Mike Gruntman
Blazing the Trail. The Early History of Spacecraft and Rocketry,
AIAA, Reston, Va., 2004 pp. 279-283

GLUSHKO OR TSANDER?

Fridrikh Tsander performed first tests of a prototype of the liquid-propellant rocket engine in 1931, about five years after the launch of the first Goddard's liquid rocket. Glushko tested his ORM engine also in 1931. The question who built the first truly liquid-propellant rocket engine in the USSR, Glushko or Tsander, would remain a highly contested issue for many years.

and in the USSR from the original German components, were launched in October and November of that year. Five launches out of 11 were successful.

Khimki

Two areas in the immediate vicinity of Moscow, *Khimki* and *Podlipki*, have emerged as the major centers of the Soviet rocket and space establishment. A *Special Design Bureau N.456* (OKB-456) was organized on the outskirts of Moscow in the town of Khimki, on the main road to the Moscow's future international airport Sheremet'evo. The head of OKB-456, Valentin Glushko, made this design bureau the leader in development of Soviet high-thrust liquid-propellant rocket engines. Today the bureau is known as *NPO Energomash*.

Khimki is also a home of the *S.A. Lavochkin Science-Production Association* (*Lavochkin NPO*) that existed since 1937 as an aircraft design bureau. Originally called the *Special Design Bureau N.301* (OKB-301) and headed by Semyon A. Lavochkin (1900–1960), it was best known for the *La* family of Soviet fighter planes, such as La-5 and La-7, during World War II and first jet fighters in the late 1940s. It was the Lavochkin design bureau that built the aircraft that first reached the speed of sound in the USSR. After the war, OKB-301 also expanded into development of antiaircraft weapons and air defense systems, beginning with the reproduction of the German Wasserfall.

Air and Missile Defenses at Khimki

The surface-to-air missile (SAM) work was taken over in 1953 by a new independent establishment, the *Fakel Machine-Building Design Bureau,* also in Khimki, that grew out of Lavochkin's OKB-301. (The word *fakel* means *plume* in Russian.) Fakel, headed for many years by Pyotr D. Grushin, also pioneered Soviet rockets for antiballistic missile defense. The first rocket intercept of a ballistic missile warhead ("to hit a bullet with a bullet") was achieved in March 1961 at the Saryshagan test range by the Fakel-designed and built V-1000 rocket. Lavochkin NPO eventually took over development of interplanetary spacecraft from Korolev's design bureau in 1965.

U-2 OVER PODLIPKI AND KHIMKI

The second photoreconnaissance overflight of the Soviet Union by the U-2 aircraft took place on 5 July 1956. This was the only U-2 mission that flew over Moscow. Glushko's rocket engine plant in Khimki and Korolev's rocket development center in Podlipki were among the mission primary targets. Both locations were covered by clouds, and no photographs were taken.

Podlipki

The other area on the Moscow outskirts, Podlipki, has grown to a special prominence in Soviet rocket development. (The word *Podlipki* literally means *under the linden trees* in Russian.) Podlipki was about 15 miles (25 km) north-

Mike Gruntman
Blazing the Trail. The Early History of Spacecraft and Rocketry,
AIAA, Reston, Va., 2004 pp. 279-283

NII-88, TsNIIMash, and TsUP

northeast from the Moscow downtown. Within a few years, it became the area of the highest concentration of the Soviet rocket and space establishment.

The Decree of 13 May 1946 established a new secret rocket research center, *Scientific Research Institute N.88*, or NII-88, about 2.5 km (1.5 miles) from the suburban railroad station Podlipki. Sergei Korolev was appointed the chief designer of long-range rockets at NII-88. Korolev's group was reorganized into a *Special Design Bureau N.1* (OKB-1) of NII-88 in 1950. NII-88 was subsequently renamed the *Central Scientific Research Institute of Machine Building*, or TsNIIMash. TsNIIMash became the leading Soviet research and certification institution in rocket and space technology. It is also a home of the Russian, former Soviet, spaceflight control center (*Tsentr Upravleniya Polyotami*, or TsUP).

SCALE OF THE KOROLEV'S ROCKET PLANT

Andrei D. Sakharov, one of the leading creators — "fathers" — of the Soviet thermonuclear weapons, wrote in his memoirs about a trip in 1953 "through a ballistic missile plant where I met Sergei Korolev, the chief designer, for the first time. We [in the nuclear weapons program] had always thought our own work was conducted on a grand scale, but this was something of a different order. I was struck by the level of technical culture: hundreds of highly skilled professionals coordinated their work on the fantastic objects they were producing, all in a quite matter-of-fact, efficient manner" (Sakharov 1990, 177).

Korolev's Design Bureau OKB-1

Korolev's design bureau became independent of NII-88 in 1956 when his OKB-1 was combined with the nearby *Plant N.88* to form the *Experimental De-*

Fig. 13.9. Entrance to the town of Korolev, former Kaliningrad, also known as Podlipki; November 1999. Podlipki remains the major center of the Soviet, and now Russian, rocket and space establishment. Photo courtesy of Mike Gruntman.

Mike Gruntman
Blazing the Trail. The Early History of Spacecraft and Rocketry,
AIAA, Reston, Va., 2004 pp. 279-283

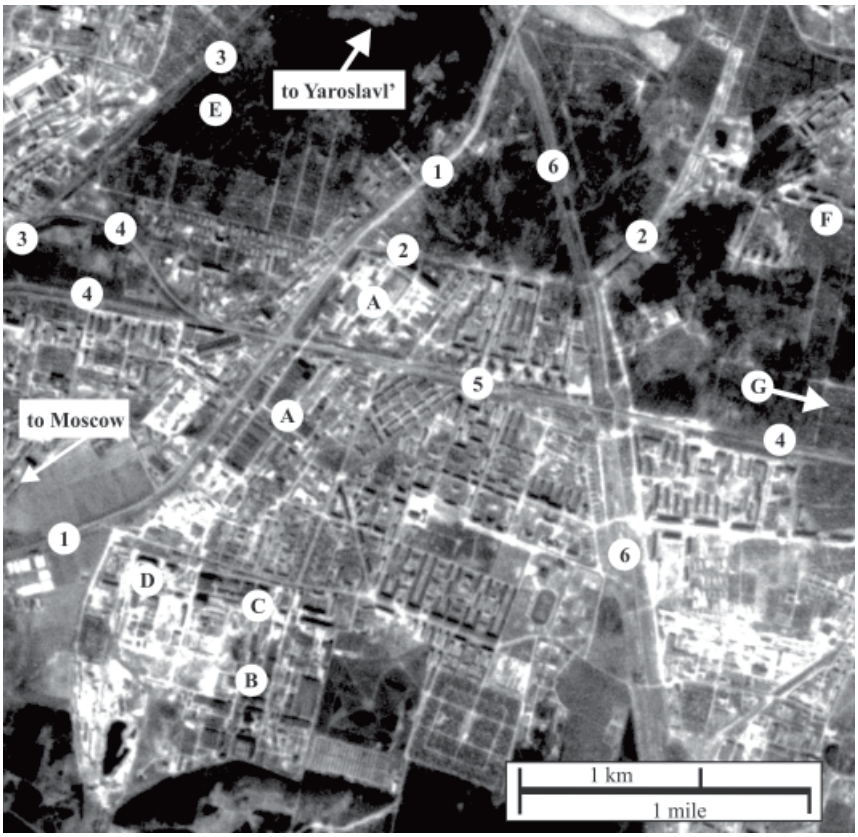


Fig. 13.10. *Corona* (Mission #1116) satellite photograph (22 April 1972) of the area with the highest concentration of the Soviet space research and development centers at *Podlipki* (after the name of the suburban train station), 25 km (15 miles) north-north-east from the Moscow downtown. Podlipki is also known as the town of *Kaliningrad*, recently renamed *Korolev*.

1) Highway Moscow-Yaroslavl'; 2) Bolshevo road; 3) railroad Moscow-Yaroslavl'; 4) railroad branch to Podlipki, Bolshevo, etc.; 5) suburban train station Podlipki (suburban trains reach the terminal station at the Moscow center in 30 minutes); 6) underground aqueduct with the restricted-access area above the ground. A) *Central Design Bureau of Experimental Machine Building* (TsKBEM), or the S.P. Korolev's Design Bureau, later known as *RKK Energia*; B) *Central Scientific Research Institute of Machine-Building* (TsNIIMash), with the *Space Flight Control Center* (TsUP) on its territory; C) *A.M. Isaev Design Bureau of Chemical Machine-Building* (KB Khimmash); D) *Scientific Research Institute of Measuring Techniques* (NIIT); E) *Moscow Technical Institute of Forestry* (MLTI, or *Lestekh*), originally an educational institution for the forest industry with a number of departments to train engineers, particularly in electronics and control, for Podlipki's space centers; F) *Scientific Research Institute N.4* (NII-4; in Bolshevo) of the Strategic Rocket Forces, Ministry of Defense; this institute would later split into NII-4 and the new co-located *NII Kosmos* of the Soviet Space Forces; G) direction toward the railroad stations Bolshevo (1 mile), Chkalovskaya (10 miles) with the *Yu.A. Gagarin Cosmonaut Training Center* at the nearby *Zvezdnyi Gorodok* (Star City), and Monino (15 miles), a home of the *Air Force Academy*.

Courtesy of Mike Gruntman.

Mike Gruntman
Blazing the Trail. The Early History of Spacecraft and Rocketry,
AIAA, Reston, Va., 2004 pp. 279-283

sign Bureau N.1. After Korolev's death in 1966 the bureau was renamed *the Central Design Bureau of Experimental Machine Building*, or TsKBEM. Today, it is known as the *Rocket Space Corporation Energia* (RKK Energia).

Podlipki's Constellation of Rocket and Space Centers

Several other leading rocket and space research and development centers were set up in Podlipki, some spun off NII-88. The *A.M. Isaev Design Bureau of Chemical Machine Building* (KB Khimmash) is located next to TsNIIMash. KB Khimmash, named after its first director Aleksei M. Isaev, was initially a part of NII-88 and became an independent developer of liquid-propellant rocket engines in 1956. Another offspring of NII-88 is the *Scientific-Manufacturing Association of Measuring Techniques* (NPO IT). In 1966, NPO IT separated from NII-88 as the *Scientific Research Institute of Measuring Techniques* (NIIT). The main military research centers of the strategic rocket forces (NII-4) and of the space forces (NII Kosmos) are only one mile away from the Podlipki station.

Podlipki, Kaliningrad, and Korolev

A town grew up in the surrounding area to house almost 200,000 inhabitants, with the majority employed by rocket and space establishments of Podlipki's cluster. In the Soviet times, the town was called *Kaliningrad*, after one of the most trusted Stalin's henchmen, Mikhail I. Kalinin. It was renamed *Korolev* after

Fig. 13.11. Space flight control center (*Tsentr Upravleniya Polyotami*, or TsUP) in TsNIIMash, Podlipki (Kaliningrad, or Korolev), November 1999. A small model of the space station *Mir* is in the bottom-right. TsUP was formed on 3 October 1960 as the *Computational Center* of NII-88. The center was subsequently reorganized as the *Coordinating-Computational Center*, and finally as TsUP. It was this center that was routinely mentioned in the official announcements of the official Soviet TASS news agency about space launches: "Coordinating-Computational Center is processing the incoming [from the spacecraft] information." Deep-space missions were operated from the control center at Yevpatoria in the Crimea, a peninsula in the Black Sea. Now the Crimea is a part of the independent Ukraine. The Space Arm of the Strategic Rocket Forces operates the main military space control center in Golitsyno-2, or Krasnoznamensk, 15 miles west of Moscow. Golitsyno-2 is supported by a dozen command, control, and communication stations throughout Russia. Photo courtesy of Mike Gruntman.

Mike Gruntman
Blazing the Trail. The Early History of Spacecraft and Rocketry,
AIAA, Reston, Va., 2004 pp. 279-283

SCIENTISTS AND ENGINEERS FOR PODLIPKI

Leading Soviet institutions of higher learning trained scientists and engineers for Podlipki's sprawling space complex.

The *Bauman Moscow Technical School* (Bauman MVTU) and *Moscow Aviation Institute* (MAI) had the branches in Podlipki. The nearby *Moscow Technical Institute of Forestry* (MLTI) established special departments for training specialists in several engineering areas, particularly in electronics and control, for the space centers. A number of senior students of the elite *Moscow Physical-Technical Institute* (MFTI, or *Fiztekh*) studied directly at TsKBEM and TsNIIMash for three years before earning their Master of Science degrees and continued as staff scientists and engineers after the graduation. Many other institutions and universities, including the *Moscow State University* (MGU), trained specialists for Podlipki.

inertial guidance system was produced by the *Scientific Research Institute N. 885* (NII-885) headed by Nikolai A. Pilyugin; the command and control equipment was developed by the *Scientific Research Institute N.10* (NII-10) led by Viktor I. Kuznetsov; and the launching site complex and fueling equipment were designed and built by the *State Design Bureau of Special Machine Building (GSKB Spetsmash)* headed by Vladimir P. Barmin. This early cooperation would remain the backbone of the Soviet rocket and space program for many years. In total, 13 research institutes and design bureaus and 35 factories and plants contributed to the development of the first Soviet long-range ballistic missile.

The first R-1 was launched at Kapustin Yar on 17 September 1948. The rocket strayed away from its trajectory by 51 deg and crashed. Out

First Ballistic Missile R-1

collapse of the communist regime in the early 1990s. The railroad station for suburban trains is still called Podlipki.

One of the top priority goals of the Decree of 13 May 1946, the reconstruction of the V-2 using the Soviet-designed and built parts, components, and materials, had been achieved by 1948. Korolev's team at NII-88 had designed and built such a rocket, the R-1. The rocket development required cooperation among a large number of the newly established Soviet research institutions and manufacturing plants. The rocket engine was built by Glushko's OKB-456; the

Core Team of the Rocket and Space Program

Fig. 13.12. Sergei P. Korolev in early 1960s. Korolev became the leader of the early Soviet rocket and space effort, while remaining unknown to the most of his countrymen. In the secrecy-obsessed totalitarian society, the Soviet people knew him only as an enigmatic "chief designer." Korolev's design bureau in Podlipki near Moscow was the major center of the early Soviet space effort and spun off several rocket and spacecraft research and development centers. Photo courtesy of S.P. Korolev Memorial House-Museum, Moscow.

Steep Learning Curve

Winner of the *Luigi Napolitano Book Award* (2006) from the International Academy of Astronautics

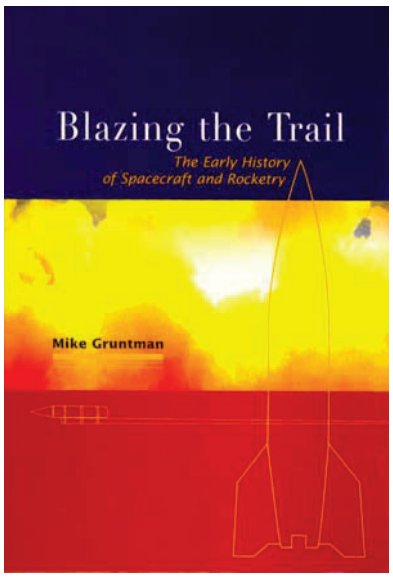
Blazing the Trail

The Early History of Spacecraft and Rocketry

Mike Gruntman

AIAA, Reston, Va., 2004
ISBN 156347705X; 978-1563477058

505 pages with 340 figures
Index: 2750+ entries, including 650 individuals



This book presents the fascinating story of the events that paved the way to space. It introduces the reader to the history of early rocketry and the subsequent developments which led into the space age. People of various nations and from various lands contributed to the breakthrough to space, and the book takes the reader to far away places on five continents.

This world-encompassing view of the realization of the space age reflects the author's truly unique personal experience, a life journey from a child growing on the Tyuratam launch base in the 1950s and early 1960s, to an accomplished space physicist and engineer to the founding director of a major U.S. nationally recognized program in space engineering in the heart of the American space industry.

Most publications on the topic either target narrow aspects of rocket and spacecraft history or are popular books that scratch the surface, with minimal and sometimes inaccurate technical details.

This book bridges the gap. It is a one-stop source of numerous technical details usually unavailable in popular publications. The details are not overbearing and anyone interested in rocketry and space exploration will navigate through the book without difficulty. The book also includes many quotes to give readers a flavor of how the participants viewed the developments. There are 340 figures and photographs, many appearing for the first time.

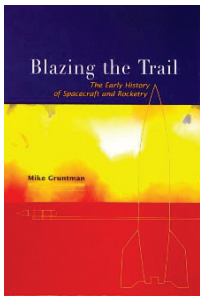
Table of contents

Book details (including **index** and **reviews**) at: **http://astronauticsnow.com/blazingthetrail/**

About the author. Dr. Mike Gruntman is professor of astronautics at the University of Southern California. Accomplished physicist, Mike is actively involved in research and development programs in space science and space technology. He has authored and co-authored nearly 300 publications, including 4 books.

Mike Gruntman **http://astronauticsnow.com/blazingthetrail/** **mikeg@usc.edu**

Books by Mike Gruntman



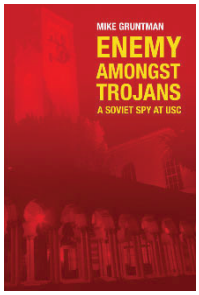
Mike Gruntman
Blazing the Trail:
The Early History of Spacecraft and Rocketry
AIAA, Reston, Va., 2004

Winner of the Luigi Napolitano Award (2006) from the Int'l Academy of Astronautics

ISBN 978-1563477058
475 pages, 340 figures, 250+ references

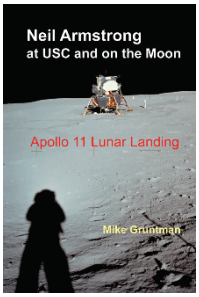
Mike Gruntman
Intercept 1961:
The Birth of Soviet Missile Defense
AIAA, Reston, Va., 2015

ISBN 978-1624103490 (print)
eISBN: 978-1624103506 (at http://arc.aiaa.org)
330 pages, 120+ figures, 200+ references



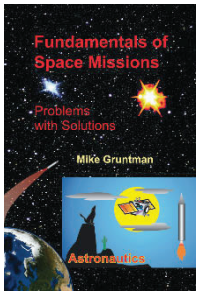
Mike Gruntman
Enemy Amongst Trojans:
A Soviet Spy at USC
(World War II story)
Figueroa Press, Los Angeles, Calif., 2010

ISBN 978-1932800746
88 pages, 12 figures, 94 references



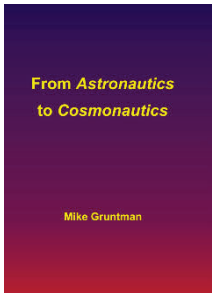
Mike Gruntman,
Neil Armstrong at USC and on the Moon:
Apollo 11 Lunar Landing
Interstellar Trail Press,
Los Angeles, Calif., 2025

ISBN: 979-8985668780 (paperback)
ISBN: 979-8985668773 (hardcover)
ISBN: 979-8985668797 (Kindle Print Replica)
186 pages with 80+ figures and 140+ references



Mike Gruntman
Fundamentals of Space Missions:
Problems with Solutions
(160+ problems)
Interstellar Trail Press
Los Angeles, Calif., 2022

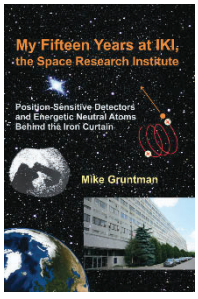
ISBN 979-8985668742 (paperback)
ASIN B0BN9H648T (Kindle Print Replica)
478 pages, 175+ figures



Mike Gruntman
From Astronautics to Cosmonautics:
Space Pioneers Robert Esnault-Pelterie and Ary Sternfeld
Booksurge, North Charleston, S.C., 2007

Nominated for the Eugene M. Emme Astronautical Literature Award (2007) of the American Astronautical Society

ISBN 978-1419670855 (papeback)
ASIN: B002E19WDO (Kindle)
84 pages, 24 photographs, 75 references



Mike Gruntman
My Fifteen Years at IKI, the Space Research Institute:
Position-Sensitive Detectors and Energetic Neutral Atoms Behind the Iron Curtain
Interstellar Trail Press, Los Angeles, Calif., 2022

ISBN 979-8985668704 (paperback), 979-8985668728 (hardcover),
ISBN 979-8985668711 (Kindle Print Replica)
328 pages, 150+ figures, 180+ references