IX. 技術交換事業

本調査団は、プロジェクトの専門家並びにカウンターパートとともに平成元年11月9日～12日にかけて、タイ王国の「金属加工機械工業開発振興事業」のサイトを訪問し、技術交換事業を実施した。

目的・日程・参加者等をここに記すので、詳細はX. 資料 10－5 技術交換事業報告書 を参照ありたい。

9－1 技術交換事業の目的

タイ金属加工プロジェクトは、金属加工分野全般に係る技術移転を目的としたものであり、一方、本プロジェクトは、金属加工の中の鋳造技術の移転に主眼を置いている。

「マ」国の実施機関であるＳＩＲＩＭの場合、既に、鋳造を除いた金属加工については、技術協力を実施した経験があり、この意味では、タイ金属加工プロジェクトのノウハウを経験を十分に活用できると思われる。

9－2 実施内容と期待される成果

本プロジェクトは、討議議事録（R／D）署名・交換後約1年が経過し、いわゆるプロジェクト準備段階の最終ステージに差し掛かっており、現在、実施段階のメルクマールともいえるプロジェクトのオペレーショナルターゲットを策定するため、現地の鋳物工場を視察・調査している。

一方、タイ金属加工プロジェクトは、全協力期間（R／D：1986.10. 1～1991. 9.30）の半分以上を経過し、移転した技術を応用・発展させる段階にある。

このような時期に、専門家とカウンターパートがタイ金属加工プロジェクトのサイトを訪問し、以下の点を協議・確認することは極めて重要であると考えられる。

1. タイ金属加工プロジェクトのオペレーショナルターゲット
   a. 内　容
   b. 作成時の留意点
   c. 現在の反省点
   d. 活動状況
   e. 想定している評価方法
2. 地場の鋳物工場との関連
3. 現在までの活動状況および留意点（本プロジェクトに対する提言）

9－3　実施チームの構成

1. 日本人専門家

原　　尚道　　チーフアドバイザー

正本　進二郎　　溶　　解

深井　伸之　　造　　型（現地で合流）

2. マレイシア側カウンターパート

Helme Hashim, Project Head

Muhammad Fauzi Ismail, Research Officer

3. 計画打合せ調査団

林　　健太郎　　団　　長

山下　　誠　　団　　員

9－4　実施スケジュール

日　順	月／日（曜）	内　　容
1	11／9（木）	ＭＨ782　（移動） ＭＩＤＩ表敬 ＴＧ641　（山下団員・深井専門家合流）
2	11／10（金）	ＭＩＤＩとの協議 鋳物工場見学（Prompong Foundry Co., Ltd）
3	11／11（土）	林団長合流・経過報告 資料整理
4	11／12（日）	ＴＧ415　（マレイシアへ移動）

9－5　成　　果

我が方が期待していた初期の目標は、十分達成できたと思われる。

特に、「最初から余り多くを望んだ計画を作成せぬように」という「タイ金属加工プロジェクト」からの忠告は、現在、オペレーショナルターゲットを作成中の本プロジェクトにとって非常に有益であった。

このように、同種のプロジェクトで定期的に情報交換・協議の場を持つことは極めて有意義であると考えられる。可能ならば、平成２年度は本プロジェクトにタイ金属加工プロジェクトの専門家・カウンターパートを招いて技術交換事業を行なえればと考える。

X. 資　　料

10－1　短期専門家ミニッツ

平成元年9月21日から29日にかけて派遣した短期専門家が作成したミニッツ。

今回の調査団の協議のベースとなった資料である。

MINUTES OF MEETING BETWEEN JAPANESE EXPERTS, SIRIM AND CONSULTANTS

DATE : 21st, September, 1989
PLACE : Meeting Room, Foundry Technology Unit, SIRIM

MORNING SESSION

PRESENT:

1.	DR. NAOMICHI HARA	JICA
2.	MR. NORIYASU OE	JICA
3.	MR. TAKEO ONO	JICA
4.	MR. MUHAMMAD FAUZI ISMAIL	SIRIM
5.	MR. AHMAD ZAINAL ABIDIN	SIRIM
6.	MR. MOHD. AKHIR YEOP KAMARUDIN	SIRIM
7.	MR. HOH CHEONG SENG	RJP
8.	MR. HASSAN SUNI	RTSZ&P
9.	MR. Y.H. MOH	RTSZ&P

1. A schedule of work has been agreed by all parties:

Thursday (21/9/89)

A.M. : - Discussion of foundation for furnace with the consultants.
- Site inspection of furnace trench

P.M. : - Site inspection of furnace trench (cont.)

- Discussion on electrical and water cooling system with consultants.

Friday (22/9/89)

A.M. : - Foundation of machinery

P.M. : - cont.

Saturday (23/9/89)

A.M. : - Fabrication of template by contractor

P.M. : - Templates and bolts are sent to SIRIM.

M. Itara

Monday (25/9/89)

A.M. : - Checking of template dimensions by Japanese side

- Checking of all formworks for furnace, sand dryer, jolt squeeze machine and green sand machines

Tuesday (26/9/89)

A.M. : - Pouring of concrete to all trenches and pits.

2. Template

All dimensions are confirmed by the Japanese side after discussion with consultants. The width of the 100kg template has been changed from 422mm to 432mm. Other dimensions and tolerances remained as before.

The Japanese side insist on the dimensions as given earlier for the 100kg and 500kg templates. Consequently, the Malaysian side had taken steps to fabricate the template according to the agreed dimensions (+/- 1mm). The Malaysian side supervised the fabrication with the assistance from Metrology Unit of SIRIM and the final checking of finished templates was done by the Japanese side on 23/9/89.

3. Shims

The Japanese side agreed to the use of shims (for levelling purposes) provided by the Malaysian side.

The Malaysian side will prepare the base for foundation to the level of +/- 5mm.

4. Dust Collector for Induction furnace

The Japanese side confirmed that the bends for the ducting for the dust collector will be in accordance of the formula R = 1.5D . The drawings from the Japanese side will be sent by the end of October, 1989.

5. Furnace Trench

The Japanese side carried out inspection of the furnace trench. As a result of this inspection, the length of the template is now changed to 1150mm from the original 1230mm for the 100kg furnace.

Since the contractor has not received detailed drawings for the anchor bolt areas, the pouring of concrete for the floor except for the said areas was done on 22/9/89.

AFTERNOON SESSION

PRESENT:

1.	DR. NAOMICHI HARA	JICA
2.	MR. NORIYASU OE	JICA
3.	MR. TAKEO ONO	JICA
4.	MR. HIROSHI KANAMORI	JICA
5.	MR. MUHAMMAD FAUZI ISMAIL	SIRIM
6.	MR. AHMAD ZAINAL ABIDIN	SIRIM
7.	MR. MOHD. AKHIR YEOP KAMARUDIN	SIRIM
8.	MR. S.V. LORGANADEN	SIRIM
9.	MR. JAMIL SULEIMAN	SIRIM
10.	MR. HASSAN SUNI	RTSZ&P
11.	MR. Y.H. MOH	RTSZ&P

1. WATER SUPPLY

Malaysian side was concerned of the water supply from Block M. All piping works from Block M to the cooling tower is being now changed to 50A size, but only at the end of the cooling tower fittings will be 40A and the return pipe from furnace to cooling tower will be 80A.

The Japanese side will provide piping drawing by the 28th. September, 1989. Malaysian side has requested for a complete drawing for a separate water tank, they will also consider tapping water direct from the underground main pipe. The Japanese side will confirm the present potential head of 8.5m between Block M and the cooling tower with the manufacturer by late October, 1989.

The Japanese side has recommended 3 safety features of water supply, for the furnaces . They are :

i) In the event of power failure, the generator set will operate the electrical pump.

ii) If generator set fails, the mechanical pump will operate.

iii) If the water pump or the generator failed to operate then the water will be supplied directly from Block M by gravity.

For (ii) and (iii) chain block will be used to pour out the molten metal. The Malaysian side will design and fabricate the chain block.

The Malaysian side suggested, that the water will be tapped directly from the pipe dropper of 2 inch. of Block M. Both parties have agreed that there is a change in pipe size from 1 inch to 2 inch. There will also be a by pass system which will be connected directly to a 50A diameter pipe. The Malaysian side will inform the Japanese side of the water pressure. While the Japanese side will inform the capacity required for the cooling system, together with the new drawings as soon as possible.

The Japanese side has suggested that a warning gadget should be installed, to alert the level of water should it be below the required level. The Malaysian side have agreed to install a warning device at the furnaces area.

The Japanese side have provided the circuit design of the layout of the water supply system to Malaysian side, on the 28th. September, 1989.

The Japanese side suggested that a roof should be erected for the cooling tower, to protect from direct sunlight. Malaysian side did not agreed to the suggestion.

PIPING SYSTEM

The Malaysian side suggested that the water and electrical conduit will be separated and buried underground, until it reaches the building, and was agreed by the Japanese side.

The Japanese side will provide the materials and supervise the piping installation within the furnaces area.

All piping to the cooling tower will be carried out by the Malaysian side. The Japanese side will provide the cooling tower fitting details by the end of October, 1989.

2. ELECTRICAL SYSTEM

GENERATOR SET

The Japanese side provided the certificate of noise level for the generator set to Malaysian side. Malaysian side will check with the Department of Environment for the allowable noise level, after the installation of the generator.

Fuel tank for the generator set is built-in, with the capacity of 100 liter. The Malaysian side will check the consumption and rate of fuel used. On the 23rd. September, 1989, Malaysian side confirmed the existance of the control box.

During main power failure, the generator will supply power to:

i) the hydraulic pump for tilting the crucible

ii) water pump of the cooling tower, and the overhead crane.

EARTHING

1(a) The first level earthing is for the XRF Spectrometer with a maximum resistance of 10 ohms.

(b) The second level earthing is for the high frequency furnace with a maximum resistance of 10 ohms and the earthing rod size of equal to or greater than 50 mm^2. Both earthings will be done separately.

(c) The third level earthing for all other machines and panels, with a maximum resistance of 100 ohms.

All earthing works will be performed by the Malaysian side.

DISTRIBUTION BOARD

DB6 - for vacuum and cooling system of XRF Spectrometer.

1. The current rating for XRF Spectrometer had been changed to 50 Amp. single phase with two power sources. The Malaysian side will consult with the consultant on the use of miniature circuit breaker (MCB) after transformer.

2. The wiring works from the machine to the transformer and the vacuum pump will be supervised by the Japanese side. Materials will be provided by the Japanese side. The Malaysian side have confirmed the final location of the transformer at the analysis room on the 28th. September, 1989.

3. Two transformers connected to XRF are;-

a. 9320D6, 10kVA weighing 40 kg
b. 9321B4, 5 kVA weighing 39 kg.

DB5 - for X-Ray generator.

The transformer type 9321B6, 10 kVA weighing 75 kg will be provided by the Japanese side.

The Malaysian side will provide 3 phase circuit breaker of 50 Amps. with six outlet which will comprise 4 outlets of 5 Amps and 2 outlets of 10 Amps. Location of the terminal will be decided by the Malaysian side.

DATE : 22nd. September, 1989.

1. The following documents was provided for today's meeting.

i). Sketches of circuit drawing for DB5 and DB6, with their respective standard specification.

ii). Complete detail drawing of green sand preparation machine, high frequency furnace, CO_2 sand processing machine, and the cooling tower.

2. The Japanese side have demonstrated the usage of the chemical anchor.

VESTIBULE

1. Grinder, hydraulic press and the dust collector to be located in the vestibule will be provided by the Japanese side, whilst the ducting and working tables must be prepared by the Malaysian side.

7

2. Mould for sample:

(i) Y-block wood patterns for ductile iron and cast steel

(ii) metal mould of XRF sample for grey iron and cast steel.

will be provided by the Malaysian side.

GREEN SAND PREPARATION MACHINE

1. The Malaysian side must provide a 15A water pipe with a manual operating valve to the muller. They will also carry out ducting work. The installation diagram was provided by the Japanese side on the 28th. September, 1989.

DATE : 23rd. September, 1989.

1. A new foundation drawing for jolt-squeeze machine was given to the Malaysian side (both side agreed to new proposed area). See Appendix 1.

2. All ducting details for dust collectors will be provided by the Japanese side by late October, 1989.

3. The Japanese side briefed the basic functions of CO_2 sand processing machine and the green sand machine. The electrical installation diagram was also given.

DATE : 25th. September. 1989.

1. The Japanese side provided the schedule of installation. (See Appendix 2.). Machines listed in group 2 will be installed with the asssistance of the Japanese experts. The workmanship will be provided by the Malaysian side.

2. The installation for the high frequency furnace, XRF Spectrometer, sand dryer, green sand preparation machines and CO^2 sand processing machine will be supervised by the short-term expert. The expert will also assist the Malaysian side on the installation of the dust collectors.

3. The installation of the platform scale at the high frequency furnace will be done by the Malaysian side.

SAND DRYER MACHINE

1. The capacity of kerosene in the tank is 400 litres. The Japanese side has suggested to the Malaysian side to construct a safety pit for the tank. Two LPG gas cylinders are required (Malaysian side).

2. The Japanese side will provide the drawing of ducting and chimney, and will be fabricated by the Malaysian side. The manufacturer's drawing will be given by the end of October, 1989.

3. Schematic drawing of the compressed air piping , LPG piping, city water piping and emergency water supply piping for the high frequency furnace was given on the 28th. September, 1989, by the Japanese side.

SAND TEST EQUIPMENT

1. The universal mixer scheduled to be located in the Sand Test Room is now relocated to the area near the core making machine.

2. The Japanese side has confirmed the layout of equipment and machines in the sand test room (see Appendix 3).

PATTERN MAKING EQUIPMENT

1. The Malaysian side has proposed a renovation work at the pattern making floor area. After discussion both sides agreed that a two storey structure can be built at the said area.

2. Ducting drawing for the pattern making area was given by the Japanese side. All installations of machines at the pattern making section will be carried out by the Malaysian side.

DATE : 26th. September, 1989.

1. The Japanese side has provided two documents on the transfer of foundry technology (see Appendix 4 and 5) and a document on scope of technology transfer (see Appendix 6).

2. The Malaysian side provided a document on the approach to develop operational plan, and a document on proposed products. (See Appendix 7 and 8).

3. Mr. Helme briefed today's meeting with the basic structure of the Foundry Technology Unit and it's needs. He also elaborate the method of technological transfer, which should be adopted by 1993.

4. Both parties discussed at length about the technological transfer and the needs of local foundry industry on product development. Mr. Helme showed the operational planning as an example for efficient learning method (see Appendix 7). The Japanese side agreed to the method.

5. The Malaysian side suggested that the product selection can be based on the following example criteria :

1. Already making.

2. Potential market.

3. Have problem.

4. Its technology.

6. The Japanese side suggested the following criteria in choosing products for development.

Stage 1:

1. Shape - simple
- uniform thickness
- without core
- round shape
- small size (1 to 3 kg/piece)

2. Material - FC 10, 15

Stage 2 :

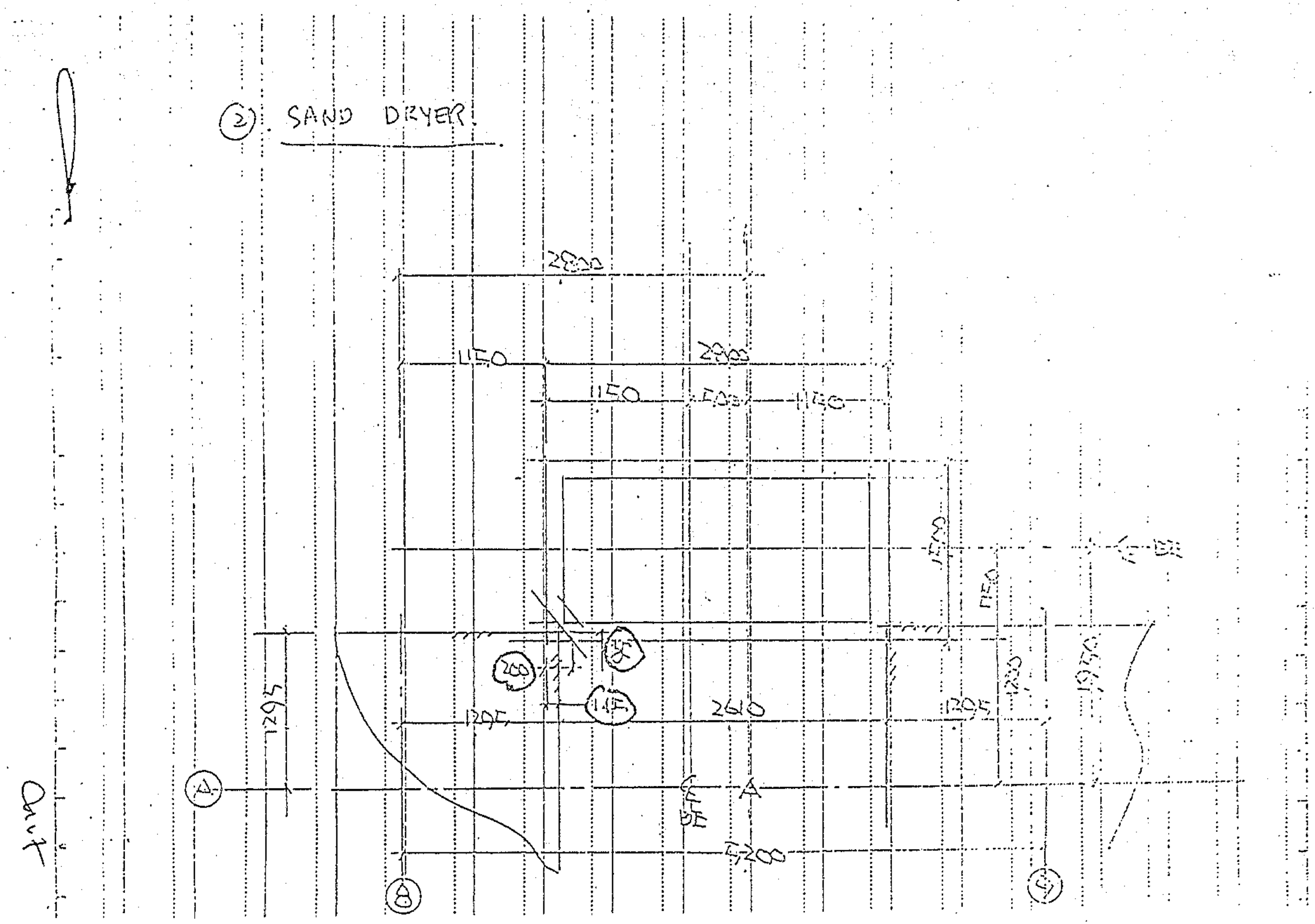
1. Shape - simple
- different thickness
- with core
- simple irregular shape

2. Material - FC 20, 25

7. The discussion concluded that products will be chosen through further discussion by both parties, and develop them with the cooperation of the Japanese side. Both parties also agreed that the transfer of foundry technology would be implemented through product development.

8. All documents provided by the Japanese side were fully discussed. The Japanese side requested to change the long-term expert to short-term experts for the pattern making section, which will be despatched between 1990 and 1993. The Malaysian side agreed to the above request, but the final decision will be discussed further with the Japanese Consultation Team during their visit in November, 1989.

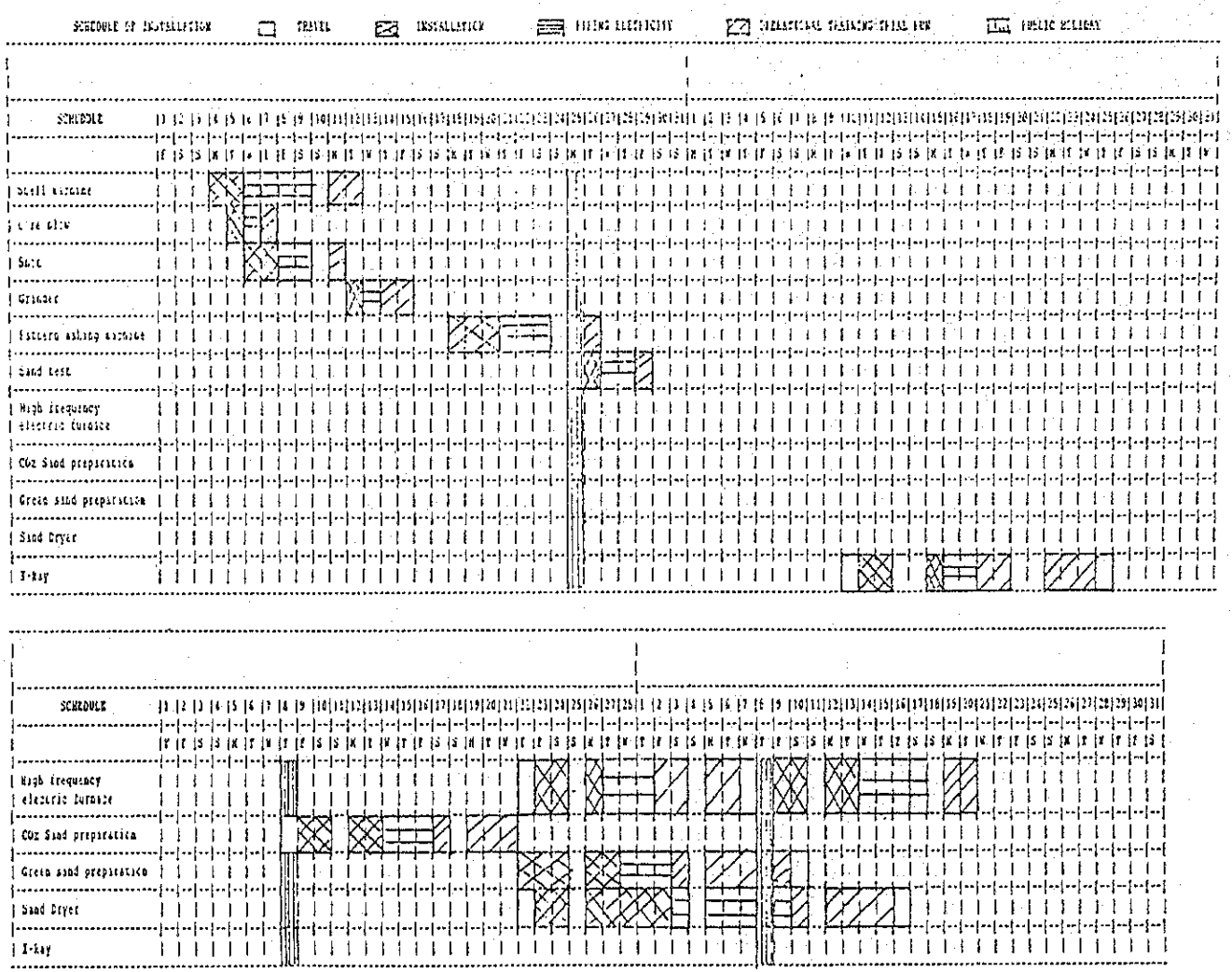
9. The Japanese side has proposed that four officers from FTU would be trained in Japan from May 1990 to August 1990 .The final decision on this matter will be further discussed during the Japanese Consultation Team visit. A document on training programme was handed out. (See Appendix 9).


② SAND DRYER
2800
1150
1150
1295
4200
A
B

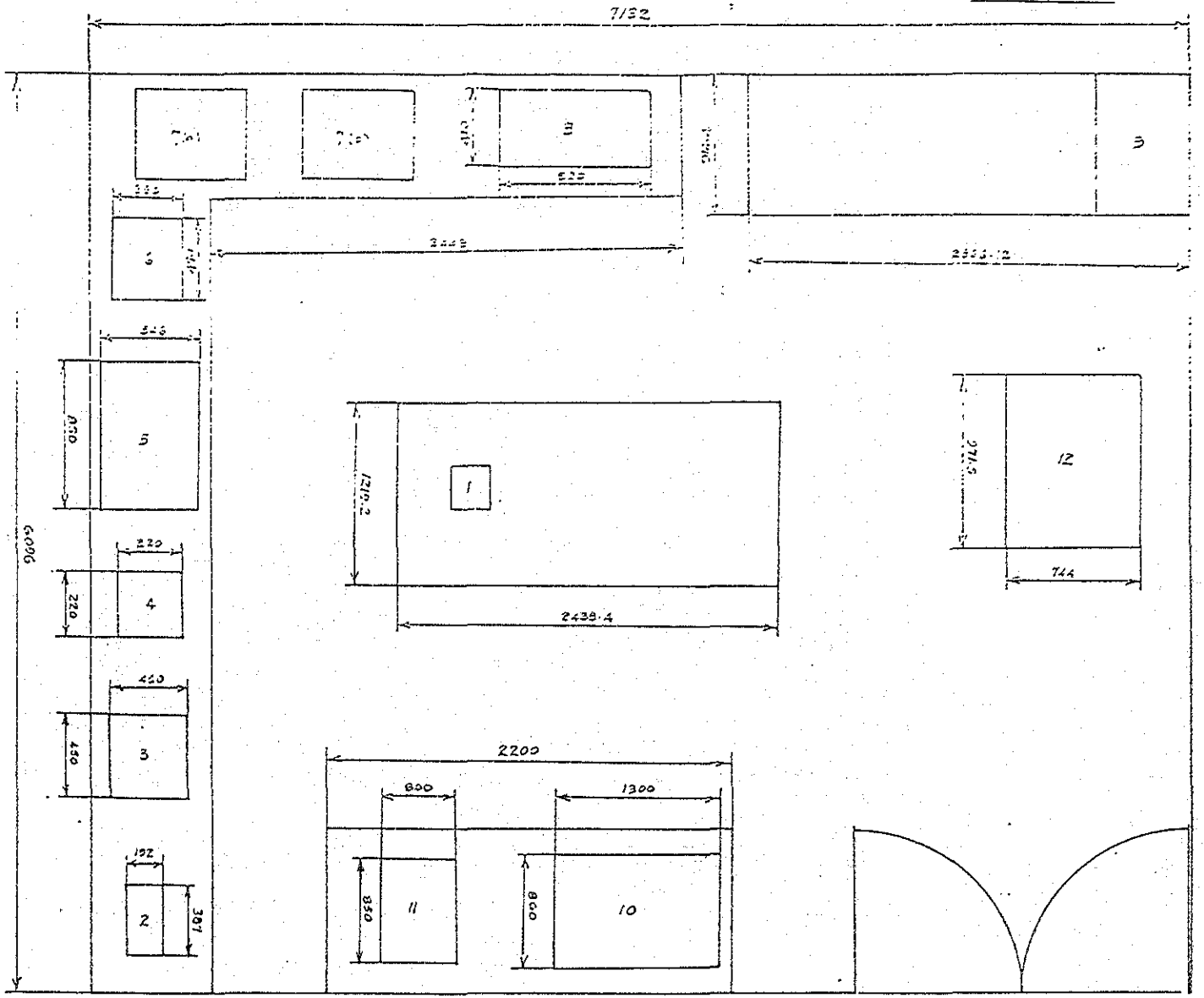
APPENDIX 1b

INSTITUT PIAWAIAN DAN PENYELIDIKAN PERINDUSTRIAN MALAYSIA

APPENDIX 2



1. ANALYTICAL BALANCE
2. MOISTURE TESTER
3. MOULDABILITY TESTER
4. COMPACTABILITY TESTER
5. SAND STRENGTH TESTER
6. PERMEABILITY TESTER
7 (a). ELECTRIC OVEN
7 (b). ELECTRIC OVEN
8. SAND WASHER
9. ACTIVE CLAY TESTER
10. RO TAP SIEVE SHAKER
11. SAND RAMMER
12. SAND MULLER MSF 0L



SAND TESTING ROOM

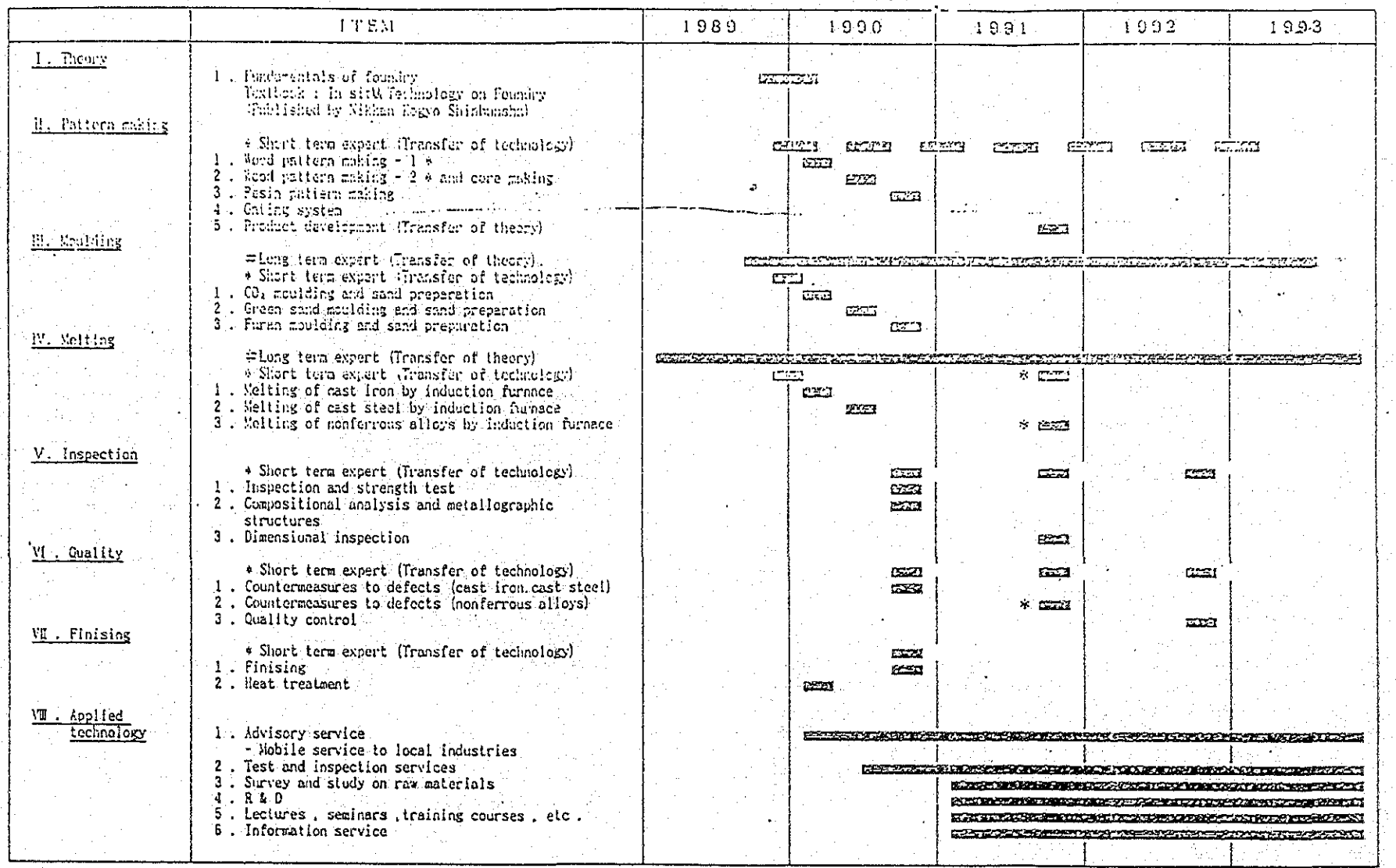
APPENDIX 4

TRANSFER OF FOUNDRY TECHNOLOGY

THEORY	PRACTICAL TECHNOLOGY	APPLIED TECHNOLOGY	REMARKS
Lecture Textbook : In-situ Technology on Foundry (Published by Nikkan Kogyo Shimbunsha) Contents : 1. Outline of metal casting 2. Fundamentals of foundry 3. Patterns and pattern making 4. Casting plan and its planning 5. Sand moulds and moulding sands 6. Special sand moulds 7. Melting of cast iron and moulding 8. Melting of cast steel and moulding 9. Melting of nonferrous alloys and moulding 10. Finishing and heattreatment 11. Inspection and testing 12. Defects and countermeasures 13. Special casting 14. Foundry workshop	Step 1 1. Wood pattern making - 1' and gating system 2. CO_2 moulding and sand preparation 3. Melting of cast iron** by induction furnace 4. Inspection and strength test 5. Countermeasures to defects (cast iron**) 6. Finishing Step 2 1. Wood pattern making - 2' and core making 2. Green sand moulding and sand preparation 3. Melting of cast steel by induction furnace 4. Compositional analysis and metallographic structures 5. Countermeasures to defects (cast steel) 6. Heat treatment Step 3 1. Resin pattern making 2. Furan moulding and sand preparation 3. Melting of nonferrous alloys# by induction furnace 4. Dimensional inspection 5. Countermeasures to defects (nonferrous alloys#) 6. Quality control	1. Advisory service - Mobile service to local industries 2. Test and inspection services 3. Survey and study on raw materials 4. R & D 5. Lectures, seminars, training courses, etc. 6. Information service	* Target products are chosen by survey of local industries. **Ductile and malleable cast iron are included. # Aluminium and copper alloys.

APPENDIX 5

TRANSFER OF FOUNDRY TECHNOLOGY



APPENDIX 6

Scope of Technology Transfer (Operational Plan)

1. Sorts of metals

1-1. Gray cast iron

JIS G 5501	FC 10, 15, 20, 25, 30, 35	6 classes

1-2. Spheroidal graphite cast iron

JIS G 5502	FCD 37, 40, 45, 50, 60, 70, 80	7 classes

1-3. Malleable cast iron

JIS G 5702	FCMB 28, 32, 35, 37	4 classes

1-4. Cast steel

JIS G 5101	SC 37, 42, 46, 49	4 classes

1-5. Aluminium alloy castings

JIS H 5202 Al-Cu, Al-Cu-Si, Al-Si, Al-Si-Mg, etc. (13 classes)

1-6. Copper alloy castings

JIS H 5101 brass castings

2. Foundry technology

2-1. Pattern making

2-1-1. Casting plan

a) Gating system
b) Solidification simulation

2-1-2. Pattern making

a) Sorts of patterns and characteristics
b) Selection of wood
c) Finishing allowance, draft
d) Pattern making
e) Inspection
f) Maintenance and storage of patterns

2-2. Melting

a) Chemical compositions
b) Mass effect
c) Inoculation
    * mechanical properties
    * micro and macro metallographic structures

2-3. Moulding

2-3-1. Green sand

a) Selection of sand and bentonite
b) Hardness of mould
c) Water content of mould
d) Effect of additives
    * dimensional stability
    * defects

2-3-2. CO_2 process
a) Selection of sand
b) Sodium silicate (Na_2O/SiO_2)
c) Flow of CO_2 gas

2-3-3. Furan sand

2-3-4. Pep set mould

2-3-5. Core
a) CO_2
b) Shell core

2-4. Quality control
a) X-ray fluorescent analyzer
b) C.S analyzer
c) Furnace front test
    chill test, CE meter, immersion pyrometer, gas analyzer .

2-5. Test and inspection
a) Visual inspection
b) Measurement of dimension
c) Inspection by striked sound echo
d) Liquid penetrant testing
e) Magnetic crack detection
f) Non-destructive testing

2-6. Finishing
a) Cleaning
b) Grinding
c) Rough machining
d) Heat treatment
    * Removal of internal stress
    * Change of metallographic structures
        malleable, ductile, cast steel

2-7. Product development

a) Brake drum

b) Motor casing and housing

c) Automotive spare parts

d) Pump, motor, and generator casings

e) Engine block

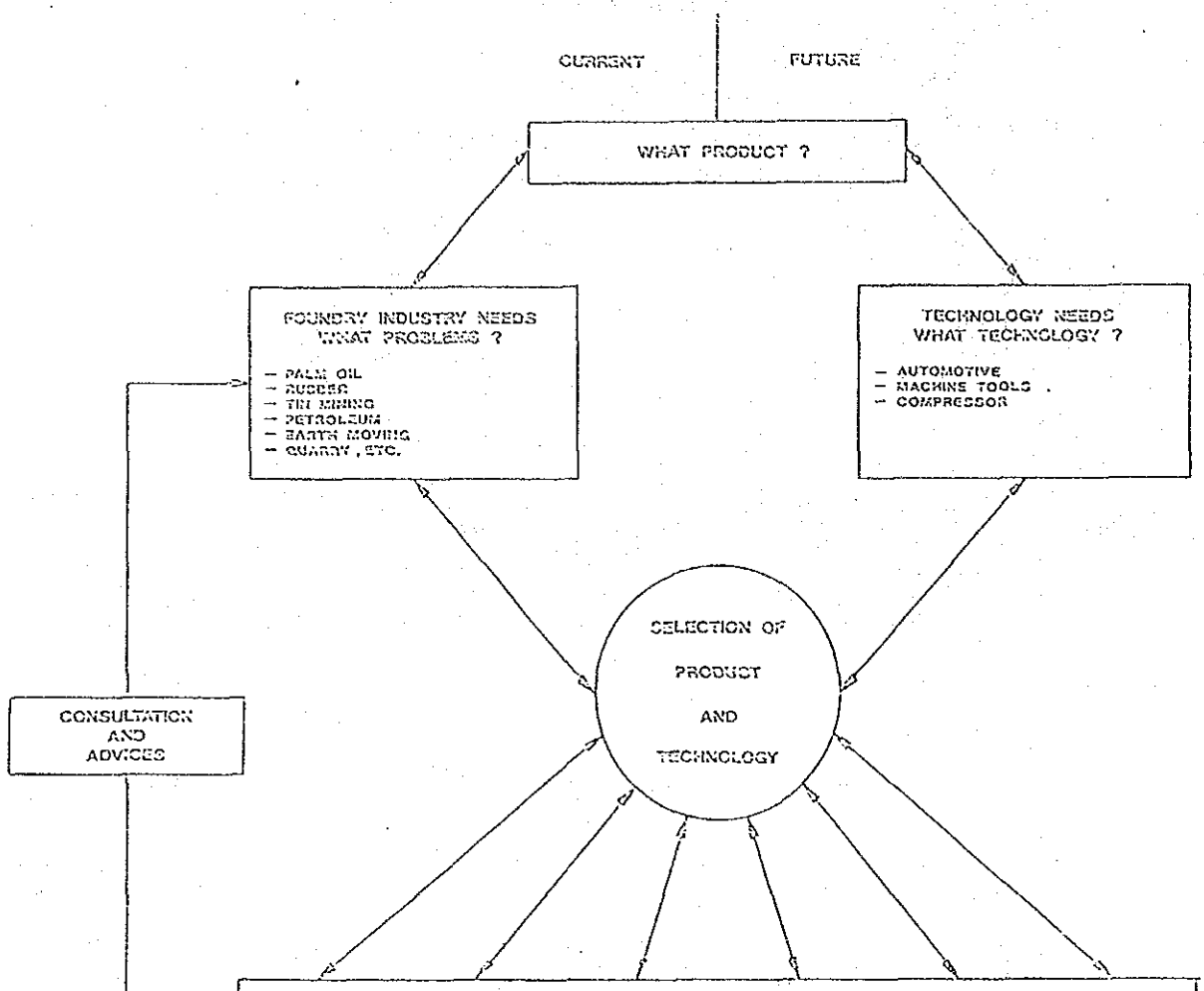
f) Lathe bed

g) Milling bed

STANDARD AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA

FOUNDRY TECHNOLOGY UNIT

OPERATIONAL PLAN



		FOUNDRY TECHNOLOGY UNIT					
		PATTERN MAKING	MOULDING	MELTING	TEST AND INSPECTION	FINISHING	QUALITY
YEAR	PRODUCTS						
1990							
1991							
1992							
1993							
1994							

APPENDIX 8

LIST OF CASTINGS CURRENTLY PRODUCED BY EXISTING FOUNDRIES

A. Rubber Industry

1. Rubber processing machinery
2. Rollers
3. Gears
4. Bearing housing
5. Chain gears
6. Pulleys
7. Others

B. Building Material Industry

1. Pipe and pipe fitting
2. Manhole cover
3. Valves
4. Hydrant
5. Pumps
6. Lamp posts
7. Coupling for pipe
8. Gibault joint and saddle
9. Weight blocks for lifts
10. Surface box
11. Concrete mixer parts
12. Pile shoes
13. Sanitory parts
14. Others

C. Mining Industry

1. Water pumps and gravel pumps
2. Pump liner
3. Impeller
4. Coupling for machine
5. Pump casing
6. Dredging parts
7. Bushes
8. Sledge
9. Others

D. Automobile Industry

1. Brake drum
2. Clutch disk
3. Exhaust manifold
4. Cyclinder liner
5. Air-condition bracket
6. Air-condition pulleys
7. Engine pulley
8. Others

E. Motorcycle Industry

1. Kick starter lever
2. Piston
3. Brake drum
4. Block Manifold
5. Cylinder block
6. Cylinder head
7. Crane case
8. Disk brake set
9. Brake shoe
10. Others

F. Railway Industry

1. Brake drum
2. Wheels
3. Others

G. Palm oil mill industry

1. Worm screw
2. Sleeves
3. Pulleys
4. Boiler parts
5. Furnace grate
6. Dust collector parts
7. Sterilizer
8. Digester
9. Others

I. Steel Industry

1. Rolling mill machinery
2. Plate plugs
3. Machine parts
4. Rollers
5. Others

J. Brick Industry

1. Brick making machinery
2. Gears
3. Wheels
4. Pulleys
5. Bushes
6. Screw housing
7. Shovel conveyor
8. Others

J. Quarry Industry

1. Coupling
2. Crusher
3. Griding
4. Others

K. Agriculture Machinery Industry

1. Chain gear
2. Sucket teeth
3. Sucket
4. Dredging parts
5. Weight blocks
6. Others

L. Marine Industry

1. Propeller
2. Impeller
3. Shaft
4. Couplings
5. Ship trimmings
6. Others

M. Chemical & Food Processing Industry

1. Valves
2. Pipe fitting
3. Joints
4. Boiler parts
5. Pulley
6. Impeller
7. Dust collector parts
8. Others

N. Electrical Equipment Industry

1. Motor casing
2. Bearing housing
3. Protection box
4. Sleeve bushing
5. Griding
6. Fan for motor
7. Induction motor
8. Others

O. Telecommunication Industry

1. Telephone junction box
2. Manhole cover
3. Joints
4. Steps
5. Others

P. Cement Industry

1. Crushers
2. Pulley
3. Drum barrel
4. Rollers
5. Sleeves for cement concrete vehicles
6. Others

Q. Glass Industry

1. Glass moulds
2. Others

R. Plastic Industry

1. Die set
2. Mould components

S. Weighing Machine Industry

1. Weights
2. Components

T. Sport Equipment Industry

1. Weights
2. Components

U. Overhead Crane

1. Rollers
2. Others

V. Machinery Parts

1. Pulley
2. Coupling
3. Gear
4. Shaft
5. Tools
6. Wheels
7. General engineering parts
8. Others

W. Water Treatment Equipment

1. Self priming pump
2. Centrifugal pump
3. Valves
4. Others

X. Diesel Engine and Parts

1. Engine
2. Cylinder block
3. Cylinder head
4. Crane case
5. Others

APPENDIX 9

TRAINING PROGRAMME IN JAPAN
(May - Aug., 1990)

I. Guidance

Group training to acquire fundamental knowledge and and technical skill

Field	Lecture 9:00-12:00	Practice 13:00-16:30
1. Pattern making	5 days (15 h)	5 days (17.5 h)
2. Melting	5 (15)	5 (17.5)
3. Sand preparation	2 (6)	2 (7)
4. Core making	1 (3)	1 (3.5)
5. Moulding	2 (6)	2 (7)
6. Finishing	2 (6)	2 (7)
7. Test and inspection	3 (9)	3 (10.5)
	20 days (60 h)	20 days (70 h)

II. R & D Training

Individual training is given by lectures for total 160 hours and practice for 80 hours. Examples of R & D subjects are given in the following :

1. Pattern making and product development
   * Simulation of pattern design
2. Moulding
   * Hardness of mould and dimensional preciseness
3. Melting
   * Spheroidizing heat treatment
   * Inoculation and its effect on properties of cast iron
4. Test and inspection
   * Reliability of X-ray fluorescent analyzer in quantative analysis

Textbook : In situ Technology for Foundry (published by Nikkan Kogyo Shinbunsha) and textbooks prepared by lecturers.

III. Visit for survey

1. Foundry Testing and Research Institute of Saitama-ken
2. Government Industrial Research Institute, Nagoya
3. Foundry Testing and Research Institute of Mie-ken
4. Nissan Tochigi Factory
5. Asahi Malleable
6. Hitachi Metals, Kuwana Factory
7. Sukita Iron Works
8. Hitachi Metals, Kyushu Factory

10－2　プログレスレポート

プロジェクト側が今回の合同委員会の資料として作成したもの。

SIRIM/JICA PROJECT TYPE COOPERATION
PROGRESS REPORT
ON THE
ESTABLISHMENT OF FOUNDRY TECHNOLOGY UNIT
between the period of
12TH OCT. 1988 to 11TH OCT 1989

1 INTRODUCTION AND GENERAL REVIEW

This report presents the overall status of implementation of the current SIRIM/JICA project for the establishment of Foundry Technology Unit in SIRIM. Over the one year period, since the signing of the Record of Discussion (R/D), much progress have been achieved and this report will serve as a feedback to the Joint Committee for their assessment on the implementation of the project.

Upon signing of the R/D on 12th October, 1988, both the Japanese side and the Malaysian side have carried out their respective responsibilities as stipulated in the R/D. Major responsibilities are as follows :

Malaysian Side

- to provide the building and relevant infrastructure required for the project
- to provide the necessary manpower for the successful implementation of the project.

Japanese Side

- to provide the necessary equipment for the project
- to dispatch Japanese experts in the relevant foundry technological areas (as stipulated in the R/D).
- to provide counterpart training programme for the project.

Since the signing of the R/D, two teams of Japanese experts and administrators have been dispatched to FTU, namely;

- A Survey Team : 29th March - 6th April,1989
- Building Construction experts: 20th - 29th September, 1989.

2 STATUS OF IMPLEMENTATION

This section describes the progress of the implementation of the project :

2.1 Organisation Structure of Foundry Technology Unit

(a) 1988/89

Annex I shows the organisation structure of FTU for the year of 1988/89. The total breakdown of manpower for this period is as follows :

-	Research Officer	4
-	Industrial Design Officer	1
-	Assistant Research Officer	1
-	Technician	9
-	Draughtman	1

Annex II provides brief background of the above personnel.

Japanese Experts dispatched so far are as follows :

-	Chief Adviser	Dispatched on 7 June, 1989
-	Coordinator	Dispatched on 16 March, 1989
-	Melting Expert	Dispatched on 16 March, 1989

(b) 1990 onward (prospect)

Annex III shows the total manpower distribution in the planned organisation structure of FTU for 1990 onwards.

The overall manpower requirement for FTU has in principle been approved by the Public Service Department (JPA). Manpower intake will be carried out annually upon approval by the Ministry of Finance. The following are the intake programme as approved by JPA :

	Post	1989	1990	1991	1992	1993	1994
-	Research Officer	3	1				
-	Industrial Design Officer	1					
-	Senior draughtman	1					
-	Special grade technician	1					1
-	Senior technician	2					1
-	Technicians	7	4			6	
-	Stenographer	1					
-	Driver	1					
	TOTAL	16	5	1	-	6	2

The intake for 1989 has been carried out early this year.

2.2 **Budget allocation at Malaysian Side**

Budget allocation on the Malaysian Side is divided into three categories, namely; the operating budget, development budget and R&D budget. So far, the first two categories are related to the current development of FTU.

(a) 1988/89

As for 1989, the following are the breakdown of the budget;

- Development budget

As up to 1989, the amount of Development budget allocated by the Malaysian Government for the project is $1,170,000 which was spent on the construction of the building extension. Annex IV illustrates the expenditure of the development budget for the construction of the building.

- Operating Budget

Under the present arrangement FTU is not specifically allocated with an operating budget but all expenditure under this budget is accounted for in the MIDEC's operating budget. From the MIDEC's total operating budget of $408,300.00 for 1989, $45,608.39 has been spent on foundry activities.

(b) 1990 onward (prospect)

- Development budget

The amount of development budget applied for 1990 and subjected to approval in the next fiscal year is as follows;

- For building	$ 430,000.00
- For equipment	$1,180,000.00
- For installation of equipment	$ 130,000.00
	$1,740,000.00

Equipment to be acquired with this budget are as follows and their estimated price are as follows ;

- Thermal video system	$280,000.00
- Heat-treatment facility	$250,000.00
- Heat conductivity tester	$270,000.00
- Casting simulation software	$180,000.00
- Others	$200,000.00

- Operating budget

  The amount of operating budget requested for 1990 is $477,397.00 and this amount will be used to purchase most of the materials required for the casting work and other operating expenses of foundry activities.

- R & D budget

  For 1990, FTU personnel will be fully involved in the installation, testing and commissioning of all equipment donated by JICA. Furthermore, most of the officers in FTU will be going for counterpart training in Japan. Hence, as anticipated, no R & D budget was applied for 1990. However, budget will be requested in the Sixth Malaysia Plan (1991-1995) for FTU to undertake its R & D programme.

2.3 Status of facilities and equipment and related problems

(a) The Japanese side

The Japanese side is to provide the machinery and equipment required for the project as stipulated in the R/D. To date a total of four shipments of the equipment has been delivered (Annex V and Annex VI) to site amounted to $2,276,025.23 and all shipments of equipment are expected to arrive before February 1990. In addition supportive equipment have also been provided by the Japanese side which amounted to $395,733.12. Detailed breakdown of these supportive equipment purchased in Malaysia is shown in Annex V.

The total contribution from the Japanese side so far has amounted to $2,671,758.35.

There is no apparent problem facing FTU in receiving the equipment except of minor administrative and procedural problems faced from time to time.

(b) The Malaysian Side

As stipulated in the R/D the Malaysian Side is to provide the building and working space towards the successful implementation of the project. Annex VII shows the building schedule and the progress of the implementation. The total cost of the building and other infrastructure is expected to amount to $1,088,132.64 and the expenditure is reflected in Annex IV.

There is some delay in the construction of the building due to some problems faced earlier in the construction work. During the preparation of the building foundation huge rock outcrops have interrupted in most of the digging work. Significant amount of work and time have been wasted in removing these rocks before the foundation work could proceed.

To finalize the foundation work of large equipment such as induction furnaces, sand preparation and moulding machines, two Japanese experts were dispatched. Through their proper guidance at the site, the most critical work on the foundation of induction furnaces could be overcome.

However, this slight delay in the building construction will not jeopardise the progress of the project as the overall planning has taken into account of

anticipated delay in the construction work as a contigency measure.

2.4 Activities and Achievements in 1988-89

The first year of this project is mostly centered on the infrastructural development activity and receiving of equipment from Japan (inclusive of equipment purchased locally with JICA budget). However, a number of activities were carried out as preparations for the full operation of FTU. Some of the activities are as follows:

- Survey of local foundries

  A total of 24 foundries were visited in order to gauge the level of technology and know-how existing in these foundries. The data obtained from this survey provides the guideline for FTU to formulate its future operational plan.

  During these visits, the melting expert currently serving FTU managed to provide some on-site consultancy on a number of problems faced by the foundries.

- Training

  Four FTU personnel (3 technicians and 1 draughtman) have been dispatched to Japan for three months practical training. Areas of training include ; Pattern making, moulding, melting and foundry draughtmanship.

  Training programme for the transfer of technology will be intensified in the following year as FTU facility is fully established.

- Services

  At present FTU is only capable of rendering information services. A number of enquiries from various internal and external agencies related to the Malaysian foundry industries have been received. Agencies such as JETRO, MIDA, HICOM Engineering Sdn. Bhd. have been in close rapport with FTU.

- R&D activities

  While waiting for its full establishment of the foundry workshop, the FTU personnel on their own initiatives have successfully developed a complete low-cost investment casting line through their R&D programme. This exercise has provided some preliminary experiences and exposures towards their preparation to receive the transfer of foundry technology expected from the Japanese side.

3 ANNUAL WORK PLAN (NOV. 1989 TO NOV. 1990)

3.1 Installation of the equipment

After the completion of the building extension scheduled at the end of November 1989, installation of the equipment will start in December. For the installation of 1) High Frequency Induction furnaces, 2) CO_2 sand preparation, 3) Green Sand preparation, 4) Sand Dryer and 5) X-Ray Flourescent Analyzer, short-term experts will be dispatched for supervision (Refer to Annex VIII & IX).

3.2 Transfer of technology

On completion of the installation, training of operation for FTU personnel will start with support and guidance of Japanese experts. It may be adequate to recognize the former half of 1990 till around June as a preparatory operation. In view of characteristics of this project and in order to fulfil expectations from foundry industries in Malaysia at the earliest time, both Malaysian and Japanese sides agreed that transfer of technology should be implemented mostly through products development.

Based on this premise, target products, i.e. not only suitable for practice at FTU as training materials but also expected in industries to improve and develop qualities, were selected through repeated discussions. The results are listed in Annex XI. Among them, manufacture of brake drum, pulley and gear will be practised in this year according to the schedule shown in Annex VIII.

These products were selected to meet the following criteria defined as "Stage 1 Technology":

1) Shape : simple, uniform thickness, without core, round-shaped, small size (1 - 3 kg/piece)

2) Material: grey cast iron - FC 10, 15

In the practice, pattern making proceeds first, and melting, moulding and finishing follow. Test and inspection, and quality control are practised parallely and their results are fed back to respective fields for further improvement.

3.3 Preparation of textbook and lecture

A manuscript of"Practical Technology of Castings" (Kenji Chiijiwa, et.al) was sent from JICA to FTU at the beginning of October. Copy of the manuscript was sorted out into respective fields of technology and distributed to FTU research officers concerned for checking. Parallely, the manuscript has been input into a word processor by FTU stenographer. The latter will be proof-read compared with the checked manuscript and then sent for printing.

Lecture will start in December by using the manuscript of textbook. Before dispatch of research officers to Japan for training, lecture on fundamental technology, viz. general course, will be completed.

3.4 Training of the counterpart personnel in Japan

Training for this year is characterized by spending much time for R & D training as shown in Annex X. It is advisable that the trainees should summarize results of R & D training into the form of report, which will be published later for dissemination.

3.5 Services to industry

After training of the counterpart personnel in Japan, maybe from October, analytical testing using X-Ray Flourescent Analyzer and C,S Analyzer will be ready for service.

Advisory and consultancy services are carried out according to needs from industries. Visit to foundry factories will be repeated not only for these services but also to update the data base on Malaysian foundry technology which FTU is compiling.

4 OTHERS

4.1 Major problems faced

- Operational Budget

As previously stated (2.2 (a)) that the operational budget for FTU is accounted for in MIDEC's operational budget. This poses problem of uncertainty in the amount of money allocated for FTU. As such budgetary planning and monitoring on FTU expenditure is rather difficult.

- Office space

Initially, the present building where FTU is located was intended for other project. When it was given to FTU, emphasis was placed on maximizing the available space to house all the equipment donated by JICA. Some modifications were made to meet the short-term need of office space. After the start of the project, additional budget was allocated by JICA to purchase textbooks. In addition, with the incoming of both short and long term experts, it is foreseen that FTU will face a shortfall of space to meet this new requirement especially library and meeting room.

4.3 Proposals

- It is proposed that a separate operating budget be allocated to FTU for a better planning and monitoring of the Unit's purchasing requirements and activities.

- It is proposed that additional office space within the present building be constructed to meet the new requirement.

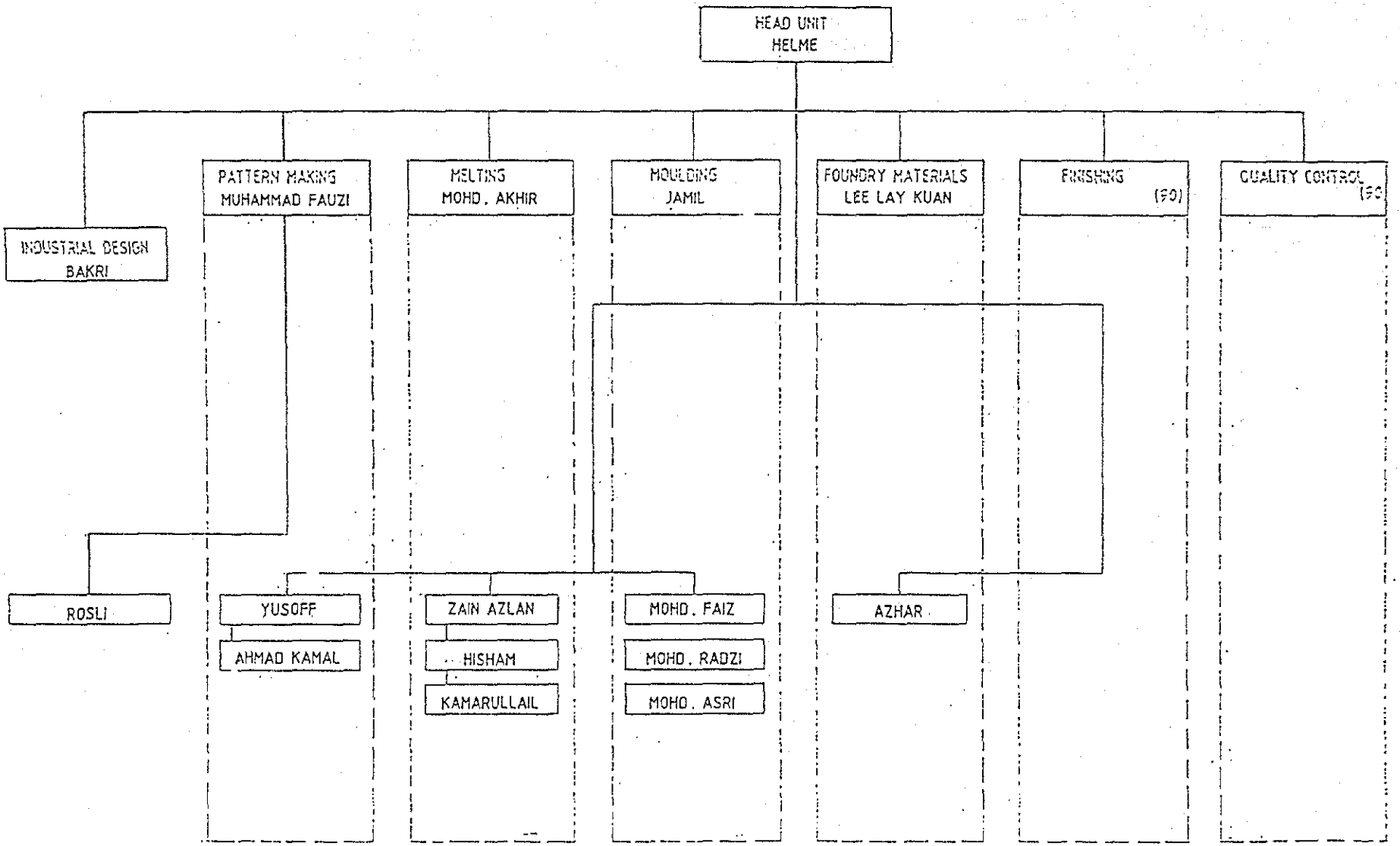
- It is also proposed that a special supervisor be dispatched to coordinate and supervise the whole installation programme of the equipment.

5 CONCLUSION

The overall progress of the project has been very good with full cooperation of every party involved. It is foreseen that FTU will be partially operational by middle of 1990 as the installation work is expected to be completed by March of the same year. Gauging on this expectation, the project can be considered as having achieved tremendous progress as some foundry activities can be carried out within two-year period after the signing of R/D although the joint cooperation is agreed for five-year term.

ANNEX I

ORGANIZATION STRUCTURE OF FOUNDRY TECHNOLOGY UNIT FOR 1988 / 1989



BACKGROUND OF FTU CURRENT PERSONNEL

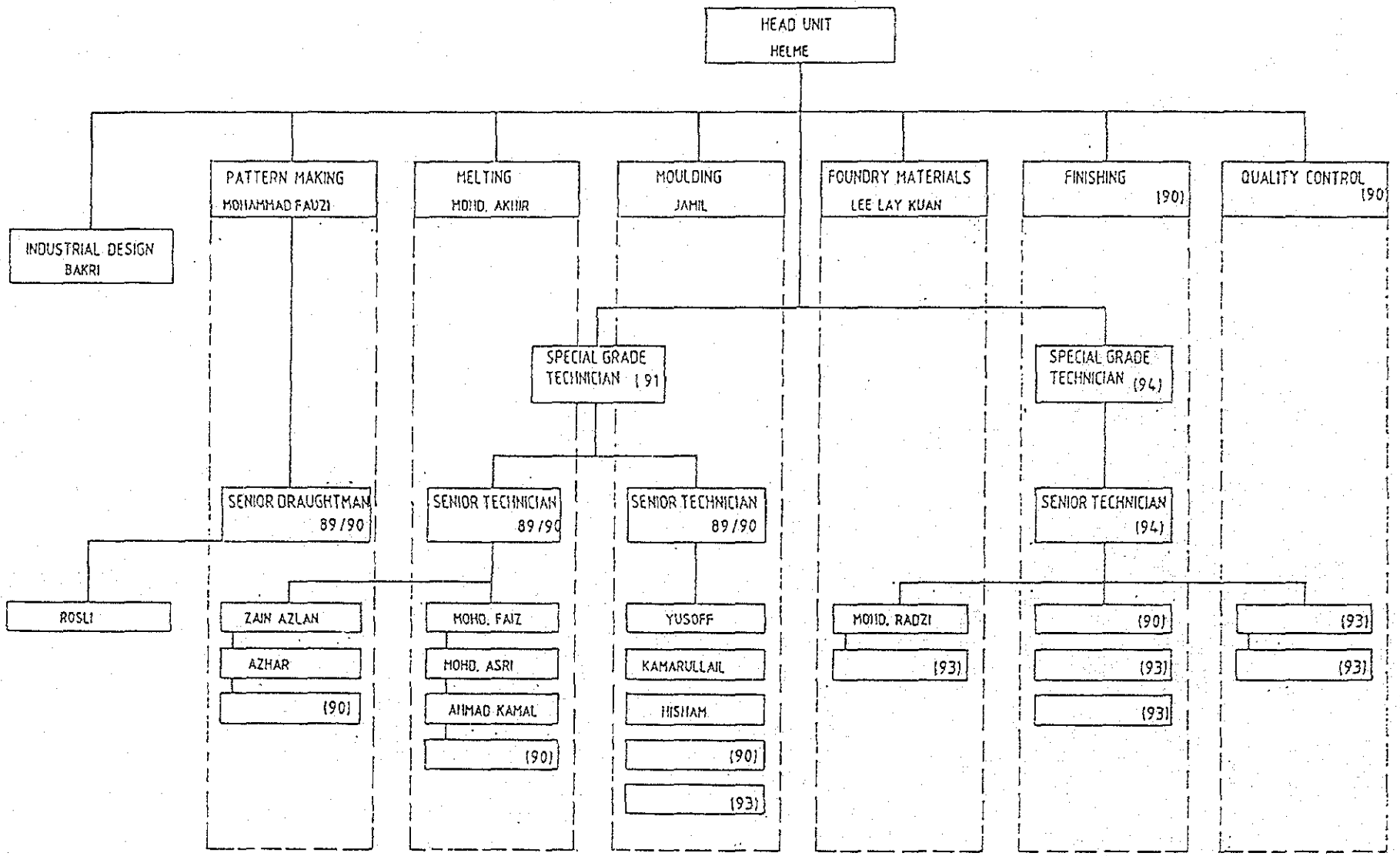
ANNEX II

NAME OF COUNTERPART	DESIGNATION	YEAR OF JOINING	QUALIFICATION
MR. HELME BIN HASHIM	Head, Foundry Technology Unit	1979	B.Sc (Hons.)Prod. Eng., M.Eng. Sci.
MR. MUHAMMAD FAUZI BIN ISMAIL	Research Officer PATTERN MAKING	1985	B.Sc. MECHANICAL ENGINEERING
MR. MOHD. AKHIR BIN YEOP KAMARUDDIN	Research Officer MELTING	1989	B.Sc. MECHANICAL ENGINEERING
MR. JAMIL BIN SULEIMAN	Research Officer MOULDING	1989	B.Sc. MECHANICAL ENGINEERING
MISS LEE LAY KUAN	Research Officer TEST & INSPECTION	1989	B.Sc. Nuclear Science (Hons)
MR. BAKRI BIN BAKAR	Design Officer PRODUCT DEVT.	1988	DIPLOMA IN INDUSTRIAL DESIGN
MR. MOHD. SABRI BIN ABDULLAH	Asst. Research Officer	1986	DIPLOMA IN MECH. ENGINEERING
MR. ZAIN AZLAN BIN UJANG	Technician MELTING	1986	CERTIFICATE IN MECH. ENGINEERING
MR. LORGANATHAN S/O VARATHAN	Technician FINISHING	1986	B.Sc IN METALLURGICAL ENGINEERING
MR. ROSLI BIN HUSSEIN	Draughtman PATTERN	1988	SIJIL PELAJARAN VOKESIONAL
MR. YUSOFF BIN SAPIAN	Technician PATTERN	1988	SIJIL PELAJARAN VOKESIONAL
MR. MOHD FAIZ BIN EYUB	Technician MOULDING	1989	CERTIFICATE IN MECH. ENGINEERING
MR. HISHAM BIN MOHD ARIS	Technician MELTING	1989	CERTIFICATE IN MECH. ENGINEERING
MR. KAMARULLAIL BIN MAHAD	Technician MELTING	1989	CERTIFICATE IN MECH. ENGINEERING

NAME OF COUNTERPART	DESIGNATION	YEAR OF JOINING	QUALIFICATION
MR. AHMAD KAMAL BIN ARIFFIN	Technician MOULDING	1989	CERTIFICATE IN MECH. ENGINEERING
MR. MOHD ASRI BIN MOKHTAR	Technician FINISHING	1989	CERTIFICATE IN MECH. ENGINEERING
MR. AZHAR BIN ABDULLAH	Technician MOULDING	1989	CERTIFICATE IN MECH. ENGINEERING
MR. MOHD RADZI BIN HARUN	Technician PATTERN	1989	CERTIFICATE IN MECH. ENGINEERING
MISS ROSLINDA BINTI SHAMSUDDIN	Stenographer SECRETARIAT	1989	DIPLOMA IN STENOGRAPHY
MR. MOHAMED BIN ABDULLAH	Store Keeper STORE	1988	LOWER CERTIFICATE OF EDUCATION
MR. YUSOFF SUKIMAN	Driver	1989	LOWER CERTIFICATE OF EDUCATION

ORGANIZATION STRUCTURE OF
FOUNDRY TECHNOLOGY UNIT FOR 1990 ONWARD

APPENDIX III



BREAKDOWN OF DEVELOPMENT BUDGET ALLOCATION FOR 1998 & 1999

ANNEX IV

PROJECT CODE : 6003018

CODE	PARTICULARS	ALLOCATION	COMMITTED	NOT COMMITTED	NOTES	ACTUAL SPENDING	NOTES
130133	Building extension	322,725.37	344,703.89		Work has started	30,700.29	First payment
	Variation Order	60,000.00					
	Consultants' fees	40,781.52					
	Crane	143,000.00					
	Electrical work	274,200.00					
130189	Raised Floor/Air-conditioned - Analysis Room	48,500.00	48,500.00		Work completed	46,075.00	Payment - 951
130253	Office Renovation	49,320.00	49,320.00		Work completed	44,342.00	Payment - 951
130358	Electrical work- Office renovation	8,679.60	8,679.60		Work completed	8,679.60	Payment - 1091
130455	Air-condition- Office renovation	35,350.00	35,350.00		Work completed	37,382.50	Payment - 901
130489	Fire fighting system- Analysis room	41,720.00	41,720.00		Work completed	35,514.80	Payment - 951
130529	Transportation of equipment	20,000.00		20,000.00			
130589	Installation of equipment	0.00		0.00			
130729	Office furniture	0.00	0.00	0.00		0.00	
130859	Reception Area furniture	17,291.15	17,291.15	0.00	Purchase of furniture	17,291.15	Payment - 1051
130989	Draughting equipment	9,323.00	9,323.00	0.00	Draughting equipment	9,323.00	Payment - 1031
130989	Analysis room modification	22,515.00	22,515.00		Work completed	21,339.25	Payment - 951
131029	Pattern Room	50,000.00		50,000.00	Pending drawings from JICA	0.00	
131189	Telephone	7,085.00	7,085.00	0.00	Additional lines	7,085.00	Payment - 1001
131259	Signage	0.00	0.00	0.00	ZTB signboard	0.00	
131389	Ramp/Staircase	5,000.00	2,980.00	2,020.00	Additional ramp for existing building media ada	0.00	Work will be done at the end of October
	TOTAL	1,160,152.64	1,038,132.64	72,020.00		302,422.58	

PURCHASED IN MALAYSIA

ANNEX V

	MODEL	VALUE(JYE)	VALUE(M$)
1	COPY MACHINE	1,303,102.70	27,300.00
2	FORKLIFT CAR	3,747,016.00	78,500.00
3	PERSONAL COMPUTER	1,616,181.00	33,859.00
4	VIDEO SET	775,044.00	15,432.00
5	BUS	5,821,302.07	108,155.80
6	UNINTERRUPTIBLE POWER SUPPLY(UPS)	188,381.55	3,500.00
7	WORD PROCESSOR(α 335)	767,830.21	14,046.00
8	AUTOMATIC VOLTAGE REGULATOR	638,433.10	11,800.00
	SUB TOTAL	14,857,290.63	292,592.80
9	REFERENCE BOOKS		(50,394.21)
10	PROJECT CAR(PAJERO)		(52,746.11)
	TOTAL		395,733.12

DELIVERED EQUIPMENT

	DATE	VALUE(JYE)	VALUE(M$)
• DIGITAL THERMOMETER	'89.03.30	300,000.-	5,760.00
• 1st Shipment	'89.05.24	12,989,000.-	267,686.03
• 2nd Shipment	'89.08.22	42,100,000.-	808,320.00
• 3rd Shipment	'89.10.19	27,801,000.-	455,059.20
SUB TOTAL		83,190,000 -	1,536,825.23
• 4th Shipment	Arrival on '89.11.03	38,500,000.-	739,200.00
TOTAL		121,690,000.-	2,276,025.23

ANNEX VI

LIST OF THE EQUIPMENT ACCORDING TO R/D

NO.	EQUIPMENT AND APPARATUS	PLAN SPECIFICATION	QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
1	Melting										
	(1) High frequency electric furnace (with power unit)	500kg/325kw	1	325	INDUCTOTHERM						
	(2) High frequency electric furnace	100kg/230kw	1	230	INDUCTOTHERM						
	(3) Crucible furnace	80kg (for Cu)	1	75	INDUCTOTHERM						
		25kg (for Al)									
	(4) Cooling tover	for electric furnace	1	7.5							
	(Hydraulic pump)			2.2							
	(5) Dust Collector	50m /min	1	3.7	SINTO	CDR-6PR					
	(6) Scale	50kg/max	1		YAMATO	SD-50			*********		
		500kg/max	1		YAMATO	D1-2					
	(7) Ladle	50kg/max	1		NIPPON LADLES	NLG-50			*********		
		100kg/max	2		NIPPON LADLES	NLG-100					
		600kg/max	2		NIPPON LADLES	NLG-600					
	(8) Burner (gas fired)		1	0.4	CHUGAIRO	TMG-6B-L-D			*********		
	(9) Over head hoist crane	5 ton, 14mx28m	2 set								
	(10) Fork lift car	1.5 ton, (with shovel)	1		BOBCAT	SKID-STEER LOADER MODEL 743	*********				

NO.	EQUIPMENT AND APPARATUS	PLAN SPECIFICATION	QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
2	Moulding										
	(1) Jolt squeeze stripper moulding machine	650x575 (mm) (with pattern 2 sets)	2		SINTO	FD-2A					
	(2) Roller conveyor	300mm (width) double	1		NAGAOYA KIKOH				*********		
	(3) Flask	300x240x (200/200)mm	10 set		HISAGOYA					*********	
		580x460x (250/250)mm	5 set		HISAGOYA						
		1,000x800x (300/250)mm	3 set		HISAGOYA						
	(4) Pneumatic rammer		2		NSK	FR-00, FR-00L			*********		
3	Core Making										
	(1) Core blowing machine	310(W)x 400(L)x340(H) (with pattern 1 set)	1		SINTO HISAGOYA	SBO-3C					
	(2) Shell core machine	300(W)x(70/70)x300(H) (with pattern 1 set)	1		SINTO HISAGOYA						

NO.	EQUIPMENT AND APPARATUS	PLAN SPECIFICATION	QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
4	Sand Preparation										
	(CO & Organic Sand)										
	(1) Bucket elavator	10 t/h	1	2.2	SINTO						
	(2) Sand storage with belt feeder	3 cu.m	1	1.5	SINTO						
	(3) Whirle mixer	150kg/Batch	1	15	SINTO						
	(4) Dust collector	50 cu.m/min	1	3.7	SINTO						
	(Green Sand)										
	(5) Shakeout machine	1,000x1,000 (mm)	1	3.7	SINTO						
	(6) Belt conveyor	10 t/h with magnet pulley & magnet separator	1	2.2	SINTO						
	(7) Bucket elavator	10t/h	1	2.2	SINTO						
	(8) Sand storage with belt feeder	3 cu.m	1	1.5	SINTO						
	(9) Sand mixer	120kg/Batch, 7.5kv	1	7.5	SINTO						
	(10) Dust collector	50 cu.m/min	1	3.7	SINTO						
	(Sand Dryer)										
	(11) Sand dryer (with sand supplying equipment and dust collector)	0.5 t/h	1 set	(20)	To be informed later						

NO.	EQUIPMENT AND APPARATUS	PLAN: SPECIFICATION	PLAN: QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
5	Finishing										
	(1) Shot blasting machine with dust collector	Table type 1m(dia.)/5.5kw	1	10	SINTO	SHT-OPT					
	(2) Grinder with dust collector	Wheel 510mm(dia.)/11kw	1	14.7	MATSUZAKI	MYG-20			*********		
6	Air Compressor etc.,										
	(1) Air compressor with dehydrator	15kw (2 cu.m/min.)	1 set	15	KOBBE STEEL	KST-15-C			*********		
	(2) Emergency electric power	Diesel engine, 37KVA	1 set		DENYO	DCA-45SPI		*********			
7	Instrumental Analysis										
	(1) X-Ray fluorescent analyzer	80mA, 60kV	1	20	RIGAKU	3070E					*********
	(2) C.S. analyzer	C: 0 - 3.5%	1	4	LECO	CS-244			*********		
		S: 0 - 0.35%									
8	Physical Test										
	(1) CE meter	2000 - 2500 F	1	0.1	NISABU	EH100-001		*********			
	(2) Immersion pyrometer	Digital type	1		NISABU	NSP-203(R)		*********			
	(3) Gas analyzer	Graduation 0.01ccH /100g	1	0.5	AL FAITH	DP-MKII		*********			

NO.	EQUIPMENT AND APPARATUS	PLAN SPECIFICATION	QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
9	Sand Test										
(1)	Sand mill	20kg/Batch	1	0.75	SINTO	NSP-0L				*********	
(2)	Universal mixer	30kg/Batch	1	3.7	SINTO	OTM-101				*********	
(3)	Sand rammer	for test piece	1		SINTO	SR				*********	
		(o 50x50mm)								*********	
(4)	Sieving apparatus	240 r.p.m.	1	0.2	SINTO	RO-TAP SS				*********	
(5)	Sand washer	Timer:60min	1		SINTO	SW				*********	
(6)	Permeablity tester	for green sand	1		SINTO	PT				*********	
(7)	Sand strength tester	Compressive strength	1	0.03	SINTO	US-H				*********	
(8)	Moisture tester	Infrared lamp drying	1	0.5	SINTO	F-2B				*********	
(9)	Hardness tester (green sand)	Load range:105 - 237g	1		SINTO	GHT				*********	
(10)	Hardness tester (dry sand)	Load range: 1.1 - 2.0kg	1		SINTO	DHT				*********	
(11)	Active clay tester	with PH meter	1	0.2	SINTO	DT-535A				*********	
(12)	Mouldability tester	controlled by a timer	1	0.1	GF	PMT			*********		
(13)	Specific surface tester	820x236x207mm	1		GF	POF			*********		
(14)	Compactability tester	Comp,10kg/cm	1		NAGAKAWA	NS-CBT-2		*********			
(15)	Transverse strength tester	430x613x180mm	1		GF	PFG			*********		
(16)	Balance	Digital type	1	0.01	A&D	FR-300		*********			
(17)	Electric oven	40 - 300 C	1	1.4	YAMATO	DX-41			*********	*********	
		250 - 12000 C	1	1.0	SINTO	NMR 12SX					
(18)	Wooden pattern for test piece	for Transverse strength	1		GF	PBC			*********		

NO.	EQUIPMENT AND APPARATUS	PLAN SPECIFICATION	QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
10	Pattern Making										
	(1) Single furnace planer	Max.600(W) x 300(T)mm	1	4.85	IIDA KOHGYO	SX-633				**********	
	(2) Hand feed planer	Max.295(W)mm	1	1.5	IIDA KOHGYO	HJ-302			**********		
	(3) Band saw machine	Max.390mm	1	4.1	JONAN SEISAKUSYO	JBS-650		**********			
	(4) Radical drill machine	Drill dia.13mm	1	0.25	YAMAMOTO KOHKI	RFP24			**********		
	(5) Wood working lathe	Length of bed : 2500mm	1	1.5	FUJIKYU KIKAI	FT-24			**********		
	(6) Cutter lapping machine	Length 300mm	1	0.2	FUJIKYU KIKAI	TF			**********		
	(7) Electric hand planer	Capacity 136(W)mm	1	1.14	HITACHI KOHKI	P40			**********		
	Electric hand drill	Drill dia.13mm (steel)	1	0.62	HITACHI KOHKI	BUL-SH-3					
	Electric hand jig saw	Capacity 60(W)mm	1	0.38	HITACHI KOHKI	JH-60A					
	Electric hand sander	Capacity 114 x 180mm	1	0.35	HITACHI KOHKI	SV 12Y1					
	(8) Measuring tools							**********			
	Height gauge	300m, 600mm	each 1		MITSUTOYO	H-730M-H-760M					
	Box parallels	203.2x203.2x203.2mm	1		NABEYA	BP-19M					
	Vernier caliper	200,300mm	each 1		MITSUTOYO	NB-20, NB-30					
	Scale	300,600mm	each 1								
	(9) Surface plates	600x600, 900x1800mm	each 1		OSS	OS-6060, OS-90180		**********			
	(10) Router machine	Table size 810x510mm	1	1.5	SHODA IRON	RO-116		**********			
	(11) Circular saw machine	Table size 1000x900mm	1	2.2	ISHIZU SEISAKUSH	ISB-16				**********	
	(12) Grinder	Wheel size 255mm	1	0.97	HITACHI KOHKI	ABT-4			**********		
	(13) Planer cutter lapping machine	Capacity 600x90mm	1	0.75	TAKEGAWA IRON	JG-T60		**********			
	(14) Manual cutting tools		1		To be informed			**********			
	(15) Dust collector	80 cu.m/min.	1	5.5	NIHON SHUJIN				**********		

NO.	EQUIPMENT AND APPARATUS	PLAN SPECIFICATION	QUANTITY	POWER (KW)	MANUFACTURER	MODEL	PURCHASED IN MALAYSIA	FIRST SHIPMENT 24/5/89	SECOND SHIPMENT 22/8/89	THIRD SHIPMENT 19/10/89	FOURTH SHIPMENT 3/11/89
11	Information Instrument										
	(1) Copy machine		1		MINOLTA	EP-870Z	*********				
	(2) Personal computer		1				*********				
			1		COMPAQ	DESK PRO 286					
			1		COMPAQ	LAPTOP SLT/286					
	(3) Video set						*********				
	Video camera		1		SONY	CCD0V200					
	Color corrector		1		SONY	XV-C700					
	Color monitor		1		SONY	KX-21HGI					
	Video cassette recorder		1		HITACHI	VT-498EM					
12	Vehicle										
	(1) Minibus	16 passengers with office room	1		MERCEDES	03090/35	*********				

WORK PROGRAMME FOR THE BUILDING EXTENSION

ANNEX VII

NO		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		27/4-4/5	5/5-11/5	12/5-18/5	19/5-25/5	26/5-1/6	2/6-8/6	9/6-15/6	16/6-22/6	23/6-29/6	30/6-6/7	7/7-13/7	14/7-20/7	21/7-27/7	28/7-3/7	4/8-10/8	11/8-17/8	18/8-24/8	25/8-31/8	1/9-7/9	8/9-14/9	15/9-21/9	22/9-28/9	29/9-5/10	6/10-12/10	13/10-19/10	20/10-26/10	27/10-2/11	3/11-9/11	10/11-16/11	17/11-23/11	24/11-30/11
	EXTERNAL WORK :-																															
1	SITE PREPARATION			*****	*****	*****	*****	*****	*****																							
				#####	#####	#####	#####	#####	#####	#####	#####	#####																				
2	DRAINAGE															*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	
3	ROADS																		*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
4	DIVERSION OF SEWER LINES							*****	*****	*****																						
								#####	#####	#####	#####	#####																					
	MAIN BUILDING WORK :-																															
1	FOOTING & GROUND BEAM								*****	*****	*****																					
									#####	#####	#####	#####																					
2	FLOOR												*****	*****	*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####				
3	COLUMNS										*****	*****	*****																			
											#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####								
4	BEAMS (UPPER FLOOR BEAM)												*****	*****	*****	*****	*****	*****	*****													
																#####	#####	#####	#####	#####	#####	#####	#####	#####								
5	ROOF SLAB (CORRIDOR)															*****	*****	*****	*****													
															#####	#####	#####															
6	WALLS															*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	
																										#####	#####					
7	PLASTERING																	*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	
8	WINDOWS															*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####					
																										#####	#####					
9	DOORS															*****	*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####			
																										#####						

NOTE: **** ORIGINAL SCHEDULE ##### REVISED SCHEDULE

!!!! ACTUAL WORK

NO		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		27/4-4/5	5/5-11/5	12/5-18/5	19/5-25/5	26/5-1/6	2/6-8/6	9/6-15/6	16/5-22/6	23/6-29/6	30/6-6/7	7/7-13/7	14/7-20/7	21/7-27/7	28/7-3/7	4/8-10/8	11/8-17/8	18/8-24/8	25/8-31/8	1/9-7/9	8/9-14/9	15/9-21/9	22/9-28/9	29/9-5/10	6/10-12/10	13/10-19/10	20/10-26/10	27/10-2/11	3/11-9/11	10/11-16/11	17/11-23/11	24/11-30/11
10	ROOF TRUSS											\\\\\\		*****	*****	*****	*****															
11	ROOFING WORKS																	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####					
12	RAINWATER GOODS																*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####			
13	PAINTING & FINISHES																		*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
14	SPECIAL FOUNDATIONS										*****	*****	*****									#####	#####	#####	#####	#####	#####					
15	ELECTRICAL WORKS																*****	*****	*****	*****	*****	*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####
16	CRANE																*****	*****	*****	*****	*****	*****	*****	*****	*****	#####	#####	#####	#####	#####	#####	#####
																				\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\	\\\\\

NOTE: ***** ORIGINAL SCHEDULE ##### REVISED SCHEDULE
\\\\\ ACTUAL WORK

NO		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		27/4-4/5	5/5-11/5	12/5-18/5	19/5-25/5	26/5-1/6	2/6-8/6	9/6-15/6	16/5-22/6	23/6-29/6	30/6-6/7	7/7-13/7	14/7-20/7	21/7-27/7	28/7-3/7	4/8-10/8	11/8-17/8	18/8-24/8	25/8-31/8	1/9-7/9	8/9-14/9	15/9-21/9	22/9-28/9	29/9 5/10	6/10-12/10	13/10-19/10	20/10-26/10	27/10-2/11	3/11-9/11	10/11-16/11	17/11-23/11	24/11-30/11
	L.L.X SUBSTATION & RELATED BUILDINGS																															
1	SITE PREPARATION									*****	*****																					
										#####	#####	#####																					
2	RETAINING WALL																															
3	FOOTING & GROUND BEAM											*****	*****																			
												#####	#####	#####																		
4	FLOOR																*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****				
5	COLUMNS													*****																		
													#####	#####	#####	#####	#####	#####	#####													
6	BEAMS														*****	*****																
																#####	#####	#####	#####												
7	ROOF SLABS															*****	*****															
																#####	#####	#####	#####	#####												
8	WALLS																	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****					
																										#####	#####					

NOTE: ***** ORIGINAL SCHEDULE ##### REVISED SCHEDULE
ACTUAL WORK

NO		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		27/4-4/5	5/5-11/5	12/5-18/5	19/5-25/5	26/5-1/6	2/6-8/6	9/6-15/6	16/5-22/6	23/6-29/6	30/6-6/7	7/7-13/7	14/7-20/7	21/7-27/7	28/7-3/7	4/8-10/8	11/8-17/8	18/8-24/8	25/8-31/8	1/9-7/9	8/9-14/9	15/9-21/9	22/9-28/9	29/9 5/10	6/10-12/10	13/10-19/10	20/10-26/10	27/10-2/11	3/11-9/11	10/11-16/11	17/11-23/11	24/11-30/11
9	PLASTERING																															
10	WINDOWS																															
11	DOORS																															
12	ROOF TRUSS																															
13	ROOFING WORKS																															
14	RAINWATER GOODS																															
15	PAINTING & FINISHES																															
16	ELECTRICAL																															

ANNUAL WORK PLAN (Nov. 1989–Nov. 1990)

Annex VIII

Month	Nov., '89	Dec.	Jan., '90	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Reconstruction	⇨												
Instllation of equipment		⇦	⇦	⇦	⇦								
Experts for instllation			⇦	⇦	⇦								
Preparation of textbook	⇨	⇨	⇨	⇨	⇨								
Lecture		⇦	⇦	⇦	⇦	⇦							
Training of C/P in Japan							⇦	⇦	⇦	⇦			
Short-term experts													
Pattern making				⇦	⇦	⇦	⇦	⇦			⇦	⇦	⇦
Melting			⇦	⇦	⇦	⇦	⇦	⇦					
Moulding				⇦	⇦	⇦	⇦	⇦					
Finishing											⇦	⇦	⇦
Test and inspection											⇦	⇦	⇦
Quality control												⇦	⇦
Technical guidance team												⇦	⇦
Practice :													
1. Brake drum													
Pattern making				⇦	⇦								
Melting						⇦	⇦						
Moulding						⇦	⇦						
Finishing						⇦	⇦						
Test and inspection						⇦	⇦						
Quality control							⇦	⇦					
2. Pulley													
Pattern making						⇦	⇦						
Melting								⇦	⇦				
Moulding								⇦	⇦				
Finishing								⇦	⇦				
Test and inspection								⇦	⇦				
Quality control									⇦	⇦			
3. Gear													
Pattern making								⇦	⇦				
Melting										⇦	⇦		
Moulding										⇦	⇦		
Finishing										⇦	⇦		
Test and inspection										⇦	⇦		
Quality control											⇦	⇦	
Test and inspection service												⇦	⇦
Advisory & consultancy serv.						⇦	⇦	⇦	⇦	⇦	⇦	⇦	⇦

Remarks :

1. Details of the installation schedule of equipment is given in Annex IX.
2. Training schedule of C/P personnel in Japan is given in Annex X.

SCHEDULE OF INSTALLATION

ANNEX IX

-- TRAVEL ++ INSTALLATION ## PIPING/ELECTRICAL // TRAINING/TRIAL RUN

SCHEDULE	DECEMBER 1989																													JANUARY 1990																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
SHELL MACHINE				++	++	--	--	--	--	--	//	//	//	//	//	//	//																																					
CORE BLOW					++	--	--	//	//	//																																													
SHOT BLASTING						++	++	--	--	--	//	//	//																																										
GRINDER											++	--	//	//	//	//	//																																									
PATTERN MAKING MACHINE																		++	++	++	--	--	--	//	//																													
SAND TEST																									++	--	--	//	//																									
HIGH FREQUENCY ELECTRIC FURNACE																																																				
CO2 SAND PREPARATION																																																				
GREEN SAND PREPARATION																																																			
SAND DRYER																																																			
XRF																																																			

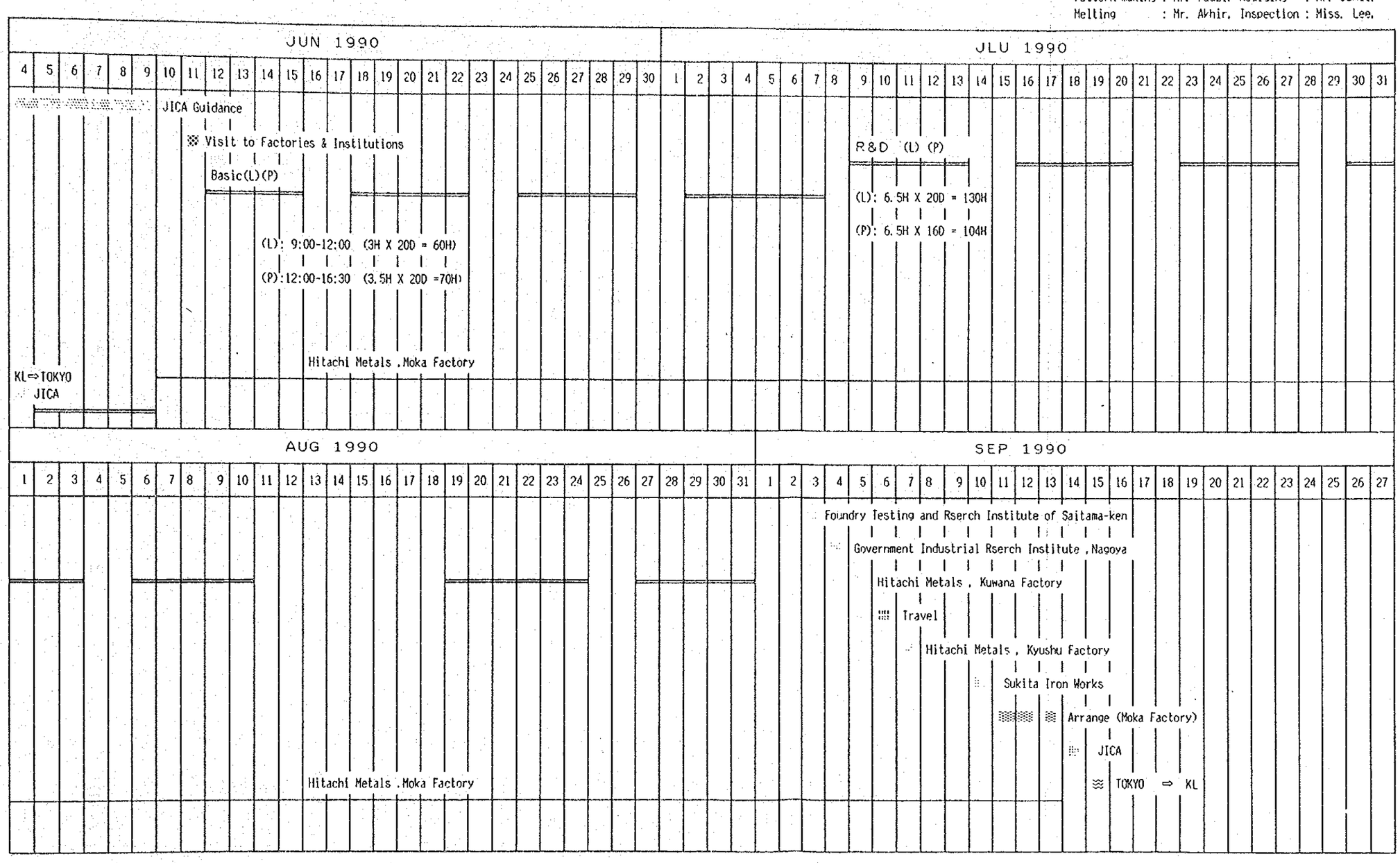
SCHEDULE	FEBRUARY 1990																														MARCH 1990																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
HIGH FREQUENCY ELECTRIC FURNACE																													##	++	++		++	##	##	##	//	//	//	//			++	++		++	++	##	##	##	##	//	//	//	//
CO2 SAND PREPARATION								##	++	++		++	++	##	##	##	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//
GREEN SAND PREPARATION																					++	++	++		++	++	##	##	##	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//
SAND DRYER																				##	++	++		++	++	++	++	##	##	##	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//	//

TRAINING PROGRAMME IN JAPAN
(10 JUN 1990 ~ 18 SEP 1990)

ANNEX X

(L) Lecture (P) Practis
※ Visit

Pattern making : Mr. Fauzi. Moulding : Mr. Jamil.
Melting : Mr. Akhir. Inspection : Miss. Lee.



OPERATIONAL PLAN BASED ON PRODUCT DEVELOPMENT

ANNEX XI

Products	Type of metal							Year of practice				Classification/application
	FC	FCD	FCMB	SC	FC-al	Al-al	Cu-al	1990	1991	1992	1993	
1. Brake drum	○							○				AUTOMOBILES
2. Pulley	○							○				AUTOMOBILES, PALM OIL, CEMENT
3. Gear	○	○						○	○			AUTOMOBILES, MACHINE TOOLS
4. Gear housing	○	○				○			○		○	AUTOMOBILES, MACHINE TOOLS, +
5. Motor cover	○								○			ELECTRICAL EQUIPMENT
6. Screw press (worm screw)		☆		○					☆			PALM OIL
7. Hydrant	☆								☆			HOUSING
8. Hub		○							○			AUTOMOBILES
9. Bracket		○							○			AUTOMOBILES
10. Pipe fittings			○							○		HOUSING
11. Roller				○						○		RUBBER
12. Crawler shoes				○						○		TRACTOR
13. Crusher teeth					○					○		MINING, CONSTRUCTION
14. Valve							○				○	HOUSING
15. Parts for electrical appliances							○				○	ELECTRICAL EQUIPMENT
16. Propeller							○				○	MARINE
a. Pump housing	☆											MINING, QUARRY
b. Sluice gate valve	☆											IRRIGATION
c. Clutch pressure plate	○											AUTOMOBILES
d. Working wheel	☆	☆										MACHINERY
e. Bogie wheel				☆								RAILWAY

Remarks : ○ Training-oriented products. ☆ R & D oriented products. + MINING, PALM OIL, RUBBER, CEMENT.

1) Target products and year of practice are subject to change due to requirements from industries.

2) Products with indications from a. to b. are optional.

3) FC=grey cast iron, FCD=ductile cast iron, FCMB=malleable cast iron, SC=cast steel, FC-al=alloy cast iron, Al-al=aluminium alloy, Cu-al=copper alloy.

10－3　オペレーショナルターゲット

10－3－1　プロジェクト側が作成したもの

10－3－2　調査団が持参したもの

OPERATIONAL TARGET AND PLAN

1. Introduction

The Project aims at developing human resources for the transfer of technology in the field of the foundry technology and, thus, contributing to the technical development of foundry industry in Malaysia.
The operational target and plan were formulated in order to achieve this aim effectively and fruitfully under conditions given for implementation of this Project within the limited duration allowed until October, 1993.

2. Scope of Technology Transfer -- Operational Target

The operational target of this project is given as the scope of transfer of foundry technology as shown in Annex I.
Transfer of basic technology is carried out mostly by lecture. Through this lecture, a common concept and a common language on foundry technology will be shared among FTU personnel and Japanese experts, which will create a common base for a "Group Work" inevitable in foundry technology.
Practical technology is transferred through practice. It is tentatively classified into 3 steps considering needs and difficulties of respective technological elements. As mentioned below, transfer of practical technology is implemented through practice of product development with an aim to cover a certain sphere of applied technology.
Applied technology is the most important field in which foundry industries are expecting FTU's activities. It is not too much to say that the raison d'être of FTU in future will much rely on achievements in this field.

3. Operational Plan

Annex II shows the operational plan as a form of time schedule of technology transfer based on technological elements, which are shown in Annex I.
However, in view of characteristics of this Project and in order to respond to needs from foundry industry in Malaysia at the earliest time, both Malaysian and Japanese sides agreed that transfer of technology should be implemented essentially through practice of product development.
Based on this premise, the operational plan based on product development was formulated as shown in Annex III. In a sense, Annex II is supplemented by Annex III.

Target products in Annex III were chosen as products not only suitable for practice at FTU but also expected in industries to improve and develop their qualities.

So far, only a few survey reports on Malaysian foundry industry [1, 2] are available, but both publications date back to 1986. To update the related informations and to find out technological needs that the industry is facing, survey on foundryshops was carried out by FTU in cooperation with Japanese experts from July to September, 1989, in which 24 foundryshops were visited[3].

Some of the needs and recommendations found out during the survey are as follows :

1) Introduction of spheroidal graphite cast iron (ductile cast iron).
2) Standardization of pattern drawing.
3) Control of chemical compositions.
4) Upgrading of grey cast iron.
5) Selection and preparation of moulding sand.
6) Heat treatment technology.
7) Testing service (chemical analysis, physical testing, metallographic structures, etc.).
8) Inspection service (visual inspection, dimension, surface defect, inner defect, etc.)
9) Systematization of inspections --- Formulation of inspection sheet.
10) Product development --- high quality, import substitutes, exportable, etc.
11) Energy and material saving technology.
12) Countermeasures to pollution problem.

These are reflected in the selection of target products.

The time schedule of practice was formulated considering types of metals and difficulty of casting so as to practice from easy ones to difficult ones.
As for types of metals, grey cast iron is first and then ductile cast iron, malleable cast iron, cast steel and cast alloys follow.
As for products, those with simple- and round-shape, uniform thickness and small size (1 - 3 kg/piece) and without core are practiced at early stages, which are followed by more sophisticated ones.

In this Project, foundry technology to be transferred is classified into 7 fields, i.e. 1) Pattern making, 2) Melting, 3) Moulding, 4) Quality control, 5) Test and inspection, 6) Finishing, and 8) Product development. However, in the implementation of technology transfer, it should be noted that whole fields should be coordinated to promote a "Group Work" aiming at a common target, because each field can not be independent of others in foundry industry. For example during practice, all fields should focus on manufacture of a target product. In this sense, FTU should often function as a kind of mini-foundryshop.
However, it goes without saying that efforts to upgrade technical capability in respective fields based on their own curriculum should be continued in parallel with "Group Work".

4. Concluding Remarks

This Project is implemented based on the operational target (Annex I) and two forms of the operational plan (Annex II and III).
The operational plan should be transformed into "Annual Work Plan". In the latter, further breakdown of respective technological elements will be done through discussions among related personnel.
As described in the Record of Discussions, the ultimate target of this Project is to develop human resources well equipped with foundry technology and capable for contributing to the technical development of foundry industry in Malaysia. Therefore, all activities mentioned above should be converged on this target.

References :

1) Engineering Survey - Part 1 The Malaysian Foundry Industry
Joint survey by - Bank Kemajuan Perusahaan Malaysia Bhd.
- Standards and Industrial Research Institute of Malaysia
- National Productivity Centre
Published in - May, 1986
2) Directory of Engineering Supporting Industries in Malaysia
Joint survey by - MIDA
- DEG
Published in - July, 1986
3) Survey Report on Foundry Industry in Malaysia, 1989 (in preparation)

SCOPE OF TRANSFER OF FOUNDRY TECHNOLOGY

ANNEX I

BASIC TECHNOLOGY	PRACTICAL TECHNOLOGY	APPLIED TECHNOLOGY	REMARKS
Lecture Textbook : PRACTICAL TECHNOLOGY OF CASTINGS By K.Chijiiwa, E.Matsumura, H.Shimada, I.Taki and H.Nara Contents : 1. Introduction 2. Fundamental study of castings 3. Patterns 4. Casting plan 5. Sand moulds and moulding sands 6. Sand moulds with special binders 7. Melting and pouring of cast irons 8. Melting and pouring of various metals 9. After-treatment and heat treatment of castings 10. Inspection and testing of castings 11. Defects of castings and the counterplans 12. Special casting methods 13. Foundryshop	Step 1 1. Wood pattern making - 1* and gating system 2. CO_2 process and the sand preparation 3. Melting of cast iron** by induction furnace 4. Inspection and strength test 5. Counterplans to defects (cast iron**) 6. After-treatment (including finishing) Step 2 1. Wood pattern making - 2* and core making 2. Green sand moulding and the sand preparation 3. Melting of cast steel by induction furnace 4. Compositional analysis and metallographic structures 5. Counterplans to defects (cast steel) 6. Heat treatment Step 3 1. Resin pattern making 2. Furan moulding and the sand preparation 3. Melting of nonferrous alloys# by induction furnace 4. Counterplans to defects (nonferrous alloys#) 5. Quality control 6. Safety measures	1. Product development (R & D) a. Quality improvement b. Effective use of locally available materials c. New products (product diversification, localization, import substitute, etc.) 2. Advisory service - Mobile service to local industries 3. Test and inspection services 4. Information service 5. Lectures, seminars, training courses, etc.	* Target products are chosen by survey of local industries. **Ductile and malleable cast iron are included. # Aluminium and copper alloys.

OPERATIONAL PLAN BASED ON TECHNOLOGICAL ELEMENTS ANNEX II

	ITEM	1989	1990	1991	1992	1993
I. Basic technology	1. Fundamentals of foundry Textbook : PEACTICAL TECHNOLOGY OF CASTING By K.Chijiiwa, E.Matsumura, H.Shimada, I.Taki and H.Nara					
II. Pattern making	* Short term expert (Transfer of technology) 1. Wood pattern making - 1 * 2. Wood pattern making - 2 * and core making 3. Resin pattern making 4. Gating system 5. Product development (Transfer of theory)					
III. Moulding	=Long term expert (Transfer of theory) * Short term expert (Transfer of technology) 1. CO_2 process and the sand preparation 2. Green sand moulding and the sand preparation 3. Furan moulding and the sand preparation					
IV. Melting	=Long term expert (Transfer of theory) * Short term expert (Transfer of technology) 1. Melting of cast iron by induction furnace 2. Melting of cast steel by induction furnace 3. Melting of nonferrous alloys by induction furnace					
V. Test and inspection	* Short term expert (Transfer of technology) 1. Inspection and strength test 2. Compositional analysis and metallographic structures 3. Dimensional inspection					
VI. Quality	* Short term expert (Transfer of technology) 1. Counterplans to defects (cast iron, cast steel) 2. Counterplans to defects (nonferrous alloys) 3. Quality control					
VII. Finising	* Short term expert (Transfer of technology) 1. After-treatment (Including finishing) 2. Heat treatment 3. Safety measures					
VIII. Applied technology	1. Product development (R & D) 2. Advisory service - Mobile service to local industries 3. Test and inspection services 4. Information service 5. Lectures, seminars, training courses, etc.					

OPERATIONAL PLAN BASED ON PRODUCT DEVELOPMENT

Products	Type of metal							Year of practice				Classification/application
	FC	FCD	FCMB	SC	FC-al	Al-al	Cu-al	1990	1991	1992	1993	
1. Brake drum	○							○				AUTOMOBILES
2. Pulley	○							○				AUTOMOBILES, PALM OIL, CEMENT
3. Gear	○	○						○	○			AUTOMOBILES, MACHINE TOOLS
4. Gear housing	○	○				○			○		○	AUTOMOBILES, MACHINE TOOLS, +
5. Motor cover	○								○			ELECTRICAL EQUIPMENT
6. Screw press (worm screw)		☆		○					☆			PALM OIL
7. Hydrant	☆								☆			HOUSING
8. Hub		○							○			AUTOMOBILES
9. Bracket		○							○			AUTOMOBILES
10. Pipe fittings			○							○		HOUSING
11. Roller				○						○		RUBBER
12. Crawler shoes				○						○		TRACTOR
13. Crusher teeth					○					○		MINING, CONSTRUCTION
14. Valve							○				○	HOUSING
15. Parts for electrical appliances							○				○	ELECTRICAL EQUIPMENT
16. Propeller							○				○	MARINE
a. Pump housing	☆											MINING, QUARRY
b. Sluice gate valve	☆											IRRIGATION
c. Clutch pressure plate	○											AUTOMOBILES
d. Working wheel	☆	☆										MACHINERY
e. Bogie wheel				☆								RAILWAY

Remarks : ○ Training-oriented products. ☆ R & D oriented products. + MINING, PALM OIL, RUBBER, CEMENT.

1) Target products and year of practice are subject to change due to requirements from industries.

2) Products with indications from a. to b. are optional.

3) FC=grey cast iron, FCD=ductile cast iron, FCMB=malleable cast iron, SC=cast steel, FC-al=alloy cast iron, Al-al=aluminium alloy, Cu-al=copper alloy.