

# Racing 101

## A

**AERODYNAMICS** - This crucial aspect of race car design and tuning defines how the car moves through the air and how areas of high and low pressure can be generated and manipulated to maximize down force while minimizing drag. In Atlantic this includes the airflow underneath the car, generally referred to as "ground effects".

**ANTI-ROLL BAR / Sway Bar/ Stabilizers**- This is a mechanical linkage, set up for both the front and rear suspension, that helps keep the car from "rolling over" in the corners. This complex linkage helps keep all four tires gripping the track, and is adjustable by the driver using levers within the cockpit. Also called a sway bar.

**APEX** - The geometric center of a corner. In racing, a driver will often use a "late apex", turning into the corner a little later than normal in order to straighten out the last part of the corner. This allows the driver to accelerate earlier and harder, gaining maximum speed down the subsequent straightaway.

## B

**BACKMARKER** - A car running near the back of the field.

**BANKING** - On oval tracks, the corners are often tilted inwards to provide higher speeds. On some road courses, certain turns may actually be banked outward, a very difficult type of corner known as "off-camber".

**BLACK FLAG** - This flag is used by the starter to signal a driver that he or she must immediately report to the pits for consultation related to a dangerous mechanical condition or a driving infraction. Failure to heed the flag can result in exclusion from the final results of the event. This flag may be displayed in a "furled" (rolled up) manner as a warning. Corner workers may also display a black flag if the session has been halted by the display of a red flag by the starter.

**BLUE FLAG** - This flag is used by corner workers around the track to signal a driver that a faster car is either approaching (steady flag) or actually attempting a pass (waved flag). The driver being flagged has no obligation to do anything other than be alert, maintain the racing line and avoid intentionally obstructing the faster car.

**BODYWORK** - The exterior of the car. The bodywork is generally made from lightweight carbon fiber and is made to come apart in sections, providing access to certain mechanical components. Bodywork is carefully sculpted to maximize aerodynamic efficiency.

**BRAKE BIAS** - In most cars, including streetcars, pressing on the brake pedal applies a little more force to the front brakes than the rear. This is designed to take advantage of the fact that under braking, weight transfers to the front of the car. With lots of weight on the front tires, the brakes can be applied very hard without completely stopping the wheels from rotating. At the same time, the rear of the car tends to get lighter so the rear brakes must be engaged less strongly than the fronts to avoid locking the wheels

and possibly losing control. In a racecar, brake bias is adjustable by the driver to compensate for changing conditions.

**BRAKE FADE** - When the fluid in the brake system exceeds its boiling point due to hard use, bubbles can form in the brake lines and calipers. Since these bubbles can be squeezed smaller by pressure from the brake pedal, the pedal tends to "go soft" and may even go to the floorboard without the brakes working properly.

**BUMP** - In shock absorbers, a bump adjustment is a change to the dampening of the shock on the compression stroke. As a car passes over a bump on the track, each wheel assembly rises up to pass over it. Without compression dampening, the inertia of the wheel assembly would cause it to continue to rise after the bump until the spring finally overcomes the inertia and pushes the wheel back down. Since a tire can't do any work while in the air, bump dampening stops the upward inertia and allows the tire to stay in constant contact with the pavement. Bump adjustments can also affect how the weight of the car shifts around during braking, acceleration and cornering.

## C

**CAMBER** - An element of chassis tuning. Each tire can be tilted inwards or outwards depending on the track. The usual idea is to tilt the top of the tire inwards (negative camber) so that under cornering loads, the entire surface of the tread is being used to the maximum. On oval tracks, since the car only turns left the left-side tires may actually be tilted outwards (positive camber). Teams adjust the camber setting based on reading tire temperatures across the surface of the tread, with the goal of having equal temperatures on the inside, middle and outside edges. This temperature equilibrium indicates the tire is being used to its maximum capacity.

**CASTER** - Another element of chassis tuning related to the front wheels. The front wheels are attached to the suspension at the top and bottom of the wheel assembly. The top attachment is typically set a little farther back than the lower attachment, creating caster. The more caster used, the more the wheel resists turning forces, providing stability. Too much caster makes it very difficult to steer, and causes the tire camber to change excessively as the wheel is turned.

**CATCH FENCE** - At most oval tracks, or in any place where the crowd is close to the track, catch fences are used to stop cars and car parts from flying into the crowd in the event of a crash. One of the most dangerous flying parts in a crash are the wheel assemblies, which can bounce very high.

**CAUTION PERIOD** - When an accident happens, or for other reasons such as debris on the track or a sudden downpour, the officials may put the track under caution by waving yellow flags at the starter stand and around the track. This brings out the pace car to gather the field and lead them around at reduced speed until the time for a restart.

**CHASSIS** - The basic structure of a car, including the driver tub, gearbox and suspension. Engines are provided separately.

**CHECKERED FLAG** - This black-and-white checked flag is the most famous in racing, signifying the end of the session or race. At the end of a race, the first car to receive the checkered flag at the finish line is the winner.

**CHICANE** - A quick succession of opposite-direction turns, usually intended to reduce excessively high straightaway speeds.

**COMPOUND** - Tires are extremely important in Atlantic, with Yokohama providing one of the best tires in racing. Compound refers to the chemical composition of the rubber tread, which requires a balance between the conflicting goals of traction and long wear.

**CORNER WEIGHTS** - This refers to the distribution of a car's weight among the four wheels. Management of these corner weights is very important to handling. This weight is usually adjusted through raising and lowering each corner by rotating a threaded spring perch on each shock absorber.

**CORNER WORKERS** - The quiet heroes of racing. These volunteer workers will travel across the country at their own expense, eating peanut butter sandwiches and sleeping in tents to provide flagging and marshalling duties around the track. Their expertise is one of the keys to the tremendous safety record of Formula Atlantic, and the drivers waving to the corner workers at the end of an event it is a reflection of their acknowledgement of the contribution these great people make. If you are interested in getting involved in this sport, volunteering for training at club racing events around the country is a great way to get immersed in the action.

## D

**DATA ACQUISITION** - Atlantic teams use sophisticated sensors and software to provide information on what the car is doing. Everything from engine stress to steering wheel position can be monitored. This information is analyzed to provide a basis for improvements to handling, performance and even driver technique. This data acquisition can be accomplished by connecting a computer to the car, or by use of wireless telemetry.

**DIFFUSER** - This piece of bodywork is underneath the rear of the car and is intended to manage airflow as it exits. A good diffuser design can generate significant down force.

**DOWNFORCE** - The wings on a Toyota Atlantic car are set up opposite from an airplane. Instead of providing lift, they are used to press the car harder onto the track providing increased traction for braking, acceleration and cornering. Down force is also provided by the ground-effects tunnels on each side of the car. Increased down force also results in increased drag, so a tradeoff is required.

**DRAFTING** - A fast-moving car creates a low-pressure area behind it, causing the air to try and move with the car. A car following behind can take advantage of this low pressure as it actually sucks the car along faster, known as "being in the slipstream". A savvy driver can either use the draft to pass, or to lift off the gas slightly and conserve fuel.

**DYNO** - A condensation of "Dynamometer", a device used to test an engine in the shop by simulating the loads and environment a racing engine encounters.

## F

**FLAGS** - Flags are used to signal drivers of events or conditions. Flags used in Atlantic include green, white, white and red, black, checkered, blue, yellow, red and red/yellow. See each individual color for an explanation of what each flag means.

**FLAT SPOT** - If a driver locks a tire (brakes so hard that the wheel stops turning entirely), a flat spot will be created on the surface of the tire. This can create a vibration so bad that the car is almost undriveable.

**FORMULA CAR** - Formula car is a term to define open-wheeled racecars that must fit within a specific set of design rules or "formula".

## G

**GEARBOX** - Refers to the transmission attached to the rear of the engine.

**GREEN FLAG** - The green flag is used by the starter to signal drivers that the race is underway, either at the start of the event or at the conclusion of a full-course yellow flag condition.

**GRID** - The starting order of cars, as determined by qualifying position.

**GROUND EFFECT** - This describes the nature of airflow near the ground. In airplanes, this refers to a cushion of air that builds up as a plane nears the ground. In racecars, this refers to artificially generated low-pressure areas underneath the car, which help it adhere to the ground. This is done by use of three-sided ground-effect 'tunnels' on each side of the bottom of the car, which start off small near the front and gradually get bigger towards the rear, creating a vacuum as the car moves forward using the ground as the fourth side of the tunnel. The greater the gap between the tunnel side and the ground, the more vacuum escapes and the less down force is generated.

## H

**HAIRPIN** - A sharp, 180 degree turn.

**HEAT CYCLE** - A tire that has been heated up through use and then cooled down has experienced one heat cycle. This often results in a slight hardening of the tire compound, which can make the tire perform at a high level for a longer period of time. See Scrubbed Tires.

**HORSEPOWER** - A measure of an engine's maximum output in terms of torque over a period of time. A typical medium-sized family sedan produces around 150 horsepower to move 3,000 pounds.

## I

**INFIELD** - The portion of a racing facility that lies inside the boundary of the track.

## K

**KEVLAR** - A brand name for a certain type of carbon fiber, used in everything from driver's helmets to bodywork to the bullet-proof vests used by police. A very strong and lightweight material.

**KITTY LITTER** - This term describes two things: the absorbent powder used to soak up fluid spills on the track (often actual kitty litter) and the gravel runoff areas on the outside of certain road course turns used to slow cars that go off the track.

## L

**LINE** - This is the quickest way around a race circuit, taking advantage of braking, cornering and acceleration techniques. For example, the line for a typical right-handed corner would involve lining up on the left side of the approaching straight, braking hard, turning in all the way across the track to the inside curb, and then unwinding the steering wheel on the exit to release the friction of the turn, which takes the car back across the track to the outside again. The idea is to use the maximum amount of arc possible to maintain the greatest speed through the corner. The line is often visible due to the rubber laid down by cars, and interestingly is not the shortest way around the track, just the fastest.

**LOOSE** - Same as Oversteer. Typically describes a cornering condition where the rear tires lose adhesion before the front tires, resulting in a car that feels like it wants to spin easily. This is one of the most unpleasant sensations for a driver at high speed. Solutions include adjustments to tire pressure, increasing the angle of the rear wing to press the tires harder to the ground, softening the rear anti-roll bar setting or spring rates in order to provide more grip, or by making changes to reduce grip at the front such as reducing the front wing angle or stiffening the front anti-roll bar setting or spring rates.

## M

**MARBLES** - Bits of rubber are scrubbed off of racing slicks while cornering. These small balls collect on the outside of the turn, and if a car goes wide (into the marbles, or into "the grey", referring to the lighter appearance of an area covered with marbles) then much adhesion is lost. This often can cause a car to understeer straight into the wall or off the track.

**NOMEX** - A fire and heat-resistant material used to make driving suits, gloves, shoes, helmet liners, balaclavas and underwear. When combined with fuel bladders that are resistant to breaking open in a crash, the risk of fire has been greatly reduced over the last 20 years. Much of this technology was developed by the military.

## O

**OPEN WHEEL** - Refers to any type of racecar that does not have enclosed wheels. CART, Formula Atlantic and Indy Lights are open wheel cars, as are the sprint cars, midgets and modifieds that run at local Saturday night tracks all over North America. Stock cars and sports cars are typically based more closely on production cars with the wheels enclosed within fenders.

**OVAL TRACK** - Used to describe tracks with a layout that incorporates some version of a circle, usually with a rectangular, triangular or oblong shape, and incorporating either banked or flat turns.

**OVERSTEER** - Same as Loose. Typically describes a cornering condition where the rear tires lose adhesion before the front tires, resulting in a car that feels like it wants to spin easily. This is one of the most unpleasant sensations for a driver at high speed. Solutions include adjustments to tire pressure, increasing the angle of the rear wing to press the tires harder to the ground, softening the rear anti-roll bar setting or spring rates in order to provide more grip, or by making changes to reduce grip at the front such as reducing the front wing angle or stiffening the front anti-roll bar setting or spring rates. Here is an easy way to remember whether a car is loose (oversteer) or tight (understeer)

**OFF-CAMBER** - Some turns on road and street courses are actually banked outwards, which can make them very tricky to negotiate. This is known as an off-camber turn.

## P

**PADDOCK** - The area where the team transporters are located, and where the teams work on the cars between on-track sessions. This area is usually accessible to the general public.

**PIT** - The area where cars come in for fuel, tires, adjustments and repairs during on-track sessions. The name originated from early racetracks, where the mechanics actually stood in a shallow pit where they could duck if an out-of-control car came their way. Today, mechanics are protected by concrete walls, and the pit lane is segregated from the actual racing surface.

**POLE** - This historic term refers to the driver who starts at the front of the field on the inside of the front row by virtue of the fastest qualifying time. The term originated at horse tracks, where many of the original Champ Car races were held on dirt. The finish and distance markers of a horse track are marked by poles set on the inside edge of the track.

**PUSH** - Same as Understeer or tight. Typically describes a cornering condition where the front tires lose adhesion before the rear tires, resulting in a car that feels like it wants to go straight. Solutions include adjustments to tire pressure, increasing the angle of the front wings to press the tires harder to the ground, softening the front anti-roll bar setting or spring rates in order to provide more grip, or by making changes to reduce grip at the rear such as reducing the rear wing angle or stiffening the rear anti-roll bar setting or spring rates.

## Q

**QUALIFYING** - Qualifying determines starting positions, and usually consists of the combined results from two on-track sessions. Each car is timed, and the starting grid is determined by the order of fastest cars. For road and street courses, all the cars are on the track at the same time which requires careful management of track position in order to avoid being blocked by a slower car. For oval events qualifying is one car at a time, usually for two timed laps.

## R

**RAIN TIRES** - Treaded tires used on a wet track. Also referred to as "Wets".

**RAKE** - Most racecars are slightly lower at the front than at the rear. This provides for a natural "ground effects" tunnel under the car, and can also be adjusted to change the weight distribution between the front and rear wings.

**REBOUND** - In shock absorbers, a rebound adjustment is a change to the dampening of the shock on the expansion stroke. Without rebound dampening, the car would tend to bounce as it passes over bumps on the track. Rebound adjustments can also affect how the weight of the car shifts around during braking, acceleration and cornering.

**RED FLAG** - This flag, when displayed at the start/finish line, signifies an immediate halt of the session due to a major problem such as heavy rain or an accident that is blocking the track. Corner workers around the track will display black flags when this happens, and all cars are required to stop racing and slowly return to the pits. The lap in progress is discarded, and the field results to the order of the previous lap when racing resumes. If the race has run more than 50% of the laps, the chief steward has the option to declare a complete race if track conditions are not expected to improve. If a race has run less than 50%, it will be concluded on another date.

**RED AND YELLOW FLAG** - This striped flag is displayed by corner workers to signify debris on the track, which can be oil, sand, water or some other substance.

**RIDE HEIGHT** - This refers to the height of the chassis above the ground. Because of the relationship between the height of the ground effect tunnels and their performance, maintaining optimum ride height is an important feature of car setup and design.

However, it is hard to manage since the faster a car goes, the more the aerodynamic effects press it to the ground. Many very complex methods are used to maintain a consistent ride height.

## S

**SCRUBBED TIRES** - Also known as Scuffed Tires. Tires that have a few laps on them to remove the outer sheen and provide more consistent traction. See Heat Cycles.

**SETUP** - There are a huge number of variable adjustments which can be made to an Atlantic car to improve the handling and performance. The driver with the best setup is in a good position to win. A driver with a less than perfect setup can sometimes "hustle the car" and compensate for the deficiency, but most drivers perform at their utmost only when the car is comfortable.

**SHUNT** - British term for crash or accident.

**SLICKS** - A racing tire with no tread. There is a misconception that the tread pattern of a tire provides traction. This is true in dirt, snow or on wet pavement, but on dry pavement the maximum amount of "contact patch" is desirable.

**SLIPSTREAM** - See Drafting.

**SPOTTERS** - Teams on an oval track will usually have a crew members on top of the grandstand, where they can see the entire track and warn drivers of an accident or advise them where to go in traffic.

**STICKERS** - A brand new tire, with the manufacturer's sticker still on the tread.

## T

**TAKE A LOOK** - A driver following closely behind another car may dart momentarily to the inside of the entry to a corner, pretending to attempt a pass in order to disrupt the concentration of the driver in front and hopefully causing a small mistake.

**TELEMETRY** - The portion of data acquisition that is transmitted wirelessly while the car is on the track.

**TIGHT** - Same as Push or Understeer. Typically describes a cornering condition where the front tires lose adhesion before the rear tires, resulting in a car that feels like it wants to go straight. Solutions include more front wing to press the tires harder to the ground, softening the front anti-roll bar setting or spring rates in order to provide more grip, or by making changes to reduce grip at the rear such as reducing the rear wing angle or stiffening the rear anti-roll bar setting or spring rates.

**TOE** - In order to provide stable tracking, all four tires are usually pointed slightly inwards if viewed from overhead. More toe-in provides more stability but increased tire drag. On high-speed oval tracks, these toe settings are even more crucial. Toe-out may be used in certain types of cars and situations, but toe-in is more common. Teams usually adjust toe with the most unsophisticated methodology seen in racing, using a string around the outside of the car and a caliper to measure the difference in the distance from the string between the front outside of the tire and the rear outside of the tire.

**TORQUE** - A measure of engine power, described in foot/pounds of force. 10 foot/pounds of torque would raise ten pounds of weight one foot in the air. Horsepower is a measurement of torque over a period of time.

**TURN IN** - As a car reaches a corner, this is the moment at which a driver actually begins to turn the wheel. The timing of this action and the car's response to it are crucial for setting fast lap times.

**TUNNELS** - Ground effect-generating areas underneath the sides of an Atlantic car.

## U

**UNDERSTEER** - Same as Push or Tight. Typically describes a cornering condition where the front tires lose adhesion before the rear tires, resulting in a car that feels like it wants to go straight. Solutions include more front wing to press the tires harder to the ground, softening the front anti-roll bar setting or spring rates in order to provide more grip, or by making changes to reduce grip at the rear such as reducing the rear wing angle or stiffening the rear anti-roll bar setting or spring rates.

## V

**VORTEX** - An area of revolving compressed air. The most obvious examples are the vortices that are visible coming off the rear wing of an Atlantic car in humid conditions.

## W

**WHITE FLAG** - When used by the starter, this signifies the last lap of the race. When used by a corner worker, it signifies that a slow-moving vehicle is on the track.

**WHITE AND RED FLAG** - Used by the starter, this white flag with a diagonal red stripe indicates to the field that an emergency or service vehicle is on the track, and extreme caution should be used.

## Y

**YELLOW FLAG** - If displayed by a corner worker, this means the subsequent section of the track has a problem that requires that drivers slow down and not make any passes. Usually this arises because a car has crashed and is in a dangerous position. If the starter displays two yellow flags, it signifies a full-course caution that prompts the pace car to enter the track and lead the cars around at reduced speed.