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Chapter 25

The Activities and the Role of Vladimir Petrovich Vetchinkin in the Field of Rocketry¹

B. L. Belov²

Vladimir Petrovich Vetchinkin (1888-1950) occupies a prominent place among the pioneers of rocketry and cosmonautics. He is a distinguished scientist in the sphere of aerodynamics, airplane flight dynamics, theory of propellers and is the first Russian researcher and creator of the methods of airplane strength calculations. V. P. Vetchinkin took an interest in "cosmic" problems when he was already a specialist of high scientific repute, one of the founders of the Central Aerohydrodynamic Institute (TsAGI), where he headed the general theory department.

A disciple and immediate associate of Nikolai Ye. Zhukovsky, Professor Vetchinkin was scientifically broad-minded and had a special kind of democratic view on the ways of scientific development, which enabled him to properly assess the promising nature of research in the domain of cosmonautics, even before many contributions appeared on that circle of problems in this country and abroad.

A genuine interest in rocketry on the part of a scholar in the field of classical mechanics, and an expert in aviation science, was an exceptional phenomenon for the late 1920s and the early 1930s. A certain analogue in this respect can be found in the creative activities of Maurice Roy, a prominent French specialist, who made a fundamental study on the comparative efficiency evaluation of flying vehicles with direct reaction engines.³ The fact that such eminent scholars as V. P. Vetchinkin and M. Roy

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² Intercosmos Council, U.S.S.R. Academy of Sciences, Moscow, U.S.S.R.

addressed themselves to the research of rocket-propelled vehicle flight problems, apart from its independent value, was of great importance in giving rocket-and-space studies a status of a scientific-technological trend in its own right. This had been not infrequently compromised by immature designs of space vehicles.

Professor Vetchinkin embarked on the elaboration of problems pertaining to jet propulsion and space travel in the early 1920s. That period is reflected in his rough notes, entitled "On the feasibility of flying to the Moon by rocket,"⁴ kept in the archives of the N. Ye. Zhukovsky Scientific-Memorial Museum. Relevant documentary materials in the Museum testify to the fact that the beginning of the scientific-popularizing activities of Vladimir Vetchinkin dates back to 1922 and was marked by his delivering a lecture on the subject "Voyage to other planets."⁵ The evidence relating to V. P. Vetchinkin's scientific-popularizing activities in the 1920s shows that he did not confine himself totally to popularizing the works of K. E. Tsiolkovsky, the founder of theoretical cosmonautics, and other researchers, but he also familiarized the audience with the results of his own investigations and calculations.

The second half of the 1920s is marked in the creative activities of Professor Vetchinkin by intensive work in the investigation of airplane flight dynamics. The first edition of his "Flight dynamics,"⁶ a unique work at that time, appeared in 1927. In that book, in addition to airplane flight dynamics, the scientist considered issues pertaining to the flight dynamics of winged flying vehicles, in particular rocket-propelled ones. Thus, it was in 1923 that TsAGI Transactions carried V. P. Vetchinkin's contribution "On falling and gliding in a variable density medium,"⁷ dealing directly with the descent of a winged vehicle towards the Earth, i.e. an idea reflected in the creative efforts of a number of rocketry and cosmonautics pioneers.

In the scholar's own words, from early 1925 on he did not give public lectures and reports. However, his interest in rocket flight problems never slackened, and he participated actively in the examination of a series of relevant inventors' proposals, and in the reviewing and scientific-technological editing of original studies on "rocket-and-space" problems.

For instance, he rendered substantial assistance in the publication of Yu. V. Kondratyuk's book, "Conquering interplanetary space,"⁸ which appeared in 1929 in Novosibirsk under his editorship and with his extensive preface. Without diminishing the significance of Yu. V. Kondratyuk's original study in any way, one cannot but admit that in the high scientific reputation of that work a considerable merit belongs to its scientific

³ Roy, M. On useful actions in conditions of the application of rocket apparatus.

⁴ Pioneers of Rocket Technology: Vetchinkin, Glushko, Korolyov, Tikhonravov. Selected works (1929-1945), Moscow, 1972, p.5.

⁵ *Ibid.*, p.6.

⁶ *Ibid.*, p.6.

⁷ *Ibid.*, p.6.

⁸ Kondratyuk, Yu. V., Conquest of Interplanetary Space, Novosibirsk, 1929.

editor and author of the foreword. Also well known is a positive appraisal of Friedrich A. Tsander's papers by Professor Vetchinkin, who, in his review, convincingly showed the distinctive nature of Tsander's research, and the priority status of a number of that scientist's proposals.⁹

In the mid-1930s, Vladimir Vetchinkin carried out several original projects on aircraft flight dynamics, which were published in Soviet periodicals "Jet propulsion" and "Rocketry." The very fact that Professor Vetchinkin's theoretical contributions appeared in the said specialized editions, proved that the problems examined by him were recognized as topical, while the papers themselves turned out to be the first serious theoretical investigations on rocket dynamics, corresponding to the development level of rocketry in the subsequent decades.

In 1934, V. P. Vetchinkin, in his work "Winged rocket flight at supersonic speeds,"¹⁰ turned to the analysis of the effect of forces acting upon the airfoil at supersonic flight speeds, he calculated the thrust curves required for the conditions of supersonic flight, and investigated the problem of the climb and acceleration of a jet plane with a constant angle of attack.

It is to be noted that the publication of that paper by Professor Vetchinkin, entitled in a most noteworthy way, pointed to the acceptability, if not expediency, of a joint analysis of phenomena accompanying the implementation of two different motion principles of a flying vehicle, namely, the rocket-dynamic and aerodynamic ones, i.e. the principles underlying the development of today's aerospace systems. It is quite understandable that the development level of aerodynamics and gas dynamics of the 1930s compelled the scientist to resort to approximating a number of important relationships in solving theoretical issues, which affected the accuracy order of final results. Nevertheless, in a number of instances, Vladimir Vetchinkin succeeded in overcoming certain mathematical difficulties by studying concrete problems, and in giving practical recommendations concerning the traffic organization of flying vehicles at supersonic speeds, well before the peculiar problems of supersonic flows were established through special investigations and experiments.

In the first part of his 1934 work entitled "Forces acting upon airfoils at supersonic speeds," Professor Vetchinkin investigated a profile formed by two arcs, which had once been suggested by Busemann and Walchner. He considered an idealized streamlining scheme first, and then completed the problem by introducing coefficients, taking into account the friction and drag due to lift caused by a finite span of the wing. V. P. Vetchinkin then suggested a conventional shape of characteristic performance curves for calculating the flight, with due regard for an additional multiplier to take care of the profile change during the supersonic motion of the vehicle. Coupled with the calculated dependences of power consumption in a supersonic flight and an analysis of supersonic airplane acceleration problems, the findings of that research signified the beginning of a theoretical elaboration of the motion of a rocket-propelled vehicle at an advanced scientific level for that time, and of an organic combination of flight dynamics problems proper of an airplane and a rocket-propelled vehicle.

⁹ Tsander, F. A., *Out of Scientific Heritage*. Moscow 1964.

¹⁰ *Rocket Technology*, Number 4, Moscow, 1937.

In 1935, Professor Vetchinkin published an article entitled "Vertical motion of rockets" in the collection "Jet propulsion."¹¹ In the first part of the paper, believing correctly that on the unpowered part of the flight the motion of a rocket is similar to that of an artillery projectile, he examined a problem known from studies on exterior ballistics. It might be fairer to say "unknown," but having analogues in solution techniques, since in artillery practice no one had explored vertical trajectories of shell motion. Certain mathematical difficulties of obtaining solutions to these problems by quadrature prompted the scholar to segregate three characteristic parts of the flight, and for each of them he proposed procedures for finding the speed in any point of the ascending, "passive" leg of the path.

In the second part, the scientist addressed himself to the analysis proper of rocket motion on the "active" flight stretch under the assumption of "constant weight." This assumption is not correct for the motion of variable mass bodies, but quite acceptable from the viewpoint of analyzing the influence of motion and speed, with reference to the resistance change of the medium. Having examined this "interim" problem, in the third part of his article Vladimir Vetchinkin turned to the realistic case of rocket motion, allowing for the change in medium resistance and rocket mass. In that section, having formulated the initial premises of the problem, he suggested a practicable calculation method of consecutive approximations. V. P. Vetchinkin proposed a number of relations for determining the required supply of propellant, with its known consumption law and ratio of propellant to oxidizer, including the instance where the ambient oxygen is used as oxidizer.

The same collection, "Jet propulsion" (1935), carried Professor Vetchinkin's extensive work, "Several problems from the dynamics of a jet plane." We shall limit ourselves here to listing the titles of its sections: "Gliding from high altitudes in a variable density medium," "Gliding range," "Gliding time," "Effect of centrifugal forces," "Jet plane acceleration and climb," "On the most profitable flight speeds with a jet engine," "Jet plane speed-up and ascent with account taken of fuel consumption at the most profitable flight speeds," "Angle of ascent of a jet plane."

V. P. Vetchinkin made a very substantial contribution to the training of professional personnel specializing in rocketry. He was among the first members of the "Jet Propulsion Study Group" (GIRD), which took its organizational shape in the autumn of 1931, and he actively participated in the work of the first special engineering and design courses under the GIRD umbrella, where he delivered a course of lectures on the dynamics of jet vehicles.

The trend and nature of Professor Vetchinkin's activities in rocketry varied in keeping with its significance at individual development phases.

By right, we highly appreciate the merits of our prominent scientist, Vladimir P. Vetchinkin, among major professionals, whose contribution to a large extent determined the first successes scored by Soviet rocketry and cosmonautics. A crater on the Moon's back side has been named after him.

¹¹ Reactive Motion - Collection of Articles, Moscow, 1935.