From a young age I have been obsessed by cars and especially the iconic brand of Ferrari. When professors Van Tooren and Beukers offered me an internship within Ferrari it was a dream come true. I continued my internship in my thesis work, for which I won the Ferrari research grant of €25,000. To finish my project I am at the moment inside the Ferrari factory in Maranello, Italy, working to develop a prototype.

TEXT MSc. Jeroen Klein Geltink, Alumni Aerospace Engineering, System Engineering and Aircraft Design & Design and Production of Composite Structures, (DPCS), and Ferrari. The focus of the collaboration was on weight saving.

WEIGHT SAVING OF A SPORTS CAR
As an aerospace student and an active member of the DUTRacing formula student team, weight saving was not a new subject to me, but to work within the limitation set by an exclusive brand like Ferrari was. In aerospace we are used to expressing the performance of aircraft in power-to-weight ratios. Within Ferrari a similar ratio is used: the mass-to-power, the lower this ratio the higher the performance of the vehicle. Comparing two similar models can illustrate the development of Ferrari sports cars in the past.
twenty years. Table 1 shows the Ferrari 348, which was introduced in 1989 and the new Ferrari 458, which will be introduced this year. Both models are two seater, mid-engined V8 sports cars.

Next to the differences in styling and aerodynamics, compare figure 1 with figure 2, the mass of these cars is very similar. Although the 458 profited from twenty years of technological development with, for example, an aluminum chassis, the weight of the steel 348 is only 13 kilograms more. This is mainly due to improvements in passenger comfort and safety, which compensated for the weight savings that have been achieved.

The mass-to-power ratio of the 458 is about twice as low as the 348 due to an almost doubling of the amount of power of the engine. This is very typical for the development of the Ferrari sports cars in this period of twenty years. The performance of these vehicles has been increased, not by a decrease in mass, but mainly by an increase in power. That this is not the way to go was already clear to Colin Chapman of Lotus when he stated: “Adding power makes you faster on the straights. Subtracting mass makes you faster everywhere.” Maybe it was a coincidence that the lightweight Lotus cars were green, but subtracting mass also decreases the fuel consumption and the emission of harmful exhaust gases of a vehicle. Ferrari recognizes weight saving as the way of the future and asked for the help of the TU Delft to achieve the required results. Within this collaboration four projects were defined, these were chassis, suspension, wire harness and exhaust. I was assigned to the last project, the exhaust system. Unfortunately, I am not allowed to elaborate on the content of each project due to the confidentiality that is involved.

AEROSPACE MATERIALS FOR FERRARI
That mass can be saved with the use of aerospace materials, like carbon fiber composites, is obvious due to the very high strength over density of these materials, but one should keep in mind the differences between the aerospace and the sports cars industry. A company like Airbus has around 57,000 employees and produced almost 500 aircraft in 2009, while the industrial part of Ferrari has around 1,500 employees and produced 6,250 cars in 2009. Although Ferrari is an exclusive brand it thus produces a lot more products with a lot less people. This means that materials and production methods that might be suitable for the aerospace industry will not always be suitable for Ferrari. The main differences are in the production time and the cost. The production time for Ferrari has to be a lot less than for Airbus, which means that a product can only be a success if it is made with an automated process. Although costs are less important to Ferrari than to other car manufacturers, they are still very important. This was one of the things that surprised me in my first period of work at Ferrari, but then again a company like Ferrari, like any other company, has to make profit and can only do so if their cars are reasonably priced. The goal in the Ferrari – TU Delft cooperation was thus not saving weight, but saving weight while keeping the cost similar to the current cost. This proved to be a real challenge.

BACK FOR MORE
During my internship I developed a concept that in theory would result in a tremendous weight saving. I continued my internship in my thesis to develop this
the Alps and you can escape the heat of summer at one of the many lakes or at the coast, but you don’t have to go far to experience the real Italy. Have a pizza or pasta in one of the many restaurants and afterwards enjoy the tiramisu or the wonderful coffee. Or, one of my favorite activities, enjoy a beer while watching football among the passionate Italian fans.

In February of this year I graduated from the faculty of aerospace engineering for my master degree with the excellent score of a 9. The result was a weight saving of 65% compared to the current component, while the expected cost were reasonable for the Ferrari customer. Only one week after my graduation I would return to Italy to live in Maranello Village. This complex is owned by Ferrari and has a hotel, coffee bar, fitness center and a restaurant. All the temporary employees are housed in this complex, which also has apartments. The inhabitants are constantly reminded of the rich history of the prancing horse. When I enter my red apartment block I am greeted by pictures of Ferrari cars on the wall. In the staircase hang part of the V8 engine of the 430 and the carpets on the floor name all the Ferrari models that have been built so far. Some people would say that the Italians here are crazy, but I tell you they are just very passionate and proud of their cars and I think they should be. I offered my colleagues a beer if they can find a shop, restaurant or hotel less than ten kilometers from the factory, which does not have a logo or picture of Ferrari. Until now nobody came to collect his beer, because it will be impossible. If it is the haircutter, the supermarket or the little coffee bar across the street, they all have a Ferrari flag hanging on the wall.

ARE YOU NEXT?
In the next months I am developing a prototype that will be tested inside the factory. This is all very exciting of course. Next to this the TUDelft has started the process of applying for a patent on my thesis research. This will already be the third patent within the Ferrari – TUDelft collaboration and hopefully some companies will evolve from these projects. It all shows the success of this collaboration and the potential for the future. Of course this future will only happen with the help of the aerospace students involved and at the moment we are looking for new students in this project, so if you have a passion for cars, are a master student of the chair of SEAD or DPCS, are creative and can work independently, then you can write to Femke Verdegaaal (f.m.verdegaaal@tudelft.nl) and maybe you will be selected to go to Maranello and help to make the beautiful red Ferrari cars a little greener.