THE FORMULA ONE™ TECHNOLOGY CHALLENGE

2015 Technical Regulations

Competitive Category

Bloodhound SSC Class Categories

Secondary Competitive

F1 Class Category

Secondary Competitive

F1 in Schools - 2015 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 kennethtan@f1inschools.com.sg

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Bloodhound SSC CLASS

The Bloodhound SSC project aims to break the world Land Speed Record, recorded by achieving 1000 mph or Mach 1.4. It is an iconic engineering adventure that will push our science and engineering knowledge beyond current boundaries.

It's number one aim however, is to inspire more young people to take up exciting careers in Science and Engineering.

A SSC is a Super Sonic Car that is a car which travels faster than the speed of sound and in Bloodhound's case, faster than a bullet.

The F1 in Schools Bloodhound SSC category is built around speed and aerodynamic with just one key design rule stating that the vehicle must have a minimum of four wheels.

The Land Speed Record is currently held by Thrust SSC which stands at 763.035 mph.

All information about Bloodhound SSC will be shared with schools and colleges across the UK, including research, design, build, test and the problems they encounter. Ensure your school is registered to receive posters and email updates by visiting **www.BLOODHOUNDSSC.com**

BLOODHOUND SSC CLASS TECHNICAL REGULATIONS

All cars must comply with the following minimum and maximum dimensions (all dimensions stated in millimetres, mm)		
Description	**Min**	**Max**
T1. ASSEMBLED CAR BODY DIMENSIONS ➢ Length (measured between front and rear extremities of assembled car body) ➢ Weight of assembled car ➢ Minimum cross sectional area of 175mm2 between the axles. This area should be solid(i.e. no holes/intrusions) and must be clearly identified on the drawing. This is a critical safety rule!	170mm 45g	290mm
T2. WHEELS ➢ All cars must have a minimum of **4 wheels**, two at the front and two at the rear. ➢ All four wheels must rotate freely about their own centre axis to facilitate motion of the car during racing. The scrutineering judge must be able to validate this with reasonably minimal effort. Wheel systems designed to impede free rotation during racing may be deemed as unsafe due to risk of damage to the track surface. ➢ All 4 wheels should touch the racing surface at all times. ➢ A Team may manufacture their own wheels as long as they comply with this specification. ➢ Front wheels are permitted to be enclosed within the body of the car.		
T3. POWER PLANT ➢ Cartridge Chamber Diameter ➢ Lowest point of chamber to track surface ➢ Depth of Chamber ➢ Wall thickness	19mm 22.5mm 50mm 3.5mm	20mm 40mm 60mm -
T4. TETHER GUIDES ➢ Each car must have **2 tether guides** firmly secured at the front and rear of the car body, running along the car body base centre line. The tether line guide must pass through the two tether guides. ➢ Each tether guide must not make contact with the racing surface. Teams are allowed to use their own tether guides provided the dimensions of the guide has been adhere to. ➢ It is permissible for use of glue in securing tether guides. ➢ Teams must make sure that the tether guide holes are tightly closed to prevent the string from slipping out of the tether guides. This should be done prior to registration at the event. ➢ Inside diameter of tether guide ➢ Guide separation, the shortest distance between inside edges of the guides, measured parallel to the track surface and vertical reference plane	3mm 150mm	5mm 270mm
T5. CAR BODY ➢ No add-ons, such as body strengtheners, fenders, plastic canopies, exhausts or airfoils should be		

attached or enclosed within the car body. Any add-ons will result in disqualification.

- The car body should be made from one whole piece of balsa wood. Two or more, like or unlike, pieces of balsa wood or any other material will not be considered one piece.
- Designs will be tested and examined for any hidden implants within the car body/wheels. Any implants will result in disqualification.
- Must include a **team logo** of size greater or equal to **30 mm by 15 mm** on the assembled racer. Team logo must be clearly visible when viewed from the top or the side or the front of the racer.
- All cars must clearly display both a F1 in Schools logo in a prominent location.
- Parts that are of the wheel assemblies (eg axle, axle bushes, wheels and etc) can be adhered to the racer body.
- Primers, fillers & paint are permissible.

T6. REPAIR & MAINTENANCE

- No repair or maintenance is to be carried out after the vehicle has been registered without the permission of F1 in Schools staff.
- If any entry becomes damaged during the event, teams will be allowed to use their spare car, as long as the judges have determined that the spare is identical to the original. In the unlikely event that the second car becomes damaged, the entry will be evaluated by the event coordinator, who will make a ruling as to whether or not the team will be allowed to repair the vehicle. This is the only reason a team should be allowed to tamper with their car after registration.
- Wheels that come off during the race may be replaced as determined by the race coordinator.
- Damaged wheels may only be replaced with the permission of the event coordinator.

BLOODHOUND SSC CLASS SPECIFICATION SCORE CARD

Team Name:	**Team No:**
School Name:	
Designed using (CAD):	
Manufactured Using (CNC):	

All measurements are in millimetres / Tolerances: Dimensions ±0.1mm

No.	Detail	Measurement/Value	
ASSEMBLED CAR BODY DIMENSIONS		Race	~~Spare~~
1	Assembled Car Body Length – Min:170mm / Max:290mm		
2	Minimum cross sectional area - 175mm^2		
3	Assembled Car Body Width		
WHEELS			
3	Minimum of 4 wheels (two at the front, two at the rear)		
4	All 4 wheels must rotate		
5	All 4 wheels should touch the racing surface at all times		
POWER PLANT			
6	Wall thickness around chamber – Min: 3.5mm		
7	CO2 Cartridge Chamber Diameter		
8	Lowest Point of Chamber to track surface – Min: 22.5mm / Max: 40mm		
9	Depth of chamber – Min: 50mm / Max: 60mm		
TETHER LINE GUIDES			
7	Inside diameter of screw eyes **– Min: 3mm / Max: 5mm**		
8	Distance Apart – Min: 150mm / Max: 270mm		
ASSEMBLED CAR BODY			
9	Weight of Assembled Car Body - *Min: 45.0grams*		
10	No add-ons, inserts or voids		
11	Body made from one whole piece of balsa wood		
12	No hidden implants		
13	F1 in schools logo sticker		
	Total Deductions (10 points per infringement per race car)		
	Points Available		
	Grand Total		

For clarification on individual rules please refer to the published rules & regulations.

F1 CLASS

This is also referred to as 'the car'. Designed and manufactured according to these regulations for the purpose of participating in races on the F1 in Schools™ track at the World Finals event. Powered only by a single gas cylinder containing 8 grams of pressurised CO^2. F1 in Schools cars are designed to travel the 20 metre race distance as quickly as possible, whilst withstanding the forces of launch acceleration, track traversing and physical deceleration after crossing the finishing line.

An F1 in Schools car assembly must only consist of the following components:

- A body (which includes virtual cargo)
- A CO2 cylinder chamber
- A front wing
- A rear wing
- Wing support structures
- A nose cone
- Wheels
- Wheel support systems
- A tether line slot
- Tether line guides
- Surface finish and decals
- Adhesives with no dimensional impact are permissible for joining components

For clarification on individual rules please refer to the published rules & regulations.

ARTICLE T1

T1.2 Fully assembled car

An F1 in Schools car, without a CO2 cylinder inserted, presented ready for racing, resting on the track surface, free of any external force other than gravity.

T1.3 Body

The body consists only of balsa wood and is manufactured using one or more CNC machining processes. The body encompasses a virtual cargo and bounds the CO2 cylinder chamber and tether line slot. Whilst the balsa wood material may continue to the very front of the car, it is not defined as body forward of the front axle centre line. For dimensional purposes the body also includes any attached decals and surface finishes.

T1.4 CO2 cylinder chamber

A circular cylinder of clear space bounded along its side and one end by car body only. This is where the CO2 gas cylinder is placed for racing.

T1.5 Wing

A wing on an F1 in Schools car is an aerodynamic feature that permits airflow around ALL of its surfaces including its features of a leading and trailing edge. A wing is dimensionally defined by the maximum and minimum span, chord and thickness. The vertical cross-sectional shape of the wing, parallel to the direction of car travel, is referred to as an aerofoil. The following diagram assists with describing relevant aerofoil features.

Wing cross-section / aerofoil nomenclature

T1.6 Wing support structure

It is a non-metallic feature, other than wing, car body or nose cone that is joined to a wing surface and may join the wing to any other part of the car assembly.

Rear Wing Support Structures

Front Wing Support Structure

T1.7 Nose cone

The nose cone is a component of the car, other than wheel, wheel support system, wing or wing support structure, that exists forward of the front axle centre line. This includes any balsa wood material that continues forward from the body.

T1.8 Wheel

A wheel is a single part or assembly of components, cylindrical in form, with its maximum circumference contacting the track surface, facilitating motion of the car through rotation. All material existing within the volume of the extreme diameter and width is considered to be part of the wheel.

T1.9 Wheel support system

Wheel support systems are single parts or an assembly of components that connect a wheel to any other part of the car. These may consist of a combination of manufactured or commercial parts. I.e. Bearings, bushes and axles could be used.

T1.10 Tether line slot

The tether line slot is a rectangular prism of clear space that is bounded by car body on three sides of its length.

T1.11 Tether line guide

A tether line guide is a key safety component which completely surrounds the track tether line so as to safely connect the car to the tether line during races. A tether line guide can be a component sourced from a supplier or manufactured wholly or in part by the team.

T1.12 Surface finish and decals

A paint finish on an F1 in Schools car is considered to be any visible surface covering on any component of the car. A decal is thin material adhered to a component or paint finish surface. To be defined as a decal, 100% of the adhering side must be attached to a surface.

T1.13 F1 in Schools™ logo decal

The official F1 in Schools™ logo decal consists of the F1 in Schools™ logo graphic printed on either black or white adhesive vinyl with a horizontal dimension of 30mm and vertical dimension of 15mm. Teams choose whether to use black or white background decals. A team must manufacture their own decals, in the correct size, color and graphic design.

Decal design with white background

T1.14 Hand finishing

Hand finishing is defined as use of a hand powered device (e.g. abrasive paper) for removing only the irregularities that may remain on a CNC machined surface of the car body. These irregularities are often referred to as ‘scalloping marks’.

T1.15 Vertical reference plane

To assist with describing dimensions, it is assumed that an invisible plane exists two dimensional along the length of the CO2 cylinder chamber centre axis and perpendicular to the track surface. This is known as the vertical reference plane.

T1.16 Official balsa wood blank

The official balsa wood blank is a homogenous piece of forested balsa wood, processed to the dimensional features as shown by diagrams in the appendix of this document.

ARTICLE T2 – FULLY ASSEMBLED CAR

T2.1 Design, manufacture and construction

T2.1.1 Design - All F1 in Schools™ cars must be designed and engineered using CAD (Computer Aided Design) and CAM (Computer Aided Manufacture) technology. CAD software used should provide for 3D part modeling, assembly and 3D realistic rendering. We recommend teams use Autodesk software. The CAM package should allow students to simulate CNC machining processes so they can show evidence of these in their portfolio. We recommend the use of DENFORD QuickCAM PRO software.

T2.1.2 Manufacture - The body of all F1 in Schools™ cars must be manufactured via material removal using a CNC router/ milling machine. We recommend all teams use a DENFORD CNC router. This manufacturing process should occur at your school / college or at a designated manufacturing centre/partner site.

T2.1.3 Hand finishing of the car body is permitted. Refer ARTICLE 1.14

T2.1.4 Paint finish - Each car body should feature a high quality paint finish.

T2.1.5 The primary and back-up race cars must have identically designed components.

T2.2 Undefined features

The car assembly must only consist of components listed in ARTICLE 1.1.

T2.3 Overall length

This is measured parallel to the track surface and vertical reference plane, between the front and rear extremities of the assembled car.

Min: 170mm / Max: 210mm

T2.4 Overall width

T2.4.1 Maximum assembled car width, measured normal to the vertical reference plane, between the outside edges of the widest feature of the car assembly.

Max: 85mm

T2.4.1 Minimum assembled car width, measured normal to the vertical reference plane, between outside edges of the front or rear wheels, whichever is widest.

Min: 60mm

T2.5 Overall height

Maximum assembled car height, measured normal to the track surface.

Max: 60mm.

T2.6 Total Weight

Total weight is the weight of the car excluding a CO2 gas cylinder. If ruled underweight, ballast will be added before racing, at 2 grams for every gram under weight.

Min: 55.0grams.

T2.7 Body to track distance

Measured normal from the track surface to any part of the underside of the car body that exists between the front and rear axle centre lines, no part can be 'lower' than the minimum or 'higher' then the maximum.

Min: 2mm / Max: 15mm

T2.8 Status during racing

The car assembly must be designed so that no items other than CO2 cylinders are removed, replaced or added to the assembly during scheduled racing sessions.

ARTICLE T3 – BODY

T3.1 Body construction

The car body must be CNC machined from a single official balsa blank.

T3.2 Implants and voids

No implants or hidden voids are permitted in the car body

T3.3 Virtual cargo

The car body must encompass a virtual cargo measuring a minimum of 60mm x 40mm x 8mm to be wholly positioned between the front and rear axle centre lines. When viewed from the front the virtual cargo must be 40mm wide. The location of the virtual cargo should be identified on the orthographic drawing submitted within the design portfolio.

T3.3.1 Exclusion Zones

When viewed from the top, car body must not exist within a volume 15mm immediately rear of either front wheel. The volume width is equal to the wheel width, and height from track surface is equal to the wheel diameter. This is measured in the top view, parallel to the vertical reference plane and track surface.

T3.4 Body thickness

T3.4.1 No part of the body is allowed to be less than 3mm thick.

T3.5 F1 in Schools™ logo decal location

A surface of car body measuring no less than 30mm wide x 15 mm high must be visible in each side elevation, between the front and rear wheels AND OUTSIDE of the virtual cargo WIDTH, The F1 in Schools™ logo decal must be located within this area before cars are submitted.

ARTICLE T4 -CO2 CYLINDER CHAMBER

T4.1 Diameter

CO2 cylinder chamber diameter, measured at any point through its depth.

Min: 19.5mm +/-0.5mm

T4.2 Distance from track surface

Lowest point of the chamber opening to the track surface, measured normal to the track surface.

Min: 20mm / Max: 30mm

T4.3 Depth

Depth of chamber measured parallel to the vertical reference plane anywhere around the chamber circumference from opening to chamber end.

Min: 50mm / Max: 60mm

SECTION A-A

T4.4 Thickness of chamber surrounds

The CO2 cylinder chamber must be surrounded by balsa wood only. Chamber surrounds below the minimum thickness may be considered a safety issue, refer ARTICLE 2.4. Thickness is measured through any line of the chamber radius. The entire circumference and length of the cartridge chamber must not be punctured by any object.

T4.5 Finishing of chamber surrounds

The inside surface must be free of any paint finish or decals.

ARTICLE T5 – TETHER LINE SLOT

T5.1 Location

A tether line slot is an **optional** feature, free in length and location. The official balsa wood features a standard slot machined along the cener of its underside as shown below.

ARTICLE T6 – TETHER LINE GUIDES

T6.1 Location

Each car must have two (2) tether line guides firmly secured, one toward the front and one toward the rear of the car. The tether line must pass through both tether line guides during racing.

T6.2 Track clearance

As part of the fully assembled car, the tether line guides must not make contact with the racing surface.

T6.3 Diameter

Referring to the hole within the guide which the tether line passes through, diameter.

Min: 3.5mm / Max: 5mm

T6.4 Guide separation

The shortest distance between the inside edges of the guides, measured parallel to the track surface and vertical reference plane.

Min: 120mm / Max: 190mm

T6.5 Tether line guide safety

Guide holes must be completely closed to prevent the tether line from slipping out during racing. The construction of the tether line guides must be robust so as to prevent the diameter or shape changing during racing,

ARTICLE T7 – WHEELS

T7.1 Number and location

The car assembly must include 4 cylindrical wheels, two at the front and two at the rear. Opposing wheels must share a common centre axis.

T7.1.1 Distance between opposing wheels

The innermost distance between THE TWO opposing wheels which are the FURTHEST APART. Measured parallel to the track surface.
Min: 30 mm

T7.2 Diameter

Wheel diameter measured to the rolling surface.

Min: 26mm / Max: 34mm (Tolerance is +/- 0.1mm)

T7.3 Width

Wheel width measured along the rolling surface contact line.

Min: 15mm / Max: 19mm (Tolerance is +/- 0.1mm)

T7.4 Visibility

The wheels are not allowed to be inside the car body and the wheel view cannot be obscured in any way, in the car top and side elevation views.

T7.4.1

Visibility from top, bottom side

The wheel view cannot be obscured in any way, by any component of the car, in the car's top, bottom and side elevation views. A 1mm +/- 0.5mm exclusion zone must be present and in the top view, the track surface must be visible immediately in front and behind the wheel width. View of all wheels not obstructed in the top or side views

T7.4.2 Visibility in front view

Visibility of the front wheels in the car's front view may only be obstructed to height of 15mm from the track surface

T7.5 Race track contact

All 4 wheels must touch the racing surface at the same time across the full width of the wheel, assuming a tolerance of +/-0.1mm

T7.6 Rolling surface

The wheel diameter must be consistent across the whole rolling surface.

T7.7 Wheel support systems

Wheel support systems may only exist within the cylindrical volume generated through the maximum diameter of two opposing wheels.

T7.8 Rotation

The track contact surface of all four wheels must rotate freely about their own centre axis to facilitate motion of the car during racing. The scrutineering judge must be able to validate this with reasonably minimal effort. Wheel systems designed to impede free rotation during racing may be deemed as unsafe due to risk of damage to the track surface.

ARTICLE T8 – NOSE CONE

T8.1 Construction

The nose cone can be manufactured from any non-metallic material

ARTICLE T9 – WING AND WING SUPPORT STRUCTURE

T9.1 Description and placement

The design of the car should resemble an actual F1 car through the inclusion of a wing on the front nose of the car and a wing at the rear of the car. Each wing must have a leading edge and a trailing edge. Refer to definition at ARTICLE 1.5.

T9.2 Construction

The front wing, rear wing and any support structures may be manufactured separate non-metallic material. The wing chord and span dimensions must remain unchanged during races. I.e. Wings must be rigid, ruled at the Judge's discretion.

T9.3 Clear airflow

A wing surface must have a minimum of 3mm of clear 'air' space completely surrounding it, measured normal to the wing surface to any other part of the car.

Example of 3mm clear airflow around wing surface.
Rear wing cross-section.

Example of 3mm clear airflow around wing surface
Front wing cross-section

T9.4 Rear wing location

The whole of the rear wing and any support structure must be behind the centre line of the rear wheel when viewed in the side elevation.

T9.5 Rear wing height

The bottom surface of the rear wing must be higher than 34mm when measured from and normal to the track surface.

T9.6 Front wing location

The whole of the front wing and any support structure must be in front of the centre line of the front wheel when viewed in the side elevation.

T9.7 Visibility of front wing

Visibility of the front wing must not be obstructed by any other component when viewed in the front elevation.

T9.8 Identification method for scrutineering

To assist with scrutineering - the surfaces defining both the front and rear wings MUST either be identified clearly on the orthogonal drawing submitted for specification judging, OR painted in a different colour from the rest of the surrounding car.

T9.9 Front and rear wing span

Where the wing span is intersected by another part of the car, the total span is the sum of each segment. The wing span is measured on the top or bottom surface of the wing, whichever is shortest, parallel to track surface and normal to the vertical reference plane.

T9.9.1 Front wing span - Min: 40mm (Tolerance is +/- 0.1mm)
T9.9.2 Rear wing span - Min 40mm (Tolerance is +/- 0.1mm)
T9.9.2 - Minimum Rear wing span = E+G
T9.10 - E and G each measure at least 20mm
T9.9.1 - Minimum Front wing span = A+B
T9.10 - A and B each measure at least 20mm

T9.10 Span segments

The span of a wing can be intersected by the car body, nose cone or wing support structure to form span segments. All span segments must conform to the wing chord and thickness regulations. At least two (2) of the segments must be of the minimum size.

Min segment size: 20mm

Wing Span Calculations

Minimum front wing span = A+B or C+D
Minimum rear wing span = E+G
Segments A, B, C, D, E & G must each
measure at least 20mm. If a segment is less 20mm than it cannot be included in the span calculation
If C, D or F were less than 20mm, they would then be
defined as wing support structure.

T9.11 Front and rear wing chord

The wing chord minimum and maximum dimensions must exist within the minimum span dimensions of a wing. The chord is the distance between the leading edge and trailing edge measured parallel to the vertical reference plane.

T9.11.1 Front wing chord -Min: 15mm / Max: 25mm (Tolerance is +/- 0.1mm)
T9.11.2 Rear wing chord – Min 15mm / Max 25mm (Tolerance is +/- 0.1mm)

X = Rear wing chord

Y = Front wing chord

T9.12 Front and rear wing thickness

The wing thickness minimum and maximum dimensions must exist throughout the wings minimum span, measured perpendicular to the chord line.

T9.12.1 Front wing thickness - Min: 1.5mm / Max: 6mm (Tolerance is +/- 0.1mm)
T9.12.2 Rear wing thickness - Min 1.5mm / Max 6mm (Tolerance is +/- 0.1mm)

Rear wing thickness

Front wing thickness

F1 CLASS SPECIFICATION SCORE CARD

Team Name:	**Team No:**
School Name:	
Designed using (CAD):	
Manufactured Using (CNC):	

All measurements are in millimetres / Tolerances: Dimensions ±0.1mm
Car 1 = Primary race car | Car 2 = Back-up race car.

No	Regulation Overview	Penalty per Car	Pass or Fail	Score
			Car 1	
FULLY ASSEMBLED CAR				
1	Designed and engineered using CAD / CAM	NA		
2	Body manufactured using CNC only.	NA		
3	Hand finishing as per definition.	NA		
5	Undefined features	-12		
6	Overall length – Min: 170mm / Max: 210mm	-12		
7	Overall width –Max: 85mm	-12		
9	Total weight – Min: 55.0grams	-12		
10	Body to track distance – Min: 2mm / Max: 15mm	-6		
11	Car status during races	-12		
BODY				
12	Body construction	-12		
13	Implants and voids	-12		
14	Virtual cargo – Min: 40mm x 60mm x 8mm	-12		
	Exclusion Zones	-12		
15	Body thickness – Min: 3mm	-6		
17	F1 in Schools™ logo decal	-12		
CO2 CYLINDER CHAMBER				
18	Diameter – Min: 19.5mm +/- 0.5mm	-6		
19	Distance from track surface – Min: 20/Max: 30mm	-3		
20	Depth – Min: 50mm / Max: 60mm	-3		
21	Thickness of chamber surrounds - Min:3.5mm	-6		
22	Finishing of chamber surrounds	-3		
TETHER LINE GUIDES				
25	Location	-12		
26	Track clearance	-6		
27	Diameter – Min: 3.5mm / Max: 5mm	-3		

28	Guide separation – Min: 120mm / Max: 190mm	-3		
29	Tether line guide safety	-6		
WHEELS				
30	Number and location	-12		
	Distance between opposing wheels: Min 30mm			
31	Diameter – Min: 26mm / Max: 34mm	-12		
32	Width – Min: 15mm / Max: 19mm	-12		
33	Visibility from top and bottom side	-12		
	Visibility in front view			
34	Race track contact	-3		
35	Rolling surface consistency	-6		
36	Wheel support systems	-6		
	Rotation			
NOSE CONE				
37	Construction	-12		
WING AND WING SUPPORT STRUCTURE				
38	Description and placement	-12		
39	Construction and Rigidity	-12		
40	Clear airflow – Min: 3mm	-12		
41	Rear wing location	-12		
42	Rear wing height	-12		
43	Front wing location	-12		
44	Visibility of front wing	-6		
45	Wing Identification	-6		
46	Front wing span – Min: 40mm / Max: 65mm	-6		
47	Rear wing span – Min: 40mm/Max: 65mm	-6		
48	Span segments	-6		
49	Front wing chord – Min: 15mm / Max: 25mm	-3		
50	Rear wing chord – Min: 15mm / Max: 25mm	-3		
51	Front wing thickness – Min: 1.5mm / Max: 6mm	-3		
52	Rear wing thickness – Min: 1.5mm / Max: 6mm	-3		
		Total Deductions		

PORTFOLIO & PIT DISPLAY SCORE CARD

Team Number: **Team Name:**

PORTFOLIO ONLY ASSESSMENT ITEMS				
Project Management	Little evidence of project management presented.	Simple management and planning used to guide progress. A range of project resources identified.	Comprehensive project management. A range of factors considered; e.g. scope, time, resources and project risks. Plan changes discussed	
	1 2 3 4 5 6 7	8 9 10 11 12 13 14 15 16 17 18	19 20 21 22 23 24 25 26 27 28 29 30	
Team Work	Limited team work evident.	Evidence of effective team work with roles defined	Highly structured team with clear roles. All team members had effective and critical contributions. Role interactions recognised	
	1 2 3 4 5 6 7	8 9 10 11 12 13 14 15 16 17 18	19 20 21 22 23 24 25 26 27 28 29 30	
Portfolio Clarity & Quality	Difficult to follow with basic presentation standard.	Clear structure, well organised. Good use of ICT's enhancing presentation and impact.	High impact and professional throughout. Consistent and clear organisation. Excellent use of ICT's to enhance presentation	
	1 2 3 4 5 6 7	8 9 10 11 12 13 14 15 16 17 18	19 20 21 22 23 24 25 26 27 28 29 30	
			Portfolio Total	/ 90

MARKETING & PIT DISPLAY ASSESSMENT				
Team Identity	Inconsistent, limited or obscure identity	Effective team identity consistent through various project components..	Excellent and highly effective team identity. Team 'brand' consistently applied through all project elements.	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Marketing	Limited or irrelevant	Some marketing activity / sponsorship explained	Creative and effective activities linked to sponsorship & sponsor 'return on investment' (ROI)	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Pit Display	Repetition of folio elements	Clear and effective presentation and messaging. ICT's used to enhance presentation	Clean, well-organised with high impact. Highly professional with attention to detail. Excellent integration of technology and ICT's	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
			Pit Display & Marketing Total	/ 60

PORTFOLIO & PIT DISPLAY SCORE CARD

F1 CAR DESIGN PROCESS – PRESENTED IN PORTFOLIO OR DISPLAY				
Ideas	Little evidence of project management presented.	Simple management and planning used to guide progress. A range of project resources identified.	Comprehensive project management. A range of factors considered; e.g. scope, time, resources and project risks. Plan changes discussed	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Development	Limited team work evident.	Evidence of effective team work with roles defined	Highly structured team with clear roles. All team members had effective and critical contributions. Role interactions recognised	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Testing	Difficult to follow with basic presentation standard.	Clear structure, well organised. Good use of ICT's enhancing presentation and impact.	High impact and professional throughout. Consistent and clear organisation. Excellent use of ICT's to enhance presentation	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Evaluation	Inconsistent, limited or obscure identity	Effective team identity consistent through various project components.	Excellent and highly effective team identity. Team 'brand' consistently applied through all project elements.	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
			F1 Car Design Process Total	/ 60

Portfolio + Pit Display & Marketing + F1 Car Design Process = Portfolio and Display Total = / 210

VERBAL PRESENTATION SCORE CARD

Team Number: **Team Name:**

PRESENTATION TECHNIQUE				
Visual Aids	Little use of aids.	Some aids used effectively	Highly professional aids effectively improve communication	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Team Contribution	Minimal team participation	Good contributions from most team members	Excellent team work with all members participating effectively	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Dynamic/Energy	Artificial and/or low energy	Speakers generally enthusiastic with lively delivery	Passionate with effective and appropriate levels of liveliness	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Engagement	Minimal engagement	Some audience connection at times	Audience fully engaged and excited throughout presentation	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
			Technique Total	/ 60

COMPOSITION OF THE PRESENTATION				
Concept Clarification	Several concepts lacked clarification	Clear and appropriate concept explanations	Everything presented was understood through excellent explanations	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Use of Time	Too fast or ran out of time	Good timing. Balanced topic depth and pace	Ran on time or under. Excellent balance of depth for each topic	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Presentation Structure	No structure presented	A basic structure / outline provided and could be followed by audience	Clear presentation outline / overview. Excellent connections between topics and easy for audience to follow	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
			Composition Total	/ 60

IN SCHOOLS

VERBAL PRESENTATION SCORE CARD

SUBJECT MATTER / PRESENTATION CONTENT / TOPICS				
Innovation	Little innovation presented	Innovations described and justified	Originality. Clever innovations with high positive project impact	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Collaboration	Little collaboration discussed	Links with industry or higher education described	Collaborations justified with links to learning and project outcomes	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
F1 in Schools Learning Experience	No real reflections discussed	Good explanation of some learning outcomes	A range of personal, life-long learning and career skills acquired and identified as project outcomes for a range of team members	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
			Subject Matter Total	/ 60

Technique + Composition + Subject Matter = Verbal Presentation Total = / 180

ENGINEERING SCORE CARD

Team Number: **Team Name:**

COMPUTER AIDED DESIGN AND ANALYSIS				
Application of CAD-CAM	Basic application. Final design in CAD only	Appropriate use of CAD in product development stages. Good understanding of CAM evident	Advanced use of CAD and CAM technologies throughout. Final CAD identical to the physical model car produced	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Computer Aided Analysis	Minimal analysis shown	Good analysis. Results applied to development	Variety of advanced and relevant analysis techniques conducted	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Organisation	Generally unorganised	Satisfactory organisation of data and models	Data & parts highly ordered & linked. Full CAD product assembly	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
Orthographic & Rendering	Basic drawing & rendering	Good technical drawing and realistic rendering	High detail & includes spec dimensions. Photorealistic render	
	1 2 3	4 5 6 7 8	9 10 11 12 13 14 15	
			CAD & Analysis Total	/ 60

MANUFACTURING				
Quality of Finish and Assembly	Reasonable finish with some inconsistencies	Good overall finish quality and assembly with attention to detail	Showcase' finish quality on all components. Exceptional attention to detail across all assembly and finishing. Two cars are identical.	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Manufacturing discussed in portfolio	Little manufacturing details	Manufacturing processes and some issues	Detailed assessment of all manufacturing, stages, materials & issues	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
Use of CNC Machining	Minimal evidence of CNC understanding	Effective use and understanding of CNC machining processes used	High level of CNC machining competence. Appropriately complex techniques and processes used to achieve manufacturing goal	
	1 2 3 4	5 6 7 8 9 10 11	12 13 14 15 16 17 18 19 20	
			Manufacturing Total	/ 60

CAD & Analysis + Manufacturing = Engineering Judging Total = / 120

IN SCHOOLS