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CENTRAL INTELLIGENCE AGENCY
WASHINGTON, D.C. 20505

(2)

2 February 1979

MEMORANDUM FOR: Mr. Jeremiah Kratz
Chairman, Technical Task Group A
Division of International
Security Affairs
Department of Energy

SUBJECT : Soviet and East European Production
of Multiaxis Numerical Control Units

REFERENCE : OER Memorandum of 10 August 1978,
"Soviet Production of Multiaxis
Contouring Machine Tools"

Attached per request of Technical Task Group A, is a discussion of Soviet and East European production of 3-axis and above numerical control units. For additional information on individual Soviet models of multiaxis machine tools, please consult the Table attached to the referenced memorandum. If you have further questions on the subject, please contact [REDACTED]

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Attachment:
As stated.

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Office of Economic Research

ERM 79-10086

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DECLASSIFIED BY [REDACTED] 1 FEB 1985
Multiple

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ATTACHMENT

Soviet and East European Production
of Multiaxis Numerical Control Units

Main Points

- 1) The USSR is the only Communist country that is known to be producing, serially, 3-axis NC control units. The USSR produces two models, both hardwired.
- 2) Hungary claims that two of its models, both softwired, have a 3-axis capability. Only one model, which uses clandestinely acquired US microprocessors, has been demonstrated operating in three axes; its production status is not known. There is no evidence that either model is being used operationally in a 3-axis mode with any Hungarian NC machine tools.
- 3) Poland is in the process of importing technology for the production of 3-axis units. As far as can be determined, production has not yet begun. Indeed, all of the production technology may not yet have been acquired.
- 4) Czechoslovakia claims to be producing 3-axis units, but their own literature shows that the units for which a 3-axis capability is claimed, are really 2½-axis units.
- 5) The USSR has produced a few controllers capable of 4- and 5-axis control. Hungary claims that its basic softwired 2-axis controller is expandable to 4 and 5 axes of control, but there is no hard evidence that 4- and 5-axis controllers have actually been built.

Production

The annual level of output of 3-axis control units in the USSR is estimated to be about 200 units.

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Output of 4- and 5-axis units is negligible. This compares with an annual production of about 1600 3-axis controllers in the United States (1977), and upwards of 1000 4- and 5-axis units. Thus, annual Soviet production of multiaxis (above 2 axes) NC control units is less than 10% that of the United States. For all practical purposes, Soviet production represents the total production of 3-axis (and above) NC controllers in all Communist countries. ()

USSR

The USSR began producing a few transistorized 3-axis contouring machine tools and control units in 1972. Those were open-looped systems capable of linear, but not circular, interpolation. ()

During 1974-75, the USSR began serial production of a new generation of 3-axis hardwired NC units. These units, designated N331 and N332, use conventional types of low density integrated circuits (ICs) and represent current Soviet state-of-the-art in numerical control technology. Work is underway to develop new NC devices based on higher density ICs including LSI (Large scale integration) but serial production of such NC controllers is not imminent. We expect that the N331 and N332 will continue to be the mainstay of Soviet production for the next several years. ()

The N331 is an open-loop system; the N332 is a closed-loop system. As far as we can determine from available () material, the open-loop system is in more common use than the closed-loop system. Virtually all 3-axis milling machines observed in the literature utilize the N331 open-loop system, whereas the use of the closed-loop N332 is rarely observed. We conclude that, of these two types of controllers, the Soviets make mostly the N331. ()

Closed-loop numerical control systems are rare because the USSR has encountered problems in the serial production of the high quality subcomponents, namely transducers and resolvers, used in their feedback systems. Until 1974, at least, these components were imported. They may still be imported for we have no hard evidence that they are being produced. ()

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The USSR has produced a small number of contouring units that can be used for any level of multiaxis control up to 5-axis, the N551 (open-loop) and N552 (closed-loop). Mostly, they are used for 2- and 3-axis control. To date, only about 10 machine tool models have been observed equipped with either the N551 or N552 control units. Only one of these machines -- the GF1860 milling machine -- operates in 5 axes simultaneously; one other, the 2623PF4, in 4 axes. Another 5-axis controller, the Razmer 4, has been mentioned in the literature, but probably exists only in prototype; at least, no machine tool has ever been observed equipped with the Razmer 4. [REDACTED]

Hungary

Hungary makes two softwired NC control units that are of interest -- the UNIMERIC and the DIALOG. The DIALOG was demonstrated operating a machine tool in 3 axes at the Hanover Fair in the Fall of 1977. The UNIMERIC is said to have a 3-axis capability. This claim has not been verified. There is no evidence that either of these models is in operational use with Hungarian 3-axis machine tools. [REDACTED]

The DIALOG system is basically a 2-axis system that the Hungarians claim can be expanded to 3-, 4-, and 5-axis simultaneous control. This system was produced at the rate of about 75 units annually, in 1978. In the absence of contrary evidence, we assume that most, perhaps all of the DIALOG control units (with the exception of units used for demonstration) are 2-axis units. [REDACTED]

To date, both the UNIMERIC and the DIALOG systems have used Motorola, Texas Instruments, or Intel Corporation microprocessors. These microprocessors are embargoed and apparently have been acquired illegally outside COCOM channels. [REDACTED]

Poland

Poland signed a contract in 1976 to purchase manufacturing technology and equipment for the Swedish ASEA NUCON 400 control unit, and, in addition, 150 complete NUCON 400 systems. The Polish purchaser is the Automation and Measuring Apparatus Industry Association (MERA). As of mid-1978, approximately 90% of the technology for

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the NUCON 400 had been transferred to Poland and roughly 75 systems. One unit was reportedly mated to a vertical machining center in January 1978, but we suspect that was probably one of the systems that was purchased. Polish technical journals give no hint that the NUCON 400 is being widely used on Polish machine tools, which suggests that series production of the NUCON 400 unit probably has not yet begun. [REDACTED]

Czechoslovakia

Czechoslovakia has displayed a hardwired control unit, model NS471, for which 3-axis contouring capabilities are claimed. However, we do not believe this unit has a true 3-axis capability for two reasons; first, a review of the specifications supplied in a Czechoslovakian brochure on this machine indicates that only 2 coordinates can be programmed within one block of information, and that 3 axes can be programmed only in a "rigid cycle." Such systems are normally characterized as 2-1/2-axis systems. Second, engineers at the Czechoslovakian Research Institute of Machine Tools and Machining (VUOSO), indicated in a 1975 article that the NS470 was a "simplified continuous path control system ... for control of four coordinates, two of which can operate simultaneously." There is no fundamental difference between the NS470 and the NS471, the device in question. The different final digit in the designation merely indicates a different end use; it does not indicate a difference in the number of axes of control. [REDACTED]

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State 161287, 12 July 1977, [REDACTED]
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