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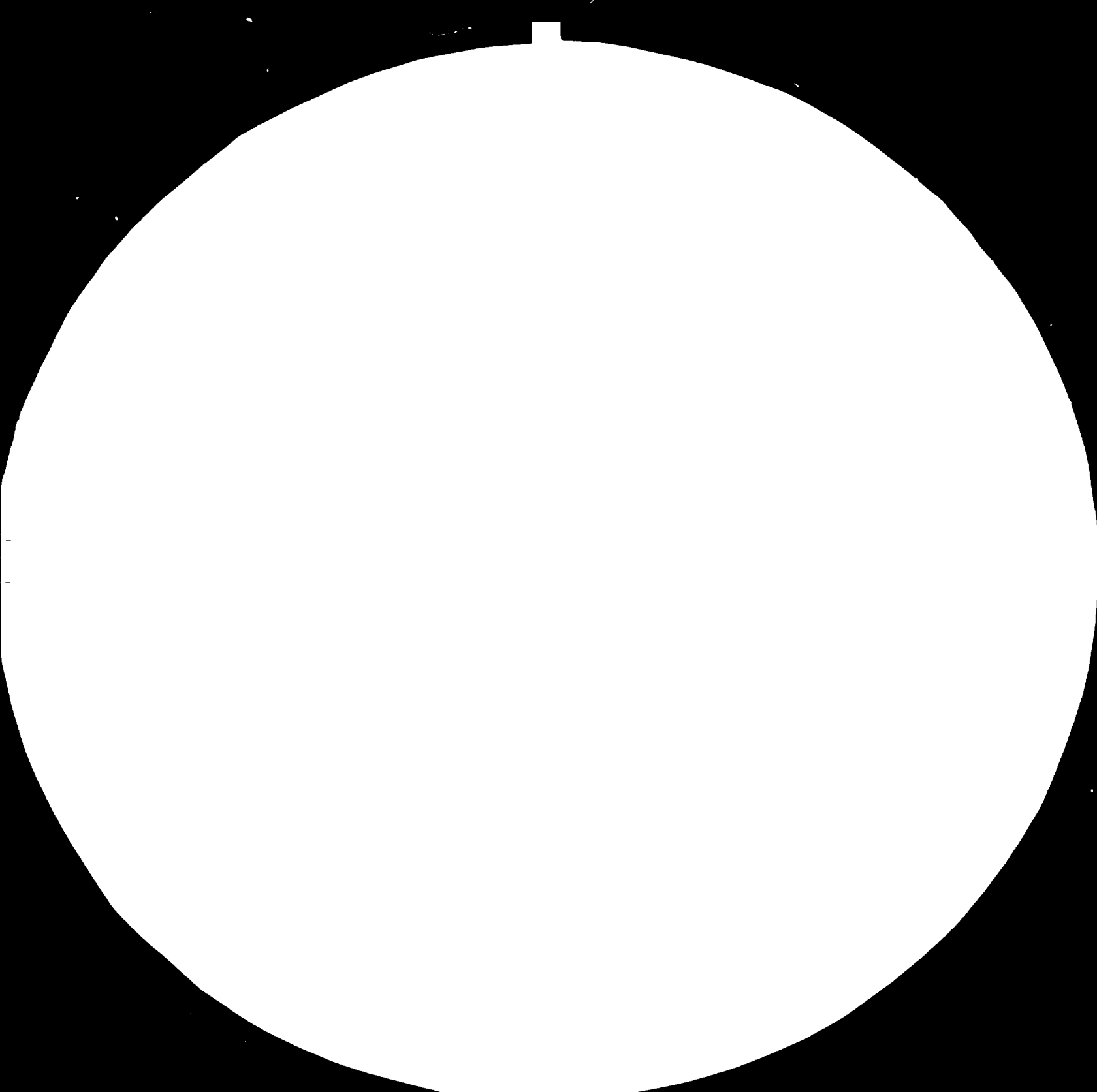

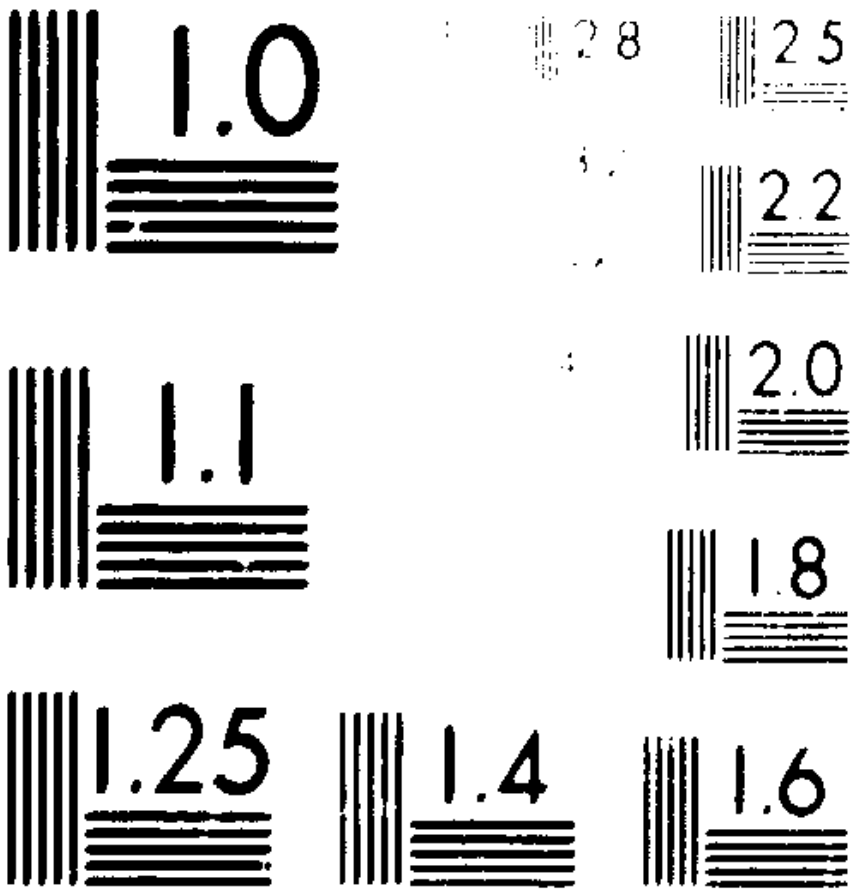
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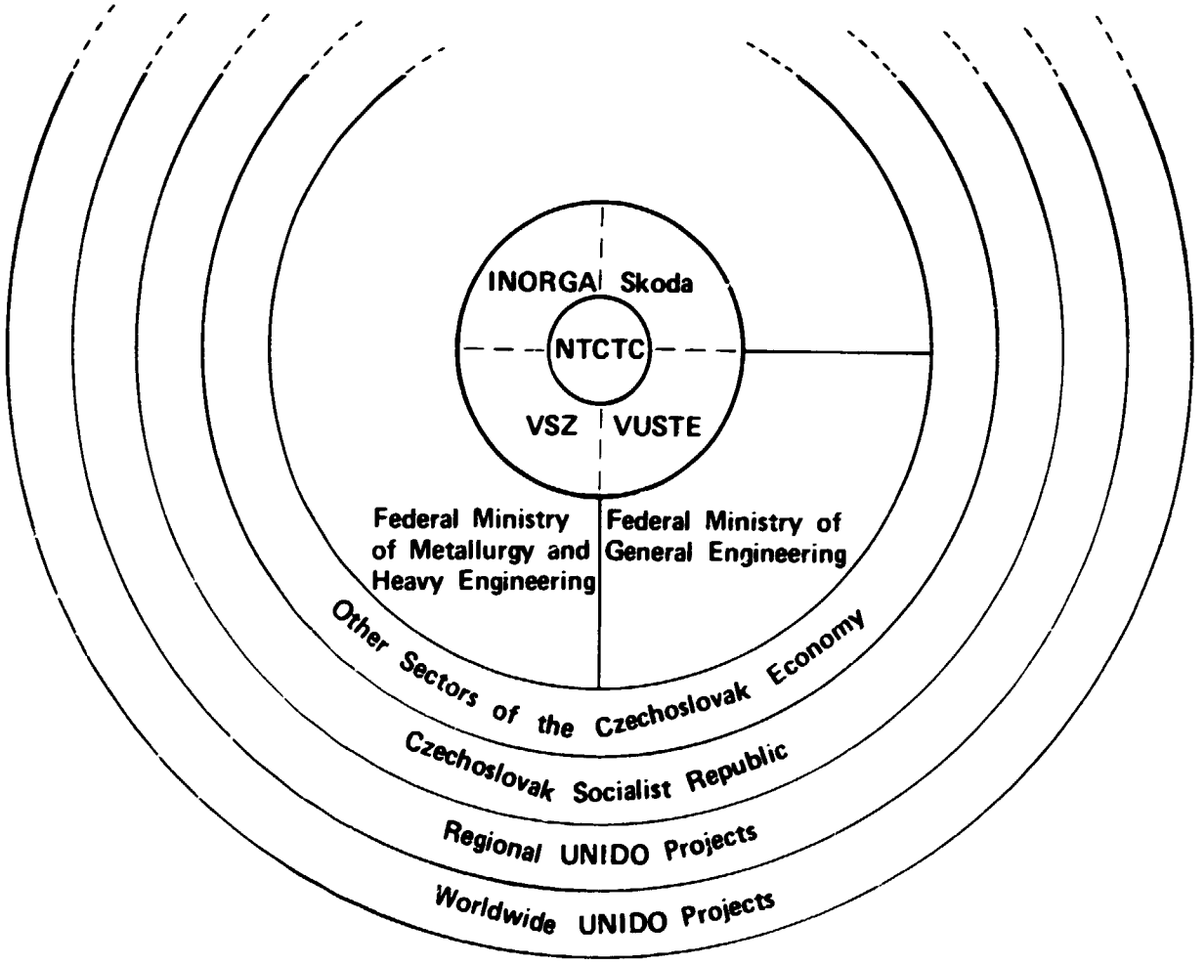
CONSULTATION FINAL REPORT

Czechoslovakia:
Preparatory Assistance in Establishing a
Consultancy and Training Center
on Modern Maintenance and Control Systems
in Metallurgy

Project DP/CZE/80/001

Submitted by
Angus Reynolds
September 1983


INORGA
Skoda
NTCTC
VSZ
VUSTE
Federal Ministry of Metallurgy and Heavy Engineering
Federal Ministry of General Engineering
Other Sectors of the Czechoslovak Economy
Czechoslovak Socialist Republic
Regional UNIDO Projects
Worldwide UNIDO Projects

## ABSTRACT

The consultation for the Czechoslovak National Technical Consulting and Training Center (NTCTC) was completed as planned, and without difficulty. The organizations involved provided complete cooperation, facilitating the gathering of information.

Distinct differences exist among the Center's planned functional areas of Maintenance Management, Production Control, and CAD/CAM in regard to the degree of development of products and services. The three areas, maintenance management, production control, and CAD/CAM are also distinctly different in terms of the existing situation and likelihood of change over the course of time. The degree of development of these is in the order listed. This may be seen as an advantage, since it supports the recommended phased establishment of the Center. Other areas may become significant in the scheme of the Center offerings, as it develops. Among the priciple of these areas is CAD/CAM interface with robots.

Particular attention was directed to the Computer-based Learning (CBL) training capabilities of the NTCTC. It is anticipated that will CBL be employed as a method of instruction. Experience with CBL is limited in Czechoslovak organizations. In this regard, it is recommended that the fundamental exposure to the CBL process planned, but not completed, as a part of the DP/CZE/77/005 project, be completed without further delay. The

planned training is a generic introduction to the CBL process, and is hardware independent. Such training will form a logical part of a comprehensive plan to introduce CBL technology. As a part of such a comprehensive program, a full-day Seminar on Computer-based Instruction Systems was conducted as a part of the consultation and a number of journal articles were delivered to provide additional reading in CBL.

The situations of the Center is considered, and each of the pertinent areas is discussed. These areas include the goals, structure, functions, activities, staffing, facilities, equipment, training methodology including computer-based learning, public relations, training course offerings, computer aided project monitoring and documentation, and the future of the center.

In addition to these comments, ideas, and observations, the derived conclusions and a lengthy list of specific recommendations are provided. The appendices of this report include position descriptions for recommended Center personnel for all phases of the Center's growth, a description of the minimal equipment needed to operate the facilities for the Center to adequately meet its goals, diagrams of the STELA system and the VÚSTE CAM laboratory, as well as a simple but complete description of how the courseware development process is conducted.

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# LIST OF FIGURES

## INTRODUCTION

The project consultation relates to the establishment of the Czechoslovak National Technical Consulting and Training Center (NTCTC). The subject of this report is an account of the consultation, with recommendations for further execution of the basic project concept. The purpose of this report is to provide recommendations in a very broad range of subjects, all of which are needed to serve as a basis from which to establish the Center. Before the Center can actually be established, there must oe a determination as to size, location, purpose, and a host of other matters. This report will set forth all of these for approval (or revision) and ultimate action.

Since there are very broad range of issues covered in this report, it is difficult to avoid a sort of "shopping list" organization. This report is organized generally from basic matters, through related considerations, to secondary matters. The purpose of this study was to provide recommendations for the establishment of the Center including: goals, structure, functions, activities, staffing, facilities, equipment, training methodology including computer-based learning, public relations, training course offerings, computer aided project monitoring and documentation, and the future of the Center. These have been provided in the body of the report. Considerable detail is provided in the appendices regarding position descriptions for recommended Center personnel and descriptions of the facilities,

furnishings, and equipment needed for operations.

The entire consultancy was conducted on a satisfactory basis. The assistance provided by the Director of INORGA, Ing. D. Trkalová, and Ing. Jan Kroužek were significantly helpful in execution of the project's consulting services. Initial interviews were conducted and data collected from representatives of the respective counterpart organizations, information was collated, synthesized, analyzed and organized for presentation. Information collected was satisfactory for completion of all of the project tasks.

## TERMINOLOGY USED IN THIS REPORT

This report is written, as far as possible using common English terminology. The report is submitted with appologies for mistakes in Czech accent marks. This section is included to assist in any subsequent translation, and to clarify the use of a few words for the reader.

"Center," in this report, refers to the Czechoslovak National Technical Consulting and Training Center (NTCTC). Several official abbreviations are used to avoid the frequent repetition of organization names. These are as follows:

INORGA - Czechoslovak Institute for Automation and Industrial Management

VSŽ - East Slovakian Iron Works

VÚSTE - Czechoslovak Research Institute of Technology and Economy in Mechanical Engineering

A number of words are used in this report in an ordinary context. Some of these may, in some places and situations, be associated with special and limited meaning. Such generic English terms which may possibly have special connotation in Czechoslovakia, or elsewhere, are:

project

industry

organization

sector

Standard terms associated with Computer-based Learning (CBL) are used in certain sections of this report. These terms are not used with precision by the persons interviewed. Use of the appropriate terms lends clarity to discussions of CBL. Terms used in this report are:

Computer-based Learning (CBL)

Computer Assisted Instruction (CAI)

Computer Managed Instruction (CMI)

Computer-based Learning Resource Managed (CBLR)

These terms, as well as others in common use, are defined in Appendix A. Misuse of the CBL terminology in English speaking countries is already a problem. Hopefully, the equivalent terms rendered in the Czech and Slovak tongues use result in more precise usage. For a more complete definition see the appropriate reference.

## SCHEDULE

The work on Project DP/CZE/80/001 was initiated in Prague, Czechoslovakia on June 27, 1983. Two visits were required for information gathering and confirmation. The general host organization for my visits was INORGA. The Director of INORGA, Ing. D. Trkalová, and her staff, provided great professional courtesy and arranged access to those persons necessary to the gathering of information essential to the project. The complete cooperation, total professionalism, and warm hospitality of Škoda, VSŽ and VÚSTE, as well as INORGA is gratefully recognized.

A very productive agenda had been prepared in advance of my arrival and, with the help of Ing. Jan Kroužek, I was able to understand the significance of the present work as a part of the continuing series of related UNDP/UNIDO projects; ie., DP/CZE/77/003, DP/CZE/77/005, DP/CZE/80/001, and DP/CZE/82/006. Meetings were planned with the organizations involved with these projects, and which will be involved with the NTCTC.

A number of interviews were conducted. See the list of persons who contributed to the data collection process. See Appendix B. The organizations that were involved and their principle area of input include INORGA, and East Slovakia Iron Works, in the area of Maintenance Management; Skoda, in the area of Production Control; and VÚSTE, for Computer Aided Design/Computer Aided Manufacturing (CAD/CAM). CAD/CAM input was

also obtained from the INORGA Experimental Laboratory at Krč. Discussion with Mr. Josef Kříž, Director of the Office of the Minister, Ministry of Metallurgy and Heavy Engineering was particularly beneficial in understanding the eventual relationships between the Center and counterpart organizations. All of those interviewed possess a clear vision of the goals of the Center, its evolution, and a realistic basis for participation by their respective organizations.

## SCOPE

The scope of the consultation is to include in particular the following items relative to the NTCTC:

- determination of the structure, with corresponding functions and activities
- recommendation for staffing, facilities and equipment
- outline for training methodology
- outline for public relations
- development of training course offerings, including design/evaluation methodology
- outline for CBL systems
- outline for computer aided project monitoring and documentation

## LIMITATIONS OF THE STUDY

In general the information gathered during the study is limited to the information concerning the setting and conditions provided by those interviewees made available during the

scheduled visits to the Czechoslovak Socialist Republic.

The study will not generalize its findings to other type organizations, circumstances, dates, or countries.

A limitation in conduct of the study was that, during the first visit to the ČSSR, planned interviews with persons from VUSTE did not materialize. It happened, by unfortunate chance, that the key individuals were away on a business trip to UNIDO in Vienna at the time of my visit. Some information was gathered, on my behalf, from other staff persons at VÚSTE by Mr. Kroužek in order to provide basic comparative information. The necessary visitations were accomplished during the second project-trip in August 1983. At that time the complete cooperation of the VÚSTE staff was evident. Visitation to VÚSTE included meetings, a very thorough briefing, and a guided tour of the new facilities there.

## NATIONAL TECHNICAL CONSULTING AND TRAINING CENTER DISCUSSION

The establishment of the Center will help to solve several existing problems. For example the formal existence of the Center will relieve the workload of staff of the East Slovakia Steel Works from consulting with other industries. The East Slovakia Steel Works has been gracious in providing assistance in the area of maintenance management, but is not organized to do so. Further, such assistance can work to the detriment of the providing organization since budgetary planning, in terms of

human and material resources, do not (and in reality cannot) reflect this goal. Establishment of the NTCTC will provide a formalized framework for beneficial activities, which now must be provided gratis. The magnitude of this problem is so significant that failure to establish the Center, as planned, could slow the spread of beneficial technology throughout the country's industry.

A second whole range of benefits relate to the synthesis which will occur once the Center is functioning. The range of such benefits is quite extensive. Work with other industries will result in feedback which can be applied in new ways. The possibilities of transfer of technology from abroad through UNIDO projects executed by the Center will benefit the Center, counterpart organizations, and the industry of Czechoslovakia in general. Training provided by the Center will raise the general level of technical competency of the staff of the counterpart and user organizations.

Finally, the Center will serve not only on a Czechoslovak national basis, but as a regional, and even worldwide, model. This role will, in effect, serve to provide a continuing return on the UNDP/UNIDO investment in the several projects which led to the establishment of the Center.

## GOALS OF THE CENTER

A number of reasonably achievable goals are suggested for

the Center as follows:

1. Develop systems and applications in the areas increasing and enhancing the national industrial productivity, including; maintenance management, production control, and CAD/CAM.

2. Increase awareness of Center systems and applications both among the organizations within the Federal Ministries of Metallurgy and Heavy Engineering, and General Engineering and the remaining sectors of the national economy.

3. Provide consulting services in the Center's areas of expertise.

4. Provide training related both to the Center's systems and applications, and its areas of expertise.

5. Develop a capability to effectively use the latest training methods and technology for initial use in Center programs and eventual sharing of expertise among the organizations within the Federal Ministries of Metallurgy Heavy Engineering, and General Engineering and eventually other areas of the national economy.

NEED

There are differences in basic nature and the current readiness of the counterpart organizations to provide training and consulting services in their respective areas. This "maturity" is based on a number of factors, which will be detailed in this section of this report. It is NOT related to the duration, stage, or age of related UNDP projects in the

respective areas. The maturity of the several areas is approximated in figure 1.

| | MATURITY LEVEL | | |
|---|---|---|---|
| | HIGH | MEDIUM | LOW |
| Maintenance Management | X | | |
| Production Control | | X | |
| CAD/CAM | | | X |

Figure 1. Maturity of Center Areas

The maintenance management application developed at VSŽ is by far the most mature of the proposed component programs areas of the Center. It has actually proven many aspects of the technology center methodology. The maintenance management system handles emergency, as well as scheduled, maintenance for the full range of plant activities. It also provides a scheduling function for periodic inspections. There are plans to implement the maintenance management system on the Czechoslovak SMEP system, which will enhance its general availability to other organizations in the country.

The System for Teleprocessing Applications (STELA), developed as a part of a previous UNDP project, represents an

important part of system software support. The maintenance management system runs under STELA. The STELA system is now used by more than 20 organizations, including those outside of the steel industry. The maintenance management system runs under STELA. A diagram of the STELA system is attached as Appendix C.

The noticeable difference in the maturity of the counterpart organizations at the moment reflects their experience with external demand for their contribution, up to the present. East Slovakia Steel is burdened by the demand for external assistance. Skoda has not yet experienced the same degree of genuine external demand, and has different actual needs. CAD/CAM is too new to have reached comparable stages of either demand or readiness, as have the other programmatic areas. The general demand, as it has been expressed up to the moment was provided by each of the counterpart organizations. A quantification of the currently estimated demand for maintenance management assistance from the Center is shown in figure 2.

| AREA | SAME MINISTRY | OTHER |
|---|---|---|
| Preventative Maintenance | 5 | 2 |
| Inventory Control | 5 | 4 |
| SP Manufacture | 2 | 5 |
| System Software (STELA) | 6 | 14 |
| System Documentation | 3 | 7 |
| TOTALS | 21 | 32 |

Figure 2. Demand for Maintenance Management Assistance

Production control is a key area for manufacturing industries. It can effect significant cost savings and productivity -- with dramatic effect. An example of the savings is the current Škoda implementation of the production control system. Due to the significant power of such systems the potential for assistance to other organizations is both significantly large and important.

Experience has shown that not all organizations that express

interest can be helped. There are problems of the various potential user organization's system compatibility and capacity which must be resolved in order to permit utilization. In fact, one-half did not find current possibility of application. There is a significant level of interest from beyond the steel industry. A quantification of the currently estimated demand for production control assistance from the Center is shown in figure 3.

| AREA | Škoda | SAME MINISTRY | OTHER |
|---|---|---|---|
| Production Control | 30 | 50 | 40 |
| TOTALS | 30 | 50 | 40 |

Figure 3. Demand for Production Control Assistance

Actually, the capability of Skoda to provide assistance is tied to the computer equipment needs that are contained in a later section of this report.

Demand for the provision of CAD/CAM assistance from the Center is least developed. This is to be expected, and is a natural result of the fact that exploitation of CAD/CAM is not yet fully realized anywhere, and is newly emergent in

Czechoslovakia. There is a lack of system resources, problems of compatibility of programs, and other hurdles. But, the overall importance of CAD/CAM to improvement in productivity, as well as accuracy (not to mention future robot interface role) is of such magnitude that it is an important part of the planned Center.

The CAD/CAM activities at VÚSTE are nearly ready to make an important impact. Instruction in CAD/CAM has been developed and presented. Extensive facilities for CAM training is near completion. VUSTE, as well as the INORGA Experimental Laboratory at Krč, show great potential for contribution to Czechoslovak CAD/CAM efforts.

| AREA | GEN. ENG MINISTRY | MET.& HE MINISTRY | OTHER |
|---|---|---|---|
| AWARENESS | 60 | 60 | 3 |
| CONSULTING | 15 | 20 | 5 |
| CAD/CAM SERVICES | 5 | 7 | 1 |
| TOTALS | 80 | 87 | 9 |

Figure 4. Demand for CAD/CAM Assistance

## PROBLEMS AND LIMITATIONS OF THE CENTER

The setting in which the Center is to be created is very dynamic. Therefore the situation, as it exists at the time of the Center is created can not be expected to be best suited for the Center over its entire lifetime. The numbers of staff, equipment and facilities needed to meet the increasing demand for services should be capable of change, based on accumulated experience. The Center's applications and services will never be fewer or more limited than at the time of its creation. As the Center progresses in the completely foreseeable direction of providing increasingly flexible services, it must develop, and continue to grow in order to meet the need.

A number of thorny problems must be resolved in order for the Center to function. Not the least of these is the problem of personnel. The Center needs well qualified staff. Those that would be the most likely candidates for this group are already assigned difficult tasks in their current organizations. In order to justify their transfer to the Center, they must be provided a full work load there. Since the Center does not currently exist, it is not reasonable to expect a demand to exist for a large Center staff. This situation also is supportive of a phased implementation. In such a phased approach, personnel can be added to the Center as the demand for their services becomes established.

## LIMITATIONS OF THE CENTER'S CLIENTS

The limitations of the Center's clients will be at a maximum at the time of the Center's creation. Many potential client companies may presently be lacking in one or more of the necessary technical conditions necessary to utilize the services of the Center, ie., may have a system with capacity less than is needed to handle the desired application. This limitation can be addressed by: the publicity function of the Center to create an awareness of potential capabilities; partial or limited implementation of a Center application; planning for increased client system capacity in a succeeding five year plan.

# STRUCTURE

## COUNTERPART ORGANIZATIONS

The Center is a small staff of specialists. The strength of the Center is drawn from counterpart organizations which support, contribute to, and cooperate with the Center. These counterpart organizations are INORGA, Prague: VSŽ, Košice; VÚSTE, Prague; and Škoda, Pilseń. This grouping presents a balance of institutional types. Two are research institutions, with a like number of heavy industrial organizations. All have been involved with this, or other related, UNIDO projects. The specific projects are as follows:

| | |
|---|---|
| VÚSTE | - DP/CZE/77/003 |
| INORGA/VSŽ | - DP/CZE/77/005 |
| Škoda | - DP/CZE/82/006 |

All four of the counterpart organizations have benefited from participation in previous UNDP projects and are well qualified to contribute to the Center. Not only do they represent important application areas, but each has good facilities for training of specialists from other organizations.

BROADER PARTICIPATION

Other participants in the Center project are: the respective sectors which fall under the two concerned ministries of the government of the Czechoslovak Socialist Republic, the Federal Ministry of Metallurgy and Heavy Engineering and the Federal Ministry of General Engineering; other sectors of the Czechoslovak economy, Regional UNIDO Projects; and Worldwide UNIDO Projects. The far reaching effect which the Center can have can be likened to the effect of a pebble thrown into a pond. The ripples created by the stone can reach very far indeed. See Figure 5.

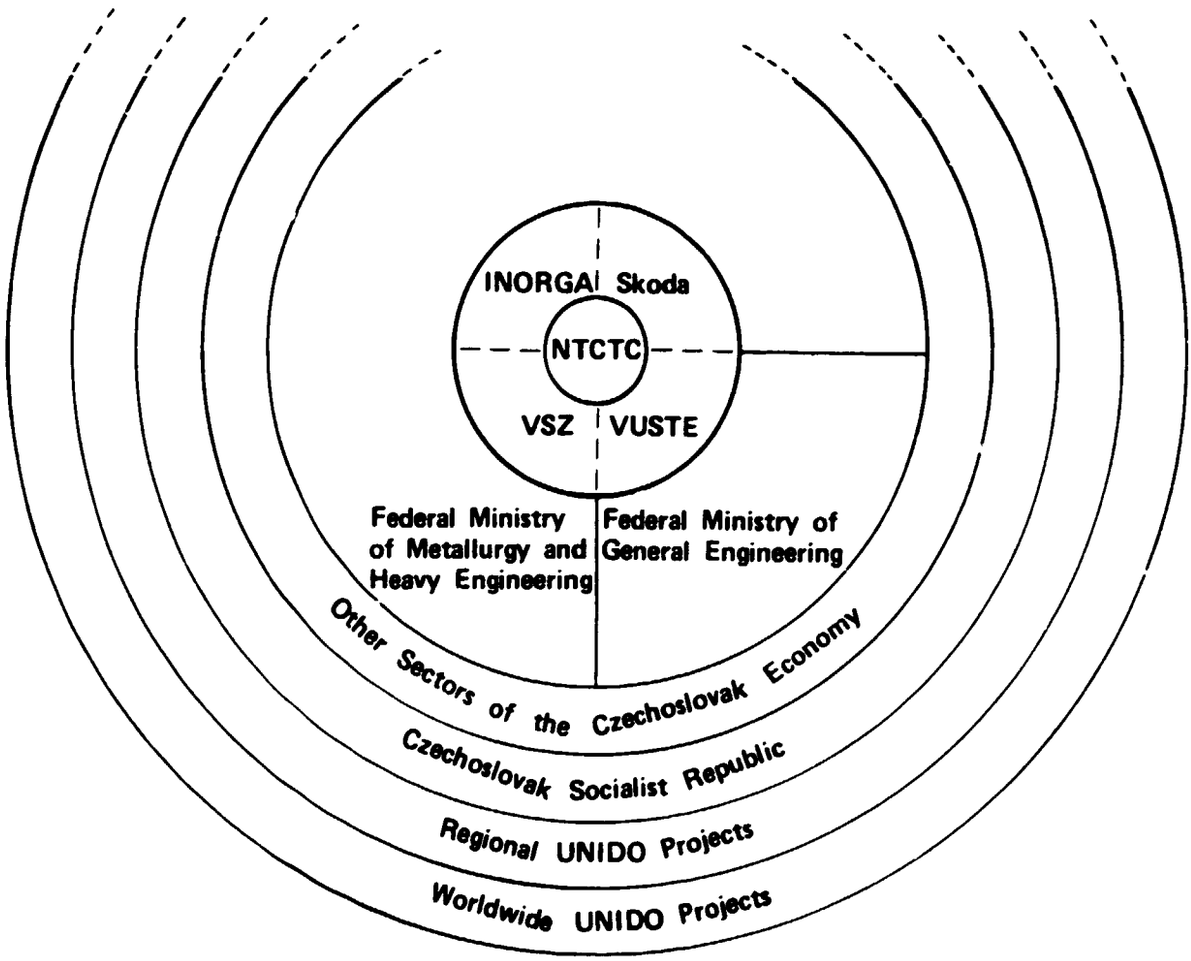


Figure 5. - Relationship of NTCTC Participants

CENTER GUIDANCE

The Center will receive guidance from a NTCTC Advisory Board. The membership of the Board will derive principally from

the counterpart organizations. Members, who will come from a variety of professions and locations, will set strategic direction for the Center and will establish policy, as well as organizational and resource priorities. The principle goal of the Board will be to keep the Center attuned to the needs of its clients, on the leading edge of its target technologies, and enabled to play a central role in the national development. An annual report will be delivered to the board each year by the Center manager. The Board will meet a minimum of twice per year.

The Chairperson shall determine the agenda for the UNIDO Advisory Board meetings, act as a spokesperson for the Board, establish Board committees and appoint committee chairs. I have been informed that the Chairperson to head such a board, when called, has been named. He is Mr. Josef Kříž, who in addition to other qualifications, is well acquainted with UNDP projects. Thus, the Chairperson is the national level person responsible for the Center project.

The post of board Secretary will be filled by the manager of the Center.

NTCTC Advisory Board Regular Members

The board will be composed of the following regular members.

Chairperson

NTCTC Manager (Secretary of Board)

Representative, Ministry of Metallurgy and Heavy Engineering

Representative, Ministry of General Engineering

Representative, INORGA

Representative, Škoda

Representative, VSŽ

Representative, VÚSTE

NTCTC Advisory Board Ex-Officio Members

In addition to the regular members of the Advisory Board, a benefit can accrue from the participation of other ex-Officio members. Ex-Officio members who can contribute to the board's wider purpose may come from a number of sources, and can be added as identified in the future. Two that can contribute to the purpose of the board from the beginning are:

Representative, UNIDO

Representative, Prague Technical University (ČVUT)

Board Outputs

The board will provide such written guidance to the Center and counterpart organizations as is required for the fulfillment of the Center's objectives. These will include at least the following:

1. Operating instructions for the Center, including
   a. initial Center "charter"
   b. organizational priorities
   c. policy guidance
2. The annual plan for the Center, including

a. computer resource allocations and assignments

b. human resource allocations and assignments

3. The mid-term plan for the Center, which should coincide with contempory Czechoslovak five year plans.

4. Strategic directions, in the form of a continually revised and updated long range plan.

## FUNCTIONS

The functions of the Center will include consultation and training, as well as research and services. Each of these contains a number of aspects which are outlined below.

### CONSULTATION

- consultative assistance in evaluation of applicability of topical areas of expertise
- provide assistance in implementing Center applications
- provide consultation in CBL and other state of the art industrial training technology

### TRAINING

- increase awareness of how Center application area projects can increase productivity
- promote increasing self-sufficiency of users in the Center's application areas
- technical updates on application areas
- maintain publications specifically related to Center application and interest areas

RESEARCH

- monitor state of the art
- innovate technical knowhow
- computer aided monitoring and control of complicated EDP projects
- computer aided system design
- develop CBL sophistication
- develop and operate office automation of the Center itself, to serve as a prototype
- CAD/CAM robot interface
- explore potential new application areas for the Center's services

SERVICES

- design, develop, and maintain centralized computer data bank on EDP progress on engineering and metallurgical and other basic industries
- facilitate industry-wide information and resource sharing
- serve as a focal point for dissemination of information on applicable equipment, software, developed or accessible to Center users

## ACTIVITIES

The Center will function in at least in the areas of Maintenance Management, Production Control, and CAD/CAM. As the Center develops, other areas may become significant in the total Center offerings.

The three areas, maintenance management, production control, and CAD/CAM are distinctly different in terms of the existing situation and likelihood of change over the course of time. These principle Center activity areas are outlined here.

MAINTENANCE MANAGEMENT

The maintenance management function of the Center is based on the work done by INORGA/VSŽ under project DP/CZE/77/005 at the East Slovakia Iron Works in Košice. The system has three parts. The parts and their potential magnitude are:

1. Planning and Operation of Operative Maintenance Planning. This application is currently in place in the sintering plant. There are 120 selected production lines in the application at present.

2. Material Procurement and purchasing. This aspect of the system follows the cycle of 119 items. There are 30-40,000 in process.

3. Shopfloor Capacity Planning and Scheduling of Spare Parts Manufacture. The supporting data base requires 180,000 operations.

The maintenance management system is a viable application, which finds use in other organizations and industries, as well as in Košice. Sample printouts from the maintenance management program are included in Appendix D.

As the Center's only current fully mature application, pages

from the maintenance management "book of experience" will prove invaluable in the formulation and initial growth of the Center.

As the maintenance management application can point with pride to accomplishment, it can also present the reality of the problems that accompany success. The demands on the time of the maintenance management staff to satisfy the needs of other organizations must be considered when establishing the Center.

PRODUCTION CONTROL

The Center's Production Control capability will stem from the production control efforts and progress at the Škoda Company, in Pilseň. Škoda holds a special position in the marketplace. Skoda production is essentially single piece or small lot production of complex machinery items and special plants for export. Škoda found that available production control programs, based on requirements planning, were not well suited to its situation. Škoda developed its own version of the tracking of the production unit, suited to the Czechoslovak situation. The basis of the system has been experimentally tested, and developed (in batch mode) in two plants, for almost five years in one case. The system is accepted at Škoda, which would like to implement it much more fully within their own organization. In plants with single piece production of Cs. 600 million per year, savings of Cs. 5 - 20 million per year can be expected to accrue from implementation of a mature production control system. The benefits of the system for production are sufficiently strong

that a demand for utilization exists beyond the Škoda environment, and propagation of the system to other areas of the economy are logical.

There are a number of limitations on the existing production control system. The current batch-oriented system would be vastly improved by conversion to an interactive mode. A qualified staff of 20 is currently involved in the project. There is a need to train 300 people on the use of the system within Škoda. Current estimates of the time needed to implement the system due to analysis and training requirements is two years in any given situation. Ability to implement the system will be limited by ability to train these people. The production engineering approach to the present system produces a "full loading." At present the system doesn't handle inventory. The current system resources available at Škoda cannot support the Center's proposed activities. Therefore, in order for the production control aspect of the Center to reach a stage of reality, provision must be made for enhanced computer resources for this purpose. This issue is addressed in a later section of this report.

The natural growth areas of the production control system are:

- interactive mode
- enhanced (imbeded?) training
- inventory module

CAD/CAM

CAD/CAM can be expected to become an ever more important element of operation improvement and increased productivity. The areas of Computer Integrated Manufacturing, Computer Graphics, integration of CAD and CAM, and integration of CAM and robots will emerge as the Center's areas of expertise.

The VÚSTE CAD/CAM activities and facilities will make an important contribution to the Center. Goals of the VÚSTE project have been:

1. Installation and functioning of two laboratories (CAD/CAPP and CAM).

2. Training VÚSTE specialists in operation of the labs.

3. Training 150 Czechoslovak specialists, and 10-20 from developing countries.

4. Development and implementation of software packages.

A CAM Laboratory for training purposes has been constructed, and is nearly completed. A block diagram of the hardware and floorplan for the laboratory are included in Appendix E. The VÚSTE CAD activities are based on a GRAFIXI system (product of the French FIXI firm) with System Graphics C-2, graphics display and software. The CAM system is a Siemens R 30, to which Czechoslovak machine tools will be interfaced.

VÚSTE has been hampered in efforts to establish their project by delays in equipment delivery. At present, these problems are nearly resolved, and it appears that they will be

able to make maximum exploitation of their UNDP project. Even up to the present, VÚSTE has been active conducting training for about 115 specialists and has worked with those Czechoslovak factories that already have equipment, such as ADAST Adamov, TOS Mostivař, ELITEX Liberec, ZVS Bruno, ČDK Prague, and OSTROJ Opava. In addition VUSTE has cooperated with the technical university in Prague (ČVUT).

The CAD/CAM activities demonstrated at the INORGA Experimental Laboratory at Krč as a part of the DP/CZE/77/005 project also promise expertise which can be available to the Center. The system there has been available since January 1983. The INGE CAD/CAM system is used. It is claimed that engineers can make use of INGE with as little as two hours of training. It will be verified at the Skoda plant and East Slovakia Iron Works, with planned use in 1984. Future plans for the Krč CAD/CAM facility are 50% experimental and 50% practical. At present work is underway on a 3D version of INGE. The practical component will involve training and the transfer of knowhow. The Krč Experimental Laboratory will provide support for the Center with its INGE CAD/CAM system. It will also serve as a resource in providing CAD/CAM expertise to the Center's client organizations.

## RELATIONSHIPS

The establishment of a new entity, such as the NTCTC, requires that a number of new relationships be established. It

is difficult to determine all of them in advance with accuracy, but an effort must be made. Additional relationships can be expected to emerge, in the future, from the Advisory Board.

Relationships which are recommended for the establishment of the Center are:

CENTER REPORTING RELATIONSHIP

The Center reporting relationship is simplified by the appointment of Mr. Kříž as Chairperson of the Advisory Board. This provides a direct link with the regular hierarchical relationships which already exist (except in the case of VÚSTE). The rights and responsibilities of the participants in the Center project will be established by a decree issued by the Ministry of Metallurgy and Heavy Engineering. Day-to-day operations will be controlled by a plan approved by the Advisory Board. The Director of INORGA will serve in a position of trust for the four counterpart organizations to provide economic area functions and support to the manager of the Center. Management functions for the Center manager will be provided by the Chairperson of the Advisory Board. Since INORGA is directly supported by the Ministry, the Chairperson is in a position to directly follow the activities of the Center, in all its aspects.

CENTER COORDINATION ROLE

1. Coordinate the applicable activities of the counterpart organizations, based on the recommendations of the Advisory Board.

2. Act as the central clearing-house of user organization needs and requirements to the respective counterpart organizations.

3. Provide for the transfer, maintenance and update of the appropriate system and application software, wherever located.

4. Design a uniform standard for documents and other media used for technology transfer from the counterpart organizations to other industries.

SOFTWARE OWNERSHIP

In general, the laws and customs of the Czechoslovak Socialist Republic will govern. Additionally, in order to avoid operational difficulties, the following principles are recommended:

1. The Center will be guaranteed permanent access to the appropriate system and application software, wherever located.

2. Changes to the appropriate system and application software, approved by the Center, will be implemented wherever the said software may be located.

RESOURCE ACCESS

1. The Center will have priority of access to computer resources of the counterpart organizations, based on an Annual Plan, updated and approved by the Advisory Board.

2. The Center will have access to the resource people of the counterpart organizations, based on an Annual Plan, updated and

approved by the Advisory Board.

## GROWTH STAGES OF THE CENTER

In examining the establishment of the Center, it is beneficial to consider the likely changes in demand for its products and services, and the capability to apply them in industry, over a period of time. The Center must be established with the understanding that it will change in only a few years time. This understanding suggests a "phased approach" to growth. Three phases are suggested. Phase I "Establishment," is the year of establishment (year 1) and the succeeding year (plus 1 year). Phase II "Initial Growth" is the plus 2 year and plus 3 year. Phase III "Maturation" is the period beginning in the plus 4 year. The stages are tabulated in figure 6.

| Phase | Characterization | Project Year | Calendar Year |
|---|---|---|---|
| Phase I | Establishment | 1 and +1 | 1983/4 |
| Phase II | Initial Growth | +2 and +3 | 1985/6 |
| Phase III | Maturation | +4 onward | 1987 - |

Note: Current UNDP projects expire in Phase II of the Center's growth.

Figure 6. NTCTC Growth Stages

It should be noted that although the UNDP projects which

provided the basis for the Center's existence are scheduled to expire before the Center matures (in Phase III), the Center can be expected to continue to grow in terms of capabilities and maturation of its basic application areas. New applications can also be expected to be developed. In any event, the results achieved should not be lost. The UNDP "investment" can be returned over a period beyond the Centers initial growth stage.

The differences inherent in the make-up, activities, and capabilities of the Center in each of its phases are reflected in a number of areas such as staffing, facilities and equipment. In the establishment of the Center, it must be recognized that there is a certain minimum requirement, below which the Center would be no different than the existing informal arrangements.

## STAFFING

### MINIMUM REQUIREMENT

The Center will consist of three sections under the supervision of a manager. The sections are the minimum required for the independent functioning of a small specialist organization: Functional, Training, and Administrative. The fewest number of staff needed to meet the requirements of a viable center are shown in figure 7.

| Manager | Functional | Training | Accountant | Office |
|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 1 |

Figure 7. Minimum Staffing Requirement by Function

Minimum requirement Position Descriptions

The minimum staff required is eight persons. This configuration represents the minimum staff which can be expected to accomplish the goals of the Center. Basically, figure 8 lists a staff member for each of the areas needed except CAD/CAM. See Appendix F for detailed position descriptions.

A-01 Manager
F-01 Functional Specialist - Maintenance Management
F-02 Functional Specialist - Production Control
T-01 Training Specialist - Program Delivery
T-02 Training Specialist - CBL Technology
T-03 Training Specialist - CBL Systems
A-02 Accountant
A-03 Office Manager

Figure 8. Minimum Staffing Requirement by Job

PHASE I

The Phase I staffing requirements shown in figure 9 represent the recommended staffing for the establishment of the Center. It differs from the minimal configuration by the addition of a staff CAD/CAM specialist and driver/maintenence

person.

| Manager | Functional | Training | Accountant | Office |
|---|---|---|---|---|
| 1 | 3 | 3 | 1 | 2 |

Figure 9. Phase I Staffing Requirement by Function

## Additional Required Position Descriptions

The CAD/CAM functional specialist is recommended to give the Center the capability to focus simultaneously on its three identified functions. Failure to provide a separate CAD/CAM specialist will necessitate the division of attention of one or more other staff members. Although CAD/CAM is not extensively used, it is a rapidly emerging field which will require considerable effort simply to ensure that the Center remains current in the field.

The office area is also incremented by one driver/maintenance person. This position is needed to permit the Center to operate smoothly. Personnel and equipment can be picked-up, delivered, and retrieved -- and the Center's equipment maintained by this person.

F-03 Functional Specialist - CAD/CAM
A-07 Driver/Maintenance Person

Total Recommended Phase I Staff

The total number of staff required for Phase I is ten persons. The principle difference, from the minimal configuration, in the jobs listed in figure 10 is the addition of a separate CAD/CAM specialist role. See Appendix F for detailed position descriptions.

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A-01 Manager
F-01 Functional Specialist - Maintenance Management
F-02 Functional Specialist - Production Control
F-03 Functional Specialist - CAD/CAM
T-01 Training Specialist - Program Delivery
T-02 Training Specialist - CBL Technology
T-03 Training Specialist - CBL Systems
A-02 Accountant
A-03 Office Manager
A-07 Driver/Maintenance Person

Figure 10. Phase I Staffing Requirement by Job

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PHASE II

Phase II represents the period when the then established Center begins to assume its full role in the targeted application areas. The first of these is the incorporation of maintenance management into the Center itself. The training and office functions expand to reflect both the additional load and the then growing position of the Center in its relationships to the various levels of interface which it maintains. Figure 11 shows these increases.

| Manager Functional Training | Accountant | Office |
|---|---|---|
| 1 | 8 | 4 | 1 | 2 |

Figure 11. Phase II Staffing Requirement by Function

## Additional Required Position Descriptions

Reflects the incorporation of maintenance management function into the Center, and consequent removal of burden from the counterpart organization. These additional personnel are distributed as follows: 2 maintenance management technical, 1 technical control, 1 systems/STELA.

The growth of production control is taking place in the counterpart organization, the Center monitors and coordinates, while the Center's role in CAD/CAM by growth of the section. Reflection of expected growth of use of CBL techniques by addition of a CBL programmer in the training section. The Center will meet the increasing administrative needs with the addition of a typist. See Appendix F for detailed position descriptions.

F-04 Functional Specialist - Maintenance Management, Technical
F-05 Functional Specialist - Maintenance Management, Technical
F-06 Functional Specialist - Maintenance Management, Technical Control
F-07 Functional Specialist - Maintenance Management. Systems/ STELA
F-08 Functional Specialist - CAD/CAM
T-04 Training Specialist - CBL Programmer
A-04 Typist

Total Recommended Phase II Staff

The total Phase II Center staff is 17 persons. The total of all of these positions is listed in figure 12.

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A-01 Manager
F-01 Functional Specialist - Maintenance Management
F-02 Functional Specialist - Production Control
F-03 Functional Specialist - CAD/CAM
F-04 Functional Specialist - Maintenance Management, Technical
F-05 Functional Specialist - Maintenance Management, Technical
F-06 Functional Specialist - Maintenance Management, Technical Control
F-07 Functional Specialist - Maintenance Management. Systems/ STELA
F-08 Functional Specialist - CAD/CAM
T-01 Training Specialist - Program Delivery
T-02 Training Specialist - CBL Technology
T-03 Training Specialist - CBL Systems
T-04 Training Specialist - CBL Programmer
A-02 Accountant
A-03 Office Manager
A-04 Typist
A-07 Driver/Maintenance Person

Figure 12. Phase II Staffing Requirement by Job

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PHASE III

By the time Phase III is implemented, the Center will be a significant force in the sectors influenced by the respective ministries. The staffing recommendation reflects growth of the production control capability to the degree that it is entirely incorporated within the Center. CAD/CAM can be expected to increase greatly in significance also, but is dependent on many

other factors for implementation throughout Czechoslovak industry that staffing is augmented more gradually than would have been appropriate for either of the other two application areas. The general increase in Center capabilities result in increases in the training, accountant and office functions also. Figure 13 lists the totals for each of the respective functions.

| Manager | Functional | Training | Accountant | Office |
|---|---|---|---|---|
| 1 | 13 | 5 | 2 | 3 |

Figure 13. Phase III Staffing Requirement by Function

Additional Required Position Descriptions

It is not fully possible to anticipate the configuration of an entity emerging in a dynamic area, such as the Center, five years in the future. Likely progression of events will result in the incorporation of the production control function into the Center, following the pattern established with maintenance management. Continued growth of CAD/CAM seems an almost guaranteed process. The Center must grow in CAD/CAM capability. Addition of a course design specialist provides personnel support for an aspect of the Center that will grown in importance as its other capabilities expand. Other increased capabilities in the support of Center operations is reflected in addition of an

accounting clerk and typist/file person. See Appendix F for detailed position descriptions.

F-09 Functional Specialist - Production Control, Technical
F-10 Functional Specialist - Production Control, Technical
F-11 Functional Specialist - Production Control, Technical Control
F-12 Functional Specialist - Production Control, Systems
F-13 Functional Specialist - CAD/CAM
T-05 Training Specialist - Course Design
A-05 Accounting Clerk
A-06 Typist/File Person

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A-01 Manager
F-01 Functional Specialist - Maintenance Management
F-02 Functional Specialist - Production Control
F-03 Functional Specialist - CAD/CAM
F-04 Functional Specialist - Maintenance Management, Technical
F-05 Functional Specialist - Maintenance Management, Technical
F-06 Functional Specialist - Maintenance Management, Technical Control
F-07 Functional Specialist - Maintenance Management. Systems/ STELA
F-08 Functional Specialist - CAD/CAM
F-09 Functional Specialist - Production Control, Technical
F-10 Functional Specialist - Production Control, Technical
F-11 Functional Specialist - Production Control, Tech. Control
F-12 Functional Specialist - Production Control, Systems
F-13 Functional Specialist - CAD/CAM
T-04 Training Specialist - CBL Programmer
T-01 Training Specialist - Program Delivery
T-02 Training Specialist - CBL Technology
T-03 Training Specialist - CBL Systems
T-04 Training Specialist - CBL Programmer
T-05 Training Specialist - Course Design
A-02 Accountant
A-03 Office Manager
A-04 Typist
A-05 Accounting Clerk
A-06 Typist/File Person
A-07 Driver/Maintenance Person

Figure 14. Phase III Staffing Requirement by Job

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Total Recommended Phase III Staff

The total Phase III Center staff of 27 persons reflects the addition of the 8 additional members in three different areas. The complete list of all of the Center positions is provided in the preceding figure 14.

## FACILITIES

### LOCATION FACTORS

Care should be taken in selection of a site for the Center. Since the Center will be used by students and other visitors who (presumably) do not regularly live at the Center's location, a number of factors should be taken into account. These include at least: transportation, lodging, dining, medical care and other considerations.

#### Transportation

The Center should have convenient access to all major means of local, national and international transportation. These include: trolley, metro, and railroad station, as well as an international airport.

#### Lodging

A hotel acceptable to the anticipated visitors should be reasonably accessible to the Center.

#### Dining

The Center will not have an integral food service capability. It should be located sufficiently near a public

dining facility that employees, students, visitors, and other users of the Center can obtain their meals there, as needed.

Medical Care

The Center should have reasonable access to the same medical facilities usual, and available to citizens, in the Czechoslovak Socialist Republic.

Other

The heavily transient nature of Center users, and the sum of the foregoing requirements, suggest that it be located in major metropolitan area. Such an urban location will automatically secure an additional benefit to the Center -- cultural facilities.

## FACILITIES DESCRIPTION

A minimal configuration providing facilities to provide sufficient working space for the staff to carry out all of the functions for the role of the Center during Phase I (except computer equipment) will require approximately 210 $m^2$ of building space. Later Phases will require additional space, furniture and furnishings, but are not included in this report. For a detailed listing of apurtenant furniture and furnishings, see Appendix G.

## EQUIPMENT

### TRANSPORTATION

In order to pick-up, deliver, and retrieve personnel and equipment the Center will require some transportation. The recommended transportation is a total of two cars, one each in

Phases I and II. These vehicles should provide the maximum flexibility in their role. Six passenger vehicles with ample room for luggage and/or equipment are recommended. It should be noted that only one driver/maintenance person is recommended (in Phase I). The second vehicle can be operated as needed by various members of the Center staff in Phase II.

COMPUTING EQUIPMENT

Center's computer equipment would be colocated at the Central Computer Center of INORGA (actually located physically at the Federal Ministry of Metallurgy and Heavy Industry).

Option I (recommended)

Establish a computer with sufficient capacity to serve the total needs of the Center, and its counterpart and client-centered operations with expansion capability that would serve all envisioned Center applications. The computer would house the system software for the all of the Center's primary programs and enable enhancements to be implemented at the central site.

The computer must be selected both for its capability to meet the needs at hand and upgrade capability to meet the foreseeable needs of the Center. Ideally, the computer would, in addition, be compatible with SM 4-20 computers and the existing IBM and ICL computers at INORGA, Škoda, East Slovakia Iron Works.

Option II

First Priority.

Extend the capacity of the ICL computer at Škoda (currently 512K bytes) to provide extended memory and interactive capacity. Škoda is currently unable to proceed with further development of its application due to the enforced limitations of the existing computer resources.

Second Priority.

Extend existing INORGA IBM 370-145 by 512K bytes (currently 1024K memory) and extend storage by 2 each 300 megabyte disk drives, and 5 terminals. Resources of this scale will be needed to enable INORGA to provide computer resources for the Center, if the Center does not have its own capability.

CBL EQUIPMENT

The Center should first determine total requirements, including expansion needs. In general, each counterpart organization should have one set of the identical CBL equipment, to permit utilization and exchange of courseware. Such compatibility will enhance the natural synergy of the Center.

A definition of Center CBL system requirements should be based on the CBL capabilities which are a part of that system. The characteristics of a practical learning system required to meet the needs of an organization will vary with the particular application selected. The complete system for Center training would have the capabilities listed in figure 15.

1. a powerful authoring system, preferably with both;
    a. a high level, user oriented training specific author language, and powerful authoring utilities
    b. "programmerless" authoring
2. flexibility in instructional strategy
3. powerful instructional management system
4. high resolution graphics
5. learner input through tactile screen interaction
6. stand-alone delivery capability
7. auxiliary device control, including;
    a. random access audio
    b. random access videotape and videodisc
    c. electronic voice synthesis
8. transportability of courseware to other systems

Figure 15. Computer-based Learning System Capabilities

Authoring System

The authoring system should be comprised of powerful, user friendly courseware generation utility programs. These utilities will be supplemented by continued, but presumably diminishing, use of high level CBL specific author languages. An example of today's growing library of author utilities are programmerless

courseware development utilities. These utilities may include editor, driver, and help lesson. Using this utility, the technical subject expert can very easily create and edit displays including graphics. Displays can then be linked together for interactive use. Knowledge of a CBL author language is not required to enter complex graphics or specify branching. The widespread use of such utilities will significantly increase the productivity of the Center's training group, while decreasing the cost of lesson development. These useful author utilities should also aid in the effort to produce high quality courseware.

The author language, suitable for unreserved recommendation to the Center organization, must be high level, specifically designed for educational computing, and user oriented. That it must be a language specifically designed for educational applications is obvious. Hardly anyone would attempt to calculate the shape of a new airfoil with a programmimg language intended for generating business reports. Major organizations involved with CBL will use generators and appropriate languages for their courseware. As flexible utilities come into more common use, they should ease development efforts and eliminate the use of the author language.

Flexibility In Instructional Strategy

The use of courseware generator development utilities is not new. One of the major pioneer CBL systems used this method. One approach to this problem is to standardize a utility for the

creation of courseware. Unfortunately, an overly specific solution to this problem results in a standardized instructional approach which then must be used for all courseware. Utilities, and the courseware generator concept ARE good. However, a fixed instructional strategy is undesirable. The loss of instructional flexibility which results from only one strategy will tie the efforts to fully utilize CBL in the organization's training efforts in knots.

Instructional Management System

The purpose of CMI is to provide a method of: ensuring that the student's interaction is appropriate to ability, carefully tracking each student's progress, assessing student progress and learning resource effectiveness, and carrying out these functions with simplified clerical activity. CMI is an extensive and powerful learning management tool that has been remarkably developed on large central service systems, where it is the most heavily used capability. In use, the instructional materials are broken into content areas and within each of these the student alternates between the activities of testing, reviewing test results, selecting study materials, and studying. As a part of a computer managed instruction program, the learner is directed, as needed, to learning experiences that are presented by a media device other than the computer terminal. Extensive records of the students progress are automatically collected and maintained

for the instructor's use in helping the student to learn. These training techniques facilitate the management and control of the educational process for the instructor, provide feedback to the learner as well as facilitator regarding the progress and retention of knowledge, and allow the learner to progress at one's own pace.

This can be a powerful technique for the Center. United Airlines has publicly described the very effective use of CBL solely through use of CMI. CMI, as implemented on microcomputers, continues to grow in sophistication but will probably not approach the power of central versions in the near future. The benefits and possibilities of important savings possible through CMI suggest that extra effort and attention directed toward effective incorporation in the Center's CBL effort will be justified.

High Resolution Graphics

A system's graphics capability is based on the number of pixel elements (dots on the screen) controlled by the computer and used to make letters and pictures. Educational researchers determined decades ago that a graphics capability is essential to serious educational computing. Low resolution block graphics can be useful for some purposes, but for full implementation of computer-based learning for adults in human resource development programs such as those the Center will be providing, experience shows that high resolution graphics have been an important asset

in the majority of cases.

True "high" resolution (approximately 1024 x 1024 or better), is used in Computer Aided Design. The high resolution of the CBL world is about half or (approximately) 500 x 500. This degree of graphic resolution is ample for any human resource development program the Center may establish.

Tactile Input

Experience with learners in a variety of training situations has shown that, although use of CBL systems is not perceived as threatening per se, some user groups respond better to use of the screen for input. Managers, physicians and aviators are such groups. Use of the screen for access to the computer can be accomplished with a light pen or a touch-panel screen. A "mouse" is included in this category. Using these access methods avoids the need for typing, which can hardly be considered a universal prerequisite skill to learning. Serious CBL can be conducted without such tactile input, but there is little question that the Center's CBL system should provide such a capability if possible.

Stand-Alone Delivery

The history of computer-based learning is one of delivery on a learning terminal that is connected to a large system, or mini. The surge of microcomputer availability that characterizes the current era makes the delivery of high quality courseware on a micro (or stand alone) system an important possibility. However,

the most powerful utilization of CBL, which is computer managed instruction, cannot yet be utilized as extensively on the stand-alone systems.

There is a general problem in authoring on the same stand alone delivery system, since many of the powerful authoring utilities can not yet "fit" in current micro systems. One emerging pattern is that courseware authoring and instructional management should be done in the most practical environment, the mainframe or mini -- due to their power and storage capacity; while courseware delivery is on a microsystem due to the reduced cost.

Auxiliary Device Control

CMI frequently directs the learner to learning experiences that are presented by a media device other than the CBL terminal -- such as a book or film. Accessory devices, such as a graphics tablet may be interfaced with the instructional terminal. Random access audio, random access videotape and videodisc may be controlled through use of software drivers. In some areas, where successful performance on the job is critical, audio or visual presentation which is an integrated, interactive part of the computerized learning program, rather than prescribed for separate use, can bring a very dynamic aspect to the learning. Implementation of these presentations is by means of a random access audio or video device. This is sometimes termed interactive video. The real power of interactive video is not

the often flashy graphics shown, but the method behind which is shown, done by the CAI program which controls the video. The Center's CBL system should provide control capability for auxiliary devices, including random access audio, random access videotape and videodisc. Use of these standard, or other unique, accessory devices will permit an approach to the full potentiality that should be expected of the Center's CBL system.

Delivery on Other Systems

The CBL system, if not simply a delivery system, offers the possibility of courseware creation. The advent of powerful authoring utilities brings an additional benefit, the transportability of courseware to other stand-alone delivery systems. As this capability is implemented in organizations it can help overcome the difficulties in courseware utilization caused by multiple hardware types. This is a capability that should be carefully considered for the Center's system.

Simulation

Simulation is one of the modes of CAI rather than a CBL system capability. It is, however, so linked to the system and methodology selected that it deserves consideration at the same time. Simulation allows learners to observe and practice with "artificial" equipment in a way that, if done on a real one, would be costly, dangerous or both. Use of a real item of equipment for learning will tie up costly equipment and run the

risk of damaging that equipment in the process. Simulation techniques are very desirable for training in subjects in which students operate in situations where information must be assessed and correct action initiated within a short period of time. This is characteristic of many high technology occupations. The combination of the hardware and software features make CBL an excellent choice for many complex simulations which can be envisioned in the sector covered by the Center's counterpart organizations and two ministries. Graphics capability, combined with the tactile input screen, permit the student's terminal to function as though it were the item of other specific equipment. The learning experiences which result approximate the benefits of a "hands on" practice session with the actual equipment.

Simulation can increase insight into the cause and effect relationship being illustrated in the CBL lesson. Through the use of special control features and feedback CBL can provide the learner the opportunity to see and understand complex electronic and mechanical (or other) phenomena in a unique way. Often the process can't be seen in the actual operating equipment. Even in the special training simulators only meters, lights, and switches are available to the learner for interaction.

OFFICE AUTOMATION EQUIPMENT

The Center's office automation equipment can be microcomputer-based. Additionally useful off-the-shelf software packages, compatible with the equipment, such as C/PM, Wordstar,

Supercalc, dBase II, and typical languages such as CBASIC, MBASIC, and Pascal should be acquired as a part of the initial office automation package.

VIDEO EQUIPMENT

Studio quality video equipment to be available at INORGA can be used by the Center. The Center will require its own equipment in order to implement instructional television where appropriate. Instructional television equipment is recommended in the Appendix that will augment the INORGA-provided equipment to ensure a video training capability that can support an operation of the quality expected of the Center.

## PUBLIC RELATIONS

The Center must be the source of information concerning its own activities and services. Such information will be a part of the Center's effort to make the products and services available from the Center available to potential client organizations. In order to be available, they must first be known. The vehicles for the ongoing publicity efforts of the Center will include printed descriptors, other publications including an NTCTC specific publication, presentations, and short seminars.

PRINTED MATTER

The Center's printed descriptors should include the following:

News Media Releases

Product Announcements

Brochures

Flyers

Product and Services Data Sheets

OTHER PUBLICATIONS

Other publications include the utilization of the full range of existing publications which may exist within the counterpart organizations, industry areas, Federal Ministries and any other vehicle available. The Center should establish its own periodic NTCTC Publications including at least regularly issued newsletters or bulletins designed to provide publicity to current applications and Center success stories, and results achieved within the UNIDO program. Additionally, the Center should sponsor or otherwise provide for publication of highly detailed and thoroughly documented studies or papers written about specific areas of subjects or fields of inquiry within its purview.

STAFF PROFESSIONALISM

The Center should officially encourage its staff members to contribute to the professional literature within their respective areas.

PRESENTATIONS

Presentations will be an important vehicle for making the work of the Center known, especially until the Center becomes an

established institution within the country. Presentations of short duration should be planned, scheduled and conducted for at least the following:

- for other organizations within the Federal Ministry of Metallurgy and Heavy Engineering
- for organizations within the Federal Ministry of General Engineering
- for organizations in other sectors

SEMINARS

Short Seminars on the Centers application and research areas will serve to create the technologically advanced user base needed to utilize Center programs. Such seminars would typically range from one to three days in length and provide good coverage targeted for a user category of particular subject area and degree of sophistication.

CONSULTING

Consulting will be provided by the Center for client organizations in Czechoslovakia, and on other UNIDO projects, at least in the following areas:

- choice of computer hardware specifications
- terminals (communication means)
- process, and production, control instrumentation
- selection of algorithms to be used for client projects
- systems and application software
- EDP project control

network analysis

use

applications

approach

- system maintenance
- user training applications

## TRAINING METHODOLOGY

### ANDROGOGY

Czechoslovak trainers are well acquainted with the science of adult learning (called androgogy). Industrial training, termed Human Resource Development (HRD) in many countries, is concerned with adults. Programs developed at the Center must fit the adult learning situation. CBL can contribute effectively to nearly any learning program. Its impact on students in organizational HRD programs is especially favorable. This is true because it has inherent compatibility with adult learners, a powerful advantage for HRD utilization.

The highly individualized way CBL handles instruction provides a very close match for what we know about adult learners. Some of the characteristics of adults in learning situations are listed in figure 16.

1. The rate of learning varies between individuals.
2. Adults enter the learning situation with considerable previous experience and learning.
3. Individuals have different learning styles and preferences.
4. Individuals may have a variety of goals for learning.
5. Adults need to feel confident that they are learning what is needed to meet their own goals.

Figure 16. Characteristics of Adult Learning

## SYSTEMATIC DESIGN OF INSTRUCTION

The methodology generally referred to as Instructional Systems Development (ISD) is the method of choice for the Center's use. The ISD model in common use for all types of training development is especially suited for CBL. The ISD is a descendant of the General System Theory of Ludwig von Bertalanffy. It is related to methodological implementations in physical, biological, behavioral and social sciences.

The ISD model provides a simple and complete approach to the development of courseware that the Center can, and should, utilize for **all** training that is developed. An overview of the process is provided in Appendix H, Courseware Development

Process.

CRITERION REFERENCED INSTRUCTION

Another important concept for general training is very closely associated with CBL. It is called Criterion Referenced Instruction (CRI). Criterion referenced instruction is the process of setting clear goals for the trainee, and then measuring success against the goals. This overcomes the problems associated with not measuring trainee success at all, and comparing them with each other, which does not indicate whether the goals of training have been met.

The implementation of criterion referenced instruction is generally called "mastery learning." Trainee success is termed mastery. By establishing criteria for mastery, it can be clearly shown that trainees have reached the state of readiness for the job that is required. This concept is closely tied to CMI. Effective use of criterion referenced instruction reduces the likelihood that evaluations will show trainees are ineffective after training.

## TRAINING COURSE OFFERINGS

The Center will offer a wide range of training possibilities that serve to enhance the value of its application area offerings, ready clients and potential clients to utilize offerings, and provide a service to the industry areas. Standard training offerings will be available both on a scheduled cyclical

basis, and on-request. Custom training for a unique organization or need is also a Center capability. Center offerings will comprise a wide spectrum of subjects, methodologies, and target audiences. UNIDO participants from abroad can be expected to participate in training conducted by the Center.

General guidance on topics and instructional strategies will be provided by the Advisory Committee in the Annual Plan. Programmatic offerings will include:

PROGRAM CATEGORIES

Center Applications:

- awareness programs for prospective users
- introductory seminars
- core programs
- follow-up programs for current users (as updates/ improvements are made)

State of the Art for:

- all organizations in the basic industries
- specialists for DP
- management personnel
- specialists from user departments that cooperate in the development of systems

INSTRUCTIONAL METHODOLOGY

- conventional
- Computer-based Learning
- video-based

EXPORTABLE TRAINING FOR

- other countries in the region
- developing countries

COURSE EVALUATION METHODOLOGY

The evaluation of training will be an integral part of the course development process. Each course developed will have an evaluation plan that is prepared and executed concurrently with the development process. Evaluation will be both formative, and summative. The exact evaluation scheme will vary appropriately, according to the specific program involved. For example, the awareness programs cannot, and should not, be evaluated in the same way as the core instruction for application users. Evaluation of introductory and core programs is especially important, since their success is directly related to the impact and success of the Center. Primary among evaluation techniques for these programs will be feedback based on trainee success on the job after a specific period of time, such as 60 days. Feedback on the value of the training to the trainee, as well as areas in which the trainee needed more instruction should be collected from the trainee, as well as the applicable manager.

COMPUTER BASED LEARNING

Since the NTCTC is expected to employ Computer-based Learning (CBL) as an method of instruction, an assessment of the preparation necessary for successful implementation was also

conducted. The use of CBL, where appropriate, is not yet fully implemented in the CSSR. The NTCTC experience can be expected to provide a significant impetus to such use contributing, not only to the counterpart organizations, but to all sectors of Czechoslovak industry and the national development as a whole.

ADVANTAGES

Computer-based learning not only is theoretically compatible with adult learning characteristics -- there is good evidence that it works in practice. In an analysis of over 75 studies, results showed significant gains in achievement and positive attitude. Most important for cost-effective programs, learning time was reduced by 25-50 percent! A less scientific aspect can be noted in most CBL HRD projects. As was mentioned earlier, in general, industrial workers seem to appreciate being treated like adults. A sad, but true, observation is that not everyone enjoys school. Unfortunately, many HRD programs present new subjects in the same way it was done in school...with very much the same results. CBL is far better able to deal with heterogeneous groups (those composed of people who are different from one another). In CBL, the person who can progress rapidly is not bored while the instructor tries to present on a level suited to the bulk of the group. Another person, who would not be able to keep up with that same group presentation, doesn't have to.

INDIVIDUALIZATION

CBL is an inherently individual form of learning. The

maximum benefits from CBL, depend on its ability to treat each learner as an individual. It should be obvious that it is best employed in an individualized learning setting. The impact of CBL on the organization can be seen as an extension of the effect on the learning specialist. There are areas where CBL not be as desirable as other strategies, for example; where human interaction is essential to learning. In many other cases though, the strengths of CBL suggest it in favor of a "lecture." The obvious implication for HRD is that the role of the instructor must change to accommodate the new tool.

The instructor continues to be important in CBL, but in a new way. As a "facilitator" of learning the learning specialist performs the tasks most trainers find more enjoyable. Most people involved in training enjoy working with people. Almost incongruously, CBL provides more opportunity to work with people. In a CBL environment, the facilitator works with each learner as an individual -- coaching, tutoring, and guiding the learning activities. The facilitator has the opportunity to make a difference in the working lives of individuals.

## BUILDING A CBL INFRASTRUCTURE

In order to achieve results on a scale near the potential, considerable attention must be devoted to the establishment of an appropriate infrastructure of understanding. In this regard, it is noted that the fundamental exposure to the CBL process

originally planned as a part of the DP/CZE/77/005 project, but postponed, should not be delayed on account of lack of ideal hardware. The planned CREATE training is an introduction to the CBL process which is hardware independent, and will therefore be beneficial regardless of the eventual implementation system. Further, exposure to generic introductory information will help those who are involved plan intelligently for implementation of CBL as a significant part of the NTCTC program.

During the visit, a full-day Seminar on the subject of Computer-based Instruction Systems was conducted. The seminar was attended by representatives of INORGA and East Slovakia Iron Works. This event will contribute to the necessary accumulation of knowledge in the area of Computer-based Learning, which is essential to the introduction of CBL as a viable and significant instructional strategy for NTCTC programs. In addition a number of articles were delivered to attendees, to provide additional reading and resource material in CBL. It is recommended that the Center staff be provided with a coherent package of CBL training to increase the Center's general level of readiness to utilize this important instructional strategy.

## COMPUTER AIDED PROJECT MONITORING AND DOCUMENTATION

The Center should acquire or develop computer aided project monitoring and documentation software. This application should be compatible with the computer equipment acquired to support other Center activities. This stands as a Center interest area,

in which the Center could provide significant assistance to client industry organizations.

## THE FUTURE OF THE CENTER

The significant question is, "Where will the Center programs be more than five years in the future?" Obviously, the Center must have a useful life beyond five years in order to justify its creation. It appears that there will be a role for the Center in the Czechoslovak setting, as well as within the region, and internationally in the future. The following includes suggestions elicited from representatives of the counterpart organizations about some elements of that future setting:

### WHAT WILL THE CENTER DO?

- its basis will be the same
- there will still be work to be done (in future) due to developments in the field
- it will be a new center of innovation

### WHAT WILL THE COUNTERPART ORGANIZATIONS DO?

- provide a new round of innovation
- experience in practical use can be applied
- growth of production control
- there will be an improved link between production and maintenance
- programs will extend to other user areas
- programs will ex nd to other systems

- role of the counterpart organizations will be to continue the lead in their respective areas

WHAT EFFECT WILL TECHNOLOGICAL CHANGE EXERT?

- new technical means for Center activities
- more intelligent applications
- systems will be increasingly accessible for people
- increased use of color and graphics
- a view of the current situation will be available from the shop floor
- there will be self adjustment (intelligent warnings of impending problems)
- closely related with automated production

## CONCLUSIONS

A number of conclusions follow logically from the body of the study. These are as follows:

1. The Center should be established without delay in order to eliminate the drain caused by the current informal arrangements.

2. A wide range of benefits can be expected to accrue due to the synergy of the counterpart organizations, industry in Czechoslovakia, the region, and beyond, once the Center is functioning.

4. The establishment of a new entity, such as the NTCTC can often best be done in phases. In this case, the concept of phased introduction is supported by a number of factors,

including differences in maturity level of the various Center application areas. Phased establishment of the Center allows for planning, and change based on experience.

5. The nature of the Center suggests that direction setting, priority establishment, and resource allocation could be beneficially handled by an advisory board.

6. In order to have the maximum beneficial impact, the Center should provide consultation, training, research, and other services.

7. The planned activities of the Center: maintenance training, production control and CAD/CAM are correctly chosen.

8. Relationships among the Center, counterpart organizations, and clients will develop over time. Meanwhile the a number of principles must be established from the outset. The advisory board will establish additional guidelines as experience is gained in the operation of the Center.

10. Phased establishment of the Center necessitates a coherent plan for staffing based on the phases.

11. Care should be taken when establishing the Center physically, and in selecting Center facilities.

12. There is an absolute need for additional computing equipment to enable the Center to perform its functions. There are a number of different possibilities to resolve the need for the computing equipment. Two of these are described in the

Equipment of this report.

13. The Computer-based Learning system for the Center should be based on the maximum number of the desired capabilities, listed earlier in this report, which can be obtained.

14. At least one set of the Computer-based Learning equipment acquired as a part of this project must be located in each of the counterpart organizations in order to maximize the benefits of courseware that is developed.

15. The office of an entity like the Center should provide a model in the area of office automation.

16. A number of training technologies exist which can make the Center's programs better than can be done by traditional means. Prominent among these are: Instructional Systems Development (ISD), and Criterion Referenced Instruction (CRI).

17. The Center should use a practical evaluation methodology centered on productivity increases and improved student job performance -- rather than a theoretical one.

18. The Center can provide a valuable service in the ČSSR by use and development of CBL technology. Before this can occur, the Center must build a CBL infrastructure.

19. The Center should become a Center for knowledge in industrial CBL technology nationally. Achievement in this area will suggest export of the technology regionally, and to worldwide UNIDO projects.

20. The area of computer aided project monitoring and

documentation should be identified formally as a Center interest area. Developments in this area are well within the capability of the Center and counterpart organizations.

## RECOMMENDATIONS

The following recommendations are presented, based on the body and conclusions of this report:

1. Establish the Center in 1983, if possible.

2. Establish an advisory board to operate as recommended in the Structure section of this report.

3. The Center should provide consultation, training, research, and service from the time of its inception.

4. The Center should function in those areas recommended in the Activities section of this report.

5. Initially, relationships should be as recommended in the Relationships section of this report.

6. Establish the Center in three phases over the period of five years.

7. Establish the staff of the Center in the three phases, as recommended in the Staffing section of this report.

8. Establish the Center in at least 210 $m^2$ of space, in an urban area, as recommended in the Facilities section of this report.

9. Select computing equipment, recommended as Option I, in the Equipment section of this report.

10. Select Center CBL equipment based on the maximum number of CBL system capabilities described in the Equipment section of this report.

11. Procure at least one set of the Computer-based Learning equipment to be located in each of the counterpart organizations.

12. Provide transportation equipment, as recommended in the Equipment section of this report.

13. Establish the Center's office as a model of office automation. The recommended equipment described in the Equipment section of this report, and appendix will achieve this end.

14. Center training should be designed, developed and delivered, based on Instructional System Design and Criterion Referenced Instruction principles.

15. Establish training for Center personnel in ISD and CRI as needed to carry out recommendation 14 above.

16. Establish and use a practical evaluation methodology, centered on productivity increases and improved student job performance, as described in Training Course Offerings.

17. Implement the use of CBL wherever appropriate, and as growing experience permits.

18. Complete the CBL training planned as a part of project DP/CZE/77/005, but not yet executed as soon as possible. This training is fundamental to the creation of a CBL infrastructure in the Center.

19. Follow the training contained in recommendation 16 above with a specific consulting program designed to assist the Center in building its CBL organization.

20. When established, be prepared to share experience in CBL with other sectors within the ČSSR, and beyond.

21. Formally identify the area of computer aided project monitoring and documentation as a Center interest area.

# APPENDIX A

## COMPUTER-BASED LEARNING TERMS

# APPENDIX A

## COMPUTER-BASED LEARNING TERMS

**Analysis**

A process of determining the scope and nature of instructional materials required to satisfy a given set of training needs. Training requirements and the instructional program are defined. Existing materials are surveyed, and the design and development effort are planned. One of the phases in the ISD process. The others are design, development, implementation and evaluation.

**Animation**

The apparent movement of objects on a CRT. Characters can be drawn, selectively erased and repositioned to produce animation. Animation can aid understanding through illustrating, and helps aid recall by highlighting steps in processes. It is an essential element of an equipment simulation. For example a needle of a gauge moving realistically.

**CAI**

Abbreviation for Computer Assisted Instruction. The use of a computer to deliver instruction. Modes of CAI are drill and practice, modeling, tutorial and simulation. This is the preferred term. The same as CAT and CAL. CAI, along with CMI and CSLR are the components of CBL.

CBL

Abbreviation for Computer-based Learning. CBL is the umbrella term which includes all forms of use of computers in support of learning. The components of CBL are CAI, CMI and CSLR. CBL has been defined as, "anytime a person and a computer come together and one of them learns something."

CMI

Abbreviation for Computer Managed Instruction. The aspect of CBL which includes testing, prescription generation and record keeping. CMI, along with CAI and CSLR are the components of CBL.

Courseware

Term used to describe those computer application programs, as well as other media such as texts and video, which support educational objectives. Computer courseware is a special form of "software."

CSLR

Abbreviation for Computer Supported Learning Resources. A computer supported learning resource is any form of computer support or function which supports learning other than those which teach (CAI) or test, prescribe or keep records (CMI). A CSLR is often a data base, similar in purpose to a traditional non-computer learning resource the library. CSLR, along with CAI and CMI are the components of CBL. Compare with CAI and CMI.

Designer

The member of an instructional development group who specializes

in design activities. In small groups this may be only one of the tasks performed by a single person.

Developer

The member of an instructional development group who specializes in development activities. In small groups this may be only one of the tasks performed by a single person.

Ergonomics

The science of humanizing "technology." Also called human factors. In general, the design of equipment based on the human body so that people are comfortable working. In Computer-based Learning, those aspects of terminal or CBL course material which were included to make it easy for people to use.

HRD

Abbreviaio@ for Human Resource Development. A series of organized activities, conducted within a specified time and designed to produce the possibility of behavioral change. HRD activities include training, education and development.

Individualized Instruction

A form of instruction where the learner is only taught the material which is not already known, rather than everything in a specified curriculum as is the case with traditional instruction. A computer-based learning terminal is an inherently individually oriented device. A CBL system has the power necessary to administer individualized instruction, and it is almost always

conducted in that format.

Module

A unit of instruction. Usually a module is constructed to teach one specific thing. Modules can be assembles to form complete courses and curricula.

SME

Abbreviation for Subject Matter Expert. The person familiar with the content of instruction to be developed, who works with others on the design of instruction for CBL delivery.

# APPENDIX B

## LIST OF PARTICIPANTS

# APPENDIX B

## LIST OF PARTICIPANTS

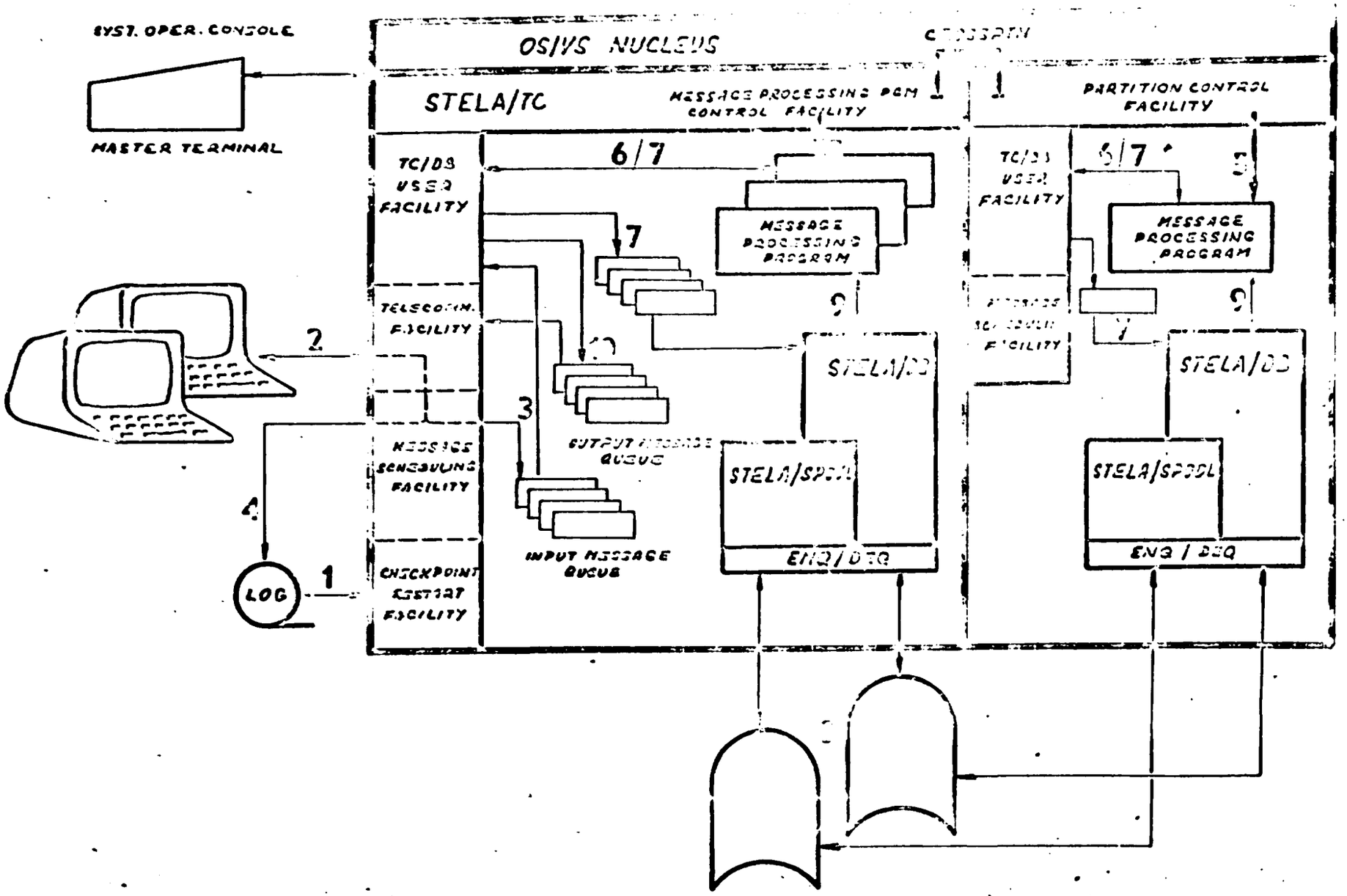
The persons, listed below in alphabetical order, provided information during the course of the project DP/CZE/80/001.

| Name | Title | Organization |
|---|---|---|
| Ing. Ján Bilička | Deputy Manager, Computer Methods Department | East Slovakia Iron Works, Košice |
| Ing. Ladislav Bureš | Manager, Dept. for Management and Computer Technique | East Slovakia Iron Works, Košice |
| Ladislav Cifka, M.Sc. | Senior Advisor | INORGA, Prague |
| Ing. Josef Dobřický | Head, CAD/CAPP Dept. | VÚSTE, Prague |
| Miroslav Dub, Ph.D. | Chief, CAM | VÚSTE, Prague |
| Mr. Václav Gafron | Senior Scientist | INORGA Experimental Laboratory, Krč |
| Mr. Kříž | Director of the Office of the Minister | Ministry of Metallurgy and Heavy Engineering |
| Ing. Jan Kroužek, CSc. | National Project Manager | INORGA, Prague |
| Mr. Miloslav Martinek | DP Asst. Manager | INORGA, Prague |
| B. Mikušiková | Asst. Project Director | VÚSTE, Prague |
| J. Novák | Educ. Research Worker | VÚSTE, Prague |
| Ing. Augustin Pullmann | Chief Project Designer | East Slovakia Iron Works, Košice |
| Ing. Ján Raposš | UNIDO Project Director | VÚSTE, Prague |
| Mr. Ján Šaffa | Head, Staff Training | East Slovakia Iron Works, Košice |
| RNDr. Jan Sedlák, CSc. | R&D Section | INORGA, Prague |
| Ing. Dagmar Trkalová | Director | INORGA, Prague |
| Mr. Stanislav Tomko | Programmer | INORGA, Košice |
| Mr. Atilla Toth | Senior Programmer/ Team Leader | INORGA, Košice |
| Ing. Jitka Urbanová | Chief of Education | VÚSTE, Prague |
| Mr. Jiří Zaloudek | Advisor to the General Director | Škoda, Pilseň |

Note: Additional brief contacts at Skoda, Pilsen and East Slovakia Iron Works, Kosice are not identified by name.

# APPENDIX C

## STELA DIAGRAM


SYST. OPER. CONSOLE
MASTER TERMINAL
OS/VS NUCLEUS
STELA/TC
MESSAGE PROCESSING PGM CONTROL FACILITY
PARTITION CONTROL FACILITY
TC/DS USER FACILITY
TELECOMM. FACILITY
MESSAGE SEQUENCING FACILITY
CHECKPOINT RESTART FACILITY
LOG
MESSAGE PROCESSING PROGRAM
OUTPUT MESSAGE QUEUE
INPUT MESSAGE QUEUE
STELA/DB
STELA/SPOOL
ENQ / DEQ
1
2
3
4
5
6/7
7
8
9

# APPENDIX D

## SAMPLE MAINTENANCE MANAGEMENT PRINTOUTS

PLAN INSPEKCNYCH CINNOSTI S INSP.KARTAMI UTF02121

ZAVOD A OS.CIS. 003089 DRUH I ZAC.PL.OBD. 830822 MENO IT. KARCH

| Cis.cyklu | Nazov OUS | Po | Ut | St | Stv | Pia |
|---|---|---|---|---|---|---|
| BTHAA_009 | DOPRAVNY PAS S299 | | | 001 09 | | |
| BTHAAM017 | DOPRAVNY PAS S299 | | | | | 001 17 |
| BTHAA6016 | DOPRAVNY PAS S299 | | | | | 001 16 |
| BT2AAM017 | DOPRAVNY PAS S98 | | | 001 17 | | |
| BT2AA6016 | DOPRAVNY PAS S98 | | | 001 16 | | |
| BT3AAM017 | DOPRAVNY PAS S99 | | | | 001 17 | |
| BT3AA6016 | DOPRAVNY PAS S99 | | | | 001 16 | |
| BT5AAM017 | DOPRAVNY PAS S399 | | 001 17 | | | |
| BT5AA2008 | DOPRAVNY PAS S399 | | | 001 08 | | |
| BT5AA6001 | DOPRAVNY PAS S399 | | | 001 01 | | |
| BT5AA6016 | DOPRAVNY PAS S399 | | 001 16 | | | |
| BT7AAR010 | DOPRAVNY PAS S100 | | | | | 002 19 |
| BT7AA7007 | DOPRAVNY PAS S100 | | | | | 002 07 |
| BT8AAH008 | DOPRAVNY PAS S200 | 002 08 | | | | |
| BT8AAK006 | DOPRAVNY PAS S200 | 002 06 | | | | |
| BT8AAR010 | DOPRAVNY PAS S200 | 002 10 | | | | |
| BT8AA6012 | DOPRAVNY PAS S200 | 002 12 | | | | |
| BT8AA7007 | DOPRAVNY PAS S200 | 002 07 | | | | |
| BT9AA6006 | DOPRAVNY PAS S300 | | | | 003 06 | |
| BUAAA6006 | DOPRAVNY PAS S400 | | | | 003 06 | |

VSZ N.P. KOSICE ROZPIS MATERIALU A NAHRADNYCH DIELOV SPRACOVANE 23.08.1983/11.07 # 3

ZACIATOK OPRAVY 830818
KONIEC OPRAVY 830818

CIS ZAK.- PR.PR.- ZDR.OP. RT4AAAB001 001 01
C.ZAK.ST - NAZOV OUS DOPRAVNY PAS S299

| C.OPER | NAZOV OPERACIE | C.MAT. A ND | M.J. | MNOZSTVO P | MNOZSTVO S | VAHA KG | CENA KCS | SKLAD | ZMENY VYHODNOT. |
|---|---|---|---|---|---|---|---|---|---|
| 01 | GUMA STIERACA - VYMENA | 20X200X800 | 33 | 1.0 | | 0.000 | 0.00 | | |
| 02 | DRZIAK - VYMENA | 9910616002000 | 60 | 2.0 | | 2.000 | 38.00 | | |
| 03 | VALCEK HORNY - VYMENA | FI108X300 | 60 | 20.0 | | 0.000 | 0.00 | | |
| 03 | | 9910330000000 | 00 | 20.0 | | 60.000 | 2260.00 | | |
| 04 | VALCEK SPODNY - VYMENA | FI108X900 | 60 | 10.0 | | 0.000 | 0.00 | | |
| 04 | | 9910390000000 | 00 | 10.0 | | 60.000 | 1700.00 | | |
| 05 | TELESO VYSYPKY - OPRAVA ZVARAN | PL10 | 60 | 4.0 | | 0.000 | 0.00 | | |
| 05 | | 9020303585000 | 00 | 4.0 | | 0.000 | 0.00 | | |
| 07 | CLONA ZADNA - VYMENA | GUMA10 | 33 | 1.0 | | 0.000 | 0.00 | | |
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| 17 | | 9911990000000 | 00 | 2.0 | | 90.000 | 1856.00 | | |

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C.ZAK.ST - NAZOV OUS  DOPRAVNY PAS S299

NAZOV ZAKAZKY  BO - DOPRAVNY PAS S299
NAZOV PRAC.PRIKAZU  S 299
NAZOV ZDRUZ.OPER  S 299

| ZACIATOK OPRAVY | 830818 | OD | HOD | KONIEC OPRAVY | 830818 | OD | HOD | TRVANIE V HOD |
|---|---|---|---|---|---|---|---|---|
| NAJSKOR MOZNY ZAC.OPRAVY | 830818 | OD | HOD | NUTNY KONIEC OPRAVY | 830818 | OD | HOD | |

| PC | C.OPER | NAZOV | C.NOR | PROF | PT | KOD | POC | PRACOV. P | PRACOV. S | SUCET NH | SUCET KCS | TC | MK |
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| 02 | 02 | DRZIAK - VYMENA | Z0244 | 39 | 6.0 | X6 | 21 | 21 | | 0.9 | 9.8 | 20 | 3 |
| 03 | 03 | VALCEK HORNY - VYMENA | Z1201 | 39 | 5.5 | X6 | 201 | 21 | | 4.8 | 49.2 | 20 | 3 |
| 04 | 04 | VALCEK SPODNY - VYMENA | Z1205 | 39 | 5.5 | X6 | 101 | 21 | | 4.8 | 49.2 | 20 | 3 |
| 05 | 05 | TELESO VYSYPKY - OPRAVA ZVARANIM | Z2958 | 45 | 7.0 | 4J | 41 | 11 | | 3.3 | 40.9 | 20 | 3 |
| 06 | 06 | BOCNICA - OPRAVA ZVARANIM | Z2686 | 45 | 7.0 | 4J | 21 | 11 | | 1.6 | 19.8 | 20 | 3 |
| 07 | 07 | CLONA ZADNA - VYMENA | Z0235 | 39 | 6.0 | X6 | 11 | 21 | | 0.4 | 4.3 | 20 | 3 |
| 08 | 08 | GUMA - VYMENA | Z0257 | 39 | 5.5 | X6 | 21 | 21 | | 1.6 | 16.4 | 20 | 3 |
| 09 | 09 | DRZIAK - PRIVARIT | Z2565 | 45 | 7.0 | E2 | 21 | 11 | | 0.4 | 4.9 | 20 | 3 |
| 10 | 10 | PREVODOVA SKRINA - KONTROLA A DOPLNENIE | Z4421 | 49 | 4.0 | 6A | 11 | 11 | | 0.4 | 3.4 | 20 | 3 |
| 11 | 11 | KRYT OCHRANNY - OPRAVA A MONTAZ | Z1661 | 39 | 5.5 | 2C | 11 | 21 | | 0.4 | 4.1 | 20 | 3 |
| 12 | 12 | KRYT OVHRANNY - OPRAVA A MONTAZ | Z1665 | 39 | 5.5 | 2C | 11 | 21 | | 0.4 | 4.1 | 20 | 3 |
| 13 | 13 | LOZISKOVY DOMCEK - OTVORIT A ZAVRIET | Z2359 | 39 | 6.0 | 40 | 21 | 21 | | 0.9 | 9.8 | 20 | 3 |
| 14 | 14 | LOZISKOVY DOMCEK - OTVORIT A ZAVRIET | Z2356 | 39 | 6.0 | 40 | 21 | 21 | | 0.9 | 9.8 | 20 | 3 |
| 15 | 15 | LOZISKOVY DOMCEK - OTVORIT A ZAVRIET | Z2357 | 39 | 6.0 | 40 | 21 | 21 | | 0.9 | 9.8 | 20 | 3 |
| 16 | 16 | LOZISKOVY DEMCEK - OTVORIT A ZAVRIET | Z2329 | 39 | 6.0 | 40 | 21 | 21 | | 0.9 | 9.8 | 20 | 3 |
| 17 | 17 | VALEC PREVADZACI - VYMENA A USTAVENIE | Z1940 | 39 | 6.5 | 2J | 21 | 31 | | 4.8 | 55.9 | 20 | 3 |

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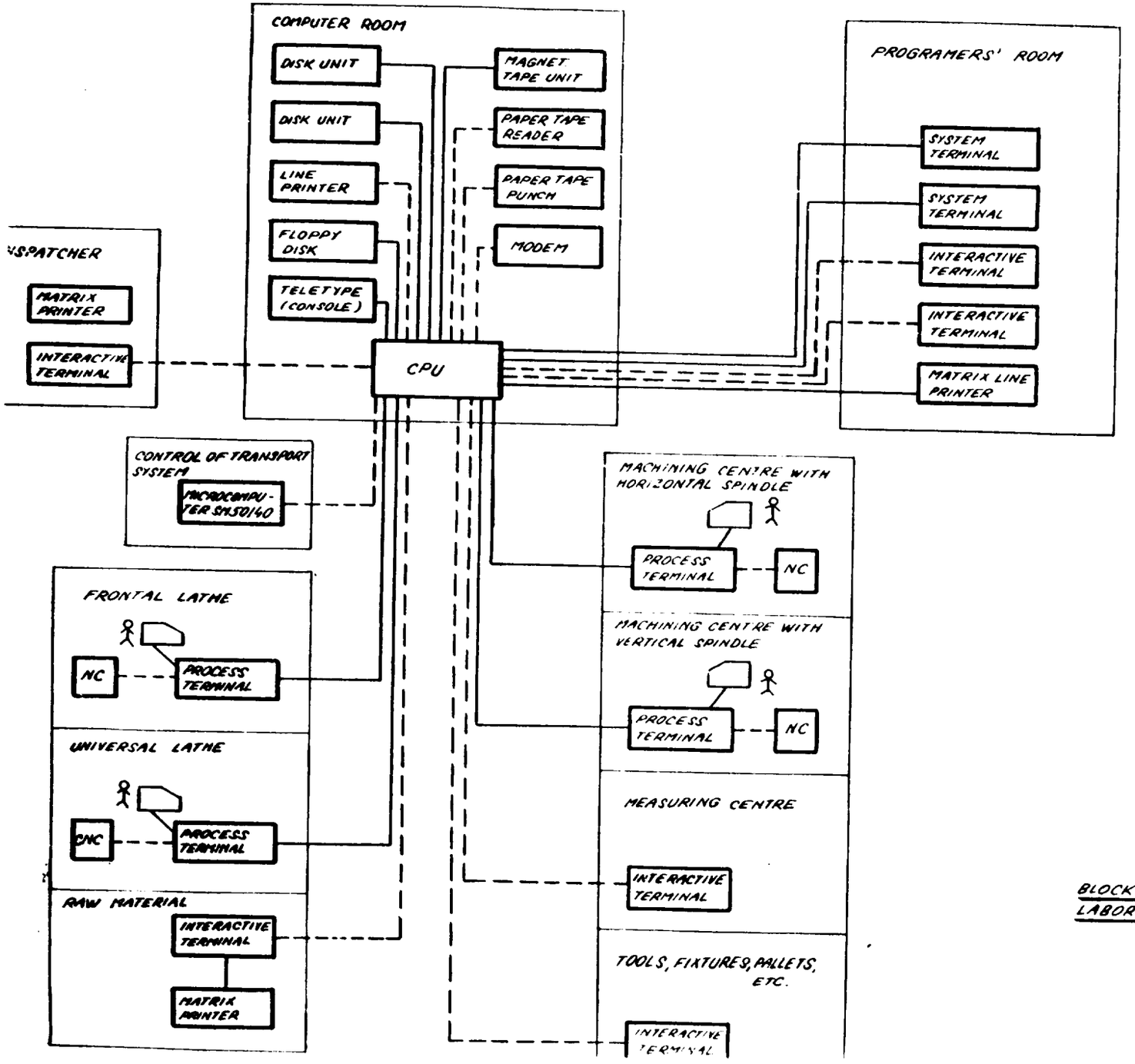
| OPRAV.ORG | ZASTUPCA | MENO ZVAR | ZACATIE | UKONCENIE |
|---|---|---|---|---|
| | | | | |

| DO OPRAVY ODOVZDAL / PREVZAL | ODPRAC.HOD | NA OPRAVE / NA PRIPRAVE | PO OPRAVE ODOVZDAL / PREVZAL |
|---|---|---|---|
| | | | |

| INSP.ZAMOCNIK | MAJSTER | NACELNIK OPRAVY | POZNAMKA |
|---|---|---|---|
| | | | |

# APPENDIX E

## VUSTE CAM LABORATORY

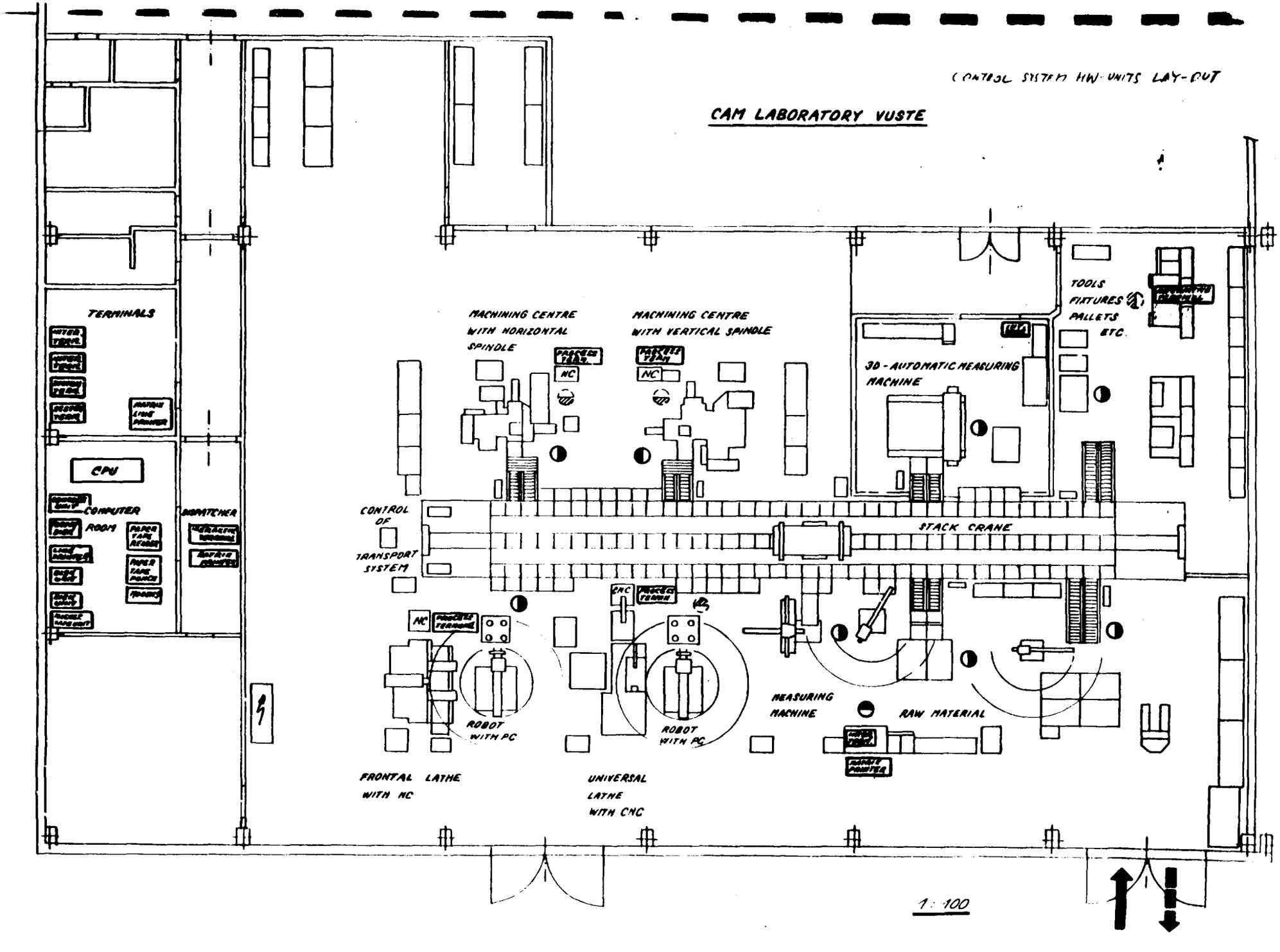



CENTRAL PROCESSING UNIT - SIEMENS R30K
TELETYPE - CONSOLE - -"- 3914
FLOPPY DISK UNIT - -"- 3944
DISK UNIT - -"- 3941
MAGNET TAPE UNIT - -"-
MATRIX LINE PRINTER - -"- 3915
LINE PRINTER - VDT 27090 (HUNGARY)
PAPER TAPE READER - FS 1503 (ČSSR)
PAPER TAPE PUNCH - DT 105S (POLAND)
MODEM - ZPD 1200 Bd (ČSSR)
TERMINALS
- SYSTEM - SIEMENS 3974R
- AROCESS - -"- 3821
- INTERACTIVE SM 7202 (ČSSR)
VT 52100 (HUNGARY)
MATRIX PRINTER - C 2113 (ČSSR)
CONTROL OF TRANSPORT SYSTEM - MICROCOMPUTER SM50/40 (ČSSR)

BLOCK DIAGRAM OF HW IN CAM LABORATORY VUSTE

CONTROL SYSTEM HW-UNITS LAY-OUT

# CAM LABORATORY VUSTE

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# APPENDIX F

## POSITION DESCRIPTIONS

# APPENDIX F

## POSITION DESCRIPTIONS

CODE: A-01

POSITION: MANAGER

DESCRIPTION:

This position is the focal point for management responsibility for all aspects of Center operations. All of the usual managerial functions are involved. Additionally, the manager will arrange the elements of coordination with other organization, as well as training and consultations. The manager will negotiate contracts for services with client organizations based on professional knowledge.

BACKGROUND AND EXPERIENCE:

The manager should have experience in the management of an organization or functional area within an organization. Additionally, expertise in computers, metallurgy, economics, and international relations are very desirable. Experience in the procedures of UNDP and UNIDO, as well as experience in preceding projects would be ideal.

EDUCATIONAL REQUIREMENT:

Ph.D.

LANGUAGE REQUIREMENT:

English required.

Additional language desirable.

CODE: F-01

POSITION: Specialist - Production Control and Maintenance Management

DESCRIPTION:

This professional position is responsible for transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation. The incumbent will also be required to actively contract with clients for Center products and services.

In later phases of Center growth this incumbent will lead the maintenance management specialist group.

BACKGROUND AND EXPERIENCE:

This position, one of two similar positions in minimal and recommended Phase I staffing configurations is distinguished by a metallurgy background. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems. The incumbent must have the necessary background to be the Center resident for maintenance management technology and application.

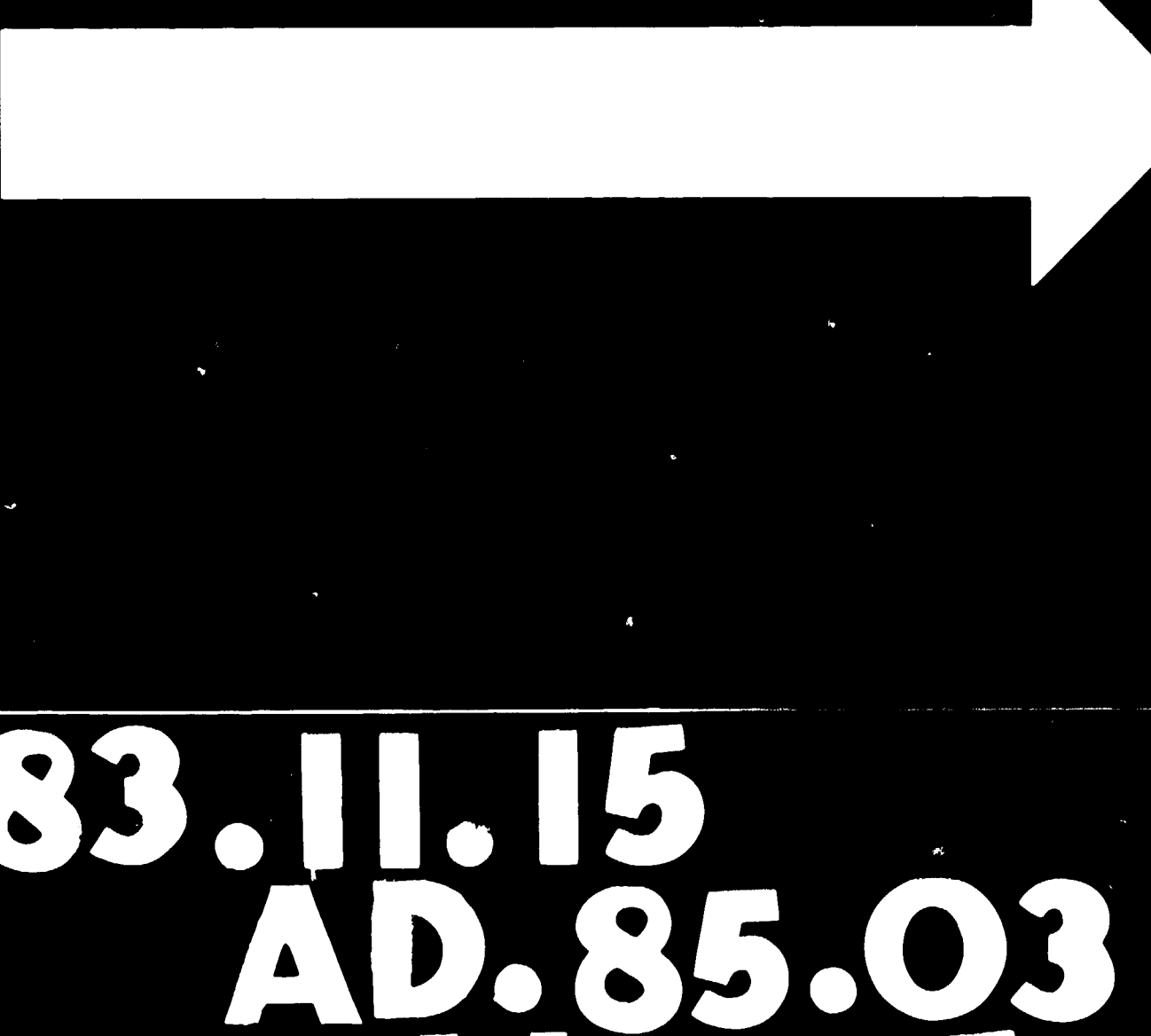
EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.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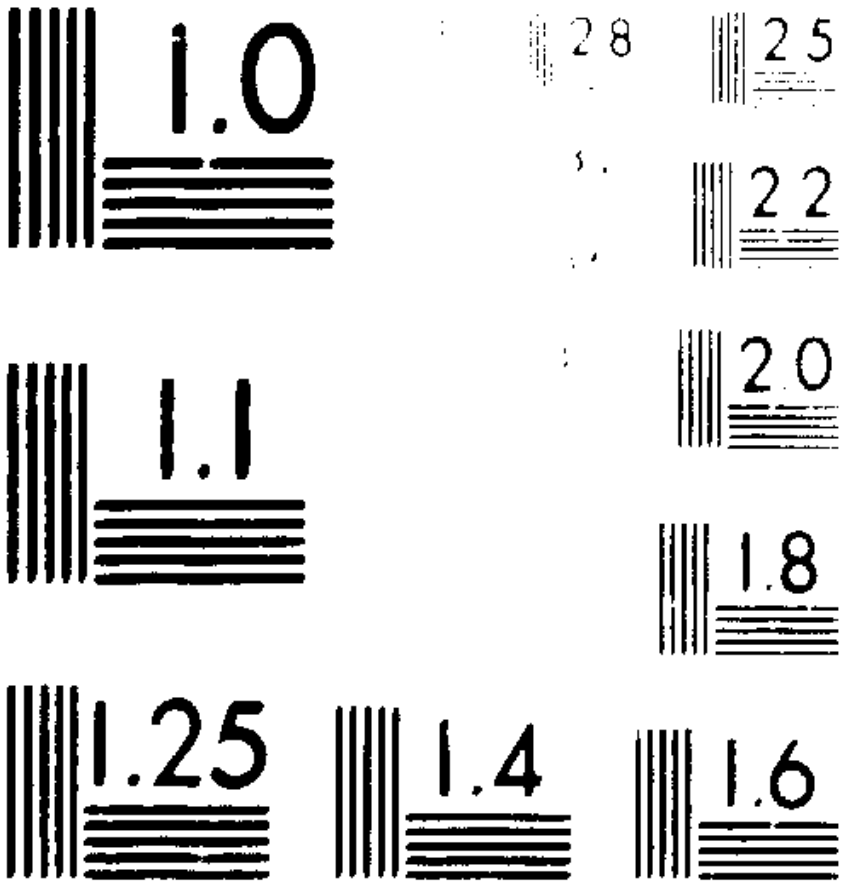
1.0
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1.8
1.25
1.4
1.6

CODE: F-02

POSITION: Specialist - Production Control and Maintenance Management

DESCRIPTION:

This professional position is responsible for transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation. The incumbent will also be required to actively contract with clients for Center products and services. In later phases of Center growth this incumbent will lead the production control specialist group. In the minimal Center staffing configuration, this incumbent will act as the Center resident for CAD/CAM systems technology and application.

BACKGROUND AND EXPERIENCE:

This position, one of two similar positions in minimal and recommended Phase I staffing configurations is distinguished by an engineering background. The incumbent must be acquainted with, and experienced in, the technology of metallurgy, process control systems. The incumbent must have the necessary background to be the Center resident for maintenance management technology and application. Experience or familiarity with CAD/CAM is a requirement if the minimal staffing configuration is used.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required, additional language required.

CODE: F-03

POSITION: Functional Specialist - CAD/CAM

DESCRIPTION:

This professional position is responsible for transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation. The incumbent will also be required to actively contract with clients for Center products and services. Due to the emergent nature of CAD/CAM this position will require considerable research, and monitoring of what is accomplished outside of the Center.

In later phases of Center growth this incumbent will lead the CAD/CAM specialist group.

BACKGROUND AND EXPERIENCE:

This position, one of three similar positions in the recommended Phase I staffing configurations is distinguished by expertise in CAD/CAM. The incumbent must be acquainted with, and experienced in, the technology of metallurgy, process control systems. The incumbent must have the necessary background to be the Center resident for CAD/CAM technology and application.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-04

POSITION: Functional Specialist - Maintenance Management Technical

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the maintenance management specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of two similar positions in recommended Phase II staffing configurations is distinguished by more experience than the second position. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-05

POSITION: Functional Specialist - Maintenance Management Technical

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the maintenance management specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of two similar positions in recommended Phase II staffing configurations is distinguished by less experience than the second position. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-06

POSITION: Functional Specialist - Maintenance Management Technical Control

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, and software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the maintenance management specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of several positions implemented in the recommended Phase II staffing configuration is a specialist in the group. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-07

POSITION: Functional Specialist - Maintenance Management Systems/ STELA

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, and software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the maintenance management specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of several positions implemented in the recommended Phase II staffing configuration is the systems specialist in the maintenance management group. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-08

POSITION: Functional Specialist - CAD/CAM

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, and software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the maintenance management specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of several positions implemented in the recommended Phase II staffing configuration is an addition to the growing CAD/CAM group. This position requires experience in CAD/CAM applications. Experience or understanding of CAD/CAM - robot interfacing is a plus. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-09

POSITION: Functional Specialist - Production Control Technical

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the production control specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of two similar positions in recommended Phase III staffing configurations is distinguished by more experience than the second position. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and production control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-10

POSITION: Functional Specialist - Production Control Technical

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the production control specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of two similar positions in recommended Phase III staffing configurations is distinguished by less experience than the first position. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and production control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-11

POSITION:

Functional Specialist - Production Control Technical Control

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the production control specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of several positions in the recommended Phase III staffing configuration is a specialist in the production control group. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and production control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-12

POSITION:

Functional Specialist - Production ControlSystems

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the production control specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of several positions in the recommended Phase III staffing configuration is a systems specialist in the production control group. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and production control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: F-13

POSITION: Functional Specialist - CAD/CAM

DESCRIPTION:

This professional position is engaged in the transfer of Center documentation, and software to clients. The position requires the ability to conduct training, as well as problem solving consultation.

This incumbent works under the supervision of the maintenance management specialist group leader.

BACKGROUND AND EXPERIENCE:

This position, one of several positions implemented in the recommended Phase III staffing configuration is an addition to the CAD/CAM group. This position requires experience in CAD/CAM applications. Experience or understanding of CAD/CAM - robot interfacing is a plus. The incumbent must be acquainted with, and experienced in, the technology of metallurgy and process control systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language required.

CODE: T-01

POSITION: Training Specialist - Organization and Delivery

DESCRIPTION:

The incumbent in this position is responsible for the organization and delivery of Center training events. Responsibilities extend to all aspects of preparation and logistics of delivery, regardless of location. The incumbent is also responsible for Center involvement with fellowship and study tours, both in Czechoslovakia and abroad. The position requires the ability to plan and conduct training. The incumbent will also be required to actively contract with clients for Center training products and services.

This incumbent will work under the supervision of the training group leader.

BACKGROUND AND EXPERIENCE:

This position, is one of two training group positions in minimal and recommended Phase 1 staffing configurations. The incumbent must be acquainted with, and experienced in production and process control systems. Ideally, the incumbent will also be familiar with metallurgy. The incumbent must have the necessary background to be the Center resident for CBL technology.

EDUCATIONAL REQUIREMENT:

Batchelor or MS

LANGUAGE REQUIREMENT:

English required.

One additional language required.

CODE: T-02

POSITION: Training Specialist - CBL Technology

DESCRIPTION:

The incumbent in this position analyzes, designs, develops, and evaluates computer-based training programs. The position requires the ability to plan and conduct training. The incumbent will also be required to actively contract with clients for Center training products and services. In the minimal Center staffing configuration, this incumbent will act as the Center resident for CBL systems technology and application.

This incumbent will lead the training group.

BACKGROUND AND EXPERIENCE:

This position, one of two training group positions in minimal and recommended Phase I staffing configurations is the primary CBL expert. The incumbent must possess experience or familiarity with computer-based training programs. The incumbent must be acquainted with, and experienced in production and process control systems. Ideally, the incumbent will also be familiar with metallurgy. The incumbent must have the necessary background to bc the Center resident for CBL technology.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language desirable.

CODE: T-03

POSITION: Training Specialist - CBL Systems

DESCRIPTION:

The incumbent in this position analyzes, designs, develops, and evaluates computer-based training programs. The position requires the ability to plan and conduct training. The incumbent will also be required to actively contract with clients for Center training products and services. This incumbent will act as the Center resident for CBL systems.

This incumbent will work under the supervision of the training group leader.

BACKGROUND AND EXPERIENCE:

This position, a training group positions in recommended Phase II staffing configurations is the primary CBL systems expert. The incumbent must possess experience or familiarity with Micro and Mini computer systems and computer-based training systems. The incumbent must be acquainted with, and experienced in production and process control systems. Ideally, the incumbent will also be familiar with metallurgy. The incumbent must have the necessary background to be the Center resident for CBL systems.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language desirable.

CODE: T-04

POSITION: Training Specialist - CBL Programmer

DESCRIPTION:

The incumbent in this position programs CBL training materials. Additionally, the incumbent will be called upon to participate in the analysis, design, development, and evaluation of computer-based training programs.

This incumbent will act as the Center resident for programmerless authoring systems.

This incumbent will work under the supervision of the training group leader.

BACKGROUND AND EXPERIENCE:

This position, a training group positions in recommended Phase II staffing configurations is the training group's primary CBL programmer. The incumbent must possess experience or familiarity with CBL programming languages for both central and micro computer-based training systems. The incumbent will also be familiar with developments and products for programmerless CBL authoring. Ideally, the incumbent will also be familiar with metallurgy.

EDUCATIONAL REQUIREMENT:

BS

LANGUAGE REQUIREMENT:

Additional language desirable.

CODE: T-05

POSITION: Training Specialist - Course Design

DESCRIPTION:

The incumbent in this position analyzes, designs, develops, and evaluates multi-media training programs. The position requires the ability to plan and conduct training. The incumbent will also be required to actively contract with clients for Center training products and services. This incumbent will act as the Center resident for course design.

BACKGROUND AND EXPERIENCE:

This position, one of several training group positions in recommended Phase III staffing configurations is the training group's primary course designer. The incumbent must possess experience or familiarity with computer-based training programs. The incumbent must be acquainted with, and experienced in production and process control systems. Ideally, the incumbent will also be familiar with metallurgy. The incumbent must have the necessary background to be the Center resident course design.

EDUCATIONAL REQUIREMENT:

MS

LANGUAGE REQUIREMENT:

English required.

Additional language desirable.

CODE: A-02

POSITION: Accountant

DESCRIPTION:

This incumbent carries out the complete monetary functions of the Center. Requirements of the position include bookkeeping and budgeting. The incumbent places and monitors orders for all Center supplies. The incumbent uses office automation equipment in the course of performing regular duties.

This position includes additional duties as the Center public relations person.

The incumbent supervises an accounting clerk in Phase III of center growth.

BACKGROUND AND EXPERIENCE:

Formal training and experience in accounting are required. Practical experience is required in the funding and procurement of material for projects. The incumbent must have a knowledge of economic regulations. Experience or familiarity with use of office automation equipment in the accounting function is desirable.

EDUCATIONAL REQUIREMENT:

Batchelor or MS

LANGUAGE REQUIREMENT:

English desirable.

CODE: A-03
POSITION: Office Manager

DESCRIPTION:

This incumbent works independently to process the documents and documentation produced by the Center. The position includes work with the assistance of computer resources. The incumbent uses office automation application programs in the normal course of duties. The position will require familiarity with office automation application programs used by either the office or accounting function. The incumbent uses common office machines and is familiar with Roman and Cyrillic typewriters. The position also performs Center librarian function.

The incumbent supervises other office employees in Phase II and III.

BACKGROUND AND EXPERIENCE:

Experience with the use of office automation equipment for data entry retrieval is desired. Knowledge of typing is required.

EDUCATIONAL REQUIREMENT:

High school education.

LANGUAGE REQUIREMENT:

English desirable.

CODE: A-04

POSITION: Typist

DESCRIPTION:

The incumbent keyboards the documents and documentation produced by the Center. The position requires use of office automation applications or electric or manual typewriters. The incumbent uses common office machines and Roman and Cyrillic typewriters.

The incumbent works under the supervision of the office manager.

BACKGROUND AND EXPERIENCE:

Experience and/or formal training in Typing and office procedures.

EDUCATIONAL REQUIREMENT:

Formal training in Typing and office procedures.

LANGUAGE REQUIREMENT:

Additional language desirable.

CODE A-05

POSITION: Accounting Clerk

DESCRIPTION:

The incumbent carries out accounting functions including bookkeeping. The position involves use of office automation equipment in the course of performing regular duties.

The incumbent works supervision of the Center Accountant.

BACKGROUND AND EXPERIENCE:

Formal training and experience in accounting.

EDUCATIONAL REQUIREMENT:

High school education. Formal training and experience in accounting.

LANGUAGE REQUIREMENT:

Additional language desirable.

CODE: A-06

POSITION: Typist/File Clerk

DESCRIPTION:

The incumbent keyboards the documents and documentation produced by the Center. The position requires use of common office machines, office automation applications, electric or manual typewriters, and familiarity with Roman and Cyrillic typewriters. The incumbent creates and maintains files.

BACKGROUND AND EXPERIENCE:

Experience and/or formal training in Typing, filing and office procedures.

EDUCATIONAL REQUIREMENT:

Formal training in Typing, filing and office procedures.

LANGUAGE REQUIREMENT:

Additional language desirable.

CODE: A-07

POSITION: Driver/Maintenance Person

DESCRIPTION:

The incumbent is the primary operator for the vehicles assigned to the Center. This involves pick-up and delivery of personnel and equipment as needed, both in the Center's location and distant parts of Czechoslovakia. The incumbent will convey information and messages to foreign visitors to the Center independently of other staff members. The position requires use of vehicles common to the region. The incumbent performs routine maintenance of the vehicles and other equipment assigned to the Center. The incumbent also routinely sets up and takes down small equipment used by the Center as required, without assistance of other staff members.

BACKGROUND AND EXPERIENCE:

Professional experience driving a passenger vehicle is required.

EDUCATIONAL REQUIREMENT:

Formal training in driving required. Chauffer's license, or equivalent certification according to the laws of Czechoslovakia is required.

LANGUAGE REQUIREMENT:

English required. Additional language required.

# APPENDIX G

## CENTER PHYSICAL REQUIREMENTS

# APPENDIX G

## CENTER PHYSICAL REQUIREMENTS

The following Center physical requirements for rooms and their appurtenant details of furniture and furnishings are described in this appendix:

Manager's Office

Administrative Office

Functional Specialist's Office

Functional Specialist's Office

CBL Author Office

Multi-media Learning Center

Training Classroom

Utility and Storage Room

Overflow Space

These listings are applicable for the minimum and Phase I staff and equipment configurations.

## Managers Office

Size: 20 $m^2$

Occupied by: Manager A-01

1 - Airconditioner
1 - Ashtray, pedestal
N - Blinds (one per window)
1 - Bulletinboard
1 - Cabinet, low
1 - Cabinet, tall
1 - Cabinet, steel
1 - Cabinet, Steel with glass
1 - Cabinet, tall with multiple shelves
1 - Carpet, wall to wall
4 - Chair, guest
10 - Chair, meeting
1 - Chair, Manager's executive type
1 - Coatrack
1 - Coffee Maker, small
1 - Cup and saucer set, guest, sugar and creamer set for 6
1 - Cupboard, wood tall
N - Curtains
N - Curtain Rods
1 - Desk, manager's double pedestal
1 - Fire Extinguisher
1 - First Aid Kit
1 - Flag set pair, United Nations and Czechoslovak
1 - Intercom Set
N - Lighting, central indirect
1 - Light, desk
1 - Magnetic board
1 - Map, world
1 - Picture Set, Czechoslovak Leadership
3 - Plants, live in planter
1 - Overhead projector
1 - Safe (or fire resistant file cabinet with combination lock)
1 - Screen, projection
1 - Smoke and fire detector
1 - Sofa
1 - Stand, folding, flipchart
1 - Table, small utility
1 - Table, coffee
2 - Table, extension (to combine with meeting table for conference)
1 - Table, meeting
1 - Table, Telephone
1 - Table, typewriter

1 - Telephone
1 - Typewriter, portable
N - Valence
1 - Wardrobe with shelves and doors
1 - Wastebasket, steel

## Administrative Office

Size: 25 $m^2$

Occupied by: Accountant A-02
Office Manager A-03

1 - Airconditioner
1 - Ashtray, pedestal
1 - Ashtray, table
N - Blinds (one per window)
1 - Bulletinboard
1 - Cabinet, tall
1 - Cabinet, tall with multiple shelves
1 - Carpet, wall to wall
4 - Chair, office, with arms
7 - Chair, guest
1 - Coatrack
1 - Coffee Maker, small
1 - Computer, personal with disk drives
1 - Cup and saucer set, sugar and creamer set for 6
1 - Cupboard, wood tall
1 - Cupboard, wood with glass
N - Curtains (one per window)
N - Curtain Rods (one per window)
3 - Desk, single pedestal
1 - Electric Distribution Panel with circuit breakers
1 - Electric extension cable set
3 - File cabinets
1 - Fire Extinguisher
1 - First Aid Kit
1 - Hotplate
1 - Insulated pad (for hotplate)
2 - Intercom Set
N - Lighting, central indirect
1 - Magnetic board
1 - Medicine Cabinet
1 - Mirror
1 - Monitor, personal computer
3 - Plants, live in planter
1 - Photocopier
1 - Printer, personal computer
3 - Shelves
1 - Smoke and fire detector
1 - Steel Cabinet
1 - Steel Cabinet with glass doors
1 - Table, long, work
1 - Table, coffee
1 - Table, personal computer

1 - Table, printer personal computer

Administrative Office (continued)

1 - Table, photocopier
2 - Table, Telephone
2 - Telephone
1 - Teletype set
1 - Typewriter, desk with changeable font element and memory
1 - Typewriter, portable
1 - Typewriter, portable Cyrillic Font
N - Valence
3 - Wastebasket, steel

## Functional Specialist Office

Size: 16 $m^2$

Occupied by: F-01
F-02

1 - Airconditioner
2 - Ashtray, pedestal
N - Blinds (one per window)
1 - Bulletinboard
1 - Cabinet, tall
1 - Cabinet, with multiple shelves
1 - Carpet, wall to wall
2 - Chair, office with arms
3 - Chair, meeting
1 - Coatrack
1 - Coffee Maker, small
1 - Cup and saucer set, sugar and creamer set for 6
1 - Cupboard, wood tall
1 - Cupboard, wood with glass
N - Curtains (one per window)
N - Curtain Rods (one per window)
2 - Desk, single pedestal
1 - Electric Distribution Panel with circuit breakers
2 - File Cabinet
1 - Fire Extinguisher
1 - First Aid Kit
2 - Intercom Set
N - Lighting, central indirect
1 - Magnetic board
1 - Mirror
2 - Plants, live in planter
2 - Shelving
1 - Smoke and fire detector
1 - Stand, flipchart
1 - Steel Cabinet
1 - Steel Cabinet with glass doors
1 - Table, long
2 - Table, small
2 - Table, Telephone
2 - Telephone
1 - Typewriter, desk with changeable font element
1 - Typewriter, portable
N - Valence (one per window)
2 - Wastebasket, steel

## Functional Specialist Office

Size: 16 $m^2$

Occupied by: T-01
T-02

1 - Airconditioner
2 - Ashtray, pedestal
N - Blinds (one per window)
1 - Bulletinboard
1 - Cabinet, tall
1 - Cabinet, with multiple shelves
1 - Carpet, wall to wall
2 - Chair, office with arms
3 - Chair, meeting
1 - Coatrack
1 - Coffee Maker, small
1 - Cup and saucer set, sugar and creamer set for 6
1 - Cupboard, wood tall
1 - Cupboard, wood with glass
N - Curtains (one per window)
N - Curtain Rods (one per window)
2 - Desk, single pedestal
1 - Electric Distribution Panel with circuit breakers
2 - File Cabinet
1 - Fire Extinguisher
1 - First Aid Kit
2 - Intercom Set
N - Lighting, central indirect
1 - Magnetic board
1 - Mirror
2 - Plants, live in planter
2 - Shelving
1 - Smoke and fire detector
1 - Stand, flipchart
1 - Steel Cabinet
1 - Steel Cabinet with glass doors
1 - Table, long
2 - Table, small
2 - Table, Telephone
2 - Telephone
1 - Typewriter, desk with changeable font element
1 - Typewriter, portable
N - Valence (one per window)
2 - Wastebasket, steel

## Functional Specialist Office

(Used for CBL Authoring)

Size: 16 $m^2$

Occupied by: T-03

1 - Acoustic Ceiling Tile
1 - Airconditioner
1 - Antistatic floor pad
N - Blinds (one per window)
1 - Bulletinboard
1 - Cabinet, tall
1 - Carpet, wall to wall
2 - Chair, office with arms
3 - Chair, meeting
3 - Chair, with casters
1 - Coatrack
1 - Computer, CBL with disk drive (author station complete)
1 - Cupboard, wood tall
1 - Cupboard, wood with glass
1 - Cupboard, top
1 - Cupboard, top with glass
N - Curtains (one per window)
N - Curtain Rods (one per window)
2 - Desk, single pedestal
1 - Electric Distribution Panel with circuit breakers
2 - Electric extension cable set
1 - Fire Extinguisher
1 - First Aid Kit
1 - Handcart
2 - Intercom Set
N - Lighting, central indirect
1 - Magnetic board
2 - Plants, live in planter
1 - Printer, CBL with screen-copier capability
2 - Shelf, under terminal
2 - Shelving
1 - Smoke and fire detector
1 - Stand, flipchart
1 - Steel Cabinet
1 - Steel Cabinet with glass doors
1 - Table, long
2 - Table, CBL system
1 - Table, CBL printer
2 - Table, work
1 - Table, Telephone
1 - Telephone

1 - Tool Set, complete
1 - Typewriter, long platen with small pitch
1 - Typewriter, portable
N - Valence (one per window)
2 - Wastebasket, steel

## Multi-Media Learning Center

Size: 30 $m^2$

Occupied by: Primary use by students

1 - Acoustic Ceiling Tile
1 - Airconditioner
1 - Antistatic floor pad
1 - Audio recorder, stereo
N - Blinds (one per window)
1 - Bulletinboard
1 - Carpet, wall to wall
1 - Chair, on casters
7 - Chair, guest
7 - Chair, with folding writing surface
12 - Chair, Folding
17 - Chair, student
6 - Coathooks
1 - Coatrack
3 - Computer, CBL with disk drive
N - Curtains (one per window)
N - Curtain Rods (one per window)
1 - Electric Distribution Panel with circuit breakers
2 - Electric extension cable set
1 - Fire Extinguisher
1 - First Aid Kit
1 - Interpreter's set, central and distribution, complete
N - Lighting, central indirect
1 - Loudspeaker set
1 - Magnetic board
2 - Monitor, television
1 - Overhead Projector
5 - Plants, live in planter
1 - Printer, CBL with screen-copier capability
1 - Projector, filmstrip
1 - Projector, overhead transparency
1 - Projector, video
1 - Screen, projection
3 - Shelf, under terminal
1 - Shelf, special
1 - Smoke and fire detector
1 - Stand, flipchart
1 - Stand, overhead projector
2 - Table, Instructor
3 - Table, CBL printer
3 - Table, CBL student workstation
6 - Table, student work
1 - Tool Set, complete

N - Valence (one per window)

Multi-Media Learning Center (continued)

1 - Video camera
1 - Video editor 3/4" U-matic
1 - Video film-image converter
1 - Video projector
1 - Video recorder 3/4" U-matic
2 - Wastebasket, steel

## Training Classroom

## (Capable of Subdivision)

Size: 45 $m^2$

Occupied by: Primary use by up to 30 students

1 - Acoustic Tile
3 - Airconditioner
3 - Ashtray, pedestal
1 - Audio recorder, stereo
N - Blinds (one per window)
N - Blinds, with automatic remote control (one per window)
1 - Bulletin board
1 - Carpet, wall to wall
10 - Chair, guest
4 - Chair, on casters
12 - Chair, Folding
20 Chair, student
6 - Chair, with folding writing surface
20 - Coathooks
1 - Coatrack
N - Curtains (one per window)
N - Curtain Rods (one per window)
20 - Desk, student
1 - Electric Distribution Panel with circuit breakers
1 - Electric extension cable set
1 - Fire Extinguisher
1 - Flag set pair, United Nations and Czechoslovak
1 - Flag set small, United Nations member states
1 - Interpreter's set, central and distribution, complete
N - Lighting, central indirect
2 - Loudspeaker set
1 - Magnetic board
1 - Medical kit
2 - Monitor, television
1 - Picture Set, Czechoslovak Leadership
5 - Plants, live in planter
1 - Projector, film 16mm
1 - Projector, filmstrip
1 - Projector, overhead transparency
1 - Projector, slide 35mm
1 - Projector, video
1 - Remote control
1 - Screen, projection
1 - Shelves
1 - Smoke and fire detector
3 - Stand, flipchart

1 - Stand, 16mm movie projector

Training Classroom

1 - Stand, overhead projector
1 - Stand, 35mm slide projector
1 - Table, instructor
N - Valence (one per window)
1 - Video camera
1 - Video film-image converter
1 - Video recorder 3/4" U-matic
4 - Wastebasket, steel

## Utility and Storage Room

Size: 25 $m^2$

Occupied by: Not occupied by persons. Also used as utility and workroom.

1 - Antistatic floor mat
N - Blinds (one per window)
1 - Cabinet, steel, small
3 - Chair, on casters
1 - Coatrack
1 - Cupboard, steel
1 - Cupboard, top steel
1 - Cupboard, wood with glass
1 - Cupboard, top wood with glass
1 - Desk, small
1 - Desk with drawers
1 - Desk with shelves
1 - Electric Distribution Panel with circuit breakers
1 - Electric extension cable set
1 - Fire Extinguisher
1 - First Aid Kit
1 - Handcart
N - Lighting, central indirect
1 - Light, work
1 - Pad, table rubber antistatic
2 - Shelf
1 - Smoke and fire detector
1 - Steel Cabinet, utility
1 - Stepladder
1 - Table, maintenance
1 - Tool Set, complete
2 - Wastebasket, steel

## Overflow Space/Reading Room

Size: 20 $m^2$

Occupied by: Provides periodic use space for 25 people when not inside other areas.

Must have convenient access to toilet facilities.

5 - Ashtray, pedestal
1 - Bulletinboard
1 - Cabinet, low
1 - Carpet, wall to wall
3 - Chair
10 - Coathooks
1 - Coatrack
1 - Coffee pot, 30 cup
1 - Cupboard, wood tall
1 - Cupboard, wood with glass
N - Curtains (one per window)
n - Curtain Rods (one per window)
1 - Fire Extinguisher
1 - First Aid Kit
N - Lighting, central indirect
1 - Mirror
3 - Plants, live in decorative planters
1 - Shelving
1 - Smoke and fire detector
3 - Sofa
1 - Table, coffee
N - Valence (one per window)
2 - Wastebasket, steel, large

# APPENDIX H

## COURSEWARE DEVELOPMENT PROCESS

# Courseware Development Process

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## CONTENTS

# INTRODUCTION

The development of lecture, individualized, and computer-based education (CBE) courseware by Control Data Corporation's functional organizations follows a systems approach process. The systems appoach, a process in which related steps are identified and sequenced to solve training problems and achieve instructional goals, is presented in the CREATE® curriculum. The CREATE curriculum is a computer-based education program employed throughout Control Data Corporation and used by numerous customers. The courseware development process described within this booklet may be employed by individuals or by organizations using a team approach.

Control Data Information and Education Systems Company, one of the functional organizations of Control Data Corporation, employs a team of specialists in the application of the courseware development process in the design and development of its

courses. The Company uses the process to coordinate development in other organizations, as well as to monitor courseware development activities external to Control Data Corporation.

The systems approach used by the Information and Education Systems Company to develop instructional materials consists of six phases: analysis, design, development, evaluation (formative), implementation, and evaluation (summative). (See figure 1.) These six phases build upon each other to reach the goal of integrated, instructionally efficient, and sound course materials.

The development process described herein is intended to result in courseware products that are verified to be effective. Within each of the six phases, a step-by-step process is carried out. The following sections detail the activities in each phase.

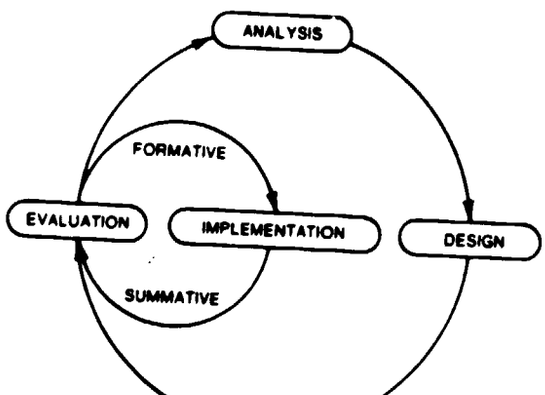


**Figure 1. The development process**

**Phase 1. ANALYSIS**
Analyze requirements and determine the effort for design and for development

**Phase 2. DESIGN**
Specify the product that will satisfy the requirements

**Phase 3. DEVELOPMENT**
Develop the products described in the specifications

**Phase 4. EVALUATION, PART I**
Test and revise the product

**Phase 5. IMPLEMENTATION**
Implement the product in the intended environment

**Phase 6. EVALUATION, PART II**
Measure the product's effectiveness against original requirements

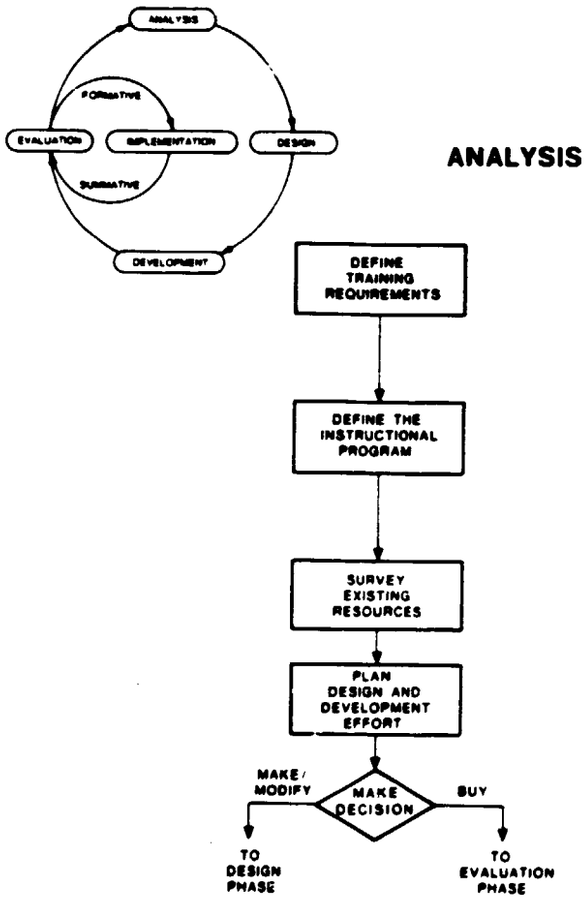


**Figure 2. The analysis phase**

# PHASE 1: ANALYSIS

The purpose of the analysis phase (see figure 2) is to determine the scope and nature of instructional materials required to satisfy a given set of training needs. The basic tasks performed during this phase are:

1. Define training requirements
2. Define the instructional program
3. Survey existing courses
4. Plan design and development effort

## Define Training Requirements

Training requirements are identified by: (1) analyzing training needs; (2) defining needs and constraints; and (3) analyzing the target population. For example, suppose that a company's payroll department is expanding and also has had a high turnover in clerical jobs. The error rate has risen, and the department is seeking a solution through training. Presently, each new hire has a two-week orientation and training session with the head clerk; now, with the addition of so many new employees, the head clerk

## Define the Instructional Program

In this step, course goals that define the scope and purpose of the instruction are stated. The major tasks and topics to be included in the instructional program are defined at this time, as are specific requirements concerning media and expected performance levels.

The documentation resulting from the steps so far is a general course specification intended to solve the instructional problem within constraints. The document includes: overall course length, structure, and proportion presented by the allowable media; a description of the target population and its present level of performance; definitions of the constraints placed on the instruction; and the goals and topics to be covered. Various options for media mix, instructional strategy and development plans form the preliminary basis from which the design phase proceeds.

## Survey Existing Courses

Identifying existing courses and comparing them with needs are the two steps in the survey of courses. Before time and money are expended to develop a new course, existing courses are identified and analyzed for applicability to the training needs. If an existing course appears to meet the needs and fulfills required quality standards, it is considered for use. In addition, source manuals, technical manuals, subject matter experts, and resource people are identified.

## Plan Design and Development Effort

At this point, there are three alternatives. The first is to proceed directly to the design of the instructional program. The second is, given the availability of an existing course, to go directly to an evaluation of that course. Third, it may be desirable (or necessary) to discontinue the courseware development effort. The estimated costs and anticipated requirements associated with each alternative must be examined prior to making this decision.

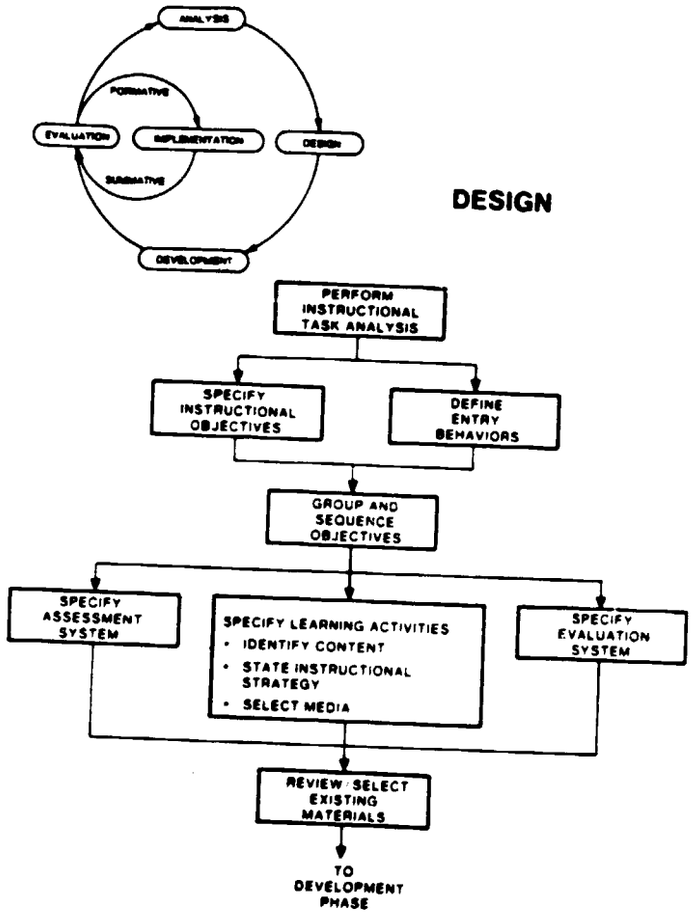


**Figure 3. The design phase**

step is a hierarchically arranged learning map, a visual representation of how the tasks and subtasks relate to each other within the overall goal.

## Specify Instructional Objectives

The tasks and subtasks on a learning map form the basis from which instructional objectives are written. Each objective describes the desired performance or behavior, the conditions under which the behavior or performance will be observed, and the criteria for acceptable performance.

## Define Entry Behaviors

After the objectives are completed, entry behaviors are defined. In this step, entry behaviors are identified and thoroughly analyzed.

## Group and Sequence Objectives

In this step, the objectives are arranged in groups that are logically related in terms of instructional purpose. The objectives are then sequenced so that the ordered relationships indicated in the learning maps are preserved. This step assures that learning will progress logically and efficiently.

## Specify Learning Activities

When each group of objectives has been identified, learning activities can be determined. Learning activities are small segments of instructional material that correspond to one or more objectives in a particular group. In the specification of learning activities, three tasks must be performed:

1. Select media
2. State instructional strategy
3. Identify content

Media (text, audiotapes, videotapes, PLATO assisted learning, lecture, and so forth) are selected for each learning activity on the basis of appropriateness and instructional strategy. The instructional strategy determines the teaching approach for presenting concepts, eliciting interaction, providing feedback, and so on. A brief description of content specific to each learning activity is also identified.

## Specify Assessment System

The means by which learning performance is measured and reported is specified in this step. The use of pretests, progress checks, and posttests is defined. A plan may be presented for administering, scoring, and using test results. PLATO learning management is the usual mode of student assessment, although alternate modes that employ more traditional forms of assessment may be used, depending upon requirements and constraints.

## Specify Evaluation System

In this step, a plan is prepared to outline the strategy for validating the instructional material in the evaluation phase. The plan details the arrangements that pertain to student groups, sample sizes of groups, and data analysis requirements. The nature of the evaluation will determine the time required to complete the course, the attitudes expressed by the students, and the students' performance.

## Review/Select Existing Materials

In this step, the lessons or portions of courses identified for possible inclusion are reviewed. The sections that are appropriate are selected, and their sequence in the course materials is identified.

## Provide Documentation

During the design phase, detailed specifications of the courseware and deliverables are drawn up. These specifications are the primary documentation products of the design phase. They become the basis for communication and developmental decisions.

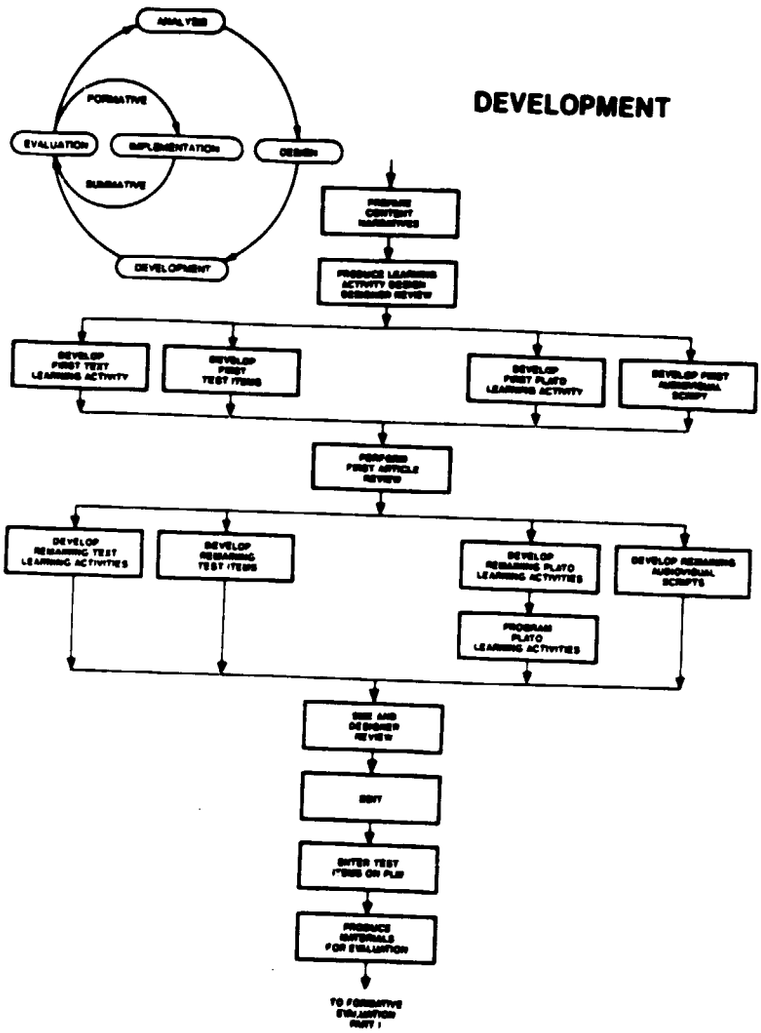


**Figure 4. The development phase**

# PHASE 3: DEVELOPMENT

During the development phase (see figure 4), all instructional materials are produced as specified in the design document. The development of individual courseware components is accomplished in accordance with the design and development strategy specified during earlier phases. The result of the development phase is a complete course which is ready for learner checkout.

## Prepare Content Narratives

A critical initial step in the development is the acquisition and documentation of all subject matter content required to achieve the stated objectives. Subject matter experts and developers work together in the organization and preparation of the content. After the required content is assembled, the content narratives are then structured by the developer into individual learning activity designs. Each learning activity design with all relevant content is then reviewed by the designer to assure consistency with the design and by one or more subject matter experts to assure content accuracy and completeness. After designer and subject matter expert approvals, the development of learning activities by media type begins.

## Develop Learning Activities

The development of learning activities involves the structuring and writing of the content so that it will communicate effectively with the learner. The content of the first learning activity must be written and structured so as to employ the strengths of the medium (PLATO assisted learning, text, and audiovisual) and to maintain a sensitivity to the target audience characteristics and learner needs. Test items for each learning activity are reviewed by the designer to assure consistency with the intent of the design. After the first article or learning activity of each media type is reviewed, the remaining items of courseware are then developed.

## Reviews

At this point in the development process, all the materials are in draft form. The text materials have been written, edited, and typed. The test items are written and entered into the PLATO learning management system. The PLATO assisted learning materials have been designed and programmed. The audiovisual materials have been produced.

There are two principal reviews of the materials at this stage. First, the subject matter experts review the materials to determine the technical accuracy and completeness of the products. The subject matter experts also provide feedback to the development team so that necessary corrections may be made.

Second, the designer reviews the materials in order to determine whether they meet the requirements of the analysis and of the design phases. The designer will have worked closely within the team to assure conformance to the design specification. The design review signifies the formal approval of the materials.

## Editing

The editor assigned to the team establishes a close working relationship with other team members. The editor reviews all courseware components for grammar, style, and consistency; makes the necessary adjustments or corrections; and coordinates those changes with the designer and developer. The editor also establishes format and composition requirements.

## Provide Documentation

The documentation products of the development phase are the PLATO assisted learning lesson designs and the draft materials for the entire course.

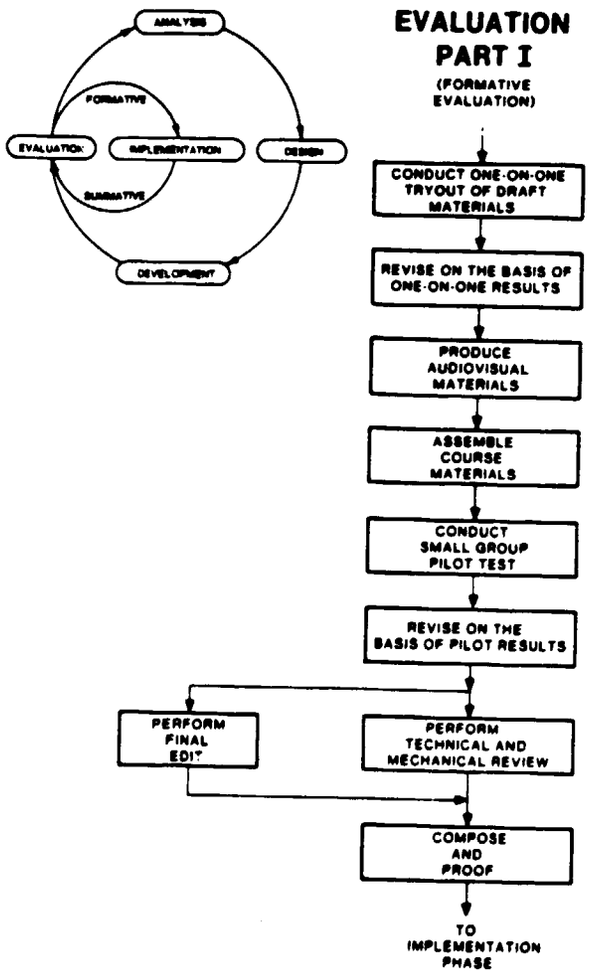


**Figure 5. Formative evaluation**

# PHASE 4: EVALUATION, PART I
## FORMATIVE EVALUATION

The purpose of evaluation, part I (see figure 5)—or formative evaluation—is to try out and revise the course materials based upon student use data. During this phase, the following tasks are performed:

1. Conduct one-on-one tryout of draft materials
2. Revise on the basis of one-on-one results
3. Produce audiovisual materials
4. Assemble course materials
5. Conduct small group pilot test
6. Revise on the basis of pilot results
7. Edit and produce

### Conduct One-on-One Tryout of Draft Materials

The one-on-one tryout of each learning activity is conducted by a developer, who closely monitors the activities of one student who represents the target population. The purpose of the tryout is to

test the draft materials for gaps or confusing or erroneous portions in any content area. The result of the one-on-one is a list of revision requirements for the course.

## Revise on the Basis of One-on-One Results

After the one-on-one tryout, the designer, developer, and editor make the necessary revisions. Additional tryouts may be called for if the revisions are extensive.

## Produce Audiovisual Materials

After the one-on-one is completed and all revisions are finalized, audiovisual materials are produced. The completed scripts result in the audiotapes, filmstrips, videotapes, and other audiovisual training materials specified in the design document.

## Assemble Course Materials

In this step, all course materials are put together. All examinations, text materials, audiovisual products, and PLATO assisted learning activities are assembled in a cohesive package with directions that enable each individual to proceed through the course materials without requiring additional information. The course is now ready for testing in the intended environment.

## Conduct Small Group Pilot Test

During this step, a small group that represents the target population tries the course. In this pilot test of the course, the conditions of the environment in which the course will actually be used are simulated. Various evaluation instruments (including questionnaires, interview forms, and examinations) are used to gather data. This data is then used to evaluate the effectiveness of the course. The pilot further ensures that lessons do not conflict with or unnecessarily duplicate one another, that no objectives have been overlooked, and that the training materials are coherently organized from the student's perspective.

## Revise on the Basis of Pilot Results

Problems identified in the small group pilot test are analyzed, and appropriate corrections or modifications are made.

## Edit and Produce

Technical and mechanical review is performed on the PLATO assisted learning activities and the PLATO learning management (testing) portions of the course. In addition, the final editing and formatting are performed, and the text is composed in its final form.

The technical and mechanical review ensures that all PLATO related elements of the course conform to system standards. The final edit ensures completeness and appropriateness of all text materials, and the composition process readies the final text product for reproduction and distribution.

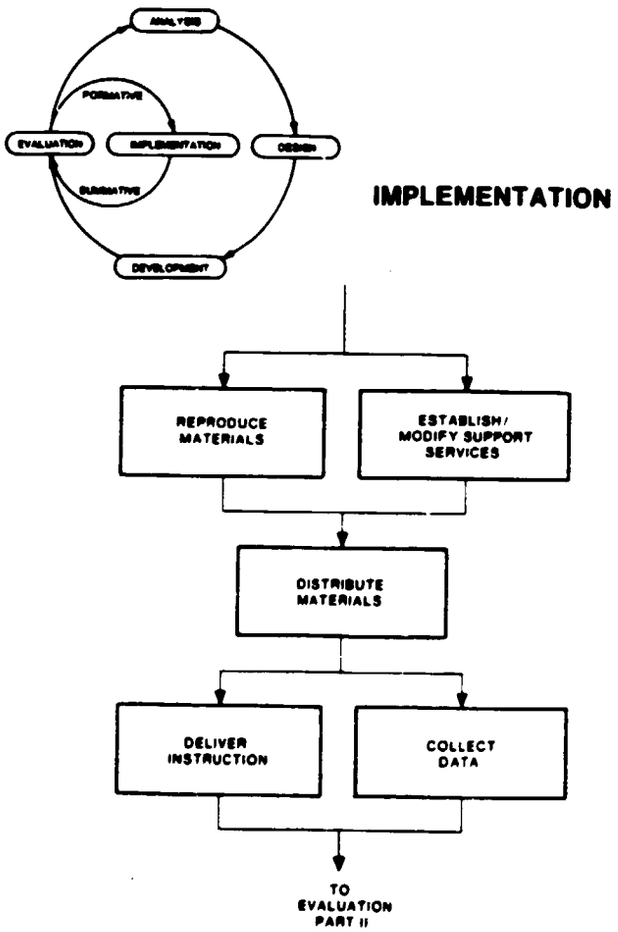


**Figure 6. The implementation phase**

## PHASE 5: IMPLEMENTATION

During the implementation phase (see figure 6), all instructional materials are reproduced and distributed by the client organization. The course is actually used with the target population in the intended environment.

When the course has been reproduced and prepared for delivery, any specific services required to maintain or support it when it is implemented are established. All PLATO related materials are transferred to the client's files. The assembled course is then distributed to the locations at which it will be offered.

While the course is being used with its intended target population, data is collected on student performance and attitudes. Information is also recorded about the students' job performance after they complete the course. This practice reflects the degree to which the original problem was solved.

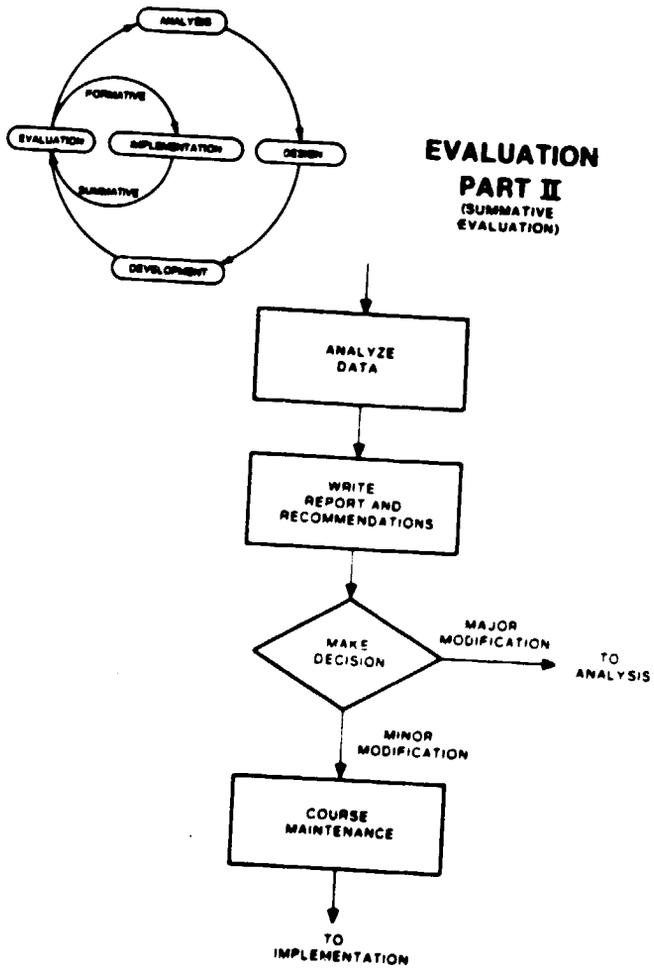


**Figure 7. Summative evaluation**

## PHASE 6: EVALUATION, PART II

### SUMMATIVE EVALUATION

The evaluation in this phase (see figure 7) is of a summative nature. It is intended to measure the effectiveness of the course in solving the educational or training problem identified in the analysis phase.

In this phase, data gathered during field use of the course is analyzed and summarized. This data is the basis for a report containing recommendations for course and delivery system modifications. Finally, a decision based on these recommendations is made. If minor modifications are to be made, corrections follow the course maintenance procedure. Usually these corrections do not interrupt the operation of the course. However, if major problems are identified, it may be necessary to go back to the analysis phase to identify the source of the problem and take corrective action.

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## REFERENCES


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