

# dallara

Nr. 7  
Year 2010

# MAGAZINE

PUBLISHED  
BY DALLARA

THE PURSUIT OF EXCELLENCE



## INTERVIEW

AN IN DEPTH CONVERSATION WITH THE FACTORY'S FOUNDER HELPS US UNDERSTAND WHY THE PASSION FOR INNOVATION AND SOCIAL RESPONSIBILITY ARE IMPORTANT FOR THE FUTURE

## SIMULATOR

WE DISCOVER THE AMAZING VIRTUAL HABITAT THAT ALLOWS DRIVERS TO LIVE THROUGH THE TRACK EXPERIENCE AND HELPS THE TEAM TO EXPERIMENT AT LOW COST

## TECHNOLOGY

STEREOLITHOGRAPHY TRANSFORMS MATHEMATICAL EQUATIONS INTO 3D IMAGERY AND MEANS THAT THE TESTING OF COMPONENTS CAN BE DONE IN A FEW HOURS: HOW DALLARA CONTRIBUTED TO ITS DEVELOPMENT





# DRIVING THE FUTURE

FOR GIAN PAOLO DALLARA INNOVATION HAS ALWAYS BEEN THE KEY TO SUCCESS. THE DRIVING SIMULATOR REPRESENTS A NEW HORIZON FOR THE ITALIAN COMPANY. IT IS AN INSTRUMENT WHICH IS ALREADY CHANGING THE WAY IN WHICH WE LOOK AT RACING. ANOTHER BIG STEP TAKEN IN THE NAME OF SAFE AND RESPONSIBLE BUSINESS

To have success in the world of racing it is fundamental to have a clear idea of what is happening in the sport, and what role your own business will play.

**For Gian Paolo Dallara, the driving simulator is an important part in the world of a cars' future.**

"We are working on a simulator which will really be able to help the driver, it is based on a precise mathematical model. A model that can replicate all the car's responses to different track conditions; with configurations that can be changed such as tyres, suspension, shock absorbers and engines. This way it will be possible to develop the car before it goes into production. The time needed to develop the car will be shorter, and there will be the possibility of improving the product. We will also help the teams to prepare the car as best as possible, and to expand the recruitment procedure whilst avoiding a situation where the young are forced to spend a lot of money at the beginning of their career in the hope that someone will pick them. In a way, it is the rich families that make the selection, or perhaps the families that are prepared take large risks. Becoming a driver is very expensive nowadays".

**Another positive effect of the simulator will be to give the most prepared and best drivers a quicker path to the next category.**

"It will become easier for the drivers to find sponsors", explains Dallara, "because there will be a system to show if the driver possesses the necessary qualities".

**In the future a good result on the**

**simulator will be like a high mark from university, a way of opening doors that would otherwise stay closed. Lewis Hamilton is a good example of a highly successful driver who trained in the McLaren simulator and who has known how to drive competitively since his F1 debut. It is no coincidence.**

"In the example of Hamilton, it was Ron Dennis who saw his potential when he was racing karts, and Ron understood that he could become a great F1 driver. In the future, with the simulator, the numbers will speak for themselves. We put a lot of planning into the structure of the simulator, which surrounds the driver. He experiences the same acceleration as he would in a real car.

It is a very big piece of equipment, which moves in such a way as to give the same sensation that an F1 driver gets from inside the cockpit. In the future we will build a smaller version for Indianapolis. Following that, we will be able to look at making a cheaper version, with the same software but different mechanical hardware, so that teams can test their cars before they take them out on the track. For the driver it will make it possible to see how the car responds when the aerodynamics change in the wake of another car. It is a complex design from a mathematical point of view and needed a lot of work from many people to create it".

**The future is now.** "In autumn our simulator will be ready and there will also be a GP2 equivalent for all circuits. It will be possible to understand straight away if

***“IN HIGH LEVEL CATEGORIES SUCH AS GP2 THERE IS NO SPACE FOR AMATEURS. THE SIMULATOR WILL ACT AS A FILTER TO SHOW WHO THE REAL TALENTS ARE”***

a driver is good enough, even if it is also possible to develop raw talent, and then come back after a year to see how it has grown.

There are many races which can be joined for fun, not everyone can be a professional. How many of those that join the New York marathon do so to win? Maybe about sixty? And how many compete? Thousands. In high level categories such as GP2 there is no space for amateurs. The simulator will act as a filter to show who the real talents are”. “I am not obsessed with the simulator”, Dallara explains, “but if someone made

one before me, which then changed the racing world, I’d lose a great opportunity. The simulator will be an important instrument, and we will certainly use it in F3, to improve the cars’ performance. Without it we would be left behind by our competitors”.

**During a conference on economic technology in 2009, Nick Wirth argued that the simulation of aerodynamics through a computer now allows us to understand when a single element is able to improve performance in a wind tunnel or on the track, with an accuracy of 99%. This reduces the waste of construction**

**materials that are necessary for the different configurations, the majority of which end up being of no use.**

**Dallara has his reservations:** “The CFD does not give precise, one hundred percent results, but I think we have changed the face of F1. The wind tunnel gives more accurate results but does not explain the behaviour of the air around the car. CFD is quantitatively less accurate, but shows the air speed, downforce and turbulence all together”.

**Having said that, the history of racing is full of solutions that work in the wind tunnel, but that cannot be reproduced on**



**the circuit.**

“Yes, it’s true”, admits Dallara. “We get the right results, but at times they are not exactly mirrored in the race”.

**Dallara have two models, the dimensions being fifty and sixty percent, both in the wind tunnels on conveyor belts. Toyota F1 used the same system with full size models, apparently there were no great advantages.**

“Toyota F1 had some of the greatest resources, but they weren’t very successful, which is very strange. You need to compete on a level playing field, or otherwise be able exploit your own

resources. If you do this well, even with less than fifty percent of the resources, you will be able to get better results. But if this percentage is lower, let’s say ten percent, you will not have a chance of competing. A low cost initiative might have success in one race but it cannot win in the long term. However, it is also true that it is not always the richest team that wins”.

**The Toyota example is proof of how an intelligent use of adequate resources can beat an unlimited budget, at least up to a certain level. Other examples include Force India-Mercedes, or Brawn-Mercedes who beat McLaren-Mercedes.**

“This team is able to survive thanks to a well put together mix of components and people who work very hard... up to the point when everything collapses. They have to rely on many people, and people are fragile. Take Red Bull as an example, they depend on one person (Adrian Newey - editor) to grow”.

**Here is another example: try to think about what Bragham might have been like without Gordon Murray, the designer of the Brabham cars in the seventies.**

“Sometimes there are these ‘supermen’ who create change, but obviously, the stability of this type of team is in serious

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trouble if that ‘superman’ decides to change team”.

**In the future, not all of the cars produced by Dallara will end up on the track.**

“I want to produce a small numbers of road cars. I’d like to drive them in the hills where I live. Nowadays the car is mainly a means of transport, no one ever thinks, ‘today I’m going to get behind the wheel to enjoy myself’. But I will make a car just for those days when I want to drive.

Perhaps one hundred cars a year, made in

Indianapolis, with a low emission engine, an ecological car. I’m thinking of a Lotus 7 for today’s world. I really admire what Colin Chapman was able to do, he was a man with vision. I would like to make something that is born out of our experience with racing cars, but that does not have any problems being driven on the road”.

**Would you consider a high performance electric car?**

“I’d like to wait to see which of the

technologies comes out on top”, explains Dallara. “Today there are various different versions. Eventually one of them will become the standard”.

**It will be a couple of years before we find out exactly what Gian Paolo Dallara’s ‘enjoyable drive’ is like.**

**One of the objectives of the Dallara engineer is long term stability of his company:** “We don’t want to grow too much, we want to be solid. Sometimes in our business, and in the racing world in





general, a competition organizer might decide to postpone commissioning a new car by a year due to an economic crisis. We need to be flexible enough to respond to these events. Our CEO, Andrea Pontremoli, is well prepared and we have agreed to maintain stable working conditions for our employees, a future without problems. The conception of mobility is different for people in Europe with respect to people in the USA. When you buy a house in Italy, you want one

made of bricks and mortar, and you will probably plan to live there for a long time. We are a small business and our employees have an average age of 31”.

**It is admirable to see a company that puts stability at the top of its list of priorities, in a world where the energy is usually concentrated on increasing the value for the shareholders and the salary of the managers.**

“Our company has always made a good profit and we always get reinvestment”,

says Dallara. “I think that it is the only way to have a future, to construct foundations for a solid business. I see a certain social responsibility in this. Despite the economic crisis, we are comfortable”.

With its all round technological expertise, Dallara is a business that will be around for a while, and not only as a producer of racing cars but also as a technological centre for the whole industry.

Norm De Wilt



***“OUR COMPANY HAS ALWAYS MADE A GOOD PROFIT AND WE ALWAYS GET REINVESTMENT. I THINK THAT IT IS THE ONLY WAY TO HAVE A FUTURE, TO CONSTRUCT FOUNDATIONS FOR A SOLID BUSINESS”***





## A NEW ERA FOR TOMORROW'S MOTORSPORT

THANKS TO ITS SIZE AND REFINED SOFTWARE IT IS ABLE TO PERFECTLY REPRODUCE RACE CONDITIONS, WHICH ALLOWS FOR THE BEST TRAINING FOR THE DRIVER AND GIVES THE DESIGNERS THE CHANCE TO EXPERIMENT AND GET THE BEST PERFORMANCE AT A LOW COST

# REALITY SHOW

In Varano, a town that is almost hidden amongst the hills near Parma, they say that Dallara is the perfect business: at a level of innovation; for its working environment and the “brains” that work there.

If you were to stumble across the unassuming building that houses the new simulator, you would be left speechless as it is as if you had entered the Star Ship Enterprise with control rooms from NASA. The first glance is impressive, the main room is an intense anti-reflective blue in colour and has over two hundred cubic metres of space. At the centre a large steel frame rests its six legs on a two hundred tonne base, that framework is actually a driving simulator. There are many driving simulators, for the most part derived from aircraft simulators that have been developed to train drivers for “mission impossible”. The simplest are those that can be found online, the next step is consoles and videogames; then there are the static simulators in business fairs and on cruise ships; finally the semi-professional and professional versions. The Dallara simulator is something different: conceived, created and developed by an excellent team of engineers at the best Italian and European universities, almost all of whom are under thirty. They are led by a young engineer, the thirty-three year old Alessandro Moroni, having each

been individually selected by engineer Andrea Toso, Head of Research and Development at Dallara.

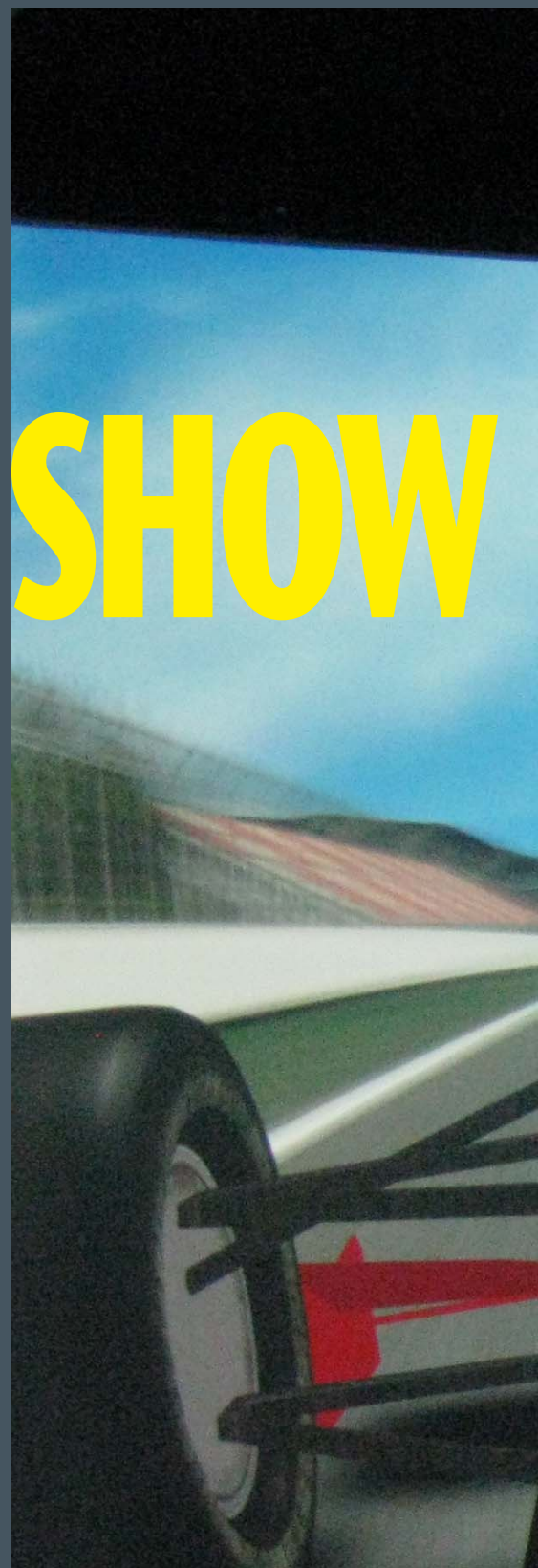
We met them in their mini NASA headquarters and talked openly about the future of Dallara...

### Engineer Toso, can you tell us about the latest generation of driving simulator?

“It is complete immersion in a virtual atmosphere. The monocoque body is contained within the simulator, and it is complete with all the controls that are available to the real driver: the gears, pedals, steering wheel, the electric brake force distribution and even the rear view mirror. The simulator is made up of a test bench in which a virtual car can be driven, so that the driver believes he or she is really on the track or road. It is a very intense driving sensation, so close to the reality that after a few laps the driver is no longer aware of the outside world. This equipment has been designed not only to handle track cars but also prototypes and road cars.”

### Why did Dallara decide to create it?

“In a period where there is pressure to cut costs and development times, the driving simulator is a necessity for the car's set up and to develop new solutions; to avoid, or at least drastically reduce, investment in prototypes and all the costs associated with on track testing.



We couldn't carry on like that. Up until recently the practice was to create a prototype as soon as possible and then improve on it. Today, thanks to the symbolic modelling technology, the drop in the cost of hardware and software and the quality of the aerodynamic, structural and cinematic simulation it is now possible to create the almost perfect prototype. It is the “right first time”





concept that is every engineer's dream!"

**Could we say that the simulator is the bridge between man and car?**

"Rather than a bridge between man and car, it is the man that is the bridge between two worlds, reality and virtual reality. These two worlds have finally spoken to one another, they help each other and complement each other. Reality and experience are fundamental

for the richness of emotions and feelings, but virtual reality offers controlled conditions that are repeatable, allowing for the analysis of details, correlations and combinations that would otherwise be impossible to create.

At Dallara we call it the "stimulator", because it stimulates amazing ideas! An excellent stimulator has to produce a

high level of realism and immersion. The simulators for military and civil aircraft, for example, are objectively classified according to the level of immersion or realism."

**In what sense does the man become the "bridge", and what exactly does "realistic" mean in this case?**

"Perception becomes realistic when the



***“THE ADVANTAGES FOR TEAM AND DRIVER WILL BE CLEAR. THEY WILL BE ABLE TO TRAIN IN THE SIMULATOR AS WELL AS GOING OUT ON THE TRACK, WITH CONSIDERABLE SAVINGS IN TERMS OF COSTS AND TIME. THE DRIVERS WILL BE ABLE TO GET TO KNOW THE CIRCUITS AND THE FEATURES OF A NEW CAR”***

human sensorial reaction to a synthetic stimulus is similar to the reaction to real stimulus. In this sense, the aim of the simulator is to find the right mixture of artificial and interdependent stimuli able to generate the same reactions that a driver might have on the track or road. If I wanted to simulate braking over a hundred metres, I would need movement of the simulator equal to one hundred metres. This is impossible. Therefore I have to be able to generate a perception for the driver, focusing on the reactions and emotions, which are real and appear real.”

**Engineer Moroni, what are the technical characteristics of this simulator?**

“To have the maximum sensation of realism, we decided to look at the best simulators on the market. Think that the space in which all the simulator’s movements happen is a sphere that is eight metres in diameter. All the systems that join man to car (chassis, steering wheel with electronic controls, power steering, cockpit, seat, etc.) are exactly the same as those which the driver has on the track or on the road, to maintain the maximum level of “immersion” in reality.

The system has a 180° screen surrounding the driver, allowing for peripheral vision and therefore he can see what happens out of the corner of his eye. The vehicle model, or rather the software that animates the

simulator, was completely developed in house and is able to assess the interactions between driver, car, tyres and track at every turn.”

**What are the main advantages of an innovation of this type?**

“The advantages for team and driver will be clear. They will be able to train in the simulator as well as going out on the track, with considerable savings in terms of costs and time. The drivers will be able to get to know the circuits and the features of a new car (e.g. different ways of braking, different electronic procedures etc.), whilst the engineer will be able to develop everything on the car and determine the best aspects”.

**Could it also be useful to those who design and construct cars?**

“Yes, absolutely. For those who construct cars, but also for those who construct car components. They will be able to check ideas and concepts (new suspension and braking systems etc.) before construction, including immediate human feedback on their good ideas.

Think that in Formula 1 the position of the F-duct (an inlet for air that arrives at the rear wing and disrupts the air flow, stalling the rear wing and reducing downforce increasing performance on straights and at high speeds - editor) was studied in a simulator. Many teams have adopted that type of positioning that was studied in a virtual way, in the reality of the race”.

**Engineer Toso, you have a lot of experience in vehicle dynamics, one of the Dallara’s key competences. Which aspects of this project do you think will be developed in the future?**

“In the study of the dynamics of the traditional vehicle, the car is driven by a computer: the driver is analytically modelled as a complex controller of manoeuvres. The manoeuvre is considered to be known, deterministic and completely predictable. This however is far from the reality of the situation, in which the results of a vehicle’s dynamics are often incomplete, not significant or of limited application. The driving simulator is instead a “dream” of vehicle dynamics because the drivers can try out a complete virtual car and judge all the fleeting moments, with immediate correlation to the car on the track or road. The simulator is a real “dynamic of the car”, that traditional car suddenly seems limited.”

**Is this what happens with the CFD and wind tunnel?**

Yes and no. Yes in the sense that the CFD (Computational Fluid Dynamics - editor) allows us to analyse details of the airflow inside and outside the car and to understand why. The wind tunnel is the real test that checks the quality of the simulation.

No, in the sense that neither the CFD (simulation) or the wind tunnel (laboratory experimentation) are reality. In the case of the driving simulator on the other hand, there is a





direct comparison with reality. Other than the aerodynamics, we have taken into account the human factor. Whether they are computational or experimental, aerodynamics cannot foresee interaction with the driver. In the case of the simulator on the other hand, the man-machine interaction is fulfilled and it is of real benefit.”

**We could therefore conclude that “CFD” is to the “wind tunnel” what the “dynamics of the car” are to the “simulator”?**

“We could say that CFD is to wind tunnel as simulator (or stimulator) is to experimentation, be it in the laboratory or on the track. I would widen the concept however as the driving simulator is really the “virtual” model for all the possible ways of making a car, including therefore not

only the car’s dynamics, but also the design, aerodynamics, production etc.. So many opportunities for a designer to look at the real forces on a component in virtual conditions; so many opportunities for those working on aerodynamics to check the pilot’s perception of the ground effect; so many opportunities for those building the car to assess the driver’s fatigue or the usability of system!

**Engineer Moroni, is it true that this simulator could have other applications, beyond the world of cars and races (e.g. social, scientific and educational etc.)?**

“There is still a lot of development to be done for the applications that we have discussed so far (training instrument for teams and drivers, support in the planning phase etc.), so

I see it as something that is a long way off, but not impossible. In particular there could be medical applications in the sport to detect the driver’s heartbeat, blood pressure, his visual response in situations of prolonged psycho-physical stress or in an emergency manoeuvre”.

**What stage of development are you at, and when do you plan opening for your clients?**

“Before summer we carried out successful testing of the car and now we are refining the handling and, in general, the software that it needs. The aim is to present it during the autumn, to make it available for the end of the year”. If the product catches on, a new era of motorsport is around the corner.

Alessandro Santini

***“THE DRIVING SIMULATOR IS INSTEAD A “DREAM” OF VEHICLE DYNAMICS BECAUSE THE DRIVERS CAN TRY OUT A COMPLETE VIRTUAL CAR AND JUDGE ALL THE FLEETING MOMENTS, WITH IMMEDIATE CORRELATION TO THE CAR ON THE TRACK OR ROAD. THE SIMULATOR IS A REAL “DYNAMIC OF THE CAR”, THAT TRADITIONAL CAR SUDDENLY SEEMS LIMITED”***






# PREMA AND DALLARA A WINNING PARTNERSHIP

TEAM PREMA IS ONE OF THE MOST INTERNATIONALLY RENOWNED ITALIAN TEAMS AND FOR YEARS THEY HAVE USED THE F3 SINGLE-SEATER CONSTRUCTED BY DALLARA. THEY HAVE ALWAYS TAKEN PART IN THE EUROPEAN SERIES AND FOR A COUPLE OF YEARS HAVE BEEN INVOLVED IN F3 ITALIA. THE TEAM IS MANAGED BY ANGELO ROSIN WHO EXPLAINED TO US THE REASONS THEY HAVE WORKED WITH DALLARA FOR TWENTY YEARS







**The Prema team has been one of Dallara's clients for years. When did you start working with them?**

"We started working with the Italian company in 1992 when we bought three F392, our first F3 cars to be made in Italy, after many years of being linked with English brands such as Ralt and Reynard. It has not always been a normal customer and supplier relationship, but it has always been very cooperative with many exchanges of information, especially considering the amount of competition between different constructors in that period."

**Why do you always stick with Dallara and not choose another constructor in the category?**

"Dallara is definitely synonymous with quality and safety. Buying a Dallara product means having something at the highest level, for this reason we

continue to be linked to them. The technical level reached by Dallara cannot be reached by other constructors in such a short time."

**Since it is possible to make changes in the European series, does Prema work on the technical developments of the Dallara car?**

"The changes we make are purely of a mechanical nature and optimizing aerodynamics. You cannot make too many changes to a top car. What is possible is optimizing and improving the areas where Dallara has tried to satisfy the wider market."

**How is the relationship with Dallara? Are there exchanges of ideas with the Italian company during the season?**

"Always respecting that relationship between customer and supplier that allows Dallara to treat all of its clients the same; we have exchanged ideas with Dallara for years, searching to improve what little we can with such a high level car. Teams that have invested millions of euros in F3

aerodynamics research trying to improve the cars constructed in the Parma factory have then been forced to retrace their steps."

**Which aspect of the Dallara car most convinces your team's engineers?**

"The quality of material, the finishing touches, the service provided and naturally the best levels of technology that is in their products."

**Up until 2009 you also participated in WSR, which is monopolised by Dallara. What memories do you have of that single-seater and what struck you the most?**

"We entered WSR in 2006, at that time the Dallara certainly represented a product at the highest level with reasonable running costs for the type of competition we were facing. Then, due to Renault's marketing strategy, the car did not evolve naturally but it did maintain that high quality and efficiency".

**Alessandro Santini**



# SCULPTING WITH A LASER

THE TECHNIQUE THAT ALLOWS FOR THE DEVELOPMENT OF 3D IMAGES THROUGH MATHEMATICAL EQUATIONS WAS INVENTED AT THE END OF THE EIGHTIES. THANKS TO DALLARA IT HAS MADE CONSIDERABLE PROGRESS AND TODAY THE JOURNEY FROM DESIGN TO PROTOTYPE CAN BE COMPLETED IN JUST A FEW HOURS

**S**tereolithography is a constantly evolving laser technique, which allows for the creation of three dimensional objects directly from a mathematical digital starting point. Stereolithography literally means three dimensional printing. It is mainly used for rapid prototyping (RP), which means it is possible to have physical objects to test before industrial production begins. It is also used to prepare models from moulds and to have replacement parts in a short space of time.

Its use in mass production only occurs when other techniques become too difficult or expensive and in general is only ever used for a very limited number of models. It

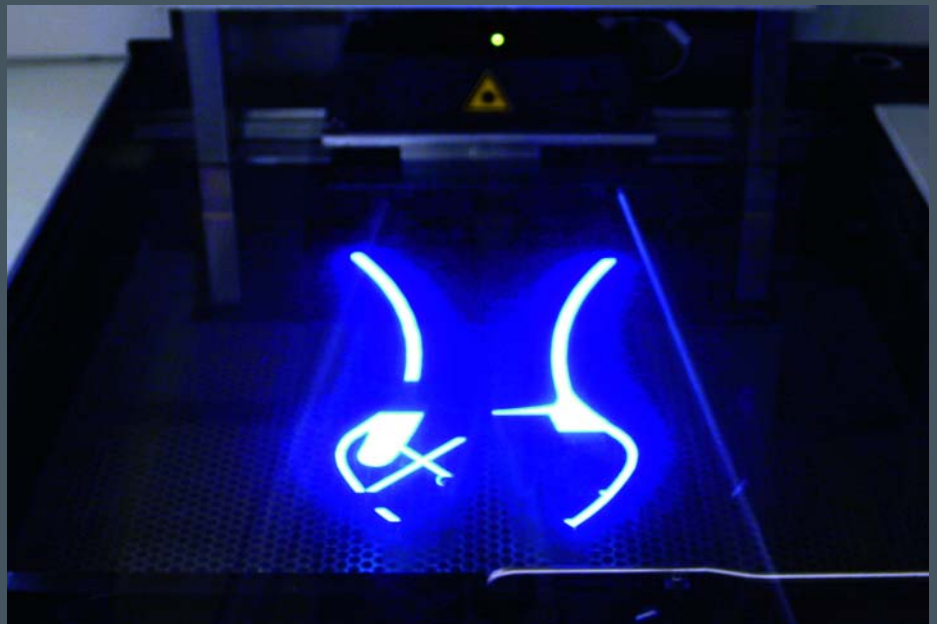
is an area with infinite possibilities and is already being used in aerospace, for car production, and also for medical, nutritional, electronic and stylistic purposes. Rapid prototyping differs from the traditional techniques of mechanical work in that it does not aim to remove material from a pre-existing block. Instead it inverts the concept, adding material with the possibility of creating complex forms, impossible to imagine with traditional methods.

In 2001 the push to reduce production costs and cut times convinced Dallara to start a rapid prototyping department. At Dallara this process is mainly exploited for the production of aerodynamic components in scale models, that

are then tested in the wind tunnel. At the moment the models that are used in the wind tunnel are made up of about 70% stereolithographic components.

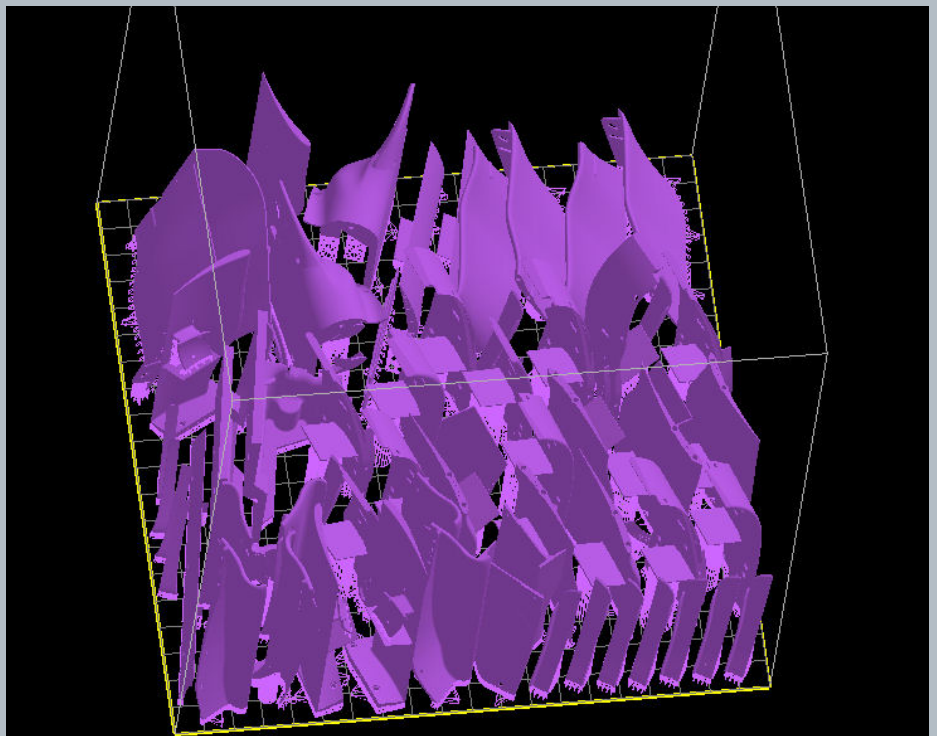
The stereolithography laser machine was put on the market in 1987 by the American company, 3D Systems®. In a decade full of projects Dallara has invested a lot in this sector, resulting in having three machines of the highest production level. All three of the machines are the SLA7000, each with a usable volume 500x500x600mm. The objects produced are made completely of a special photosensitive epoxy resin. On average Dallara produce over 6000 pieces a year, using around 800kg of resin.





The efficiency and the management of the devices are fundamental in achieving these results. The care and the cost of the individual components make a series of basic procedures necessary, to avoid interrupting production; another extremely important factor in obtaining the maximum efficiency and clear and proper planning of the production. With the aid of planning facilities installed in the Bom Manager system, we have found a significant contribution to the planning and management of the files. Thanks to the rapid prototyping, it is now possible to obtain aerodynamic test result just a few hours from the design of a single piece. And in motorsport, time is a determining factor in staying ahead of the field.

Nelle foto, alcuni passaggi dal design elettronico al componente vero e proprio



**Roberto Giacomelli**  
Rapid Prototyping Engineer

dallara

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THE PURSUIT OF EXCELLENCE

On the road since 1972.

- Consultancies, design and production of racing cars and high performance road cars.
- Aerodynamics: wind tunnel and computational fluid dynamics (CFD).
- Research & development: vehicle dynamics and driving simulator.



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