



PHOTOGRAPHY: MALCOLM GRIFFITHS

66



RACE SUITS HAVE RECEIVED JUST AS MUCH CARE, RESEARCH AND DETAILED DEVELOPMENT AS OTHER AREAS OF MOTOR SPORT SAFETY

SAFETY

OVERALL OVERHAUL

The protective, fire-resistant garments worn by racing drivers today have come a long way since the simple cotton overalls of the '50s. Now they're light, flameproof and breathable. But only thanks to decades of ceaseless development

A racing driver's work clothes of 60 years ago couldn't have been more basic. They usually consisted of: lightweight cotton trousers and a T-shirt, and thin-skinned leather/suede shoes, often with rubber soles – an outfit topped off by a flimsy fabric skullcap. Compounding this ensemble's flammable sins were combustible leather gloves, often with perforated or stringed backs, and goggles with aluminium frames that could become branding-iron hot in the blink of an eye. How very different from the clothing worn by today's so much better protected heroes.

Decent progress has suffered a hot and bumpy ride, however. Safety crusaders weren't always welcomed with open arms, minds or wallets, and it often took the death of a high-profile figure – Jim Clark (1968), Ayrton Senna (1994) or NASCAR's Dale Earnhardt (2001) – to trigger Damascene conversions or institutional re-evaluations both inside and outside the cockpit, to stimulate meaningful safety developments.

Suppliers such as Stand 21, Sparco, OMP and Alpinestars have been responsible for many innovations, while latterly the FIA and FIA Institute have become more and more proactive in developing and enforcing standards that are regularly reassessed in rigorous testing. ▶

67



1960s

1960s

America took an early lead in the 'safety race' – the wearing of crash helmets was made mandatory at Indianapolis in 1935, as were flame-retardant race suits in 1959 following Jerry Unser Jr's death there from appalling burns.

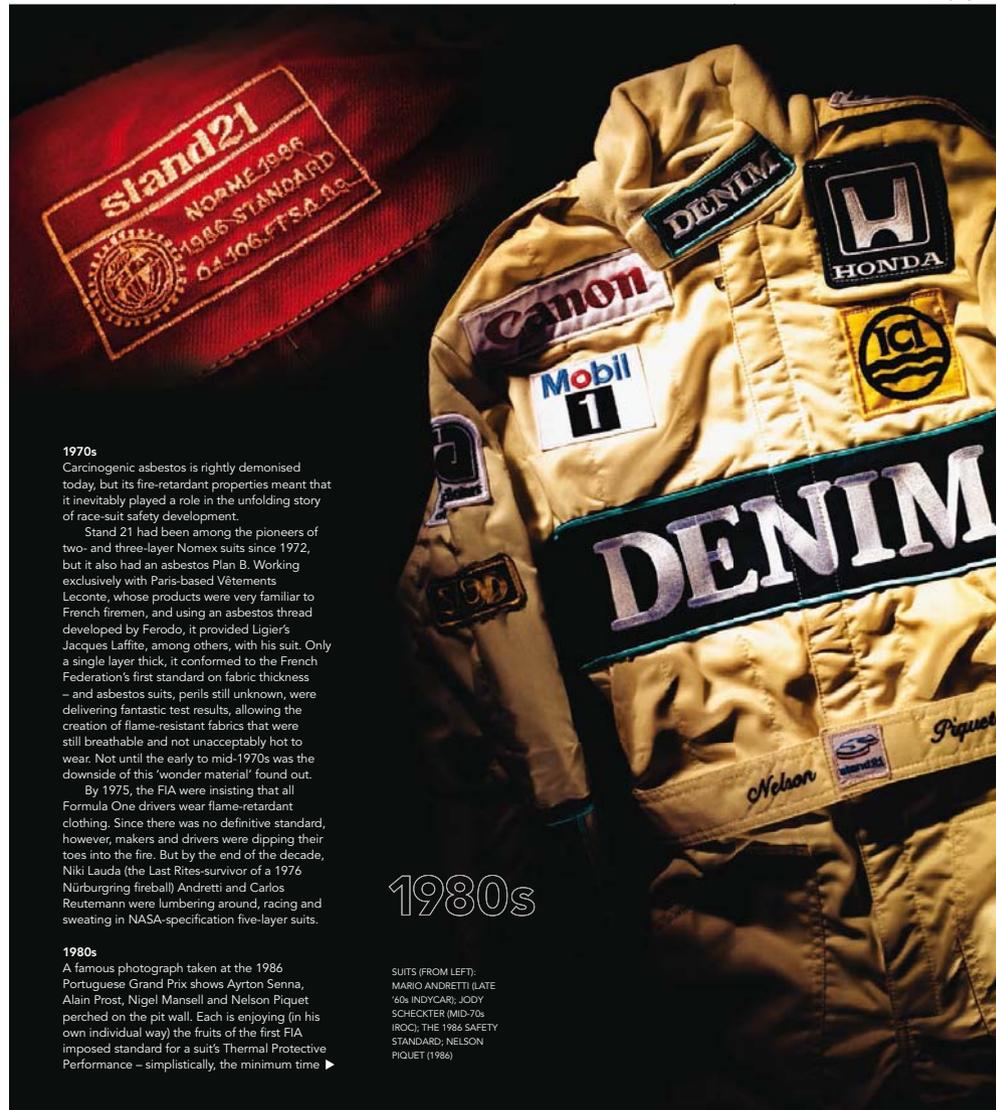
But the vital technological leap was Du Pont's US Army-funded invention of a light, flexible, comfortable and hardwearing synthetic fibre – Nomex – which was also characterised by low flammability and a high melting point.

At approximately 370°C, this polymer's carbon and nitrogen atoms realign to form a protective coating. Not only does this chemical process absorb heat, but the resultant carbon layer also thickens the fabric, creating a stronger barrier that traps air between the flames and the driver. Carbon, a superb thermal insulator, will only sublimate – change directly from a solid to a gas – at 3642°C, which is substantially above the highest metallic melting point.

Du Pont approached the Indianapolis-based firm Hinchman, makers of customised race wear since the 1920s. Mel Kenyon then wore its first Nomex race suit at Indy in 1966. They spread swiftly through the field – a young Mario Andretti was among the converts – and from this base the new material soon conquered Europe.

They were, however, of only a single-layer construction, so drivers were advised to wear Nomex underwear as well, military tests having proved that several thin layers are many times more protective than a single thick one.

1970s



1970s

Carcinogenic asbestos is rightly demonised today, but its fire-retardant properties meant that it inevitably played a role in the unfolding story of race-suit safety development.

Stand 21 had been among the pioneers of two- and three-layer Nomex suits since 1972, but it also had an asbestos Plan B. Working exclusively with Paris-based Vêtements Leconte, whose products were very familiar to French firemen, and using an asbestos thread developed by Ferodo, it provided Ligier's Jacques Laffite, among others, with his suit. Only a single layer thick, it conformed to the French Federation's first standard on fabric thickness – and asbestos suits, perils still unknown, were delivering fantastic test results, allowing the creation of flame-resistant fabrics that were still breathable and not unacceptably hot to wear. Not until the early to mid-1970s was the downside of this 'wonder material' found out.

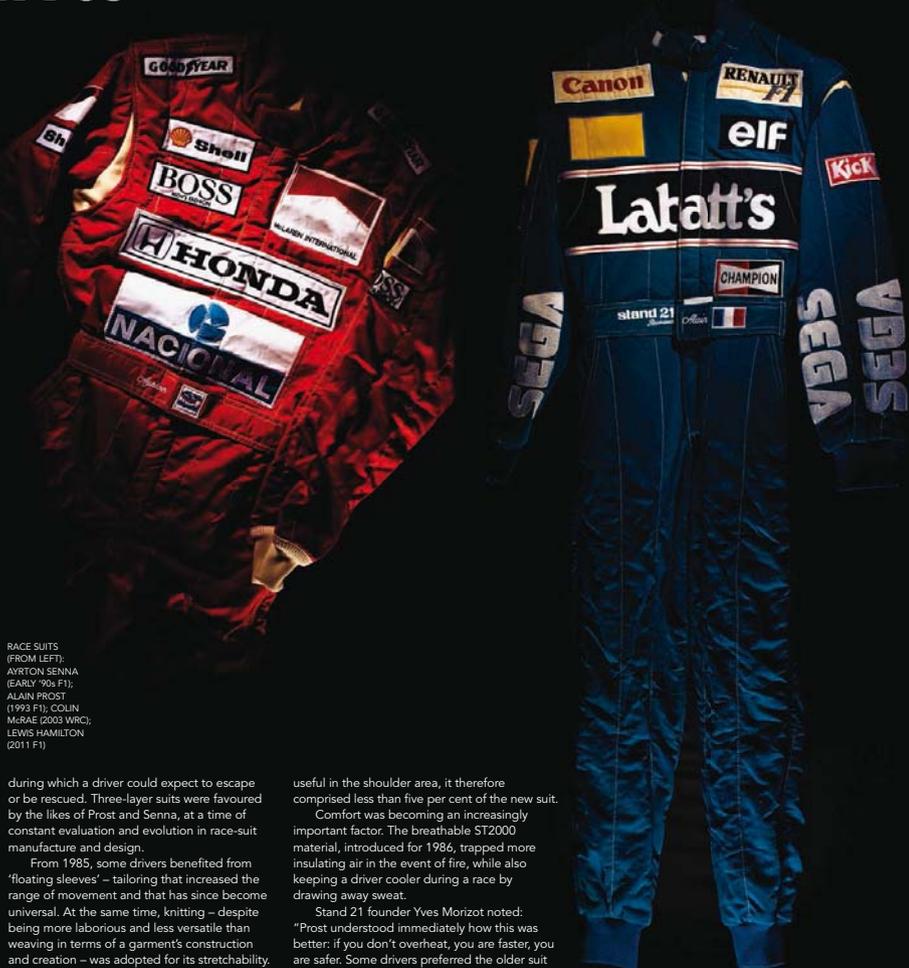
By 1975, the FIA were insisting that all Formula One drivers wear flame-retardant clothing. Since there was no definitive standard, however, makers and drivers were dipping their toes into the fire. But by the end of the decade, Niki Lauda (the Last Rites-survivor of a 1976 Nürburgring fireball) Andretti and Carlos Reutemann were lumbering around, racing and sweating in NASA-specification five-layer suits.

1980s

A famous photograph taken at the 1986 Portuguese Grand Prix shows Ayrton Senna, Alain Prost, Nigel Mansell and Nelson Piquet perched on the pit wall. Each is enjoying (in his own individual way) the fruits of the first FIA imposed standard for a suit's Thermal Protective Performance – simplistically, the minimum time ▶

SUITS (FROM LEFT): MARIO ANDRETTI (LATE '60s INDYCAR); JODY SCHECKTER (MID-70s IROC); THE 1986 SAFETY STANDARD; NELSON PIQUET (1986)

1990s



RACE SUITS
(FROM LEFT):
AIRTON SENNA
(EARLY '90s F1);
ALAIN PROST
(1993 F1); COLIN
MCRAE (2003 WRC),
LEWIS HAMILTON
(2011 F1)

during which a driver could expect to escape or be rescued. Three-layer suits were favoured by the likes of Prost and Senna, at a time of constant evaluation and evolution in race-suit manufacture and design.

From 1985, some drivers benefited from 'floating sleeves' – tailoring that increased the range of movement and that has since become universal. At the same time, knitting – despite being more laborious and less versatile than weaving in terms of a garment's construction and creation – was adopted for its stretchability. Lycra, the obvious solution, was found to be too elastic which adversely affected a suit's stability, puncture-resistance and strength. Although

useful in the shoulder area, it therefore comprised less than five per cent of the new suit.

Comfort was becoming an increasingly important factor. The breathable ST2000 material, introduced for 1986, trapped more insulating air in the event of fire, while also keeping a driver cooler during a race by drawing away sweat.

Stand 21 founder Yves Morizot noted: "Prost understood immediately how this was better: if you don't overheat, you are faster, you are safer. Some drivers preferred the older suit because it was shiny and looked better. But he came to realise that safer, more comfortable suits could give a driver an edge in speed too."

2000



Modern era

A much more comprehensive standard for flame-retardant clothing was introduced in 2002. Fabric, zips, thread, seams, sewing, embroidery (through the outer layer only), elastic (encased in fireproof material), socks, shoes, gloves, long underwear (now mandatory and of a minimum 180g/m² weight), durability, construction and structural integrity after a fire – nothing escaped the scrutiny of FIA standard 8856-2000.

Exhaustive research continued, most notably in a heat stress programme inaugurated in 2002 by Morizot, in conjunction with the French Army. Professor Claude Meistelman of the University of Nancy, Dr Paul Trafford, the FIA Institute's medical

adviser, and IndyCar surgeon Dr Terry Trammell. Their work measured, scientifically, the benefits of suit breathability.

The research concluded that, considering normal body temperature is about 37°C, even a one-degree increase could lower human performance significantly, yet some drivers were operating at more than 40°C. The message was clear: hot drivers are more likely to tire, and so make mistakes and crash.

This discovery drove race-suit development still harder towards garments that were lighter and cooler – both in terms of performance and fashionability. The simple solution settled on was a snug two-layer suit – except that it had to

provide the same protection as three layers. This was achieved in 2005 by marrying a thin inner layer to a much thicker outer layer. Made from a new material – ST3000 – which features a smaller diameter thread and a looser knit, this overall design allowed for better air circulation, while its thicker outer layer compensated for the reduced amount of trapped air by halting combustion at the surface. It proved ideal in the most demanding context of all, triple-stinting in long-distance sports car races. Romain Dumas (see race suit, far right, on page 67) wore this suit during Penske Racing's victory for Porsche in the 2008 Sobering 12 Hours, a race he won with the similarly attired Timo Bernhard and Emmanuel Collard. □