



# FORMULA TRANSFORMATION

Like a science fiction novel metaphor for an uninhabitable planet of the imagination the incessant Santa Ana winds made the featureless landscape of Riverside uncomfortable for the spectators, and every effort an arduous labor for the teams. Cooper, BRM, Lotus, Scarab were all present for this second U.S. Grand Prix, and the last round of the 1960 season. Only Ferrari had stayed home, choosing wisely to prepare for the new 1.5 liter Formula coming into force next season. Maranello's absence was illustrative of the contretemps going on between the CSI and the emergent British teams. Having finally moved to the forefront of Grand Prix the British constructors weren't enthusiastic about the uncertainties of competitive engine supply implied by the new "small" formula and were attempting to organize the three-liter based Intercontinental Formula. This exhibited strength, or lack of foresight, by the British teams was indeed emblematic of the sea-change which had taken place during the last seven seasons of the 2.5 liter formula. All save two of the Formula One cars in Riverside's pits were British chassis', and significantly, mid-engined; the majority of which were British powered.

Tony Vandervell's invective to "beat those bloody red cars" became a *raison d'être* for the British at the inception of the formula in 1954. The ignominy of the overly complex BRM 1.5 liter supercharged car may have fired the British public's imagination, but it was the Vanwall that brought satisfaction, and the Championship in 1958. As the decade closed it was the mid-engined cars of Charles

and John Cooper that were showing the way round the premier circuits of Europe. This represented a startling change, creating unexpected division in the motor enthusiast ranks. From the design studios and shop floors to arm chairs in front of the Wide World of Sports principles of engineering were being reexamined, tradition and change questioned.

## I.

One car at Riverside that November weekend was emblematic, in the enthusiast mind, of the last seven years of Grand Prix, the 250F Maserati. The driver who had taken the 250F from victory in the first race of 1954 season and on to the World Championship in 1957 was the personification of the sport during the 2.5 liter Formula: Juan Fangio. The gifted Argentine had piloted each of the GP cars with the greatest potential to the Driver's Championship, Maserati & Mercedes ('54), Mercedes ('55), Ferrari/Lancia ('56), and Maserati ('57). Superb engines had fired all of these cars, yet it was an unrelenting search for traction and handling that was truly the focus, and primary outcome, of this displacement regulated Formula.

As the Grand Prize moved from Formula 2 back to Formula 1 for the '54 season, engineering had picked up where it had left off, with the continued evolution of the varying diameter tube chassis. By the end of the first year the large diameter twin tube frame had become the small diameter multi-tube frame. Mercedes and Maserati led the way, employing triangulated multi-tube frames. Lancia had gone further by using the engine as a stressed member of their frame, reducing weight and size while increasing rigidity. Mercedes and Maserati experimented with aerodynamics, the former successful, the latter not so. Vanwall experimented with both the triangulated space frame and aerodynamics to achieve the inaugural

Manufacturer's Championship in '58. Engineering development during the period was impressive, the competition riveting; yet it was to be an unprepossessing car, in the opening round of the 1958 Grand Prix season, that was to shock.

As the Christmas Holidays of 1957 came to pass Vanwall and BRM knew they would not be able to finish reengineering their power plants to run satisfactorily on Av-Gas, the newly stipulated replacement for alcohol fuel in '58, by the 19 January competition in Argentina. Sighting "cursory organization", the British teams chose to protest the Argentine race in an effort to delay the first championship round of Grand Prix season. Unfazed by the British protest, the CSI went on with the race. Amongst the predominantly Italian field of 246 Dino Ferraris and 250F Maseratis was indeed one British entrant. Six months previously this car hadn't even been a Formula One car.

The car, which wore the Scotch Blue livery of Rob Walker's team, had originally been purchased from the Cooper works in Surbiton for competition in the forthcoming 1.5 liter Formula Two competitions. During testing of the team's new 1500cc Cooper T41 F2, Roy Salvadori expressed to Rob Walker and team manager Alf Francis that with an engine to meet the minimum displacement requirement of 2 liters, they would have a Formula One car whose forgiving, precise handling could prove eminently competitive. Intrigued by this impressively economical entree into the top rank of competition Walker gave Alf Francis the go-ahead to develop the engine. The Walker financed effort resulted in Francis and the Climax engineers working around the clock to modify the latter's new FPF twin-cam engine, and the F2 car itself. Modifications complete, testing of the Walker team "special" amounted to a run up the Kensington Road to insure proper connection of controls and vitals before

being loaded for transport to its debut at Monaco. With Roy Salvadori running in F1 for the BRM team, Cooper's Jack Brabham accompanied the car to the Principality. As expected practice on the demanding circuit was little more than a shake-down of the untried mechanicals, with inauspicious results; Brabham crashed, rendering the car inoperable. The Walker team's F2 Cooper, present for the accompanying race, was brought in for a bit of field hospital transplant. Brabham took the altered F2, with two liter Climax, out on Friday and managed to make the field of sixteen, just; placing it thirteenth on the grid.

Brabham quickly drew the attention of the spectators after Louis Chiron flagged the start by adroitly using the nimble handling of the diminutive racer to gain nine places in short order. One of the primary chassis alterations of the F1 special had been larger fuel tanks to run the two liter through to the checker. Lacking these the F2 chassis required a fuel stop. Brabham very nearly brought this effort a third place finish. Following the pit stop Brabham dramatically worked his way through the field, only to have a fuel-pump mounting fail. The cheering and applause of the Montegase spectators echoed through the Principality's streets as Brabham pushed the silenced car across the line into sixth. Alternating between the F2 1.5 and enlarged 2 liter power the little blue racers wetted their feet in a number of competitions after its Monaco debut.

Walker's nascent F1 effort presented no great threat to the competition in '57. Starting at the season opener in Argentina, the fates and the rules of '58 would provide an entirely different result. Protest having failed, Vandervell was disinclined to incur the expense of fielding an ill-prepared team in the Argentines, this left Stirling Moss without a ride for this first points earning round of the Driver's Championship. An approach to Walker, for Moss to field the Cooper, was met with the enthusiasm that was

the mark of this Scottish sportsman. Moss, Alf Francis and team mechanic Tim Wall were immediately dispatched to Argentina with the team's well tested car.

In the event Moss' irrepressible talent, the chassis' potential perceived by Roy Salvadori, and the uncanny reliability of the Alf Francis maintained engine saw the Cooper running up front with Maranello's eminently powerful 246 Dinos. Unconcerned by the upstart British "special", Ferrari ran their own race in expectation of the inevitable tire-change pit stop that would most certainly be lengthy because of the Cooper's multi-stud wheels. Walker's improvised team had a different strategy, to run to the end. With canvas showing on Moss' Continental tires in the final laps, a startled Romolo Tavoni had Musso and Hawthorn put the crop to their 246s', but it was too late. Moss crossed the line a mere three seconds in front of a charging Musso, and thirteen seconds ahead of Hawthorn.

Enzo Ferrari had later commented that Walker's victory was the result of new rules limiting Grand Epreuve competitions to 300kms distance or two hours, rather than the previous 500kms or three hours. In this the Drake of Modena was indeed correct. Moss' tires could not have lasted much beyond the checker, but the die was cast. All the mechanical traction and precise handling sought by the manufacturers had been most effectively found and exhibited by moving the engine behind the driver and afore the rear wheels. When Maurice Trintignant crossed the checker into the laurels at Monaco four months later, against the full weight of the Formula's front line teams, what may have been dismissed as an anomaly brought forth through the great talent of Moss, was now engineering affirmation. The fifteen-race 1958 season was not to witness the apotheosis of Cooper. Even with the new Climax 2.2 liter engine it was woefully underpowered on fast circuits, but by mid season the upgraded T45 factory

cars were placing Brabham, McLaren, Salvadori, Trintignant, and an occasional Stirling Moss, uncomfortably, for the competition, in the points.

Nineteen fifty-nine was to be a different story. With the progressive mix and match upgrades inherent in the effective, yet parsimonious, development under the direction of Charles Cooper, the front coil spring, double wishbone T45 evolved into the occasionally coil sprung, rear wishbone T-51. Climax' commitment to Formula spec engines bore fruit initially in the 2.2 liter, found in many a T45. To reach their goal of a full spec 2.5 with the FPF engine, which had started life as a 1.5 liter, Climax had to cast an entirely new block to accommodate the greater bore and stroke. The new strengthened and rebalanced engine cured most of the structural weakness inherent in the 2.2 liter engine, while being a much smoother running unit. When completed the 2495cc engine produced 230hp at 6750rpm. With larger valves power increased to 240hp. In these configurations it took both T45s and T51s into the points. The original Citroen Traction Avant transaxles were continuously upgraded through the efforts of Jack Brabham, whose fine engineering skills were to be so effectively imprinted upon the Surbiton cars. As were his achievements behind the wheel.

During 1959 Brabham took the laurels three times, placed second four, while Cooper cars took multiple positions in the top six of every competition; assuring Brabham the Driver's Championship, and Cooper the Manufacturer's. 1960 was a reflection of the workmen like efforts that had brought them this far, and advanced the state of F1. Ironically it seemed a disjointed amalgam of effort that created the new "low line" T53; carried out sub-rosa, contrary to the company patriarch's commands. The intense mid-course correction, that created the T-53, was implemented between the February race in the Argentine and the May competition at Silverstone. It was inspired

by the dominant performance of Innes Ireland in the opening laps of the South American race, driving Colin Chapman's new car, the Lotus 18.

The Coopers were often referred to as blacksmith's cars because of the manner in which a group of disparate industry parts-bin components were ingeniously "assembled" to achieve an end. In contrast, the new Lotus was a clean sheet of paper project; reflective of the not insignificant vision of Chapman. While others had quite effective-

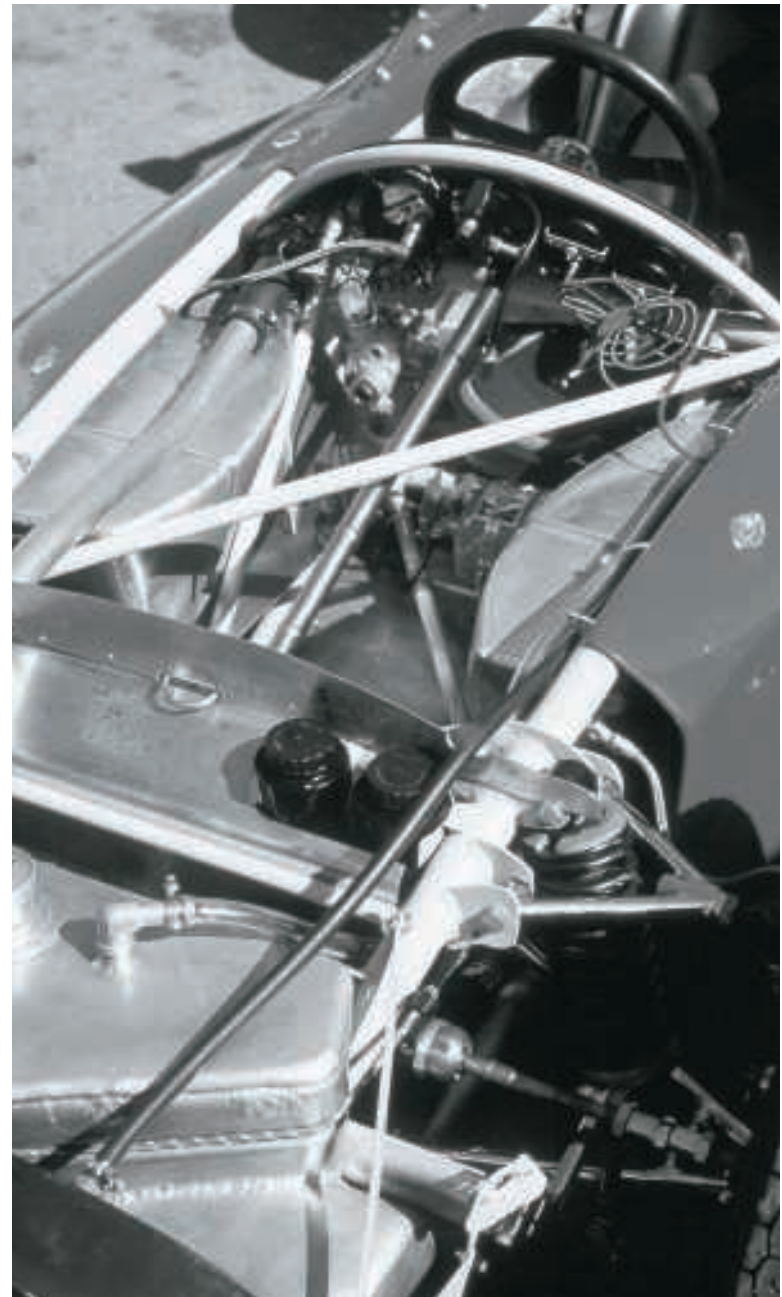
ly evolved multi-tube frames and space frame construction to provide lightweight rigidity, Chapman had pursued the latter in extremis. Like Cooper, his entree into Formula One was through Climax' engine displacement evolution from the F2 1.5 liter to 2.2. Chapman's first foray into the realm of single-seater competition cars was the front engined Lotus 12, then the 16.

Unburdened by engine development and manufacture, Chapman and his team were focused solely on pursuing



the limits of the Formula through strategic manufacture of the chassis. The Strategy formulated was much as Ferrari's had been in going after the Alfa 158/159s; creating cars that could run through to the end of the race sans pit stops. Ferrari had done it by creating engines that segued the use of fuel consuming supercharger engineering. Chapman saw the potential of achieving the same results by creating chassis' of such lightweight and low unsprung weight as to eliminate the necessary tire-change pit stops. He was aided in this strategy by the rules change of '58 which had, as previously mentioned, reduced the length and duration of F1 competitions. The Lotus 16 sought to achieve these goals with such parsimonious material application that it was *reducte ad Absurdum*. The only distinguishing feature exhibited by this car during the 1959 season was its ability to progressively disintegrate during competition.

Lesson learned, in material application, and point made, by Cooper &c., in regard to direct power application of the Climax FPF through mid-ship engine placement and driveline simplicity, Chapman developed the Lotus 18. Here theory entered the realm of the practical, and many a theory was being applied to this diminutive package. Chapman had learned much through his association with Frank Costin about shaping frontal aspect for effective air penetration. The opportunity presented by relocating the engine behind the driver was to shape the front around driver form. With this as a starting point the driver's seat was placed at a 60 degree recline and the frame built around. For the 18 the twenty-two gage mild steel of the previous car was replaced by eighteen & sixteen gage mild steel in 1" and  $\frac{3}{4}$ " diameters. Further strengthening for the fully triangulated frame was achieved through strategic placement of stressed sheet steel; one of which was the scuttle hoop acting as cockpit cross brace, carrying the instruments, steering wheel mount, requisite





switches, through which the drivers legs passed. The rear suspension and frame members converged onto a similar sheet steel hoop placed about the transmission. The frame was really a series of distinct, inter-connected, triangulated frames serving to carry the loads of individual sections, and distribute said loads through the structure as a whole. The end result was a rather squarish shape which was carried forward to the body.

As was to be expected from this engineer whose special focus was suspension, the 18 expressed several of Chapman's developing theories on suspension positioning and subsequent reaction in relation to his *raison d'être* of this car, reduced tire wear and consistent full tread contact with road surface. At this point, pursuit of these goals was often academic because of cost. The front suspension uprights came straight from the Triumph sedan; one of the first independently sprung British economy cars. Their cost of £1.50 being irresistible to Cooper and Chapman. The delicate unequal length tube steel A-arms at front were mounted to the frame in parallel approximating the height of the uprights, while ingeniously positioned to lower roll-center. For precise steering the wheels turned absent of Ackerman.

The rear suspension was designed to achieve negative camber in extreme cornering through the lowest possible center of gravity. To reach these goals, Chapman used reversed lower A-arms which were attached to the rear sheet metal hoop on the center line of the chassis, with the wide ends pivoting on the bottom of the hub center. To match the very low chassis position of these A-arms a special hub center was cast that controversially extended beneath the rim. The lower radius rod swept forward from bottom of the hub center to bulkhead between driver and engine. In parallel was an equally delicate radius rod sweeping forward to said bulkhead from hub center at axle height. So great was Chapman's faith in having met

the numerous goals of weight and handling, in relation to tire wear, that wheel weight was further reduced by elimination of knock-off hubs. The magnesium Wobble Web wheels used had five studs in anticipation of these cars never having to stop for tires during a race. The concepts and construction methods inherent in Lotus' single seaters were being pursued in the absence of empirical data as to the loading of these new suspension designs and the strength to which they need be manufactured; often during the 1960 season the results were not as desired.

## II.

The Lotus 18 made its debut at the Argentine GP. Innes Ireland had led the field impressively until the unexpected, shall we say, pit stop dropped him from contention. Credit for tenacity is due here as Ireland brought the new Lotus home sixth with the left front wheel adrift and a shattered disc brake. Impression made, John Cooper and Jack Brabham immediately began planning the "low line" T 53 on the plane home, and Rob Walker placed an order with Chapman.

As the flags snapped audibly in the Santa Ana winds, Moss showed why he had earned the title maestro by covering the Riverside circuit in 1:55.0 during practice on Thursday. On Friday he lowered it to 1:54.6. Saturday he took the pole with a time of 1:54.4. These record setting lap times for the Riverside course were impressive in of themselves for this November competition, dually so for Moss. Following the unexpected departure of the left front wheel from his Lotus 18's suspension at Spa in June he had been absent from the entire mid-season schedule. His dramatic three wheel pirouette left him at the side of the road with two broken legs, a broken nose, some busted ribs and a compressed, nearly crushed, vertebrae. Impatiently allowing only three months recovery he

returned to take the victory at Oulton Park on 24 September.

The second fastest qualifying time at Riverside of 1:55.0 by Jack Brabham was showing not only his familiarity with the Southern California course, but also that his second Drivers Championship in a row was no fluke. Brabham had been able to take full advantage of Moss' absence, and his competitors on circuit, by taking the laurels at the Dutch GP, Spa, Reims, Silverstone, the non-championship Brands Hatch and Portuguese GP in sequence from 6 June through to 14 August. In only its third year of Formula One competition Cooper cars had equaled Ferrari's 52-53 dual championship record, and shown a dominance in competition reminiscent of Mercedes in '55. Almost reluctantly the Surbiton constructor had instigated a transformation of Formula One engineering.

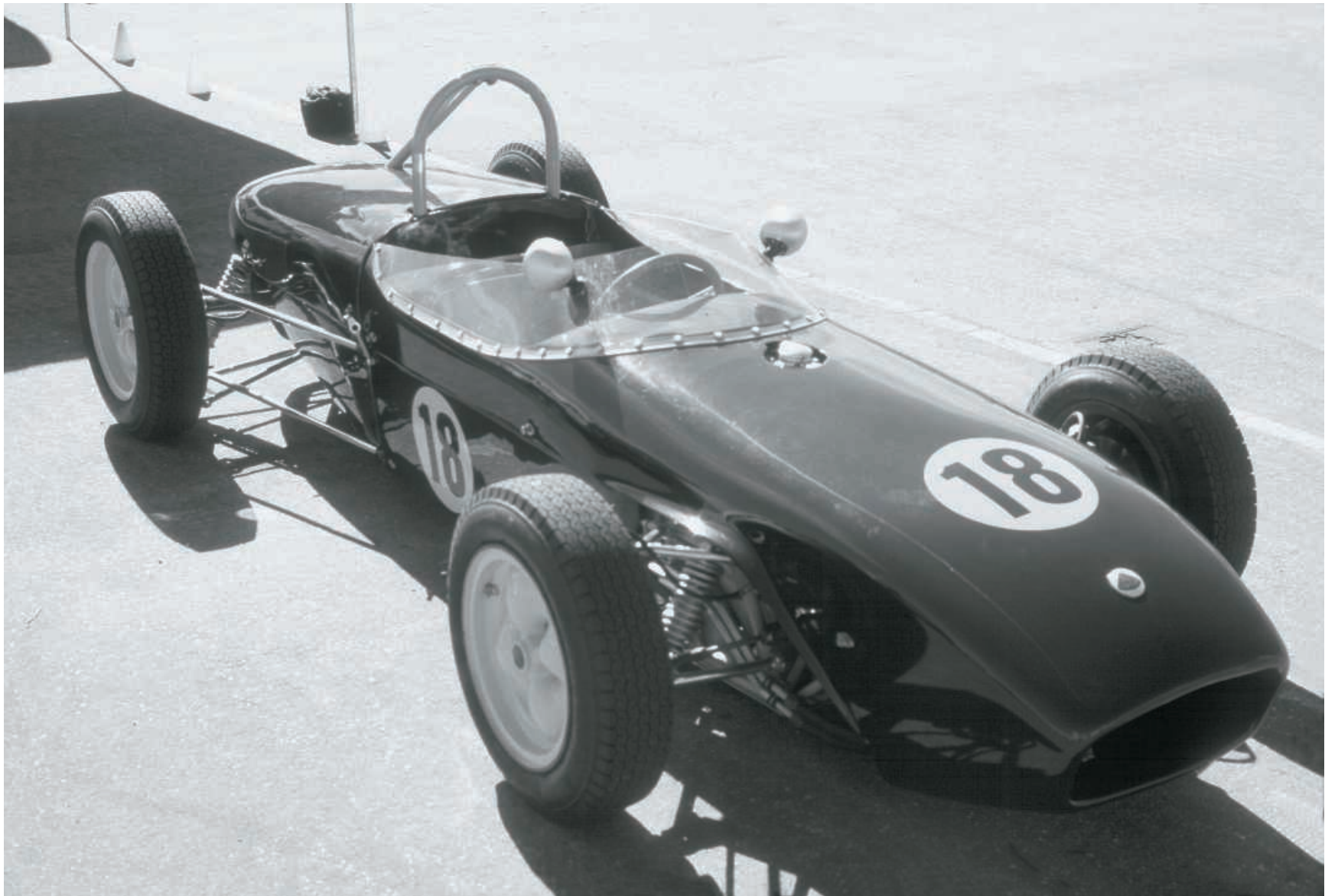
Third on the Grid was local favorite Dan Gurney in BRM's recently developed mid-engined P48. The car had continuously let down he and team mates Jo Bonnier and Graham Hill all season. His 1:55.2 qualifying time was well received, and much deserved after a season of frustration.

Everyone woke Sunday to unexpected silence; the Santa Ana winds had subsided and left Riverside in the exquisite clarity of a warm early winter day. The fine race weather seemed wasted upon the Compact Sedan Car Race, which left the grid at noon and the spectators in search of refreshments. Once the sedans had unhurriedly returned to the car park, Zora Arkus-Duntov took his experimental CERV-1 monoposto for a lap. Moss was then allowed to sight-see about the course in it; only the nervous reps from Chevy checked the time of these laps.

At two o'clock the F1 cars were flagged off with the audible excitement. At twenty eight minutes, fifty-two seconds past Four o'clock Moss blurred beneath the check-

er. His grid partners had had a most interesting, if frustrating, race. Brabham's Cooper had a vent come loose on one of the fuel tanks. The leaking fuel proceeded to slosh about until the vapor built to a point that a back-fire would spontaneously ignite it. After two startling, and fortunately localized, ignitions of fuel vapor behind him, and as many pits stops to figure it out and fix it, he had gone from the lead to nineteenth. Gurney was again being visited by the maladies that had beset he and the BRM team all year. First a glitch in the linkage sent him from fourth gear to first on a third gear downshift. Then his manifold came adrift. His day was ended on lap 18, of the 75 to be completed, by an inexplicable shower of water coming over his shoulder. Seems the complexity of the BRM's head casting, you'd think they would have simplified things by this late date, required that holes be drilled in two locations to insure removal of casting sand. These holes were then sealed by screws. Only one screw was found in place when Gurney had returned to the pits fully showered.

Thirty seconds behind Moss, Ireland brought his Lotus across the line. McLaren in his team Cooper was next a mere 40 some seconds later. A lap down was Jack Brabham who had motored rather decisively through the field once the tank was sealed. Jo Bonnier, who had been running second prior to his engine beginning to sing off key, followed in fifth. Phil Hill, who had to have his loaned Cooper pushed off the line, brought it through a respectable sixth, followed by Jim Hall in his private Lotus 18. Eighth was taken by Roy Salvadori, the sage of the Formula's transformation. Count von Trips brought one of the three Scuderia Centro-Sud Cooper Maserati's present at Riverside across in ninth. Rounding off the top ten was Chuck Daigh, who had one of the more uneventful, pleasantly so, competitions with the now much modified Scarab GP car.



That evening's victory party was also a celebration of the victor's birthday. Moss was presented with a cake whose decoration was he at the controls of the Lotus 18. In the signature style of this man at the peak of his powers, and in full humour, the first piece he cut was the left front wheel, which he presented to Colin Chapman.

### Epilogue

In 2000 I was sitting having lunch at Concorso Italiano's Strada Club. I had recently finished this story and

through introduction was going to give Stirling Moss a call to confirm the slice of birthday cake at Riverside. The Strada Club patio was crowded, but in a lull of conversation I heard a distinctive voice to my left. It was Moss sitting with his wife and some friends. When I saw they had finished eating I ventured over.

"Excuse me, Sir Stirling, I was wondering if I could intrude for a moment and ask you a question?" I lowed myself to one knee beside the table while speaking so as to be at eye level.

He looked up from the card I had just given him, and



generously agreed.

"I have just completed a story which discusses the 1960 Grand Prix at Riverside...."

At this point I could see the eyes of everyone at the table glazing over. Stirling politely maintained eye contact, but looked less than interested in reliving some past memory in this non-interview setting.

"I come across a bit of research I had included and was hoping to confirm it. I believe it was your birthday that day and you were given a cake with a Lotus 18 on it, with you at the wheel..."

Suddenly I saw light come to his eyes and a smile begin to spread across his face.

"Was the first piece of cake you cut the left front suspension, which you handed to Chapman?"

At this point the whole table lit up with laughter. We were suddenly the focus of the entire patio, which had been trying not to notice Moss too obviously.

"Yes," Moss said through his laughter.

"You know Scott," he went on, chuckling behind the words, "Colin's early cars, as you were driving them, you could watch them progressively come apart. It was most unsettling."

SSC 2000





