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1. There are two basic organizations conducting topo-geodetic and cartographic work in the Soviet Union -- the GUGK [Main Administration of Geodesy and Cartography] attached to the Council of Ministers USSR, and the Seventh Section of the General Staff of the Soviet Army.

2. The structure of the GUGK has changed several times since 1927. There had been a Geodetic Committee, attached to the Labor and Defense Council (Sovet Truda i Oborony) USSR, charged with the coordination of topographic and geodetic work in all departments conducting such operations. In 1926, the Geodetic Committee passed a resolution introducing in the Soviet Union the Gauss-Kruger planar rectangular coordinates into topo-geodetic and cartographic work. The Supreme Geodetic Administration was created and attached to the Commissariat of Internal Affairs, which conducted topo-geodetic and cartographic operations for civil departments of the Soviet Union. In 1938, GUGK was established under the Council of Ministers, USSR, which exists to this day. GUGK not only coordinates topo-geodetic operations on the territory of the USSR, but controls them insofar as concerns the requirements of technical directives. GUGK enjoys extensive rights in the field of geodesy and cartography. It concentrates in its hands the training of specialist cadres, has seven technical schools (secondary educational institutions), and three higher geodetic educational institutions (in Moscow, Voronezh, and Khar'kov). In connection with the training of specialist cadres, the curricula and programs of the technical schools and higher educational institutions have been altered. Within the GUGK system have been integrated all cartographic factories of Leningrad, Moscow, Tashkent, Sverdlovsk, Omsk, Tbilisi, Saratov, Novobelitsa, Khar'kov, and Novosibirsk. Prior to 1936, all cartographic factories were equipped with flat offset presses and lithographic machines exclusively of foreign origin (Faber,

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Schleicher, and Johannesberg). Soviet offset presses began to appear in 1936, designed according to the best foreign models (the "Drukma" and "Planeta-Quinta" types). The Rybinskiy Polygraphic Equipment Plant designs and builds Soviet printing machinery.

3. The increased growth of cartographic activity before World War II (1938-40) encountered an obstacle in the shortage of qualified specialists, an inability to use the new Soviet and imported equipment, and, in addition, the inferior quality of the paper and dyes. As a result, spoilage was as high as 40 percent. A large percentage of idle machines and streaky maps were a common occurrence and, as a result, there was a chronic nonfulfillment of plans by the cartographic factories. The Penza "Mayak Revolyutsii" Factory manufactures cartographic paper for the cartographic factories. The paper is made with 50 percent rag content.

4. In the GUGK system there is a Geological Information Bureau (Geospravbyuro) which collects and systematizes all the data derived from astronomical, geodetic, topographic, and cartographic operations on the territory of the Soviet Union. It summarizes, in catalogue fashion, data derived from every type of operation and groups such data in the form of maps, which are scaled in millionths. The catalogues are issued for the use of interested organizations. The GUGK is responsible for all technical publications in all branches of topo-geo-cartography ("Geodezizdat" /Geodetic Publications/), and publishes the technological literature and most important works in the area of geodetics and cartography.

5. Before World War II, a "Catalogue of Published Geographic and Special Maps" was issued as a reference book for compilers. By 1941, there were published technical manuals and instructions for topographic work and triangulations of various orders. They replaced all the departmental technical instructions. All scientific research and experimental work in the field of topo-geo-cartography is carried on in TsNIIGAiK /Central Scientific Research Institute of Geodesy, Aerial Photo Survey, and Cartography/. The head of the institute is Engineer A. I. Suchov, a member of the Communist Party and former employee of the Administration of Military and Topographic Service; I. S. Baranov, an old party member and specialist in a different phase of the work, heads the GUGK. His assistant is I. S. Morozov, a party member and electrical engineer by profession. Direction in the technical work of GUGK is exercised by Professors Kel', Ditts, Maksimovich, and Aleksapol'skiy and Engineers Sukhov, Nesmeyanov, Romanovskiy, Zhukov, Glinkin, Rusinov, Drobyshev, Bardukov, Veseiovskiy, Durnev, and Sudakov.

6. Topo-geodetic tools and instruments for the needs of the Soviet Union are produced in the following plants:

(a) The Leningrad Optical Glass Plant (Lenzos);
(b) The Izyum Optical Glass Plant (Izos), which fuses optical glass for topo-geodetic instruments and photographic apparatus;
(c) The Moscow "Geofizika" Plant, which designs and constructs astronomic and geodetic instruments (general-purpose instruments, geodetic instruments, telescopic alidades, plane-tables, technical levels, and pantographs);
(d) The Moscow "Geodeziya" Plant, a large experimental-design shop. It conducts scientific research work and produces complex apparatus (photo-transformers, stereoapthographs, stereoplanographs designed by Drobyshev, multiplexes, photo-reducers and aerial cameras;
(e) The Leningrad Experimental "Aerogeopribor" Plant, which produces astronomic and geodetic instruments (2", 5", 10"), precision levels, balance tools, instruments, and devices;
(f) The Leningrad "Gosgeoinstrument" Plant, which produces instruments for kolkhozes, for construction purposes, and which also repairs instruments;
(g) The Leningrad All-Union Scientific-Research Institute of Metrology (VNIIM), which makes chronographs of the Hipp type, astronomical clocks of the Rifler and Short type, and precision physics instruments for astronomical work;
(h) In addition to these plants, there are repair shops in all the capital cities of the republics of the Soviet Union, where simple repairs are made and simple instruments are manufactured.

7. For topo-geodetic field work, the GUGK has field PPs (production enterprises), which conduct all terrestrial topo-geodetic work. In view of the great importance of aerial photography in topographic operations, an aerial-photography unit is attached to each PP. In addition, the GUGK also has aerial photography units in the Ministry of Railways (MPS), Forest Aviation [?], Ministry of Agriculture, and the Main Administration of the Northern Sea Route (Glavmorsevput'). Single-engine, two-seater planes of the P-5 type, with a speed of 180-200 kilometers per hour are used in aerial photography.

8. The second organization doing the bulk of the topographic work on the territory of the Soviet Union is the Military-Topographic Administration of the Soviet Army (VTU), which is also called the Administration of Military-Topographic Services of the Soviet Army, or Section Seven of the General Staff of the Soviet Army. It is headed by Major General M. K. Kuaryavtsev and his deputy, Colonel Aleksandrov. The chief of UVTS [Military-Topographic Service Administration] is subordinate to the Chief of the General Staff of the Soviet Army. UVTS provides for the needs of the Soviet Army in topographic materials and geodetic catalogues. There are twelve topographic units in the UVTS system, seven geodetic units, three aerial photography units, and geodetic and cartographic units in the cities of Leningrad, Moscow, Kiev, Kremenchug, Rostov, Tbilisi, Tashkent, Sverdlovsk, Omsk, Irkutsk, and Khabarovsk. All UVTS units are subordinated structurally and politically to the staff of the Military District on whose territory they are located, but they receive technical assignments from the UVTS in Moscow. The military-topographic and geodetic units are staffed with military personnel, civilian employees, specially assigned officers, and casuals (enlisted men). Officers are called for periods of from two weeks to three months. There is a branch of the Military-Topographic Service in each Military District responsible for providing the troops of the district with topographic maps and military catalogues, the servicing of the troops during maneuvers, concentration of the geodetic network for the artillery, and so forth. There are scientific, research, and experimental units in the UVTS, founded in 1938 on the basis of the photogrammetry section of the UVTS. There is a special area south of the city of Serpukhov, about 300 square kilometers, for field testing of methods and instruments, where the geodetic network has been brought up to a density of one point per square kilometer and the points are observed and computed with precision by means of second-order triangulation.

9. The composition of the scientific-research polygon [sic] includes the following:

(1) a photogrammetry branch
(2) aerial and ground stereophotogrammetry branch
(3) geodetic branch
(4) a cartographic and map-publishing branch
(5) photographic branch
(6) aerial photography branch.

Colonel Pasha heads the scientific-research polygon. Directing the subdivisions are Colonel Shilov, military engineer 1st grade, A. I. Mitin, N. N. Nechayev, Starosel'skiy, and A. S. Skiridov.

10. The training of officer specialists is carried on in the military-topography school (Leningrad, ulitsa Krasnych Kursantov No. 17) composed of a battalion of officer cadets. The cadets are selected from among persons having secondary school training, and mainly members of the Party and Komsomol. The duration of studies for topographers is two years; for triangulators, three years. The UVTS draws up the school's curriculum. The higher military school for the Military-Topographic Service is the Geodetic Command School of the Military Engineering Academy imeni Kuybyshev (Moscow, Pokrovskiy Boulevard, 5). The geodetic school is an outgrowth of the former geodetic branch of the Nikolayevskaya Academy of the General Staff (Leningrad). The geodetic school has the following departments:

(1) photogrammetry (Topographical)
(2) geodesy
(3) cartography and map publication
(4) aerial photography
(5) instrumentation.

In technical matters, the school is responsible to the UVTS, which prepares the curriculum. The geodetic command is composed mainly of units of the Military-Topographic Service and 2-3 percent from other branches (artillery and aviation). The chief of the military-geodetic school is appointed by the chief of the UVTS. Attached to the geodetic school of the VIA (Military Engineering Academy) is a night school for officer topographers, who receive training without being detached from their service. The night school has the same program as the basic school. 30-40 trainees attend night school. Upon conclusion of the work, the officer topographers enjoy the same rights as graduates of the day school. The chief of the night school is Colonel Gusnin.

11. The best of the UVTS specialists are assigned to teaching in the Geodetic Command School -- Professors Urmayev, Gapochko, and Aleksopol'skiy, and Engineers Skiridov, Shiryayev, Petrov, Mazayev, Gerasimov, Sergeyev, Shipitsin, Vysotskiy, Zvonov, and others. Specialists from the /civilian/ MIIGAiK /Moscow Research Institute of Geodesy, Aerial Photography, and Cartography/, namely, Engineers Neameyanov, Zhukov, Romanovskiy, and Drobyshev, are invited to lecture at the Geodetic Command School, and, reciprocally, teachers of the Geodetic Command School lecture at the civilian MIIGAiK. Upon completion of studies in the Military Geodetic School, officers receive a rank not lower than captain and are appointed to a position in a unit of the Military-Topographic Service. An officer of the topographic service with higher training wishing to receive an academic degree must obtain permission from his command, and is attached to the Geodetic Command School of the VIA for work on a chosen subject. The academic degrees of Candidate or Doctor of Technical Sciences are awarded. Women also receive academic titles and teach in higher academic institutions and military academies, but cannot be students in any military academies.

12. Several departmental bulletins are published in the Military Engineering Academy, and one general academic bulletin appears at intervals not exceeding three to four months, depending on the availability of material and the urgency of the question. The general academic bulletin is issued in printed form and distributed to the libraries of interested organizations. In addition to the academic bulletin, the press issues technical literature and teaching aids, which may be purchased at the kiosks. The academic bulletin contains materials which bear no security classification, but carry the stamp, "For Official Use". The journal, Geodesist, edited by GUGK and UVTS and issued by Geodezizdat after World War II, is not for sale. The majority of specialized themes are printed in the Works of TsNIIGAiK and in the Notes of the Military-Topographic Service, in which are printed reports of work completed and all types of expeditions.

13. The Arctic Survey /Service/, attached to the Arctic Institute in Leningrad, makes extensive use of aviation, maintains liaison with the polar stations, and is engaged in guiding ship convoys along the Northern Sea Route, in ice surveys, and aerial surveys. Maps of the Chukotskiy Peninsula, the islands of Yakutiya, Wrangel' Island, and others were made with the aid of aerial survey.

14. The radio-interpretive method of coordinates (RISK), the use of radio for determining location, was tested by various scientific institutes of the Soviet Union (the Institute of Communications, TsNIIGAiK, and UVTS). The scientific-research polygon of the UVTS, together with TsNIIGAiK (Engineers Nechayev, Mitin, Shcheglov, and Balushko) used this method to determine distances in geodetics at the polygon outside the city of Serpukhov, in the neighborhood of the Sokol'nicheskiy Radio Station in Moscow. Experiments prior to World War II gave satisfactory results. Errors in determination of distance were about 15-20 percent /sic/.

15. Navy topographers are trained by the specialized naval technical schools and the Naval Academy of Leningrad. All topo-geodetic operations are conducted by the Navy's Military Hydrographic Administration. Besides the Hydrographic Administration, which services the Navy, there are specialists in the Northern Sea Route system.

16. The technical schools under the GUGK turn out three types of specialists: topographer-technicians, who conduct plane-table surveys and make relief maps scaled to any proportion, making use of aerial surveys of the fourth order. The geodesist-technician carries out observational work and processing of triangulation of the third order and below, polygonometric work, and technical leveling. Cartographer-technicians are concerned with the execution of large-scale maps, the use of aerial surveys, the mounting of maps, and technical editing.

17. Geodetic polygons of the first and second order are numbered in the order of their completion. They are situated, in the form of closed figures, along parallel meridian lines at distances of 200-300 kilometers, in populated areas; in areas difficult of access, such as Siberia and the Far East, the chain intervals are 800-1,000 kilometers. The GUGK and UVTS conduct trigonometric work of the first and second order. Data of the first and second order are published only if they have scientific and theoretical significance. Data of triangulation operations of the lowest orders are considered "not for publication".

18. The first-order series of triangulations from Novosibirsk to Khabarovsk yielded basic data for a first- and second-order series along the rivers Yenisey, Lena, Kolyma, and along the shores of the Okhotsk Sea as far as the town of Ol'ga. However, for the making of maps scaled 1:200,000 and 1:500,000 astronomical points of the second and third order were used, so that the first- and second-order triangulation problems in these instances were different. During the production of maps scaled 1:200,000 and 1:500,000 in these areas, provision was made also for maps scaled 1:100,000. Therefore, astronomical reference points of the third order were determined with an error of 1.5" for latitude and 4" for longitude, with an average distance of 60-80 kilometers.

19. The process connecting the first-order network along the shores of the Okhotsk Sea with the American network in Alaska had been planned in the Third Five-Year Plan. All cartographic work in these regions was based on aerial surveys. The mapping of the northern edge of Siberia and the Okhotsk Sea is performed by GUGK, UVTS, GULAG, SEVMORPUT' [Northern Sea Route], Gidrograf. Uprav. [Hydrological Administration], and SOYUZZOLOTO [All-Union Gold Industry Association?]. The process of connecting the Middle Asiatic triangulations with those of India presents no difficulty since the first-order series for Alma-Ata--Arys' was finished in 1940.

20. Along the Iranian and Turkish borders, a first-order triangulation was made and recalculated at the beginning of World War II, but, unfortunately, at that time neither the Iranian nor the Turkish triangulations in the frontier areas met the requirements of a first-order triangulation, and talks on this matter were broken off by the outbreak of the war. UVTS has maps of the Ashkhabad region, which may be reproduced in the GUGK printing shops and which carry the number of the factories of the "polygraphic trust".

21. Aero-geodetic enterprises or production enterprises of the GUGK are to be found in all the territories of the Soviet Union (northwestern enterprises in Leningrad; others in Moscow, Kiev, Tbilisi, Tashkent; also Eastern Siberian enterprises in Irkutsk). These enterprises assume the task of conducting aerial surveys and geodetic and cartographic operations for the needs of civil establishments in economically important areas of the interior; in frontier areas and those of strategic importance, the work is conducted by the UVTS.

22. Until 1946, Bessel's ellipsoid was employed in geodetic and cartographic operations, and after that year it was introduced as an ellipsoid mandatory for the TsNIIGAik, computed under the direction of Professor Krasovskiy.

23. The annual astronomical bulletin periodically publishes data on new reference points, for the general use of all interested persons and organizations.

24. The Siberian triangulations of the years 1900-1910 carried out by the Corps of Military Topographers, the Administration of Resettlement, and the Geological Committee, were used in laying out a first-order series for Novosibirsk and Khabarovsk. The external reference marks of the old triangulations were not preserved but the mark-stones laid for different centers were discovered in the majority of cases (90 percent).

[redacted]

25. At the time of the German invasion in World War II, the geodetic reference centers on the territories of the Ukraine and Belorussia were preserved by the Germans, in addition to a number of external reference marks. During World War II, one occasionally encountered German maps at the front (taken from prisoners) for the territories of the Ukraine and Belorussia. These maps had been drawn up on the basis of the Soviet maps, and some of the sheets were more detailed than the Soviet sheets. During the war, with aid of aerial surveys, the Germans added to the maps a number of important areas, railway centers, and other information.

26. The primary reference points for topo-geodetic operations up to 1928 were /the town of/ Pulkovo, for the European section of Russia, Yur'yev for the western section, Ferro for the Caucasus, and Svobodnoye for Siberia as far as Lake Baykal. After 1928, Pulkovo and Greenwich triangulations were combined in a single system and re-computed. The average elevation of the Baltic Sea, derived from a series of observations made over the years at Kronstadt, was taken as the primary elevation for the Soviet Union. This level was confirmed by a system of basic leveling marks near the Chudovo station, south of Leningrad. Precision leveling work has been carried out from the level of the Baltic Sea to the Pacific Ocean (Vladivostok), in connection with which it was discovered that the level of the Baltic Sea was 1.98 meters higher than the level of the Pacific Ocean.

27. The most important deflections of the plumb line from the perpendicular in the USSR territories, were noted in the regions of Moscow, the Caucasus, the Ural's, and Lake Baikal. In these areas, following the suggestion of Professor Krasovskiy, first-order triangulations were carried out for computations in separate groups.

28. The projected plans in the Five-Year Plan for topo-geodetic operations were not fulfilled in all particulars (particularly in regard to quality). Reports about the fulfillment of the GUGK Five-Year Plan were published in the Works of TsNIIGAiK. According to the Third Five-Year Plan, a separate triangulation of Sakhalin was included in the general triangulation network of Siberia.

29. In Mongolia, triangulation was based on second- and third-class astronomical reference points. Topographic maps scaled 1:200,000 and 1:500,000 -- and in part, 1:100,000 -- were assembled by Soviet topographers according to an agreement with the Mongolian Government. At the time of the conflict of the Red Army and the Japanese in 1939, in the region of Lake Khasan, cartographic material fell into the hands of the Japanese (topographic maps and trigonometric tables).

30. All the data about trigonometric points contained in the Notes of the VSU have become obsolete, since they have been recalculated and altered.

31. Following the seizure of the Baltic republics and Eastern Poland in 1939, the triangulations of these lands were included in the All-Union network. A part of the geodetic reference points of the first order, along the arc of Struve, were re-observed in 1940 (in Renets and Vinnitsa), and the results published in the Works of the TsNIIGAiK.

32. The foundation point /station mark/ is the emplacement of the center of the polygonometric course. The topographic maps issued by GUGK and UVTS are divided into three groups:

(a) Large-scale: 1:10,000, 1:25,000, 1:50,000 and 1:100,000.
(b) Medium-scale: 1:200,000, 1:500,000, and 1:1,000,000;
(c) Small-scale: 1:1,500,000 and 1:2,500,000.

To the first group belong maps assembled in the field (plane-table, theodolite, and aerial survey); to the second group belong the maps which were originally made partly in field conditions and partly in the office on the basis of large-scale maps. On maps of scales 1:200,000 and less, the roads are marked in red, and on maps scaled 1:1,500,000 and less, relief features are illuminated (shaded).

33. The cutting of horizontal planes is spaced at 2 meters on maps scaled 1:10,000, at 5 meters on 1:25,000, at 10 meters on 1:50,000, at 10 or 20 meters on 1:100,000 - depending on the relief - at 20 or 40 meters on 1:200,000, at 50 meters on 1:1,500,000, and 100 meters on 1:1,000,000 maps. Since 1928, the ruling of topographic map sheets from 1:10,000 to 1:1,000,000 has been done in accordance with the international system of rulings, whose basis is the map sheet scaled in millionths, with intervals of 4 degrees along the meridians (latitude) and 6 degrees along the parallels (longitude). The prime meridian is Greenwich. On contemporary maps up to 1:1,000,000, a kilometer grid network is superimposed, which is drawn across the total number of kilometers. As a result of the coordination of designation figures on maps of varying scales, identical points on the map will have the same coordinates regardless of the scale of the map.

34. The basic tactical map in the Soviet Army is scaled 1:100,000. The officer and political personnel of all the armed services who direct battle operations, from the platoon commander up, are provided with it. Junior commanders receive the map only in connection with the execution of independent battle assignments. In areas provided with maps scaled 1:25,000 and 1:50,000, the latter are issued only to artillery, infantry, and engineer troops. For bombing and aerial reconnaissance, maps scaled 1:200,000 and 1:500,000 are issued only for a target area with a radius of 30-50 kilometers.

35. Maps scaled 1:500,000 and 1:1,000,000 are used as basic field maps by air force units. Maps scaled 1:1,500,000 and 1:2,500,000 are used for survey work and long-range aviation. Military catalogues of geodetic points are issued only to artillery, hydrotechnical, and topographic units. Reports that 70 percent of the Soviet Union is covered by maps scaled 1:100,000 are of a doubtful nature. According to the third Five-Year Plan, a 40-percent coverage was contemplated but it was upset by World War II. When small-scale maps carry the note, "All available informational and cartographic material has been used," this means that the material available to the Geodetic Information Bureau has been used. This bureau is regularly supplied with new cartographic material on the Soviet Union. There are branches of the information bureau in all the republic capitals, which are also engaged in the collection of cartographic information and materials. The central bureau is located in Moscow on Rybnyy Pereulok /Fisherman's Lane/ and is headed by Engineer Nesmeyanov.

36. The accuracy of the topographic maps scaled 1:25,000 and 1:50,000 meters fully meets the requirements of artillery and engineer troops. During World War II, the artillery in battle areas was always interested in maps so scaled. The accuracy of the maps issued in the scales of 1:25,000 meters and 1:50,000 meters was of the order of 0.3 to 0.4 millimeters, which corresponded to 7-15 meters on the ground.

37. On maps ranging from 1:25,000 to 1:100,000 principal roads fall into the following six categories:

(a) Motor highways and roads;
(b) Improved highways (asphalt and concrete);
(c) Highways surfaced with stone, gravel;
(d) Improved dirt roads (with ditches);
(e) Dirt roads (former transport and postal roads);
(f) Dirt roads (country roads between populated points).

These classifications are mandatory for the indicated scales. For scales of 1:4,000,000 and less (educational and special), the gradation and legend concerning the roads are different. Highways and common roads are differentiated according to width and the type of surfacing -- asphalt or tar, in the first case, and stone and gravel (broken brick), in the second case.

38. The majority of instruments used in topographic work in the Soviet Union are manufactured in Soviet plants according to the designs of the best foreign firms.

The following are employed in topographic work:

(a) Large plane-table with a board measuring 60 x 60 centimeters;
(b) Light plane-table with a board of 40 x 40 centimeters;
(c) Large alidade with a vertical disk of 30"
(d) Small alidade with a vertical disk of 60"

The alidades have a special attachment for the automatic derivation of [spherical] excess (the Stadolkevich headpiece). Theodolites with a precision of 2" and 5" of the Hildebrant and Bamberger types with check tube, and electric illumination are used in making triangulations of the first and second order.

39. For triangulation work of the second and third order, the 5" geodetic theodolite of the Hildebrant type, the 10-inch all-purpose measuring instrument produced by the Moscow Geodeziya Plant, and the new U-5 all-purpose instrument built by the Leningrad "Aerogeopribor" plant are employed. Before World War II, experiments were carried out on the production of the geodetic theodolite, T-2, with an accuracy of 2" on the horizontal disk and 6" on the vertical disk.

40. In triangulations of the lowest orders, TA theodolites are employed, having a division value of 20", with an optical plumb line and tripod; a 30"-theodolite produced by the "Geodeziya" factory, as well as Vil'd [Wild?] and Zeiss theodolites are also used. In aerial survey work. The following cameras have been used: the RMK camera (produced on the model of a Zeiss), the NASh with a tube carrying a LIAR-6 lens for maps of 1:100,000, with a focal point of 100 millimeters, a film of 18 x 18 centimeters, and a 300-shot film strip, and the RMK-S-3, with a focal point of 205 millimeters, a film of 18 x 18 centimeters, and a 300-shot film strip. For small scale maps, the AD-2 (nine-lens camera of Drobyshev), the T-2A and T-3A cameras (4 and 5 lenses), and cameras with a Russar lens, a 100-millimeter focal point, and film of 18 x 18 centimeters are used.

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