

Alexander A. Nikolsky

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THE life history of Alexander A. Nikolsky (Fig. 1), whose early years could pose as a theme for an interesting adventure novel, is well summarized in the following biographical sketch issued by Princeton University after his untimely death in 1963.

"Alexander Alexandrovitch Nikolsky, or 'Nick' as he was affectionately known, lived three distinct lives; first as the son of an aristocratic Russian family in Moscow, then, following the Revolution, as a displaced student in Cairo and Paris and, finally, as a naturalized American, at M.I.T., Sikorsky Aircraft, and Princeton University. During this time, he became more American than many who were born in

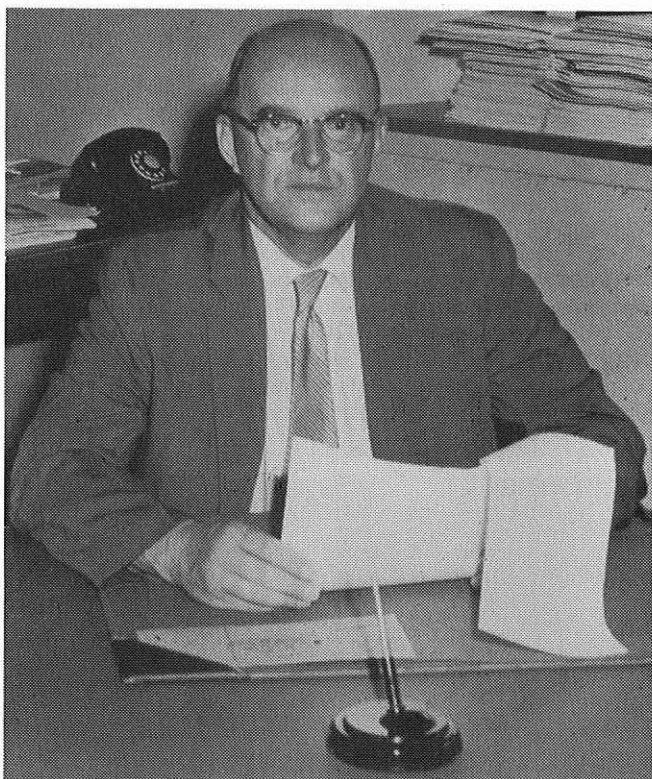


Fig. 1 Professor Alexander A. Nikolsky at his desk at Princeton University.

*Recipient, American Helicopter Society's, first Alexander A. Nikolsky Honorary Lectureship.

EDITOR'S NOTE: In 1981 the Society established an honorary lectureship in the name of Alexander A. Nikolsky to be given to an "individual who reflects the highest ideals, goals, and achievements in the field of helicopter and VTOL aircraft engineering and development." It is especially appropriate that the first recipient has compiled a biographical tribute to Nikolsky to accompany publication of his lecture.

America, and accomplished more for his adopted country than most of its natural citizens. Throughout his whole life, he displayed the virtues of courage and excellence.

"'Nick' began his career as a cadet in the Russian Imperial Navy. He was serving on a naval training ship in Vladivostok when the revolution overwhelmed Russia. He and his fellow cadets took the ship and sailed it to Japan. He later made his way, first to Cairo and then to Paris. The White Russian community in Paris took him in charge and entered him in the Sorbonne, where he received certificates in general mathematics in 1924 and physical mechanics in 1926. Before he left Paris, he also qualified for degrees in electrical and mechanical engineering.

"During his years in Paris, Nikolsky came to the conclusion that his future lay westward; and, not waiting for legal entry documents, he signed on a merchantman as a sailor, arrived in Philadelphia in 1928, jumped ship, and worked his way to Boston, where the Russian community again sponsored his further education and entered him in the Aeronautical Engineering Department of the Massachusetts Institute of Technology. He graduated the next year, receiving an M.S. in Aeronautical Engineering, and was immediately employed by Igor Sikorsky, president of Sikorsky Aircraft, who had an engineering staff made up, to a large extent, of Russian emigres. Later, in 1937, under some pressure from the Government, Nikolsky, together with several dozen of his Sikorsky colleagues, was marched to the local city hall and was naturalized a citizen of this country.

"Nikolsky spent thirteen years at the Sikorsky Division of the United Aircraft Corporation, serving successively and successfully as stress engineer, Chief of Structures, and Assistant Chief of Design. More importantly, he became part of a small nucleus of engineers who worked with Igor Sikorsky to develop the world's first practical helicopter. The concern which developed during this phase of his career colored his professional interest for the rest of his life.

"When Dan Sayre formed the Department of Aeronautical Engineering at Princeton University in 1942, he persuaded Nikolsky to join him. 'Nick' left Sikorsky and became the second faculty member of the new department. He rose to the rank of Professor two years later, and overcoming the handicap of illness, in 1954 he became the first incumbent of the Robert Porter Patterson Chair in Aeronautical Engineering.

"The simplest way to discuss Nikolsky's technical achievements is to say that he dominated a new and important field. The field of rotary-wing aircraft, exemplified first and most strikingly by the helicopter, and later by the new categories of aircraft known as vertical takeoff and landing machines, was his domain. His original work with the small group at Sikorsky created a technical breakthrough."

Shortly after joining Princeton University, he published his *Notes on Helicopter Design Theory*¹; based on a series of lectures delivered in 1944 to a group of engineers from the U.S. Army Air Force, Navy, and the aircraft industry.

When one looks today at that early text, with unavoidable nostalgia, wherein appears the names of Glauert, Locke, Bennett, Wheatley, and others, one can not escape a feeling of

gratitude to all of these men whose theories Nikolsky presents and who, along with 'Nick' himself, were layers of the foundations of the present state-of-the-art of rotary-wing aircraft.

In addition to a review of airscrew theories, the book contained considerations of helicopters in all regimes of flight, blade flapping, some performance calculations, a glance at static stability, and an approach to the determination of loads applied to the blades. Nikolsky realized, however, that the exposition of blade-load analysis contained in his first book would be inadequate for practical engineering applications. Consequently, in 1947, in cooperation with Ed Seckel (later, Professor at Princeton University), he wrote a comprehensive text on that subject.²

Autorotational flight of helicopters, both in vertical descent and in forward translation, and especially, transition into autorotation attracted Nick's attention, and he decided to take a new look at the problem. Again, in cooperation with Ed Seckel, he developed an analysis of those phenomena, supported by experiments^{3,4,5}. In that respect, tests were performed on autorotating rotor-models freely sliding along a vertical wire strung inside the so-called Nikolsky Tower. This was an ugly structure, sticking out like the proverbial 'sore thumb' above the beautiful landscape of the Princeton campus. Fortunately for the advancement of the rotary-wing aircraft state-of-the-art, the tower withstood attacks by enraged defenders of the aesthetics of university surroundings long enough to provide the necessary experimental data.

In 1951, Nikolsky published his major work *Helicopter Analysis*,⁶ which covers a broad scope of rotary-wing science: aerodynamics, mechanics of flight in all regimes of helicopter operation, mathematical analysis of dynamic stability, control response, and concludes with an elastic analysis of rotor blades.

Another area of rotary-wing aerodynamics which attracted Nikolsky's attention was the induced flow generated by the rotor in various regimes of flight, and the role of rotor-wakes in that process. Here, mostly in cooperation with Robin Gray (then a graduate student, and later Professor at Georgia Institute of Technology), he published several reports on that subject (e.g. Refs. 7-9). These works contributed an important building block in the present understanding of the vortex theory of lifting airscrews.

Nikolsky strongly believed that purely analytical treatment

of rotary-wing flight phenomena, especially those related to aircraft dynamics and control response, was not adequate in itself, and that continuous checking and confirmation through experimental measurements was necessary. To bridge the gap between analysis and experiments, he began, in the early 1950's, the development of a unique testing facility, in which a properly dynamically-scaled model could be tested under conditions approaching, as closely as possible, those of free flight. However, at the same time, the largest possible amount of information regarding forces and moments acting on the model as well as the reaction of the model to those inputs, and control displacement would be transmitted to the experimenter. Following this line of reasoning, the so-called 'Princeton Track' was created. From a modest pilot setup (Fig. 2), the track grew to the stage where its building was about 450 feet long, with adjacent office and shop facilities (Fig. 3). In parallel with developing the physical aspects of the track, Nikolsky studied objectives and methods of testing helicopters regarding dynamic stability together with such associates as Len Goland.¹⁰ During the following years, the track was extended to its present length of about 800 feet and, under the direction of Professor H.C. Curtiss, still serves as an important tool for studies of control and stability problems; not only of helicopters, but also of such new concepts as the Sikorsky ABC (Fig. 4).

The highest tribute to Nikolsky as a teacher is marked by the fact that his students, guided and motivated by him, attained some of the highest positions in industry, government service, and the universities. Even those of his students who did not choose to follow his immediate interests remember him with the greatest affection and respect.

In the nation's service, he was a consultant to his old colleagues at Sikorsky and to several echelons of the government. At the time of his death, he was serving on the U.S. Army Scientific Advisory Panel Committee. He had previously been a member of other committees of the National Aeronautics and Space Administration, the Office of Naval Research, and the Department of Defense.

Nikolsky was a teacher-scholar in the best tradition, and contributed to three very important areas of the state of the art of rotary-wing and VTOL aircraft by (1) developing suitable analytical methods leading to comprehension and quantitative evaluation of complex helicopter flight phenomena, (2) providing experimental facilities capable of

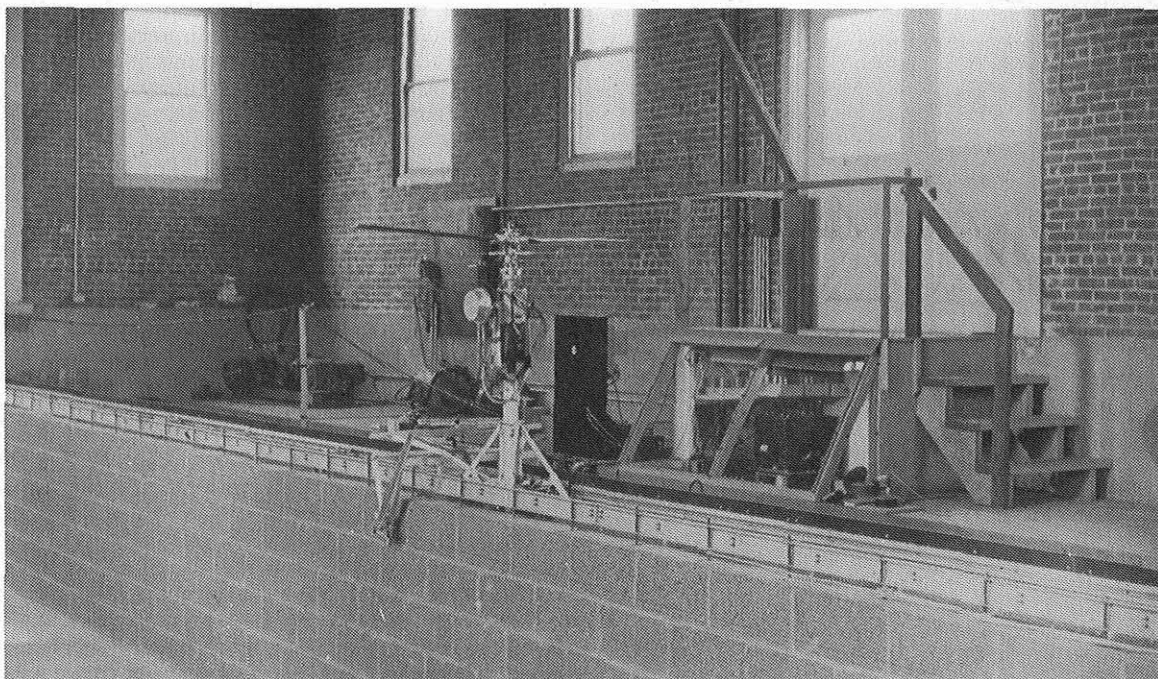


Fig. 2 First version of Princeton Dynamic Model Track (1952-1954).

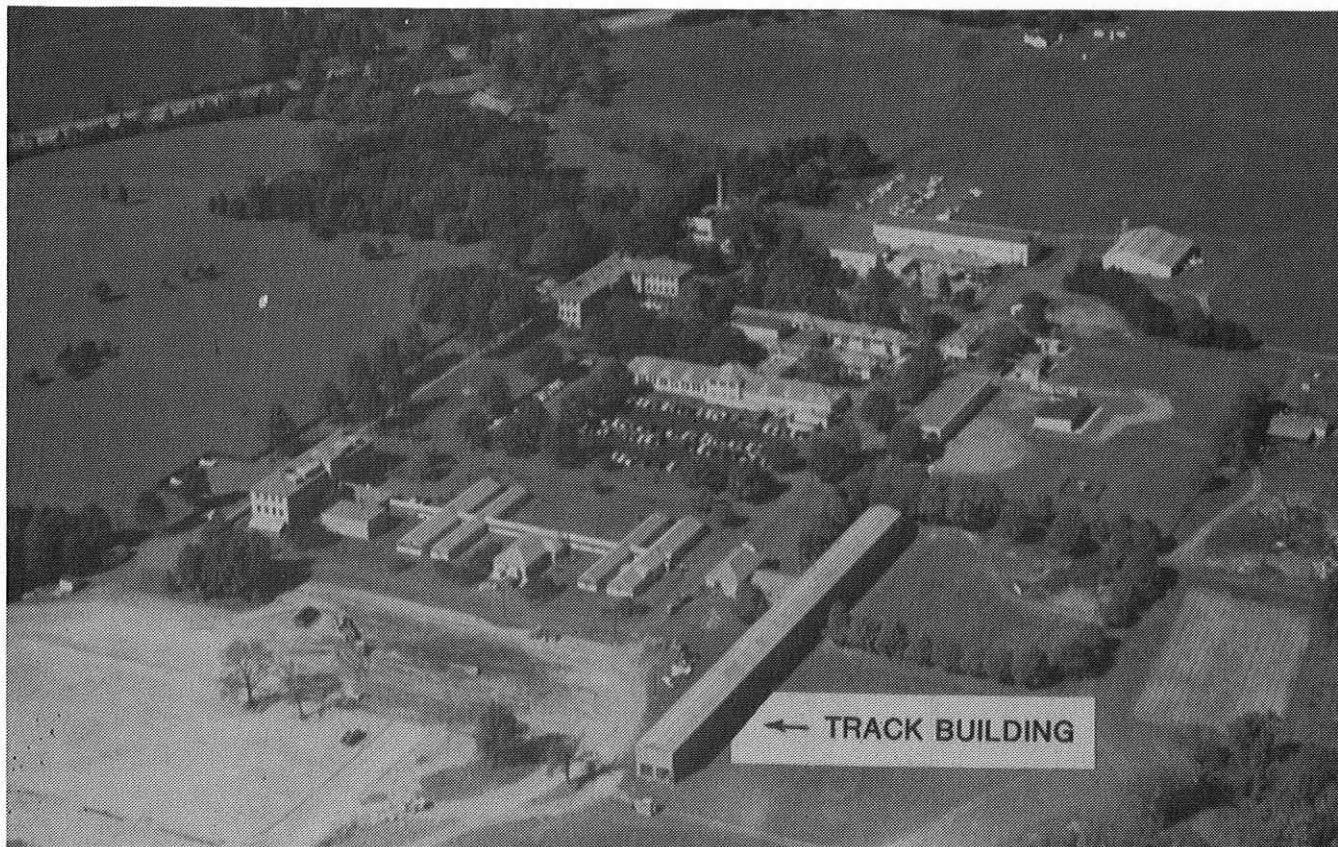


Fig. 3 Aerial view of the Princeton Track building before extension (1957).

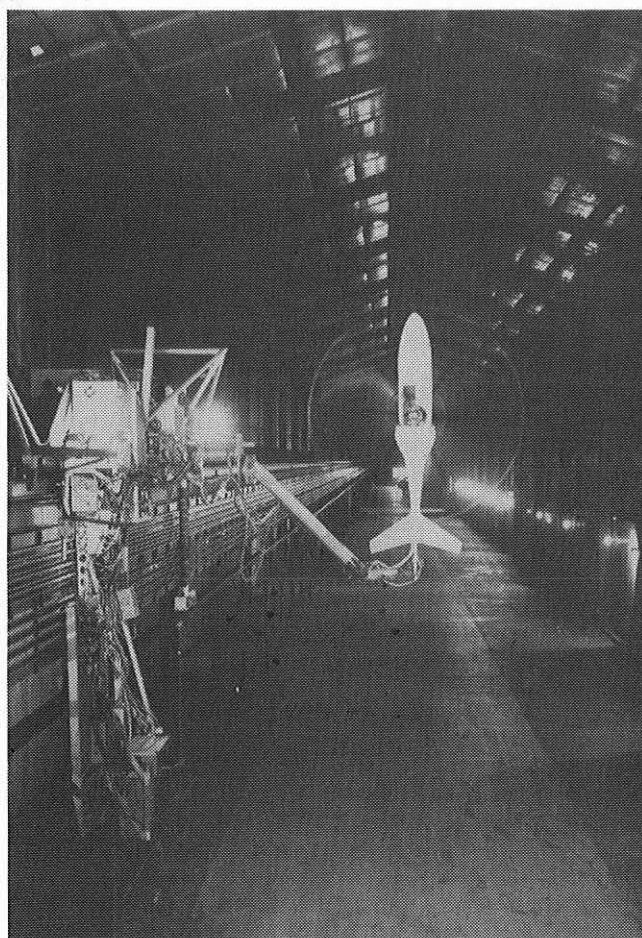


Fig. 4 Skikorsky ABC dynamic model operating in simulated "vertical" flight on the Princeton Dynamic Model Track.

checking and supporting analytical findings, and (3) educating highly qualified and motivated people prepared, as well as possible, to deal with all the complexities of the expanding field of rotary-wing aircraft, and VTOL in general.

In view of all this, it appears only just that an Honorary Lectureship instituted by the American Helicopter Society is named after this valuable, versatile, but at the same time, humble man.

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