

2017-2018 Hybrid Motor High Powered Rocket Competition

Sponsored by the NASA Florida Space Grant Consortium (FSGC) and the North East Florida Association of Rocketry (NEFAR)

I. Introduction

The objective of the competition is to build and launch a hybrid powered rocket. There are two categories of competition to choose from. The first category consists of launching a hybrid rocket to the maximum altitude. The second category challenges the teams to fly their rocket closest to 2,000 feet in altitude. There must be at least two teams competing in each category. If there is only one team, they will be asked to move to the other category.

- This competition is open to any university or community college team in Florida, both public and private.
- The rocket can be built from scratch or from a kit.
- The engine must be a hybrid motor rated “G” or from a lower class. The engine can be built from scratch or purchased from a company. NOTE: If the motor is built from scratch or is modified in **any way**, a minimum of two documented motor tests must be done to demonstrate the safety, quality, and performance of the motor. Documentation must be performed and submitted two-weeks before launch and must show thrust curves, impulse, burn-time, etc. from the two tests (please confer with FSGC prior to making any modifications to the motor).

II. Proposal

The **Faculty Advisor** of the university team must submit a two-page proposal with a budget of up to \$600.00. **If a faculty advisor is requesting funds for more than 1 team, then the maximum funding request for 2 teams is \$1000, for 3 teams, \$1400 and 4 teams, \$1700.** The proposal must be submitted by the Faculty Advisor through that institution’s Sponsored Research Office – otherwise the proposal will not be accepted. If a team is planning to enter both categories, please submit separate proposals (maximum two-pages each).

The proposal will include:

1. 2017-18 Hybrid Rocket Proposal Cover Page with Signatures.
2. Faculty Advisor’s email address and contact information.
3. The team name.

4. Which category is the team competing in (Maximum Altitude or Closest to 2,000ft).
5. Answer the following questions: Why does your team want to compete in this competition? Why do you think your team can actually meet the objective of building and launching a hybrid powered rocket?
6. A Detailed Budget (Please note that Indirect costs are not allowed). The budget should only include items that are needed for the construction of the hybrid rocket. Stipends to students are disallowed. Travel costs to the launch site can be included. **Please note that travel funds can only be provided to US citizens.**
7. Student Project Manager, Student Project Alternate Manager, All Team Members:
 - Name and email address.
 - Status (Freshman, Sophomore, Junior, Senior etc.)
 - Subject major enrolled
 - Hometown
 - Gender
 - Race (Needed for Reporting to Funding Authority - Please Choose: Native American, Pacific Islander, African American, Hispanic, Caucasian, Other, Asian)

Please note that the starting date is October 9, 2017. This date is just the award date for funding purposes. Teams can begin their work from September 26, 2017 (announcement date for the selected teams). **Or main grant from NASA, which funds this competition, ends on April 7, 2018. Thus the ending date of this project will be April 4, 2018.**

Proposals without the team member information (see item 7) will not be accepted. Teams can always change the composition of the team. If the team members differ from the original proposal, please email the relevant student information (see item 7) to the FSGC office. **We require the student demographic information as NASA requires us to report the data. We only submit aggregate numbers. Individual information is never released.**

All teams that submit a proposal, and are accepted, will be eligible to take part in the competition and compete for additional funding. At least 6 teams (from both categories) will be selected and awarded up to **\$600 (1 team) or \$1000 (2 teams), or \$1400 (3 teams) and \$1700 (4 teams)** to build the rocket (detailed budget must be provided in the proposal). For teams that design their own engines, static testing and data from two test launches is expected. **The funds will be provided as a cost reimbursable grant to the Faculty Advisor.** The funds can be used for supplies, motors, kits and travel. Salary and capital expenditure is not allowed. Indirect costs are not allowed.

Submit Proposal via email to: Dr. Jaydeep Mukherjee
jaydeep.mukherjee@ucf.edu

Submit Technical Questions via email to: Robert Eppig, beppig@cfl.rr.com

Proposals, with the signed coverage, must be emailed to Dr. Jaydeep Mukherjee (jaydeep.mukherjee@ucf.edu) by 5pm on September 22, 2017.

Inquiries: Financial and Other

All financial inquiries must come from the **Faculty Advisor and/or that institution's Sponsored Research Office**. We will **not** entertain any award related and/or financial inquiries from the Student Project Manager, Student Project Alternate Manager, or Team Members.

All other inquiries must come from the Student Project Manager or the Student Project Alternate Manager. FSGC will not entertain any inquiries from other Team Members.

III. Reports and Flight

Teams will build and test their rockets for flight and will be required to submit an engineering notebook due approximately two-weeks before the launch. Also, the Student Project Manager or the Student Project Alternate Manager from each team will be required to submit, every two-weeks, a "Progress and Accomplishment Report" of no more than 3/4 page text to the **PBWorks website**:
<http://hybridrocket.pbworks.com/>

On September 29, 2017 the Faculty Advisor, Student Project Manager, and the Student Project Alternate Manager will be given access to the PBWorks website (via an email account and password log-in).

Reports should include work done plus attachments including parts lists, photos, etc. NOTE: There are no points awarded for submitting the Progress and Accomplishment Reports however, points will be deducted for non-submittal and late reports.

Also, each team will be required to submit to the **PBWorks website** a **Hazard Analysis and a Failure Modes & Effects Analysis (FMEA)** report by **November 17, 2017**. The Hazard Analysis should focus on the handling and use of the nitrous oxide and any pyrotechnic systems or materials. The Failure Modes & Effects Analysis should focus on what kinds of things could go wrong with your launch equipment and rocket, as well as, what you have done to mitigate or reduce the identified failure modes. These reports should be no more than four text pages in length, tables and graphs are not included in page count. They should be updated and resubmitted as your designs evolve. The reports are to show that you are ready

to test and fly your rockets and motors safely. Failure to submit these reports may result in your being removed from the competition.

IV. Launch Day

Teams will have their rockets and motors inspected for safety by a NEFAR representative just before launch (TBA). NEFAR will sponsor the launch at the club site in Bunnell. Results of launch must be in to the judge by 3:00 pm on the day of the launch; judge will leave site at 3:15 pm. NOTE: We are not responsible for problems at the NEFAR launch site. Be there early. Don't wait until it is too late to launch. To be awarded points for flight you must have a successful flight; i.e. launch, deployment of recovery system, and controlled landing. All other flights will be judged on a case by case base. NOTE: Rockets deemed unsafe will not be allowed to fly in the competition until fixed and approved.

NEFAR Website: <http://www.nefar.net>

a. Altimeters

A recording barometric altimeter must be used to record data for competition. The launch site should be considered zero altitude and the altimeter should be calibrated to zero, it is up to flier to provide proof of a properly calibrated altimeter to the Judge upon request.

Altimeters with altitude sensors other than barometric sensors, such as accelerometers or magnetic apogee detection, may be used to deploy the recovery systems. However, they are prohibited from use in determining the actual altitude.

b. Determining Actual Altitude

The actual flight profile will be determined by the competition judges. The graph or other flight profile display provided by a recording device will be examined for accuracy. If it is shown that a sudden peak in altitude is attributable to the ejection charge, that peak will be not be used to determine the recorded altitude. The altitude just prior to or just after that sudden peak will be the official recorded altitude.

c. Launch Rails & Firing Electronics Requirements

Teams should provide their own launch rails/pads and firing electronics and if requested must be inspected for safety by a NEFAR representative. **NOTE THIS REQUIREMENT: firing electronics must be at least 300 feet away from launch rails/pads. Firing electronics should incorporate at least one safety switch to prevent accidental ignition of rocket during setup. Please insure that you have enough current available to ignite the motor with 300 foot of cable.** If you wish to use NEFAR launch equipment please contact Robert Eppig for our

NEFAR representative contact information – to check if what you need is available. Please check early if you wish to use NEFAR equipment-**THERE IS NO GUARANTEE THAT WHAT YOU NEED IS AVAILABLE.**

d. Static Judging

For the teams that build their rocket and/or engine from scratch, their scores from the judges will reflect the originality and performance of the rocket and/or the engine.

Motor Class Total Impulse

G or less: 160 Newton-seconds or less

V. Scoring

Points will be awarded for the phases of the competition. The successful flight is worth 80% of the total points and the teams Engineering Notebook report is worth 20% of the total points. The points for each part are as follows:

1. Points for Flight
 - 100 pts for highest or closest to altitude
 - 90 pts for 2nd highest or closest to altitude
 - 80 pts for 3rd highest or closest to altitude
 - 70 pts for 4th highest or closest to altitude
 - 0-10 pts for self-built motor
 - 0-5 pts for self-built rocket
2. Points for Engineering Notebook
 - RockSim or other software simulations (30 pts)
 - Engineering Data (70 pts)
3. Points for Progress and Accomplishment Report
 - There are no points awarded for submitting the Progress and Accomplishment Reports however, points will be deducted for late and non-submittal reports. For each day late you will lose 1% of your total weighted score (with a maximum of 3% lose for each late report). For each no-submittal report, you will lose 3% of your total weighted score.
4. Hazard Analysis and a Failure Modes & Effects Analysis Report (FEMA)
 - There are no points awarded for submitting the Hazard Analysis and FEMA reports, however failure to submit these reports may result in your team being removed from the competition.

Engineering Notebook - will be a bound notebook (Composition type notebook) which will have all of the team's engineering data, calculations, drawings and sketches, test results, notes, ideas, meeting notes, etc.

NOTE: The notebook is NOT a formal final report. We are looking for your project/laboratory workbook. You will submit the Engineering Notebook to the PBWorks website (digitally) or mail a hard-copy of the report to the NASA FSGC offices (if mailed, the notebook will be returned to the teams on flight day).

VI. Additional Funding

As mentioned earlier in this RFP, at least 6 teams (from both categories) will be selected and awarded up to \$600 to build the rocket (detailed budget must be provided in the proposal).

The winning teams from each category will receive additional funding according to the following chart. These additional funds will be provided to the winning team(s) as additional funding to the project award given to them earlier at the start of the program.

Each winning team has to submit a simple budget stating how they would spend the additional funding. Ideally, the additional funds should be used for setting up the project for next year or using the funds to attract more students for the next competition. The additional funds should not be used for any student's stipend or any travel costs

Place	Maximum Altitude Category	Closest to 2000 ft. Category
1 st Place	\$500.00	\$750.00
2 nd Place	\$300.00	\$450.00
3 rd Place	\$100.00	\$200.00

Inquiries: Financial and Other

All financial and award related inquiries must come from the **Faculty Advisor and/or the institution Sponsored Research Office**. We will **not** entertain any financial

inquiries from the Student Project Manager, Student Project Alternate Manager, or Team Members.

All other inquiries must come from the Student Project Manager or the Student Project Alternate Manager. FSGC will not entertain any inquiries from other Team Members.

VII. Timeline

- Sept. 22, 2017: Proposal with Budget and Cover Page with Signatures, Deadline.
- Sept. 26, 2017: Announcement of winners and grant awarded to faculty advisor.
- Sept. 29, 2017: Participant access given to the PBWorks website via email.
- Oct. 9, 2017: First of the every two week report due.
- Nov. 17, 2017: Hazard Analysis, Failure Modes & Effects Analysis due.
- March 2, 2018: Engineering Notebook due at Florida Space Grant Offices (either hard copy or digital upload to the PBWorks website).
- TBA: Launch date (TBA: alternate date). Launch date is subject to change.