



April 12, 2023

Dear American Rocketry Challenge Finalist,

Congratulations! You are a finalist for the American Rocketry Challenge. Your team's local qualification flights have earned you an invitation to attend the American Rocketry Challenge National Finals the weekend of May 19-21, 2023, at Great Meadow in The Plains, VA. 798 teams from 45 states entered this year's competition and your qualifying score was one of the 100 best. You can be proud of your achievements in aerospace design and rocketry.

To accept your spot in the National Finals please fill out and return the registration form that the registered supervisor for your team will be receiving. Do so online using the ARC Portal. All confirmations must be received by **Thursday, April 27, 2023**. If we do not receive all forms from your team by Thursday April 27, 2023, we will offer your spot to an alternate team Friday, April 28, 2023. If you will not be able to attend the fly-offs, please let us know as soon as possible so that we may offer your spot to one of these alternate teams.

The enclosed information should answer your questions about procedures, lodging, and other aspects of the National Finals. It also addresses many of the questions that we have been receiving from teams over the last several months concerning event rules, legal rocket designs, etc; please read the entire document carefully. In case of conflict, the official rules take precedence. Remember that the exact model you fly at the National Final must have previously been test-flown successfully, and you will not be able to do any test or practice flights at Great Meadow before your Finals flight.

Please contact us at rocketcontest@aia-aerospace.org if there are things that you need to know about registration that are not covered by this letter.

We look forward to meeting you at the National Finals!

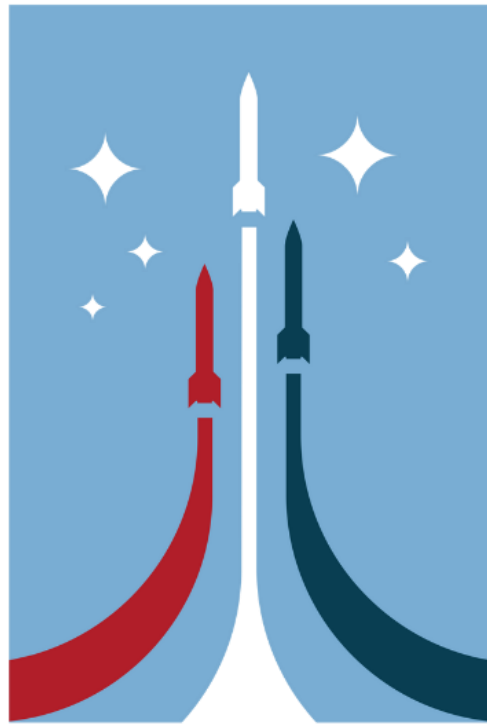
Sincerely,

Katrina Hill
ARC Director
Aerospace Industries Association (AIA)

Trip Barber
ARC Manager
National Association of Rocketry (NAR)

THE AMERICAN ROCKETRY CHALLENGE - TABLE OF CONTENTS

Finals Schedule and Event Logistics.....	3
Tentative Schedule	4
Attendance.....	6
Travel	6
Food.....	6
Lodging.....	8
Other Competitions	9
Rocket Motors, Finals Procedures, and Rocket Design and Construction.....	12



**AMERICAN
ROCKETRY
CHALLENGE**

2023 American Rocketry Challenge Finals

Finals Schedule and Event Logistics AMERICAN ROCKETRY CHALLENGE 2023 SCHEDULE

Friday, May 19

Friday's contestant briefing is at Metz Middle School, 9950 Wellington Road, Manassas, VA 20110

8:00 AM – 11:00 AM	Rockets on the Hill (space is limited)
9:00 AM – 4:00 PM	NAR set-up for Saturday contest at Great Meadow (no flights)
5:00 PM – 6:00 PM	Metz Middle School Issue NAR uniform items to NAR range crew
6:00 PM – 9:45 PM	Metz Middle School Contestant registration & rocket pickup
6:00 PM – 7:00 PM	NAR range crew briefing (auditorium)
7:30 PM – 8:45 PM	Contestant team briefing (auditorium)

Saturday, May 20

All Saturday events will be held at Great Meadow, 5089 Old Tavern Road, The Plains, VA 20198

6:45 AM	Contestant Registration & Egg Issue open
7:00 AM	Pre-Flight Check-In opens (1st 24 teams)
7:30 AM	Great Meadow gates open for spectators
8:15 AM – 8:30 AM	Opening Ceremony/National Anthem
8:30 AM – 9:15 AM	24 team 1st launches (Goddard 1 launch window)
9:15 AM – 10:00 AM	18 team 1st launches (Stine 2 launch window)
10:00 AM – 10:45 AM	24 team 1st launches (Goddard 3 launch window)
10:00 AM – 3:00 PM	Team Rocket-Building Competition (Member's Hill)
11:00 AM – 2:00 PM	Lunch for Finalists & Team Advisor (Dining Tent)
10:45 AM – 11:30 AM	18 team 1st launches (Stine 4 launch window)
11:30 AM – 12:15 PM	17 team 1st launches (Goddard 5 launch window)
12:45 PM	NAR High Power Rocket Demonstration
1:00 PM	Deadline for returning rockets post-flight (1 st flights)
1:15 PM	Announcement of top 42 teams from preliminary round
2:15 PM – 4:00 PM	Ice Cream Social for teams (Dining Tent) battle
2:15 PM – 3:00 PM	1 st -24 th team 2nd launches (Goddard 6 fly-off launch window)
3:00 PM – 3:45 PM	25 th -42 nd team 2nd launches (Stine 7 fly-off launch window) ** WEATHER PERMITTING **
4:00 PM – 4:30 PM	NAR High-Power Rocket Demonstration
4:30 PM	Deadline for returning rockets post-flight (2 nd flights)
5:00 PM - 6:00 PM	Award Ceremony (Dining Tent)
6:00 PM - 8:00 PM	BBQ Dinner

Friday Daytime:

American Rocketry Challenge staff will be out at the launch site at Great Meadow from 9:00 AM until 4:00 PM on Friday, May 19th setting up equipment for the fly-off. Teams may come out to look during this time, but **NO TEST FLIGHTS** can be supported and there are no other flying sites available.

Rockets on the Hill 8:00 AM – 11:00 AM:

The Aerospace Industries Association will be hosting a continental breakfast reception for ARC participants on Capitol Hill on Friday. Teams are invited to bring their rockets. If you are interested in attending, please indicate this on your RSVP form. **Space at this reception is limited and will be allocated on a first-reply basis.** To allow the maximum number of student participants, only one adult chaperone per team may attend.

National Air and Space Museum Udvar-Hazy Tour 1:00 PM-2:30 PM:

Special 90-minute guided tours of the National Air and Space Museum's Udvar-Hazy Center (near Dulles Airport) will be offered Friday afternoon. **Space is limited and on a first-reply basis.**

Aurora Flight Sciences, a Boeing Company Tour 2:00 PM – 5:00 PM:

National finalists will have an opportunity to tour the Aurora Flight Sciences Manassas facility. Only one chaperone per team is permitted to attend. The tour includes lunch. **Space at is limited and will be allocated on a first-reply basis.** To allow the maximum number of student participants, only one adult chaperone per team may attend.

Friday Contestant Briefing:

The contestant registration and briefing are at 7:30PM on Friday evening at Metz Middle School, 9950 Wellington Road, Manassas, VA 20110. Metz Middle School is located 6 miles from the hotels. The roads will be busy, so plan your trip accordingly. You should plan to arrive no earlier than 6:15 PM and no later than 7:00 PM in order to pick up your registration materials before the briefing. Rocket motor orders that were made in advance to Performance Hobbies and rockets and/or motors shipped ahead to Aurora Flight Sciences will be available for pickup during this event, beginning at 6:00 PM and will also be available on-site on Saturday morning at the NAR information tent.

We will announce the decision at the Friday contestant briefing if the weather forecast for Saturday is so unfavorable (heavy rain or wind above 20 miles per hour all day) that the fly-off must be postponed to Sunday. This has not happened in the previous nineteen years, so keep your fingers crossed! We will also do a coin toss to determine if the flight challenge target for second-round flights on Saturday will be 25 feet higher or 25 feet lower than 850 feet.

Saturday Flying Schedule:

All events on Saturday, May 20th, will take place at Great Meadow, 5089 Old Tavern Road, The Plains, VA 20198. To get there, take I-66 exit 31 (which is 16 miles west of the Manassas hotels, toward Front Royal), turn left on Highway 245, away from the town of The Plains and toward the village of Old Tavern, and follow the signs 2 miles to Great Meadow, which will be on your left. Parking is free.

Teams assigned the first launch window time slot (7:00 AM check-in opening, 8:30-9:15 AM liftoffs) should plan to be at the flying field at 6:45 AM on May 20. Other teams may choose to arrive later than this, but each team should arrive at least two hours before its assigned rocket flight window time. All teams should plan to remain at the flying site until the conclusion of the award ceremony at 6:00 PM on Finals Day. The barbecue after the award ceremony will end before 8:00 PM Saturday. Teams should be flexible enough in their plans to be able to stay for a May 21 (Sunday) fly-off if bad weather on Saturday forces postponement.

Attendance:

Teams that are selected to attend the Finals must confirm their participation with the form that was sent to all supervisors no later than **Thursday, April 27, 2023**. Alternate teams will be invited to participate in order of place beginning Friday, April 28, 2023, if one or more primary teams have declined their invitation.

We ask that any team that attends do so with an adult chaperone, preferably the supervising teacher, and at least one of the students; it is not mandatory that every student team member attend, but the more the better.

You may not add team members after your initial qualification flight attempt, except in the special case described in the ARC rules where a school has more than two teams whose scores are better than the Finals cutoff and has to limit Finals participation to just two teams in accordance with the rules. Please submit an add/drop form if you choose to drop team members. All team members who are registered as of the date of the fly-off (regardless of whether they attend the fly-off) will share equally any prizes awarded to a winning team. All team members on the final team should have contributed to the designing, building, and/or launching of the team's entry.

TRAVEL

There are no additional event fees for those teams selected for the Finals, however travel expenses to attend are the responsibility of each team. The entire team is not required to attend the Finals, but for a team to compete, at least one member plus a supervising adult must be present.

The nearest major airports to the launch site are:

- Washington Dulles (IAD): 17 miles away
- Reagan National (DCA): 35 miles away
- Baltimore-Washington International (BWI): 70 miles away

Teams must provide their own transportation to get from the hotel to the launch site, and to/from any airport. In planning your travel, please keep in mind DC rush hour: I-66 westbound from the DC area to Manassas and beyond is very heavily congested and very slow-moving by 2:00 PM on Fridays.

FOOD:

Student contestants and one team supervisor per team with credential badges will receive free lunch, ice cream, and a BBQ dinner.

There will be a food and beverage vendor on the field for lunch and anyone else that wishes to purchase food. Free water will be available throughout the day.

We will end the day on Saturday with a BBQ dinner after the award ceremony. Parents and other spectators can purchase tickets for this event for \$25.

SITE RULES:

Great Meadow is an incredible venue that we wish to preserve for future years. Please be sure to observe the following site rules.

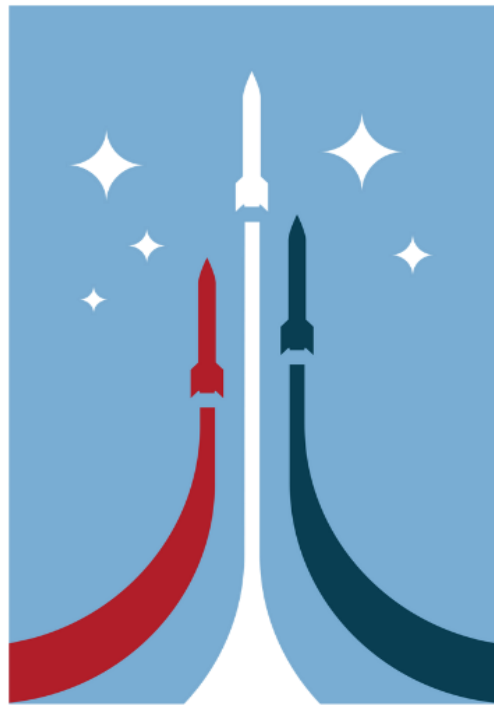
- Please do not bring cooking devices to the field. Coolers are OK.
- Glass bottles are not permitted.
- Drone flying is not permitted.
- Dogs are not permitted (service animals exempted).



LODGING FOR ARC 2023:

Teams are responsible for making their own lodging arrangements. The primary location for hotels that are convenient to ARC activities is at Exit 47 on I-66 in Manassas, VA. All of the hotels are within the first two blocks after the exit, either to the south or to the north. All the hotels are within a few blocks of each other and are surrounded by restaurants and shopping. This year, the Courtyard by Marriott at 10701 Battleview Pkwy is offering a group rate to American Rocketry Challenge teams. To receive this discounted rate, you must book at the following link or by contacting the hotel directly at 703.335.1300 and requesting the American Rocketry Challenge rate: <https://www.marriott.com/event-reservations/reservation-link.mi?id=1666363155520&key=GRP&app=resvlink>

Hotel	Exit	Address	Phone Number
Quality Inn Manassas	I-66 Exit 47A	10653 Balls Ford Road, Manassas, VA 02109	(703) 368-2800
Days Inn	I-66 Exit 47A	7249 New Market Ct., Manassas	(703) 659-9023
Red Roof Inn Manassas	I-66 Exit 47A	10610 Automotive Drive, Manassas	(800) 733-7663
Comfort Suites	I-66 Exit 47A	7350 Williamson Blvd., Manassas	(703) 686-1100
Courtyard by Marriott	I-66 Exit 47B	10701 Battleview Pkwy., Manassas	(703) 335-1300
Hampton Inn	I-66 Exit 47A	7295 Williamson Blvd., Manassas	(703) 369-1100
Best Western Battlefield Inn	I-66 Exit 47A	10820 Balls Ford Road, Manassas	(703) 361-8000
LaQuinta Inn & Suites	I-66 Exit 47B	6950 Nova Way, Manassas	(703) 393-9966
Holiday Inn Manassas Battlefield	I-66 Exit 47A	10424 Balls Ford Road, Manassas	(571) 292-5400
Wyndham Garden	I-66 Exit 47B	10800 Vandor Lane, Manassas	(703) 335-0000
Holiday Inn Express	I-66 Exit 47B	10810 Battleview Pkwy, Manassas	(703) 393-9797



AMERICAN ROCKETRY CHALLENGE

2023 American Rocketry Challenge Finals

Additional Competitions: Rocket-Building Competition

Additional Awards: Outstanding Team Advisor, Outstanding Mentor,
and Special Awards

ROCKET-BUILDING COMPETITION: SPONSORED BY NORTHROP GRUMMAN FOUNDATION

Student teams who qualified for the ARC Finals have developed good model rocket-building skills, and our rocket-building competition puts them to the test! Teams will have a 75-minute time slot between 10:00 AM and 3:00 PM on Saturday to build a rocket out of a bag of rocket parts provided by ARC staff. We will provide basic tools (yellow carpenter's glue, X-acto knives, sandpaper). Teams are free to bring their own tools and building supplies, but not additional rocket parts.

Teams can sign up for this competition starting at 6:15 PM on Friday night, prior to the contestant briefing. Teams will only be permitted to sign up for a time slot after their team's assigned launch window time. Alternates will take the place of any team that ends up making the fly-off round and is therefore unable to participate in the building competition during the time slot they signed up for.

The purpose of the competition is to build a creative, well-assembled rocket that has the required components to fly, such as a motor mount and recovery system, and that in the judgment of the event judges could most likely fly stably. However, these rockets will not be flown during the ARC Finals. Teams may pick them at the end of the day after judging and go fly them elsewhere.

Cash prizes (\$500) will be awarded to the team with the best rocket in each of two categories: best craftsmanship and most creative design

OUTSTANDING TEAM ADVISOR AND OUTSTANDING MENTOR AWARDS

The American Rocketry Challenge grows bigger and better each year thanks to the teachers and mentors who inspire and encourage students to excel in our program. We want to gather stories and share the excellent work of ARC's unsung heroes.

Each year, we recognize one outstanding team advisor/teacher and one outstanding ARC mentor. To nominate a team advisor or mentor (or both) for these awards, write a short summary (two pages max; photos – no more than two -- are optional but encouraged and do not count towards the page limit) of how your teacher and/or mentor went above and beyond to support your team and make ARC a great experience for the students. Team advisors/teachers may only be nominated by students. Mentors may be nominated by team advisors and/or students. Nominations are open to all teams, not just national finalists, but the awards will be announced at the National Finals.

All nominations must be submitted by April 29th at 5:00 pm ET at the below forms:

[Outstanding Team Advisor Nominating Form](#)

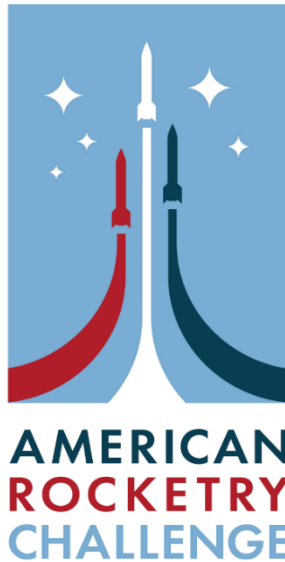
[Outstanding Team Mentor Nominating Form](#)

SPECIAL AWARDS

In addition to the prizes and places based on rocket flight performance, five teams will be selected by judges on the field at the Finals for the following awards:

- Best Rocket Craftsmanship
- Best-Dressed Team (uniform/costume) ****See flyer for more information****
- Spirit of ARC (combination of teamwork, sportsmanship, team spirit) sponsored by The Boeing Company
- Most Innovative Approach to Mission sponsored by Raytheon Technologies

Plaques and \$500 cash prizes for each of these categories will be given out at the awards ceremony.



AMERICAN ROCKETRY CHALLENGE

Best Dressed Team Competition!

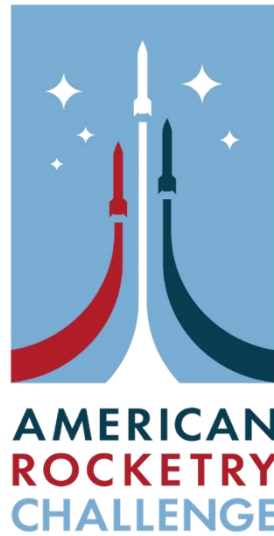
Think your team has what it takes to be named “Best Dressed” at the 2023 National Finals? Be sure to show up to Great Meadow decked out in team uniforms/costumes to be considered for this year’s award!

What: Best Dressed Team Competition

Where: AIA Information Booth (Near the Exhibit Tent)

When: 12:00 pm – 2:00 pm

Winning team will be announced at the awards ceremony at the end of the day. Be sure to take your own photos and share them on ARC’s Facebook, Instagram and Twitter pages @RocketContest! #ARC2023



2023 American Rocketry Challenge Finals

Rocket Motors, Finals Procedures, and Rocket Design and Construction

APPROVED ROCKET MOTORS

Your rocket must be powered only by commercially-made model rocket motors that are safety-certified by the NAR and listed on the **final** NAR Engine Certification List at www.rocketcontest.org.

Performance Hobbies will support advance (pre-paid) orders for delivery at the Finals. They have motors of all types, plus other supplies such as parachutes. **IF YOU CANNOT TRAVEL BY AUTO TO THE FINALS WITH YOUR MOTORS (see below) YOU SHOULD ORDER THEM IN ADVANCE, FOR DELIVERY ON-SITE AT THE FINALS.** Do not count on Performance Hobbies happening to have the motor that you need at the Finals, order whatever you need in advance, and it will be delivered to you Friday evening at ARC Registration. Performance Hobbies is operated by Ken Allen and can be reached at:

Performance Hobbies
www.performancehobbies.com <http://www.hangar11.com/>
kensrockets@rocketmail.com
(202) 723-8257

If Performance Hobbies does not have what you need in stock when you call, then do not backorder; go to one of the program's online vendors (Wildman Rocketry at www.wildmanrocketry.com; Balsa Machining Service at www.balsamachining.com; Apogee Rockets at www.apogeerockets.com; or Chris' Rocketry <https://csrocketry.com>) and order motors for delivery to your team, shipping them to Aurora Flight Sciences as described below (there may be a HAZMAT shipping fee).

Shipping Rockets and Launch Equipment:

It is ILLEGAL to put model rocket motors, igniters, or other pyrotechnic materials in your baggage on an airplane, **DO NOT TRY THIS**. It is also illegal to ship a rocket motor by UPS or USPS without disclosing to the shipper what you are shipping, and these shippers will not accept motors for shipment by private individuals. Order these things from Performance Hobbies or another vendor who has the necessary shipping permits, and have them delivered to you care of the address below.

You may ship your model rockets and launching equipment to us and they will be given to you at the contestant briefing on May 19. A vendor with the proper license may also ship motors that you have ordered to this location. **Make sure you use a shipper that utilizes a tracking system to confirm delivery of your rocket, do not call Aurora Flight Sciences.**

Aurora Flight Sciences Corporation
c/o Jason Ganzhorn, Facilities
9950 Wakeman Dr.
Manassas VA 20110
Hold for ARC Team # _____, _____ High School

FINALS PROCEDURES

Students Only:

All elements of rocket design, preparation, and flight are to be done by student members of teams. Only student team members -- no teachers, mentors, parents, or non-team members -- may go into the team check in area, onto the flying field, pad, or approach the pad which includes assisting with rocket preparations before flight. Anyone can help on recovery if the rocket drifts outside the main flying field area.

Time Management:

Each team will be assigned a 45 minute "launch window," preceded by a 45-minute "prep window". **These time assignments will be posted on our website www.rocketcontest.org no later than May 15, 2023, and are not negotiable. You must fly during your assigned window.** Between 18 and 24 teams will be assigned to each launch window period, and each may fly at any time during that period. You will not be allowed to set up your rocket or launch system on the flying range until your prep window time slot begins, which is the beginning of the launch window period before your own launch window. You should plan to be done setting up by the time your launch window opens. You should plan to be issued your eggs and to present your rocket to us for pre-flight safety and rules-compliance inspection prior to this prep window. This means that you should plan to be on the flying field at minimum of **two hours prior to your launch window** -- earlier if you still need to do registration on the field because you were not at the Friday evening contestants' meeting. The first launch window will open at 8:30 AM on the Finals flight day (with a 7:00 AM checkin window), so teams who get assigned this window should be prepared to be on the field at 6:45 AM on Saturday, May 20.

You must fly your rocket during the launch window, and will be disqualified and must clear the pad if you fail to achieve liftoff during this window. Misfires are not an excuse for missing an assigned launch window -- so do not wait until the last moments of your window to fly.

The top 24 to 42 teams based on scores from first flights (all of which must be completed by 12:15 PM) will be asked to make a second flight during one or two final "fly-off" rounds to be held between 2:15 PM and 3:45 PM. The flight objective for this second round will be either 25 feet and one second higher or lower than the first round, based on the results of a coin toss at the Friday evening team briefing. The teams making second flights will include the 5 teams who each had the best score in their respective initial flight round, plus the 19-37 next best teams overall. If thunderstorms develop which require closing the range early or opening it late for safety reasons (one or the other has happened five times in the last eighteen years) then this flyoff will be limited to the 24 teams promised in the ARC 2023 Rules, flying in one round. Otherwise we will fly two rounds, a total of 42 teams. The flyoff teams will be notified as soon as possible after 12:15 PM but no later than 1:15 PM. The top 40 places in ARC 2023 (20 places if there are only 24 second flights) will be awarded to these teams, ranked on the basis of the SUM of the scores from their two flights. Any team that cannot make a second flight or that is disqualified on the second flight will be ranked behind all teams that do make a second flight.

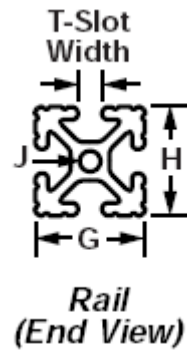
Primary and Backup Models:

We recommend that you bring two models to the Finals, if possible. If your primary model lands in a tree, power line, or other dangerous place where it is visible to the judges but cannot be recovered safely, or if you experience a rocket motor catastrophic failure as judged by the Range Safety Officer (burst motor or complete failure of the ejection system, with the cap still retained in place on the ejection charge), or if you have an altimeter failure (an altitude reading of greater than zero but less than 50 feet after a normal qualified flight) the judges may allow you to have a second flight.

Otherwise only one initial flight attempt is allowed. If a rocket clears the pad and becomes airborne, this is considered a "flight attempt". If there are any "backup" flights allowed, there will be a few time slots reserved for this purpose in the last first-flight launch window of the day (11:30 AM-12:15 PM). For your second-round flight, if your first flight is good enough to earn you this opportunity, you may use a different model if desired to achieve the different flight performance targets.

Equipment:

The launch system provided for contestant use will have individually-assigned, well-spaced sturdy three-legged pads with the a single, 6-foot-long "1010" (1 inch on a side, ¼ inch center slot) T-slot launch rail on an adjustable base (see photo below) and one pair of high-current 12-volt electrical igniter leads with a single pair of micro-clips at the end. These will provide 18 amperes from our launch system from a car battery through 60 feet of 16-gauge wire, which will light any igniter or cluster of up to 4 igniters. Launch rods will not be provided and may not be used; rockets will need "rail buttons" in order to fly from the launchers provided at the Finals. Teams are not required to use the launch system and rail that we provide. They may bring their own launch pads, towers, rails, or other hardware, "clip whips" to light clusters of motors from our single pair of micro-clips on the ignition wires, and even their own electrical launch systems if they need anything different from what we provide. Such individual launch systems must comply with the NAR Safety Code requirements and will be subject to our safety check and approval. Launch rods may not be used and a minimum rail/launcher length of 6 feet is required.



Returns:

All teams that have a safe and otherwise qualified flight must return the model with egg and altimeter still inside in flight configuration to the "Returns Table" for post-flight inspection of the egg and recording of altimeter reading. This must be done no later than 1:00 PM for first flights, which is 45 minutes after the final "launch window" for the first-flight rounds closes; and it must be done by 4:30 PM for flights from the final fly-off round(s). We will have several ingenious devices available to assist teams in plucking rockets from trees if this unfortunate circumstance occurs. Rockets that land in a tree above where we can reach or that land on a power line are considered non-recoverable and do not count; a replacement rocket may be flown.

NAR MEMBERSHIP AND INSURANCE

You are not required to be a member of the National Association of Rocketry to participate in this contest as a teacher or team member. But we certainly encourage membership, and you may need to become a member if you need insurance coverage for rocket flying in addition to whatever coverage may be provided by your personal insurance.

Your NAR membership includes personal liability insurance to cover YOU against liability claims from rocket activities conducted in strict accordance with the NAR Safety Code. This individual insurance does not cover others (such as your school or the owner of your launch site.)

ROCKET DESIGN AND CONSTRUCTION

First and foremost, read the Model Rocket Safety Code of the NAR, and the ARC rules, very carefully. These answer many questions about what is allowable and what is not. We have been asked many questions of interpretation and have provided answers both individually and via the FAQ on the website. If you are in doubt about your design's compliance with our rules, it is better to ask us early than to find out at the Finals that what you did is not allowable. Remember that your rocket cannot weigh more than 650 grams at liftoff (with egg and rocket motor or motors) or have more than 80 Newton-seconds of total impulse in all its rocket motors put together.

The assembled rocket must have an overall height when standing on a table of at least 650 millimeters from the bottom of the fins or other lowest part of the structure to the tip of the nose. It must recover in two separate sections, each with a parachute. The official time is recorded for the upper section, the one containing the egg and altimeter. The section containing the egg must be big enough in diameter to contain an egg that may be up to 45 millimeters in diameter.

Motors must be retained in the rocket during flight and at ejection by a positive mechanical means (clip, hook, screw-on cap, etc.) and not retained simply by friction fit inside the motor mounting tube. If this mounting tube end sticks out at the base of the rocket, it is permissible to retain the rocket motor by exterior wraps of non-heat-sensitive tape (not cellophane or masking tape) that adhere to both the end of the exposed motor mounting tube and the exposed end of the motor casing.

Painting and Decorating:

Rockets flown at the Finals must have a decorative finish (paint and/or adhesive patterns) on any exterior surface of the rocket that is made of paper, wood, or fiber. Fiberglass, carbon, and plastic parts are not required to have this covering. A 5-point penalty will be assessed against any rocket not meeting this requirement.

Some of the common topics of questions we have been asked about rocket designs have been:

Design Changes:

You are free to change your team's design in any manner that you wish up until the moment you check in at the Finals. You are not required to use the same design that you flew for your "qualification" flight. If you make the second (fly-off) round you can use a different model than the one you flew in the first round. All rockets flown at the Finals must have been test-flown previously. Please put your ARC team number on the rocket that you fly at the Finals.

Motor Selection:

Make sure that you have or can get the rocket motors you plan to use with your design at the Finals or change your design to suit the motors that you can get. Some teams have problems with very slow liftoffs that make their rocket vulnerable to tipping over in flight ("weathercocking") in windy conditions. This is the result of an inadequate thrust-to-weight ratio for the rocket. If the average thrust of your motor(s) in Newtons (the unit of measurement of thrust that is labeled on the motor) is not greater than 20 times the liftoff weight of the rocket in pounds, then your rocket is underpowered and may weathercock.

Staging:

Use of more than one stage is not permitted.

Commercial vs Custom Parts:

The flight vehicle must be made by the student team members. You may use commercially-available "off the shelf" component parts (body tubes, nose cones, egg capsules, etc.) and may adapt rocket kits for the event -- or you can scratch-build components if you prefer. If some company should release a kit specifically for this event or for the NAR "Eggloft" contest event you would not be allowed to use such a kit. Having a custom flight vehicle part fabricated by a composite or plastics company or custom wood machining company (even if it is to your design) does not constitute sale of a "standard off-the-shelf product" and is not allowed. Having a mandrel fabricated to your specifications that you wrap fiberglass on to make your rocket body (for example) would be OK. In this case the company is making a tool that you are using, but you are making the part that flies. 3D printed parts are fine as long as the team did the design and printing.

Metal Parts:

You may only use non-metal parts for the nose, body, and fins of your rocket, those parts that are the main structure of the vehicle. Fiberglass is OK. You may use miscellaneous metal hardware items such as screws, snap links, engine hooks, electronic circuit boards, and (if you wish) commercial reloadable metal rocket motor casings.

Eggs:

Your rocket must contain one egg, oriented in any manner. We will provide a tray full of eggs for issue to the contestants, all of them measured to be no more than 45 millimeters in diameter and between 55 and 61 grams in weight, and all of them marked with their weight to the nearest 0.1 gram.

Recovery:

Your rocket must separate into two portions during the recovery phase of its flight, both of which must recover by parachute. If structural pieces (not counting disposable recovery wadding) or the rocket motor casing separate prior to landing, the flight will be disqualified. Breakage of fins or other parts on landing is not disqualifying.

Time will be recorded from the moment of liftoff to the moment that the section of the rocket containing the egg and altimeter touches the ground, ceases its descent (e.g. lands in a tree), or disappears from the timers' sight.

Rockets may not be controlled by human intervention; radio control is prohibited. Flight control systems carried onboard the rocket such as electronic or other forms of timers, altimeters, etc. that control duration in some safe manner are permitted. They may not use pyrotechnic charges (black powder, pyrodex, or small rocket motors) to deploy recovery systems. They may use burn-through wires or igniters. If they are designed to sense acceleration or deceleration of the rocket as the basis for starting an ignition or ejection sequence through an igniter or other trigger, then there is a great risk that they can trigger on the ground or in your hands if you drop or jog the rocket while carrying it. Such systems must have a power switch, plug, or other disconnect mechanism that permits you to maintain them in a completely "safe" configuration until they are placed on the launching pad, and will not be allowed to fly if they do not.

The field for the Finals is not huge (see the site map posted on the www.rocketcontest.org website), but with winds of 20 miles per hour or less (the NAR Safety Code limit) a rocket that stays up no more than 50 seconds will remain on the field. We will have some devices to help pluck rockets out of the lower portions of trees, if you are unlucky on recovery. We have never had a payload portion of a rocket lost to a tree at the ARC Finals.