

EARTH-ORIENTED APPLICATIONS OF SPACE TECHNOLOGY

**VOLUME 2 1982
VOLUME CONTENTS
AND AUTHOR INDEX**



PERGAMON PRESS Oxford · New York · Paris · Frankfurt · Toronto · Sydney

NIKOLAI ALEXEYEVICH RYNIN (1877–1942), SOVIET ASTRONAUTICAL PIONEER: AN AMERICAN APPRECIATION

FRANK H. WINTER

National Air and Space Museum Washington, D.C. 20560, U.S.A.

INTRODUCTION

NIKOLAI ALEXEYEVICH RYNIN is little known outside of his native USSR, save for his masterpiece, a nine volume encyclopedia of spaceflight and the world's first space encyclopedia, *Mezhplanetynie soobsheniya* (*Interplanetary Communications*), published in Moscow and Leningrad from 1928–1932. Fortunately for Western historians of spaceflight, the former historian of the US National Aeronautics and Space Administration (NASA), Dr. Eugene M. Emme, arranged for this work to be translated into English at the suggestion of Derek de Solla Price, Professor of the History of Science and Technology at Yale University. Rynin's books appear as NASA TT's (Technical Translations) F-640 to F-648. They were published from 1970 to 1971 in Jerusalem by the Israeli Program for Scientific Translations [1].

Prior to this time perhaps a handful of copies of this invaluable work existed in the West. During his lifetime Professor Rynin bestowed copies of the original Russian-language editions of the encyclopedia as well as copies of his many other writings to fellow space travel advocates in other countries, such as Willy Ley, the well-known German-born popular writer of the topic. In exchange, Professor Rynin would receive spaceflight literature from his Western contemporaries. In a sense this literature exchange was the first example of East–West space cooperation.

It was by this means also that Rynin's encyclopedia became more well known outside of his country although the man himself and his considerable other accomplishments remained largely hidden. Rynin gave a set of the books to the old Prussian State Library in Berlin (now in the Democratic Republic of Germany) and the work was reviewed by German aeronautical journals like *Der Flug* and *Zeitschrift für Flugtechnik und Motorluftschiffahrt*. Willy Ley also mentioned them in his *Grundriss einer Geschichte der Rakete* (1932) and in subsequent writings [2].

Rynin himself wrote a rare autobiographical sketch which appears in Werner Brügel's *Männer der Rakete* (1933) though this book became very scarce and was not well known outside of Germany. English-speaking Western countries mainly knew of Rynin and his work through the English-language editions of Willy Ley's highly popular *Rockets, Missiles, and Space Travel* and other writings. The encyclopedia was also very thoroughly reviewed, except for the first volume which was unavailable to the reviewer, by G. V. E. Thompson, in a three part article in the *Journal of the British Interplanetary Society* for July and November

and March–April 1956. Because Thompson made such an excellent survey and since the English translations have been available for several years and were also reviewed, it is not necessary to treat the contents of the encyclopedia in any great detail here other than a cursory outline. Rather, the present paper will concentrate upon the career of N. A. Rynin. It is interesting to note in this respect that in his introduction, Thompson wrote that: 'Little is known of the author, Professor Nikolai Alekseyevich Rynin, except that he lived in Leningrad, and was therefore possibly on the staff of Leningrad University. He was one of the leaders of the pre-war Russian rocket Society, Gruppa Izucheniya Reaktivnogo Dvizheniya [GIRD]. Since he was publishing works on descriptive geometry and optics in 1907–8, he must be at least 65–70 years old if still alive today.' When Thompson wrote those words, in 1954, Rynin had been dead for 12 years. He died in Kazan in 1942 aged 65 [3].

EARLY CAREER

Nikolai Alekseyevich Rynin was born on 23 December 1877 in Moscow, the son of a minor official of the War Department. The Rynin family remained there until 1886 when Rynin's father died. The boy with his sister and mother first moved to Tiflis, then in 1887 to Simbursk (later Ulyanovsk). Here he spent eight years and received his secondary education at the Gymnasium. 'My love of mathematics originated [here], 'he later recalled, 'and developed more and more, thanks to the influence of my teacher E. Vilkovsky.' Following graduation at the age of 19 in 1896, Rynin took and passed a competitive examination in order to enter the Institute of Transportation Engineering in St. Petersburg (later, Leningrad). The young man excelled in his studies and graduated in 1901. He was accepted as a graduate engineer with the Nikolayev Railroad and remained with the railroad until 1912 [4].

In the meantime Rynin was such a promising individual that he was sent abroad to advance his studies in engineering and to learn teaching techniques. He visited universities in Norway, Sweden, Denmark, Germany, and the US. Rynin's American travels were extensive enough and fascinating for him that he afterwards wrote a 103 page illustrated paper, entitled *Puteshestvie po Severo-Amerikanskim soyedinennym shtatam* (*Travels Throughout the United States of North America*). This paper was presented at the meeting of the Highway Engineers Society on 28 January 1905 [5].



Fig. 1. Professor Nikolai Alexeyevich Rynin, (1877–1942), Russian astronautical, rocketry pioneer. Prolific writer on rocketry and astronautics, including the first astronautical encyclopedia, *Interplanetary Communications*, 1928–1932; organizer of astronautical societies, such as LenGIRD. From Werner Brügel, *Manner der Rakete* p. 79, Leipzig, (1933).

It was neither Rynin's first publication nor lecture since at the same time he was with the Nikolayev Railroad he was advancing his education and also lecturing at St. Petersburg's Polytechnic Institute as well as the Institute of Transportation Engineering. At first, he concentrated on the fields of civil engineer-

ing and descriptive geometry. In 1902 the Polytechnic Institute published his *Sbornik... orthogonal'nykh proyetsiyakh* (*Collection of... Orthogonal Projections*). He wrote about ice-breaking ships in 1903 (*Ledorezy*; or *Icebreakers*); metal-coating on constructions in 1905; a treatise on descriptive geometry in 1907; and

Dear Mr W. Ley
 In answer of your letter of 20/1/35
 I have the honour to inform you,
 that I do not know anything about
 the construction and flight of the
 100 km. of rocket in U.S.S.R.
 But the calculation of the rocket to
 133 km. of height was made and the
 results were published in the book,
 about which I have written to you.
 (pg. 845) in the foregoing letter.
 There are many scientific institutions
 in U.S.S.R. (about 200). I have seen a
 book with description of these insti-
 tutions, if you want, I can send
 this book to you.

Sincerely yours
 7/6/35 N. Rynin

U.S.S.R.
 Leningrad 104
 Januzskaja Str. 4, Flg. 7.

Fig. 2. Letter from the Soviet aeronautical pioneer, Nikolai Alexeyevich Rynin (1877–1942) to Willy Ley (1906–1969), dated 7 June 1935, regarding an alleged 100 km rocket flight attributed to the Russians. From the Willy Ley Collection, NASM.

a handbook on illumination in buildings in 1908. During his actual work career at this time, Rynin designed buildings, piers and bridges. This work was carried out at St. Petersburg. Rynin was also preparing a dissertation entitled 'The Calculation of Hinged Rings Made of Hard Materials' which was successfully defended in 1909 in the presence of the famous Russian mechanical engineer Ivan Vsevolodovich Meshcherskiy [6].

It would have appeared as if Rynin's career as an engineer and teacher was set, but according to his later biographical sketch, 'I first became interested in aviation in 1907.' Rynin characteristically thrust all of his energy into the new field, voraciously reading and collecting everything he could. In the same year he went to France to see the Aeronautics Exposition at Nancy. From there he hastened to another aeronautical exposition in Frankfurt-am-Main, Germany. In

1909 he went to the very important international aviation meeting in Rheims, France. This was really the first great aviation meeting of history, held from 22 to 29 August of that year, and in which 38 airplanes competed including Curtiss, Wright, Farman, Voisin, Bleriot, and Esnault-Pelterie biplanes. Many of the early aeronautical pioneers themselves were present, including Robert Esnault-Pelterie. It is not known whether Rynin met Esnault-Pelterie at Rheims but years later they corresponded as Esnault-Pelterie, or REP as he was called, also became an eminent astronomical and rocketry as well as an aeronautical pioneer. In fact Rynin presented a set of his encyclopedias to REP who in 1949 donated them to the British Interplanetary Society; those particular volumes were used by G. V. E. Thompson to make his 1954–1956 review of the encyclopedia [7].

Rynin witnessed other aeronautical events in Europe in 1909 and also visited aeronautical institutions and attended conferences. From this period Rynin began to become personally acquainted with many of the world's leading aviation personalities, such as Alexandra Gustav Eiffel of Eiffel Tower fame who also used his considerable engineering talents towards aerodynamic studies; fellow Russian Igor Ivan Sikorsky who afterwards pioneered in the development of the helicopter; Gaetano Crocco of Italy; and Dmitri Ryabushinsky of Russia. The latter two, like Esnault-Pelterie, also subsequently became rocketry pioneers. It is interesting to note how several rocketry or astronomical pioneers, including Rynin, initially got their start in aviation [8].

From 1909 Rynin, with Professor N. N. Mitinsky, helped organize the first All-Russian Aviation Club in St. Petersburg. He also began to teach courses in aeronautics in the Aviation Club which was itself a milestone in the history of aeronautical education in Russia. In the same year Rynin established a Civil Engineering Institute and was the first teacher. It was also through his tireless efforts that an aviation museum was begun here and that an aerodynamic laboratory was erected, including a wind tunnel with which the students could test the aerodynamics efficiency of their airplane, dirigible, and even train designs. The great Nikolai Yegorovich Zhukovsky, or Joukowski as he is known in the West, considered the founder of modern aerodynamics and hydrodynamics, commented very favorably on Rynin's laboratory in his book *Teoriya Aviatsii (Theory of Aviation)*. Professor Zhukovsky noted the 'lively activity' of the laboratory and that 'around it there was formed a student aeronautics club whose members were zealous workers' who, with Rynin, presented papers at All-Russian aviation congresses. Engineer B. Tsirkov summed up Zhukovsky's remarks when he wrote that in effect Rynin was the first Russian to popularize and disseminate aviation in his country. This was a worthy precedent to Rynin's later career as a space-flight popularizer [9].

In the meantime, Rynin began his extensive writings on aviation. In 1910, for example, he authored *Noveyshiye uspekhi vozdukhoplavaniya (Latest Progress in Aeronautics)* and edited *Opredeleniye vysoty poletov i nektoryye meteorologicheskiye nablyudeniya vo vremya 1-oy aviatsionnoy... (Determination of the Altitude of Flights of Aeroplanes and Certain Meteorological Observations During the First Aviation Week in St. Petersburg, 25 May–2 June 1910)*. In 1910–1911 he published *Kurs vozdukhoplavaniya (Course in Aeronautics)*, the first Russian textbook for students. In 1911, for the All-Russian Aviation Club, there appeared *Aeroplan Farmana... (The Farman Aeroplane and the 'Gnome' Engine)* [10].

Nor was Rynin's original love of mathematics forgotten. *Nachertatel'naya geometriya (Descriptive Geometry)* was first published in 1911–1914 with a continuation and expanded version in 1916. In 1913 Rynin wrote on wind pressure on buildings as a result of tests in the Institute of Highway Engineers and in 1914 he produced a series of three related papers: on the effect of wind pressure on bridge girders and other structures; wind resistance encountered by trains in motion; and the function of snow shields on vehicles. These papers, as noted by the American magazine *Aero and Hydro* for 4 July 1914, were presented at the Third Russian Aeronautical Congress in St. Petersburg [11].

Rynin was a man of 'action' too. He was an avid and accomplished aeronaut. He set a Russian balloon altitude record of 6400 m (20,997 ft) in a flight of the balloon 'Vasilii Kornya' during 21–22 September 1910 from St. Petersburg to the Ellola wood, Finland, just to the north of Lake Lagoda. The flight was made with F. I. Odintsov as passenger. Rynin was proud of this feat and described it fully in Volume 6 of his *Interplanetary Flight* encyclopedia; this volume covers 'Superaviation and Superartillery.' The flight is also treated in detail in *Vozdukhoplavaniya* for June 1911. In 1911 Rynin flew in the airships *Sokol*, *Lebed*, *Astra*, *Golub*, *Duks*, *Yastreb*, and *Tseppelin*. Later, he obtained a pilot's license. By 1914 he was experienced enough to be asked to participate in the summer tests that year of the world's first 4-engine bomber, the famous *Il'ya Muromets*, designed by Igor Sikorsky. This is apparently how he met Sikorsky [12].

Rynin was also one of the first Russians to present a paper at an international aeronautical meeting. In 1911 he came to Italy to read his report 'On Testing Propellers' at the Fifth International Aeronautical Congress. The paper was so well received that the organizational committee invited him to read another paper which was subsequently presented in 1913 in Ghent, Belgium. Following this particular congress, Rynin journeyed to England where he visited the Teddington Aerodynamic Laboratory. He then went to Paris where he assisted Alexandre Gustave Eiffel in his aerodynamic experiments [13].

In 1916 Rynin was appointed Professor of Descriptive Geometry at the St. Petersburg Institute of Transportation Engineering and in 1920 he organized a Department of Air Communications there. In the following year he was made professor of that Department [14].

EARLY ASTRONAUTICAL WORK TO 1930

Rynin dates his interest in rockets to 1917 as he was then concerned with an ever more 'rapid means of transportation.' This inevitably 'led me to the problems of interplanetary communication,' he later wrote.

In actuality there are different accounts of how Rynin began his interplanetary flight studies. In his autobiographical sketch he says that during his infancy 'I was already very fond of fireworks, and particularly of rockets. ... When a student at the Gymnasium, I prepared powder rockets by myself. But, I became acquainted with the theory of this problem in 1903 only when K. E. Tsiolkovsky's work *Investigations of Space by Means of Reactive Devices* happened to come into my possession. My systematic occupation with the rocket problem and with the theory of spaceflight date, however, from 1917 only, when I had to straighten out my library which consists of books on aviation and which now [1933] includes more than 6000 titles. While examining some of those books, I found several papers that were concerned with the problems of rockets and of communication with the planets, such as the works of Professor I [van Vsevolodovich] Meshchersky, [Dmitri] Ryabushinsky, N. Dshukovsky *et al.* I began studying their work and to systematize the existing material. At the same time I succeeded in obtaining the classical works of Esnault-Pelterie, Goddard, Oberth, Hohmann, and other specialists of reactive propulsion from foreign countries. Later, news concerning practical work and experiments with rockets of [Max] Valier, [Fritz von] Opel, [Fritz] Stamer and [Hermann] Oberth *et al.* reached Russia. All that gave me the idea of revising and editing the collected material in a series of books since books on interplanetary communication were practically non-existent in Russia [15].

In Engineer B. Tsirkov's account of the life of Rynin, there is another version of how Rynin began his astronautical investigations. Tsirkov says that Rynin read Tsiolkovsky's classic paper, cited above, at the end of 1915 and that it had made an enormous impression on him. Tsirkov also says that Rynin had already been acquainted with Tsiolkovsky earlier when the two corresponded with each other from 1911. Tsirkov also adds that the two actually met each other at the Third All-Russian Aeronautical Congress which was held in May, 1914 at the Civil Engineering Institute. However, Rynin did not mention this earlier correspondence nor the alleged meeting in Vol. 7 of his encyclopedia which is titled 'K. E. Tsiolkovsky Life, Writings, and Rockets.' Moreover, he clearly stated in his 1933 autobiographical sketch, as quoted above, that he read the Tsiolkovsky book in 1917 and in the same year began his systematic study of the interplanetary problem [16].

It took Professor Rynin 11 years of collecting and organizing his material from 1917 until the appearance of the first volume of his encyclopedia in 1928. At first, there was little he could publish in a preliminary way as there was so little or accessible data available. As early as 1918, however, he did write a review of the 1881 reaction-powered flying machine of Nikolai Ivanovich Kibaltchich. Kibaltchich, who had made the bomb which assassinated Tsar Alexander II, drafted his concepts of rocket propulsion while in prison. Kibaltchich's notes remained hidden in the secret police archives for almost 40 years. Rynin's commentary of the Kibaltchich project, along with an introduction by P. Shchegolev, appears in the journal *Byloe (The Past)* for October–November 1918. Rynin also expressed his own ideas of interplanetary flight in

his fantasy novel *V Vozdushnom okeane (In the Aerial Ocean)*, published in Moscow in 1924. In Volume 2 ('Spacecraft in Science Fiction') and elsewhere in his encyclopedia Rynin alluded to his fictional electromagnetic 'radio ship' which was to go to the Moon by electromagnetic waves transmitted from powerful stations set up on Earth; the stations were to transmit either positive or negative magnetic forces. Theoretically this scheme would work but requires enormous amounts of energy. It is far-fetched from our perspective but does show Rynin's visionary imagination at a time when the rocket was nothing more than a firework [17].

As the literature of space travel increased, particularly as the works of Tsiolkovsky, Fridrikh Tsander, Oberth, Goddard, and Esnault-Pelterie became more well known in the USSR, there emerged many space travel enthusiasts who were bound to unite into clubs and societies. Professor Rynin soon became one of the best known and most ardent supporters of this new space travel movement and was himself responsible for establishing one of its earliest organizations. He appears to have included the subject of interplanetary flight amongst his regular lectures at the Department of Air Communications of the Institute of Transportation Engineering, particularly from the late 1920s. In 1927 the Leningrad branch of the All-Union Association invited him to present a talk on 'interplanetary communications' and from this period he began his more extensive writings in the field of space travel and all aspects of rocketry which culminated in his encyclopedia. In January 1928, for example, his article 'Reaktivnaya bomba' ('The Rocket Bomb') appeared in the magazine *Voyna i Tekhnika (War and Technology)*. In February 1928 the journal *Vestnik Znaniya (Herald of Knowledge)* carried his article 'O mezhpλανetnykh soobscheniyakh' ('On Interplanetary Travel') while a little later in the year the same journal printed his report on the rocket-propelled car of the German experimenter Fritz von Opel. In the following year Rynin described space stations in his article 'Kosmicheskaya observatoriya' ('Space Observatory') in *Mir Prikluchenii (World of Adventures)*. This article was based on the book by the Austrian pioneer Hermann Noordung, *Das Problem der Befahrung des Weltraums (The Problem of Travelling into Outer Space)* which had just been published. Rynin's article is indicative of how well informed he was of the latest developments in the world's astronautical literature besides rocketry experiments. It is likely that he wrote to or attempted to correspond with Noordung [18].

Rynin's organizational activities in astronautics, or 'cosmonautics', as the new science came to be called, began in 1928. In the Fall of that year he created a 'Department of Interplanetary Travel' at the Leningrad Institute of Transportation Engineers just as he had set up a Department of Air Communications eight years earlier here when the institute was then known as the St. Petersburg Institute of Engineering. He was named Chairman of the new Interplanetary Travel Department which must have been the world's first educational body devoted to this subject. K. E. Veiglin and Yakov Issodorovich Perelman, both of whom shared with Rynin the distinction of being amongst the earliest writers of space travel concepts, were designated as Rynin's assistants. Perelman was,

like Rynin, particularly well known as a popularizer of space travel, even in the West. In 1929, Rynin's Department undertook modest experiments with small pyrotechnical rockets with the intent of eventually constructing 'stratospheric' vehicles, or rockets capable of ascending to 100 km (62 miles). Liquid-fuel systems were also planned. Also in 1929, Rynin expressed hopes for an international research institute of interplanetary travel. This latter desire was doubtless an influence of Rynin's earlier participation in international aeronautical organizations. However, neither the stratospheric rockets nor the international space travel institute came about, mainly because of a money shortage, according to Rynin, and also because of 'the complex problems involved' and 'pressing academic duties.' [19]

For much the same reasons, the first space travel organization in the USSR and perhaps the world also prematurely ended soon after its formation in 1924. This was the *Obschestvo po Izutcheniya Mezplanetarykh Soobschenii*, or Society for the Study of Interplanetary Communication, also known as OIMS. This group was started on the initiative of the Soviet rocket pioneer Fridrikh Tsander and was based in Moscow. It is not known if Rynin was a corresponding member though he was certainly aware of it as this organization is described in Volume 1 and 9 of his encyclopedia. In any event, it lasted less than a year. Rynin's later involvement in the formation of another space travel group, the Leningradskaya Gruppya po Izutcheniyu Reaktivnogo Dvizhenia (Leningrad Group for the Study of Reactive Motion, or LenGIRD) was much more successful than either OIMS or Rynin's Department of Interplanetary Travel but by that time anyway (1931) there was much more general support for the space travel dream and for the development of the rocket [20].

Besides propagandizing, teaching, and encouraging the organization of space travel groups, Rynin also worked towards the space travel goal through some most interesting biological experiments carried out in the Spring and Summer of 1930 in the Scientific Research Bureau of the Institute of Civil Aviation in Leningrad. These experiments are well covered in a separate paper in Volume 8 of Rynin's encyclopedia as well as in Bulletin No. 1 of the Institut Grazhdanskogo Vozdushnogo Flota (Institute of the Civil Aviation Fleet). This article, written with one of the principal participants of the experiments, the physician Professor A. A. Likhachev, was also separately printed as an offprint in 1931 and entitled *Effekt uskoreniya na zhivye organizmy* (*Effect of Acceleration on Living Organisms*). Rynin built two centrifuges for the experiments, one with a radius of 1 m (3.28 ft) which could spin up to 300 r.p.m. while the other had a radius of 0.32 m (1 ft) which could revolve up to 2800 r.p.m. Accelerations of 100 and 2800 *g* were thus obtained, respectively. Smaller animals and also raw chicken's eggs were tested in the smaller centrifuge while larger animals were placed in the larger machine. Different kinds of insects (cockroaches and flies), carp fish (in water and out water) frogs, birds (siskins, pigeons and crows), mice and rats, rabbits, and cats were subjected to systematic testing on the centrifuges and were afterwards examined by a team of physicians under the direction of Professor Likha-

chev. The doctors were M. M. Likhachev, V. M. Karasik, A. M. Vasil'ev and A. A. Sergeev. Amongst some of the conclusions reached were that the smaller animals withstood far greater accelerations than the larger animals; the animals could endure the effects of acceleration if cushioned or placed in a certain position in the chambers; and the duration of acceleration was a key factor in the effects of the acceleration. As noted by the reviewer of Rynin's encyclopedia G. V. E. Thompson, writing in 1956, the experiments 'have relevance both now and in the future of astronautics. . . They gave useful material for when the time came to construct much larger centrifugal machines for use in experiments with human beings. Such machines have, of course, since then been constructed and used in many countries [21].'

The crowning achievement of Rynin's astronautical work during the late 1920's to early 30's was unquestionably his encyclopedia. Published from 1928 to 1932 in Leningrad largely at his own expense, the work consists of nine volumes:

- I. *Mechty, legendy i pervye fantazii* (*Dreams, Legends, and Early Fantasies*). (1928). 110 pages, 82 figures. 2000 copies printed.
- II. *Kosmicheskie Korabli* (*Cosmic Ships*). (1928). 160 pages, 164 figures. 15,000 copies printed.
- III. *Luchistaya energiya v fantazirakh romanistov i v proektakh uchenykh* (*Radiant Energy in Science Fiction and in Scientific Projects*). 1931. 153 pages, 65 figures. 1000 copies printed.
- IV. *Rakety* (*Rockets*) (1929). 216 pages, 186 plates. 800 copies printed.
- V. *Teoriya reaktivnogo dvizheniya* (*Theory of Reactive Propulsion*). (1929) 64 pages, 22 figures. Copies printed, unknown.
- VI. *Superaviatsiya i superartilleriya* (*Superaviation and Superartillery*). (1929). 218 pages, 200 figures. 1200 copies printed.
- VII. *K. E. Tsiolkovskii, ego zhizn', raboty i rakety* (*K. E. Tsiolkovskii (Life, Writings, and Rockets)*). (1931) 112 pages, 34 figures. 1000 copies printed.
- VIII. *Teoriya Kosmicheskogo polete* (*Theory of Cosmic Flight*). (1932) 358 pages, 123 figures. 1000 copies printed.
- IX. *Astronavigatsiya, letopis' i bibliografiya* (*Astronavigation, Chronicle and Bibliography*). (1932) 358 pages, 123 figures. 1000 copies printed [22].

It is noted that Volumes IV, V and VI were printed earlier than Volume III. This is because, as explained by Thompson, 'Rynin's conception of the work changed as it progressed.' The nine books were actually issued in the order of I, II, IV, V, VI, III, VII, VIII, and IX. Some of the changes in publication plans were no doubt due to the great amount of progress made in astronautical theory by 1930 and also in the development of rocket technology. Rynin also mentioned that publication dates were uncertain because of 'financial reasons.' In the final volume of the work, Rynin acknowledged that he had not only received—and translated for the first time into Russian—the writings of Oberth, Walter Hohmann, Willy Ley, Esnault-Pelterie, Robert Goddard, but he had also benefited from contributions by more than 300 readers 'from remote parts of the USSR, supplying remarks and additions and often describing their



Fig. 3. Title page, N. A. Rynin's *Interplanetary Flight*, Vol. I, No. 1, *Dreams, Legends, and Early Fantasies*, Leningrad (1928).

own valuable and interesting researches in the field of rocket propulsion and the history of interplanetary travel.' Rynin was particularly indebted to Tsiolkovsky, the patriarch of cosmonautics in the USSR. Tsiolkovsky's letter of June 11, 1926 in which he

enclosed his autobiographical sketch, was proudly published in Volume 7 which specifically deals with Tsiolkovsky and which was planned by Rynin to appear on the pioneer's 75th birthday. It was, however, published a year earlier [23].

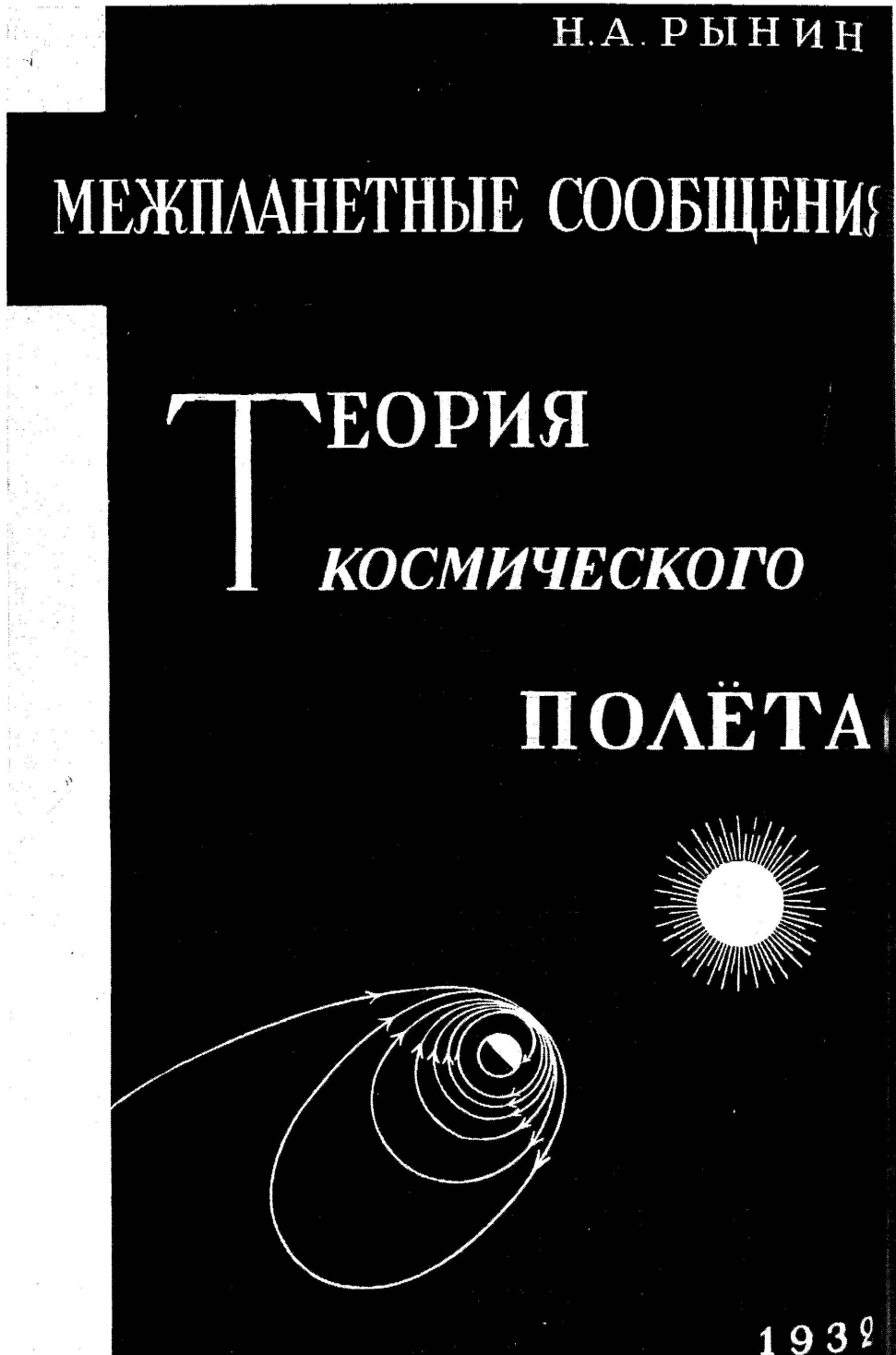


Fig. 4. Title page, N. A. Rynin's *Interplanetary Flight and Communication*, Vol. III, No. 8, *Theory of Space Flight*, Leningrad (1932).

In his own autobiographical sketch written in 1933, Rynin specifically pointed out that 'the main result of my theoretical work' (in the encyclopedia) 'was the determination of rocket weight for various rates of climb and types of fuel. In addition, I determined the

effect of the starting place of the rocket and of the direction of the landing flight. For a more precise determination of the trajectory of a space rocket, I constructed—with the aid of astronomical tables in orthogonal projection, in accordance with the rules of

descriptive geometry—the trajectories of all planets of the solar system and of the principal comets and asteroids.’ Rynin’s trajectory studies appear in Volume 9. Another important theoretical contribution to the literature is Rynin’s own interpretations of the theory of reactive motion which is mainly contained in Volume V, which also brings together the theories of other pioneers up to that time. This volume was considered significant enough that it was reprinted as paper No. 101 in the *Sbornik Instituta Leningradskii Inzhenerov Putei Sooshcheniya (Proceedings of the Leningrad Institute of Transportation Engineers)* in 1929. Single offprints were also available [24].

Generally, all of the reviews of Rynin’s masterpiece have been highly favorable, both in Rynin’s day and in our own time. G. V. E. Thompson writing in 1956, for example, concluded that Rynin’s work ‘certainly represents a great achievement, whether one is considering it as a statement of the position reached by aeronautical studies in the 1930’s or as a bulky literary work. As an encyclopedia of astronautics it is still quite unchallenged.’ Colin A. Ronan, writing in the *Journal of the British Astronomical Association* for August 1973 on the publication of NASA’s English language translations of the work, commented: ‘This is an important history that is itself of historical significance, and NASA is to be congratulated on the foresight to do this, and the wisdom to give libraries at least to buy complete and so take advantage of a variable example of NASA’s responsible attitude to the history of the notable aspect of modern technology that is vital to astronomy today.’ Robert W. E. Lademann, writing in *Luftfahrt (Air Travel)* for 22 February 1929, said of Volume II, then released; ‘It is regrettable that this work is not written in German [25]!’

Willy Ley, however, later recalled that not only did he get copies but that Rynin ‘also mailed sets of his work to Professor Oberth ‘and to Vienna’, the latter meaning either Dr. Franz von Hoefft... or Baron von Pirquet; possibly both. I knew that he sent one to Robert-Pelterie. I had a second but incomplete set, received from Dr. Yakov I. Parelman, which I passed on to a young and enthusiastic member of the VfR [the German Rocket Society which ceased in 1933] who intended to become the Society’s librarian. I don’t know what happened to it.’ Ley also mentioned that a set was sent to the Prussian State Library and to the old (pre Second World War) Bibliothek für Wehrwissenschaften (Library of the German Army). The German space travel popularizer, Werner Brügel, who included Rynin’s biographical sketch in his *Männer der Raketen* of 1933 also got copies as did the German experimenter Rolf Engel. In France a set was sent to Alexandre Ananoff, the Russian-born pioneer living and working in that country since 1920s. Ananoff in turn presented the books to the American aeronautical writer, Frederick I. Ordway, III, who during the 1950s was studying at the Sorbonne in Paris. Years later, when NASA authorized the English translation of the encyclopedia, it used the incomplete set of Willy Ley—these had been deposited with other books of Ley’s library of the University of Alabama. In order to fill in the gaps, Ordway who was then a professor at the University, supplied the missing

volumes which came from his set originally given to him by Ananoff. Still other sets of the encyclopedia were bestowed upon the British Interplanetary Society when it was formed in 1933, but this set was incomplete. The Royal Aeronautical Society in London also received a set. It also appears from the published correspondence from Rynin to Robert H. Goddard that the American pioneer also got the encyclopedias, especially as the American had furnished the Russian with biographical data for use in the books [26].

LATER WORK IN AERONAUTICS

All the while as Rynin was pursuing his aeronautical endeavors, he was still very much involved with aviation. Often the two fields overlapped. On 30 March 1927, for instance, a letter was written to Rynin from the Bureau for the Promotion of Inventions of the Supreme Council of the National Economy of the USSR requesting his judgement on the metal dirigible of the aeronautical pioneer he admired so much, Konstantin E. Tsiolkovsky. He was also asked to report whether the airship designed by the great aeronautical pioneer was suitable for official adoption by the Government. He responded with a positive report in which Rynin also stated ‘I believe that he [Tsiolkovsky] should long ago have been granted support in his further experiments.’ Rynin both revered and championed Tsiolkovsky and his ideas. The old pioneer clearly recognized this. ‘You... were the first to support my efforts,’ Tsiolkovsky told Rynin. ‘I, in fact, owe the most to you, to your writings, sacrifices, and boldness [27].’

In the early 1920s Rynin performed invaluable aeronautical service in helping to lay out the Soviet Union’s domestic air routes from the city of Rybinsk to Ul’yanov and from Rostov to Moscow. He also flew in a Fokker F.3 airplane to investigate the Moscow to Königsberg, Germany (now, Kaliningrad, USSR), route which also took him to Berlin and Potsdam. As a result of this work, the Soviet Union initiated its first international route. In 1931 Professor Rynin’s career was further enhanced when he was named Chairman of the greatly expanded Department of Air Communications of the Leningrad Institute which now became the Institute of Transportation Engineers. Rynin was also elected a member of the Institute’s Academic Council [28].

Throughout his career Rynin habitually kept abreast of the latest aeronautical developments. He also perennially wrote on aviation as well as space travel topics. These works ranged from his *Izmeritel'naya perspektiva i yeye primeniye v aerofotografii (Measurement Perspective and its Application on Aerophotography)*, published in Petrograd in 1918 and *Kino-perspektiva i yeye primeniye v aviatsii (Kino-Perspective and its Application in Aviation)*, printed in Leningrad in 1932, to *Zavoyevaniye stratosfery. K poletam sov. aerostatov v stratosferu (Conquest to the Stratosphere. Towards Flights of Soviet Aerostats into the Stratosphere)* and *V Stratosferu! (Into the Stratosphere!)*, published in Leningrad and Moscow in 1933 and 1934, respectively. The latter books were essentially about the Russian stratospheric balloon flight flown on 30 September 1933 by G. Prokofiev, F. Godu-

nov, and E. Birnbaum to an altitude of 60,695 ft (18,499 m) [29].

As a former balloonist himself, the stratospheric leap of the balloon USSR and other flights excited Rynin very much. He was led to present the paper 'Metody osvoeniya stratosfery' ('Methods of Mastering of the Stratosphere') which was read at the First All-Union Conference on the 'Study of the Stratosphere,' held in Leningrad from 31 March to 6 April 1934. The proceedings were afterwards published by the USSR Academy of Science (Akademii Nauk SSSR) as *Trudy Vsesoyuznoi Konferentsii po Izucheniyu Stratosfery (Proceedings of the All-Union Conference of the Study of the Stratosphere, Leningrad and Moscow, 1935)*. Rynin's paper was also published in Italian in the July 1934 issue of the aviation magazine *L'Aerotecnica*. It is interesting that at the same conference Professor A. A. Likhachev of the 1st Leningrad Medical Institute also presented a paper. This was on the biological experiments he had performed with Rynin on Rynin's centrifuges four years earlier. Also present and listening intently was Sergei P. Korolev, future Chief Spaceship Designer of the USSR [30].

It was perhaps because Rynin's paper appeared in *L'Aerotecnica* that the Italian rocketry pioneer Gaetano Crocco invited Rynin to give a paper at the important Fifth Volta Congress of High Speed Flight, held in Rome, from 30 September to 6 October 1935. But General Crocco had apparently already known of Rynin several years before as Crocco's theories on what he termed 'superaviation,' or high-altitude, high speed aircraft flight are well treated in Rynin's encyclopedia, particularly in Volume 6 which was largely devoted to aeronautics and is entitled *Superaviation and Superartillery* (1929). Professor Rynin, however, did not attend the Volta Congress. Instead, his paper, 'Propulsione a reazione senza utilizzazione dell'aria esterna' ('Reaction Propulsion without Utilizing Air'), was read by Crocco. An abstract of the paper appears in *L'Aerotecnica*, for September–October 1935, and was also published separately by the sponsor of the conference, the Reale Accademia d'Italia (The Royal Italian Academy), in 1935 [31].

Rynin's last major writing on aviation appears to have been his textbook *Proyektirovaniye vozdushnykh soobshcheniy (Design of Air Travel)*, published in 1937, though he also completed both a history and textbook on descriptive geometry in 1939. About 1941, not long before he died, Rynin also wrote a monograph entitled *Zavoyevaniye neba (Conquering the Sky)* [32].

LATER ASTRONAUTICAL WORK FROM 1930

Even before his space travel encyclopedia was complete, Professor Rynin had achieved considerable fame in his own country as an indefatigable and prolific worker in the cause of aeronautics, though he tended to travel less during the 1930s period than previously. It was therefore a rare and honored occasion when he did pay a visit to Moscow to deliver a major lecture illustrated with many slides before the Air Force Academy of the Soviet Union on 28 November 1931 on 'Reaction Propulsion [33].'

However, that very same month a much more important event took place. The famous LenGIRD

(Leningradskaya Gruppya po Izutcheniyu Reaktivnogo Dvizheniya), or Leningrad Group for the Study of Reactive Motion, was formed. The idea for an organization in which dedicated enthusiasts could pool their talents to solve the great technical problems of perfecting a rocket for the conquest of the stratosphere and then outer space was not a new concept. Already, as mentioned earlier, the Society for the Study of Interplanetary Communication (OIMS) was created as early as 1924 but quickly became defunct before the year's end. A MosGIRD (Moscow Group for the Study of Reactive Motion) was started officially on August 18, 1931 upon the initiation of Fridrikh A. Tsander and Sergei P. Korolev and with similar groups became much more viable. Through the aegis of the OSOVIAKHIM (Society for Assisting the Defense and Aviation and Chemical Construction in the USSR) other branches soon sprung up at Leningrad, Kharkov, Kiev, Tiflis, and more remote places. 'These groups,' wrote Rynin in 1933, 'have hundreds of members in every city.' Rynin was one of the principal organizers of the Leningrad branch. The other organizers were the space travel popularizer Yakov Perelman and Vladimir Vasilyevich Razumov, then a newly graduated engineer who had worked in the Kronstadt shipyards, and another engineer by the name of M. V. Gazhala [34].

Actually, LenGIRD was formed quite independently of MosGIRD but became a branch of the latter. Thirty years after these events, V. V. Razumov recalled that the end of March, 1931, 'I was with Rynin, discussing with him the calculation of rocket flight by a method which I had proposed, and casually mentioned to him that I had entered with the Osoviakhim and would be working in an unofficial way on rockets with the Bureau of Air Technology. Rynin responded with the fact that he had also spoken with the Osoviakhim on this question and that he, Gazhala and Perelman had joined together to participate in this work. Many times we gathered either at Rynin's or at my place to discuss at length, present propositions, and draw up plans regarding the development of work on rockets and the prospects of interplanetary communication. Thus was created the pioneer groups for studying reactive propulsion at the Leningrad Osoviakhim comprised of Rynin, myself, Gazhala and Perelman [35].'

Razumov was named Chairman of the new organization, Perelman Vice-Chairman, and Rynin was Director of Publicity. This was a natural extension of what he had already been accomplishing on his own. But it was no less an important task, for apart from building rockets, the group activity sought to educate the general public and also the scientific community on the potential of the rocket and the possibilities of spaceflight. Before the Second World War, LenGIRD built and flew several rockets, though it is not known if Rynin also played a role. In any case, according to Rynin, writing in 1933: 'The propaganda for and the development of the idea of space flight have turned out to be the principal mission of GIRD.' To reach this aim, for which Rynin was largely responsible, several broad programs were organized, including: popular public lectures which featured demonstrations, drawings, slides, and so on; seminars, consisting of some for a relatively uneducated audience

such as workers and secondary school students, and other seminars for more technically trained or professional people. Systematic courses were also arranged for students at technical universities; specialized treatises were published, including several of Rynin's writings; and newspaper and magazine articles were written to further draw public interest [36].

It is an interesting and hitherto little known fact that prior to Rynin's association with LenGIRD he was already associated with space travel societies in the West. Rynin, the internationalist who early advocated an international space travel organization, donated money to the German Rocket Society, according to donor lists in the Society's journal *Die Rakete (The Rocket)*, as early as 1929. Also, by January 1931 he was corresponding with Noel Deisch of the American Interplanetary Society (later called the American Rocket Society). It was through Deisch, who had won an honorary mention in the first REP-Hirsch Prize of Astronautics in 1928 for his paper 'The Navigation of Space,' that Rynin was introduced to *The Bulletin of the American Interplanetary Society*. Deisch, who was then living in Washington, D.C., arranged for Rynin to receive a subscription to the magazine which was published in New York. Deisch also led Rynin to become an honorary member of the American Interplanetary Society. Later, Rynin was similarly named an honorary member of the British Interplanetary Society after it was formed in 1933 [37].

In the Soviet Union, Rynin's name became more intimately linked with that of his idol Konstantin Tsiolkovsky when, on 17 October 1932, Rynin was one of the main speakers on the celebration of the 75th anniversary of Tsiolkovsky's birth. Rynin's words must have touched many. Earlier, he had told Tsiolkovsky, '... Your generous heart will be valued by posterity... Your beautiful works and the nobility of your feelings will make your name immortal.' Perhaps the same could have been said of Rynin. Through his 255 articles and books on several different topics throughout his lifetime, his many years of devoted teaching, and his passionate lectures on spaceflight, Rynin must have influenced literally thousands. This was a generosity too as he gave of himself to a noble cause, the enlightenment of mankind [38].

In July, 1942 Nikolai Alekseyevich Rynin, along with many other Leningraders, was evacuated from the city under siege by the invading Germans. He was now seriously ill. Soviet military pilots transported him to Yoshkar-Ola and from there to the hospital in the ancient city of Kazan, more than 700 miles (1126 km) east of his beloved Leningrad. Where many years before he would have delighted in such an aerial adventure, now this plane trip was apparently too arduous for his failing health. Rynin died of lung cancer at Kazan on 28 July 1942 and was buried with military honors in the Arsk Cemetery [39].

Rynin was hardly forgotten. Not long after the war, according to a lengthy tributary article in *Pravda* on the 100th anniversary of the birth of Rynin, in December 1977, a young man knocked at the front door of No. 4 Zhukovskaya Street in Leningrad where the Professor had lived since 1932. A woman answered but informed the young man that the Pro-

fessor had passed away. The young man who had been so much inspired by the Professor was identified as Georgi Grechko, the future cosmonaut of Soyuz 6 and Soyuz 26 and who had lived in space aboard the space station Salyut 4 and Salyut 6. Still another young man influenced by Rynin and in fact who studied under him was B. V. Raushenbakh, an early GIRD member, co-worker of Sergei P. Korolev, and later an academician and supervisor of the control systems for the Soviet Union's first spacecraft that reached the Moon, the Luna series [40].

Surely the greatest remembrance and monument to the works of Rynin was the immortality bestowed upon him by the International Astronomical Union. They named a crater on the far side of the Moon in his honor [41].

REFERENCES

- [1] Interview, Dr. Eugene M. Emme, 15 July 1981.
- [2] Willy Ley, A famous Russian encyclopaedia on Astronautics, *J. Br. interplanet. Soc.* **13**, 362-363 (1954); *Grundriss einer Geschichte der Rakete* p. 15, Hachmeister & Thal: Berlin, (1932) Buchbesprechung. *Der Flug*, 10 Jahrg., Nr. 4, 140 (April 1928); *Z. Flugtech. Motorluftschiff*. 20 Jahrg., 7 Heft 174 (1929).
- [3] N. A. Rynin, Professor Nicolai Alekseyewitsch [sic] Rynin, in (Werner Brügel, ed.) *Männer der Rakete* pp. 79-85. Hachmeister & Thal: Leipzig, (1933); G. V. E. Thompson, A famous Russian encyclopaedia [sic] of astronautics—1, *J. Br. interplanet. Soc.* **13**, 193-202 (1954); part 2 in 301-302 (1954) and part 3 in **15** 82-91 (1956); T. F. Mackenzie, book review, *Interplanetary flight and communication, Spaceflight* **15**, 478 (1973); Colin A. Ronan, *Interplanetary flight and communication, J. Br. astr. Ass.* **83**, 390-392 (1973).
- [4] B. Tsirkov, Pilot, ucheiniy, populyarizator, *Aviatsiya i Kosmonavtika*, Nr. 6: 22-23 (1968); Rynin, 'Professor,' 79.
- [5] Bibliographic list of works by N. A. Rynin provided to the author by E. O. Mayo-Znak, Section Head, Information and Bibliographic Section, The Lenin Library, Moscow, 26 Nov. 1976; Tsirkov, 22.
- [6] Bibliographic list; Tsirkov, 22.
- [7] Tsirkov, 22; Rynin, Professor, 80; Charles Harvard Gibbs-Smith, *Aviation An Historical Survey* p. 145 HMSO: London, (1970), Thompson, *J. Br. interplanet. Soc.* **13**, 194 (1954).
- [8] Tsirkov, 23; Rynin, Professor, 80.
- [9] Tsirkov, 23.
- [10] Bibliographic list.
- [11] *Aero and Hydro* **8**, 168 (1914).
- [12] N. A. Rynin, *Interplanetary Flight and Communication* Israeli Program for Scientific Translations: Jerusalem (1971), Vol. II, Nr. 6 (NASA TT F-645), 172-174; Tsirkov, 23; N. A. Rynin, *Vserossiskii prazdnik vozdukhoplavaniya, Vozdukhoplavaniya* 376-389 (1911).
- [13] Tsirkov, 23.
- [14] Rynin, Professor, 80.
- [15] *Ibid*, 80-81.
- [16] Rynin, *Interplanetary Flight*, Vol. II, Nr. 4 (NASA TT F-643), 36-43, and Vol. I, Nr. 2 (TT F-641), 95-96.
- [17] Tsirkov, 22; Willy Ley, *Rockets, Missiles, and Space Travel*, p. 91. The Viking Press, New York (1959).
- [18] Tsirkov, 23-24; Bibliographic list.
- [19] Rynin, *Interplanetary Flight*, Vol. III, Nr. 9 (NASA TT F-648), 3, 177; G. V. Petrovich, *Development of Rocket Engineering in the USSR* p. 13. (no publisher, no date).

- [20] Rynin, *Interplanetary Flight*, Vol. I, Nr. 1 (NASA TT F-640), 18–19, and Vol. III, Nr. 9 (NASA TT F-648), 3.
- [21] *Ibid.*, Vol. III, Nr. 9 (NASA TT F-648), 173, and Vol. III, Nr. 8 (NASA TT F-647), 337–340; Thompson, *J. Br. interplanet. Soc.* 15, 87–88 (1956).
- [22] Thompson, *op. cit.*, 90; the NASA translations of Rynin's encyclopedia.
- [23] *Ibid.*; Rynin, *Interplanetary Flight*, Vol. III, Nr. 9 (NASA TT F-648), 3–4, and Vol. III, Nr. 7 (NASA TT F-646), v. 2.
- [24] Rynin, Professor 82; Thompson *J. Br. interplanet. Soc.* 13, 301 (1954); Rynin, *Interplanetary Flight* Vol. III, Nr. 9 (NASA TT F-648), p. 172.
- [25] Thompson *J. Br. interplanet. Soc.* 90 (1956); Ronan, *Interplanetary Flight and Communication*, p. 391; Robert W. E. Lademann, *Die Raumschiffahrt in der zeitgenössischen Belletristik, Luftfahrt. XXXIII Jahrg.*, 64 (1929).
- [26] Ley, A famous 362–363; Interview, Frederick I. Ordway, III, 21 July 1981; *J. Br. interplanet. Soc.* 15, 292 (1956); Esther C. Goddard and G. Edward Pendray *The Papers of Robert H. Goddard* Vol. I, pp. 575, 577, 583, 585, 607, 608. McGraw-Hill; New York. (1970).
- [27] Tsirkov, 25–26.
- [28] *Ibid.*, 23.
- [29] Bibliographic list.
- [30] F. J. Krieger, *Behind the Sputniks* (Public Affairs Press: Washington, D.C., 1958), 353; N. A. Rinin [sic], La conquista della stratosfera. 1° congresso dei Sovieti per lo studio stratosfera. *L'Aerotecnica*, Vol. XIV, July 1934: 876–891; Yaroslav Golovanov, *Sergei Korolev The Apprenticeship of a Space Pioneer* (Mir Publishers: Moscow, 1975), 282–284.
- [31] Letter, Alfred Bussemann to Frederick C. Durant, III, 7 Nov. 1974. copy in N. A. Rynin file, Library, National Air and Space Museum, Washington, D.C.; N. A. Rinin [sic], 'Propulsione a reazione senza utilizzazione dell'aria estera. *L'Aerotecnica*, Vol. XV, Sept.–Oct. 1935: 912–914; Ley, *Rockets*, 509.
- [32] Bibliographic list; Tsirkov, 26.
- [33] Golovanov, 244.
- [34] Moscow Group for Study of Reactive Motion and Razumov, Vladimir Vasilyevich, In Prof. G. V. Petrovich, ed., *The Soviet Encyclopedia of Space Flight* (Mir Publishers: Moscow (1969) pp. 270 and 333; Rynin, "Professor," 85.
- [35] V. V. Razumov, From the History of the Leningrad Group for the Study of Jet Propulsion (LENGSJP), [sic], in USAF Systems Command, Foreign Technology Division, *From the History of Aviation and Cosmonautics (Collection of Articles)*, FTD-HT-23-1233-68, 20.
- [36] N. A. Rynin, Die GIRD, in Werner Brügel, *Männer der Rakete*, pp. 138–139; 'Leningrad Group for Study of Reactive Motion.' in Prof. G. V. Petrovich, *The Soviet Encyclopedia*, pp. 217–218.
- [37] Frank H. Winter, Birth of the VFR: The start of modern astronautics. *Spaceflight* 19, 247 (1977); John Noel Deisch file, Library, National Air and Space Museum, Washington, D.C.
- [38] Tsirkov, 26, 24, 22.
- [39] *Ibid.*, 26.
- [40] Avtor 'Mezhplanetnye soobsheniya' k 100-letino so dyna rozhdennya N. Rynina. *Pravda*, 2 Dec. 1977; Interview, Dr. Eugene M. Emme.
- [41] Rynin, Nikolai Alexeyevich, in Prof. G. V. Petrov, ed., *The Soviet Encyclopedia*, 36.