THE FORMULA ONE™ TECHNOLOGY CHALLENGE

2016 Competition Regulations

Competitive Category

Bloodhound SSC Class Categories

Secondary Competitive

F1 Class Category

Secondary Competitive

F1 in Schools - 2016 Season Rules & Regulations

This document has been ratified and approved for release by F1 in Schools. Any approved revisions will be officially released as supplementary regulations through the F1 in Schools website. This is accessible via www.f1inschools.com.sg at the rules and regulations notices and downloads page.

Feedback is welcome and should be sent to terrylim@mastereign.com

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PART TWO

WHAT IS F1 IN SCHOOLS?

F1 in Schools™ is a multi-disciplinary challenge open to all Primary and Secondary schools, Junior Colleges, Institutes of Higher Learning and other organised youth groups where teams of students aged 9 to 19 deploy CAD/CAM software to collaborate, design, analyse, manufacture, test, and then race miniature compressed air powered balsa wood F1 cars Teams of 3 – 6 students are judged on car speed, as well as supporting evidence of their design, verbal presentation and marketing display stand in ‘‘the pits”.

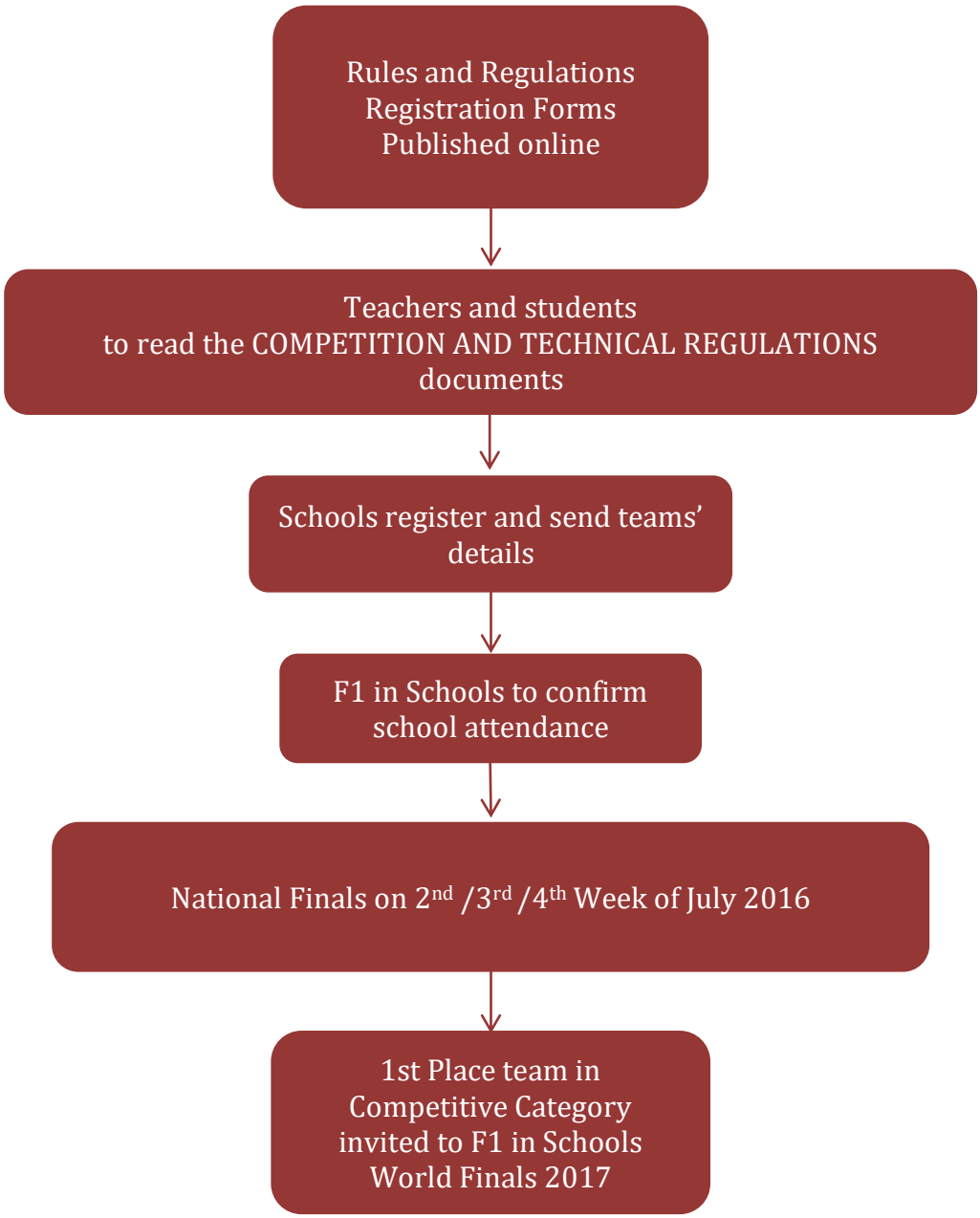
The National Schools F1 in Schools Championships will be held in Singapore where student teams will compete against each other. The winner in the competitive category will be invited to compete at the F1 in Schools World Finals 2017.

The F1 in Schools™ Technology Challenge is supported and sponsored by the following companies and agencies: Denford Ltd, City University London, Autodesk, Mastereign Enrichment, Vivarch Enrichment, Kingmaker Enrichment and C’ignature Enrichment.

GETTING STARTED

F1 in Schools, Bloodhound SSC Design Challenge

2016 Flowchart



How to obtain software, hardware and consumables

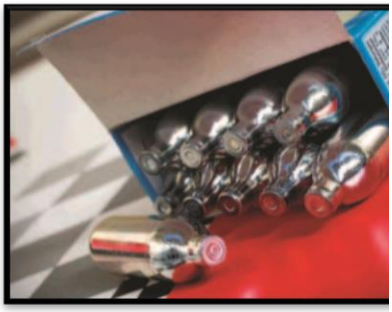
Bloodhound SSC Carkit

- Balsa Wood Block
- A set of 4 wheels
- 2 axles (Long and Short)
- 4 Washers
- 2 Tether Guides
- 3 pieces coarse sandpaper
- 3 pieces fine sandpaper

Formula One Carkit

- Balsa Wood Block
- A set of 4 wheels
- 2 axles (Same Length)
- 4 Washers
- 2 Tether Guides
- 3 pieces coarse sandpaper
- 3 pieces fine sandpaper

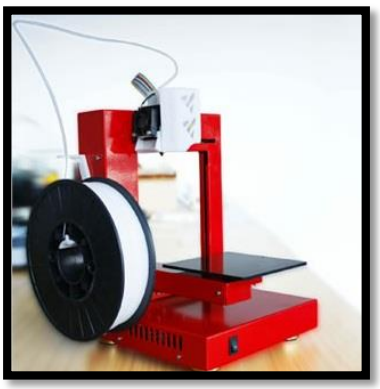
Racing Management System



CO^2 Cartridges (Per Dozen)

Elevated Racing Tracks

CNC Router Milling Machine



3D Printer

IF YOU WOULD LIKE TO PURCHASE ANY EQUIPMENT FOR THE CHALLENGE PLEASE CONTACT ANY OF OUR AUTHORISED AGENTS.

Autodesk CAD Software

We are delighted to have Autodesk as our Premium Global Software Partner, providing free tools for the next generation of design. Through F1 in Schools, schools are provided software to support their teams through the competition season.

Get started—request free access to our powerful design products:
Professional 3D design software

- Autodesk® Inventor® Professional software: Create and simulate your design with this 3D mechanical CAD, visualization, and documentation software
- Autodesk® Flow Design software: Wind-tunnel simulation software for your F1 car's airflow studies
- Autodesk® Showcase® software: Transform your F1 car into photo-quality visuals for effective virtual presentation

Creative design apps

- Autodesk® Pixlr® Express app: Fun and easy-to-use professional photo editing tool that helps you build an awesome marketing portfolio of your F1 cars. Download the free app today.
- Autodesk® 123D® Make app: Turn your amazing F1 car 3D models into even more amazing DIY projects. Download the free app today.

Simple steps to gain access to free Autodesk technology:
Autodesk® Education Master Suite is a one-stop solution to help you conceptualize, create, analyze, render, document, and manufacture your designs. Join the F1 in Schools program and request free* Autodesk Education Master Suites for your school via the Autodesk Academic Resource Center (ARC)*by clicking on the link at the bottom of this page.

How to Request Autodesk CAD Software if you are a Student
Students also have the opportunity to access their own free copy of the software for their personal learning needs by visiting The Autodesk Student Community.

Manufacturing Centres, Test Centres and Race Centres
All details of accredited manufacturing, test and race centres are posted on the tools page of the F1 in Schools website. (www.f1inschools.com.sg)

Enquiries and Questions
All questions and queries about the Formula One™ Technology Challenge should be emailed to: contactus@f1inschools.com.sg

Registration
IMPORTANT – Please register your teams online as soon as you have allocated your job descriptions

THE DESIGN BRIEF

You are the Design Team commissioned to design, construct and race the fastest car on the planet driven by compact compressed air power plants.

In order to enter the Championship, you must allocate job roles to the members of your group. Ideally, one role should be allocated to each person. However, you may have to double up on your role and responsibilities, depending on the number of people you have available. The following job roles are examples of what could be covered by the members of your team:

- **Team Manager** (maximum 1 person).

This person could be responsible for managing the team, ensuring that the primary and back-up cars are ready for the finals. The team manager works closely with all members of the team, offering assistance where necessary.

- **Resources Manager**

This person organises time, materials and equipment for design and making the cars. They could be responsible for developing ideas regarding team marketing (presentation). The resources manager will need to liaise with all members to check tasks are progressing on time and offer additional help, if needed.

- **Manufacturing Engineer**

These people could be responsible for advising team members on the manufacture of the car and the constraints of the machining process. Manufacturing engineers will need to liaise with the design engineers to report and help solve any problems with construction of the car.

- **Design Engineer**

This role could be responsible for the styling and aerodynamic performance of the car design. Design engineers will need to liaise with the manufacturing engineers to ensure their ideas can be realised.

- **Graphic Designer**

This person could be responsible for producing the colour schemes applied to the vehicle, including any special sponsorship decals, together with the final

graphic renderings and any additional team marketing materials. The graphic designer will need to liaise with the design engineer to ensure any schemes will fit the shape of the vehicle and the resources manager for additional marketing development.

There are so many tasks that must be mastered, in order to design, manufacture, prepare and finally enter a car for racing, that teamwork will be vital to your success.

Remember, no one person is more important than other members in the team.

DESIGN CONSIDERATIONS

Design Preparation

Before beginning to design your car, you will need:

- A 3D CAD solid modelling software package at your school/college such as Autodesk Inventor.
- A design template suitable for the balsa wood blank.
- Hopefully, an endless supply of ideas!

Training

Autodesk CAD packages will help you draw and develop your ideas in 3D. Of course, as with most drawing packages, it takes time to learn how to use them. Your teacher should be able to show you how the software works, but members of your team will need to spend some time exploring the software, so you can see what it can do and how it can help you design your Bloodhound/F1 car.

Research

Investigate existing land speed record car designs. Your teacher may be able to help you use the internet to find out the latest Bloodhound SSC land speed record attempt and F1 designs developments. Concentrate your research on areas that could help your team, for example, aerodynamics and car body designs, and then try to apply the principles to your own ideas.

Testing

Your team may want to consider testing a variety of car designs, or car parts, in a wind and/or smoke tunnel to evaluate their aerodynamic performance. Virtual Wind Tunnel software is available to purchase, please see www.f1inschools.com.sg

MANUFACTURING CONSIDERATIONS

a. If you choose to purchase a Bloodhound SSC or the Formula One Class Car Kit you will receive a balsa wood block, a set of 4 wheels, 2 axles and some sandpaper, which is the minimum that you need to enter the challenge.
b. **Note that your car design template must be at least 10mm shorter at one end,** compared to the actual balsa wood block. You will not be able to machine to the extreme ends of the balsa wood block, since they are sometimes used for attaching the CNC machine fixtures. Damage could occur if the cutting tool hits any of these fixtures.
c. The fixture is used to stop the balsa wood block moving whilst being machined. It also allows the block to be accurately repositioned. Please note however that some machines will process with only one cut, others may require two or more cuts, and therefore you will need to take this into account when you are designing the car.
d. Once machined, you can smooth down the balsa wood design and finish with primer and paint. Note that only a limited amount of hand finishing to the body is allowed. You could also decorate the car body with any sponsorship stickers, advertising or colour schemes.

ARTICLE 1 – DEFINITIONS

A number of terminology and phrases will be used in all documentation and during an F1 in Schools™ event. This article will give a definition for each one:

Article

Each section in all documentation will be referred to as an Article which brings F1 in Schools Ltd documents in line with the Fédération Internationale de l'Automobile (FIA) documentation.

Parc Fermé

A secure area where all primary and back-up race cars are held to prevent unauthorised handling, but to allow technical inspections to be conducted by the Judges. (Literal meaning in French of 'closed park').

Competition Schedule

The competition program will detail the schedule of judging activities for all teams.

Key performance indicators (KPI's)

These are portions of text that feature on the scorecards within a corresponding points range. The KPI's describe the type of evidence the Judges will be looking for in order to score the team appropriately.

Car race time value

A 'car race time' value is the actual time taken for a F1 in Schools™ car to travel the track from start to finish, measured from the instant the launch pod fires to when the car breaks the finish line timing beam. In the case of reaction races, the 'car race time' value is calculated as the 'total race time' value displayed on the electronic start gate minus the 'reaction time' value displayed for that race.

Total race time value

The 'total race time' value is displayed in the total time field on the electronic start gate at the conclusion of every race. This time is the sum of the 'car race time' value and any 'reaction time' value displayed on the electronic start gate.

During time trial races where the automatic launch mode is used there is a zero reaction time value.

Reaction time value

A 'reaction time' value is the time recorded from the instant the five (5) start lights extinguish to the instant the start trigger is activated by the driver. This value is displayed in the reaction time field on the electronic start gate.

Project elements

These are any materials and resources that the team presents as part of its entry for any judging activity.

ARTICLE 2 – GENERAL INFORMATION

Competitive teams

a. Each team must consist of a minimum of 3 students to a maximum of 6.

b. Each team member must be between the ages of the following categories. The age of each team member will be taken at the time of the regional final.

Category	Age as on 1st Jan 2016
Bloodhound SSC – Secondary	13 – 17 years old
Formula One Class – Secondary	13 – 19 years old

c. Each team must use **Autodesk Inventor 3D CAD** (Computer Aided Design) software to produce their ideas and model them in 3D.

d. Each team should use a CNC machine such as a Denford CNC Router, or an F1 in Schools SG approved Manufacturing Centre to produce the car body.

e. Each team should manufacture their car body either at their school/college or at a designated manufacturing centre/partner.

Team responsibilities

a. Teams must read the **SG Technical & Competition Regulations** (This document), carefully to ensure that all project elements satisfy these regulations and that they understand the requirements and procedures for all aspects of the competition and judging.

b. During competition it is the team's responsibility to ensure that team members are present at the correct time and location for all scheduled activities.

Role and responsibility of supervising teacher / adult.

a. All supervising teachers / adults should carefully read and understand the terms and conditions for entry into F1 in Schools SG, and have explained all relevant information within this agreement to their team(s).

b. It is the primary responsibility of the supervising teacher / adult to ensure duty of care / well-being for all their student team members. Any concerns arising during the event in relation to this should be

brought to the attention of the F1 in Schools SG Event Directors immediately.

c. The supervising teacher / adult are permitted to be present during all judging activities with their team, but, must not interact in any way with the student team, Judges or judging process. Any incident considered inappropriate will be brought to the attention of the Chair of Judges.

Regulations documents

a. F1 in Schools SG issues the rules and regulations, all revisions and amendments made.
b. Technical & Competition Regulations (This document) is mainly concerned with regulations and procedures directly related to judging, the competition event and car design/ manufacture.

Interpretation of the regulations

a. The final text of these regulations is in English, should any dispute arise over their interpretation. The regulation text, diagrams and any related definitions should be considered together for the purpose of interpretation.
b. Text clarification - Any frequently asked questions that are deemed by F1 in Schools SG to be related to text needing clarification will be answered. The question and the clarification will be published to all teams at the same time.

Supplementary competition regulations

In the event of any changes to the regulations or event logistics, teams will be contacted by F1 in Schools SG with further information. Any supplementary regulations will be issued to all teachers and team managers, where the team manager has supplied F1 in Schools SG with a contact email address.

Design ideas and regulation compliance queries.

Teams are not permitted to seek a ruling from F1 in Schools SG or any competition official or judge before the event as to whether a design idea complies with the regulations. Rulings will only be made by the Judges at the National Final event. Design compliance to the regulations forms part of the

competition. As in Formula 1™, innovation is encouraged, and F1 in Schools SG teams may also find, sometimes controversial ways, of creating design features by pushing the boundaries in order to get an extra competitive edge.

Outside assistance

a. F1 in Schools SG - Competitive categories teams' are encouraged to develop mentoring partnerships with businesses, industry or higher education organisations throughout their project.
b. All design work, text and scripting for all project elements presented for assessment must be wholly undertaken and created by the team. This includes all CAD and CAM data, electronic portfolio and graphic content.
c. All aspects of any partnerships should also be represented in the team's portfolio. For any project element produced utilising some outside assistance, teams should be able to demonstrate to the Judges a high level of understanding and justification for any of the processes used.
d. Common sense' will prevail for project elements or components that a team has purchased from a supplier. E.g. bearings, screw eye, electricity power board. Teams should be able to explain and justify why a specific component was selected / purchased over other similar available components.

Mandatory project elements required for National Competition entry

Following is a summary of the mandatory elements to be submitted for judging:

- ✓ F1 in Schools™ - 2 x Bloodhound Class or Formula One™ Class Car(s) (1 Primary and 1 backup)
- ✓ A design portfolio
- ✓ An orthographic drawing and 3D render included in design portfolio
- ✓ A pit display
- ✓ A 10 minute verbal presentation
- ✓ A design specification document

a. F1 in Schools SG - Competitive Category - Each team must produce a minimum of three (3) race cars for the - a primary race car, a backup car and an identical car for display during the National Final. Each team only needs to submit two (2) cars for judging and racing.
b. Portfolio - Each team must produce a 'hard copy' 20 page design portfolio, presented in an A3 (or similar) sized format for exhibition within the teams pit display. Refer to ARTICLE 6 of these regulations along with the portfolio and display judging scorecard for portfolio specification and content requirements.

c. Orthographic drawing - A 3rd angle orthographic projection, including plan, side and end elevations of the fully assembled car must be included in the design portfolio. A 3D rendering of the final car design must also be included. These elements must be produced using CAD. **The orthographic technical drawing should include dimensions and corresponding regulation numbers in order to illustrate regulation compliance.**
d. Pit display - Each team will be provided with a table ONLY for set-up of their pit display.
e. Verbal presentation - Teams will be required to deliver a verbal presentation in relation to their project to the Judges. The presentation must not last longer than 10 minutes at national. Teams should save their presentation on USB or storage device ready to be uploaded onto a laptop provided by the teams.
f. Design specification sheet - Each team must complete and submit a design specification sheet using the template issued by F1 in Schools SG.

Team registration at the event

Teams will be required to register with F1 in Schools SG once arriving for the event. At this registration teams will be issued National Final accreditation, event programs and detailed welcome pack. The student team manager and supervising teacher for each team should make themselves known to F1 in Schools SG upon arrival.

Submission of F1 in Schools™ car

Once cars have been submitted, they are considered as being in parc fermé.

Project elements to be retained by F1 in Schools SG.

It is a condition of the F1 in Schools SG National Final entry that each team permits F1 in Schools SG to retain 1 x race car, usually the nominated back-up car and the 20 page design portfolio. This can be submitted electronically if the team wishes to keep the printed version.

ARTICLE 3 – COMPETITION AND JUDGING FORMAT

Competition program

- Each team will be judged as per the competition program. The competition program will be formulated by F1 in Schools SG to best and fairly accommodate all judging and other competition activities. Teams will rotate around judging activities as per this program, with each rotation usually of 20 minutes in duration.
- Judging Streams – The competition program will normally be divided into two parallel judging streams to ensure quality judging time intervals within the event time constraints. A number of strategies are implemented within the judging process, including Judge Briefings and Judge reviews for cross moderation to ensure there is consistency across the judging streams.

Judging categories

There are five (5) main judging categories, each with its own team of judges and specified judging activities as detailed in further articles.

- ✓ Specification Judging
- ✓ Engineering Judging
- ✓ Portfolio and Display Judging
- ✓ Verbal Presentation Judging
- ✓ Racing

Judging score cards

The F1 in Schools SG judging score cards provide detailed information in relation to what the Judges will be looking for. The key performance indicators are used by the judges in awarding points during the judging activities. The 2016 judging score cards can be found in the appendix of this document.

Specification Judging	
Specifications	80 points
Engineering Judging	
CAD CAM and Analysis	60 points
Quality of Manufacture	60 points
Portfolio and Pit Display Judging	
Portfolio	90 points
Pit Display and Marketing	60 points
F1 Car Design Process	60 points
Verbal Presentation Judging	
Technique	60 points
Composition	60 points
Subject Matter	60 points
Racing	
Time Trials	200 points
Reaction Racing	200 points
TOTAL	**990 points**

READING THE SCORE CARDS CAREFULLY IS IMPORTANT. THEY PROVIDE CRITICAL INFORMATION FOR TEAMS AS TO WHAT NEEDS TO BE PRESENTED FOR EACH JUDGING CATEGORY.

Point allocations

Points will be awarded to teams across five (5) categories with maximum possible scores as detailed in the following table.

Critical regulations

- Some of the Technical Regulations have been identified as being critical regulations. If a team's primary race car is judged as being NON-COMPLIANT with any critical technical regulation they will be INELIGIBLE for the following awards: National Champions / Fastest Car / Best Engineered Car.
- If the back-up race car is used for any races, it must also comply with all critical Technical Regulations for the team to be eligible for these awards.

ARTICLE 4 – SPECIFICATIONS JUDGING (80 points)

What will be judged?

Specification judging is a detailed inspection process where the race car (and back-up car at the National Final) is assessed for compliance with the F1 in Schools SG - SG Technical Regulations. Refer to the specification judging scorecard for scoring details.

Team preparation

Teams must ensure that their race car(s) and design specification document are complete and ready for specification judging before they are submitted.

Who needs to attend?

Specification scrutinizing is a closed activity that no team member or supervising teacher may attend.

Judging process / procedure

Teams begin specification judging with a full allocation of 80 points. Any infringements of the Technical Regulation articles, on either car (back-up car at the National Final), will result in point's being deducted as detailed in the Technical Regulations. Scrutinizing will be conducted within the confines of parc fermé, where the specification Judges will scrutinise cars for compliance to the Technical Regulations. A series of specially manufactured gauges will be used to broadly check compliance. Accurate measuring tools, such as vernier callipers will then be used to closely inspect any dimensions found to be near to dimensional limits per the initial gauge inspection.

ARTICLE 5 – ENGINEERING JUDGING (120 points)

What will be judged?

The engineering Judges will assess the teams' use of CAD/CAM technologies along with the quality of manufacture of both the primary and back-up race cars (National Final only) submitted. The specific areas to be assessed are:

- ✓ Application of CAD CAM
- ✓ Analysis
- ✓ Organisation of CAD data
- ✓ Orthographic drawing and 3D rendering
- ✓ Quality of manufacture and assembly of the two submitted cars
- ✓ Manufacturing process discussed in the portfolio
- ✓ Use of CNC machining and/or 3D Printing

Team preparation

The team is allowed to take their race car(s) to engineering judging along with the design portfolio. Other items may also be taken to help the team explain any engineering or manufacturing concepts. The engineering judges will not have access to the team pit display for judging purposes. Preparation should include careful reading of the scorecard, the key performance indicators for the application of CAD CAM, analysis and associated data organisation, describe what the judges will be looking for.

Who needs to attend?

This judging session must be attended by the team manager and team design and manufacturing engineers as a minimum.

Judging process / procedure

Teams will be awarded points as per the key performance indicators shown on the engineering scorecard. The scheduled engineering judging interview session will focus on the application of CAD CAM, analysis, CAD data organisation, orthographic drawing, 3D render and use of CNC machining and/or 3D printing. This is an informal interview where Judges will ask the team to demonstrate their CAD / CAM work and query teams on what they have done. The quality of

car manufacture and car assembly will be judged during a separate ‘closed to teams’ session.

ARTICLE 6 – PORTFOLIO AND DISPLAY JUDGING (210 points)

What will be judged?

The portfolio and display judges will examine each teams 20 page design portfolio and pit display so that they can assess the following specific areas.

- ✓ Project management
- ✓ Team work
- ✓ Portfolio for clarity and quality
- ✓ Team identity
- ✓ Marketing
- ✓ Pit display for clarity and quality
- ✓ F1 car design process
    - Idea
    - Development and testing
    - Evaluation

Refer to the portfolio and display judging scorecard for detailed point scoring and key performance indicator information.

Team preparation

Teams are required to read the portfoilio and display judging scorecard carefully to ensure that all areas to be assessed are included within the context of their design portfolio and pit display. It is each team's decision how and where each area is presented. Teams should be mindful of the time constraints of judging when making these decisions.

Who needs to attend?

All team members must be present during the portfolio and display judging session.

Judging process / procedure

Portfolio and display judging will take place at each teams pit display. The Judges will usually introduce themselves then ask the team to stand clear of their display so the Judges can conduct assessments. Team members may be asked

questions by Judges to help them find certain content and or seek further explanation.

Design Portfolio requirements

The design portfolio must be in a printed 'hard copy' format of A3 or similar size. The portfolio is limited to 20 pages which include the front and back covers. This can be 20 single sided or 10 double sided sheets. If a portfolio comprises more than 20 pages, the Judges will only review the first 20 pages for assessment purposes.

This is a general guideline of what should be included in the portfolio

- Cover Page
- Research
- Development of Ideas
- Design Concept
- Computer-Aided-Design
- Car Specifications
- Manufacturing Process
- Testing of Car(s)
- Team Identity
- Marketing & Sponsorship (Optional)

This only serves as a guide. All other components are up to the discretion and creativity of the participants. There MUST be content related to the use of CAM and CNC manufacturing included in the portfolio as this will be referenced by the engineering Judges. An orthographic drawing and 3D render must also be included in the portfolio. Content related to project management, the team, design ideas, design development, research, testing and evaluation are commonly presented within the portfolio.

Pit display setup and parameters

- F1 in Schools SG will provide each team with a self-contained exhibition style display booth including integrated lighting and 1 x power supply with pins (on request). Teams need to supply any power adaptors they may require. The precise booth and table dimensions for the National Final will be announced closer to the event.
- All teams will be able to set-up their pit displays on arrival prior to the judging and welcome brief commencing. Participants are given a **maximum of 90 minutes** to set up the whole booth, after which no further

set up is allowed. Violation would result in **1 point deduction**/ extra minute. Extra time will be allocated to teams who face unforeseen circumstances such as power failure and the decision will be solely based on the discretion of the judges.

- No part of the teams completed pit display is allowed to protrude beyond the physical dimensions of their allocated pit booth. This includes anything that might protrude above the pit booth highest point e.g. Flags.
  Any component that protrudes beyond the physical dimensions of the pit booth will be removed.
- ONLY student team members are permitted to set-up their pit displays. There must be no supervising teacher / adult or other outside assistance, unless deemed to be a health and safety issue.
- F1 in Schools SG and / or the Chair of Judges may instruct a team to take actions required to reduce or remove noise or the impact of any other physical or visual display inclusions deemed to be inappropriate. F1 in Schools Ltd. will instruct teams to remove or alter any display inclusions considered to be a safety hazard.
- Any electrical appliance connected to the power supply must be electrically sound.

ARTICLE 7 – VERBAL PRESENTATION JUDGING (180 points)

What will be judged?

The verbal presentation Judges will assess each teams 10 minute verbal presentation across the following specific areas:

- ✓ Presentation technique
  - Use of visual aids - effective use of multimedia and / or other 'props'.
  - Team contribution – effective participation by all team members
  - Dynamic – levels of enthusiasm and energy.
  - Engagement – audience interest and excitement
- ✓ Presentation composition
  - Concepts clarification – clear and concise explanations where required.
  - Use of time – how effectively was the 10 minute used.
  - Presentation structure – overview explained and connection between topics.
- ✓ Subject Matter (the topics which need to be talked about)
  - Innovation – detail key innovations related to car design, project management, marketing or any other aspect of the teams project.
  - Collaboration – detail and justify any partnerships or mentoring from outside the team in terms of improving project outcomes.
  - Learning experiences – explain how the F1 in Schools™ project has benefited team members.

Refer to the verbal presentation judging scorecard for detailed point scoring and key performance indicator information.

Team preparation

Each team is required to prepare a verbal presentation as per the requirements above and saved/shown using the teams own laptop. Teams need to have all presentation resources tested and ready with them for verbal presentation judging. Most importantly, teams should read the verbal presentation judging scorecard carefully to ensure their verbal presentation features all elements and content that the verbal presentation judges will be looking for.

Who needs to attend?

All team members must be present during the verbal presentation judging session.

Judging process / procedure

Teams will be given an opportunity at the start of their time to set-up and test their laptop and any other presentation technologies and resources. The team will inform the Judges when they are ready to begin. The Judges start timing the 10 minute duration and will provide a discreet time warning signal when one minute of presentation time remains. The team will be asked to cease presenting when the time limit has been reached. At the conclusion of the team's presentation time, the Judges may choose to provide some feedback and / or ask any clarifying questions they feel necessary. Verbal presentations may be filmed for Judges review or promotional and future resource purposes.

Verbal presentation judging provisions

F1 in Schools SG will provide a dedicated private space, such as a small meeting room, where each team will deliver their presentation to the Judges. This space will include a data projector or screen and VGA cable to connect your team's laptop. These will be in fixed positions but usually with sufficient cable length to allow teams some freedom for choosing where they wish to locate their laptop. A single table will also be made available with its use and location in the presentation space being optional.

ARTICLE 8 – RACING (400 points)

What races will be conducted?

The F1 in Schools SG racing points will be awarded through reaction racing – manual / driver launch mode, two races in each lane**. Single fastest 'car race time' value from all time trial and reaction races will determine the Fastest Car Award.**

Team preparation

- Teams should be familiar with the operation of the F1 in Schools™ Race System. Race officials will give instructions prior to their scheduled races.
- Manual / driver starts - One or more team members (driver/s) must be nominated for launching of the teams' car using the manual launch method.
- Finish line management - At least one member of the team must be nominated as responsible for managing the finish line deceleration system (i.e. deceleration towels), and return of team car along the track to the start area.
- Start line car staging – one team member may be nominated as being responsible for 'staging' the car. This team member is permitted to set the alignment of the car with respect to the launch pod and track under close supervision from the race track Judges. Nomination of this team member is optional. The race Judges can assist or perform this task for the team.

Who needs to attend?

All team members must be present during their scheduled racing sessions and should assemble at the track start for briefing by the race track Judges at their scheduled time.

Reaction race procedure

Cars are launched in manual / driver reaction mode with four (4) races total per team, two (2) races in each lane. The TOTAL RACE TIME displayed and the REACTION TIME displayed for each race is recorded. The reaction race events will be conducted using the following procedure:

a. Teams race in order as shown in the competition program.
b. Driver and team stands trackside with corresponding lane start trigger.
c. One team member to track finish for deceleration system control.

d. Race1 - Judge sets cars on track / tether line and inserts CO2 canister.
e. Judge arms launch pod - SAFETY ON – makes initial launch pod adjustments.
f. A team member is then allowed to 'fine tune' the staging of their car.
g. Judge switches launch pod - SAFETY OFF – checks track is clear for racing.
h. Judge presses the start system reset button – car is launched.
i. Judge records TOTAL RACE TIME and REACTION TIME displayed on start gate.
j. Team member at finish control returns car and canister along track to the start.
k. Race 2 conducted in same lane as above, driver can be inter-changed.
l. Judges remove cars from tether line and change lanes.
m. Race 3 and Race 4, driver can be inter-changed.
n. Cars removed from track and returned to Parc Ferme.

Reaction race scoring (Manual / Driver Launch Mode)

(Maximum possible points - 200)

All two (2) 'total race times' recorded from the reaction races are considered.

The points of these two (2) times is used in the following formulae to calculate the points awarded:

- ✓ **Points = 100 / (Avg. of Team's 2 Race Times)**

  e.g Reaction Race 1 = 1.02s

  Reaction Race 2 = 1.05s

  100 / ((1.02 + 1.05) /2) = 96.61 (round off to 2 decimal point)
- ✓ A deduction of 10 points will be made for any teams did not finish (DNF) reaction race result.

Time trial race scoring (Automatic Launch Mode)

(Maximum possible points - 200)

The two (2) 'car race times' recorded during the time trials will be considered.

The points of these two (2) times is used in the following formulae to calculate the points awarded:

- ✓ **Points = 100 / (Avg. of Team's 2 Race Times)**

  e.g Reaction Race 1 = 1.02s

  Reaction Race 2 = 1.05s

  100 / ((1.02 + 1.05) /2) = 96.61 (round off to 2 decimal point)
- ✓ A deduction of 5 points will be made for any teams did not finish (DNF) reaction race result.

Track, tether line and timing system information

The F1 in Schools™ Elevated Race Track, as manufactured by Pitsco Inc., will be used. The official length of the track, from start line to finish, is 20 metres. A

monofilament tether line of diameter 0.6mm, fixed at the start end, passes down the centre of each lane. At the finish end the line passes through 90 degrees over a single pulley then attached to a 1.0kg mass suspended above the floor.

Launch / Timing System – The F1 in Schools™ F1 Race System will be used for launching cars and timing races and driver reaction times to 1/1000th of a second.

Deceleration system

- The deceleration system acts to bring cars to rest once crossing the finish line. F1 in Schools SG will provide a standard race car deceleration system, consisting of two towels positioned behind the finish line of each lane.
- Teams may supply their own deceleration system and the team will be responsible for its management. Any system supplied by a team must be simple to setup and must not impede the opposing track lane, race car or the race schedule in any way. The Judges, at their discretion, can rule any system supplied by a team to be inappropriate and revert to use of the standard deceleration system.
- Deceleration systems must be located a minimum of 25mm after the finish line.

CO2 Race cylinders

CO2 cylinders to be used for all SG competition races will be supplied by F1 in Schools SG. Each CO2 cylinder will be separately weighed before competition to ensure that all CO2 cylinders used for races are within a weight range of 0.5 grams. All race cylinders will be kept in a temperature controlled environment of 21 degrees Celsius.

Car weight

There is a weight limit for the both Car Classes therefore a special consideration for the durability and safety of the car should be made to ensure your race car completes two races as a minimum.

DNF (Did not Finish) race results

Damage or part separation occurring during a race, before the car crosses the finish line, (e.g. wheel or any other part of the car separating), or car not crossing the finish line at all, effects in a DNF race result. The Judges may refer to video evidence to verify a DNF result.

False starts

A false start (jump start) occurs when the driver depresses the trigger button before the 5 start gate lights have extinguished. This will be signalled with the outer red light above a lane illuminating.

All false starts will incur a **5 point penalty** and by default forfeit that race.

Judges handling cars

The race Judges will not be required to comply with any special car handling requests made of them by teams. This includes use of any special gloves or tools.

ARTICLE 9 – CAR REPAIRS AND CAR SERVICING

Car repairs

- All damage issues and related repair work during racing is at the Judge's discretion and may be referred to the scrutinizing Judges and/or Chair of Judges for a final decision.
- No items can be removed or added to a car during racing, other than CO2 cylinders, except in the case of a repair.
- If the primary race car sustains damage during racing and this damage is ruled to be related to engineering deficiencies, the back-up race car will be reverted to immediately for races remaining in the current race event. **This will incur a single 15 pt penalty**, applied against the teams score for this race event. The primary race car can later be repaired in any car service time that may follow. If then ruled as safe by the Judges, the team may use the primary race car for further races.
- Team members will be allowed to make 'trackside' repairs to the damaged car as racing continues.
- If the back-up car is damaged the repaired primary car will be reverted to and another 5 pt penalty will be applied.
- The Judges may choose to suspend racing in order that repairs can be made.
- If the Judges rule that damaged sustained was not due to engineering deficiencies, immediate repairs or revert to back-up car will be permitted without penalty.
- No penalty is applied for damage incurred during knock-out racing or a team's final race of any race event.

ARTICLE 10 – PROTESTS

Submitting a protest

Any protest issues must be submitted by the team manager to an Event Director, who will register this and immediately lodge it with the Chair of Judges. This must occur by the date and time stated in the event supplementary regulations or during event registration. All protests must be lodged in writing via the official protest form available from the Event Directors. The Chair of Judges decision related to any protest is final.

Unsuccessful protests

Teams should carefully consider their grounds for submitting a protest or appeal. Any protest or appeal that is unsuccessful, with the Judges initial decision remaining unchanged, will result in the team having a 15 point penalty applied against their total score.

ARTICLE 11 – JUDGES

Overview

There will be six (6) teams of Judges that form the entire Judging panel. Each judging team will have one Judge appointed as the Lead Judge. Judges are normally STEM Ambassadors and other education and industry experts invited by F1 in Schools Pte Ltd. All Judges sign a 'declaration' to ensure there are no conflicts of interest with respect to Judges and the teams they are judging.

Chair of Judges

An independent authority appointed by F1 in Schools SG to oversees all Judging procedures. The Chair of Judges will determine the final judging decision where a protest has been submitted or other judging issue needs resolution. The Chair of Judges will also preside over a meeting of all lead Judges to ratify the final results along with nominations and winners for relevant awards.

The judging teams

a. Specification Judges - will scrutinise each primary and back-up race car with respect to the F1 in Schools SG Technical Regulations.
b. Engineering Judges - The Engineering Judges will be assessing each team's use of CAD/CAM, CNC technologies and quality of manufacture. They will be nominating team's deserving the Best Engineered Car Award.
c. Verbal presentation Judges – will assess each team as per the verbal presentation scorecard. They will also be nominating team's deserving of the Innovative Thinking Award.
d. Portfolio and display Judges – will assess each team as per the portfolio and display scorecard. They will also be nominating team's deserving of the Best Team Sponsorship and Marketing Award.
e. Race Judges – will oversee and rule on all race events and any incidents. This will determine the Fastest Car Award.

Judging Decisions

The decision of the judges is final.

ARTICLE 12 - AWARDS

Awards Celebration

The F1 in Schools Singapore National Schools Final awards will be presented at an awards ceremony at the end of each event.

List of awards to be presented

Every school will be awarded Gold, Silver or Certificate of Participation according to their overall performance during the race.

This list may be amended at the discretion of F1 in Schools SG.

- **1st Place -** The team which achieves the highest total score in the individual Class.
- **Fastest Car Award -** This will be awarded to the team that achieves the fastest 'car race time' recorded during the time trial and reaction racing events.
- **Best Engineered Car Award -** This will be awarded to the team that scores the highest score from the Engineering judging
- **Team Sponsorship and Marketing Award -** At the Judge's discretion, this will be awarded to the team with the best marketing and sponsorship related project content.
- **Team Identity Award -** At the Judge's discretion, awarded to the team with the best overall identity.
- **Best Pit Display -** At the Judge's discretion, this award will be presented to the team that displays the most unique / clever feature or idea aesthetically and informative that impresses the judges.
- **Best Use of R&D -** This is awarded to the team which can demonstrate excellence, leadership and innovation in the application of Research and Development to the design, concept, technology or materials.
- **Best Verbal Presentation –** This is awarded to the team that impresses with the best verbal presentation.