SERGEY ALEKSEEVICH CHAPLYGIN: ON THE 150TH ANNIVERSARY OF HIS BIRTH

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April 5, 2019, marks the 150th anniversary of the birth of Sergey Alekseevich Chaplygin, Academician of the Soviet Union Academy of Sciences, an outstanding Russian and Soviet scientist in the field of mechanics, who was among the founders of aeromechanics and gas dynamics (Fig. 1). Sergei Alekseevich Chaplygin was born in 1869 in Ranenburg town (now Chaplygin town in the Lipetskaya region renamed after him). In 1877, he entered a school in Voronezh, from which he graduated with a gold medal award in 1886 and became a student in the Department of Mathematics and Physics at Moscow University. He attended all lectures, and in his free time gave private lessons. Sergei sent almost all of his earnings to his mother in Voronezh, who raised four children all alone. Chaplygin was half-starved, but he did not complain about fate and persistently acquired knowledge; physics, mathematics, mechanics, and astronomy were the subjects in which he excelled.

After attending lectures by N.E. Zhukovsky, Chaplygin became seriously interested in mechanics, and on the advice of the professor, he began scientific work on hydrodynamics. This study formed the basis of his graduate thesis, in which he was awarded a gold medal. In 1890, Chaplygin graduated from the department and stayed with the university to prepare for a professorship. In 1898, he obtained his master's degree with the scientific work "On some cases of the motion of a solid body in a liquid."

At the turn of the century, N.E. Zhukovsky and S.A. Chaplygin conducted scientific research related to the creation of the theory of flight. In 1902, at the very beginning of this new era in

FIG. 1: Sergey Alekseevich Chaplygin

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the field of mechanics, Chaplygin's historical study "On gas jets" was published. This marked the beginning of a new branch of mechanics—gas dynamics—and the 34-year-old scientist, Chaplygin, successfully defended it in 1903 as a thesis for a doctor of science degree. The hodograph method developed in his thesis was far ahead of its time, because the study of gas flows at speeds close to the speed of sound was not relevant to engineering at that time; it would take 30 years before the approaches developed by Chaplygin at the beginning of the 20th century became in demand.

In 1910, Chaplygin's first work on the theory of the wing was published, and since then the problems of aerodynamics have become central to his scientific activity. After one of Zhukovsky's reports on the nature of lift, Chaplygin made a scientific conclusion of extreme importance: in the case of flow over a wing with a sharp trailing edge, the line of flow separation from the wing corresponds to (or coincides with) that trailing edge. This conclusion, called the Zhukovsky–Chaplygin postulate or hypothesis, is important in that it allowed calculating the circulation in the Zhukovsky formula for lift force in a simple way. The level of results obtained by scientists, containing basic knowledge of the airfoil operation in incompressible gas, allows Chaplygin together with Zhukovsky to be rightfully considered the creators of the modern wing theory. The basic relations of the theory of a finite-span wing were obtained by Chaplygin much earlier than L. Prandtl managed to do in Germany, although not all of his works were published in due time.

After the establishment of the Central Aerohydrodynamic Institute in 1918, Zhukovsky recruited Chaplygin to work as the head scientist at the TsAGI branch in Kuchino near Moscow. In 1921, after the death of Zhukovsky, Sergei Alekseevich Chaplygin became the scientific director at TsAGI. From 1921 to 1930, S.A. Chaplygin was the chairman of the board, and from 1928 to 1931 he was the head of the Central Aerohydrodynamic Institute. When S.A. Chaplygin formed the TsAGI scientific team, he preferred university graduates with deep mathematical training who were entrusted with solving topical as well as the most complex technical problems; in particular, the formidable and mysterious phenomenon of flutter was among these problems. From 1931 to 1941, S.A. Chaplygin led the establishment of the largest aerodynamic laboratories at TsAGI.

Having left the administrative duties as the director and chief at TsAGI in 1931, Chaplygin headed the General Theoretical Group. In the famous seminars of the General Theoretical Group at TsAGI, which operated from 1932 to 1940 under his leadership, the already well-known scientists and future luminaries of science M.V. Keldysh, N.E. Cochin, M.A. Lavrentiev, L.I. Sedov, and S.A. Khristianovich, among others, took part. These unique seminars, as well as the personality of the leader, played an extremely important role in the development of mechanics, and above all aviation science in Russia. The development of an effective mathematical model of a mechanical phenomenon was the key point for Chaplygin, because, according to M.V. Keldysh, "he did not have a single mathematical work that would not be applied to the solution of specific problems of mechanics." Along with the problems of aerohydrodynamics, general and celestial mechanics and the theory of elasticity were among Chaplygin's research interests. Chaplygin foresaw the development of world aviation, in particular, jet aircraft. He supported research in this area, much more so than others, realizing that this development should be based on fundamental science. When the World War II began, Chaplygin together with the TsAGI employees went to Novosibirsk, where under his leadership the TsAGI branch was organized, which later grew into the Siberian Research Institute of Aviation named after S.A. Chaplygin (SibNIA).

Sergey Alekseevich Chaplygin died on October 8, 1942, which was a huge loss for the country. During his life, he received main awards and honors. For his outstanding scientific achievements, S.A. Chaplygin was the first among scientists to be awarded the title of Hero of Socialist

Labor. He was awarded two Orders of Lenin, two Orders of the Red Banner of Labor, and he was a laureate of the Zhukovsky Prize. Chaplygin was also awarded the title of Honored Scientist of the Russian Soviet Federated Socialistic Republic (RSFSR).

Sergei Alekseevich Chaplygin was truly a scientist ahead of his time, infallible in his scientific and organizational decisions, and an outstanding, multi-faceted person. Dispersed and soft by nature, he became incredibly focused, calculating, and tough when it was necessary to carry out an important personal or, especially, a large civil affair—be it pedagogical work, which he carried out as a professor at the Moscow University and the head of the Moscow Higher Women's Courses, or the construction of the TsAGI complex in the difficult years for his country and the creation of its scientific school.

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