## OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

## DISCLAIMER



## FAIR USE POLICY



## CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

17893

UNIDO Contract No. 86/124
Project No. DP/IND/85/002

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

Prepared by
Vladimir BULLA
Contractor's Team Leader
VYCHODOSLOVENSKE ZELEZIARNE
statny podnik, KOSICE

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 trade organization 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 firm in the project "Introduction of Computer Managed Maintenance System" in SAIL plants, India. During 27 months, from the sign of contract between UNIDO and Polytechna, the subcontractor`s team cooperated with Indian counterparts and managed:

.development of the modified Czechoslovak CMMS in the implementation area

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

In order to reach original targets, team of Czechoslovak experts was extended in implementation area by hired Indian experts 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 cooperation can be found in three outputs:

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

.pilot implementation of CMMS in Rourkela Steel Plant

.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 development in india:

.to improve material conditions for computer utilization in RSP

.to change the rules and procedures for computers operation in Rourkela Steel Plant

.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 home made CMMS parts that would be transfered into Indian project

.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 trade organization Polytechna to East Slovakian Ironworks Kosice. After contract sign, there were appointed experts to take part in project activities. All of them had been experienced in tne CMMS area, because they had been members of teams developing this project for contract between Czechoslovakia and UNIDO in 1979-1982. Finally, following staff was specified:

for missions to implementation area:

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

this group from VSZ was extended by

| | |
|---|---|
| Dr Dagmar BYDZOVSKA | Burroughs applicatoion |

for activities in subcontractor`s area:

Ing Stefan LINK
Ing Ladislav BURES
Ing Lubos ADAMEK
Ing 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 ready made programmes, internal Czechoslovak CMMS documentation had been modified before team's leaving. For the first mission, following documents were prepared:

.list of modules, submodules, transactions and programmes

.printed copies of input/output screens

.list of required data

.structures of individual database files and their logical interrelationships

.coding systems for CMMS elements

.coding systems for individual data types

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 The First Mission

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

Dr 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.

During this mission, following were the main activities of the developers and experts:

.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 developing 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

.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 modifv 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. To support subcontractor`s team efficiency, another TBL expert

Mr Ajay BHARADWAY

was again hired for the mission period. He helped team very much to solve all 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. 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 from 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. Mr Grebtsow from UNIDO Vienna and Mrs Sukuntha from UNDP Delhi took part in this seminar, too.

In the end of mission, it was declared by both the Czechoslovak representatives (Mr Lescisin and Mr Dusek) and Mr B. N. Saha that all Czechoslovak duties in CMMS project had been fulfilled, but full success of its implementation required immediate start of the project second phase in India.

## 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 (i. e. Mr. Agrawal) are being sent from the development area to end-users area 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.

## 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

## 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.

## 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.

## 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 and management in Czechoslovakia by subcontractor.

In both 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 three 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.

## 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 - List of Training Courses and Study Tours

### Participants

The first training course

Mr Avasthi, Behera, Chandrasekaran, Das A., Gopal, D. Saha, Sen, Shankar, Singh, Som - all from RSP
Moudgil, Padegaonkar - from BSP
Ashok Kumar, Sinha - from Bokaro

The second training course

Mr Batni, Bhattacharya, Bhuttia, Das D., Garg, Gupta D., Gupta S., Koushik, Krishnamurty, Maitra, Mishra, Padhi, Panda, Prasad, Reddy, Saibaba, Trivedy

The first study tour:

Mr Chawla, Roy, Gupta S.

The second study tour:

Mr De Tarafdar, N. Murty, B. Saha

The third study tour:

Mr Mazumdar, Manjunathan