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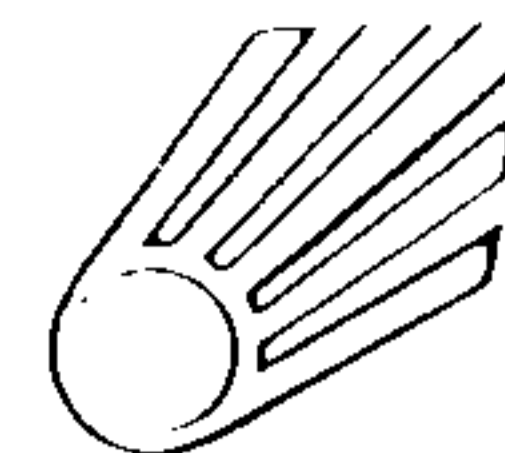
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Published By The British Interplanetary Society

Vol. 36 No. 8 August 1994

Space Education

- 269 SPACEWALK IN NOORDWIJK**
A look at the largest permanent space exhibition in Europe.
- 272 ROCKET PROPULSION, Part 2**
Three systems of rocket propulsion involving advanced technology are explained.

Soviet Policy & Technology

- 280 LEONOV'S WAY TO SPACE**
The airlock that enabled the Soviets to carry out the first EVA by *Dietrich Haeseler*.
- 282 SOVIET ORBITAL SPACE STATION-1 DESIGNED IN 1965**
Early work on space station design in the USSR is investigated by *Charles P. Vick*.
- 283 SOVIET SPACE PROGRAMME, Part 1**
Organisational structure in the 1940s -1950s is reviewed by *Asif A. Siddiqi*.

Features

- 254 MOON ADDED TO EURO SPACE AGENDA**
ESA's initiative for a 21st century Moon programme.
- 255 INTERNATIONAL LUNAR WORKSHOP**
Bob Parkinson reports on discussions about a return to the Moon.
- 262 IN-SPACE LIDAR**
A Shuttle payload due to fly for the first time in September is described by *Ben Evans*.
- 263 GOES-8**
Roger G. Guillemette emphasises the importance of this launch for US weather-forecasting.

News & Events

- 257 LAUNCH REPORT**
News of recent launches and forthcoming launch preparations, including Oersted, Denmark's first satellite, by *J.K. Andersen*.
- 260 INTERNATIONAL SPACE REPORT**
Space news from around the world.
- 275 STS-59: MISSION REPORT**
A report by *Roelof Schuiling* from the Kennedy Space Center.
- 279 SATELLITE DIGEST - 267**
This month's listing of recent spacecraft launchings.

Space Miscellany

- 266 BOOK NOTICES**
Contents of books likely to be of interest to readers are described.
- 268 'SPACE LAUNCHERS' COMPETITION**
Books are the prizes for this month's competition winners.
- 287 SOCIETY NEWS**
From the British Interplanetary Society.

Front Cover: A scene at the Noordwijk Space Expo, which is the largest permanent space exhibition in Europe and also functions as the official Visitor's Centre for ESTEC, the technical centre of ESA.

ESA



Soviet Space Programme

BY ASIF A. SIDDIQI
Northampton, MA, USA

The first Sputnik of October 1957, which impressed Khrushchev so much that he took a personal interest in the new space programme.

Part 1 - Organisational Structure 1940s-1950s

A major reassessment of the history of the Soviet space programme in the Western press has occurred in the past few years as a result of the large number of disclosures concerning various aspects of that programme. One area that has remained relatively unexamined in the light of these disclosures has been the organisational structure of the former Soviet space programme. Very little was known about the command-system of the programme until only two or three years ago; what little was known or inferred was often based on speculation more than on any solid evidence. It is now possible to make an early attempt to fill the gap for the first time, based upon recent official Soviet and Russian literature.

Before beginning this narrative, it is instructive to briefly describe the nature of the political structure of the former Soviet Union. On paper, the Communist Party of the Soviet Union (KPSS) and the government of the Soviet Union were two autonomous organs of the state. In the case of the defence and space programmes, all policy directives came directly from the top leaders of the KPSS.

Orders were then administered by the different bodies of the government, such as the Ministries, Chief Directorates, State Committees, State Commissions, etc. This chain-of-command was made easier due to the fact that many of the top leaders of the governmental structure were also high Party officials.

The KPSS structure normally originated from the Defence Council of the Presidium (later the Politburo), or from the Secretariat. Usually there was an individual in the Secretariat who was responsible for defence and space matters.

The next level of command was the Central Committee where the De-

fence Industries Department handled the space programme. From this level on, orders would be handed down to the top leaders in the government structure to accomplish the given projects.

Government: 1940s-1950s

The Soviet space programme had its industrial and administrative beginnings following the end of World War II when the government undertook a study of the possibility of very long-range rocketry as part of the defence of the USSR. On May 13 1946, less than a year after the end of World War II, the Soviet government signed the first decree for the development of ballistic missiles [1]. The missile industry was to be a special sector of 'machine building', a general euphemism for the defence-related industry. The May decree was followed by the organisation, in August 1946, of the Scientific Research Institute No. 88 (NII-88) for Jet Armaments within the USSR Ministry of Armaments in the city of Kaliningrad near Moscow [2].

Overall supervision of the work was

entrusted to Minister of Armaments Dmitry F. Ustinov, while the principal organisational concerns were delegated to Ustinov's Deputy, Vasili M. Ryabikov. Most early work on ballistic missiles was centred at the NII-88 and it has been rumoured that the group may have reported directly to Soviet leader Josef Stalin in a somewhat informal manner and "above the heads of the ministers" [3].

The post as first Director of the NII-88 was filled by Leo R. Gonor, the former head of one of the largest artillery plants in the Soviet Union, while the Chief Engineer was named Yuri A. Pobedonostsev, a missile engineer who was soon transferred to the newly created Academy of the Defence Industry.

There were three principal structures created within the NII-88 to achieve the task of designing and building ballistic missiles:

1. An experimental plant;
2. A Special Design Bureau (SKB) consisting of several departments focusing on the design of missiles; and
3. A group of scientific subdivisions specialising in such areas as materials science, strength, aerodynamics, engines, fuels, control, testing and telemetry [2].

The SKB was headed by K. Tritko, the Chief Engineer of the plant where the NII-88 was located. Within the SKB itself, the division responsible for long-range missiles was delegated to Sergey P. Korolev who was appointed Chief Designer for the development of ballistic missiles by Ustinov himself on August 9 1946 [1]. Korolev at the time appointed a control systems specialist named Vasili P. Mishin to be his First Deputy.

This small department in the NII-88 eventually grew to become a design bureau in its own right and defined the principal thematic thrust of the NII-88 for years to come. A total of 52 engineers were employed by Korolev in August 1946 at Kaliningrad, including such later famous Designers as V.P. Mishin, B.E. Chertok, L.A. Voskre-

Sergei Korolev, chief designer of space rocket systems.





Valentin Glushko, designer of rocket engines.

senskiy, K.D. Bushuyev, D.I. Kozlov, V.M. Kovtunenkov, V.P. Makeyev, M.F. Reshetnev, V.P. Radovskiy, M.K. Tikhonravov, B.V. Rausenbakh and P.I. Tsybin [2].

While the NII-88 was the primary organisation responsible for the design and development of long-range missiles, there were several other institutes who were assigned significant roles in the programme in 1946. These included the NII-885 headed by D. Maksimov and organised within the USSR Communications Equipment Industry. It was here that two other Chief Designers, Nikolai A. Pilyugin and Mikhail S. Ryazanskiy headed departments for automatic control systems and radio control systems respectively.

Additionally the NII-944 headed by Chief Designer Viktor I. Kuznetsov was given the responsibility of developing missile gyroscope instruments while Chief Designer Vladimir P. Barmin working within the Special Machine Building SKB of the USSR Ministry of Machine and Instrument Building was given the task of the design and construction of ground equipment in support of missile launches.

One of the most important responsibilities, the design and development of high-powered rocket engines was entrusted to the General Design Bureau No.456 (OKB-456) headed by Chief Designer Valentin P. Glushko.

A total of 25 NIIs and KBs and 18 plants took part in the development of the first post-war Soviet ballistic missile, the R-1, essentially a modified German A-4 rocket. To streamline the widespread scattering of responsibilities, Chief Designer Korolev organised the Council of Chief Designers for the "operative resolution of all fundamental scientific and technical issues" [2]. The original Council comprised the six most important individuals in the programme for developing long-range

ballistic missiles: Korolev (Head), Glushko, Pilyugin, Barmin, Ryazanskiy and Kuznetsov.

In the beginning, the Council was an informal and separate entity from the NIIs, but was eventually to assume control of much of the early development of the Soviet space programme. One of its obvious advantages was that it circumvented the normal chain of command in the missile building industry and facilitated swifter and more efficient work.

Since the NII-88 was the primary organisation responsible for long-range missiles, a special top-secret branch, named the 7th Chief Directorate was created within the Ministry of Armaments to have direct oversight over long-range missile development. This Directorate was originally headed by S. Vetoshkin [4]. Essentially, the 7th Chief Directorate was to handle the design, procurement and production of all long-range ballistic missiles for the Ministry of Armaments.

Party: 1940s-1950s

While the above was the industrial (i.e. governmental) side of the new missile sector, measures were taken at the time to institutionalise a top-level Party body to determine policy issues that would be handed down to the government. Soon after the May 1946 decree, in April 1947, a special body named the Special Commission No.2 was created below the Presidium level (see Organisation Chart opposite).

This Committee, the first body in the Soviet government to direct the development of long-range weapons, was originally headed by KPSS Presidium member Georgy M. Malenkov, the number two official in the Soviet leadership after Stalin himself. Malenkov's Deputy for missile programmes was Minister of Armaments Ustinov, the individual directly responsible for the development of missile programmes in the government [4].

Its members were later expanded to include the top Party representatives of the various Ministries responsible in the development, construction and procurement of missiles in the USSR. These Ministries included: the Ministry of Armaments (under which was the NII-88); the Ministry of the Communications Equipment Industry; the Ministry of the Ship-building Industry; the Ministry of Machine and Equipment Building; and the Ministry of the Armed Forces. The latter was essentially the customer for the missile industry. Each Ministry had jurisdiction over a Scientific Research Institute that was involved in a particular aspect of the missile industry.

Clients: 1940s-1950s

The prime customer of the missile

industry was the USSR Ministry of the Armed Forces (MVS), but it is clear from available descriptions that the MVS had little to do with actual missile development and building. The Main Artillery Directorate (GAU) under the jurisdiction of the MVS, however, exercised control of the rocketry programme through two key organisations:

1. The NII-4, a military institute organised to develop methods of testing, acceptance, storage and combat applications of missile weaponry; and
2. A group of 'rocket troops' organised at the State Central Test Range created in the area of the town of Kapustin Yar.

Named the Special Purpose Brigade (BON), these rocket troops were actually established in July 1946 within the Soviet Army. The first Commander of the BON was Maj.-Gen. A.F. Tveritskiy. Later in 1950, they were reorganised into the 23rd Special Purpose Engineer Brigade of the Artillery Force High Command Reserve (RVGK) headed by Col. Mikhail G. Grigoriev. Another Army officer named Lt.-Gen. Vasili I. Voznyuk was appointed the first Chief of the Test Range at Kapustin Yar. Thus the MVS had key influence on the missile sector by influencing the design of rockets through specific requirements which were developed at the NII-4, while at the same time directing the launch of all test rockets through the special unit of the MVS organised at Kapustin Yar [2,5].

Related Bodies: 1940s-1950s

With the advent of nuclear weapons, a special body was created within the USSR government to direct the construction of strategic nuclear weapons. This body, originally known as the 1st Chief Directorate was reorganised and named the Ministry of Medium Machine Building on June 26 1953 [6]. Its first Head, Vyacheslav A. Malyshev, was just six months later appointed a Deputy Chairman of the Council of Ministers.

It seems that this Directorate had more jurisdiction over the nuclear weapons development programme than the rocketry programme, although Soviet physicist Andrei Sakharov has stated that Malyshev's responsibilities were to direct the building of new military technology including missiles. Certainly in the 1950s, both programmes had many overlaps; in particular the specifications laid down by scientists employed by the 1st Chief Directorate had a profound influence on the specifications of the first Soviet Inter-Continental Ballistic Missile (MBR), the R-7.

1950s

Following Stalin's death, there seems to have been a period of transi-

tion during which the new leaders had less understanding of the workings of the strategic missile programmes. This may have stemmed in part from the fact that in many cases the NII-88 reported directly to Stalin, thus bypassing the official hierarchy of the industry.

Science Sector: 1950s

By 1955, the USSR Academy of Sciences (AN-SSSR) began to be involved in proposals for the first artificial satellite. In particular, its Vice-President, mathematician Mstislav V. Keldysh exerted a good deal of influence on the scientific specifications for the design of the first satellite. On August 30 1955, a special scientific Commission was formed under the jurisdiction of the AN-SSSR to develop a programme for the launch of the first artificial satellite [7]. Keldysh was named Chairman of this Commission, at the personal request of Chief Designer Korolev. It appears that this Commission or an extension of this Commission remained in existence for much of the early days of the space programme as an advisory panel to the government on space policy issues.

Government: 1950s

The management of the entire defence industry and thus the early space programmes of the USSR was performed by a very powerful body named the Military-Industrial Commission (VPK), which essentially coordinated and controlled all defence-related research, design, development, testing and production activities [8].

Established in January 1938, all the appropriate Ministries and Directorates came under the direct supervi-

sion of the VPK which had a key input in policy decisions. At appears that by the later 1950s, its jurisdiction and powers had gradually increased.

Korolev's power within the administration of the rocketry programme had also increased throughout the 1950s. As far back as April 1950, he had replaced Tritko as head of the SKB within the NII-88 [9]. On September 1956, his group, i.e. this SKB, was detached from within the NII-88 and given the new designation Experimental Design Bureau No. 1 (OKB-1) [10]; by this time, Korolev's organisation was playing the undisputable lead role in the design of the first Soviet ICBM.

It appears that, on paper at least, Korolev reported through the head of the 7th Chief Directorate, to Minister of Defence Industries Ustinov, to the Chairman of the VPK, to the Special Commission No. 2, and finally to the new Soviet leader Nikita S. Khrushchev. This chain of leadership, however, became more of a formality than anything else following the launch of the first Sputnik in October 1957.

The first launch impressed Khrushchev so much that he took a personal interest in the new space programme and often consulted with Korolev himself.

The Council of Chief Designers appears to have exerted influence not only over programmes that had been approved by Khrushchev, but also began to have some input into programme starts and approval. In particular, the Council would often pass "resolutions" that were binding (albeit unofficially) for all the KBs and NIIs involved. Final approval of programmes, more than often, rested with Khrushchev who often consulted



Vasili Mishin, who was deputy to Sergei Korolev and later led the Korolev design bureau. He is seen here at the 41st International Astronautical Congress at Dresden, Germany in 1990.

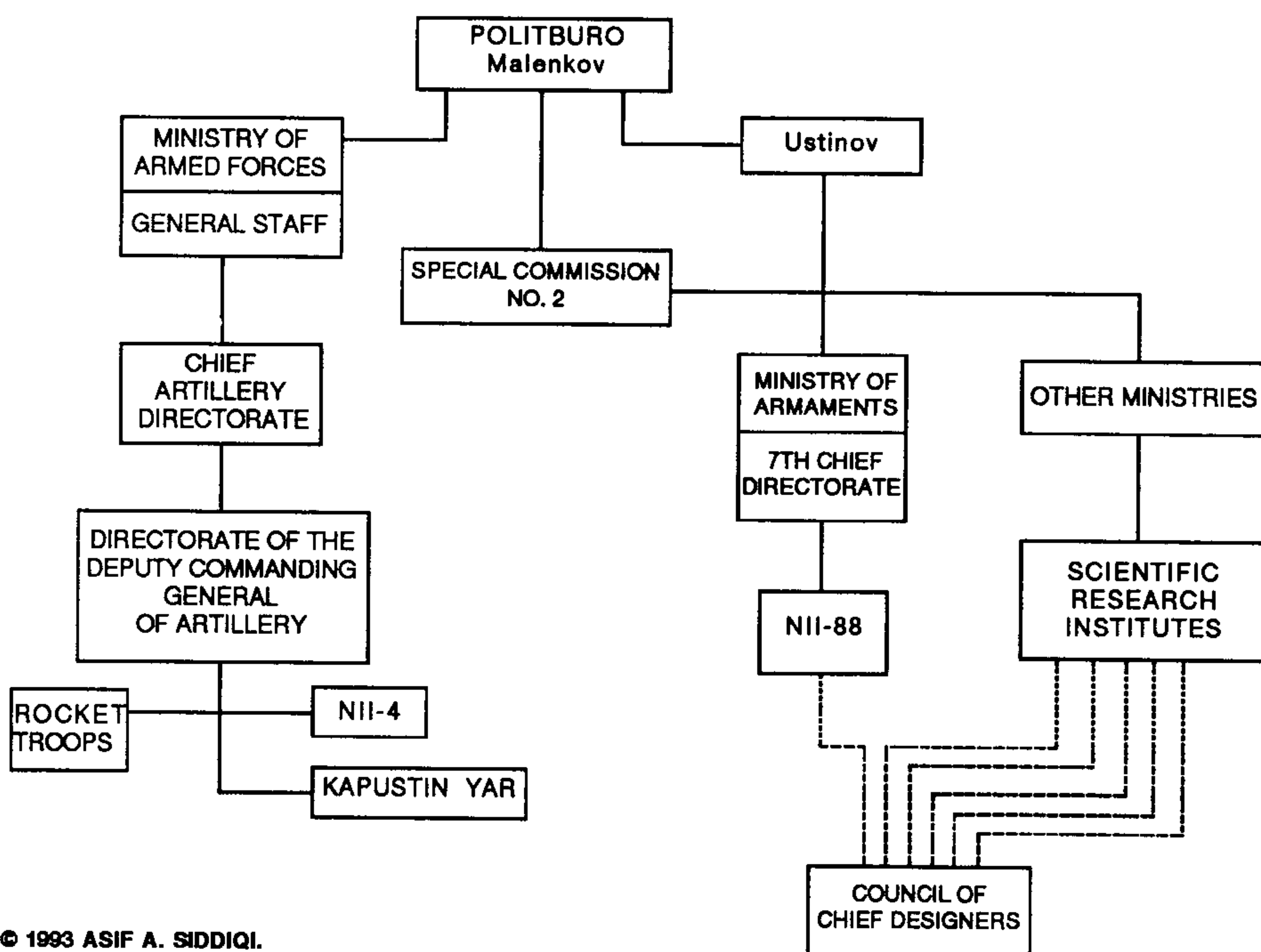
with Ustinov, still the Minister of Defence Industries. It may be noted that the Ministry of Armaments was renamed the Ministry of Defence Industries in 1953, Ustinov still remaining its head.

In the period 1957-1959, further changes were instituted in the governmental structure of the space and missile programmes. In late 1957, Khrushchev initiated certain reforms in the R&D structure of the military-scientific industry. As a result, institutions that were originally under ministerial jurisdiction acquired new labels, the majority of them transferred to State Committees under the Council of Ministers [11].

Thus R&D institutions in the Ministry of Defence Industry were transferred in late 1957 to the new State Committee for Defence Technology (GKOT). Konstantin N. Rudnev, a former Deputy Minister of the Defence Industry was appointed the Chairman of the GKOT in March 1958 [12]. Rudnev had served as Director of the NII-88 organisation in the early 1950's. The GKOT essentially took over the responsibilities of the Ministry of Defence Industries whose head had been Ustinov until 1957. The 7th Chief Directorate had in fact been transferred from the Ministry of the Defence Industries to be under the jurisdiction of the GKOT at this time [4]. Ustinov was meanwhile 'promoted' to be the new Chairman of the VPK in 1957 becoming Rudnev's immediate superior [8].

A special Commission was also formed in 1957 to monitor and approve the actual programme for launching the first satellites. Named the State Commission for Testing Boosters and Launches of the First Satellites, it was headed by Gen.-Col.-Engineer Vasili M. Ryabikov [13], who was also the Deputy Chairman of the Council of Ministers of the Russian Soviet Federated Socialist Republics (RSFSR).

Organisation of the Soviet Space Programme 1940s - 1950s.



Ryabikov had been appointed Ustinov's First Deputy in 1946 and had exerted a notable influence over the rocketry industry throughout the late 1940s and 1950s.

The powers of this precursor Commission appear to have been restricted to the monitoring and approval over actual launches rather than supervision over any policy issues. Following the first satellite launches in the 1957-1958 period, this temporary body was re-organised and renamed simply the State Commission in 1958; its powers were extended to the day-to-day direction of the space programme.

Organisations such as the State Commission were common at that time in Soviet industry and their duties were essentially to make sure that certain guidelines were followed in the facilitation of important programmes. Heads of State Commissions were always prominent individuals in the defence sector.

Rudnev, already the Chairman of the powerful GKOT, was also appointed the first Chairman of the State Commission for the Space Programme in early 1958, thus assuming two of the most powerful administrative positions in the space programme. Thus, Rudnev not only exercised control over the day-to-day administration aspects, but also exercised key control over the industrial aspect of the space programme as Chairman of the GKOT. Rudnev reported directly to VPK Chairman Ustinov.

The new State Commission for the Space Programme comprised of 16 core members by 1960 as shown in the table on the right.

Through the ensuing years, the membership was expanded to include other Chief Designers and government officials, as the requirements for particular missions changed.

Party: 1950s

As the highest organ in the governmental sector of defence and space, the VPK maintained direct contact with the Party structure (i.e. with the real power). It seems that the person

State Commission for the Space Programme 1960.

Chairman:

Konstantin N. Rudnev: Chairman, State Committee for Defence Technology

Members:

Boris Y. Butoma:	Chairman, State Committee for Shipbuilding
Pyotr V. Dementyev:	Chairman, State Committee for Aviation Technology
Valery D. Kalmykov:	Chairman, State Committee for Radio and Electronics
Mstislav V. Keldysh:	Vice-President, USSR Academy of Sciences
Rodion Y. Malinovsky:	Minister of Defence
Mitrofan I. Nedelin:	Commander-in-Chief, Strategic Rocket Forces
Sergey I. Rudenko:	Deputy Commander-in-Chief, Soviet Air Force
Vasili M. Ryabikov:	Deputy Chairman, RSFSR Council of Ministers
Dmitry F. Ustinov:	Deputy Chairman, Council of Ministers

Designers:

Vladimir P. Barmin:	Chief Designer, SKB for Machine Building
Valentin P. Glushko:	Chief Designer, OKB-456
Sergey P. Korolev:	Chief Designer, OKB-1
Viktor I. Kuznetsov:	Chief Designer, NII-944
Nikolai A. Pilyugin:	Chief Designer, NII-885
Mikhail S. Ryazanskiy:	Chief Designer, NII-845 [14].

below Khrushchev in determining space policy was Leonid I. Brezhnev. He had been appointed Secretary of the Central Committee in 1956 and remained in that position until 1960 overseeing matters of "heavy indus-

try, construction, modernisation of military weaponry and space flight" for the Party [15]. Khrushchev and Brezhnev thus determined the actual course of the space programme during that period.

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Soviet Space Artifacts Sold

The Lunokhod 2 rover that is still on the Moon sold for nearly \$70,000 at a Sotheby's auction last December. The auction house felt obliged to note that transfer of title to the Lunokhod 2 lunar rover - and the descent module that got it there - did not imply that the auction house would actually bring it back to Earth.

In another 'inaccessible' purchase, more than \$13,000 was paid for a guitar that has been circling the Earth

since 1987 aboard the Russian space station Mir. More than 200 artifacts from three decades of Russian space exploration fetched a total of \$6.82 million in the sale.

Two Soviet space capsules sold for \$1.6 million and \$552,500 and the Tokyo Broadcasting Corporation paid \$230,000 for the spacesuit used by Japanese journalist Toyohiro Akiyama, who became the first reporter in space when he travelled aboard Soyuz 10 and Soyuz 11 in 1990.

Gagarin's original report of his flight, meanwhile, fetched the fourth-highest price of the day when it sold for \$354,000, 10 times the presale estimate. The orange spacesuit that Gagarin trained in before his flight sold for \$112,500, while his Soviet Air Force dress uniform went for \$34,000.

Among the more esoteric items was a slide-rule that was used by Sergei Korolev, chief designer of the Soviet space programme. Nicknamed "the magician's wand", the slide-rule sold for \$24,000. See Reference 6 on p.282. Further auctions of Soviet space items are being arranged.