



# NASA'S MINNESOTA SPACE GRANT CONSORTIUM: 2014-2015 MIDWEST HIGH-POWER ROCKET COMPETITION

(SPRING 2015 COMPETITION LAUNCH  
HOSTED BY THE MN SPACE GRANT  
CONSORTIUM AND BY TRIPOLI MN)

Informational telecon slides: September 23, 2014

# Introductions

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- MN Space Grant Organizer

U of MN's Prof. James Flaten

<[flate001@umn.edu](mailto:flate001@umn.edu)>

- Technical Advisor

Tripoli MN's Gary Stroick

<[president@offwegorocketry.com](mailto:president@offwegorocketry.com)>

- Round Robin Introductions

# Number of Teams Participating

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- Teams competing last year (spring 2013)
  - ▣ 13 teams, all from the Space Grant “Great (Lakes) Midwest” Region
  - ▣ MN (4), IL (4), WI (3), IA (1), OH (1)
  - ▣ 2 other teams were involved but dropped out late)
  
- This year we are opening the up the competition to teams from states outside the Space Grant Midwest Region and are hoping to attract about 20 teams.

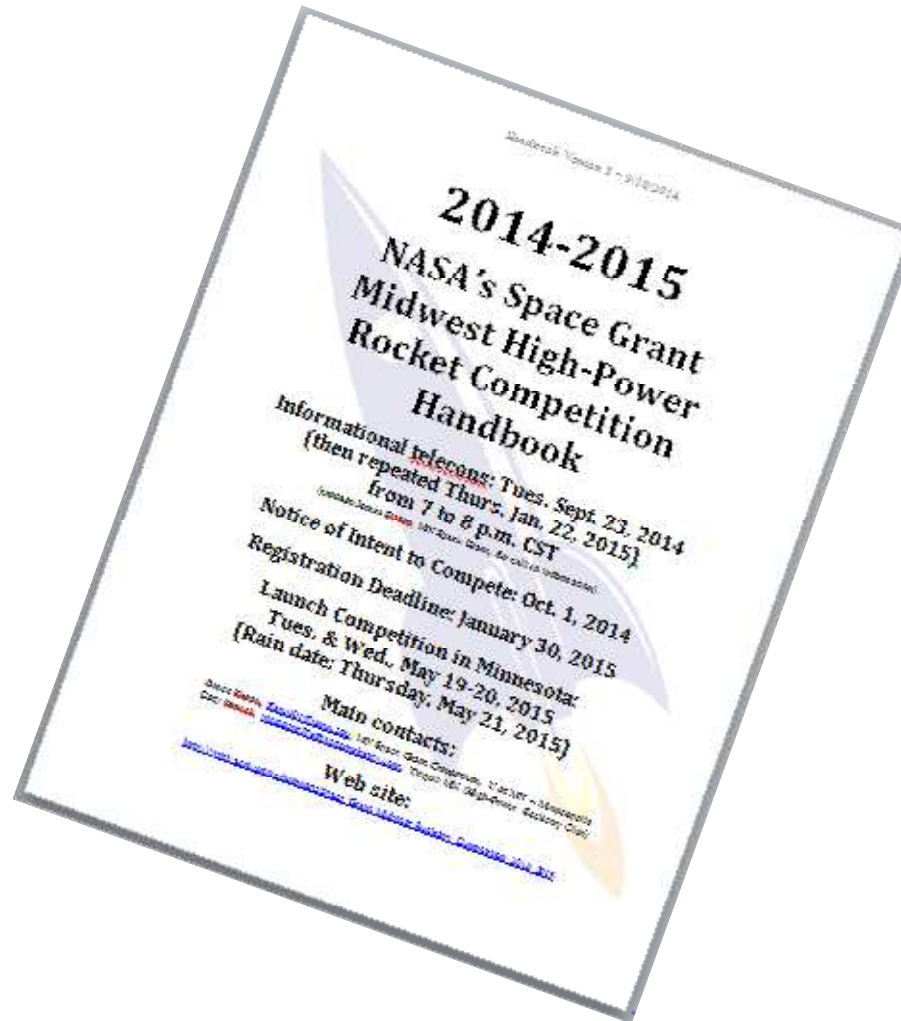
# What you need to know

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- Competition Handbook
- Fees & Supplied Equipment
- Schedule
- 2014-2015 Competition Parameters
- Pre-Competition Requirements
- Five Aspects of the Competition
- Flight Safety
- Judging
- Q & A

# Competition Handbook & Website

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Website: [http://www.aem.umn.edu/msgc/Space\\_Grant\\_Midwest\\_Rocketry\\_Competition\\_2014\\_2015/](http://www.aem.umn.edu/msgc/Space_Grant_Midwest_Rocketry_Competition_2014_2015/)

# Fees & Supplied Equipment

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- Registration Fee: \$400 (due January 30, 2015)
- The Registration Fee Covers (on Launch Day):
  - Competition Flight Data Recorders (two Altimeter Two per rocket) to monitor altitude and other basic parameters
  - One Competition Motor Reload & Igniter – a Cesaroni 475-1445-16A (54mm, 1-grain, “Vmax”)
  - Note: Teams are allowed to bring additional motors or purchase more at the competition and fly more than once

*\*We are seeking outside sponsorship support which may allow us to provide more things (like a motor casing) and/or possibly reduce the registration fee. More details coming no later than January 2015.*

# Space Grant “Sponsorship”

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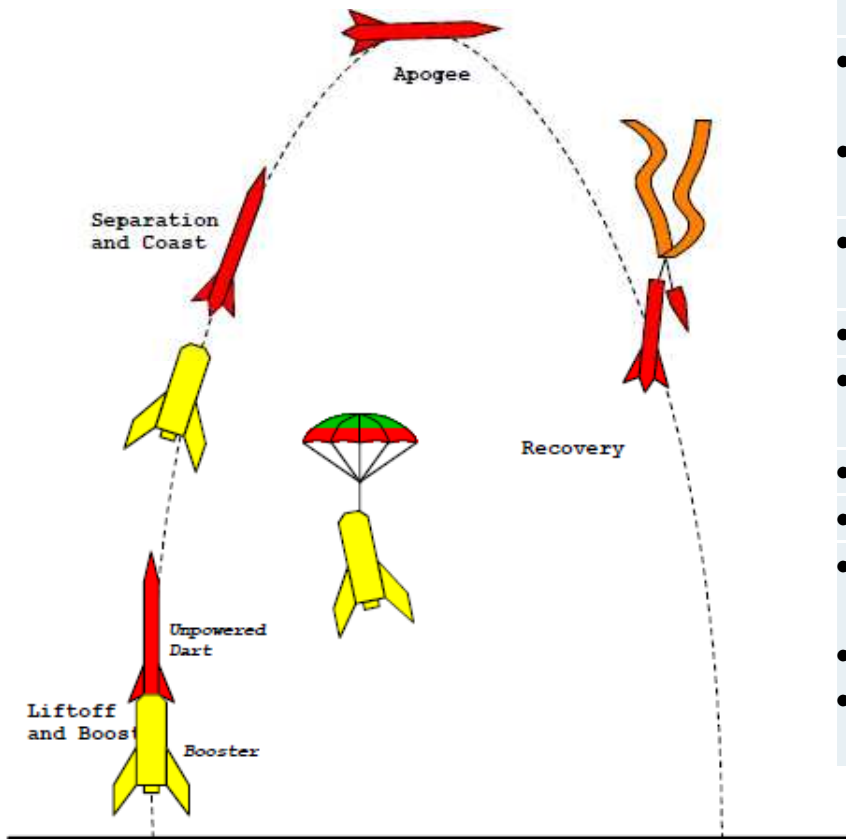
To help us keep tabs on participants for Space Grant Reporting, we require that every team contact their state’s Space Grant to “get sponsorship.” We are not suggesting to Space Grants what “sponsorship” might mean for them – this is to be negotiated on a case-by-case basis. For example, it doesn’t necessarily entail full (or even partial) financial support so most teams will need to find other sources of funding.

However we hope that Space Grants will at least consider helping with some basic competition expenses such as:

- (a) registration fee (\$400)
- (b) travel to MN for the competition launch (\$ varies widely)
- (c) building and instrumenting the rocket itself (will vary; perhaps ~\$500-1000)
- (d) paying for a 54 mm 1-grain motor casing with closure (~\$80)
- (e) buying something like an I445 motor for the required practice launch (~\$50).

# 2014-2015 Competition Parameters

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## RULES/CONSTRAINTS

- Required competition motor (provided): Cesaroni I445 V-max in booster; no motor in the dart (upper stage)
- Drag separation of dart from booster after burn-out – no imparting upward momentum to dart from booster.
- Booster recovery: post-apogee-deployed recovery parachute; motor eject must be left intact
- Dart recovery: must be electronically deployed
- Competition altimeters (provided): "Altimeter Two" in each section
- Radio-tracking of dart optional, but recommended.
- Required down-looking video from dart.
- Required non-commercial 3-axis rotation characterization of dart.
- Both booster and dart have fins and have  $SM > 1$ .
- Point based on max altitude of dart plus difference in max altitude of dart and booster.

*Challenge: Student teams will design and construct a high-power “**Boosted Dart**” that will be recovered safely and in flyable condition, predict its flight performance, collect look-down on-board video of the entire flight from the dart (looking-down during ascent configuration), and construct a non-commercial on-board data collection package for the dart that will characterize its rotation in the X, Y, and Z axes over time.*



# Pre-Competition Requirements

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## Educational Outreach

- ❑ Validated by each State's Space Grant
- ❑ State Space Grant Notifies Technical Advisor
- ❑ Must be accomplished no later than May 4, 2015
- ❑ Failure to Complete: 10% Score Reduction

# Pre-Competition Requirements

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## Model Rocket Demonstration Flight

### ▣ Purpose

- Demonstrate a minimum knowledge of rocketry

### ▣ How to do it

- Purchase a model rocket flight kit
- Assemble
- Successfully fly and recover the rocket in flyable condition
- Document the flight with before and after photos of the rocket and the team “in the field”
- E-mail photos to the MN Space Grant along with flight date and location no later than March 20, 2015

### ▣ Potential Waivers

- If your whole team has high-power rocketry experience you may request of Gary Stroick a waiver from this requirement
- If you prefer to build and fly a standard (non-competition) high-power rocket instead of a model rocket, that is acceptable

# Graded Aspects of the Competition

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- Preliminary Design (Written) Report (30%)
- Fight Readiness (Written) Report (10%)
- Fight Readiness (Oral) Presentation (10%)
- Competition Flight (30%)
- Post-Flight Performance Report (20%)

*Note 1 – There is a 10% overall reduction if you do not complete the Educational Outreach component of this program.*

*Note 2 – Written reports are due by e-mail by 5:00 p.m. Central Time on the dates specified in the schedule. Scores for late reports will be reduced by 20% for each portion of a day that they are late.*

# Five Aspects to the Competition

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## Preliminary Design (Written) Report (30%)

- ▣ Communicate the engineering and design effort
  - Provide detailed design and diagrams
  - Analysis of predicted performance
  - Analysis of non-“pre-qualified” components
- ▣ Estimated Budget
- ▣ 25 pages MAX
- ▣ Due March 20, 2015

# Five Aspects to the Competition

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## Flight Readiness (Written) Report (10%)

- SHOW the construction and completed rocket
  - Construction Pictures, diagrams, etc.
- Test Flight (using H or larger motor)
  - Flight Performance Analysis
  - Flight Results Discussion
  - Improvements planned prior to competition
- Actual Budget
- 25 pages MAX
- Due May 4, 2015

# Five Aspects to the Competition

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## Flight Readiness (Oral) Presentation (10%)

- ▣ Communicate the design and engineering effort
- ▣ Organization and presentation
- ▣ Rocket Construction
- ▣ VISUAL AIDS
- ▣ 10 minutes for presentation plus 3 for Q&A
- ▣ Tuesday evening before the launch (May 19, 2015)

# Five Aspects to the Competition

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## Competition Flight (30%)

### ■ Successful flight requires:

- Launch
- Booster and dart separation
- Deploy of both booster and dart recovery systems
- Safely land all parts of rocket
- Recover in re-flyable condition

### ■ Flight Scoring:

- Successful flight

$$\text{Flight Score} = 50 * (\text{Dart Altitude} / \text{Competition Maximum Dart Altitude}) + 50 * ((\text{Dart Altitude} - \text{Booster Altitude}) / \text{Maximum Competition Booster : Dart Separation Achieved})$$

- Teams that fly safely and recover in flyable condition will receive no less than **15** points (out of a max. of 100 points from this part)

# Five Aspects to the Competition

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## Post-Flight Performance (Written) Report (20%)

- Flight Performance Comparison
  - Actual vs simulated flight performance analysis
  - Graphs, charts, etc.
  - Results and discrepancy discussion
- 15 pages MAX
- Due May 29, 2015



# Safety Reviews

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- Each team must go through a safety review in their home state prior to coming to the competition launch
- Each team will go through a safety review with Tripoli MN the evening of their oral presentation
- On the day of the launch:
  - Each rocket must be examined for flight safety by the Range Safety Officer (RSO)
  - **The Tripoli RSO has the final word on flight safety!**

# Judging

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- Separate from safety checks by Tripoli, MN, the written and oral reports and the performance in the competition flight itself will be evaluated according to the rubrics in the handbook by a panel of judges from industry and/or academia.
- **Each Space Grant sponsoring more than one rocket will be expected to provide one judge.** If you don't have someone from your state you'd like to send to MN for the competition dates, contact Gary Stroick about possibly retaining someone from Tripoli to serve as "your" judge. Typically judges' travel expenses are reimbursed (at least). Please identify your judge no later than the end of 2014.

# Schedule Summary

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- Oct 1, 2014 – Notice of Intent to Compete
- Dec 31, 2014 – All state's judges identified
- Jan 30, 2015 – Formal Team Registration (pay \$)
- Feb 13, 2015 – Declaration of Comp. Attendance
- Mar 20, 2015 – Preliminary Design Report
- April 2015 – Test Flight
- May 4, 2015 – Flight Readiness Report
- May 19-20, 2015 – Competition
- May 29, 2015 – Post Flight Performance Report
- June 5, 2015 – Competition Results Announced

$$v_x = v \cos \theta$$

$$v_y = v \sin \theta$$

$$x = v \cos \theta \cdot t$$

$$y = \left( v \sin \theta - \frac{g}{2} t \right) \cdot t$$

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Comments or Questions?