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**Wisconsin
Space Grant
Consortium**

**2008
Collegiate Rocket
Competition**

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Rev. 07-NOV-2007

Competition Objective

The Wisconsin Space Grant Consortium's (WSGC) Rocket Competition is intended to supply teams of WSGC affiliated university students with the opportunity to demonstrate engineering and design skills through direct application. It allows the teams to conceive, design, fabricate and compete with high powered rockets. The restrictions on rocket motors and dimensions are limited so that knowledge, creativity and imagination of the students are challenged. The end result is a great aerospace experience for the students that would not otherwise be available in the state of Wisconsin.

Rocket Design Objectives

The objective of the WSGC 2008 Collegiate Rocket Competition entries can be stated as simply:

Engineering teams will compete to design a one-stage rocket that will, following apogee, land safely under an operating parachute(s) and deploy a Ground Excursion Module (GEM).

Judging Categories

To truly evaluate the engineering behind the designs, the entries will be judged on the performance of their design, the demonstration of their knowledge and their ability to communicate effectively. This will be accomplished in four parts; a presentation to a selected group of judges, the flight of the rockets, an examination of predicted vs. actual performance for the acceleration of the rockets, and a design report.

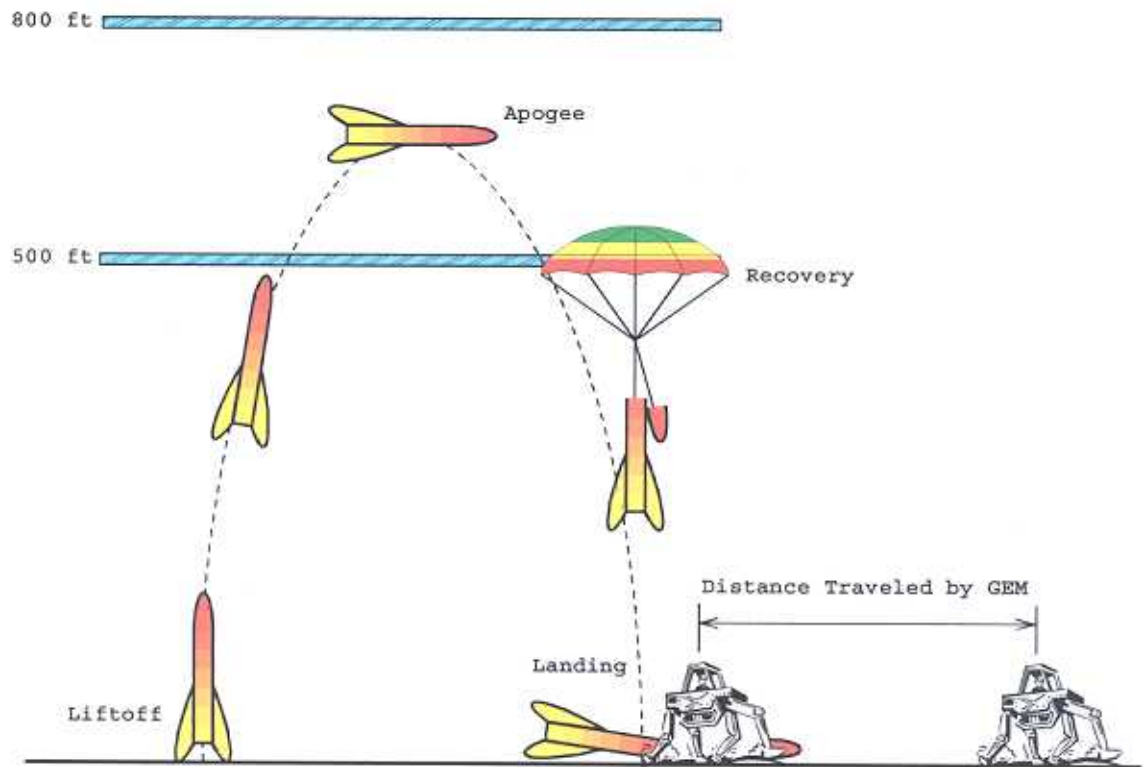
The total score for each student team will be based on several parameters:

Presentation of design	15
Design report (provided prior to launch)	25
Competition Flight	45
Flight Performance Evaluation	15
	—
Total	100

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Competition Engineering Parameters

Supplied with their choice of a I-284, a J-350 or a K-550 rocket motor (provided by WSGC), student teams will be required to fabricate and/or purchase a suitable rocket, such that the rocket shall reach apogee between 800 ft and 500ft. It must recover safely and deploy a self-propelled Ground Excursion Module (GEM).



Flight Path of Rocket

The winner of the competition flight will be the team whose rocket successfully meets the flight requirements and whose GEM travels the farthest straight-line distance from the point where the GEM first touches the ground. All components must be recovered safely and intact, under an operating parachute(s).

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Other parameters include:

- Maximum altitude: † 800 ft
- Minimum altitude: † 500 ft.
- Rocket Safety Inspection † Each rocket must pass the Range Safety Officer's Inspection before it will be allowed to fly.
- GEM: † Must operate autonomously.
 † No external control allowed following liftoff.
 † May not contain anything/system that in normal operation could leak a contaminating fluid, or create a fire hazard.
- Distance Traveled by GEM: † GEM tracking official will place a marker at the location they visually judge as the point the GEM first settles on the ground.
 † The GEM will be allowed 5 minutes to travel autonomously.
 † The GEM tracking official will place a second marker at the new location of the GEM.
 † The distance traveled will be measured as the straight-line distance between the two markers.
 † The GEM tracking official's judgment will become the official measurement.
- Equipment provided by WSGC: † Team's choice one of the following motors: I-284, J-350 or K-550
 † Flight recorder inserted at time of launch (to measure acceleration & altitude)
 † 1.8 in. dia. x 7.0 in.
 † 3.0 oz.

Comment:

Interested students with questions about the capabilities of the launch motors or seeking help in getting started are highly encouraged to contact **Frank Nobile** (Maxq3@aol.com) or **Bob Justus** (rtjustus@att.net) of Tripoli Wisconsin Association (a high-power rocketry association). Students interested in gaining information or experience by observing rocket launches are encouraged to contact these individuals, or to attend one of the regular rocket launches held by Tripoli at Bong Recreational Area. More information and launch schedules can be accessed at <http://www.tripoliwisconsin.org>.

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Presentation

Presentation Format

One or more team members will deliver the presentation to the judges. All team members who will deliver any part of the presentation, or who will respond to the judges' questions, must be in the podium area when the presentation starts and must be introduced to the judges. Team members who are part of this "presentation group" may answer the judge's questions even if they did not speak during the presentation itself.

Presentations are limited to a maximum of ten (10) minutes. The judges will stop any presentation exceeding ten minutes. The presentation itself will not be interrupted by questions. Immediately following the presentation there will be a question and answer session of up to five (5) minutes. Only judges may ask questions. Only team members who are part of the "presentation group" may answer the judges' questions. If time allows there may be opportunity to take additional questions from the audience. If questions are taken from the audience, a designated presentation official will determine if the question is appropriate and if so then allow the team to answer.

Evaluation Criteria

Presentations will be evaluated on content, organization, visual aids, delivery and the team's response to the judges' questions. The scoring criteria are detailed in Appendix A-1 "Presentation Judging". The criteria are applied only to the team's presentation itself. The team that makes the best presentation, regardless of the quality of their rocket, will win this event.

Scoring Formula

The scoring of the Presentation is based on the average of the Presentation Judging forms. There is a maximum of 50 points from the Presentation Judging Form that will be scaled to meet the 15% of the competition total score.

It is intended that the scores will range from near zero (0) to ten (10). In the event of multiple judging teams, the Presentation Event Captain may at his/her discretion normalize the scores of different judging teams.

$\text{PRESENTATION SCORE} = 10 \times P_{\text{your}}/P_{\text{max}}$

Where:

- "Pmax" is the highest score awarded to any team
- "Pyour" is the score awarded to your team

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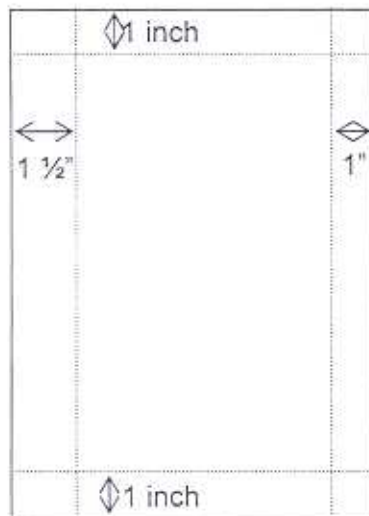
Design Report

Design Report Objective

The concept of the design report is to evaluate the engineering effort that went into the design of the rocket, the GEM and how the engineering meets the intent of the competition. The rocket and GEM that illustrates the best use of engineering to meet the design goals and the best understanding of the design by the team members will score the highest.

Report Format

The design report can be no longer than twenty five (25) single-sided pages in length. It must be in a font not smaller than 12pt in height. The left margin must be no less than 1 inch and the remaining margins must be no less than 1 inch from the edge of the page. All pages (except for the cover page) must be numbered in the upper right hand corner. Each section of the report must be clearly delineated with a heading. All section headings must appear in a table of contents.



Material that must be included, as a minimum:

- Cover Page
- Table of Contents
- Executive Summary
- Design Features of Rocket and GEM
- Anticipated Performance
 - Estimated Maximum Altitude
 - Estimated Peak Acceleration

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- Plot of Estimated Acceleration vs. Time
- Estimated distance that GEM will travel
- Construction of Rocket and GEM (photos are helpful)
- Photographs of Completed Rocket and GEM
- Conclusion
- Budget

Evaluation Criteria

Reports and design will be evaluated on content, organization, clarity, completeness and professionalism of the material. The criteria are detailed in Appendix A-2 "Design Judging".

Scoring Formula

The scoring of the event is based on the average of the report judging forms. There is a maximum of 100 points from the Design Judging Form that will be scaled to meet the 25% of the competition total score.

It is intended that the scores will range from near zero (0) to twenty five (25). In the event of multiple judging teams, the Presentation Event Captain may at his/her discretion, normalize the scores of different judging teams.

PRESENTATION SCORE = $25 \times P_{\text{your}}/P_{\text{max}}$.

Where:

- "Pmax" is the highest score awarded to any team
- "Pyour" is the score awarded to your team

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Competition Flight

Launch and Flight Format

The launch will take place at a site determined by Tripoli Wisconsin Association. Each rocket must pass a safety inspection before launch and any additional equipment must be cleared by the Range Safety Officer (RSO) before entering the launch area. The official flight data recorder will be placed in the rocket by the altitude tracking official or designee. The RSO will have discretion over the number of team members that attend the rocket once it is in the launch area. Each team must assemble a recovery team that will follow the directions of the RSO or designee.

To be considered a successful flight, the rocket must launch, deploy its recovery parachute, safely land, and be recovered intact. The entire rocket must be returned to a designated location for post-flight inspection by the RSO or designee. It must also successfully deploy the GEM, and the GEM distance must be measured by the GEM tracking official.

A flight performance report sheet will be filled out by a designated flight operations recorder. The flight operations recorder will record the data on the sheet during and following the flight. Upon completion, a team member must initial acceptance before a copy will be released to the team.

Evaluation Criteria

Finishing order for of the competition flight will based on
Successful flight and recovery (including the altitude requirements)
Distance traveled by GEM

First in order will be the rocket with a successful flight, and the longest distance traveled by GEM.

Scoring Formula

Teams will score points based on the formula: $50 - 3 * (\text{Finish order} - 1)$, but no more than 40 points will be awarded to unsuccessful flights and no less than 15 points will be awarded to rockets that safely launch.

Flight Performance

Performance Comparison

The comparison of the flight performance to the predicted performance will help to demonstrate the team's knowledge and understanding of the physics involved. It will be presented in the form of a brief report that will include a "Flight Performance Comparison Sheet" and discussion of the results, especially any differences between the actual and the predicted values.

Performance Comparison Format

The performance comparison document should follow the same guidelines as the Design Report and be no more than four (4) pages in length.

Material that must be included, as a minimum:

- Cover Page
- Flight Performance Comparison Sheet
 - Table of performance characteristics (Table 1)
 - Plot: "Acceleration Performance Comparison of Predicted and Actual" (Figure 1)
- Discussion of Results
 - Separate headings for each characteristic discussed

Evaluation Criteria

Reports will be evaluated on how closely the predicted results compare to the actual results, how well the team explains any differences, clarity, completeness and professionalism of the material. The criteria are detailed in Appendix A-3 "Flight Performance Judging".

Scoring Formula

The scoring of the Flight Performance is based on the average of the Flight Performance Judging forms. There is a maximum of 100 points from the Design Judging Form.

It is intended that the scores will range from near zero (0) to fifteen (15). In the event of multiple judging teams, the Presentation Event Captain may at his/her discretion, normalize the scores of different judging teams.

$\text{PRESENTATION SCORE} = 15 \times P_{\text{your}}/P_{\text{max}}$

Where:

- "P_{max}" is the highest score awarded to any team
- "P_{your}" is the score awarded to your team

SAMPLE: FLIGHT PERFORMANCE REPORTING SHEET

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SCHOOL _____ Team _____

1	Operation (determined by RSO or designee)	<input checked="" type="checkbox"/>
	Launch	<input type="checkbox"/>
	Main Chute Deployment	<input type="checkbox"/>
	Recovered	<input type="checkbox"/>
	GEM deployment	<input type="checkbox"/>
	Recovered intact	<input type="checkbox"/>

		Predicted	Actual	
2	Maximum Altitude	(ft.)		
3	Peak Acceleration	(ft/s ²)		
4	Distance traveled by GEM	(ft.)		

Table 1 Example of Flight Performance Characteristics Table

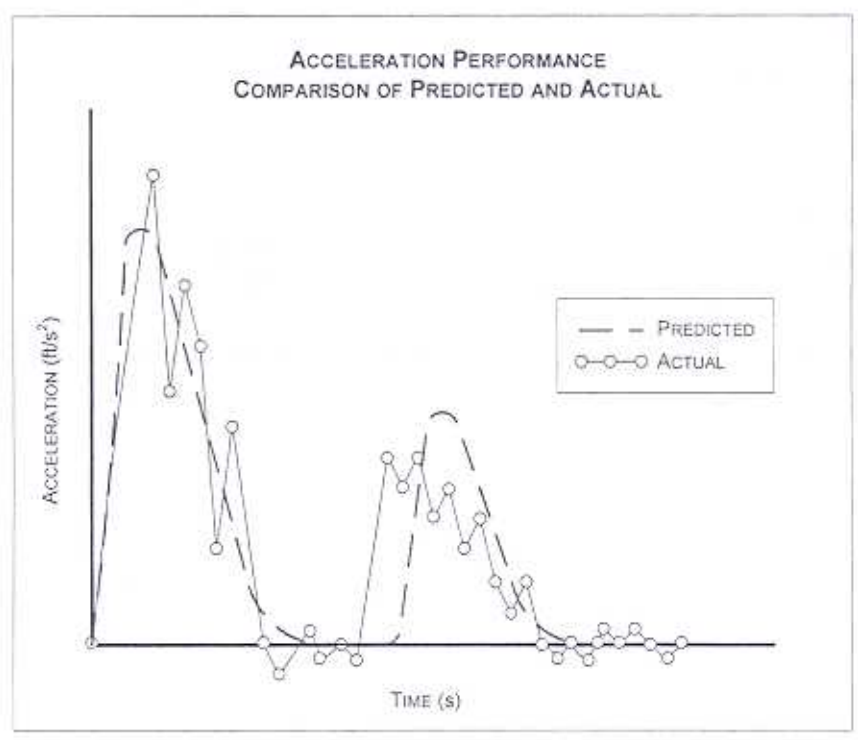


Figure 1 Example of Acceleration Performance Plot

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APPENDIX A-1

SCHOOL _____

Team _____

PRESENTATION JUDGING

Score the following categories on the basis of 0-10 points each according to the following scale (any number or fraction along this scale may be used).

- 0.0 = inadequate or no attempt
 2.5 = attempted but below expectation
 5 = average or expected
 7.5 = above average but still lacking
 10 = excellent, perfectly meets intent

_____ **CONTENT:** Were the concepts presented appropriate and adequate to explain how the rocket and GEM meet the intent of the contest? Were enough technical details presented without being boring?

_____ **ORGANIZATION:** Were the concepts presented in a logical order progressing from basic concept and showing how the engineering accomplished the concept? Was it clear to the audience what was to be presented and what was coming next? Were distinct introduction and overviews as well as summary and conclusions given?

_____ **VISUAL AIDS:** Were visual aids used or clear visual references made to the rocket? Were the illustrations visible for all of the audience?

_____ **DELIVERY:** Did the presenter speak in a clear voice? Did the presenter show enthusiasm and promote confidence in the technical aspects? Did he/she maintain eye contact?

_____ **QUESTIONS:** Did their answers illustrate that the team fully understood the questions? Is there doubt that the team understood their answers? Did the team promote complete confidence in their response to the questions?

TOTAL = PRESENTATION POINTS (50 points maximum)

COMMENTS:

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APPENDIX A-2

SCHOOL _____ Team _____

DESIGN JUDGING

_____ **AESTHETICS (0-10)** - Does the rocket look attractive? Does it have a high performance appearance?

_____ **ROCKET MECHANICAL & ELECTRICAL DESIGN (0-20)** - Do components appear to have been sized properly for the loads? Does form follow function?

_____ **GEM MECHANICAL & ELECTRICAL DESIGN (0-10)** - Do components appear to have been sized properly for the loads? Does form follow function?

_____ **ANTICIPATED PERFORMANCE (0-15)** – Do the anticipated performance values make sense? Is there enough evidence to verify the methods used and the resulting values?

_____ **INNOVATIVENESS (0-15)** - Are any of the components or systems unique? Do the innovations add to the rocket's functions?

_____ **SAFETY (0-10)** - Is the rocket designed to function in accordance with the safety guidelines supplied? Does the rocket require any "special" preparation that if not performed properly might compromise its safety?

_____ **MISCELLANEOUS (0-20)** – Is the report complete? Is it professional in its appearance and presentation of the information? Does it accurately represent the work that was done? Did the project meet the intent of the competition?

_____ **TOTAL = DESIGN POINTS (100 points maximum)**

COMMENTS:

APPENDIX A-3

SCHOOL _____ Team _____

FLIGHT PERFORMANCE JUDGING

_____ OPERATION of Rocket (0-20) – Did the rocket function properly?
Explain

_____ MAXIMUM ALTITUDE (0-15) – How closely does the anticipated
altitude match the actual values? Was there a reasonable explanation for
any difference?

_____ PEAK ACCELERATION (0-15) – How closely does the anticipated
peak acceleration match the actual values? Was there a reasonable
explanation for any difference?

_____ OPERATION OF GEM (0-15) – Did the GEM function as planned?

_____ Distance Traveled by GEM (0-10) – How closely did the actual
distance traveled by the GEM compare to the distance anticipated? Was
there a reasonable explanation for any difference?

_____ MISCELLANEOUS (0-25) – Is the report complete? Is it professional
in its appearance and presentation of the information? Does it accurately
represent the work that was done?

_____ TOTAL = FLIGHT PERFORMANCE POINTS (100 points
maximum)

COMMENTS:

WHAT YOU NEED TO KNOW ABOUT THE WSGC ROCKET COMPETITION

Acceptance:

To accept, you must agree to be able to meet the requirements listed in your award letter and outlined in more detail below. Please complete the Information Form attached and return via, mail, email or fax to WSGC by October 26, 2007.

As a team, please review the following guidelines, and then choose a team leader.

Team Leader Responsibilities: The team leader will be the primary contact for the WSGC office and be responsible to disseminate information to the team members. You would be responsible for submitting the teams proposed budget, keeping track of expenditures, receipts for reimbursement, interim and final report. **It is important that you inform us immediately of any change in team members and contact information.** If your team and/or rocket design changes, please have it approved by your advisor and the WSGC Program Office before proceeding.

1. Each team has a budget of \$1,000* to be used for the purchase of supplies and equipment for your rocket and the rocket launch, including travel-related expenses involved in the launch at Richard Bong Recreational Center, Kansasville, WI.

*In addition to this amount, at the request of our affiliates, we are testing a procedure to assist those teams that have a distance to travel. Teams, whose schools are outside the following radius (roundtrip) measured from Richard Bong State Park, are eligible to claim:

<100 miles = \$0 & no lodging; >100miles<200miles = \$75 & 1 night hotel; >200miles = \$125 2 night hotel
It is expected that the team will travel in one vehicle and share one hotel room. Lodging must comply with UW-System Guidelines. Contact WSGC office for specifics.

2. Please submit a proposed budget (see sample provided at the Kickoff meeting) to the WSGC Program Office no later than January 8, 2008 and prior to making any purchases. The budget will be reviewed by the program advisors and you will be notified of approval which is needed for you to make purchases.

3. The team's interim report is due in the WSGC Program Office no later than February 18, 2008. This report should be a 1-2 page summary describing your activities. Your advisor must sign it and then forward the report to the WSGC Program Office. **NOTE:** Failure to submit your interim report on time will jeopardize your standing as a Rocket Competition participant.

4. The team's final report will have both oral and written components. The oral component will be judged as part of the competition. The written component will include the results of the launch and will be due two weeks after the launch date.

5. Supply and travel reimbursements will be made in two separate payments. Each team member is to prepare their own Summary Expense Report, attach the **ITEMIZED ORIGINAL RECEIPTS** and submit it to the team leader for approval and recordkeeping. The team leader then submits the Summary Expense Report with attached **ITEMIZED ORIGINAL RECEIPTS** to WSGC Program Office. If ordering on-line, print the receipt that shows method of payment and payment was made. The first request for payment is at your discretion based on your spending history. The second request should be after the launch date and should include all launch-related expenses and any other expenses not already claimed.

NASA/WSGC Acknowledgement: Please acknowledge the support of the National Space Grant College and Fellowship Program and the Wisconsin Space Grant Consortium in your reports, and in any papers or presentations that emanate as a result of your work.

Wisconsin Space Conference Participation: The three winning engineering teams and one non-engineering team will be honored and may be asked to participate in the 2008 Wisconsin Space Conference, scheduled for August 14 & 15, 2008, at UW-Fox Valley in Menasha, WI. This is a great opportunity for you to meet others interested in the aerospace field and share experiences. Summary papers will be published in the Conference Proceedings of the 2008 Wisconsin Space Conference.

NOTE: The University, WSGC, and the NASA National Space Grant College & Fellowship Program are not liable for any possible tax implications that the acceptance of this award may create. Award recipients assume any and all tax liabilities when accepting this award.

Contact Information:

Please direct any questions, comments or concerns to the WSGC Program Office, University of Wisconsin-Green Bay, 2420 Nicolet Drive, Green Bay, WI 54311-7001

Phone:(920)465-2108

Fax:(920)465-2376

E-mail: wsgc@uwgb.edu

October 22, 2007

Congratulations! On the recommendation of our Task Force, I am pleased to inform you that your team has been selected as a competitor in the Wisconsin Space Grant Consortium Student Rocket Competition!

You will be competing against teams from all over the state of Wisconsin to construct a one-stage rocket that will, following Apogee, land safely under an operating parachute(s) and deploy a Ground Excursion Vehicle (GEV). Your rocket must be flown to a minimum altitude of 500 feet and not exceed a maximum altitude of 800 feet. It must land safely and either after landing or during descent must safely deploy a GEV. The winner of the flight portion of the competition will be the team whose rocket completes a successful flight and whose GEV is the farthest, following a straight line, from where it first settled on the ground after five minutes following touchdown. A design report and post-launch comparison of predicted vs. actual results for an on-board accelerometer will also be included in the competition scoring. A first, second and third prize (\$5,000, \$2,500 and \$1,000 respectively) award will be awarded to teams with the highest scores. Additionally, there will be a separate \$2,000 prize for first place among teams wishing to compete as "non-engineering" teams; teams competing for this prize are not permitted to compete for the general first, second and third prizes.

Additional conditions for your acceptance are listed below and on your What You Need to Know about the WSGC Rocket Competition:

1. At least one team member needs to attend the first informational kickoff session held at Milwaukee School of Engineering.
2. Each team will receive a budget of up to \$1,000 to be used for the purchase of supplies and equipment for your rocket and the rocket launch, including travel-related expenses to the meetings and launch. You must **submit a budget** (see sample provided at the kickoff meeting) on how you plan to spend the \$1,000 to the WSGC Program Office **no later than January 8, 2008** and prior to making any purchases. Please read the instructions on the What You Need to Know about the WSGC Rocket Competition document regarding the \$1,000 expense money and follow them closely.
3. You must submit a team interim report to the WSGC Program Office no later than February 18, 2008.
4. The team's final report will be part of the launch portion of the competition. It will have both oral and written components. The oral component will be done prior to the launch. The written component will include the results of the launch and will be due two weeks after the launch date. Both components will be judged as part of the competition.
5. You must select a team leader to communicate with the WSGC Office and to make sure all of the conditions of this letter and the What You Need to Know about the WSGC Rocket Competition are met.

If your team wishes to enter the competition under the conditions listed in this award letter and the What You Need to Know about the WSGC Rocket Competition, please complete the enclosed information form and forward it to our office at the address above by October 26th. If you do not wish to accept, please let us know by the deadline as well. If you have any questions or concerns, please do not hesitate to contact us at 920-465-2108.

We are pleased to announce a new competition in connection with the rocket launch. WSGC will award \$500 to the team videographer who puts together the best video of up to 10 minutes in length of the Rocket competition and process. We encourage footage of multiple teams representing the Rocket competition as a whole. The videographer must be a student at a WSGC member school and must be named by the team as their official videographer. The videographer does not need to be a member of the present team. **Teams interested in this opportunity must notify the WSGC** by the first official WSGC rocket competition informational kickoff session and a specific videographer with pertinent team information must be named by the second informational session. We encourage team members to start documenting the process immediately, including participation in the information sessions. The completed video must be submitted to WSGC within two weeks following the Rocket Competition launch.

On behalf of the Wisconsin Space Grant Consortium, I offer my congratulations! We look forward to attending your launch and reviewing your science results.

Sincerely,
Dr. R. Aileen Yingst, Director, Wisconsin Space Grant Consortium

Budget Preparation 11/2007

Reimbursable expenses for Rocket Competition Participants

Team Leader Responsibilities: As the leader selected by my team, I understand that I am responsible to make sure all of the conditions of the award letter and the What You Need to Know about the WSGC Rocket Competition document are met. I will be responsible for all contact to the WSGC Office (you may delegate responsibilities to other team members, but they should report back to you). I will respond quickly to all communication from the WSGC Office or Bill Farrow, WSGC Associate Director for Student Satellite Programs.

Each team member is to prepare their own Summary Expense Report, with attached **ITEMIZED ORIGINAL RECEIPTS** and submit to the team leader for approval and recordkeeping. The team leader then submits the Summary Expense Report with attached **ITEMIZED ORIGINAL RECEIPTS** to WSGC Program Office. If ordering on-line, print the receipt that shows method of payment and that payment was made. Mileage is .32 per mile and meal cannot exceed Breakfast (\$7), Lunch (\$8), Dinner (\$10), attach **ITEMIZED ORIGINAL RECEIPTS**. No alcohol allowed. The first request for payment is at your discretion based on your spending history. The second request should be after the launch date and should include all launch-related expenses and any other expenses not already claimed.

WE CANNOT REIMBURSE YOUR EXPENSES WITHOUT AN ORIGINAL ITEMIZED RECEIPT THAT SHOWS PAYMENT WAS MADE!

If you have questions about reimbursement procedure, please contact:

Sue Weiler, Wisconsin Space Grant Consortium, Phone: 920-465-2108, Email: wsgc@uwgb.edu

Sample Budget

ITEM	DESCRIPTION	COST PER UNIT	NUMBER OF UNITS	TOTAL COST
Nosecone	Nosecone, size and shape to be determined	20.00	1.00	20.00
Body tubing	Body tubing for the airframe, size to be determined	90.00	2.00	180.00
Motor mount tubing	Tubing used to hold the motor, size dictated by motor diameter	30.00	1.00	30.00
Coupler tube	Tube for coupling sections of the airframe	10.00	1.00	10.00
Fins	Size and shape to be determined	10.00	4.00	40.00
Payload section	Payload section to hold avionics	75.00	1.00	75.00
Bulk plates	Bulk plates used to separate different sections of the rocket	2.00	2.00	4.00
Centering rings	Centering rings used to connect the motor mount to the airframe	3.00	2.00	6.00
Launch lugs	Launch lugs used to connect the rocket to the launch rail	5.00	1.00	5.00
Motor retainer	Motor retainer used to hold the motor in the motor mount	35.00	1.00	35.00
Parachute	Parachute to provide a safe and controlled landing	60.00	1.00	60.00
Shock Cord	Cord used to absorb the shock during parachute deployment	30.00	1.00	30.00
Altimeter - <i>WSSC</i>	Altimeter used to measure altitude and to trigger deployment charges	180.00	1.00	180.00
Parachute control system	System used to steer the parachute and rocket to the landing zone	200.00	1.00	200.00
Flight test motor -	Motor to be used in a flight test before the final flight	100.00	1.00	100.00
Paint	Used to paint the rocket	10.00	2.00	20.00
Miscellaneous hardware	Nuts, bolts, screws, etc...	20.00	1.00	20.00
Epoxy	Epoxy for joining various parts of the rocket	20.00	1.00	20.00
Mileage	Two trips, approximately 90 miles round trip	0.32 per mile	180.00	57.60
Total				1088.40

*All prices are based on values taken from various internet sources

1-MONTHS ADVANCE FOR
ORDERING
FLIGHT TEST MOTOR

