

TCM-2011

HISTORICAL SESSION

Review Lecture

As a detailed summary of the review lecture on the history of turbulence research, by Professor Michael Eckert, is given elsewhere, only a brief overview of the main points will be given here. The talk began with an account of the history of turbulence research dating back to the time in between the First and the Second World War, where it was put in the context of the tradition of “scientific engineering”. Turbulence research as such did not yet really exist and results were rather presented at congresses for “Applied Mechanics” organized among others by von Kármán and Burgers in the 1920’s. It was highlighted, that important contributions to turbulence research were presented in the years 1924 – 1938. Historically, the influence of the Second World War on turbulence research is difficult to quantify. It was however stressed, that research was being conducted separately in Germany and the US, mostly on topics related to aerodynamics, such as for example the “Tollmien-Schlichting waves” in the context of stability analysis. Results were obtained simultaneously in Germany and the US. Due to the war, some of the regular congresses had to be postponed, as for example the one planned for the year 1942 in Paris, which was then held in 1946. It was there, that G.K. Batchelor first reported on Kolmogorov’s $2/3$ scaling law for the second order structure function. It was also during this and the following year, that Burgers as its main promoter created IUTAM, the International Union of Theoretical and Applied Mechanics. At the same time, R.J. Seeger founded the “Fluid Dynamics Division” as a division under the American Physical Society, which acts as its umbrella society. The last part of the talk was concerned with the development of Journals devoted solely to research in fluid dynamics. While in 1956 G.K. Batchelor at Cambridge University, UK, had founded the “Journal of Fluid Mechanics” (JFM), Francois Frenkel promoted as head of the aforementioned “Division of Fluid Mechanics” a journal devoted to basic research in “Fluid Physics”, which is today known as “Physics of Fluids” (PoF). G.K. Batchelor, however, opposed strongly to the introduction of this second journal, as he saw a potential rivalry to “his” JFM. It was after the introduction of the two journals, which both still exist are among the most prestigious journals on fluid mechanics, that turbulence research flourished most.

Comments on the Review Lecture

William George highlighted the importance of two people in the development of turbulence theory around the second world war, namely G. I. Taylor, for he was the first to study turbulence on Mathematical basis, and Hans W. Liepmann.

Michel Coantic stressed the close connection between war events and turbulence research. He also pointed out the crucial role played by meteorology i) The cascade picture by Richardson (1920) in the atmospheric context has been instrumental for the development of Kolmogorov-Obukov theory ii) Atmospheric sciences were considered as a research field neutral enough so that Russian scientists were allowed to come to France to attend the 1961 meeting, despite the complications related to the political situation during cold war.

Jim Wallace emphasized the role of Burger in the development of turbulence research, as well as theoretical physicists such as Hendrik Lorentz in Holland. He mentioned that Lorentz realized early on the importance of hot wire measurements.

Michael Eckert mentioned the fluctuating relations between fluid dynamicists and physicists in different countries around the Second World War.

Prof. Keith Moffat, one of the last surviving attendees of the 1961 Marseille turbulence colloquium explained that Doklady (the English language version of the Proceedings of the USSR Academy of Sciences) and many other scientific journals were used as ballast on ships returning from Murmansk (in northern Russia) to Scapa Flow (in the Orkney Islands, Scotland) during World War II, these ships having taken armaments for besieged Russian cities on the outward journey. The voyage was very perilous, because of the danger of German U-boats and mines, as well as very cold stormy weather! This is by this way that Batchelor was able to read and later disseminate in the west the seminal papers by A.N. Kolmogorov.

Christian Favre, the son of the 1961 organizer, Alexandre Favre, gave an account of his recollection of the 1961 meeting, which he helped organize as a student. Influenced by his father, he grew up in a very scientific atmosphere. He said that, all to the surprise of his friends, he knew better the names of some of the great scientists of these years, than of the local famous soccer players. For example, people, such as Jean Bass, helped him with his homework. At the 1961 conference he was, among other tasks, responsible for welcoming the people coming from all over the world. In the following, he told anecdotes, regarding his encounters with these great scientists. He said that Les Kovaszny possessed almost encyclopedic knowledge. One day, a Sunday, he was asked by Kovaszny, who was a gourmet, to take him to a good restaurant. However, to the best of Favre's knowledge, all restaurants were closed on Sundays. Kovaszny however, who had read a guide to Marseille, and remembered almost all of what he had read, knew by heart a good restaurant, which was open on Sunday's. The second anecdote concerns A.N. Kolmogorov, who arrived one day late in Marseille, as during the time of the Cold War it was difficult for the Russians to travel and he had problems receiving the proper visas. Kolmogorov, who was in very good physical shape wanted to go swimming so that Favre took him to the local Calanques. However, Kolmogorov was so well trained that once he had entered the water, Favre soon lost sight of him. Worried, how he could possibly explain to the others, that he had "lost" Kolmogorov, he swam back to the beach, where Kolmogorov was already waiting. Favre's last account is on Theodore von Kármán who invited him to a good fish restaurant at Marseille to thank him for his effort in organizing the meeting. Favre also remarked, that von Kármán spoke his "own French", sometimes sounding as if he was speaking English. As closing remarks, he said about his father, that he always said, that curiosity is the basis for good research, while teaching is the basis to accumulate knowledge from generation to generation.

General Discussion

Ed Spiegel mentioned the importance of astrophysics in the early developments of turbulence. For instance, Batchelor regularly attended cosmological fluid dynamics meetings. He remembered having shared a room with Kraichnan during the conference. He said that Kraichnan was deeply disappointed by the reception of his work during the 1961 meeting. Kraichnan became sick and flew back to the US before the end of the conference.

Prof. Tatsumi showed various pictures of turbulent researchers in the 60's and commented on some of them.

Michel Coantic emphasized the important role of the creation of the "ministère de l'air" in France in 1928, directed by Albert Caquot, which was instrumental in the creation of many "instituts de mécanique des fluides" (IMF) in collaborations with universities in several cities. At that time, most knowledge in fluid mechanics was on hydraulics. Michel Coantic gave the example of Lille, where the IMF was first directed by Kampé de Frier and then by André Martinot Lagarde, following a long tradition of fluid mechanics that started with Boussinesq. In Paris, the IMF was directed by Henri Villat, with a more theoretical approach to fluid mechanics. Michel Coantic then stressed the close relation between war events, turbulence research, and the foundation of the IMST ("institut de mécanique statistique de la turbulence") by Alexandre Favre in Marseille in 1960.

Afterwards, he discussed the academic evolution of Alexandre Favre. During the occupation, many French researchers, among which Alexandre Favre, flew to Toulouse and started to work secretly on turbulence. After the war, the "Office national d'études et de recherches aérospatiales" (ONERA) was created. Maurice Roy, its director, supported the work of Favre to set a lab for basics research in turbulence, the IMST.

Michel Coantic emphasized the important role of Favre as an experimentalist. The necessity of the development of more careful experiments for future progresses in turbulence was a major conclusion of the 1961 Marseille congress. Alexandre Favre setup in Marseille i) a low turbulence wind tunnel ii) a supersonic wind tunnel iii) an air-water tunnel. He has also been involved in the nuclear fusion project with the CEA, and on the Concorde project.

The session was closed by Keith Moffatt. He mentioned another impressive swimmer: Vladimir Arnold, who was also a former student of Kolmogorov !

There remains a mystery. It is a fact that every attendee of the 1961 meeting was impressed by the figure of Kolmogorov. But there seems to exist divergent versions about the language Kolmogorov used when presenting his work at the meeting. According to K. Moffatt, Kolmogorov spoke in French, but a "sort of French that was incomprehensible to the French themselves or to the other participants". But according to C. Favre, Kolmogorov spoke a perfect French, while M. Coantic remembers Kolmogorov presenting his work in Russian, with someone translating into English.

We shall therefore leave this issue open.