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Laura Giraldi

# Tutakart



Questo indumento ad alta protezione per competizioni motoristiche e in particolare per la pratica del *karting* è il risultato della tesi di laurea di Riccardo Imperio, tenuta presso la Facoltà di Architettura dell'Università degli Studi di Firenze,

il cui relatore è il prof. Massimo Ruffilli, Presidente del Corso di Laurea in Disegno Industriale di Firenze e correlatore la sottoscritta. Il lavoro, lungo e complesso, si è avvalso della preziosa collaborazione del Safety lab di Spidi Sport, azienda leader nel settore dell'abbigliamento motoristico. La Spidi ha messo a disposizione del laureando il suo *background* specialistico: tali competenze sono risultate indispensabili per uno studio poliedrico di tutti gli aspetti

connessi alla progettazione e alla realizzazione di un indumento altamente specialistico. In particolare la collaborazione con Spidi ha permesso di raggiungere gli obiettivi di sicurezza, ergonomia e comfort che il progetto si prefiggeva. Il lavoro si è concluso con la realizzazione di un prototipo.

L'abbigliamento protettivo attualmente utilizzato dai piloti di go kart nel corso delle competizioni è lo stesso che usano i piloti di automobilismo, studiato per soddisfare esigenze di sicurezza profondamente diverse dalle specifiche richieste del *karting*. Tali indumenti risultano, quindi, scarsamente protettivi e inadatti a garantire un adeguato grado di sicurezza in caso di incidente al conduttore di go kart che risulta non protetto da nessun tipo di dispositivo specifico. Lo studio progettuale si è rivolto principalmente a incrementare gli standard protettivi degli indumenti dei piloti di go kart e a garantire, allo stesso tempo, un alto livello ergonomico e di comfort.

La prima fase di lavoro si è basata su un'attenta raccolta di informazioni, a cui ha fatto seguito una lettura analitica dei dati. Questo ha permesso di realizzare una banca dati delle possibili tipologie di traumi a cui è esposto il pilota di go kart. Grazie a questi dati è stato possibile costruire una mappa delle parti anatomiche più a rischio e delle tipologie traumatiche più frequenti, indispensabili per suggerire soluzioni progettuali innovative. Una indagine sulle esigenze di mobilità del kartista in fase di guida ha condotto, inoltre, alla progettazione di soluzioni ergonomiche specifiche che hanno permesso di inserire protettori innovativi all'interno

*This high-protection garment for motor-racing, more specifically for go-karting, was developed by Riccardo Imperio for his degree thesis, as part of his course at the Faculty of Architecture, University of Florence. The supervising professor was Massimo Ruffilli, president of the degree course in Industrial Design in Florence, while I was the course assistant.*

*This long and complex project was facilitated by the cooperation of the Spidi Sport lab. Spidi Sport, a leading company in the racing garments sector, offered the student their specialist knowledge, and this was essential for an all-round study of the aspects concerning the design and production of a highly specialised piece of clothing.*

*Working with Spidi made it possible to reach the project objectives of safety, ergonomics and comfort. The study culminated in the creation of a prototype. Normally, go-kart drivers use the same protective gear as is used by motor-racing drivers, which is however designed for very different safety requirements.*

*Such garments therefore offer insufficient protection, and they cannot provide adequate safety if the go-kart driver should be involved in an accident. Such vehicles offer no form of specific protection mechanisms.*

*The design study aimed principally at increasing the level of safety available to go-kart drivers, while also offering a high level of ergonomics and comfort. The first stage of the project comprised*







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used to produce a map of the anatomical parts most subject to risk, along with the most common traumas, data that was essential for suggesting innovative design solutions. A study of the driver's necessities in terms of mobility was used to develop the ergonomic factors, with innovative forms of protection incorporated into the garment without hindering fluidity of movement and safety of driving. Another design objective was that regarding a powerful visual impact, so that the garment could immediately be recognised as a go-karting suit. The shape of the suit is based on bionics. The study of nature, above all animals such as the crocodile and the shark - associated with strength and toughness - offered suggestions regarding the final form. The suit thus becomes a shell, a coat of armour, a tough second skin, an elastic, durable and highly protective membrane.

## Materials used for the prototype: technical characteristics

### Cordura

Weight 500 g  
 Thread manufactured by DuPont  
 Fabric manufactured by Lenz Egisto S.p.a.  
 Cordura is a textile incorporating a considerable amount of high technology. It possesses excellent characteristics of strength and lightness. It is also intrinsically comfortable.  
 It was used in areas subject to risk of abrasion: thorax, abdomen and legs. In the thoracic area, Cordura was combined with other materials having different protective characteristics.  
 Combinations with other textiles were also developed in the rear part of the suit, in order to guarantee sufficient lumbar elasticity.

### Keular

Weight 500 g  
 Manufactured by DuPont.  
 This material has excellent strength and a low specific weight, and these qualities make it a high-safety material that can be used for many applications. In this instance, it was used to protect parts of the body exposed to the risk of penetration by pointed objects.  
 It was used to protect soft body parts such as the spleen, the liver, and the entire abdominal region.  
 The chemical composition of Keular make it impermeable to external agents, tough, and also comfortable and light.  
 Keular is used as a lining in the abdominal and kidney part of the suit.

### Cowhide

Thickness 11/70 mm.  
 The highly compact structure of leather makes it particularly suitable for protection against abrasion. Here, it was used in the parts of the body most exposed to the airflow. Leather was used on the upper surfaces of the arms, the femoral triceps area (upper part of the legs), and it is used with other textiles in the pattern on the back of the suit.

### Keprotect

Weight 370 g  
 Manufactured by Shoeller Switzerland  
 Composition 10% EL, 26% AR (Keular Du Pont), 64% PA  
 Longitudinal elasticity 45%, transversal elasticity 35%.  
 This material was used for all the sections for which special mobility is essential during driving.  
 These include the inner legs, the back of the knee-joint, and the dorsal and thoracic area.

### Shock-absorbing silicone rubber

Thickness 6 mm  
 Manufactured by ElleRes  
 Specific weight 0,086 g/cc  
 Model R1218300  
 This material is used in areas subject to trauma, in which optimum anatomical mobility is also required.  
 The special feature of this material is the fact that its reaction to stress is variable. When this silicone rubber undergoes a changing but protracted load, it maintains its characteristic softness virtually unaltered, remaining in a fluid state. However, when subject to a sudden stress (such as a collision), the silicone component of ElleRes takes on a different configuration and gives the material mechanical characteristics typical of a semi-rigid solid with very high toughness. This silicone rubber was used in the plates situated in the rear part of the suit. Here, the ElleRes cushions were covered in printed leather. The same type of pads were positioned on the pectoral area. Two small circular pads in shock-absorbing silicone rubber were positioned inside the knees, encapsulated into the Cordura textile. Another two pads of this high-performance rubber were placed on the femoral and ankle joints.

### Plastic protectors

Material: polyurethane.  
 State of the art protectors were used to protect the elbow and shoulder joints. They are made in injection-moulded polyurethane.  
 These protective shells are positioned on the shoulders and elbows, and the latter extend to protect the forearm.

### Airmesh

Weight 153 g  
 Textile manufactured by Lenz Egisto S.p.a.  
 A number of inserts made from Airmesh were used to highlight the shape of the suit. The mechanical characteristics of this material make it comparable to Cordura.  
 This material forms the connecting layer for most of the dorsal pattern, and it is used with leather over the shoulder and elbow protectors.

Prototipo della tuta ad alta protezione. Collaborazione tecnica e consulenze esterne: Dott. Egisto Ferzi (Tessitura Lenzi), Redazione di Vroom Magazine, Pietro Zanetti, Spid Sport

High-protection suit, prototype. Technical cooperation and external consultancy: Dr. Egisto Ferzi (Tessitura Lenzi), editorial staff of Vroom Magazine, Pietro Zanetti, Spid Sport