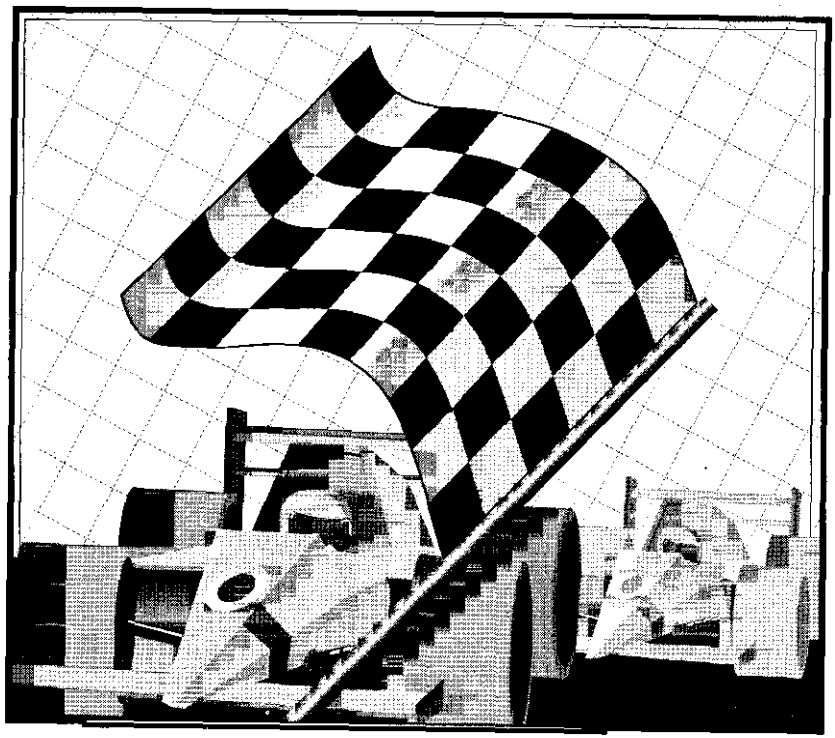
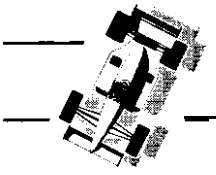
GRAND PRIX



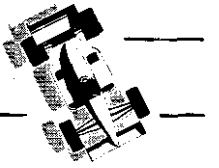
Game characteristics described in the documentation may very on some computers

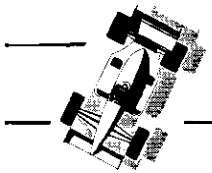
Unit 1, Hampton Road Industrial Estate, Tetbury, Gloucestershire GL8 8DA
Tel: 0666 504326 Fax: 0666 504331



CONTENTS

CONTENTS





SORTING THE MATERIALS

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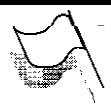


provides a Quickstart driving lesson for learners, including circuit diagrams, detailed operating instructions and background on modern Formula One Grand Prix racing. It is applicable to all computer systems.

THE TECHNICAL SUPPLEMENT

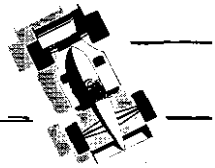
gives specific instructions for loading and/or installing the simulation for your computer. It also provides a complete reference of all the graphics and keys used in the game.

[redacted]

[redacted]

gives at-a-glance information for all keys used in the game. Designed to stand upright next to your computer screen.

OVERVIEW



MicroProse Formula One Grand Prix is a complete simulation of the full Championship Season. At the end of the 16 races there are two trophies to be won: the Drivers' and the Constructors' Championship.

It's always tough to win even one Grand Prix race and, at the highest level we think you'll find it very difficult. However, for the less experienced drivers we have included 5 levels of difficulty with 6 major driving aids that, when fully implemented, will leave you free to race the car on a previously defined ideal line. You can even choose to re-distribute the driving performance of all the other drivers.

You can win the Championship at the lowest level of difficulty but it will only he at the highest level that you will receive the ultimate accolade.

The major elements of the simulation are:

Quickstart Driving ***Tutorial***

A drive through of the Monza circuit for Rookies. The best way to get to grips with controlling the Fl car and to get to know the circuit.

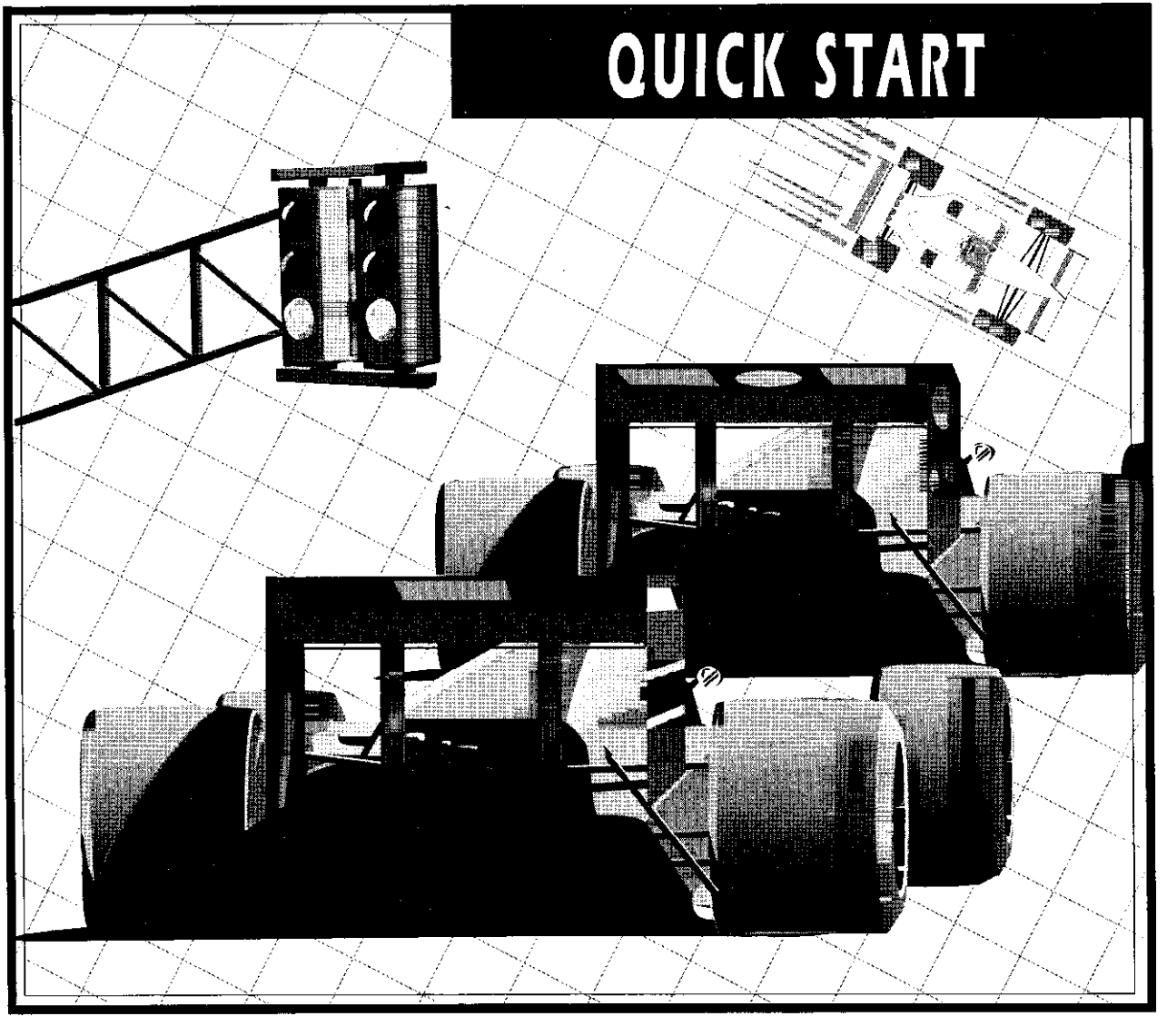
Cockpit and Car Controls

Understand and learn all cockpit controls until everything becomes second nature to you. Get used to looking in both mirrors and being aware of what is going on behind you.

Car Set-up

You must find out how your car behaves on each circuit with various set-ups for wings, tyres, brakes and gears. Don't be afraid to experiment! As you improve and hone your driving skills, you will appreciate the value of such things as the correct wing downforce.

QUICK START



JOYSTICK/KEYBOARD CONTROL

This manual will refer to the Accelerator, the Brake, Changing Gear and Steering. You will be able to control these functions by keyboard and joystick. Key K toggles Keyboard/Joystick mode. The simulation is initially in Joystick Mode; the recommended method.

If you have a Joystick fitted on your computer study diagram 1 opposite.

Joystick = Controller

Fire Button = Selector

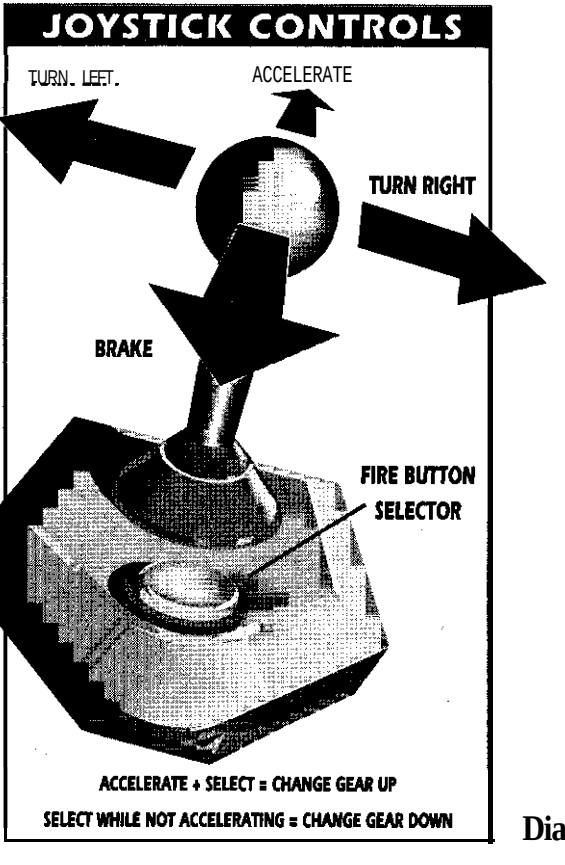
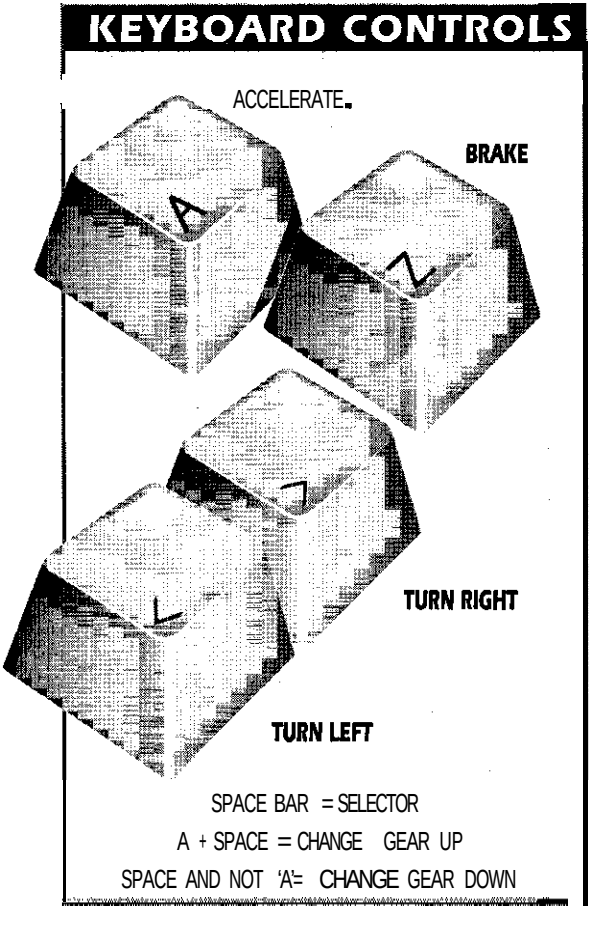


Diagram 1



If you are driving on keyboard study diagram 2 opposite.

A/Z = Controller-Accelerate/Brake

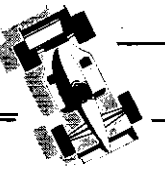
</> = Controller-steer Left/Steer Right

Spacebar= Selector

The simulation does not support mouse control, except during menu selection. The keyboard cursor keys can also be used to highlight menu options.

Diagram 2

QUICKSTART DRIVING INSTRUCTIONS



ONE LAP OF MONZA FOR ROOKIES

Loading

Install and/or load the simulation as explained in the Technical Supplement and follow any on-screen prompts until you see the Main Menu.

Choose Race Set-Up Options. Find Race Distance and reduce the figure to 10%. Find Level of Difficulty and select Rookie. Return to Main Menu.

Highlight the Driver Select Menu.

Select a driver and, if you wish, you may delete the name using the Backspace key and type in your own name. Press the Selector again. Then select 'Driver Selection Complete'.

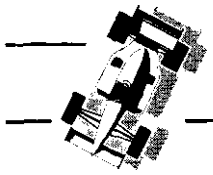
Highlight Practise any Circuit with your Controller and press the Selector.

Highlight the Circuit Select Menu.

Select Monza. You will see a view of the circuit. Choose Info. This gives you the Lap Records and Distance. Select OK.

You will now find yourself in the Pits at Monza, Italy.

Look at the cockpit controls. Accelerate with the Controller and listen to the engine noise.



QUICKSTART DRIVING INSTRUCTIONS

Press the Function keys Fl, F2, F3, F4, F5 and check that each Function key has illuminated 5 of the 6 symbols that appear on the dashboard panel. Each key turns on a driving aid to help you control the car. Do not press Function Key F6.

You will not need to worry about changing gear or braking. You may crash if you stray from the racing line, but you will not be damaged by any 'shunt'. If you spin off, the car will right itself, once it has come to rest. It will face the correct direction to continue the race.

Turn to page 90 in the manual. You will see a diagram of the track at Monza. Find the Start line then follow the circuit with your finger to the finish line. Keep a marker in the manual on this page.

Monza is an excellent circuit to practise on. It's fast with some good corners that let you get into a good driving rhythm. It has also got lots of open spaces where you can leave the track without crashing into concrete walls.

You are still in the Pits, on the jack. Press the Selector and when you have been lowered accelerate using your Controller. You will begin to move forward. If not then check that you have pressed Function Key F2 and that the symbol is lit on the display.

When you leave the pits you will join the circuit by driving to one side of a yellow dotted line. Once you are on the circuit the yellow line will disappear and you will see a white long dotted line; like the line that divides two-way traffic in a normal road. Try to line up the middle of the steering wheel with the dotted line as you move around the circuit. This is the best driving line; the ideal path to take so that you can go into bends at the fastest possible speed.

The first bend at Monza turns to the left then quickly to the right followed by another left and right. This is a double chicane called the *Variante Goodyear.*

If a joystick is being used, press 'Space' to pause the simulation. Otherwise, press P.

Find the ***Variante*** Goodyear on your manual map and also examine the following ***bend:*** the ***Curva Grande.***

Sow press the pause key again to re-start the game.

You should now see a white sign with a black arrow bending to the left. Then countdown markers signs: 200 and 100.

These signs tell you how many metres to go before the approaching left-hand bend.

Steer carefully around the chicane. Try to follow the dotted line, even though it sometimes appears to be aiming away from the track.

Continue along the short straight and steer around the long sweeping right-hander Curva ***Grande.*** You will find that you can drive through this comer quite fast.

Just after the blue bridge you will see another sign warning you of a right turn. Press the pause key to pause the game and have another look at the map in the manual.

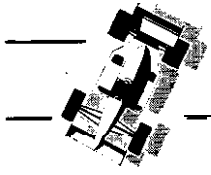
This is the Curva ***della*** Roggia: another chicane.

Look ahead on the map to the next 3 bends. Try to imagine what they will look like from your cockpit view.

Press the pause key to continue.

Steer through the chicane then carefully along the two right-hand curves. You will then see a long downhill straight.

Accelerate on the straight.



the indicator. When you are in Neutral, accelerate. The engine should rev and make a high pitched noise. The red indicator should move across the curved r.p.m. scale. Don't worry about damaging the engine.

Push the accelerator until the red band is around the 11 mark then press the Selector to change gear but *keep it pressed in.*

You should have changed into 1st gear; shown by the 1 on the gear change indicator. (If not then the Controller was not pressed forward when you pressed the Selector, try again). You will not be moving forward because you are holding the car on the clutch (the Selector pressed and held).

Now, with the Controller pressed forward, let the Selector go!

You will be moving forward. Listen to the change of tone in the engine noise. The mph indicator should show the speed you are travelling at.

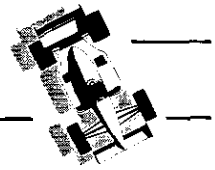
Accelerate again and watch the red power band get to about 12 on the dial, then change up again in the same way as before. The indicator will now show 2.

Try to change up to at least fourth gear.

Then try changing down to take a bend by taking note of the suggested gear indicator (the number in the blue circle). Note that it is not necessary to brake when changing down.

Gear changing is difficult to master even if you are a seasoned driver but try to experiment with the gear shift. You have six forward gears, Neutral, Power Turn (you can only change ***down*** into this gear) and Reverse.

When you are in Reverse you will see Ron the gear indicator. Accelerate with the Controller, just like in a real car, to move backwards.



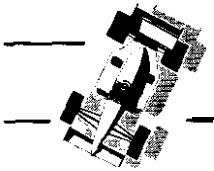
DRIVING INTO THE PITS

When you think you are familiar with the Monza circuit and the basic car controls, practise driving into The Pits. The Pits are where all repairs are carried out and where you are fitted with new tyres.

You will have noticed the Yellow Dotted Line just before the main grandstand straight. This is the line leading to the Pit Lane.

Drive a complete circuit, during which at any time, you may press 'Return' to inform your pit crew of your intention to stop. You will see the pit signal on your instrument panel light up in yellow. This enables you to enter the pit lane when you see the dotted line. Drive slowly into the Pit Lane. You may see several pit crews waiting. As you continue forward motion aim the car towards the Pit bays. The programme will direct you into the correct bay but you must brake just in front of the crewman directly ahead of you.

You will be jacked up and a sign placed in front of the car telling you to keep your brakes on. A selection of tyre types appears on the digital display but don't worry about this for now. Press the Selector and you will be jacked down. You can now drive away from the Pits, weave through the Pit lane, then carefully re-join the circuit.



QUICKSTART DRIVING INSTRUCTIONS

A TIMED PRACTICE/QUALIFYING SESSION

Press ESC to return to the Main Menu. Choose Non-Championship Race then Qualifying/Timed Practice. You will be placed back in the Pits, jacked up but this time you will have a monitor appear in front of your car. It will list drivers in the Qualifying session including yourself (highlighted). You will also see the Tyre choice display A B C D Q W.

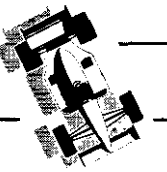
Q should be chosen but try to move the Controller left/right to see the effect. Then back to Q. You will be running on Qualifying Tyres. Good for about 3 fast laps. You have four sets for this session but you can use any other tyres if you so wish.

You are still in Rookie level. If you want to drive with Auto Gears, Auto Brakes or any other Driving Aids you can.

Press the Selector. The monitor will move out of the way and your car be jacked down.

Drive away from the Pits to the circuit then complete one lap. You will not be timed until you have passed the Start/Finish Line. Then you will see that the car timer has begun. Race around the circuit for 1 lap then, as you cross the line you lap time will be displayed. You *should* return to the pits now, but if you were held up for some reason there may be enough life left in your tyres for another fast lap. Don't push your luck too soon, unless you want to find out what it's like to drive on bald tyres!

Drive to your bay, wait to be jacked up. The monitor should reappear in front of you with various times from the other drivers in the Timed Practice session. The session lasts up to 2 hours. To speed up the time, Accelerate with the Controller. The other drivers times will appear very quickly. If you want to go out and beat a



particular fast time Accelerate with the Controller again to switch off Accelerated Time, then return to the circuit in the usual way. If you want to leave the session press Esc, but all non-selected drivers will complete at least 1 lap in Accelerated Time, before this is implemented.

When the Qualifying session is over, you will be shown the results. Select 'Continue' and you will be given the option of a Pre-Race Practice Session. Do not choose this but go straight to the race itself.

A NON-CHAMPIONSHIP RACE

You will find yourself on the Starting Grid at Monza with 25 other cars. If you have achieved a reasonable lap time you will be placed relative to the other drivers' performance. If you failed to get a time, got a bad time, or have just jumped in at this stage, then you will begin from the rear of the grid.

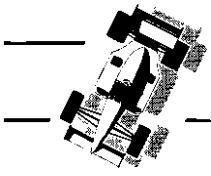
Wherever you are, you will see the starting gantry: a bank of 3 red lights and a bank of 3 green lights. None should be illuminated.

Wait for the red lights to come on. That is the warning that the start will take place within 4 to 7 seconds. Hold the car on the 'clutch' with 1st gear engaged (see earlier).

When the green lights come on, accelerate!

Try to keep out of trouble for the first bend until the cars sort themselves out.

Race around the circuit for the number of laps shown on the display but keep an eye on the Pits Indicator (bottom right in the cockpit). If it turns yellow you are being called by radio to go into the Pits to change tyres, or repair damage. Drive into



the Pits as soon as possible, you will lose performance if you don't change your tyres. The pit stop will be timed! If you do not wish to pit, inform the pit crew by pressing 'Return', which cancels the pit signal.

Complete the required number of laps. When the race is over you will lose power and then you will be shown the results screen. If you wish to retire early from the face then press 'ESC'. The race will then be completed for the other drivers in Accelerated Time.

QUICKSTART GUIDE TO WINNING THE WORLD CHAMPIONSHIP

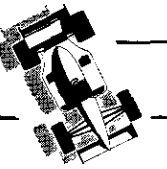
The other circuits

If you think you know Monza quite well, after following the Quickstart tutorial, then you must study all the other 15 tracks with equal intensity to win the World Championship. You can win the World Championship at the lowest level with all Driving Aids Fl to F6 turned on and the opposition at their lowest performance level but you *must know the courses like the back of your hand.*

Making use of the Driving Aids

You may find that you start the season off with all driving aids on but as you progress you might prefer to control your own brakes and gears. If you win a World Championship, you will only win at the lowest level. You cannot use any Driving Aids when competing at Ace level.

Probably the most difficult part of the simulation to master is the correct driving line. To win the Championship at Ace level you'll have to get used to

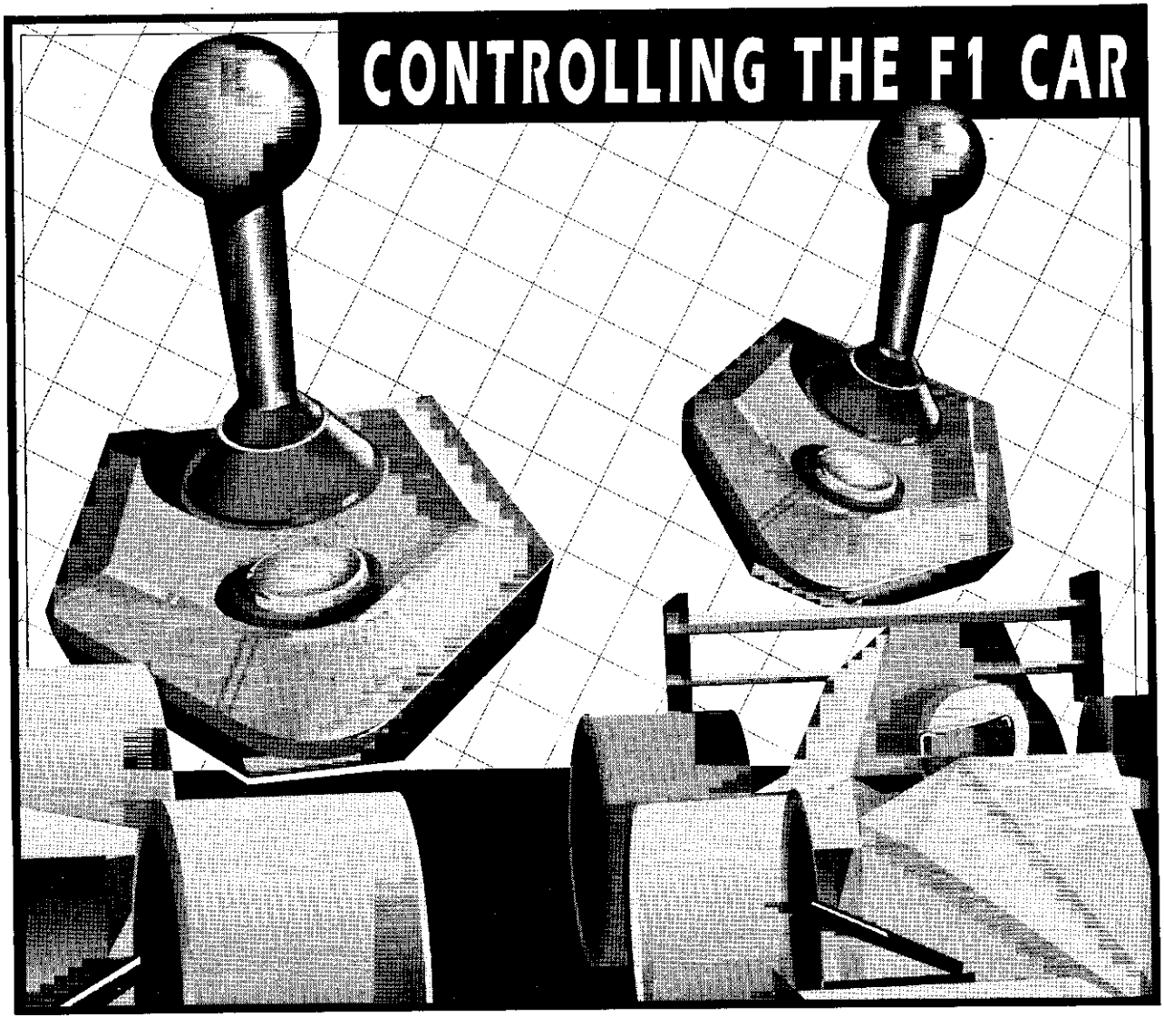


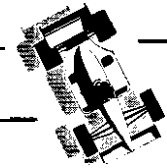
driving without it. Press Function Key F5 to turn off the ideal line and try to drive around a circuit without it. You will find that the most important guide will be the coloured rumble strip kerbs that appear on the approach of each comer. Try to remember the places where you begin to brake and turn on the approach to each bend and consult the manual Driving Hints on pages 122-143.

Making use of the manual

The back pages of any computer simulation manual are sometimes seen as unimportant to the winning of the game but *it is recommended that you read all of the* manual. It will give you a complete understanding of attitude, general approach to races and other drivers on the circuit plus numerous hints and tips to help you win. Remember that MicroProse Formula One Grand Prix is a simulation not just a racing game.

CONTROLLING THE F1 CAR





METHODS OF CONTROL

This manual will refer to the Accelerator, the Brake, Changing Gear and Steering. You will be able to control these functions by keyboard and joystick.

Keyboard/Joystick (Key K)

Key K toggles Keyboard/Joystick mode.

If you have a joystick fitted on your computer study diagram 1.

Joystick **= *Controller***

Fire Button **= *Selector***

If you are driving on keyboard only study diagram 2.

A/Z **= *Controller-Accelerate/Brake***

</> **= *Controller-Steer Left/Right***

Spacebar **= *Selector***

NB In Joystick Control mode all Keyboard Control buttons are disabled, except when menus are shown.

For information about the Controllers on your computer please refer to the Technical Supplement.

MicroProse Formula One Grand Prix does not support mouse control, except when menus are shown.

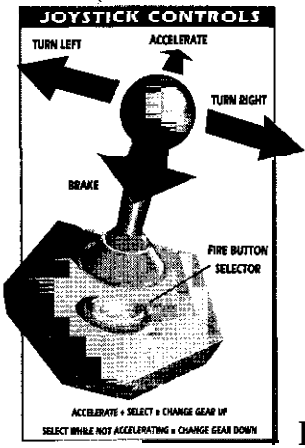


Diagram 1

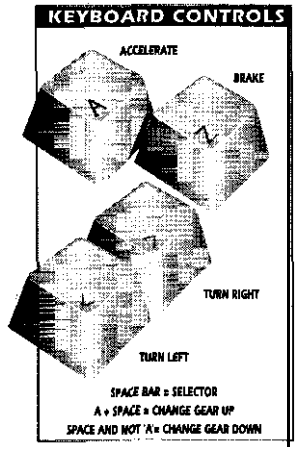
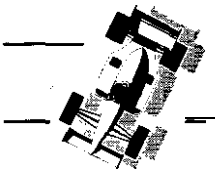


Diagram 2



The sound of the Formula One engine is very important in the simulation for, as in real racing, it is a good indication of when to change gear.

Sound (+/-)

Turn the sound level up and down with the +/- keys.

THE BASIC DRIVING CONTROLS

Gear Change: Up

The sequence is Reverse-Neutral-lst-2nd-3rd-4th-5th-6th

Start in Neutral. Accelerate with the Controller and press the Selector once, the red gear indicator will show 1 and the car will begin to move. Accelerate again until the red power band is between 11 and 12 then *while still accelerating, press* the Selector. You will have now changed gear, the indicator shows the number 2 and the tone of the engine changes. Accelerate again and increase the power, then press the Selector again. You have now changed up into third gear!

Gear *Change: Down*

The sequence is 6th-5th-4th-3rd-2nd-lst-Power Turn-Neutral-Reverse.

With the Controller not accelerating, press the Selector. The number on the Gear Indicator will change down.

Power Turn

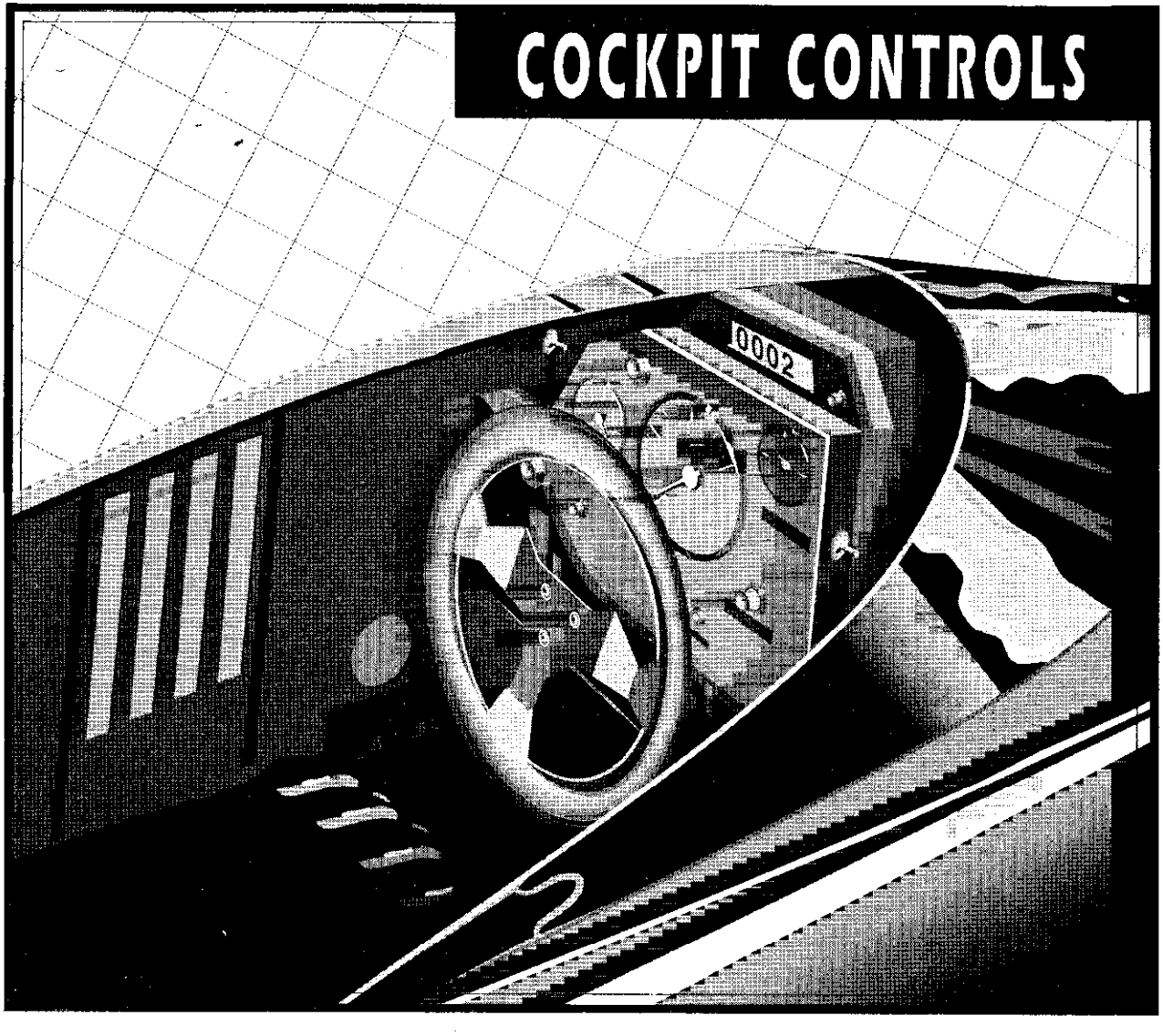
You can only change down into this gear. If you have not implemented Function Key F3 or are racing at a Level that does not allow you to use it, you may recover from any spin by changing down to this gear. The red indicator will show;

To straighten out a spin, accelerate from rest, steering momentarily in the ***opposite*** direction to where you want to turn, before steering in the desired direction, keeping the accelerator depressed throughout, but change up to first gear as soon as you are facing in the right direction.

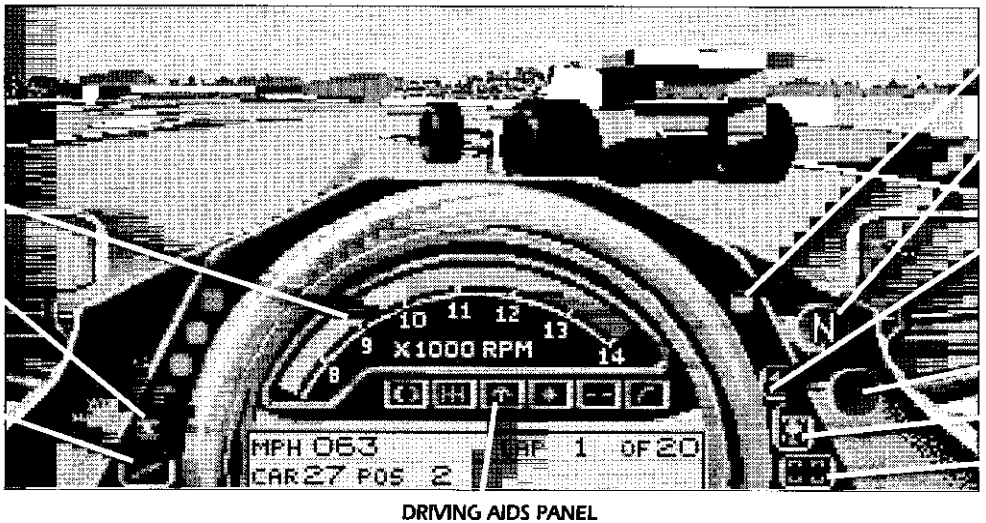
Reverse

You must change down into Reverse. Once the R appears on the gear indicator accelerate with the Controller, as in a real car, to move backwards.

COCKPIT CONTROLS



COCKPIT CONTROLS



DRIVING AIDS PANEL

Summary

Before you start any race, qualifying lap, or practice session you must familiarise yourself with the MicroProse Formula One car cockpit. You must be able to take in all information presented to you at a glance, because at the speeds you will be travelling on circuits such as Monza, a lost second is all it takes to make the difference between a devastating shunt and a brilliant overtaking manoeuvre. At 200 mph the car will travel 90 metres in that second!

It's very important to know who is behind you and who is trying to overtake. Some cars may weave from side to side looking for an opening at a crucial corner, be conscious of their presence. They will try to pass, if you show any weakness or leave a gap where they might dart past. Whilst not advocating a breach of Racing Etiquette it is not unusual for drivers to 'shut the door' on other cars behind them.

Five levels of difficulty (Accessed from the Main Menu)

The difficulty level you have chosen is shown by five lights in a row on the left of the steering wheel. If the lowest green light is shining then you are racing at Rookie level, if the highest light is on then you are competing at Ace level. The levels are related to and control the number of Driving Aids you can access.

The levels are:

Ace

Pro

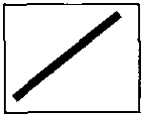
Semi-Pro

Amateur

Rookie

Distribution** of Performance **(Accessed from Main Menu)

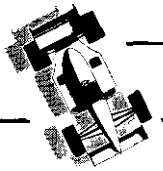
Just below the Difficulty Level indicators there is a panel that shows your choice for the distribution of performance among the other drivers.



1991 performance for teams and drivers

All teams and drivers at the same potential performance

Random distribution of performance throughout the grid.



The Rev Counter

In the centre of the screen just below the top of the steering wheel you will see the Rev Counter, a long sweeping dial that shows your engine's rpm in 1000's from 7 to 14. If you 'blip' the accelerator to rev the engine in Neutral you will notice that a red band moves across the dial. This is the most important indicator of how fast your engine is running when in a particular gear.

You must be aware of being in the right gear at the right moment. The basic guideline is to try and keep the revs up between 10,000 and 12,000 rpm. Changing into the wrong gear will lose you power or you may overrev and damage your engine. You should always know the optimum point on the Rev Counter for gear changes in order to drop the engine back into the meatiest part of its powerband.

Gear Indicator

To the right of the steering wheel is the Gear Indicator. This tells you which gear you are in. There are 6 forward gears, neutral N, reverse R, and a 'spin recovery' gear.

Suggested Gear Indicator (Activated by F6)

If F6 driving aid is implemented you will see a blue indicator just below the normal red gear indicator that tells you the suggested gear to be in at the next corner. This is an 'intelligent' aid that will vary depending on the car set-up; wings, brakes, gears and tyres.

Driver ***Status Indicator***

On the right of the steering wheel there is another small LED. If it is Green then you are currently in your own car cockpit. If you choose to see other drivers' cockpit views by pressing the Up/Down Arrows, the light will go off. Unless you are in

Replay Mode, use this facility at your peril for the car will not be controlled by the computer.

Detail On/Off indicator (Alt/D)

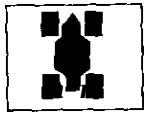
Just below the Gear Indicator is the Detail On/Off indicator. There are 3 levels of detail in MicroProse Formula One Grand Prix and you may step between them by pressing Alt/D.

At the highest level 2 green triangles are illuminated, and you will see all the scenery, stands and spectators.

Press Alt/D once and you remove all large buildings.

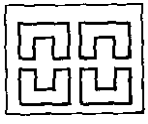
Press Alt/D again: smaller buildings, trees and bushes will disappear.

A further press will ***return*** all original track and landscape details.



Damage Indicator

Below the Detail Adjust Indicator is the Damage Indicator operated by Radio Telemetry from the Pits. This shows damage to front and/or rear wings, and if lit, extreme caution is advised in driving. Returning to the Pits will repair any damage.



Pits ***Indicator***

Below the Damage Indicator is the Pits Indicator operated by Radio Telemetry from the Pits.

COCKPIT CONTROLS

There are 3 modes:

GREY Pits are empty. Call in at any time.

YELLOW You have been called in to the Pits or have indicated an intention to call in.

RED CROSS Pits are occupied by your other team car. The pit crew is not available to you, so you may have to wait longer if you go in.

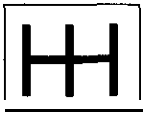
Driving Aids

The Driving Aids panel is the bank of 6 boxes directly below the Rev Counter. Driving Aids correspond directly to the Difficulty Level you have chosen.

Fl Auto Brakes

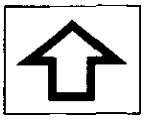
The computer applies braking functions for you to suit the circuit, but will not brake to avoid other cars.

F2 Auto Gears



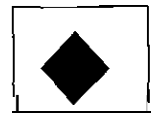
The computer changes all gears for you when it thinks it is the appropriate moment.

F3 Self-Correcting Spin



In the event of you spinning off the track, when you have come to rest, the computer will point you in the correct direction to continue the race, assuming you are in a fit state of repair

F4 Indestructible Mode

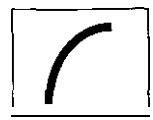


No damage will be sustained in this mode, no matter how serious the shunt.

F5 Ideal Line

This lays down a white striped line to show you the best line to drive on the circuit you have chosen. Ideally, you must keep the line on the centre point of the cockpit to get the benefit of the best driving line.

F6 Suggested Gear



Indicates which gear to be in at the following comer.

The Driving Aids Fl to F6 can be turned on at any time from the cockpit if you are in Rookie Mode. However if you are racing at higher levels you will have less help available to you.

Level Of Difficulty/Driving	*Aids Available Summary*
Ace	No Driving Aids
Pro	F5, F6
Semi-Pm	F3, F4, F5, F6
Amateur	F2, F3, F4, FS, F6
Rookie	Fl, F2, F3, F4, F5, F6

DIGITAL DISPLAYS

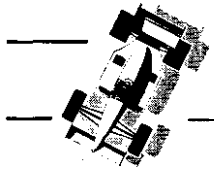
Monitor

During Qualifying/Timed practice you will be placed in the Pits and a Telemetric Monitor is placed in front of your cockpit. The Monitor lists the other drivers in the race by:

POS	current grid position
N	racing number
DRIVER	driver's name
LAPTIME	current best laptime
SET	sets of qualifying tyres used
TIME	the amount of time left for practice/qualifying
CARS OUT	the number of cars already out on the track.

If you watch the monitor you will see the other drivers best lap times for the circuit. The fastest laptime is placed above all the others. You will be positioned in the middle of the monitor display with your nearest rivals on either side of you, unless you are the fastest driver!

You may speed up the time it takes for all drivers to finish qualifying by Accelerating the Controller. Or, you may quit Timed Practice/Qualifying by pressing ESC. All non-selected drivers will complete at least 1 lap in accelerated time before this is implemented.

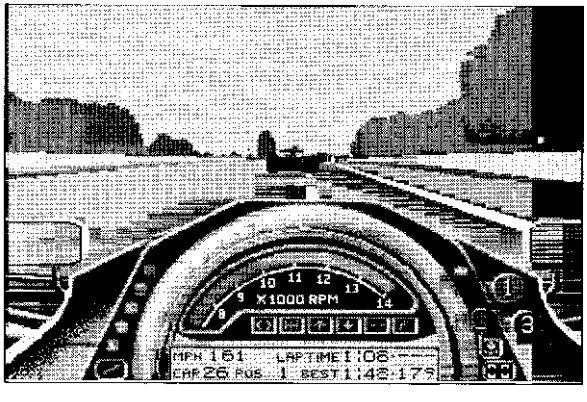


COCKPIT CONTROLS

A	B	C	D	(Q)	W
← TYRE CHOICE →					

When you are jacked up in the pits the top row on the digital readout panel will change to:

TYREs: ABCDQW Move the Controller left/right to select your choice of tyres from Wets, Compounds A (hard) to D (very soft) and Qualifyers.



MPH **161**	LAPTIME 1: **08.**
CAR **26** POS 1 BEST	**1:48.179**

Qualifying/Practice Display:

KM/MPH	Your speed around the circuit.
CAR	Your team car number
POS	Your current position on the grid
LAPTIME	Your current lap time
BEST	Your previous best laptime

Brake with the Controller to access the car Set-Up Menus.

COCKPIT CONTROLS

Racing Display:

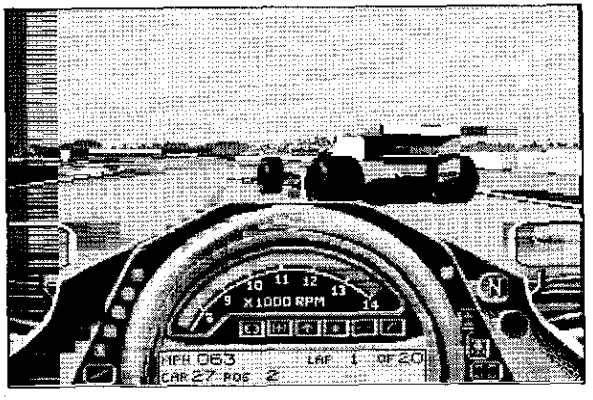
KM/MPH Your speed.

LAP/OF Your current lap out of total.

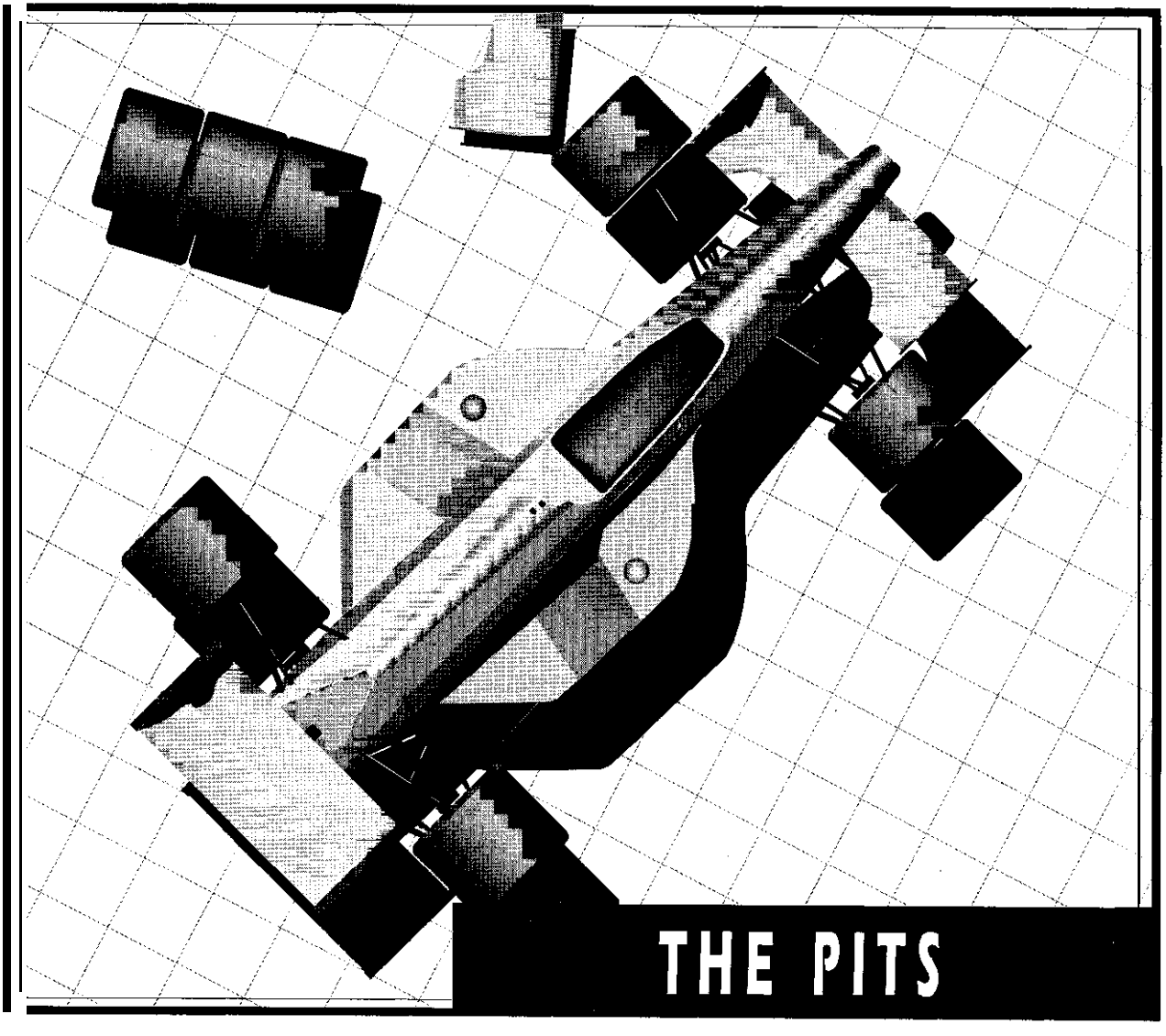
CAR Your car number.

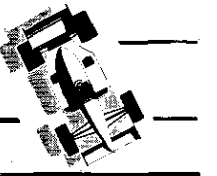
POS Your position in the race.

Key N will display the name of the current car driveron the Digital Display.



MPH 063	LAP 1 OF 20
CAR 27	POS 2


THE PITS



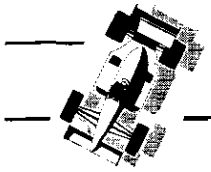
SUMMARY

You begin any practice or timed/qualifying session in the pit lane. From here you can choose to drive straight away with the current Set-Up, or change any of the car settings. You can also drive into the pits at any time during practice to change your car Set-Up.

For the Rookie Driver the car Set-Up will seem very complex at first. Do not worry! Accept the current Set-Up, learn to drive fast around the circuits, then return to this section and adjust the settings. Do not adjust more than one setting at a time before trying it out in a practice session. That is when you *will notice the difference in performance.*

Each of the 16 circuits is unique so it's necessary to Set-Up your Formula One car with the correct combination of Wing, Gear Ratios, Brake Balance and Tyres. You are advised to study the track layouts in this manual (pages 67 to 99) and take note of all the track notes and summaries; these will give you an indication of the type of car Set-Up required but there is no substitute for experience. Try a few laps with various settings, get an idea of how the car is running through corners and along straights. Compare your performance with other cars in practice, go into the pits and adjust a setting then try again.

If you are having problems with your car Set-Up and are finding it difficult, for example, to drive into corners please consult the Set-Up Problem Chart at the end of this chapter.



CAR SET-UP OPTIONS

Front/Rear Wing Downforce Adjust.

In general terms the wings on a Formula One racer push the car down on the track. This achieves more grip and less roll giving better control in corners but less speed on the straights because of more drag.

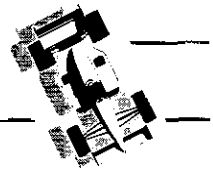
You can adjust the amount of front and rear wing used by the car. This is on a scale from 1 to 64. The higher the number, the more Downforce. Adjust the wing front and back by selecting +/-

Front/Rear Brake Balance.

Grand Prix cars have a low centre of gravity, centred just behind the driver. If you brake hard at speed the weight shifts onto the front of the car. Therefore brakes must be balanced to cope with the transfer of weight during deceleration (slowing down).

You can change the brake balance of your car by altering the way in which the front and rear brakes are applied. It's always best to have more brake bias at the front than at the rear. Ideally, as soon as the front wheels begin to feel the effect of the brakes, the rear wheels should just be beginning to slow down.

The scale goes from 32 at the Rear to Zero in the middle to 32 at the Front. Move the slider to give you the correct degree of balance.



Gear Ratios

You must set the gear ratios of your gearbox to suit each circuit. This is usually done by Setting the 6th gear for the fastest possible speed along the longest straight; then setting the lowest gear for the slowest corner. The rest of the gears are ranged somewhere between the two.

Gear ratio selection is very important. Different cogs can be fitted to the gearbox which can have a major effect on the car's acceleration, performance in bends and top speed.

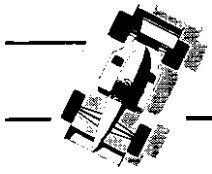
Twisty circuits with few long straights and plenty of chicanes demand 'short' gearing for quick acceleration.

Other circuits with long straights require 'long' gearing to give the car the top speed it will need to keep up with the opposition.

The gearbox has a range from 1 to 64. Move the slider to set the ratio for each gear.

The nearer the cogs are to each other, the less work the lower gear has to do to get to the higher gear (short gearing).

The further away the cogs are from each other the more work it has to do to get up to the higher gears but the faster the speed at the top gear (long gearing).



Tyre Choice

You can choose from a variety of tyres when you are in racing trim and you can choose qualifying tyres when you are participating in timed practice/qualifying and when you are ready to do a 'hot' lap, otherwise you can use any of the other compounds. Remember, you are limited to 4 sets of Qualifyers.

To change tyres, enter the pits during a race/practice when the Pits Indicator signals that your tyres need changing, or press Return to indicate that you are coming in. Or, if in practice mode, press Q to quit a timed lap immediately.

When you are jacked up, move the Controller left/right to make your tyre selection.

'D' COMPOUND / VERY SOFT

Spongy tyres that give excellent dry condition grip but which wear out quite rapidly and will not last the whole race.

'C' COMPOUND /SOFT

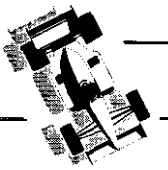
These provide slightly less grip than D's but are harder wearing. You will probably need to change these at least once during a normal race.

'B' COMPOUND /MEDIUM

These provide less grip than C's on the track but they are quite hard wearing and will usually last for the whole race without needing to be changed.

'A' COMPOUND /HARD

A hard tyre that will definitely last a complete race but with less grip in the corners than B's.



Q-QUALIFYING TYRES

Good for approximately THREE laps, including the starting and slowing down lap. Ultra sticky therefore they lack durability. You are limited to 4 sets per qualifying period. It's sometimes possible to squeeze an extra lap out of these tyres, if you're careful.

W-WETS

These tyres have tread for wet weather driving. If the race is in wet conditions, Wets are already fitted.

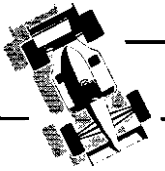
Quit Session (ESC)

You can choose to end your current session by pressing ESC.

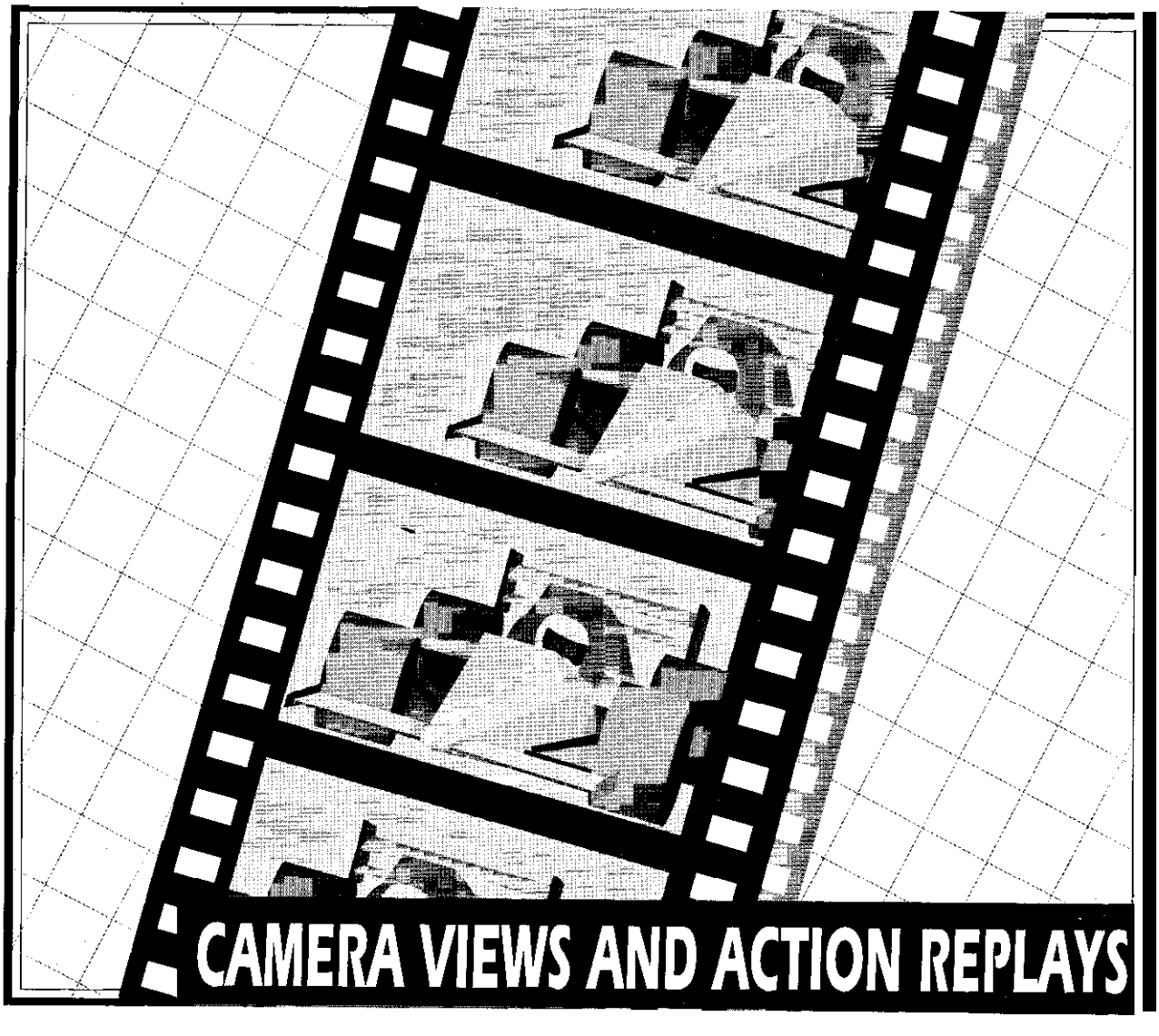
Save the Car Set-up

You can save the Set-Up you have chosen for your car when you are in the Pits, by pulling back on the Controller, to access the Set-Up options.

Problem	The car does not want to steer into the corners	The car wants to turn into the corners too quickly or spins too easily when cornering	Other cars run much faster on the long straights	Car does not grip in corners/ other cars are faster in corners	In a wet race, car loses all control
Cause	Understeer	Oversteer	Too much downforce/Gear ratio too 'short'/not enough speed through the previous corner	Not enough downforce/Too high a speed	Lack of grip from tyres
Remedy	Increase front wing/ Perhaps decrease rear wing	Decrease front wing/Increase rear wing	Reduce wings front and back/Space out higher gear ratios/use more throttle	Increase wing front and back/Slow down	Fit Wet tyres
Further Options	Move brake balance towards rear/Install softer tyres.	Move brake balance to the front/ fit harder tyres	Fit softer compound tyres for quicker cornering/Check driving line.	Select softer compound tyres	Adjust driving style to suit conditions



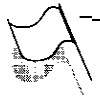
Problem	The car lacks acceleration over short distances	The car has a tendency to spin on when braking into corners	The car is slow in corners or on straights	Gradual loss of performance	Tyres wear out too quickly
Cause	Gear ratios too long	Underbraking/Braking too late	Gearing	Tyres wearing out	Wrong compound tyres fitted for car as currently set-up
Remedy	Close down gaps between gears	Move brake balance towards the front/Brake earlier	Lengthen the gears	Fit new set of tyres.	Fit harder compound/Lessen wing downforce
Further Options	Fit softer tyres if wheelspin is apparent	Softer tyres/Increase wings	Reduce wing	None	None


CAMERA VIEWS AND ACTION REPLAYS

CAMERAS, VIEWS AND ACTION REPLAYS

The camera can be moved around at any time by using the camera control keys. Some camera options are mainly suitable for replay or when you are out of a race and watching other cars. It would be difficult to drive from those viewpoints.

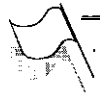
TRACKSIDE CAMERA VIEWS



(Left/Right Arrow)

You can view all the action centred on any car at any time during a race by pressing the Left Arrow Key. The Right Arrow Key will return you to the cockpit.

CHASE VIEW



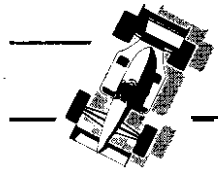
(Help Key)

You can view any car from just behind and above the cockpit.

REVERSE CHASE VIEW

(Undo Key)

View any car from the front with all the action behind it.



CAMERAS, VIEWS AND ACTION REPLAYS

OTHER CAR VIEWS

(Up Arrow/Down Arrow/Home)

You can move forward into the cockpit of the car ahead by pressing the Up Arrow Key. Further presses will move you forward one car per press.

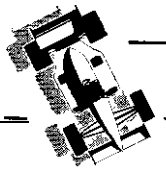
Similarly, you can move back one car by pressing the Down Arrow Key and further presses will move you further back. Home will return you to your own car. A small LED on the right of the control panel will light up when you are in your own car but will go out when you are viewing from other cockpits.

Remember, your car is at risk if you use this option outside of Replay Mode.

REPLAY MODE

(Pause/Replay (R))

The Pause button pauses the action and R replays the previous 20 seconds of action. You can freely move the camera around during Replay. At the end of Replay the game is left paused, ready to continue the race. At this point, you can on-pause the game and the camera will return to its original position, and you will be back in control of your car. Or, if you wish, press 'R' for another Replay with the camera starting from its current position. There is no limit to the number of times you can Replay an event on the track.



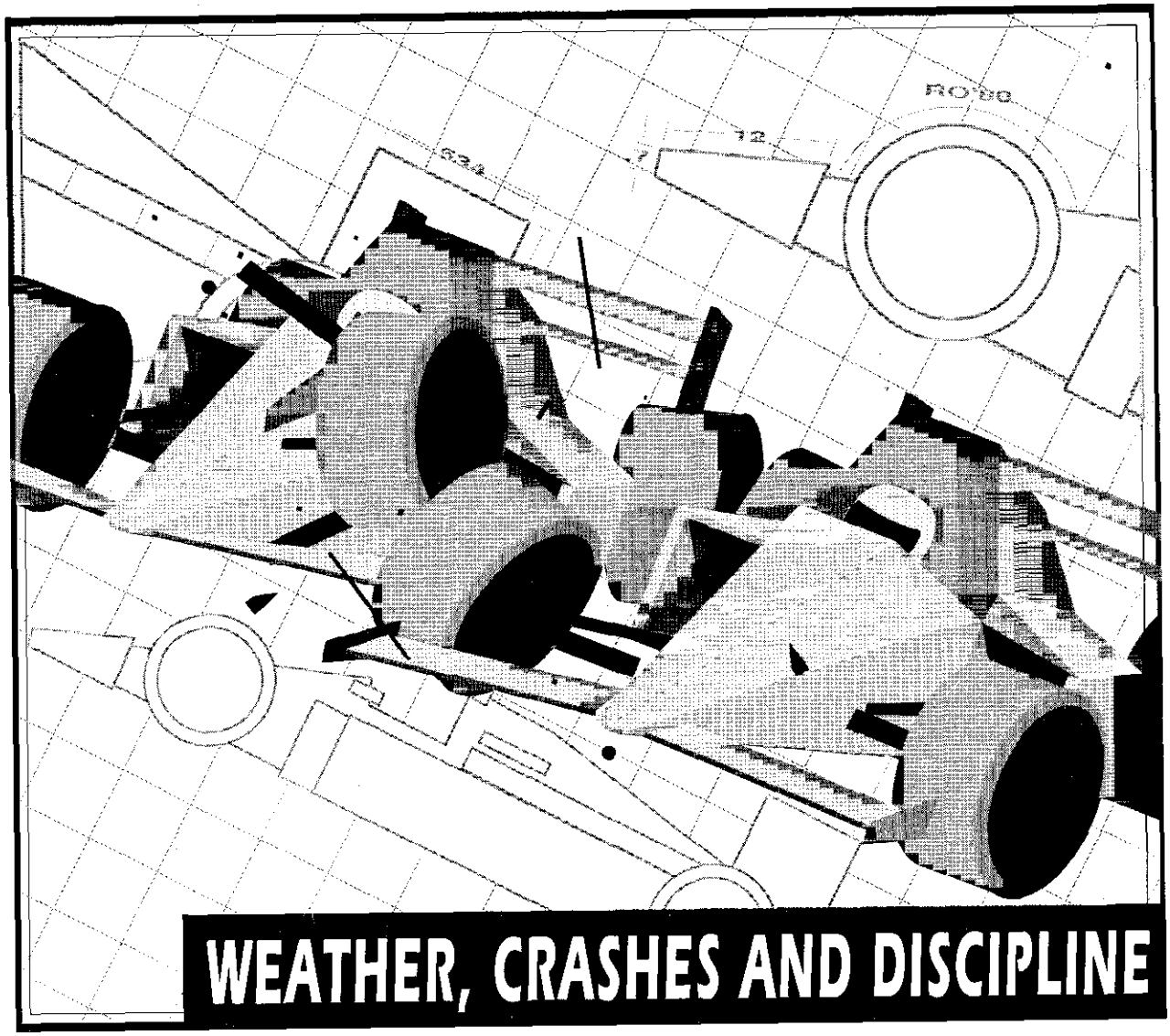
OTHER ACTION REPLAY MODE

(Insert)

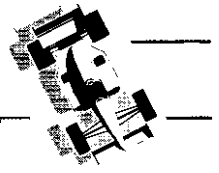
After receiving a message that a car is out of the race, then if the action is still recent, you can see a replay of the event by pressing Pause then Insert. This operates on a normal Replay, but the camera starts with the car in question. If the event is not recent enough, then 'Insert' will have no effect.

DEMO MODE

You can watch a race in Demo Mode from any circuit by de-selecting all drivers then entering any driving or race mode. It's often a good way to see the circuit; how fast it is, how twisty. It will also help if you have the manual open on the circuit diagram; follow the car as it races through the straights and corners, watch where most driven overtake and take note of such features as 'slipstreaming'. Press Esc to return to to the Main Menu.



WEATHER, CRASHES AND DISCIPLINE



Wet Weather

Some races in the Grand Prix season may take place in rainy conditions. The sky will be grey and your car will already be fitted with wet tyres. If you want to survive in the race you must drive carefully. You will be notified of impending danger by marshals waving a yellow flag.

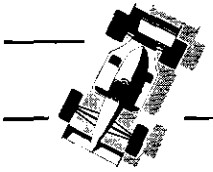
Spinning off

The most common spin causing you to leave the circuit occurs when you take a bend too quickly. You will find this will happen quite often at first. If the circuit is one with wide grassy areas and run-off strips then you can rejoin the race but you will find it slow going trying to accelerate smooth Grand Prix tyres on slippy surfaces. You are advised to drop to the spin recovery gear, straighten up, then engage 1st gear. Watch out for faster cars crossing your path, and get back to the track. Your tyres might feel strange for a while.

Crashes

Crashing into other cars on the circuit may damage both vehicles, one of you may go into an uncontrollable spin. If you can still race then the damage will not be serious enough to stop you competing but you may enter the Pits as soon as possible for repairs. Crashing into walls or barriers will have a similar effect.

There are 3 levels of crash that will put you out of the race. If you have crashed, you might be lifted off the track by the crane or pushed out of the way by the track marshals.



If you have sustained a crash that has ended your chances in a Championship race you can choose to speed up the events and get the race result or watch the race unfold from another drivers cockpit. When you are Practising any Circuit you can start again with a spare car from the Pits.

Race Circuit Discipline

You will be warned of any dangerous incident such as a shunt by a Yellow Flag.

A Green Flag will inform you that it is all clear.

Consult the Flags section in this manual (page 111) for a full description of racing flags.

THE MAIN MENU

The Main Menu is the screen you will see most often in the simulation. It is the start/finish point of all races, practices, loads and saves. It presents the player with 8 options:

Driver/Team Selection

Load/Save Game

set up

Practise Any Circuit

Non-Championship Grand Prix Race

Grand Prix Championship Season

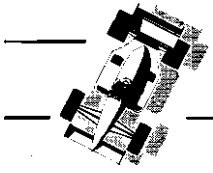
Game Options

Review Championship History

DRIVER AND TEAM SELECTION

Select Team

Choose from any of the eighteen teams shown on the screen. You can change the names of the teams. For more information of the 1991 season Teams and Drivers see pages 100 to 109.



Select Driver/ Enter New Driver

Choose from any of the listed drivers. Press Select and the driver number will light up in the right-hand panel. To erase an existing driver highlight the name, press the Selector, then press the Backspace Key and delete the name. Type in your chosen name and press the Selector. You will see the chosen driver number change colour. If you wish to change your mind you can Deselect or return to the Default Name. You may want to choose more than one driver if you want to play Multi-Driver Mode. Select Choose Another Team and you will return to the Team Menu. For more details on Multi-Driver Mode see page 65.

When you have completed your selections you can exit back to the Main Menu.

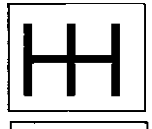
In a World Championship the saved file will always be updated to show your position throughout the season and you can save any race at any point, by pressing ESC.

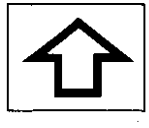
You can load a previously saved race from the point where you decided to stop racing. If you were in the middle of a race, the game will re-start in Paused Mode with a 20 second replay. Press P to continue.

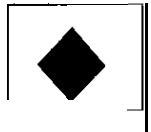
SET UP OPTIONS

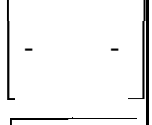
Realism Level

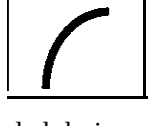
AUTO BRAKES F1  The brakes will be controlled by the computer.

AUTO GEARS F2  The gear changes will be selected by the computer.

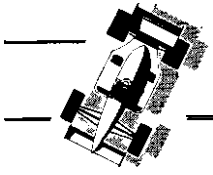
SELF-RIGHTING SPINS F3  The car will always end up facing the right way in the event of a spin if this option is on, once the car has come to rest.

INDESTRUCTABLE F4  The car you are driving will not crash or be affected by any crash and will not sustain damage.

BESTLINE F5  A dotted white line will appear to show you the best driving line to follow on every circuit.

SUGGESTED GEAR F6  A blue gear indicator will appear to show you the suggested gear to be in on the next bend.

(All the above can be toggled during a race by pressing the Function Keys F1 to F6 subject to the limitations of the difficulty level. See page 36).



Race Options ,

RACE DISTANCE

Choose the distance you want for the races as a percentage of the actual distance. From 10% to 100%. For example in a 60 lap race 10% will give you 6 laps. This will apply to all circuits if you are competing in a Racing Season, and cannot be changed during a Championship.

QUALIFYING PERIOD

Choose the amount of time you want available for a timed qualifying session, from 5 minutes to 120 minutes. This will apply to all circuits if you are competing in a Racing Season, until you change it again.

LEVEL OF OPPOSITION

Decide on the level of opposition you want to face by selecting the Difficulty Level you desire from Ace to Rookie.

The Difficulty Level you have already chosen is shown by five lights in a row on the left of the steering wheel in the driver's cockpit. If the lowest green light is shining then you are racing at Rookie level, if the highest light is on then you are competing at Ace level. The levels also determine the number of Driving Aids you can access. You can change levels throughout a Championship, but the overall Championship will be decided at the lowest level you competed at.

The levels are:

Ace
Pro
Semi-Pro
Amateur
Rookie

DISTRIBUTION OF PERFORMANCE

1991 Performance 

The drivers and cars are based on the real events and performances of the 1991 season. Some drivers are rarely out of the points; others regularly appear lower down in the order.

All the Same Performance

Each driver performs equally. All cars have the same power and performance.

Random Performance 

Each driver and car achieves a random performance.

PRACTISE ON ANY CIRCUIT

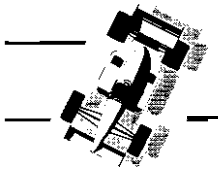
The option that enables you to get to know all the circuits without competing with other cars.

Select Driver Menu

The Select Driver Menu will appear If you have not already chosen a driver and a team.

Circuit Select Menu

You are given a choice of the 16 Grand Prix circuits to practise on. You may practise on all of them in any order. It is only when you start the World Championship season that you will have to race each in turn in the pre-determined order. Highlight your chosen track then press the Selector.



You will see a view of the circuit. You can choose to see Information about that particular circuit, go to the Previous or Next circuit in the sequence, or get an unobscured View.

Select OK when you have made your choice. You will then be put into the Pits in the car of your choice.

Practice

Your car will appear in your Pits garage ready for you to make adjustments to the car Set-Up or for you to practise with the current Set-Up on the circuit of your choice. In this session, you will not be in a race and there will be no other drivers practising on the same track. Return to the Pits by driving in or by pressing Q.

NON-CHAMPIONSHIP GRAND PRIX RACE

Driver/Team Select Menu

If no driver or team has been chosen this option will appear. Choose an existing team and driver or enter a new driver.

Circuit Select Menu

Select any Grand Prix circuit for a full 26 car race. This will not feature as part of the World Championship season. Practise racing on all the circuits and get to know them before embarking on the full season.

Free Practice

Your car will appear in your Pits garage ready for you to make adjustments to the

Set-Up, or race with the existing Set-Up on your chosen circuit. Free Practice can take place up to a maximum time of 120 minutes. You will always have the option to Quit/Save or Continue.

Qualifying/Timed Practice

You start in the Pits and you are allowed one timed qualifying session per race. This lasts for a maximum of 2 hours or minimum of 5 minutes. You can choose to go into the Pits at any time if you feel you have achieved a good enough time. A Telemetric Monitor will be placed above your cockpit panel and you can watch the times of other drivers. If you notice that other drivers are improving on your lap times, then you can go out again (as long as there is enough time remaining for practice).

You are limited to 4 sets of qualifying tyres per session.

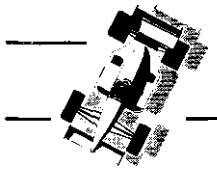
You can Accelerate Time for the other drivers by moving the Controller forward and letting go. This toggles accelerated time On/Off.

You may abandon the current qualifying lap by pressing Q. You will re-enter the Pits. Esc returns you to the Main Menu.

If you manage to set a lap record in any race or qualifying session, the computer will automatically save that information under your chosen driving name, if when you exit the game you use the 'Save' option.

Pre-Race Practice

You will also have the option of Pre-Race Practice in full racing trim (fuel, settings). This session has a time limit of 1 hour (or proportion of 1 hour). This is your final chance to get to know how your car will perform in the race itself. Beware, there may be a lot of other cars on the circuit.

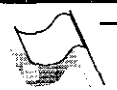


Race

Once you have practised, got to know the circuit,' then qualified for a good grid position, you can enter the face itself. If you have not achieved a good time, or any time at all, you will still be on the starting grid but at the back.

You will be placed on the starting grid among all the other 25 cars waiting for the Red and Green lights. After completing the specified amount of laps, you will be given the Final Race Positions. The face will not count towards any Championship points.

THE GRAND PRIX CHAMPIONSHIP SEASON



Initialise Season/Load Saved Game

Start from Phoenix in the American Grand Prix and drive through to Adelaide in the sixteenth and final race using all the best car Set-Ups gleaned from Practice and with all your acquired knowledge of the various circuits. If you are starting the complete season, the first track will be displayed. If you are in the middle of a season, the latest track will be displayed and you can load a saved season and continue your Championship challenge.

Free **Practice**

Your car will appear in your Pits garage ready for you to make adjustments to the set-up or race with the existing set-up on the circuit of your choice. You will have a maximum of 120 minutes in Free Practice. You will always have the option to Quit or Save.

Qualifying/Timed Practice

You start in the Pits and you are allowed one timed qualifying session per race. This lasts for a maximum of 2 hours or minimum of 5 minutes. You can choose to go into the Pits at any time if you feel you have achieved a good enough time. A Telemetric Monitor will be placed above your cockpit panel and you can watch the times of other drivers. If you notice that other drivers are improving on your lap times, then you can go out again (as long as there is enough time remaining for practice).

You are limited to 4 sets of qualifying tyres per session.

You can accelerate time for the other drivers by moving the Controller forward and letting go. This toggles accelerated time On/Off.

You may abandon the current qualifying lap by pressing Q. You will re-enter the Pits. Esc returns you to the Main Menu.

If you manage to set a lap record in any race or qualifying session, the computer will automatically save that information under your chosen driving name, if when you exit the game you use the 'Save' option.

Pre-Race Practice

You will also have the option of Pre-Race Practice in full racing trim (fuel, settings). This session has a time limit of 1 hour (or proportion of 1 hour). This is your final chance to get to know how your car will perform in the race itself. Beware, there may be a lot of other cars on the circuit.

First Race Of the Season

Once you have practised, got to know the circuit, then qualified for a good grid position, you will enter the race itself and flnd yourself on the starting grid among all the other 25 cars waiting for the Red and Green lights. After completing the race,

you will be shown the Final Race Positions, then the Drivers' Championship Positions and Constructors' Championship Positions.

Next Circuit in the Season

If you are in the middle of a Championship you can Save the season or you will be given the option to continue to the next Circuit. If you have completed the last race of the season you will see the final points table.

Game Options

Animations
Choose the on screen animations you wish to appear during the simulation.

All, Victory, None.

Multi-player Turns
Specify the number of turns per player during a multi-player race.

REVIEW CHAMPIONSHIP HISTORY

Before continuing a season you can study the points tables in a saved Championship.

Driver Championship Positions

Look at what has happened in previous races, who won the points and who is the most consistent driver.

Constructor Championship Positions

Summarises the points allocated to the teams and shows the leading constructors.

MULTI-PLAYER MODE

By selecting more than one driver you can implement Multi-player Mode on any race.

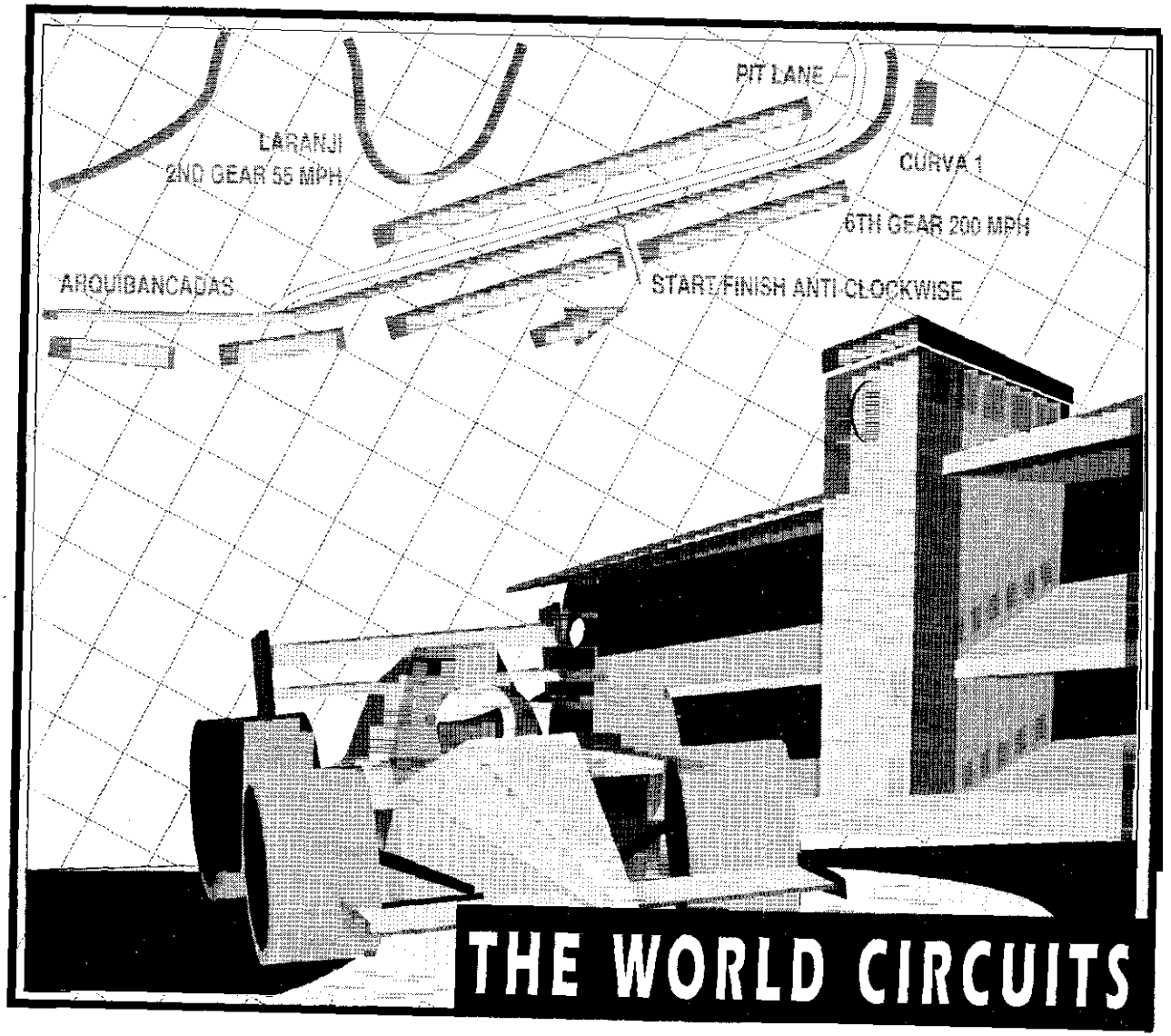
The programme will allocate equal time slots to each driver. For example, if two play& wish to compete in a ten lap race, they each enter their names at the Driver Selection Menu, the computer then chooses one player to drive first and drives the other car as well as all the remaining cars on the grid.

A 'programme manager' will allocate equal time for each driver and give a warning of the changeover. The single LED on the right of the steering wheel will flash red for 15 seconds to warn the current player of the change over. Then a five second warning is given before the computer takes control of the current player's car. The camera view then changes to the next player's car, which is being controlled by the computer. Another 5 sec warning is given before control passes to the next player. The option to pause and replay could be used during this period if the new player wishes to see more of his car's recent action.

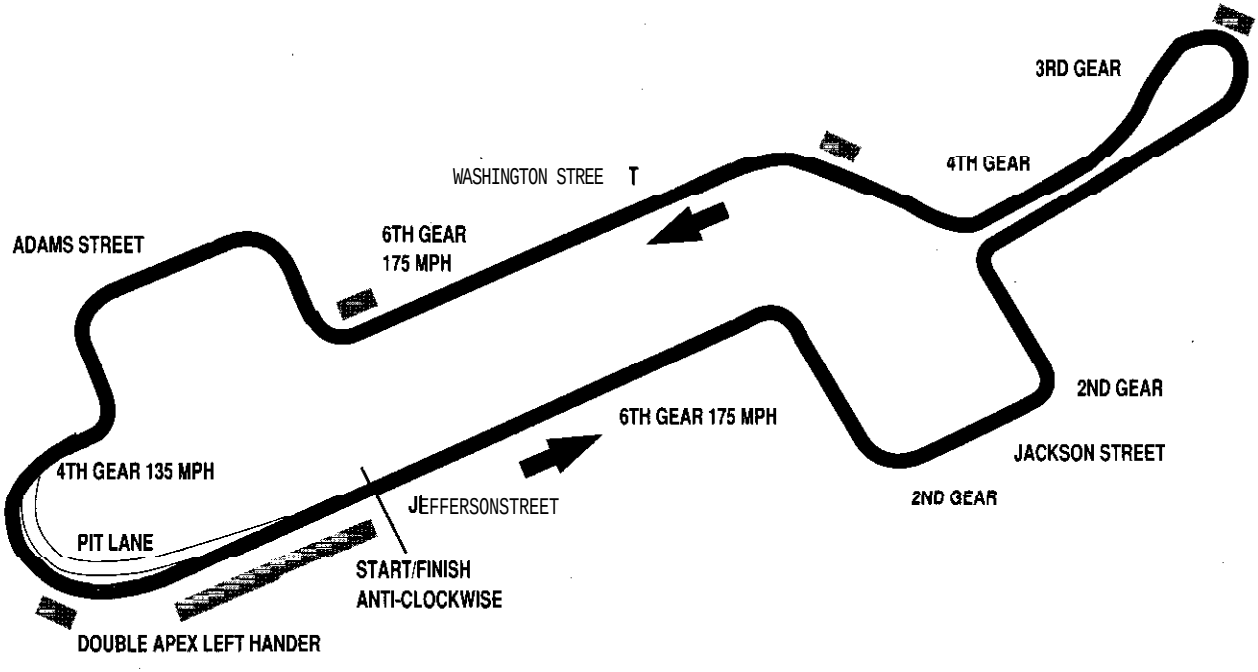
The players can control the number of changeovers which occur during the race by specifying the number of turns per player in the Game Options Menu.

Remember to set-up enough laps for each person to get a good drive.

In qualifying mode up to 35 players can take part. Changeover occurs when a player returns to the pits. The session ends automatically once the session period is complete and all the players have used the same number of tyre sets. ESC can be used to force an exit. Remember, only the fastest 26 will qualify - but players will always qualify in preference to computer controlled cars.

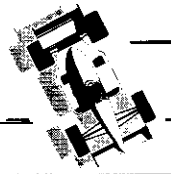

PIT LANE
LARANJI
2ND GEAR 55 MPH
CURVA 1
6TH GEAR 200 MPH
ARQUIBANCADAS
START/FINISH ANTI-CLOCKWISE
THE WORLD CIRCUITS

PHOENIX CIRCUIT



CIRCUIT DATA

Circuit Length: 2.280 miles/3.668km
Race Distance: 81 laps, 190.392 miles/306.342 km
Location: Phoenix, USA



UNITED STATES GRAND PRIX

This is the first race of the season. Everyone is keyed up and excited, desperate to make a good start to the Grand Prix year.

Phoenix is a street circuit, full of bumps, manholes and a wide variety of different surfaces. Camber changes can be quite difficult for the driver who is not in top form. Most of the corners are 90 degree turns and overtaking opportunities are few and far between, especially if the driver in front wants to be difficult. It's one of those circuits that can be awkward when you're trying to make a fast qualifying time and you find yourself blocked.

PHOENIX GRAND PRIX CIRCUIT
PHOENIX, ARIZONA, USA

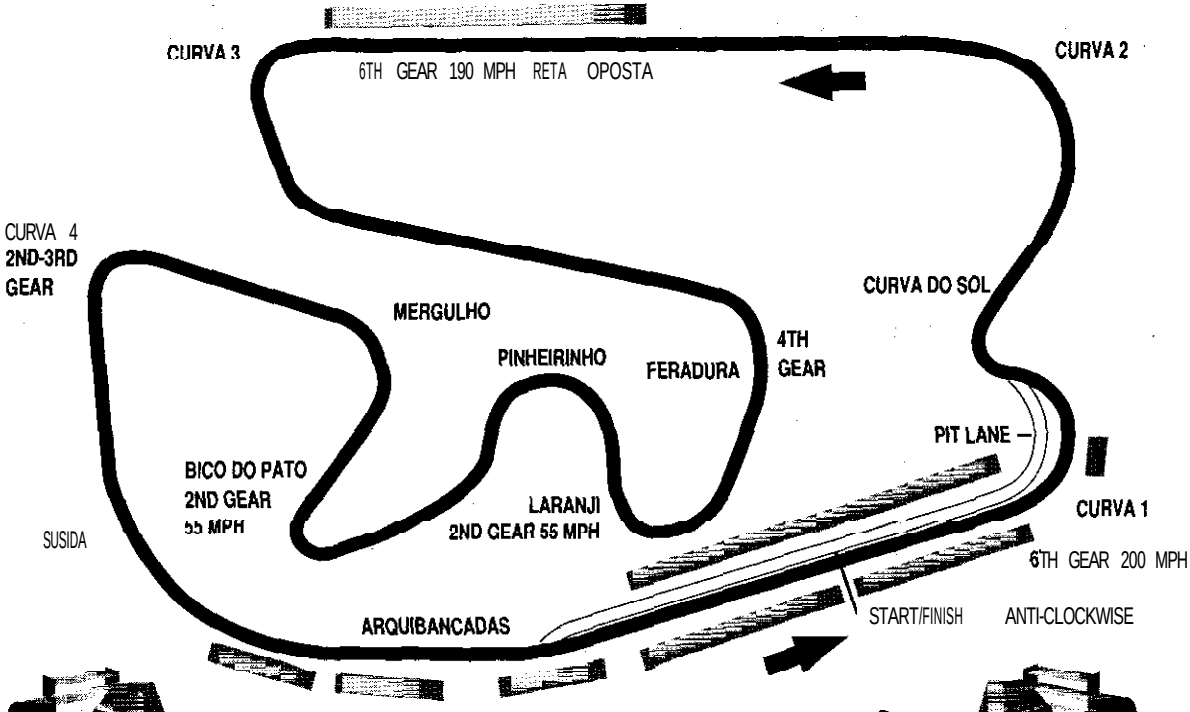
Length of Circuit:	.2.28 miles/3.668 km
Number of Laps:	81
Total Distance:	190.392miles/306.342km
Lap Record (Qualifying):	1m.21.434sec
Lap Record (Race):	1m.26.758sec

An an&clockwise circuit, the cars race along Jefferson Street flat out in sixth getting to 175mph before they try to outbrake each other into the right-bander for Madison Street. Corners are always tricky on this track; the varying surfaces give many levels of grip, especially in the first few laps, before rubber is laid down along the racing lines.

Through the second gear left-bander into Jackson Street, then a series of left and right 90 degree bends, the third gear hairpin and then right and left again before you accelerate down Washington Street. This and Jefferson Street are the two main overtaking straights. Out of the straight, then very quickly, right, left into Adam Street, left again, then right into the fourth gear, 135mph double-apex left-bander before roaring out back into the finishing straight.

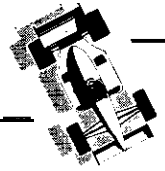
Most drivers agree that Phoenix is a very demanding circuit. It also takes a lot out of the cars. Tyres wear out quicker than expected, engines and gearboxes also suffer, especially when it's hot.

INTERLAGOS CIRCUIT



CIRCUIT DATA

Circuit Length: 2.668 miles/4.325km
Race Distance: 71 laps,. 190.848 miles/307.075 k m
Location: Autodromo José Carlos Pace, Interlagos, Brazil



GRANDE PREMIO DO BRAZIL

A circuit that demands a great deal from the transmission with numerous gear changes. The long left-hander can also make it very exhausting for the drivers who have to fight the strain on their neck muscles. It's important to be quick on the two long 200mph straights, so cars are set-up with very little downforce. However, this makes the inner sections of the track more difficult to drive with the wheels losing some grip and the cars feeling jumpy and twitchy.

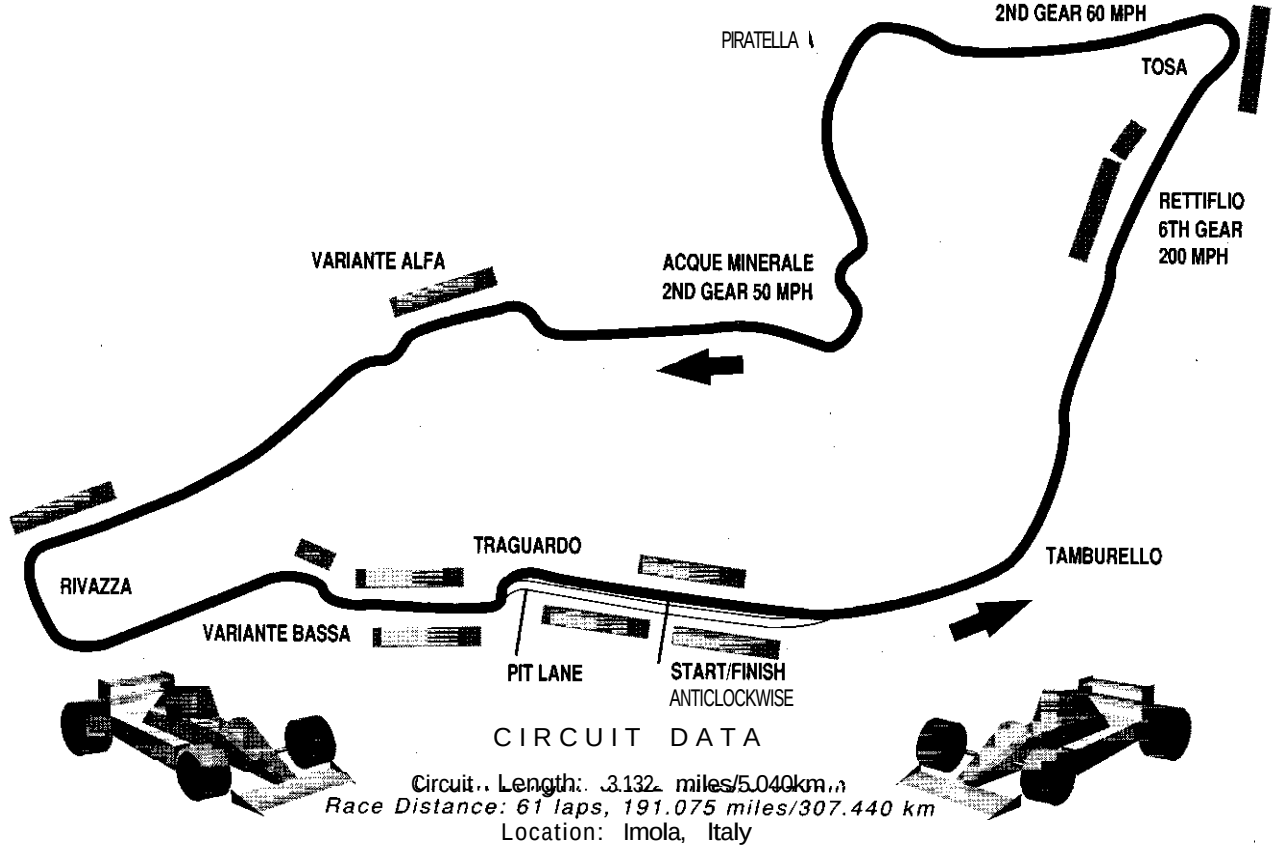
AUTODROMO JOSE CARLOS PACE, INTERLAGOS, BRAZIL

Length of Circuit:.	2.699miles/4.325km
Number of Laps:	71
Total Distance:	190.848miles/307.075km
Lap Record (Qualifying]:	1m. 16.392sec
Lap Record (Race):.	1m. 19.089sec

From the pits straight, flat out in sixth at 200mph, you sweep left and right for Curva 1 and Curva de Sol then wind up for the long Curva 2 left-bander and accelerate past Reta Oposta in sixth gear at 190mph. Two slight left-handers after Curva 3 and storm through the fourth gear Feradura. From here you need to get into a good rhythm to take you through a series of slow winding bends: Laranji (second gear, 55mph) then Pinheirinho, Bico do Pato (second gear, 55mph) and finally, Merghulho.

Curva 4, taken in second or third gear is next, a bumpy slow left-hander. This corner is important in that, taken properly it can put you in a good position to approach the long left-bander that leads to the pit straight, Arquibancadas. Winding up through Subida, it's quite possible to line yourself up to 'get a tow', slipstream a car in front of you and overtake.

IMOLA CIRCUIT



CIRCUIT DATA

Circuit Length: 3.132 miles/5.040km

Race Distance: 61 laps, 191.075 miles/307.440 km

Location: Imola, Italy

GRAN PREMIO DI SAN MARINO

A bumpy, bruising anti-clockwise circuit where the cars run little wing and are often struggling for grip or clipping the kerb.

From the grid, you roar towards **Tamburello,** a long, fast sixth-gear left-bander that pushes you into speeds in excess of 170mph. Accelerating into Rettifiolo, the cars can reach 200mph before they brake for Tosa, an off-camber tight left-bander that's taken in second at 60mph. Here, you have a good chance of getting on the brakes late and overtaking but it's not easy. Double-back up the hill to a fast left at **Piratella,** flat-out in fourth, then change into fifth just as you leave the bend.

AUTODROMO ENZO AND DINO FERRARI, IMOLA, ITALY

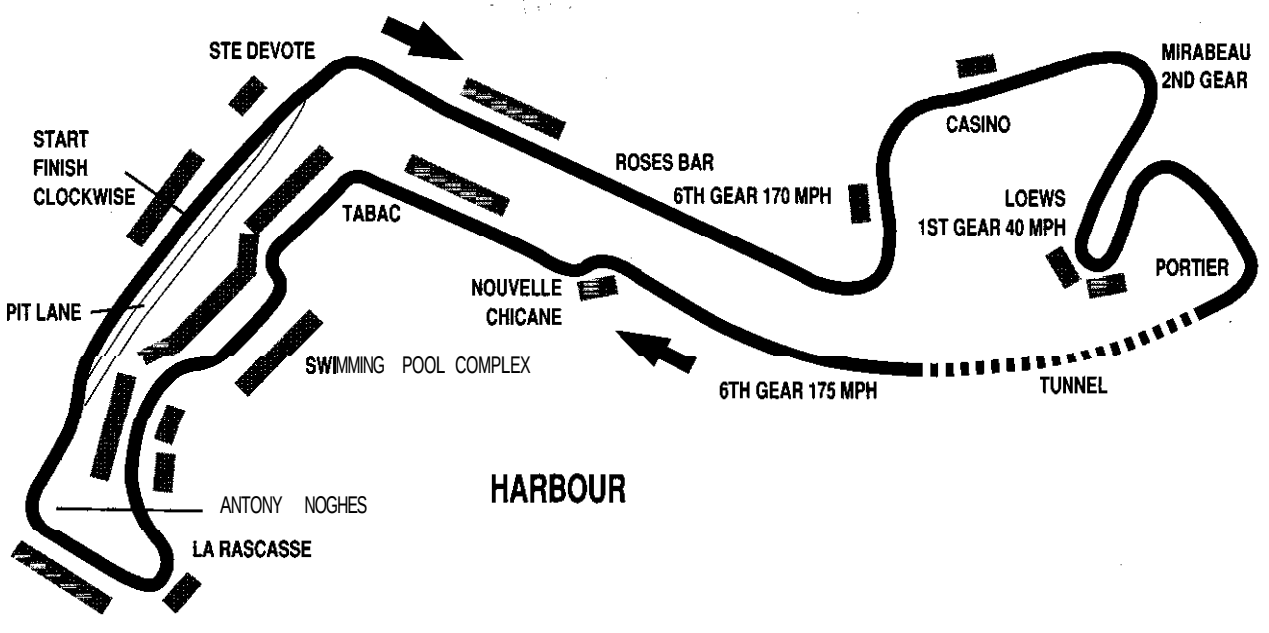
Length of Circuit:.	3. 132miles/5.040km
Number of Laps:	61
Total Distance:.	191.075miles/307.440km
Lap Record (Qualifying):	1m.21.877sec
Lap Record (Race):.	1m.26.531sec

Next, down the hill into the long left-bander towards the **Acque Minerale** chicane. The approach is off-camber and blind; you have no view of the 's' until you are in it, in second at 50mph. Here, there is a tendency to bounce from one side of the track to the other and many drivers spin off on this corner.

Then flat-out through the small chicane at **Variante Alfa** and down towards two bumpy left-handers, Rivazza, that shake the car so much you can hardly see where you are going.

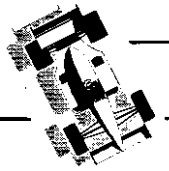
Back in fifth gear, you approach Bassa, a right-hand chicane that leaves you a bit blind with no idea where the apex is, then weave through Traguardo and back into the finishing straight.

MONACO CIRCUIT



CIRCUIT DATA

Circuit Length: 2.068 mi/es/3.328km
Race Distance: 78 laps, 161.332 miles/259.584 km
Location: Monte Carlo, Monaco



GRAND PRIX DE MONACO

The qualifying laps for this circuit are very important because it is practically impossible to pass anybody here unless they make a driving error or crash.

The cars are set up for maximum *downforce* and suspension is a little softer to deal with the many bumps on the course.

After the mayhem of the first bend at Sainte Devote, when the field tries to squeeze through, you pass Roses **Bar** flat out in sixth at 170mph, a great uphill straight but full of dips, bumps, and manhole covers that make the car judder and thump.

CIRCUIT DE MONACO, MONACO	
Length of Circuit:.	2.068miles/3.328km
Number of Laps:	78
Total Distance:.	161.332miles/259.584km
Lap Record (Qualifying):	1 m.20.344sec
Lap Record (Race]:.	1 m.24.368sec

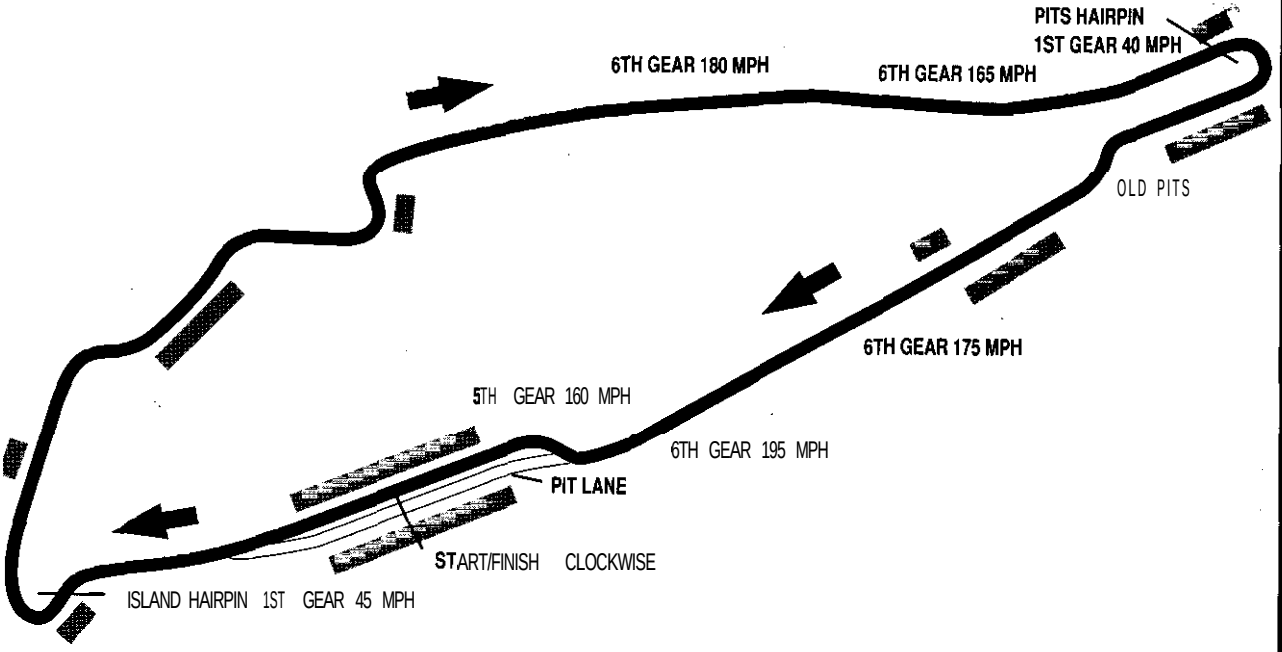
Then to Casino, hard through the left-hander and quickly right downhill, off camber, almost brushing the barrier as the road gets narrower, slippery and very bumpy.

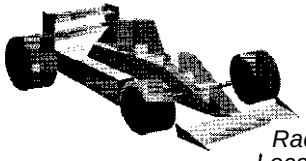
Mirabeau next; a tight, simple, second gear bend. Accelerate sharply then brake practically to a standstill for Lows. This is a first gear, 40mph, hairpin that needs maximum lock (many drivers increase the lock of the car for this race). Often, there is a procession of cars here and if you're not in the first six then you have to wait you turn.

Accelerate gently through **Portier** then flat out into the **Tunnel,** third, fourth, fifth. The improved lighting in the tunnel means that it's not so much of a shock coming out of the daylight but you have to be careful; the dirt, grease and oil does not get washed away by the rain and this is not the place to skid.

Roar out in sixth at about 175mph, stay well out to the right and line up for the Nouvelle Chicane. Take this fast in fourth, left-right zig-zag but this narrow section needs to be driven with the utmost precision. One touch of the kerb and you're out of the race. Out of the chicane, flat out in fifth, the road widens and you head for **Tabac** and the **Swimming Pool Complex.** In third, two esses, accelerate briefly, brake hard and almost touch the barriers with the right hand side of the car. La **Rascasse** next, then in second for Antony Noghes, accelerate out of this bend, roar through the gears and then flat out in sixth heading for the finishing straight.

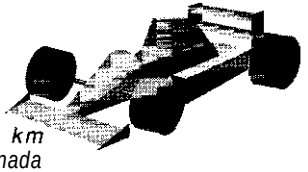
MONTREAL CIRCUIT

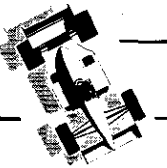




CIRCUIT DATA

Circuit Length: 2.753 miles/4.430km
Race Distance: 69 laps, 169.975 miles/305.670 km
Location: Circuit Gil/es Villeneuve, Montreal. Canada





CANADIAN GRAND PRIX

A fast circuit comprising of a succession of hard braking and accelerating. Drivers take off downforce which make the slower sections much more difficult and emphasises the uneven surface.

From the start, the cars proceed into the slow left/right first gear Island Hairpin, taken at 45mph. The drivers get a lot of wheelspin as they leave this corner and build up to the long extended 's' bend which they can approach in fifth at 160mph. Then it's flat out in sixth, 180 to 185mph along the back straight before slamming on the brakes for the first gear, 40mph Pits Hairpin. It's very important to get a good, fast exit out of this bend, then right, left, through what is thought to be the most dangerous part of the circuit with high concrete walls on either side of the track. Past Old Pits and into sixth gear, then accelerate through the straight at 175-185. 195mph. This is the fastest section of the track and leads to one of the least favourite corners among many drivers, down to fifth, 160mph, a quick right-left. It's very easy to clip the kerb and spin off here either on entry or on the apex, but if you come out of it well, it sets you up for a charge down the finishing straight.

CIRCUIT GILLES VILLENEUVE, MONTREAL, CANADA

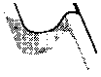
Length of Circuit:.	2.753miles/4.430km
Number of Laps:	69
Total Distance:.	189.975miles/305.670km
Lap Record (Qualifying):	1 m. 19.837sec
Lap Record (Race):	1 m.22.077sec

MEXICO CITY CIRCUIT

CIRCUIT DATA

Circuit Length: 2.747 miles/4.421km
Race Distance: 69 laps, 189.564 miles/305.049 km
Location: Mexico City, Mexico

GRAN PREMIO DE MEXICO



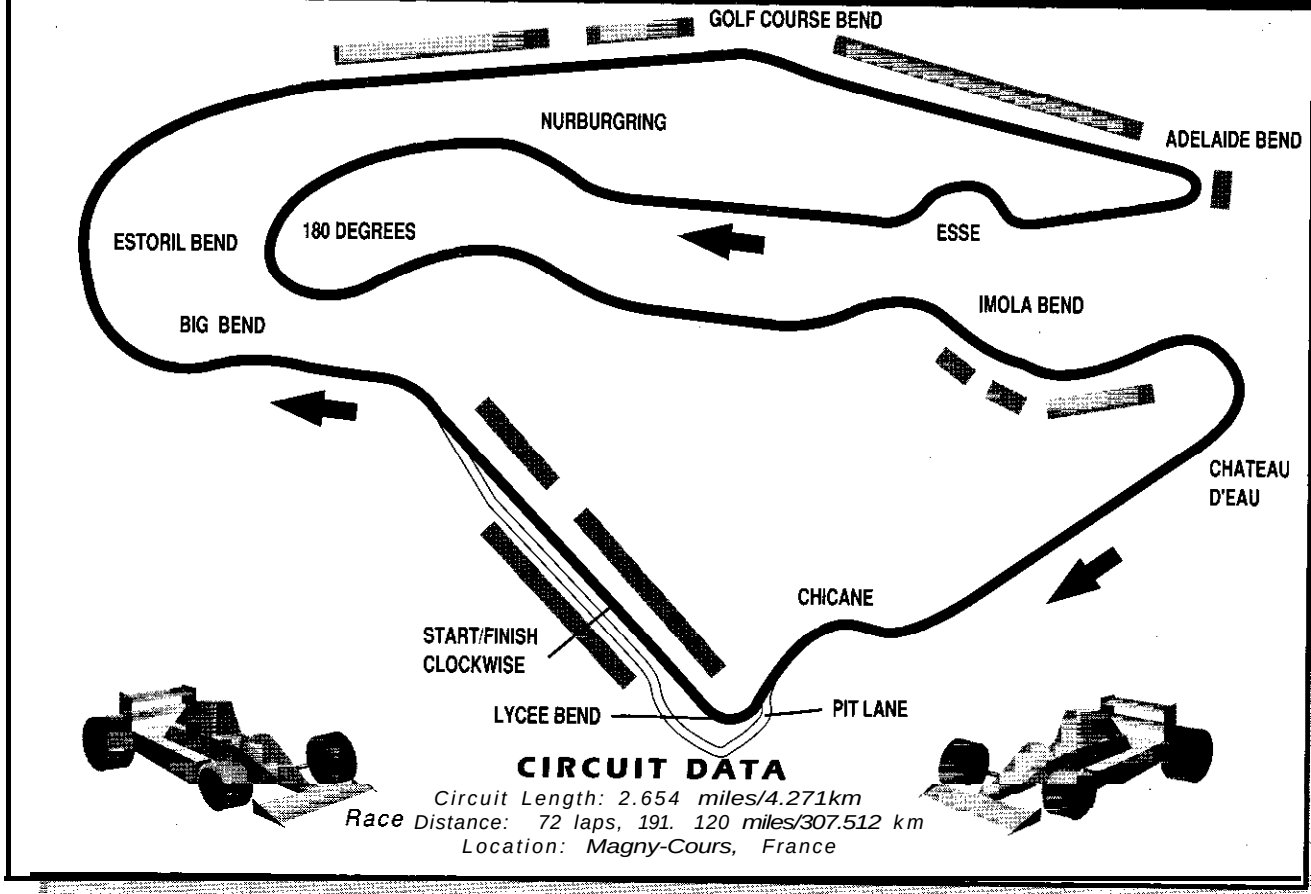
A hard, bumpy circuit, which needs lots of gear changes but generally very fast. The cars require little downforce and because of the high altitude almost 20% of power is lost but this is compensated by a reduction in 'drag'. Concentration is vital on this course. Drift off-line and you find dusty parts of the track with little grip. Mexico can also have vicious bumps that can cause a lot of damage to the car and knock the breath from your body.

AUTODROMO HERMANOS RODRIGUEZ, MEXICO CITY, MEXICO

Length of Circuit:.	2.747miles/4.421km
Number of Laps:	69
Total Distance:.	189.584miles/305.049km
Lap Record (Qualifying):	1 m.16.696sec
Lap Record (Race]:.	1 m. 16.788sec

After a long straight, the fastest on the course in sixth at 190mph, and one of the best places to overtake, you brake hard into the first comer, down to 55mph in second or third. Right, left, right into the shorter straight flat out towards a long series of bends, the Esses. It's easier if you can get into a rhythm because they are very similar. When you hit the back straight in sixth and head for Peralta, a notorious corner taken in fifth at 160mph and a challenge to any driver, exit on the kerb then accelerate to 170mph past the grandstand.

MAGNY-COURS CIRCUIT

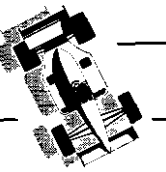


CIRCUIT DATA

Circuit Length: 2.654 miles/4.271km

Race Distance: 72 laps, 191. 120 miles/307.512 km

Location: Magny-Cours, France



GRAND PRIX DE FRANCE

This is a new course in the World Championships. Smooth and challenging, doubling back on itself, with fast fourth-fifth gear comers and first gear hairpins as well a long top-speed straight, Magny-Cours has been built to appeal to the Formula One spectators and TV crews alike. The circuit has several constant radius corners but the cars are set up to carry less downforce. The five fast straights mean that acceleration and top-speed are more important than the fraction of a second to be gained at comers when carrying more downforce.

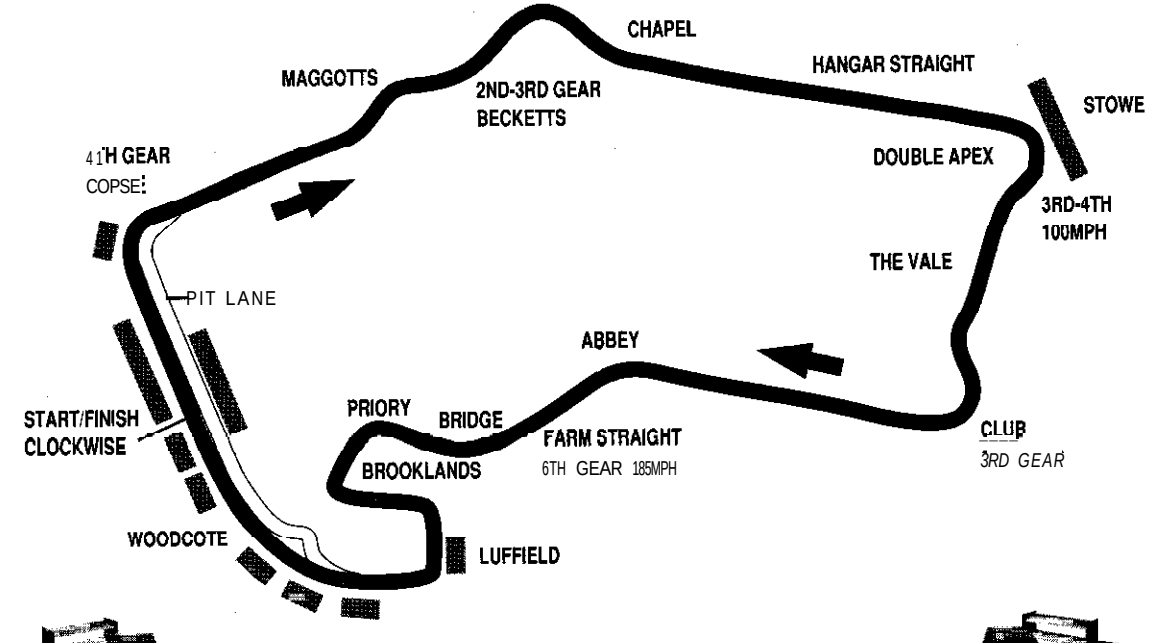
CIRCUIT DE NEVER8
MAGNY-COURS, FRANCE

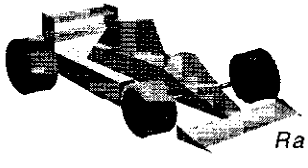
Length of Circuit:.	2.654miles/4.271km
Number of Laps:	72
Total Distance:.	191. 120miles/307.51km
Lap Record (Qualifying):	1m. 14.559sec
Lap Record [Race]:.	1m. 19.168sec

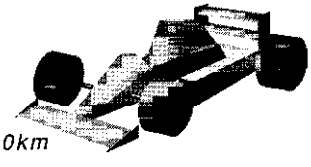
After the pits straight, you roar into a fast left-hander which changes into a slow left-bander at Big Bend then turns into a long sweeping right-hander: Estoril Bend. Taken in fourth or fifth, this propels you into the long back straight, past the Golf Course Bend, in top at 190mph. After the fastest point, brake hard for the first gear hairpin at Adelaide Bend and turn into the infield part of the course. Swing into the second or third gear Esse then a short straight before Nurburgring, a slight right, then a sweeping left which turns into a double-apex 180 degree bend that throws you into another short straight almost parallel with the previous one.

Next, a fifth gear left-hander, Imola, which leads into the fast fourth gear bend at Chateau d'Eau, then another short straight, under the bridge and into the Chicane before you take a good line sharp right into the Lycee Bend, then flat out across the finishing line.

SILVERSTONE CIRCUIT

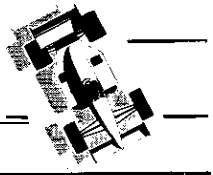




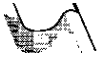


CIRCUIT DATA

Circuit Length: 3.202 miles/5.153km
Race Distance: 60 laps, 192.000 miles/309.180km
Location: Northamptonshire, Great Britain



BRITISH GRAND PRIX



The circuit has been altered for the 1991 Championship because it was considered far too dangerous. A bend such as Club Corner taken in sixth at 185mph with no run off track was particularly hazardous.

SILVERSTONE,
NORTHAMPTONSHIRE, BRITAIN

Length of Circuit: 3.202miles/5.153km

Number of Laps: 60

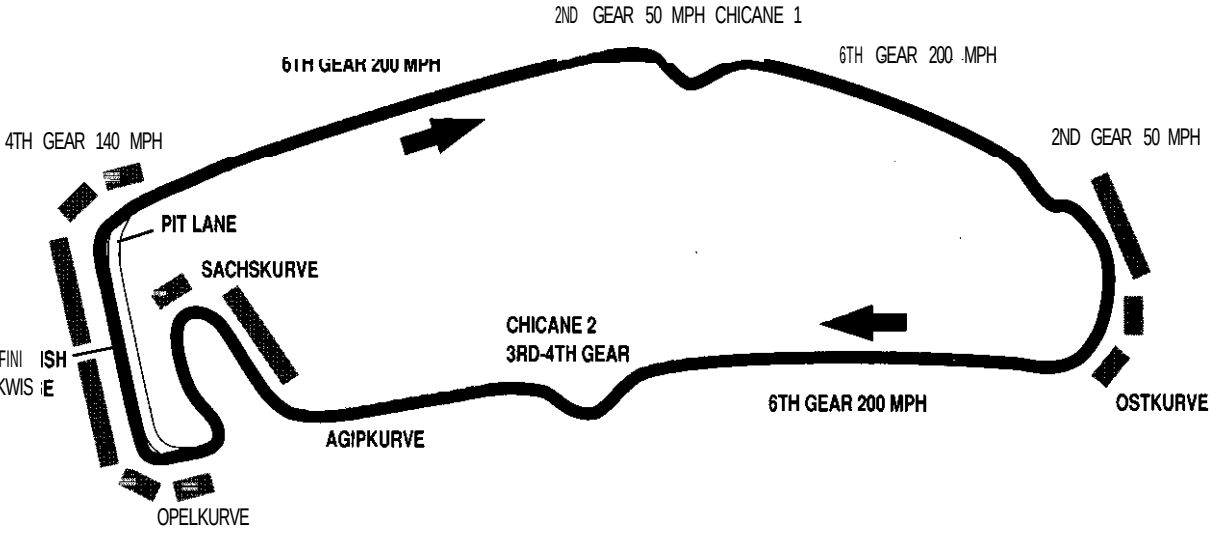
Total Distance: 192miles/309.180km

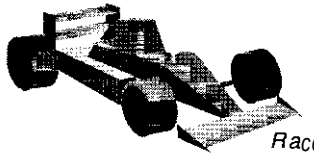
Lap Record (Qualifying): 1m.20.939sec

Lap Record (Race): 1m.26.379sec

Copse is a fourth gear corner that pushes you into a fast straight leading to Maggotts where you swing into the S shaped Becketts in second or third. This slows the cars down and provides a better spectacle for the crowd. Then the cars roar away from Chapel along the Hangar Straight, under the bridge, towards the double apex right-bander Stowe; taken in third or fourth at 100mph. After the Vale complex you have to take Club, a third gear left-bander that throws you into the Abbey straight, a favourite overtaking stretch. In sixth, at 185mph sweep into the Farm Straight and a fast right under Bridge towards Priory and Brooklands. Two second or third gear left-handers followed by two right-banders ending at Luffield, then it's flat out along the fast Woodcote and through the finishing straight.

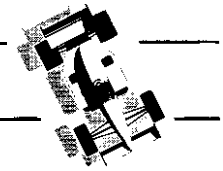
HOCKENHEIM CIRCUIT





CIRCUIT DATA

Circuit Length: 4.227 miles/6.802km
Race Distance: 45 laps, 190.236 miles/306.090 km
Location: Heidelberg, Germany



GROSSER PREIS VON DEUTSCHLAND

HOCKENHEIMRING, HEIDELBERG, GERMANY	
Length of Circuit:.	4.227miles/6.802km
Number of Laps:	45
Total Distance:.	190.236miles/306.90km
Lap Record (Qualifying):.	1 m.37.087sec
Lap Record (Race]:.	1 m.43.569sec

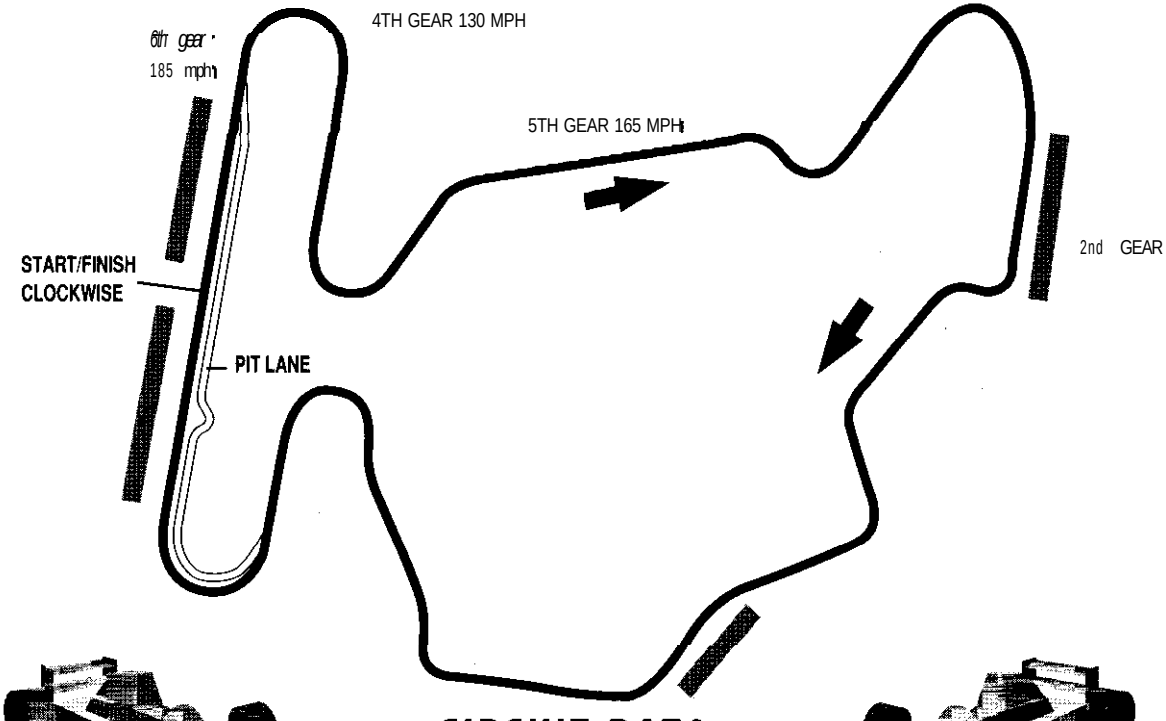
There are three chicanes on the circuit, one fast and two that have to be taken slowly. The rest of the course is a series of straights. This means that to have good top speed almost all downforce is taken off, and the cars are a horror to drive with no grip and twitchy on any bend.

From the start you take a fourth gear right-hander at 140mph, then put your foot down 'till you hit sixth at 200mph for the fastest part of the course. Brake hard for Chicane 1 which hooks sharp right and can be taken in second at 50mph but if you drive a bad line you may be forced to drop to bottom gear. Up through the gears again, flat out, 200mph for the sweeping right-bander then brake again for another chicane which you take in second at 50mph, come out of that and roar into Ostkurve, one of the fastest bends of any championship course, take it in sixth, 200mph. Slow down for Chicane 2, drop to fourth or third, then flat out for the rest of the straight until Agipkurve. This is the most difficult part of the circuit and tends to wear out tyres prematurely. Drivers have not built up any rhythm for the bends and all concentration is lost on the long straights.

Approaching Sachskurve, slip to fourth, line the car into the right-bander, foot down, sweep round, then second gear to take the hairpin, speed up, line up the car for the tight right-bander, brake lightly and roar out of Opelkurve in third towards the finishing straight.

Hockenheimring is a good overtaking circuit but the slow chicanes require brutal braking and brakes tend to cool off on the long straights making them less efficient. Most drivers find it difficult to establish a satisfactory rhythm on this course.

HUNGARORING CIRCUIT



CIRCUIT DATA

Circuit Length: 2.466 miles/3.968km
Race Distance: 77 laps, 189.851 miles/305.536 km
Location: Hungaroring, Budapest, Hungary

HUNGARIAN GRAND PRIX

A tough but relatively slow circuit with a large number of corners and few straights. It's difficult to overtake on this course and you have to be quite patient, waiting for the right moment. Cars are usually set up for more downforce to gain the advantage of good grip on the numerous bends.

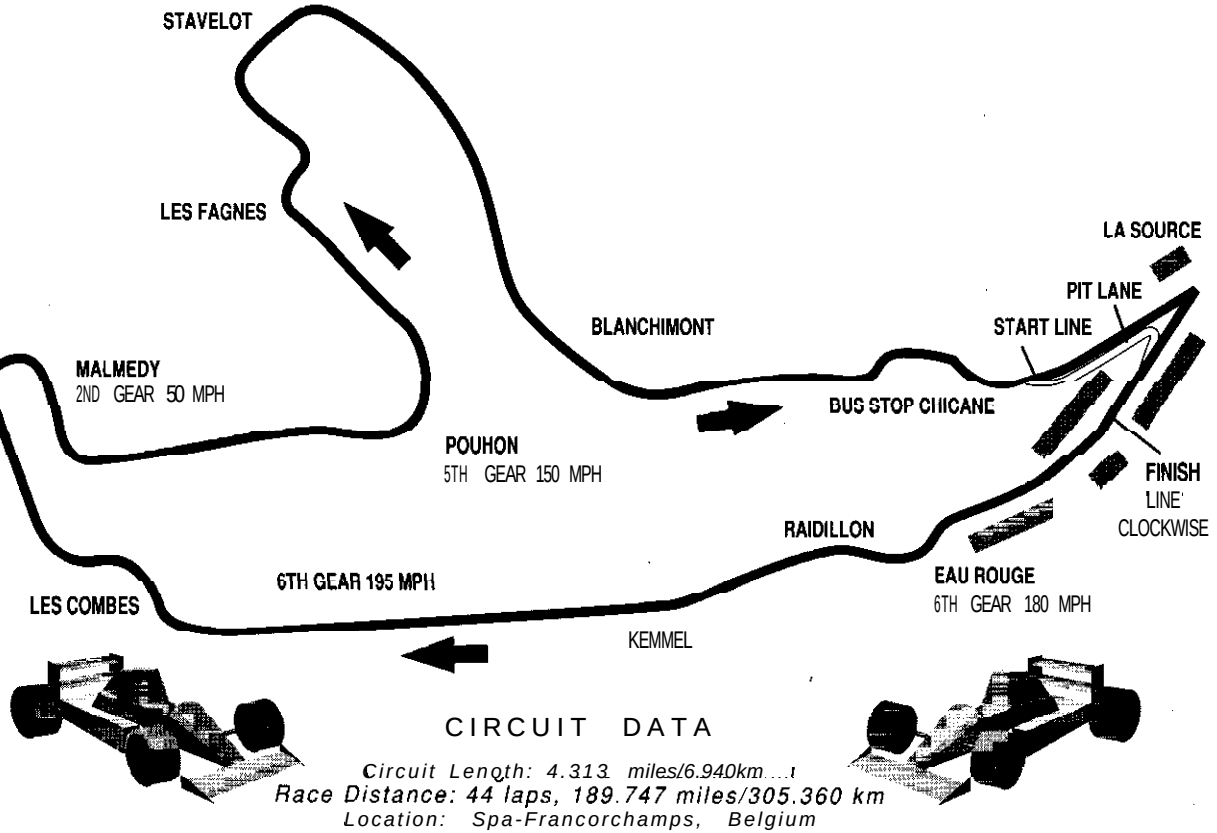
HUNGARORING, BUDAPEST, HUNGARY

Length of Circuit:.	2.466miles/3.968km
Number of Laps:	77
Total Distance:.	189.85 1miles/305.536km
Lap Record (Qualifying):.	1m. 16.147sec
Lap Record (Race):.	1m. 21.547sec

Roaring away from the start, downhill, flat out in sixth at 185mph, the pit straight is the main overtaking point on the course. Then through the first of several constant radius corners at 130mph in fourth, a short back straight, then a double-apex left-bander leading to a long sweeping right. Accelerate to 165mph in fifth, sweep left then go into another double-apex bend. Slow down for the second gear chicane, then drive hard into a whole series of fast corners before the constant radius Pit Lane bend throws you out into the long finishing straight.

The twisting up and down nature of the track means that average speeds are quite low, about 105-110mph, and tyres wear out quickly as the drivers lose patience and try to exit corners faster than the tyres will allow. Most teams find that drivers come in for a tyre change much earlier than planned, if only to get away from the queues that develop on this circuit.

SPA-FRANCORCHAMPS CIRCUIT

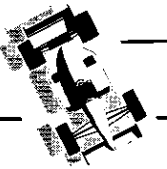


CIRCUIT DATA

Circuit Length: 4.313 miles/6.940km

Race Distance: 44 laps, 189.747 miles/305.360 km

Location: Spa-Francorchamps, Belgium



GRAND PRIX DE BELGIQUE

Fast, challenging and exhilarating, Spa is a favourite circuit among Grand Prix drivers. It successfully combines fast sixth and fifth gear comers with good first gear hairpins and second gear chicanes. Generally cars are set up with little downforce.

CIRCUIT DE SPA-FRANCORCHAMPS. FRANCORCHAMPS, BELGIUM	
Length of Circuit:.	4.3 13miles/6.940km
Number of Laps:	44
Total Distance:	189.747miles/305.360km
Lap Record (Qualifying):	1m.47.811sec
Lap Record (Race):.	1 m.55.087sec

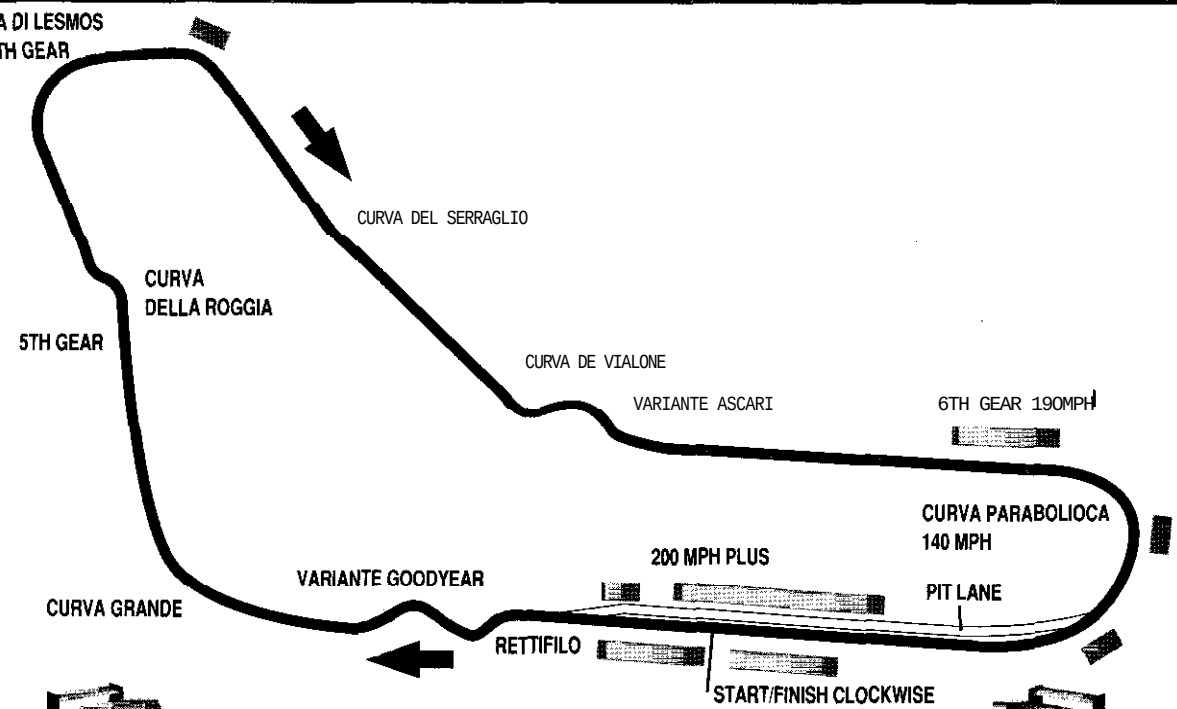
From the start line, there is a short space of time before the cars reach the first gear, 45mph La Source hairpin, the scene of many opening-lap shunts, as 26 cars brake from 160mph to 45mph while trying desperately to overtake each other. Then, it's a race up through the gears, downhill in sixth at 180mph, you drop into the Eau Rouge dip, a slight left, then sweep right uphill past Raidillon. This is one driving line you cannot afford to get wrong, one error and you're off the circuit!

Speed up through Kemmel and into the long straight, flat out at 195mph, weave through Les Combes and then take Malmedy in second. This is a tricky 180 degree corner, downhill and off-camber. Pouhon is next; an extremely difficult left-bander that starts off in sixth, then drops to fifth at 150mph.

Through Les Fagnes and Stavelot you take a series of fast comers that lead you to the long sweeping right and left towards Blanchimont then brake hard for the Bus Stop Chicane. Bus Stop is the drivers least favourite corner, to be quick you have to run over the shallow kerbs, which is always a risk.

The weather is always a big factor at Spa-Francorchamps and it is invariably wet which results in small, hazardous streams crossing the circuit, making drivers adjust their driving line.

MONZA CIRCUIT



CIRCUIT DATA

Circuit Length: 3.604 miles/5.800km
Race Distance: 53 laps, 191.009 miles/307.400 km
Location: Milan, Italy

GRAN PREMIO D'ITALIA

Monza is always full of screaming, hysterical crowds being marshalled by even more hysterical officials. The drivers absorb the atmosphere and are spurred on to perform to their utmost, especially if they are driving an Italian car.

The cars run little wing to take advantage of the very fast start/finish straight, Rettifilo, which is crossed at speeds in excess of 200mph. The track has been modified to make it safer including the introduction of the second gear Variante Goodyear, a chicane that leads into the famous fifth gear Curva Grande.

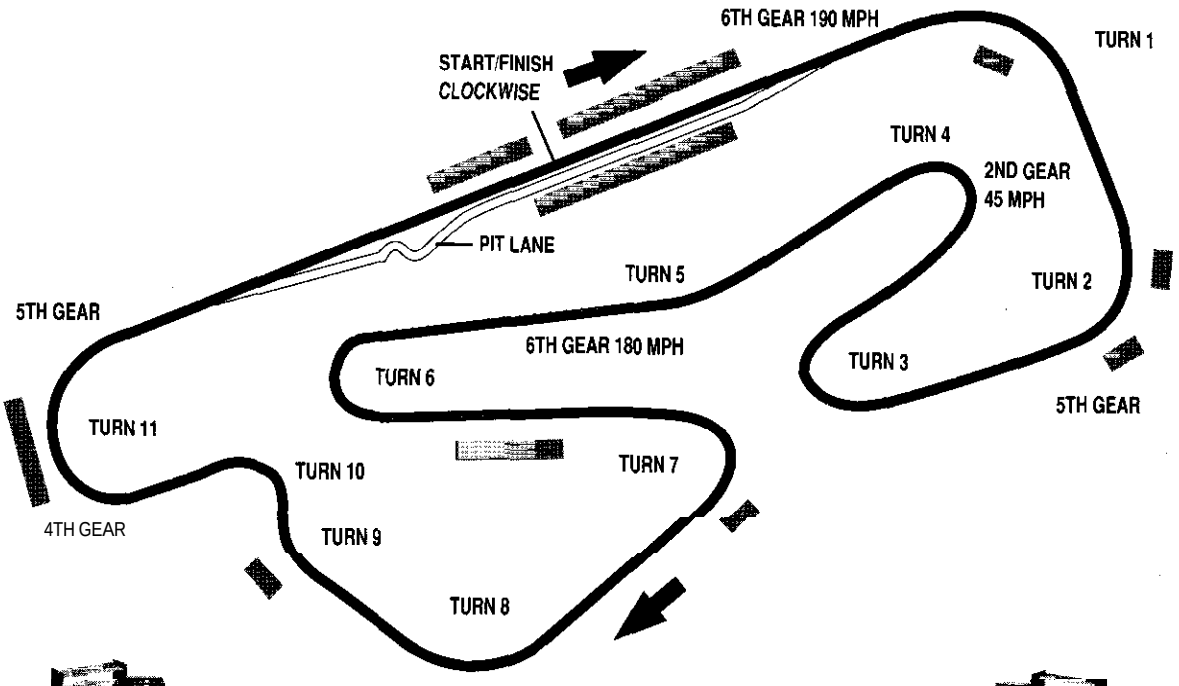
AUTODROMO NAZIONALE DI MONZA, MILAN, ITALY

Length of Circuit:	3.604miles/5.80km
Number of Laps:	53
Total Distance:.	191 .009miles/307.400km
Lap Record (Qualifying):	1m.21114sec
Lap Record (Race]:.	1m.26.061 sec

Flat out towards Lesmos in fifth there is another second gear chicane: Curva della Roggia before the double right-hander Curva di Lesmos corner. You take the first part in fourth gear then power up to take the second part flat-out. These comers have to be taken just right for any slight error will slow you down considerably and put you in a bad position for the 180mph back straight, Curva del Serraglio.

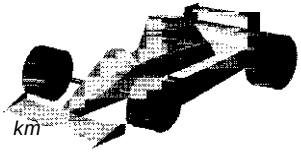
Then it's a tricky third gear chicane Variante Ascari, come out of this in fifth and charge down Rettifilo Centro at 190mph in top and brake hard for the famous Curva Parabolica, a fast, 180 degree right-bander that's taken in fourth at 140mph. Accelerate to 160mph out of the bend, then storm through the finishing line with your foot down in sixth.

ESTORIL CIRCUIT



CIRCUIT DATA

Circuit Length: 2.703 miles/4.350km
Race Distance: 71 laps, 191.951 miles/308.850 km
Location: Autodromo do Estoril, Portugal



GRANDE PREMIO DE PORTUGAL

Estoril is a tough, tiring circuit with several long, constant radius corners and some very bumpy straights. If the car is starting from near the front of the grid then it's wise to run a lot of downforce to cope with the long bends, but if you are starting low down in the order then you must use less downforce, otherwise you'll find it very difficult to overtake.

The start/finish line is in the middle of the circuit's longest straight. Cars accelerate to 190mph in sixth before Turn 1, trying to overtake each other, before braking into the fourth gear corner. Turn 2 is another sweeping right-hander, then it's up to fifth for the short straight, brake hard for Turn 3, the Martini Bridge Bend, a tight double-apex right-hander. It's important to drive a good line through the infield at Estoril, avoiding the kerbs and the sandy, greasy edges.

AUTODROMO DO ESTORIL, PORTUGAL

Length of Circuit: 2.703miles/4.350km

Number of Laps: 71

Total Distance: 191.951miles/308.850km

Lap Record (Qualifying): 1m. 18.751sec

Lap Record (Race): 1m.22.837sec

Turn 4 is almost a mirror image of the previous corner. Take the left-bander in second at 45mph, then race up through the gears, swing through the slight right-bander, Turn 5, then flat out in sixth at 180mph. This is probably the best place to overtake on the whole circuit.

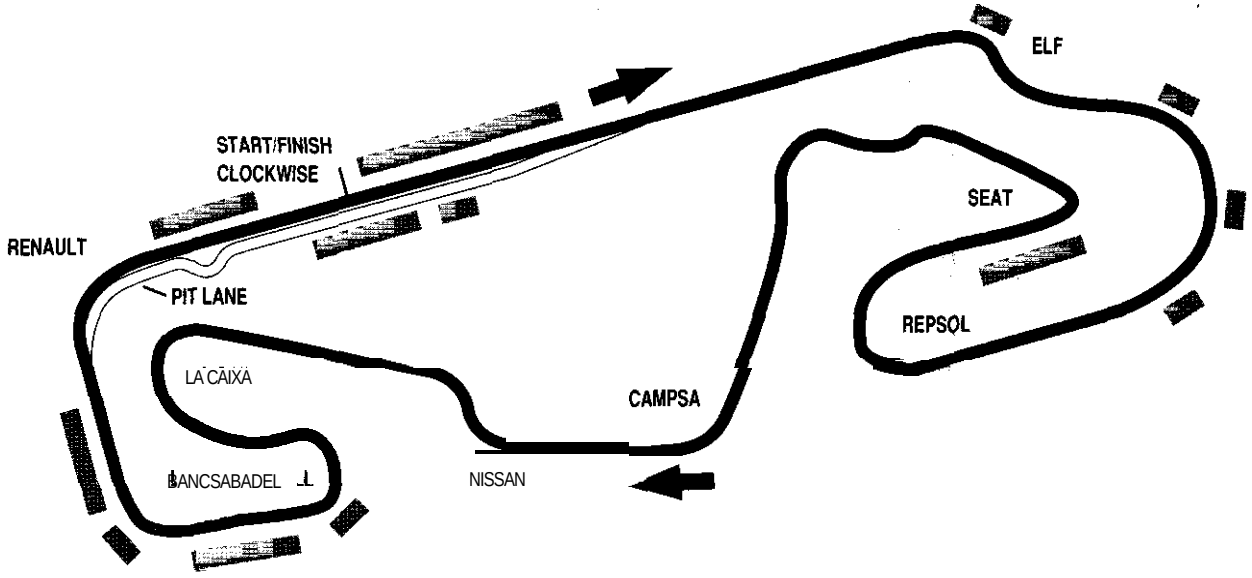
Through Turn 6, a comer that begins tight then opens out, foot down for a short straight and into the long series of fast bends, Turns 7-8-9-10.

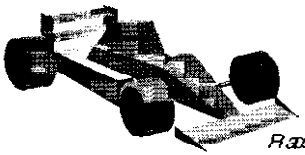
It's important to maintain a good rhythm through these bends, keep concentrating, change up, change down, brake hard.

The final corner before the pit straight, Turn 11, is a real challenge for any Formula One driver. It's a long, constant radius sweeping bend that you enter in fourth and leave in fifth, accelerating all the way, ready to get in position to overtake.

Estoril is a circuit that's not only hard on gears and brakes but also tough on tyres; the long sweeping bends often mean that many drivers return to the pits earlier than planned as the heat and rough surface take their toll.

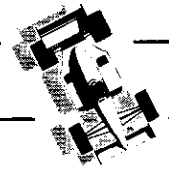
BARCELONA CIRCUIT





CIRCUIT DATA

Circuit Length: 2.950 miles/4.747km
Race Distance: 65 laps,191.768miles/308.555 km
Location: Barcelona, Spain



GRAN PREMIO DE ESPANA

A new circuit that has a wide range of corners from slow, second gear to fast fourth/fifth gear and includes a very long 200mph overtaking straight. In shape it is very similar to Estoril but the surface is much smoother. Drivers will have to compromise between the downforce needed for the many bends and the speed required for the pit straight. Most will opt for little downforce and try to nurse their cars through the infield section.

CIRCUIT DE CATALUNYA, BARCELONA, SPAIN

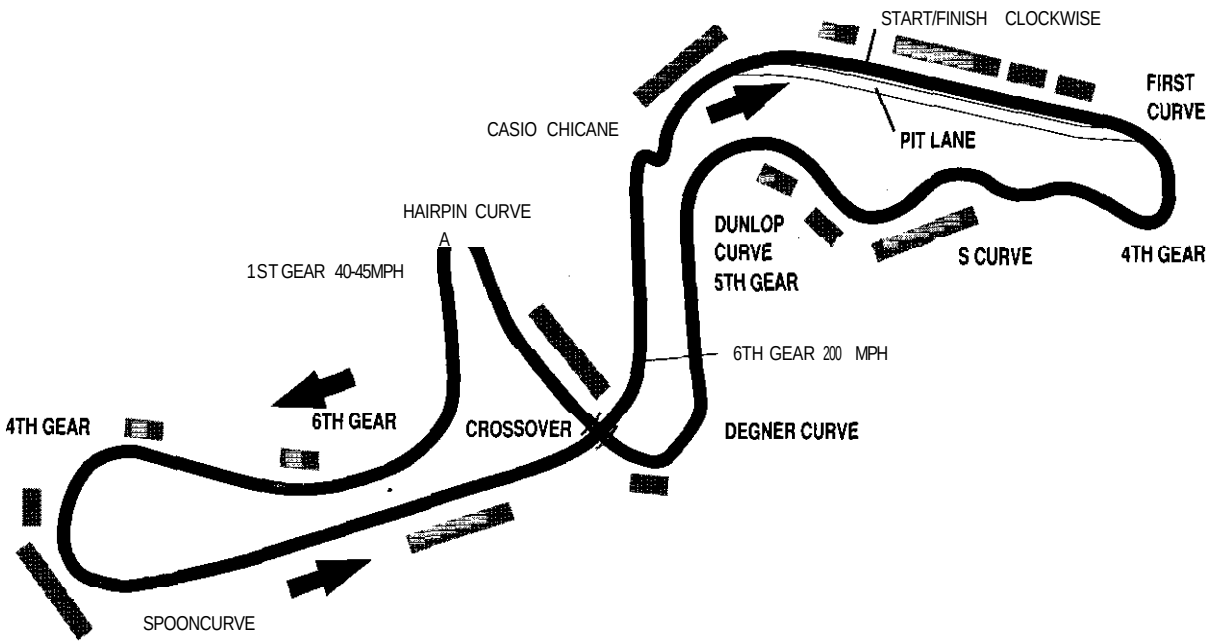
Length of Circuit:	2.950miles/4.747km
Number of Laps:	65
Total Distance:.	191 .768miles/308.555km
Lap Record (Qualifying):	1 m.18.75 sec
Lap Record (Race):.	1m.22.837sec

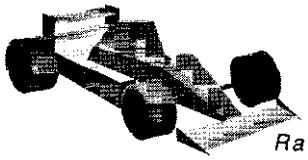
From the start, accelerate through the gears, flat out in sixth heading for Elf, a slow left-bander. If you are not in the lead, this gives you a good opportunity to overtake under braking. Then, it's a slight left before a long sweeping fourth gear right-bander that you leave in fifth and speed up for the short straight to Repsol; a comer which turns back on itself but whose angle progressively widens. Next, a short burst of speed into Seat, brake, drop to second at 45mph, accelerate, then slight left, slight right before taking Wurth in fourth and roaring off to Campsa, a fast, third/fourth gear right-hander.

After that it's right and left through Nissan and flat out, up to La Caixa. This is another corner that starts tight and opens out. Steer in, get on line early and as the corner widens, move to the outside of the track. There is no time to put your foot down before you reach the Banc Sabadell, a long constant radius bend.

Next comes the approach to the straight. Sweep right, foot down, then right again take Renault in third, change to fourth and charge out in fifth before hitting sixth, flat out, past the finishing line.

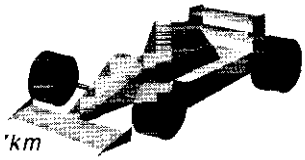
SUZUKA CIRCUIT

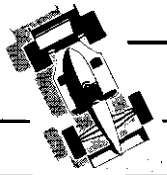




CIRCUIT DATA

Circuit Length: 3.641 miles/5.859km
Race Distance: 53 laps, 192.952 miles/310.527 *km*
Location: Shiroko, Japan





JAPANESE GRAND PRIX

An interesting, undulating course and the only figure of eight in the Grand Prix. Tough, sixth gear corners combine with first gear hairpins to make tyre stops essential. Little downforce is set because of the three long straights and the cars generally feel sluggish in the corners.

The pits straight is a sixth gear, 190mph charge where it is perfectly possible to overtake, then it's down to fifth for the First curve. You drift the car to the left side of the track, down to fourth and race out of the corner.

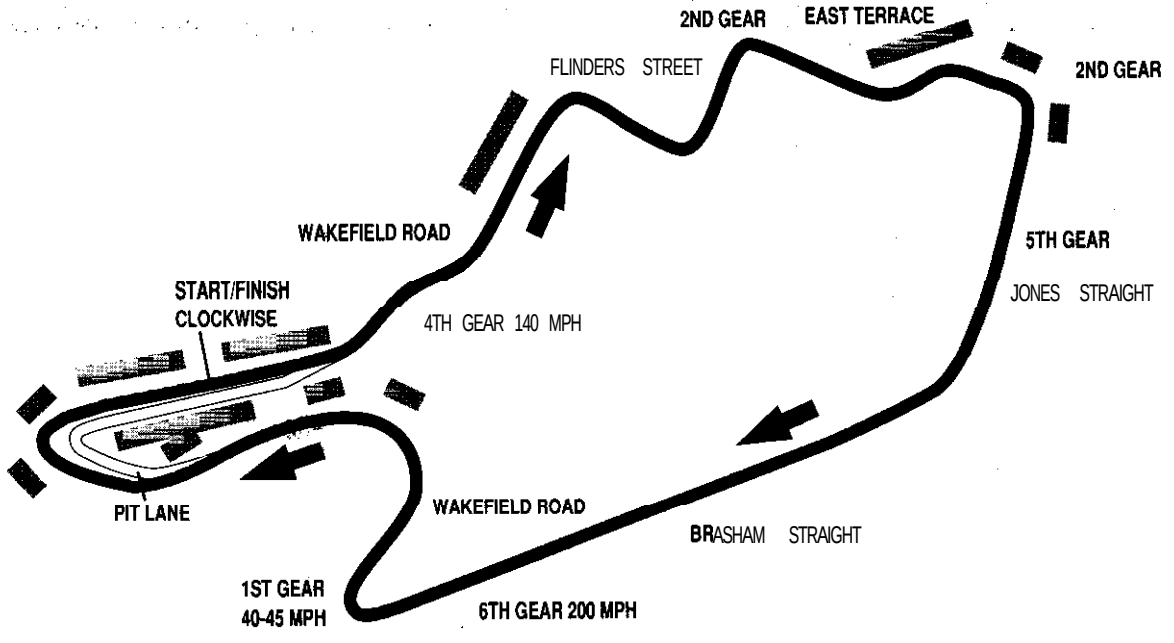
SUZUKA, SHIROKO, JAPAN

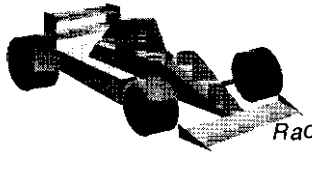
Length of Circuit:.	3.641 miles/5.859km
Number of Laps:	53
Total Distance:.	192.952mile/310.527km
Lap Record (Qualifying):	1m.36.996sec
Lap Record (Race):.	1m.43.506sec

Next you come to a series of fourth gear bends (The S Curve). Driving as tight a line as possible through these, you leave Dunlop Curve with your foot down in fifth, going uphill and blind for the oncoming left-hander. The car feels light as you roar over the bumpy crest and come down hard for the two right handers Degner Curve and Crossover. You now pass under the circuit and approach at a slow 40mph for the first gear Hairpin Curve. This corner can play havoc with your rear tyres if you try to exit too quickly and overspin the back wheels. Now line up the car for the long double apex left hander. Enter in fourth but slow down for the second part of Spoon Curve for it's quite easy to spin off here.

Next you get to one of the fastest straights, sixth gear, 180mph, sweeping left with both hands on the wheel, ease your car carefully through the slow Casio Chicane then storm through flat out past the finishing straight.

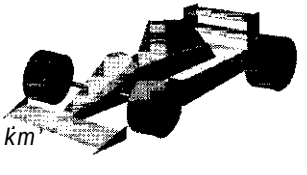
ADELAIDE CIRCUIT





CIRCUIT DATA

Circuit Length: 2.349 miles/3.780km
Race Distance: 81 laps, 190.292 miles/306.180 km
Location: Adelaide, Australia



THE CIRCUITS

AUSTRALIAN GRAND PRIX

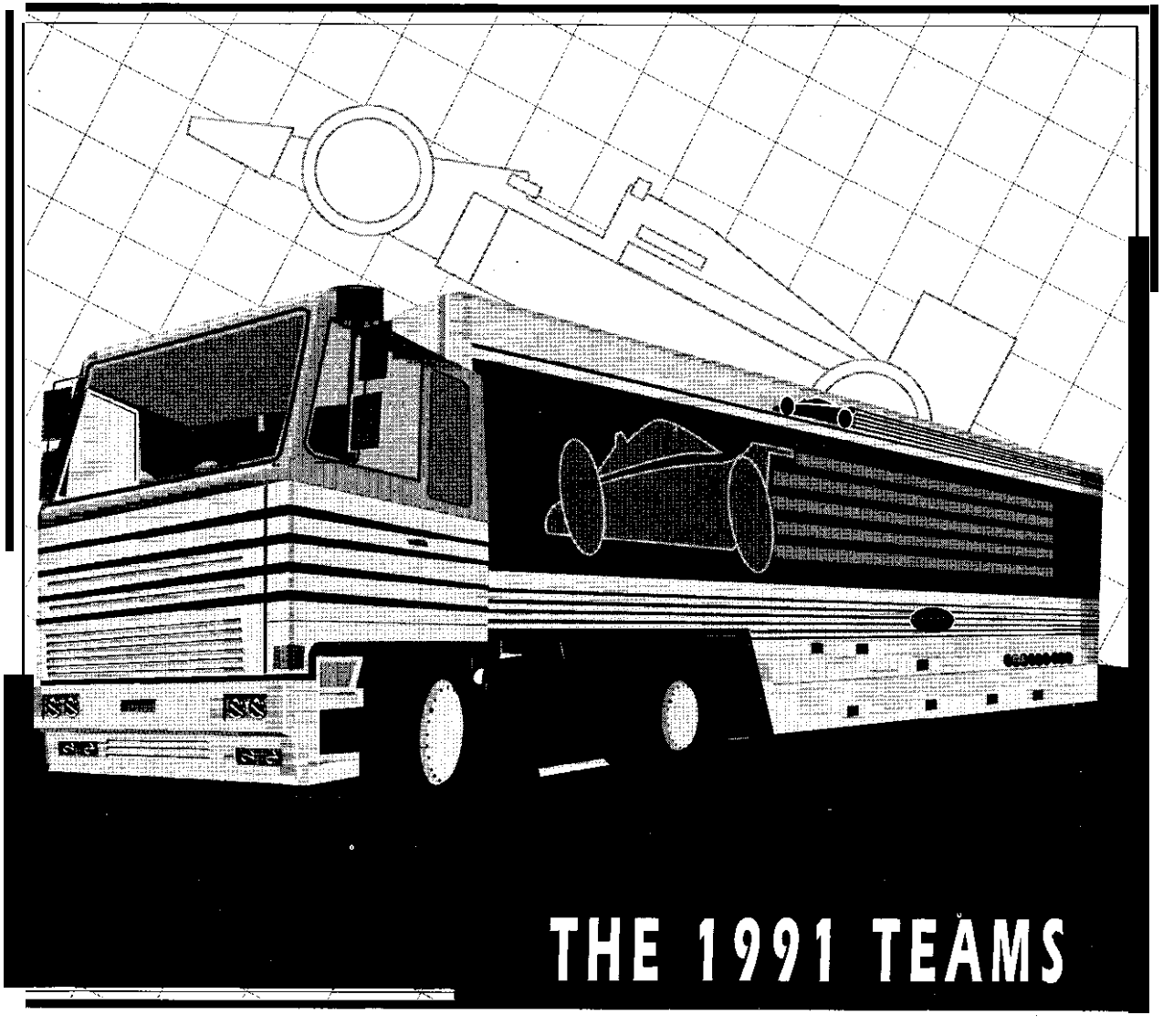
A hard, unforgiving street circuit that requires numerous gear changes and is very tough on brakes and tyres. The last Grand Prix venue of the Championship season and always very exciting as teams try to finish the year off with a win. Adelaide has been responsible for deciding the outcome of several championship, the most famous being Nigel Mansell's blowout in 1986. Again, there is a need to compromise with downforce; you'll need a lot for the 90 degree bends but you will also need the speed for the Jones and **Brabham** straights.

ADELAIDE GRAND PRIX CIRCUIT.
ADELAIDE. AUSTRALIA

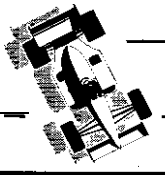
Length of Circuit:.	2.349miles/3.780km
Number of Laps:	81
Total Distance:	190.292miles/306.180km
Lap Record (Qualifying):	1 m. 15.671 sec
Lap Record (Race):.	1m. 18.203sec

After the start, your come to a fast, fourth gear chicane at **Wakefield Road,** take this at about 140mph then flat out towards the **Finders Street Complex.** The road is very bumpy here and the occasional manhole cover will knock the breath out of you. Brake hard for a difficult second-gear, 90 degree right-hander, then left 90 degrees, and right 90 degrees. Through **East Terrace** and a fast off-camber left hander, drop down to second and steer a good line to hit **Jones Straight** in fifth. Foot down, then a slight right and into **Brabham Straight, under the two bridges flat out,** 200mph in sixth.

Next, you step hard on the brakes to take a tricky, first gear, 40mph hairpin and speed up, into third for a deceptive tightening comer. Stay wide as long as possible, hit the apex late, brake, change down, take a line on the outside and follow the curve of the bend to give you the smoothest possible exit angle. Past Pits and right through Racecourse, brake hard, change down into second for a good fast exit into the finishing straight.



THE 1991 TEAMS



SCUDERIA FERRARI

A famous team throughout motor racing history, established by Enzo Ferrari in 1929 to race Alfa Romeo cars, becoming an independent team in 1939 using the prancing horse symbol. The company faced financial problems in the 1960's and was taken over by Fiat but the racing arm remained under Enzo's control right up to his death in 1988.

Ferrari are using an updated version of the successful 1990 car, the type 642. It is fast and performed well in pre-season tests. Prost is a meticulously consistent driver, who avoids trouble and will be keen to get even with Ayrton Senna. Alesi is an outstanding young prospect who will certainly be in the rankings in 1991.

BASED IN MARANELLO, ITALY

Engines: Ferrari V12

Drivers: (27) Alain Prost
Aged 36, French

(28) Jean Alesi
Aged 26, French

HONDA MARLBORO MCLAREN

Originally set up by New Zealander Bruce McLaren in 1963 and then continued by Teddy Mayer after McLaren's death in 1970. They were amalgamated with the Project 4 team in the 1980s at the insistence of sponsors Marlboro. With the use of the latest Honda engine technology, the, team has not looked back and has gone from strength to strength.

The thinners of the last three Driver and Constructos' Championships the McLaren team are aiming high yet again. They have a new Honda V12 engine sitting on the latest MP4/6 chassis which was completed only a couple of weeks before the start of the 1991 season. The team boasts probably the best set of drivers in the Championship in Senna and Berger.

BASED IN WOKING. SURREY, BRITAIN

Engines: Honda RA 121E V12

Drivers: (1) Ayrton Senna
Aged 31, Brazilian

(2) Gerhard Berger
Aged 31, Austrian

CANON WILLIAMS RENAULT

BASED AT DIDCOT, OXON, BRITAIN

Engines: Renault RS3 V1 0

Drivers: (5) Nigel Mansell
Aged 36, British

(6) Ricardo Patrese
Aged 36, Italian

Frank Williams built up the team through the early sixties and seventies when Piers Courage drove for him but he was to suffer a series of setbacks: Piers was killed in the Dutch Grand Prix in 1970 and the company went into liquidation in 1976. Resilient as ever the new team stormed to their first Grand Prix victory in 1979 and its first World Championship in 1980. The last decade has seen consistent success for the team and even though Frank Williams suffered a terrible accident in 1986, they feature prominently as 1991 championship contenders.

In 1991 Nigel Mansell came back to Williams. Running on a new FW14 chassis, powered by the latest Renault V10, he is seen as a good championship prospect. Patrese is an excellent number two for the team, a relaxed and mature driver who has spirit and lacks pretension.

CAMEL BENETTON FORD

BASED AT GODALMING, SURREY, BRITAIN

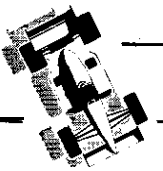
Engines: Ford-Cosworth HB V8

Drivers: (19) Michael Schumacher
Aged 25, German

(20) Nelson Piquet,
Aged 38, Brazilian

The team from the Toleman car service that built the Formula 2 car which won the 1980 European Championship. In 1984 it was bought by Benetton, the millionaire Italian knitwear family and in 1987 the renamed Benetton Formula became the Ford-works Formula One team.

With the veteran Nelson Piquet leading the team and the prospect of a new car appearing in the early part of the season the team will be ready to take advantage of any failure among the V12's and V10's.



BRABHAM YAMAHA

Jack Brabham was the first and only driver to win a Championship in a car bearing his name. He had wins in 1959, 1960 and 1966 and then Denny Hulme followed up his success by winning the championship in a Brabham in 1967. After Brabham's retirement in 1970, the company was sold twice in succession but prospered once again as Nelson Piquet won the Championship for them in 1981 and 1983. Brabham has since passed through various hands and is currently controlled by the Japanese Middlebridge Group. The team is hoping for great things in 1991 from its drivers and the new Yamaha engine. Blundell is new to Formula One but he has vast experience as a Williams test driver.

BASED AT CHESSINGTON, SURREY, BRITAIN

Engines: Yamaha VI 2

Drivers: (7) Martin Brundle, Aged 32, British

{8} Mark Blundell, Aged 25, British

MINARDI

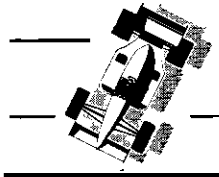
From Formula 2 roots, Giancarlo Minardi set up the Fl team in 1985. Using a variety of engines all unsuccessful, the team only scored its first point in Detroit, 1988 on the Ford Cosworth VS. Still in the 'promising' phase the team hopes to achieve great things with the new Ferrari V12 engines installed on the Ml91 chassis.

BASED AT FAENZA, ITALY

Engines: Ferrari VI 2

Drivers: (23) Pierluigi Martini, Aged 30, Italian

(24) Gianni Morbidelli. Aged 23, Italian



BRAUN TYRRELL HONDA

BASED AT WOKING, SURREY, BRITAIN

Engines: Honda RA101EV10

Drivers: (3) Satoru Nakajima, Aged 38, Japanese

(4) Stefano Modena, Aged 27, Italian

Ken Tyrrell raced in Formula 3 before turning to management. He gave Jackie Stewart his first chance in 1964, then entered the Fl circus in 1968 with the Ford Cosworth installed in French Matras. Stewart stormed through to win the World Championships in 1969. In 1971 and 1973 the team won two more Championships this time in Tyrrell cars but since Stewart's retirement there has been a dearth of Grand Prix points. Tyrrell lost Jean Alesi to Ferrari and Nakajima looks like he will be retiring at the end of 1991. This will give Modena a chance to get into the 'big time' with the 'new-concept aerodynamics' car.

LEYTON HOUSE RACING

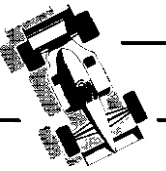
BASED AT BICESTER, OXON, BRITAIN

Engines: Ilmor V10

Drivers: (15) Mauricio Gugelmin. Aged 27, Brazilian

(16) Ivan Capelli, Aged 27, Italian

Owned by Japanese multi-millionaire Akira Akagi who entered Formula One by financing the March organisation. March gained its reputation by constructing cars for Jackie Stewart and Ronnie Peterson. Leyton House has promised much but achieved little; the cars have had problems with reliability and set-up. Now with a change of engine in 1991, from Judd V8 to the Ilmor V10, Leyton House hope to make more of an impression in Fl.



TEAM LOTUS

Founded by Colin Chapman in 1954, Lotus were seen as technical innovators on the Fl scene. Jim Clark raced them into the limelight from 1962 until his death in 1968. In 1965 Clark won the Indianapolis 500 and in the 70's the radical Lotus 72 made a startling impact. In recent years they have experienced bad luck, with Donnelly's accident in Spain 1990, and a lack of success with the 1990 Lamborghini engine.

BASED AT WYMONDHAM. NORFOLK, BRITAIN

Engines: Judd EVV8

Drivers: (11) Mika Hakkinen, Aged 22, Finnish

(12) Johnny Herbert Aged 25. British

VS

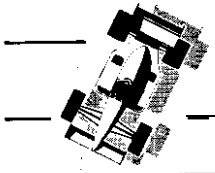
Originally, the Arrows Team which was founded by a group of disgruntled Shadow team personnel. They were never consistent enough over any particular season with their best showing a fourth place in the Constructors' Championship of 1988. By 1990, they were controlled by the Japanese Footwork Corporation who invested heavily in the team. The team has still to win a Grand Prix race and the new Al2 chassis will not be ready until after the season begins.

BASED AT MILTON KEYNES, BUCKS, BRITAIN

Engines: Porsche VI 2

Drivers: (9) Michael Arboreto, Aged 34, Italian

(10) Stefan Johansson Aged 34, Swedish



7-UP TEAM JORDAN

BASED AT SILVERSTONE, NORTHAMPTONSHIRE, BRITAIN

Engines: Ford-Cosworth HB V8

Drivers: (32) Alessandro Zanardi Aged 25, Italian

(33) Andrea de Cesaris, Aged 31, Italian

From 1982, Eddie Jordan has built up the team from a small Formula 3 concern to one of the fastest growing set ups in Fl, a bright prospect for the future. The team has helped the likes of Martin Brundle and Jean Alesi win their way through Formula 3000 to senior racing. Now it has a major sponsor with the Pepsi-Cola 7-Up brand and looks well set for success.

LARROUSSE

BASED AT SIGNES, FRANCE

Engines: Hart-Cosworth DFR V8

Drivers: (29) Eric Bernard, Aged 25, French

(30) Aguri Suzuki; Aged 29, Japanese

A new team, founded in 1987 and originally sporting a Lamborghini V12 with its Lola produced chassis but now uses the Ford-Cosworth VS. Espo of Japan were briefly in control but have since backed out of the arrangement.

LIGIER LOTO

Founded by Guy Ligier, a former rugby international who raced Formula One cars in the 1966 and 1967 seasons. Good sponsorship deals have kept the money flowing in even though the wins have dried up recently. They have great hopes of the Renault V10 engines which they will run in 1992. Both drivers have a lot of potential if given a good reliable machine.

BASED AT
MAGNY-COURS, FRANCE

Engines: tamborghini 35 I2 Vl 2

Drivers: (25) Thierry Boutsen,
Aged 33. Belgian

(26) Erik Comas,
Aged 27, French

SCUDERIA ITALIA

Entered Grand Prix in 1988 and owned by Italian millionaire Beppe Lucchini, the team is small, well organised and eager for success. They have an exclusive deal for the Judd V10's from which they hope to profit in the future. However, in the Fl 'pond' they are still 'small fish'.

BASED AT BRESCIA,
ITALY

Engines: Judd GVV10

Drivers: (2 1| Emanuele Pirro,
Aged 29, Italian

(22) JJ. Lehto,
Aged 25, Finnish

BASED AT
GONFARON, FRANCE

Engines: Ford-Cosworth DFR V8

Drivers: (17) Gabriele Tarquini
Aged 29, Italian

(18) Fabrizio Barbazza
Aged 25, Italian

From Formula 3 roots in 1951 to Formula One status in 1987 based on the old Renault chassis but often among the ranks of the non-pre-qualifiers. Prospects are not too bright even though the drivers ate quite highly regarded.

CENTRAL PARK MODENA TEAM

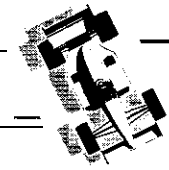
BASED AT MODENA.
ITALY

Engines: tamborghini 35 12 V12

Drivers: (34) Nicola tarini.
Aged 25, Italian

(35) Eric van de Poele,
Aged 29, Belgian

The Italian car manufacturer and Patrucco's Modena team joined forces under the auspices of Japanese millionaire businessman Yoshitoshi Doi but they still have much to prove on the Fl front. They might make an interesting comparison with the Ligier team on the Grand Prix circuit for both cars carry the same engine.



COLONI

This team just has not got the finance or the technological depth to live with the 'big boys' and always has a struggle to get on to the starting grid.

BASED AT
TRASIMENTO, ITALY
Engines: Cosworth DFR V8

Drivers: (31) Pedro Chaves,
Aged 26,
Portugese

FONDMETAL

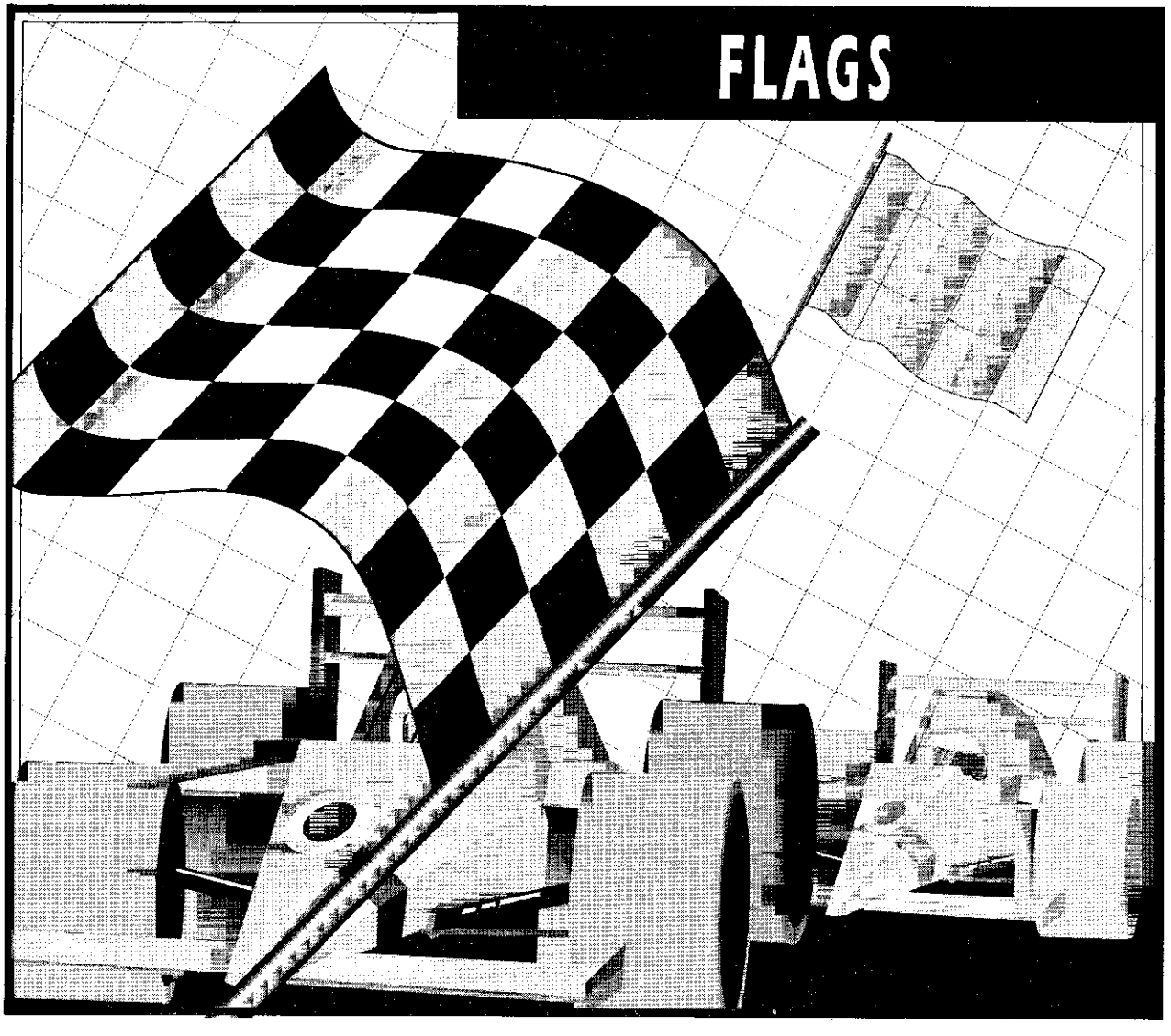
Formerly Osella which built racing cars and then progressed to Formula One in 1980. The team lasted until 1990 before selling to Fondmetal, the wheel makers.

BASED AT PALOSCO, ITALY

Engines: Hart-Cosworth DFR V8

Drivers:
(14) Olivier Grouillard,
Aged 32,
French.

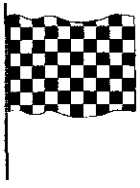
FLAGS



RACE MARSHAL'S FLAGS

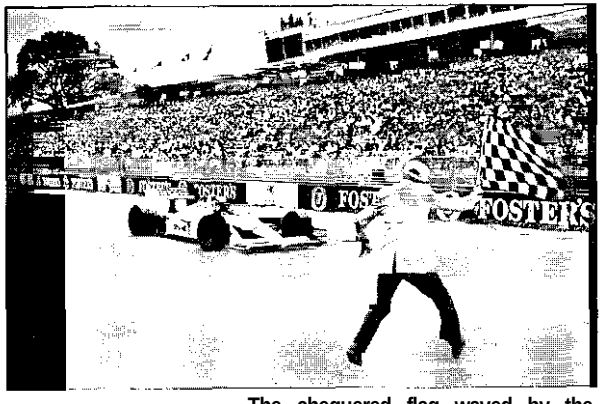
Starting Flag

This is usually the national flag of the country hosting the Grand Prix but it must not be similar to any other flag used by the marshals. The starting signal must be given by lowering the flag.



Finishing Flag

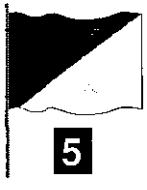
A black and white chequered flag waved at the cars on the finishing line.



The chequered flag waved by the clerk of the course; the traditional symbol to mark the end of a Grand Prix race.

Red Flag

Indicates that the race has been stopped by the Clerk of the Course. It is displayed motionless. All drivers must stop racing immediately and proceed to the pits.



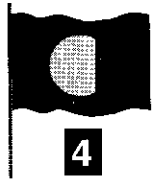
Black and White Flag *(divided diagonally into black and white halves)*

Shown motionless with a white number on a blackboard. This is a warning to the driver of unsportsmanlike behaviour.

OBSERVATION POST FLAGS

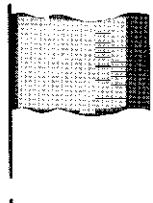
Black Flag

Shown motionless, together with a white number on a black signalling board. Informs the driver of the car that he must stop at his pits on the next lap.



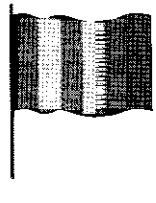
Black Flag **with** *40cm diameter Orange Disc*

Shown with a white number on a black signalling board. Informs the driver that his car has mechanical problems, likely to endanger himself or others. Driver must stop at his pit on the next lap.



Yellow Flag

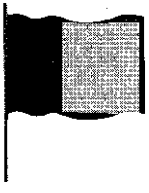
The signal of danger or a situation of danger. Slow down, prepare to stop. Keep your position and do not overtake until you see the Green Flag.



Yellow Flag with Red Stripes

Deterioration of adhesion. Tells the drivers that the grip on the track surface has suddenly deteriorated in the area after the flag. This is usually the flag used when oil has been dropped on the track, a pool of water is causing aquaplaning or when there is a sudden change from a dry to a slippery surface.

OBSERVATION POST FLAGS



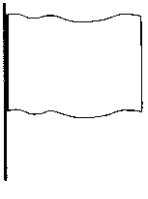
Red Flag

Stopping of the race (see above).

NB All flags must measure 60cm X 80cm ***except the Red Flag which is 80cm X 100cm.***

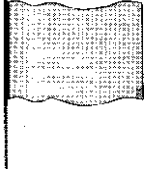
Green Flag

All clear. This is used at the end of a danger area controlled by the yellow flags.



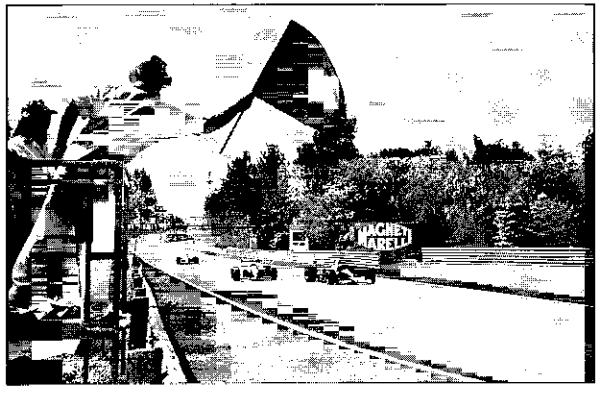
White Flag

Slow-moving vehicle on the track. This tells the drivers that they are about to overtake a vehicle which is travelling on the track at a much slower speed than the competing cars.

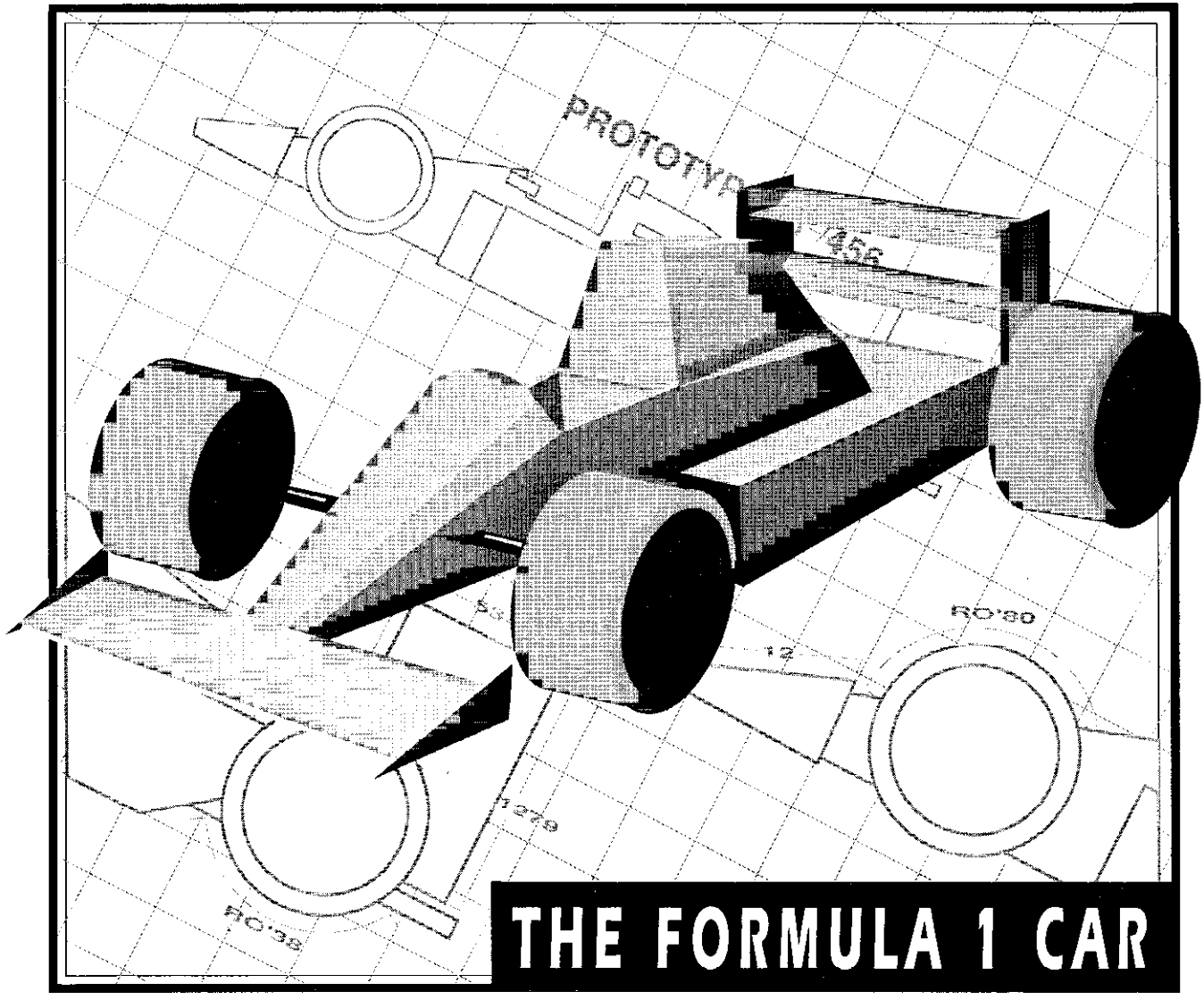


Light Blue Flag

The overtaking signal. Waved, it informs the driver that he is going to be overtaken by one or more faster cars. Shown motionless means that the faster car is still some distance away.



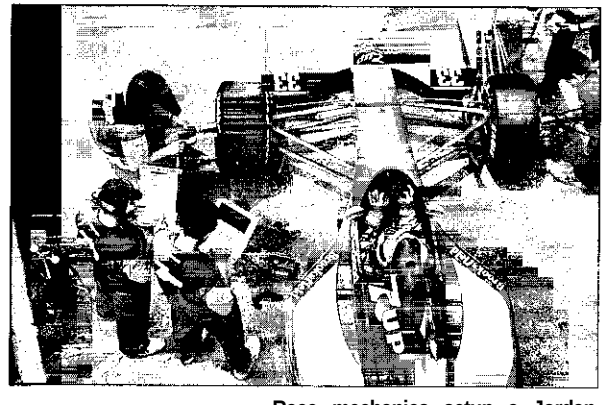
A race marshal waver the light blue overtaking flag to let the driver in front know he is about to be lapped by a faster car.



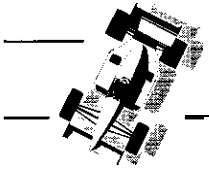
THE FORMULA 1 CAR

SETTING UP

The aim is to have a well-balanced car that achieves excellent weight distribution. Measurements must be precise and a variety of methods are used to ensure perfect straight axes from which to measure the settings. First and foremost the mechanics must place the car on a totally flat surface, one that will not vary from circuit to circuit. Fl teams use a large metal plate that the car sits on. Under each wheel are four adjustable blocks that will give create the perfect level surface for the car to rest on.



Race mechanics setup a Jordan 191 at the Mexican Grand Prix. The driver must sit in the cockpit fully kitted up and the fuel tanks must be half-full.



THE STATIC SET UP

- Check tyre pressure.
- Check tyre circumference.
- Disconnect anti-roll bars to release suspension and check free movement.
- Check ground clearance with special blocks.
- Check the castor angle. The greater the angle the heavier the steering and better the stability of the front end.
- Check the camber angle. Camber makes a tyre work as effectively as possible as the car throws itself into a corner.
- Check toe-in/toe-out. To see how a car reacts as the weight shifts onto the front suspension and take care of the distorting problems of 'induced steering'.
- Check balance and distribution of weight. Usually done with the driver sitting in the car and half-full tanks.
- Check alignment of wheels and that both sets are on the same axes.

THE DYNAMIC SET UP

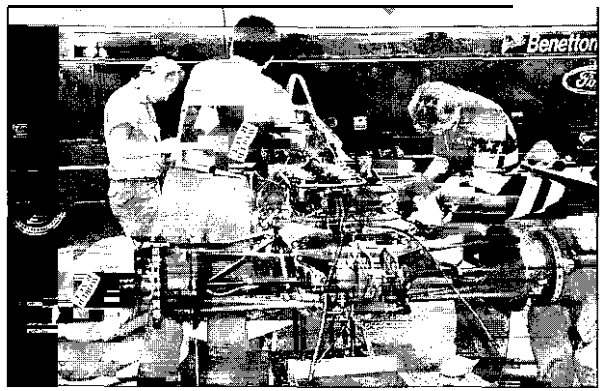
The aerodynamic settings apply to everything that affect the airflow of a car:-

- the front wing
- fhe rear wing (double or single plane)
- the bodywork
- the trim

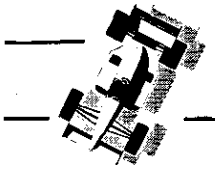
This is where downforce must be implemented correctly. The car must first be balanced correctly, then adjusted to the needs of the particular circuit. Generally, the more downforce a car has the better it grips the road but the slower it will be on the straight. Setting downforce is always a compromise between the need for good cornering and speed.

Mechanical settings are useful for aspects of the car that are important at 70mph or lower (before aerodynamics come into play). These are:-

- springs
- dampers
- anti-roll bars
- bump stops



A stripped down Benetton B188 jacked up *to give the mechanics good* access to the rear suspension unit.



In the event of a car understeering and losing front grip the mechanical aspect of the adjustments can be to soften the front springs, dampers or anti-roll bars, alternatively the solution could be to harden rear suspension components. For an oversteering car, when the rear wheels lose grip, the mechanical adjustments involve the same balance of adjustments to the suspension.

BRAKE BALANCE

Most cars are set up with more brake bias at the front than the rear because of the transfer of weight in a car under heavy braking.

At rest the weight of a car is split between front and rear wheels but when in motion a Formula One car suffers many changes in balance. The weight on the front is lessened by fast acceleration and pushed to the rear but during braking the reverse happens and weight transfers to the front. Each car cockpit also has a manual brake balance lever that lets the driver shift brake bias according to the demands of the race and the levels of grip on the track.

When it is raining, the settings should be much softer because grip is lessened by rain and the car should have more downforce from the front and rear wings.

Perfect brake balance should be set up with high-speed deceleration in mind but this may mean that it will not be as efficient at slower speeds.

GEARING

Top gear is usually set up first. This should be chosen so that the engine can work flat out at the top of its power curve to achieve the maximum speed on the fastest part of the circuit with no spare revs available.

The next gear to be decided upon is First. The lowest gear is the least used and its only function is at the start and tight hairpins.

The remainder of the four or five gears must be spread out between top and bottom, with a minimum difference of about 250rpm between cogs. Gearing should be as tight as possible, so that the engine works between maximum torque and peak power.

TYRES

Grid position is decided by a single fastest time from two qualifying sessions and the cars are set up to achieve the best time over one lap.

A tyreman mover a complete set of qualifying tyres from the tyre company truck to the racing team pits.

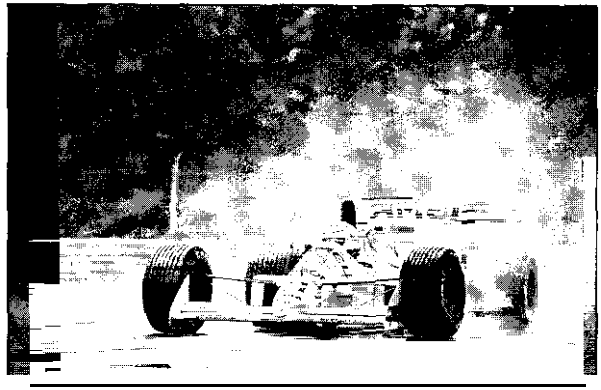
Qualifying Tyres have maximum grip and minimum life. They are soft and give very good grip. The rules allow two sets of qualifying tyres per car per session. This allows the driver to learn about the tyre performance from the first set, then make a better use of the second set. Tyres are not efficient until they have warmed up and this is done with special heaters.

The major F1 tyre manufacturers are Goodyear from the U.S. and Pirelli from Italy. The two companies are great rivals and the industrial battle between the two has led to great technological progress in tyre research. (Pirelli has invented a qualifying tyre that can skim off the top used layer and give the driver one more good lap).

Tyres can be roughly graded into hard, medium to soft, very soft, wet weather and hot weather, two-lap and full two hour race tyres. But there are many other combinations.

TYRES

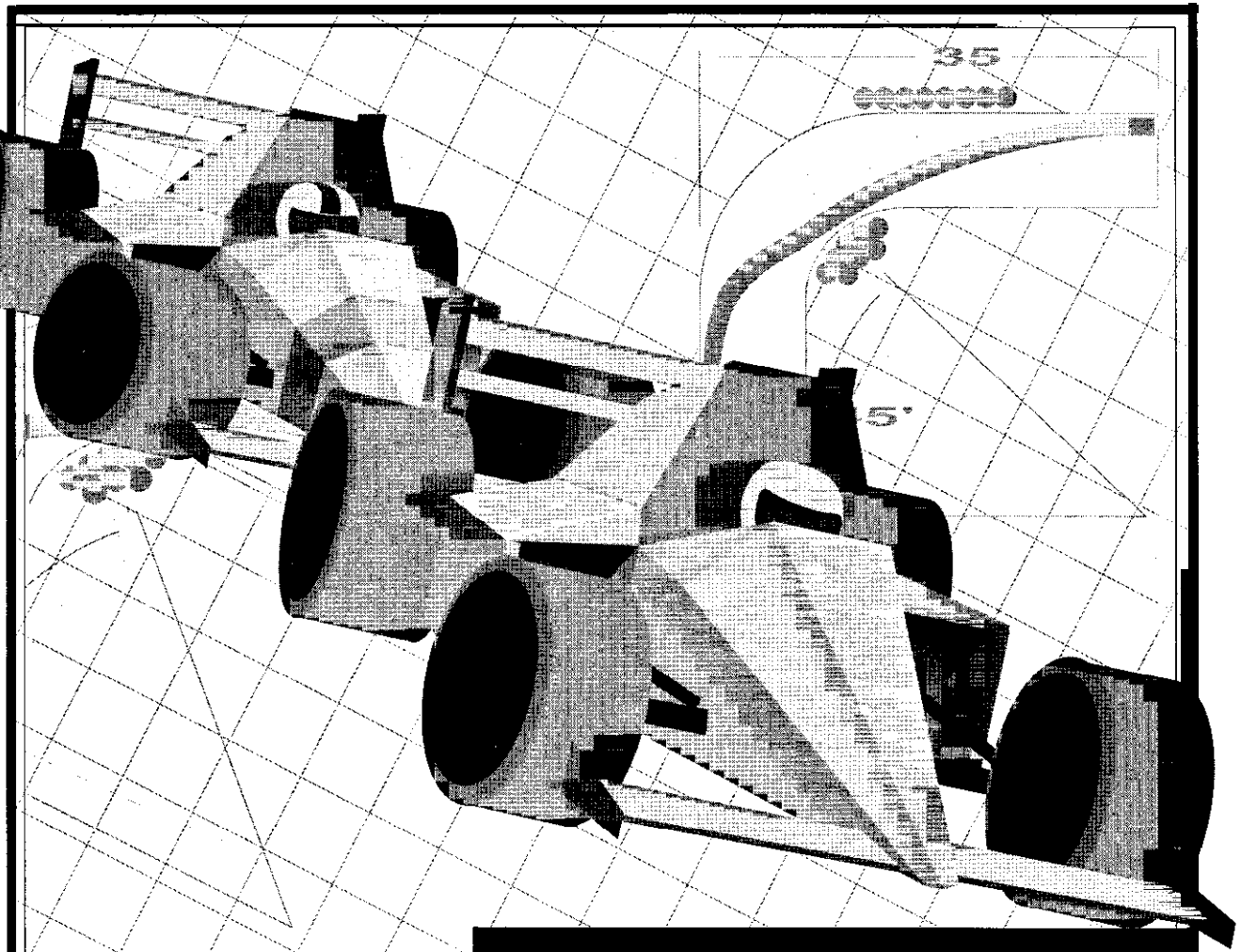
Wet weather tyres. When it rains during a race, the water that falls on the track cannot be dispersed by the wide, smooth dry tyres. The slick tyre loses its contact patch and it begins to aquaplane, a situation that's made worse by rubber particles and oil on the ideal driving line. Wet tyres (Wets) have tread that squirts out the water. These do not always come ready made, sometimes they are actually cut out by hand. Rain tyres are made from very soft compounds and only survive during a long wet race because rainwater is an excellent cooling agent. Unfortunately, when a track begins to dry wets break up very quickly and get sticky.



A Lotus 10 1 driven by Nelson Piquet ploughs through a rain drenched Canadian circuit. Wets are the only Formula One tyres with any tread.

Tyre permutations. Each separate tyre on an Fl car is subject to diverse stresses. Sizes vary (smaller front, larger rear) and compounds per wheel are often very different. If the circuit is mainly a right-hander, then teams would choose to use a hard front left and relatively soft front right with two medium hard rear tyres. At all times during a race, drivers must be constantly aware of their tyres; rear view mirrors are adjusted to keep sight of rear wheels as well as other cars.

Tyres have become one of the most important factors in Fl racing and particular care is taken during tyre trials.



DRIVING TECHNIQUES

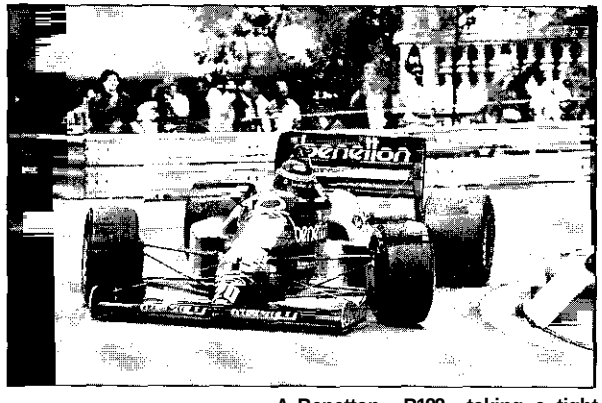
THE RACING LINE

A racing car must take a bend or a series of bends at the maximum possible speed and reduce the shape of the comer to its minimum possible angle.

The best racing line can be seen as being made up of three distinct points on the bend.

A) the turn-in point, usually at the end of the braking area and the position when the car actually enters the comer.

B) the apex or the clipping point. This is the slowest part of the bend and the point where the car is nearest to the inside of the corner.



A Benetton B188 taking a tight hairpin at Monaco. The lock is often increased on cars on this circuit to cow with this first gear left-hander.

C) the exit point when the car is back on a straight line. This is usually the fastest part of the bend.

Obviously, the best racing line also depends on the driver and the car. Is he trying to overtake another car into the comer? Is the corner before or after a fast straight? Is the track surface wet or oily? All these considerations come into play and the driver must adjust his line accordingly.

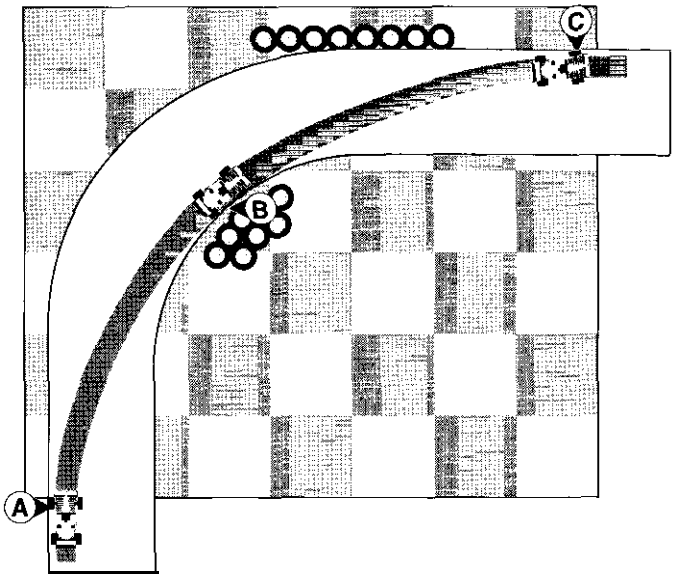
TYPICAL CORNERS AND BENDS

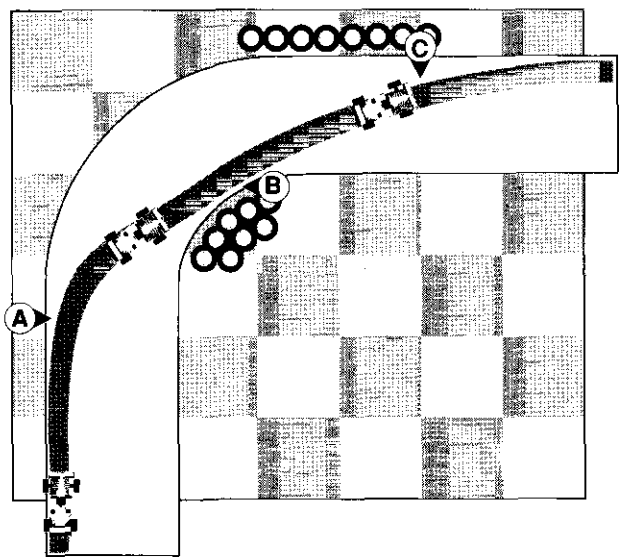
A driver must try to use all the available space on the track, even the 'rumble strip'- the run off area on the edge of the tarmac. In a typical corner, for example a right-hander, the driver arrives on the left side of the track, brakes, changes down, checks for his turning-in reference point then steers the car towards the clipping point on the inside of the bend. Once past, he eases back to the other side smoothly and exits the corner. Driver priority must be to get power back on as soon as possible to achieve maximum speed into the straight.

Andrea de Cesaris clips the apex of a right-bander at the Canadian Grand Prix. It's quite common for cars to mount the rumble-strip at these corners.

Fast Corner

Most of the racing circuits have a corner of this sort that can be taken at speeds in excess of 140mph. The driver turns in at A, passes the apex at point B then keeps his line all the way through to exit point C. The driver makes no sudden turns on the wheel and the whole process should be very smooth.



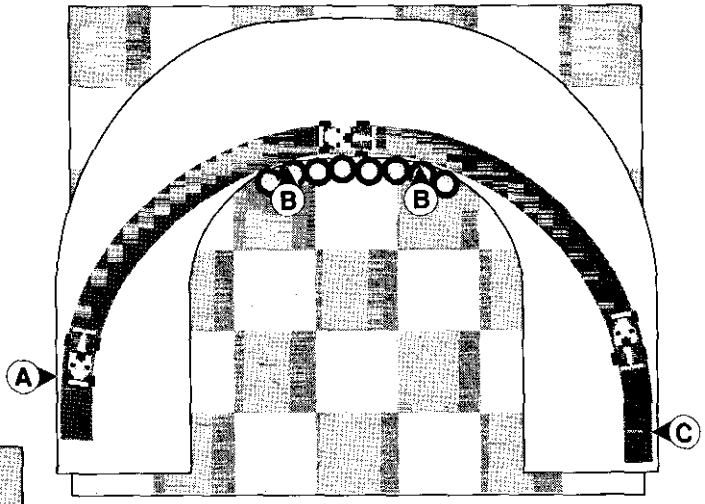


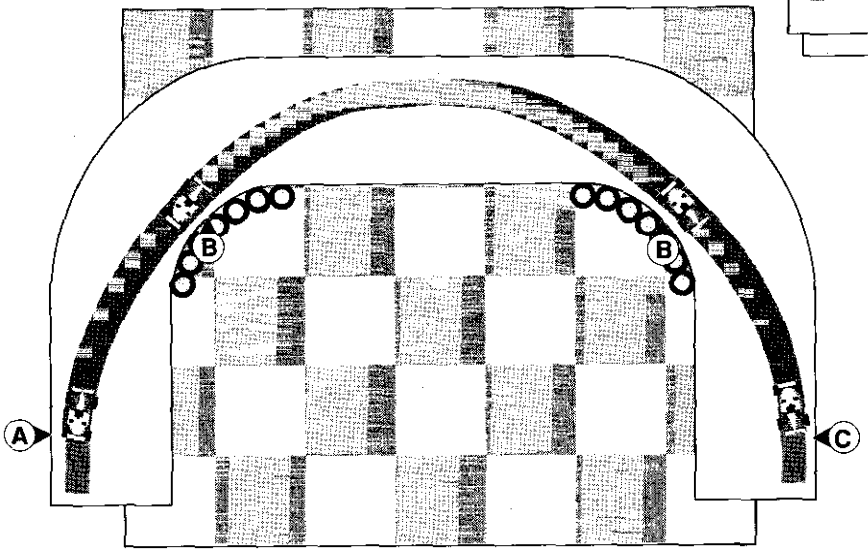
90 Degree Turn.

There are many different ways to turn into this type of comer depending on whether the driver is about to overtake, but the classic approach is to turn in late at A, pass the apex again late at B, and accelerate fast from that point to get a good clean exit at C.

The Constant-Radius Comer

There is a very long apex on this type of comer so there is no gain in taking the entry point late. The driver turns in early at A then stays close to the contact points B and B as long as possible. As he leaves the apex, he crosses the track and touches his exit point at C.



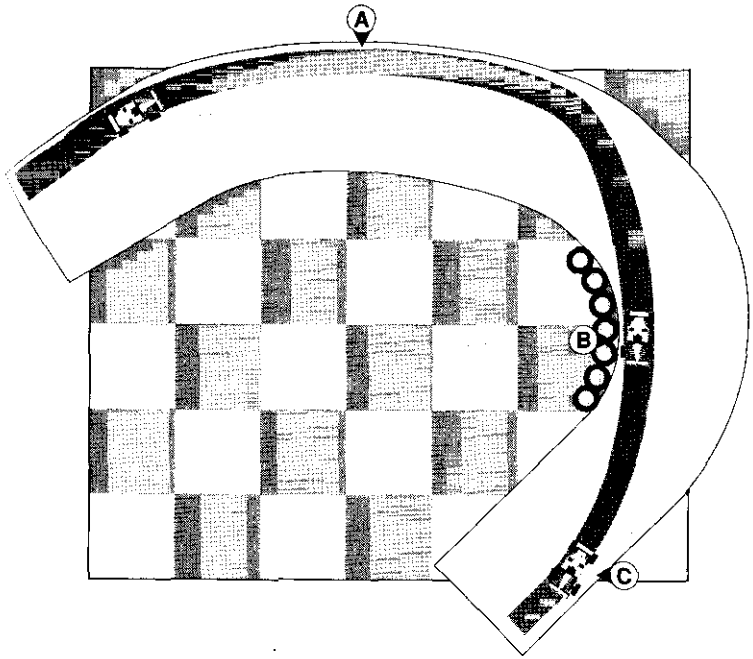


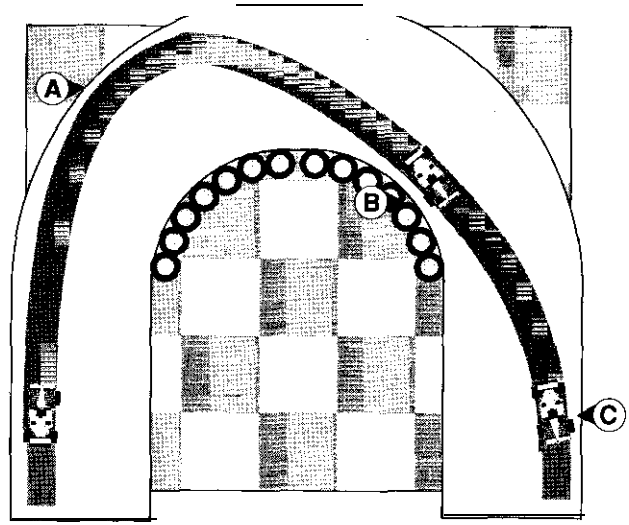
Double-Apex Comer

The key to negotiating this type of bend is to make one corner out of two. The driver aims for the ideal line and stays inside the track's width, effectively making the exit line of the first bend the entry line of the second. If the line is perfect then the driver does not have to correct his steering.

Hairpin

The aim here is to turn in late to create the widest possible angle so that after point A the bend can be treated like a fast corner. The sharp initial turn is vital to make the car as fast as possible out of the hairpin. When point B has been touched the driver can safely put his foot down before reaching point C.



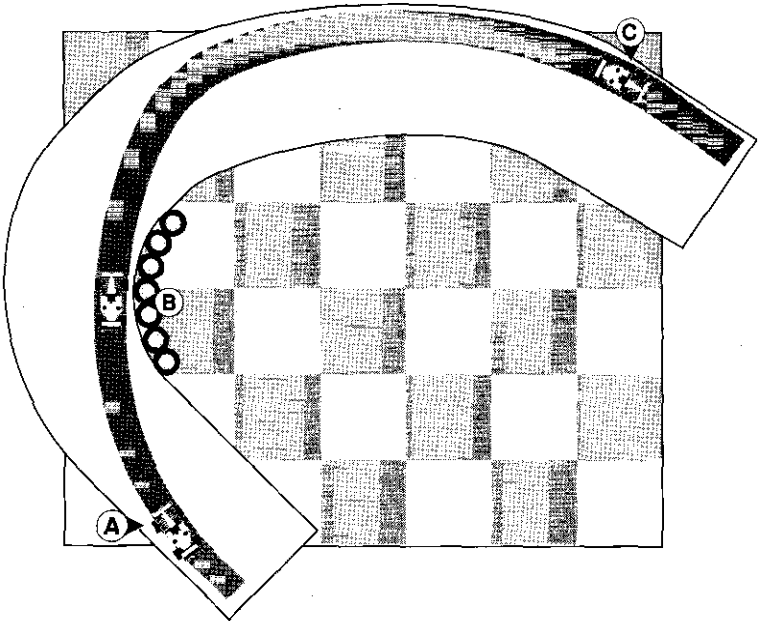


The Tightening Comer

The car stays wide so that the driver can touch the apex extremely late at B, then brake, select a lower gear, cross the track following the curve of the bend and get a good clean exit at C.

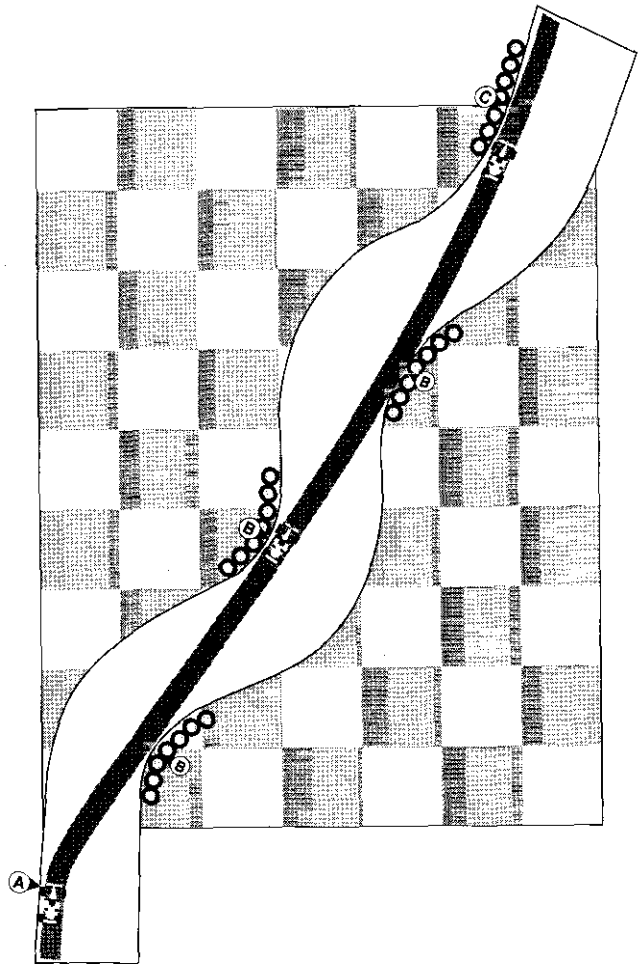
The Opening Corner

The driver turns in early at A, covers the short distance to the apex B then smoothly moves to the outside. This allows the last phase of the bend to be driven like a straight and the driver can accelerate quickly long before passing point C.



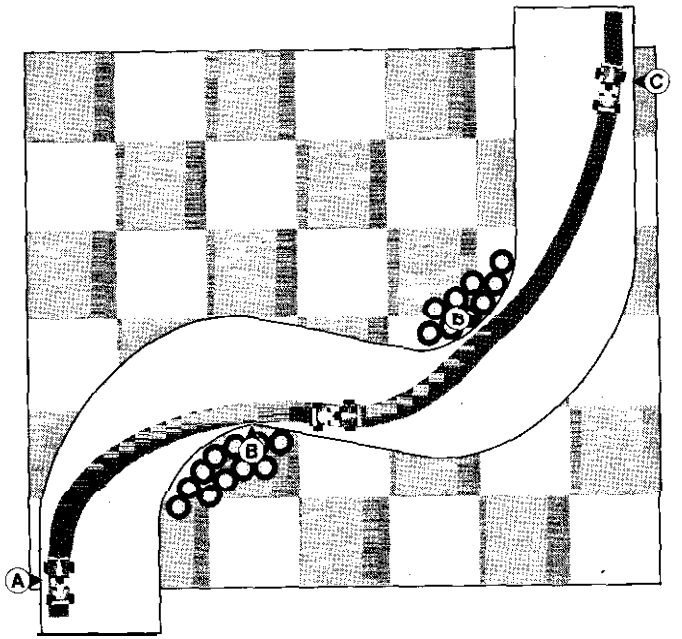
The 'S' Bend or Chicane

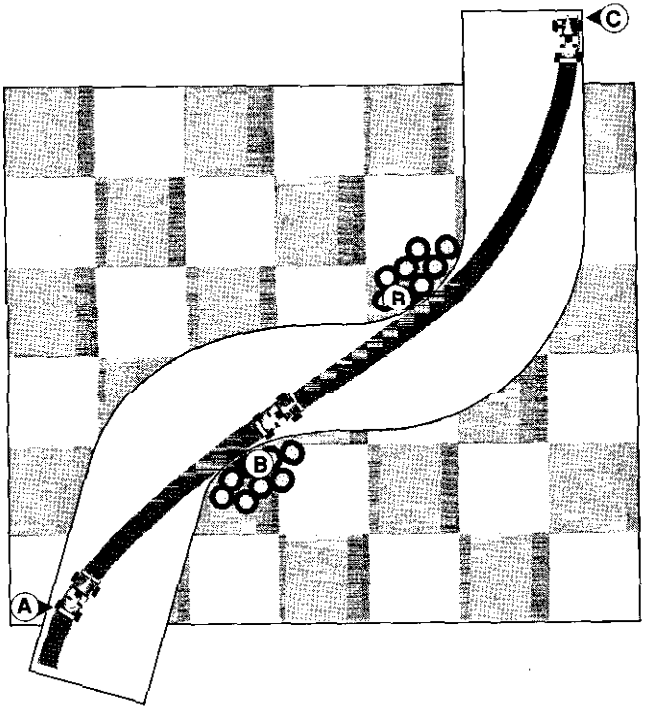
Ideally, a good racing line can straighten out some bends without the need for sudden turns. The driver turns in slightly at A approaching the first right-bander, then clips points B,B,B with hardly any modification before exiting at C.



Tight Comer After a Fast Bend

Take a tight line into the fast right-hander but brake as the second point B approaches. The car must slow down to take the left-hander but this is not a problem, for the driver has gained speed in the first two-thirds of the series of bends.



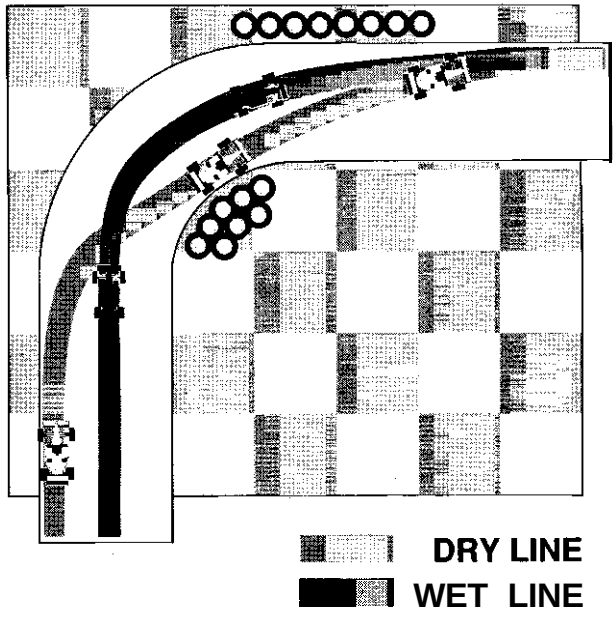


A Long Straight After Two Identical Comers

The important point about this series of bends is the approaching straight. The driver turns in late to the right-hander and hits the clipping point well into the bend. He then takes the fast left-hander as though the previous bend had not existed. Thus the first corner is taken slowly to give the car as much benefit as possible from the oncoming straight.

Cornering in Wet Weather

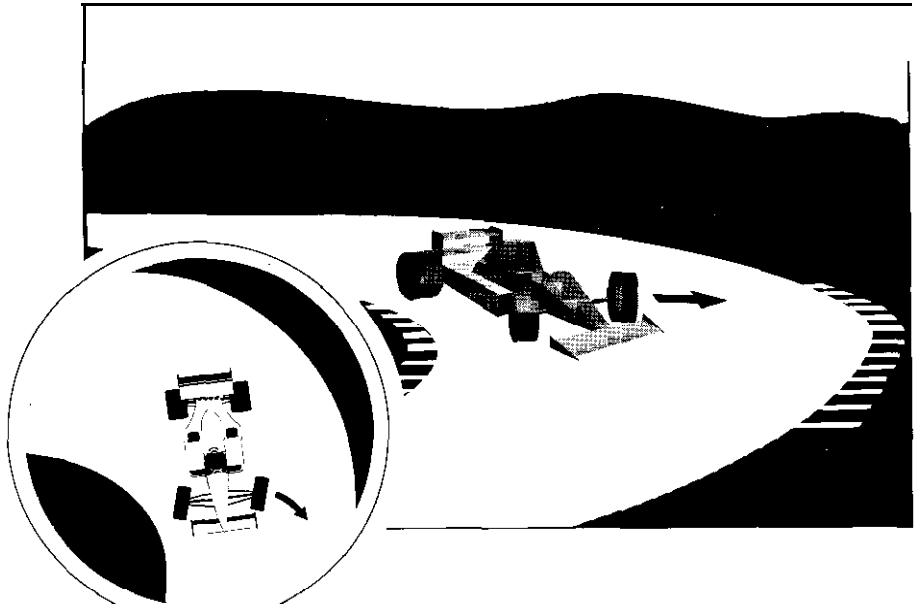
Taking the classic right-angle comer as an example it's easy to compare the dry line with the wet line. The driver takes up position in the middle of the track, keeping off the outside line which is likely to be very slippery. The line he drives will be cleaner and give far better grip in the rain. The car is kept in the middle of the track as it passes the apex then steers for the outside line. The main aim of drivers in wet weather is to look for maximum grip.



REACTION OF CAR THROUGH A CORNER

Understeer

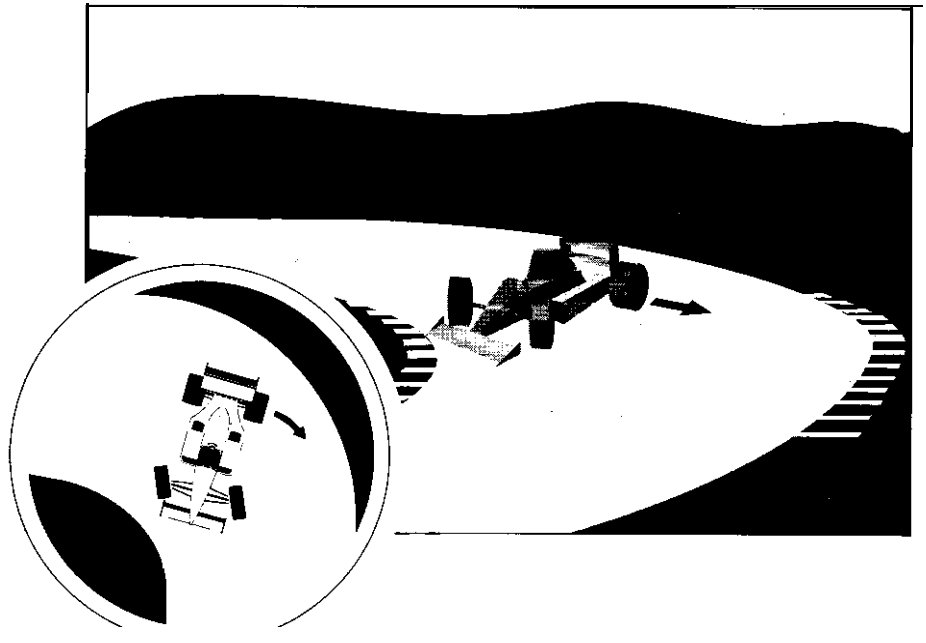
An understeering car means that although the rear wheels have got good grip, the front wheels have lost all adhesion and will not react to the driver turning the wheel. Since Fl cars are rear-wheel driven, the vehicle will begin to move towards the outside of the track. The driver in such a situation can do one of two things: ease up on the accelerator, making the driving wheels push less, giving the front wheels a better chance to grip; if the car still does not respond, brake lightly without locking the wheels. The car will slow down enough to give good grip to the front.



Oversteer

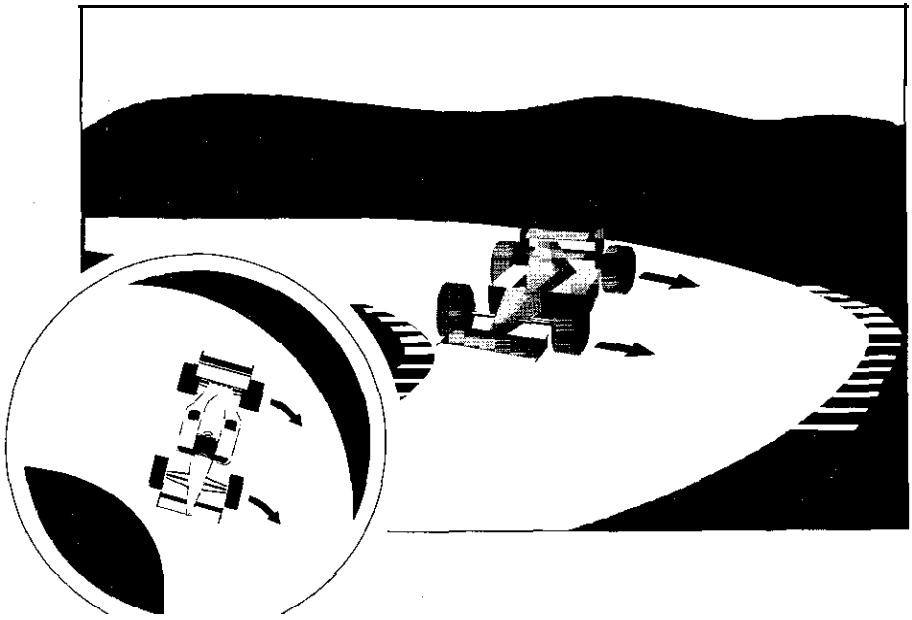
An oversteering car means that although the front wheels maintain grip on the track, the rear set have lost all traction, possibly because of too much power. The rear wheel spin makes the back end of the car slip out towards the outside of the comer. The consequence might be the car spinning off altogether!

To counter oversteer a driver can do one of two thiigs: opposite lock on the steering wheel might just establish the car's balance; otherwise easing up on the accelerator will slow down the car and give the rear wheels a chance to grip. There are also certain times when drivers might accelerate, but knowing when to do this comes with experience.



Neutral Handling

The ideal situation, as the sideways drift of the rear wheels is matched by those of the front. All four wheels slide in the same way. The driver sets up the car on entry to the corner, so the front wheels are straight and the driver doesn't have to steer.

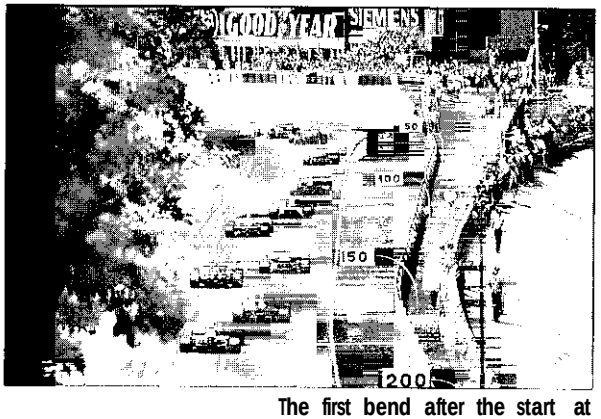


MARKER POINTS

To set up the ideal racing line on a Formula One circuit you must find as many markers as possible to use as reference points. The individual tracks provide 300, 200, 100 metre boards before a bend but these are too general for most drivers; many rely on advertising boards, bumps in the track, certain trees or bushes for turn-in points, braking zones or accelerating areas.

In fact, the driver must know every square metre of the circuit and the markers, once memorised, allow the driver to think ahead, to anticipate the next comer.

Imagine you are accelerating through a fast straight. When you see the marker for the braking zone into a bend, your mind will be already thinking about the next marker for the turn-in point. As this is passed, you are thinking about the apex marker and finally the exit point. Think ahead. Look out for the next marker. Don't wait until you see it to react.

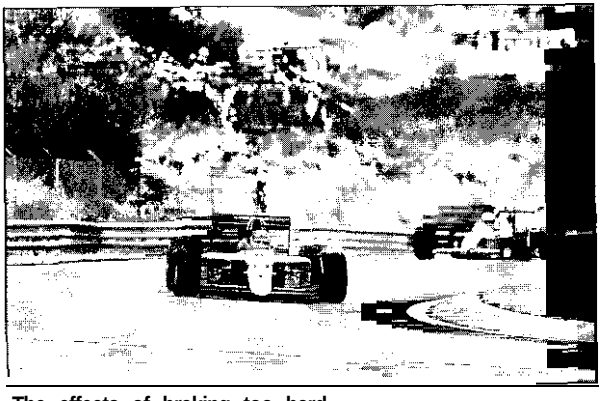


The first bend after the start at Monza. Most circuits have countdown markers (in metres) to warn drivers of approaching corners.

BRAKING

Ideal Braking

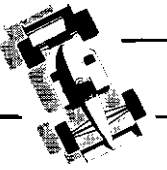
In Formula One the driver aims to keep his foot down on the accelerator as long as possible. When he gets to a comer, he will wait until the last moment before braking and then brake as hard as possible over the shortest possible distance. The only reason to brake should be to achieve the best speed for entering a bend and the only reason for removing your foot from the accelerator must be to 'jump' to the brake pedal. Ideally, there should be no compromises with braking.



The effects of braking too hard and locking up the inside front wheel. The point of contact burns away for a split second creating a 'flat spot'.

Wheel Lock

Braking hard can present the Fl driver with another problem; that of locking wheels. It's possible to lock up one, two, or even all four wheels if you brake too hard in a given situation. A locked wheel is no good to anybody. The tyre wears out excessively on the locked patch and this creates a 'flat spot' which will feel like violent bumps when the wheel is turning again. The tyre will be out of balance and the car almost impossible to control. To avoid wheel lock the driver must besensitive enough to brake hard and to detect the first signs of lock-up.



CHANGING DOWN

Changing down into a lower gear must always accompany the act of braking. One without the other is not good Formula One driving. The aim is to brake to the ideal speed for the approaching corner then change down in order to be in the right gear for the moment you need to accelerate again. Changing down is done as you brake. Any earlier and the car will still be at full speed; any later and the driver has too much to do in mid-corner.

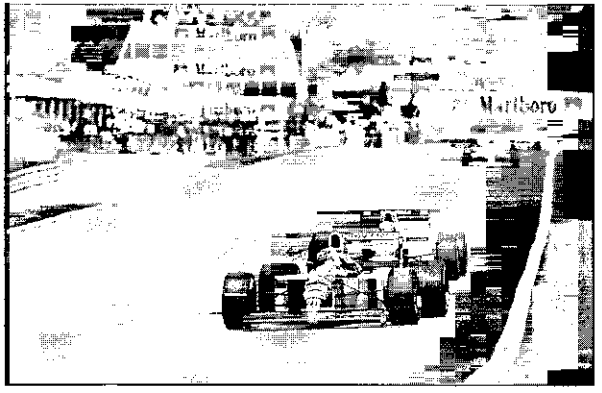
Braking and changing down means that the driver must double-declutch because there are no synchro-mesh gears in Fl cars. It is also less damaging on the gearbox and transmission.

Double-declutch. The right foot comes off the accelerator onto the brake, then the left foot declutches. The driver slips into neutral and releases the clutch. Meanwhile, the right foot still applies the brake but at the same time 'blips' the accelerator to keep up engine revs. Once again the left foot declutches, the correct gear is selected and the left foot comes off the clutch. The right foot still presses on the brake to achieve the best speed for entry to the bend and then returns to the accelerator.

OVERTAKING

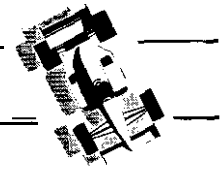
If you're not at the front of the grid in every race then chances are that you will need to overtake other cars at some point. Overtaking is not just a matter of more power in your engine. It usually boils down to three factors. Can you take a corner better than a rival? Can you exit a corner faster and enter a slight at a greater speed? Or, can you brake later than a rival at the end of a straight?

To overtake successfully, especially against a determined rival, you must be aware of the driver ahead. Where is he slowest? Where does he brake earlier? On what part of the circuit is he the least confident? Eventually, you will have a good picture of his strengths and weaknesses. You must make his worst manoeuvre your best, wait for the right moment then make your challenge.



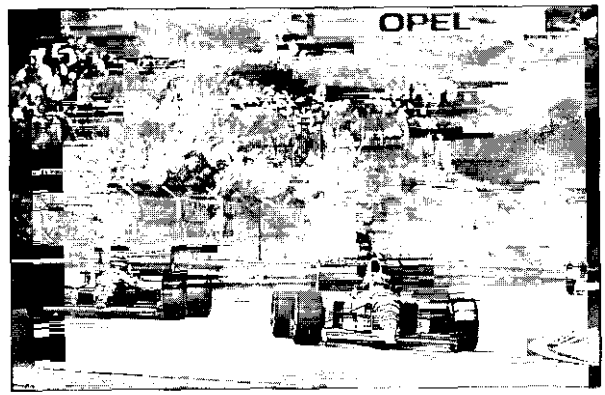
The rear car 'slipstreams' the car in front of it on the straight in the Portuguese Grand Prix; 'getting a tow' prior to overtaking.

All the above assumes that the driver ahead will not make a mistake; but all drivers make mistakes during a two hour race, such as changing up into the wrong gear, (fifth instead of third), so take every opportunity offered to you and wait for that error!



Driving faster through a corner than a rival

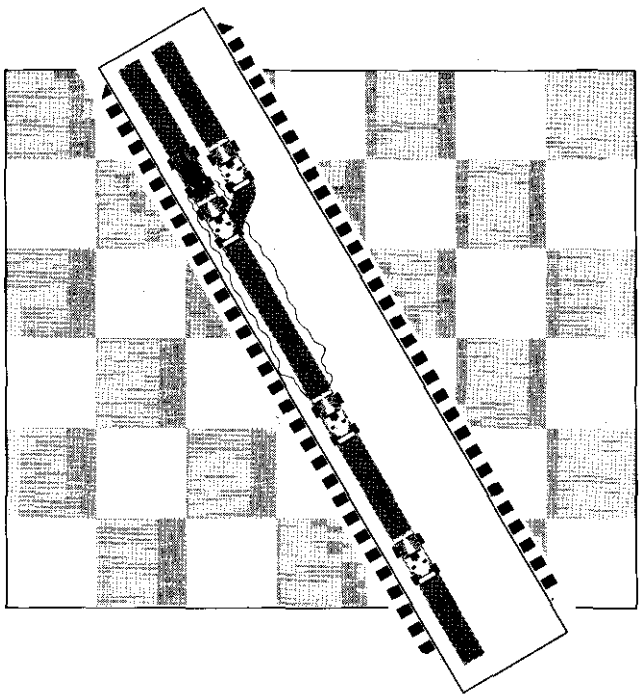
The driver ahead is not confident through a certain corner. Choose your moment. Leave a space between the two cars so that he can't force you to slow down. Just enough room to let you attack the comer at the speed of your choosing. When you leave the corner you will have more speed than the other car. The faster exit speed gives you the advantage to overtake in the following straight.



The rear car tries to overtake a leading rival in the Portugese Grand Prix by driving faster through the corner and leaving enough room to attack the bend.

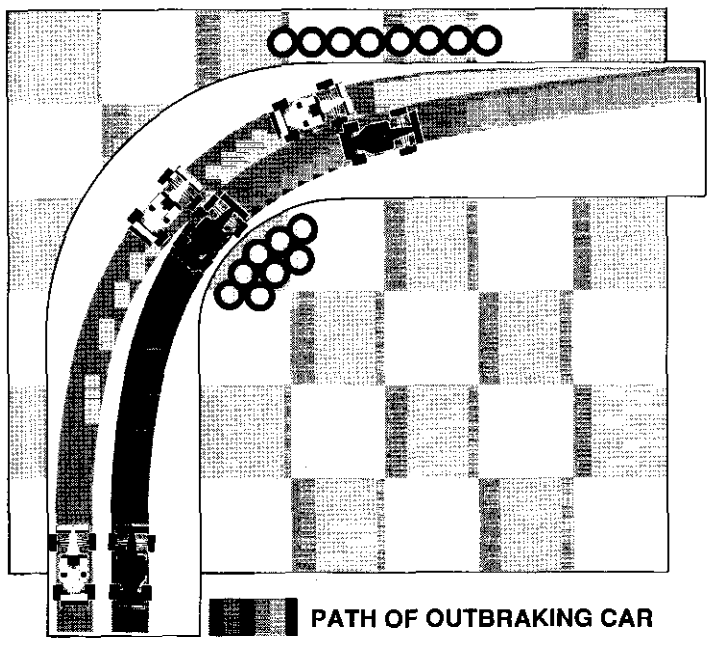
Slipstreaming

Slipstreaming is a phenomenon that occurs at speeds above 70mph. Catch a rival car on the beginning of a long straight and get very close behind him (within a few inches). Both of you are travelling at the same speed but you are in a small area, a few metres long, which is free of air turbulence. The car ahead is doing all the work while you gain mph. You can tell that you are successfully slipstreaming by the loss of turbulence and the gain in acceleration. By now you're probably travelling at 140mph just inches behind the rival car. You wait until the last possible moment then slip out to the side of the other car. Although you will now be subject to the same forces of turbulence, your speed gain during the sheltered period will give you the edge to move slightly ahead.



Outbraking a rival car

If a driver has managed to get a lead on a rival in the previous straight and is now on the inside line for the next corner, he must **try** to brake a little later into the bend, giving himself right of way. If the rival driver stays in contention, around the outside of the track, he is in danger of spinning off. It's important to 'close the door' after you exit the comer, especially if the rival car is trying to get level again. Take a strong position off the ideal line, in the centre of the track and make his overtaking attempt as difficult as possible.



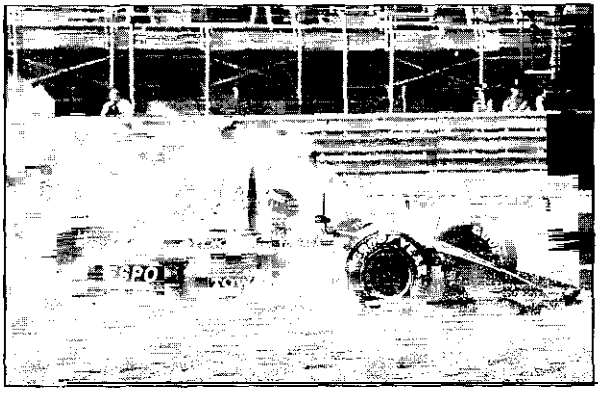
DRIVING ERRORS

Overrevving

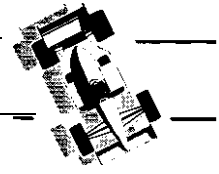
This is possibly the most common way a driver can ruin his engine and put himself out of the race.

Most Formula One cars now have built-in rev-limiters to stop a driver going past a pre-set limit but it is still possible to overrev the engine. Changing down too early before braking sufficiently is quite common among inexperienced drivers. A driver must be a third of the way into the braking zone before changing down. It is quite tricky to get this right in short braking bends but in longer braking areas you can use markers for gear change points.

A second common way to overrev is by exiting a corner and not changing up at the right time; quite easy to do if you're busy controlling the car through a difficult bend.



Aguri Suzuki spins off at the Italian Grand Prix after he has gone into the corner too fast. The sand stops the spin, often without damaging the car.



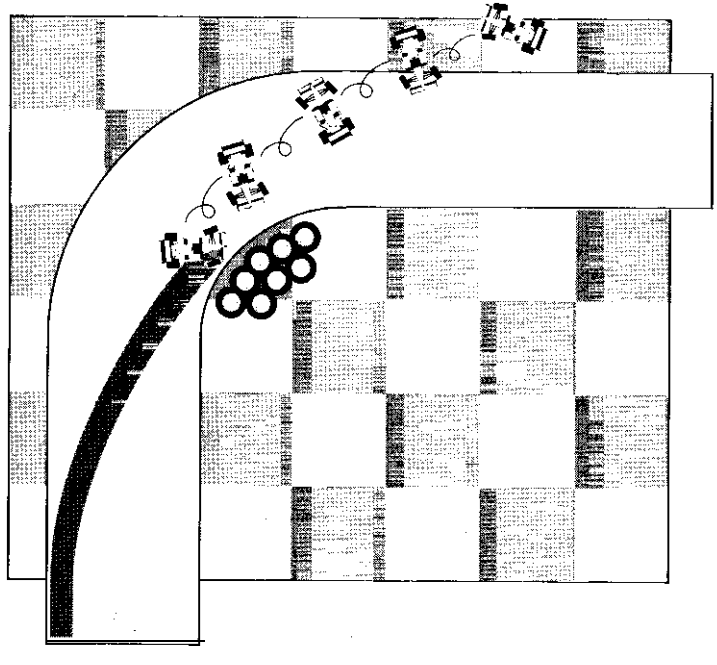
Loss of Control

The most common ways of losing control of your car in a race are:-

* going into a comer too fast giving strong oversteer.

- accelerating out of a corner in the wet.
- under braking when there is too much bias on the rear wheels.
- mechanical failure
- oil, sand, dirt or grease on the track

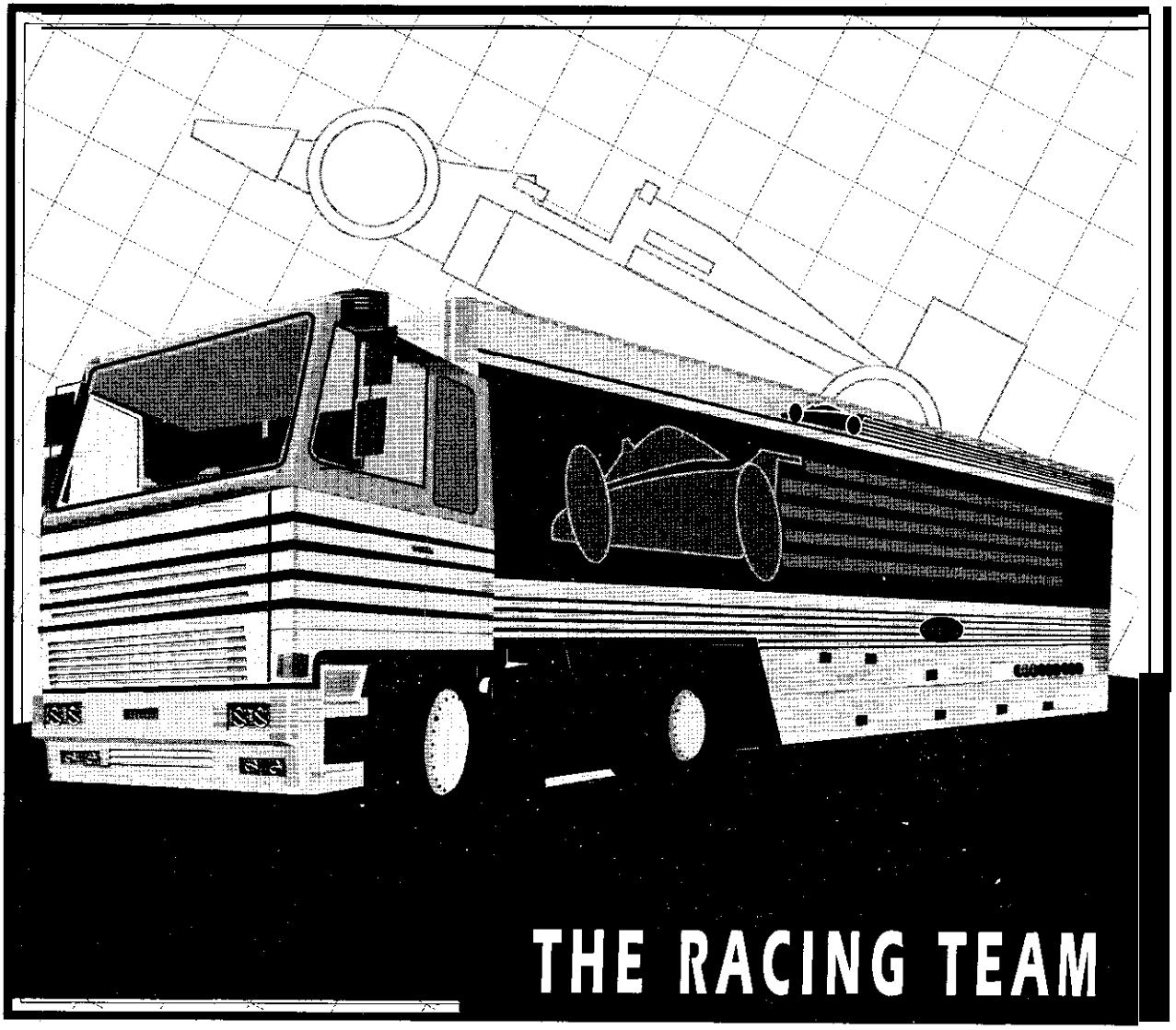
In all cases, as soon as the driver feels the loss of control, he must brake hard while keeping his revs up to prevent stalling. If possible, he must keep the car on the circuit, for once it touches the grass the spin will speed up tremendously.



Spinning off before reaching the apex of a comer will result in the car moving across the track to the outside of the bend. Generally, the inertia that it retains will send it off in an arc similar to the early shape of the comer.

Spinning off after the car has passed the apex of the comer will often give the driver a better chance of staying on the track, for although the car will be moving faster it is more likely to follow the exit profile of the curve.

If all else fails and the driver knows that he is going to hit something, it's wise to protect himself as much as possible from the impact. He must lift his feet from the pedals, try and curl up as much as the cramped monocoque will allow, then at the last moment let go of the steering wheel to prevent his wrists from being broken.


THE RACING TEAM

THE RACING TEAM

R

The racing drivers and their struggle for points in the Formula One Championship are the key symbols of the Grand Prix for the media. Television and newspapers concentrate on the personalities and the glamour before they talk about the cars or the teams. But how do the top two dozen drivers get to occupy such an enviable position? What qualities do they require and what is the best path to success?

Traditionally, the first step has been to compete in motorcycle races. These will give you an appreciation of racing lines, engine and gearbox performance, controlled driving aggression and pack racing. Karting is also a very useful introduction with modern karts now performing on a par with Formula Ford and Formula 3. Nowadays, there is an added option to enroll into good racing schools like Magny-Cours in France, and progress through a recognised merit system from junior to Grand Prix. If you manage to be 'pupil of the year' at one of these schools, you are sponsored in one junior formulae race. If you win, or impress your sponsor, you may get a drive in a senior race.

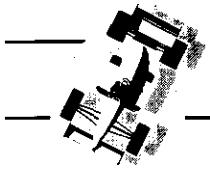
Brakes

TECHNICAL INFORMATION

Brake performance in F1 cars is phenomenal, cars can decelerate from 200mph to full stop in under four seconds. They must be incredibly powerful, very low weight and have exceptionally high thermal resistance at temperatures in excess of 2000°C. Disc and brake pads are made from carbon fibre and their peak performance level is at about 350°C, so when they are first used they are slow to react and it's not until they have warmed up that they are totally efficient.

The brake system on a F1 car is split between the front and rear sets of wheels. This is partly done for safety reasons, in case of brake failure, and partly to balance the braking forces that come about during changes in weight distribution. The driver can adjust the brake balance from the cockpit to take into account such things as the change in weight as the fuel is used up.

The high temperatures achieved during fast deceleration means that cooling the brake system is crucial. This is achieved by carbon fibre cooling ducts which channel air on the brakes to prevent overheating. The size and number of ducts is variable and depends on the circuit conditions.



THE RACING TEAM

As an example, an analysis of Alain Prost's early record may give prospective Fl drivers some useful insights.

Prost was born in February 1955. At the age of 17 he started karting, one year later he was second in the French karting championship. When he was nineteen he became French and European Karting champion. The following year he was champion once again and also won the Elf scholarship at the Le Castellet driving school. French Formula Renault champion when he was 21, he became European Formula Renault champion at 22. The following year, 1978, Prost was French Formula 3 champion and in 1979 French and European F3 champion. In 1980 he drove in his first Formula One race at the age of 25 and ended the season 15th in the World Championships, since that time he has been one of the leading drivers in every Championship.

Engines

All engines for F1 cars are 3.5 litre, normally aspirated, developing 600-700 b.h.p. There is no rev limit to the engines but generally, the more cylinders the more power it will develop but with less torque. V12's (e.g. Lamborghini and Ferrari) are more powerful but they are longer, heavier engines that use up more fuel. Engine performance in a modern F1 car is phenomenal: first gear will take the car to 80mph, the car will go from 0 to 150mph in just under 7 seconds, generating 1.3 g. Unfortunately, there is a downside to this fantastic performance; engines do not last and most are completely rebuilt after 300 miles.

The racing driver needs to be mentally strong, mature in outlook and possess an overwhelming will to win. He must be able to drive fast and accurately, without any errors of judgement, and be able to learn from his strengths and weaknesses. Motor racing has never been thought of as a 'physical' sport but any top driver will tell you that his body is subject to many extreme forces. Acceleration, braking, cornering, shaking and juddering, all put terrific strain on the shoulders, neck and upper body. Niki Lauda once had an extremely painful displaced vertebra through g-forces suffered in practice. Lauda had to physically build up certain muscles in his spine in order to withstand those forces acting on his body during a race.

Static stress is not the only problem faced by Fl drivers, circulatory stress is another factor. Studies, first carried out through the telemetric system, showed that the pulse rate of an Fl driver can be at around 150 for periods in excess of six hours and peak at critical times to over 200 pulses per minute. It also proved that unfit drivers can lose consciousness for fractions of a second during a long practice session.

The last type of stress is metabolic. Drivers must be able to control the reserves of energy stored in their bodies. Diets must be checked over a long period with special emphasis on the morning of the race.

If you do get into the top ten league of Formula One drivers then you will be able to negotiate annual contracts that run into seven figures. In 1961, Stirling Moss made £6,000 in his last competitive year, a fortune compared to the average person's annual pay. In 1991 Ayrton Senna's annual retainer is f.8 million, Alain Prost's about f.7 million and Nigel Mansell's £6 million. In relative terms over the 30 years, taking inflation into account, the modern Fl driver earns upwards of 12 times more than his predecessors but this is not surprising considering the amount of money pumped into the sport by major sponsors; it is estimated that Marlboro alone finance McLaren to the tune of £30 million per annum.

TECHNICAL INFORMATION

Fuel

F1 cars use special 102 octane fuel that gives the engine far more power than normal petrol. The teams use more powerful fuel for the qualifying laps than in the actual race when economy is more important and they want the lowest consumption possible to reduce the weight of the car. The average car consumes 1 litre for every 1,600 metres and in a 200 mile race, the car must have a vast 200 litre tank. This is located within the chassis width, between the driver's back and the engine.

With a full tank, the car is still only half the weight of an average family car but it feels heavy and sluggish in acceleration and bends. 200 litres of fuel is about a third of the weight of a F1 car. Fuel consumption figures are very important to the racing teams and these are monitored carefully during practice. Information is gathered by the telemetry system and passed to the pits. Ideally, the car should finish the race with two or three litres left in the tank. If the rate of consumption is high then drivers can set the mixture control to a leaner setting. It's vital that they know how much fuel is left in the tank, down to the last drop.

DESIGNERS, CONSTRUCTORS, ENGINE MAKERS AND SPONSORS

The modern Formula One car designer is part of a test team that runs many research and development projects, some of which may be quite long term. The end result, the car on the grid, looks very like all the other cars so you can be forgiven for asking what does a designer do?

Designers are always looking for clever ways to make the car go faster. However, they must always work with one hand on the rule book, the FIA regulations, that make sure cars are built to stringent specifications. The agreement between the sport's governing body and the constructors is that teams should be given two years notice before any chassis modifications are implemented, but FIA can insist that any changes involving the safety of drivers should be acted upon immediately. This does not make for a pleasant design environment when something that has been worked on for over a year has to be scrapped or amended at the last minute.

Designers have been greatly helped by the tremendous growth in Fl technology over the last ten years. Now the top teams all have specialists in such fields as aerodynamics, transmission, suspension, carbon-fibre composites and model-making. Modern CAD facilities can give designers a 3-D view of their planned chassis layout before any materials have actually been cut. Various configurations

TECHNICAL • INFORMATION

Gears

F1 cars usually have six gears selected by a short 4" lever on the right of the cockpit. The basic set up is an H formation plus fifth and sixth and it's designed to have very little movement in the changes. In the last few years Ferraris and recently Williams have tried semi-automatic systems using short levers just behind the steering wheel (the right side for up, the left side for down). It means that the driver's hands stay on the wheel at all times, changes are much quicker and they can fit in an extra gear.

Gears are not synchromesh and have to be timed very carefully. The ratios in the box are set up for each individual circuit depending on information received during practice. A cog is fitted based on the top speed needed in the fastest straight and the remainder adjusted downwards.

are tried out on the screen before quarter-scale drawings are printed and made into models for wind-tunnel tests. The modern carbon-fibre composite monocoque would have been impossible to construct before the advent of these tech-specialists.

Once the car is designed, then comes the job of actually building it. The modern Fl team has specialists who work on a variety of computerised and conventional machine tools. All the turning and milling work is done on site and the fabrication shop makes all exhaust systems and metallic structural items. In fact everything is home-made except for castings and forging.

Pit Boards

TECHNICAL INFORMATION

These are used by the pit crew to tell the driver his position in the race, the number of laps left, how many seconds he is from the leader, how many seconds he is from the car behind and any other information they think helpful. Although most F1 cars carry radios, teams prefer to have a surefire visual sign for the driver. For example if a pit board read: P4 L23 -3.5 +7.0 the driver would know that he was in fourth position, with 23 laps to go, 3.5 seconds behind the third place car and 7 seconds in front of the fifth place car.

Even in these days of high-tech telemetry and in-cockpit radios Pit Boards are still used to give visual signals to the driver.

Ford engine technicians work alongside Benetton Team race mechanics at the Italian Grand Prix.

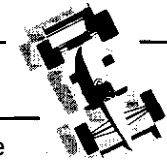
Next comes the problem of the engine, the powerhouse of the car. Formula One engine production changed radically in the mid-1960's when Ford chose to subsidisea purpose-built engine for a Grand Prix racer. The company financed the Cosworth V8 which was installed in a Lotus chassis and raced at Zandvoort in 1967. The engine performed well and the car won the race. Jackie Stewart's Tyrrel, which won him the title in 1971 and 1973 was also powered by a Ford engine. This was still a time when the engine maker's name was not plastered all over the car. However, the situation changed dramatically yet again when the Japanese, particularly Honda, became interested in F1.

Honda's background was in motorcycle racing and the company tried to make an impact in Fl from the beginning of the 1960's. However, it did not power a winner until the Williams-Honda of 1984, subsequently achieving four Grand Prix wins in 1985, and nine in 1986 and 1987 taking the Team Championship.

TECHNICAL INFORMATION

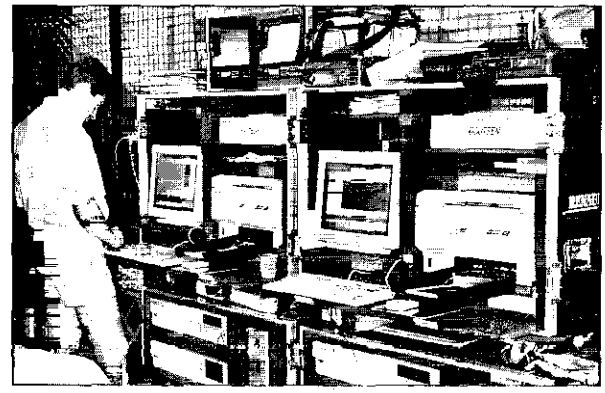
Suspension.

F1 suspension has to be strong and rigid enough to stand up to the huge forces exerted by downforce. At 180 mph the car effectively quadruples in weight and the faster a car goes the lower it drops so it's vital that the car should have extremely stiff springs. At slower speeds however, before aerodynamics begin to play a major role, the cars need a softer spring in order to achieve mechanical grip. To overcome this problem, teams have developed variable rate springs, so that the faster a car goes the stiffer the suspension becomes.



In the 1988 season Honda signed a contract with McLaren and has stayed with the team ever since. If you were to walk through the McLaren pits before a race you would see'the British mechanics working on the chassis and the Japanese engineers consulting computer printouts and tinkering with the engines. Honda engineers refine and develop the engine constantly, even from race to race; Ayrton Senna's 1990 engine, the V10 RA 100E was changed six times throughout the season. Meanwhile other engineers were working on a completely new V12 power unit. If Ayrton misses a gear and overrevs the engine during a practice session the engineers have an immediate report of the event through the telemetry system and are faxing back to H.Q. in Japan for technical analysis,

Electronic analysis equipment for the Williams team in the Brazilian Grand Prix. Every major team has a similar set up to provide data about car and driver performance.



Nowadays, Grand Prix teams would find it very difficult to survive without sponsorship deals which cover the car with advertising for items from clothes and cameras to computers. The concept of a company, totally unrelated to the sport, sponsoring a Fl racing team just for the added value of prestige and TV exposure is a relatively new one.

Timing and Other Data

TECHNICAL INFORMATION

In Formula One races a small radio transmitter is fixed onto each car which emits an unique signal back to an antenna buried in the track asphalt on the finish line. Data collected includes lap times, maximum lap speeds and speeds over certain specified sections of the circuit, as requested by individual teams. A print-out is produced for each car and is studied very carefully by the engineers, mechanics and drivers. Other data that can be collected includes: throttle position, exhaust gas analysis, the temperature of air pouring through the engine, pressure in clutch and brake lines, stress in suspension components, steering angle and g forces. The highly accurate data gathering equipment is manufactured by Longines and the processing by Olivetti.

TECHNICAL INFORMATION

Pit Stop

A good tyre change pit stop can take six seconds but a bad one can take double that time and mean the loss of a good position in the race. Usually, the big teams have three men to a wheel, two men to handle the jack and one man to hold the board to tell the driver to keep his brakes on, a total of fifteen in the crew.

A pit stop for anything else but tyres might only be worthwhile if a team is likely to gain points or, in the case of smaller teams, the possibility of finishing which may affect pre-qualification. Some drivers may be asked to come into the pits earlier than expected for tactical reasons if they are stuck in traffic and will benefit from returning to a clear track with new tyres.

The driver must not drive excessively fast in the pit lane, otherwise he will be fined $10,000. He must position the car carefully to the exact point indicated by the pit crew, not an easy task when the pit lane is dirty, greasy and full of people. When the car is jacked up the driver keeps his foot on the brake, stays in neutral and keeps the engine revs up above 4000rpm to prevent stalling. As soon as the pit crew are ready, the car is jacked down, the 'Brakes On' board is taken away, the driver has already revved up to about 8000rpm, he slips into first and drives away carefully trying to avoid the other people in the pit lane. At the end of the pit lane stands a marshal with a light blue overtaking flag who will signal if a faster car is approaching on the track.

The Williams pit crew in action at the Brazilian Grand Prix. Nigel Mansell would expect to have a new set of tyres fitted in just over 6 seconds.

In the past motor racing was a rich man's sport. Powerful cars were bought, transported to various European circuits and raced. If you were not wealthy, you did not compete. However, by the 1950's there was a radical shift in Grand Prix racing as **Mercedes-**Benz, Ferrari and Maserati all sought to re-establish their pre-war status as car manufacturers **and** financed their own cars on the circuit. BRM and Vanwalls made similar efforts with British cars. Although this was a boost to Grand Prix racing, the sport was still not self-financing.

In the 1960's with the production and easy availability of the Coventry-Climax engine there was an influx of new blood into Fl racing. Lotus and Cooper developed the rear-engined chassis and a new breed of

'specialist builder' emerged. However, teams like McLaren, Brabham and Williams still had to survive and race on a shoestring.

Money did not pour into Grand Prix until the 1970's when the Formula One Constructors Association made it compulsory for each team to actually turn up for every race. Previous to this, some teams would withdraw or threaten to withdraw from a face if they were not happy with any aspect of the organisation. The ruling gave consistency and stability to racing organisation, led to much greater public and media interest in the Championship battle and subsequently attracted the rich sponsor. In 1977 the Williams team broke new ground by getting sponsorship from Saudia, the Saudi Arabian Airline. At the time it was seen as very unusual for an airline to be involved in Grand Prix hut this was the beginning of a brand new era.

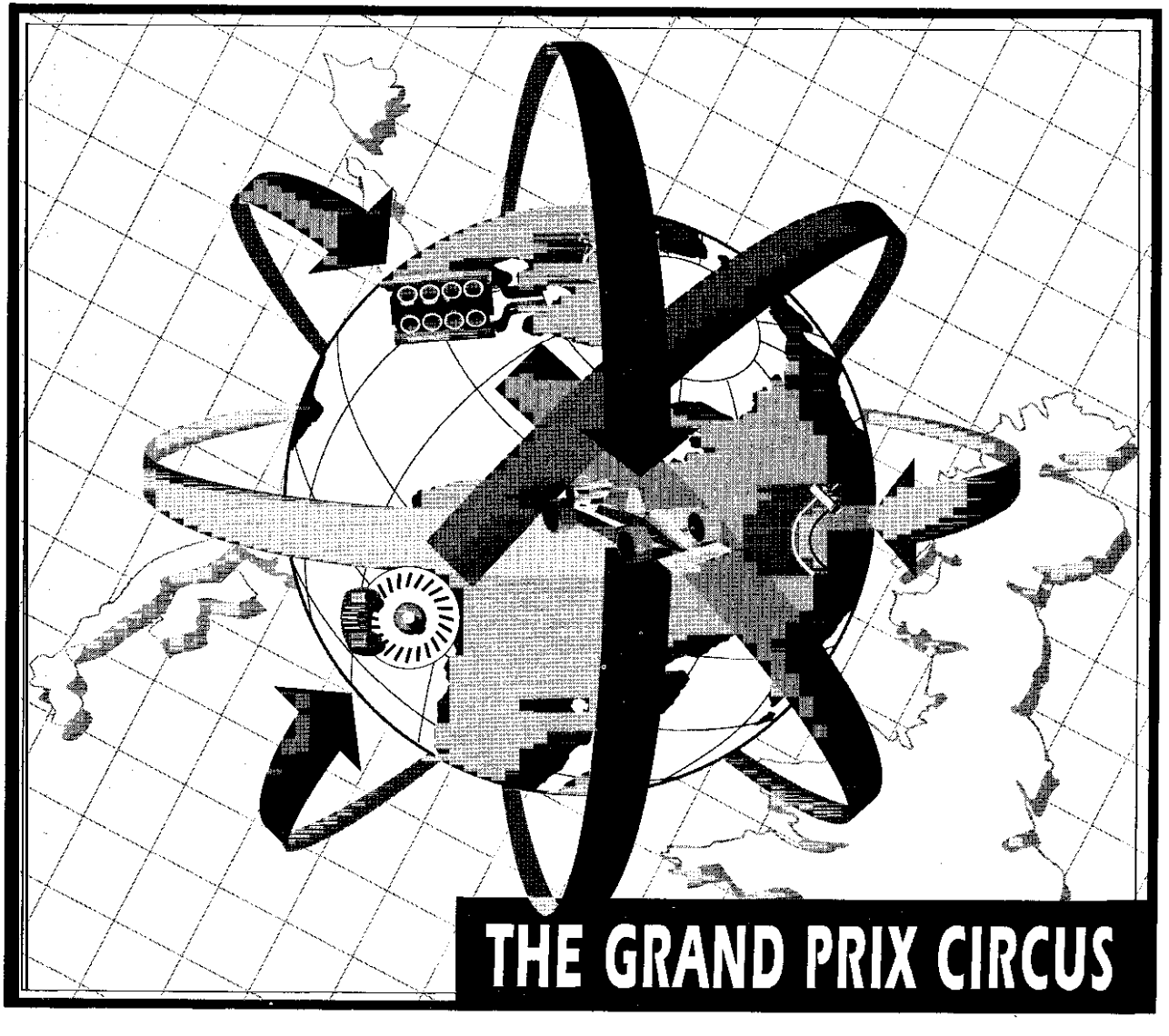
Safety Regulations for the protection of the driver.

TECHNICAL INFORMATION FISA

These are stringent rules specified by FISA.
The nose cone and the survival cell chassis must have undergone impact tests.
The fuel tank must be within the chassis width and behind the driver.
The driver's feet must rest behind the front axle line.
The driver's head must be below a line drawn from the main roll over bar to the dash hoop.
The driver must be strapped to a six point seat harness.
The driver must wear fireproof underwear, balaclava, gloves, three layer overall, boots and a helmet. These must have the capacity to give him 30 seconds protection in a blazing car.
F1 cars must have a fire extinguisher and power cut-off points accessible from inside and outside the car.

From the 1980's Grand Prix sponsorship gradually became a very complex business. Television Overage increased so that each Fl race came a close third in viewing figures after the Olympics and the World Cup. The influx of money enabled Fl car construction to he in the forefront of the new technology. Computer aided design, computer aided manufacture, carbon fibre material developments; all were made possible by the new sponsors.

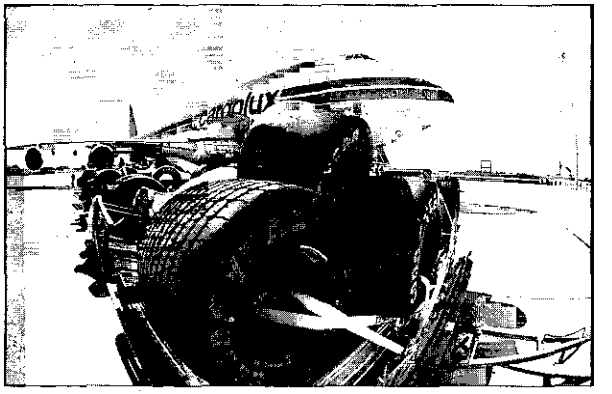
Cameramen, Press and TV journalists swarm around Pierluigi Martini in the Minardi MN 189 before the start of the Spanish Grand Prix.


THE GRAND PRIX CIRCUS

THE GRAND PRIX CIRCUS

Circus might seem a strange term to describe the meticulous world of designers, and high-tech car specialists but circus sums up the seeming chaos that surrounds the teams as they set up their bases in 16 different track locations, complete with awnings, bright colours, adverts, TV film crews, journalists and glamorous looking hangers-on. The drivers, the cars, the speed and the danger are the main attraction for the vast crowds that flock in from early morning onwards and the hordes watching on television. The performance usually lasts about two hours then the crowd streams home until next year. The circus then packs up and drives on to the next venue.

Except for the one Grand Prix that's on home ground, most teams have to transport huge amounts of kit and large numbers of people across Europe and when the teams have to transport themselves across continents, they pack their gear into containers, the cars on wooden pallets and load them into Boeing 747 freighters; an operation which can take two to three days.



A Boeing 747 Freighter with F1 cars packed on board about to be loaded with several sets of racing tyres. The loading process can take 3 days.

Before an European Grand Prix two huge articulated transporters are packed with three cars (two racers and one complete spare car), all the spares and equipment needed to service them and the motorhome: the debriefing/conference room. All three cars are fitted with brand new engines from the team supplier (Honda, Renault etc.) and spare engines, tools and components are also stowed aboard. Each transporter has a driver and a co-driver and, in Europe, they aim to get to a circuit by the Tuesday before a race weekend.

When they pull up at the track, the transporters are under the strict control of the Formula One Constructors Association which has specific Paddock parking rules to get the monster vehicles tucked away neatly. The trucks are backed up behind their pits in an order determined by last year's Championship. In theory, each team is only allowed one motorhome but the practice in the last few years has been for engine suppliers to have their own motorhomes, thus adding to the chaotic problems of those organising Paddock parking.

Race mechanics complete their checks on Nigel Mansell's car at Phoenix. The tyreman makes sure the blankets have raised the working temperature of the tyres.

On the Thursday morning the mechanics and engineers fly out from team base, and arrive at the Paddock by early afternoon when the transporters should be in place with their awnings set up. The cars sit in the garages waiting for the official scrutineers who tour around inspecting between 10am and 6pm.

Three mechanics are assigned to each car plus several electricians, sub-assembly men and numerous technicians from the engine makers.

The chassis is then set up, checked and a meeting arranged with the tyre company to talk about the circuit and which tyres would be most suitable for its surface. When it has been decided the team tyre man sends the wheel rims to the tyre company fitters.

Race mechanics are a rare breed. They must be prepared to work very long hours and be away from their families for weeks at a time. The are paid more than the home-based technicians, including board and lodging and a generous subsistence allowance. In the last few seasons some mechanics have been sponsored by various companies, several are quite famous and liable to be poached by other teams

If everything has gone well, mechanics will be heading back to their hotels by eight or nine o'clock, leaving the cars in the pit-lane garages and the transporters locked up under the watchful eye of circuit security. Teams have to be very careful with their cars; it's not been unknown for certain new components to disappear overnight and for other teams to produce the exact same part within a few months!

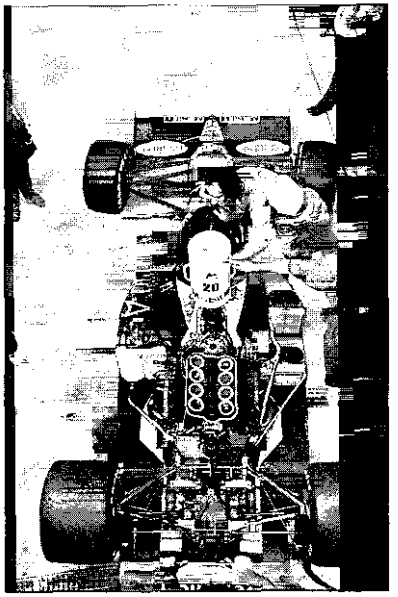
On the Friday before the race, the mechanics are buzzing around the car by 7.30 am and the managers and engineers usually arrive about half an hour later. The cars are checked and warmed up before the first 90 minute practice session after which the drivers appear and have their preliminary meeting with the engineers.

The first session in the car is untimed. The drivers are merely looking for the best chassis set-up and trying to get a feel for how the car is performing. They usually belt round for a few laps on the soft rubber qualifying tyres and see how the compound reacts on that particular track surface. They have to get it right because for the official session in the afternoon they'll only be allowed two sets of tyres.

The driver and technicians of the Jordan team look at the data recorded by the telemetry system over a previous qualifying lap to help ret the ideal gear ratios For the Phoenix circuit.

The first qualifying lap period is always scheduled between 1 and 2 pm. This is a tense and nervous time for the teams but especially for the drivers who've got to lay down two fast laps just when the car, engine and tyres are at their peak performance. Each driver faces the same dilemma at this stage: do they get out early and try to get a clear run in the traffic before anyone has dumped a load of oil on the track? Or, do they wait until a good grip has been created by other drivers' rubber on the driving line? This session is officially ended by a marshal waving a chequered flag.

On the Saturday, the schedule for the previous day is repeated except that the 90 minutes practice session is used to work out the racing set-up for the car; running on race tyres and three-quarter full fuel tanks. If the Friday session did not register a good lap time then the drivers will now be under tremendous pressure. It's their last chance for a high grid positions.



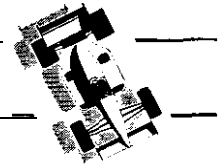
Refuelling the Benetton car at Hockenheimring. A F1 car holds 200 litres of 102 octane fuel and consumer 1 litre every 1,600 metres.

The drivers wake up early on the morning of the race, now there is much to do and no time to get nervous, They try to get to the track before the crowds start arriving to prepare for the morning's 30 minute practice session. Usually called a 'warm-up', this is the time when final checks are made on the performance of the car in full race set-up. Weather and temperature charts are studied before the final decision is made on which tyres to use.

The track is usually dirty and not an ideal surface to judge how the car is performing. Most drivers also use this time to look over the opposition during their warm-up laps. It's usually a better indication of how a rival car is performing than the qualifying laps, for all cars should now be fully fuelled and sporting race tyres.

With three hours to go and no other decisions to be made, the drivers retire to the team motorhome and are given a wide berth by the rest of the racing crew. Alone with their thoughts, many of them are already running the race over in their minds.

Half an hour before the start the drivers emerge from the paddock and trundle off to the assembly point near the circuit access area. Never popular with the drivers, attendance at this meeting is now compulsory and a truant can be heavily fined. Here, they are given last minute instructions by the Clerk of the Course. The drivers

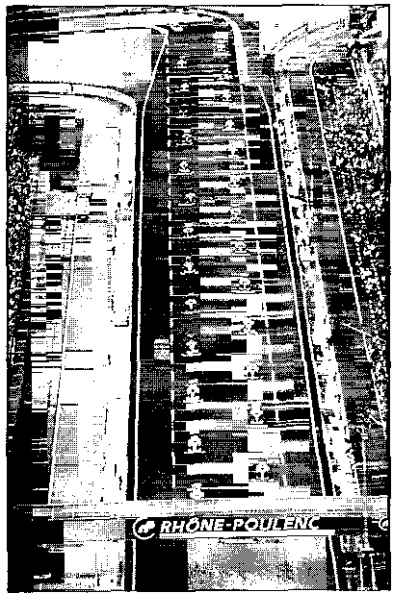


then get in their cars and go out onto the circuit one after the other, for a reconnaissance lap. This is a slow lap on cold tyres which ends up with the cars finding their place on the starting grid.

Engines are switched off for five minutes, final checks and adjustments are made to the car by beavering mechanics and team managers give their last minute instructions to the drivers. TV crews, photographers and journalists are allowed onto the grid. The drivers check their fireproof clothing, fit ear-plugs and make sure they are comfortable before they put on their helmets. There's nothing worse than having an itch on the back of your head and being unable to scratch it for two hours!

The Start-Line Marshal raises a series of boards to show the length of time before the start. On the two-minute warning, the grid is cleared and the engines are started up, Drivers whose engines have not fired signal to their pits by raising their hands.

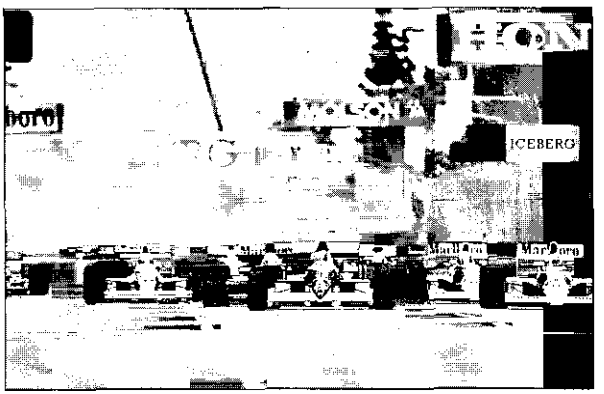
The Green Flag is waved to release the cars for one final 'warm-up' lap. The drivers try to avoid any dirt or grease on the track while at the same time zig-zagging and driving through corners very fast to warm up the tyres. Grid order is maintained with the pole position car controlling the speed of all the cars. Many drivers believe that the real race begins with the warm-up lap, when they are pushing the car to the limit to see how it reacts. Inevitably, the cars in the lower order bunch up and get no benefit from the warm-up.



The starting grid at the French Grand Prix after the warmup lap. An official at the back will signal to the starter when all the cars are in the correct position on the grid.

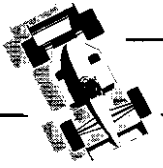
The cars line up on the grid again, two by two, with the pole position driver holding the inside line for the first corner, and wait for the Red Light. Engine revs are kept up to prevent stalling and the water temperature dial rises as the engine begins to heat up. When every car is in the correct position on the grid an official at the back gives the Start Marshal a signal. The 30 seconds board is raised. It's wise for drivers not to engage first gear and slip the clutch too early at this point of they'll end up with a burnt-out clutch.

The Red Light. There are now a maximum of ten seconds to go before the start. The drivers select first gear to the accompaniment of grinding, grating and crashing gearboxes. First has to be forced in because the clutch has so little play and, with the drivers revving at 10,000 rpm, it gets very hot and cannot disengage fully. A hot clutch can lead to a false start as the car creeps forward and the driver will get a time penalty. In the critical seconds before the start the drivers use the 'heel-toe' movement: brake with the toes and blip the accelerator with the heel, but some drivers maintain that 'blipping' could give you a slow start if your foot is coming up off the accelerator at the time when the green light is given. The important thing is to build up the revs to just below the point of peak torque.



The start of the American Grand Prix. The car in pole position turns in slightly; aiming For the ideal line around the first corner and makes it difficult for other cars to pass.

The Green Light. The drivers let out the clutch with just a touch of slip. If they slip it too much then the clutch will bum out at 10,000rpm, if they let it out with a 'bang' the car may stagger off line. Once the clutch is disengaged, the right foot controls the amount of rear wheel spin the drivers get. Drive wheels are not effective if they spin because they have lost firm contact with the ground. Push your right foot down too hard and you end up with lines of rubber on the road, smoke, wasted power and the car will make a bad start. The start is probably the most important moment of the race; a good one will get over the handicap of a lowly grid position and a poor one will destroy all the hard work of qualifying.

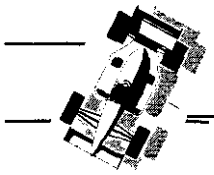


The start is also the point of greatest risk. Imagine 26 cars, tightly packed, all released at the same time, charging together for the first comer. Most drivers look briefly in the mirror to see if anyone has got a 'flyer' and watch out for the car that has stalled. The safest place is always out in front.

It's impossible to hear your own engine among 25 other cars, so it's difficult to know when second gear should be shoved in. Drivers check their tachometers to prevent overrevving but it's always better to change up too soon then too late. When the cars reach the first corner they are usually bunched, moving slower than at any of the previous practice laps. Opportunists who find a gap into which they can dive will gain, otherwise drivers usually aim for the inside of the corner to make it difficult for others to pass them. Often, if too many cars have made for the inside, the normal racing line on the outside will be opened up for cars further down the grid. If there is such a thing as 'instinctive driving' then this is the time that it comes into its own.

At the end of the race the cars are driven to the Part Ferme and there they will stay for an hour. The winning car is examined in detail with a random selection of others and no one from the teams is allowed to touch them. Fuel is also tested and official scrutineers have been known to 'seal' engines for detailed inspection at a later date. Within an hour of the end of the race, the team managers and chief engineers are heading home. Fuel is pumped out of the car's tanks, tyres are stripped from wheel rims and the cars are re-packed into the transporters. Everything is stowed away ready to get back to base by Tuesday. The show is over.

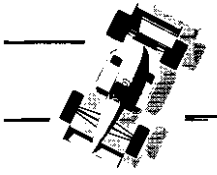
The next morning the sports pages will be full of stories about the leading drivers, interested readers will look at the drivers' championship points table,



some may glance at the constructors' championship table. Back at the team home base, the designers, engineers and drivers sit around a table and talk about what went right, what went wrong and what to change for the next race.

GLOSSARY OF TERMS

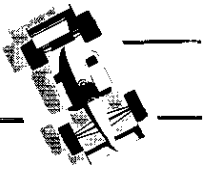
Aerodynamics	The force that comes into play when the car has picked up speed. Wings mounted upside down give negative lift, and hold the car down.
Angle of slip	The angle between the direction of the wheels (front and rear) and the direction of travel.
Anti-Roll Bars	Adjustable parts of the front suspension. A car should have minimum chassis roll and maximum grip.
Apex or Clipping Point	The nearest point a car gets to the inside of a curve in an ideal racing line.
Camber	Slight upward curve to the centre of race track.
Camber Angle	Camber angle is designed to make a tyre work as effectively as possible when a car is going through a corner. Negative camber is applied so that when fully stressed a tyre will be as close to perpendicular as possible.
castor Angle	Castor gives greater responsiveness and stability to the front wheels. The larger the castor angle, the heavier the steering and more stable the front end.
Chicane	A barrier placed before a dangerous corner to reduce speeds by allowing drivers through in single file.



GLOSSARY OF TERMS

Downforce	Inverted wing positions front and back which can be adjusted mechanically to create downwards pressure.
FIA	Federation Internationale de l'Automobile. The motor racing sport's governing body.
Getting a Tow	Another term for 'slipstreaming', gaining speed by sitting behind a rival car prior to overtaking.
Ground Effect	Now outlawed by FIA but in the period 1980 to 1982 virtually all cars were built in this way. The car had an underbody shaped like an inverted wing which almost sucked the car on to the track and gave tremendous grip.
Increase the Lock	For some tight hairpins, such as Loews in Monaco, the car steering lock is increased to take the bends faster albeit to the detriment of the tyres.
Outbrake	To brake very late into a corner when dicing with a rival car.
Paddock	The parking area behind the pits where all the equipment, trucks, spare cars are kept by the teams.

GLOSSARY OF TERMS



Part Ferme	The state of isolation imposed on cars after a race has been run. Only officials may touch the vehicles for an hour after the finish. Some engines may be 'sealed' for later inspection.
Rumble Strip	The bobbly, coloured strip on the edge of the track which serves as a warning to the driver to transgress no further.
Run Off Track	A stretch of track close to a dangerous section of the circuit, that gives the driver an escape route.
Shunt	Any form of crash or spin that ends the race for the driver.
Telemetry System	Multi-function system to measure all aspects of car and driver performance.
Torque	The amount of thrust driving through from the engine to the wheels.
Tyre Blankets	Special electric blankets placed over tyres just before a start to keep them up to racing temperature.