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BRIEFING\*

SOVIET INDUSTRIAL CAPABILITY AND ITS RELATIONSHIP TO R&D

1. Gentlemen, the purpose of my talk is to give you an idea of the general industrial strength of the Soviet Union and its relationship to Soviet research and development. I hope my remarks will give you some perspective on the detailed descriptions by later speakers of the Soviet atomic energy program.
2. The Soviet economy is somewhat less than half the size of the U.S. economy. The gross national product of the USSR for 1965 is estimated at 45% of US GNP. Aggregate industrial production lies about the same proportion -- somewhat less than half of U.S. industrial production. The Soviets use 50% more workers in industry than we do, so the output per Soviet worker is about 1/3 that of the U.S. [26 vs 18 mil industrial workers] Net agricultural production is about 60% of U.S. agricultural production; since the Soviets use 30 million workers in agriculture compared to our 5 million, the ratio of output per worker is about 10 to 1 in our favor.
3. The relative rates of growth of the two economies has changed markedly in the last decade. In the 1950's the gross national product of the Soviet Union was growing at an average rate of 6% per annum, whereas U.S. GNP was growing at a rate of only 3%. In the 1960's, however, the Soviet growth rate has slipped to 4 1/2% and ours has risen to 4 1/2%. [two graphs on growth rates] The Soviets have consistently said that their number one

\* Presented to DCI's Nuclear Intelligence Panel

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economic goal is to overtake and surpass the U.S. in first industrial production, and then total production. They are extremely sensitive to U.S. government releases showing that they are now making no progress at all toward that goal.

4. But even if the Soviets have no present prospects of overhauling the U.S. in GNP, they are allocating their resources in directions that are of vital consequence to our national security.
  - a. They continue to emphasize the development of heavy industry, including military industry, at the expense of agriculture, housing, consumer industry, and consumer services.
  - b. They maintain a military-and-space establishment which, if valued in dollars, would cost about 80% of our own.
  - c. On the other hand, per capita consumption is only 30% of U.S. per capita consumption and even this figure does not take into account all the U.S. advantages in the quality and the ready availability of consumer goods.
  - d. Research and development is one of those areas to which the Soviets devote proportionately more of their resources than does the U.S. Comparisons are difficult due to lack of data, the dissimilarity of economic institutions, and the always knotty problem of identifying the cut-off point where R&D changes to production activity. My own personal feeling is that the Soviets put about 80% of the manpower and equipment resources into R&D. than we do. Their efforts measured by results instead of by inputs would be less.

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5. In order to give you a more concrete feeling for the size of the Soviet economy, let me give you the comparative output of 9 major products for 1964:

Crude steel	85 mil Mt vs 115 for the U.S.
Coal (bit & anthr)	410 mil MT vs 450
EP	459 bil kwh vs 1,146
Crude oil	224 mil MT vs 377
Aluminum	975 thou MF vs 2,316
Grain	125 mil MT vs 163
Meat	7 mil MT vs 15
Rayon Yarn & Syn. Fl.	.4 mil MT vs 1.3
Passenger autos	185 thou. vs 7.7 mil.

6. On the average, the quality of output and the level of technology of Soviet industry is behind that of the U.S. The range of variation in quality and technology is much more striking in the Soviet Union. The Soviets concentrate their energies and their resources on production that is associated with national prestige and national power; this concentration includes the assignment of the best managers, the most skilled scientists and engineers, and the ablest workers to these fields; the provision of the best raw materials, the best machinery, the best support by the construction industry, and the best R&D support. For example, a U.S. construction engineer who recently visited the USSR observed that a large electric power plant under construction was being well built under the supervision of a very competent manager but that work at other, less important construction sites fell woefully short of U.S. standards.

- \* 7. We should be careful, however, not to think of the Soviet economy being a monolithic system with a single purpose and a single well-defined priority. Priorities are not absolute and interest groups have to be placated. After the poor harvest of 1963, for example, 12 million tons of grain were imported and the quality of bread was adulterated. The populace grumbled but it was fed. After the mediocre harvest of 1965, imports of 9 million tons of grain were arranged, but the quality of bread was not adulterated. The give-and-take argument between Khrushchev and the military chiefs about how far the ground forces were to be cut is another example of the absence of fixed absolute priorities.
8. Now on the organization of Soviet industry
- a. Historically the industrialization of the USSR under Stalin was organized through a series of powerful vertically integrated ministries, one for iron & steel, one for electric power, one for petroleum, and so on. Each of these ministries was a self-contained empire, which to the greatest extent feasible provided its own raw materials, its own equipment, tools, and supplies, its own research and development facilities, even housing for its own workers. These ministries were tied together only at the top in Moscow, and lateral communication between them at lower levels was practically nil.
- b. The development of new technologies and new fields of production has meant the addition of new ministries, for instance, a ministry for aircraft production.

\* Omitted in actual briefing.

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- c. This ministerial system worked well in its time, given the political and military purposes of the Soviet state. Production of basic commodities grew rapidly, and direct control out of Moscow was crudely effective.
- d. Gradually, however, the addition of more ministerial pyramids in the system led to a considerable overlapping and interpenetration of the pyramids at lower levels. The examples multiplied of duplicative support facilities, cross-hauling, and failure to take advantage of specialization. Furthermore the central planning and guidance system in Moscow became overloaded.
- e. So in 1957 Khrushchev moved to end the branch-of-industry principle of economic organization, replacing it by the territorial principle. He set up one hundred Councils of National Economy, <sup>(sovnarkhozy)</sup> each to manage the economic affairs in its own geographical area, with close guidance from the center, of course. But Moscow retained direct control over producing military goods and over the plants/allocation of critical materials and important R&D.
- f. The new sovnarkhozy gave rise to their own set of problems, one being a natural disposition to place local economic interests above national interests. The new Brezhnev-Kosygin administration has dissolved the local Councils of National Economy and has gone back to the ministerial branch-of-industry organization. There's no indication that the ministerial system will work any better than it did the last time.

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9. On the organization of R&D

- a. In the Soviet "command economy" lines of authority converge at the top in the hands of a dozen top leaders, two of whom -- Brezhnev and Kosygin -- are more equal than the others. These men sit, as it were, as a board of directors over a giant nationwide corporation whose subsidiaries are vast industrial enterprises. The locus of power organizationally is the presidium, that is, the executive committee, of the Central Committee of the Communist Party of the Soviet Union, headed by Brezhnev. The government organ that translates basic economic decisions into action is the Council of Ministers, which Kosygin heads.
- b. Research and development is no exception to the rule that all major decisions are made at the top. The size of the R&D effort, its direction, its organization, its funding -- are all decided at the top.
- c. One of the government bodies reporting to the Council of Ministers is the State Committee on Science and Technology (V.A. Kirillin). This government organization plans the main R&D objectives of the USSR, arranges for the import of foreign technology, and is the chief coordinator and expediter of science and technology throughout the economy.
- d. Another important government body reporting to the Council of Ministers is the USSR Academy of Sciences (M.V. Keldysh). The divisions and affiliates of the Academy of Sciences run the 200 research institutes performing basic research in physics, chemistry, mathematics, economics, and the like.

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- e. A third government body to be mentioned here, which also reports to the Council of Ministers, is the Ministry of Higher Education (V.P. Yelyutin). Higher education in the Soviet Union is made up of 40 universities and 700 specialized higher educational institutions, which are roughly equivalent to our engineering colleges, business schools, teachers colleges, A&M colleges, and medical schools. The faculties of these higher educational institutes perform some research in their own laboratories, in the research institutes of the Academy of Science, and in industrial research facilities.
- f. I have mentioned the research carried on by the basic research institutes of the Academy of Sciences and by the higher educational institutions. Now I turn to the industrial and other economic ministries such as ag and health construction. These ministries maintain 1800 research institutes for applied research in their product field. Product development is the task of several thousand design bureaus and laboratories which are attached to industrial ministries, to groups of plants, or to large industrial plants. However, basic research, applied research, and development are not neatly divided up among R&D organizations.
- g. The Ministry of Machine Tools, as an illustration, maintains a large research institute in Moscow, with 2,000 scientists and engineers. [Experimental Scientific Research Institute of Metal Cutting and Machine Tools (ENIMS)] This institute may work on fairly esoteric

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problems such as a theoretical study of vibrations as they affect machine operations or it may work on a new model machine or it may do trouble-shooting research for a production plant in the ministry. In its annual plan, this Machine-Building Research Institute may on its own initiative or on initiative from above include the development of an improved gear-cutting machine. The project, once the general mode of attack is decided, is assigned to a project manager with a suitable group of engineers. The design for the new machine is roughed out, then detailed, and a prototype is built in the production shop attached to the research institute. The prototype is tested, suitably modified, and shipped out to a user plant for trial use.

- h. If all goes well, the Machine-Building Research Institute suggests to the front office of the Ministry of Machine-Building that the new gear-cutting machine be put into production, say at the Gorky plant of the Ministry. The manager of the Gorky plant probably does not want to disturb his production flow because it will affect bonuses, wage incentives, productivity standards, etc. He is paid to produce gear-cutting machines, not to produce improved gear-cutting machines. After his arm is twisted, he agrees to changeover and his production engineers go over the blueprints in consultation with the research people. Ultimately, the new machine may go into production.

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- i. Note that the Gorky plant's customers did not force the change. Note also that even if the Gorky plant was producing for high-priority consumers such as plants building missiles, the customers' priority would have to penetrate bureaucratic barriers before Gorky would move.
- \*j. Another source of R&D could be the production plant itself. Continuing with the machine-tool example: the Gorky plant might be dissatisfied with a grinding machine used in its own operation. Its own design shop might draw up specifications for a modification in the grinding machine and the proposal would then be checked out with the research institute in Moscow.
- \*10. As for military R&D, we have very little direct information. We conjecture that once top-level approval is gotten for a new or improved weapon:
  - a. Specifications are worked out by the Ministry of Defense in consultation with the appropriate scientific and industrial officials.
  - b. Problems in the development of such a weapon are parceled out to the appropriate research institutes and design bureaus.
  - c. Schedules for the supply of supporting equipment and construction work are drawn up, with appropriate priorities.
  - d. Prototypes are built and tested.
  - e. Finally, large-scale production and delivery to the military presumably accomplished.

\* Omitted.

7. The considerable success achieved by the Soviets in military production is, of course, partly a matter of high priorities. But another important element is that this has been the only place in the Soviet economy where the customer can say no to equipment of low quality.

\*11. Problems faced by the manager of an individual industrial plant.

- a. He is faced with a variety of sometimes mutually inconsistent directives from above, covering all aspects of his operation -- amounts and mix and specifications of output delivery schedules, wage rates and total wage bill, increase in labor productivity, amount of investment, and the like.
- b. He must continually worry about the supply of raw materials, equipment, and spare parts. He must even construct housing and provide other benefits in order to keep his better workers.
- c. Above all, he must increase output.

\*12. What is his reaction to all this

- a. Sacrifice of quality -- what will get by.
- b. Squirreling away of tools, supplies, raw materials, labor.
- c. Employing of fixers and expeditors.
- d. Upgrading of workers, so they can be paid more.
- e. Juggling of accounts and reports.
- f. Neglecting worker safety and worker amenities and scheduling unreported overtime.

\* Omitted.

- e. Resisting the modernizing or replacing of equipment and the introduction of new products if they interrupt present production.

12. Problems

- a. I have noted that the USSR is a "command economy", that orders come from the top down, and that the system worked in the early days when the products were few and simple and when there was elbow room in the economy. With the advance of technology and the greater demand for quality and variety in the final product, the system has become overloaded and inflexible.
- b. Also, the USSR has relied on Western technology for a long time in many areas and at the same time has rapidly improved its own technological base. The gains are now harder to make, yet considering the frightening dynamism of modern military technology, the gains are even more vital if the Soviet power position is to be maintained, let alone improved.
- c. The USSR lacks the advantages of a "market economy" in this matter of initiating and applying scientific advances.
  - (1) Note my mention of the difficulty of lateral communication between industrial ministries; in the U.S. it is the market that supplies excellent lateral communication, that supplies new machinery, new construction methods, new materials, etc., without regard to industrial boundaries. The Soviets have

great trouble in transferring advances made in one field to a related field. In large measure, this is because they lack the equivalent of the market and the entrepreneur.

- (2) Note that in the U.S. the more aggressive and more efficient firms are allocated an increasing share of available resources via the market mechanism. In the USSR there is no such flexibility in making production or R&D assignments. An unsuccessful manager can be fired, but the organization remains.
- (3) Note that in the U.S. the user can enforce quality standards because he has alternative suppliers. He can make sure his construction gets done on time or else -- or else he hires another contractor.
- (4) Next, the market automatically provides central pooling of services, e.g., a truck rental service or a plant protection service, when economies of scale dictate. But in the USSR 29 different design bureaus could and did develop 600 different molds used in vulcanizing rubber tires.
- (5) The U.S. system of military R&D seems to me to be costly only on first inspection. I am referring to the U.S. competitive presentation of proposals for new aircraft or other weapons. The Soviet system of directed assignment appears direct and efficient only when the long-run elements of "dynamism" and "cross-fertilization" are ignored.

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(6) Most important of all, to judge from discussions in the Soviet press, is the delay in getting the fruits of research and development into actual production. Khrushchev was always complaining that Soviet science had developed plastic pipe that could replace steel pipe at a saving of more than 30% but that planning and production officials had donned "steel blinkers" and kept on shouting for more steel.

13. Let me summarize

- a. Soviet economic and industrial capacity is somewhat less than 1/2 that of the U.S. and the Soviet economy is growing at about the same rate. Nonetheless, we should be concerned that Soviet resources are being allocated in a manner that directly affects our national security interests.
- b. In the past few years the gap between U.S. and Soviet science has not appreciably narrowed.
- c. Compared to the U.S., Soviet economic and political institutions are much less suited for the successful incorporation of R&D results into industry.
- \* d. The Soviets recognize these problems and are trying various industrial reorganizations and reforms which do not seem promising since they leave the basic rules of the game unchanged. If, as we think likely,

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the new measures do not reverse the trend to lower growth rates and slower gains in productivity, we can expect the Soviets to try even more radical experiments in the field of industrial organization. When you're No. 2 you've got to try harder.

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