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# THE MOSCOW HIGHER TECHNICAL SCHOOL (1917-1955)

-USSR-

/Following is the translation of selected pages from a book entitled 125th Anniversary of the Moscow Higher Technical School, 1955, Moscow, pages 282-361./

The Great October Socialist Revolution opened a new era in the history of our Motherland and all humanity. It led our country on to the path of socialist development.

One of the most important tasks in the socialist transformation of our country was the creation of a powerful industry, with special emphasis on heavy industry, which would serve as the new technical base of the entire economy, including agriculture. It was V.I. Lenin who in 1920 gave impetus to the creation of the GOELRO (State Commission on the Electrification of the Republic) plan which was a detailed outline of the development of the national economy on the basis of electrification. The most urgent matters taken up by the plan were the reinforcement of transportation and metallurgy, and the increase of fuel production.

The Communist Party based its decision on the fact that only the speeded-up development of heavy industry could assure a complete victory for the new social order. For this reason, the creation of heavy industry was the most important and at the same time the most complex task of the Soviet State.

In making the transition to peaceful endeavor following the conclusion of the Civil War, the country could not embark on its new construction directly with the creation of a heavy industry; it was first necessary to heal the wounds inflicted by the War, to reestablish the national economy, and to bring order to industry, transportation, and agriculture.

The heavy industrial output in 1920 was almost seven times smaller than that of the prewar period. Together with the maintenance factories, the machine building industry in 1921 produced only 16% of the 1913 production level.

The reestablishment of industry began with light industry, and first and foremost with those sectors which served the needs of agriculture. Increased activity in agriculture and light industry made it possible to accumulate a certain amount of capital for the reestablishment of heavy industry.

Despite the extremely rapid growth in metal production, the reconstruction period in ferrous metallurgy lasted until the first year of the first Five-Year Plan, since the damage inflicted in this branch of industry was greater than in any other.

By 1925, heavy industry was providing about three quarters of the prewar production volume. Rapid gains were made in all branches of industry producing the means of production and means of consumption. Significant successes were likewise achieved in the reestablishment of agriculture: it was to rise to 87% of the prewar level both with respect to area under cultivation and grain production.

In 1926, as a result of the successful fulfillment of the GOELRO plan, the electric power stations of the Soviet Union exceeded by one and a half times the prewar level of electric power production. New electric power stations to be built were the Volkhovskaya, Shaturskaya, Kashirskaya, Balakhninskaya, etc. The electrical power produced was basically used for industrial purposes; this made possible a considerable increase in the level of industrial mechanization.

In the petroleum industry, the prewar level of oil production was exceeded in 1926-1927: 10.2 million tons were obtained as against the 9.2 million tons in 1913. Obsolete methods of obtaining petroleum were replaced by the use of modern machines (depth pumps and compressors). The general level of mechanization in petroleum production was likewise increased on the basis of new technical methods.

Great changes also took place in the coal industry. In addition to a constantly improving level of coal extraction mechanization, this industry underwent a process of reestablishing old and cutting new and larger mine shafts.

Machine building was not only reestablished, but branched out into new areas as well.

Thus, for example, tractors were built for the first time in our country, although on an insignificant scale. There were already more textile looms being produced than in the prewar period. The production of agricultural machinery far exceeded the prewar level. Particularly great achievements were made in power production machinery construction.

In 1926, machine building constituted 10.7% of the entire industrial product as against 6.8% in 1913.

Machine building exceeded the prewar level by more than one and a half times.

By the end of the reconstruction period, the USSR occupied the eleventh place in the world with respect to electrical power production, the tenth place in coal production, the seventh place in pigiron production, the sixth place in steel production, and the eleventh place in truck production (116 trucks were built in 1925).

The foundations of socialist industrialization were laid in the process of reestablishing the national economy.

Industry occupied an ever greater role in the country's economy. This created a firm basis for the continued growth of productive forces in the succeeding reconstruction period.

Although fraught with the greatest difficulties, the restoration of the national economy was completed in a historically unprecedented length of time. This was achieved as a result of the superiority of the Soviet economic system over that of the capitalist countries. But a nation building socialism could not rest on its laurels.

The 14th Congress of the All-Russian Communist Party of Bolsheviks in December, 1925, guided by the objective laws of social development, outlined the future plans for socialist industrialization. This was the basis for the creation of an industrial-technological base for socialism and the liquidation of technological and economic backwardness in our country.

The policies of socialist industrialization bore fruit during the time of the five-year plans.

The first Five-Year Plan had as its purpose the fulfillment of the task posed by the Party of creating an advanced domestic technological base for the socialist reconstruction of the entire national economy and the achievement of technological-economic independence for the USSR. Such a task could be coped with by industry only if machine building were to assume a position of primary importance in it. It is precisely for this reason that the Five-Year Plan envisioned a 350% increase in machinery production and metal processing as against the projected 230% growth in heavy industry in general.

The creation of a domestic industrial base in the first Five-Year Plan for the reconstruction of industry, transportation, and agriculture effected a radical change in the structure of the Soviet national economy.

From an agrarian nation, the Soviet Union became an industrial power.

Likewise of universal historical importance were the succeeding achievements of the USSR during the course of the second Five-Year Plan (1932-1937), and to some extent the third Five-Year Plan (1937-1941).

Heavy industry exhibited a particularly high rate of growth in the USSR. During the years of the second Five-Year Plan, the mean annual growth rate in heavy industry amounted to 17.1%. For the sake of comparison it is sufficient to point out, that in the United States, the major industries grew at a rate of 2% per annum from 1919 to 1936, while heavy industry over the years 1922-1929 grew at a rate of 6.1%.

The realization of socialist industrialization introduced significant changes into the economic geography of the Soviet Union. The country's productive forces began to develop according to a plan which was based on the principles of liquidating economic and cultural inequality between the industrial and agricultural regions, the fuller use of natural resources, the bringing of industry closer to the sources of raw materials, increased labor efficiency, and the strengthenin of the economic independence and defense capability of the Soviet State.

The old industrial regions around Moscow and Leningrad underwent radical reconstruction in the course of the five-year plans. The dominant industries in this area now became those concerned with producing the tools and means of producti despite the fact that the primary industry prior to the revolu was textile making. These two areas became the powerful focal points of socialist reconstruction and technological re-armament of the entire national economy.

One of the resolutions adopted at the 17th Congress of the All-Russian Communist Party of Bolsheviks reads as follows: "On the basis of developments in the old industrial centers, new support bases for industrialization in the eastern regions of the Soviet Union are being created in the Urals, Western and Eastern Siberia, Bashkriya, the Far Eastern Kry, Kazakhstan, and Central Asia" /note: The All-Russian Communist Party of Bolsheviks in its Resolutions, Part II, pages 585, 586./

As the Soviet machine building industry grew, the importation of machines dwindled off. Thus, in 1929-1931, the value of tractor imports amounted to 876 million rubles, while already in 1932, no tractors were imported due to the initiation of mass tractor production in the Soviet Union. This also occurred in the case of automobiles. In 1934, the importation of automobiles was suspended despite the fact that in 1929, imported autos made up 79% of the total automobile influx into the national economy.

The importation of machines, equipment, and the most important raw materials for heavy industry was exploited in the interests of assuring the uninterrupted continuance of the industrial expansion process.

The second Five-Year Plan was basically fulfilled with the aid of the domestic machine building industry and domestic raw materials. In 1937, machine imports fell to 0.9% as against 43.6% in 1913, and 21% in 1928, with a concomitant increase in machinery consumption of 198.3% in 1928 over the 1913 level, and 1869.1% in 1937 over that same level.

In 1937, the prewar level of machinery production was exceeded by a factor of 28. The Soviet Union itself began to export machines and equipment.

Due to the successful development of the machine building industry and both ferrous and non-ferrous metallurgy, an end was put to the ancient backwardness in the field of agriculture. Soviet agriculture become one of the major technologically advanced agrarian systems in the world.

Upon completion of the second Five-Year Plan, the total industrial output of socialist industry exceeded by 17% the level of German industry, by 46.4% the British level, and by more than 300% the industrial level of France. In the production of pigiron and steel, the USSR assumed the second position in Europe and the third in the world. In electrical power production the Soviet Union jumped from fifteenth place to second in the world and first in Europe.

In 1937, industrial production in the USSR accounted for 77.4% of the national output as against 42.1% in 1913.

The enormous scale of industrial production, the primary emphasis placed on the development of heavy industry according to the industrialization plan, the location of new construction projects in regions which formerly had no industry, the creation of completely new forms of production whose technical aspects had to be mastered, and finally the technical reconstruction of agriculture--all of this made the problem of trained cadres extremely acute.

Over the period of 1928 through 1940, the number of workers and employees occupied in the USSR national economy increased from 10.8 up to 31.2 million persons, i.e., by 300%. By the end of the second Five-Year Plan, industry was employing over 10 million workers and employees. This figure was 3.6 times greater than that of 1913. It was during these years that the Soviet Union created its engineering-technical intelligentsia.

In a historically short period of time, our country built a socialist society and liquidated the exploiting classes.

In the course of the third Five-Year Plan, the USSR entered a new phase of its development--that of a gradual transition from socialism to communism. The 18th Congress of the All-Russian Party of Bolsheviks set forth as one of the most important conditions for this transition the realization of a new economic goal for the USSR--that of overtaking and surpassing the major capitalist nations in economic might, ie, in per capita industrial output. By 1941, our industry was rebuilt on a new technological base. As a result of the realization of the industrialization policy, the USSR became an industrial power with an industry differing both in kind and technological advancement from that of the pre-revolutionary era.

1941 marked the start of the Great War of the Motherland, which was to interrupt the peaceful endeavors of the Soviet people. Everything was subordinated to wartime conditions, and the entire Soviet people backed up the war effort. But even under the difficult wartime conditions, industrial production in the Eastern region of the country continued to grow.

The severe test to which our industry was subjected during the War proved the economic might and independence of the USSR.

The basis of the economic and cultural activity of the Soviet people in the postwar years was the Five-Year Plan for the reconstruction and development of the national economy (1945-1950).

During the years of this Five-Year Plan, socialist industry rose to a new and unprecedented level of development; the technological rearmament of the Soviet national economy progressed at unheard of rates.

Great successes were achieved in the development of the machine building industry. Production in this sector of the economy in 1950 exceeded by 2.3 times the 1940 volume, the production of metallurgical equipment increased by 4.8 times, steam turbine production increased by 2.6 times (to include the largest turbines in the world, with a power of 100-150 kilowatts), electric power equipment increased by three times, oil drilling and refining equipment by three times, tractor production by 3.8 times, combine production by 3.6 times, tractor ploughs by 3.1 times, etc.

The rapid growth of Soviet machinery construction was aided by the extensive introduction of advanced technological processes and methods of production: rapid techniques of metal cutting, stamping, high-frequency current tempering, as well as by the introduction of continuous and automatic machinging equipment, etc. About 250 new types of general-purpose metal cutting machines, over 1000 types of specialized and aggregate machines, 23 types of automatic and semi-automatic metal cutters, 34 types of automatic forging and pressing machines, etc. were introduced; 26 automatic metal shaping lines were created and an automatic factory for producing automobile parts was produced. Over the last three years, the machine building industry has created over 1600 new types of machines and mechanisms. New types of equipment have been produced for electrical power stations, the metallurgical, chemical, and other industries, including more economical hydraulic and steam turbines, highly efficient rolling equipment, and new types of apparatus and devices for automatic control and regulation of production processes.

The results of the fourth Five-Year Plan provided clear evidence of the power and might of the Soviet State and represented an expression of its peace-loving policies, as well as a triumph of the peaceful creative endeavors of the Soviet people.

"The successful completion of the fourth Five-Year Plan makes it possible to undertake a new five-year plan to assure the further growth of all branches of the national economy, material wellbeing, health, and cultural advancement for the people" /see note/ --so reads a directive of the 19th Party Congress on the five-year plan of development in the Soviet Union for the years 1951-1955. /Note: the Resolution of the 19th Congress of the Communist Party of the Soviet Union, 1952./

The fifth Five-Year Plan for the years 1951-1955 envisions enormous growth in all branches of the national economy. The most important place in the plan is again played by the development of socialist industry. By 1955, the volume of industrial production is to have increased by three times over the 1940 level.

The creation and strengthening of the material-productive base for socialism and the further provision of high-quality machinery to all branches of the national economy depends on the level of development of heavy industry. For this reason, the fifth Five-Year Plan, just as the fourth, once again reiterates the task of increasing the role of heavy industry in the total national economy.

Rapid growth rates in heavy industry, enormous capital construction, with particular emphasis on electrical power stations, the continued electrification of the national economy and its improvement with the aid of electrical equipment placed at the disposal of labor, the further technical rearmament of industry through mechanization and automation, the better utilization of the industrial potential, and the lowering of production costs and improvement of product quality, the further alteration of the geographic distribution of industry--such are the more characteristic general features of the fifth Five-Year Plan in the field of industrial development.

Technical progress represents one of the most important features of the basic economic law of socialism. The improvement of socialist industry on the basis of advancing technology assures its continued growth and rapid rates of expansion.

The mechanization and automation of production are both important trends in our technological policy. In the fifth Five-Year Plan, the problems of work mechanization and production automation occupy an extremely important place.

The Plan envisions rapid growth rates in the machine building industry--the basis for new and powerful technological progress in all branches of the Soviet national economy. The growth rate in machine building is somewhat higher than, for example, in the metallurgical, coal, and petroleum industries. The production of machines and metals must increase by approximately 200%.

Basing its effort on the outstanding successes achieved by socialist industry in the Soviet Union, the Soviet people are successfully bringing to fruition the grandiose plans which portend a new stage in the creation of a material-technical base for Communism.

It was in the light of the task of economic and cultural-political development in our Motherland that the problem of higher technical education was attacked in the USSR.

## The Moscow Higher Technical School (MVTU)

### Higher Technical Education in the USSR

History knows no examples of such successes in the growth of higher education as were achieved by the USSR following the victory of the Great October Socialist Revolution.

The system of higher technical education inherited by the working class from the bourgeoisie and the landlords was completely inadequate to the needs of the socialist State.

Radical changes in the whole content, form, and methods of work in the higher technical school, its transformation into a source of enrichment in all cultural achievements for the workers, its transformation into a school for the preparation and education of the builders of a communist society--such were the tasks that confronted the proletarian state in the field of higher technical education.

The measures taken by the Soviet regime toward the solution of these problems received ardent support from the progressively-minded scientists and engineers, while meeting the resistance of the reactionary technological intelligentsia.

Despite the generally difficult conditions in which the nation found itself in the Civil War period, the higher technical schools, owing to the solicitude of the Communist Party and Government, were by 1921 able to reopen their doors and to produce more specialists than in the pre-revolutionary period.

But at the same time, the higher technical schools did not as yet face up to the political challenge. This was the basic difficulty to be remedied and the one which received the greatest attention.

Following the conclusion of the Civil War and with the transition to the reconstruction period, our country was in need of numerous technical cadres. In order to satisfy this need, there was established an extensive network of higher and secondary technical schools. During the 1922-1923 school year, the RSFSR (Russian Socialist Federated Soviet Republic) had 248 colleges and higher technical schools with

216.7 thousand students, in addition to 932 technical schools (technicums) and other specialized institutions with 121.6 thousand students. In the succeeding years, the number of educational institutions continued to grow without interruption.

The rapid growth of higher technical education was assisted by the successful realization of the Party directive concerning the further political involvement of higher educational institutions and the organizational reinforcement of political life in them.

In 1925, however, serious shortcomings were discovered in the work of higher technical schools. One of the basic shortcomings was the gulf between educational institutions and the national economy; the reason for this gap was the unfortunate geographical distribution of the higher technical schools, their archaic organization, and the imperfect character of the teaching process. All of this applied particularly to certain old polytechnic highschools which developed under conditions of technological and economic backwardness in old Russia.

The rapid development of productive forces during the period of socialist reconstruction created an unprecedented need for new cadres prepared in accordance with the needs of technology and industrial organization. The old system of preparing technical cadres was inadequate to meet the new needs and became a mere obstacle.

The realization of the decisions adopted at the July (1928) and November (1929) Plenary Sessions of the All-Russian Communist Party of Bolsheviks and the resolutions of the USSR Central Executive Committee of 19 September, 1932, led to a radical reconstruction of the entire system of technical education in the country. This program of reconstruction proceeded along the following lines:

1) The attachment of colleges, higher technical schools, technicums, and rabfaks (worker training courses) to the appropriate economic organizations;

2) The reorganization of polytechnic schools having several departments and the creation of specialized educational institutions on this basis;

3) The improvement of the teaching process;

4) The creation of a network of new colleges, higher technical schools, and technicums with due regard for the needs of the growing national economy, the economic division of the country, and the cultural construction program in the national districts.

The quantitative growth of higher educational institutions and the student population was accompanied by a qualitative improvement in the entire educational system.

The number of colleges and higher technical schools increased to 719 by 1932-1933, while the number of students rose to 463.0 thousand.

The systematic growth of the network of higher educational institutions was combined with their rational distribution over the territory of the USSR. Higher educational institutions in the national republics grew and expanded as well.

As a result of the enormous political and organizational effort to prepare technical cadres and cadres for various branches of the national economy during the period of the first five-year plan, the number of specialists increased sharply. In 1929, the number of specialists with a higher education was 57.0 thousand, while the number with a secondary education was 55.0 thousand; in 1932, these figures reached 216.0 and 288.0 thousand respectively.

During the first Five-Year plan, the percentage of technical cadres at industrial enterprises rose from 3.8% to 7% of the total work force.

Despite this fact, however, the number of available specialists could not satisfy the needs of the national economy.

For this reason, the problem of cadres assumed decisive importance in the second Five-Year Plan. As a result of the intensification of efforts on the preparation of cadres capable of mastering the newly developed technology and using it effectively, the graduation of specialists from educational institutions during the years of the second Five-Year Plan rose to over twice that of the first Five-Year Plan.

The mass training of specialists in higher educational institutions made it possible to satisfy to a considerable degree the needs of the national economy. The problem of cadres was thus solved.

The old slogan about mastering technology was replaced by a new slogan calling for the mastery of Bolshevism, the political education of cadres, and the liquidation of political apathy.

The realization of the directives adopted at the 18th Congress of the All-Russian Communist Party of Bolsheviks and the succeeding Party and Government decisions on higher technical education led to further growth in this area. In the three and a half years of the third Five-Year Plan (1938-1941), the higher educational institutions graduated 409.0 thousand specialists, including 116.5 thousand engineers, while the network of higher educational institutions grew to include 782 units.

The Great War of the Motherland proved to be a severe test for our country.

The higher educational institutions did not for a single day interrupt their training of highly qualified specialists for the national economy. Despite the temporary occupation of a portion of the Soviet territory by the enemy and the concomitant reduction in the number of schools as well as the evacuation of the majority of the population into the interior of the country, 182.5 thousand specialists, including 41.6 thousand engineers were graduated over the period 1942-1945.

As the enemy was being driven from our country, the higher educational institutions performed the enormous task of reconstructing the educational system. By the end of the War, the USSR had 720 functioning colleges and higher technical schools.

With the end of the Great War of the Motherland, the higher educational institutions fulfilled all of their responsibilities as outlined in the fourth Five-Year Plan for the reconstruction and development of the national economy (1946-1950). By 1951, the network of higher educational institutions in the USSR reached a figure of 847, while the student population numbered 841.0 thousand. During this time, the institutions graduated 652 thousand young specialists for all branches of the national economy.

The period of postwar development in the educational system is noteworthy not only for quantitative growth, but also for the serious qualitative changes wrought in all fields of pedagogical, methodological, scientific research, and ideological work. In all of this, the educational system was assisted by the historical decisions of the Central Committee of the Communist Party on ideological problems, as well as by philosophical discussions, creative discussions on the problems of biology, physiology, and language study.

The large financial allocations made by the State to the educational system assured the creation of a modern material base.

The 19th Congress of the Communist Party of the Soviet Union held in 1952 confronted the Soviet system of higher education with the task of affecting further expansion in the country's higher education. The directives dealing with the fifth Five-Year Plan for 1951-1955 envision a two-fold increase in the number of specialists graduating from higher educational institutions into the most important branches of industry, construction, and agriculture.

The rapid development of the national economy, science and technology, and the organization of new branches of production, as well as the introduction of advanced technological methods has posed new and higher demands before the schools.

In 1954, the USSR Council of Ministers and the Central Committee of the CPSU adopted a resolution on the improvement of the preparation, assignment, and utilization of specialists with a higher and secondary specialized education. This resolution represented an extensive outline for the further development of higher and secondary specialized education.

The fulfillment of the Party and State directives required a new qualitative change in the work of the higher technical schools.

As previously, the higher educational institutions were faced with the basic problem of doing everything possible to improve the ideological-political education of the students and faculties in the spirit of Soviet patriotism and friendship among peoples.

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Following the Great October Socialist Revolution, the finest members of the scientific and technical elite placed themselves in the service of the people on the side of the Soviet regime. Another segment of the old technical intelligentsia, however, failed to understand the enormous historical significance of the Revolution for the fate of our Motherland. The leaders of this intelligentsia, intimately connected with the forces of capital, undertook to struggle against the Soviet power.

The correct policies of the Communist Party assured the winning over to the Soviet side of the great majority of the old technical intelligentsia.

An enormous army of new, democratic, Soviet intellectuals arose during the years of the first Five-Year Plan.

Its high moral-political qualities became apparent during the years of the Great War of the Motherland, when the intellectuals struggled selflessly side with side with all the people to secure victory over the enemy.

"Another reason that we were able to cope with the problems of the battlefront and heartland during the war years", said Comrade Molotov, "was that the Soviet intelligentsia did its duty for the Motherland. The War made it quite clear what the intelligentsia had become during the years of the Soviet regime. No longer do we hear talk of the old and new intelligentsia. This problem has been eliminated by life itself...it is with great satisfaction that we can now say that the Soviet intelligentsia is worthy of its people and serves the Motherland faithfully" /Note: V.M. Molotov, 28th Anniversary of the Great October Socialist

Revolution, 1945, pages 20-21.7

The problem of improving the social composition of the leadership in various branches of the national economy was attacked in the very first few days following the October Revolution. The basic source for such cadres was the higher educational institution. The enrollment of members of the proletarian class in the higher educational institutions becamse a major task for a number of years. Measures aimed at realizing it included the creation of rabfaks and courses for preparing applicants to colleges and higher technical schools, as well as the improvement of the secondary schools.

Of the greatest political importance was the enrollment in colleges and higher technical schools of the finest Communists with practical experience in Party, economic, and trade union work ("the tysyachniks").

Not only was the enrollment of the Communist "tysyachniks" in higher educational institutions important in improving the social and Party composition of the student community, but it was likewise of great organizational and political influence in the struggle of Party organizations within these institutions for the realization of Party and State decisions on the reconstruction and improvement of higher education.

As a result of the practical measures taken to improve the social composition of the student population, the proportion of students of working-class origin in the colleges reached 50.3% in the colleges and 64.6% in the higher technical schools.

The problem of improving the social composition of the leadership cadres in the national economy equipped with sufficient specialized preparation was solved by the end of the second Five-Year Plan.

The pre-revolutionary higher technical schools had extremely small professorial and teaching staffs. Their growth was exceptionally slow. The organized training of young scientific forces was almost totally lacking. The contamination of the professorial and teaching staffs by class enemies and hostile elements for a number of years made possible the hostile activities of reactionary elements. This fact is confirmed by the fierce battles which arose in the higher educational institutions in connection with the realization of Party and State decisions regarding the reorganization of these institutions and the preparation of new cadres of Soviet intellectuals.

Starting in 1920, the Soviet government undertook to bring to fruition the practical task of preparing new scientific cadres. Organized and coordinated efforts in this direction were only initiated in 1925, however, with the organization of graduate study programs. Graduate level work improved from year to year, especially after the decisions of the July and November Plenary Sessions of the Central Committee of the All-Russian Communist Party of Bolsheviks (1928 and 1929) and the subsequent governmental decisions.

Despite a number of shortcomings, the graduate study programs produced 7.9 thousand young scientists during the period from 1925 through 1934.

In 1938-1939, there took place a radical reorganization of the system of preparing scientific cadres through graduate study.

By 1941, the basic scientific cadres were the products of the Soviet higher educational system and people who had received graduate training.

During the years of the Great War of the Motherland, the training of scientists through graduate study was curtailed, only to expand considerably after the War; the postwar Five-Year Plan envisioned the preparation of 13.5 thousand young scientific workers. The successful fulfillment of the plan made it possible to satisfy the needs of the country as regards scientific cadres.

The fifth Five-Year Plan includes an approximately two-fold increase in the training of scientific-pedagogical cadres through graduate study as compared with the preceding Five-Year Plan.

Graduate study programs have played a major role in the preparation of new professorial and teaching cadres.

Concurrently with the solution of the problem of preparing young cadres, the educational system took up the task of educating old teachers in a proper political spirit. As a result of the great effort carried out under the direction of the Party, both young and old scientific cadres have fused into a single and powerful creative collective which is working successful on behalf of our great Motherland.

The old higher technical schools also played a role in the devdopment of higher technical education in the USSR. Among them, a major role was played by the Moscow Higher Technical School, which in many ways served as an example in the preparation of highly-qualified Soviet engineers and laid the foundations for the creation of new higher technical institutions which were subsequently to become the largest in the country.

The Basic Stages in the Development of the MVTU During the Period from 1917 through 1955

Following the Great October Socialist Revolution, the Moscow Higher Technical School entered a new historical phase in its development /see note/. /Note: the new name for the School and the renaming of the Committee on Instruction to be henceforth called the School Council was adopted by a resolution of the Committee on Instruction in 1917./

From the very first days of the proletarian State, both the Communist Party and the Soviet Government devoted special attention to the School as an organization representing one of the major scientific-technical centers in our Motherland. This assistance in even the most difficult years in the country's history testifies to the great concern and solicitude of the Party and State. It was not by accident, therefore, that the School Rector declared at a meeting of the Council on 25 April, 1918, that the needs of the School were receiving sufficient attention. This statement was made at a time when the reactionary segment of the professorial staff and students assumed a position hostile to the Soviet regime. The statement was made in earnest, since the people connected with the School still remembered vividly the "attention" lavished on it by the Czarist and Provisional governments, who with their flood of promises submerged any chance for realizing the "Plan for developing the Moscow Higher Technical School into a school of the polytechnic type, and the transformation of the legal and financial status of the School.

The years 1914-1917 were difficult for the Higher Technical School; many of the higher educational institutions had already closed their doors for almostly completely suspended operations. The Moscow Higher Technical School, despite the small number of students studying there, continued to exist throughout these years within the limits of the established norms, with almost no reduction in its basic scientific force /see note/. /Note: a new class metriculated as usual in the summer of 1917, but was for the most part drafted into the army one or two months after the start of the fall semester./

The 1917-1918 school year saw intensive work on the introduction of changes and amendments into the plan for transforming the School into one of the polytechnic type.

On 24 April, 1918, the school's Rector, Professor V.I. Grinevetskiy reported to a meeting of the mechanics department that the People's Commissariat of Education had deemed it necessary to organize two new departments based on special subjects studied in the mechanics department, as well as to reorganize the sections and departments. On the next day, 25 April, the School Council decided to undertake the immediate organization of an electrotechnical and civil engineering departments as well as a chemical engineering subsection within the chemistry department.

During the next two months, two commissions worked on the two newly-organized departments. These commissions consisted of professors and teachers of specialized and general subjects relating to these departments, where they were to teach courses in addition to their activities in the mechanics department.

The results of the work carried out by the commissions and the school collective assured the opening of the electrotechnical and civil engineering departments by the fall semester of the 1918-1919 school year.

It was also at this time (1918) that the Theoretical Aviation and Aeronautics Courses started in 1915 were reorganized into the Moscow Aviation Technicum which was soon to become the Institute of Aeronautic Engineers imeni Professor N.Ye. Zhukovskiy. Later, the Institute was transformed into the Military Air Academy imeni Professor N.Ye. Zhukovskiy.

The 1918-1919 school year had a more lively start than the preceding 1917-1918 year. As always, instruction began on 1 September for all students except freshmen, since admissions continued until the end of September; the freshman class began to receive instruction on 1 October.

In connection with the opening of two new departments, the School found it possible to admit 114 former students from the Riga Polytechnic Institute which was evacuated to Moscow in 1915 and could not resume its work.

It was likewise in 1918 that the question was posed of transferring to the MVTU some of the students from the Warsaw Polytechnic Institute then studying at the Nizhniy-Novgorod Polytechnic Institute; this problem was not solved, however.

In order to assure smooth functioning, measures were taken to clear out all of the available space in the school not being used for the proper purpose. 1918 saw the removal of the armory, medication plant, urotropine factory, hospital, and Command Staff document room occupying a part of the north wing of the main building during the war.

At the same time as it was organizing its educational life, the School was taking part in the work of the People's Commissariat of Education in laying the ground work for the forthcoming reforms in higher education.

The reactionary segment of the leading professorial and pedagogical group at the MVTU met the first attempts at Sovietizing higher education with a hostile attitude. This was especially apparent in the organization of administrative organs in 1918: the School Council, the Council Presidium, the Administrative Commission, and the departmental councils and presidiums.

1920 was a year of acute class struggle.

Under the leadership of a small but determined Party organization, the progressively-minded students led the struggle to proletarianize the MVTU and to win over professors and teachers to their side. The hard core of progressive professors who went along with the proletarian students served as an example to those who had not yet taken a firm stand; in the course of the struggle within the ranks of the teaching staff, ever greater numbers of teachers split off from the reactionary group andwent over to the proletarian camp.

Starting in the fall of 1920, the academic life at the School became extremely lively.

This revitalization was aided, in the first place, by the completed school reform (the transition to a four-year program), secondly by a timely and well administered admissions program, and thirdly by the organization of studies in such a manner as to expedite the rapid training of future engineers.

In order to assure the national economy with a steady supply of degree-holding engineers, the Council of People's Commissars on 24 March, 1920, decided to institute accelerated engineer training programs at some of the more advanced higher technical schools.

This decision placed a responsibility upon educational institutions to work out study plans and programs such that the standards of the training given would not be lowered. The accelerated programs were made available to advanced students having sufficient theoretical and practical preparation. With this same purpose, all former upper-classmen working in various places and serving in the army were commandeered to the appropriate educational institutions.

All of the organizational work on the accelerated training at the School was headed at first by a special committee on accelerated training, and later by a revolutionary troika (revtroika) consisting of the School's director, a representative of the People's Commissariat of Education, and a student representative. During March and April, 1920, all of the necessary preparations were completed and starting in May, groups of about 400 students each embarked on the new program; they were to complete their studies in the period from 1 September, 1920, to 1 January, 1921.

The groups formed later were to embark on the program in the first half of 1921.

The graduation of engineers completing the accelerated course is characterized by the following figures [Note: see Table I at end of report.]

In connection with the revitalization of scientific and academic life at the higher technical schools, there arose the problem of preparing scientific cadres. In 1920, the Main Professional Education Committee (Glavprofobr) of the People's Commissariat of Education gave its approval to the "Directive on Scientific Research Courses in Higher Technical Schools".

The aforementioned courses were aimed at channelling some of the engineers into scientific areas both for teaching and research. In 1920, the MVTU organized training courses in 24 specialties in each of its four departments.

In the 1921-1922 school year, academic life at the School was in full swing despite the difficult material conditions under which it found itself: shortage of funds, poor supply, lack of fuel, etc.

This time also marked the revitalization of scientific-technical activities.

At the start of the 1921-1922 school year, the number of students increased as compared with the preceding school year by 400 students, to reach 3367 students in all. The amount of practical training in laboratories, workshops, and demonstrations rooms likewise grew considerably; this growth was determined not so much by the increased number of students as by the transition to a four-year course. There arose an urgent need for opening new facilities and expanding old laboratories. There was a shortage of auditorium space as well.

In a request to the People's Commissariat of Education, the School, having described the condition in which it found itself asked that the attention of the Government be drawn to its need for new quarters.

In the opinion of the School administration, the most suitable building for this purpose would be that of the former military academy.

Facilities were furnished first for the electrotechnical department, and later for the chemical and civil engineering departments.

The successes achieved by the School in 1922 in all of the areas of scientific and academic life, its active participation in the solution of problems involved in higher technical education, as well as other factors, all brought with them the intensification of the class struggle. The enemies of the people created an atmosphere of hostility and distrust toward the honorable professors and teachers who were active in realizing the new functional principles of the School.

In the spring of 1922, an attempt was made to organize a strike among the professors and teaching staff; this resulted in a week's delay in the start of instruction. The Trotskyites who had wormed their way to positions of leadership in the People's Commissariat of Education insisted on the arrest of a certain part of the professorial and teaching staff. In this manner, they hoped to put the School's activities in an impossible position.

The strike left a deep scar as an open act of class struggle whose aftermath and highest expression was the subsequent sabotage activity on the part of certain active strikemongers.

On 29 April, 1922, the Council of People's Commissars received representatives of the professorial and teaching staff in order to receive testimony on the conditions then prevailing at the School /see note/ /Note: Archives of the Educational Reform of the Moscow Oblast Archive Administration, File 372, interrogation 1, witness 177, case 1075, lines 70, 71./

The Council of People's Commissars deemed it necessary to create a special monetary fund to subsidize the higher technical schools within the framework of the All-Russian Council on the National Economy; in pursuance of this decision, the Council, in a resolution dated 19 July, 1922, pointed out the purposes for which the funds allocated were to be used.

This resolution stated that in view of the several months' lag in payments by the People's Commissariat of Education to the higher technical schools, the All-Russian Council on the National Economy should immediately set aside funds for covering this indebtedness.

As a result of this aid, the School was already able in late 1922 to support the work of auxilliary academic institutions, supplying them with materials and allocating monetary subsidies; it was also in a position to heat the classrooms and laboratories, to completely renovate the entire building, and to furnish the newly-assigned building for the electro-technical department.

After a long wait, the chemical laboratories finally received reagents which were adequate to the needs of the students both in quantity and quality.

Because of the aid extendedby the All-Russian Council on the National Economy, the School was soon able to resume normal academic activities.

In 1922 alone, the All-Russian Council on the National Economy allocated the sum of 8.5 million rubles to the School for the purchase of machines, instruments, and materials; this amounted to 30.9% of the entire sum spent on the MVTU.

On 3 July, 1922, the Council of People's Commissars of the RSFSR approved the "Resolution on Higher Educational Institutions" which introduced considerable changes into the administration of such institutions.

According to this resolution, the administrative organs of the higher educational institutions were to be the council and governing board. The council was made up of administrators, deans, deputy council representatives, professional organizations, interested People's Commissariats, professors, instructors, scientific researchers, and student representatives. The members of the governing board were to be appointed by the People's Commissariat of Education upon the recommendation of the appropriate organizations, teaching staff groups, and student organs.

The tenure of each member of the governing board was to be one year.

The resolution likewise envisioned the organization of commissions on special academic subjects whose functions would include the most intimate direction of academic life.

Within two weeks of the publication of this resolution, the administrative organs at the School were already created: the governing board was appointed, the Council was created, and 88 commissions on special subjects were organized.

The commissions on special subjects, despite their organizational cumbersomeness, played an important role in the task of effecting further improvements in the academic life of the School.

Reelections for certain posts in the administration were held in 1923. The People's Commissariat of Education thought it necessary to place in the positions of leadership candidates nominated by various State and social organizations. This need was motivated by the fact that the former administration, especially the Rector, resisted the realization of educational reform measures, sabotaged the instructions issued by the People's Commissariat of Education, and supported and reflected the views of the reactionary segment of the professorial and teaching staff. Discussions over the selection of possible candidates to serve in the new administration lasted five months; finally, the Main Committee on Professional Education of the People's Commissariat of Education was forced to appoint a new governing board, which then proceeded to fulfill its responsibilities toward the end of July, 1923.

The struggle for the proletarization of the MVTU was a heroic period in the history of the Party-spirited organization of the School; it was a reflection of the enormous struggle waged by the Party to secure victory on the front of proletarianizing all of the higher educational institutions. As early as the 1923-1924 school year, 75% of the entering class was made up of workers, 40% of whom were members of the Communist Party and 17% of the Komsomol (Young Communist League).

An important role in assuring the enrollment of proletarian cadres and of Sovietizing the school was played by the worker department (rabfak) organized there in 1920.

Of all of the rabfaks organized at certain of the major higher technical schools, the one at the MVTU was one of the earliest to be organized and had one of the largest memberships.

Its participation in the work of the professorial and teaching staff at the School in many ways determined the organization of the academic process and assured a sufficiently high level of training given to the students.

Some idea of the social composition of the student body in the MVTU rabfak (evening and daytime divisions) and graduating classes over the period 1921-1926 may be gained from the table below /see Table II at end of report/ which to some extent reflects the increased enrollment of members of the proletarian class in the School.

In sending their workers to study at the rabfak, some organizations extended material assistance not only to the future rabfak graduate, but to the rabfak itself ("Anilozavod", the Semenovskaya Textile Bleaching Works, the Russian-American Instrument Factory, the State Furniture Factory, and numerous other enterprises).

The 1924-1925 school year marked the solution of a number of important questions: that of merging the MVTU with two other higher technical schools, of academic reorganization at the School, the organization of a new section within the Chemistry Department, etc. One of the most important problems solved was the organization of cyclical organs based on the principle of basic specialties.

The merger of the MVTU with two other higher technical schools had important effects on the development of the civil engineering and electro-technical departments.

Despite a number of difficulties which had to be overcome by the civil engineering department, it still managed to develop successfully in the subsequent years. 1922 was a year which brought with it proof of the viability and great necessity for this department in providing civil engineers for industry. It served to cover that territory which was not taken care of either by the Moscow Institute of Transportation Engineers, or the Civil Engineering Institute.

The successes of the School in the matter of training highly-qualified cadres of builders were consistently resisted by the Trotskyites who had made their way into the organs of the People's Commissariat of Education. Using the excuse that the civil engineering department was graduating the same type of specialists as the two aforementioned institutions, and that the work of the department wholly paralleled that carried on there, the Council on Higher Educational Institutions of the People's Commissariat of Education on 4 September, 1922, decided to close down the department. Upon appeal of this decision by the School to the Council of the National Economy of the RSFSR, the latter body reversed the decision and directed the All-Russian Council on the National Economy to extend all possible material assitance to the School in order to promote the growth of the civil engineering department.

The civil engineering department began to grow extremely rapidly in late 1924, when it was merged with the Moscow Civil Engineering Institute (MIGI) in pursuance of a decision by the Council of People's Commissars of the RSFSR dated 8 August, 1924. /Note: the merger of the MIGI and MVTU took place on 5 September, 1924./

The MVTU staff was enriched by a large group of outstanding scientists, builders, architects, and artists. Among these were V.N. Obraztsov, N.D. Kolli, L.A. Vesnin, V.A. Vesnin, I.I. Rerberg, B.N. Vedenisov, et al.

Despite the fact that the merger was effected in September, i.e., after the start of the school year, it did not interfere with the regular academic life of the department. The students of the Institute and civil engineering department began their studies on time, with the seniors continuing on the old study plan, and the others on the new program worked out at the School.

The enrollment in the department increased to 2200 students.

In order to assure the further development of the Department, it was moved into a separate building /see note/ with a number of new laboratories and demonstration rooms. All of this made possible an extension of scientific and academic work. /Note: the Department building was located at 5 Pokrovskiy Boulevard./

The Electrotechnical Department was also playing a prominant role by 1924.

Already in 1920, in connection with the adoption of the plan for electrification throughout the country, the problems of developing electrical technology assumed exceedingly great importance. Much emphasis was placed on the training of electrical engineers, the organization of scientific institutions, the solution of electrotechnical problems, and the creation of a domestic electrical industry.

On the initiative of Professors K.A. Krug and K.I. Shenfer of the Electrotechnical Department, the Government decided to create a large scientific research institute. In 1921, the State Experimental Electrotechnical Institute (GEEI) was organized under the Scientific-Technical Society of the All-Russian Council on the National Economy; it was later renamed the All-Union Electrotechnical Institute. The Institute was headed by Professor K.A. Krug and staffed mainly by professors and instructors at the School.

The creation of the Institute marked the beginning of intensive training in the field of electrical technology. Despite several important difficulties, a number of higher electrotechnical schools were created in Moscow, and the electrotechnical department at the MVTU grew by leaps and bounds.

The State devoted special attention to the work of the electrotechnical department as a pivotal scientific-academic center staffed by highly-qualified technical and scientific cadres.

In February, 1922, the Dean of the Department, Professor K.A. Krug submitted to V.I. Lenin a request for assistance in extending quarters to the Electrotechnical Department and the GEEI for the organization of scientific-experimental and academic laboratories.

In his letter, Professor K.A. Krug wrote:

"The Electrotechnical Department of the MVTU arose at the aforementioned School without receiving new buildings despite the fact that the School was exceedingly crowded. At the present time, the Electrotechnical Department has 750 students, so that in the next two years, when the majority of the freshmen and sophomores will become juniors and seniors, the total enrollment in the Department will reach 1200-1300 students. In view of these high enrollment figures, the Department already constitutes a large educational institution; despite this fact, it still does not have at its disposal suitable space for classrooms, drafting rooms, and laboratories.

"The State Electrotechnical Institute, which represents an experimental station serving the needs of electrical construction and industry and for the performance of scientific and practical studies in the field of electrical technology already has certain equipment and thanks to the efforts of the Scientific-Technical Society is soon due to receive some relatively large installations from abroad; despite these facts, it still does not have suitable quarters.

"With the aim of promoting more intimate contact between the school and actual life, as well as the training of highly-qualified engineers who could successfully compete with foreign specialists, it would be highly desirable to create more intimate ties between the Electrotechnical Department of the MVTU and the State Experimental Electrotechnical Institute; this would require that the two institutions be united territorially through the assignment of adjacent buildings. It is only under such conditions that it will be possible, using the available apparatus at the electrotechnical laboratory of the MVTU, to begin work immediately at the Experimental Electrotechnical Institute; on the other hand, the professors and instructors at the School as well as outstanding students will find it possible to carry out scientific projects and to serve the needs of practical electrical technology; this desirable state of affairs can not be brought about by any other means, since the meager funds of the People's Commissariat of Education provide no reason to hope for adequate financial assistance from that source". /Note: Archive of the Educational Reform of the Moscow Oblast Archive Administration, file 372, hearing 1, 1919, deposition 177, case 1075, page 75./

In 1922, the Electrotechnical Department and GEEI received two buildings and an additional appropriation of 250 thousand rubles in gold for the purchase of equipment abroad. /Note: the Electrotechnical Department received House no. 29 on Gorokhovskaya Street (now called Kazakov Street), while the GEEI got House no. 23 on the same street./

All of this allowed the department to rapidly create a number of laboratories, to attract additional scientific forces, and to develop training programs in almost all fields of electrical technology and the allied disciplines of thermal and hydraulic technology.

Engineers graduating from the Electrotechnical Department were so well trained that they soon were to assume an important place in power production technology; they also played an important role in the organization of scientific research. For example, the entire basic staff of the GEEI consisted of MVTU graduates.

In connection with the reorganization of the Moscow network of higher electrotechnical institutions carried out in 1924, the Communications Division branched off into a special section which provided advanced training in the field of communication (the Electrotechnical Communications

Institute) which was joined in the form of a communications section to the Electrotechnical Department.

Somewhat later, in connection with the liquidation of the Electrotechnical Department of the Lomonosov Institute, its students were transferred to the Electrotechnical Department at MVTU.

In connection with the rapid growth of the Chemistry Department, the Government in 1924 allocated 700 thousand rubles for the purchase of equipment and assigned to the Department the old building next to the Chemistry Department which formerly housed the Fanagoriyskiy regiment.

This building was to house the Second Chemical Institute; the original Chemistry building received the name of the First Chemistry Institute.

1924 marked the opening of the Higher Pedagogical Courses at the MVTU; these were designed to train teachers in the specialized disciplines for electrotechnical, chemical, and civil engineering technicums. During the period 1924-1926, these Courses were taught by 48 instructors.

In 1924, some of the basic principles embodied in the "Resolution on Higher Educational Institutions" began to hinder the further general growth of academic activity. For this reason, the School in 1924 petitioned the People's Commissariat of Education to amend the provisions of the Resolution as regards the administration of academic life. Essentially, the proposed changes boiled down to a recommendation that the administrative functions for each department be conducted by departmental academic councils whose functions would coincide with those of the commissions on special subjects but would extend to the entire department and not to a single group of allied disciplines.

The councils were to be made up of representatives of teachers in the various disciplines, the student body, and interested professional and economic organizations. The most direct preliminary discussion of academic problems relating to the cycle of allied disciplines was to be conducted by the cyclical commissions.

The People's Commissariat of Education took these proposals into consideration, and decided to incorporate them in the future MVTU charter then being worked out.

The Charter of the MVTU was approved in 1925. The problem of working out such a Charter for the School was first mentioned in 1921. The original provisional charter stated that:

"1. The Moscow Higher Technical School has as its basic purpose the training of socially developed and highly qualified specialists for the various branches of the national economy; it is to train engineers and organizers sufficiently well prepared for the organization of new branches of production and capable of directing the exploitation of existing enterprises in the capacity of technical factory directors, workshop engineers, etc., and also able to plan and carry out independent production programs, and to work out technological production processes as directors of technical and planning bureaus, laboratory chiefs, etc.

General scientific and technical training is given these engineers in an amount sufficient to impart to them a deep social consciousness and mastery of scientific and technical method as it applies to the needs of a wide general speciality.

Special training has as its purpose the assurance of technical and organizational mastery of a given discipline on the basis of familiarization with a special cycle of problems.

2. The second aim of the Moscow Higher Technical School is the performance of scientific-technical studies both on an independent basis and at the request of industrial and State organs, as well as the preparation of scientific and technical workers including teachers for higher educational institutions.

3. The third task of the Moscow Higher Technical School is the propagation of the most timely production method and the extension of scientific-technical assistance to the population of the Union through the organization of courses, excursions, exhibits, the presentation of lectures, the writing of popular scientific literature, and the organization of courses for improving the qualifications of industrial workers".

The organizational structure of the School according to this Charter was to be broken down into three departments: the mechanical, chemical, electrotechnical, and civil engineering departments.

The Mechanics Department was further divided into the heating technology, technological, and aeromechanical cycles, as well as the textile section.

The Chemistry Department included the following cycles: physical chemistry, the technology of inorganic materials and metallurgy, organic materials technology, food technology, and chemical textile production technology.

The Electrotechnical Department included the following cycles: electrical energy production and aplication, machine building, and communications.

The Civil Engineering Department was broken down into the structural engineering, communal, hydrotechnical, factory-plant and architectural cycles.

The cycles were further broken down into a number of specialties.

In addition to the specialized cycles, each department included a general technical cycle encompassing both physico-mathematical and general technical subjects.

The charter granted the school extensive rights on the publication of scientific and other works, the establishment of scientific societies, the convocation of scientific conferences, the organization of various productive enterprises, technical installations, experimental stations, the duty-free importation of machines, devices, apparatus, and publications from abroad, etc.

The charter stipulated that the School was to be under the control of the People's Commissariat of Education through the Main Professional Education Committee and was to have the following organs of direct administration: the Council and Governing Board, departmental councils, deans' offices, sectional councils and presidiums, and departmental cycle bureaus and plenums.

The Council was to consist of members of the Governing Board, deans, six trade union representatives, representatives of the All-Russian Council on the National Economy, representatives of the People's Commissariats, and five representatives each from the professorial staff, the instructors, and the student body. The Council was to adminster and control all of the school's activities in general.

The Governing Board consisted of the Rector (who was also the Council Chairman), his deputy, two prorectors (on academic and administrative matters), and a single board member. The members of the Governing Board were elected on an annual basis. The functions of the Board were of an executive nature and encompassed all of the School's activities.

The departmental academic councils consisted of the departmental deans, the sectional presidiums, the chairmen and secretaries of the cycle bureaus, trade union representative representatives of economic organizations interested in the work of the department, and representatives from each of the basic disciplines. The council chairmen were to be the departmental deans. The function of the councils was to direct, control, and coordinate all departmental activities. The deans assumed direct control over scientific and academic life within the department.

The cycle bureaus consisted of 3-5 members; they included a professor or responsible instructor as their chairman, one or two instructors, and one or two representatives from student organizations. The charter permitted the expansion of the bureaus to include representatives of trade unions and economic organs interested in the given specialty.

Candidates to membership in the cycle bureaus were nominated by the cycle plenums and confirmed by the School Governing Board with preliminary approval from the dean.

The cycle bureaus were responsible for the direction of academic life in each of the specialties within the cycle, the administration of current work within the cycle, the detailed preliminary elaboration, of problems referred to the departmental council (as restricted by the cycle interests), surveillance over the work of the auxilliary agencies within the cycle and the preliminary examination of their budgets, the nomination of candidates to graduate study, etc.

The plenums were assisted in their work by all of the scientific workers in a given cycle and student representatives in a number equal to one half that of the scientific workers. The plenums were charged with the responsibility of electing cycle bureaus, carrying out preliminary discussions of possible candidates to fill vacant professorial chairs and teaching positions, and the receipt of bureau reports and statements.

In accordance with the charter, engineers graduated by the MVTU received in accordance with the general rules as set forth by the qualifying committees, the following credentials: Mechanics Department graduates--the Mechanical Engineering Degree, Chemistry Department graduates--Chemical Engineering Degree, Electrotechnical Department graduates--the Electrical Engineering Degree, Civil Engineering Department graduates--the Civil Engineering Degree.

The charter conferred many rights and privileges on the School and set forth in writing its traditional prerogatives.

The internal organization of the MVTU began to differ from that of other higher educational institutions with the adoption of the charter.

An example of this difference is the organization of cyclic organs constructed according to the principle of basic specialties, as well as the departmental councils which united the efforts of the entire School.

Already at the start of their activities, the cyclic organizations were of great help in the elaboration of study plans and programs, and, what is particularly important, contributed much to the establishment of lively and intimate ties with industry and social organizations.

By 1925, the School had achieve significant successes in scientific-technical and academic work.

This advance was made possible primarily through the continually increasing annual appropriations, as may be seen from Table III /see end of report/:

Very large sums in the School budget were set aside to provide students with government stipends. Expenditures for this purpose usually amounted to 25% of the budget.

Taking into account the fact that the number of students, professors, instructors, and employees at the School had grown considerably since 1914, as did the number of auxilliary academic departments, it turned out that the budget for 1925-1926 had not yet even reached the prewar level. This fact hindered the complete restoration and renovation of laboratory, workshop, and demonstration room equipment. The financial position of the professors and instructors had to be improved as did the material well-being of the students.

In 1925, a preliminary plan for the development of the School over the years 1925-1930 was worked out.

This plan envisioned the expenditure of 10.4 million rubles for the reestablishment and equipment of auxilliary academic departments and the refurbishing of buildings and technical installations; the plan did not exclude the construction of new buildings which would require additional appropriations in the amount of 26.0 million rubles. Already in 1925-1926, the School received 0.5 million rubles which aided its extensive restoration and development.

The period 1921-1928 was one of advancement in all of the School's endeavors; old departments were expanded to include new sections (such as the textile sections in the Mechanics and Chemistry Departments) and new specialties, and a transition was made to a four and one half to five-year programs on the basis of new academic plans and programs; there were likewise improvements in the material base, the problem of training professors and teachers, the expansion of scientific research, the intensification of ties with industry, etc.

During these years, there took place the further proletarianization of the School and an increase in the proportion of Party members.

An analysis of the numerical composition of the MVTU shows that the Party-Komsomol segment at the School increased from 23.1% in 1924 up to 48.4% in 1929, so as to include almost one half of the entire student body. Likewise on the increase was the proletarian enrollment, which by 1929 amounted to almost 50%. /see Table IV at end of report./

The proportion of rabfak graduates within the MVTU student body increased from year to year, as shown by the following figures: /see Table V at end of report./

The successes achieved by the School in 1927-1928 in all areas of its activity were the results of the Party and Government policies with regard to its efforts.

Great also was the role of the Party organizations within the MVTU in the achievement of these successes. In all phases of the School's work, it exerted every effort to educate politically the professores, instructors, and students; it was under the leadership of these organizations that the new Soviet intelligentsia was formed, and it was these organizations that led the fierce struggle against the enemies of the people. It was the Party organizations that led the battle to annihilate the Trotskyites who were attempting to make the MVTU one of their pivotal centers.

The MVTU Party organizations emerged from this struggle strong both ideologically and organizationally, having forged a spirit of unity and discipline within its ranks. One of the most important stages in the development of the MVTU occurred in 1928-1929, when in its work the School brought to fruition the decisions of the July (1928) and November (1929) Plenums of the Central Committee of the All-Russian Communist Party of Bolsheviks regarding Soviet higher education.

Along with the best segment of the professorial staff, the proletarian students at the MVTU initiated the struggle to transform the School in accordance with the new tasks. Changes were brought about in the academic system, and all efforts were guided by the needs of socialist industry.

Specialization was introduced as early as the freshman year, some lectures were eliminated, a group seminar method of learning was introduced, theses and projects were eliminated, rigid schedules for graduation were established, and continuous industrial training (in a 1:1 ratio) replaced the existing program of summer practice. These reforms were carried out with the purpose of facilitating and accelerating the time that the student spent at the School and providing industry with a sufficient number of new engineering-technical cadres in the shortest possible time. A system of learning without interruption of actual work on the job which required the organization of evening groups was instituted.

This was a time when socialist work methods began to develop rapidly in work and study.

The further reinforcement of the proletarian and Party core among the student body continued.

Thus, in the 1929-1930 school year, the student body consisted of 72% workers, 50% members and candidates for membership in the Communist Party, and 21% members of the Komsomol. Among these were 510 "parttysyachniks" and "proftysyachniks"--persons who had much experience in Party and Soviet work.

In the 1928-1929 school year, the MVTU considerably expanded its enrollment, having organized the evening division which included 524 students.

This marked the beginning of a trend toward the considerable improvement in the graduate study method of training scientific cadres. When the graduate study program was instituted at the MVTU in 1925, it had only 16 students; in 1926 this figure reached 21 students, and by 1931 this number rose to 100 persons, 95% of whom were Communists.

The development of the School was aided by the decision of the July Plenum (1928) of the Central Committee of the All-Russian Communist Party of Bolsheviks on increased appropriations for technical education and the improvement of the material well-being of students.

The practical realization of this decision was dealt with in the resolution passed by the Central Executive Committee and the USSR Council of People's Commissars dated 27 July, 1928 ("On the Increased Financing of Technical Education and the Improvement of the Material Well-Being of Students").

The USSR budget for 1928-1929 included an appropriation for the higher technical schools and industrial technicums which exceeded that of the preceding fiscal year by 45 million rubles. A 3% tax was levied on State industrial enterprises to serve the needs of technical education.

In 1929, the MVTU was able to build new laboratories and improve the old ones, to complete the general library building started in 1914, to purchase 2.5 million rubles worth of equipment, etc. All these measures made it possible to increase the size of the annual admissions to 800 persons.

At the same time, there was a 15-30% increase in the salaries of professors and instructors; undergraduate and graduate stipends were likewise increased, and the general material well-being of the students was improved.

In 1927-1928, the MVTU received 5 million rubles in accordance with the State budget part of which it distributed among 3294 students (53.3% of the entire student body) in the form of stipends; in 1928-1929, it received an appropriation of 6 million rubles, in addition to the 3% levied on industrial profits, which enabled it to aid 4197 students, or 70% of the entire student body.

The November Plenum of the Central Committee of the Communist Party (1929) emphasized the importance of systematically increasing the proportion of expenditures on technical education and scientific research.

In pursuance of this directive, the Central Executive Committee and the Council of People's Commissars on 18 November 1929, adopted a resolution "On the Increase of Financial Support to Higher and Secondary Industrial and Agricultural Education". The size of expenditures on capital investment, renovation, and equipment, etc., was set at 135 million rubles; there was a further increase in the size and number of student stipends, as well as higher salaries for professors and teachers. The total expenditures for higher and secondary industrial and agricultural education in 1929-1930 were 271 million rubles.

The necessity for establishing closer ties with industry and for more concrete direction of the business of training engineering-technical cadres, as well as the need for increasing the number of specialists graduated by the higher educational institutions occasioned the removal of certain higher technical schools from the control of the People's Commissariat of Education to be placed under the appropriate people's commissariats. In 1929, the MVTU was one of the first major higher technical schools to be placed under the control of the USSR All-Union Council on the National Economy.

In 1930, the School reached a considerable level of development. The increased teaching staff, general development in all of the departments, and considerable increase in the number of engineers produced provide clear evidence of this fact.

The growth of the School in the very first years after its transformation into an institution of the polytechnic type is indicated by the following figures /see Table VI at end of report/.

This growth became even more significant after 1924 when the School was merged with the Moscow Civil Engineering Institute, and somewhat earlier with the Moscow Communications Institute; it was at this time that new scientific-technical trends began to appear. Especially noteworthy is the fact that the departments, having obtained the means for further growth, began to strengthen the old and to open up new specialties.

For example, the Chemistry Department began to reinforce its organic chemistry section and to open special sections on artificial fibres, physical chemistry, etc.

The leading physicians in the various sections began to attract outstanding scientists, including former students at the School. The number of professors increased five-fold by 1930 as compared to 1917, while the number of instructors grew by more than 6.5 times. /see Table VII at end of report/.

By 1930, the Electrotechnical Department had become a major electrotechnical and power production school in the Soviet Union; it had an adequate teaching staff and proper scientific and academic facilities both in the field of electrical technology, as well as thermal and hydraulic technology.

The Civil Engineering Department grew into a first-rate school.

The oldest Mechanics and Chemistry Departments, for a long time recognized as excellent technical schools for mechanists and chemical technologists, were in full flower.

In accordance with the School's general development, there was a growth both in the enrollment and in the number of engineers produced. [see Table VIII at end of report].

In the period from 1917 through 1930, admissions increased by one and a half times, the student body by almost four times, while the average annual number of engineers graduated reached 315.

The experimental and laboratory plant of the School grew from 45 laboratories and demonstration rooms in 1918 up to 98 laboratories and demonstration rooms in 1930. All of the auxilliary academic facilities were located in 22 buildings scattered over 6 locations in various parts of the city. In addition to this, the School had at its disposal 5 student dormitories which at that time housed over 1000 students.

## The Basic Phases in the Development of the MMMI-MVTU from 1930 through 1955

On the basis of a Government decision to reorganize the major multi-department higher technical schools into specialized institutions, the MVTU was broken up into a number of higher technical schools in 1930.

The Mechanics Department was transformed into a machine building technical school under the name of "The Higher Mechanical and Machine Building School", which soon received the name of the Moscow Mechanical and Machine Building Institute (MMMI), subsequently (16 December, 1930) being named in honor of N.E. Bauman. Some of its subdivisions, such as the thermal engineering section were turned over to other specialized institutes; the machine tractor station was taken over by the Automechanical Institute; the textile machinery division went to the Moscow Textile Institute, etc.

One and a half months after its opening on 15 February 1930, the new Aeromechanical Department branched off from the Institute. On the basis of this department, and allied sections from certain other institutes, was founded the Higher Aeromechanical School. In August, 1930, the School began to be called the Moscow Aviation Institute.

The Chemistry Department became the Chemical Defense Academy of the Red Army. Some of the special sections within the Department were turned over to other institutes. For example, the old dye technology section was taken over by the Moscow Chemical Technology Institute. Some of the other special sections within the food technology division served as a basis for individual scientific research institutes such as the Sugar Institute, etc.

The Civil Engineering Department became the Higher Civil Engineering School, which several months later merged into the Military Civil Engineering Academy, while some of the specialties not related to the activities of that institution formed the basis of a civil engineering institute.

The Electrotechnical Department became an independent higher technical school under the name of the Moscow Power Production Institute, while the communications section was merged with the Moscow Military Communications Academy.

In that same year of 1930, the Moscow Power Production Institute took over the electrical industry department of the National Economy Institute imeni Plekhanov.

This unified academic institution was named the Moscow Power Production Institute, later receiving the name of Vyacheslav Mikhaylovich Molotov.

The specialization of the higher technical schools proceeded under the conditions of a fierce struggle. In his concluding remarks to the 16th Party Congress, I.V. Stalin said:

"Remember that business of turning over the higher technical schools to the economic narkomats (people's commissariats). All we wanted to do was to turn over two schools to the All-Union Council on the National Economy. It would seem that this was a small matter. But what happened was that we ran into a solid wall of opposition on the part of the rightist deviationists: 'What's the use of turning these two schools to the All-Union Council on the National Economy? Would it not be better to wait. You had better look out that something doesn't happen as a result of this game you are playing'. But now that all of the technical schools have been turned over to the economic narkomats, you can see that we are still alive and breathing" /see note/.
/Note: I.V. Stalin, Works, Volume 13, page 13./

Everyday life at the MMMI, which now became a specialized technical school, showed that the reform had been well timed and absolutely correct.

The Mechanics and Machine building Institute, created for the purpose of training engineering-technical cadres for the Soviet machine building industry, became one of the major higher technical schools in the country and in a short time became the leading institution in the field.

Some idea of its rapid quantitative growth may be gained from the following figures on the composition of the student body during the period 1930-1932 /see Table VIII at end of report/.

Of all the students studying at the Institute and not holding jobs at the same time in 1932, 81.1% were workers and children of workers, of whom 74% were Communists or Komsomol members.

During the period 1930-1932, a great deal was done at the Institute toward the reorganization of academic and scientific life; the new developments included the final consolidation of the Institute's structure, the reorganization of auxilliary academic facilities, the institution of new specialties, the elaboration of problems of an academic and methodological character, the intensification of scientific research efforts, etc.

The Institute consisted of five departments: thermal and hydraulic machines, cold metal processing, hot metal processing, general machine building, and precision mechanics.

Fourteen of the 37 special sections trained engineers in 16 special fields.

1932 marked the organization of the special-purpose department (FON--fakul'tet osobogo naznacheniya) /see note/, as well as the reestablishment of the textile machinery division which was returned from under the control of the Moscow Textile Institute. /Note: the FON was transformed in 1934 into the Institute for Raising the Qualifications of Management Personnel; it was liquidated in 1936./

1932 was a year of radical change in the entire academic life of the Institute on the basis of the resolution passed by the USSR Central Executive Committee dated 19 September, 1932, on the matter of higher education. Increased enrollment was made possible by the organization of additional groups consisting of students working on production-line jobs and studying at the same time, as well as the so-called self-supporting groups commandeered by various economic planning organs.

There was also an increase in the number of engineers graduated. Thus, 203 persons graduated in 1931, 243 in 1932, 284 in 1933, and about 450 in 1934.

The Party organization at the Institute led the struggle to produce highly-qualified Soviet engineers devoted to their Motherland. In this connection, the Institute in 1932 initiated the All-Union Socialist Competition among the higher educational institutions in the country.

Through a resolution of the USSR Central Executive Committee dated 17 November, 1933, the Institute was awarded the Order of the Red Banner of Labor for its revolutionary contributions in the past and its special efforts in the realm of socialist construction.

Part of an order issued by the People's Commissar of Heavy Industry G.K. Ordzhonikidze entitled "On Measures for the Further Development and Strengthening of the Moscow Mechanics and Machine Building Institute imeni Bauman in Connection with its Hundredth Anniversary" dated 14 February, 1933, reads as follows: "with the purpose of promoting the further development and strengthening of the oldest higher technical school in the USSR and creating a solid material base for the training of engineers armed with a knowledge of advanced modern technology, I hereby order:

1. That the diesel engine laboratory of the Scientific Research Institute imeni Lenin be turned over to the MMMI.

2. The organization of a scientific research combine (NIK--nauchno-issledovatel'skiy kombinat) /see note/ be organized within the MMMI on the basis of its leading laboratories and workshops. /Note: the NIK was later transformed into a scientific research sector which encompassed the research work of all the special sections. Organizationally it was united with the mechanical workshops which, as before, constituted a production enterprise of the factory type./

That the Institute be permitted as of the first quarter of 1933 to publish a monthly scientific bulletin dealing with the scientific research activities of the Institute".

The order prescribed the following measures: a) the allocation of 750 thousand rubles for the purchase of equipment and placement of orders; b) the conveyance to the Institute laboratories of prototypes of machines slated for production along with their blueprints for study and testing with the aim of effecting further improvements; c) the provision of the Institute with planning materials having to do with the special subjects studied there; d) an appropriation of 50 thousand rubles for modernizing classrooms and laboratories; e) an appropriation of 1750 thousand rubles for the construction of new facilities.

The order likewise contained provisions placing a resthome in Abkhaziya at the disposal of the Institute, as well as on the construction of a resthome in the Moscow suburbs and the building of vacation cabins for the professors and teachers, etc.

By this time (1933), the Institute budget was twelve times greater than the prewar budget of the MVTU: 8311 thousand rubles as against 688.6 thousand rubles in 1914.

The considerable improvement in the material security of the Institute made possible in the next few years the expansion and renovation of existing auxilliary academic facilities and the provision of new ones. With the creation of the scientific research combine, the Institute began to draw even closer to industry through the completion of a number of special projects for factories and by keeping industry informed on forthcoming scientific investigations.

In 1933-1934, some changes were effected in the structure of the Institute. Two new departments were added for training students in welding production (1933) /see note/ and general technology; the hot and cold metal processing departments were unified under the single name of the mechanical-technological department. /Note: the welding production department was opened on the basis of the Autogenous Welding Institute transferred to the MMMI in 1933./

Thus, by 1934, the Institute consisted of five departments: the thermal and hydraulic machinery department, the mechanical-technological department, the precision instrument construction department (formerly called the precision mechanics department), the production welding department, and the general technology department.

The organizational structure of the general technology department was designed to combine the general scientific and technical training of students and to improve scientific and methodological work in special disciplines. The urgent need to organize this department was also occasioned by the fact that specialization began only in the third year.

Despite certain achievements in the work of the Institute, the presence of shortcomings became apparent in 1934; these were subjected to severe criticism.

These shortcomings had to do primarily with the organization and teaching methods.

The diffuse character of the study plans, their lack of a number of subjects needed by the engineer, the attempt at curtailing the training period through the establishment of unusual tempi resulting in an inordinately large rate of failure among students, especially in the first two years (up to 20% in 1933), frequent changes in method, the incorrect organizational approach to academic work, etc.--all of this brought about a slowdown in the training of specialists needed so badly by the country.

During its first meeting, the Institute Council created in 1934, discussed the future tasks of the Institute, but did not make any decisions as to measures directed toward the liquidation of the aforementioned shortcomings; this was the case despite the fact that a number of professors pointed out the need for action.

As it later turned out, the reason for the indicated shortcomings in the academic process was sabotage activity.

Under the leadership of the Party organization, the Institute collective liquidated the consequences of this activity and achieved new successes in the subsequent years. There were improvements in the ideological and political effort, the solidarity of departments and sections, as well as in the organization of student work groups, etc.

These measures were a direct embodiment of the decisions of the 17th Congress of the Communist Party.

In 1936, the State ordered the merger of the Institute with the Moscow Automechanical Institute which was to assume the functions of a machine tractor department at the MMMI.

The merger of the Institute with other higher technical schools, the development of old specialties and the opening up of new ones required the constant improvement of academic and scientific efforts. The elaboration of new organizational forms for the teaching process, the development of an experimental base, the expansion of ties with industry, etc.--all of this was fundamental in the work of the Institute throughout 1936 and constituted the realization of the 23 June, 1936 resolution of the Council of People's Commissars and Party Central Committee on the work of the higher educational institutions and the administration of the higher schools.

Such successful efforts on the part of the Institute were due solely to the major political program carried on by the Party organization which included numerous Communist students experienced in Party, council, and trade union work. In 1936-1937 this segment of the student body (the "parttysyachn and "proftysyachniks") was about to graduate. The membership of the Party organization began to fall off. But political efforts did not diminish. This was a time of increasing membership in the Komsomol organization, which under the leadership of the Party organization actively participated in all areas of social and political life at the Institute.

Of great importance in the intensification of scientific work at the Institute was the decision of the USSR Council of People's Commissars dated 20 March, 1937 authorizing the institution to confer degrees of Candidate and Doctor of Technical Sciences.

In 1938, the Institute expanded its program of training mechanical engineers through the introduction of new courses. This purpose was further served by the organization of new departments and the reorganization of the machine tractor department, which branched off into the newly-created automechanical Institute by turning over its tractor and automotive exploitation sections to the latter institution.

The welding department was likewise reorganized into a welding section within the mechanical technology department.

The section on metal rolling and rolling mill construction, along with the laboratory then being built for it, was turned over to the steel institute. This later formed the basis for the Scientific Research Institute of Special

Property Steels under the People's Commissariat on Ferrous Metals.

The textile section was turned over to the Leningrad Industrial Institute.

The food machinery section was taken over by the Moscow Chemical Machinery Institute. The training of earth-moving machinery engineers was suspended.

The sections having to do with instrument construction began to develop intensively.

The aforementioned organizational changes required the development of new basic academic principles.

The great material possibilities placed at the disposal of the Institute made it possible to organize and provide first-rate equipment to the auxilliary academic facilities, as well as to initiate the general renovation of all such facilities and to establish close contacts with a number of machinery construction factories that soon led to close cooperation between science and actual industrial practice; this in turn produced important results in future years.

The intensive growth of the Institute insistently posed the question of extending available space. A new master construction plan was worked out in 1939 on the basis of a 26 million ruble appropriation. 1940 marked the start of construction work on new academic buildings and a dormitory to house 500 students (in Moscow).

Of great importance to the academic life of the Institute in 1939 was the decision of the USSR Council of People's Commissars dated 20 December on the establishment of 100 scholarships imeni I.V. Stalin to be awarded to the most promising students.

The subsequent 1940-1941 period was one of further growth for the Institute.

The Great War of the Motherland which started on 22 June, 1941, did not interfere with the normal life of the Institute. The fall 1941 semester began as usual on 1 September in accordance with the established academic norms. Studies continued on a normal basis only through September, however.

The patriotic desire among the students to come to the defense of the Motherland took many of them away from their studies. Some of the students volunteered for the battlefront, while others worked on setting up the defenses of Moscow. Many teachers likewise departed for the front lines or worked in the Institute workshops and laboratories on behalf of the defense effort.

Under the direction of the Party organization, the Institute underwent conversion to wartime conditions.

The All-Union Committee on Higher Education decided on 14 October, 1941, to evacuate the Institute to the town of Izhevsk in the Udmurt Autonomous SSR.

On 18-20 November, almost all of the professors and teachers and a majority of the students left Moscow.

Studies were resumed on 10 November, 1921, for the first, second, and third year students, and on 8 December for the seniors.

February, 1942, marked the start of preparations for the resumption of studies at Moscow. On 1 March, these studies began in two departments which had formerly represented affiliates of parent departments functioning at Izhevsk.

The evacuated Institute took in not only its former students from Moscow, but also some from other evacuated higher technical schools located in Moscow.

The teaching staff consisted of Institute staff members which for some reason or other had remained in Moscow.

Toward the end of 1942, studies both in Moscow and Izhevsk were proceeding normally. The admission of new students and the graduation of engineers was not suspended. Both locations instituted special retraining courses for engineers needed in the defense industries.

Early in 1943, the MMMI imeni Bauman petitioned the government for the return of its old name of the Moscow Higher Technical School. The All-Union Committee on Higher Education supported this request.

Taking into consideration the fruitful scientific efforts of the Institute, one of the oldest higher technical institutions in the country, as well as its fame, the State Defense Committee on 22 May, 1943, decided to return the old name to the institution.

The resolution included the following measures: 1) the MVTU should train mechanical engineers with a wide background in many special fields, including steam technology; 2) the academic process at the School should be reorganized with the aim of improving the general theoretical and technical qualifications of the engineers.

The realization of the State Defense Committee resolution was the basic concern of the School throughout the period 1943-1945.

At the end of April, 1943, the MVTU was returned to Moscow. It is important to note that this return did not interfere with normal academic activity: the entire operation was planned so as to insure the resumption of operations two days after the arrival at Moscow.

Thus, during the years 1941-1943, the MVTU not only continued its activities on the training of engineering cadres, but intensified them; this fact is important in view of the wartime conditions. The School suffered no losses in its professorial and teaching staff and preserved its entire material base for academic and scientific work. All of this was possible only due to the exceptional concern of the Party and State for the MVTU.

The postwar development of the School is characterized by the further improvement of the academic process and the expansion of scientific activity.

In the course of the subsequent 1946-1950 period, the School considerably expanded and improved its scientific and academic endeavors, and established closer ties with industry. The great material resources placed at its disposal by the Government made it possible to equip some of the laboratories with first-class equipment. All of this led to certain changes in the organizational structure.

The 1948-1949 school year marked the creation of the engineering physics department; an engineering pedagogical department was started in 1949-1950 with the purpose of training mechanical engineers to teach in technicums and other technical schools. New specialties also arose during this period.

The intensive development of academic and scientific activities at the School already toward the end of the 1940s required the expansion of the auxilliary academic base. The MVTU began to experience a number of difficulties. The basic obstacle, as formerly, was the extreme shortage of space; this led to the organization of classes in two and one half shifts, which still did not completely alleviate the classroom shortage.

Laboratories and equipment rooms were used for classroom space, and this had a negative effect on the scientifi-methodological work (due to the interruption of work rhythm and the concomitant impossibility of performing extensive long-term continuous studies, etc.).

The rates of new construction of the MVTU lagged considerably behind its total growth rate.

The School struggle insistently to accelerate the program of building new facilities, laboratories, and the suburban installation.

The increased enrollment likewise posed the problem of building more student dormitories. A new dormitory was completed in 1950-1951 in the Moscow suburbs, and plans were submitted for the construction of another one in Moscow itself.

The School also pressed for a solution of the problem of increasing the time norms allotted for various activities and projects (annual projects and degree theses, group sessions, etc.).

A memorandum issued by the MVTU entitled "On the present state and prospects for the future development of the MVTU imeni Bauman and its essential needs" (1951) contained the following statement:

"We realize full well that much still remains to be done: we must strive tirelessly to carry forth a large scientific-methodological effort for the improvement of the academic process, concentrating special attention on the improvement of technological training given our engineers; we must intensify political educational efforts; we must work more intensively to produce scientific cadres; we must produce more study aids than ever before; we must develop our laboratories and strengthen ties with industry.

"But what we need is the assistance of the Ministry of Higher Education in the solution of a number of basic and essential problems--first and foremost that of accelerated additional construction". /Note: minutes of the MVTU Scientific Council meeting held on 2 July, 1951, page 6/.

And as always, the needs of the School received due attention. In September, 1952, the Government extended an additional appropriation for the construction of academic buildings, a 100-unit apartment house for professors and teachers, and a student dormitory to house 1200 persons.

Some idea of the scale of construction may be gained from the fact that the 1953 plan included an expenditure of 15 million rubles for building and installation costs.

The School won approval of its recommendation directed toward the development of scientific and academic work.

In its subsequent endeavors, the MVYU outlined an extensive work plan reflecting the directives of the 19th Congress of the CPSU.

The Scientific Council resolution dated 10 November, 1952, and entitled "On the problems of the MVTU in connection with the resolution of the 19th Communist Party Congress" proposed:

1) The intensification of ideological work;
2) The improvement of teaching methods;
3) The revision of study plans and programs in connection with the transition to a five-year term of study, with special attention directed toward the problems of automation, complex mechanization, etc.;
4) A revision of the work of special sections, especially in the matter of solving large-scale problems in science and technology;
5) The strengthening of ties with industry;
6) The increased introduction of scientific results into actual practice;

7) An intensification in the program of preparing new scientific cadres, etc.

A major event in the life of the School, as well as of the entire higher education system, was the resolution of the USSR Council of Ministers and the Central Committee of the CPSU of 1954 on the improvement of the training, distribution, and utilization of specialists with a higher and secondary specialized education.

Among the timely problems whose solution will in great measure determine the improved quality of specialized training in the higher educational institutions are the following: the liquidation of extreme compartmentalization, and, conversely, the production of specialists with a wider general background, the reduction of compulsory assignments and activities of students to provide for great independent effort, and the significant improvement of actual production training.

The concrete realization of the Party and State directives proceeded in the direction of reexamining and revising study plans and programs, widening the purview of special sections, divisions, and departments, developing teaching methods designed to promote independent work on the part of students, and creating improved textbooks and study aids. All of this required a radical reappraisal of the character of scientific methodological and scientific research work.

## The Organization and Methods of Engineer Training

### Basic Principles of Engineer Education in the 1917-1930 Period

The Moscow Higher Technical School always considered its main and most important purpose to be the training of politically developed and highly-qualified engineers and organizers having full command of the methods of scientific and technical thinking and equipped with extensive technical knowledge. This was precisely the purpose which guided the organization of the entire academic process at the School throughout all stages in the development of the Soviet higher technical school system.

The original academic system reflected a progressive trend in the field of higher technical education. The subsequent creative development of the principles embodied in this system led to the creation of the "Project for the Development of the Moscow Technical School into a School of the Polytechnic Type".

Measures taken in the 1917-1918 period included the establishment of more definite study plans, the development of academic programs, and the formulation of basic steps to be taken in connection with the forthcoming organization of the electrotechnical and civil engineering departments and the reorganization of the Mechanics Department.

The new study programs were based on the old subject-course system with a five-year term of study.

The plans provided that the first and second year students would take up the study of general scientific and certain general technical subjects: mathematics, physics, mechanics, strength of materials, etc. Starting in the third year, concurrently with general technical courses, the student would begin to specialize, later concentrating most of his attention on his specialty.

A considerable role in the study plans was devoted to the teaching of socio-economic disciplines.

The coverage and character of the plan, as well as the ratio of time devoted to various types of study, remained the same.

In 1918-1919, the study plans were approved by the People's Commissariat of Education and began to be put into effect in connection with the completed reorganization of the mechanics department and the opening of the electrotechnical and civil engineering departments. These study plans were in effect until 1921.

The basic premises of the higher technical school reform introduced in 1920 established a course system with a three-year term of study in all of the higher technical schools.

Upon reexamining its study plans, the School came to the conclusion that the provision of good training for engineers required the institution of a four-year study term. This idea was taken into consideration by the People's Commissariat of Education, which agreed to this change.

The new study plans preserved the old course sequence for the general theoretical and scientific required subjects, as well as the order of specialization. The changes consisted in the fact that three years were devoted to general training and the last year to specialized courses.

The school year was divided into three trimesters: fall (four months), spring (four months), and summer (two months), with the first two taken up by studies at the School and the third by actual experience in industry. Lectures were to take up 1536 hours, exercises 1040 hours, laboratories and workshops--368 hours, drafting--512 hours, and the time to be devoted to project planning activities unspecified. This brought the total study time to 3456 hours, with an additional 2856 hours of homework on the part of the student.

In addition to this, the plans set aside 384 hours on the possible study of foreign languages, as well as field trips, colloquia, and examinations.

The working time allotted in the last year for the completion of senior theses was longer than that allowed formerly.

Actual experience in using these study plans during the period 1921-1924 showed that new conditions and new problems confronting technology were not receiving sufficient reflection in the academic process.

A new five-year study plan was worked out in 1924. According to this plan, the first and second years included general course in all of the departments with the exception of the civil engineering department, with the gradual introduction of specialization in the third year; the specialized courses gradually increased in proportion, making the fourth year completely specialized; the fifth year was devoted to the final project and diploma thesis. Of all of the time allowed for completing the full course, 33% was devoted to lectures and seminars, 30% to exercises, 20% to laboratory work and 17% to planning.

The total number of possible specialties in each department was as follows:

a) Mechanics Department--16;
b) Chemistry Department--14;
c) Civil Engineering Department--8;
d) Electrotechnical Department--10.

Foreign languages and the cycle of political courses were not included under any department.

At the same time, programs were worked out for newly-instituted courses and old ones reexamined.

Special attention was devoted to the compilation of programs on political subjects; these were made considerably more extensive and complete than was the case previously.

The All-Russian Conference of Rectors held in 1925 approved the proposal for the transition to a 4.5-year term of study at the higher technical schools of the country. The People's Commissariat of Education at first approved the School's plans for a 4.5-year term, and then extended this to 5 years in a number of specialties.

The study plans for 1925 devoted a great deal of attention to production practice. The "Resolution on Summer Training at the MVTU" clearly defined its aims, purpose, order of enrollment, and grading. According to the academic plan, the summer training was to be an extension of the usual studies. The summer trimesters were used for training the students as follows: the third trimester program would be administered in the School workshops in the area of geodetic and structural practice; the sixth trimester was to be spent in general factory training, while the ninth trimester went for specialized factory training. The organization and administration of the summer program was made the responsibility of the departmental and general school commissions.

Subsequent years showed that the School, despite its considerable achievements, did not provide adequate training to Soviet specialists.

"Even in one of our best higher technical schools, the MVTU," said Comrade Molotov at the July Plenum of the Central Committee (1928), "we encounter at every step blatant examples of our technical backwardness.

Here is an example from the Civil Engineering Department. Investigators in this case have made the following comments:

'Even such subjects as new materials and structures are taught within the department exclusively. New construction machinery purchased from abroad and used in the Soviet Union for several years is as yet completely unfamiliar to the students.

'The senior theses produced by the students tend to be extremely abstract; the experience of foreign technology is poorly reflected in them'.

"This is what the inspectors had to say about the Chemistry Department:

'The Chemistry Department program requires revision so as to cover the newest achievements of chemistry. There is extreme backwardness in familiarizing the students with new developments in applied chemistry as well as a complete lack of contact with those general organizational and economic problems of industry without which the modern engineer cannot function in our country'.

"The investigators comment as follows on study aids for the students:

'That which we saw in the area of study aids for students was interesting indeed. First of all, there was the library. The library is an old one and has very little new material. Its contents could be considered exemplary for the year 1885. The textbooks had been used so much that some of the more commonly used pages have become unreadable. The lathes used in the workshops, for example, bear an 1847 stamp. The equipment presently being used at the MVTU would make a fine museum. The School has no Soviet-made machinery, not to speak of foreign equipment'.

"This is what the students have to work with at the MVTU, the largest technical school in the USSR". /Note: V.M. Molotov, On the Training of New Specialists, Moscow-Leningrad, 1928, pages 25-26./

The decisions of the July Plenum of the Central Committee on the improvement of training and increased output of specialists mobilized the efforts of a collective of scientists at the school toward the modernization of this training. They reexamined all of the study plans and programs as well as the specialty classifications, abolished senior theses and projects, established definite time limits for graduation, altered the character of production training, etc.

From the system of "continuous study in production" the School went over to that of "continuous practice in production", whereby the first-year students began to receive their technological training at the School; production practice at actual industrial enterprises began with the sixth semester.

The considerable improvement of the material base of laboratories and workshops in many ways aided the improvement of training quality.

In subsequent years, much attention was devoted to the elaboration of general and particular methodological problems in connection with the organization and development of new departments, introduction of new specialties, and the opening of new and expansion of old laboratories, as well as the alteration of study and practical training procedures.

By the time the five-year plan of study was introduced in the School as well as in the other higher educational institutions in the country, the group-laboratory study method was beginning to be introduced. In the case of the general scientific disciplines (mathematics, mechanics, etc.), it had to do with the division of the entire material of a given course into sections some of which were studied only in lectures, a second category--only in group sessions, a third--both in lectures and in groups, and a fourth--in lectures, conference hours, and on an individual basis.

An important role in the general methodological effort was played by the problems of correlating the subject matter studied by the lower division students with the students' level of general knowledge prior to entering the School.

What follows is a brief examination of the development of several general principles at the basis of the academic process according to departments.

The Mechanics Department. The problem of revising the study plan for this department arose in connection with its subdivision to form two new departments during the 1918-1919 schoolyear.

A special commission consisting of professors and instructors in the most important special technical disciplines introduced a number of changes into the existing study plan. The term of study remained five years as formerly, with a total 30-hour weekly academic work load and a 2-semester academic year. The scientific-technical disciplines were grouped according to four categories and 20 sub-classifications covering all of the basic specialties.

Special attention in the study plans was devoted to special project work, as was the case formerly.

The commission recommended the inclusion in the plan of a proposal for the organization of a specialty in agricultural machine building; the School Council turned down this proposal, however.

The new study plan was introduced in 1921; it set the term of study at the School at four years.

In view of a number of shortcomings in this plan, the department in 1924 initiated the development of a new study plan to cover a five-year term, and also set about to revise the course programs.

The new study plan and programs were approved in 1925. In later years, it was amended to include changes having to do mainly with the introduction of new courses and certain small changes in time devoted to various forms of study.

The essential points in the plan were as follows. The first two years encompassed studies of a general nature for all sections and specialties; specialization began in the third year, with 80% of the work load, on the average, still taken up by general departmental disciplines. In the fourth year, special courses took up about 65% of the total time, while the fifth year was devoted solely to the senior project.

Practical work experience was to be gained during the summertime exclusively, and as a rule started on June 1; the type of work at each stage was as follows: second year--general departmental practice; third year--general practice, fourth year--specialized work; fifth year--work in preparation for the senior project. The average academic work load from the first through the fourth years totalled 35.5-36 hours per week. The average number of compulsory courses was 37, 9 of these of a general scientific nature, 15 dealing with technology in general, and 13 specialized courses.

A very important role was likewise played by general economic training. For example, among the economics courses, in addition to the general "Industrial Economics" course taken by all of the students, the metal technology, wood technology, and general machine building sections had a course in "Metal Industry Economics", while the students in the thermal technology section took "Fuel Supply Economics" and the textile section offered "Textile Industry Economics", etc. But this was only one part of the general economic training envisioned by the plan. Problems in calculation and industrial economics were treated in almost every specialized course.

Thus, the problem of extensive economic preparation outlined in the early plan for converting the School into a polytechnic institution was adequately resolved.

The study plan and programs of the Mechanics Department envisioned the training of engineers with an extensive general scientific and technical background.

A good example of this may be found in the type of project work carried on by the students.

The gradual development of project planning, as before, was intended to acquaint the students with the independent solution of technical problems through the assignment of ever more difficult tasks of a constructive nature. This was a tradition at the MVTU.

The planning work carried out by the student was subdivided into general, specialized (annual), and senior-thesis categories.

The senior thesis project was the last independent piece of work carried out by the student which consummated his training in his own chosen field.

In working on their projects, the students were able to consult specialized project leaders.

This collective, cooperative direction of senior thesis work was always considered to be important at the MVTU and was a characteristic feature of an effort designed to promote lively and deepseated interest in the student during the elaboration of the main problems involved in his theme.

Preparatory training in draftsmanship bore a direct relation to the project work.

The drafting aspect of project planning involved new problems connecting it with the subject matter of other courses (mathematics, mechanics, etc.); machinery design, furthermore, became more modern.

The drafting programs were considered basic in the Mechanics Department.

The drafting programs in the electrotechnical, civil engineering, and chemical departments in simplified and abridged form reflected most of the drafting assignments administered in the mechanics department butincluded certain specific features having to do with the subject matter of each department.

The general development of the study plan can to a certain extent be characterized by the development of specialties as shown in the following comparison: [see

Table 14 at end of report./

In connection with the division of the study plan according to sections, the Mechanics Department produced:

In the thermal technology section--specialists on the organization and administration of thermal power production in factories and plants, designers of thermal power production stations for regional and central areas; designers of steam engines, boilers, locomobiles, steam turbines, stationary internal combustion engines, automobiles, tractors, and aircraft engines; designers of locomotives, moving railway equipment, and diesel locomotives; specialists in traction equipment; designers of refrigeration and ice-making machines and apparatus; specialists on industrial refrigeration equipment and refrigeration installations.

In the general machine building section--designers of hydraulic machinery and specialists on the installation and exploitation of hydraulic power and pumping stations. Specialists on lifting, transporting, and unloading devices; specialists on the installation and use of grain mills.

In the metal and wood technology section--designers of stationary equipment and machine tools; engineers for the organization and exploitation of specialized plants (producing machinery, engines, pumps, compressors, textile machines, automobiles, aircraft, agricultural machinery, etc.), as well as of rolling mills, general and pipe casting plants, sawmills, and railway repair workshops.

In the aeromechanics section--aircraft designers and wind power production installations.

In the textile section--textile engineers familiar with all of the methods of fiber treatment; engineers for the design and mass production of textile machinery and specialists on the installation and exploitation of textile factories (spinning and weaving).

The Chemistry Department. The study plan of the Chemistry Department following the transformation of the School into an institution of the polytechnic type did not undergo any significant changes. The organization of the new technological-engineering and chemical engineering sections merely perpetuated the old features of the departmental program for chemical engineers. Some of these had been receiving extensive training in technology, industrial apparatus, and general plant operations, while others were trained in the development of chemical methods. Engineers of the second type were produced only by the school.

The study plan of the Chemistry Department introduced in 1921-1922 differed from the former one mainly in its shortening of the term of study to four years, with specialization taking place in the fourth and last year.

In 1924, work was started on the development of a new study plan to cover five years of work. In the fifth year, in addition to working on his senior project, the student would have an opportunity to enrich his knowledge in his chosen specialty by means of special electives offered by the department. The plan likewise placed special emphasis on the laboratory-seminar type of teaching which tended to curtail the time spent on lectures and increase the time spent in laboratories.

Instead of two sections, the plan envisioned four separate four separate sections and one subdivision.

These new proposals in connection with the transition to a five-year term of study were reflected in the new study plan introduced during the 1925-1926 school year covering a 4.5-year term of study.

With certain insignificant changes, this plan continued in effect until 1928, at which time changes were introduced having to do with the addition of new courses, the amount of time devoted to various forms of study, especially in the lower classes, etc.

The new plan included general scientific and technical training in the first six semesters, with specialization starting in the sixth semester along two basic directions: the technology of inorganic and organic chemical production, respectively. Those specializing in inorganic production were obliged to carry out a somewhat smaller amount of practical work in the field of organic chemistry than those specializing in organic production, making up for this difference by the performance of practical work on inorganic synthesis (in the inorganic chemistry laboratory) and the extension of the practical studies in physical chemistry.

Specialization increased in the seventh semester. Here, along with general technical disciplines, the basic role was already played by specialized course and additional work on physical and inorganic chemistry designed to improve the theoretical background of the student in special areas with reference to his own field.

For example, those specializing in pharmaceutical technology learned about the chemistry of heterocyclic compounds, while those taking up the chemical technology of metals and silicates had extra work on phase theory, etc.

The eighth semester increased the degree of specialization. Here, the courses were given within the framework of each specific section. The main body of subject matter in each specialty during this semester consisted of specialized technological courses, the study of technical analysis with reference to the given specialty, the planning of special pieces of apparatus, and participation in special seminars intended to prepare the student for his final project or thesis.

Subjects taken during the eighth semester were completely specialized. At this point, the subjects were taught with reference to each special section. The basic material learned in each specialty during this semester was made up of special technological subjects, technical analysis with application to the given specialty, the designing of special equipment, and participation in special seminars aimed at preparing the student for the subsequent completion of senior theses or projects.

During the fourth year, specialization proceeded along two directions in chemical technology; this determined the training received by the two types of engineers, concentrating either on production technology or the technology of chemical methods itself. Specialists of the first type had the opportunity of improving their knowledge in subjects of a technological character (structural engineering, general electrical technology, boiler installations, and special equipment design), while specialists of the second type who were not required to take the latter subjects continued to study various aspects of analytical, organic, inorganic, and physical chemistry by spending more time in laboratory work.

During the fifth year, those specializing in the first of the aforementioned areas completed a senior project and thesis, while those in the second group had to submit a thesis and a technological-economic report whose preparation required a sufficiently good knowledge of production processes and their economic aspects. The major emphasis in the work of the first group was placed on technological training and the completion of the senior project; in the case of the second group, central importance was placed on the improvement of knowledge in the field of scientific chemistry and the senior theses which had to conform to extremely high standards.

The overall development of each specialty is apparent from the list of specialties within each department in the years 1918 and 1930.

The character of the general and special projects changed little in the course of the period under examination. Their natural and main point of difference consisted in the modern character of the themes involved. /Note: see Table XI at end of report./

In working on his senior project, the student was required to include the following material:

1. A brief description of the production process on which the project was based; its economic significance and the conditions serving to make it profitable.

2. A complete plan of the given enterprise in which the assignment was carried out; this was to include a description of the products manufactured, the necessary raw materials, and the sequence of processes involved in the production of particular commodities.

3. A choice of designs and an estimate of the required number of pieces of apparatus and machines along with their specifications, efficiency, and power consumption.

4. An estimate of the space required and a sketch of apparatus and machinery placement.

5. Information on power and steam requirements; this included: a) an estimate of the amount of steam required in the process; b) an estimate and selection of a steam boiler system; c) a choice of motors, their placement and transmissions; d) the rational use of steam; e) a choice of fuel, an estimate of the quantities to be consumed, and the methods of delivery and storage.

6. Information on the water supply; a calculation of the required amount of water and the number of tanks and pumps needed. Information on the purification of the water used in the factory. Information on waste removal and decontamination.

7. A plan and estimate of building costs (including fire prevention features). Building heating and ventilation.

8. A calculation of the work force required at the plant; a calculation of the necessary wages.

9. Information on hygienic working conditions, cultural and educational facilities, and the organization of the latter.

10. A calculation of the cost of the product manufactured.

The blueprints submitted with the project were aimed at providing a graphical representation of the basic aspects of the productive process under consideration. Thus, it was necessary to indicate the placement of machinery, motors and auxilliary equipment, ventilation and heating facilities, illumination, the placement of stairways, doors, latrines, and cloakrooms, as well as to include sketches of factory building placement and the location of the production facilities within each building.

It was likewise considered desirable to submit diagrams depicting graphically the course of production, as well as the use of steam and power.

In addition to submitting the senior project itself, the students were required to carry out technical-economic calculations.

Materials collected by the student during his practical training served as the basis for the compilation of his technical-economic report.

These reports included information on staffing the production process with qualified workers, the correct distribution of the work force, and the provision of favorable working conditions and hygienic environment for the workers.

The Electrotechnical Department. The Electrotechnical Department had as its purpose the preparation of engineers for a number of technical fields in which work processes are based on the use of electrical energy. In accordance with this task, the study plans for the 1918-1919 school year were worked out in such a way as to provide first of all a sufficiently extensive general scientific and engineering background, and only then to develop the students' special knowledge. The first part of the plan covering the general scientific and engineering curriculum was based on the physico-mathematical disciplines whose study would enable the student to understand and evaluate physical phenomena from the mathematical standpoint.

The second part of the plan covered general technical preparation consisting of the study of a number of technical disciplines, most of them in concentrated form.

The third and basic part of the plan had to do with the study of special electrotechnical subjects which made up the specialized training given the student together with the senior project.

Practical studies in the School laboratories as well as industrial work experience were an important component in the electrical engineering program.

The basic principles of this study plan were likewise applied in the program worked out for the years 1921-1925, when the term of study was cut down to four years.

Of great importance to the development of the department were the study plans introduced during the 1925-1926 school year. These plans, designed to cover a full term of study lasting 4.5 and then five years, were in effect with certain minor changes until 1930.

The structure of the plans was such that approximately 2.5 years were devoted to the study of subjects required by students in every specialty; some special subjects were introduced in the second half of the second year. Part of the third, and all of the fourth year was taken up by special courses. For the fifth year, the plan envisioned the extension of knowledge in a given specialty and the completion of senior theses and projects. The study plan for the 1928-1929 school year included programs in almost all of the specialties then introduced at other higher electrotechnical schools. This is apparrent from the following comparative data on the development of each specialty. /Note: see Table XII at end of report./

Project work played an especially important part in this study plan. The general project program was similar to that of the Mechanics Department.

Annual projects within the department were determined by the student's specialty. For example, those specializing in the field of electrical drive mechanisms, the project has to do with the design of a motor; the student was obliged to calculate and determine the size of the motor, to construct characteristic curves, and to draw up detailed design blueprints. Students specializing in telegraphy would make use of a given equipment load to calculate and design battery stands, calculate the accumulator battery parameters, choose the proper battery chargers, design charging circuits and the charging board layout, plan the general switching circuit, design the central commutator, etc.

Themes chosen for the senior projects were highly varied. They could be subdivided into the following categories: electrical machines and devices, electrical equipment manufacture, and the distribution and application of electrical power and communications.

The Civil Engineering Department. The Civil Engineering Department was intended to train specialists for a number of fields in technology whose fundamental technical basis consists of the various civil engineering disciplines.

The basis of the general training program as envisioned in the 1918-1919 study plans were the physico-mathematical disciplines which in turn laid the foundation of the study of various other technical subjects.

At the same time, these plans also included training in the general engineering disciplines (draftsmanship, geodesy, structural mechanics, etc.). The subsequent training of the future civil engineer consisted in the study of a number of specialized subjects as well as in project work. All training was based on a solid practical base consisting in the performance of laboratory work in connection with many of the disciplines studied and participation in academic and industrial practical experience programs.

Among the various sections and specialties included in the department, a special place was occupied by the structural engineering section, which actually arose as early as 1900.

The study plan and programs of the architecture section were intended to produce engineers whose ability to correctly and precisely calculate the dimensions of a structure and structural habits and knowledge would be combined with a correctly developed artistic taste enabling him to impart an aesthetic architectural treatment to any structure in accordance with its functional purpose.

The 1918-1919 study plan was revised in 1922 in order to make possible the completion of the full course within four years. Since actual experience showed, however, that this length of time was insufficient, the department in 1923-1924 began to work out new study plans covering a five-year span. In connection with the 1924 merger of the Moscow Civil Engineering Institute with the Civil Engineering Department of the MVTU, the study plans reflected the valuable achievements of both academic institutions in the training of specialists in various fields of civil engineering.

The study plan assumed a clear-cut form by the 1927-1928 school year. Some idea of its nature may be gained from the following data on the development of each specialty. /Note: see Table XIII at end of report./

The plan encompasses two general fields--civil engineering and architectural engineering; the civil engineering curriculum has an independent plan for each specialty starting with the third year.

The study plan included programs for training engineer in the following specialties:

1) Civil engineers acquainted with the calculation, design, and erection of complex engineering structures (bridges), major public buildings (railway stations, airplane hangers, etc.) and urban commercial facilities (elevators, cold storage plants, etc.);

2) Engineers specializing in factory and plant construction (all areas);

3) Engineers acquainted with the problem of water utilization in all of its aspects, i.e., the technological applications of water regarded as a source of energy, waterways as channels of communication, water as the meliorative factor, and water supply problems in general. The basic concern however, was the problem of utilizing water as a source of energy;

4) Engineers specializing in various aspects of urban industry and public works (water supply and sewerage, heating and ventilation, etc.);

5) Architectural engineers acquainted with modern design and building standards as applied to public facility, and at the same time able to plan housing and special buildings as well as entire cities and settlements.

The study plan of the civil engineering department devoted a great deal of attention to project work, as so did those of the other departments.

The existing order and character of general, annual, and senior project work in the civil engineering and architectural fields already in force for many years served as a basis in the development of project plans for the civil engineering department. By the 1925-1926 school year, project work standards took on a clear aspect and were maintained almost intact until 1930.

Actual project work began in the third year, at which time the students were put to work on small designs (structural details, etc.); this was followed in the fourth year by the independent solution of more or less serious technical problems having to do with the compilation of special annual projects which were sometimes continued during the course of the fifth year. There was a total of four course projects. During the fifth year, the students were on their senior project. The theme of this project consisted in the solution of an entire engineering problem. Depending upon the scope of the theme, the project included both detailed and sketch elaboration of the elements in order that the student might be able to discuss all relevant issues raised during his defense of the project.

The four compulsory parts of each project were as follows: 1) The planned resolution of the given theme; 2) its resolution by means of calculations and designs; 3) its resolution with respect to work organization and actual construction; and 4) an economic treatment of the problem.

Each portion was developed according to a comparative method through a study of variations and the choice of the most expedient variant. In cases of extensive themes, it was possible to limit the treatment of some particular detail to the extent, however, that the student satisfied the four aforementioned requirements.

## The General Precepts of Engineering Training in the Period from 1930 through 1955

After the reorganization of the MVTU in 1930, the period from 1930 through 1932 was one in which the Mechanics and Machine Building Institute did a great deal of work to organize new academic organs (departments, special sections, etc.), to resolve pedagogical problems arising as a consequence of the newly-altered academic-organizational structure (the emergence of new specialties), and to improve the work of the auxilliary academic facilities, etc.

The study plans for these years differed little from the Mechanics Department plans for 1930.

The period 1932-1933 brought with it a radical change in the entire academic life of the Institute in accordance with the decision of the USSR Central Executive Committee dated 19 September, 1932. These changes had to do with the simplification of the organizational structure of the academic sector, the revision of study plans and programs, the adjustment of subject matter in line with the needs of socialist industry, and finally, the introduction of such specialties as locomobile design, boiler design, food machinery construction, etc.

In order to prepare specialists equipped with extensive theoretical knowledge, the total proportion of general scientific, technical and specialized disciplines within the curriculum rose to 80-85%. In the new study plans, the mathematics requirement rose from 280 hours to 403 hours, physics received 200 hours instead of the former 60-100 hours, etc.

The new plans and programs as worked out at the Institute were adopted by the People's Commissariat of Heavy Industry, and the Committee on Higher Technical Schools as the basis for unified plans, programs, and profiles for all higher machine building schools.

The new academic program at the Institute went into operation on 1 January, 1933. Most of the teaching was done by means of the laboratory-seminar technique, with special emphasis on independent work by the students. Senior projects (and theses) as well as the system of individually-graded examinations was reestablished.

In 1933, an important role in the academic life of the Institute was assumed by the problems of mass production practice: basic methodological instructions on its organization and introduction were worked out, and the role of the institute and industry in its direction was clearly defined. The Institute was made responsible for 30 factories in scientific research institutes.

It turned out in 1934, however, that the content of the academic process was lagging behind the organizational norms of mass production. For this reason, all resources were martialled in 1934-1935 to make up for this lag.

Of great importance to the development of the academic process was the resolution of the Council of People's Commissars and the Central Committee dated 23 June, 1936, entitled "On the Work of the Higher Educational Institutions and on the Administration of Higher Education".

The development of new and firm organizational principles to be applied in the academic process (study plans for programs to be covered in four years and ten months for some specialties and five years and two months for others, programs, methodological instructions, etc.), the alteration of the organizational structure of the academic sector (the opening of new departments and special sections), the establishment of more clearly defined specialties, etc--this was what occupied the Institute in the 1930s.

During the period 1941-1943, the Institute continued to operate on the basis of its old established norms, managing to function in a normal manner during the difficult wartime years.

An event of considerable importance to the development of the academic process was the resolution of the State Defense Committee dated 22 May, 1943. This resolution required the School to revise its academic program in such a way as would enable it to train engineers of a wide background in almost all fields of machine building, instrument design, and certain other allied areas. The resolution likewise reestablished the old program of training design engineers in the field of steam technology.

All of the study plans were reexamined in 1943-1945; many old specialized and some general syllabi were likewise revised and new syllibi drawn up. The teaching of mathematics, theoretical mechanics, the theory of machines and mechanisms, strength of materials, and other general theoretical and technical disciplines was intensified in the study plans for several of the specialties. The programs for all disciplines were reexamined and adjusted in accordance with new scientific and technical achievements. The total amount of study time according to the new plans was 5000-5100 hours, of which 3700-3800 hours were devoted to compulsory subjects for all students, and 1300-1400 hours to special disciplines.

Despite the fact that the School's study plan did not differ significantly as regards the total time devoted to academic work from those of other machine building higher technical schools in the country, the quality of engineer training turned out to be higher. This superior training was due first and foremost to the presence of highly-qualified scientific cadres who were keeping in constant touch with industry and scientific research organizations, and secondly, to the availability of a sufficiently advanced laboratory base.

Aside from certain insignificant changes, the study plans of 1943-1945 remained in effect throughout the following years.

Despite the successes achieved by the School in its scientific and pedagogical efforts during the period 1943-1945, it turned out that there were still certain shortcomings as regards the solution of academic problems. The

Ministry of Higher Education took note of this fact in 1946.

The School responded directly to this criticism and, starting in 1946, undertook the revision and considerable improvement of all aspects of the academic curriculum. The first result of this work was the convocation in May, 1948, of a methodological conference on production training. This conference attracted a great deal of attention on the part of the major higher educational institutions of the country (the Moscow Power Production Institute imeni Molotov, the Moscow Aeromechanical Institute imeno Ordzhonikieze, the Military Air Academy imeni Zhukovskiy, the Moscow Agricultural Institute, the Steel Institute, etc.), and industry.

This attention to the work of the conference was only natural, since production training had always played and continues to play a decisive role in the preparation of highly qualified modern engineers. A resolution on the production training of students in higher educational institutions adopted by the Council of People's Commissars on 26 March, 1938, stated that "production training is an organic part of the academic process and has as its purpose the testing and reinforcement of theoretical knowledge obtained by the students in their study of specialized disciplines".

Participants in the conference discussed the main problems of production training: practice study in the workshops of machine building technical schools, exploitative practice for design specialists, as well as technological and pre-graduation practice.

Touching on the general problems of production practice, the conference delegates noted that the industrial enterprises which make their facilities available to students do not always provide qualified instructors, adequate working space, control over practice norms, etc. They also noted shortcomings in the direction of such programs on the part of the higher technical schools; the responsibility for conducting production training sessions frequently devolves upon second-rate and not always sufficiently qualified instructors; there is a lack of order in the preparation of performance reports, etc.

The conference recognized the need for convoking a special session consisting of representatives of the machine building ministries at the Ministry of Higher Education for the discussion of basic measures to improve the entire production practice situation and to organize student field trips to various industrial enterprises.

Of especially great importance were the conference decisions as regards individual types of practice. These reflected the achievements obtained by the school as well as general proposals for the further improvement of practice program quality.

Work Practice in Workshops. The School administration held the view that work practice in the School workshops should be the first stage in the preparation of the student for actual work at an industrial enterprise, and that it should likewise serve as his background for the study of various topics in machine building, technology, machinery details, etc. This practice is an integral part of the course in "Metal Technology", which should take the form of a unified course taught by means of a single methodological approach. The fragmentation of the course on "Metal Technology" and the assignment of its various topics to other specialized courses as was done at certain higher technical schools was considered unwise from the pedagogical standpoint. The course should be differentiated for the technological and non-technological specialties.

The basic principle in conducting workshop sessions consisted in having the students do independent work on the production of machine components in technological sequence (building the model, casting, forging, welding, mechanical processing, final assembly, and conveyance of the finished product to the warehouse). As a rule, the direction of component production should be supported by methodical documentation.

In the workshops, the student gains practical knowledge of the following matters:

1) All of the basic manual and machine methods for the processing of metals, wood, and non-metallic material;

2) The basic technological processes involved in the production of details;

3) The designing of several types of equipment and apparatus for the hot and cold treatment of metals;

4) Layout, cutting, and measuring instruments and devices;

5) The use of special equipment, machinery, and instruments; the orderly arrangement of tools and materials;

6) The correct safety techniques to be employed at the working space in shaping metals and wood manually and with the aid of machines;

7) The technical difficulties encountered in producing details constructed without regard for production technology.

In order to provide a well coordinated practical workshop program, it was deemed expedient to introduce the various aspects of metal technology in the following order: a) modelling, casting, forging, machining, and welding--semesters 1-4; b) mechanics--semesters 5-6;

In order to provide students with practical work experience of a sufficiently high level, the time to be spent in workshops was increased from 256 up to 374 hours, with each of the workshops occupying 51 hours with the exception of the mechanics shop which was to take up 119 hours.

The conference pointed out: 1) the necessity for organizing typical workshops in all machine building schools, equipping them with the latest domestic machinery; 2) the necessity for issuing workshop practice guides.

Exploitative practice for the building specialties. Exploitative practice was intended to:

1) Familiarize the student with the general conditions of exploiting the object, as well as with exploitative organization and economics;

2) Enable the student to master the methods used in testing and receiving finished products in factories;

3) Familiarize the student with assembly and maintenance.

In setting the term of practice training at 4-8 weeks (depending on the specialty), the School worked out an outline of the work to be performed by the students which was later proved by the conference; testing and grading standards were also defined.

Technological practice. This was a traditional part of the MVTU curriculum and was perhaps its best and most highly-developed segment. As formerly, it was intended to familiarize the student with all phases of machinery construction under actual production conditions.

The technological practice program encompassed all stages of the machine construction process through an examination of the functions performed in each shop: open-hearth smelting, rolling, steel casting, shaping, assembly, etc. The greatest amount of attention in the practice programs was devoted to the work most relevant to the student's specialty.

Pre-graduation practice. The conference noted that pre-graduation practice must pursue the following ends:

1) The assimilation of additional knowledge of equipment such as could not have been provided at the School, as well as the more thorough study of production process details. This knowledge was to be drawn by the student in a particular phase of production, as well as from lectures and consultations conducted by the technical staff of the host factory;

2) The development of a habit of applying the knowledge obtained at the School; this was done through the independent completion of individual assignments within a given workshop;

3) The selection and systematization of materials for the senior project.

Having considered the experience of the MVTU, the conference considered it advisable to initiate the development of general and specialized programs for pre-graduation practice, increasing the time spent in this activity from 7-8 to 12-14 weeks; the functions of supervision were likewise defined.

In connection with the matter of production practice, the methodological conference also discussed the problem of industrial field trips.

The rich experience gained by the School over the almost 100-year period that it had been conducting such excursions served as evidence of the enormous pedagogical significance of such programs.

Despite this fact, the conference noted that field trips arranged by the School became less and less frequent in the early 1930s; there were no more large-scale excursions such as those conducted in 1927 to the largest factories in the country (the Novo-Kramatorskiy, Dnepropetrovskiy, Makeyevskiy, and other Factories).

Such were the results of the methodological conference held in 1948 as the result of an extensive creative effort on the part of the scientific community at the MVTU on the problem of production practice as one of the most important portions of the pedagogical process.

The conference resolutions provided a basis for a further and considerable improvement of all production work programs not only at the MVTU, but at some of the other higher technical schools of the country as well.

In 1949, there was a scientific-methodological conference held to sum up the results of the methodolcgical work carried out at the School since 1946. The matters taken up by the conference were determined by the goal of realizing the resolutions of the Central Committee on ideological problems, and for this reason marked a new phase in the development of the School.

The conference took up important pedagogical-methodological problems. A discussion by many scientific workers from other higher technical schools of the country made it possible to define definite trends in the field of project work, the manner of conducting practical exercises, and the solution of the problem of providing visual aids materials. There was an important discussion on the matter of student work schedules. This problem is of great importance to the proper organization of independent work on the part of students.

As a result of its discussion of student project work, the conference defined the aims of this activity as follows:

1) The systematization, extension, and improvement of the student's knowledge and practical experience obtained throughout his schooling;

2) The familiarization of the student with the independent solution of complex problems which take into account both technical and economic indices;

3) The development in the student of a feeling of creative initiative, responsibility, independence, and work discipline;

4) A thorough and extensive mastery of that branch of technology with which the theme of the project is concerned;

5) The testing of the student's mastery of the material study at the School and his preparedness for independent work in industry.

It was considered absolutely necessary to conduct senior project work in special facilities at the School which would be furnished with adequate equipment, reference literature, blueprints, etc.

The creative development of scientific-methodological thought in succeeding years was reflected in the work of the scientific-methodological conferences held during the period 1950-1954. These conferences scrutinized the results and future outlook with reference to broad and specific methods for holding lectures, seminars, and laboratory sessions, as well as of administering project programs, production practice, field trips, etc. An exceptionally important role in the work of the conferences is played by the problems of ideologic political education among the students, the problem of teaching political and socio-economic subjects, and the problems of studying the history of science and technology.

In the elaboration of methodological problems, the MVTU assumed an important role among the higher technical schools of the Soviet Union.

If the development of scientific-methodological thought is an example of the general improvement in the work of the MVTU in the area of organizing the basic precepts of the academic process, no less convincing is the example such as is provided by the brief general description of the MVTU study plans over the period from 1947 through 1953.

The study plans for the period 1947-1953 were based on a full term of study lasting from five year six months to five years nine months. The first six semesters (the first through the third years) students in all specialties received the same gemeral technical and scientific training. This preparation consisted of the following courses: the foundations of Marxism-Leninism, political economics, foreign languages, higher mathematics, physics, chemistry, descriptive geometry, mechanical drawing, theoretical mechanics, strength of materials, machine components, the theory of machines and mechanisms, metal technology, thermodynamics, thermal technology, metallurgy, electrical technology, lifting and transport machines, hydraulics, and hydraulic machinery.

Most of the general courses were supplemented by laboratory work: general chemistry, physics, materials testing, metalography, electrical technology, hydraulics, thermal technology, etc.

The students were required to complete a cycle of practical assignments in the mechanics, modelling, forging, casting, welding, and machine shops.

In studying the special subjects, each student completed a cycle of laboratory assignments having to do with his own specialty.

An important role in the study plans was played by project work.

Course Project Work. Course projects had to do with machines, mechanisms, and instruments for installations of technical interest which provided appropriate material for study. The assignments were quite concrete, since they were based on the actual conditions under which the object at hand was produced or exploited in modern industry. The size of the report ranged from five to seven sheets. The assignment as received by the student included sketches or diagrams of the object without excessive detail such as might lead to simple copying; it also included a list of materials and references. Assignments of a technological nature included blueprints of the article with all necessary dimensions precisely indicated.

Senior projects. The themes of senior projects had to do with machines, apparatus, instruments, and installations important in the machine building industry. The project assignment was so devised as to require the independent elaboration by the student of a number of problems and questions on the basis of advanced scientific and technical knowledge.

The senior projects constituted complex studies encompassing a number of problems in design, calculation, experimentation, economics, and technology as related to the general assignment and theme. The total size of the report ranged from 15 to 16 sheets, of which no less than 10 sheets were to be taken up by materials having to do with planning and design exclusively.

Assignments having to do with design projects also covered the elaboration of the technical aspect, which consisted in the construction of working blueprints, a description of the technological process employed, etc. This portion of the report made up 15-20%.

As before, the student was required to develop his theme under expert guidance and to consult industrial specialists on special topics. The established tradition of reflecting the modern achievements of science and technology in the project and of judging them according to extremely high standards remained unchanged with respect to this important aspect of an engineer's training.

In 1954, there began a major effort on the realization within the academic process of the resolution of the USSR Council of Ministers and the Central Committee of the CPSU on the improvement of the training, distribution, and utilization of specialists with a higher and secondary specialized education.

## The Development of the Laboratory-Experimental Base

The experimental method of instruction, which in the past occupied an important place in the generalsystem of higher technical education, underwent further development at the MVTU. This development occurred in two distinct stages: the first period (1918-1930) proceeded in line with the general polytechnic orientation of the School, while the second (1930-1952) coincided with its specialization in the area of mechanics and machine building.

The experimental base underwent an extremely rapid period of growth from 1918-1930, as may be seen from the following comparative list of laboratories and equipment rooms: /note: see Table XIV at end of report./

This comparative list does not include the central electrical station and heating station, both of which were among the thermal technology laboratories of the Mechanics Department. This Department also included several facilities (such as the regulator laboratory) which did not grow during this period, as well as a small mechanical workshop.

A major portion of the laboratories and equipment rooms whose organization was outlined in the "Plan for the Development of the Moscow Technical School" were finally built. The only laboratories listed in the Plan which were not added were those requiring considerable space; this included, for example, the technical physics, steam engine, and hydrotechnical laboratories, the hydrological experimental station, the chemical technology station and equipment facility, the experimental purification station, etc.

Concurrently with the intensive growth in the number of laboratories, a major effort was being exerted toward the development of general and specialized laboratory work guides. This was equally applicable to both the new and old laboratories. By 1930, the character of laboratory work coincided with the general teaching level and reflected modern achievements in science and technology.

1930 marked the start of the second period in the development of the experimental-laboratory base and laboratory work methods.

In the period from 1930 through 1941, the number of laboratories increased from the 14 which remained after the 1930 reorganization to 30. The most rapid growth of the laboratory base and intensification of scientific-methodological work took place in 1937-1941 when old specialties were expanded and new departments and specialties organized.

The Great War of the Motherland interrupted this growth for some time. The improvement of the laboratories was resumed in 1943, however, at which time special emphasis was placed on the internal combustion engine and precise instrumentation laboratories.

In subsequent years, new equipment was received in ever greater volume.

Never before in the hundred years of its existence had the MVTU received so many new machines, lathes, pieces of apparatus, instruments, etc. All of this aided the growth of the new technological laboratories, enabling them to answer the needs of modern technology, and promoted the growth of the old laboratories, as well as the scientific development of general and specialized laboratory work guides and the general elevation of the level of scientific research.

## The Problems of Laboratory Work Methods in the School Workshops

The number of School workshops remained unchanged for a number of years. As before, there were the wood shop, metal forging shop, foundry, machine shop, and mechanical shop.

The type of work done in the workshops since 1917 improved and developed in subsequent years. Work methods were improved, new assignments were introduced, old projects were changed, etc. The general development of the workshops can be broken down into two periods: the first lasted from 1917 through 1930, i.e., until the reorganization of the School, and the second--from 1930 through 1954. The first period may best be described by the following brief list of projects in each workshop until 1930.

The woodworking shop. Demonstrations. The latter were designed to provide students with a general knowledge of modelling, materials, instruments, and machines used in wood modelling. The studies were accompanied by demonstrations of methods and techniques used.

Individual work. Each student completed the following projects:

1) Squaring a board with a plane and sawing it into a jamb; this project was intended to acquaint the student with the use of such tools as the hacksaw and coping saw, planes, brace and bit sets, various drills, squares, dividers, etc;

2) The joining of two blocks of wood into a penon or scarf joint; the student continued his familiarization with such tools as chisel, mallet, hammers, etc.;

3) The turning of a saw handle on a wood turning lathe according to exact dimensions with the aid of a template;

4) The construction of a simple model or box to hold a model (completely finished).

The forging shop. The assignments were as follows:

1) The extrusion of a square-head bolt from square steel stock; the extrusion of a hexagonal bolt from a round length of steel;

2) The forging of a square and hexagonal nut from flat steel;

3) Bending two angles in flat stock--one with preliminary scoring, the other without;

4) The welding of two round rods and the forging of a welded chisel or punch followed by tempering;

5) The forging of a two-ended wrench.

This work was done by two students who alternated in handling the stock and operating the hammer.

In addition to these required individual assignments, there were likewise demonstrations on the screw press.

This work consisted in having the students take down the operating characteristics of the press functioning freely and operating with dyes (extrusion, flattening, bending, and cutting), and then calculate the power of the equipment.

The foundry. The students became acquainted with the properties of pigiron, apparatus used in melting it, casting materials, various types of clay casting, the production of complex shapes, and the melting of non-ferrous metals.

Each student independently completed 10-12 assignments and became acquainted with 5-7 operations included in the cycle of general student assignments.

The machine shop. The work program in the machine shop was as follows:

1) Demonstrations explaining cutting, scraping, grinding and threading; work with several manually operated lathes and instruments; demonstrations of annealing and tempering of chisels in the furnace; demonstrations of impact and pressure training apparatus;

Table I

| Time of graduation | Mechanics | Electricians | Chemists | Builders | Total |
|---|---|---|---|---|---|
| By 1 July 1921...... | 190 | 35 | 106 | 50 | 381 |
| By 1 Jan. 1922....... | 108 | 62 | 105 | 30 | 305 |
| Total....... | 298 | 97 | 211 | 80 | 686 |

[Table II: see next page]

Table III

| Years | 1914 | 1923-24 | 1924-25 | 1925-26 |
|---|---|---|---|---|
| State appropriations in thousands of rubles | 391.0 | 558.0 | 1563.0 | 1990.0 |
| Special funds in thousands of rubles....... | 298.0 | 179.0 | 281.0 | 488.0 |
| Total.............. | 789.0 | 737.0 | 1844.0 | 2478.0 |

[Table IV: see below]

Table V

| Years | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 |
|---|---|---|---|---|---|---|
| Percentage of rabfak graduates in total student body | 33 | 30.3 | 32.7 | 36.2 | 41.6 | 45.4 |

Table II

| Years | Total graduates | Percentage of Student Body | | | | | | Total number of students |
|---|---|---|---|---|---|---|---|---|
| | | Social status | | | Party membership status | | | |
| | | Workers | Peasants | Employees | Communist Party Members | Young Commun. League Members | Non-Party Members | |
| 1920-1921 | 92 | 81 | 5 | 14 | 40 | 9 | 51 | 506 |
| 1921-1922 | 166 | 88 | 4 | 8 | 39 | 8 | 33 | 564 |
| 1922-1923 | 190 | 80 | -- | -- | 31 | 10 | 59 | 742 |
| 1923-1924 | 192 | 80 | 5 | 15 | 34 | 8 | 58 | 682 |
| 1924-1925 | 178 | 84 | 10 | 6 | 46 | 35 | 19 | 672 |
| 1925-1926 | 128 | -- | -- | -- | -- | -- | -- | 705 |

Table IV

| Years | Social composition (%) | | | | Party composition (%) | | |
|---|---|---|---|---|---|---|---|
| | Workers and children of workers | Peasants and children of peasants | Employees | Others | Communist Party members | Young Communist League members | Non-Party members |
| 1924 | 36.1 | 6.8 | 53.5 | 3.6 | 17.4 | 5.7 | 76.9 |
| 1925 | 34.7 | 8.9 | 50.3 | 6.1 | 21.8 | 8.5 | 69.7 |
| 1926 | 34.0 | 8.6 | 54.0 | 3.4 | 25.0 | 10.3 | 64.7 |
| 1927 | 38.4 | 7.9 | 43.4 | 5.2 | 21.8 | 11.7 | 66.3 |
| 1928 | 43.4 | 9.0 | 43.6 | 4.4 | 27.1 | 13.1 | 59.8 |
| 1929 | 51.2 | 10.1 | 32.1 | 6.6 | 32.6 | 15.8 | 51.6 |

Table VI

| Departments | Sections | Number of professors Dec. 1917 | Sept. 1918 | Sept. 1920 | Number of professors according to plan |
|---|---|---|---|---|---|
| Mechanics | 1. Mathematics... | — | 1 | 1 | 2 |
| | 2. Mechanics..... | 1 | 1 | 1 | 1 |
| | 3. Physics....... | 1 | 1 | 2 | 1 |
| | 4. Applied mechanics and machine building........... | 5 | 10 | 18 | 9 |
| | 5. Mechan. wood and metal technology.... | — | — | — | 4 |
| | 6. Mechanical fiber technology.......... | 3 | 3 | 6 | 3 |
| | 7. Civil engineering and architecture ...... | 2 | 3 | — | — |
| | 8. Electrical technology.... | 1 | 3 | — | — |
| | 9. Engines and shipbuiling... | — | — | — | 3 |
| Chemistry | 1. Chemistry...... | 2 | 2 | 3 | 4 |
| | 2. Chemical technology and metallurgy | 6 | 9 | 12 | 3 |

Table VI (continued)

| Departments | Sections | Number of Professors | | | Number of professors according to plan |
|---|---|---|---|---|---|
| | | Dec. 1917 | Sept. 1918 | Sept. 1920 | |
| Chemistry | 3. Botany........ | -- | 1 | 1 | 1 |
| | 4. Geology and mineralogy | -- | -- | 2 | 1 |
| Electrical technology | Electrical technology........ | -- | -- | 3 | 5 |
| Civil engineering | 1. Structural mechanics and construction engineering.... | -- | -- | 5 | 4 |
| | 2. Urban and rural planning and construction... | -- | -- | 4 | 4 |
| | 3. Sanitation engineering...... | -- | -- | 3 | 4 |
| | 4. Architecture... | -- | -- | 4 | 4 |
| | 5. Hydraulic engineering........ | -- | -- | -- | 3 |
| | Total....... | 21 | 34 | 68 | 62 |

Table VII

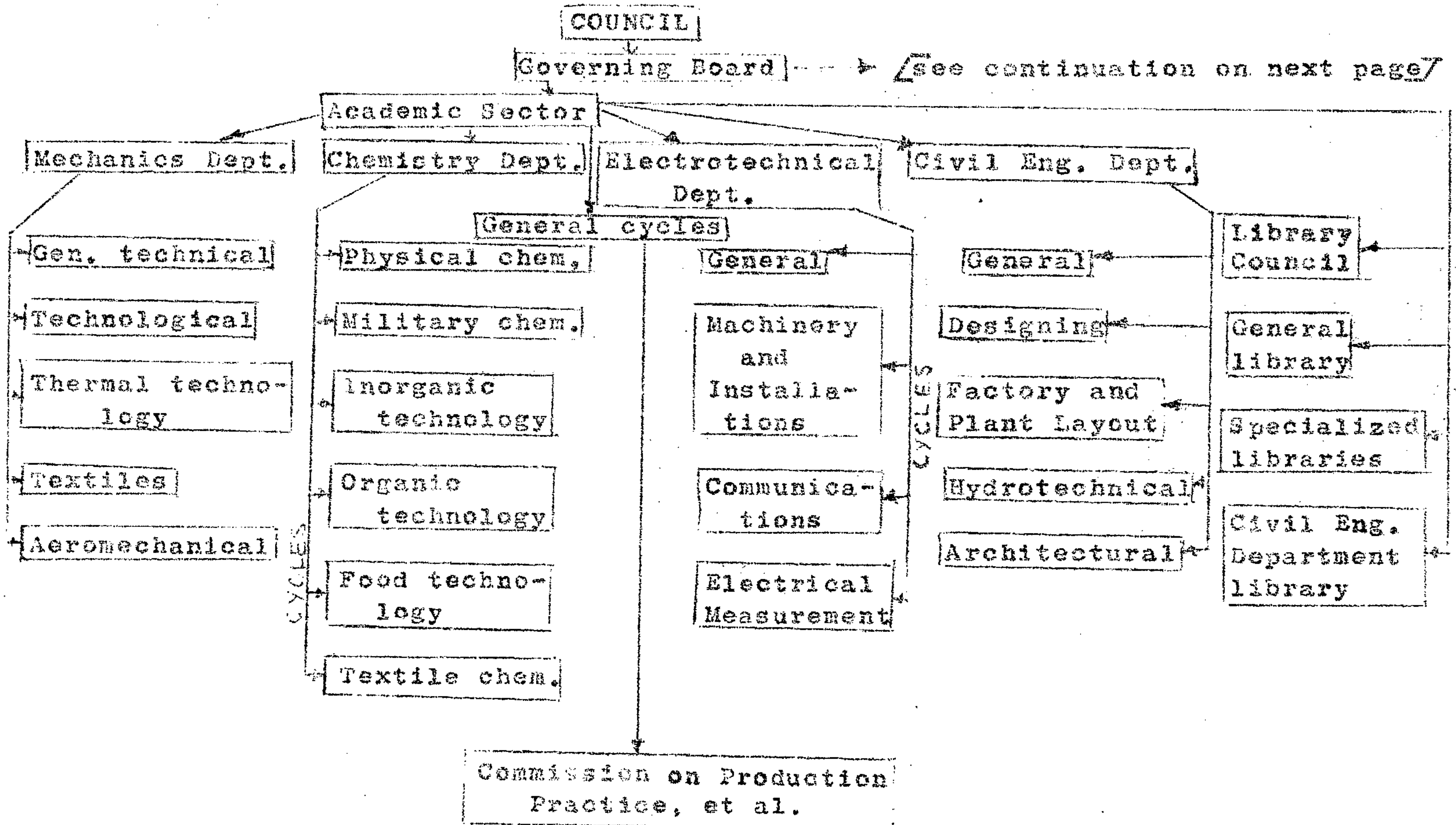
| | Dec. 1917 | Sept 1919 | 1922 | 1925 | 1930 |
|---|---|---|---|---|---|
| Professors....... | 21 | 68 | 74 | 97 | 106 |
| Instructors...... | 80 | 103 | 341 | 425 | 532 |
| Total... | 101 | 171 | 415 | 522 | 638 |

Table VIII

| Years | 1917 1918 | 1918 1919 | 1919 1920 | 1920 1921 | 1921 1922 | 1922 1923 | 1923 1924 | 1924 1925 | 1925 1926 | 1926 1927 | 1927 1928 | 1928 1929 | 1929 1930 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of students attending | -- | 1869 | 3278 | 2972 | 3367 | 3392 | 3681 | 5012 | 5190 | 5331 | 6180 | 6033 | 7227 |
| Newly admitted | (540) | -- | 447 | -- | 1250 | -- | -- | 439 | (451) | (701) | -- | 890 | (811) |
| Number of engineers graduated | 328 | 113 | 416 | 219 | 320 | (296) | 177 | 523 | 263 | 378 | 305 | -- | 752 |

Note: Figures in parentheses are approximate.

General Organizational Diagram of the Moscow Higher Technical School as of 1930



Organizational Chart [Continued]

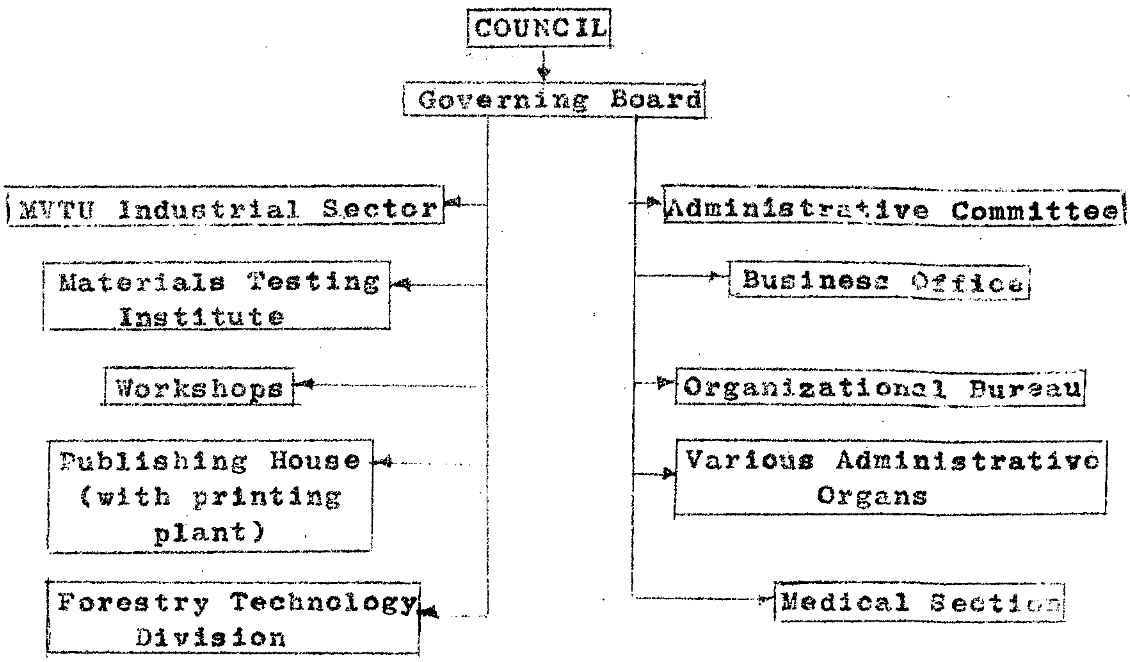



Table IX

| Years | Number of Students | | |
|---|---|---|---|
| | not holding jobs | holding jobs | total |
| 1930 | 2252 | 648 | 2900 |
| 1931 | 2555 | 1182 | 3737 |
| 1932 | 2733 | 2099 | 4832 |

List of Departments at the Moscow Mechanical and Machine Building Institute imeni Bauman During the Period 1930-33

| Departments | Sections |
|---|---|
| General (all departments) | 1. Leninism |
| | 2. Dialectical materialism |
| | 3. Political economics |
| | 4. Theory of the Soviet economy |
| | 5. Theoretical mechanics |
| | 6. Machine details |
| | 7. Strength of materials |
| | 8. Chemistry |
| | 9. Applied mechanics |
| | 10. Physics |
| | 11. Higher mathematics |
| | 12. Descriptive geometry and drafting |
| | 13. Foreign languages |
| | 14. Military science (tactics) |
| | 15. Military industrial production |
| | 16. Metal industry economics |
| | 17. Fundamentals of construction |
| | 18. Industrial organization |
| | 19. Electrical technology |
| | 20. Marxist history of technology |
| Thermal and hydraulic machinery | 21. Internal combustion engines |
| | 22. Hydraulic machinery |
| | 23. General hydraulics |
| | 24. Refrigeration machine building and installation |
| | 25. Steam and diesel locomotives |
| | 26. Thermodynamics |
| | 27. Compressors and ventilators |
| Cold metal shaping | 28. Metal cutting |
| | 29. Control and study of machine building processes and materials |
| | 30. Metals technology |
| | 31. Technological standardization |
| Heated metal shaping | 32. Metal casting |
| | 33. Metal pressing |
| General machine building | 34. Lifting and transport mechanisms |
| | 35. Textile machine building |
| | 36. Food processing machine builing |
| Precis. mechanics | 37. Precision instrument making |

Table X

| Divisions and Specialties | | |
|---|---|---|
| According to 1915 Plan | Organized in 1918-1920 | Functioning in 1929-30 |
| I. Thermal technology | I. Thermal technology | I. Thermal technology |
| | 1. Boiler installations | 1. Thermal power and boiler installations |
| | 2. Steam engines | 2. Steam engines (steam machines and turbines) |
| | 3. Refrigeration machines and installations | 3. Refrigeration machines and installations |
| | 4. Stationary internal combustion engines | 4. Stationary internal combustion engines |
| | 5. Steam locomotives | 5. Steam locomotives and railway cars |
| | 6. Railway operation | 6. Automobiles and tractors |
| | 7. Self-propelled equipment | 7. Aircraft engines |
| II. General machine building | II. General machine building | II. General machine building |
| 1. Hydraulic machinery and technology | 1. Hydraulic machinery | 1. Hydraulic power and pumping stations |

Table I [Continued]

| Divisions and Specialties | | |
|---|---|---|
| According to 1915 Plan | Organized in 1918-1920 | Functioning in 1923-1930 |
| 2. Refrigeration machinery | 2. Transport machinery | 2. Transport machinery |
| | 3. Aircraft machinery | 3. Grain milling equipment production |
| III. Mechanical metals technology | III. Wood and metal technology | III. Mechanical wood and metal technology |
| | 1. Casting<br>2. Mechanical cold metal processing<br>3. Heated metal processing<br>4. Wood technology | Same specialties as in 1918-1920 |
| IV. Aeronautics | IV. Fiber technology | IV. Aeromechanics |
| V. Mechanical fiber technology | 1. Cotton spinning<br>2. Linen spinning<br>3. Wool spinning<br>4. Silk spinning | V. Textile division<br>1. Cotton spinning<br>2. Linen spinning<br>3. Wool spinning<br>4. Silk spinning<br>5. Weaving |
| VI. Mechanical transport<br>1. Railway operation<br>2. River shipbuilding and marine engines<br>3. Transport and lifting machinery<br>4. Automotive technology | | |

## Table XI

| Divisions and Specialties | | |
|---|---|---|
| According to 1915 Plan | Organized in 1918-20 | Functioning in 1929-30 |
| I. Technological engineering | Department broken up into two divisions: | I. Inorganic technology |
| 1. Technology of minerals, organic materials, and foods (and metallurgy)<br>2. Paint technology | I. Technological engineering | 1. Basic chemical industry<br>2. Chemical technology of silicates<br>3. Chemical technology of fertilizers<br>4. Chemical technology of metals<br>5. Technological electrochemistry |
| II. Chemical engineering | II. Chemical engineering | II. Organic chemical technology |
| III. Mechano-chemical | This included the following subdivisions and specialties:<br>1. Technology of mineral substances (basic industrial chemistry, silicate technology, and organic fertilizer technology.<br>2. Technology of organic substances (technology of fats and animal products, petroleum and pyrogene technology, pharmaceutical technology, fuel technology) | 1. Chemical technology of fuels and pyrogenes<br>2. Chemical technology of fats and animal topsoils<br>3. Pharmaceutical technology<br>4. Chemical technology of photographic materials<br>III. Chemical-textile industries<br>1. Chemical technology of bleaches and dyes |

Table XI [Continued]

| Divisions and Specialties | | |
|---|---|---|
| According to 1915 Plan | Organized in 1918-20 | Functioning in 1929-30 |
| | 3. Food technology (technology of carbohydrates and fermentation, food preservation technology) | 2. Chemical technology of dyes<br>3. Chemical technology of cellulose |
| | 4. Technology of chemical textile industries (technology of dyes, technology of bleaching, dyeing, and special apparatus) | IV. Food products<br>1. Chemical technology of foods<br>2. Chemical technology of food preservation |
| | 5. Cellulose technology | |
| | 6. Metallurgy and metallography (ferrous and nonferrous metals) | |

Table XII

| Divisions and Specialties | | |
|---|---|---|
| According to 1915 Plan | Organized in 1918-20 | Functioning in 1929-1930 |
| I. Electrical machine building | I. Electrical machine building | I. Electrical machine building |
| II. Electrical railways | II. Electrical railways | II. Production, distribution, and utilization of electrical power |
| III. Installation and utilization | 1. Urban electrical railways | 1. Thermal power stations<br>2. Hydroelectric power stations |
| | 2. Long-distance railways | 3. High-voltage technology |

Table XII [Continued]

| Divisions and Specialties | | |
|---|---|---|
| According to 1915 Plan | Organized in 1918-20 | Functioning in 1929-1930 |
| IV. Technology of weak currents | III. Production and transmission of electric power | 4. Electrical drive mechanisms<br>5. Electrical equipment of testile mills<br>6. Electrical lighting |
| | 1. Thermal stations | III. Communications |
| | 2. Hydroelectric stations | 1. Radio technology |
| | 3. Electric power transmission | 2. Signalling, centralization, and blocking<br>3. Telegraphy<br>4. Telephony |
| | IV. Electrical installations | |
| | 1. Textile station equipment | |
| | 2. Factory and plant equipment | |
| | V. Radiotelegraphy and weak currents | |

Table XIII

| Divisions and Specialties | | |
|---|---|---|
| According to 1916 Plan | Organized in 1918-1920 | Functioning in 1929-1930 |
| I. Engineering structures | I. Engineering structures | I. Engineering structures |
| | 1. Bridges | 1. Bridges and structures |
| | 2. Complex engineering structures | 2. Urban public works structures |
| | 3. Underwater and underground structures | 3. Plant and factory construction |
| II. Hydraulic technology | II. Hydraulic technology | II. Hydraulic technology |
| III. Sanitation technology | III. Sanitation technology | III. Communal facilities engineering |
| 1. Waterworks | 1. Waterworks and sewerage | 1. Waterworks and sewerage |
| 2. Sewerage and water purification | 2. Heating and ventilation | 2. Ventilation and heating |
| 3. Heating and ventilation | | 3. Road construction |
| IV. Urban technical facilities | IV. Railways | IV. Architecture |
| V. Agricultural technology | V. Engineering architecture | |
| VI. Architecture | VI. Factory and plant construction | |

Table XIV

Laboratories and Equipment Rooms Functioning

| in 1918 | in 1920 |
| --- | --- |
| **MECHANICS DEPARTMENT** | |
| **Mechanics Institute** | |
| Laboratories | Laboratories |
| 1. Materials testing (mechanical) | 1. Materials testing (mechanical) |
| 2. Hydraulics | 2. Hydraulics |
| 3. Steam engines | 3. Steam engines |
| 4. Steam boilers | 4. Steam boilers |
| 5. Steam turbines | 5. Steam turbines |
| 6. Internal combustion engines | 6. Stationary internal combustion engines |
| 7. Heating and ventilation | 7. Automobiles |
| 8. Building materials testing | 8. Cargo lifting machines |
| 9. Cargo lifting machines | 9. Refrigeration |
| 10. Refrigeration | 10. Aerodynamic |
| 11. Metals technology (metal cutting) | 11. Metal cutting |
| 12. Aerodynamics | 12. Casting |
| **Institute of the Mechanical Technology of Fibers** | 13. Heated metal processing |
| 13. Station for technical testing of spun and woven materials | 14. Grain milling equipment production |
| 14. Spinning and weaving machine station | 15. Cotton-paper |
| **Physico-electrotechnical Institute** | 16. Linen spinning |
| 15. Physics | 17. Wool spinning |
| 16. Electrical technology with machine, electrometric, and photometric branches) | 18. Silk spinning |
| | 19. Weaving |
| | 20. Loom testing |
| | 21. Spinning and weaving materials testing station |
| | 22. Physics (with a number of branches) |

Table XIV
[Continued]

| Equipment Rooms | Equipment Rooms |
|---|---|
| 1. Applied mechanics | 1. Applied mechanics |
| 2. Machine details, with machine building museum | 2. Machine details, with machine building museum |
| 3. Mechanical technology (under the School workshops) | 3. Metal and wood technology |
| 4. Railway gear and cars | 4. Railway gear and cars |
| 5. Study aids on the mechanical technology of fibers (materials and products on spinning, weaving, equipment, looms, and machine details) | 5. Cargo lifting machines |
| 6. Geodesy | 6. Drafting and modelling |
| 7. Architecture | 7. Theoretical mechanics |
| 8. Drafting and modelling | 8. Mathematics |
| 9. Photocopying | 9. Chemistry |
| 10. Physics (demonstration devices) | 10. Physics (demonstration equipment) |

CHEMISTRY DEPARTMENT

| Chemistry Institute<br>Laboratories | Laboratories |
|---|---|
| 1. Qualitative analysis | 1. Qualitative analysis |
| 2. Quantitative analysis | 2. Quantitative analysis |
| 3. Inorganic chemistry | 3. Inorganic chemistry |
| 4. Organic chemistry | 4. Organic chemistry |
| 5. Mineral technology | 5. Physical chemistry |
| 6. Organic technology | 6. Colloid chemistry |
| 7. Food technology | 7. Electrochemistry |
| 8. Dye technology | 8. Mineral technology and metallurgy |
| 9. Metallurgy | 9. Organic technology (with equipment rooms in fuel and stationery technology) |
| 10. Mineralogy | 10. Food technology |
| 11. Bacteriology | 11. Food preservation technology |
| Equipment Rooms | 12. Brewing technology |
| 1. Physical chemistry | 13. Pharmaceutical technology |
| 2. Electrochemistry | |

Table XIV
[Continued]

3. General chemistry
4. Stationery industry
5. Dye chemistry and technology
6. Crystallography
7. Mineralogy
8. Botany and bacteriology
14. Technology of photographic materials
15. Dye technology (with equipment room
16. Bleaching and dyeing
17. Artificial fibers
18. Chemistry of toxic substances
19. Chemistry of explosives
20. Anti-gas chemistry
21. Mineralogy (with equipment room)
22. Botany (with equipment room)

ELECTROTECHNICAL DEPARTMENT
(Functioning as of 1930)

Laboratories

1. Electrical machinery
2. Electrometric
3. Electrical drive mechanisms
4. High voltage
5. Vacuum techniques
6. Radio (telegraphy)
7. Telephony
8. Telegraphy
9. Telegraphic-telephonic measurement
10. Standardization
11. Photometry
12. Electrometry

Equipment Rooms

1. Lecture hall
2. Museum

CIVIL ENGINEERING DEPARTMENT
(Functioning as of 1930)

Laboratories

1. Structural materials
2. Sewerage and waterworks
3. Heating and ventilation
4. Highway construction
5. Chemistry
6. Electrical technology
7. Heating and ventilation
8. Sanitation
9. Factory and plant construction
10. Urban pulic works construc.
11. Urban and rural conveniences
12. Geology
13. Geodesy
14. Construction methods
15. Architecture
16. Drafting
17. Drawing (and water colors)
18. Railways
19. Steam locomotive

-Equipment Rooms-

1. Hydraulics
2. Engineering structures
3. Bridges
4. Roadways
5. Waterworks; 6. Sewerage

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-END-