 Upon receipt of the RECORD NOTIFICATION FORM, the CAR contest Board shall prepare a standard RECORD HOMOLOGATION REPORT-A (CC No. 806A) and send one copy to the Record Claimant, one copy to the National Aero Club and one copy to the CAR Publication Board.
 - 15.7.3 The Record Claimant shall compile and submit a Record Claim Dossier containing:
 - (a) a completed APPLICATION FOR RECORD HOMOLOGATION FORM (CC No. 807);

- (b) the Record Claimant's CONTEST ENTRY FORM (CC No.801) and COMPETITION FLIGHT CARD (CC No. 802). These forms shall be completed and signed in ink. The Flight Card shall bear the signatures of the Record Claimant and all Judges. Specify the record attempt flight number on the Flight Card whenever it contains multiple flight data;
- (a) three (3) clear and accurate working drawings of at least 20 x 25 centimeter size depicting in scaled detail the model entry flown in the record attempt. The drawing shall also provide all principal dimensions, and gross launch, burnout and airframe masses of the model entry;
- (d) three (3) sharply focused photographs of at least 13 x 18 centimeter size. The model entry shall be centered in and consume as much of the photograph as possible without loss of model entry details. The photograph shall include a ruler with its scale visible and aligned as close as possible and parallel to the model entry;
- (e) record homologation fee.

This Record Claim Dossier shall be transmitted to the CAR Contest Board within thirty (30) days of the record attempt, otherwise the record claim shall be defaulted.

- 15-T.4 Upon receipt of the Record Claim Dossier, the CAR Contest Board shall acknowledge receipt of these materials by transmitting a RECORD HOMOLOGATION REPORT-B (CC N. 806B) to the Record Claimant. The CAR Contest Board may request further record claim substantiation materials from the Record Claimant. If such additional materials are not received within thirty (30) days of the transmission of the same, the record claim shall be rejected. Homologation will be completed within sixty (60) days of the receipt of all Record Claim Dossier materials.
- 15.7.5 The CAR Contest Board shall rule on the record claim and prepare a standard RECORD HOHOLOGATION REPORT-C (CC No. 806C) and send the original to the Record Claimant, and one copy each to the CAR Publication Board and the National Aero Club, and retain a copy for its files.
- 15.7.6 The CAR Contest Board reserves the right to solicit additional record homologation data and reject any record claim considered to originate through unfair conditions and/or falsified documentation.

16. CAR C1 ALTITUDE COMPETITION RULES (K=1)

- 16.1 Altitude Competition is comprised of six (6) events in which the contestant whose model entry attains the highest tracked and reduced altitude shall be declared the event winner.
- 16.2 A maximum of two (2) models may be entered and flown by each contestant. The model entries may be staged; however, except for the jettisoned stages and recovery wadding, the model may not separate into two (2) or more unattached portions during flight.
- 16.3 Altitude measurements shall be undertaken in accordance with rule 14.1.
- 16.4 Altitude Competition shall be divided into classes based on the maximum permitted launch mass and maximum allowable total impulse as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)
C1A	60	0.00-2.50
C1B	60	2.51-5.00
C1C	120	5.01-10.00
C1D	180	10.01-20.00
C1E	240	20.01-40.00
C1F	500	40.01-80.00

17. CAR C2 PAYLOAD ALTITUDE COMPETITION RULES (K=2)

- 17.1 Payload Altitude Competition is comprised of two events in which the contestant whose model entry attains the highest tracked and reduced altitude while carrying a single Standard Payload shall be declared the winner.
- 17.2 A maximum of two (2) models may be entered and flown by each contestant. The model entries may be staged; however, except for the jettisoned stages and recovery wadding, the model may not separate into two (2) or more unattached portions during flight.
- 17.3 A Standard Payload shall:
- (a) be a non-metallic, sealed cylinder;
 - (b) have a mass of no less than 28 grams;
 - (a) have a diameter of $19.1 + 0.1$ millimeters;
 - (d) contain a fine and loose substance.
- No material may be affixed to it, nor shall it be punched, drilled or otherwise modified in a manner that would affect its form or mass.
- 17.4 The Standard Payload shall be completely enclosed and secured inside the model entry. If the model entry is a staged vehicle, the Standard Payload shall be flown in the upper stage. The payload shall be easily removable from the model entry.
- 17.5 Standard Payloads shall be processed as follows during Payload Competition:
- (a) the contestant shall submit the payload to the Payload Judge who shall measure the payload's diameter and mass;
 - (b) if the payload complies with all event parameter requirements of Rule 17.3, the Payload Judge shall identify the payload and record same on the contestants Flight Card;
 - (c) prior to the model entry's first flight, the Entry Processing Officer or Deputy shall return the payload to the contestant and advise same of the payload's acceptability. If in compliance with the event payload requirements, the payload may be employed in competition;

- (d) the Entry Processing Officer shall witness the insertion of the payload, and the loaded model entry shall be immediately taken to a Launch Station;
- (e) if required by Rule 10.8, immediately upon recovery after flight the contestant shall return the model entry to the Entry Processing Officer or Deputy and remove the payload in the presence of this official'. The payload identification shall be verified as correct. The payload may be re-subjected for a mass measurement if a suspected or evident loss of contents is found.

17.6 Altitude measurements shall be undertaken in accordance with Rule 14.1.

17.7 The model entry shall fully deploy a parachute recovery device.

17.8 The flight shall be disqualified if when a return is required the payload has been removed in the absence of the Entry Processing Officer/Deputy or if the model is not returned for inspection, or if the payload is found in a postflight examination to be in contravention of the payload event requirements, or if the payload separates from the model entry in flight.

17.9 Payload Altitude Competition shall be divided into classes based on maximum permitted launch mass and maximum allowable total impulse as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)
C2B	90	0.00-5.00
C2C	90	5.01-10.00

18. CAR C3 PARACHUTE DURATION COMPETITION RULES (K=2)

- 18.1 Parachute Duration Competition is comprised of four (4) events in which the contestant whose combined model entries remain aloft under deployment of a, parachute for the highest total time of all official flights shall be declared the event winner.
- 18.2 A maximum of two (2) models may be entered and flown by each contestant. The model entry shall be single-staged, powered by a single model rocket engine and contain one or more parachutes. The parachute shall contain at least three (3) shroud lines. Parachutes may be substituted at any time during competition. The parachutes shall deploy at least to the minimum requirements of: (a) complete unfurling of shroud lines, and (b) unfurling of the parachute canopy but not inflating, other-wise the flight shall be disqualified.
- 18.3 The model entry shall not separate into two or more portions during flight.
- 18.4 Duration measurements shall be undertaken in accordance with Rule 14.2.
- 18.5 Each contestant shall be entitled to three (3) official flights. The total time of the three (3) official flights shall be the basis for final event competition standing wherein the contestant achieving the highest total time shall be immediately declared the event winner. If there is a tie for first place, the tied contestants shall be provided the opportunity for additional flights (fly-off) immediately after the last flight of the event has been completed. The maximum time of flight for each additional round shall be incremented by sixty (60) seconds over the maximum time or the previous round. Each fly-off round shall be fifteen (15) minutes in duration. Staging of fly-off rounds shall continue until a winner is determined.

18.6 Parachute Duration Competition shall be divided into classes based on maximum permitted launch mass, maximum allowable total impulse and maximum timing limit as follows:

Class	Maximum Launch Mass	Maximum Total Impulse (G)	Maximum Time Limit (N-S)	(5)
C3A		100	0.00-2-50	240
C3B		100	2.51-5-00	360
C3C		200	5.01-10.00	480
C3D		500	10.01-20.00	600

18.7 C3A event maximum total impulse/time limit may be adjusted to 0.00-1.25/120 at the option of the Contest Director.

19. CAR C4 BOOST/GLIDER DURATION COMPETITION RULES (K=3)

- 19.1 Boost/Glider Duration Competition is comprised of six (6) events in which the contestant whose combined glider entries remain aloft by aerodynamic lifting surfaces for the highest total time of all official flights shall be declared the event winner.
- 19.2 A maximum of two (2) model entries may be entered and flown by each contestant. The model entry shall be launched with an essentially vertical boost trajectory.. Model entries which perform significant rotations about its pitch or yaw axes, or transition into a shallow boost climb shall be disqualified. The launched model entry configuration shall not be radio-controlled.
- 19.3 The gliding model portion or the model entry shall attain a stable aerodynamic glide and shall not employ a parachute or streamer recovery device to effect such a descent. The gliding model portion shall not be radio controlled.
- 19.4 The model entry may jettison a spent power pod or model rocket engine provided the component deploys a parachute or streamer in accordance with Rule 2.4. Recovery device entanglement of a jettisoned model portion and the gliding model portion shall not cause the disqualification of the flight unless in the Judge's opinion, the recovery system is enhancing the glide, or if this model configuration is deemed unsafe by the ESO. If there is a separation of a firing power pod or engine from the gliding model portion while on the launch device or during flight, the flight shall be disqualified.
- 19.5 Duration measurements shall be undertaken in accordance with Rule 14.2 wherein timing shall be restricted to the launch and flight of the gliding model portion if the model entry separates as per Rule 19.4.
- 19.6 Each contestant shall be entitled to three (3) official flights. The total time of the three (3) official flights shall be the basis for final event competition standing wherein the contestant achieving the highest total time shall be immediately declared the event winner. If there is a tie for first place, the tied contestants shall be provided the opportunity for additional flights (fly-off) immediately after the last flight of the event has been completed. The maximum time of flight for each additional round shall be incremented by sixty (60) seconds over the maximum time of the previous round. Each fly-off round shall be fifteen (15) minutes in duration. Staging of fly-off rounds shall continue until a winner is determined.

19.7 Boost/Glider Duration Competition - shall be divided into classes based on maximum permitted launch mass, maximum allowable total impulse and maximum timing limit as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)	Maximum Time Limit (5)
C4A	60	0.00-2-50	120
C4B	90	2.51-5.00	180
C4C	120	5.01-10-00	240
C4D	240	10.01-20.00	300
C4E	240	20.01-40.00	300
C4F	500	40.01-80.00	300

19.8 C4A event maximum total impulse/time limit may be adjusted to 0.00-1.25/60 at the option of the Contest Director.

20. CAR C5 SCALE ALTITUDE COMPETITION RULES (K=4)

- 20.1 Scale Altitude Competition is comprised of six (6) events in which the contestant whose model entry accumulates the highest total of Scale Points, and tracked and reduced altitude shall be declared the event winner.
- 20.2 One (1) model entry may be entered and flown by each contestant. Said entry shall comply with and be judged by Rules 16 and 22 unless overruled by special C5 event rules. A model entry shall be disqualified if scale integrity has been purposely minimized in an attempt to improve its altitude performance capabilities. Actual scale judging shall precede competition flying.
- 20.3 No altitude points shall be accumulated if the tracks could not close. The contestant whose model entry acquires the largest number of total points calculated by summing the Scale Fidelity Points to the highest total of Flight Points and altitude in metres attained in the same flight shall be declared the winner. Scale Points shall decide ties.
- 20.4 Scale Altitude Competition shall be divided into classes based on maximum permitted launch mass, and maximum allowable total impulse as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)
C5A	90	0.00-2.50
C5B	90	2.51-5.00
C5C	120	5.01-10.00
C5D	240	10.01-20.00
C5E	240	20.01-40.00
C5F	500	40.01-80.00

21. CAR C6 STREAMER DURATION COHPETITION RULES (K=2)

- 21.1 Streamer Duration competition is comprised of four events in which the contestant whose combined model entries remain aloft under deployment or a streamer for the highest total time of all official flights shall be declared the event winner.
- 21.2 A maximum of two (2) models may be entered and flown by each contestant. The model entry shall be single-staged, powered by a single model rocket engine and contain one streamer. The streamer shall be a single piece of flexible and homogenous material. The streamer shall have a length to width ratio of at least 10:1. The streamer shall not be cut or perforated, nor similarly modified in such a manner that would interrupt its continuous surface. A single line shall be employed connecting the streamer at a single point on its narrow end to a single point on the model body. The streamer must completely unfurl in flight. Streamers may be substituted at any time during competition.
- 21.3 The model entry shall not separate into two or more portions in flight.
- 21.4 Duration measurements shall be undertaken in accordance with Rule 14.2.
- 21.5 Each contestant shall be entitled to three (3) official flights. The total time of the three (3) official flights shall be the basis for final event competition standing wherein the contestant achieving the highest total time shall be immediately declared the event winner. If there is a tie for first place, the tied contestants shall be provided the opportunity for additional flights (fly-off) immediately after the last flight of the event has been completed. The maximum time of flight for each additional round shall be incremented by sixty (60) seconds over the maximum time of the previous round. Each fly-off round shall be fifteen (15) minutes in duration. Staging of fly-off rounds shall continue until a winner is determined.
- 21.6 Streamer Duration Competition shall be divided into classes based on maximum permitted launch mass, maximum allowable total impulse and maximum timing limit as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)	Maximum Time Limit (5)
C6A	100	0.00-2-50	120
C6B	100	2.51-5-00	180
C6C	200	5.01-10-00	240
C6D	500	10.01-20.00	300

21.7 C6A event maximum total impulse/time limit may be adjusted to 0.00-1.25/60 at the option of the Contest Director.

22. CAR C7 SCALE COHPETITION RULES (K=5)

- 22.1 Scale Competition is an event in which only flyable model rockets constructed as true scale replicas of a historical or current missile, rocket or space vehicle shall be entered and flown.
- 22.2 Scale Competition measures and assesses the quality of scale reproduction and flight performance. The contestant whose model entry accumulates the highest S @ e Points shall be declared the event winner.
- 22.3 The contestant shall enter one (1) model of a specific serial-numbered prototype except where the extended production or the prototype precludes scaling of same.
- 22.4 Scale model entries assembled from commercially available kits are acceptable for competition provided that the contestant provides data not supplied with the kit corroborating its scale qualities.
- 22.5 All pre-manufactured components incorporated in the scale model entry shall be identified by the contestant within the scale documentation materials.
- 22.6 A model entry scaled from a multi-staged prototype may include one or more unpowered upper stages; however, an upper stage configuration of a multi-stage prototype may not be entered and flown without its powered lower stage(s) unless proof is provided that this upper stage configuration flew as entered.
- 22.7 If a prototype lacks fins or has insufficient fin area to produce stable flight characteristics if incorporated in true scaled size on the scale model entry, transparent fins may be added to the scale model entry. The execution of this addition shall be judged for workmanship.
- 22.8 Scale models shall be initially judged for Scale Fidelity Points in flight condition minus the model rocket engine(s) and recovery wadding. The entry shall subsequently be flown and judged for Flight Points with the only permitted model entry changes being the addition of the model rocket engine(s) and recovery wadding.
- 22.9 Each scale model entry shall make a stable, official flight with two opportunities made available subject to time and weather permitting. A scale model entry shall be awarded zero (0) Landing Points if it cannot be returned to the Judges after said flight.

- 22.10 The scale model entry shall have a maximum gross launch mass of 500 grams and a maximum total impulse of 80.00 Newton-seconds.
- 22.11 The contestant's CAR Code shall be visibly displayed on an external model entry surface. No Scale Fidelity Points shall be deducted for the addition of such identification; however, Workmanship Points shall be awarded for the execution of the identification.
- 22.12 Scale Points shall be the sum of Scale Fidelity Points (Rules 22.12.1-22.12.4) and Flight Points (Rule 22.12.5) awarded as follows:
 - 22.12.1 Quality of Scale Substantiation Data - 50 points maximum

Proof of scale is the responsibility of the contestant. Data shall substantiate the particular scale model prototype. Minimum acceptable data shall be:

- a) Vehicle serial/flight number
- b) Scale factor
- 0) Overall length
- d) Maximum body diameter
- e) Nose cone length
- f) Fin root length, fin span, fin tip, length and thickness
- g) Length of transition sections
- h) One clear photograph
- i) colour scheme (either in writing or depicted by photograph(s))
- J) table of prototype and scale model dimensions for (a) to (g)

Failure to provide the minimum acceptable data shall result in the disqualification of the scale model entry from competition.

Points shall be awarded as follows:

- a) Major Source of Scale Substantiation Data - 10 points maximum
 - (1) Manufacturer 10
 - (2) Contractor (eg.NRC) 8
 - (3) CAR Plans 6
 - (4) Model magazine/newsletter 4
 - (5) General Information Sources/kits 1

b) Drawings - 20 points maximum

(1) A maximum of 15 points shall be awarded for exceptional drawing presentation. The award shall be proportionate to the amount of details and dimensions provided, and general quality of the reproduction if not the original drawing;

(2) A maximum of 5 points shall be awarded for exceptional proof of prototype finish, colour and markings.

c) Photographs - 20 points maximum

The number of points awarded shall reflect the quantity and quality of external details discernable. At least one photograph shall be in colour if no colour scheme data is presented elsewhere in the Scale Substantiation Data. The Judges should consider the difficulty in obtaining photographic data of vehicles for which it is impossible to obtain exhaustive authentication provided a detailed drawing is supplied.

22.12.2 Adherence to Scale - 350 points maximum

a) General Appearance - 50 points maximum

Assess the resemblance of the model entry to the prototype, correct shapes for nose cones, fin plan forms etc., colour scheme complete, lettering reproduced, etc.

Superior	41-50 points
Excellent	31-40 points
Good	21-30 points
Fair	11-20 points
Poor	0-10 points

b) Body and Nose Cone - 100 points maximum (If no fins - 200 points maximum)

Assess the accuracy of scaled model dimensions for body maximum diameter, overall length, nose cone length, and two other dimensions selected at random. If the other dimensions are not provided, deduct 20 points (or 40 points if no fins) for each omitted dimension. Calculate the Percent Error for the Prototype/Model dimensions (as per Technical Appendix-D) and deduct 2 points (or 4 points if no fins) for each nearest whole percentage error up to a maximum of 20 points (or 40 points if no fins) per dimension.

c) Fins - 100 points maximum

Assess the accuracy of scaled model dimensions for fin span, fin tip length and thickness, fin root length and one other dimension selected at random. If the dimension is not provided, deduct 20 points. Calculate the Percent Error for the Prototype/Model dimensions, (as per Technical Appendix-D) and deduct 2 points for each nearest whole percentage error up to a maximum of 20 points per dimension.

d) Colour and Markings - 100 points maximum

(1) Colour - 50 points maximum

Prototype colour(s) may be determined from colour photographs, acceptable published descriptions or from actual samples of protons type paint. The texture and luster of the scale model entry surface shall also be assessed with respect to the prototypes qualities.

(2) Markings - 50 points maximum

By definition, this feature includes roll patterns, first motion targets, insignia, lettering, scratches, paint trim etc. Assess the accuracy of all markings with respect to size, shape and location. If there are no markings visible in the photograph(s), or if the paint pattern is of an elementary scheme, then award no points for "Markings".

Colour - Markings

Superior	81-100
Excellent	61-80
Good	41-60
Fair	21-40
Poor	0-20

22.12.3 Workmanship - 300 points maximum

The Judges shall initially determine those components (if any) which have not been fabricated by the contestant e.g. body tube, lettering. Those pre-manufactured parts should normally be awarded zero points for workmanship unless there has been considerable effort expended in reworking the part, in which case, points should be awarded proportionate to the degree of same.

a) General Workmanship - 200 points maximum

Assess whether wooden parts are sealed without evidence of a grained surface, are body tube seams invisible, are fins spaced as required, are edges sharp, has ingenuity been used to conceal launch lugs or plastic fin mounts, is the paint finish of correct texture without brush marks, runs or smears, are colour separation lines sharp and straight etc.

Superior	175-200
Excellent	151-175
Good	126-150
Fair	76-125
Poor	0-75

b) Detailed Workmanship - 100 points maximum

Assess whether prototype bolt heads, rivets, corrugations, antennae, fine lettering etc. are reproduced and properly affixed, are flush fit details on the prototype flush fit on the scale model, are polished metallic surfaces reproduced as such on the scale model, are all scratch and crate marks realistically reproduced etc.

Superior	81-100
Excellent	71-80
Good	61-70
Fair	41-60
Poor	0-40

22.12.4 Degree of Difficulty - 200 points maximum

Points are awarded based on the extent to which the prototype's complexity is reproduced in the model entry and the difficulty involved in adapting the model to flight. Scoring shall proceed by reviewing all model entries to establish a comparative standard in each of the complexity categories.

a) Body/Nose Cone - 75 points maximum (if no fins - 135 points maximum).

b) Fins - 60 points maximum

Consider the number of fins modeled, cross-section complexity and mounting techniques.

c) Finish - 60 points maximum

Consider whether the contestant mixed special Paints, the difficulty required to reproduce a paint pattern and the skill shown in duplicating same, are insignia and lettering hand painted, and the difficulty in reproducing unusual prototype finish textures.

d) Construction - 30 points maximum

Consider the number of model components that were scratch built, and overall model intricacy.

e) Adaptation to Flight - 25 points maximum

Assess the engineering required to produce a stable model, and how well proper dynamic and static stability has been attained without compromising the scale qualities of the model.

22.12.5 Flight Characteristics - 100 points maximum

a) Launch - 10 points maximum

If the model experiences no tip-off after clearing the launch device, award maximum points, otherwise downgrade the launch points in proportion to equal zero for tip-off angles greater than 60". Deduct 2 points for each misfire up to a maximum of 6 points.

b) Flight - 65 points maximum

If the flight path is essentially straight and true, award 15 points. If no oscillations, coning or other motions indicating inadequate dynamic stability were observed, award 20 points. Award 15 points for nominal ejection and deployment of the recovery device, and 15 Points for correct and safe operation of the recovery system during descent. Award 15 bonus points for each successful staging event up to a maximum of 30 points. Deduct 15 points for each staging misfire.

c) Landing -25 points maximum

Award up to 25 points if no damage was incurred by the model during landing. Award zero points if the scale model is caught preventing ground contact during landing.

23. CAR C8 ROCKET/GLIDER DURATION COMPETITION RULES (K=3)

- 23.1 Rocket/Glider Duration Competition is comprised of six (6) events in which the contestant whose combined model entries remain aloft by aerodynamic lifting surfaces for the highest total time of all official flights shall be declared the event winner.
- 23.2 A maximum of two (2) model entries may be entered and flown by each contestant. The model entry shall be launched with an essentially vertical boost trajectory. Model entries which perform significant rotations about its pitch or yaw axes, or transition into a shallow boost climb shall be disqualified. The model entry shall not be radio-controlled.
- 23.3 The model entry shall not separate into two or more portions, nor eject its spent engine casing(s) in flight.
- 23.4 The model entry shall attain a stable aerodynamic glide, and shall not employ a parachute or streamer recovery device to effect such a descent.
- 23.5 Duration measurements shall be undertaken in accordance with Rule 14.2.
- 23.6 Each contestant shall be entitled to three (3) official flights. The total time of the three (3) official flights shall be the basis for final event competition standing wherein the contestant achieving the highest total time shall be immediately declared the event winner. If there is a tie for first place, the tied contestants shall be provided the opportunity for additional flights (fly-off) immediately after the last flight of the event has been completed. The maximum time of flight for each additional round shall be incremented by sixty (60) seconds over the maximum time of the previous round. Each fly-off round shall be fifteen (15) minutes in duration. Staging of fly-off rounds shall continue until a winner is determined.

23.7 Rocket/Glider Duration Competition shall be divided into classes based on maximum permitted launch mass, maximum allowable total impulse and maximum timing limit as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)	Maximum Time Limit (S)
C8A	60	0.00-2.50	120
C8B	90	2.50-5.00	180
C8C	120	5.01-10.00	240
C8D	240	10.01-20.00	300
C8E	240	20.01-40.00	300
C8F	500	40.01-80.00	300

24. CAR C9 HELICOPTER DURATION COMPETITION RULES (K=3)

- 24.1 Helicopter Duration competition is comprised of four (4) events in which the contestant whose combined model entries remain aloft by autorotating lifting surfaces for the highest total time of all official flights shall be declared the event winner.
- 24.2 A maximum of two (2) model entries may be entered and flown by each contestant. The model entry shall deploy autorotating lifting surfaces which will induce rotation about the roll axis of the model entry, and produce a retarded and safe descent.
- 24.3 The autorotating lifting surfaces shall be essentially rigid in structure and effect model deceleration primarily by aerodynamic lift vis-a-vis aerodynamic drag.
- 24.4 The model entry shall not separate into two or more portions nor eject its spent engine casing(s) in flight.
- 24.5 Duration measurements shall be undertaken in accordance with Rule 14.2.
- 24.6 Each contestant shall be entitled to three (3) official flights. The total time of the three (3) official flights shall be the basis for final event competition standing wherein the contestant achieving the highest total time shall be immediately declared the event winner. If there is a tie for first place, the tied contestants shall be provided the opportunity for additional flights (fly-off) immediately after the last flight of the event has been completed. The maximum time of flight for each additional round shall be incremented by sixty (60) seconds over the maximum time of the previous round. Each fly-off round shall be fifteen (15) minutes in duration. Staging of fly-off rounds shall continue until a winner is determined.
- 24.7 Helicopter Duration Competition shall be divided into classes based on maximum permitted launch mass, maximum allowable total impulse and maximum timing limit as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)	Maximum Time Limit (S)
C9A	100	0.00-2.50	120
C9B	100	2.51-5-00	160
C9C	200	5.01-10-00	240
C9D	500	10.01-20.00	300

25. CAR C10 RADIO CONTROL GLIDER DURATION COMPETITION RULES (K=5)

- 25.1 Radio Control Glider Competition is comprised of two (2) events , in which the contestant whose combined radio-controlled glider entries that remain aloft by aerodynamic lifting surfaces for the highest total time of all official flights shall be declared the event winner.
- 25.2 The model entry shall be radio-controlled during boost and/or glide flight phases by the pilot on the ground.
- 25.3 A maximum of two (2) model entries may be entered and flown by each contestant.
- 25.4 Competition may be open to Boost/Glider and Rocket/Glider type model entries, or restricted to one type at the option of the Contest Director. Rules 19 and 23 respecting the type shall accordingly apply, unless overruled herein. The Judges shall be informed of the type employed by the contestant prior to its flight. Duration measurements shall be undertaken in accordance with Rule 14.2 wherein timing shall be restricted to the launch and flight of the radio-controlled gliding model portion if the Boost/Glider model entry separates as per Rule 19.4.
- 25.5 The contestants shall be organized into groups in accordance with the radio frequencies used to permit as many flights simultaneously as possible. The flying order within each group shall be established by draw.
- 25.6 All transmitters shall be submitted to the Entry Processing Officer or Deputy upon commencement of the event. The transmitter shall be returned to the contestant when the contestant's name has been called to perform a flight. Upon completion of the flight, the transmitter shall be returned to the Entry Processing Officer or Deputy. Unauthorized transmissions during the contest will result in the disqualification of the contestant from the meet.
- 25.7 Contestants shall be called at least five (5) minutes before they are required to perform a flight. If the contestant fails to appear, the attempt shall be processed as a disqualified flight. Once the contestant has been notified to launch, the contestant shall launch the model entry within a five minute window, otherwise the attempt shall be processed as a disqualified flight.

25.8 Each contestant shall be entitled to three (3) official flights. The total time of the three (3) official flights shall be the basis for final event competition standing wherein the contestant achieving the highest total time shall -be immediately declared the event winner. If there is a tie for first place, the tied contestants shall be provided the opportunity for additional flights (fly-off) immediately after the last flight of the event has been completed. The maximum time of flight for each additional round shall be incremented by sixty (60) seconds over the maximum time of the previous round. Each fly-off round shall be fifteen (15) minutes in duration. Staging of fly-off rounds shall continue until a winner is determined.

25.9 Radio Control Glider Duration Competition shall be divided into classes based on maximum permitted launch mass, maximum allowable total impulse and time limit as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)	Maximum Time Limit (S)
C10D	300	0.00-20.00	120
C10E	300	20.01-40.00	240

26. CAR C11 BIO-SIM ALTITUDE COMPETITION RULES (K=2)

- 26.1 Bio-Sim Competition is comprised of five (5) events in which the contestant whose model entry attains the highest tracked, and reduced altitude while carrying and returning undamaged a Standard Biological Payload shall be declared the event winner,
- 26.2 A maximum of two (2) models may be entered and flown by each contestant'. The model entry may not separate into two or more- portions in flight except as per rule 26.4.
- 26.3 A Standard Biological Payload (SBP) shall be a fresh Grade A Hen's egg having a mass of no less than 55 grams and no more than 65 grams, and a diameter of no less than 40 millimeters and no more than 45 millimeters.
- 26.4 The Standard Biological Payload shall be flown completely enclosed and secured inside the model entry. If the model entry is a staged vehicle, the Standard Biological Payload shall be flown in the upper stage. The payload shall be easily removable from the model entry. The capsule containing the Standard Biological Payload may separate from the booster model portion in flight; however, each portion shall deploy a parachute or streamer recovery device as per Rule 2.4.
- 26.5 Standard Biological Payloads shall be processed as follows during Bio-Sim Competition:
- (a) The Entry Processing Officer or Deputy shall provide the contestant with a Standard Biological Payload during the first pre-launch check-in. The payload shall be pre-tested for compliance for size and mass requirements of Rule 26.3, and appropriately numbered by the Payload Judge. This number identification shall be recorded on the contestant's Flight Card. This Standard Biological Payload shall be the sole payload issued to the contestant, and may not be transferred to any other contestants.
 - (b) The Entry Processing Officer shall witness the insertion of the payload, and the loaded model entry shall be immediately taken to the Launch Station.
 - (c) Upon recovery after flight, the contestant shall immediately return the model entry to the Entry Processing Officer or Deputy and remove the payload in the presence of this official. The payload shall be verified for correct identification and inspected for damage.

- 26.6 Altitude measurements shall be undertaken in accordance with Rule 14.1.
- 26.7 The flight shall be disqualified if human interference impedes or prevents the model entry from landing. The flight and model entry shall be disqualified if the Standard Biological Payload is damaged, or if it was removed in the absence of the Entry Processing Officer or Deputy, or if the model entry cannot be returned for inspection, or if the payload separates from the model entry in flight, or if the Standard Biological Payload was found to be other than the one originally assigned to the contestant.
- 26.8 Bio-Sim Altitude Competition shall be divided into classes based on maximum permitted launch mass and maximum total impulse as follows:

Class	Maximum Launch Mass (G)	Maximum Total Impulse (N-S)
C11B	150	0.00-5.00
C11C	150	5.01-10.00
C11D	250	10.01-20.00
C11E	350	20.01-40.00
C11F	500	40.01-80.00

27. CAR RESEARCH AND DEVELOPMENT COMPETITION RULES (K=4)

- 27.1 Research and Development Competition Provides research oriented rocketeers with a forum to engage in personal innovative scientific/engineering studies to advance the state-of-the-art within the field of model rocketry. The winner shall be that individual who has accumulated the highest total of Research and Development Points.
- 27.2 Research and Development competition may be conducted at any Provincial or National Meet, or R&D Symposium wherein:
 - (a) the Symposium Director has applied for and obtained a CAR contest sanction;
 - (b) the Symposium includes only the CAR Research and development Competition event.
- 27.3 Proxy entries shall not be permitted.
- 27.4 Any model entry involved in whole or part in the contestant's project shall comply with the CANADA MODEL ROCKET SPORTING CODE.
- 27.5 This event shall be scored by a team of Judges who shall possess a background of experience and/or education sufficient to effectively understand not only the project's method, operation and results, but also to weigh its overall significance in the context of model rocketry. Judges should be members of the CAR although in special instances wherein authoritative non-members are available for judging, this requirement may be waived.
- 27.6 Each contestant shall submit for judging a written paper which shall define the following details of the project:
 - (a) purpose(s)
 - (b) method
 - (a) observations
 - (d) conclusions

- 27.7 The contestant shall present an uninterrupted, brief oral report of not more than ten (10) minutes duration abstracting the details of the project required by Rule 27.6. Following the report's presentation, the contestant shall then respond to questions from the Judges and/or audience for a period not exceeding ten (10) minutes in duration. A Judge's query shall have precedence over those of the audience at any time during this question period. The Symposium Director shall make every effort to furnish the contestant with any devices such as a blackboard, projector etc., required to assist with the presentation of the oral report.
- 27.8 The Judges may request or permit operation of the project if available for demonstration. The contestant is accountable to the Judges for any deviation in the projects reported performance.
- 27.9 The Judges shall award Research and Development Points as follows:
- | | | | |
|------------------------------------|---|-----------|---------|
| (a) Scientific/Engineering Thought | - | 40 points | maximum |
| (b) Originality | - | 30 points | maximum |
| (e) Skill | - | 10 points | maximum |
| (d) Practicality | - | 10 points | maximum |
| (e) Paper and Oral Presentation | - | 10 points | maximum |

The Judges may refuse to award standings for project entries which lack reasonable depth of quality with respect to scoring criteria 27.9 (a) and 27.9 (b).

CLASSIFICATION OF CAR ROCKET EVENTS

CATEGORY	EVENT	TOTAL IMPULSE N-S	MAXIMUM MASS-G	MAXIMUM TIME-S	K FACTOR
C-1 Altitude	C1A	0.00-2.50	60		1
	C1B	2.51-5.00	60		
	C1C	5.01-10.00	120		1
	C1D	10.01-20.00	180		1
	C1E	20.01-40.00	240		1
	C1F	40.01-80.00	500		1
C-2 Payload	C2B	0.00-5.00	90		2
	C2C	5.01-10.00	90		2
C-3 Parachute	C3A	0.00-2.50	100	240	2
	C3B	2.51-5.00	100	360	2
	C3C	5.01-10.00	200	480	2
	C3D	10.01-20.00	500	600	2
C-4 Boost/Glider	C4A	0.00-2.50	60	120	3
	C4B	2.51-5.00	90	180	3
	C4C	5.01-10.00	120	240	3
	C4D	10.01-20.00	240	300	3
	C4E	20.01-40.00	240	300	3
	C4F	40.01-80.00	500	300	3
C-5 Scale Altitude	C5A	0.00-2.50	90		4
	C5B	2.51-5.00	90		4
	C5C	5.01-10.00	120		4
	C5D	10.01-20.00	240		4
	C5E	20.01-40.00	240		4
	C5F	40.01-80.00	500		4
C-6 Streamer	C6A	0.00-2.50	100	120	2
	C6B	2.51-5.00	100	180	2
	C6C	5.01-10.00	200	240	2
	C6D	10.01-20.00	500	300	2
C-7 Scale	C7	0.00-80.00	500		5
C-8 Rocket/Glider	C8A	0.00-2.50	60	120	3
	C8B	2.51-5.00	90	180	3
	C8C	5.01-10.00	120	240	3
	C8D	10.01-20.00	240	300	3
	C8E	20.01-40.00	240	300	3
	C8F	40.01-80.00	500	300	3

C-9 Helicopter	C9A	0.00-2.50	100	120	3
	C9B	2.51-5.00	100	180	3
	C9C	5.01-10.00	150	240	3
	C9D	10.01-20.00	300	300	3
C-10 R/C Glider	C10D	0.00-20.00	300	120	5
	C10E	20.01-40.00	300	240	5
C-11 Bio-Sim	C11B	0.00-5.00	150		2
	C11C	5.01-10.00	150		2
	C11D	10.01-20.00	250		2
	C11E	20.01-40.00	350		2
	C11F	40.01-80.00	500		2

NOTE: Performance Records may be set in all but the C-7 Category.

TECHNICAL APPENDIX

A - VERTICAL MIDPOINT ALTITUDE REDUCTION METHOD

This method shall be adopted as the standard altitude reduction method by virtue of its inclusion in Section 4B of the Federation Aeronautique Internationale (FAI) Sporting Code.

The method considers that the model entry is tracked to an altitude (H) which is the vertical midpoint between the attitudes (H1, H2) reduced by each tracking station. The closure error (C) is equal to one-half the length of the vertical line between the line of sight of the two theodolites and must not be more than 10 percent of the altitude otherwise the 'tracked altitude shall be rejected as per Rule 14.1.4 (a). The tracking geometry is depicted in Figure A-1. The altitude reduction parameters and equations are:

- Aw, Ae Azimuth angles
- Ew, Ee Elevation angles
- B 300 meter Baseline
- D approximately $\frac{B}{2}$

$$Z = \frac{B}{\sin (Aw+Ae)}$$

$$H1 = \sin Aw \times \tan Ee \times Z$$

$$H2 = \sin Ae \times \tan Ew \times Z$$

$$H = \frac{H1 + H2}{2}$$

$$C = \frac{|H1-H2|}{H1+H2} \times 100$$

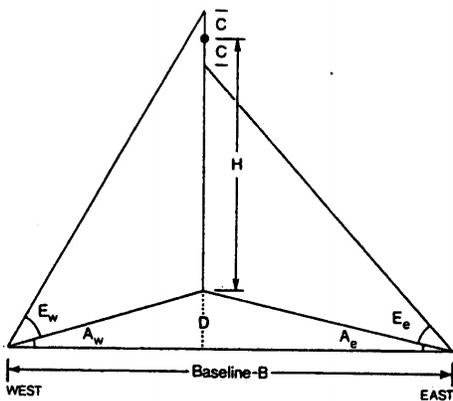


Figure A-1 Vertical Midpoint Tracking Geometry

TECHNICAL APPENDIX

B NUMERICAL ROUNDING PROCEDURE

Rounding a number is a process by which inaccurate or superfluous figures are deleted. The intent with this procedure is to present a standard rounding method to minimize process errors.

The following set of. rounding instructions shall be employed:

- (1) Where possible, carry measurement or computation to two (2) places beyond the required value;
- (2) Round these final digits wherein;

- (a) if the digit to be deleted is less than 5, do not alter the preceding digit.

For example:

30.432--> 30.43 --> 30.4

- (b) if the digit to be deleted is greater than 5, raise the preceding digit by 1.

For example:

468-78 --> 468.8 --> 46.9

- (e) if the digit to be deleted is equal to 5, round to the nearest even number.

For example:

103.55 --> 103.6 108.65 --> 108.6

NOTE: The final. rounded digit must be acquired from the most exact value present.

For example:

0.3499--> 0.350--> 0.35--> 0.3
0.3501--> 0.350--> 0.35--> 0.4

The above follows since the most precise values are less than and greater than 0.35 respectively.

TECHNICAL APPENDIX

C GO-NO GO TESTING PROCEDURE

The purpose of this procedure is to qualify a mass for compliance to a maximum or minimum limit. This procedure may be utilized whenever the test object is expected to be, more than 1% from the mass limit, otherwise an absolute mass measurement shall be performed. Although an actual balance is employed, this method circumvents the time consuming process of mass qualification by take an absolute (i.e. exact) mass measurement. Depending on the balance used, the procedure shall be as follows:

(1) Equal Arm Balance:

- (a) Place the mass limit poise on one tray. For example, if the mass limit equals 60 grams, use a 60 gram poise. The balance is now initialized;
- (b) Place the model entry/payload (test object) on the other tray;
- (a) For Maximum Tests, if the balance tips towards the mass limit, the test object is of satisfactory (GO) mass and is eligible for contest use;
- (d) For Minimum Tests, if the balance tips towards the test object, the test object is of satisfactory (GO) mass and is eligible for contest use.

(2) Triple Beam Balance:

- (a) Dial the poises to equal the mass limit. For example, if the mass limit equals 300 grams, position the poises along the beams to equal a 300 gram "reading". The balance is now initialized;
- (b) Place the model entry/payload (test object) on the tray;
- (e) For Maximum Tests, if the balance pointer reads below zero, the test object is of satisfactory (GO) mass and is eligible for contest use;
- (d) For Minimum Tests, if the balance pointer reads above zero, the test object is of satisfactory (GO) mass and is eligible for contest use.

For either balance application, if the test object does not comply with the GO determination, the test object shall be ineligible for contest use (NO GO).

TECHNICAL APPENDIX

D SCALE PERCENT ERROR SCORING PROCEDURE

Determine the models Scale Factor with reference to the entry's Scale Substantiation Data.

The scale Percent Error for each dimension shall be calculated as follows:

- (1) measure the model dimension;
- (2) calculate the difference between the measured model dimension and the corresponding scaled model dimension (Prototype dimension, times the scale factor);
- (3) calculate the Percent Error equal to the absolute value of the above difference x 100 divided by the scaled model dimension. Round the calculated Percent Error to the nearest whole percent.

EXAMPLE:

Scale Factor	=	1:10
Measured Model Dimension	=	5.75 cm
Scaled Model Dimension	=	5.85 cm
Percent Error	=	$\frac{ 5.75 - 5.85 }{5.85} \times 100$
	=	1.71%
Percent Error (Rounded)	=	2%

In this example, 4 points would be deducted for the magnitude of the scale error in this dimension as per Rule 22.12.2.

NOTES :

