

Challenges for logistics in the pinnacle of motorsports - Formula 1

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ABSTRACT

The article refers to the challenges for the logistics which comes together with the organization of big sports events. The article is based on the example of the most demanding discipline which is Formula 1. It is here, where besides the latest technologies and the best drivers in the world, the latest methods of managements are applied as well as modern logistics techniques. New ideas of modern logistics were born in this highly demanding field. The logistics issues will be followed by very important aspects in preparing to the season, the race, and the qualifying that is the analysis of telemetric data, which is transferred from the car to the garage every time the car is on track.

KEYWORDS: logistics, telemetry, sport events, Formula 1

1. Introduction

In its purest form, Formula One is all about cars driving around pre-determined stretch of road as quickly as possible. It is about drivers fighting wheel-to-wheel in ferociously rapid machines. For some casual observers this is all that Formula One will ever be, but those who delve a little deeper will discover a vast, ever moving circus of people and parts. The same people that are chatting in France one week might find themselves in the US the next, staring at the same laptop, wearing the same shirt and even drinking the same coffee. When Robert Kubica won this year Canadian Grand prix, he understandably received most of the plaudits. But supporting Kubica's superb driving effort was a crew of 143 people, 18 hire cars and 11 articulated trucks. Those people had to be flown on 18 different flights and required 104 hotel rooms.

For millions of television viewers around the world, a Grand Prix begins when the red lights go out on a Sunday afternoon, but for the logistics department, each race starts a lot earlier – before the season has started to be precise.

The logistics race starts much earlier than the Formula 1 season as soon as the next season's calendar is confirmed, teams starts they work. They are booking flights, hotels and crucially planning how the cars will make their way to the race tracks on five continents with barely any time to catch the breath in between races. They arrange visas for every team member who will be travelling with the racing team.

All the teams have their factories in Europe, so it means that for the European Grand Prix's the cars and all equipment is transported with four trucks. For the fly-away races part of the equipment is sent by ships, mostly big and heavy items like cables, garage and motor-home constructions.

As the number of races outside Europe continues to expand, so the logistical effort required to transport the teams and their equipment will expand alongside it. Already the amount of transport required for a season of Formula One has been described, only half jokingly, as being similar to that needed for a medium sized military campaign.

2. Grand prix numbers

Every year, when Formula 1 circus starts, teams are travelling around 160000 km. Some of them even more if they decide to test at non-European circuits. Going as far West as Brazil and as far East as Australia in the course of the year. Teams take with around 33 tones of equipment, around 80 people have to accommodate and ensure a ground transport, build and dismantle their corporate hospitality facilities and motor homes, set up secure data links to their factories, they need nineteen telephone lines at every race. For this they take 500 meters of data cable and 300 meters of power cable. The basic equipment also includes 16 computers, 28 laptops and 100 radios for quick communication. Arguably most important, water and feed for their staff. The teams take around 3000 bottles of mineral water with them. Every member of the team needs two passports, when they are travelling with one, the other is sent away to get the necessary visas and all of them have ten shirts with team logos that means there are more than 400 shirts to wash after every race. Teams usually take three complete cars to the venue and another one can be built from parts. They used to take several engines and gear boxes. This all has to be repeated from 17 to 19 times per season plus testing which is another several times during the season and another several times off-season. And all of this has to be multiplied by ten teams which now are present in Formula 1.

Assembling of the garages and motor homes as well as hospitality facilities which are standard equipment for each of the teams, for special guests and sponsors representatives takes 8 hours.

Dismantle of the garages and packing back takes roughly the same time. It means that if there are back to back races, there is very little time. Summarizing, the list of items which have to be taken by the teams to the race track is enormous from the screwdriver to the engine; the complete list is an 80 pages document with around 20,000 positions. The logistics in F1 is not only a trip to the racing circuit. Formula One cars develop all the time during the season; even if at the end of season it is the same car, it is much different from that, which has started the season. We can imagine that not everything is done by the team themselves; they have more than 100 suppliers of different parts of the car and they have to integrate them very much in process to deliver required parts on time. The time of some parts production and delivery can be very short. If engineers invent something what can improve the car speed, they need to have this immediately, because development of car speed is crucial in today Formula 1. It is not everything yet that teams take with them on a Grand Prix weekend. Cars also need



Fig. 1. F-1 equipment

Source: Williams F1 Team, Graphics Allianz

the tyres and gas to move on the track, but this is a part of the FIA¹ and team supplier's responsibilities. Formula 1 team needs around 2000 - 2200 litres of fuel during a GP weekend. It is delivered by their fuel suppliers, for example for Renault it is Elf and for Ferrari it is Shell. Tyres are delivered by tyres supplier, which nowadays is only the Bridgestone and it is also a huge challenge, because every team needs to get 14 sets of tyres for dry conditions and six sets of tyres for wet conditions per single car. Bridgestone delivers the tyres for the Grand Prix with twelve dedicated trucks.

The interactive television is another interesting issue, present on each grand prix with the help of small screens which can be borrowed by the fans on the circuit. They can follow their favourite drivers from any available camera they want, as well as the current statistics are displayed. This mobile broadcasting centre is assembled in the paddock of each race from 200 tones of equipment. This equipment is transported by two jumbo jets and they need 200 technicians during Grand Prix.

More facts about Formula 1:

- A Formula 1 engine is composed of 5,000 individual parts
- About 20,000 individual items are transported by air to each overseas race site
- It takes seven weeks for equipment to travel by ship from Europe to Melbourne.
- Last-minute deliveries to the race locations can be made in less than 24 hours.
- The largest component transported is the unibody or monocoque of F1 car

¹ La Fédération Internationale de l'Automobile - established as the Association Internationale des Automobile Clubs Reconnus (AIACR) on June 20, 1904 to represent the interests of motoring organisations and motor car users. To the general public, the FIA is mostly known as the governing body for many motor racing events.

3. Road to fly away grand prix

Packing up. Teams usually take three complete car chassis for a Grand Prix and parts from which they can build the fourth chassis, if needed. They usually have 7 engines for a race, lot of spare parts, tools and the equipment; we have to remember that a track garage is a complete garage where mechanics are able to build a complete racing car from the spare parts. The packing list that is an 80 pages long document detailing every item that has to be accounted for with around 20,000 positions in it. We can find there not only parts connected with the car, tools and garage equipment but also umbrellas, awnings, marketing materials, food and water, paper serviettes for the hospitality service. Other items on the checklist include 50 computers, 100 radios, 500 meters of data cables, 300 meters of power cables. Every item has its fixed position in the specially designed containers. Because on the track the teams have no time to look for anything.

It takes two days to ensure everything is in working order and loaded onto the trucks.

Journey. For the fly away races a lot of equipment is sent by ship three months before the race. This includes garage and motor home constructions, cables and other heavy equipment. The air transportation of the equipment is managed by FOM (Formula One Management). Teams take 22-24 tonnes plus the cars. For the British based teams everything is transferred with four trucks to Stansted airport in certain time slot. All the cargo is then weighed and put to three chartered Boeing 747 freighters. The part of the crew is on the track usually on Monday morning before the Sunday race. They begin to setup the pits, that includes sweeping the floor, hanging up numerous monitors and installing the computer network. After that the rest of the team arrives with four trucks of equipment from the airport including racing cars.

Go – back. When drivers reach the end of the race and see the chequered flag as a sign to slow down and relax, other members of the team crew take it as a signal to accelerate. They start to pack-up everything and make ready for transportation by midnight at the latest. Especially, when the next race starts on next Sunday. This situation happened twice in fly-away GP in last year Chinese GP after Japanese and USA after Canada. Known as back-to-back Grand Prix weekends, there is no time to go back to the Headquarter in Europe. In this case there is an additional team and boxes which already are being setup in the place of coming Grand Prix.

4. Innovations

As the racing teams want to use the maximum space available on the trucks, planes and ships, they have specially designed trailers and air containers, and each part and item have its exact space there. There is only one way to fit all the stuff to such truck or container. One of the biggest challenges is that the breathless pace of development in Formula One makes life harder; the parts often need to be delivered at the very last minute, normally by hand brought in a suitcase by one of team members. The same happens when spare parts of the car were used due to repairs after some accidents; then more spare parts are required in the garage. For this every spare part has its own unique serial number so replacement can be rushed from the factory to the track with no time lost. In the containers and trailers all spare parts, tools and equipment have their dedicated place in the garage on the track. Especially designed garages and motor homes are fast to assembly and fast to dismantle. After all, the speed is everything in Formula 1, even in the preparation before the race.

The team's headquarter and its factory do not live alone. In the racing world they have to depend on their suppliers, which can be major ones like engine, gas,



Fig. 2. The air transportation of the equipment

Source: Williams F1 Team, Graphics Allianz

tyre suppliers and many others; altogether each team has around 100 suppliers. As the Formula 1 car develops all the time during the season often car parts are changing, teams may need development of a new part in a very short time, sometimes they need to be delivered even in a few hours before race weekend starts. For this reason very close collaboration and IT systems integration of both partners – F1 Teams and their suppliers – is required.

The plan may be very good, but even the best made plan can sometimes be compromised by unforeseen circumstances. The logistics managers have to be on their toes and always ready for plan “B”.

5. Telemetry

The telemetry is an extremely important factor in modern motor racing. Drivers and engineers are able to interpret the huge amount of data collected during a test or race. Those analyses help with proper tuning of the car for optimum performance. Telemetry and data analysis have become advanced to the point where the potential lap time of the car can be calculated and this is what the driver is expected to meet. Some examples of useful measurements on a race car include accelerations, G forces in 3 axes, temperature readings, wheel speed and the displacement of the suspension. In Formula 1 the driver inputs are also recorded so that team can assess driver performance and, in the case of an accident, the FIA can determine or rule out driver error as a possible cause.



Fig. 3. Ferrari telemetry center on the track
Source: <http://www.amd.com.pl>

At the moment a “two-way” telemetric system is completely banned in Formula 1 since 2003 season. This means that the data transfer is possible only from the car to the garage. Two-way telemetry means that engineers have the ability to update calibrations on the car in real time, possibly while it is out on the track. In 2002 David Coulthard would not have won the Monaco Grand Prix if the engineers would not use the telemetric system to change some engine parameters. Because in half distance of the race, a tiny smoke started to appear above his car. However, the two-way telemetry is not in use in Formula 1 any more, the technology is there and is used in different

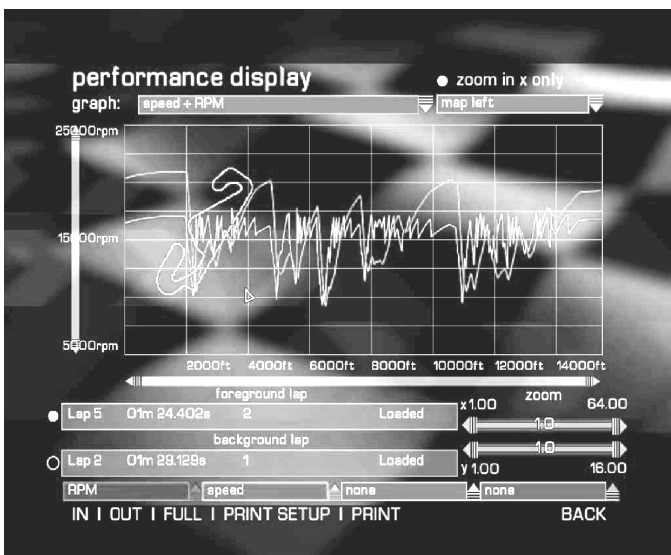


Fig. 4. Example of telemetric data chart analysis of engine rpms and speed of the car
Source: GP4 Formula 1 racing simulator

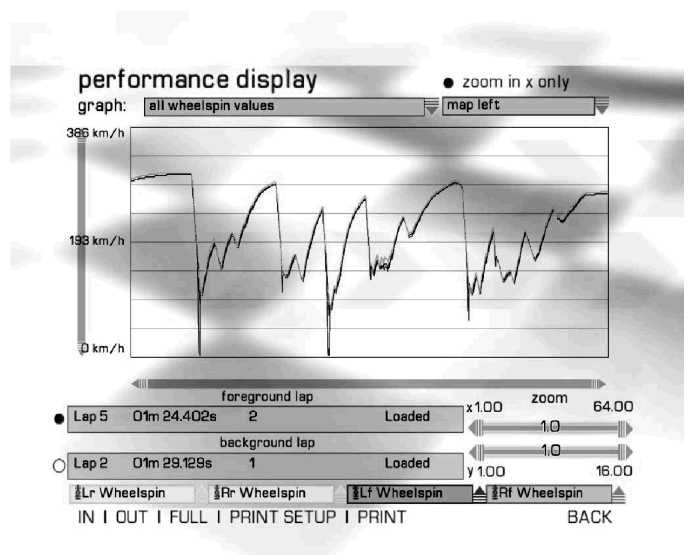


Fig. 5. Example of telemetric data analysis chart, which shows the wheel spin during the lap at Barcelona circuit
Source: GP4 Formula 1 racing simulator

racing series as it is ready to use in road cars for example.

The telemetry still has a huge impact on the development of the car or preparing to the race even if it is only a one-way system. Now drivers have a lot of switches and controls on their steering wheel so they can change the parameters of their car (particularly engine) by themselves. Engineers look at the telemetry all the time during the race, tests and qualifications, they can suggest the driver to change one of the parameters; they also often suggest on which corners drivers can go faster. During the race the telemetric data is not only transmitted to the pits but also to the team's headquarter where board of engineers can resolve some problems. The Panasonic Toyota Racing F1 team engineer Dieter Gass says: "As engineers we rely on telemetry to give us a picture of the car's status in more detail than a driver can tell us through the radio".

The telemetric system for Formula 1 car is very demanding and it was very demanding from the beginning, when it was born – there was no wireless system that could support those high requirements. The only solution was to develop a new radio system to support the required data rates. The requirements were not only about data rates but also acceptable latency, quality of service, countries of operation, hardware size, cost, power consumption and more. The telemetric data is also very demanded for the IT infrastructure at F1 teams. Data from around 250 sensors from the car is being sent in real time to the garage, teams collect an 800 GB of data during a race weekend, the same amount of data is also sent to team's headquarter so the crucial thing is to have a high bandwidth link through the satellite from tracks to the factory.

Deeply detailed data analysis can be achieved only at factory and then conclusions, to perform modifications; all the setup data is sent back to track for car improvement.

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