

APRIL 24, 2009

09
**Michigan Aerospace
Challenge**

**ELEMENTARY EDUCATOR'S
GUIDEBOOK**

**The Michigan Aerospace Challenge I
is a student program of the
MAISD REGIONAL MAISD REGIONAL MATHEMATICS & SCIENCE CENTER
In cooperation with
The Michigan Aviation Hall of Fame
See Page Two For "Program Reminders"**

For more information contact the MRMSC at
1001 Wesley Avenue Muskegon, MI 49456 Phone 231-767-7318 Fax 231-773-0505

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** These forms must be turned in at your first activity.*

Dates to Remember

Registration Deadline – March 27, 2009 (Friday)

Registrations **must be received** by March 27, 2009. No registration fee is required. You may e-mail (rwitham@muskegonid.org), fax (231-773-0505) or send by U.S. mail to:

MAISD Regional Mathematics & Science Center
1001 Wesley Ave.
Muskegon, MI 49442

Confirmation Mailing – April 8, 2008 (Friday)

If registration is sent and confirmation not received by April 15 – call 767-7318.

Program Reminders!

1. Each classroom will complete the registration form by identifying their arrival and departure time and what activities in which they wish to participate. A custom schedule will be prepared for each classroom. **One registration form for each classroom is required.**
2. Each student is to have “**Permission for the Publication of Student Images**” completed by their parents or guardian. This form is to turned in at your first event (see page 11). This is **not a permission slip** to participate. **Nor does a school’s “permission to photograph” serve the same purpose.** This form allows the MAISD Regional Math & Science Center and the MAISD to photograph students during the event for use in training sessions and to promote the program. Students are never identified by name or school and no other personally identifiable information is included in the photograph in any form.
3. Each classroom is **required to launch their rocket with an egg in the payload bay** and must devise a method to protect that egg during launch and recovery. Students may provide their own small or medium egg or an egg will be available at the launch site. In all cases, classrooms must provide their own materials for protecting the egg — see page four.
4. Each classroom is **required to prepare a 35 mm film canister payload** — see page four through six.

Schedule at a Glance – April 24 & 25, 2009

Friday, April 24, 2009

Elementary Students Rocket Launch Mart Dock Property Launch Site	Beginning at 9:00 AM and concluding at 1:30 PM
Hands-on Activities To Be Determined	Beginning at 9:00 AM and concluding at 2:30 PM
“Exploring Space” Stewart Bailey L.C. Walker Annex	Times to be determined
“Why Airplanes Fly?” J. Godell/J. Pahl L.C. Walker Annex	Times to be determined

Saturday, April 25, 2009

8:00 AM

High Power Rocket Competition Launch
Mart Dock Property Launch Site

The elementary student Payload Projects are launched in the first high powered rockets launched on Saturday morning and elementary students and teachers are invited to attend.

Project Timeline/Checklist

- Register Classroom – Deadline March 27, 2009.
- Arrange for bus transportation to downtown Muskegon.
- Arrange for parent volunteers for April 24, 2009 — one for every 15 students is recommended.
- Obtain Rocket from the MAISD Regional Math/Science Center. (Your rocket will be sent as soon as you register)
- Begin work on your rocket and payload. We suggest that this work be done in small groups (i.e. a painting team, a fin team, payload team and egg packing team, etc.)
- Complete plan for “packing” small or medium size egg in the rocket payload.
- Complete the “Student Activity Participant Information” form. You will need to turn it at your first event on April 24.
- Send the “Permission For The Publication of Student Images” home with students to completed by parents of guardians. This document grants us permission to use photographs and video of students in training and promotional material for our student programs. Students will never be identified and we never store or publish any personally identifiable information on any student. A standard school permission slip does not do the same thing. You will need to turn them in at your first event on April 24.
- Confirmation packets mailed to registered teachers April 8, 2009.
- Complete rocket before April 24, 2009.

What is Elementary Michigan Aerospace Challenge?

The Michigan Aerospace Challenge (MAC) Elementary program is an exciting educational opportunity for elementary school students and teachers. Students construct a model rocket to launch an egg and return it to earth safely. In addition, students participate in a daylong series of exciting aerospace activities in downtown Muskegon.

What is the Egg-Lifting rocket?

The egg-lifting rocket, the students build, is about 24" tall with a payload section large enough to hold a small to medium size egg. The rocket kit requires 5-10 hours of class time to construct. One kit is per classroom is free. Additional kits can be purchased for \$16.50. The school supplies glue, sand paper, paint, etc. We suggest that the construction be broken down so small groups can be assigned.

Who may participate?

Any fourth (4), fifth (5) or sixth (6) grade elementary school classroom may participate. Elementary students are registered as a class. A classroom of students must have adult supervisors during the daylong event. Transportation is the responsibility of the participating school district.

Where is the program held?

The Elementary Rocket Launch and Hands-on Activities (held on Friday, April 24) and the High Powered Rocket Competition Launch (held on Saturday April 25) will be held at the Mart Dock Property in downtown Muskegon. The presentations by J. Godell/J. Pahl and Stewart Bailey on April 24, 2009 will be held at the L.C. Walker Arena Annex, also in downtown Muskegon.

What are the classroom objectives?

Each classroom is to construct an Egg-Lifter Model Rocket, devise a way to keep an egg from breaking during the rocket's launch and recovery and design a payload that will fit into a 35 mm film canister.

Rocket Construction

Each classroom must construct an Egg-Lifter model rocket. This rocket is supplied to each classroom free of charge. The rocket will be shipped to the classroom teacher after the registration form is received. **Students must do ALL rocket assembly work.**

Egg Payload

The payload compartment of each Egg-Lifter rocket is designed to hold a small or medium sized egg. The engineering challenge that your class must meet is to design a way to protect the egg during your rocket's launch and recovery. You may bring your own egg or one will be provided to you at the launch site.

Film Canister Payload Project

Each classroom is required to bring a 35 mm film canister containing a payload. Teams must use the cylindrical film canisters. The film canisters will be launched on Saturday during the Michigan Aerospace Challenge High Power Rocket Competition, then returned to the teacher on-site or mailed the following Monday. The payload will reach a speed of 300 mi./hr. in two seconds then coast to an altitude over one-half mile.

What makes a good payload. An interesting example are seeds – will seeds sprout after experiencing the acceleration of a rocket launch? The seeds are planted after launch to see if the high "G" forces have an effect on their ability to grow. A set of seeds that have not flown (control group) are also germinated and compared to the launched seeds (experimental group — see page 6). Other payloads may be considered. Have the students use their imagination.

Seed Experiment

(These are only suggestions. The class will come up with their own.)

Question: What effect will rocket g-forces have on seed growth? (Students may choose one or more kinds of seed to test. Bean, pop corn, radish seeds are common examples.)

Hypothesis (suggestion, class will develop their own): The increased g-forces on the experimental group seeds will decrease the plants size by half compared to the control group. (leaf diameter, area, stem length, thickness etc. will be halved, amount of time to sprout)

Materials:

- Sample of seeds divided into two equal sized random groups (experimental and control)
- Two labeled containers for seeds (example: experimental – pop corn, control – popcorn)
- Soil and pots (or moistened paper towel in ziplock bags tacked to cork board)
- Balance scale and weights
- Mm/cm ruler
- Magnifying Glass
- Water
- Measuring device for determining amounts of soil (mg) and water (ml)

Procedures:

1. Select a sample of seeds and divide into two groups, each containing the same number of seeds. The experimental group of seeds must fit into a Kodak film canister (grey top/black body).
2. Be sure to keep Rocket and Non-rocket seeds separate
3. Using your senses, find similarities or differences in Rocket and Non-rocket seeds. Record your findings. (See example 1)
 - Smell the seeds
 - Feel the seeds
 - Observe seeds with eyes and then magnifying glass
4. Constants (Keeping all conditions the same for the entire class)
 - Fill the two identical pots with the same kind and same amount of potting soil (amount to be determined)
 - Plant the same number of seeds at the same depth (tbd)
 - Water with exactly the same amount and on the same days in the future(tbd)
 - Place all plants in the same growing conditions (light, temperature)
5. Independent Variable (The one difference in the experiment)
 - Experimental group (Rocket seeds)
 - Control group (The seeds that have had no rocket trip)

Results:

1. Dependent Variable(s)-Decide what the class wants to count, measure, order, or rate on the growth of the plants
 - Height of plant or stem (cm, mm)
 - Thickness of main stem (at half height)
 - Number of leaves (count)
 - Average width of all leaves (max.)
 - Color (rating: 2=dark green, 1=light green, 0=yellow)
 - Length of longest and/or shortest leaf (cm, mm)

2. Determine the length of time between each data collection
3. Set up one data collection table for each group (See example 2)
4. Set up one large data collection table to compile group data
5. Each student find mean, median and mode of all class data
6. Graph data-use large group results of each test and/or m,m,m
7. Discuss in small groups what the results mean for both the Rocket and Non-rocket seeds
8. Discuss in class what each group finds

Conclusions:

1. Each person should begin with their hypothesis and plug in findings
2. Refer to data in results and Venn Diagram (See example 3)
3. Error analysis-What may have caused inaccuracies and why?
4. Changes-Would you do anything differently the next time?
5. Given more time, what could you do with this experiment?

**Note: Seeds for Wisconsin Fast Grow Plants are available from
Carolina Biological (www.carolina.com) and Nasco (www.enasco.com)
Visit this website to see the growth cycle <http://www.fastplants.org/intro.lifecycle.php>**

Example 1

Sense	Non-rocket seeds ONLY	Rocket seeds ONLY	Both groups of seeds
Eyes			
Eyes/magnifier			
Smell			
Touch			

Example 2

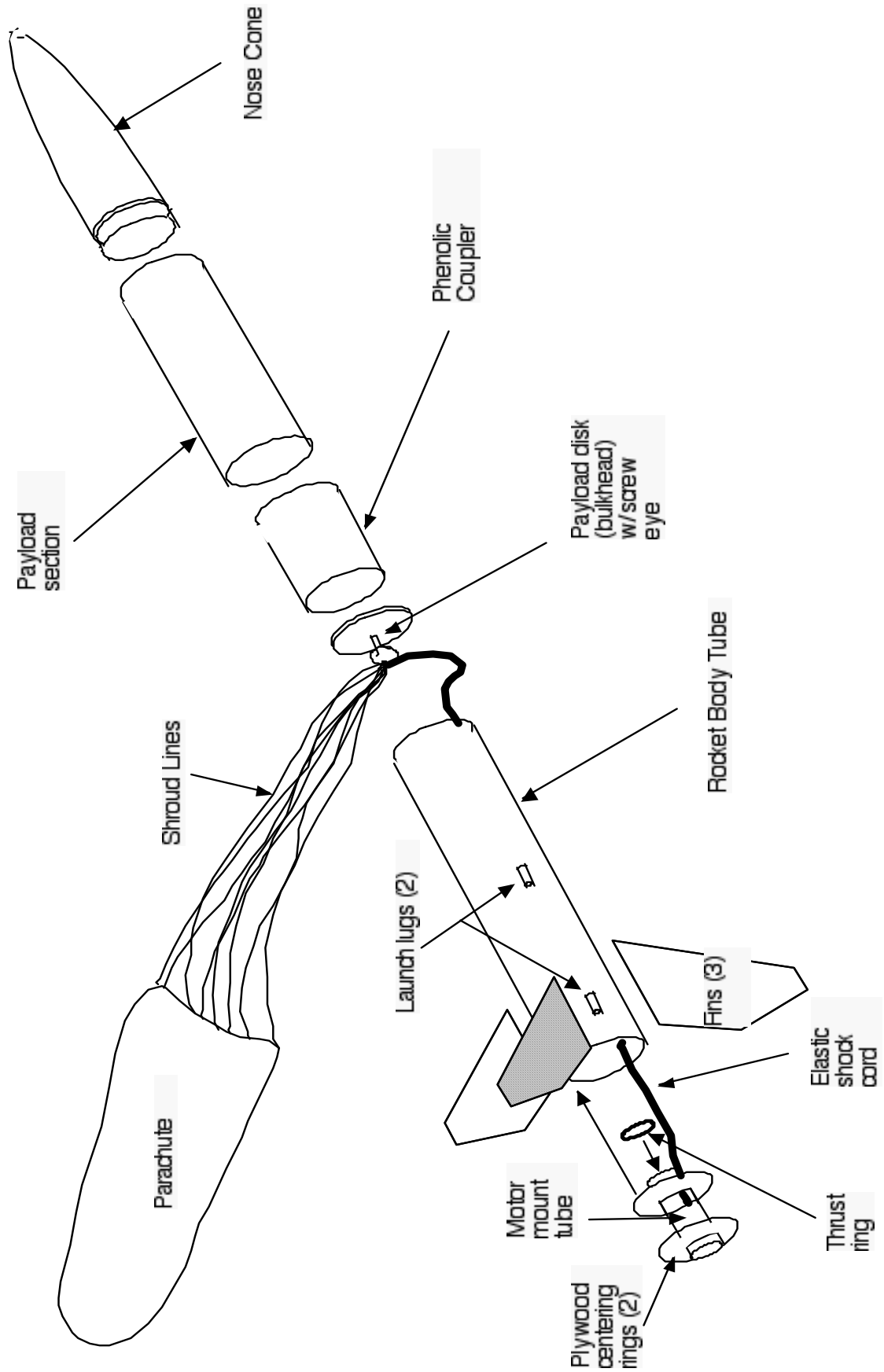
Independent Variable	Dependent Variable (G-Force)	
	Non-Rocket Group	Rocket Group
Number of leaves		
Height of plant		

(The Independent Variable list will depend on class/group assignment)

Example 3

The increased g-forces on the experimental group seeds decreased the plants' size by half compared to the control group. This can be proven by comparing the results on the graph. The Rocket group plant growth was..... compared to the Non-rocket group. The mean, median, and mode of all student groups also proves this. The Hypothesis in the conclusion should reflect the outcome of the experiment.

Egglifter Rocket- Exploded View



Egg Lifter –Assembly Instructions

Step 1: Locate the 2 plywood centering rings, 24mm motor mount tube, and elastic shock cord. Choose one of the centering rings and cut or sand a notch on the inner hole large enough for the shock cord to pass through.

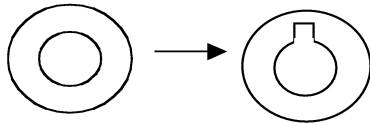


Diagram 1

Step 2: Measure 1/8” from each end on motor mount tube and make a mark with a pencil.

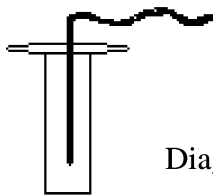


Diagram 2

Step 3: Test fit both centering rings onto the motor mount tube, sand if needed for a proper fit. Once happy with the fit, take the notched centering ring and place one end of the shock cord in the notch and slide the ring onto the motor mount tube. Slide the centering ring until it reaches one of the marks. Now carefully slide the shock cord until one end is covering of the motor mount tube and the other end is hanging freely.

When both pieces are in place, put a few random drops of glue to hold them. Once the glue sets place a sufficient amount of glue around the centering ring on both sides, this will permanently secure the forward centering ring in place. Also place glue on the shock cord to permanently mount it to the motor mount tube.

Step 4: Locate a small cardboard ring. This is a thrust ring used to prevent the motor from going up into your rocket. Test fit the ring into the forward end of the motor mount tube (end with the shock cord sticking out), sand if necessary. Once happy with the fit place a thin ring of glue on the inside of the motor mount tube and slide the thrust ring into place. The ring should be flush with the forward end of the motor mount tube.

Step 5: Place the aft centering ring on the other end of the motor mount tube; slide it on until it reaches the pencil mark. Place glue on both sides of the centering ring to permanently mount the aft centering ring in place. Set aside to dry before inserting unit into one end of the body tube. Place a ring of glue about 5cm into one end of the body tube. Shock cord end of motor mount unit goes into body tube first. Push unit into body tube until motor mount tube and body tube are flush (level).

Step 6: Locate the plywood disk and eyebolt. Screw the eyebolt into the center hole of the plywood disk. Place a small amount of glue on both sides to permanently attach the eyebolt in place. To protect the egg, the threaded end of the eyebolt will need to be covered. A small cork or plenty of foam will help protect the egg. If you are going to place a covering over the bolt now is a good time, if foam will be used you will want to wait until after step 7.

Step 7: Test fit bulk plate into phenolic coupler, sand if needed. Once happy with the fit, place a thin layer of glue into coupler and slide the bulk plate in so it is recessed 1/8 of an inch inside the coupler. Put a thin layer of glue around the edge to serve as a glue fillet, this aids in strength.

Step 8: Fill the coupler with foam or other egg protecting material until the coupler is completely full and even at all of the edges. This is done to cushion the egg during the thrust phase and to move the egg closer to the top of the rocket.

Step 9: Measure 2" from one end of the coupler and make a mark with a pencil. Locate the payload section (short kraft paper tube). Test fit the coupler into the payload section, sand if needed. Once happy with the fit place a layer of glue around the inside edge of the payload section and slide the coupler in until you reach the mark. Set aside to dry.

Step 10: Carefully cut out the fin tube-marking guide on the outside edge keeping it as one piece. Now wrap the guide around the aft end of your body tube (the side with the motor mount tube glued in) and tape the guide to itself after lining up the 3 marks. With a pencil make a mark at the point of each arrowhead and label the "launch lug" line. Once all 8 marks are made, slide off the fin guide and connect the lines on the body tube, extend the Launch Lug line the entire length of the body tube. (A doorframe works well as a straight edge for this step!)

Step 11: Locate the balsa wood strip and using the template on page 15 of this guide book, carefully cut out the times. Then carefully rough up one of the fin lines on the body tube using 100 grit sandpaper. Then apply a thin layer of glue to the root edge of one fin and place it on the fine line. The bottom of the root edge should be even with the bottom of the body tube, and the leading edge should be facing upwards. When the glue has dried, move on to another fin. Start again by roughing up the line with sandpaper and gluing the fin in place, do the same for the third fin. All fins should be 120° apart.

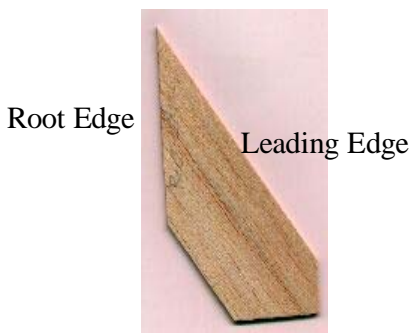
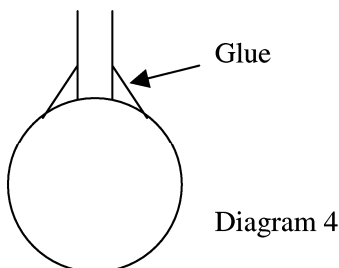


Diagram 3

Step 12: After the fins have dried completely place a glue fillet on *all the root edge joints*. See diagram 4. Put a healthy amount of glue at the fin/body tube joint, this will strengthen the joints up significantly. After applying the glue, a finger can be used to give the fillet a nice curved shape.



Step 13: Locate the green piece of nylon material and white cording. The nylon material is used to make the parachute canopy and the cord becomes the parachute shroud lines. Carefully cut the cord to make four (4) equal length pieces. Cut the nylon material into an octagon shape. The shroud lines (cord) need to be attached to the corners on the octagon canopy. This can be done by sewing the lines to the corners or by gluing them with “GOOP”. “GOOP” can be found at most hardware stores. The shroud lines should be connected at neighboring corners similar to the drawing below. If the shroud lines are sewn on, a small drop of “GOOP” on the area will help prevent it from fraying. See diagram 5

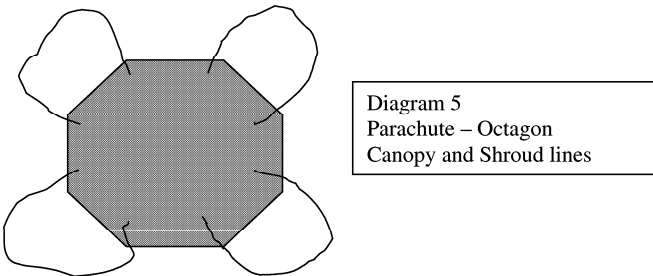


Diagram 5
Parachute – Octagon
Canopy and Shroud lines

Step 14: Pull all the shroud lines together so they form 1 loop. Tie 1 overhand knot with all of the shroud lines together to form a permanent small loop near the end of the shroud lines furthest from the canopy. Just before launch tie the parachute shroud lines to the eyebolt at the base of the payload section. Use strong string with a secure knot. ***Tug on the knot from several angles to make sure it is securely tied!***

Step 15: Find the end of the shock cord that is hanging out of the larger body tube. Using the end, tie a double overhand knot to the same eyebolt that the parachute is connected to. Tug on the shock cord gently to make sure that it is on tight.

Step 16: Locate the two short 3/16 launch lugs (little straws). The Launch lugs are a very crucial part on your rocket. They are used to keep the rocket going straight until it reaches a stable speed. This means that the launch lugs need to be glued on as straight and strong as possible.

Start by making 2 marks on the launch lug line at 2” from the bottom and 8” from the bottom of the rocket. This will be the starting mark for each lug. The lugs should be glued to the long line but start on top of the mark that was just made. The Easiest way to attach the lug is to slide a STRAIGHT 3/16” dowel or piano wire through the launch lugs. Then place a line of glue along the launch lugs and then carefully place it on the launch lug line. Once both lugs are glued on, look down the side of the rocket to make sure the launch lugs are as straight as possible and lined up with each other. The dowel or piano wire can be left in during the drying process to make sure everything stays aligned. ***If the launch lugs are not lined up they will not fit on the launch pad!***

Congratulations, you now have a completed rocket!

Preparing for flight - check list...

- ❑ **Just before launch -make certain all rocket components have DRY glue and paint.**
- ❑ **Use plenty of foam or other material to protect the egg. A zip-lock bag is recommended to make clean up easier in the event of an omelet.**
- ❑ **Use masking tape around the neck of the nose cone so it fits snugly into the payload section after inserting the egg. An egg falling out at 500’ is not fun! Transparent tape may also be used on the outside to hold the nose cone and payload section together.**

**Good luck. Michigan Aerospace Challenge
wishes you blue skies and happy landings!**

Permission for the Publication of Student Images

I understand that the Muskegon Area Intermediate School District may wish to promote its programs or services by publishing photographs in print media and on the MAISD website. Also through videotape of students in electronic media and the MAISD website. I understand that images published on the Internet will not display the child's name, school or any other personally identifiable information.

Videotape or photographs of my child can be:

- In print media
- Through electronic media (video, etc)
- On the MAISD website

Student Name: _____ **Student Age:** _____

Student Signature (if 13 years of age or older): _____

Parent or Legal Guardian Name (print): _____

Parent or Legal Guardian Signature: _____

COPPA Background Information

In April 2000, the Children's Online Privacy Protection Act (COPPA), enforced by the U.S. Federal Trade Commission, went into effect. COPPA requires most web site operators to obtain verified parental consent before collecting, using or storing "personally identifiable information" (PII) about children 13 years of age. PII means data such as first and last name, street address, telephone number, e-mail address or other information that could enable someone to contact the child physically or online.

MAISD Regional Math & Science Center
STUDENT ACTIVITY PARTICIPANT INFORMATION FORM 2009

This information is required by the Michigan Department of Education and Grant Awards for statistical reporting. Please complete the items below:

School: _____ Contact: _____

Number of Students (*Enter numbers of students participating in the program only*):

	Male	Male Underrep (include disabled)	Female	Female Underrep (include disabled)	Unknown Race/Gender
Grades K - 4					
Grades 5 - 8					
Grades 9 - 12					

Number of Teachers (*Enter numbers of students participating in the program only*):

	Male	Male Underrep (include disabled)	Female	Female Underrep (include disabled)	Unknown Race/Gender
Grades K - 4					
Grades 5 - 8					
Grades 9 - 12					

Student Ethnicity (*Enter numbers of students participating in the program only*):

Females

African American	Caucasian	Native American	Hispanic	Pacific-Islander	Person with Disabilities

Males

African American	Caucasian	Native American	Hispanic	Pacific-Islander	Person with Disabilities

Number of parents: _____

Number of administrators: _____

The Day of the Launch

1. Arrange of arrive on time — with time to check in and get students to your first activity
2. When you check in at your first activity please turn in the “Student Activity Participant Information Form” and one “Permission to Photograph” for each student.
3. Keep your group together when moving from one activity to another, particularly to and from the arena.
4. Follow the schedule sent to you.
5. Let each activity leader know when your ground arrives for each activity.
6. Read and follow the “Rules for a Successful Hands-on Tent Experience” below”
7. There will be some picnic tables available at the Mart Dock Property for lunch, but there might not be enough for every classroom, so it might be wise to come prepared with some old sheets or blankets. Please have students clean up after eating. There will be several trash receptacles around the Mart Dock Property.
8. There are restrooms located in the L.C. Walker Arena Annex and porta-potties on the Mart Dock Property.

Rules for a Successful Hands-on Tent Experience

1. Classes should line up at the entrance on the West side of the tent.
2. Teachers should check-in and receive their packet.
3. Activities are not in any order, therefore, students should move to the least busy stations.
5. Please help keep the tent clean by throwing garbage in containers.
6. Everyone is to walk in the tent.
7. Teachers should **check-out** of the tent at the given time, so the next group can enter.
8. There is a separate exit area on the North side of the tent.
9. Have a great time with physics!