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Chapter 14

The Contribution of Ju. V. Kondratjuk to the Foundation of the Theory of Space Flight*

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Jury Vasiljevich Kondratjuk belongs with those scientists, whose works, by the end of the first quarter of the 20th century, laid the foundations of the theory of Space Flight. The name of Kondratjuk will go down in the history of Russian and World astronautics, and grateful descendants will always remember him as one of those who contributed to the coming of the space era of Humankind.

Jury Vasiljevich Kondratjuk (Alekzandr Ignatjevich Shargey) was born on June 21, 1897 in Poltava, Ukraine.[1] His father—Ignatiy Benediktovich Shargey—was a student at Kiev University, while his mother—Ludmila Lvovna Shlippenback—was a teacher in one of Kiev's gymnasiums. During his early years the boy lost his parents and was mostly brought up in the family of his grandmother, Ekaterina Kirilovna Datsenko.

In 1916 he graduated from the second Poltava gymnasium with the silver medal and the same year entered the mechanical division of the Petrograd Politechnical Institute (College).[2] But in November 1916, in accordance with the procedure of recruiting of students to military service, he was called up to the army and was sent to a short term military school—the school of ensigns. After graduating from this school he was sent to the Southern Front in the Caucasus. Kondratjuk took part in World War I and in the Civil War in Russia, and

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after the end of the wars in the 1920's he worked in Ukraine, in the North Caucasus and in Siberia.

In 1916-1917 Kondratjuk started to think over the possibility of human space flight. In March 1917 he finished the first version of his manuscript, which was devoted to the problems of interplanetary travel. This version was a compilation of preliminary notes and cannot be qualified as a completed work. It looks like the pages of a scientific dairy, where the author sometimes makes mistakes, argues with himself, and in some cases reformulates some statements and makes new calculations.

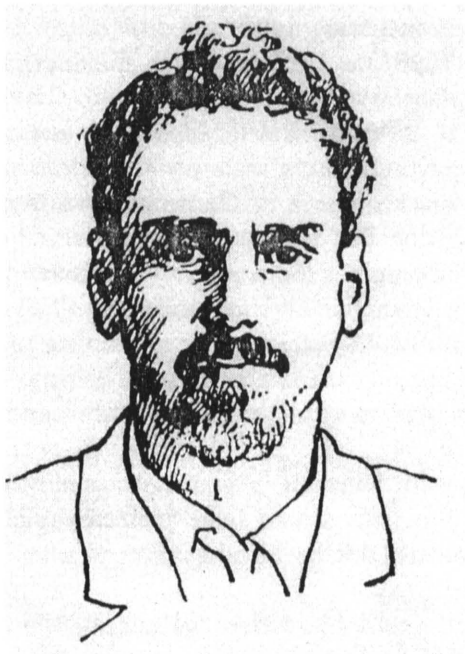
But even in these early notes one may find a number of interesting ideas, which deserve serious attention. Thus, after coming to the conclusion that flight to the other planets by means of a rocket is possible in principle, Kondratjuk started to specify in this manuscript some points, related to human space flight.

He suggests the use of the planetary atmosphere for the glide descent, elaborates the possibility of utilizing solar energy, and on the use of mirrors for such purposes, on the means of producing material radiation (consisting of particles and cathode rays), analyzes the conditions of flight in the Solar System, thinks over the problem of establishing intermediate interplanetary bases, and makes the first steps towards the idea of a practical use of multistage rockets (Kondratjuk called them multicomponent).

He wrote: "In every case, when I refer to activeness (power-consumption) of substance, I mean that this activeness must be calculated per unit of weight of the material plus the weight of the vessel, in which particular substance is placed. When a part of active substance is consumed, the vessel, which contains the substance becomes useless and is disposed of. That's why it is more efficient and probably more expedient not to keep the whole amount of active substance in one vessel, but in several, progressively decreasing in size. This is further more practical, because one vessel is not convenient for the purpose of greater lightness".[3]

In the same manuscript Kondratjuk for the first time suggests that landing on another natural space body (planet or star) should be implemented only by a special landing module, which will consequently to be returned to orbit around this natural space body. In the part of the manuscript entitled "The theory of stops" he wrote: "In order not to consume a large quantity of active substance, it may be necessary not to stop the vehicle itself, but only to reduce its speed, so that the vehicle would move at a steady speed around the space body, intended for stopping (landing) by keeping as close to the space body as possible. After this the nonactive part of the vehicle with the amount of active substance aboard necessary to stop the nonactive part is separated for consequent catching up (and docking again) with the rest of the vehicle".[4]

Kondratjuk continued to further think over the problem of human space flight. Within the seven years from 1918 until 1925, he produced three additional versions of the manuscript on this subject.



Line drawing of Yuri Vasilyevich Kondratjuk (1897-1942), Soviet astronautical pioneer, known for his "For Those Who Will Read in Order to Build," 1919, discussing basic problems of Spaceflight. He worked on rocket dynamics, and suggested metals for rocket fuels.

His second manuscript, dated as far back as 1918-1919, opens with the words: "For those who will read in order to build," thus pointing out that he himself considers the manuscript as a completed work, which is intended for those who would start practical experiments in this direction. This version of the manuscript is the follow-on to the previous work, which is different from the latter in its somewhat more systematical and detailed exposition. Apart from this Kondratjuk wrote some new parts for his second manuscript. They are: "Active substance and its burning," "An instrument for the orientation," "Acceleration Indicator," "Utilization of mutual movement of space bodies," and others.

The third version of the manuscript (without a title) is dated 1920, but later Kondratjuk added on it: "rewritten and reedited in 1923-1924)".[5] This variant is essentially different from the two previous versions, in both the composition and the form of presentation. Here Kondratjuk tries to produce a more elaborate mathematical foundation for his deliberations so, as he himself puts it, "to present the mission of conquering the Solar System not in the form of theoretical assumptions, the development and the practical application of which relates to science and technology of the future, but in the form of a project, although not presented in very much detail, but with the specific figures, which

may be implemented today by means of present day technology after a series of preliminary experiments involving no special difficulties".[6]

And finally, in 1925, he sent the fourth manuscript later entitled "The Conquest of the Interplanetary Space" to Moscow, to Glavnauka, from where it was sent to Professor V. P. Vetchinkin for his review and commentary.

While analyzing Kondratjuk's manuscripts, one could see how step by step within several years his vision of the problem of the exploration of outer space developed. From the first somewhat immature and in some cases naive conclusions, Kondratjuk assumes the perspective reflected in his book *The Conquest of Interplanetary Space*, which was published in Novosibirsk in 1929.[7]

His talent and outstanding abilities as a scientist and researcher become ever more evident, if one takes into account that because of the grave circumstances of his life he tried to get a higher education and thus had developed many points of his own.

Acquainting himself with his manuscripts one cannot but notice how deeply Kondratjuk had penetrated into some problems related to the exploration of interplanetary space and to the development of some kinds of rocket and space technology.

One will also be surprised how deeply Kondratjuk understood the difficulties, which arose on the way to the development rocket and space technology and how right he was in proposing the ways to overcome them.

Suffice it to take a look at an example. It concerns the return of a space craft to the Earth. Many authors of the 1920s considered that the descent of the spacecraft could be implemented by means of the aerodynamic drag in the Earth's atmosphere. But Kondratjuk did not only describe the possibility of the utilization of aerodynamic drag, but he also put forward a specific technical means of implementing this proposal. Another novelty by Kondratjuk was his proposal to accomplish the descent of the spacecraft under a very large angle of attack. In this case the aerodynamic forces produce drag resistance, and the process of the landing is controlled by the slope. It should be underlined that such a technique of landing is common for most of the modern space flights.

Some other deep deliberations by Kondratjuk concerning the development of some directions of rocketry and space science and technology may be cited from his manuscripts. It is worth mentioning his ideas concerning in-flight stabilization by means of a gyroscope, the staggered mutual location of fuel and oxidizer injectors, utilization of the liquid components of fuel for cooling the engine, location of the crew during the acceleration stage, application of space suits and docking units in the course of an exit into open space, application of the forces of gravity of space objects (planets, stars etc.) for orbital correction, establishment of intermediate interplanetary bases, which he proposed to be an artificial satellite of the Moon, but not the Earth, the application of orbital and landing modules more efficiently for reaching the space bodies, and some other proposals.

Kondratjuk's talent revealed itself in other areas of technology. Kondratjuk ranks among those wonderfully gifted persons, who did not graduate from high school and did not get special training, but still developed the outstanding talents of inventors in many areas of human endeavor. Kondratjuk was the author of many inventions and discoveries in the field of elevator equipment, the mechanization of construction works, wind energetics and other areas of engineering knowledge. But the main line of Kondratjuk's research, which made his name immortal and famous forever, was his work in the field of the theoretical foundations of cosmonautics.

Unfortunately, the tragic pages of his biography (which became known only after his death, and after the end of the World War II) did not allow him to be engaged in what he considered the main cause of his life—that is, the problems involved in the exploration of interplanetary space. One can only be sorry that his fate turned out to be so unfortunate.

In the 1930s Kondratjuk was manly engaged in wind energetics. He had developed the plan for a wind electrical station in Crimea. This project got him his first nomination in the appropriate contest, and preparatory work for its implementation was started.

However, with the beginning of the war in June of 1941 Kondratjuk joined a division of the Moscow home guard in the Kiev region and spent several months in combat. At the beginning of 1942 (as the latest data indicate, on February 25, 1942) Kondratjuk died at the front.

A peculiar feature about Kondratjuk was that he belonged to a rather small group of scientists who saw the possibilities and the prospects of cosmonautics even in the first quarter of our century—at a time when a majority of people, including many members of the scientific community, considered the exploration of space as a problem of the distant future.

As for Kondratjuk, he not only focused on the larger perspective of cosmanuatics at the end of the 1910s and the beginning of 1920s, but considered that the essence of his writings could be only by the means of technology available at that time—that is, the technology of the first half of the 20th century. That is why he had considered the problem of space flight as a realistic task, which he faced. He had projected the main stages of the exploration of space and the sequence of their implementation.

Kondratjuk devoted considerable attention to the problem of the expected results of humankind's exploration and the practical use of outer space. In this respect he predicted that "it is the possibility to begin an efficient management of our planet, that should be considered the main element of the great significance of the conquest of the space of the Solar System".[8]

This year it is centennial of Jury Vasiljevich Kondratjuk's birthday. Celebrating this important date we would like once more to honor the memory of this outstanding scientist and man who had lived a complicated and difficult

life, which he devoted to the implementation of the age-old dream of humankind.

References

[1]A. Shargey's birth certificate. Collection of the Institute for the History of Science and Technology.

[2]Personal Papers of Shargey, Aleksandr Ignat'evich. Ibid.

[3]The First Manuscript of Yu. V. Kondratjuk, p.14. Ibid.

[4]Ibid., p.18.

[5]The third manuscript of Yu. V. Kondratjuk, p.1. Collection of the Institute for the History of Science and Technology.

[6]Ibid., p.3.

[7]yu. V. Kondratjuk. *The Conquest of the Interplanetary Space*. Novosibirsk, 1929.

[8]Ibid., p.3.