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Man-made Fiber Industry of the USSR

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### I. Present Status

The USSR ranks third among the man-made fiber producers of the world, being surpassed only by the United States and Japan. In 1967, Soviet production of man-made fibers was 511,000 tons, an amount equal to about 8.5 percent of total world output, 30 percent of output in the US, and more than half of the total production of man-made fibers in Communist countries. These bare production statistics, however, conceal some very important differences in the structure and quality of Soviet fibers as compared to those produced in the Free World. For example, production of the more modern and complex synthetic fibers (the non-cellulosics) in the USSR in 1967 amounted only to about 11 percent of that in the US, 20 percent of that in Japan and about 46 percent of that in West Germany. As indicated by the table in the handout, the synthetic fibers accounted for only 21 percent of total Soviet output of man-made fibers in 1966, whereas synthetics accounted for 58 percent of the total in the US. According to preliminary data, the share of synthetics rose to about 23 percent of Soviet man-made fibers in 1967, compared to some 63 percent in the US. Soviet synthetic fibers largely consist of nylon-6 types. The USSR has experienced substantial difficulties in development of polyester and acrylic fibers and has relied, in part, on purchasing Western technology for these

types. Other synthetic fibers produced experimentally or on a very small-scale include Vinol, a polyvinyl alcohol fiber; polypropylene; polyvinyl chloride; two fluorine-based fibers; and nylon-7 ("ENANT"). The USSR has also claimed to have developed fibers which are germ-and fungus-proof ("LETILAN", "BIOLAN") and that reportedly will find application in surgical thread, bandages, and clothing.

Of the cellulosic fibers, viscose types account for the lion's share. In 1966, for example, viscose fibers accounted for about 89 percent of all cellulose, cuprammonium and acetate each representing only about 5.5 percent of the total cellulose. Development of acetate fibers appears to have been impeded by the lack of cheap acetic acid and acetic anhydride. An acetic acid plant with an annual capacity of 35,000 tons was purchased from the UK in 1964 and is expected to come into full operation this year. Some of the acetic acid from this plant, located in Armenia at Yerevan, probably will go into cellulose acetate intended for use at the Kirovakan plant you will be visiting. Triacetate fiber has been produced in the USSR at Kaunas, in Lithuania, since late in 1965. Information of late 1966, however, suggests that the plant management was dissatisfied with the quality of the cellulose triacetate and methylene chloride raw materials it was receiving and with domestically-supplied spinnerets. Experimental production of polynosic fiber has been reported at the All-Union Institute of Artificial Fibers and it is claimed that properties of the fibers are comparable to similar types produced in the Free World. Work on modified cellulose is also conducted at the Moscow Textile Institute.

## II. Recent Development

### A. Production, Investment and Problems

Although Soviet production of man-made fibers has grown impressively in recent years, the pace of development has been well behind schedule. During the Seven Year Plan, for example, production was to rise from 166,000 tons in 1958 to 665,000 tons in 1965. Actual production of all man-made fibers in 1965, however, amounted to only 408,000 tons, almost 40 percent below plan. During 1959-65, a sharp increase in the share of the non-cellulosic fibers was planned, and output of these types was to rise from about 13,000 tons to 166,000 tons, or to 25 percent of all man-made fibers manufactured in 1965. The shortfall in non-cellulosic fibers was particularly severe; output in 1965 (77,600 tons) amounted to only about one-half of the original target.

About a dozen new fiber plants and several small production units were commissioned in this seven-year period, a substantial part of the equipment coming from Free World firms. Investment in the chemical fiber industry during the seven-year period amounted to 1.1 billion rubles, or about \$1.2 billion at the official rate of exchange. Inasmuch as the increase in production amounted to 241,000 tons, the data suggest an investment of about \$5,000 per ton of new capacity. Actual investment per ton of new capacity probably was slightly less, because capacity was not fully utilized in 1965 and some of the investment made in the latter part of the seven-year period did not result in commissioned capacity until after 1965.

Data on labor productivity in the man-made fiber industry confirm that the USSR experienced many problems in 1959-65 that prevented attainment of initial goals. For example, although output per worker computed on a value basis reportedly rose 42 percent during the seven-year period, output expressed in tons per worker rose only about 16 percent rather than the 60 percent planned. Even allowing for a certain amount of over-optimism at the onset of this period or for an "incentive margin," the data on production and productivity indicate definite malfunctions in the system.

Major problems encountered by the USSR in expanding its man-made fiber industry have included, in addition to the lack of skilled workers, poor planning of construction, shortcomings in technology, shortages of equipment and spare parts, and poor quality raw materials. Deadlines for completion of fiber plants frequently were not coordinated with those for construction of the required raw material facilities. Process development has proved more time-consuming and costly than was anticipated. The low quality of cellulose and caprolactam raw materials and the poor quality of many Soviet textile dyes have evoked numerous complaints in the Soviet press. As of 1967, the Soviet fiber industry provided insufficient quantities of fibers needed by the wool and cotton industry for the manufacture of light fabrics and rugs.

On the positive side, according to one Soviet claim, the man-made fibers produced during 1959-65 were the equivalent of 2.4 million tons of cotton and 215,000 tons of wool, yet took only one-third the investment that the natural fibers would have required. Technical achievements claimed by the USSR in recent years have included the development of a semi-continuous process for viscose fiber and continuous processes for

production of viscose cord and nylon-6 staple fiber. In addition, progress was made in production of more durable viscose cord. Three large viscose cord installations went into operation during 1959-65, as did several installations for production of nylon-6 cord.

Inasmuch as the demand for man-made fibers exceeds the supply, the USSR has been an importer of these goods. In 1965, about 67,000 tons valued at about 43 million dollars were imported and in 1966, about 54,000 tons valued at about 38 million dollars. Although most of these imports consisted of rayon staple fiber, there was a slight increase in the share of the more expensive non-celluloses in 1966. In addition to the direct imports of man-made fibers, the USSR imports a substantial quantity of goods incorporating these fibers, such as tire cord and fish-nets, and also imports intermediates and dyes used in the production or processing of fibers.

B. End-Use

At present about two-thirds of the total output of man-made fibers in the USSR go to the textile industry for processing into consumer goods. Technical uses, however, have absorbed a growing share of total output, 15 percent in 1955 and almost 30 percent in 1965. According to preliminary information, technical uses were to require 33.5 percent of the Soviet production of man-made fibers in 1970 and this share may even be higher in view of recent plan revisions. In 1966, synthetic fibers accounted for about one-third of all man-made fibers going for technical use and 15 percent of those going into consumer goods.

### III. Plans for 1966-70

Under the Khrushchev regime, the 1970 production target for man-made fibers was optimistically set at 1.35 million tons. Late in 1965, after an evaluation of progress, and perhaps a reassessment of competing demands for resources, the post-Khrushchev administration reduced the 1970 goal to 780,000 - 830,000 tons. This new goal was roughly double the level of output in 1965. A second review in 1967 resulted in yet another reduction of the 1970 plan to 700,000 tons, about one-half of that called for under Khrushchev. The scheduled structure of output in the newest version of the plan for 1970 is not yet entirely clear, although the share of non-cellulosics certainly will continue to rise. Under the earlier goal of about 800,000 tons, the non-cellulosics were to rise to about one-third of the total or 265,000 tons. Plants purchased from the Free World are to provide a substantial portion of the increased output of non-cellulosics, including output of the required raw materials. The purchases include installations for production of 50,000 tons of acrylonitrile, 100,000 tons of caprolactam, 50,000 tons of dacron and 25,000 tons of acrylic fiber.

During 1966-70, about 10 large facilities for production of man-made fibers are to be commissioned. These include, in addition to the dacron and acrylic fiber plants mentioned, two acetate plants, two viscose staple plants and a few new nylon installations.

Apparently production of man-made fibers in the USSR in 1970 still will be substantially below requirements. Even before the recent reduction in plan, it was suggested in a Soviet article that, given the

limitations in output, first priority should go to the manufacture of technical articles and fabrics.

In spite of the shortcomings noted in recent development of man-made fibers in the USSR, production obviously will advance at a rapid pace at least through 1980. Much has been learned from the purchased Western facilities and the USSR has a growing potential for independent research and development. The areas where the USSR may still gain from Western experience include the production of acrylic fibers, polypropylene, nylon-66 (including the production of the required intermediates), and polyinosic fibers.

It is difficult to pinpoint the areas of Soviet development that would be of greatest interest to you, particularly because new developments at the institutes often are reported at least a year late. The work at the Moscow Textile Institute on modified cellulosics, including some work on phosphorus derivatives, should be of interest. Some work was done there earlier on copolymers of acrylonitrile and vinylidene chloride and on a fluorine-based polymer called FTORLON, but I'm not sure whether these areas still come under the institute's responsibility. At the All-Union Institute of Synthetic Fibers you may be interested in the work on nylon-6, PVC and possibly other non-cellulosics. The USSR has done quite a bit of development work on the higher polyamides such as nylon-7, 9, and 11, but their status remains unclear. These polyamides might, however, be interesting areas for discussion.

Structure of Chemical Fiber Production in USSR  
1958, 1965-1967

(Metric Tons)

Type of Fiber	1958	1965	1966	1967*
<u>Artificial</u>	153,200	330,300	362,400	395,200
Incl. Viscose	139,300	294,900	322,500	
Acetate	2,500	17,500	20,200	
Cuprammonium	11,400	16,700	19,700	
<u>Synthetic</u>	12,700	77,600	96,300	115,800
Incl. Polyamide (Nylon)	11,900	65,700	83,000	
Polyester (Dacron)	....	7,300	7,300	
Polyacrylonitrile (Orlons)	....	2,900	4,100	
Polyvinyl Chloride	800	1,600	1,800	
<b>Total Chem. Fiber Prod.</b>	<b>166,000</b>	<b>407,900</b>	<b>458,700</b>	<b>511,000</b>

\* Only partial breakdown available