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CONTRACT
between
THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
and
POLYTECHNA
for the
provision of services relating to the
PROJECT No. DP/IND/85/002
INTRODUCTION OF COMPUTER MANAGED MAINTENANCE SYSTEM (CMMS)
IN STEEL AUTHORITY OF INDIA LTD. (SAIL) PLANTS
IN INDIA

FINAL   REPORT
_____

Submitted by

POLYTECHNA

PRAGUE

C Z E C H O S L O V A K I A

OCTOBER 1989

In January 1987, the Contract between the Czechoslovak agency Polytechna and UNIDO Vienna was signed. This Contract specified following duties for Polytechna:

. to introduce modern integrated CMMS in RSP using Burroughs computers (with possibility to a follow up transplant of this pilot CMMS application to other SAIL plants, namely Bokaro and Bhilai)

. to upgrade the present system of inventory and purchase control for spare parts, assemblies and subassemblies and their reconditioning and manufacture in captive shops

. to establish centralised data bank to integrate CMMS modules and existing system

. to arrange training of EDP and maintenance specialists in various fields of CMMS to be able to further develop CMMS and transfer the acquired know-how to other plants in the country and elsewhere

The Contract duration was set to 27 months and it included 55 man-months of subcontractor`s services carried out in India and 31 man-months carried out at Contractor`s home office area, arranging training courses and study tours for Indian personnel.

This report describes how Polytechna commitments were fulfiled in 1987-89 and results of Czechoslovakia-India cooperation. It describes situation as was in March 1989 with addition of one end-users training course and one study tour that were arranged in October 1989 in Czechoslovakia.

Table of Content

1.00 Introduction

The aim of this report is to summarize activities and results of work of the Polytechna, Prague, and East Slovakian Ironworks, Kosice, as the subcontractor in the project "Introduction of Computer Managed Maintenance System" in SAIL plants, India. During 27 months, from the sign of the contract between UNIDO and Polytechna, the subcontractor's team cooperated with Indian counterparts and managed:

.introduction of the CMMS in the implementation area based on know-how transfered from VSZ where CMMS had been developed in the beginning of eighties

.training programmes and study tours for Indian developers, end-users and managers in subcontractor's home area

In order to reach the Contract targets, team of Czechoslovak experts was extended in implementation area by hired Indian specialists from Tata Burroughs Ltd. for the Burroughs computer systems utilization, who helped to solve problems of non compatible computers systems IBM (Czechoslovakia) and Burroughs (India), namely in software field (LINCII).

Results of subcontractor's activities can be found in four outputs:

.pilot implementation of CMMS in Rourkeia Steel Plant

.arrangement of 3 training programmes for 42 Indian analysts, programmers and end-users in Czechoslovakia (the third and last one for 11 participants was held, according to Polytechna-RSP additional agreement, in Czechoslovakia in autumn 1989)

.arrangement of 4 study tours for 9 members of top management of RSP

.preliminary study and suggestions for the CMMS project implementation in SAIL plant Bhilai, training programmes for selected developers from this plant and from the steel plant in Bokaro

In present, pilot implementation in RSP is very seriously influenced by following facts:

.limited capabilities of installed hardware

.problems with power supply

.problems with computer and terminal network operation staff

Listed problems imply suggestions for successful continuation of CMMS project in RSP and full utilization of its results in India:

.to improve material conditions for computer utilization in RSP

.to change procedures for maintenance operations in those Rourkela Steel Plant areas, where CMMS has not been implemented yet, in order to support computerization of mentioned operations and to introduce CMMS in RSP as the whole

.to prepare proper material and human resources for CMMS introduction in Bokaro, Bhilai and Durgapur

.to start the second phase of CMMS introduction in India as soon as possible

This report summarizes the subcontractor's activities

a) during preparation stages

b) in project area during each of five missions

c) in subcontractor's area during realization of study tours and training programmes .

2.00 Preparation Stage

During period, that lasted from the beginning of January 1987 to the first arrival of subcontractor's team to India, following activities were carried out:

.preparation of staff for individual duties in project area and subcontractor's area, as well

.final definition of those CMMS parts that would be transfered into Indian project because the others had been added to the project to support local VSZ problems using some special proceedings, valid only in VSZ

.preparation of documentation for know-how transfer to Indian conditions

.definition of schedule and content of individual training programmes and study tours

2.01 Personnel

The subcontractor's duties were delegated by the Polytechna agency to East Slovakian Ircnworks Kosice. After contract sign, there were appointed experts to take part in project activities. Following staff was specified:

for missions to implementation area:

Augustin PULLMANN	team leader
Frantisek PROROK	preventive maintenance
Ervin BERES	material management
Andrej DUDAS	shop management
Ladislav NEMETH	database management, system programming
Vladimir BULLA	application programming

this group from VSZ was extended by

Dagmar BYDZOVSKA   Burroughs applications

for activities in subcontractor's area:

Stefan LINK
Ladislav BURES
Lubos ADAMEK
Jan BILICKA

2.02 Preparation of Documentation

After thorough analysis and in connection with decision that CMMS transfer to India would be based on know-how. rather than on transfer of COBOL programmes directly. internal Czechoslovak CMMS documentation had been modified before team's work in India started. Czechoslovak COBOL programmes could not be transfered directly. because VSZ utilized IBM hardware and appropriate software for CMMS activities and there were Burroughs systems proposed in RSP and other SAIL plants. This situation caused namely following serious problems:

1. COBOL compilers were different

2. telecommunication capabilities of both systems were based on various principles

3. database systems had got similar features. but there were differences in rules for their exploitation

4. program package CLASS. that was used as the basis for shop scheduling in VSZ, was not able to run on Burroughs systems

For the first mission, following documents were prepared:

.list of modules, submodules, transactions and programmes intended to be utilized in CMMS project in SAIL plants

.printed copies of original programmes and listings of their compilations

.printed copies of input/output screens

.list of processed data, their resources and flows

.structures of individual database files and their logical interrelationships

.coding systems for CMMS elements

.coding systems for individual data types

.end-users documentation for CMMS activities that was used in VSZ

All types of mentioned documentation were prepared and printed in VSZ, and copies of them were recorded on magnetic tape. Both versions were provided to Indian development staff during the first team's mission.

3.00 Subcontractor`s Team Missions to India

3.01 Th· First Miss·on

This mission started in India 3/2/1987 and finished 13/4/1987. All six basic team members spent this period in RSP. Moreover.

Mrs Bydzovska

took part in team`s activities for the period of 2 weeks. In order to speed up the work progress. two Indian experts from TBL

Mr Vicram DAYAL
Mr Ashok PADHI

were hired for roughly one month each. They became regular members of subcontractor's team in order to provide other implementation staff with their knowledge on Burroughs systems – hardware and software.

During this mission. following were the main activities of the implementation teams:

.detail analysis of managed area

.analysis of data flow in existed systems

.analysis of data availability. accuracy and consistency

.analysis of existed and proposed coding systems

.overall system design preparation

.programming of special functions

.preparation of basic functions design in individual teams

After subcontractor`s team leaving Rourkela. situation was as follows:

.Indian development teams were appointed and their responsibilities defined

.final decisions on CMMS content. duration and schedule of development were agreed

.developers had analysed existed automated and manual systems for maintenance managemet and related activities

.overall system design had been almost completed

.it was decided to utilize LINCII and PCSIII packages, developed by Burroughs, for CMMS in RSP to support programmes efficiency and to replace originally used STELA and CLASS packages that were not able to run on Burroughs systems

.detail specifications for individual parts of CMMS, for logic of transactions and/or programmes were being prepared

After thorough analysis of situation and development requirements, it was decided to modify original time schedule and, instead of planned three missions, to perform all subcontractor's activities in India in four split missions plus the final visit of team leader.

3.02 The Second Mission

All six Czechoslovak experts took part in the second mission from 20/10 to 17/12/1987. Because of the fact that, in the period between the first and the second mission, a group of Indian developers called on Czechoslovakia for the first training course, their knowledge from this course could be considered as the base for next CMMS development in RSP. During this mission, following problems were solved:

.detailed design of new modules/submodules/functions and individual programmes or transactions

.database files/elements definition, integrating of individual databases

.scheduling and monitoring of CMMS development and implementation

.preparation of training programme and methodology for Indian end-users in RSP

.preparation of subcontractor's team visit to Bokaro and Bhilai during the third mission

Most of transactions and programmes developed during this mission came to the stage of programming and even testing. Progress had been sped up because of the LINCII training course that had been held in RSP in September 1987. Another TBL expert,

Mr Ajay BHARADWAY

was again hired for the mission period. He helped all teams to solve all new occured problems concerning Burroughs software and/or hardware.

Input data collection for database was started. database content and relationships of main data sets were definitely approved. High priority was assigned to Captive Shop module and all its parts.

3.03 The Third Mission

The third mission started almost immediately after the second one's finish and lasted from 26/1 to 31/3/1988. The subcontractor's team continued in works from the previous mission. Moreover, five days in the beginning of mission its members spent in Bhilai where they analysed situation in another SAIL plant - Bhilai Steel Plant . After those five days suggestions for CMMS implementation in BSP were prepared and delivered to BSP management (see Append D).Originally, similar short visit to Bokaro Steel Plant was planned in the end of the third mission but because of changed conditions and policy of Indian government (concerning foreign computers import) this visit was cancelled.

In between, a new problem raised in RSP. It was found that an enormous migration of professional programmers. namely to USA. has a very serious impact on CMMS development. During two years of Czechoslovakia-India cooperation as many as ten programmers - very often the best ones - after receiving any kind of certificate in programming (LINCII, CMMS ...) moved from Rourkela. Their replacement by new. not experienced developers. required additional effort and this situation mirrored in project development being slowed down. although in the end of cooperation original targets were reached.

During this period, there were prepared new terminals for installation - for CMMS development and end-users as well - in RSP. Top priority was again assigned to Captive Shops module, where a new part - Rolling Master Plan - was introduced.

3.04 The Fourth Mission

Just before this mission, that was held fron. 18/10 to 20/12/1988, important changes in team management had occured. Because of appointment of Mr Pullmann to position of Chief Technical Adviser in this project, number of team's members had been reduced to five and Dr Bulla had been appointed to the post of the team leader.

Following the original targets and plans. testing runs of individual CMMS parts started. There were involved not only EDP people but also end-users in these activities. New terminals had been installed in RSP and terminal network in plant was almost totally prepared for pilot implementation. Data for basic parts - plant register. breakdown planning activities. store elements control. master planning - were completed for first implementation areas. i. e. Blooming and Slabbing Mill.

3 05 The Fifth Mission

The last mission was held in period 2/2 - 23/3/1989. Originally. it was planned to be carried out only by team leader. but in order to fulfil all time commitments. two Czechoslovak experts (Bulla. Beres) took part in it.

Main targets of this mission were:

.to finish all planned activities

.to help Indian staff in preparing CMMS seminar

.to help with definition and schedule of the second phase of CMMS introduction

.to evaluate results of cooperation

.to check possibilities of successful regular operations of implemented pilot project in RSP

During this mission. a seminar on CMMS was held in RSP. Team leaders from RSP introduced different CMMS parts to participants from other SAIL plants and for authorities from India government. Situation reports from Bhilai. Bokaro and Durgapur were also presented. Representatives from UNIDO Vienna and from UNDP Delhi took part in this seminar. too.

In the end of mission. it was declared by both the Czechoslovak representatives (from Polytechna and VSZ) and the Indian NPC that all Czechoslovak duties in CMMS project had been fulfilled. but full success of the poject implementation required immediate start of the project second phase in India (see Append D).

4.00 Present Situation

Situation in RSP in the end of March 1989 can be described like this:

.pilot CMMS implementation on Blooming and Slabing Mill in RSP is prepared and, depending on individual submodules, also in testing run

.supporting terminal network, covered by Indian made personal computers in positions of terminals, is installed and in normal conditions respons time is acceptable

.data are prepared and utilized

.problems are caused by supporting facilities (power frequency stabilizers, air-condition)

.duties of EDP and network maintenance staff in regular operations of CMMS are not clearly defined, there do not exist strict rules for their behaviour yet

.exploitation of the A3K machine and its peripheral units is in some day intervals too high and computer limits are almost reached

.people from developing teams are being sent from the development area to end-users areas to help to speed up CMMS implementation in production conditions

.basic materials for seminars and training courses are prepared, some types of documentation must be finished

5.00 Modules Activities Descriptions

5.01 Plant Register and Preventive Maintenance Modules

Development for these modules was supervised by Mr Agrawal and Mr Prorok. In December 1988 Mr Agrawal was replaced by Mr Seth. Developed programmes and transactions cover following problem areas:

Equipment Classification
Inspection Planning and Feedback
Shutdown Planning and Feedback
Repair Jobs History

Mentioned submodules create basic repair cycle in methodology of preventive maintenance planning in RSP. Their basic automated functions are:

in Equipment Classification

.data preparation and update
.random inquiries

in Inspection Planning and Feedback

.daily and monthly inspection planning
.equipments in sick condition processing
.conversion of defects findings to repair jobs

in Shutdown Planning and Feedback

.jobs selections for regular week shutdown
.spare requirements for repair jobs
.shutdown feedback reports processing
.monthly shutdown planning
.capital repairs planning

in Repair Jobs History:

.data preparation and update
.reports on jobs performed in different horizons

Additional transactions and programmes were prepared for Job catalog and Job description preparation and update. Developers introduced also a new method for breakdown causes qualification. They also defined records, data sets and sets for integrated database.

List of modules outputs:

- list of production centres. cost centres
- list of group of equipments and sub-groups
- bill of materials for each assembly
- report of all installed parts of any equipment
- report of material stock/order status for any part
- job description directories
- job catalogues
- inspection schedules and generation of defects
- conversion of defects into jobs
- materials required for any specific job
- sequence of activities for any job
- shutdown planning for normal and capital repairs
- total job load for a shutdown
- list of selected jobs for a shutdown
- feedback on execution of jobs
- breakdown details entry
- planned sequence of activities for Capital Repairs
- actual sequence of activities for Capital Repairs
- material requirements for shutdowns
- explosion of any assembly/equipment/cost centre
- implosion of any spare part
- basic technical details of each part in an assembly
- searching of all locations of identical parts
- list of jobs for any equipment
- monthly/daily inspection schedules
- backlog of unliquidated defects
- status of shutdown jobs

5.02 Material Management Modules

In accordance with Terms of Reference and results of analysis in RSP. Indian team. under supervision of Mr Moorthy and Mr Beres. has developed this module in following way:

Activities were divided into three submodules:

Material Planning
Inventory and Stores
Purchase

To cover all their requirements and to support Material management in RSP. transactions and programmes for following tasks have been prepared:

in Material Planning:

.spare parts requirements generation
.indents printing
.budgeting
.Make-buy Commitee decisions support
.indents status monitoring
.item groups specifications printing
.suppliers selection for indents

in Inventory and Stores:

.stock items data collecting
.calendar data for requirements generation preparation
.customers ordering preparation
.indenting of stock items
.new type of stock transactions processing

in Purchasing:

.history of purchase orders creation and update
.tender inquiries creation
.suppliers data management
.transfer of approved indents to purchase orders

Moreover, suggestions and rules were prepared

.for cooperation of A3K machine with the old Burroghs machine
.for cooperation with Preventive Maintenance and Captive
 Shops Module
.for data sets, subsets and relations in the integrated
 database

List of modules outputs:

- catalogue groups in a department
- spare part technical and inventory related data
- specifications/group specifications
- availability of critical spares on shop floor
- net requirement generation with manual interface
- indent print-outs
- order recommendation print-outs
- management information reports
- complete details about any spare part
- detailed specifications/ordering text
- group specifications for multiple parts
- parts having same group specifications
- total stock balances
- critical spares availability on shop floor
- pending orders/indents against any spare part
- listing of indents raised
- details about any indent/order recommendation
- list of insurance items
- list of fast moving/ A class / B class items
- technical and inventory data of AP items
- nomenclature and specifications
- calendar month indication of class of items
- inventory policy
- requirement generation for periodic review items
- requirement generation for perpetual review items
- capital repair requirements entry
- indent item entry
- printing of indents
- printing of alarm stock status items
- printing of stock-out items
- printing of excess stock items
- floating of tender enquiries
- printing of reminders to suppliers for delays
- stock item basic data
- detailed specifications or ordering text
- calendar month indenting and budget
- listing of indents
- display of specific indent/item on indent
- capital repairs reservation & dereservation status
- locationwise stock balances of any item
- pending orders against any specific item
- list of reports
- status of deliveries from of any vendor

5.03 Captive Shops Module

Supervision of team responsible for this module was delegated to Mr Mohanti and Mr Dudas. Transactions and programmes for this module were grouped into five submodules:

Engineering Data Control
Indenting
Rolling Master Planning
Production Planning and Scheduling
Feedback

An Burroughs programming package (PCSIII) was chosen as the basic tool for the basic parts of this activities. Some of its programmes were modified, some were replaced by new ones, written in Cobol and LINCII . All programmes for master planning were prepared by the developers.

Main activities in mentioned areas were:

in Engineering Data Control

.products and materials structures
.production operations descriptions
.extra operation connections
.work orders printing

in Indenting

.requirements creation
.capacity bin management
.capacity balancing

in Rolling Master Plan

.orders extract
.plan printing
.plan update

in Production Planning and Scheduling

.capacity requirements planning
.operations scheduling and loading

in Feedback

.material delivery from vendors
.material delivery to shops
.operation performance
.monthly reports

Similarly to other modules. Captive Shop module prepared defintions of its parts of integrated database and relations to other modules.

List of module outputs:

-analysis of capacity requirement of work centres
-forecasting of realistic delivery dates
-status monitoring of work order processing
-rolling master plan for selection of work orders
-requirement of raw materials
-long term capacity requirement planning
-short term scheduling of operations on weekly basis
-monthly production and other MIS reports
-assigning priorities for work orders
-pending work order list
-list of work centres
-list of pending operations in a work centre
-final route card printing
-cost ticket printing
-weekly make/buy committee report
-orders selected to master plan
-w/c group utilization report
-daily loading chart
-man and machine hours utilization report

5.04 Integrated Database

This group, headed by Mr Neelakantan and Mr Nemeth, was responsible for definition, tuning and reliable run of integrated database, for final definition of individual datasets, sets and relations in this database. Moreover, it had to prepare rules and processing for database utilization, coding systems for individual CMMS elements (tasks, modules, programmes) and prepare suggestions for solution of intermodule relations.

Members of this group were also responsible for communication with EDP staff and for hardware installation, for concepts of cooperation between two Burroghs mainframes and terminals and/or PCs as well.

Main components of the integrated database are as follows:

Equipment classifications related entities
-Production centres
-Department
-Cost centres
-Group of equipment
-Sub-group of equipment
-Subassemblies/components
-Crane details.

Preventive maintenance and repairs planning related entities.
-Job description
-Cause & nature of failure
-Defect observations with linkage to jobs like material facilities, special tools etc.
-Monthly repeat jobs
-Shutdowns planned
-Shutdown jobs
-Capital repair jobs
-Job history with history observations

Material planning related entities
-Inventory master
-Spare parts
-Stock items
-Locationwise stock balance of inventory
-Yearly spare requirement.
-Indents & items
-Tender Enquiries
-Enquiry-Supplier link
-Suppliers

-Purchase order and items
-Procurement history

Captive shops related entities
-Engineering parts
-Operation on part with description
-Production structure including raw materials
-Estimated times for indented items without engineering data
-Work orders
-Route card items
-Route card operation
-External operation connection
-Parent component relation
-Scheduled operations
-Shop calendar
-Work centres
-Capacity bins of related work centres.

6.00 Activities in Subcontractor's Area

During cooperation period, there were arranged three training programmes and three study tours for Indian developers, end-users and management in Czechoslovakia by subcontractor.

In all training courses, participants were divided into groups depending on their professions - programmers, system analysts, end-users - and presentation of the Czechoslovak CMMS differed from group to group. Training courses were held in Kosice and Prague

from 7/9 to 25/9/1987
from 30/8 to 16/9/1988
from 6/10 to 27/10/1989

CMMS was presented in three forms:

.read lectures
.excursions to shops and other places of CMMS implementation
.consultancies

Moreover, subcontractor arranged also four study tours for RSP top management staff. These study tours were held

from 26/5 to 30/5/1987
from 24/6 to 26/6/1987
from 8/9 to 12/9/1987
from 9/10 to 16/10/1989

During these study tours, CMMS and all procedures of maintenance management were presented to participants in order to help them to learn as much as possible from these tours.

7.00 Conclusions

The aim of this chapter is to review main results of VSZ/Polytechna efforts in this project:

1) In RSP
. Czechoslovak experts spent 55 man-months dealing with implementation of CMMS in RSP
. they specified requirements and rules for changing of procedures, used in RSP, as one of basic prerequisities of successful CMMS implementation there
. they provided Indian counterparts with complete documentation of those parts of Czechoslovak CMMS that had created the basis of Indian project
. they have applied know-how on CMMS in Indian conditions in close cooperation with Indian development staff
. they took part in modifications of Burroughs programming packages to RSP conditions

2) In BSP
. Czechoslovak group has defined conditions and prerequisities for successful transplantation of CMMS from RSP to BSP

3) In Czechoslovakia
. VSZ/Polytechna arranged training courses for enormous number of Indian specialists from Indian metallurgical industry. As many s 42 Indian specialists spent 126 manweeks attending these courses. Such amount of courses and participants is really the highest one in history of VSZ as training centre and is higher than originally intended 26 participants.
. in present, subcontaractor is preparing the best conditions to participate in second phase of CMMS or other Indian project (SAIL software house, alluminium company project, etc.) concerning metallurgical maintenance automation and/or other metalurgical activities, if similar reqquirements from India or UNDP/UNIDO occur

Append A - Abbreviations

BSP - Bhilai Steel Plant

CMMS - Computer Managed Maintenance System

RSP - Rourkela Steel Plant

SAIL - Steel Authority of India, Ltd.

TBL - Tata Burroughs Ltd

VSZ - East Slovakian Ironworks

Append B - Training Courses and Study Tours

The first training course

 Held in Czechoslovakia in september 1987
  Participants :
    10 from RSP
    2 from BSP
    2 from Bokaro

The second training course

 Held in Czechoslovakia in august-september 1989
  Participants :
    17 from RSP

The third training course

 Held in Czechoslovakia in october 1989
  Participants :
    8 from RSP
    1 from BSP
    1 from Bokaro
    1 from Durgapur

The first study tour :

 Held in Czechoslovakia in may 1987
  Participants :
    3 from RSP

The second study tour :

 Held in Czechoslovakia in june 1987
  Participants :
    3 from RSP

The third study tour :

 Held in Czechoslovakia in september 1987
  Participants :
    2 from RSP

The fourth study tour

 Held in Czechoslovakia in october 1989
  Participants :
    1 from RSP

Append C

Recommendation
for transplantation of CMMS
from RSP to BSP

Introduction

The aim of the Project No. DP/IND/85/002 is to introduce a modern integrated comuter managed maintenance system (CMMS) at Rourkela Steel Plant (RSP) of Steel Authority of India Ltd. (SAIL) with a follow-up transplantation of this pilot application to the other plants of SAIL, namely Bhilai and Bokaro.

In accordance with the aim of the Project as well as the Contract between the UNIDO and Polytechna our team has visited the Bhilai Steel Plant of SAIL. Visits has been realized in period from 30th January to 4th February 1988.

The main topics of visit have been as follows:
- to recognize the BSP organization and the organization of maintenance services particularly
- to become familiar with both manual and computerized management and information systems presently used, especially in the maintenance and supplying activities
- to understand specific requirements of BSP on CMMS implementation
- to specify recommendations for transplantation of CMMS from RSP to BSP

Our team consists of 6 specialists from East Slovakian Ironworks (VSZ) Kosice:

Mr. A. Pullmann   –   team leader
Mr. F. Prorok   –   system analysts, specialist in preventive maintenance and repairs planning and monitoring
Mr. E. Beras   –   system analyst, specialist inmaterial planning, inventory, stores and purchase control
Mr. A. Dudas   –   system analyst, specialist in captive shops control and engineering data control
Mr. V. Bulla   –   system programmer, specialist in application programmes in CMMS
Mr. L. Nemeth   –   system programmer, specialist in data base and teleprocessing systems

Our team would like to thank Mr. R. Krisnamurthi. Mr. V.P. Moudgil and others for cooperatve spirit. willingness. readiness and effort to make our visit successful and our staying in Bhilai very pleasant.

Recognizing of problem

Our team has visited the BSP main production facilities, maintenance shops, plant stores, computer centre and some workplace equipped by PCs or terminals. We have seen several computer applications in different areas and we have visited also the INCOS laboratory where the brief information on overall system conception was given to our team.

We have been studying the Approach paper with specification of ideas about CMMS implementation, CMMS requirements on personnel for the system development and implementation, requirements on hardware as well as the work plan proposal. We have seen many other documents as organizational charts, data flow diagrams, manual forms for data collection, printed outputs from computer, identification system and codes, etc.

We have met about 40 managers from various departments, mostly from the maintenance area. We have discussed the Approach paper and other documents, ideas and expectations on CMMS and proposal of system implementation with many managers especially in the maintenance section of Plate mill and with CMMS group. All discussions were very concrete and useful and helped us to be familiar with the environment for CMMS implementation and to understand specific needs of BSP.

The essential points of facts discovered are as follows:

1. BSP CMMS team consists of project leader and 7 members at present. Project leader is not assigned for full time. Only 2 of team members have been trained in Contractor's home base for 3 weeks duration. Number of designers and programmers must be increased.

2. Approach paper and partial documentation of RSP CMMS is being used for developmemnt of individual parts of the system. Overall design of BSP CMMS with specification of functional and data structure, internal and external linkages, requirements of personnel, hardware and software, data as well as other needs have to be concretized early and approved by BSP management.

3. Development effort is intended mostly in Equipment Classification module and data collection and storage using personal computers.

4. There are no significant differencies between RSP and BSP organization and methodology of Preventive Maintenance and Repairs. Spare part and Material Procurement procedures and Captive shops control. Transfer of know-how from RSP to BSP is possible but level of programme transplantation will depend on hardware/software compatibility.

5. There are some differencies between mechanical and electrical sections of BSP maintenance in methodology of planning and work preparation as well as identification or codes. Unification and standardization are needed.

6. Maintenance standards (with specification of duration, requirement of manpower and spares, costs, etc.) needed for effective planning and scheduling of maintenance activities (inspection, preventive maintenance, repairs, etc.) are not available. Special group for maintenance standards creation must be established for full time.

7. The following requirements on new features of CMMS are specified by BSP management:
   -application of Plant Condition Monitoring module
   -application of CAD/CAM systems
   -incorporation of foundry and forge into Captive shops module
   -incorporation of Personnel skills and Resources module
   -linkage of INCOS module
   -implementation of CMMS in Power plant maintenance
   -extensive application of PCs with trend towards distributed CMMS

   These requirements can be incorporated into overall system design but implementation will depend on availability of resources.

8. Available computer resources in BSP are allocated to applications of INCOS modules and/or MIS. Limited use for CMMS development is possible, but there is a serious problem of hardware/software compatibility for transplantation of CMMS programmes from RSP to BSP as well as the problem of disk storage capacity and terminal network for CMMS implementation. Procurement of new powerful hardware is a must.

Recommendation.

1. Appointment of CMMS Project leader for full time.
2. Establishment of CMMS teams for:
   a) Integration activities
      (data base, systems of identification and codes,
      computers/terminals network and communication,
      methodology of design, programming and testing,
      documentation standards, project planning, scheduling
      and monitoring)
      -3 or 4 EDP specialists
   b) Preventive Maintenance and Repairs Subsystem
      - team leader, 2 designers, 2 programmers, 2 users
   c) Spare part and Material Management Subsystem
      - team leader, 2 designers, 3 programmers
   d) Captive Shops Subsystem
      - team leader, 2 designers, 3 programmers

3. Establishment of special group for maintenance standards
   (mechanical, electrical and other activities)

4. Arrangement of premises for CMMS teams as well as for
   maintenance standards group.

5. Arrangement of training programme for small group with
   following topics:
   -project planning, scheduling and monitoring
   -system design and documentation standards
   -distributed systems
   -programme packages
   -maintenance standards

6. Arrangement of short duration study tours for senior
   executives from intended places of pilot implementation.

7. Overall System Design with specification of:
   a) Functional structur:
      - subsystems, modules, submodules, functions
      - what parts of RSP CMMS will be used in BSP and level
        of know-how transplantation
      - what parts of RSP CMMS cannot be used/transplanted
        to BSP and why
      - new components of BSP CMMS
   b) Main outputs, inputs and data needed, including systems
      of identification and codes
   c) Linkages:
      - internal linkages between all CMMS modules
      - external linkages to the existed and proposed
        applications
   d) Level of integration/distribution from functional and

data point of view
e) Hardware/software requirements:
   - mainframe comuter
     (Burroughs A3K or fully comptible one with suitable
     capacity of disk memory, magnetic tapes, line
     printer, communication facility, etc.)
   - terminal network and PCs
     (8-10 terminals, 2-3 printers for system development.
     20-25 terminals, 12-14 printers for pilot
     implementation, 80-100 terminals, 50-60 printers for
     full implementation
     about 30-40% of total amount should be PC-based.
     indigenous terminals are available)
   - software support for data base and data communication
   - software support for system development (e.g. LINC
     12) and compilers of high-level languages
   Actual requirements will depend on the scope of CMMS
   implementation
f) Proposal of training programme and study tours
g) Requirements of changes and organization and/or
   methodology and proposal of measures taken (e.g.
   establishment of maintenance standards group)
h) Schedule of system development and implementation
i) Estimation of costs and benefits of the system.

8. Close cooperation with RSP personnel and coordination of
   joint effort by N.P.C. and C.T.A. is needed

9. To solve specific problems of transplantation and also
   new features of CMMS it is recommended to hire external
   specialists for limited time.

Conclusion
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     In accordance with the aim of Project DP/IND/85/002
"Introduction of CMMS in SAIL plants" it is recommended to
specify a requirement of new project for transplantation of
CMMS from Rourkela Steel Plant to Bhilai Steel Plant, Bokaro
and Dhurgapur sponsored by UNDP/UNIDO and Indian Government
within the modernization programme of SAIL.

On behalf of Polytechna team: A. Pullmann, team leader

Append D - Protocol signed during terminal visit of VSZ and
Polytechna representatives to Rourkela in
February 1989

A) Aims of the Protocol

The aims of this protocol is to evaluate the performance of
the duties and responsibilities from the Contract No. 86/124
between United Nations Industrial Develompment Organization
(UNIDO) and Polytechna Prague by the East Slovakian
Ironworks (VSZ) Kosice.

B) Evaluation of Contract Conditions

2.02 Contractor's Services

. Project Area Service
Fifty-five man-months had to be carried out by the
contractor's teams in the project area, that had been
defined as India. Actually, the contractor's team visted
India five times and has spent there intervals as follows:

Date	Persons	Man-weeks
1. 2. - 16. 4.1987	6	64
21.10. - 16.12.1987	6	48
27. 1. - 30. 3.1988	6	54
20.10. - 20.12.1988	5	43
1. 2. - 22. 3.1989	2	14
		223

Moreover, following experts worked as members of group in
given periods:

19. 2. - 4. 3.1987	Dr Bydzovska	2
12. 2. - 4. 3.1987	Mr Dayal	3
6. 3. - 13. 4.1987	Mr Padhi	6
16.11. - 12.12.1987	Mr Bharadway	4
		15

Totally, contractor's group has carried out 238 man-weeks,
what is more that its comitment.

. Home-office Service
During preparation of India visists, Preparation of Indian
counterparts trainings and good will studies, as well as
during trainings and stuidies the contractor's comitment of
31 man-months of carried out services has been fully
performed.

. Home Office Support
All needed technical facilities and personal support for the
back-stopping support has been provided by Polytechna and
VSZ to their experts during India missions.

2.03 Contractor's Personnel

. Name and Assignment of the Contractor's Personnel
During conract duration, following experts have taken parts
in its performance:

Name	Man weeks in	
	Project Area	Home office
A. Pullmann	28	20
(team leader)		
F. Prorok	36.2	17
E. Beres	43.2	20
A. Dudas	36.2	18
V. Bulla	43.2	20
(team leader)		
L. Nemeth	36.2	20
S. Link		15
L. Bures		5
L. Adamek		5
J. Bilicka		5
	223	145

.Replacement of Contractor's Personnel
Because of Mr Pullmann's appointment to post of CTA in
october 1989, he was replaced by Mr V. Bulla in the post of
team leader. This replacement was approved by UNIDO and SAIL
representative.

2.05 Commencement of Contractor's Work in Project Area
The time table of five visis of experts' group in India is
under evaluation of 2.02.

2.08 Facilities and Services Provided by the Contractor
All needed facilities and services for full success of
project have been provided by contractor's. Four additional
expert were hired during the first and second visit to India
to help in CMMS development in RSP.

C) Evaluation of Proposal for Project Services

This proposal is part of Contract (Annex D) and there were defined following commencements for Contractor's:

3.1. CMMS Modules
i. The objective of Contractor's team was to provide support for the developing teams for following modules:
  M1: Plant Register and Classification
      - Carried out by Prorok, Pullmann, Bulla
  M2: Preventive Maintenance and Repairs Planning
      - Prorok, Bulla
  M3: Material Planning
      - Beres, Bulla
  M4: Capacity Resource Planning
      - Prorok
  M5: Inventory, Stores and Purchase Control
      - Beres
  M6: Captive Shops Planning and Control
      - Dudas, Nemeth, Bulla
  M7: Maintenance Process Monitoring
      - Prorok, Pullmann
  M8: Integrated Data Bank
      - Nemeth

ii. All possible documentation from VSZ implementation of CMMS was provided to Indian counterparts mainly during the first team's mission Printed documentation consisted of

    Processing algorithms
    Input/Output transactions description
    Screen layouts
    Record layouts.

Copies of these documents were stored also on magnetic tape, that contained also source programs and program listings of VSZ's CMMS and users documentation. This tape was also provided to Indian personnel.

iii. Database structures and record layouts were also provided to the RSP personnel.

3.2, 3.3 Modifications and Development
Because of great differncess between IBM (VSZ) and Burroughs (RSP) computers' hardware and software, it has been decided to transfer VSZ know-how and develop CMMS on this base. That is why, Czechoslovak experts bacame members of developing teams for each individual modul (see i) and they provided assistance in each stage of modul development. They cooperated also during development of new CMMS parts.

3.4. Training
.overseas training for Indian counterparts was arrnged in
two parts:

Date	Persons	Man-weeks
September 1987	14	42
September 1988	17	51
Total		93

.good will studies were also arranged in three parts- in May
1987 (3 people) and in June 1987 (3 and 2 people) - for
Senior Executives of RSP

.during last two missions VSZ experts took part in preparing
the staff training, they provided their advise and
suggestions concerning the program and duration of
trainings.

3.5 Follow-up implementation.
Folow-up implementation in RSP is being prepared in
cooperation with VSZ experts and recommendation for it were
prepared after the fourth and fifth mission, depending on
individual teams.
The CMMS transer to Bhilai and Bokaro has been influenced by
problems with non-Indian computers and decision in it has
been postponed. For this reason, only recommendation for
transfer to Bhilai has been prepared by VSZ group.

Conclusion

All commencements, duties and responsibilities, implied by
the Contract and Proposals in original and revised versions
were performed by the Polytechna and VSZ.

This protocol was signed by representatives of Polytechna,
VSZ and by NPC