

GCCC

Guide to Competition for the Casual Competitor

Subtitled: Pink Book for Newbies

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Preface

The use of this notebook is for a beginning competitor to quickly look up certain events being held, and what he/she needs to do for it. This is not meant to replace the Pink Book, or is it to discourage someone from reading the Pink Book. This is for the competitor who shows up at a launch, finds out there is a competition, and to see what in his box of models would make a qualified flight. Some tricks and hints are given, to aid the modeler.

Any model mentioned (Estes, Pratt, Edmonds, etc) as good competition models are of my opinion and do not express the opinion of the company that makes them. Your success in competition depends on the weather, your building skills, the alignment of the moon and sun (just kidding on the moon and sun part), how well you pack your recovery system, and loads of other Murphy's Laws. Remember, you are in the contest to have fun, see how well you can do, and to beat the pants off of any other club.

How to Use this Notebook

This notebook is designed to give beginning competitors a “flavor” of the rules in the Pink Book. Take the list of events for an upcoming contest (or one that is happening right now, and you want the scoop). Look up the event and get the basics: Returns, Scoring, How many Flights do I get, what model in my sport models may work for this. Hopefully, you will have a Pink Book, and you can look up the rules at your leisure.

Altitude

Events -ALT - Altitude (Pink Book Section 20)

Altitude is getting the rocket to go the highest. It's measured using two tracking stations (usually) and the closure (percent error) must be 10% or lower. You can pick any recovery system that you want in your model, parachute or streamer. Most competitors use streamer for weight and recoverability.

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 9.10) The model may come down in more than one piece, but it needs to come down safe.

BEGINNERS

For beginners, I would suggest a 13-mm body tube with fins for 1/4A to A (like an Estes Gnome) You can use Estes engines for these. For A-C events, you can use an Alpha, or a Wizard (the Wizard is more streamlined).

HOW MANY FLIGHTS?

Usually you get two chances to fly. However, if your altitude model is tracked but not closed, you can opt to ignore that flight and continue trying. You can continue to fly until the trackers get you a flight that closes. If you do not get a flight that closes, you cannot place in the event (i.e. place 1st through 4th) but you can get flight points. If you DQ one of your flights, that counts as one of your flights. If you keep trying, and get two DQs you are done for altitude. Sometimes it makes sense to just take the flight that didn't close.

HOW IS IT SCORED?

Highest Altitude (single flight) wins.

Other information

Use tracking powder. What is tracking powder? Tracking powder is the line chalk carpenters use. Rocketeers sometimes make the chalk lighter by adding baby powder. Some also use a dry paint.

Most competitors use the minimum diameter model if they can. So, for 1/4A - A, the minimum would be 13mm. Look at the NAR website to see what engines are competition certified. This will determine what the minimum diameter of the model will be.

Events - SRA -Super-Roc Altitude (Pink Book Section 21)

Super-Roc Altitude is getting the longest model to go the highest. It's measured using two tracking stations (usually) and the closure (percent error) must be 10% or lower. You can pick any recovery system that you want in your model, parachute or streamer.

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 9.10) The model may come down in more than one piece, but it needs to come down safe.

The engine class determines the length of the model. It has to meet the minimum requirement, but can go over the maximum length. However, the extra length doesn't count (just makes it easier to fix on the field and still have some length left to it.)

From Pink Book Section 21.6 (I have converted it into inches as well)

Motor	Min (cm)	Max (cm)	Min (inches)	Max (inches)
1/4A	25	50	9.8	19.6
1/2A	50	100	19.6	39.4
A	75	150	29.5	59
B	100	200	39.4	78.7
C	125	250	49.2	98.4
D	150	300	59	118.1
E	175	350	68.9	137.8
F	200	400	78.7	157.5
G	225	450	88.6	177.2

BEGINNERS

For D SRA, use an Estes Mean Machine. For the rest, try to find a long, skinny model that is at least the minimum length. Look at the NAR website to see what engines are competition certified. This will determine what the minimum diameter of the model will be. Estes has the FireFlash, it will take 18 mm engines and is 105cm long. That would work for A and B SRA.. Aerospace Specialty Products has a model out called Tall Boy for 24 mm mounts. It can be a variety of lengths.

HOW MANY FLIGHTS?

Usually you get two chances to fly. However, if you altitude model is tracked but not closed, you can opt to ignore that flight and continue trying. You can continue to fly until the trackers get you a flight that closes. If you do not get a flight that closes, you cannot place in the event (i.e. place 1st through 4th) but you can get flight points. If you DQ, that counts as one of your flights. If you keep trying, and get two DQs you are done for altitude. Sometimes it makes sense to just take the flight that didn't close.

HOW IS IT SCORED?

Length of model (from tip of nosecone to end of engine,) times the altitude.

Example: 1/4A SRA. Length is max, 50. Altitude is 33 meters. Score $50 \times 33 = 1650$

Other information

Use tracking powder. What is tracking powder? Tracking powder is the line chalk carpenters use. Rocketeers sometimes make the chalk lighter by adding baby powder. Some also use a dry paint.

This is 3 fins and body tubes together. Most competitors have the model taper down to a 10.5 or 6mm body tube half way. This is where the model separates for the recovery system. The model may come down in two pieces, but they must come down safely.

Events - Precision Altitude (Pink Book Section 22)

Precision Altitude has three different "flavors". For any of these, you can pick the model, engine (as long as it is NAR contest certified) and recovery system. The altitude is measured using two tracking stations (usually) and the closure (percent error) must be 10% or lower. This event must be flown before any other event using tracking (i.e. you can't practice with the trackers).

PREDICTED ALTITUDE (PRA) - You predict the altitude your model will fly to, and then compare it to the actual altitude measured. Person coming closest wins.

SET ALTITUDE (STA) - You are told of an altitude, and the person who comes closest to the actual altitude wins.

RANDOM ALTITUDE (RDA) - The altitude is chosen the morning of the meet, using dice, a model flown, random number generator, etc. Person coming closest wins.

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 9.10)
The model may come down in more than one piece, but it needs to come down safe.

BEGINNERS

Any model will do for this. Choosing the right engine is the tricky part. If the altitude is low, go with an Alpha on an A. (Or a Bertha on a B).

HOW MANY FLIGHTS?

You get one chance. If you misfire, or have a Cato, you can fly again, but it must be the same engine and model. If you get a track lost, or track not closed, you get another chance (Pink Book Section 14.9) but it must be the same model and engine type.

HOW IS IT SCORED?

The actual altitude, divided by the predicted, time 100. If the result is over 1, subtract one.

Example: Predicted Altitude 150 meters. Measured altitude 75 meters. $75/150 = .5 \times 100 = 50\%$. Person coming closest to 0 wins.

Other information

Use tracking powder. What is tracking powder? Tracking powder is the line chalk carpenters use. Rocketeers sometimes make the chalk lighter by adding baby powder. Some use dry paint.

Events – CA - Cluster Altitude (Pink Book Section 23)

Cluster Altitude is getting a model using more than one engine the highest. The model must be single staged. It's measured using two tracking stations (usually) and the closure (percent error) must be below 10%. You can pick any recovery system that you want in your model, parachute or streamer.

RETURN

You must return your model and show that all engines stayed with the model. You do not have to light all of them, IF the RSO says it was a safe flight.

The number of engines to cluster is determined by the engine class (Pink Book Section 23.5)

1/4A - 2 (1/4Ax2 CA)

1/2A - 3 (1/2Ax3 CA)

A - 4 (Ax4 CA)

B - 5 (Bx5 CA)

C - 6 (Cx6 CA)

BEGINNERS

There are not a lot of kits out there for clustering. There are many different designs and different ways to put 4 tubes and even 5 and 6 tubes together. Check to CP and CG on these. Painting helps keep them together (and sometimes the model needs the extra weight of the paint.)

HOW MANY FLIGHTS?

Usually you get two chances to fly. However, if you altitude model is tracked but not closed, you can opt to ignore that flight and continue trying. You can continue to fly until the trackers get you a flight that closes. If you do not get a flight that closes, you cannot place in the event (i.e. place 1st through 4th) but you can get flight points. If you DQ, that counts as one of your flights. If you keep trying, and get two DQs you are done for altitude. Sometimes it makes sense to just take the flight that didn't close.

HOW IS IT SCORED

Highest Altitude (single flight) wins.

Other information

Use tracking powder. What is tracking powder? Tracking powder is the line chalk carpenters use. Rocketeers sometimes make the chalk lighter by adding baby powder. Some also use dry paint.

Events – PAY - Payload (Pink Book Section 25)

Payload is getting the model, with a payload, to go the highest. It's measured using two tracking stations (usually) and the closure (percent error) must be 10% or lower. You must use a parachute for recovery (Pink Book Section 25.4).

The Payload must be a non-metallic cylinder containing fine sand, with a mass of no less than 28.0 grams. This cylinder shall be 19.1 millimeters (+/-0.5 millimeter) in diameter, and 70 millimeters (+/- 10.0 millimeters) in length. (Pink Book Section 25.2)

RETURN

You must return the model. Open the payload section in front of the returns person. They might weigh the payload before or after your flight (sometimes both).

BEGINNERS

The Pratt Super-6 kit is perfect for Payload. The body tube is 19-mm tube that can hold the payload. You will need an extra engine block. Some people cut down the fins since the Center of Gravity has changed on the model.

HOW MANY FLIGHTS?

Usually you get two chances to fly. However, if your altitude model is tracked but not closed, you can opt to ignore that flight and continue trying. You can continue to fly until the trackers get you a flight that closes. If you do not get a flight that closes, you cannot place in the event (i.e. place 1st through 4th) but you can get flight points. If you DQ, that counts as one of your flights. If you keep trying, and get two DQs you are done for altitude. Sometimes it makes sense to just take the flight that didn't close.

HOW IS IT SCORED

Highest Altitude (single flight) wins.

Other information

Use tracking powder. What is tracking powder? Tracking powder is the line chalk carpenters use. Rocketeers sometimes make the chalk lighter by adding baby powder. Some also use dry paint.

Sometimes the payloads are available at the contest. Apogee has a kit to make your own payloads. The Contest Director may want to impound your payload until you fly (making sure everything is the correct weight, length, etc.) You can write your NAR number on your payload.

Events – ELA - Egg Lofting Altitude (Pink Book Section 26)

Egg loft Altitude is trying to get an egg to go the highest, and to recover it without breaking the egg. The altitude is measured using two tracking stations (usually) and the closure (percent error) must be below 10%.

The Contest Director will provide the egg. Eggs must weigh between 57 and 63 grams and have a diameter of 45 mm or less. (Pink Book Section 26.1) They will be numbered or marked in some way so the returns person can tell it is the same eggs you have checked out.

RETURN

You must return your flight. Open the egg capsule in front of the returns person and show them your egg. The egg must return unbroken (no cracks, breaks, yolk, etc).

BEGINNERS

The Estes Eggspress is a good choice. Apogee has capsules, as does Pratt Hobbies. You can also get a capsule from Apogee or Pratt and put it at the end of a body tube. (The Egg capsule will be the nosecone) If you can find the old B-Liner instructions, it will tell you how to make a competition model with those capsules.

HOW MANY FLIGHTS?

Usually you get two chances to fly. However, if your altitude model is tracked but not closed, you can opt to ignore that flight and continue trying. You can continue to fly until the trackers get you a flight that closes. If you do not get a flight that closes, you cannot place in the event (i.e. place 1st through 4th) but you can get flight points. If you DQ one of your flights, that counts as one of your flights. If you keep trying, and get two DQs you are done for altitude. Sometimes it makes sense to just take the flight that didn't close.

HOW IS IT SCORED

Highest Altitude (single flight) wins.

Other information

Use tracking powder. What is tracking powder? Tracking powder is the line chalk carpenters use. Rocketeers sometimes make the chalk lighter by adding baby powder. Some also use dry paint.

Cushion the egg with foam or bubble wrap. Some people put the egg in a baggie before putting it into the capsule.

Events – DELA - Dual Egg Lofting Altitude (Pink Book Section 27)

Dual Egg Loft Altitude is trying to get two eggs to go the highest, and to recover both without breaking the eggs. The altitude is measured using two tracking stations (usually) and the closure (percent error) must be 10% or lower.

The Contest Director will provide the egg. Eggs must weigh between 57 and 63 grams and have a diameter of 45 mm or less. (Pink Book Section 27.1) They will be numbered or marked in some way so the returns person can tell it is the same eggs you have checked out.

RETURN See Above

BEGINNERS See Above

HOW MANY FLIGHTS? See Above

HOW IS IT SCORED See Above

Other information See Above

Cushion the egg with foam or bubble wrap. Some people put the egg in a baggie before putting it into the capsule. For Dual Egg Loft, but a barrier between the eggs so they don't smash into each other. A plastic disk or balsa will work fine.

Duration

Events – PD - Parachute Duration (Pink Book Section 30)

Parachute Duration is launching a model with parachute recovery, and getting it to stay in the air the longest. Timing is measured from first motion on the pad until the model lands.

RETURN

You must return one of your models, with the engine in it, and the model in one piece.

BEGINNERS

The Estes Wizard is good for 1/4A to A (hard to pack a chute in it), and the Alpha is good for A-C.

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

The sum of your two flights, in seconds, is your score. Example:

50 sec + 45 sec = 95 sec

120 sec + DQ = 120 sec

Other Information

Most people use a minimum diameter model. But you can pack a pretty big chute into an Alpha.

Dust your parachute with baby powder to prevent it from sticking.

PARACHUTE DURATION - MULTI-ROUND (PD-MR)

Parachute Duration – Multi-Round is the same thing as Parachute Duration, but worth 4 more weighting factors, and a couple of twists. Each motor class has a different “MAX”. You try to get the MAX on three flights.

Motor Class	MR Maximum (Seconds)	Motor Class	MR Maximum (Seconds)
1/4A	60	B	240
1/2A	120	C	300
A	180		

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 15.12.5, 9.10, 15.12.2)

BEGINNERS See above.

HOW MANY FLIGHTS?

You get three flights, but are only allowed two models. Make sure you can find one to fly again.

HOW IS IT SCORED? Example: Max is 120 seconds.

50 sec + 45 sec + 120 sec = 215 sec 2nd

120 sec + 120 sec + DQ = 240 sec 1st

Other Information See above.

If two or more people MAX all three flights, then there is a fly-off. It is up to the Contest Director to decide if you are flying to a higher time, or to make it whoever flies the longest in that round wins.

Events – SD - Streamer Duration (Pink Book Section 31)

Streamer Duration is launching a model with streamer recovery, and getting it to stay in the air the longest. Timing is measured from first motion on the pad until the model lands. The streamer must have a minimum length-to-width ratio of 5:1.

RETURN

You must return one of your models, with the engine in it, and the model in one piece.

BEGINNERS

The Estes Wizard is good for 1/4A to A, and the Alpha is good for A-C. You will need to add streamer material to make it competitive.

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

The sum of your two flights, in seconds, is your score. Example:

$$50 \text{ sec} + 45 \text{ sec} = 95 \text{ sec}$$

Other Information

Most people use the 10:1 ratio, so most streamers are 1 inch x 10 inch, 2x20, etc. Use whatever ratio you can put into your model. Most people use the minimum diameter model (i.e. the tube size of your engine).

You may choose what material to make your streamer. Some materials are Mylar, mica film, crepe paper, tracing paper, etc. Many Research and Development projects have been about streamer material.

STREAMER DURATION - MULTI-ROUND (SD-MR)

Streamer Duration – Multi-Round is the same thing as Parachute Duration, but worth 4 more weighting factors, and a couple of twists. Each motor class has a different “MAX”. You try to get the MAX on three flights.

Motor Class	MR Maximum (Seconds)	Motor Class	MR Maximum (Seconds)
1/4A	30	D	300
1/2A	60	E	300
A	120	F	300
B	180	G	300
C	240		

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 15.12.5, 9.10, 15.12.2)

BEGINNERS See Above.

HOW MANY FLIGHTS?

You get three flights, but are only allowed two models. Make sure you can find one to fly again.

HOW IS IT SCORED? Example: Max is 120 seconds.

$$50 \text{ sec} + 45 \text{ sec} + 120 \text{ sec} = 215 \text{ sec} \quad 2\text{nd}$$

$$120 \text{ sec} + 120 \text{ sec} + \text{DQ} = 240 \text{ sec} \quad 1\text{st}$$

Other Information See Above.

If two or more people MAX all three flights, then there is a fly-off. It is up to the Contest Director to decide if you are flying to a higher time, or to make it whoever flies the longest in that round wins.

Events – HD - Helicopter Duration (Pink Book Section 32)

Helicopter Duration is launching a model using helicopter blades as a method of recovery, and getting it to stay in the air the longest. The model must rotate on the long axis. You cannot use a parachute, streamer or anything acting like those recovery devices. Timing is measured from first motion on the pad until the model lands.

RETURN

You must return one of your models, with the engine in it, and the model in one piece.

BEGINNERS

QCR (Qualified Competition Rockets) has several kits that are good for the first time helicopter builder.

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

The sum of your two flights, in seconds, is your score. Example:

$$50 \text{ sec} + 45 \text{ sec} = 95 \text{ sec}$$

Other Information

Make sure your burn string is really thin. The engine exhaust is what burns the string and allows the rubber bands to pull the blades into the position for rotation.

Rubber bands are important. Make sure they are in place before launching!

HELICOPTER - MULTI-ROUND (HD-MR)

Helicopter Duration Multi-Round is the same thing as Helicopter Duration, but worth 4 more weighting factors, and a couple of twists. Each motor class has a different "MAX". You try to get the MAX on three flights.

Motor Class	MR Maximum (Seconds)	Motor Class	MR Maximum (Seconds)
1/4A	30	D	300
1/2A	60	E	300
A	120	F	300
B	180	G	300
C	240		

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 15.12.5, 9.10, 15.12.2)

BEGINNERS See Above

HOW MANY FLIGHTS?

You get three flights, but are only allowed two models. Make sure you can find one to fly again.

HOW IS IT SCORED? Example: Max is 120 seconds.

$$50 \text{ sec} + 45 \text{ sec} + 120 \text{ sec} = 215 \text{ sec} \quad 2\text{nd}$$

$$120 \text{ sec} + 120 \text{ sec} + \text{DQ} = 240 \text{ sec} \quad 1\text{st}$$

Other Information See Above

If two or more people MAX all three flights, then there is a fly-off. It is up to the Contest Director to decide if you are flying to a higher time, or to make it whoever flies the longest in that round wins.

Events – SRD - Super-Roc Duration (Pink Book Section 33)

Super-Roc Duration is getting the longest model to stay up in the air the longest. Timing is measured from first motion on the pad until the model lands. You have a choice of streamer or parachute as a recovery device. However, to get the best time, you should use a parachute.

RETURN

You must return one of your models, with the engine in it, and the model in one piece.

The engine class determines the length of the model. It has to meet the minimum requirement, but can go over the maximum length. However, the extra length doesn't count (just makes it easier to fix on the field and still have some length left to it.)

Pink Book Section 33.5 I converted the metric into inches for easy measuring.

Motor	Min (cm)	Max (cm)	Min (inches)	Max (inches)
1/4A	25	50	9.8	19.6
1/2A	50	100	19.6	39.4
A	75	150	29.5	59
B	100	200	39.4	78.7
C	125	250	49.2	98.4
D	150	300	59	118.1
E	175	350	68.9	137.8
F	200	400	78.7	157.5
G	225	450	88.6	177.2

BEGINNERS

For D SRD, use an Estes Mean Machine. For 24 mm engines, try the Tall Boy by Aerospace Specialty Products. For the rest, try to find a long, skinny model that is at least the minimum length. Estes has the FireFlash, it will take 18 mm engines and is 102 cm long. That would work for A and B SRD.

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

Length of model (from tip of nosecone to end of engine) in centimeters, times the duration in seconds. You then sum the two flights.

Example: 1/4A SRA. Length is max, 50 cm. Time 35 seconds. $50 \times 35 = 1750$.

Flight 2: 50 cm, 45 seconds. $50 \times 45 = 2250$

Total $1750 + 2250 = 4000$ points.

Other information

This is 3 fins and body tubes together. Most competitors have the model taper down to a 10.5 or 6 mm body tube half way. This is where the model separates for the recovery system. The model must stay in one piece.

Events – ELD - Egg Lofting Duration (Pink Book Section 34)

Egg Lofting Duration is launching an egg, getting the model to stay up in the air the longest and recovering it without breaking. Timing is measured from first motion on the pad until the model lands.

The Contest Director will provide the egg. Eggs must weigh between 57 and 63 grams and have a diameter of 45 mm or less. (Pink Book Section 26.1) They will be numbered or marked in some way so the returns person can tell it is the same eggs you have checked out.

RETURN

You must return your flight. Open the egg capsule in front of the returns person and show them your egg. The egg must return unbroken (no cracks, breaks, yolk, etc). . Model must return in one piece.

BEGINNERS

The Estes Eggspress is a good choice. Apogee has capsules, as does Pratt Hobbies. You can also get a capsule from Apogee or Pratt and put it at the end of a body tube. (The Egg capsule will be the nosecone) If you can find the old B-Liner instructions, it will tell you how to make a competition model with those capsules.

HOW MANY FLIGHTS?

You get two flights. HOWEVER, only the best SINGLE flight counts. If you break the egg on the first try, you get another chance and another egg.

HOW IS IT SCORED?

Flight number 1 is 60 seconds; flight number 2 is 45 seconds. Your score is 60 seconds, (Best SINGLE flight)

Other Information

Make sure your parachute is sturdy. Some people put the shroud lines over the top so that the parachute will not shred,

Cushion the egg with foam or bubble wrap. Some people put the egg in a baggie before putting it into the capsule.

Events – DELD - Dual Egg Lofting Duration (Pink Book Section 35)

Dual Egg Lofting Duration is launching two eggs, getting the model to stay up in the air the longest and recovering both eggs without breaking. Timing is measured from first motion on the pad until the model lands.

RETURN See Above

BEGINNERS See Above

HOW MANY FLIGHTS?

You get two flights. HOWEVER, only the best SINGLE flight counts. If you break the eggs on the first try, you get another chance and another two eggs.

HOW IS IT SCORED? See Above

Other Information

Make sure your parachute is sturdy. Some people put the shroud lines over the top so that the parachute will not shred.

Cushion the egg with foam or bubble wrap. Some people put the egg in a baggie before putting it into the capsule. For Dual Egg Loft, but a barrier between the eggs so they don't smash into each other. A plastic disk or balsa will work fine.

Events – BG - Boost Glider Duration (Pink Book Section 36)

A Boost glider is an airplane type of model that separates. The boost part comes down on a streamer, and the glider obviously glides down. Timing is measured from first motion on the pad until the glider lands.

RETURN

You must return one of your models, and show your pod to the returns person to show the engine did not eject.

BEGINNERS

There are several plans in Sport Rocketry for boost glide, and a couple of kits out there. One for the beginner would be the Edmonds Deltie. With the Deltie, you do not have to trim the model.

There are boost glider plans in the following Sport Rocketry Magazine

Fall 1995, page 14-15, Competition Boost Glide by Dan Wolf

September/October 1996, page 31, the A&B Boost Glider by Trip Barber

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

The sum of your two flights, in seconds, is your score. Example: 50 sec + 45 sec = 95 sec

Other Information

You should airfoil the wings so that they look like airplane wings. You can make the glider turn in a circle by putting one wing slightly higher than the other.

Trimming the glider involves throwing it and seeing how it glides. You add or subtract noseweight depending on the glide.

BOOST GLIDER DURATION - MULTI-ROUND (BG-MR)

Boost Glider Duration – Multi-Round is the same thing as Boost Glider Duration, but worth 4 more weighting factors, and a couple of twists. Each motor class has a different “MAX”. You try to get the MAX on three flights.

Motor Class	MR Maximum (Seconds)	Motor Class	MR Maximum (Seconds)
1/4A	45	D	270
1/2A	90	E	300
A	120	F	300
B	180	G	300
C	240		

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 15.12.5, 9.10, 15.12.2)

BEGINNERS See Above

HOW MANY FLIGHTS?

You get three flights, but are only allowed two models. Make sure you can find one to fly again.

HOW IS IT SCORED? Example: Max is 120 seconds.

50 sec + 45 sec + 120 sec = 215 sec 2nd

120 sec + 120 sec + DQ = 240 sec 1st

Other Information See Above

If two or more people MAX all three flights, then there is a fly-off. It is up to the Contest Director to decide if you are flying to a higher time, or to make it whoever flies the longest in that round wins.

Events – RG- Rocket Glider Duration (Pink Book Section 37)

A Rocket Glider is an airplane type of model that must stay together during boost and glide phase. Timing is measured from first motion on the pad until the model lands.

RETURN

You must return one of your models, with the engine in it, and the model in one piece. (Unless it broke upon landing)

BEGINNERS

There are several plans in Sport Rocketry for rocket glide, and a couple of kits out there. QCR has a couple of kits that are good for the beginner.

There are rocket glider plans in the following Sport Rocketry Magazine

March/April 1996, pages 45-47, Rocket Gliders by Mort Binstock

March 1989, pages 8-9, Sylph, A No-Moving-Parts Design for Rocket Glider, by Paul Vandall

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

The sum of your two flights, in seconds, is your score. Example:

50 sec + 45 sec = 95 sec

Other Information

The glider is usually made of balsa or soft wood. It cannot be made of anything flexible

ROCKET GLIDER DURATION - MULTI-ROUND (RG-MR)

Rocket Glider Duration – Multi-Round is the same thing as Rocket Glider Duration, but worth 4 more weighting factors, and a couple of twists. Each motor class has a different “MAX”. You try to get the MAX on three flights.

Motor Class	MR Maximum (Seconds)	Motor Class	MR Maximum (Seconds)
1/4A	45	D	270
1/2A	90	E	300
A	120	F	300
B	180	G	300
C	240		(Pink Book Section 37.3)

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 15.12.5, 9.10, 15.12.2)

BEGINNERS See Above

HOW MANY FLIGHTS?

You get three flights, but are only allowed two models. Make sure you can find one to fly again.

HOW IS IT SCORED? Example: Max is 120 seconds.

50 sec + 45 sec + 120 sec = 215 sec 2nd

120 sec + 120 sec + DQ = 240 sec 1st

Other Information See Above

If two or more people MAX all three flights, then there is a fly-off. It is up to the Contest Director to decide if you are flying to a higher time, or to make it whoever flies the longest in that round wins.

Events – FW - Flex-Wing Boost Glider Duration (Pink Book Section 38)

Flex-Wing Boost Glider Duration is an airplane type of model that separates. The boost part comes down on a streamer, and the glider must be made of a flexible material, and glide down. Timing is measured from first motion on the pad until the glider lands.

RETURN

You must return one of your models, and show your pod to the returns person to show the engine did not eject.

BEGINNERS

There is a plan in Sport Rocketry for flex-wing, and a couple of kits out there. QCR makes some flex-wing kits.

The flex-wing glider plan is in the following Sport Rocketry

January/February 1995, pages 47-49, Competition Rocketry Flex-wing Gliders by Dan Wolf

HOW MANY FLIGHTS?

You get two flights. You may also use two models. This is in case one flies away, you can return the other model.

HOW IS IT SCORED?

The sum of your two flights, in seconds, is your score. Example:

50 sec + 45 sec = 95 sec

Other Information

The best material to make a flexie out of is a dry-cleaning bag, a plastic bag from a store, or even Mylar. The key is that the glider must be flexible.

FLEX-WING BOOST GLIDER DURATION - MULTI-ROUND (SD-MR)

Streamer Duration – Multi-Round is the same thing as Parachute Duration, but worth 4 more weighting factors, and a couple of twists. Each motor class has a different “MAX”. You try to get the MAX on three flights.

Motor Class	MR Maximum (Seconds)	Motor Class	MR Maximum (Seconds)
1/4A	45	D	270
1/2A	90	E	300
A	120	F	300
B	180	G	300
C	240		

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 15.12.5, 9.10, 15.12.2)

BEGINNERS See Above

HOW MANY FLIGHTS?

You get three flights, but are only allowed two models. Make sure you can find one to fly again.

HOW IS IT SCORED? Example: Max is 120 seconds.

50 sec + 45 sec + 120 sec = 215 sec 2nd

120 sec + 120 sec + DQ = 240 sec 1st

Other Information

See Above

If two or more people MAX all three flights, then there is a fly-off. It is up to the Contest Director to decide if you are flying to a higher time, or to make it whoever flies the longest in that round wins.

Events - Precision Duration (Pink Book Section 39)

Precision Altitude has three different "flavors". For any of these, you can pick the model, engine (as long as it is NAR certified) and recovery system. Timing is measured from first motion on the pad until the model lands.

This event must be flown before any other timing event.

PREDICTED DURATION (PRD) - You predict the duration your model will fly, and then compare it to the actual duration measured. Person coming closest wins.

SET DURATION (STD) - You are told a set time way before the contest, and the person who comes closest to the actual duration wins.

RANDOM DURATION (RDD) - The duration is chosen the morning of the meet, using dice, a model flown, random number generator, etc. Person coming closest wins.

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 9.10)

BEGINNERS

Any model will do for this. Choosing the right engine is the tricky part. If the duration is low, go with a Bertha on a B. Use a streamer.

HOW MANY FLIGHTS?

You get one chance. If you misfire, or have a Cato, you can fly again, but it must be the same engine and model. If the timers have a malfunction, you get another chance (Pink Book Section 39.4) but it must be the same model and engine type.

HOW IS IT SCORED?

The actual duration, divided by the predicted, time 100. If the result is over 1, subtract one.

Example: Predicted Duration 150 seconds. Measured duration 75 seconds. $75/150 = .5 \times 100 = 50\%$. Person coming closest to 0 wins.

Other information

The minimum duration on all of these is 30 seconds. The time goes up in 5-second increments.

A general rule is a Big Bertha, on a B, will stay in the air for 30 seconds.

None of the models can be radio-controlled.

Craftsmanship Events

Craftsmanship Events are probably the most difficult event for a beginner. Each event is judged on how well you finish your model (paint, fins, fillets, etc.) You may enter any model that closely resembles an existing or historical guided missile, rocket vehicle, or space vehicle. Any amateur rocket or missile is excluded from this event, except for historical significance. Usually, the model is judged for static points, and then it must be flown for flight points. The flight must be safe.

There may be a couple of things you want to do before putting the kit together. Make sure you finish the fins. What I mean is, sand those fins really smooth, use sanding sealer or other finishing products, and sand again. Fill in the spiral in the body tube, and sand that as well to make a smooth finish. Make sure any paint lines are clean. Put your NAR number on the model, but put it in a discrete place. Most people put it on the launch lug. Don't paint in globs. Do many light layers to build up the color. Many articles have been written about how to finish a model.

When you enter an event, you must have a data packet. Each event asks for slightly different things. Some of the more popular models' data can be found in *Rockets of the World*. *Rockets of the World* and *The Art of Scale Model Rocketry* (both by Peter Alway) are considered the bibles of these events. If you don't have one, find someone who does, take a look, then help support Peter by buying a copy from him. Data can also be found by writing to companies that make the rockets or asking the scientists who fly them.

On the first page of this packet, you should have the model's name, the scale (i.e. 1:10, 1:13.5, etc) your division (A, B, C or T) and your NAR number. Also on the first page, you should state whether this is scratch built or from a kit, and note anything you did to the model to make it more scale. You should also note if you are doing anything for mission points.

Mission points are awarded during the flight of the model. This is when you duplicate what the original did by staging, having a payload, doing cloud seeding, smoke ejection, etc.

A judge will look at your model before you fly it. This can take hours or days at the nationals. Once he/she has finished judging all of the models on static, you get to fly the model.

Now let's talk about events.

Events – SC – Scale (Pink Book Section 50)

You must model a certain round of a rocket unless it is a mass production that there is not round number. You will be judged on how far off the exact scale your model is. At least 5 dimensions will be measured. Points will be deducted for being off certain percentages.

RETURN

You must return your model to the judges after flight. This is where you get the General Flight points awarded. If your model is not returnable, but made a safe flight, you can take maximum damage points for the return (Pink Book 10.4).

BEGINNERS

Aerospace Specialty Products has some nice kits for beginners to use. Estes and Quest have a couple of scale model kits as well.

HOW MANY FLIGHTS?

Two flights are allowed, but only one will count towards your score. If you fly a model single staged, then fly it staged for mission, and have an unsafe flight, the single staged flight will be your score.

HOW IS IT SCORED?

Static Model

- Scale Data: 50 points
- Accuracy of Dimensions: 200 points
- Accuracy of Color and Markings: 100 points
- Accuracy of Details: 100 points
- Craftsmanship: 300 points
- Degree of Difficulty: 200 points
- Sub-Total of Static: 900 points

General Flight Characteristics

- Mission: 200 points
- General Flight 100 points
- Sub-Total of Flight: 300 points

Total 1100 points.

The model that scores the most points out of 1100 wins.

Events – SCA - Scale Altitude (Pink Book Section 51)

Scale Altitude is Scale, but you add the twist of trying to get the highest altitude. This is the one event that there is an engine requirement. Everyone must build to that engine (i.e. A Scale Altitude, you build an model that flies on an A engine).

RETURN

You must return your model to the judges after flight. This is where you get the General Flight points awarded. If your model is not returnable, but made a safe flight, you can take maximum damage points for the return (Pink Book 10.4).

BEGINNERS

Aerospace Specialty Products has some nice kits for beginners to use. Estes and Quest have a couple of scale model kits as well. (Estes Black Brant, Quest Nike-Smoke)

HOW MANY FLIGHTS?

Two flights are allowed, but only one will count towards your score. If you fly a model single staged, then fly it staged for mission, and have an unsafe flight, the single staged flight will be your score.

HOW IS IT SCORED? Same as Scale

Static Model

- Scale Data: 50 points
- Accuracy of Dimensions: 200 points
- Accuracy of Color and Markings: 100 points
- Accuracy of Details: 100 points
- Craftsmanship: 300 points
- Degree of Difficulty: 200 points
- Sub-Total of Static: 900 points

General Flight Characteristics

- Mission: 200 points
- General Flight 100 points
- Sub-Total of Flight: 300 points

Total 1100 points.

The Altitude is added to your score (out of 1100), The person with the highest score wins.

Events – SUSC - Super Scale (Pink Book Section 52)

Super Scale is Scale with the launching complex added in. You must scale the launching complex as well as the model. You will be judged on the craftsmanship of the complex as well. The model must launch from the scale launch complex.

RETURN

You must return your model to the judges after flight. This is where you get the General Flight points awarded. If your model is not returnable, but made a safe flight, you can take maximum damage points for the return (Pink Book 10.4)

BEGINNERS

Aerospace Specialty Products has some nice kits for beginners to use. Estes and Quest have a couple of scale model kits as well. Look at *Rockets of the World* (or where you got your data from) to get an idea of the launch complex for your model.

HOW MANY FLIGHTS?

Two flights are allowed, but only one will count towards your score. If you fly a model single staged, then fly it staged for mission, and have an unsafe flight, the single staged flight will be your score.

HOW IS IT SCORED?

Static Model

- Scale Data: 50 points
- Accuracy of Dimensions: 200 points
- Accuracy of Color and Markings: 100 points
- Accuracy of Details: 100 points
- Craftsmanship: 300 points
- Degree of Difficulty: 200 points
- Sub-Total of Static Model: 900 points

Flight Characteristics of Model

- Mission: 200 points
- General Flight 100 points
- Sub-Total of Flight: 300 points

Launch Complex

- Scale Data: 50 points
- Accuracy of Dimensions: 200 points
- Accuracy of Color and Markings: 50 points
- Accuracy of Details: 50 points
- General Appearance: 100 points
- Craftsmanship: 250 points
- Degree of Difficulty: 200 points
- Operation: 100 Points
- Sub-Total of Launch Complex: 900 points

Total 2100 points.

The model that scores the most points out of 2100, wins.

Events – SPSC - Sport Scale (Pink Book Section 53)

Sport Scale has three different flavors. This is judged like Scale, except there are no direct measurements to the model. You are still judged on craftsmanship of the model.

SPORT SCALE – Any model can enter.

GIANT SPORT SCALE – The model must be at least 100 centimeters (~39 inches) in length OR 10 centimeters (~ 3.9 inches) in diameter. You are also limited by weight and engine size. You cannot go over 160 Newton-seconds of impulse (G engine) (Pink Book Section 9.1) and cannot weigh over 1500 grams GLM (Pink Book Section 32, 9.11).

PEANUT SPORT SCALE – The model can be no longer than 30 centimeters (11.8 inches) OR no bigger than 2 centimeters (.78 inches) in diameter.

RETURN

You must return your model to the judges after flight. This is where you get the General Flight points awarded. If your model is not returnable, but made a safe flight, you can take maximum damage points for the return (Pink Book 10.4)

BEGINNERS

Aerospace Specialty Products has some nice kits for beginners to use. Estes and Quest have a couple of scale model kits as well. (Estes Black Brant, Quest Nike-Smoke)

HOW MANY FLIGHTS?

Two flights are allowed, but only one will count towards your score. If you fly a model single staged, then fly it staged for mission, and have an unsafe flight, the single staged flight will be your score.

HOW IS IT SCORED?

Static Model

- Similarity of Outline: 200 points
- Finish, Color and Markings: 200 points
- Craftsmanship: 300 points
- Degree of Difficulty: 100 points
- Sub-Total of Static Model: 800 points

Flight Characteristics of Model

- Mission: 200 points
- General Flight 100 points
- Sub-Total of Flight: 300 points

Total 1100 points

The model that scores the most points out of 1100, wins.

Events – SPSY - Space Systems (Pink Book Section 54)

Space Systems combines Super Scale with egg loft, predicted duration, predicted altitude or spot landing. You scale a model per Scale's rules, and simulate an in-flight operation. Use eggs for astronauts, try to scale the altitude of the model in predicted scale, try to achieve scale duration in precision predicted scale and see if you can land on the moon in Spot Landing, launch from your scale complex.

RETURN

You must return your model to the judges after flight. This is where you get the General Flight points awarded. If your model is not returnable, but made a safe flight, you can take maximum damage points for the return (Pink Book 10.4)

BEGINNERS

Aerospace Specialty Products has some nice kits for beginners to use. Estes and Quest have a couple of scale model kits as well. (Estes Black Brant, Quest Nike-Smoke)

HOW MANY FLIGHTS?

Two flights are allowed, but only one will count towards your score. If you fly a model single staged, then fly it staged for mission, and have an unsafe flight, the single staged flight will be your score.

HOW IS IT SCORED?

Static Model

- Scale Data: 50 points
- Accuracy of Dimensions: 200 points
- Accuracy of Color and Markings: 100 points
- Accuracy of Details: 100 points
- Craftsmanship: 300 points
- Degree of Difficulty: 200 points
- Sub-Total of Static Model: 900 points

Flight Characteristics of Model

- Mission: 200 points
- General Flight 100 points
- Sub-Total of Flight: 300 points

Flight Simulation Points (add any of these, up to 200 points)

- Egg Loft: 25 points per egg
- Predicted Altitude: 50 points minus your score per Pink Book Section 22.6 (your percentage off)
- Predicted Duration: 50 points minus your score per Pink Book Section 39.6 (your percentage off)
- Spot Landing: 50 points minus your score per Pink Book Section 60.6 (How far away from the spot)
- Multi-stage: 50 per stage after the first stage
- Cluster: 20 points per motor, -20 points per misfire.
- Deployment: 50 points per action (i.e. you deploy a satellite)
- Data transmission/photo/instrumentation: 50 points
- Launch from scale launch complex: 50 points
- Other (approved by CD and judges): 50 points.

Possible total: 1400 points

The model that scores the most points out of 1400, wins.

Events – PMC - Plastic Model Conversion

Plastic Model Conversion is taking a model that was not meant to be a model rocket and convert it to one. You may use missiles, rocket vehicles, space vehicles, or jets whose engines are in the rear of the model or spaced apart (to cluster for example). You must convert it so that it will make a qualified flight. This event is also known as Plastic Death.

RETURN

You must return your model to the judges after flight. This is where you get the General Flight points awarded. If your model is not returnable, but made a safe flight, you can take maximum damage points for the return (Pink Book 10.4)

BEGINNERS

QCR has a couple of kits for PMC. Most of the time, you are taking a plastic model and seeing if you can convert it. A good beginner plastic model is a Jupiter-C.

HOW MANY FLIGHTS?

Two flights are allowed, but only one will count towards your score. If you fly a model single staged, then fly it staged for mission, and have an unsafe flight, the single staged flight will be your score.

HOW IS IT SCORED?

Static Model

Craftsmanship: 500 points

Degree of Difficulty: 300 points

Sub-Total of Static Model: 800 points

Flight Characteristics of Model

Mission: 200 points

General Flight 100 points

Sub-Total of Flight: 300 points

Total 1100 points

The model that scores the most points out of 1100, (and flies it without recycling the plastic) wins.

Miscellaneous Events

Events - Spot Landing

Spot Landing has three different "flavors". The object is to come closest to the spot. You may use any NAR contest certified engine. Model must stay in one piece.

PARACHUTE SPOT LANDING (PSL)- Recovery device must be a parachute no smaller than 15 cm square (5.9 inches)

STREAMER SPOT LANDING (SSL) – Recovery device must be a streamer no smaller than 2.5 cm x 30 cm (1 in x 11 in)

OPEN SPOT LANDING (OSL) – Any recovery device may be used (parachute, streamer, helicopter, rocket glider)

RETURN

Being measured counts as your return. If you cannot return your model, you get a score of FAR (more than 50 meters)

BEGINNERS

Any model will do for this. Choosing the right engine is the tricky part.

HOW MANY FLIGHTS?

You get one chance. If you have a misfire, you may change the igniter.

HOW IS IT SCORED?

Distance is measured from the tip of the nosecone to the spot, in meters (usually to the nearest centimeter). If you are more than 50 meters from the spot, you will only get flight points.

Other information

This is a fun event. Anyone with a model and a NAR Contest certified engine may do this.

Events – DR - Drag Race (Pink Book Section 61)

Drag Race is exactly what it means. You fly in pairs in a series of heats. If you misfire, you automatically are out. Any model, and any recovery system are allowed. However, you must use the same model and the same type of engine throughout all heats. (If you used an A8-3 in the first heat, you need to use an A8-3 for the rest of the heats)

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 9.10, 61.3)

BEGINNERS

Pick something out of your sport box and fly; Alpha, Big Bertha, Wizard, helicopter

HOW MANY FLIGHTS?

You get to fly once per heat.

HOW IS IT SCORED?

Winning the heat is based on three points. You win a point for the following:

1. First motion off the pad
2. Achieving the lowest altitude
3. Landing last on the ground (longest duration) if you are using a two-piece model, it is the first piece to hit the ground.

Other information

You must have two launch systems or a system set up for drag race (both models must ignite at the same time).

Events – RCRG - Radio Controlled Glider (Pink Book Section 62)

Radio Controlled Rocket Glider is an event for the RC guys. You predict your duration of 30 seconds to 8 minutes, in increments of 30 seconds. You must attempt to fly that duration and land on a pre-determined spot.

RETURN

You do not need to return a model, unless the RSO states so. (Pink Book Section 9.10)

BEGINNERS

There are plenty of RC kits out there. Be sure to practice, or find someone who can teach you to fly.

HOW MANY FLIGHTS?

You have three flights total.

HOW IS IT SCORED?

Time is scored by Actual flying time divided by predicted, multiplied by 100.

Example $100 \text{ seconds} / 90 \text{ seconds} \times 100 = 111.1 - 100 = 11.1 \%$

Distance is measured from nose of model to spot in meters. Example 2 meters.

Score is distance plus time. The three flights are added together. Person with the lowest sum of the flights is the winner.

Example $11.1\% + 2 = 13.1$ for the first flight score.

Other Information

This event is usually a fun event at NARAM.

Events – RD - Research & Development

Research and Development is an event that is (almost) always held at NARAM. You may enter this if you are using rocketry as a primary part of your research, engineering a new concept or advancing the state of model rocketry.

You must submit a written report, and include a separate 250-300-word summary.

RETURN

No return is required.

BEGINNERS

If you are an A or B Divisioner, and used model rocketry in your science project, you can enter that into R&D.

HOW MANY FLIGHTS?

You only need to fly if it is needed to demonstrate your project in operation.

HOW IS IT SCORED?

Anyone who may be placing will be asked to give a talk no longer than 15 minutes. Judges will ask questions and then open it up to the audience. Judges will determine the winners.

Other Information

Judges do not have to be members of the NAR.

You cannot duplicate previous work. You can expand upon it.

Some examples, parachute material, streamer material, body tube construction, Magazine indexing.

Appendix A Glossary of Terms

catastrophic failure (or Cato)

A failure, which, in the opinion of the judges, is not due to or caused by improper design, construction, or preflight preparations of the model. This can include a malfunction of the model rocket motor; a model being run over by a car or stolen; an irreversible error by a meet official such as a lost flight card; or a similar occurrence beyond the control of a contestant. This does not include improper assembly of a reloadable motor. A flight experiencing a catastrophic failure can be declared not to be an official flight. See Rule 11.5.

construction

The action required to complete a model starting with no more prefabrication than the amount used in the average kit. Model rockets that are completely prefabricated and require only a few minutes of unskilled effort for their completion, or in which any normally separate pieces are pre-assembled are not considered to require construction. One-piece plastic fin units are not prohibited per se, but as such depend on the of prefabrication of the rest of the model.

contestant

A NAR member or a team composed of NAR members entered in a sanctioned competition.

Contest Director

Person who is running the contest. He/she determines the events, picks any judges needed, and sends the results into the Regional Contest Board.

first motion

The instant at which a model begins to move upward under the thrust provided by a model rocket motor.

gross launching mass (GLM)

The mass of a model rocket in flight condition, including fully loaded motor(s); but not including launching devices or auxiliary equipment which does not become airborne with the model.

misfire

Failure of a model to make an official flight when its launch is attempted. Failure to launch caused by a malfunction in a meet-provided launch system shall not be considered a misfire.

NAR Contest Board

Refers to the National Contest Board of the National Association of Rocketry. If a rule applies to action with respect to a Regional Contest Board, this is specifically stated.

Pink Book Lawyer

A person who knows the Pink Book really well and feels he/she can write much stuff about it. The Attorney General is the Contest Board chairman, Tom Lyon. Several well-noted Pink Book Lawyers are Bob Kaplow and Jeff Vincent. Can also be a verb, i.e. Pink-Book Lawyering.

RSO or Range Safety Officer

The person in charge of the safety of the range. This person determines if the flight was a safe one, or "qualified" in competition.

safety ruling

A ruling by the RSO, a deputy RSO, or (in limited cases according to Rule 11.1) the Contest Jury, denying an entry the opportunity to fly due to considered judgment that the model would be unsafe in flight; also a ruling that disqualifies a model which flies in an unsafe manner. If an RSO or deputy RSO, acting in the capacity of a flight judge, disqualifies a model for a reason other than unsafe or hazardous operation or flight, this is not considered a safety ruling.

stage

Any portion or portions of the model airframe containing one or more model rocket motors designed to produce distinct thrusting phases during flight. An unpowered portion of the model is not considered a stage.

List of Web Sites and Companies

The National Association of Rocketry <http://www.nar.org/>
National Association of Rocketry
Post Office Box 177
Altoona WI 54720
(800) 262-4872
(715) 832-6432 (FAX)

The Pink Book Online <http://www.nar.org/PinkBook>

Aerospace Specialty Products <http://www.asp-rocketry.com>
P.O. Box 1408
Gibsonton, FL 33534
(813) 741 - 0032

Edmonds Aerospace <http://Members.aol.com/RobEdmonds/Edmonds.html>
Models available from a variety of vendors

Pratt Hobbies <http://www.pratthobbies.com/>
703-689-3541
info@pratthobbies.com

QCR <http://www.cybertravelog.com/qcr>
Ken Brown
Qualified Competition Rockets
7021 Forestview Drive
Springfield, VA 22150
703-451-2808

Saturn Press <http://members.aol.com/satrnpress/saturn.htm>
Saturn Press
P.O. Box 3709
Ann Arbor, MI 48106-3709
PeteAlway@aol.com
Phone - 734.677.2321
Fax - 734.677.2321

References:

United States Model Rocket Sporting Code (i.e. The Pink Book) published by the National Association of Rocketry

Magazine Index, R&D Report by Lila Schmaker (Why Us? Team) for NARAM 40, 41