

# evGrand Prix Kart Manual

# Teacher Guide



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MOTORSPORTS

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## Introduction and Purpose

It is the general idea of this guide to try and help new teachers and districts have a successful first year and provide a guide for maintaining and growing their electric vehicle (ev) go karting program. Here we will give schools and teams an overview of what is necessary for you to make a decision about participation and clearly understand what is required for success. We will cover important 1st year topics and possible directions for your program to go in the future. You will find that the academic competitions are interesting and a great platform for success in all aspects of life. Go kart building on the other hand is a bit more challenging for all the first time participants. It is our hope that this document be helpful as you move forward with a truly “hands on” STEM experience that students will remember for a lifetime.

The evGrand Prix go karting program will assist students with learning science content standards, engineering and technical skills, project management, sales and marketing, design, fabrication, team work/building and public speaking. Many of the items in the karting program fit well with concepts covered in math, language arts, communications, business and even social studies classrooms. This program provides a platform for students to improve academically in many different aspects. College bound or not, this is one program that will give students a head start and a hand up with hands on education!

The culminating event, which is held at the Indianapolis Motor Speedway, is a day students will remember and cherish for a lifetime! Teams will have a chance to interact with University and Collegiate teams, racing on the same track but a different day, in the pit and garage areas as they finalize their go karts. This interaction helps clearly demonstrates to high school students how the collegiate teams are using their coursework to study real world problems, innovating, and developing solutions to tomorrows problems, today. This mentoring opportunity allows students to learn about the rigors of University/college course work, job opportunities, and career pathways.

## Planning

One of the first things you, and your school district, will need to do is decide how you are going to run your program. There are several directions that can be taken. Do not limit yourself to only the suggestions below. As groups take time to think outside the box and develop a plan that will work for their school corporation real learning opportunities take place. Below are two suggestions of what has been successful in other school districts and programs.

1. ***Integrate into a specific course of study.*** Make your program part of a class that meets on a regular basis. ICP, Engineering, Transportation, etc., the class options are endless. Be creative and think what would work best in your school and community. To be a successful program you will need to focus on the areas of marketing, technical documentation, graphic design, engineering design, fabrication, manufacturing, logistics, data collection, and numerous physical science concepts. These can be taught as a single class or within multiple classes. Decide as a district what is best for you.
2. ***Integrate into a club.*** This program can be run as an after school club with members learning about, and focusing on, the areas of marketing, technical documentation, graphic design, engineering design, fabrication, manufacturing, logistics, data collection, and numerous physical science concepts on a repeating basis. You will need to decide when to meet, how often, and for how long in order to accomplish what it will take to have a successful program.

## **Organizing and Gathering Interest**

The first challenge you will face as a first year participant in the program will be the need to find a group of students who are willing to participate. This can be either trying to get students involved in an after school program or choosing the right students from a classroom to represent the larger group. Next, if your program is to be part of an existing course you need to determine how you will integrate the program into the existing coursework. As you organize your team, look for those individuals who excel in the areas of marketing, documentation, design, fabrication, manufacturing, logistics, and data collection. Teams will need students with strong communication skills along with students who excel in the more hands on activities like turning a wrench. These students will need to work together to accomplish the goal of building a go kart and preparing for the events throughout the year. Ideally, each team should consist of 20 or more students involved with the 4 major focuses of the program; community outreach, setup and engineering, energy efficiency, and racing. At a minimum your team will require 5 students; driver, crew chief and 3 crew members.

## **Financial Support**

Your first year of the program will be your most expensive year. An electric go kart kit will cost in excess of \$5,000 (these items can be purchased through Top Kart USA at [topkartusa.net/electric/](http://topkartusa.net/electric/)). The cost can drop if you decide to find used components or do different fabrication aspects yourself. After the first year your program will only need to maintain the karts and this might include buying new batteries, motors, tires, fixing damage caused during racing, etc. Each year will also require obtaining funds for registration, pit passes, transportation and other reoccurring costs.

To obtain the funds many schools are relying on local business sponsors. This is where the marketing aspects of the program pays dividends. The students develop a plan to reach out to businesses and seek financial or in-kind donations. To help with this process many teams/schools take advantage of websites, social media, and other methods to promote their program. As your team develops a marketing strategy to promote their program they will do things like send information to potential sponsors, present their program to community groups and companies, or many other fundraising programs. These partners may become regular participants in your program as you promote their name and products on your go kart and at events around the state.

## **Purchasing the Kart**

Today teams can purchase their entire kit from Top Kart USA. Other teams take it upon themselves to locate and purchase individual components that they are unable to manufacture themselves. One of the things that make this program successful is the adaptability built in. Teams can pursue many different options when it comes to successfully building their go kart and competing in the final race event. After reviewing the purchasing guide, your district needs to decide which options you will be pursuing. There are many factors that need to go into this decision. Take into account the space that you have to work in, along with the equipment available. Look into the resources that your staff can provide along with your community partners. Besides your resources consider the amount of time that your students will be able to work on the kart. Make sure you are choosing an option that will bring success to your program.

## **Student Karting Championship Series**

This program consists of a series of fall events designed for teams with a go kart that competed in that year's World Finals to begin collecting data, become familiar with go kart racing, and conduct science activities. Over the winter students will disassemble their go kart and reassemble it, integrating design details they developed from the fall events data analysis. The series of spring events will allow returning

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teams, and first year teams, to do more driver training, improve lap times and “test and tune” their go karts in preparation for the World Championships held at the Indianapolis Motor Speedway in May. Besides the race event itself, teams will compete in multiple academic challenges incorporated into the series of events. Race finish and the results from the academic challenge will be used to determine the top teams.

### **Engaging and Competitive Program**

The evGrand Prix program was designed to facilitate learning not just be a racing event. While the racing may be “cool” the learning is exceptional. Though driver skill and a fast kart may win a race, to win the Championship Series teams will need to be successful in design, engineering and setup, marketing, and community outreach. It takes many different students working together as a team in the same way they would as part of a true motorsports team. The Championship Series is decided based on the following categories. Rubrics and detailed explanations of the categories are available online and within the Academic Challenge Rule Book.

1. **Community Outreach:** The community outreach competition evaluates teams on how they go into the community to promote their STEM education and their electric go kart program. This is all about taking the school in to the community. Teams have presented at teacher conferences, attended local events in their community and developed a social media presence to let people know about your their program. Teams are asked to put all their efforts together into an engaging presentation that is then delivered in front of a panel of judges prior to the world finals at IMS. Your team community outreach will account for 15% of the teams overall score for the Championship Series.
2. **Engineering and Setup:** This is the part of the competition that will require a presentation of a different nature. This presentation requires the lead engineering or technology students to present the design concept of their go kart, how it works and what sets their schools kart apart from the other teams. Teams utilize detailed technical drawings, data collected, mechanical knowledge in a presentation delivered in front of a panel of judges prior to the world finals at IMS. Your team engineering and setup will account for 15% of the teams overall score for the Championship Series.
3. **Project Management and Marketing:** This part of the competition each team will be give a presentation that covers their marketing plan and overall project management. This presentation requires the lead project manager and marketing personnel to present what their team has done for marketing their program to the community and working with sponsors. They will also discuss how they managed the various components of the program deadlines and activities while staying within a planned budget and using resources wisely. Your team project management and marketing will account for 15% of the teams overall score for the Championship Series.
4. **Creative Expression:** This part of the completion student teams will be graded on a combination of (i) the visual aids used in the Marketing material and (ii) the team visual components at the evGrand Prix Finals, including: kart graphic design, e.g. sponsorships, coloring, and logos; team accoutrements, e.g. t-shirts, banners, etc. All Participating team will receive a point value from 0 to 5. Your team Creative Expression will account for 5% of the teams overall score for the Championship Series.
5. **Energy Efficiency:** This category is closely tied to engineering and setup, and requires a bit of testing on track to not only use as little energy as possible but also be competitive in the World Finals race event. The idea is to complete the race in the shortest amount of time, while using the least amount

of energy to do so. Energy will be measured before and after the race thru a Power and Energy Monitor (PEM) system used by race timing and scoring officials. Each team kart will be evaluated based on the overall energy usage from the spring IMS Race. Teams must complete 80% of race laps to receive points in this category. Your team energy efficiency will account for 15% of the teams overall score for the Championship Series.

6. **Series Placement:** Your score will be determined by points received from your finish at the evGrand Prix Finals and points awarded from Fall and Spring Events. There are three (3) fall events totaling 3.1 points and three (3) spring events totaling 1.5 points, see High School rules at [evgrandprix.org](http://evgrandprix.org) for details. The High School evGrand Prix World Finals Race event will consist of a minimum of 20 laps. Under no circumstances will the race be made longer than can be completed with the specified total kWh of battery energy available to each team. Race placement will account for 35% of the teams overall score for the Championship Series.

The **Championship Winner** will be the school/team that scores the highest total points for all six (6) categories. This will be decided upon final analysis of all scoring categories. Trophies will be awarded to the top team in each category, top 3 race finishers, and the overall Championship Series winner.

### How To Be Successful

The first thing to remember is teams are not expected to compete in this program in isolation. Our goal is to create a network of support for all schools. Do not be afraid to reach out to community partners, past teachers, or local professionals for advice. Be sure to take advantage of the following resources available to teams and schools throughout the year:

- **evGrand Prix Staff:** Purdue University has hired Stuart White as a resource for all high school teams involved in the program. Stuart has been with the high school program from it's beginning. His job is to provide you with the curriculum, program materials and communications, as well as technical service and support you need to be successful. Feel free to contact him for help (contact information below).
- **Purdue Outreach:** Another option is the Purdue Extension Offices around the State. They will be available to assist in most of the urban and extreme rural communities.
- **Teacher Input:** Teacher input is one of the best methods of growing a program. Great communication between the teachers, coaches/mentors and our MSTEM3 academic team will make things progress at a much higher rate. A list of the previous year's teams, with contact information, is available online.
- **Teacher Coaches:** There are a number very valuable High School Teachers that were in the early pilot program and are willing to lend a hand with some guidance and to help you get through those difficult times. They see the value of the program and what it has done for their students. They are great consultants and coaches. A list of Mentor Coaches, with contact information, is available online.
- **Workshops:** There will be workshops and events throughout the school year. Workshops will give teams and coaches the chance to get answers to their questions on kart assembly, kart setup, marketing and funding, and community outreach. "Karting experts" will be on hand at the workshops to help teams understand how all aspects of the go kart program, curriculum, and implementation. There will also be sessions on how to establish a testing log book, collecting and

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analyzing data, and how to use the data collected.

### **Karting Build Manual**

Each team will have access to curriculum for building their go kart. This will include detailed instructions on bumpers and guards assembly, powertrain and brake installation, rear axle installation, seat installation, steering assembly, and wheel alignment. Please refer to the manual for all questions regarding the assembly of the kart. If you are having difficulties, evGrand Prix staff is there to provide assistance.

Teams are highly encouraged to utilize these resources as they design their go kart. These manuals are designed to give instructions on assembling an electric go kart, in general, and not be a step by step instruction manual. This valuable tool will be useful when determining what components make up the go kart and how those parts are incorporated into a final product. As a “living document” it will be updated as time, technology, and experience dictates and will improve communication and program development as the program grows and progresses.

### **Classroom Curriculum**

As part of the evGrand Prix Academic Challenge, teams are required to discuss their educational experiences and demonstrate the learning that goes on during the building, testing and racing of their ev kart. Teachers and students have access to exciting, engaging and rigorous learning materials that are developed with the evGrand Prix as the setting and back drop for science, math, technology and engineering courses. These STEM centered lessons and activities guide students from start to finish. Students get hands on training with not only the designing and building of an electric go kart but also lessons that integrate directly into Integrated Chemistry and Physics, Physics, Engineering Technology, or even Transportation classroom. These lessons and activities teach students the science technology, engineering, mathematics, and language arts principles behind motorsports, marketing, kart setup and testing, and even race day events. Each lesson is correlated to state and national standards.

### **Motorsport Safety**

Motorsports safety is always our first concern. Safety is the most important mission of all motorsports. An Indy Car can safely run down a straight away at 240mph and a Top Fuel Dragster can exceed 300mph, both doing so safely. We may not reach those speeds, however we are racing these karts at high rates of speed and that is exactly why safety is so important. We would not have this program today if it were not for strong safety programs in Indy Car, NHRA and WKA (World Karting Association).

- **NFPA 610 Compliant:** All race and testing activities will be NFPA 610 compliant and enforced at all times. Training and implementation is all of our responsibilities. Keeping our students safe is the highest of priorities. A great safety system assures that.
- **Practice and Testing:** Any operation of the racing kart outside of coursework or a sanctioned track is strongly discouraged. It is highly recommended that you limit your go kart use to the prescribed curriculum and that you utilize a designed race course or one set up with Purdue or WKA supervision and over sight if you are going to run your go kart competitively outside the evGrand Prix Program.

**Indoor Tracks for Practice and possible Winter Months Race:** We are working on developing a relationship with Indoor Karting Facilities to utilize their course during the colder winter months for providing “lap time” and evkart Test and Tune events.

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Contact any of the following with your questions:

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Websites:

[www.evgrandprix.org](http://www.evgrandprix.org) – Provides information on evGrand Prix events, documents, resources, registration and staff contact.

[www.ekseries.com](http://www.ekseries.com) - Provides an online community of EV Grand Prix teams for the High School, Collegiate, and Autonomous classes to participate in discussions, ask questions, and find answers through various resources being posted about events, updates, results and more.

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