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TRANSLATIONS ON EASTERN EUROPE
SCIENTIFIC AFFAIRS
No. 539

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CZECHOSLOVAKIA

MODERNIZATION OF PRAGUE RADIO TRANSMITTER DESCRIBED

Prague TELEKOMUNIKACE in Czech No 9, 1976 (inside front and rear cover)

[Article by Engr Jiri Kopecky, Radio Communications Administration in Prague]

[Text] In the past years, the development of the radio network in Czechoslovakia concentrated in practice exclusively on the construction of a network of very short-wave transmitters. It is true that the network of very short-wave transmitters supplements well the network of medium-wave transmitters and of the long-wave transmitter, but for the time being it did not take over the bulk of transmission of radio programs. The bulk of radio reception continues to remain in the medium-wave and long-wave zone.

In the interest of improving the reception facilities of basic programs of the Czechoslovak Radio, that is of the program transmitted by the radio stations Prague, Bratislava, and Hvezda, it was decided to modernize the medium-wave and long-wave network of radio transmitters, which handles the broadcasting of the given programs. One of the first transmitters which is being rebuilt is the basic transmitter of the Prague program.

After a thorough analysis of the present situation, which has been prepared by the Research Institute for Communications in cooperation with other interested components of radio communications, it was decided to build a new transmitter with an output of 1.5 megawatts, including a modern antenna system.

The actual transmitter consists of two transmission units SRV 750, which in combined operation provides an output at the outlet of 1.5 megawatts.

The transmission unit Tesla SRV 750 is designed as a box monoblock containing low-frequency and high-frequency grades, including anode circuits, and also auxiliary rectifiers and controlling and operating elements. The other parts of the transmitter, such as heavy parts of

the main rectifiers, modulator, cooling, and power supply, are located outside of the block of the transmitter, and generally also outside of the studio. The arrangement of the actual transmission box is shown in Figure 1.

The connections of the transmitter are generally of the classic type.

The excitor consists of a highly stable oscillator controlled by a crystal. The oscillator of the excitor and of the frequency divider are located in a thermostat. The outlet of the excitor constitutes the output grade. The amplifying high-frequency chain has four grades. The first grade is equipped with three electronic tubes RD 250 VL, which are connected in parallel. The anode and adjusting circuit of the terminal grade is designed as a dual π element, which adjusts the anode impedance of the electronic tubes to the output impedance Ohms. A filter of the second and third harmonic is connected to it at the outlet.

The low-frequency grades begin with a limiting amplifier. The actual low-frequency amplifier of the transmitter has five grades. After the first three amplifying grades, there follows the cathodic scanner as an exciting grade for the terminal amplifier, which consists of two electronic tubes RD 250 VL. The terminal grade of the modulator operates in dual connection in class B.

The entire transmitter is controlled from a single panel on the door of the control box. In order to have the correct sequence of switching, the transmitter is equipped with blocking circuits which guarantee not only correct sequence of switching, but also safety of the service personnel. Signal circuits are connected with the block circuits. They have signal lights arranged on the control panel, where they form a light diagram. The arrangement of the light diagram facilitates the control of the operation of the transmitter and makes it easy to identify breakdowns when the radio is in operation.

The transmitter Tesla SRV 150 has not been used in Czechoslovakia before for purposes of broadcast service. That is why, as a point of interest, the article gives also certain interesting technical parameters which are guaranteed by the manufacturer:

High-frequency output of the carrying wave	750 kilowatts
Frequency range	525 to 1,605 kHz
Output loading impedance	60 Ohms \pm 10 percent, assymmetric
Overall effectiveness of transmitter (including the necessary accessories):	
a. At the carrying wave	65 percent
b. With modulation $m = 100$ percent, $f = 1,000$ Hz	60 percent

Frequency stability (after 40 days of continuous operation)	1.10 ⁻⁷ in 24 hours 3.10 ⁻⁷ in 6 months
Undesirable radiation	≤ 50 mW
Frequency characteristics:	
30 to 80 Hz	+ 1, - 2 dB
80 to 8,000 Hz	± 1 dB
8,000 to 10,000 Hz	+ 1, - 2 dB
Nonlinear distortion:	
50 Hz to 120 Hz with m = 50 percent	3 percent
50 Hz to 120 Hz with m = 90 percent	3.5 percent
120 Hz to 5,000 Hz with m = 50 percent	2.5 percent
120 Hz to 5,000 Hz with m = 90 percent	3 percent
5,000 Hz to 10,000 Hz with m = 50 percent	3 percent
Background noise against 100 percent modulation at 1 kHz	- 60 dB
Radiation of high-frequency energy by own transmitter into the service area	≤ 10 V/m
Acoustic noise at a distance of 0.5 meter from the transmitter box at a height of 0.5 meter from the floor	maximum 65 dB

It is worth while to mention the cooling system of the transmitter, both from the point of view of the output of the cooling equipment, as well as from the point of view of the principle of evaporation cooling of heavy-duty electronic tubes.

The need for a cooling output resulted in a substantial structural adjustment of the construction of the transmitter -- construction of two cooling towers. That is where condensers will be located, which will be cooled by natural air current. The conversion of the cooling medium steam -- water will take place there.

The principle itself of cooling by evaporation is based on the well-known physical phenomenon, which consists in a relatively large amount of heat (evaporation heat) which has to be delivered to the water so that it would evaporate. This heat must be delivered by the electronic tube, which is consequently cooled.

In the SRV 750 transmitter, the evaporation cooling method is used for cooling of electronic tubes of large outputs (ZD 70 VL, RD 70 VL, and RD 250 VL). The cooling process takes place as follows: hot distilled water from the reservoir passes through pipes to the boiling containers, in which the anodes of the electronic tubes are inserted. The conversion from water to steam takes place in the boiling containers. The steam departs through the steam conduit to the condensers. In the condenser, which is cooled by the air or by a secondary water circuit, steam condenses and returns to the collection container.

The new radio Prague transmitter will use both methods of cooling of the condensers. In the summer, the steam will be cooled by the natural air draft in the cooling tower. In the winter, the steam will be cooled by secondary cold water in the exchanger. The water, which will be heated as a result of the cooling of the steam, will be used for additional heating of the building of the radio transmitter.

Evaporation cooling of heavy-duty electronic tubes is supplemented by air cooling. Air is used to cool both electronic tubes of a smaller output and the fused parts of heavy-duty electronic tubes, while the second air circuit provides for overall cooling of individual boxes of the radio transmitter. The air is naturally sucked by filters, which retain mechanical impurities.

Many things have been taken in consideration when the decision was made to build a new antenna system of the radio transmitter. However, it was established that the existing Blaw-Knox was not satisfactory from the static viewpoint and from the viewpoint of the electric resistance of the foot and anchor insulators for the planned output of 1,500 kilowatts. Even the radioelectric point of view itself played an important role in making the decision. That is why a decision was made to build a new antenna system together with the construction of the new radio transmitter Tesla 2 x SRV.

On the basis of a recommendation made by the Communications Research Institute, a directional two-tower system is under construction, with the towers 355 meters high. From the radioelectric viewpoint, the antenna

is a dipole with a sleeve, fed from an altitude. One of the practical consequences of it is the fact that the foot insulator is not necessary. The radiators are formed by wire prisms suspended on the tower. And so the tower is merely a carrier of the antenna. The antenna described by the Communications Research Institute as the SAF (super antifeeding) type. In contrast with a typical antifeeding antenna (vertical radiator about 0.62λ long), this antenna itself has a gain of as much as 3 dB (with the same output of the transmitter). The gain of the entire directional antenna system with an output of 1.5 megawatts, in contrast with the original antenna and output of 300 kilowatts, is 8.2 dB in the principal direction of radiation (195 degrees). In the direction of 15 degrees the gain is minimal, in theory coming close to 0 dB in comparison with the original antenna with radiated output of 300 kilowatts. The antenna is supposed to provide the optimal possible coverage of the CSR territory both during the daytime as well as nighttime interval, when it pushes the escape area outside of the borders of Bohemia, with maximum shift of this border to the territory of East Moravia.

The effect of putting the Radio Prague transmitter in operation is indicated by the following figures:

The CSR has a population of 9.8 million, of which 6.1 million people were able to get good reception of the signal of the Radio Prague transmitter. When the new transmitter is put in operation, it is assumed that about 7.6 million inhabitants of the CSR will have the opportunity of getting good quality reception of the Radio Prague transmitter.

The method of feeding of the antenna system has an interesting design. The design is shown diagrammatically in Figure 2. The diagram shows the principle of the distribution and arrangement of the antenna.

The impedance adaptation of the antenna to the feeder will be made by compensation conductors. The compensation conductors "K1" built in series are placed in the input feeders of the antenna towers, the parallel compensation conductor "K2" is located between the towers. The feeder itself consists of a coaxial conductor with impedance $Z_0 = 60$ Ohms. These are wire prisms suspended on supports. The feeder is insulated from the ground, because even its outer jacket is connected with an active element of the antenna -- the external sleeve. The radiation of the antenna, and especially the size of the parasitic radiation lobe, depends on the adjustment of the voltage junction in the external jacket of the coaxial feeder (Figure 2 -- length l_2). The sectors of the feeders beyond the distribution antenna house are conducted in some sort of a bed, which is formed by Al-Fe cables suspended on the supports of the feeder. It is only this bed which is connected as a conductor with the ground network of the antenna, which is reinforced even more below the feed conductor.

The arrangement of the antenna radiators is as follows: the upper part of the radiators is formed by a prism formed from 18 cables distributed evenly

on the circumference of the hexagonal construction, which has the described diameter of 10 meters. This wire prism is connected by a conductor with the structure of the tower. The lower part of the tower is equipped first of all with a sleeve consisting of 21 conductors divided into three harps in parallel, with the walls of the triangular tower at a distance of 2.5 meters from the construction. The construction of the sleeve is insulated at the top and at the bottom from the construction of the tower by suspension pieces made of traction insulators.

A system of 15 conductors (lower part of the radiator), is also suspended between the conductors of the sleeve and the construction of the tower. The 15 conductors are also divided into three prisms, which are located at a distance of 0.70 meter from the construction of the tower. These conductors are connected at the top with the construction of the tower, and are connected below with the construction through an insulating suspension.

At the end of 1976, the new Radio Prague transmitter will be put in operation, and from the beginning of 1977 this well-known transmitter will start to operate regularly at the frequency of 638 kilohertz. The contribution in terms of the quality of reception for many of those who will listen to this program will certainly be considerable. However, the reception will be improved for many of those who will listen to the Hvezda program, because during the period of reconstruction of the Prague radio transmitter the basic transmitter of the Hvezda program will be used in the area of Bohemia for the purpose of extending the Prague radio program.

The administration of radio communications hopes that the new heavy-duty transmitter of the Radio Prague program will continue the successful tradition of the old transmitter, which as early as in the 1930's started to broadcast the program of the Czechoslovak radio on the frequency of 638 kilohertz with an output which was high in those days--120 kilowatts. And the surrounding of Cesky Brod will gain a new and unusual dominating element of the two-tower antenna system, which shows that the radio broadcasting in Czechoslovakia is being developed successfully.

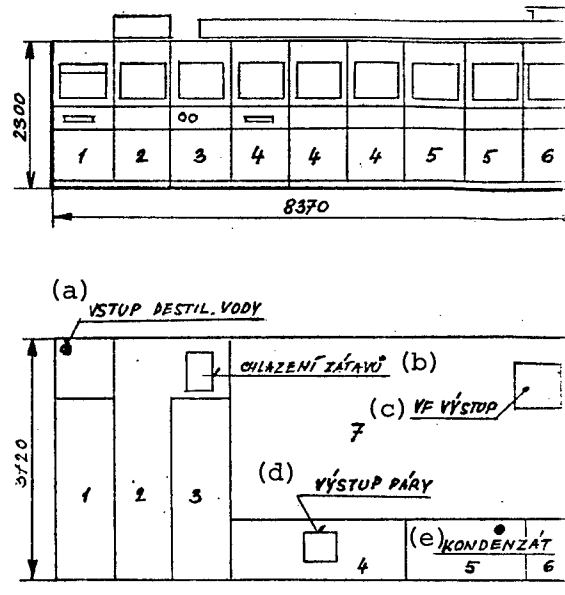


Figure 1. Diagram of the setting of the transmission box:

1. Control, auxiliary rectifiers; 2. passage; 3. high-frequency initial grades; 4. high-frequency terminal grades; 5. low-frequency terminal grade; 6. low-frequency initial grades; 7. terminal high-frequency circuits.

Legend: a. Inlet for distilled water, b. cooling of fused elements, c. high-frequency outlet, d. steam outlet, e. condensate.

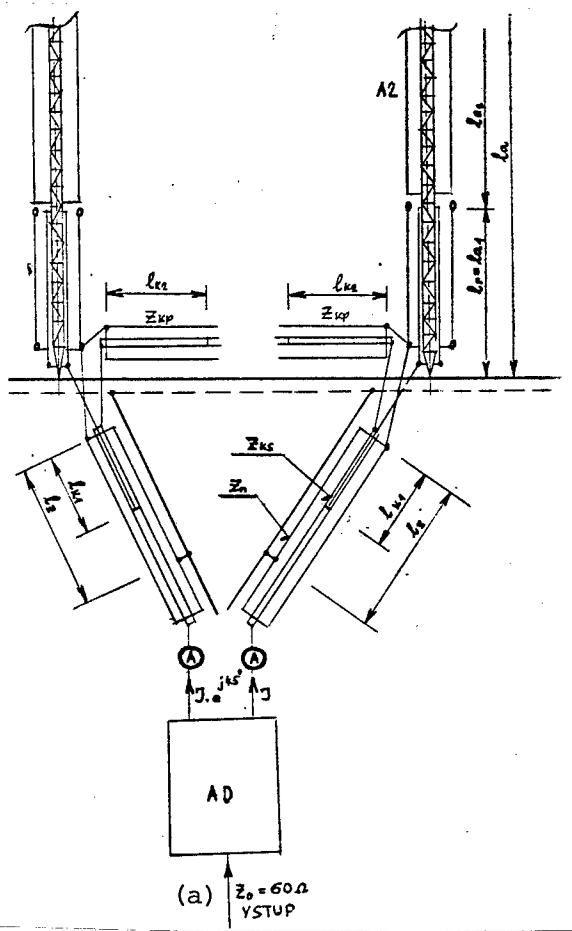


Figure 2. Principle of the antenna distribution:

- l_r = antenna 355 meters high
- l_r = sleeve 123 meters high
- l_{k1} = serial compensation 17 meters
- l_{k2} = parallel compensation of 60 meters
- l_z = 100 meter length for pole shoe radiators
- Z_n = impedance of feeder of 60 ohms
- Z_{ks} = serial compensation impedance of 100 ohms
- Z_{kp} = parallel compensation impedance of 60 ohms.

Key: a. Input.

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EAST GERMANY

ACADEMY PRESIDENT KLARE ADVOCATES MORE FLEXIBLE RESEARCH PROGRAMS

East Berlin SPEKTRUM in German Jan 77 pp 5-8

[Article by Hermann Klare, president of the GDR Academy of Sciences: "Science -- an Important Factor of Intensification"]

[Text] On 14 October 1976, for the second time within a short period, the Academy was awarded the Order of Karl Marx. We are sincerely pleased at this; but beyond giving us pleasure, this honor should prompt us to show by our actions that we take it as an obligation to help finish the work of that great classic, after whom the order is named.

The SED program makes it absolutely clear that great contributions by science and technology are needed for the improvement of production, the development of the material and intellectual-cultural life of all workers, and the promotion of wealth, happiness and spiritual needs. Moreover -- and this is not the first time that I am saying this -- this also entails consequences concerning the work of every individual working at our academy.

In this connection, I would like to recall once more the statements made by General Erich Honecker in his report to the Ninth Party Congress: "In the future, the GDR Academy of Sciences should assume even greater responsibility for the study of fundamental scientific problems and the achievement of excellent results both at its own institutes and in collaboration with the universities and colleges, the Academy of Agricultural Sciences, the other academies, and industry. In addition to the tried methods of cooperation, it is necessary to find new and higher forms directed toward the optimal utilization of research capacities. In this regard, it is necessary to improve the conditions for dealing with complex scientific problems so that the research results can more quickly be introduced into the production process."

This underlines the necessity to concentrate our efforts primarily on those requirements which we have recognized through critical analyses of the results obtained and which we have found to be appropriate for the development of

research. Thus, among the criteria for the social effectiveness of our research are the following:

1. The quality of its results, i.e. its immediate value for the internationally viable development of production, of the products of our economy, and thus its value for the living conditions of our people.
2. The rate of acceleration of scientific-technological progress under the conditions of conflict with the opponents of socialism.
3. The degree of utilization of all assets of the socialist social order, especially in regard to the solution of socially relevant and complex scientific-technological problems.
4. The contribution of effectively applying our knowledge also in the field of education, for example in the training of comprehensively educated and at the same time civic-minded socialist personalities.

Today there can be no doubt any longer that in turning to complex research tasks, we are satisfying an urgent requirement of socialist society. This is the only possibility for eliminating the trouble spots in the utilization of scientific-technological progress and thereby noticeably promoting our economic and cultural progress. At the 2-day conference of the SED Central Committee, which was attended by approximately 600 social scientists, Professor Hager emphasized repeatedly that although the problems involved in the development of our socialist society are becoming increasingly complex, we deal with them mostly on the basis of conventional structures of the scientific facilities.

Professor Hager said verbatim: "It is therefore worthwhile to reflect on how we can effectively make allowance for the complex research tasks, while improving and incorporating well-tried elements. I think that in this regard we should make greater use of certain approaches, such as uniform conceptions concerning a problem -- which conceptions are jointly worked out by several disciplines --, the preparation of complex research programs, the implementation of which is carried out by several disciplines, and the establishment of interdisciplinary research collectives of diverse status for the handling of joint projects."

Our efforts in regard to complex problems are by no means at variance with the current five-year plan. I think it is necessary once more to emphasize: The five-year plan for our research tasks is a minimum variant, the content of which we must adjust to the increasing research capacity of the Academy and to the objective social requirements. At times I have the impression that even leading scientists are not completely aware of this dynamic character of our plan, for some are incapable of employing the plan targets as an instrument of leadership for increasing demands. However, this must be accomplished in the interest of the quality of our scientific results; how else could we arrange

for additional competition initiatives and specific research tasks to be accomplished according to plan?

Nor can I share the still current opinion, according to which newly arising urgent social mandates can be executed only if we are given more cadres and investments. By 1980, 3,200 new employees will be added to the Academy staff, and during the same period, construction investments will increase by 255 percent. This is sufficient for carrying out new social mandates; for the streamlining and intensification of our research potential will continue to take priority. However, I am referring here not to just any streamlining, but to a streamlining within the framework of the necessary continuity and stability of our research. But practical experience shows that some institutes are very slow in dropping outdated subjects and that they have not yet attained the required structural flexibility; they often excuse themselves by claiming they are held back by the rigidity of the plan. We cannot accept such arguments: On the basis of economic requirements or new scientific findings, we modify current plan targets by approximately 10 percent annually -- and by more than that, if it is objectively necessary.

I would like to bring to mind here that in science, negative results -- if they ensue from a research program well-thought-out in every respect -- are not necessarily a catastrophic failure, for the plan is concerned not with results, but with tasks. A scientifically established "no" in a new research field means disappointment rather than failure, and it represents a challenge to look for new, practicable methods. Without taking any risks, it is impossible to achieve excellent research results.

In contrast to administrative work, the art of directing research projects consists in constantly adjusting the scientific concerns of the research establishments to the social requirements, while keeping in mind the Academy's overall interests. Of course, this calls for judicious anticipation of future development trends or for creative rethinking of known developments which promise to be of great social benefit. Certainly, the only scientists able to do either will be those who understand the far-reaching development problems of our socialist society. Several research sectors have already demonstrated that it is possible on the basis of the plan to formulate complex problem-oriented tasks of economic or social importance. In this connection, I would like to mention the research work done in nuclear energetics, technical microbiology and the space program; some biomedical projects or -- to mention an example taken from the field of social science -- the exploration and description of the origin and development of our state. It is safe to say that in all these cases the dialectics of discipline- and problem-oriented research have been understood and practiced.

Comments made by several ministers in regard to our plan concerning basic research are indicative of the importance of this practical work for the collaboration with our partners. For the ministers, it often was difficult to see the connections between the targets formulated in the plan and their own tasks. This likewise is evidence of the necessity to improve our planning through a

more pronounced orientation toward complex problems. It is important to awaken or cultivate in our scientists an understanding of these concerns, for in order to find an answer to the questions involved, the employment of every means and possibility is necessary. In this respect, the imagination and creative powers of the individual person are not subject to any restrictions.

We are by no means breaking new ground here. The results of space research, for example, are an outcome of such an approach. Likewise, the Academy's participation in the Guelle program contains promising elements worthy of general application. Finally, I would like to mention the Academy/industry complexes -- both those in existence and those yet to be established -- which likewise are in keeping -- and have to be in keeping -- with this trend. In my opinion, further opportunities for the formulation of complex tasks are also offered by projects such as the tapping and effective utilization of the usable water reserves in industry and agriculture, the automatization of processes, the establishment of scientific foundations for optimal nutrition, and research on cancer and cardiovascular disorders.

We know from experience that it is the border areas of various scientific disciplines which offer possibilities of obtaining research results of a basic theoretical character and great social benefit. For the most part, the problems involved here will be complex, requiring the cooperation of scientists from various disciplines, including the natural and social sciences. The contribution made by the social sciences will be directed primarily toward socio-economic aspects. It is well known, for example, that it is not exclusively scientific-technological tasks which result from energy problems. The problems involved here cannot be solved, unless one considers and examines at the same time the manifold economic, social, psychological, ecological and cultural aspects. We know that the ample opportunities which are available in the Academy for the collaboration of natural and social scientists will be made full use of only if both sides show initiative and serious commitment.

Since in the Academy we are speaking today of the experience gained by the best scientists -- which tomorrow is supposed to find general application -- it is natural to point to the results of cooperation in space research as an especially illustrative example; for at the same time, they are -- as Leonid Brezhnev stated in his telegram to Erich Honecker -- "a further example of the successful implementation of the treaty on friendship, cooperation and mutual assistance between the Soviet Union and the GDR, which was signed on 7 October 1975." Thus, our cooperation with the USSR does not exclusively serve economic objectives. Here the political importance of socialist economic integration, the consolidation of the fraternally allied socialist countries in all fields of their social development is especially evident. If this basic position is clear, then we must also emphasize the question concerning the effectiveness, for the effective research collaboration between the socialist countries is an essential factor for the acceleration of scientific-technological progress. This is illustrated by the joint work carried out in connection with the space program, which was initiated by the Soviet Union and which is developed on the basis of the ample experience gained by Soviet scientists

and technicians. The collaboration on the space program has proved to be very effective. For this reason, it should serve as a model for other cooperative tasks as well.

I am proceeding here from the assumption

-- that the cooperation in space research represents a field of basic research which for the countries involved is very important from the point of view of science policy and which already at the present time -- but much more so in the future -- will have economic consequences of unprecedented magnitude;

-- that objectively as well as methodically, space research can be said to necessitate international socialist collaboration in research work;

-- that the complex technology of space travel and the experience gained, especially the experience concerning technology, are extremely useful in the production of those essential consumer goods, in which absolute reliability and precision are essential.

Finally, cooperation in space research teaches us that flexible, dynamic organization of work can yield -- even in a short time -- qualitatively good results in the field of basic research. Four years ago, Soviet experts, scientists from our Academy and representatives of industry recognized multispectroscopy as an important method for the long-distance exploration of the earth by cosmic means; they considered its numerous possibilities of economic application and launched the appropriate investigations in the GDR. In these endeavors, they fell back on preliminary scientific experiments, which had been conducted for many years in Soviet research establishments; and the Soviet Union made available to its partners ample technological experience. Thus the research subject -- and this is remarkable -- represented an exemplary bilateral concretization of a basic multilateral problem contained in the space program.

In the course of a prolonged period -- until fall 1975 -- this complex task was tackled with a relatively small potential under the aegis of the Academy in collaboration with the Jena Carl Zeiss VEB. The development collective, which had approximately 30 members, subsequently grew into a large circle of close to 1,000 scientists, engineers, technicians and skilled workers, who accomplished the complex task with great enthusiasm and ambition -- working under conditions of pressing deadlines and stringent requirements concerning quality and reliability.

It should not be concealed here that there were also a great many objective and subjective obstacles, such as are encountered in any major research task. Even those scientists who can be considered pioneers of space research cooperation in the GDR initially doubted the practicability of the task. The crucial importance of the creative cooperation of every single individual is evidenced by the fact that young, hitherto unknown scientists and technicians were employed here, who accomplished their work with resourcefulness and talent.

Complex objectives in basic research and the social effectiveness of the research results also were the focal concern of the consultations at the symposium of the plenum of Academy members and institute directors at the beginning of December 1976. SPEKTRUM will cover the conference in detail in the February issue.

PHOTO CAPTION

p 6. At present, scientists of the Jena Institute of the Central Institute for Materials Research are studying the problems involved in the theoretical elucidation of crystal formation. In our picture, two staff members of the Institute, Dr Klupsch (in front) and Dr Pfeiffer, are discussing these problems.

8760

CSO: 2302

EAST GERMANY

EXPERIENCES, PROBLEMS IN THE APPLICATION OF PROCESS COMPUTERS DESCRIBED

East Berlin MESSEN STEUERN REGELN in German Supplement "AUTOMATISIERUNGSPRAXIS"
Dec 76 pp 268-272

[Abridged version of an address to the plenary session of the technical meeting on the "Use of Process Computers in the Chemical Industry and Related Industries" held in Leipzig on 7 and 8 July 1976. Communication from the Automation Equipment Section of the Leipzig Engineering School]

[Text] Introduction

The use of the process computer is not an end in itself. Rather, the process computer represents a means to the end of contributing to the simplification and intensification of material production. And so the deliberations to be made, the generalizations to be proposed, and the exchanges of experience to be carried out between colleagues should accordingly be subordinate to the goal that urges us on to a commitment, to a viewpoint, and to cooperation and joint responsibility, especially in consideration of the minutes of the Ninth SED Party Congress. It is a question of the further improvement of the material and cultural standard of living in our country. Hence the problems for the construction of automation equipment in the GDR consist of increasing the volume of production of modern automation equipment, raising the capacity for technical preliminary work, improving the quality of automation equipment, and providing and introducing modern automation methods. That means, among other things, the use of process computers in automation equipment for selected areas of our economy.

Although on one hand, the use of process computing technology is a method of intensifying and simplifying material production, it should not, on the other hand, be overlooked that the so-called preparation for application -- that is, all the scientific and technical work within the whole period of preparation for the use of a process computer in the investment phases (the planning, preparation and manufacturing phase) and in the research and development preparatory to investment and the following application phases -- becomes in itself the subject of comprehensive deliberations and reflections with reference to intensification and rationalization.

This appears all the more justified, in that the planned period under our circumstances can be fixed at three to five years, on the average -- a period in which considerable facilities must be prepared by the user as well as by the producer of automation equipment, in order to bring about the successful application of process computing technology. If reserves could be made available here for rationalization and intensification this could only work to the advantage of our economy and thus to the advantage of all of us.

Therefore it is both legitimate and necessary to ask whether there are obstacles and problems in the preparation for application and, if so, what kind of problems they are and what possible solutions exist. It is then of interest to see what conclusions can be drawn and what suggestions can be made for improvement.

The social authorization for making such suggestions and stipulations is drawn from the mandate given by our society to the GDR socialist organization of engineers, the KDT [Chamber of Technology], among whose working groups are the technical committee on "Process Computing Technology in the Chemical Industry" and its three subcommittees.

The contribution "Experiences and Problems in the Application of Process Computers in the GDR" is therefore to be assessed as the social viewpoint of the members of this technical committee on a whole series of problems relevant to the use of process computers in the economy of our republic.

After a first attempt was made, at the end of the Sixties, to broaden the scope of the then conventional BMSR [industrial measuring, control and regulating] technology in the construction of automation equipment by the introduction of modern, complex automation methods using small process computers, and after various process computers had been imported for this purpose, the first process computer of the Robotron 4000 family was delivered and put into use in 1972, and the automation equipment construction industry adapted itself to this development with its new Ursamat K 4000 production system.

To be sure, the total number of process computers put into use up to now appears to a certain extent to fall behind the predictions of the prognosis years, but this would be meaningless for future deliberations if possible causes for this shortfall did not still stand somehow in the way of the steady, measured introduction of process computers in automation equipment.

Here we mean things that normally have to be watched out for whenever a new type of production is taken up and the corresponding products are applied for the first time, and which are generally of a transitory nature. In the present case, these include: the complicated problems, which are present from the very beginning, of the form of the contract for automation equipment with process computers, and the mastery of this equipment, which requires a great deal of patience and good will on the part of all concerned; the unfavorable relationship, which also existed from the very beginning, between the process input/output unit (PEA) on one hand and the remaining hardware, especially the central unit, on the other; the explanation, which is unfortunately not always comprehensible to interested clients, of the basically justified economic considerations of the computer manufacturer, and the manufacturer's methods of

changing in rapid succession the relationship between certain software products, in particular, and certain cost classes (we recall, in this connection, the outworn definition of the so-called basic software package, and similar items); the difficulties that arose from the original lack of experience and qualifications in connection with this new technology on the part of managers as well as workers, especially in the user industries, and in connection with technical, management and organizational, economic, and political matters on the part of the construction industry for automation equipment, and which even today do not appear to be completely overcome.

Thus the problems to be observed in the last 4 years and still today are technical as well as judicial, organizational, and economic problems, and not least the so-called "general" problems which are apparently beyond academic interest, but which the informed specialists know can occupy up to 30 percent of the working time of an application collective -- not just the managers -- in order to find an appropriate elucidation. Up to now, there is unfortunately no sign of a successful solution for many of the details to be expounded. For some of them, changes or possible solutions are indicated, that give some hope for the future. We must, however, express the reservation that the arrangements to be made generally refer only to the application of process computers to a specific type of production, while the observations certainly do not pertain only to the application of process computers in the chemical industry.

There are, of course, connections and correlations of various kinds among the phenomena, aspects and problems to be discussed.

Goals of a Participant in Investment or Re-equipment

In this connection, it is sufficient to become familiar with the views of the principal investor (IAG), the contractor for automation equipment (AN), and the subcontractor for process computing technology (NAN). In the first approximation, the general contractor (GAN), and the principal contractor (HAN) share the viewpoint of the IAG.

The IAG is, in principle, interested in the acceptance of finished--that is, completed -- products (in general, the acceptance of complete, ready-to-use equipment, capable of production). In accordance with the work order, a complete unit of automation equipment must be ready within the contractually agreed period. The association of the product with the investment and/or the so-called scientific and technical output (WTL) was previously a secondary problem for this participant.

In principle, this participant refuses to accept partial products, especially in connection with process computing technology.

Because of his complicated situation, the AN is entitled to a different viewpoint. Previously he was actuated, on the basis of circumstances which remain to be explained, by the necessity of delivering the computer hardware (including the machine-oriented support systems, MOS) to meet the requirements of the participant above him (the HAN, the GAN, or the IAG), but of furnishing the necessary software -- that is, installing the so-called applications

program system as a monitor for the case-dependent applications programs and the conceptual and final form of the real-time operations system -- only to the extent of his capabilities as WLT.

This attitude on the part of the construction industry for automation equipment resulted, and still results from the following causes:

The constant adoption of complete software products leads to a certain extent to the reduction of the so-called conventional TEVO facilities in our economy, which, from the point of view of technical planning considerations, should actually be increased.

The efficiency of the automation equipment as a whole is no doubt determined to a great extent by the efficiency of the process computing technology (the hardware and MOS) of the computer manufacturer. The industry for the construction of automation equipment believes that it cannot fully do justice to this responsibility unless a whole series of conditions is fulfilled with respect to process computing technology.

The commitment of working facilities to software products is economically problematic for the automation equipment construction industry, because on the basis of the client relation (up to now, the software products of the automation equipment construction industry can be planned and written off only after the expenditure), the rationalization effect in the production of such products which certainly occurs for the economy of the republic (essentially through the qualifications of the workers in the process computer collectives, which have steadily increased in recent years) does not redound to the advantage of these plants. The effect of increased working productivity, which occurs in any case, cannot be proven. Mathematically, no increase in efficiency is demonstrable, and the increase in important economic indicators for the entire productive staff of a plant must also be attributed to other areas, not concerned with the preparation for application of process computers. (An alternative can be seen only in fixed-price commitments for such software products; all the activities undertaken up to now in this direction are to be welcomed.)

The automation equipment construction industry is supported in the attitude briefly described here by a possible interpretation of legal stipulations. As is well known, there are no special legal regulations pertaining to process computing. Most of the stipulations concerning commercial data processing projects, which are consulted as a substitute, say that the subsequent user himself is responsible for working out the task description for such a data processing project. This definition has been interpreted in the past to mean that the automation equipment construction industry does not have to furnish the necessary and desired software products unless there is a task description for the process computer. It is self-evident that considerations of this kind have nothing to do with the formation of optimum automation equipment, which, on the other hand, the automation equipment construction industry is legally obliged to propose, and do not further the introduction of process computers to the required extent. But even when there is a task description, it is far from being guaranteed that the IAG finally receives a complete process computing system, since the above-mentioned regulation has in the past been interpreted

to mean that the subsequent user himself is also responsible for providing the software products. When such methods of operation are practiced, there is naturally a great deal of room for contestable decisions on the part of the automation equipment construction industry, whose appeal to a lack of working facilities is not always verifiable by the user. The refusal to accept contracts for the software products associated with a complete automation equipment unit usually faces the subsequent manager of the installation with insoluble problems, and prevents many potentially interested customers from making an investment (application of a process computer) that is justified as things stand. For this reason also, efficient industrial plants have gone over to the construction of their own working facilities; it remains an open question as to whether this is an optimum condition for the general economy. However, most of the users in questions are those who, on the basis of their position in our industry, have so-called balance quotas in the construction of automation equipment, so that their work is in principle to be done on the spot. Economically less important and/or weaker plants have neither balance quotas in the automation equipment construction industry nor of sufficient means to provide their own working facilities to the required extent. Therefore they see themselves faced with a double disadvantage.

The agencies that manage the economy are called upon to make decisions for the future that are commensurate with the importance of the problem: it is a question of the strategic decision as to who, in the future, must provide the software working facilities that will be required to an even greater extent. The obscure statistics that are available on this subject hinder a real estimate of the actual need for programming facilities in the broadest sense.

Unfortunately, the above-mentioned legal regulations have also made it possible up to now to classify and treat expenses in connection with the application of process computers as investment expenses, as well as WTL. The result was a distinct economic treatment, especially with regard to contract law, of the engineering and technical output required for a complete unit of automation equipment. The products to be furnished by the automation equipment construction industry with respect to the applications program system and the real-time operations system (EOS) were until recently WTL in principle. (A decision with respect to contract law has brought about a positive change in this respect. According to this decision, all applications programs -- and naturally, the EOS also -- have for a year belonged in principle to the investment expenses, if they are necessary to demonstrate the workability of the automation equipment or the correct interaction of the automation equipment and the technical equipment.)

According to this definition, software products with reference to the production of economic information drawn from the technical and physical process, and with reference to the so-called second processing or application level, remain WTL according to contract law, and are subject, now as before the third DVO [implementing decree] to the contract law of the GDR.

The above-mentioned circumstances frequently led in the past to a situation in which two different commercial contracts had to be concluded between the principal and the contractor for a product that in principle was the same, which among other things produced a divided responsibility for the goal of automation. Such a practice could not continue for long.

In any case, the automation equipment construction industry has also interpreted the previously described situation to the effect that the partial products it received from the NAN for process computing technology should be delivered in a so-called "one-act sale," which was first demonstrated by the automation equipment construction industry, directly and immediately to the higher participants in the contractual line. This of course contradicted the above-described goals of these participants, since they had no interest at all in receiving partial products of this type -- process computer hardware including MOS -- on the basis of a standard test carried out by the computer manufacturer (essentially a statistical test in which the computer did not work with the other technical equipment planned for the factory).

On the basis of experiments concerning the delivery of process computing technology which the automation equipment construction industry believes it has made in the past in the framework of completed automation equipment with process computers, it now appears to be objectively forced to give up the previously adopted strategy of the "one-act sale" and to postpone the deadline for the acceptance transaction as far as possible in the course of the investment.

The industry must do this if it wants to avoid making the problems that were not solved by the previous form of delivery of the process computer system by the NAN for process computing technology into the subject of contractual relations with its higher-ranking partners, especially the GAN and the IAG. This development can only be welcomed in the interest of the user applying the process computer, and in the interest of the successful application of process computers in our industry. In any case, the acceptance transaction (method, deadline and contents) between NAN and AN for automation equipment, represents one of the problems that are now within sight of solution.

The hardware and software products to be furnished by the NAN for process computing technology were and are attributed to investment expenses. As the third of the stipulated partners, the computer manufacturer is of the opinion that he must furnish proof of functioning and use, in the framework of the above-described standard test developed by him, with reference to the apparatus technology and the machine-oriented support systems he has developed. More fairly, it must be admitted that the computer manufacturer does have the right to refuse to give his client, the automation equipment construction industry, proof of efficiency before delivery, since the law does distinguish between proof of usability and proof of efficiency.

Upon conclusion of the standard test, says the NAN for process computing technology, his product should be accepted at once by the automation equipment construction industry; its further performance is regulated by guarantee stipulations and warranty agreements.

Any colleague who is at all familiar with the subject knows that things are not so simple.

Behind the problem of the delivery and acceptance of a process computer, including the MOS, from the NAN to the AN, are hidden the following considerations: Is a statistically oriented standard test capable of demonstrating the usability of the whole process computer system, or at least of the hardware and MOS?

Has the AN for the automation equipment the right to demand proof of the efficiency of the computer technology before acceptance? Does the proof of usability and thus of functioning of the process computing system require the coupling of the automation and technical equipment? Is the NAN for process computing technology (hardware and MOS) jointly responsible for the efficiency of the whole process computing system, or is this (at least from a legal point of view) the affair only of the AN for the automation equipment? What new problems would be produced by the possible "release" of the process computer by the SCO for "checking out" by the AN for automation equipment, before delivery of the same technology between the same partners? What is the objectively right time for the delivery and acceptance of the products of the SCO for process computing technology to the AN for automation equipment?

Some Problems in the Present Preparation for Application of Process Computers

After the positions of participants in an investment with respect to automation equipment with a process computer were briefly sketched, we should name the most important circumstances that first provided the basis for a number of problems. We mean the following: the strongly diverging goals of the most important parties to the contract with respect to the process computer; the lack of legal stipulations or regulations especially designed for process computer technology, and the false, or at least one-sided, interpretation of the existing legal regulations concerning data processing projects with respect to the application of real-time computers by the automation equipment construction industry and various contract tribunals, as was repeatedly to be seen in the past; and the differing attribution of partial products of one and the same subject product, the "process computing system," to investment expenses and to scientific and technical output, and the differing economic and legal treatment caused by this, with all its negative consequences on the responsibility for an operational process computer system.

Moreover, it must be made clear that from the legal point of view, the investment chain corresponding to the conceptions of the lawmakers makes possible unequivocal contractual relationships and well-defined responsibilities. In reality, however, whether one wants it or not, three-sided relationships are encountered in the application of process computers, involving the user, the automation equipment construction industry, and the computer manufacturer.

When three-sided problems are already insoluble in mathematics and physics, it becomes clear how difficult the situation inevitably appears when, as in the preceding case, it is a question of technical and social events.

In the following paragraphs, some detailed problems are presented; it can be assumed that they obstruct the further simplification and intensification of the preparation for application of process computers.

1. It remains to be shown that the overall schedule (planning, preparation and completion of an investment) intended by the lawmakers is frequently interrupted by the IGA's, to the detriment of a thorough and effective preparation for application, in which case not only the effectiveness of the work but also the effectiveness of the chosen automation variants just as frequently suffers.

It can, however, be stated that the contractual treatment of various concrete problems with reference to the application of process computers is doing a better job of taking into account the requirements of the economy.

2. It is often observed that the future manager adopts the following procedure with respect to the reliability of the computer system: At the beginning, almost no attention is paid to the problem. Then in a phase in which the configuration can no longer be changed without economic drawbacks, mainly on account of the already completed design for the automation components, unqualified demands are made concerning reliability, which the computer manufacturer can not fulfill, or can fulfill only by the duplication of important components of the system, with considerable expense and consequently to the disadvantage of the manager, since they are set by the reliability of the mechanical equipment. This leads, for example, to a situation in which a uninterrupted operation of about 14 days is required of the computer or of the whole computer system, because the very robust components of the equipment (the mechanical parts, for example, in a concentrates agitator) have correspondingly high MTBF times.

3. As is well known, the future manager of the installation and the corresponding process expert often hide behind the principal investor (IAG). The duality in the responsibility for an automation project, and especially the differing views of the use of a process computer which are very frequently encountered, have in the past led to a situation in which considerable facilities were already committed to the preparation for application in the form of studies and design of automation components before it was decided, often after a considerable delay, to renounce the use of the computer. This is a waste of society's resources, which can best be countered by comprehensive training of an appropriate group of persons.

4. In this connection, the following very aggravating problem presents itself. In general, the automation equipment construction industry should make the decision concerning the choice of the most economical automation variants, in the framework of studies and design of automation components. This is actually the intention of the lawmakers. Unfortunately, potential chances for the optimum configuration of the automation equipment to be manufactured are already lost because the principal investor often makes the decisions concerning the application of the computer. The automation equipment construction industry does not make use of its right to determine and propose the most economical automation variants, and thus gives up its legitimate right to the formation of the automation structure. Incorrect decisions concerning the application of process computers can then of course not be excluded, in one direction or in the other.

5. The problem of the separate development of software and hardware is connected with this. This division is commonly to be observed in the development of the EOS and the so-called hardware project. One cause for this condition is the habitual undertaking of software products by university graduates, while the hardware projects are necessarily undertaken by the project workers in conventional BMSR technology. Another cause lies in the above-described differing economic evaluation of these products, and the attribution of costs derived from it. This in turn produces a differing structural, and therefore organizational, attribution of the corresponding partial products. The result is that,

for example, there is as yet no lasting structural coordination of hardware planning in the automation equipment construction industry. The planning of the software and hardware systems, including the measuring, control, and regulating equipment, often takes place without the necessary mutual consideration, and thus drawbacks can occur in the formation of optimum automation equipment, to say nothing of the lack of coordination. Moreover, this state of affairs is based on the nature and structure of the education in our institutions of technical learning, where the same relationships can be seen.

6. In a certain way, the next problem is derived from this one. It concerns the lack of proven, effective decision criteria for the application of process computers. This problem cannot be formalized in an economic sense, in which one concentrates to the nearest penny on the proof of usability. To be sure, a comprehensive proof of usefulness is necessary, and is difficult and problematic to obtain on account of the insufficiency of information available for reaching a decision. The proof of usability should not deal only with the saving of a certain number of jobs; rather, the interests of technical progress and the state of the productive forces must receive qualitative consideration. In particular, analytical procedures for decisions concerning the carrying out of tasks in the so-called second level of application (in computers that have already been installed), and procedures for the determination of a technical system with successful conventional equipment and inherent system reserves, are still needed as the rudiments of such a document.

7. A source of frequent conflict and irritation between the user and the automation equipment construction industry is the fact that at a certain time (at the beginning of work on the planning of automation components, and thus after the completion of prior decisions on investment), a clear, finished, and complete task description for the process computer, its operation and functions, must be submitted to the automation equipment construction industry. In this case the user is called upon to take this important condition into account through a further qualification of his work, since this condition also entails its share in the possible increase in cost of a project -- as a consequence of the resulting discontinuity of work in the automation equipment construction industry.

Above all, let us say that the data or information to be furnished by the user can have an undeniable influence on the maintenance of the maximum price as well as on the observance of the deadline agreed upon in the contract. It is an error to assume that missing data -- for example, the impossibility of doing further work on a software project -- can endanger a deadline but not increase the cost of the project itself. What then are the colleagues concerned with preparation for application to work on during the pauses that inevitably occur in the development process? Suitable small tasks are not always at hand, but constant conversion to other major tasks of the investment is only injurious.

8. Finally, it should be repeated that the future manager must actually take the responsibility for the outline for the off-line test, taking future technical stipulations into account. It must also be made clear that even the best diagnostic routine is not sufficient to simulate all the possible technical conditions that can be important for the thorough testing of the real-time operations system. Herein lies a real, unquantifiable risk for all concerned.

9. One of the most aggravating problems between the user and the automation equipment construction industry is the preparation of the various equipment lists, on time and up to standard quality. At the latest, these equipment lists must be completed by the time that the work on the design of the automation components is begun. Even worse -- a subsequent change cannot readily be permitted. This situation is problematic, because on the one hand information is required from the user at a time and to an extent for which the future installation is not yet objectively present. From the point of view of the chemical engineer, degrees of freedom for subsequent corrections must be available. For his part, the automation equipment manufacturer is contractually obliged to give the future manager a tentative and later a binding quotation, in which, for example, the budget for the process computer configuration is of exceptional importance for the decision concerning the application of the computer. Complete equipment lists are, however, the unalterable prerequisite for a projected estimate of storage requirements on the one hand and for the construction of the process input and output units on the other hand. If subsequent changes in the equipment list exceed a certain amount, which cannot even be quantitatively stated, the results are possible changes with reference to the I/O units and then possible external storage units to be added. The resulting increase in costs can be decisive for the application of the computer! The requirement of submitting equipment lists as complete as possible and as soon as possible, without subsequent changes, is therefore understandable. A way out of this situation is offered, for example, by a computer system of modular construction, in particular an appropriate operating system.

10. Unqualified attention should be paid to the timely training of the workers provided for the preparation for application. It appears that the interests of software projects generally receive greater consideration than the interests of hardware projects in training directed towards process computers. In the education of students, where appropriate instruction must help the future graduates to go to work in their application collectives as soon as possible, the conversion from ALGOL to FORTRAN appears to be complete -- a circumstance that was probably considered too late in the interest of the application of process computers.

At this point we note that the technical committee on "Process Computing Technology in the Chemical Industry" has, since its founding in 1972, always been interested in the training of the workers active in the preparation for application. The present results of the work of the subcommittee on "Methodology of the Application of Process Computers," for example, consists of a collection of methodological bases for computer application in the phases of preparation for investment. This composition includes all the activities and events necessary for the preparation of a "partial study of a process computer system." For all the activities to be carried out in this connection, the results known up to now are published; next, the method of performing some of them is outlined, in order to achieve the detailed result. Then the desired result itself is extensively described. By paying attention to all the hints of this methodology, a working collective is in a position to carry out, according to the attached organization proposal, a process computer study so complete that it will always be accepted, at least by the members of the chemical industry.

11. A certain difficulty resulted and still results to a varying extent in the different factories from the fact that the legal stipulations of the above-mentioned data transfer system (stipulations in connection with data processing projects) are formally applied to the preparation for application of a process computer according to the intuition and intention of those responsible for it. The distinction in legal wage between organizers, problem analysis specialists, and programmers, which even in commercial data processing projects is actually no longer tenable in every case, is not suited to the capabilities of the engineers working on the preparation for application in process computing technology. A division of the engineering and technical output in the preparation for application of a process computer into appropriate technical complexes cannot succeed. And therefore those factories are well advised that follow practiced examples in this connection and employ, as a matter of principle, problem analysis experts who can synthesize, organize, and program a real-time operations system and service a process computer, as well as test programs and program systems.

12. Various important phenomena are connected with the process computer manufacturer; the most important of them will be presented here, without pretension to completeness. The time spent in preparing both the tentative and the binding quotation appears to be unnecessarily long. Since the bases for the tentative quotation, in particular, are in a certain way of a standard nature, it is incomprehensible that no kind of intensification in the preparation of the corresponding quotations can be determined in this connection. In any case, it cannot be explained by insufficient cooperation only on the part of the factory preparing the process computer input/output unit.

13. In the same way, the organization and carrying out of electrical power engineering projects, including manufacturing work, in appropriate plants of the process computer manufacturer are, from the user's point of view, problematic and unacceptable. In the very interest of intensification of the preparation for process computer application, improvements are here required and are also possible.

14. The regulations for application, which have been partially brought up to date (and therefore, strange to say, are often found, upon inquiry, to be in a state of revision) and are partially maintained only with difficulty and therefore can be considered problematic, make it difficult for the potentially interested client to decide in favor of a process computer. At least, difficulties are noted in the preparation for process computer application owing to the necessary observance of all the requirements of the agreements on supplies and output, which are assembled in various installations.

15. The process computer manufacturer has responded to the clear desire to simplify the preparation for process computer application by producing standardized problem-oriented support systems (POS). From the user's point of view this is, on the face of it, a welcome undertaking. In this connection it must be pointed out that in principle, the production of universally applicable POS is problematic for two reasons: it is difficult to answer the question of the optimum cost development -- from anyone's point of view, the expense for development of universal POS will be greater than the expense of preparing POS for a particular application, either by the user or by the automation equipment construction industry;

universally applicable POS necessitate increased storage requirements, not resulting from the particulars of the specific task at hand, so that under the circumstances, the initial advantage can, for example, change into an economic disadvantage (owing to the necessity for an extended configuration).

Possibly these aspects have not always been taken into account to a sufficient extent. How else can one explain the fact that the dissemination and use of the POS obviously progressed with great hesitation in the first place, and in the second place are even today essentially limited to the universal data acquisition and reduction program (UNIMEPP)? The various changes that are coming to light in cost distributions and reuse regulations, as well as the one-sided generation tactics pursued until recently, have certainly become the point of departure for changed economic deliberations on the part of the manufacturer.

In the interest of the further application of process computer technology, and especially in the interest of as smooth and steady as possible a transition to the process computers of the next generation or to automation methods similar to process computers, it is to be hoped that information concerning delivery possibilities, prices, the release of plans, efficiency, etc., will be prepared within a time that is meaningful for the user, so that the further increase in the efficiency of our economy through modern automation methods can be assured.

The technical committee for "Process Computing Technology in the Chemical Industry" is sure of the support of its colleagues, and for its part is also prepared in the future to support this process effectively by working out methodological bases, preparing required programs, and guaranteeing the necessary exchange of experience.

The variety of the indicated problems seems to allow pessimism to prevail concerning the further inclusion of modern automation methods. Such an inference obviously cannot be allowed. This is also true considering the fact that a large number of our colleagues have in principle successfully come to terms with the conditions we have described. Examples of successfully carried out applications of process computers sound optimistic.

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CSO: 2302

HUNGARY

TELEPHONE FACTORY COMPUTER TECHNOLOGY DEVELOPMENTS REVIEWED

Budapest SZAMITASTECHNIKA in Hungarian Jan 77 p 8

[Unsigned article: "Computer Technology Development in the 100-Year-Old Telephone Factory"]

[Excerpt] Results of the Present

Since we joined the program of the ESZR [Uniform Computer Technology System] we have continuously participated in developmental work in the areas of remote data-processing equipment, modems, terminals and interface units (multiplexors). The appearance and development of the new branch brought three fundamental changes in our enterprise--these products occupy an ever-increasing part of the production value and trade of our enterprise; the manufacture of third-generation electronic equipment has been domesticated at the enterprise, bringing productive and modern manufacturing technologies; and the product documentation system has been developed according to ESZR prescriptions.

With the exception of central processing units, the remote data-processing equipment can be grouped into three basic categories--line connections (modems), subscriber points (terminals) and computer interface units (multiplexors). Our development and manufacture are involved with all three and there is even series manufacture of these products.

Line Connections (Modems)

When developing the product family we turned especially great attention to a broad use of uniform mechanical design, modern active RC filters and analog and digital integrated circuits. This equipment is linked directly to the communications net and so has to correspond to the requirements of the postal directorates and the CCITT.

The elements of the product family are: the TAM-200 and 201 200/300 bps modems, the TAM-600 and 601 600/1200 bps modems, the TTB-200 teletype signal converter and the TTX-200 teletype signal converter center caller.

These products proved in use the correctness of the developmental goals, their international testing was successful, they passed the tests of several leading large capitalist enterprises, and in several socialist countries the equipment won the certification of the postal directorates. The first elements of the product family even won prizes at the 1973 Budapest International Fair.

Subscriber Points (Terminals)

It is a general characteristic of the product selection developed thus far that it has a universal application, at most medium speed primarily oriented for paper data carriers, and cannot be programmed.

The elements of the product family are made up of the TA-600 subscriber point (a type being phased out!), the TAP-2/A and B subscriber points, the TAP-3/A and B and TAP-70 subscriber points.

The goals set were that the equipment be spread guaranteed (data carrying), be easily usable on existing communication nets (error protection) and fulfill the conditions of larger series (general purpose). The terminals listed began to go into operation in 1973 and we have installed several hundred terminals in the time elapsed since. The experiences of the users are favorable and according to the results of national and international tests even bad quality telephone lines can be used for reliable data transmission with our equipment. One element of the selection, the TAP-2 subscriber point, won a special success in being chosen in the Soviet Union as the base terminal for the institutionally connected, all-union data transmission net.

Computer Interface Units (Multiplexors)

At the end of the first 3 years of the ESZR developmental work the situation had developed that while the smaller units, such as the remote data processing equipment, were already available and in series manufacture, there was a delay in series manufacture and putting into operation of large electronic computers suitable for remote data processing. The greatest proportion of the computers in use in socialist countries were Minsk-32 computers, of which several thousand had been produced. The Minsk-32 users also needed remote data processing. The situation described gave rise to the developmental goal of solving the interface problem for the ESZR remote data processing equipment and the Minsk-32 using special interface units. We developed the TERTA-1200 for this purpose, it being capable of direct linkage with the TAP-2/A and B, the TAP-3/A and B and the TA-600, providing indirect linkage by means of its own peripherals as well. One element of the product family which was developed is the TMX-2400 remote location multiplexor. This equipment makes possible economical use of the communications channels. It transmits data at high speed through communications channels by bundling low-speed transmission channels.

In 1974, in the course of developing the ESZR remote data-processing equipment, building blocks were already available for the creation of complete remote data-processing systems suiting the needs of a given user. Starting from this, an ever greater role in development was given to systems technology and, connected with this, to the development of software and systems programs. As a result of systems design work we placed several remote data-processing systems into operation although most of these were not based on ESZR computers.

Prospects for the Future

The software development and applications needed for servicing the ESZR computers also provided concrete results and our terminals and the systems programs serving them can be used on several models. Thus international approval went to the TAP-70 linked with the GDR R-40 and the Bulgarian R-20 and to the TAP-2 and TAP-3 linked with the Soviet R-20. Another result of the systems design work is that it required in practice the development of even more auxiliary and supplementary equipment. Such, for example, were the call-up equipment which makes possible service and control conversations on rented telephone channels and the TTH-4800 equipment.

Summing up the present situation of computer technology development we can say that a great variety of third-generation remote data-processing equipment is now available and is in the process of being manufactured; regular operation of the above equipment is insured; modern, efficient technologies have been domesticated as a result of the products; and the future is guaranteed thanks to the experience and the experts available. We have defined the future of our computer technology development on the basis of a trend analysis of international developments in the area.

Examining the recent developments in remote data-processing and attempting an analysis of the further trend of this development we can discern two fundamental lines: changes in systems and changes in technology. Naturally the two trends cannot be realized in isolation from one another; indeed, development of the one presupposes development of the other and vice versa. One cannot imagine the spread of intelligent systems elements or the distribution of intelligence throughout the entire system without the appearance of large-scale integrated circuits including micro-processors and auxiliary elements.

The fundamental change of recent years in the area of remote data processing, and throughout computer technology as a whole, is the distribution of intelligence throughout the systems. Earlier the intelligence of computer technology systems was concentrated in the programs of the central computer. The central computer stored the entire user program system, the entire operational system, and the remote data processing extension thereof. The system included a hardware multiplexor and wired logic terminals but there was no processing possibility in the multiplexor or the terminal. Almost simultaneously intelligence appeared at two points. IBM, as the standard-setting dictator of computer technology, in its 3704 and 3705 models

introduced intelligent telecommunications control units or, by another name, front-end processors. In addition to being able to operate in the old systems this equipment "assumed" for itself a number of functions which had burdened the expensive time of the central computers. Of course, new systems programs were needed to service and support the intelligent multiplexors. Today, more than 10 firms provide intelligent telecommunications control units with the most varied possibilities. Some of these were developed for the systems of the firms manufacturing large computers; others are products of "independent" manufacturers but these also suit the requirements of the leading computer firms. Programmability opened new areas for the use of intelligent telecommunications control units. The appearance of intelligence in the terminals, immediately next to the user, is very interesting. As a result of technological development the programmed terminals in autonomous operational mode approach or surpass the level of services previously provided only by small computers, and their on-line possibilities make their advantages completely obvious. Compact universal terminals make up another significant group of intelligent terminals; there are representatives of this group in the selection of virtually every significant computer technology firm (Olivetti, Hewlett-Packard, Burroughs, Datapoint, etc.). It is characteristic of these that in general they provide in table-top fashion some form of modern data storage means with I/O possibilities in addition to the already standard keyboard and picture tube. The terminals can carry out significant processing or pre-processing tasks. Goal-oriented devices, primarily for commercial or financial applications, occupy an increasingly significant place among the terminals. These make up one-third of the terminals sold in the United States in recent years. The role of the intelligent or programmable terminals, summing it up from the viewpoint of the complete system, can be described as follows:

--the intelligent terminal carries that part of the intelligence distributed in the system which lies closest to the user, thus increasing its significance;

--the terminal carries out a part of the user program previously carried out only in the central computer;

--there is also a possibility here for carrying out some net control and test tasks; and

--with this step the efficiency of the entire system increases to an extraordinary degree.

The distribution of intelligence also affects an element of the system which for a long time "lived" completely independently from computer technology (and which even arose earlier)--the telecommunications medium. This process is characterized by two chief trends: the work of the postal organs in the area of open connected data nets and the telecommunications solution of the IBM SNA conception, and, in general, the data transmission organization

of the computer technology systems themselves. We have experienced great progress in recent years in the area of channels and nets established expressly for data transmission purposes. The international advisory organ for postal administrations, the CCITT, has created a dedicated system for open connected data nets and has thus encouraged the creation of such nets in various countries. From the viewpoint of distributed intelligence systems it is worthy of note here that the various net control functions are realized within the new data nets, as is that part of automatic testing affecting the net. In conjunction with the creation of the intelligent elements of the systems there has been activity for nearly 10 years in the area of computer nets. We should recall here that property of computer nets that in such systems well-defined structural levels appear, communicating with one another through well-defined interfaces. Another important characteristic of computer nets, the most important in regard to services, is the distributed utilization of sources. Finally, it is important to note in regard to computer nets the introduction of message switching or package switching operational modes, which are already recognized versions in the open data network of the CCITT.

The appearance of immense large-scale integrated circuits and economical micro-miniature storage represents a new trend in technological development. The use of magnetic materials, magnetic bands, floppy discs and documents which can be read directly by machine is increasingly forcing out paper-based data carriers.

New trends have become known in the area of data presentation also; we might mention here only the liquid crystal and plasma indicators. We worked out the future goals of our development while keeping in mind the international trends sketched here and the characteristics of them. We sketched our present in a report on three product categories and we conclude the review of our future in this system, too. It can be presumed that we will plan our work in all three categories by adjusting to the indicated international developmental trends. An important characteristic of electronic equipment in the distant future will be output capacity, which is of less significance today. Output requirements will become increasingly important in regard to the capacity of our new electronic component selection. In the area of modems or line connections the large-scale integrated circuits and the technologies connected with them will result in a decrease in the size of the equipment. Building in large-scale integrated circuits will also lead to a decrease in costs and an increase in reliability. We began working out the new modem and line connection family with the goals already described. It will thus become possible to develop the present small-size equipment on printed circuit sheets or on an even smaller area. In addition to classical communications technology nets (telephone, teletype), nets exclusively for data transmission are a reality of the future. The line connection family for the new data nets (not modems) will be realized on the basis of the new technology mentioned. In the area of terminals or subscriber points the development of intelligent, programmable modern terminals has already begun. The goal in

the first stage will be development of terminals serving banking applications (savings banks and money transfers). Going beyond the microprocessor, firmware architecture of the TAP-34 equipment, the goal is the utilization of new, modern, primarily magnetic materials as data carriers. The program stored in the terminal will assume a significant part of the operator tasks and will provide simple, swift-operating possibilities. The architecture of the simpler and more complex terminals of the foreseeable future will be defined by the use of large-scale integrated logic circuits and as a result will be characterized by functional flexibility and intelligence. In the area of interface units or multiplexors the developmental programs are beginning in accordance with what has been described earlier. In developing multiplexors or telecommunications control units, at least in the first phase, great attention will be turned to questions of compatibility; that is, for a few years, during the period of generation change, it will be necessary to accept the elements of earlier systems.

In the near future there will be available for systems design a variety which will make possible the creation of complete, complex remote data-processing systems. System stimulation will be an important part of systems design work. Reference polygons to be established in the near future will serve for an analysis of experiences gained in the behavior of large systems. Going beyond demonstrations, the development and insertion of various program components can take place here. In the future the emphasis will shift to systems design and a decisive part of our development can be expected to take place in this area.

In summary we can say that the branch can look back on a short past of at most 5 or 6 years. The profile has been domesticated in the Telephone Factory and it now constitutes a noteworthy part of our production volume. On the basis of what has been said we expect that a great future awaits integrated computer technology-communications technology or remote data processing.

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DEVELOPMENT OF COMPUTER TECHNOLOGY DISCUSSED

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[Article by Dr Eng Dinu Buznea, director of the Research Institute for Computer Technology]

[Text] As a result of our party's policy, of investment efforts, and of the contribution of specialists and workers' collectives, Socialist Romania has entered the five-year plan of the technical and scientific revolution with fine results in computer technology; it is now capable of producing, and developing further, the computer equipment which it needs. Many computer centers are now operating in our country, at enterprises, large combines, centrals, ministries, and educational institutions. The equipment which we produce and the programs which we write are efficient, and will become even more efficient in the future.

The computer technology industry is young, and the most advanced branch of our socialist industry, demonstrating the capability of Romanian workers, technicians, and engineers of broaching and mastering in a relatively short time, this important domain of modern technology. In 1968-1969, during the "pioneering era" of this industrial branch, Romania adopted and manufactured desk calculators with two and four operations, FC-15 and FC-30 billing and accounting machines, and third generation Felix C-256 computers; these were significant successes since they broke the barriers of timidity and lack of confidence, proving in practice that our country is in a position to manufacture its own computer equipment, as an indispensable means for modernizing and increasing the efficiency of the national economy at manifold levels.

It is well known that during the last five-year plan, the main objective of the computer technology industry was to provide the national economy with the means stipulated in the program approved by the party. One of significant achievements in this respect, was the Romanian design and production, at the Bucharest Computer Enterprise, of the small capacity Felix C-32 computer and of the intermediate-large capacity Felix C-512 computer, which together with

the Felix C-256 which is built under license, form a family of mutually compatible computers capable of better satisfying the needs of the national economy, including the automated control of some technical processes. The gradual integration of products which are now in production, the development of basic and applied programs, and their modernization and diversification, were all assigned priority in the design activities of the last five-year plan, and are as many testimonials to our domestic technical and scientific capabilities.

Based on this positive experience we can respond to the tasks established by the 11th Party Congress, and to the guidelines of the secretary general of the party, Nicolae Ceausescu, by maintaining during the current five-year plan such priorities as better integration, product modernization and diversification, and the availability of basic and applied programs for the computer equipment which is being manufactured and supplied to the national economy. At the same time, new demands and new priorities have arisen, prompted by the fact that this branch has developed and is in a position to produce beyond the needs of the national economy, and therefore able to also supply products for exportation. Among these are the creation of some 3.5-generation computers, of a wide variety of minicomputer systems which can be used very efficiently in many areas of activity, of resources and programs which will enable the interconnection of computer centers and direct remote access on the part of users, of high performance peripheral equipment, and of modern means for primary processing, introduction, and extraction of data.

Today, these priorities are formulated clearly and concretely in our research and development plans, which are strictly correlated with each other as indicated by the party leadership during the Meeting of the Party Central Committee and Technologic Design and Research Cadre, as well as with the equipment adoption and fabrication tasks of our own industrial branch. The programs which have been formulated demonstrate the contribution of our own research to the achievement of our goals: whereas about 8 percent of the total production was based on our own designs during the last five-year plan, during the current five-year plan this percentage will increase to 67 percent.

At the Workshop of the Party Central Committee in September, which was devoted to scientific research and technical design activities, as well as at the Plenary Session of the Party Central Committee of 2-3 September 1976, the secretary general of the party insisted on the fact that in order to fulfill the decisions of the 11th Party Congress, we will have to act firmly in order to substantially increase the economic efficiency of all areas of activity. And the computer technology industry still has significant reserves for a marked increase in its efficiency. As part of these concerns, a collective has been created within the Research Institute for Computer Technology (ICTC), which in collaboration with specialized laboratories will analyze and systematically study the efficiency of products with a view to improving it and thereby contribute to the entire computer technology industry.

It should however be pointed out that in the production of computers, the criterion of efficiency has two distinct aspects. To begin with, as in any other productive activity, efficiency can be measured by calculating and analyzing such efficiency indicators as labor productivity, profit, currency contribution, duration of investment recovery, and so on. But in second place, we must also realize that the use of computers in the management of economic branches and units, in controlling technical processes, in the administration and stewardship of property, in records and statistics, in technical and scientific calculations, and in other domains, produces increases in the productivity, effectiveness, and objectivity of certain human activities, all of which are most often very difficult to evaluate immediately and quantitatively. Moreover, any investment in computer technology is usually costly, and its results can be detected only after a certain period of time whose length will depend on the competence of the people involved in the complicated process of using and exploiting the results obtained through computerized data processing.

We have referred to this double aspect of efficiency in computer technology, in order to show the objective need for corroborating both sides: the activity of the producer as well as that of the user. Any attempt to judge solely from the position of the manufacturer or of the user, neglecting the other aspect, can end in a negative manner.

In the producer's case, of course, by correctly analyzing the value created per product and per computer system, we can determine fairly firm quantitative indicators which can lead to conclusions regarding models which need to be manufactured, possible and efficient levels of integration, suitable technologies, and so on. Under present conditions, producing enterprises are not sufficiently concerned with providing computers with applications programs which in fact constitute the utilization value of these means of production, we might even say their life. And by strictly and unilaterally applying value analysis to computer production, we could lose this very decisive aspect in our calculations.

The user, in turn, asks for powerful and reliable computer systems, with a wealth of peripherals, often failing to sufficiently take into account the economic, and especially currency effort, which is needed to create and maintain such a system. These considerations lead to the conclusion that in order to obtain a true picture of efficiency under our socialist order, the two aspects must be treated uniformly, and that optimum solutions must be reached on the basis of a superposition of effects.

It is an unquestionable fact that the human effort in the field of computer technology is increasingly concentrated on the development of basic and applied programs, since the utilization efficiency of a computer system is essentially determined, not on its composition, but on its processing capabilities and on the services which it can render to users. I personally believe that we could achieve a higher efficiency than we have until now, if we were to concentrate all the efforts in this domain in order to create

a unified organism which could become totally responsible for both the production and the development, maintenance, and utilization of computer technology, including the offer to export the best services supported by the technologic means which we produce. This organism (of the national center, central institute, industrial combine, or other type) could be an organizational formula capable of synthesizing the two efficiency criteria and of treating them as part of a single responsibility and concept, thereby exploiting within the national economy the reserves which we have available both for using computers in Romania, and for exporting these products of modern technology.

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