

ADIFP Expedition Trip

United States of America

Houston & New York City

April 29th – May 11th 2017

Report



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Introduction

Every year the Association of Doctoral Students of *IFP Energies nouvelles* (ADIFP) organizes a learning expedition, where a group of students goes abroad to visit companies, universities and research institutes. Besides giving the students an insight into the research inside companies and universities, this study trip also gives the opportunity for its participants to improve their communication skills through oral presentations of their work and contact networking. Furthermore this expedition is as well a mean for the discovering of new professional challenges and cultures.

This year, the group went to the United States of America (USA) from April 29th to May 11th, dividing the journey between two locations: Houston and New York City (NYC). The former was chosen due to its proximity with the petroleum industry, while the last for the high quality universities in its midst and neighborhood.

With 13 PhD students from different backgrounds and IFPEn working areas, as listed in *Table 3*, the group had the opportunity of visiting at Houston: Shell, Air Liquid and Total. In academic aspects, the participants also had the opportunity of attending the Offshore Technology Conference, Rice University, Rutgers University, Columbia University and Stevens Institute of Technology. For last, the group had the privilege of attending the IFP School Alumni reception, Rice-ExxonMobil reception and two personalized events, as the Total reception at the Petroleum Club.

More detailed information is given along the report, written by the participants and the organization members: ADIFP 2017, Damien Dussol, Ana Rita Costa da Cruz and Christopher Yeates.

Schedule

The expedition trip followed the schedule resume by Table 1 and Table 2. Initially the flight to New York City was programed for Friday, however, due to bad weather in the city, it was cancelled and our passage was delay to the next day. For this reason, and as well for reduction of costs, the Brookhaven National Laboratory visit was cancelled and replace by free time.

Houston

Table 1 - Fulfilled schedule for Houston.

Day	Day of the week	Plan	
29 April	Saturday	Lyon – Paris – Houston Flight + Free Time	
30 April	Sunday	Free Time	
1 May	Monday	Morning	Offshore Technology Conference
		Afternoon	
		Evening	
2 May	Tuesday	Morning	Shell
		Afternoon	Air Liquid
		Evening	IFP School Alumni reception
3 May	Wednesday	Morning	Rice University
		Afternoon	
		Evening	
4 May	Thursday	Morning	Total
		Afternoon	
		Evening	
5 May	Friday	Free Time in Houston	
6 May	Saturday	Houston – New York City Flight + Free Time	

New York City

Table 2 - Fulfilled schedule for New York City.

Day	Day of the week	Plan	
7 May	Sunday	Free Time in NYC	
8 May	Monday	Morning	Rutgers University
		Afternoon	
		Evening	Free Time
9 May	Tuesday	Morning	Columbia University
		Afternoon	Stevens Institute of Technology
		Evening	Free Time
10 May	Wednesday	New York City – Paris Flight	
11 May	Thursday	Paris – Lyon Flight	

Participants

As posed in Table 3, the participants for the 2017 expedition trip were a mix of IFPE students with different backgrounds, nationalities and thesis projects. Only 12 departed to Houston (8 from Lyon + 4 from Paris), due to the delay in Mostafa Sulaiman's visa, who join the group later on in New York City and left on the 12th of May. All of the participants had the opportunity to present their work at least one time.

Table 3 - List of participants of the 2017 Expedition trip.

Name	PhD Year	Thesis title	Field of activity
Saifuddin AHMED	3 rd	Study of the liquid-liquid equilibrium of electrolytes using an Equation of State	Process design, Modeling and Simulations, Chemical Engineering Thermodynamics
Federico BUSSOLATI	1 st	Multi-scale modeling of the fatigue of mooring wire ropes for offshore floating wind turbines	Structural Analysis, offshore engineering
Ana Rita COSTA DA CRUZ	2 nd	Compositional and kinetic modeling of bio-oils from fast pyrolysis from lignocellulosic biomass	Process engineering and modelling
Damien DUSSOL	1 st	Experimental study and kinetics modeling of the transformation of ethanol into butadiene	Process engineering and modeling
Ana Teresa FIALHO BATISTA	1 st	Location and proximity of metallic and acid sites on alumina based catalysts	Heterogeneous catalysis, catalyst characterization
Luca GEMELLO	2 nd	Gas-liquid reactors and bioreactors: population balance modelling and impact on global hydrodynamics	Process engineering and modeling - Computational and experimental fluid dynamics
André MORGADO LOPES	2 nd	Reactive Transport through Nanoporous Material	Fluid mass transfer, adsorption

Maroua MOULA	1 st	Mechanical properties of highly porous alumina for catalysts supports, influence of the microstructural morphology	Multiscale Material Characterization Mechanical Testing, FE Modeling
Céline PAGIS	2 nd	Synthesis and evaluation of hollow Y zeolite crystals	Chemistry of Materials, Adsorption and diffusion in porous media
Mostafa SULAIMAN	2 nd	Multi-scale Modeling of Shrinking Particles for Biomass Gasification processes	Reactive Flows Modelling, Fluid Mechanics
Clément TOUPOINT	2 nd	Path and wake of cylindrical particles falling in a liquid at rest or in a bubble swarm, towards the hydrodynamical modeling of ebullated bed reactors	Fluid mechanics
Marianne VAN UNEN	1 st	Kinematic evolution thermicity, exhumation and fluid-rock interactions in the Outer Dinarides	Structural Geology
Christopher YEATES	2 nd	Multi-Scale study of foam flow dynamics in porous media	Reservoir engineering, reservoir modelling

Expedition report

The following sections present the expedition trip schedule and events with a higher detail.

Saturday, April 29th

The group flew to Houston, where went directly to the accommodation. After certain logistics arrangements, the rest of the day counted as free time.

Sunday, April 30th

As well accounted as free time, each participant was in charge of its own activities.

Monday, May 1st

After a great day off, spent at the Johnson Space center, on May the 1st we took our cars to attend the Offshore Technology Conference (OTC). We arrived at 9.30 and we have been initially welcomed by Norman Carnahan, an organizer of the Conference and member of the American Institute of Chemical Engineers, which told us about the history of the conference and how it evolves each year, with new challenges as well as new solutions. Then we have attended a short presentation at the stand of Air Liquide, in which the general manager Maria Bonikowska explained how the company is involved in the offshore sector.



Figure 1 - IFP VE group at IFP booth at OTC.

We had then time to visit the all OTC, in which many different firms from all over the world showed their products and their technologies; moreover also some American universities were there to explain their research activities related to the offshore sector.

At 2pm we attended a couple of presentations given by Fabrice Deleau and Daniel Averbuch at the IFPEN stand, regarding risers pipelines connections and offshore wind technology.

Then we met at Sylvie Le Brun, communication manager of Evolen, a French organization whose members are hundreds of enterprises which work in the energy sector. Its goals are basically the diffusion of knowledge among the members and founding French start-ups operating in this field.

In the evening we were invited for dinner organized by Ed and Cathleen Biegert. We had a chance to meet some industry leader from Shell, ExxonMobil and Baker Hughes. This was interesting opportunity since it was an informal gathering and we got into interactive conversations specially related to our future career development. We also had a chance to learn from their experience about the professional life in United States. This can be really helpful for those who are willing to make decision to choose to work in US. Some of the contacts of the people we met are mentioned at the end of this report.

Tuesday, May 2nd

On the 2nd of May we arrived at 8.30 at the Shell Woodcreek office in Houston, where Cody MacDonald welcomed us. After the acquisition of our bages, we heard and read about the safety regulations within Shell, which is very important.

We started with some tea and coffee, which was followed by a talk of Amanda Getsinger. She is a specialist in geoscience, with particular regard on structural geology, geochemistry, petrology, and basin modelling. She told us about her experience within Shell after her Phd, which was interesting to hear as we could place ourselves in her shoes.

From 10:00-11:00 two people from the HR department (Jay Allen and Jessica Topletz) gave us insight into the process of recruitment. It became clear that this process is very long in Shell. Stage 1 of the process is an online assessment, consisting of a cognitive test, working-style assessment, and an on demand video interview. Stage 2 is the final assessment, in which you do a case study within a team for one day, which ends with a final presentation and interview. Once you get accepted in Shell, you have to do a 3 year recruitment program in which you will be educated and prepared for working within Shell. During this period you work on a project, but you will also follow courses to derive extended knowledge.

From 11:00-12:00 we had a very nice widely variable lunch outside in the garden of Shell. After this we made a tour through the building. The building is very large and consists of golf courts, a fitness room, a big courtyard, and a garden with fountain.

From 12:00- 13:00 Cody MacDonald told us about his project and expertise in structural geology and seismic processing. He showed us a seismic demo including 2D and 3D seismic in the area of Mexico.

In the Tuesday afternoon we visited the Air Liquide USA head corporate office at: 9811 Katy Fwy, Houston. Upon arrival we were brought up to the boardroom for presentations by senior figures in the Air liquide organisation. One talk was notably given by Etienne Lepoutre, Senior Vice President Human Resources, and included an overview of the group's activities and detailed the group's recent acquisition of AirGas. We learned with great interest about the workings of such takeover and Air liquide's long term strategy in the USA. Furthermore, we talked about recruitment possibilities and the internal movement offered to Air liquide employees within the company. One of the most interesting moments was hearing about the previous business endeavors undertaken by our hosts in sometimes difficult political environments (i.e. Ukraine during the recent Russian conflict).

After these exchanges, we visited one of the operational hubs, consisting of a large room in which engineers have different screens at their disposal displaying market prices, local gas demand and gas output data. The engineers' job is to make both technical and commercial decisions to match output and gas demand according to the market data. We had a Q&A session with an Air Liquide employee who gave us some specifics on the day to day running of Air Liquide from a more practical point of view.

We drove from the Air liquide offices to the French consulate in Houston in where a IFP School alumni meet-up was serendipitously organized during our stay at Houston. After toasts by Didier Houssin and the French consul in Houston, we mixed with the IFP School alumni and heard about their different employment paths with great enthusiasm. This made a fantastic opportunity for networking and we were taken aback by the spread of the IFP network throughout Houston.

Wednesday, May 3rd

On the 3rd of May, we participated in a seminar organized by Rice University and IFP Energies nouvelles in cooperation with the office for science and technology of the Embassy of France in the United States.

We arrived at 8h15h at Rice University, located in Houston (Texas, United States). We were welcomed by Madam Marie Contou-Carrere, research advisor for industrial partners in Rice University. During the seminar day, students from Rice University as well as all the participants of the study trip presented their research work. The most of the talks were focused on chemical and biomolecular engineering, providing a very enriching information exchange and allowing dialogue between students of IFP Energies nouvelles and Rice University.

At midday, we were invited to have lunch with the students of Rice University. This moment allowed us to discuss among several subjects. After lunch, the rest of the group did their presentations until 5pm. We finished the seminar by taking a collective picture for memory.



Figure 2 - Participants of the seminar at Rice university.

In the evening, we had dinner with some members of the Rice University and some alumni of the Rice University that are working at ExxonMobil. This dinner was an occasion to know the alumni reality in the United States and to meet some people of ExxonMobil with very interesting life experience.

The event was organized into the Rice University. During the event, the Exxon-Mobil alumni made a big donation to Rice University, as a token of thanks for the great opportunities and knowledge that the Rice University gave them.

Thursday, May 4th

The entire day was reserved for the Total Company. We started the day with a visit of the Total Technical Center and the polypropylene plant at La Porte. In the afternoon, we continued our visit in the Total Plaza at Houston, followed by a reception in the Petroleum Club at the same address.

The day began at 7.30 at Total Plaza, where we received our identification badges for the day. Afterwards, we took a shuttle, provided by Total, until the Technical Center in La Porte. There, we started our visit with an introduction of the center and its mission, by Scott Cooper, the applications manager, and Fabrice Dehais, the analytical manager. Already suited up, we were divided into two groups and, separately, went to visit the laboratories of microscopy, refining, physical testing and applications. In the first lab, the company analyses its products, the clients' complaints regarding the same products and also evaluate goods already existent in the market in order to define the introduction of a new product in the market or not (reverse engineering). At the refining lab, the

technical team analyses the crude petroleum through atmospheric and vacuum distillation for the crude essays. Such work is crucial to understand the feedstock provided to Total and to prevent any undesirable situation in the refining process. At the physical testing lab, the products generated at the polypropylene factory are tested in order to verify that they fulfill the required specifications previously defined by Total. At last, the applications lab focuses in a deeper evaluation of Total products, by submitting them to the typical processes used by the Total clients.

In the end of the morning, we moved from the Technical Center to the polypropylene plant, where once again we started our visit with an introduction of the site and the process in question by Mark Douglass, the plant manager. Here, as well in the Center, safety was from high importance, therefore all the safety process and actions were emphasized. Our visit continued on to the plant, where we had the opportunity to see some of the several units (loop reaction, flash separator and extractor) and the control room. Our visit was concluded with a lunch in the meeting room accompanied by a discussion about the future of chemical plants.

Before heading back to the Total Plaza, we stopped at San Jacinto Monument that is at about 5 minutes from the Technical center and plant. The monument is a column with 172.92 meters located in Harris County, Texas. Build in 1939, the San Jacinto Moment is dedicated to the men who died during the Texas Revolution, allowing the segregation of Texas from Mexico. The independency of Texas eventually ended with its union to the USA.



Figure 3 - San Jacinto Monument.

At Total Plaza, we add the opportunity to assist to three presentations from Herve Coutrix, President CEO, Total E&P Research & Technology USA, LCC; Scott Elo and Patrick Miles, Both from Total Petrochemicals & Refining USA, Inc; and for last Jose-Ignacio Sanz, President CEO, Total E&P USA. From the research strategy of the Exploration & Production (E&P) department by Herve Coutrix to the applications of new technologies from Scott Elo and Patrick Miles and the adrenaline behind the petroleum market of E&P explained by Jose-Ignacio Sanz, we were able to get an inside of Total and

its perspectives for the future. We also had the pleasure of meeting Isabelle Kieffer, who kindly helped us organize our visit to Total.



Figure 4 - Visit at Total Plaza, Petroleum Club.

Our day ended at the Petroleum Club, placed at the 35th floor of the Total Plaza, in the company of the afternoon speakers, other engineers of Total and as well as of Axens North America, accompanied by Didier Houssin. It was a pleasant evening with a great opportunity to improve our contact network and social skills.

Friday, May 5th

After the knowing about the cancelation of the flight to NYC, the group rearranged the logistics for the day and night. Afterwards, the remaining time was accounted as free time, where each participant was in charge of its own activities. In the meantime, Mostafa Sulaiman arrived at NYC around 23h and went directly to the accommodation.

Saturday, May 6th

The group flew to New York City, where went directly to the accommodation where met Mostafa Sulaiman. After certain logistics arrangements, the rest of the day counted as free time.

Sunday, May 7th

As well accounted as free time, each participant was in charge of its own activities.

Monday, May 8th

Rutgers is the State University of New Jersey. This university is among the top 25 public universities, as ranked by *U.S. News & World Report*. It welcomes nearly 69,000 students and 22,000 full- and part-time faculty and staff. During our trip we visited one of Rutgers' campus located at New Brunswick which welcome approximately 40 000 students knowing that 11 % are from abroad.

Jonathan Cohen, a four year PhD student at the chemical engineering department, was in charge of this successful day.

First, a presentation was given to present Rutgers University and its specificities. Then, Andreas Ehinger, who is responsible for the PhD students at IFPEN, followed with a similar, general talk to introduce our institute to the Rutgers students. Then, students' presentations started. As the talks were at the chemical / biochemical engineering department we chose, before the trip, to select and then divide the speakers up into two groups. One focused on flow and transport properties and the others on materials and chemical engineering. 6 volunteers from France and 4 from Rutgers have presented from 11am to 3pm during this day.

The lunch was kindly provided by Rutgers university and it was a really enjoyable time for talking and exchanging experiences (scientific and others). Following the presentations time, Jonathan took us for a lab tour in the biochemical building. To finish properly the day he brought us at a social event in a bar at New Brunswick frequented by many students of Rutgers.

We knew that this day would be more suitable for students dealing with chemistry, but it was a choice from the organization team to vary the field of application, and it was a success during the whole trip.



Figure 5 - A city bus bearing the Rutgers' image.

Tuesday, May 9th

We arrived at 9am at the Columbia University, located in New York City. After a quick breakfast and introduction, Ah-Hyung Park, Lenfest Junior Professor in Applied Climate Science as well as Associate Director of Lenfest Center for Sustainable Energy (also called the Earth Institute) presented her work regarding climate change solutions at the Columbia University. The Earth Institute is an interdisciplinary department aiming at gathering people of different backgrounds and making them work together, towards the development of solutions to the major environmental issues that humanity must face. The work done at the Earth Institute on CO₂ capture was showcased. More information can be found on <http://www.earthinstitute.columbia.edu/>.

Her talk was followed by a presentation of IFPEN by Andreas Ehinger. Mutual interest was shown by the participants, due to the numerous overlapping research areas between IFPEN and the Earth Institute.

We then began a tour of the Columbia University laboratories, guided by PhD candidates under the supervision of Ah-Hyung Park. Firstly, we visited a lab which performs experimental work on the use of CO₂ for the recycling of steel slag, a common waste in the iron and steel industry. Then, we were shown encapsulation experiments with three different fluids. We also visited the analysis and reaction laboratory. The tour went on with facilities dedicated to the study of biomass treatment, and ended with a mineral carbonation laboratory.

In the afternoon, we visited the Stevens Institute of Technology, in Hoboken, New Jersey. We met Susi Rachouh, the Director of International Programs, with whom we discussed international student mobility in Europe and in the US.

We began the visit with a tour of the many facilities in the campus at Stevens, starting by the food court, followed by the library and finally the sports area. At the end of the tour, we met Professor Ronald Besser, Professor Dilhan Kalyon, Director of Highly Filled Materials Institute, Professor Simon Podkolzin, along with some of their students. Andreas Ehinger presented them IFPEN, and some of the students did a quick pitch of their research topics.

Afterwards, Mo Dehghani, Vice Provost of Research, Innovation and Entrepreneurship presented a general overview of the research conducted at the Stevens Institute. The Stevens Institute has many research partnerships, most notably with the Department of Defense, but also with the National Institutes of Health, the National Science Foundation and many others.

We resumed our tour with a laboratory visit. We started with, Pr. Layon showing us the Stevens polymer extrusion laboratory, before going to the catalysis laboratory with Pr. Besser & Podkolzin and PhD. candidates.

Wednesday, May 10th

After the cancelation of the Brookhaven National Laboratory visit, this day was as well accounted as free time, each participant was in charge of its own activities. At the end of the day, the group went to the airport in order to return to Paris.

Thursday, May 11th

After arriving to Europe, the participants of Paris left and the remaining flew back to Lyon, where the trip ended. Mostafa Sulaiman returned to Europe by himself the next day.

Conclusion

This study trip was a great opportunity to meet industrial actors of the Oil & Gas industry in Houston. The meetings with engineers and executives from companies such as Shell, Total, ExxonMobil, Air Liquide or Baker Hughes were a real asset. It was the best way to discover the concerns of such companies in the USA but also around the Americas. The discovery of the scientific but also strategic plans was highly enriching.

Moreover the opportunity to meet people from the different universities gave us a unique occasion to extend our knowledge on different scientific topics. This is especially true for the French-American seminar at the Rice University. The visits of the Columbia University, Rutgers University and Stevens Institute were great to see how PhD students work in the USA.

Generally speaking everyone was satisfied with the trip since it fulfilled its purpose of meeting important actors of the industry and exchanging on research topics with the universities.