2022 WSGC
WISCONSIN COLLEGIATE
ROCKET DESIGN COMPETITION

05-NOV-2021
Welcome WSGC 2022 CRL

- Agenda
  - Who is competing?
  - What is the challenge?
  - When and where will events be taking place?
  - When are the important deadlines?
  - What support can teams expect from the WSGC?
  - What are the required deliverables?
  - Questions and Answers?
Eligibility of Teams/Members

To have qualified for the competition, individuals/teams must

- attend any WSGC Academic Affiliate Institution full-time
- be a US Citizen
- have a committed faculty mentor
- Have a committed Industry, Tripoli, and/or National Association of Rocketry mentor
- be comprised of 4-6 team members
- select a team leader
Team Recruitment

- How do we get students to participate and be engaged this year?
- Coordinate 5-10 minute presentations in classrooms and club meetings
  - In person or virtual
- Hold a virtual recruiting event
  - Max 20 minute presentation
  - Invite FNL alumni (from your institution or another returning team)
- Tap into new applicant pools
  - Work with the Office of Diversity and Office of Student Organizations to find possible members
- Reach out to other faculty for assistance, ask that they share recruiting emails
- Use the excitement of the Launch 2 Learn Workshop to get Level 1 certification
- **Share other ideas in the chat!**
- For teams with more than 6 members remember on 6 can be REGISTERED team members with the WSGC
This Year's Teams

- Teams competing in 2022
  - 10 Teams

- WSGC Affiliate Schools entered in competition:
  - Carroll University
  - Carthage College
  - Marquette University
  - Milwaukee School of Engineering
  - Ripon College
  - UW Green Bay
  - UW Green Bay, Sheboygan Campus
  - UW Milwaukee
  - UW Platteville
  - UW River Falls
2022 Competition

**Flight Mission**

<table>
<thead>
<tr>
<th>Avionic System</th>
<th>Avionic system with umbilical to:</th>
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<tbody>
<tr>
<td></td>
<td>- Confirm avionics systems ready, “stand-by”</td>
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<tr>
<td></td>
<td>- Command avionic system to “ready to fly”</td>
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<td></td>
<td>- Activate visual indication of avionic system status on rocket</td>
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<tr>
<td></td>
<td>- Actively minimize roll-rate during coast phase of flight</td>
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<td></td>
<td>- Record: roll rate; axial accel; roll control signals</td>
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<thead>
<tr>
<th>Apogee Ceiling</th>
<th>Apogee no greater than 3500ft</th>
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<tr>
<th>Flight Accuracy</th>
<th>- Predict flight of Rocket</th>
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<tbody>
<tr>
<td></td>
<td>- Closest to predicted alt &amp; max alt</td>
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**Approved Motor List**

| Aerotech Consumer Aerospace | 38 mm: I435T |
Demonstrate the rocket’s ability to actively minimize its roll-rate.

Must complete a “safe and successful flight”.

Rocket must employ dual-deploy recovery system with motor backup deployment.

Downed rocket location aid must be included in the dart design.

Max apogee and closest to team’s predicted altitude.
Demonstrate the rocket’s ability to control the onboard data avionics (separate from recovery altimeter) while on the launch pad.

- Avionics to monitor and record vs. time:
  - Rocket’s roll rate/rotation
  - Axial acceleration of rocket
  - Signals or “positions” used to command the roll-rate control system
- Ground pre-flight control will use an “umbilical” USB cable with a magnetic coupling
- Umbilical will passively separate from rocket at launch
2022 Competition Parameters

- Example of Magnetic USB Data Cable for passive “breakaway”

Magnetic Micro USB Cable
With charging and Data-Sync
“Safe and Successful Flight”

- **Safe Flight** must achieve:
  - Launch
  - Stable, vertical flight during ascent
  - Recovery system successfully deploys (or motor backup deploys successfully)
  - Rocket must be recovered in **flyable** condition (this is not the same as repair and then flyable)

- **Successful Flight** must achieve:
  - Safe Flight
  - Distinct dual deployment operations of recovery system
    - “drogue” deployed at apogee
    - Main deployed during descent
  - Apogee does not exceed 3500 ft
Competition Awarded Prizes

AWARDS

- **Mission Grand Champion**
  - $3000
  - VIP Tour Sierra Space

- Awarded to highest scoring team that **successfully completes the mission and all aspects of the competition**.

- **2nd Place**
  - $2000

- **3rd Place**
  - $1000
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td><strong>22-Oct-2021</strong></td>
<td>Notice of Intent to Compete Due</td>
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<tr>
<td>29-Oct-2021</td>
<td>Team Selection Announcement</td>
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<tr>
<td>04-Nov-2021</td>
<td>Kick-Off Meeting, On-line @ 6:00 pm</td>
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<td>12-Nov-2021</td>
<td>Award Acceptance Material Due</td>
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<tr>
<td><strong>07-Dec-2021</strong></td>
<td>PDR Report*, Preliminary Budget*, and Demo Flight* Deadline</td>
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<tr>
<td></td>
<td>Upload RockSim Model file</td>
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<td>Upload rocket demo flight video on Facebook and/or Twitter and demo flight link to team lead grant management page.</td>
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<tr>
<td>20-Jan-2022</td>
<td>Competition Update with Q&amp;A</td>
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<tr>
<td>15-Feb-2022</td>
<td>CDR Report* Deadline</td>
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<tr>
<td>15-Feb-2022</td>
<td>Final Team Roster* Deadline</td>
</tr>
<tr>
<td>18-Feb-2022</td>
<td>Deadline to Reserve Hotel Rooms in the WSGC Block for Evening of 23-Apr-2022</td>
</tr>
<tr>
<td>24-Feb-2022</td>
<td>CDR Virtual Review 4:30 PM – 6:00 PM and 7:00 – 8:00 PM, each team by appointment</td>
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<tr>
<td><strong>07-Mar-2022</strong></td>
<td>First Payout Deadline</td>
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<td>Please complete and mail the Travel Summary Expense Form and/or the Team Project Expense Form (found in Tools and Tips) to the WSGC Program Office. Include original receipts. Allow 60 days for payment.</td>
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<tr>
<td>26-Mar-2022</td>
<td>Design and Safety Review Meeting</td>
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<td>Mandatory meeting with 90% ready-to-fly rocket</td>
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<td>05-Apr-2022</td>
<td>FRR Report* Deadline</td>
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<td>05-Apr-2022</td>
<td>Education Outreach* Deadline</td>
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<td>Team will share information pertinent to aerospace with a group or audience.</td>
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<tr>
<td>19-Apr-2022</td>
<td>FRR Oral Presentation PowerPoint* Deadline</td>
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<tr>
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<td>Submitted electronically</td>
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<tr>
<td>22-Apr-2022</td>
<td>FRR Oral Presentation at Carthage College</td>
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<td>Present a 6-8 minute PowerPoint presentation discussing team’s rocket</td>
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<tr>
<td>23-Apr-2022</td>
<td>Launch Competition</td>
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<td>Attend the High-Powered Rocket Launch at Richard Bong Recreational Area in Kansasville, WI.</td>
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<tr>
<td><strong>09-May-2022</strong></td>
<td>Post-Flight Performance Review* Report</td>
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<tr>
<td></td>
<td>Final Payout Deadline</td>
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<tr>
<td>Jun-2022</td>
<td>1st place team tours Sierra Space Rocket Engine Test Center</td>
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<tr>
<td>Aug-2022</td>
<td>Annual Conference</td>
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<tr>
<td>15-Sep-2022</td>
<td>Proceeding Paper**</td>
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<td>If your team places 1st-3rd in the competition, submit a Proceedings Paper for the 32nd Annual Wisconsin Space Conference online journal.</td>
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Supplied by WSGC to Teams

- Funds for use by team towards - $1000
  - Rocket parts
  - Travel related to competition (Safety Meeting)
- Travel funds (from University to Richard Bong Recreational Area)
  - WSGC select lodging (50-100 mi/1 night/2 rooms; 100+ mi/2 night/2 rooms) Deadline for reservations - 18-Feb-2022
  - Mileage - $.56/mi
    - 4 member team: 1 advisor/1 team reimbursement
    - 5-6 member team: 1 advisor/2 team reimbursement

At Launch Day

- Rocket Motor Casing and one Rocket Motor Load of Fuel
- Ejection Charges
- Competition Flight Data Recorder (to monitor altitude and acceleration only)
WSGC Reimbursement

- Two Options:
  - The CRL team will submit reimbursement requests to WSGC through the University/College.
    - Quarterly Invoice by institution
  - OR

- Individuals will submit reimbursement requests to WSGC for supply and travel expenses.
  - March 7, 2022 and May 9, 2022 deadlines
  - Submit digital receipts and reimbursement forms per the reimbursement instructions.
Competition Logistics

- Team Award Acceptance Material due 12-Nov-2022
  - Filed online by Advisor/Team Lead on Grant Management Page

- Members must be individually registered with WSGC to be reimbursed

- Final team rosters 15-Feb-2022

Contact Connie Engberg regarding reimbursement requests and online submissions questions.

cengberg@carthage.edu
Mission Grand Champion, 2\textsuperscript{nd} and 3\textsuperscript{rd} place teams must

- Make arrangements to present at WSGC Annual Space Conference in August at Carroll University
- Submit a conference proceedings paper
- Failure to do so may affect individuals’ future opportunities within WSGC
- Teams may be invited to join the WSGC at outreach events showcasing their success
Tools and Tips — Resource Page

- Links to forms and additional information:
  - [https://spacegrant.carthage.edu/students/tools-and-tips/](https://spacegrant.carthage.edu/students/tools-and-tips/)
    - Under heading **Forms/Templates**
      - W9 Tax Form
      - Media Release Form (Adults or Minors) for items to be posted on WSGC Website
    - Under heading **Reimbursement Request Forms**
      - Project Expense Form Instructions
      - Travel Expense Form Instructions
    - Under heading **Collegiate Rocket Launch**
      - Competition Handbook 2022
      - Calendar of Events 2022
      - Education Outreach Form
Components of the Competition

- Critical Design Review (CDR) Report and Flight Readiness Review (FRR) Reports (written) (20%)
- Flight Readiness Presentation (oral) (15%)
- Competition Flight (in person) (30%)
- Post Flight Performance Report (written) (15%)
- Project Management (forms) (10%)
- Education Outreach (Outreach Form) (10%)

Total 100%

Submissions received after 11:59 pm CST on the due date will be considered late. Scores for late reports will be reduced by 20% for each day they are late.
Components of the Competition

Preliminary Design Review (PDR) Rprt

- 07-Dec-2021
- Brief document
- Identify design goals
  - Mechanical and electrical diagrams of the design
- Design Constraints
  - Limits/requirements on design by competition
  - Additional limits/requirements on design by team
- Description of preliminary solution idea
  - RockSim model file of preliminary solution
  - Temporary RockSim V9 – TARC Temporary License (Exp. Aug 31) - $20
    - [https://www.apogeerockets.com/Rocket_Software/RockSim_Educational_TARC](https://www.apogeerockets.com/Rocket_Software/RockSim_Educational_TARC)
    - TARC Team Number: CRL22_(Your team’s award #)
- Proposed schedule
- Proposed budget
- COVID-19 Safety Plan
COVID-19 Safety Plan

- Launch Site Protocol
- Carthage College Protocol
- Virtual, Hybrid, and In-Person Planning

Note: As the coronavirus (COVID-19) situation continues to evolve, WSGC will closely monitor and follow guidelines from federal, state and community officials regarding on-site competitions. Protecting the health and safety of team members, staff and judges is our primary priority. Challenge managers will be in contact with participants on specifics and changes to the challenges, if any.
Components of the Competition

Critical Design Review (CDR) Report

- 24-Feb-2022

- Purpose: to communicate the engineering and design decisions involved in system development

- Design features of “Payload”
  - Brief description of possible methods identified
  - Comparison of methods and decision process for evaluation and selection
  - Include the design of method to capture video monitor systems and remote control via USB cable
  - Image of the Rocket and its subsystems
  - Mechanical and electrical diagrams of the design
Components of the Competition

CDR Report cont.

- **Additional Design Features of Rocket**
  - Compensations made to accommodate the magnetic breakaway USB
  - Downed rocket location aid

- **Design Features of Recovery System**
  - Electronic, dual-deployment system
  - Design to allow motor deployment backup
  - Recovery systems selected
  - Shock-cord and mounting design

- **Analysis of Anticipated Performance**
- **Construction Photos**
- **Budget**
Components of the Competition
Flight Readiness Review (FRR) Report

- **Purpose**: to communicate final design and improvements
- **Results of System Performance Verifications**
  - Avionic systems tests?
  - Magnetic breakaway tests?
  - Video system tests?
  - Flight test?
- **Adjustment to design of payload**
- **Adjustment to design of rocket**
- **Accurate diagram of rocket system**
- **Adjustment to anticipated performance**
- **Photographs of completed rocket system**
Components of the Competition

Flight Readiness Presentation

- **Purpose:** to communicate the design and engineering effort involved
  - Mandatory Team Attendance
  - Rocket and Payload system
  - Anticipated performance – Apogee

- Organization and delivery of presentation important

- VISUAL AIDS, Slides, Video

- Actual Rocket and Payload system in presentation
  - Describe its operation

- Rocket’s “Fit and Finish” will be evaluated

- 10 minutes (7 for presentation, 3 for Q&A)

- Friday evening before launch
Components of the Competition

Competition Flight

- Safe & Successful flight requires:
  - Launch
  - Stable, vertical flight during ascent
  - Electronic dual-deployment recovery systems must successfully operate
  - Rocket must be recovered in flyable condition
  - Apogee within competition “window”
Components of the Competition

Competition Flight cont.

- **Flight Scoring:**
  - Safe & Successful flight
  - Max. Altitude

- **Flight score:**

  \[
  \text{Flight Score} = 20 \text{ for safe flight} + 30 \left( \frac{\text{team's rocket apogee (ft)}}{\text{maximum rocket apogee (ft)}} \right) + 50 \left( \frac{\text{minimum rocket alt diff (ft)}}{\text{team's rocket alt diff (ft)}} \right)
  \]
Components of the Competition

Post Flight Performance Report

Material that must be included, at a minimum:

- Cover Page

- Payload Performance
  - Still images from video captured by the team’s.
    - Launch
    - Separation
    - Post-separation
    - Confirmation of dual-deployment?
  - Results of avionics system data
    - Can results be correlated with the video?
Components of the Competition

Post Flight Performance Report cont.

Material that must be included, at a minimum, cont.:

- Flight Performance Comparison Sheet
  - Table of performance characteristics
  - Plot: “Acceleration Performance Comparison of Predicted and Actual”

- Discussion of Results
  - Compare predicted and actual apogees, describe and defend possible reasons for differences
  - Compare predicted and actual accelerations, describe and defend possible reasons for differences
  - Discussion of how flight could have been improved
Components of the Competition

Project Management

- **Purpose:** To support team members development of professional project management skills
- **Evaluation will include**
  - On time completion of deliverables
    - Completed in advance rates a higher score
  - Careful execution; correctly following instructions
  - Effective team communications
    - Timeliness
    - Professionalism
  - Team Attendance at mandatory CRL meetings
  - Team Attendance at voluntary CRL meetings
  - Rocket construction completion
    - At Safety Review meeting in Mar. (payload working, rocket 90%)
    - At final inspection before Presentation (100% flight ready)
  - Team work logs to document members time spent on project
Components of the Competition

Educational Outreach

- **Purpose**
  - Spread the word and share the excitement

- **Example Possibilities**
  - Meet with a K-12 class or student organization to explain how rockets work.
  - Make a presentation in the community or to a group on campus to describe the rocket competition and your team’s design.
  - Make a presentation to a group on campus describing opportunities at NASA or through the WSGC that are available to students before they graduate.
Team Demonstration Flight

- **Purpose**
  - Teams Successfully Demonstrate a minimum knowledge of rocketry

- **How**
  - Purchase a low-power, model rocket flight kit
  - Assemble
  - Successfully fly and recover rocket
  - Record flight with video with team member(s) in frame
  - Capture before and after photos of the rocket in the field with team member(s) in frame
  - Post video photos to WSGC Facebook page, along with flight date and location
  - Upload link on Grant Management Page
Team Demonstration Flight

- Examples of Kits:

  - http://www.estesrockets.com
  - http://www.questaerospace.com
  - http://www.apogeerockets.com
  - http://www.discountrocketry.com
Competition Update Mtg

20-Jan-2022 – Virtual mtg

Purpose:

- Share logistics updates with teams
- Remind teams of any upcoming deadlines
- Q & A from teams
24-Feb-2022

Purpose:

- Each team will meet online with judges to review their CDR
- Appointment times
  - Between 4:30 – 6:00 pm
  - Between 7:00 – 8:00 pm
Purpose: Assess rocket construction flight worthiness

- Teams attendance **REQUIRED**
- Location To Be Arranged
- Rocket in 90% assembled condition
  - Rocket and payload systems
  - Airframe complete
    - Body tube, fins, motor mount, nose cone, payload sections, etc. should all be assembled
    - Shockcord should be installed, attached to motor mount
  - Parachute does not need to be installed
  - Does not have to be painted
- **Photo documentation of assembly process**