



University of Liège - Faculty of
applied Sciences



VALEO - Thermal Systems
Research & Innovation

End-of-course internship report

Internship made in the research and innovation
team at VALEO THS [February - August 2016]

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Chapter 1

Introduction

The group VALEO is one of the worldwide leader in automotive equipments. It develops and offers innovative, intelligent systems and services to almost all automotive constructors. Products offered by Valeo are in constant improvement and are a response to current and future problems in the automotive world.

This is the report of the end-of-course internship that took place in the research and innovation department of Valeo thermal systems. The goal was to improved the prototyping and pre-series processes with the new technologies.

The report is divided in three parts, firstly the description of the activities and organization of the Valeo group. This will be followed secondly by the enumeration of the outline of the different steps that was done. And finally a brief conclusion will be given.

Chapter 2

Company description

2.1 History

It all began in 1910 when *Eugène Buisson*, as exclusive agent and distributor in France of friction products of English society Ferodo (Ferodo ltd), decided to create his own French limited company of Ferodo (SAFF) in the Paris region, to produce brake linings and clutch under license from Ferodo.

The company develops rapidly by various joint ventures and acquisitions, it become essential on the French automotive market for friction linings and produces clutches and brake discs, industrial gaskets, molding powders, resins , insulating and applications of asbestos. It employs 1500 workers in five factories and was introduced to the stock market in 1932.

The company's activities began to diversify and internationalize in 1960: braking systems (1961), thermal systems (1962), lighting (1970), electrical (1978). The name of **Valeo** ("I'm fine" in Latin),

arrives meanwhile in 1980 and is derived from its Italian subsidiary.

Since 2009, the group is led by Jacques *Aschenbroich*, which launched a new strategic plan. Notably by pursuing its development in Asia and emerging countries. And after 13 years of absence, Valeo rejoins the CAC 40 in 2014.

2.2 Vision and mission



FIGURE 2.1: VALEO Missions

As a technology company, Valeo has the goal to propose innovative products and systems that participate to the reduction of CO₂ emissions and to the development of intuitive driving. For sustainable development, the group also wants to get closer and integrate new markets attracting automakers.

In [figure 2.2](#), we see that the €14,5 Bn income generated by Valeo in 2015, are distributed fairly across all global manufacturers. And up to 13 of these revenues come from spare parts.

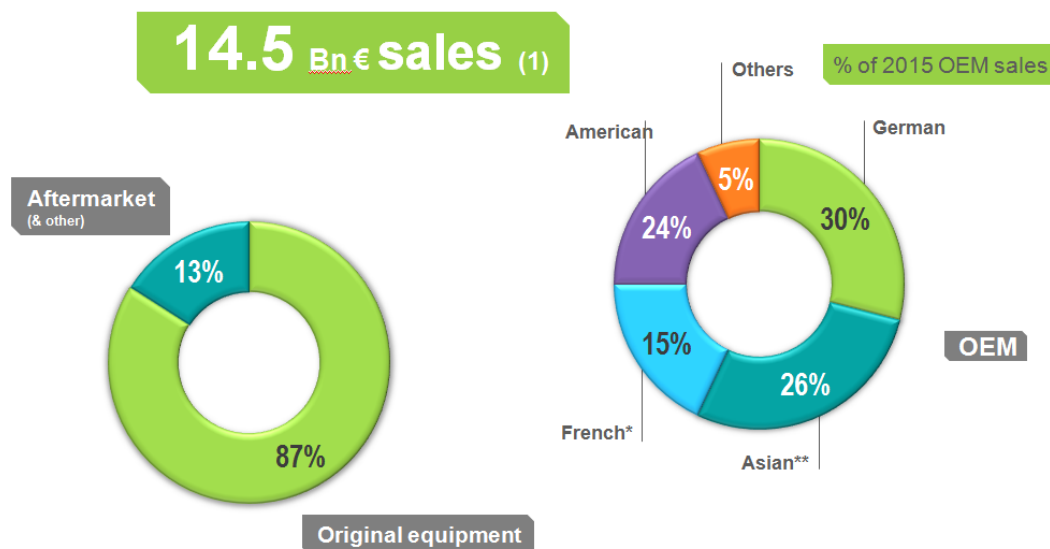


FIGURE 2.2: A well-balanced customer base

2.3 Company organisation

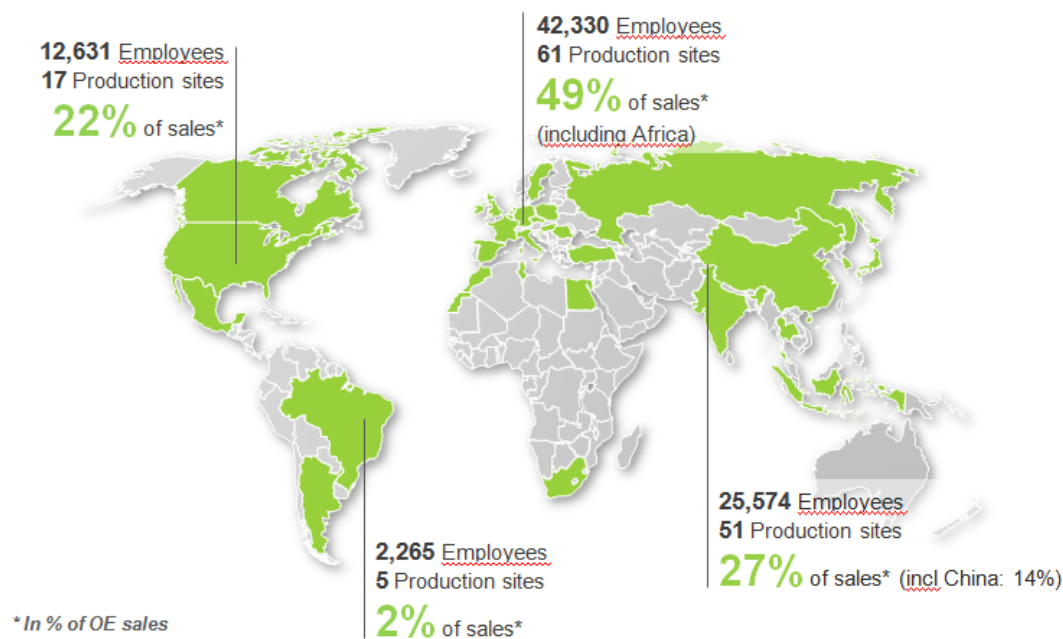


FIGURE 2.3: A balanced worldwide presence

In 2015, Valeo employs 82,000 people in 30 countries, over 134 plants, 17 research centers, 35 development centers and 15 distribution platforms (see worldwide repartition on figure 2.3). Over 10%

of the first original equipment sales are injected into research and development.

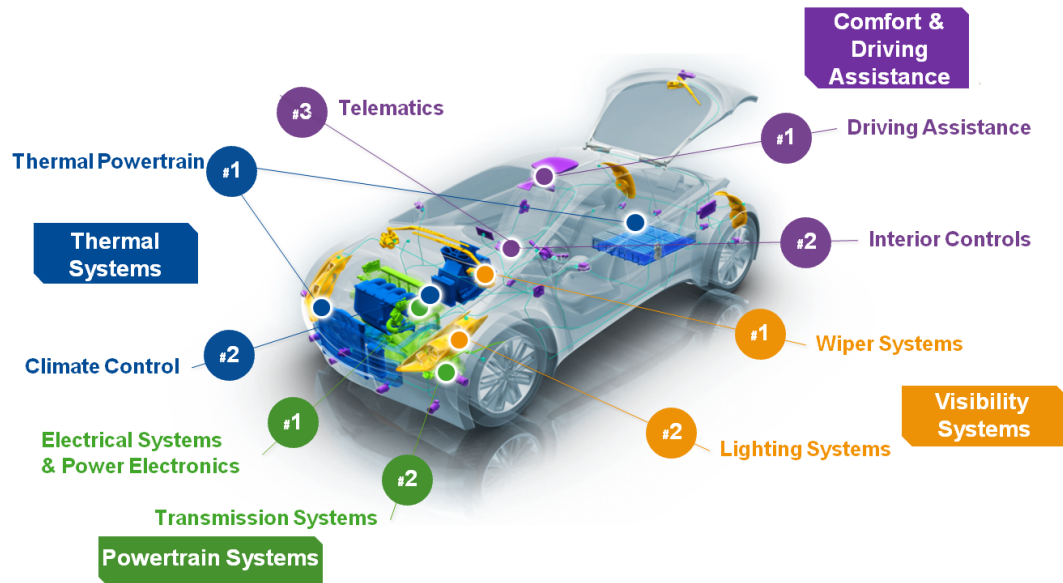


FIGURE 2.4: VALEO activities

Valeo's activities are divided into 4 business groups (see figure 2.4), they are also divided into product groups and each of them develops and produces its wide range of products.

2.3.1 Comfort and driving assistance systems (CDA)

The Comfort and Driving Assistance Business Group focuses on the driver and develops a range of unique solutions to make driving more intuitive and mobility safer, more connected and greener¹. It contains three product groups: Driving Assistance - CDV, Interior Controls - CIC and Connected Car - CCC



FIGURE 2.5: CDA key figures 2015



FIGURE 2.6: The laser scanner enables automated driving for enhanced safety



FIGURE 2.7: PTS key figures 2015

2.3.2 Powertrain systems (PTS)

The Powertrain Systems Business Group develops innovative powertrain solutions aimed at reducing fuel consumption, CO₂ emissions and other pollutants, without compromising on driving performance and pleasure¹. It contains four different product groups: Electrical Systems - PES, Transmission Systems - PTR, Electronics - PEL and Combustion Engine - PCE.

2.3.3 Visibility Systems (VIS)

The Visibility Systems Business Group designs and produces efficient and innovative lighting and wiper systems which support the driver and passengers whatever the weather, day and night, and in their various on-board activities¹. It contains two different product groups: Lighting Systems - VLS and Wipers Systems - VWS.

¹www.valeo.com, Accessed 2016 August 18



FIGURE 2.8: The electric supercharger enables fuel consumption reduction



FIGURE 2.9: VIS key figures 2015



FIGURE 2.10: *BiLED™* Improves performance while reducing energy consumption – 5 times less than halogen

2.3.4 Thermal Systems



FIGURE 2.11: THS key figures 2015

The Thermal Systems Business Group develops and manufactures systems, modules and components to ensure the thermal energy management of all types of powertrain and in-vehicle thermal comfort during all phases of vehicle use¹. It contains four different product groups: Thermal Powertrain - TPT, Thermal Front End - TFE, Thermal Compressor - TCP and Thermal Climate Control - TCC. It is in the research department and innovation of this business group that the training took place.

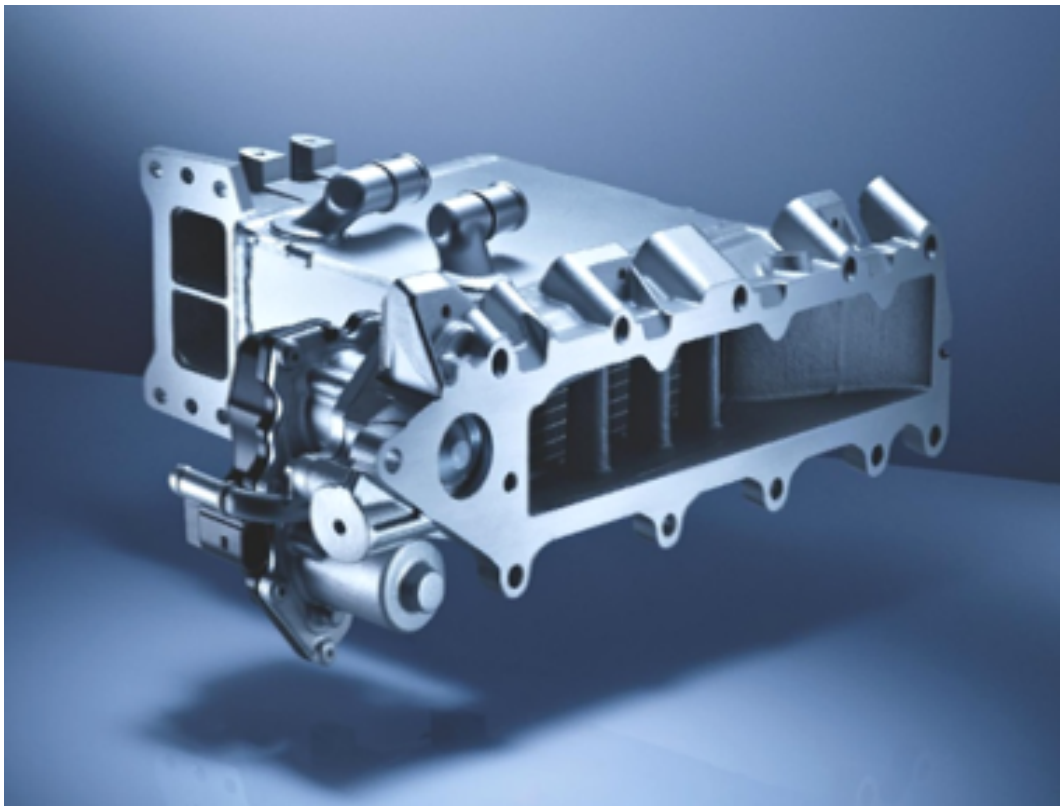


FIGURE 2.12: The air intake module enables further engine downsizing, leading to CO₂ emissions reduction

Chapter 3

Internship activities

The first part of the internship consisted to make a state of the art of the different product and service suppliers in the field of additive manufacturing. Later we participated in the exhibition spaces, visited some suppliers and undertook several quality tests, all this in order to integrate new opportunities and limitations that come with it.

3.1 Full AM suppliers Database

The database that we built shows, for all additive manufacturing suppliers, their locations, products and services, specifications and available materials. The goal was to provide to the development or production teams, a tool which could help to choice the right additive processes for a given need.

3.2 Visit of industrial trade shows

- Purpose of my visit to the tradeshow

- See the AM equipment in operation
 - Discover innovations and new products of exhibitors
 - Meet and interact with the experts of AM
 - Present our projects and unearth potential business partners
- The tradeshow for production technologies, Paris 2016
 - Bring together, in a single facility over 1000 exhibitors and brands, showcasing their equipment and products
 - Support visitors in their search for new processes to increase their production
 - Offer 9 technological sector, 3 new thematic villages including the "Village impression 3D" for AM (Additive Manufacturing)
 - Presentation of 148 technological innovations

3.3 Visit of suppliers

DMG Mori

DMG MORI distributes CNC lathes, CNC milling machines, CNC machining centers, laser or ultrasonic milling machines from Deckel Maho brands, Gildemeister, Mori Seiki, SAUER. They perform all technical services, customer service and training. In recent years DMG produces a hybrid machine LASERTEC 65 3D, unique, it combines the AM (laser deposition welding) and 5-axis milling . This machine can generate parts with a maximum size of Ø500 * 400 mm

with a density of 99.8%. The range of materials is wide and contains, among others Fe, Ni, Cr. They even announced a free choice of material for the user, provided that it is weldable. This machine is equipped with a powerful Siemens software for controlling the two processes and their superposition.

- Advantages

- Materials: Stainless steel, Inconel 625 et 718, Tungsten, Bronze, Chrome-cobalt, Stellite, Tool Steel
- Manufacture of parts with complex shapes, good density and a good finish
- Manufacturing tools with cooling channels and multi-material parts
- The print head is considered as tool and the whole as a 5 axes conventional milling machine
- Reparation of tooling and damaged parts

- Drawbacks

- Limitation to weldable metals, not including aluminum and its alloys
- Expensive machine for purchase and maintenance

Cirtes

Cirtes offers a unique additive manufacturing process called "stratoconception". It also offers a wide range of products: Marketing solution developed by Cirtes, part production from its patented processes, AM training and hotline on its products and software, The

expertise around the AM and Rapid Product Development, The integration of AM and Rapid Product Development for companies.

- Advantages:

- During my visit I saw a machine of micro milling working on a wooden layer (Strata), a wooden chair of complex shape, molds for plastic injection, metal and plastic parts with complex shapes,
- No limitation regarding, materials, shapes and the sizes of parts,
- Software developed by the Cirtes enables automatic processing before manufacturing,
- No need for a support structure when printing.

- Drawbacks:

- Manufactured parts are inhomogeneous and anisotropic in the z direction,
- Limitation on accuracy induced by the bonding method especially for metal parts.

Creatix3D

This is a company specialized in the integration of additive manufacturing solution, it offers a wide range of services such as, reverse engineering, 3D scanning, optimization, partnership for manufacturing parts, ...

- Advantage:

- Dynamic company that can address any type of AM project,
 - Possibilities in support for the development of new materials,
 - Many and prestigious partners in the area of AM.
- Drawbacks:
 - No direct parts manufacturing services, this can be done by subcontractors,
 - Provide only 3DSystems 3D printing machinery



FIGURE 3.1: part of an injection mold



FIGURE 3.2: Part obtain by reverse engineering and 3D printing

EOS

EOS is a German additive manufacturing company, it offers a wide range of high performance machines and its basic materials. These technologies could integrate the whole development cycle of a product, from prototyping to direct manufacturing. The solutions they develop are primary directed to the sector of aerospace, automotive and industrial applications

- Advantage:

- Supplier of complete pack of machinery, equipment and software,
 - Several support services,
 - High performance materials (PEEK can operate in more than $285^{\circ}c$)
- Drawbacks:
 - No direct support for the development of new materials,
 - No direct parts production services

3D systems

It is the largest manufacturer of equipment for additive manufacturing, we visited its French subsidiary in Le Mans, they provide 3D printing manufacturing services.



FIGURE 3.3: Compressor print in accura bluestone, it is a high mechanical property polymer



FIGURE 3.4: Compressor print in accura bluestone, it is a high mechanical property polymer

Chapter 4

Conclusion

4.1 Conclusion

We researched, tested and implemented several new processes. Overall we can say that things are spirited to set up and it is important not to miss the right train. Even if for large-scale production needs, such as for Valeo, there is no equivalent to traditional methods, new prototyping technics are ready and will continue to evolve.

It was an enriching and rewarding experience for the entire period of the course and certainly it will be beyond. We have centered light to new solutions, but enormous gray areas continuous to exist. It will be a pleasure and honor to have the opportunity to deepen this research.