2018 Department of Materials Industrial Tour to Provence

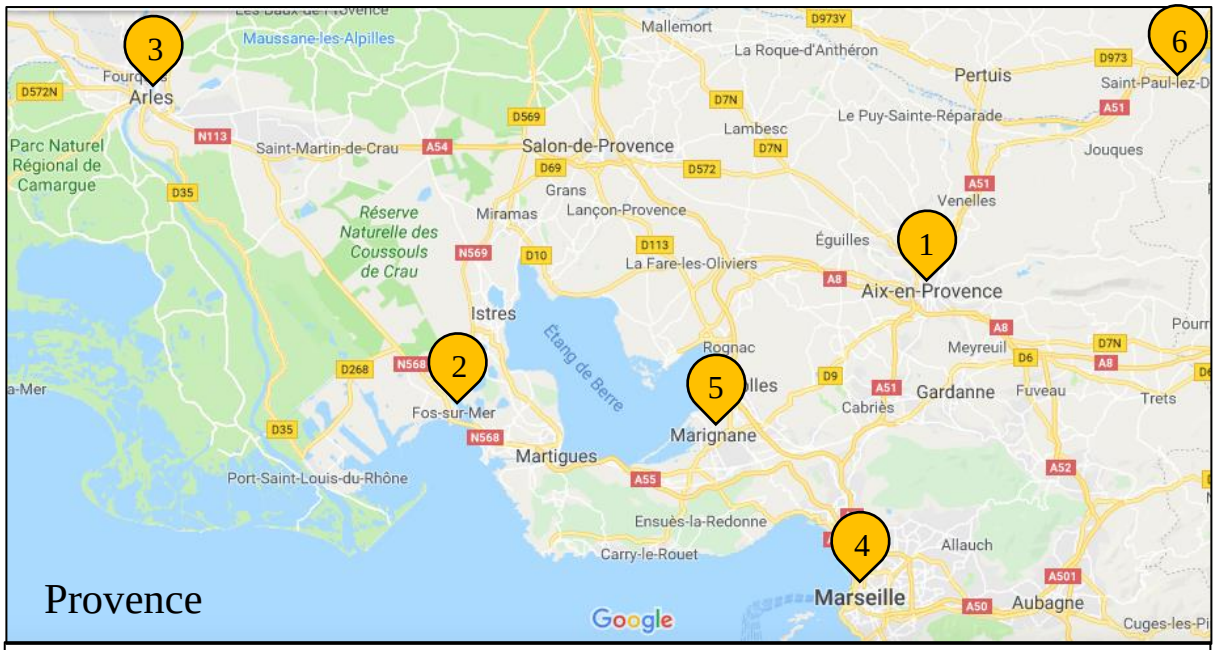
Tour Report

By Matthew Riding, Student Tour Co-ordinator.

The 2018 Department of Materials Industrial Tour took 19 members of the Department (17 Undergraduate students and 2 professors) on a six-day trip to the Provence-Alps-Côte D'Azur region of Southern France to visit industrial facilities making advanced use of Materials Science.

The party visited four industrial sites:

- ArcellorMittal's steel mill in Fos-sur-Mer
- Airbus Helicopters' Global Headquarters in Marignane
- Le Comissariat d'Energie Atomique (CEA: French atomic energy commission) in Cadarache
- The ITER organisation, the world's largest Nuclear Fusion experiment.



1: Aix, where we stayed. 2: ArcellorMittal. 3: Arles. 4: Marseille. 5: Airbus Helicopters. 6: The CEA and ITER.

Sunday the 11th of March 2018:

The group assembled early in the morning in Oxford before travelling together to Heathrow Airport where we caught our flight to Aéroport Marseille-Provence. Once in France, we were met by the coach company who arranged our transport throughout the trip. We checked in at our hostel, in the suburbs of Aix-en-Provence, at around mid-day and then ventured into the centre of Aix for the remainder of the Afternoon.

Monday the 12th: ArcellorMittal and Arles:

After Breakfast in our hostel, we boarded our coach and set off for Fos-sur Mer, by the coast, where ArcellorMittal, the world's largest steel production company, have a flat-products mill.

The generosity of our hosts and the detail and effort that went into their presentations and tour was truly amazing. We were greeted in the facility's visitors centre where the head of the Fos-sur-Mer facility gave us an introduction to the company and the site. Then, a senior metallurgy research manager who had travelled several hours specially to speak to our group gave a fascinating presentation on the research and product development that ArcellorMittal performs, presenting multiple case studies of the product development cycle in the steel industry and how the company creates bespoke alloy compositions for targeted applications.

Following the presentations, we were invited to put on special protective clothing (which proved very entertaining for the students) and begin a tour of the facility.

The party from Oxford University in their protective clothing ready to begin their tour of ArcellorMittal's Fos-sur-Mer facility. A 'bobbin' of rolled HSLA steel sheet- the main product created at the facility- is visible on the right.

The tour was such a fantastic view into the real-world applications of the metallurgical theory the students learn in their lectures. We saw every step in the process of producing high quality steel sheet from iron ore, including the coking plant, the blast furnace, the basic oxygen furnace, continuous casters and the rolling mill. At each stage we were accompanied by a member of the facility's staff who explained the functions of the equipment we were seeing with great enthusiasm and knowledge and answered the students' questions.

After the tour, we were treated to a delicious lunch back in the visitors' centre, and students had a chance to ask further questions. We were delighted to present our hosts with a small gift to express our gratitude at the fantastic experience they had provided for us.

The party and our hosts in the visitors' centre at ArcellorMittal Fos-sur-Mer.

We left Fos-sur-Mer in the late afternoon, with the students pouring over the detailed handouts and booklets they had been given during the visit. We headed west and inland to the historic roman city of Arles, where we went exploring for the remainder of the day before returning to Aix.

Right: Students by the Roman Amphitheatre in Arles.

Tuesday the 13th: Marseille

A trip to the maritime engineering company Chantier Naval de Marseille was planned for this day of the tour, but unfortunately the Harbour Master contacted us to cancel due to an emergency docking scheduled at the facility less than a week before our intended visit. Nevertheless, the group made the most of our scheduled transport to Marseille. The Coach driver was a Marseille local and gave us a wonderful narrated tour of many of the city's landmarks, working our way up to the Cathedral of Notre-Dame de la Garde that overlooks the old port area. Students then had free time to explore the city and immerse themselves in the historic attractions, food and shopping. We departed late after an enjoyable day in France's second largest city.

Wednesday the 14th: Aix-en-Provence

Wednesday was our chance to properly explore the city of Aix-en-Provence. The city had a rich history of art and artists drawn there over generations by the unique Provençal landscape. It had a much more relaxed vibe than the hustle and bustle of Marseille, and was a great chance for the students to socialise with the new friends they had made in the tour group, and practice some rusty GCSE French in the local Boulangeries. In the evening, all 19 members of the tour group assembled at a Restaurant on Aix's historic 'Cours Mirabeau' for a delicious meal of traditional French cuisine.

Thursday the 15th: Airbus Helicopters

We woke up early in the morning to get some breakfast before travelling to Marignane for our 9:00am visit to the Global Headquarters of Airbus Helicopters. We travelled in the coach through pouring rain, before we glimpsed the profile of an Airbus H125, the helicopter that holds the record for the highest-altitude take-off of any aircraft (performed at 8848m on Mt Everest in 2005) sitting atop the entrance to Airbus' huge facility in Marignane.

The Group from Oxford with our guides (right) outside Airbus Helicopters HQ in Marignane.

Our hosts were fantastic- two retired ex-engineers who now lead tours of the facility they worked at for a long time.

They began by giving us a presentation of the company and its activities worldwide, before taking us on a tour of three of the production lines for different helicopters- both civilian and military- in Airbus' range. Of particular interest to the group was the brand new model –the Airbus H160- due to start production at the facility later that year, which featured large scale application of carbon-fibre composite materials, including in its innovative 'blue-edge' rotor blades. The group was also fascinated to learn about the unique applications for magnesium alloys in complex castings for Helicopter gearboxes, and the applications of electronic materials and semiconductor devices in avionics, guidance and defence systems. There was plenty of chatter about potential careers in the coach after our visit was over! We returned to Aix and relaxed in the hostel- tomorrow was our final day in France so we prepared to vacate our rooms in the morning with a busy day ahead.

Friday the 16th: the CEA and ITER

Another early start saw us say goodbye to the hostel we had called home for the past five nights, wheeling our suitcases up the drive where a bigger 'grand car' awaited us to be our transport for the day. Our destination was Europe's largest energy technologies research centre: the French 'CEA- Commissariat d'Energie Atomique', where state-funded and private research into nuclear power systems has been conducted for over 70 years.

We passed significant security infrastructure to board a dedicated CEA bendy-bus for our tour with another wonderfully enthusiastic and knowledgeable guide. The site's visitors' centre was a real treat- museum-quality exhibits of the history of research at the facility with interactive models of fission reactor cores and plenty of informative handouts we could take away with us.

Our guide pointed out the large 'containment' domes of many of the experimental fission power plants housed on the site, some decommissioned and others planned for the future. We learned how the CEA is at the forefront of the development of a fourth-generation fission reactor design called the 'Sodium Fast Reactor', with a prototype design currently under review by the experts at the organisation, and a fleet of commercial 1500 MW SFRs intended to be joining the French National Grid circa 2050. Our guide was able to give us plenty of information about the unique materials challenges posed by a reactor using liquid metal coolant, drawing on examples from the three previous sodium-cooled reactors built in France throughout the late 20th century.

Our last stop on our tour of the CEA site was a different flavour of nuclear reactor- a nuclear fusion experiment called 'WEST' that contributes to European research into the commercialisation of nuclear fusion power. Many of the students had previously visited the JET nuclear fusion experiment in Culham, just South of Oxford, with the department of materials, and were fascinated to learn more about the special 'tungsten environment' employed in this device. A senior researcher at the WEST experiment gave us a truly inspiring talk about the prospects of nuclear fusion energy as a clean, environmentally friendly and 'non-explosive' source of electricity for the future, and prepared us perfectly for our second visit that day- the ITER organisation.

The Group from Oxford with our guide (far left) standing at the visitors' viewing platform overlooking the ITER site. The assembly hall can be seen in the centre-left, which will construct 18 'segments' of the reactor before they are lowered into the radiation-shielded 'tokamak pit'.

The ITER experiment was a fascinating vision into the cutting edge of materials, physics and engineering applied with the aim of solving one of humanity's greatest technological challenges- clean energy. Thanks to the amazing work of yet another brilliant guide, we had the unique opportunity to attend three lectures delivered by staff at the ITER organisation: the Section Leader of the superconducting magnets section, the Section Leader of the remote handling section (responsible for a fleet of robots designed to handle irradiated materials on behalf of humans) and a scientist who worked on the tritium breeding experiments, and who had previously collaborated with two of our professors at Oxford University!

The lectures and the tour were such a special experience and left everyone incredibly inspired about the future and the role materials science will play in it!

After spending nearly the entire day immersed in the world of nuclear power, we eventually left in the late afternoon to catch our evening flight. Students had a great time sharing

knowledge, photos and stories from the trip throughout the journey home and long after we had landed comfortably back in London to go our separate ways.

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