Maryland Engineering Challenges
2023 Hovercraft Challenge
Middle School Level – Grades 5 to 8

Engineer Contact:
Kathy Gunkel wildwoodenvironmental@comcast.net

Important Dates

Registration Due
⇒ **April 7, 2023**   **Prior to 4:00 PM**
- In order to be a registered team, each team must have their adult Coach register online: https://bit.ly/2023MECRegistration

Written Report Due
⇒ **Friday, April 14, 2023**   **Prior to 4:00 p.m.**
- Submit the team's **Written Report** (Email in PDF format) to challenges@thebmi.org

Hovercraft Competition
⇒ **Saturday, April 22, 2023**   **Program begins at 9:00 AM**
- Competition will be at the Baltimore Museum of Industry, 1415 Key Highway, Baltimore
- Teams should bring their completed hovercraft to the competition ready to be tested
- Full details about the Challenge event will be emailed to Coaches after the registration deadline.

Questions about Challenge specifications or judging should be sent to the Engineer Contact:
Kathy Gunkel wildwoodenvironmental@comcast.net
Other questions? Jessica Celmer   challenges@thebmi.org

THE CHALLENGE

Design and construct a Hovercraft vehicle (a land-and-water transportation vehicle that Maryland could use for a ferry service across the Chesapeake Bay) from a kit to be the fastest vehicle in a race across a 20-foot stretch of floor. Imagine you are transporting vehicles and families from Fells Point to Kent Island in a "Reach the Beach" program for the State!

ENGINEERING TEAM REQUIREMENT
For the benefit of the students, it is recommended that the team not exceed four students. There is no limit to the number of teams a school may have.

DESIGN & CONSTRUCTION STANDARDS

- Teams will use a Kelvin "Hovercraft Racer Kit" **#842389** and other materials of their choice to construct a model Hovercraft.
    - The Kelvin Hovercraft Competition Kit is available at www.kelvin.com, search by **stock #842389**[*][1] to make sure you order the correct kit as there are several sold by Kelvin.
    - The Kelvin Hovercraft has evolved since we first started offering this engineering challenge 20 years ago. The kit listed in the previous bullet point uses a battery case which requires 4 "AAA" batteries. Alternatively, you may consider using the CR2032 Button Battery and its holder (at Amazon – "Saim 2 x CR2032 Coin Cell Plastic Battery Holder 6V Output with Wire Lead On/Off Switch 12 Pcs"). In a departure from past years, you have free reign to figure out the best "power" option for designing a Hovercraft that will have the fastest time across the Bay, BUT, you may not exceed 6 Volts.
    - Be careful which kit you order because Kelvin offers several kits. You want the "KELVIN Hovercraft Racer Kit". You DO NOT want the "Hovercraft Design Challenge Kit" or the "Advanced Competition Hovercraft Kit with wired power supply", nor do you want the "Super Capacitor Hovercraft".
- NOTE: Teams may request one free kit from the BMI. *Kits will be available in the fall; you may request your kit(s) by contacting Jessica at* challenges@thebmi.org *in late October.*

PERFORMANCE DEMONSTRATION GUIDELINES

- Each team can race their Hovercraft, starting from either side of the Bay, twice across the Bay and use the best time between the two runs.
- The Hovercraft cannot be "pushed" at the start of its Bay crossing.
- The Hovercraft cannot be touched or adjusted after the start of its crossing.
- Needed adjustments and/or repairs can be made between the two runs.

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[1] ***** This is a NEW kit starting last year compared to what has been used in the past. If you have leftover kits from 2021 or before, they will not be accepted for this competition.

SCORING EVALUATION CRITERIA AND POINTS

Written Report and Drawings   *20 competition points*

- The quality of the written report has made a difference in the past between 1ˢᵗ and 2ⁿᵈ place!
- Timeliness of report submission is important — deduction is 1 point/day late until the lead engineer receives the report.
- No supplements will be accepted the day of the competition, instead incorporate any additional information into your Oral Report.

Oral Report   *15 competition points*

- Include answers to the following questions:
    - Why is the Hovercraft a good choice as an auto transport vehicle?
    - Why is it a good choice as a rescue vehicle?

Design and Fabrication   *30 competition points*

- The design and fabrication of the model vehicle should look like a passenger vehicle. It will be a factor in the award of points for this category.
- Plan the Hovercraft as though the team is presenting the design to MDOT, the Maryland Department of Transportation.

Performance Demonstration   *35 competition points*

- Each Hovercraft will be required to race across the "Chesapeake Bay", from Fells Point to Kent Island, a 20-foot distance over a flat, dry surface, under the power of a 9-volt battery.
- Performance scoring points will be awarded as follows:
    - 35 points-fastest time across the Bay
    - 30 points-2ⁿᵈ fastest time
    - 25 points-3ʳᵈ fastest time
    - 20 points-4ᵗʰ fastest time
    - 10 points-each successful "Bay" crossing
    - 5 points-each successful launch that reaches the midpoint of the "Bay"

Written Report for the Hovercraft Challenge

The Written Report plays an important role for the Engineer. It is how s/he communicates their ideas to parties in a permanent format. These parties might be investors, your boss, your client, your employees, or maybe the Patent Office if one is trying to get a patent for their work. An oral presentation enhances the written report, but the written report serves as the "take-away", the means by which an individual may refresh their memory with regard to what you covered in your presentation. How much easier is it for you to remember what your teacher told you when you have something in writing from them, along with your notes? A

patent application requires that everything be submitted in writing to create a permanent record of your patented "gizmo".

In the case of the written report you are preparing, the Sponsor is looking for your ability to put together a standard report, one which includes a Title Page, Table of Contents (in a normal format), an Abstract, a Summary, an Introduction to the report, "THE REPORT", your Conclusions and Recommendations, your Acknowledgements to the people who supported you in this endeavor, a Bibliography listing sources of your information and research, Appendices as needed, original Drawings (hand or computer), and Photos to supplement your discussion. And, most important is a Certification that you and your teammates did the work yourselves, that it was not done by your teacher(s) or parent(s). This is YOUR project, not theirs!!

Here are some notes to help you develop and prepare a quality written report. In addition to "THE REPORT", you should consider including the following features:

Title Page —include name of challenge, team name and logo, name of school or organization, names of students, name of teacher or advisor. An original logo design and its details will earn an extra 3 points. *Copying a graphic from a web site and using it for your logo will result in loss of points…better no logo than stealing somebody else's work.* These Title Page requirements have been established by the Maryland Engineering Challenges program.

Abstract, Summary, Introduction, Conclusion—Conduct an internet search to find out how the Abstract differs from the Summary, how the Summary differs from the Introduction and Conclusion, etc.

Conclusions and Recommendations —How successful was the project? What did the team members learn by participating in an engineering challenge? What did each team member learn about their aptitude for engineering related careers?

Acknowledgments —List the names of the adults who assisted in the project with a brief description of what they did. Required…lose 5 points if not included.

Certification —Include a certification, signed by all student team members and adult coaches/assistants, stating: "We hereby certify that the majority of the ideas, design, and work was originated and performed by the students, with limited assistance by adults, as described in the Acknowledgements." Required…lose 5 points if not included.

Bibliography —list all references used, including internet website/webpage, books and magazines. *(An internet website URL address is not enough…provide a few words about the information you obtained from it.)*

Appendices —conduct an internet search about Appendix (Appendices) and use them appropriately to include information about the Safety precautions you considered and incorporated, the Team Members with short bios about each, scheduling and accomplishments achieved, special tools and/or machines used to design and build the Hovercraft.

Photos – Not required, but you can earn up to 5 bonus points with the inclusion of relevant photos.

Remember, a good report can make or break a team as far as placing First, Second, or Third. Only 5 points separates the fastest Hovercraft from the 2nd fastest. And, it has happened in the past that First place was won by a team with the second fastest Hovercraft because they achieved more points with the quality of the report they submitted.

Please note: At least 1 competition point will be deducted for poor grammar, poor spelling, or clear evidence that only "spell check" was used and no proofing was performed. The report is evaluated on a scoring scale of 100 points and the scoring points are scaled to the equivalent of 20 competition points…a score of 100 points on the scoring scale is equivalent to 20 competition points and a score of 50 points is equivalent to 10 competition points. _How do we know there was only "spell check"? When we see correctly spelled words used out of context, for example, "four" instead of "for", "form" instead of "from", "touché" instead of "touched", we know spell check was used and didn't stop at the word because it was spelled correctly, even though it was the wrong spelling for the context of the discussion._

GOOD LUCK TO YOUR TEAM…WE LOOK FORWARD TO REVIEWING YOUR REPORTS AND MEETING YOU TO DISCUSS YOUR HOVERCRAFT AND ACHIEVEMENTS WITH THIS ENGINEERING CHALLENGE.