Partial screenshot (on descent) from
https://youtu.be/lOV3Bd_kw-A

NASA'S SPACE GRANT 2025-2026 MIDWEST HIGH-POWER ROCKETRY COMPETITION – THE "SECRET MESSAGE" CHALLENGE

MAY 2026 COMPETITION LAUNCH NEAR NORTH BRANCH, MN

HOSTED BY THE MN SPACE GRANT CONSORTIUM AND BY THE TRIPOLI MN HIGH-POWER ROCKETRY CLUB

Informational videocon: Monday, September 15, 2025, 7 p.m. CDT
Repeated: Thursday, January 8, 2026, 7 p.m. CST

Introductions

- MN Space Grant Organizer

  James Flaten, U of MN Twin Cities

  flate001@umn.edu

- Technical Advisor

  Gary Stroick, Tripoli MN

  gstroick@comcast.net

- Round Robin Introductions

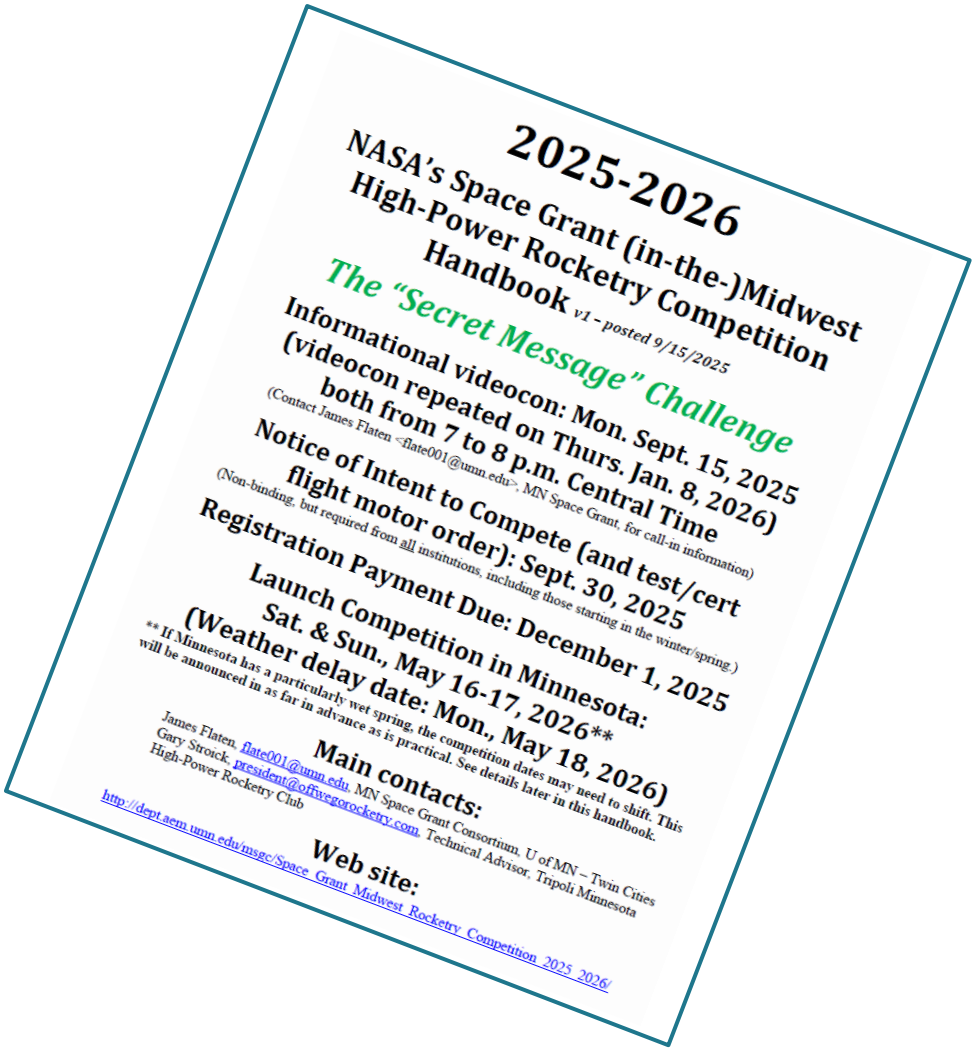
Number of Teams Participating

- Teams competing in past years
  - 10 - 15 teams typically compete, mostly from the Space Grant Great (Lakes) Midwest Region, but the competition is open to colleges/universities across the entire nation
  - Last year 13 teams registered and 11 made it to the fly-off with a competition rocket, including one from overseas!
  - One of the missing teams ultimately completed and flew their competition rocket, but not for points.
- This year we are hoping to attract even more teams to attempt the "Secret Message" Challenge.

What you need to know

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

Competition Handbook & Website



2025-2026

NASA's Space Grant (in-the-)Midwest High-Power Rocketry Competition Handbook *v1 - posted 9/15/2025*

"The Secret Message" Challenge

Informational videocon: Mon. Sept. 15, 2025 (videocon repeated on Thurs. Jan. 8, 2026) both from 7 to 8 p.m. Central Time

(Contact James Flaten <flate001@umn.edu>, MN Space Grant, for call-in information)

Notice of Intent to Compete (and test/cert flight motor order): Sept. 30, 2025

(Non-binding, but required from all institutions, including those starting in the winter/spring.)

Registration Payment Due: December 1, 2025

Launch Competition in Minnesota: Sat. & Sun., May 16-17, 2026** (Weather delay date: Mon., May 18, 2026)

** If Minnesota has a particularly wet spring, the competition dates may need to shift. This will be announced in as far in advance as is practical. See details later in this handbook.

Main contacts:

James Flaten, flate001@umn.edu, MN Space Grant Consortium, U of MN – Twin Cities
Gary Stroick, president@offwegorocketry.com, Technical Advisor, Tripoli Minnesota High-Power Rocketry Club

Web site:

http://dept.aem.umn.edu/msgc/Space_Grant_Midwest_Rocketry_Competition_2025_2026/

Website: http://www.aem.umn.edu/msgc/Space_Grant_Midwest_Rocketry_Competition_2025_2026/

Fees & Supplied Equipment

- Registration Fee: $400* (due Dec. 1, 2025)
- The Registration Fee Covers (on Launch Day):**
  - (LOANER) Competition Flight Data Recorder (A Jolly Logic AltimeterTwo data logger) to monitor altitude and other basic parameters like peak altitude, velocity, and acceleration. (Note: An AltimeterThree, if you own one, is allowed instead.) However, remember that AltimeterTwo and AltimeterThree data loggers cannot fire ejection charges, so you will still need to fly a "genuine" (commercial) altimeter for any charges other than motor eject. (Motor eject is required as a back-up, to get out at least one parachute near apogee.)
  - One Aerotech H195 DMS competition motor ($46.99) and one Cesaroni I170 competition motor ($63.88), purchased from Off We Go Rocketry (the Tripoli MN vendor)
    - The Cesaroni motor requires a 3-grain case – that is <u>not</u> supplied by the competition organizers
  - Teams need to reserve their spot in the competition and order additional motors for test launch(es) and/or certification flights by Sept. 30, 2025, even if not planning to work on this project till later in the school year.
  - Teams may purchase additional competition motors on their own dime (to pick up at the competition) and try to fly more than twice within the launch window, but only till about 4 p.m., with priority given to rockets than have not yet flown twice.

*Tentative value – might possibly go up or down (a little) depending on the number of teams that sign up and our success in finding outside sponsors – changes to this fee, if any, will be announced before December 1, 2025.

**If we garner enough outside sponsorship support, we may be able to provide more things or possibly reduce the registration fee. Additional details, if any, announced no later than December 1, 2025

Space Grant "Sponsorship"

To help us keep tabs on participants for Space Grant Reporting, we require that every team contact their state's Space Grant for "sponsorship." We are not telling Space Grants what "sponsorship" should mean – this is to be negotiated on a case-by-case basis. Note that 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 in May 2026 (cost varies widely)
(c) building and instrumenting the rocket (cost will vary; about $500 to $1500)
(d) building certification rocket(s) for bonus points (about $150 to $500 each)
(e) paying for motors (beyond the two provided) and cases (cost will depend on the motor(s) selected; about $100 to $500)
(f) buying motor(s) for at least one pre-competition test launch of the competition rocket and, potentially, L1 cert flight(s) before attempting L2 cert flights at the fly-off itself ($46.99 to $250, depending on the number of cert motors needed)

2025-2026 Competition Description

The "Secret Message" Challenge (summary description)

In this competition, *college/university student teams will design and construct a single motor, single stage, high-power rocket that will fly twice during the competition. The challenges are:*

(A) Have the rocket carry a down-facing camera system to collect in-flight video watching a set of up-facing bright lights spread out near the launch pads that are flashing a repeating coded message (about 10 seconds long, with new patterns displayed approximately every half second) and keep the set of lights in view and be able to distinguish the patterns for as long as possible, during both ascent and descent.

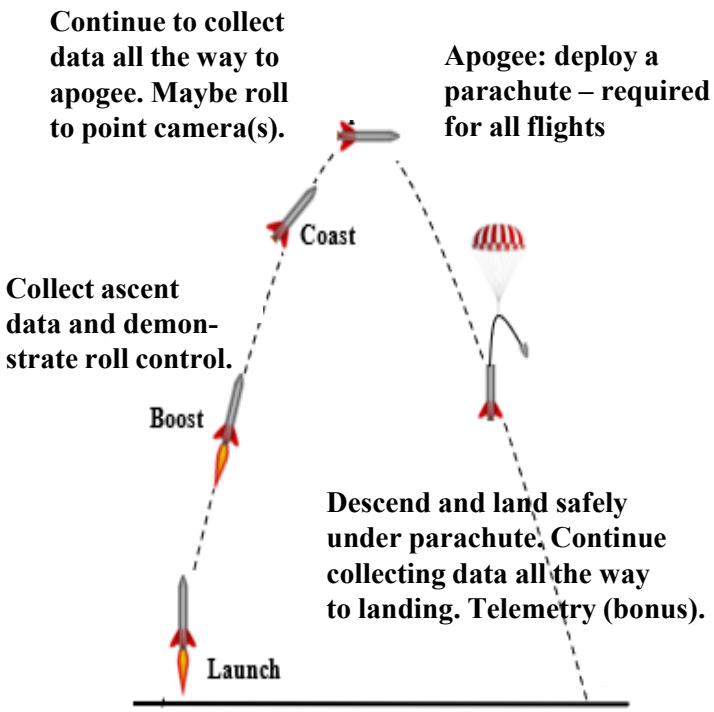
(B) Implement a roll-control mechanism, with indicator lights in view of the down-facing camera system, showing what the mechanism is trying to do. Demonstrate the ability to control the roll of the rocket on ascent (at least roll CW 90°, then roll CCW 90°). Note: Teams can try to use the roll control capability to keep the set of lights in view.

(C) Have the rocket carry a "non-commercial" (i.e. not sold for rocketry) data-logging sensor suite and use it to log at least once a second (even faster would be better) gps (latitude, longitude, and altitude), ambient pressure, 3-axis acceleration, 3-axis roll, and status of the roll control mechanism during the entire flight.

Note: One competition flight will use a 29 mm diameter AeroTech H195 DMS single-use motor (no case required). The second flight will use a 38 mm diameter Cesaroni I170 (requires a 3-grain case) reloadable motor.

Bonus points will be given to (1) teams whose member(s) increase their certification level(s) using individually-built rockets (in parallel with the (team-built) competition rocket), (2) teams that implement a telemetry system with which they can transmit information about the pattern of lights (i.e. evidence that they "got the message," even if they cannot decode it (yet)) to a ground station located near the LCO table within 10 minutes of landing and before going out to recover the rocket, and (3) teams that are able to decode the message (more bonus points given to teams that decode the message more quickly). Additional details about the competition will be included in a handbook, including due dates and report content/ page limits. Note: All fabrication work on the rocket(s), except for possibly machining of plastic and/or metal parts, must be performed by students.

2025-2026 Competition Constraints



RULES/CONSTRAINTS (see handbook for more)

- All teams are required to meet regularly with a non-student Level 2 (or higher) certified mentor, plus have a faculty adviser and Space Grant "sponsorship."
- Student teams will be required to design and team-build a single rocket capable carrying out the challenge goals.
- Receive feedback on a "Draft of Design(s)" before starting to build.
- First competition flight on an Aerotech H195 DMS motor. Second competition flight on a Cesaroni I170 motor (requires a 3-grain case – not provided).
- Do at least one test flight of the team-built competition rocket on a high-power motor prior to the fly-off date. Note: L1 cert fights (in preparation for L2 cert attempts on the fly-off date) also must be done in advance.
- All rockets must have an "apogee parachute" deployed at apogee (or just after apogee). If any rocket is dual-deploy, the main parachute must fully unfurl no lower than 500 feet above ground level. Chute releases are allowed.
- All parts of recovery systems that are electronically deployed must use commercial altimeters. The motor eject must remain in place or else a second, independently-powered commercial altimeter must back-up the parachute deployment at apogee.
- One competition data logger will be provided – a Jolly Logic AltimeterTwo.
- Radio-tracking is required on all cert flights and also on all competition flights predicted to go higher than 2000 ft AGL.
- Rocket must have $1 \leq$ static margin ≤ 5 at launch. Thrust-to-weight ratio at launch must be at least 3:1 (5:1 preferred). All parts must remain tied together during descent and the rocket must land traveling less than 35 ft/sec.

Pre-Competition Requirements

Draft of Design(s)

- **Purpose**
  - To give your team's mentor and Gary Stroick an early look at your designs and specifications BEFORE YOU START TO BUILD.*
- **Due date**
  - Submit as early as possible – definitely before you start to build any rocket(s)* (so this might need to be submitted well before the PDR is due)
  - If planning to build "late" (i.e. possibly even after getting feedback on your designs through the PDR process), still submit this Draft of Designs no later than 5 p.m. Central Time on Mon. Feb. 9, 2026 (4 weeks before the PDR is due)
- **Contents**
  - This document must include a list (at least) of all major functional components of the rocket (selection of parachute, recovery harness, rail buttons/guides, altimeter, etc.) plus simulation files (OpenRocket or RockSim – use correct rail length and launch site lat/long/alt – not the defaults) including basic details about the dimensions and materials to be used for the fins, airframes, and nose cones, connections, commercial altimeter(s) planned for ejections, etc. for all rockets (competition rocket; certification rockets, if any)
  - Gary Stroick will provide feedback within one week regarding any concerns he may have, especially regarding potential fin flutter and/or divergence issues and/or appropriateness of altimeter(s).
- **Failure to complete by Feb. 9, 2026: 20% Overall Score Reduction**

* You are allowed to build kit-rockets, but not scratch rockets, prior to getting this feedback. However, document all rockets in your Draft of Design(s).

Pre-Competition Requirements

Model Rocket Demonstration Flights

- **Purpose**
  - Demonstrate a minimum knowledge of rocketry
- **How to do it**
  - Purchase model rocket flight kits (**all different**) (students are allowed to double up, if team has more than 5 model rocket builders)
  - Assemble rockets and fly them (hopefully successfully)
  - Document each flight with before and after photos of the rocket and the builder(s) "in the field"
  - E-mail photos to the MN Space Grant along with flight date and location no later than 5 p.m. Central Time on Mon. March 9, 2026 (the PDR due date)
- **Potential Waivers**
  - If your whole team has high-power rocketry build experience, you may request a waiver by e-mail from this requirement from Gary Stroick
  - If you prefer to team-build and fly a (non-competition) high-power kit rocket instead of multiple model rockets to fulfill this requirement, that is acceptable, but it must be a different rocket than the one you will use to compete
- **Failure to complete by March 9, 2026: 10% Overall Score Reduction**

Pre-Competition Requirements

Educational Outreach (see form at end of handbook)

- Collected/validated by each State's Space Grant Coordinator or Director (note – your team's faculty advisor can provide contact information for the Space Grant Coordinator or Director in your state)
- Form must be completed and submitted to your state's Space Grant no later than 5 p.m. Central Time on Monday, May 4, 2026 – also send a copy to the Technical Adviser, Gary Stroick
- Tell your state's Space Grant office to notify the Technical Advisor that they have received and validated the form
- **Failure to complete by May 4, 2026: 10% Overall Score Reduction**

5 Judged Aspects of the Competition

- Preliminary Design (Written) Report (30%)
- Flight Readiness (Written) Report (15%)
- Flight Readiness (Oral) Presentation (15%)
- Competition Flight Performance (20%)
- Post-Competition Flight Performance Report (20%)

Note 1 – There are overall percentage reductions if you do not complete the Draft of Design(s), the Model Rocket Demonstration Flights, and/or the Educational Outreach component in a timely manner.

*Note 2 – Written reports are due by e-mail (or by another mutually-agreed upon means) to the Technical Advisor 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 day (or portion of a day) that they are late. If you are unsure about whether or not you can get documents the size of your reports to the Technical Advisor, practice by submitting comparably-sized dummy documents in advance.*

*Note 3 – Mentors must also append a 1-page report with the PDR and the FRR. **NEW PROCEDURE THIS YEAR**: The mentor report form, completed by the mentor then signed by the mentor and the team lead, should describe mentor/team interactions. Complete and submit a 1-page mentor report form with the PDR and with the FRR.*

5 Judged Aspects of the Competition

Preliminary Design (Written) Report (30%)

- Communicate the engineering and design effort
  - Provide detailed designs and diagrams
  - Plans non-commercial sensor suite, other custom features, etc.
  - Discussion of how sensor data will be processed; expected pros/cons
  - Analysis of predicted performances
  - Analysis of non-"pre-qualified" components
  - Addresses issues raised from Draft of Design(s) submission, if any
- Estimated Budget
- 25 pages MAX
- Signed mentor report (1 page)
- Due by 5 p.m. Central Time on Monday, March 9, 2026
- **Note: Model rocket mini-reports (1 page per rocket, with photos – does not count against the 25 page limit for the PDR)**

5 Judged Aspects of the Competition

Flight Readiness (Written) Report (15%)

- SHOW the construction and completed rocket(s)
  - Construction pictures, diagrams, etc.
  - Discussion of non-commercial sensor suite, etc.
- Test Flight(s) (at least 1 test flight of the team-built competition rocket on a high-power motor – perhaps some L1 cert flights (as L2 cert flight prep) too)
  - Flight Performance Analysis
  - Sensor Analysis Discussion
  - Improvements planned, if any, prior to competition
- Actual Budget
- 25 pages MAX **(plus "Code Appendix" – no page limit)**
- Signed mentor report (1 page)
- Due by 5 p.m. on Monday, May 4, 2026

5 Judged Aspects of the Competition

Flight Readiness (Oral) Presentation (15%)

- Communicate the design and engineering effort
- Organization and presentation
- Rocket construction (especially av-bay(s) and custom details for this year's challenge(s))
- VISUAL AIDS
- 10 minutes for presentation, plus up to 3 minutes for Q & A
- Separate time for safety check and to show judges the inside of your av-bay(s)
- Saturday afternoon into the evening, May 16, 2026 (will be held at a venue in the Twin Cities – location TBA)

5 Judged Aspects of the Competition

Competition Flight (20%) (see handbook for more details)

- Each successful flight requires:
  - Rocket launches, flies vertically, flies stably all the way to apogee
  - Recovery system(s) successfully deployed at appropriate altitudes
  - All parts of rocket land safely at < 35 ft/sec descent speed
  - All parts of rocket are recovered in re-flyable condition
- Flight Scoring:
  - Timely prep of rocket(s) (see details in handbook)
  - All rocket(s) have successful flights (see above)
  - Turn in requested data post-flight
  - See handbook for scoring formulas related to various aspects of the challenge
  - Flight disqualification decisions will be announced on the spot (based on observations, not logged data). Flight(s) may be re-tried as long as the RSO agrees the rocket is safe and there is adequate time in the launch window.

5 Judged Aspects of the Competition

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

- Flight Performance Comparison
  - Actual vs simulated flight performance analysis
  - Graphs, charts, links to posted videos or stills (if any), etc.
  - Performance results; discrepancy discussion; failure analysis, if needed
- 15 pages MAX **(plus "Code Appendix" – only include if code has changed since FRR – no page limit)**
- Due by 5 p.m. Central Time on Monday, June 1, 2026

Bonus Opportunities

Bonus points are available to

- teams whose member(s) increase their certification level using individually-built rockets (in parallel with the (team-built) competition rocket).
  - Students seeking Level 1 certification need to take a written test from the competition organizers (not required by Tripoli and NAR certification processes).
  - Students seeking both Level 1 and Level 2 certification need to do their Level 1 flight before the day of the competition, not try both flights on the same date.
- teams that implement a telemetry system with which they can transmit information about the pattern of lights (i.e. evidence that they "got the message," even if they cannot decode it (yet)) to a ground station located near the LCO table within 10 minutes of landing and before going out to recover the rocket
- teams that are able to decode the message (more bonus points given to teams that decode the message more quickly)

Safety Reviews

- Each team must go through two (remote) inspections with competition organizers (attended by their certified mentor) prior to coming to the competition
- 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 MN RSO has the final word on flight safety! If they won't allow a rocket to fly, they will explain why (and may be able to provide suggestions on changes that could be made to try to bring the rocket up to safety-par).**

Judging

- Separate from safety checks by Tripoli MN, the written and oral reports and the performance in the competition flights 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 team will be expected to provide <u>one</u> judge. (States fielding four or more teams may be asked to provide <u>two</u> judges.)**
- If you don't have someone from your state you would like to send to MN for the competition dates, contact Gary Stroick about possibly retaining a member of the Tripoli MN club to serve as "your" judge. Typically, judges' travel expenses are reimbursed (at least). Please select and confirm your judge(s) no later than Jan. 31, 2026.

Schedule Summary

- Sept. 30, 2025 – Notice of Intent to Compete (non-binding, but a hard deadline) and order test flight motor(s) and certification flight motor(s)
- DUE BEFORE YOU START TO BUILD – Draft of Designs (specs & sim)
- Dec. 1, 2025 – Team registration fee is due (pay $ for motors now too)
- Jan. 31, 2026 – All states' judges identified
- Feb. 9, 2026 – Declaration of Competition Attendance
- Feb. 9, 2026 – Last possible date to get credit for Draft of Designs (specs & sim)
- Late Feb. (approx.) – "50% inspection" (remote – with Gary, mentor, & faculty adviser)
- March 9, 2026 – Preliminary Design (Written) Report (PDR), mentor report form 1, Model Rocket Flights documentation
- Early Apr. (or before) – "90% inspection" (remote – with Gary, mentor, & faculty adviser)
- Late April – Test flight(s) completed. Better still, do test flights in March or **early** April
- May 4, 2026 – Flight Readiness (Written) Report (FRR), mentor report form 2, Educational Outreach form
- May 16-17, 2026 – Competition (includes Oral FRR) – weather delay date: May 18**

**Competition organizers reserve the right to shift the competition dates – see handbook.

- June 1, 2026 – Post-Competition Flight Performance (Written) Report (PCFPR)
- June 15, 2026 – Competition Results Announced

$$v_x = v\cos\theta$$

$$v_y = v\sin\theta$$

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

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

Comments or Questions?