1.3 Organization and Staffing of the Center for Industrial Technological Information

(1) The Center and its Related Organizations

For maintaining proper operation of the Center, it is recommended that an "Advisory Board of Directors for Center Operation" be organized by the Center users as the main body for advising operating policies. This body should remain independent from the main operating body made up of the "Center Organization" in order to maintain an appropriate balance between the service providers and the users.

1) Advisory Board of Directors for Center Operation

This advisory board of directors is discussed below, and the details of operation will be dealt with in Part VI (on execution of plans).

① Function : Review and advise the operating policies of the Center
② Organization : Qualification as directors (Center users), chief director, assistant chief director (rotation/election by directors)
③ Operation : Holding of board meetings, chairing of meetings, publication of resolutions (chief director), secretarial tasks

2) Center organization

The Center will be organized as follows with the functions as indicated.

① Center chief director : Chief executive of the whole organization
② Planning department : Service planning
③ Administration department : Administrative functions of the Center
④ Operating department : Service functions of the Center

3) Organization chart

Fig. V-3 shows the organizations of the advisory board of directors and of the Center.

(2) Staffing of the Center

The Center should be staffed with full-time employees, and duplication of duties of other institutions by the Chief Director of the Center and other positions should be avoided.

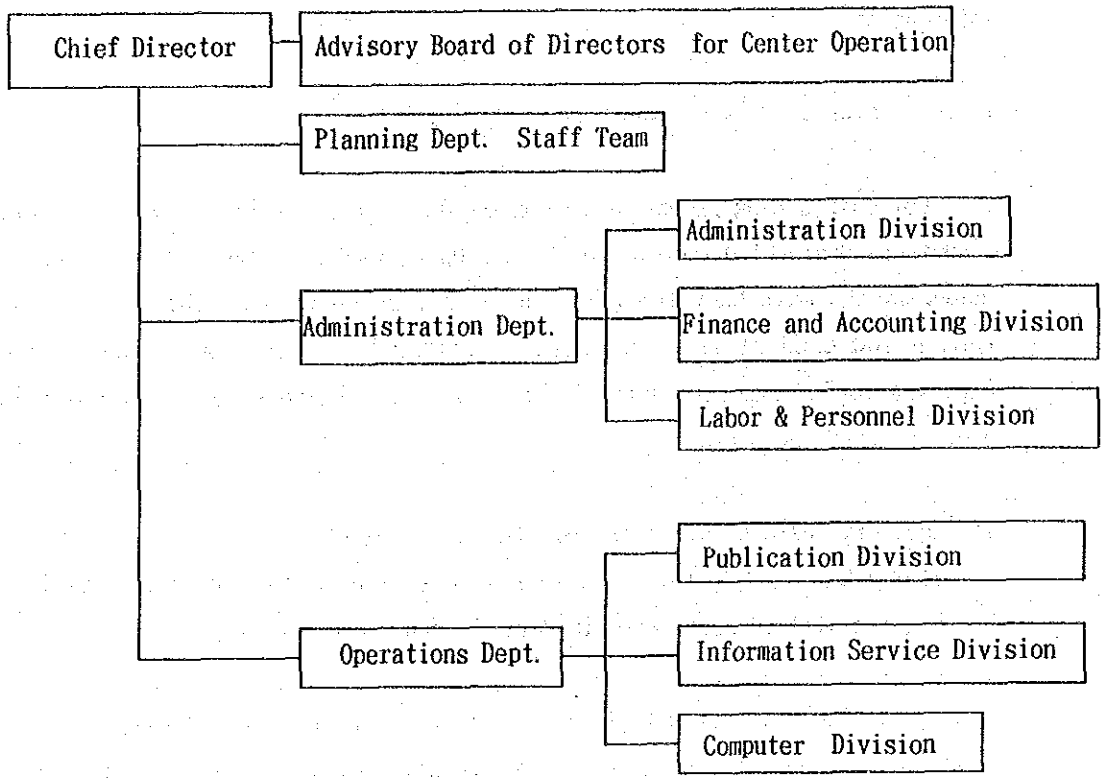


Fig. V-3 Conceptual Organization of the Center

a. Center employees : They should be, for the most part, on a full-time basis. Types of jobs are shown in Table V-1.
b. Personnel organization: Shown in Table V-2
c. Employees for the Qualification of the Center : Table V-3 also shows the required educational background, level of knowledge and experience for each of the types of job positions.

Table V-1 Types of Jobs

Grade	Type
1	General manager
2	Chief engineer
3	Manager
4	Officer, manager
5	Assistant engineer
6	Foreman
7	Mechanics
8	Operator, driver, typist
9	Helper, guard

Table V-2 Organization, Staffing and Function of the Center

Organization and Employees		Functions of Organization
1) Chief Director of the Center (1 plus a secretary)		(Overall management of the Center)
2) Planning department (Department manager plus 5 staff)		(General staffing function)
① Representative team		Supporting function for the Chief Director
② Controlling team		Coordination of the Center operation and management, budget control, etc.
③ PR team		Public relations, guides, forum office, etc.
④ Reception team		Center reception (for visitors, users, vendors, etc.)
⑤ Sales team		Customer finding
3) Administration department (Department manager plus 14 staff)		(General administration)
① General affairs division		General administration, building management, power/air-conditioning/communication facilities, maintenance, supplies other than for computers
② Accounting and financial division		Payment/billing, financial control, fund management
③ Personnel Division		Personnel management, labor relations, salary payment, welfare in general
4) Operations department (Department manager plus 43 staff)		(Service operation)
① Publication division	Editing	• Editing and publication of PUSPIPTEK-Serpong, PR materials • Editing and publication of reports from laboratories in PUSPIPTEK-Serpong
	Production	• Production and printing of publications
② Information service division		
	Service	• DB service (via computers, etc.) • Retrieval agency service by searchers
	Data filing	• Data gathering, input and filing, complex information management
	Library	• Collection, storage, circulation and rental of publications from PUSPIPTEK-Serpong as well as from publications related to industrial technological information
③ Education division	Education planning	• Investigation of request for education, planning, assignment of trainers
	Education/training	• Providing education/training, keeping or preparing educational materials and equipment
④ Computer service division		
	Service	• User guidance, consulting, billing
	Operation/administration	• Operating plan, resource management, file storage, purchasing materials, inventory control, data entry
	System technology	• Setting user environment, development management systems, resource planning, support of education courses
	Applied technology	• Managing application software library, consigned development(numerically intensive computing, scientific/engineering visualization)

Total : 67 employees

Table V-3 Desirable Qualification Guidelines for Job Positions -1

Job Positions	Number	Grade	Desirable Experience
Chief Director	1	1	Management experience, basic knowledge of information and data-communication business, knowledge of operations department
Secretary	1	6	Secretarial experience
Planning Manager	1	2	Management experience, experience in information and data communication business
Dept. staff	3	4	Experience in information and data-communication business (engineering)
Dept. staff	2	6	University graduates in engineering, basic knowledge of information and data-communication business
Administration Manager	1	2	Management experience, experience in administration
Manager class	2	3	Eperience in management
Staff	3	7	Experience in building management
Staff	5	8	Experience in administration
Staff	4	9	High school graduates
Operations Manager	1	2	Management experience, experience in publications
Publications Manager	1	3	Management experience, experience in publications
Staff	2	4	University graduates in engineering, experience in publications
Staff	2	6	University graduates
Information service Manager	1	3	University graduates in engineering, management experience, experience in building DB
Staff	1	4	University graduates, searcher experience
Staff	1	6	University graduates in engineering
Staff	2	7	University graduates
Librarian	1	4	University graduates preferably in librarian education major
Assistant	1	6	Same as above
Education Manager	1	3	University graduates in engineering, management experience, experience in information and data-communication business
Staff	2	4	University graduates in engineering, experience in information and data-communication business
Staff	2	5	Same as above with experience in information and data-communication business

(Continued)

(Continued)

Job Positions	Number	Grade	Desirable Qualification
Computer Manager	1	3	University graduates in engineering, management experience, experience in information and data-communication business
Service Section	1	4	University graduates in engineering, experience in technological calculation
Service Section	4	6	University graduates in engineering, experience in technological calculation
Operations Section	2	4	University graduates in engineering, experience in information and data-communication business
Operations Section	4	6	High school graduates, experience in information and data-communication business
Operations Section	4	7	High school graduates or graduates of computer school (including 2 for data entry)
System Section	1	4	University graduates in engineering, experience as a system programmer
System Section	1	4	University graduates in engineering, experience in data-commucation
System Section	3	5	University graduates in engineering, experience in information and data-communication business
Application engineering Section	2	2	MA's in engineering, experience in numerical calculation business
Application engineering Section	3	4	University graduates in engineering, experience in numerical calculation business

Note : Grade is according to the following Table V-1.

SECTION 2 CONCEPTUAL DESIGN FOR COMPUTER SYSTEM

As each laboratory researcher of PUSPIPTEK-Serpong will be using a computer system of the Center for Industrial Technological Information for the purpose of scientific and technological calculation, program development, data retrieval, and computer education/training, Hence, this computer system must be able to perform smoothly and quickly, and also be able to correspond to a diverse range of uses which will constantly be expanding.

The following shows the operation environment and uses of the Center's computer system, and describes its conceptual design which is based on these factors.

2.1 Conceptual Design Policy of Computer System

1) To establish an operation environment that satisfies the Center functions as early as possible.
2) To facilitate extensions of the system's functions and performance against future diversification and increased usage.
3) To consider the infrastructure of the existing electric power and communications of PUSPIPTEK-Serpong.

2.2 Software

The following shows examples of software fields to be set up in the Center by the application example in Table V-4, referring Table IV-4 in part IV, Functions for the Center for Industrial Technological Information.

Table V-4 Required Number of Software by Technological Field

Field	No.	Remarks	Correspondence with Table IV-4
Structural design and analysis	2~3	including pre-/post-	a, b, c
Impact analysis	1	ditto	a, b, d
Fluid analysis	2	ditto, flow mode	b, d.
Nuclear energy	1 set		a, c.
Chemistry	2~3		d.
Chemical engineering	2~3	Piping design, distillation column, etc.	c.
Optics	1	Lens design	c.
Electronics	1	IC chip design	c.
Electromagnetism	1	Electric field, electromagnetic field analysis	c. d
Mathematical routine	1 set		others
Graphics	1		others

The following describes the contents of software by field in Table V-4 above, in more detail.

1) Structural analysis

The program for structural analysis, must have a wide application range using the finite element method. Also, this program handles static/dynamic and linear/non-linear problems, and it is important that the program's functions can be applied not only to the structural analysis but also to field problems such as heat conduction and acoustics. Also, the program is carefully selected for the library of element material data, etc. The CAD application should also be considered. These programs require a computer with roughly a 2-megabyte main storage and 200-megabyte auxiliary storage. Also, it is recommended that a pre/post program for creating input data and editting output be provided.

2) Impact analysis

There will be a general-purpose program which can calculate the nonlinear large deformation behavior of gas, liquid, and solid on impact by the finite difference of the finite element method. In this case also, the pre/post program should be provided. The required main storage is estimated at 8 megabytes, and the auxiliary storage at 300 megabytes.

3) Fluid analysis

The fluid analysis program, must be able to perform steady/unsteady analysis of incompressible and compressible viscous fluid. Also, it is recommended that this program also be able to perform turbulent and multiphase analysis. Required main storage for this program is approximately 8 megabytes, and auxiliary storage is approximately 100 megabytes. Here, the pre/post program is also required.

4) Nuclear energy

Many programs exist in the field of nuclear energy, so the appropriate selection in this case is difficult. Here, programs that are only related directly to the operation of research reactors which were set in RSG-LP, are acceptable. The purpose of phase 1 is to provide the program necessary for evaluating the reactor core performance (group constant calculation, diffusion /transportation calculation, burnup calculation) and the incidental-screen related programs. Required main storage is approximately 8 megabytes, and auxiliary storge is approximately 100 megabytes.

5) Chemistry

The Molecular orbital method is provided as a molecular dynamics program. Both main storage and auxiliary storage size strongly depend on the size of problem to be solved. If a molecule consisting of about 50 atoms is solved by ab initio by the molecular orbital method program, required main storage is approximately 100 megabytes, and the auxiliary storage, approximately 10 gigabytes.

6) Chemical engineering

Arrange programs which are required for the design of piping, regenerator, and distillation column, etc. which would be the problem in designing a chemical factory. An application of a fermentation process should also be considered for software selection.

7) Optics

Provide programs for lens design.

8) Electronics

Perform DC analysis, AC analysis, and excess analysis of the given electronic circuit and semiconductor circuit, and install a program which performs the electric characteristics analysis of electronic circuit. Also,

it is recommended that the logical circuit design program for printed circuit board design also be installed.

9) Electromagnetism

Install programs which can calculate electromagnetic field, electromagnetic force, electric field, and eddy current.

10) Mining

Softwares for resource investigation and remote sensing will also be considered.

11) Mathematical routine

Install the library for general-purpose scientific and technological calculation.

12) Graphic routine

Install programs which can output a high-quality colored image to the image processing device which is located in the Center.

13) Program package

① Operation and management

It must include necessary functions regarding finance, management, accounting, personnel affairs, and salary, which are necessary for the administration of the Center.

② OR, statisitical prediction, simulation

The important factors pertaining to the decision as to which program to install are whether various statistical methods are provided, whether report preparation function and graphic processing function exist or not, its interface between the database management system, and whether its operation method is in menu format or in command format.

③ Development aid

With regard to these programs, the interface between the database management system and interface between various programming languages must be provided and can be used. The program must also possess a fuction for editing and controlling source code, a support function for efficiently performing screen design centered around on-line program, and function which supports development, management and maintenance of software.

2.3 Operation Environment of Computer System

(1) Provision of Service

1) Form of service provision

Mainly consists of on-line service which uses communication line and terminals.

2) Service area

As a general rule, the range of on-line service is within the PUSPIPTEK-Serpong laboratories. In the future, when the communcation conditions are improved, the on-line service will be performed also outside the PUSPIPTEK-Serpong .

3) People who take service

① Researchers in each laboratory in PUSPIPTEK-Serpong

② Education trainees

③ Visitors outside PUSPIPTEK-Serpong approved by the Center's chief director

4) Service hours

Same as the business hours of each laboratory in PUSPIPTEK-Serpong

5) Services provided

① Database service (Industrial technological information provision service)

(database retrieval)

② Provision of computer resource relating to education/training

③ Scientific and technological data processing service

(use of application programs, creation of new programs)

(2) Jobs Inside the Center

1) Database operation management

① Source data management

② Database design, construction and revision

2) User education

Preparation of teaching materials

3) System operation management

User environment arragement, resource control, operation control, data backup

4) Center management

The Center operation/administration

5) Customer service

2.4 Job Format and Use Format of Computer System

Jobs under the operation environment of the system is classified, as in Table V-5.

Also, the number of users in a day (75) which is stated in 1.2 of section 1, and 15 terminals for education/training, other 15 terminals for job inside the Center, so altogether 105 terminals would be nessesary (including CAD terminals).

Table V-5 Job Format of Computer System

(I) Scientific and engineering data processing service

Job Format	Use Format	Terminal Format
①Routine job	•Batch processing…Input job or data from remote batch terminal and job is executed. Output to printer, plotter, and graphic terminal in the Center.	•Personal computer terminal •TSS dedicated terminal •CAD/CAM (graphics terminal)
	•TSS …Perform job processing in on-line real-time from TSS terminal, and processing result is output to CRT display or required equipment.	
②Development working	•TSS …Perform job processing and modification of program and data in on-line real-time by TSS terminal.	

(To be continued)

(Continued)

(II) Database service

Job	Usage	Terminal Format
①Database provision job	·TSS ···Perform data retrieval and inquiry service to general user by TSS terminal.	·Personal computer terminal ·TSS dedicated terminal

(III) Education training regarding computer system

Job	Usage	Terminal
·Provision of computer resource regarding education/ training	·Perform practice on programming language and system development education by TSS terminal.	·Personal computer terminal ·TSS dedicated terminal

(IV) Job inside the Center

Job	Usage	Terminal
①Database design construction job	·TSS ···Perform application developing and modifying job for database access by TSS terminal.	·Personal computer terminal ·TSS dedicated terminal
②Data management job	·TSS ···Perform management regarding data input/revision by TSS terminal.	
③Data entry	·Input source data from magnetic tape, floppy disk, etc.	

2.5 Conceptual Design of Basic Software

The basic software should improve the execution of job programs and the productivity of software development by the computer system, perform system management for the Center operation efficiently, and possess functions for enhancing the system extension smoothly by simplifying the operation.

The following shows the basic software functions for establishing the operation environment described in 2.2.

(1) Hardware Management, and System Management Functions

These functions manage the hardware resources which satisfy the requirements for the database and the scientific and engineering data processing system which are the basic services of the Center, and are the functions which improve the productivity of data processing.

It must consider the on-line data processing by virtual memory management function.

(2) Task Management Function

The task management function is necessary in order to enable the multiple users to execute the application programs of the Center simultaneously, and help provide for the efficient use of resources.

(3) Job Control Function

The Job control function is necessary to prepare and complete various job executions. It aquires the required resources for job execution, and job scheduling, and also performs message exchanges between, operators and computers.

(4) Data Management, Database Management Functions

These functions control input/output stream of data, and assign I/O media of mainly common resource to the processing program, and perform management of file registration, retrieval and security.

- Access and management, operation of data set
- Performs I/O efficiently
- Assigns storage area efficiently
- Protection of data set

(5) Communication Control Function

It performs line control network control, terminal control, and message control.

(6) Security of computer system

- Qualification check function for user check such as password, identification code, etc...
- Access control function which presents qualifications such as reading, writing, and addition by each user against programs, data files, etc. stored in the computer system, and prohibits the access of non-qualified user by inquiring with the qualification conditions for access.
- Access monitoring function which watches the process of access control, and records the illegal accesse that it detects.
- Console log function which records the process of console operation in order to find traces of illegal operation.
- System use status recording function which takes all the computer system's use records in order to pick up the clues regarding illegal use.

(7) Language Processor Programs

- FORTRAN compiler
- COBOL compiler
- PL/1 compiler, PASCAL compiler
- C compiler

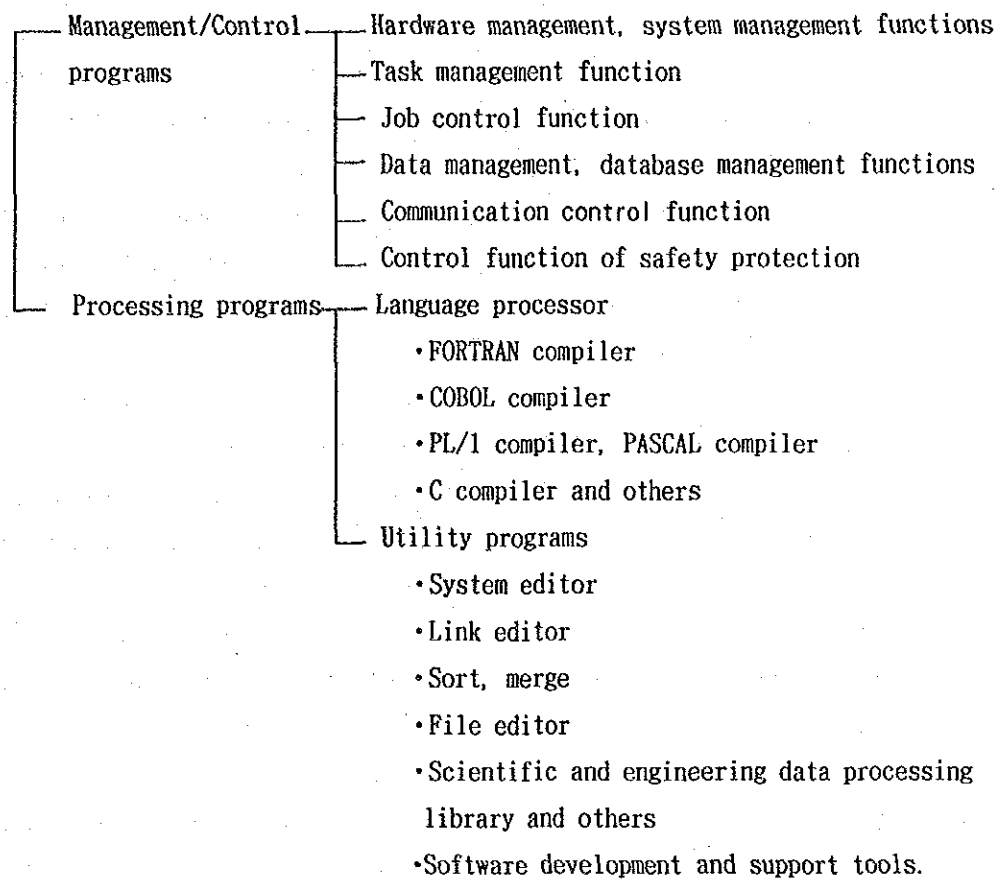
Other language processor programs required.

(8) Utility Programs

They perform the creation, editing, and maintenance of programs and files with common functions that can be applied to all data processing.

The above functions can be arranged as follows:

Configuration of Basic Softwares



Also, as an arranged environment of basic software, suport by the mainframe manufacturer is required for one year to install and operate the above basic software smoothly.

2.6 Conceptual Design of Network System

The network system for the conceptual design of the Center describes the system requirements of the following:

1) Connection between the center and each laboratory
2) Access from outside the PUSPIPTEK-Serpong

(1) Connection between the Center and Each Laboratory

As stated in "3. Infrastructure Related to Introduction of Computer ", "3.1 Communication Network" of Part III, the information communication network inside PUSPIPTEK-Serpong is able to use the telephone cable which is provided on the site as a transmission line for data commuication. This shall connect the computer and communication equipment to be installed in the Center, and terminal equipment to be placed in each laboratory.

Main system requirements are as follows.

① Because of its economy and the ease of maintenance the data communication line is, at present, the star type private communication line which is star network via MDF inside the Project Management Office.

② As for data communication equipment, analogue modem and a base-band line terminal device with a high cost performance have been adopted. Also, the configuration is such that it can flexibly correspond to the layout change of terminal equipment.

③ Data communication equipment to be located in the Center are placed in thier own cabinet, which ensures both ease of maintenance and safety.

④ Terminals shall have connecting concentrator which facilitate maintenance and provide for future increase and change, 5~10 display devices and a printer are connected per one line collection device.

⑤ Communication control devices shall be placed by considering future extensibility and shall have more than 64 ports for placing 105 terminal devices at the start of operation, and shall also have enough room to increase data communication lines in the future.

⑥ Control systems such as division of work and range of responsibility shall be clear as well as the work process, for operation and execution control of the data communication.

- System configuration creating and changing
- Line construction arranging and supervising
- Communication equipment procurement

(2) Access from Outside PUSPIPTEK-Serpong

The following may be considered as receptacles for outside users to use the Center functions through on-line connection in the future. Some parts which are difficult to cope with technically at present will be partially constructed and left open to be completed up further technological advances.

① Access by dedicated line

② Access by SKDP

③ Access by telephone exchange network

① Dedicated line·····Possible to use if PERUMTEL service is offered.

② SKDP ·····Connection with the host computer shall be X.25, as advised by CCITT (Consultative Committee for International Telegraph and Telephone) as a connection interface with exchange network. This

connection requires compatibility with the application software.

③ Telephone exchange network……At present, as the communication system between Jakarta and Serpong is wireless, it is difficult to use because of poor data transmission quality, but connection between the host computer and the exchange network (including ISDN) may be counted open in accordance with the progress of a plan to lay an optic fiber cable in the future.

(3) Conceptual Diagram of Network System

Fig. V-4 shows the concept of network system which satisfies functions in (1) and (2) above.

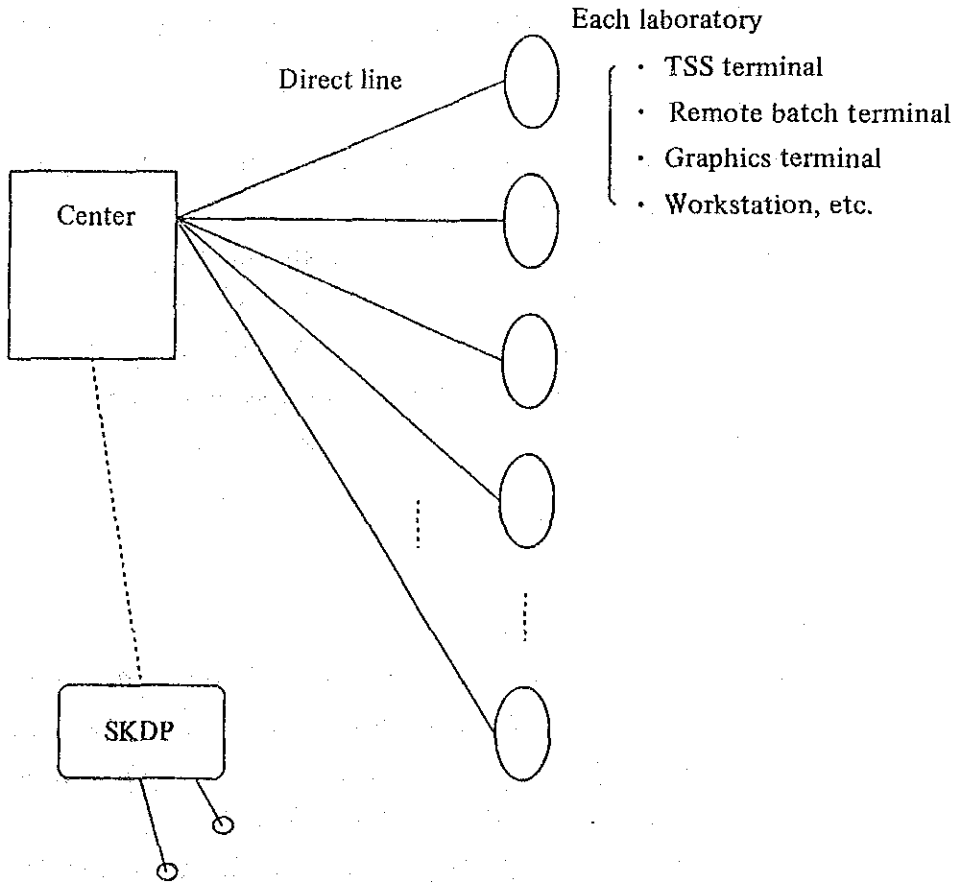


Fig. V-4 Conceptual Diagram of Network System (PUSPIPTEK-Serpong)

2.7 Conceptual Design of Hardware System

It must satisfy the functions of the basic software, ensure the environment for application programs and other various programs to be processed quickly, provide for the smooth operation of the network system and enable it to cope with use format, future diversification and demand increase.

(1) Required Scale of Hardware System

According to the operation example of a computer center, there are actual results of service by assigning the resource as the following in the mainframe computer system using both typical TSS and batch job processing.

1) Batch job rate 10 Region size 1MB
   TSS service rate 12 Work area 1MB
2) About 50% of CPU operation ratio against operation time of batch job system.
3) Response time of 100 TSS terminals is 1 ~ 3 seconds.

Basic requirements of the hardware system to satisfy the above operation environment are as follows:

- Processing speed of CPU 15 MIPS or more
- Capacity of main storage 32 MB or more
- Capacity of magnetic disk device 10 GB or more
- Connection input against disk device 4 channels or more
- Data transfer rate/channel 3 MB/s or more

(2) Hardware System

1) CPU (Central Processing Unit)

It has hardware functions which satisfy basic software functions, such as processing speed, which is necessary for processing database reference, scientific and technological calculation, and program development job smoothly. It must also have enough I/O channels.

In this system, a processing speed of 15 MIPS or more shall be required, and the required number of I/O channels shall be twelve or more.

2) Main storage

As job processing performance is largely affected not only by the processing speed of the CPU but also by the capacity of main storage, the mainstorage must have a capacity that is large enough for effective job

processing and future extensibility.

In this system, a storage capacity of 32 MB or more shall be required.

3) Magnetic disk device

The magnetic disk device must fulfill reguirements of smooth job processing, ease of use, and extensibility. In order to insure smooth job processing the magnetic disk control device must have a cross-call function. The magnetic disk device shall also be arranged separately for the database and for other systems.

4) Magnetic tape device

The recording method and recording format of the magnetic tape shall be compatible with different machines, and shall be able to read and write data with 1600 bpi/6250 bpi record density which are being generally used. Also, it shall have cross-call function, and shall have extensibility as to the number of devices to be placed in preparation for the future increase in demand.

In this system, a minimum of 2 for data I/O and 1 for work are required.

5) Line printer

One line printer shall be required for printing job processing result output with the performance of 136 characters/line and 800 lines/minute print speed at the minimum by alphanumeric character set.

6) Laser printer

One laser printer shall be required not only for job processing result output, but also for high-quality output such as research thesis and reports.

7) Floppy disk device

One floppy disk device shall be required for keyed-in data input by key punchers and for data output.

8) XY plotter

The XY plotter shall have an output precision and performance which can be used for architecture drawing (maximum A0 size) such as graphic output of calculation results and output of design drawing.

9) Communication control device

One communication control device shall be required, equipped with 64 ports or more and able to connect 105 terminals (including several CAD

terminals). This device shall have a provision for a future expansion due to a demand increase. As for extensibility, it shall be equipped with the function in conjunction with any future increase in demand.

2.8 Configuration of Related Facilities and Auxiliary Facilities

(1) Computer Related Equipments

In order to operate the computer dependable for a long period, good power, and an air-conditioning which maintains a good, constant environment in the computer room and the data storgge room under any outside circumstances, are required. In addition, safety measures which might save the computer from disasters must also be considered. Finally, a storage facility enabling the smooth operation of the computer and safe maintenane of recording media for the computer is also required.

The following describes the requirements regarding each equipment.

1) UPS (Uninterruption Power Supply)

① Constant frequency/constant voltage device

The device which supplies good power for operating the computer system dependable for a long period, and although the capacity is determined by the range of hardware system, a minimum of 150kVA shall be required for the Center's system.

② Battery device

This device protects the hardware system from power failure and momentary interruption of the commercial power supply. It also provides stable power until the generator starts its operation (backup time). In this system, one battery device with backup time of mininum 5 minutes and capacity of 150kVA or more shall be required.

③ Generator

It is the power supply device in case of commercial power failure for a long period, and the performance shall be to supply power of more than 300kVA at the minimum.

2) Air-conditioning facility for computer room and data storage room

It is the facility which keeps temperature and humidity of the computer room and the data storage room constant. It also keeps operation of the computer stable for a long period, and stores the recording media safely.

Temperature and humidity standards of each room are shown as follows:

Computer room ··· temperature 25℃±2℃ humidity 45~70%

Data storage room ··· temperature 20℃±2℃ humidity 50%

3) Distribution board for computer

One distribution board shall be required for power distribution to each piece of equipment in the computer hardware system and for protection of the system.

4) Storage facility for computer recording media and expendable supplies

This is the facility for operating the computer system smoothly and for storing the recording media safely.

① Magnetic tape storage rack(must have storage capacity of minimun 5000 tapes)

② Floppy disk storage rack (must have storage capacity of minimun 5000 disks)

③ Computer expendable supplies rack (to store paper and ribbons)

④ Modem rack

Facility for easy maintenance of the network and placing modems safely.

50 modems must be able to be stored at the minimun.

(2) Facilities and Equipment Relating to Other Service

1) Industrial technological information provision service

Device to supply information recorded on CD-ROM and overseas database information

① Personal computer with CD-ROM reading device and modem

2) Publicity and publication equipment

① Electlonic publishing system with high-quality printer for publicity and publication

② Simple bookbinding machine for binding output forms

③ Photocopying machine

3) Education related equipment

Audio-visual equipment and software for efficient education

① Audio-visual equipment

- Overhead projector/screen (can be connected to personal computers)
- Video monitoring device

② Softwares

- DBMS, statistics and spreadsheet softwares for personal computers

SECTION 3 CONCEPTUAL DESIGN FOR CENTER FACILITIES

3.1 Basic Plan of Construction of the Center

The following points are to be considered for the basic plan;

① Facilities shall be suitable for the climate and the geography in Serpong.

② The basic plan shall meet the total development plan of PUSPIPTEK-Serpong.

③ Facilities shall be properly sized and designed according to the required functions.

③ Facilities shall express the advanced aspects.

3.2 Center Site and Layout Plan

(1) Site

The site is located at the southeast end of the laboratory zone of 350ha including the existing facilities of PUSPIPTEK-Serpong. It is close to the front gate and has approximate area of 18ha. Besides this Center, a Science Center and International Conference Hall are also being planned. As can be seen from the photograph at the beginning of this Report, roads around the planned Center are already completed; however, grass has grown all over the place. The site is at an average altitude of 100m and relatively flat. A valley is running at about 10m below the ground level at the east, west, and south ends of the site.

Fig. V-5 shows the site plan provided by the Project Management Office.

(2) Layout Plan

Altough the Science Center and International Conference Hall are planned in the site plan shown in Fig. V-6, it was confirmed by the Project Management Office at the time of this study that this plan had not been finalized. From the viewpoint of the Science Center, and therefore, a decision should be made after careful and enough discussion on the exact location of the Center. In other areas, since many visitors are expected, consideration should be taken to their pedestrian linkage plans, materials, and supplies and other service traffic plans. As part of amenity services to employees in a high-technology environment, some consideration should be taken to providing them with oppotunities of observing the surrounding scenery.

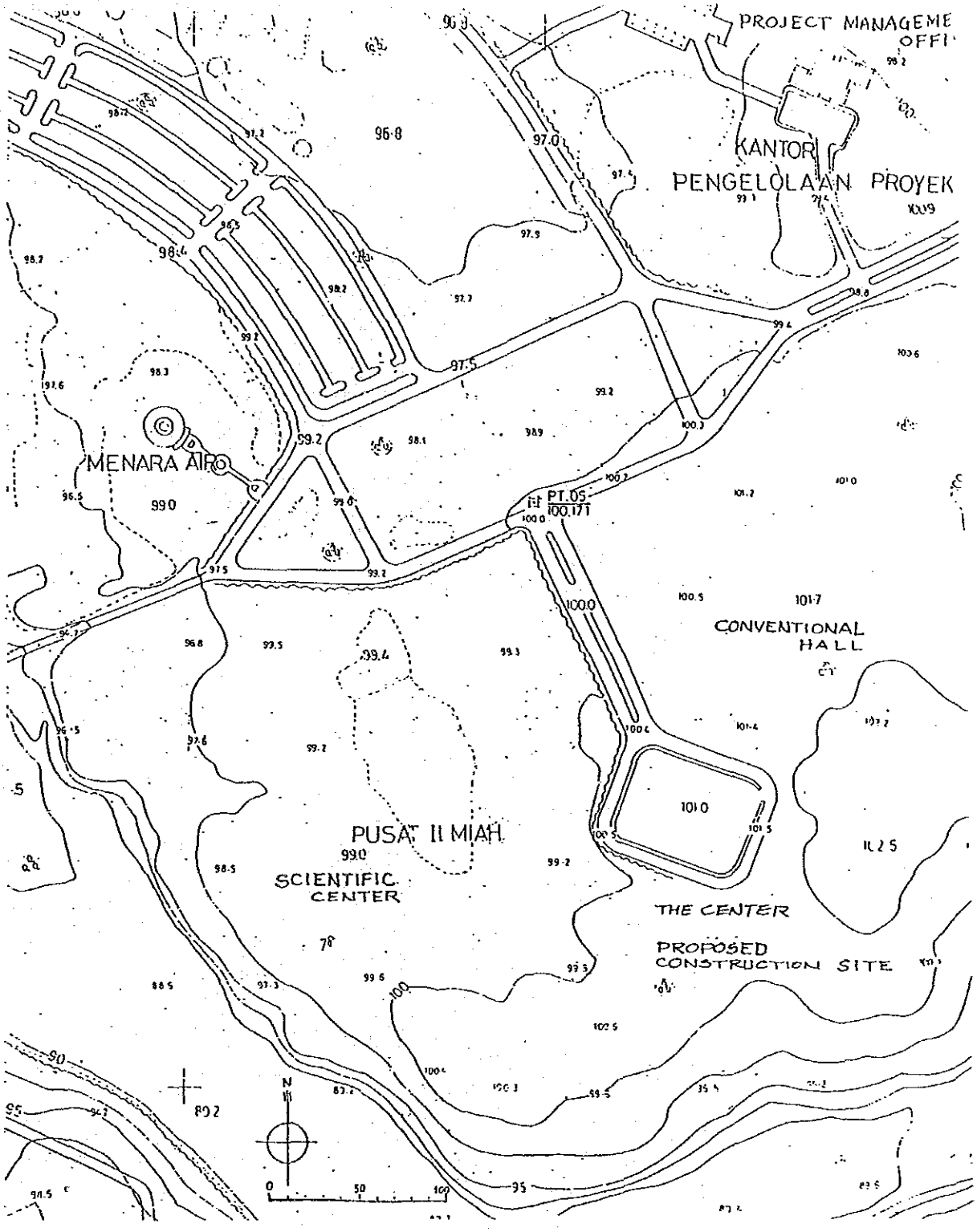


Fig. V-5 Map of Center Construction Plan

Source: Prepared by Study Team based upon the materials provided by the Project

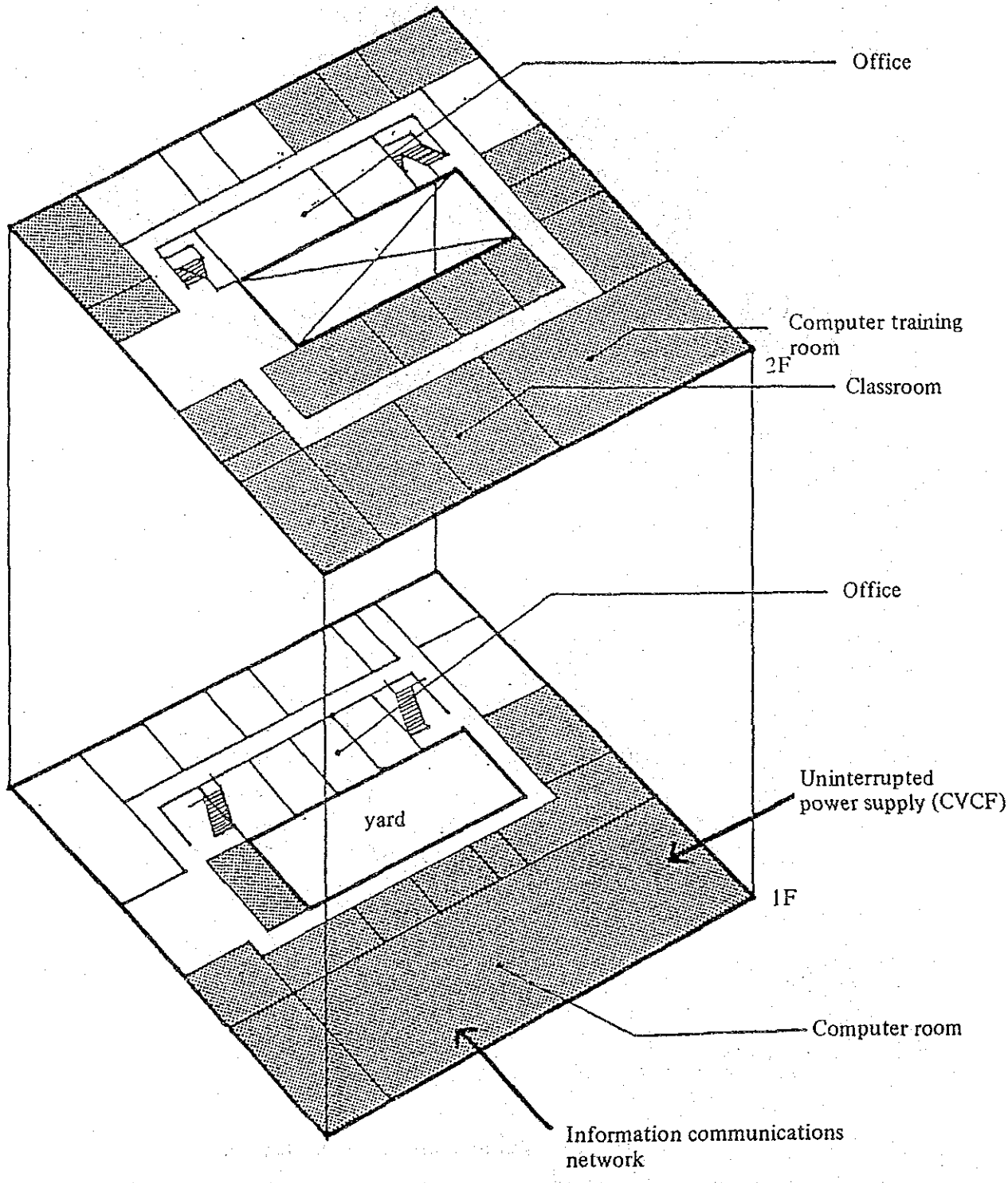


Fig. V-6 Functional of the Center for Industrial Technological Information

3.3 Construction Plan

(1) Planning

1) General concept

In the conceptual design plan of the Center, three blocks are planned in the form of the headquarters building for the Planning, Administration and Operations Departments, entrance hall building and forum building, depending upon their respective functions.

2) Operations Department

Since the computer room will include IDF communications room under one roof, it will occupy the largest floor space in this department. In consideration of the convenience of future machine relocation, a large-span plane will be recommendable. Also, the rooms which will have a close relationship with the computer room should be located as adjacent as possible. It is important to consider keeping the interconnecting cables between machines as short as possible.

It is further necessary to provide a fore-room before entering the computer room for dust prevention or data security. With this cosideration, the front door should be a slide type with a card lock.

It will be convenient to locate the computer training room and the class room should be located in consideration of their relationship with staircases and lobby to comfortably accommodate visitors and trainees. Fig. V-6 shows a sample layout with the functions considered.

3) Planning and Administration Departments

Since both the Planning and Administration Departments are responsible for the overall operation and administration of the Center, they should be located at accessible place. Also, since these departments will have the largest number of visitors, they should be located close to the entrance hall.

Inside the entrance hall, there will be an exhibit area for public relation of the operation of the Center.

In the Forum building, there will be a seminars hall for national and foreign researchers to gather and to hold seminars and meeting, and there will also be a lounge.

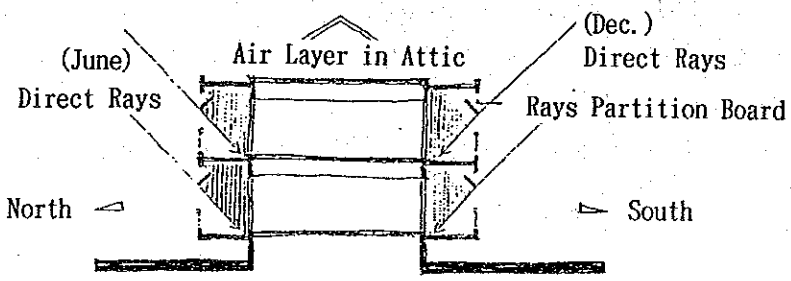
4) Power station

The power station of the Center will not only receive a high-voltage power supply and transform it to lower voltage for distribution, but will also supply stable, high-quality power without interruption. Due to vibration and noise, this station should be in a separate building from the headquarters building; however, it should be located close to the computer room to avoid unnecessary wiring.

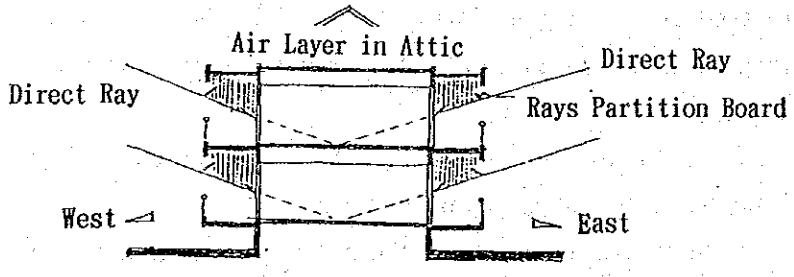
(2) Section Plan

The climate characteristic of Serpong is its annual precipitation which heavier than the avarage precipitation in Java island. Therefore, it will be necessary to pay particular attention to preventing the entry of rain water into the structures. In addition, it will be necessary to provide insulation against direct sunlight. Except for the computer-related rooms, the constant (nothwestern) breeze should be utilized aggressively throghout the year, for keeping the air-conditioning cost as low as possible. In this connection, the most efficient insulation against direct sunshine should be planned. This depends upon where the long axis line should be set-in the direction of east-west or north-south.

The following illustration compare benefits and liabilities of the long axis line established in the direction of east-west and north-south.



(1) Long axis set in north-west direction



(2) Long axis set in north-south direction

Fig. V-7 Relation of Long Axis and Insulation Board

As will be understandable from the above Fig. V-7 (1), it is easy to prevent direct sunshine from entering the rooms during the normal working hours with installation of balconies and minimum insulation boards. (The sun shining from south in this region is very high.) Also, during sunrise and sunset hours, direct sunshine can be avoided up to the insulation board.

In the Fig. V-7 (2) above, insulation boards may have to be installed for all the side to avoid direct sunshine during the sunrise and sunset hours, and this will produce a detrimental effect on the working environment.

Most of the groups of buildings of the laboratories in PUSPIPTEK-Serpong are located in the direction of the east-west axis. However, the axis line of some of the building groups is shifted to north-south by around 30, and this may be due to the constant north western wind. From the standpoint of energy conservastion, however, it is recommended that the main axis line should be in the east-west axis.

Also as cleary shown in the illustration, it will also be desirable from the same energy conservation standpoint, to slant the roofs instead of making plane roofs to provide air insulation zone underneath the roofs. This is because the intensive direct sunshine in the Republic of Indonesia usually hits plane portions. This will also be desirable in terms of preventing the waterseepage which occurs as a result of the strong squalls which are unique in this country.

(3) Building Materials Plan

The basic plan for the materials to be used in various construction projects should be worked out in consideration of the climatic conditions of the Republic of Indonesia, and after a general study of the facilities, necessary functions, regional construction situation, delivery and construction cost, reduction of maintenance cost, and other factors.

1) Structural materials

In the Republic of Indonesia, public buildings are generally constructed with a basic combination of ferro-concrete structures and brick layered walls.

There are no problems with the quality and quantity of the locally produced cement, reinforced steel bars (unconventional shapes are generally used) and bricks. Especially in PUSPIPTEK-Serpong, frame materials are easily available.

2) Finishing material

The facilities under this plan should be planned first with an emphasis upon the independent nature of their specific functions and then with a consideration for the unity of the whole program. At the existing laboratories, the unique atmosphere of PUSPIPTEK-Serpong is observable. The buildings share many things in common, although there are a few differences in the finish of structures.

① Exterior finishing

Some of the existing laboratories in PUSPIPTEK-Serpong display large buildings with steel frame construction have sheet material rooves, but these laboratories are now concerned about heat insulation. Most of other buildings have ferro-concrete construction and possess a flat roof with water-proof treatment. Because of the climatic conditions, the most suitable material for roofing may be tiles.

For the external wall area, structure material is mainly used for columns and beams with concrete bare finish while bricks are used for the external walls with a file finish. In this case, it is important to pay attention to caulking order to protect the structure from heavy squalls.

Moreover, some laboratories have buildings with a stone finish (around main entrance).

Material with excellent durability and water resistance should be selected for the finishing of the external wall area due to strong sunshine and rainfall.

② Interior finishing

Teraseau tiles are most popular for flooring but some buildings have hardwood parquet flooring or stones.

The walls are mostly brick with mortar buck finish and emulsion painting but in some cases, stones are used.

The ceiling of almost all the rooms including external and internal corridors are finished with a raising method. Various materials such as sound-absorbing board, wood, metal, etc. are used but the most popular finish is with flat boards and painting.

③ Fittings

The most popular material in the Republic of Indonesia hard-wood such as kamper. Because of the damage caused by termits, strong teak is

sometimes used. Teak's popularity, however, is limited because it is expensive. Most buildings in the laboratories at PUSPIPTEK-Serpong use relatively expensive aluminium fitting in order to prevent such damages. No complex aluminium fitting are available and steel fitting are also used for exterior.

Except for special cases, most fixture inside buildings are made of wood. When using wooden fixture, it is important to take enough time for drying.

(4) Structure Plan

The Republic of Indonesia is located in the Eurasia earthquake belt and there have been many earthquakes in the past (Table V-8).
The effect of erthquakes in area for which the center is planned, howere, is small, and the earthquake coefficient specified by the domestic law is low. Hence, this should not greatly affect the construction of the buildings. Also, this planned area is on a hillside with a standard altitute of 100 m above sea level, thus, the condition of the ground is good. (Refer to the Appendix.)

1) Super structure

The buildings of the existing laboratories at PUSPIPTEK-Serpong are low level structures (mostly, two stories) with ferro-concrete ridgid frame structure. Sometimes on iron frame truss structure is used for real-body laboratories for airplanes,etc. A person in the Project Management Office recommends 2 or 3 story ferro-concrete buildings without elevators as a consensus in the laboratory group.

2) Geological data in RSG-LP

① Underground water

According to the survey of wells in the villages around the Center, the depth of underground water ranges from 6 m to 18 m from the surface.

② Land resistance

An investigating organization has already checked the land resistance around RSG-LP. The outline of the results is shown in Table V-9.

Table V-8 Earthquake Record in the Republic of Indonesia

7.0 SEISMOLOGICAL DATA

7.1 General Data

- RSG - LP complex is situated between South latitude 8 deg. 21' and East longitude 106 deg.39'below, the list of earthquake covers the region between East longitude 105 deg - 108 deg and South latitude 6 deg. - 8 deg.

Date	Time GMT	Epicentre Latitude	Epicentre Longitude	Magnitude Richter Scale	Depth (Km)
22-06-1924		7.000	107.000 E	6.0	100
08-09-1927		7.500	107.000	6.2	50
21-05-1932		6.500	105.000	6.5	100
13-07-1933		7.700	106.500	6.2	70
22-01-1938		6.000	105.000	6.0	150
15-11-1941		6.690	107.000	5.8	290
01-04-1943		6.500	106.000	7.0	53
15-11-1957		6.200	107.080	6.0	325
19-02-1958		7.700	107.550	6.1	86
22-03-1960		6.700	107.300	4.9	150
21-02-1963	19.43.52	6.300	106.700	4.9	38
21-02-1932	19.52.27	6.300	106.800	5.0	33
22-02-1963		6.100	106.300	4.9	172
07-12-1963		6.100	106.200	5.4	133
17-07-1963		7.500	107.200	5.0	41
29-07-1963		6.700	107.100	5.5	85
28-08-'963		6.800	105.600	4.9	33
16-12-1963	01.51.30	6.440	105.480	6.2	54
16-12-1963	01.51.31	6.400	105.400	6.0	64
16-12-1963	02.06.38	6.300	105.500	5.6	33
16-12-1963	02.45.35	6.200	105.400	5.0	55
16-12-1963	04.16.43	6.300	105.500	4.8	63
16-12-1963	16.06.35	6.500	105.300	5.0	46
27-12-1963		6.450	105.200	4.4	33
29-12-1963		6.500	105.700	4.7	33
24-01-1964		7.100	106.000	5.5	94
21-02-1964		6.680	105.490	5.2	33
07-03-1964		6.500	105.300	5.3	57
24-11-1964		6.800	107.400	6.0	125
05-01-1965		7.300	106.700	5.3	89
07-07-1965		6.700	105.600	5.8	109
13-07-1965		6.900	105.600	5.7	55
09-02-1966		7.400	108.400	5.6	148
22-08-1966		7.600	107.000	5.3	33
19-08-1969		6.121	105.380	5.4	50
17-05-1974		6.500	106.800	6.0	131
14-08-1977		7.008	107.600	5.7	33

Source : Institute for Meteorology and geophysics, Jakarta.

See Figure VIII

(To be continued)

(continued)

7.2 Design Parameters

7.2.1 Maximum Horizontal & Vertical Acceleration

Maximum Horizontal & Vertical acceleration for Safe Shutdown Earthquake.

- Site acceleration, horizontal A h = 2.50 m/s *)

- Site acceleration, vertical A h = 1.25 m/s *)

To identified the design classes, it is necessary to inform Safe Shutdown Earthquake & Operating Base Earthquake.

7.2.2 Safe Shutdown Earthquake (SSE) **

The SSE for the Serpong site is defined as an earthquake having a horizontal component of ground acceleration equal to 0.25 g and a vertical component equal to 50% of the horizontal component. Class 1 component must maintain their safety function during and after this event.

7.2.3 Operating Base Earthquake (OBE) **)

The OBE is defined by applying the rules of the Indonesia Concrete Code Peraturan (Beton Indonesia 1971), N.I-18.
For this application, the zone used shall be 4 and the building importance factor shall not less than 2.
Structures are expected to remain standing after this event. Structures and components relied upon to maintain criticality safety are expected to perserve criticality safety during and after this event.

*) Page 2 - 15 SAR, for MPR - 30
**) PMO Project Procedures 5.1.
S) Horizontal acceleration data equal to 2.5 m/s

Source: Date obtained by the Study Team.

Table V-9 Land Resistance Data around RSG-LP

Depth [m]	Solid Description	Allowable Land Resistance [kg/cm²]
0-12	Cray silts Medium hardness →High hardness	0.5 → 1.0
12-18	Sandy silt Medium density →High density	1.0 (→ 4.0)
19-20	Silty sand Medium density →High density	1.0 → 4.0
20<	Silty sands →High density	4.0

Sorce: Date obtained by the Study Team.

(3) Facilities Plan

1) Electrical facilities plan

① Power supply and distribution facilities

a. High- and low-voltage power

The high-voltage power lines (20kV) are installed by PLN as a part of the works of the government, and the power will be supplied to the Center through underground cables. The Center will therefore be responsible for installing the power facilities after receiving the high-voltage power supply. The receiving system is, 20kV, 50Hz, and on the low-voltage line, 3-phase 380V for power use, and 1-phase 220V, 50Hz for illumination and wall outlets. (Refer to Fig. V-10)

The constucting the Center will require a supply of approximately 1,000kVA. For running its computers, the Center will require uninterrupted power supply units for its exclusive use.

b. Power generating facilities

A generator (approximate capacity: 500kVA) will be installed to provide an emergency power supply for the computers and their peripherals, fire extinguishing facilities and security lighting.

② Lighting fixtures

Since many personal computers will be using the Center, care should be given to the lighting equipment used in rooms containing computer

CRTs. The lights should be of a glare-less type to prevent irritating glare from monitor screens. Emergency lighting in case of power failure should be available for pedestians who may be using the facilities at night.

③ Socket outlets

For use with small electrical appliance, socket outlets will be installed. The general commonly used socket outlets in the Republic of Indonesia is 2pin+2 ground contacts.

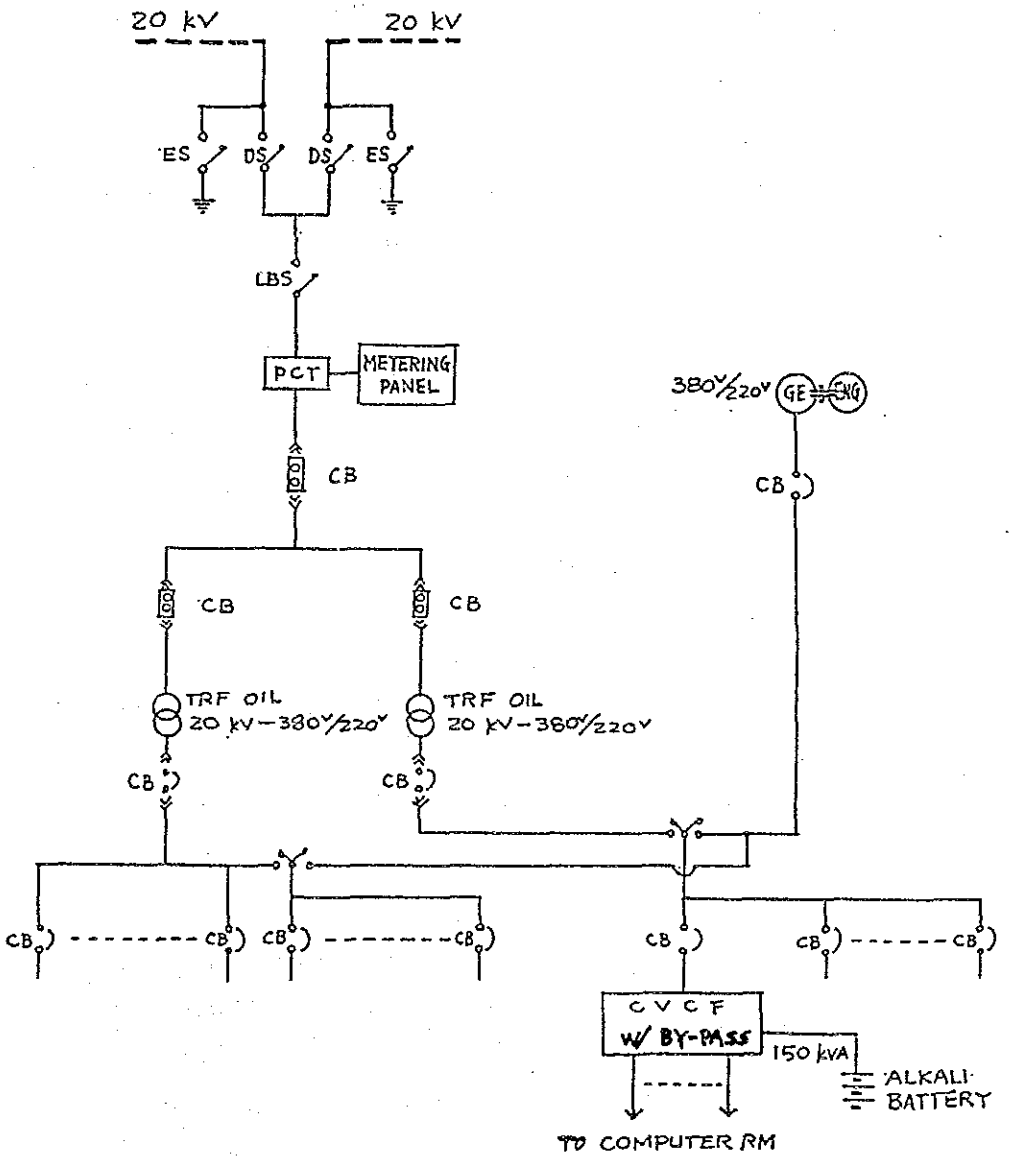


Fig. V-10 Systematic Diagram of Power Supply Lines

Source : Prepared by the Field Survey

④ Telephone system

In PUSPIPTEK-Serpong, the telephone exchange inside the Project Management Office is providing switching services to each laboratory. Therefore, the Center will be responsible for telephone sets and wirings required.

⑤ Fire alarm system

Although there are no regulations concerning fire alarm facilities in the Republic of Indonesia, fire alarm facilities should be installed for early fire-fighting activities. In addition, installation of fire extinguishers automatically activated by such alarm facilities will be desirable.

⑥ Lightening protection system

Lightening protection system will be installed in accordance with standard of the Republic of Indonesia.

⑦ Grounding (earth lines)

Regulations specify the grounding standard for receiving and transforming power to be below 1 Ω for high-voltage power and below 5 Ω for low-voltage power.

Computers and peripherals will be grounded at below 5 Ω, and public address system also at below 5Ω.

2) Air conditioning facilities plan

・Refer to the climate data of PUSPIPTEK-Serpong in Table V-12.

・The following guidelines govern the rooms to be air-conditioned and the design temperature.

Table V-11 Guidelines for Room Temperature and Humidity

Rooms	Dry Temperature	Relative Humidity
Computer room	25℃± 2℃	45~70%
OA equipment rooms	Same as above	Same as above
Data storage	20℃± 2℃	50%
Seminar hall	25℃± 2℃	
Library	Same as above	

Table V-12 Climate Data of PUSPIPTEK-Serpong

(Lat. 6° 21' S., Long. 106° 39' E.)

1. Wind Velocity

Average surface wind velocity	5.15m/s
Maximum surface wind velocity	18.25m/s

The wind velocity increases, with increasing height about the ground surface

2. Wind Direction

Dominant wind direction changes through the year

January	Northwest quardrant	Maximum	± 7.71 m/s
February	Northwest quardrant	Maximum	± 7.71 m/s
March	Northwest quardrant	Maximum	± 10.28 m/s
April	Northwest quardrant	Maximum	± 7.71 m/s
May	Northwest quardrant	Maximum	± 7.71 m/s
June	Northwest quardrant	Maximum	± 7.71 m/s
July	Changeable	Maximum	± 7.71 m/s
August	Northwest quardrant	Maximum	± 7.71 m/s
September	Changeable	Maximum	± 7.71 m/s
October	Northeast quardrant	Maximum	± 7.71 m/s
November	Changeable	Maximum	± 10.28 m/s
December	Northeast quardrant	Maximum	± 5.15 m/s

3. Atmospheric Temperature

Maximum temperature (day)	32℃ (1:00 p.m.)
Maximum temperature (throughout year)	34℃ (1:00 p.m.)
Lowest temperature(day)	22℃ (5:00 a.m.)
Lowest temperature(throughout year)	32℃ (5:00 a.m.)

Variation by altitude: -0.65℃ per each 100m in atmosphere.

4. Humidity

Maximum relative humidity	98% (6:00 a.m., April)
Minimum relative humidity	54% (1:00 p.m., August)
Daily minimum relative humidity	96% (6:00 a.m.)
Daily minimum reative humidity	62% (1:00 p.m.)

5. Precipitation

Annual precipitation	Average	1,899 mm
	Maximum	2,596 mm
Monthly precipitation	Average	156 mm
	Maximum	200 mm
Daily	Average	50 mm
	Maximum	200 mm
Days with precipitation (year)	Average	102 days
	Maximum	156 days
Days with precipitation (month)	Average	12 days
	Maximum	20 days
Precipitation per second	Maximum	1.0 mm

Source : Data supplied by the Project Management Office of PUSPIPTEK-Serpong.

Separate air-cooled cocling systems will be suitable for the other general office, conference rooms, classrooms and instructor's rooms.

① Air-conditioning system equipment facilities

Considering the regional maintenance of air-conditioning equipment, air-cooled package-type cooling equipment is recommendable for easy maintenance. Furthermore, the air-conditioning system for rooms where entry of outside soil should be minimized, such as computer rooms, should be of a single duct system because of ease in adjusting its room temperature. If a free access floor system is used for a computer room, use of both under-floor ventilation for hardwares and room air-conditioning is recommendable.

② Automatic control system

In addition to the room temperature detector which adjusts the air-conditioning equipment, it is recommended, from the viewpoint of the operation of the equipment, to design the system so that people in the management office will be able to remotely control the airconditioning equipment.

3) Water plumbing and sanitary facilities plan

① Portable water supply system facilifies

In the whole area of PUSPIPTEK-Serpong, the existing water tower centrally located in the Center supplies water to the laboratories with a direct gravity system. Therefore, new receiving tanks, water pumps and elevated tanks may not be considered necessary at this point. The final decision in this regard, however, should be made after a careful study of all the factors involved in the balance of water supply.

Table V-13 Result of Water Quality Examination

ANALISA AIR BERSIH

Hasil Pemeriksaan Contoh dari : P.A.B PUSPIPTEK

L o k a s i : GROUND RESERVOIR

Tanggal Pengambilan Contoh : 7 Maret 1988

A N A L I S A	HASIL ANALISA	SATUAN	STANDARD WHO	
			MIN.	MAX.
F I S I K A :				
Kekeruhan	0,67	NTU	-	25
B a u	Non	-	-	Negatif
Rasa	Non	-	-	Normal
Warna	5	ppm.Pt.Co	-	50
K I M I A :				
p H	7,23	-	6,5	9,2
Zat Padat	-	ppm	-	1500
Zat Organik	4,24	ppm $KMnO_4$	-	10
Carbon Dioksida bebas	-	ppm CO_2	-	-
Alkalinity :				
a. P.Alkalinity	0,00	ppm $CaCO_3$	-	-
b. M.Alkalinity	2,86	ppm $CaCO_3$	-	-
c. Carbonat	0,00	ppm $CaCO_3$	-	-
d. Hydroksida	0,00	ppm $CaCO_3$	-	-
e. Bicarbonat	2,62	ppm $CaCO_3$	-	-
Total Hardess	9,64	^oD	5	10
a. Calsium Hardess	15,58	ppm Ca^{++}	-	200
b. Magnesium Hardess	4,76	pp, Mg^{++}	-	150
B e s i	0,04	ppm Fe^{+++}	-	1,0
Mangan	0,00	ppm Mn^{++}	-	0,5
Sulfat	18,0	ppm SO_4^{--}	-	400
Chlorida	-	ppm Cl^-	-	600
Sisa Chlor	0,60	ppm Cl_2	-	0,5
BACTERIOLOGY :				
Coliform / 100 ml	N I L			
Bacteria Count / 1 ml				

Serpong, .7.Maret..... 1988.

Kontrol Kualitas & Laboratorium

(To be continued)

(Continued)

ANALISA AIR BERSIH

Hasil Pemeriksaan Contoh dari : P.A.B PUSPIPTEK.

L o k a s i : GROUND RESERVOIR.

Tanggal Pengambilan Contoh : 5 AGUSTUS 1988.

A N A L I S A	HASIL ANALISA	SATUAN	STANDARD WHO	
			MIN.	MAX.
F I S I K A :				
Kekeruhan	0,83	NTU	–	25
B a u	Non	–	–	Negatif
Rasa	Non	–	–	Normal
Warna	5	ppm.Pt.Co	–	50
K I M I A :				
p H	7,11	–	6,5	9,2
Zat Padat	–	ppm	–	1500
Zat Organik	2,83	ppm $KMnO_4$	–	10
Carbon Dioksida bebas	–	ppm CO_2	–	–
Alkalinity :				
a. P.Alkalinity	0,00	ppm $CaCO_3$	–	–
b. M.Alkalinity	2,80	ppm $CaCO_3$	–	–
c. Carbonat	0,00	ppm $CaCO_3$	–	–
d. Hydroksida	0,00	ppm $CaCO_3$	–	–
e. Bicarbonat	1,88	ppm $CaCO_3$	–	–
Total Hardess	2,33	^oD	5	10
a. Calsium Hardess	13,30	ppm Ca^{++}	–	200
b. Magnesium Hardess	2,03	pp, Mg^{++}	–	150
B e s i	0,03	ppm Fe^{+++}	–	1,0
Mangan	0,00	ppm Mn^{++}	–	0,5
Sulfat	17,50	ppm SO_4^{--}	–	400
Chlorida	20,00	ppm Cl^-	–	600
Sisa Chlor	0,35	ppm Cl_2	–	0,5
BACTERIOLOGY :				
Coliform / 100 ml	N I L			
Bacteria Count / 1 ml				

Serpong, 5 AGUSTUS 1988.

Kontrol Kualitas & Laboratorium.

(To be continued)

(Continued)

ANALISA AIR BAKU

Tanggal penganbilan contoh : 7 Maret 1988

A N A L I S A	HASIL ANALISA	S A T U A N
D O S I S :		
Tawas Alluminium	30,0	ppm
Kapur Tohor	1,90	ppm
Kaporit	1,35	ppm
F I S I K A :		
Sisa lumpur kasar	0,09	%
Kekeruhan	31,00	NTU
Bau	Non	
Rasa	Non	
Warna	35,00	ppm Pt.Co
K I M I A :		
pH	7,87	
Zat padat	-	ppm
Zat Organik	8,15	ppm $KMnO_4$
Carbon Dioksida bebas	-	ppm CO_2
A l k a l i n i t y		
a. P. Alkalinity	0,00	ppm $CaCO_3$
b. M. Alkalinity	5,80	ppm $CaCO_3$
c. Carbonat	0,00	ppm $CaCO_3$
d. Carbon dioksida	1,380	ppm $CaCO_3$
e. Hydroksida	0,00	ppm $CaCO_3$
f. Bicarbonat	0,00	ppm $CaCO_3$
Total Hardess	1,87	^{o}D
a. Calsium Hardess	6,69	ppm Ca^{++}
b. Magnesium Hardess	2,73	ppm Mg^{++}
Besi	1,56	ppm Fe^{+++}
Mangan	0,00	ppm Mn^{++}
Sulfat	-	ppm SO_4^{--}
Chlorida	-	ppm Cl^{-}

Serpong, 7 Maret ..... 1988.

Kontrol Kualitas & Laboratorium

(To be continued)

(Continued)

ANALISA AIR BAKU

Tanggal penganbilan contoh : 5 AGUSTUS 1988.

A N A L I S A	HASIL ANALISA	S A T U A N
D O S I S :		
Tawas Allurninium	30,00	ppm
Kapur Tohor	1,80	ppm
Kaporit	1,40	ppm
F I S I K A :		
Sisa lumpur kasar	0,08	%
Kekeruhan	37,00	NTU
Bau	Non	
Rasa	Non	
Warna	40,00	ppm Pt.Co
K I M I A :		
pH	7,60	
Zat padat	-	ppm
Zat Organik	4,56	ppm $KMnO_4$
Carbon Dioksida bebas	-	ppm CO_2
A l k a l i n i t y		
a. P. Alkalinity	0,00	ppm $CaCO_3$
b. M. Alkalinity	3,88	ppm $CaCO_3$
c. Carbonat	0,00	ppm $CaCO_3$
d. Carbon dioksida	1,38	ppm $CaCO_3$
e. Hydroksida	0,00	ppm $CaCO_3$
f. Bicarbonat	2,50	ppm $CaCO_3$
Total Hardess		^oD
a. Calsium Hardess	1,80	ppm Ca^{++}
b. Magnesium Hardess	8,68	ppm Mg^{++}
Besi	1,52	ppm Fe^{+++}
Mangan	0,00	ppm Mn^{++}
Sulfat	-	ppm SO_4^{--}
Chlorida	-	ppm Cl^-

Serpong, 5 AGUSTUS 1988

Kontrol Kualitas & Laboratorium

(End)

From the result of an examination of the water quality (see Table V-13), there are no particular problems. As is practiced in the existing laboratories, however, water is boiled before drinking, and it may not be suitable for drinking as it is. For drinking in the Republic of Indonesia, bottled or packed water is sold on the market and is popularly used.

② Drainage system

The sewage water disposal should be separated from rainwater disposal. Rainwater can be disposed of into the common disposal tubes, and sewege water should be disposed of by earth infiltration and evaporation through infiltration tubes, after processing in corrosion tanks. It is reported that the level of the underground water in PUSPIPTEK-Serpong is approximately 6~18 meters, according to the data supplied by the Project Management Office.

③ Sanitary fixture installation

Toilet fixtures should be in accordance with the local living customs. In certain areas, such as the Forum, building a combination of Indonesian and European toilet fixtures will be recommendable for visitors' convenience.

④ Heat source

PUSPIPTEK-Serpong has no central gas supply facilities. Kitchen, bottled LPG gas which is widely used or electric heating may be considered as heat source for cafeteria.

⑤ Indoor fire extinguisher

In PUSPIPTEK-Serpong, many laboratories are equipped with sprinklers, including computer-related rooms. This, however, is not suitable as fire extinguishers for such delicate environment, and instead of extinguishers with CO_2, halogen, or other nonflammable gas will be more desirable for computer maintenance.

In other areas, indoor fire hydrants will be adequate.

⑥ Consideration on shoes

Some guidelines should be prepared regarding a place where visitors take off the shoes, procedures, preparation of indoor slippers, etc.

3.4 Scale of Facilities

The facilities of the Center will be planned as follows according to the basic policies which are set forth in the preceding paragraph 3.1. The three major buildings, headquarters, entrance hall, forum can be separately constructed. Therefore, the cost schedule divided by phases will be possible.

(1) Headquarters Building 3,090m²

Chief Director's office 120m²
Secretary's room
Reception room

1) Planning Department 160m²
Department Manager's office
Planning administration room
Visitor conference rooms

2) Administration Department 350m²
Department Manager's office
Office (administration, supplies)
Office (finance, accounting)
Office (personnel, labor, welfare)
Conference room
Custodian's room
Sundry room

3) Operations Department 1,625m²
Department Manager's office

Publication service room (editing, publication)
Database service section
User terminal room
Searcher room
Data edit/input room

Library
Reading room
Librarian's room
Storage for books

Education service section
Education division's office (education planning, education/training)
Computer training room
Classrooms
Trainers' room
Trainers' waiting room
Computer-related room (705㎡)
User terminal room
Application user consulting corner
Operations control room (operators' waiting room)
S/A, S/E, C/E and application programmers' room
Data storage (Materials storage)
Computer room (IDF communications room)
Fore-room of computer room

4) Others 835㎡
Air-conditioner room
Pantry, toilet
Corridors and staircases

(2) Entrance Hall Building 300㎡

Entrance Hall (Exhibit area)

(3) Forum Building 1,660㎡

Seminar hall (including projection room)
Lounge lobby (with coffee/tea service)
Preparation room
Air-conditioner room
Toilet
Terrace

(4) Power Station 150㎡

Transformer room
CVCF room
Battery room
Generator room

Total Floor Space 5,210㎡

In Part V, the conceptual design of a computer system and related facilities was conducted based on the determined functions stated in Part IV. In Part VI, conditions of the feasibility for establishing the Center and an execution plan will be explained.

PART VI

EXECUTION

AND

OPERATION PLANS

SECTION 1 OPERATIONAL PLANS

1.1 Operating Body

The functions which should be provided by the Center for Industrial Technological Information were discussed in Part IV, and are summarized as follows:

(1) Effective support of research and development through information distribution

(2) Systematization of technological information and technology transfer to industries

(3) Publication/provision/promotion activities concerning industrial technological information

(4) Computer use education/training

(5) Technical calculation service and consultation

These service functions can be divided into those which cover laboratories in PUSPIPTEK-Serpong and those which cover firms and outside institutes.

To operate these service functions, it is necessary to initially offer services free of charge to researchers (users), to make them recognize the usefulness of the Center and to establish reliability, until the Center starts to achieve effective operation. Judging from actual results of use thus obtained, it will be practical to start charging for sevices at an appropriate time, The purposes of cost generation are to let users find the value of a computer use and to obtain a part of the operation cost.

The body for operating the Center should be BPPT, which is closely related to the industries and has many lobratories of PUSPIPTEK-Serpong. Further, in order to effectively provide an information service, it will be necessary to obtain the cooperation of LIPI, the main body of PDII which already is proving scientific and technological information services. As for the demand for scientific and technological calculation, a large portion is expected to come from BATAN, which is running general-purpose research reactors. Therefore, cooperation should also be obtained from BATAN.

It is necessary that appropriate staff members are accepted from the major parent institutes and placed in appropriate job positions. The personnel placement schedule was discussed in 1.3 of Part V.

1.2 Operation Plans

Table VI-1 shows the outline of operation categorized into the short-term, medium-term and long-term operation plans.

The developmental stages of the service functions are set in the first phase (1-2 years from foundation of the Center), the second phase (3-5 years) and the third phase (6-8 years).

Upon sequentially scheduling the service function, as many functions as possible are expected to be realized during the first phase, which can be expanded during the second and third phases with the consideration of how the Center will be utilized.

In order to realize as many service functions as possible during the first phase, it will be necessary to do sufficient preparation during or even before construction of the Center. The preparation stage would be two and half years and in this stage, a basic design, bidding, a detailed design, construction and material procurment will be conducted. The preparation activities needed to realize the five service functions will now be discussed.

(1) Effective Support of Research and Development Through Information Distribution

1) The selection of specialized books, data books and database in CD-ROM for information provision services should be completed prior to construction of the Center. The collection of these books should also be completed in time for the opening of the Center, in addition to the preparation of a book list. These books should be continuously collected and organized after the first phase, whose menu can then be input into databases as needed.
2) In order to collect information concerning research subjects, the number of researchers, personal histories of researchers, and details of researchers sent abroad for study, it is necessary to establish the information collection form, procedures and system before the opening of the Center. Such information gathering and preparation of databases should be completed before the opening date. Even after completing the information gathering, efforts for maintenance such as review, exchange and supplementation of information will be neccessary.
3) Schedules and selection of themes for forums should be completed before the opening of the Center and reviewed when necessary.
4) As for the provision of services for overseas technological information,

Table VI-1 Service Functions at the Center

Outline of operation \ PHASE	0 (Preparation stage)	I	II	III
	-2.5 yrs.	1-2 yrs.	3-5 yrs.	6-8 yrs.
1. Effective support to research and develoment through information distribution (within PUSPIPTEK)	• Selecting special books/data books, CD-ROM DB, etc. • Organizing special books/data books/CD-ROM DB, etc. • Organizing inf. collecting form/procedure/ system • Collecting research information within PUSPIPTEK (subject/ staff) • Preparing research exchange	• Management/provision service • Training database searchers • Providing research information exchange among laboratories • Encouraging research exchange (forums)	• ----------→ • Providing latest technical information (use of overseas on -line database servises) • ----------→ • ----------→ (interdisciplinary forum)	• ----------→ • ----------→ • ----------→ • ----------→ (joint research with laboratories in different fields)
2. Systematization of technological information and technology transfer to industries	• Setting Management/basic policies • Preparing operation procedure (SOP) and starting collection technical reports issued and disclosed • Preparing operation procedure (SOP) and collecting developed software	• Collection/management (Preparation of databases) • Collection/management (Preparation of databases) • Collection/management (Preparation of databases)	• management/provision service (inside/outside PUSPIPTEK) • management/provision service (inside/outside PUSPIPTEK) • management/provision service (inside/outside PUSPIPTEK)	• ----------→ • ----------→ • ----------→
3. Publication/provision/ promotion activities concerning industrial technological information	• Recruiting/traininr staff for translation/promotion activities	• Translating special books • Promotion concerning activities of laboratories (technology/ capacity/facilities, etc.)	• ----------→ (publication/sales) • ----------→	• ----------→ • ----------→
4. Computer use education/ trainning	• Training educational staff • Training center management staff	• Learning application use • Practicing software technological education • Conducting numerical analysis education • Training educational staff in center management/operation technology • Training educational staff in production control	• ----------→ • ----------→ • Training SA/SE educational staff • Practicing education of center management/operation technology education • Practicing education of production control technologiy	• ----------→ • ----------→ • Practicing SA/SE educational course • ----------→ • ----------→
5. Technical calculation service and consultation	• Selecting technical calcuiation software • Introducing technical	• Providing technical calculation service	• Encouraging use of technical calculation software	• Developing technical calculation software • Technical consultation service
* Preparation/organization of the computer system * Preparation/improvement of SOP.	* System design * System introduction * Completing basic SOP	* Operation of computer system * Free service * Confirmation of SOP	* Expansion of system * Improvement	*----------→ *----------→

these services should be started when the operation reaches a stable stage and its reputation has been established. By this stage, it can be expected that the Center would have budgetted to afford the cost of international data communication.

(2) Systematization of Technological Information and Technology Transfer to Industry

It is necessary that the basic control policies concerning material to be serviced such as technical reports, experimental data and developed software, issued by the laboratories are made known prior to the foundation of the Center. Based on these basic policies, the Standard Operation Procedures (SOP) should be prepared and technical materials and tools should be collected before the Center opens. It will be also necessary to prepare a menu of these materials and tools by the opening date. Collection and organization should be continued after the first phase, in which the menu of technical reports, especially, need to be incorporated into databases in parallel with collection and organization.

(3) Publication/Provision/PR Activities Concerning Industrial Technological Information

Staff members should be obtained before the Center opens and, by this time, the selection of documents to be translated as well as all promotional activities should have been planned. These translation and promotional activities should be continued after the first phase.

(4) Computer Use Education/Training

1) Appointment and training of the management staff of the Center should be started before the opening date. To train the staff, either a governmental center in the Republic of Indonesia possessing a large computer, or a computer center for science and technology outside the country could be the good ways. It would also be effective to hire experienced persons from similar centers.
2) The appointment and training of software education staff and numerical analysis staff needs to be started before the Center begins to operate. It is, therefore, necessary to carry out the recruitment of staff based on a staff training schedule and the scheduled date of inauguration, thus to be able to provide enough technical guidance externally. After the first

phase, it will be necessary to increase the staff depending on the use of the Center.

(5) Technical Calculation Service and Consultation

1) The application and basic software for technical calculation should be selected before the Center opens and additional softwares should be added after the first phase.
2) It will be necessary to recruit and train the application engineers who can consult users (researchers and general engineers) in the field of science and technology before the Center begins to operate.

The configuration, introduction and expansion of the computer system should be carried out in order according to the preparation plans to achieve these five functions.

1.3 Specialists from Overseas

It is essential to complete preparing SOP, training satff, preparing database construction during the said preparation stage in order to operate the Center smoothly right after its construction.

Besides the staff in the Center, the following specialists are absolutely indispensable.

① Management experience of a computer center ; 1 man x 18 months

② Experience of application software analysis
in the field of scientific and engineering; 1 man x 8 months

③ Experience of database management analysis; 1 man x 8 months

Although these specialists should be secured inside the country, it was found to be difficult during the field survey. Therefore, these specialists needs to be invited from overseas.

SECTION 2 EXECUTION PLAN

To organize the Center, start its operation (provide service) and gradually expand its functions, it is necessary to ① acquire human resources and carry out training, ② establish rules necessary for organization and administration and ③ define operating procedures for actual operation.

2.1 Acquisition and Training of Personnel

In order to carry out proper planning concerning assignment and training of the personnel necessary at each phase of the Center's construction, as well as commencement of service and expansion of service, it is necessary to clearly determine the nature and volume of operations at each phase. It is also necessary to acquire personnel for the work (called "leading work") to be done during the service preparation phase (hereafter called "preparation phase").

(1) Acquisition of Personnel

1) Early establishment of core functions in the initial stage
Upon approval for the construction of the Center, the organization as described in 1.3 of Section 1 in Part V, should be structured as follows:

① The Advisory Board of Directors for Center Operation should be organized first.
② The core functions of the planning and administration departments will be organized and started with a small number of staff.

2) Acquisition of personnel for leading works, start-up of works and long-term personnel planning
With the establishment of the initial core functions as referred to in 1) (above), the following steps should be taken simultaneously:
① Plans for the leading works, acquisition of personnel for leading works, and initiation of the leading works.
② Long-term personnel hiring and training plan.

3) Gradual staffing plan
① First half of preparation phase
Before starting service, there will be a great deal of leading work to be processed during this phase. Table VI-2 shows the personnel

required to carry out the leading work and their functions.

Table VI-2 Staffing during First Half of Preparation Phase

Organization	Job Description	Function	(Grade)	Number	
a.	Chief Director		(1)	1	
b.	Planning Dept.				
	Manager		(2)	1	
	Progress control/budget control		(4)	1	
	Board secretariat: PR		(6)	1	
c.	Administration Dept.				
	Manager		(2)	1	
	General/Finance/Personnel				
		General administration	(3)	2	2 managers
		Assistants & recruiting	(8)	3	
d.	Operations Dept.				
	Manager		(2)	1	
	Information service				
		Selection of specialized books	(4)	1	
	Information service				
		Coordination of information gathering system	(4)	1	
	Information service				
		Planning basic policies for information control	(4)	1	
	Publication				
		Staff (training)	(4)	1	
	Education				
		Software training staff (training)	(3)	1	Manager
		Numerical analysis	(4)	1	
		Center administration	(4)	1	
	Computer				
		Planning of operating control system	(3)	1	Manager
		Selection of technological software	(2)	2	Specialists
			Total	21	

② Second half of preparation phase

Leading works should continue, with 7 additional personel as shown in Table VI-3.

Table VI-3 Staffing during Second Half of Preparation Phase

Organization	Job Description	Function	Previously Hired	Addition (Grade)	Total
a.	Chief Director		1		1
b.	Planning Dept.				
	Manager		1		1
	(Continued from the first half)		2		2
c.	Administration Dept.				
	Manager		1		1
	General administration		3	(8) 1	4
	(Continued from the first half)				
	Personnel and labor relation		2	(8) 1	3
	(Continued from the first half)				
d.	Operations Dept.				
	Manager		1		1
	Publication (from the first half)		1		1
	Information service	Selection of specialized books	2		2
	Information service	Collection of research information	1	0	1
	Information service	SOP and collection of research results	0	(7) 1	1
	Information service	SOP and collection of research reports	0	(6) 1	1
	Education (from the first half)		3		3
	Computer	Manager	1		1
		Data entry	0	(7) 1	1
		Coordinating operating control systems	0	(4) 1	1
		Introduction of techno-logical software	2	(2) 1	3
		Total	21	7	28

③ Service initiation phase

At the time the Center fulfills all functions, all the personnel (67) defined in 1.3 in Part V should be secured. However, the 40 personnel is indispensable at this phase. Therefore, in addition to the second half of the preparation phase mentioned above, 10 staff members will be newly recruited be the Operations Department upon initiation of service; refer to Table VI-4.

Table VI-4 Personnel at Starting of Service

Department	Ideal Final Plan	Cumulative Staff at the Second Half	Minimum Recruiting Persons at Start	Total at Start
a. Chief Director	[1]	1		1
Secretary	[1]			
b. planning Department				
Manager	[1]	1		1
Staff	[5]	2		2
c. Administration Department				
Manager	[1]	1		1
Staff	[14]	7	8) 2	9
d. Operations Department				
Manager	[1]	1		1
Publication (Manager)	[5]	1	3) 1	2
Information service (Manager)	[7]	5	3) 1	6
Education (incl. Manager)	[5]	3	5) 1	4
Computer Manager	[1]	1		1
Service	[5]		4) 1	1
			6) 2	2
Operation	[10]	1	6) 4	5
System	[5]	1		1
Application	[5]	3		3
Total	[67]	28	12	40

④ Service expansion phase

Expansion of service is targeted for the third and sixth year after start-up. The staffing plan should be worked out according to this expansion plan.

a. Replenishment service personnel should be hired during the year

previous to the start-up of service. If training is necessary during the previous year, a decision should be made during the first and fourth year as to whether or not replenishment personnel will be needed for the following years, thus to be incorporated in the staffing plan of the previous year.

b. If additional personnel are required, they should be hired at an appropriate time, approximately at the end of the second and fifth years.

c. However, expansion of service activities should be properly coordinated with changes and diversification of user needs after start-up of Center operations. The expansion should be planned flexibly, and no hasty decisions should be made regarding staffing and job positions.

In Table VI-5, certain examples are presented for expansion of services, related job positions and possible job assignment.

Table VI-5 Services for Expansion and Replenishment Personnel

Department	Services for Expansion	Replenishment Personnel
a. Third year		
Information service Div.		
	Use of overseas on-line data base service.	Experience in use of overseas DB service.
Education Div.	Development of SA, SE training personnel.	Transferred from Computer div.
Education Div.	Center administration/ training on operating technology.	Same as above.
Education Div.	Training in production control technology.	Replenishment of production control engineers.
Computer Div.	Promotion of use of technological calculation softwares.	Replenishment of software engineers.
	Correspondence with demand for data entry operation.	Replenishment of support engineers. Replenishment of staff transferred to Education div.
b. Sixth year		
Education Div.	Training course on SA, SE	(none)
Computer Div.	Technological consulting service.	(none)

(2) Training of Personnel

1) For personnel education and training

As in the hiring of new staff and replenishing personnel, personnel education and training should be conducted throughout various phases of construction and operation. This is important because of difficulties in locating and hiring qualified personnel for the various job positions. Personnel education and training should be conducted all the time for new employees and for personnel reassigned from other departments, with consideration given as well to possible decreases in staff size.

Accordingly, mid-range personnel education and training programs and annual programs (as a part of the former plan outlined above) should be worked out continuously, while following the training guidelines of the Center employees.

We will now show certain guidelines on personnel education and training as follows.

2) Guidelines and contents for personnel education and training

It is recommended that personnel education and training be conducted on the basis of specific guidelines covering the length and contents of respective job types as shown in Table VI-6. And the example of courses is shown in Table VI-7.

Table VI-6 Education/Training Guidelines (Example)

① Short-term class

This is intended for general personnel, including inexperienced employees for whom a short-term (within 2 months) education and training and on-the-job training will be sufficient for performing the duties assigned.

② Standard class

This is for special personnel for whom a longer (6 months approximately) education and training program will be needed for performing assigned tasks.

③ Special class

This is for a selected group of personnel, with previous education in basic fields, who are sent out to outside institutions (corporations, universities) selectively for additional education or practical training.

3) In-house personnel education and training

It is recommended that personnel belonging to the above classes ① and ② receive appropriate education and training in the respective

Table VI-7 Proposed Training Course for Each Job Position

Training course \ Appointment (grade)	Planning manager (2)	Staff (4)	Staff (6)	Operations manager (2)	Publications manager (3)	Staff (4)	Staff (6)	Information service manager (3)	Staff (4)	Staff (4)	Staff (7)	Librarian (4)	Assistant (6)	Education manager (3)	Staff (4)	Staff (5)	Computer manager (3)	Service sec. (4)	Staff (6)	Operations sec. (4)	Staff (6)	Staff (7)	System sec. (4)	Staff (4)	Staff (5)	Application engineering sec. (2)	Staff (4)	Total
no. of persons	1	3	2	1	1	2	2	1	1	1	2	1	1	1	2	2	1	1	4	2	4	4	1	1	3	3	2	67
Basic knowledge of computer	○	○		○	○	○		○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Basic computer usage (PC level)	○	○	○		○	○		○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Basic computer usage (terminal level)	○	○	○		○	○		○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Basic knowledge of data-communication	○	○		○	○			○	○	○		○		○	○	○	○	○		○	○		○	○	○	○	○	
General knowledge of DBMS	○	○		○	○	○		○	○	○		○		○	○	○	○	○		○			○	○	○	○	○	
Basic knowledge of information service	○	○		○	○			○	○	○		○					○											
Basic knowledge of scientific/engineering calculation	○	○						○						○			○											
Rule of organization	○	○																										
SOP implementation	○	○																										
Budget control	○	○		○				○						○			○											
Project control	○	○		○				○						○			○											
Database related operating language								○	○	○		○		○	○	○	○						○	○		○		
Database implementation								○	○	○													○	○		○		
Database searching						○	○	○	○	○	○	○	○										○	○		○		
Basic knowledge of electronic publication					○	○	○	○	○	○		○		○			○											
Basic computer usage (mainframe)														○	○	○	○	○		○			○	○	○	○	○	
Basic computer usage (packaged program)	○	○												○	○	○		○		○			○	○		○	○	
Programming languages (compilers)	○	○												○	○	○		○		○			○	○		○	○	
Programming language (assembler)															○	○							○	○		○		
Basic knowledge of numerical analysis	○	○												○	○	○		○		○			○	○		○	○	
Programming tool		○												○	○	○	○	○					○	○	○	○	○	
Basic knowledge of QC/production control	○													○	○													
Center administration		○												○			○			○			○					
OS general knowledge																							○	○				
Data file back-up/restore		○																		○	○		○	○	○			
Claim handling		○															○	○		○			○			○		
Knowledge of specified OS																		○		○			○	○	○	○	○	
OS generation procedure (I/O GEN)																							○	○				
Accounting system planning/implementing																		○		○			○	○				
Configuration control																	○			○			○					
Resources planning																	○			○			○					
Resources control																	○			○			○					
Purchasing/inventory cntrl of Materials																		○		○								
Console operation (start-up/shut-down/etc.)																				○	○	○	○	○	○			
Computer operation (peripherals)																				○	○	○	○	○	○			
Communication system configuring																							○	○	○			
Communication system checkout																							○	○	○			
Local area network construction																							○	○	○			
Common mathematical program library														○	○	○							○			○	○	
Programming of numerical analysis														○	○	○								○		○	○	
Statistics														○	○											○	○	
Computer graphics and CAD (/CAM)															○								○			○		
Knowledge of several related fields																○								○		○	○	

organizations to which they belong, according to annual in-house education and training programs. Shown below is a sample guideline for such an in-house education and training.

① At the beginning of each year, long-term education and training plans are reviewed and initiated for incorporation that year.

② The education division or experienced training instructors from outside organizations will handle the education and training.

③ Course and text materials will be selected by training instructors.

④ When necessary, the education division will cooperate with training instructors on the course and text materials.

4) Education and training outside the Center

If the above-mentioned in-house education and training in 3), including courses, self-training and OJT's, are not considered to be sufficient in providing the required level of qualification, knowledge and experience needed for performing the duties assigned, education and training outside the Center will be considered to cover gaps and to provide education and training at the desired higher level.

Some of the job positions which may require such education and training outside are listed in Table VI-8.

Table VI-8 Job Positions Requiring Education and Training Outside

Department/ Division	Job Position	Recommended Training Course and Experience	Length
Planning	Planning staff	Private corporation: Practical training in operational planning	About 1 year
Information service	Searcher	Information service provider: Practical training	About 1 year
	Librarian	Practical training in library science university audit course	About 1 year
Education	Training instructors	Education in computer school	About 2 years
Computer	Operators	On-the-job training with computer users	About 1 year
Computer	Computer technology	On-the-job training with computer users	About 2 years
Computer	Application engineering	On-the-job training with computer users	About 2 years

2.2 Establishment of SOP (Standard Operation Procedure)

(1) Purpose of SOP

Standard Operation Procedure (SOP) consists of the basic rule to guarantee smooth functioning of work in all job positions, and defines the 5W2H (When, Where, Who, What, Which, How, How To) of all operations.

Prior to establishing SOP, it is necessary to first establish SOP Administration Policy as a general governing policy.

In this section, we will make a few vital points necessary in establishing SOP for computers used to provide services.

(2) SOP-related Policies

1) Regulations related to SOP within the organization

Before establishing SOP, the operational procedures of the whole organization, particularly SOP Administration Policy, should be established in advance, as listed below.

① Management policies : Articles of Incorporation, Board of Directors Policy, Policy Defining Duties and Responsibilities, Authorization Policy, Approval Policy, Organization Policy.

② Common operational policies : Policies for Document Administration, Confidentiality, Standardization, SOP Administration, etc.

③ Employees policy : Employees Working Policy.

(3) SOP Administration Policy

Prior to establishing SOP, it is necessary to initiate common rules for establishing SOP and its general application to facilitate smooth initiation of work and subsequent operations. The "SOP Administration Policy" explains the guidelines for that purpose.

The following comments on the establishment and operation of SOP refer briefly to major points of SOP Administration Policies.

(4) Establishment of SOP

1) Contents of SOP

In establishing SOP, the contents of SOP should be defined as follows:

① SOP should define itself as an "operations administration policy" for each different operation.

② It should define the terminology of individual "job positions". [e.g. Training Supervisor]

③ It should define the scope of "duties and responsibilities" of each different job position as defined in ② (above).

④ It should define the input, method of process, output storage and report relating to the functions concerned.

⑤ It should define the flow of work, timing and format required for work to be performed by each job position.

⑥ It should clearly define the relationship of job positions to other job positions.

⑦ It should also clarify issues concerning handling of cases not clearly covered by SOP.

2) Establishing of SOP

SOP should be established before the start-up of a new operation. After a new operation becomes stable, revisions and additions should be made from time to time.

3) Personnel necessary for SOP establishment and method of establishment

① Establishment organization:

SOP Administration Policy should define in advance SOP establishment activities concerning members and methods of establishment with sample SOP.

② Drafting:

Personnel experienced in related operations should draft the policies to suit the actual situation of the operation to be covered.

③ Review of contents:

The draft should be reviewed by the personnel concerned for possible problems and alterations in producing the final draft.

④ Final decision:

The final decision should be made with regard to the approval policy for specified procedures.

4) Scope of application of SOP

SOP governs all types of operations. Therefore, the common operational policies ② and employee policies ③ mentioned earlier in 1) should be clearly included to avoid any overlapping.

5) Administration of SOP application

For application and operation of SOP, management personnel will be responsible for the following:

① To acquaint all personnel concerned in their respective departments concerned with SOP.

② To ascertain that SOP is being properly adhered to, and to advise personnel concerned in cases of irregularity.

③ To take appropriate steps for temporary or periodical revisions when revisions are deemed necessary, depending upon the urgency of such revisions.

6) Revision of SOP

Certain revisions of SOP may be desirable (such as additions, alteration or deletion). Such revisions may indicate changes regarding the manner of operation and operation improvements.

① Periodical revision:

This refers to periodical revisions based upon request for revision presented during a certain period of time.

② Temporary revision:

Temporary revisions should be made when immediate revisions are deemed necessary.

(5) Computer-related SOP Supplement

If any harmful disorder occurs in an erea where communication lines and terminals are used between multiple users and the Center for multiple applications, the scope of damage will be broad with serious repercussions. Problems could spread to security and confidentiality of user data and information, slow down the response to diversification of user needs, and deterioration of service due to competition in the field of various resources. Other various problems could possibly occur due to simultaneous services or special services on a real-time basis.

To prevent such problems, or to take emergency measures if and when such unfortunate disorders could occur, the basic Standard Operation Procedure for daily operations alone is not sufficient. A separate SOP will be necessary to facilitate smooth and appropriate measures to be taken in case of emergency. The routine SOP should stipulate that the training based upon the SOP covering emergency measures, like a "fire drill", should be conducted periodically.

The next 2.3 will cover this point.

2.3 Administration of the Center Operation

(1) General

The construction of the Center will be completed with the full set of building facilities, service facilities and the personnel/organization, which are the components of the Center.

As mentioned in 2.1 of this Section (Acquisition and Training of Personnel), certain leading work will be begun prior to the start-up of service operation, in parallel with the Center construction. Therefore, since normal operation will proceed during the preparation phase, the organization must be run effectively.

The following will deal with the types and forms of the organization and function of Planning, Operations and Administration departments, referred to in Section 1 of Part V, with consideration to the start-up of the preparation phase, start-up of service operations through the completion of the Center construction.

(2) Organization Operation

To facilitate smooth operation of the Center, long-term, mid-term and annual plans must be worked out from the basic design phase of the Center, and the operation of each year should function as planned.

In order to achieve smooth planning and operation, policies, procedures and guidelines have to be prepared in advance. For starting up initial operations and for continuation of operation, the following steps should be taken.

1) Establishment of initial long-term plans and policies, procedures and guidelines

① Basic long-term plan

The initial "Basic Long-term Plan" should be established by the members of the Advisory Board of Directors for Center Operations and the main operating body of the Center, which consists of a Chief Director and four department managers. This basic long-term plan is intended to verify the spirit and contents of this conceptual design, and to comprise the basic principles for the verification process of the Center concept, as well as to establish the subsequent Advisory Board of Directors for Center Operation, and long-, mid- and short-term plans of the Center.

② Policies and procedures

For operation of the Center, various policies and procedures mentioned in 2.2 SOP (Standard Operation Procedures) have to be established and put into effect as early as possible. Although such policies and procedures may appear premature during the early stages of the Center, they should be established with consideration to the operation of the organization at the time of the completion of the Center. These policies and procedures, however, should be established with some flexibility so that they can be revised periodically or when considered necessary. Followings are the above mentioned policies to be prepared:

a. Management policies:

Articles of Incorporation, Board of Directors Policy, Policy Defining Duties and Responsibilities, Authorization Policy, Approval Policy, Organization Policy.

b. Common operational policies:

Document Administration Policy, Confidentiality Policy, Standardization Policy, SOP Administration Policy, etc.

c. Employees policy:

Employees Working Policy.

2) Periodical review and revision of plan

① Long- and mid-term operation plans

With the long-term plan mentioned in this Conceptual Design as a main guideline, more practical long- and mid-term plans at the working level should be revised at the beginning of each year and reviewed at the end of the year. The plans to be reviewed are:

a. Operating policies with attention to current status.
b. Operating plans for each department (service (preparation) plan, operating plan)
c. Brief cost generation plans for each department for different operations(Operations Department), brief budget plans for all departments.
d. Facility plans of each department for different operations.
e. Staffing, education and training plans of each department.

② Annual operating plan

After review and revision of the long- and mid-term plans, with the exception of the first year, detailed annual plans will be prepared on the basis of such review and revision. Annual plans will serve as detailed and concrete working guides for the long- and mid-

term plans, and should be expressed clearly, with charts and tables. Such review and revision will apply to the following:

a. Current year plan.
b. Current year working plan of each department (detailed).
c. Cost generation yearly plan of each department (detailed). (Operations Department only)
d. Yearly budget plan of each department (detailed).
e. Yearly facilities plan of each department (detailed).
f. Staffing, education and training yearly plan of each department.

(3) Operation of Organization

The following deals with the organizational breakdown defining the scope of respective duties.

1) Administration of the Advisory Board of Directors for Center Operation.

① Duty of the Advisory Board of Directors:

It constitutes the "Advisory Board of Directors for the Center Operation", and advises the operating policies of the Center.

② Qualifications for directors:

One director will be appointed from each laboratory of PUSPIPTEK-Serpong, each administrative agency having jurisdiction over the laboratory or the Project Management Office.

③ Election of directors:

One Executive Director and one Assistant Executive Director will be appointed from among the directors.

④ Board of Directors meetings:

The Executive Director will call and hold meetings for the Advisory Board of Directors meeting.

⑤ Secretary to the Board of Directors:

The Planning Department will serve as secretary to the Advisory Board of Directors.

2) Operation of the Center administrative organization

① Center Chief Director

a. Makes decisions on the operaing policies, coordinating the Advisory Board of Directors.

b. Calls and holds periodical and provisional executive meetings; directs and receives reports from various divisions.

c. Performs all other duties as Center Chief Director.

② Planning Department

a. Secretary to the Advisory Board of Directors:

Operation and announcements of meetings of the Advisory Board of Directors and preparation of minutes.

b. Deputy Team:

Assists the Center Chief Director, outside liaison and negotiation and superrises Secretary of the Advisory Board of Directors.

c. Coordinating Team:

Establishes operating plans (annual, mid- and long-term organization plans, cost generation plans, expansion plans, etc.) and follow-up (budget and actual, revision); prepares, renews and administers policies and procedures (Center business); other administration works (human resources, facilities, methodology/technology, patents and other industrial proprietary rights).

d. PR Team:

Acts as Center's guide and spokesman; prepares PR materials and conducts site tours.

e. Reception Team:

Handles appointments; guides visitors; handles other administrative work.

③ Administration Department

a. Administration Division

Administration:

Manages policies and procedures (for business other than for the Center); legal checks and document control.

Property & Equipment:

Manages fixed assets; introduction of facilities and purchase of equipment and supplies.

Maintenance:

Maintains environment; building management (power supply, lighting, air-conditioning, water supply, communications facilities, broadcasting facilities, entry control facilities, repair maintenance and renovation of other fixtures and

facilities).

Security:

Security management (manages entries, fire/disaster preparedness and training).

b. Finance and Accounting Division

Finance:

(Omitted)

Accounting:

(Omitted)

c. Labor and Personnel Division

Personnel:

Personnel training (others omitted)

Labor Relations:

Labor safety and sanitation management (other omitted)

Welfare:

(Omitted)

④ Operations Department

a. Publications Division

・Editing:

Edits and publishes PR and other journals of PUSPIPTEK-Serpong and each laboratory; represents laboratories in editing & publishing research reports of laboratories; accepts consigned translation/editing of overseas research publications; and for above works, reporting activities, editing, getting estimates, billing and budget control.

・Publishing:

Produces publications (creative works, document input, printing, proofreading, bindings, delivery), management of related equipment and materials.

b. Information Service Division

・Service:

Selects information/data; provision of information/data (user registration, guide of access method, etc.); consigned retrieval service by searcher; estimates on fees; billing; registration and use statistics; budget and accounting control.

・Data service:

Formats information/data; filing and classification of contents; input and verification; periodical renewal;

adjustment of stored media.

- Library:

  Selection of books and data; purchasing and receiving; indexing and cataloging; storage; book-binding; user registration; check-out/reservation/reminding; retrieval of books/data; receiving and check-out statistics.

  Management of budget, accounts and contractors.

c. Education Division

- Education planning:

  Investigation of request for education and training; setting contents of education and training; advertising for students; arrangement for training instructors, classrooms, text materials, equipment; getting estimates and billing; accounting and budget control.

- Education and training:

  Education and training courses (examining student qualification; checking of test results; final examination, certificate); preparing and producing text materials; self-study of training instructors.

d. Computer Division

- Service

  User support:

  User registration, change, cancellation (ID, password, providing code); guide of use procedure; user consultation (general inquiry, technical inquiry, complaints); preparation, publication and display of user guide/manuals.

  Consulting:

  Support for problem solving methods (elementary).

  Billing:

  Billing of use fees; collection (if chargeable)

- Applications:

  Operations management:

  Routine operating plan; temporary operating plan (weekend, holidays and midnights) and shutdown plan; administrative procedure, determining problem spots and fall-back program and training; facilities check and tests; shift duty schedules for operators and test operation.

  Resource management:

  Generation of work control and production data (by knowing

quantity); file allotment; capacity planning (machine addition/alteration plan).

File management:

Data backup/recovery; file storage and management (magnetic tapes and disk file security, storage fee data).

Materials purchase:

Characteristics test and purchased inventory control (forms, ribbons, magnetic tapes, terminals)

Data entry:

Consigned computer input of raw data.

• Systems

Setting use environment:

Setting parameters; OS renewal/OS functional addition; user consultation (OS related).

System maintenance:

Maintenance of control system; purchasing and maintenance of utilities programs; renewal and transfer of systems and expansion.

User support:

Setting and supporting user terminals (terminal emulator, setting communications environment)

• Support Engineering

DBM soft:

DB software support for database provision.

Common software:

Purchasing and maintaining basic mathematical and statistics programs and computer graphics softwares common to all field.

Specific area software:

Development of specific area application software as requested by users, or support of development, purchase and maintenance.

SECTION 3 COST EVALUATION

3.1 Construction Cost

The calculated result of a rough estimate of construction cost is shown in Table VI-8 based on the Conceptual Design for the Center for Industrial Technological Information in Part V. This rough estimate was calculated with the following preconditions:

1) Calculation date of the rough estimate: November, 1988
2) Currency exchange rate: 13 rupiahs/yen.
3) Materials are procured from the local market as much as possible. An imported material cost is based on FOB YOKOHAMA, JAPAN.
4) The construction costs show a main case and an alternative case. The main case is based on the result of the conceptual design conducted in Part V. The alternative case excludes the forum facility from the main case.
5) The construction cost for communication facilities (for computer networks) is limited to the cost of the plan and equipment within PUSPIPTEK-Serpong, and does not include external connections. Any material and labor costs relating to these construction costs are based on the local price system.
6) The computer system cost includes computer hardware, software and any related devices. This cost does not include any cost of expansion plans and equipment which is expected in future, and was calculated within the range of Conceptual Design described in Part V.

3.2 Operation and Maintenance Cost

Similarly, the calculated result of a rough estimate of the operation cost is shown in Table VI-8 based on the Operational Plan in Section 1 and the Execution Plan in Section 2. This rough estimate of cost was calculated with the following preconditions:

1) Calculation date of the rough estimate: November, 1988
2) All cost items are based on local prices.
3) Personnel cost was calculated by trial in steps from the preparation phase based on the Personnel Plan in Table VI-9 and the Local Wage Standard in Table VI-10. The local wage system values were confirmed during the field survey.
4) Maintenance and repair costs are 6.5% of the computer system cost.

Maintenance and repair costs in the first and second years are included in the construction cost, and those in the third year onwards are appropriated as an operation cost.

5) The facilities repair cost is 0.15% of the construction cost for the building.
6) It was confirmed in the field survey that, among service charges, water and communication costs will be borne by the PUSPIPTEK CENTER OFFICE. The Center will only bear the electricity charge.
7) The database construction cost includes three local typists for the input work. When the Center is in full operation, it is expected that manpower can be reduced to 60% of that of the initial phase.
8) Book purchasing cost and overseas database use cost are appropriated to be purchased and to be accessed within the assumed budget. These costs are likely to change in future by going through the utilizing conditions.

3.3 Budget Arrangements

Operation costs that are generated from the preparation phase to the second year after the start of service, conform to the budget arrangements of the Republic of Indonesia. Services up to the second year will be free to various users inside and outside PUSPIPTEK-Serpong, and consolidation of the Center functions and system are planned against chargeable services from the third year onwards in this period.

From the third year onwards, it is planned that operation costs other than those for maintenance and repair can be paid by the cost generated from the chargeable service. On the other hand, maintenance and repair costs generated from the third year onwards will need to be preserved by the Indonesian government. Budget arrangements borne by the Indonesian government are summarized below.

(1) First half of preparation phase; 50,500(thousand rupiahs per year)
(2) Second half of preparation phase; 62,500(thousand rupiahs per year)
(3) Initial and the second year; 280,500(thousand rupiahs per year)
(4) Third year on wards after the Initial year; 1,200,000(thousand rupiahs per year)

Table VI-8 Construction Cost and Operation and maintenance Cost

1. Construction cost (in 1,000 yen)

	Local Currency	Foreign Currency	Total
1) Building construction cost	550,000 *) 385,000	450,000 *) 315,000	1,000,000 *) 700,000
2) Cost for related facilities (CVCF, receiving/transforming facilities, battery, a generator, etc. . .)	1,000	199,000	200,000
3) Computer system cost (hardware, basic software, application software)	—	1,400,000	1,400,000
4) Construction cost for communication facilities (for computer networks)	5,000	5,000	10,000
5) Education equipment cost	—	6,000	6,000
6) Purchasing cost for publications etc.	—	50,000	50,000
7) Cost for recording medium of computer	—	8,000	8,000
8) Accessories cost	10,000	23,000	33,000
9) Basic software preparation cost (Residential cost of manufacturer's SE for a year)	—	20,000	20,000
10) Consultant charges (36 persons · month)	—	90,000	90,000
11) Transport insurance cost	—	20,000	20,000
Grand Total	566,000 *) 401,000	2,271,000 *) 2,136,000	2,837,000 *) 2,537,000

*) The case excluding the forum building

2. Operation and Maintenance cost (1,000 rupiahs/year)

	First half of preparation phase	Second half of preparation phase	Initial year and the second year	In full operation (third year onwards after the initial year)
1) Personnel	48,000	60,000	78,000	120,000
2) Maintenance and repair				1,200,000
3) Facilities repair			20,000	20,000
4) Electricity			60,000	60,000
5) Consumables for computer (paper, etc.)			40,000	40,000
6) Other consumables			40,000	40,000
7) Database construction	2,500	2,500	2,500	1,500
8) Book purchase			15,000	15,000
9) Overseas database uses			25,000	50,000
Total	50,500	62,500	280,500	1,546,500

Table VI-9 Phased Personnel Plan by Grade

Appointment	Third year onwards after the service starts (grade)	no. of persons	First half of preparation phase person	Second half of preparation phase	Starting operation increase/ total
Chief director	(1)	1	1	/ 1	/ 1
Secretary	(6)	1			
Planning manager	(2)	1	1	/ 1	/ 1
Staff	(4)	3	1	/ 1	/ 1
Staff	(6)	2	1	/ 1	/ 1
Administration manager	(2)	1	1	/ 1	/ 1
Manager class	(3)	2	2	/ 2	/ 2
Staff	(7)	3			2 / 2
Staff	(8)	5	3	2 / 5	/ 5
Staff	(9)	4			
Operations manager	(2)	1	1	/ 1	/ 1
Publications manager	(3)	1			1 / 1
Staff	(4)	2	1	/ 1	/ 1
Staff	(6)	2			
Information service manager	(3)	1			1 / 1
Staff	(4)	1	1	/ 1	/ 1
Staff	(4)	1	1	/ 1	/ 1
Staff	(7)	2		1 / 1	/ 1
Librarian	(4)	1	1	/ 1	/ 1
Assistant	(6)	1		1 / 1	/ 1
Education manager	(3)	1	1	/ 1	/ 1
Staff	(4)	2	2	/ 2	/ 2
Staff	(5)	2			1 / 1
Computer manager	(3)	1	1	/ 1	/ 1
Service div.	(4)	1			1 / 1
Staff	(6)	4			2 / 2
Operations div.	(4)	2			
Staff	(6)	4			4 / 4
Staff	(7)	4		1 / 1	/ 1
System div.	(4)	1		1 / 1	/ 1
Staff	(4)	1			
Staff	(5)	3			
Application engineering div.	(2)	3	2	1 / 3	/ 3
Staff	(4)	2			
Total		67	21	7 / 28	12 / 40

Table VI-10 Local Wages Standard

Grade	Type of job	Rough monthly estimate (1000 rupiahs)
1	General manager	500
2	Chief engineer	300
3	Manager	250
4	Officer, manager	150
5	Assistant engineer	125
6	Foreman	100
7	Mechanic	70
8	Operator, driver, typist	60
9	Helper, guard	50

SECTION 4 EFFECTS FROM THE CENTER OPERATION

4.1 Effects on Economy and Society

As was described in Part II Section 2, due to a vicious cycle, the Republic of Indonesia is facing a slowdown in technological development and growth.

Dependence on foreign technology → Not designing domestically → Not carrying out technical calculation/Not managing technological information → Low use of computers → Unable to develop and produce items for import substitution and for international competitiveness→ National income remaining dependent on oil and gas → Dependence on foreign technology

As has been discussed at the beginning of this report, in order to proceed from phase 1 to 2, Indonesian industry needs to overcome this vicious cycle. To do that, it is essential to introduce computers as an effective means for realization of domestic design capability. When computers are introduced and the environment for domestic design is prepared, designers and researchers become accessible to computers; they are then able to assess, verify and simulate overseas technologies.

As the result, import substitution, export encouragement through international competition and internationalization of the Republic of Indonesia are expected to be realized.

4.2 Effects on the Industrial Field

(1) Import Substitution

As shown in Table II-9 in Part II, the share of machinery imports out of the total import value in 1987 was 37%, which was the largest. When oil products, chemical products and processed products are included in the industrial products, this share reaches 82%. When referring to the national budget expenditure for 1987/88, these figures correspond to 34% and 74%, respectively. The import value for industrial products is unlikely to reach zero, even if industrialization advances. However, the import load for the Republic of Indonesia will be considerably lessened through encouraged import substitution by industrialization.

(2) Export Promotion by International Competition

The export value for oil/gas, currently amounting to more than half of the total export value, will be saved by exporting manufactured industrial products. The national revenue can be increased from fields of non-oil/non-gas and valuable energy resources can be saved. On the other hand, export tax, which produced approximately 0.3% of the total revenue in 1987/88, will increase its share by industrialization. Accordingly, it helps to reduce overseas loans and possibly to reduce income tax and value added tax. Domestic demand will be expanded as the burden of taxation for individuals is decreased, which will result in further activation of the Indonesian industry.

The export of industrial products, thus, will end the current financial vicious circle, contributing to the creation of a sound economic environment.

(3) Industries Effected by the Center service

The industries requiring computation of structural designs in their engineering designs, such as shipbuildings, constructions, vehicles, aircrafts, steel manufacturing (tank design), industrial machineries, etc. will be well supported by engineering computations accessing the computer system in the Center. Manufacturers related to minings, optics, electronics. (designing printed circuit boards) will also have a lot of opportunities to access the computer system in the Center.

In addition, the database system in the Center will be widely utilized not only by the side industries but also many private firms in their designs and R & D activities.

On the other hand, some private firms already have a close relationship with the existing laboratories in PUSPIPTEK-Serpong, such as KIM, LUK and LAGG through entrusted research activities. The Center will help laboratories create new research activities and relationship between laboratories and private firms will be closer and enlarged by expanding entrusted activities.

Consequently, the technology for engineering computations will be transferred from the Center to an industrial field.

(4) Effects on Communication

As described in Part IV, Indonesian companies have been making efforts

to collect and control the technological information and documents, etc. necessary for designing and manufacturing. They have also obtained information from overseas as needed. The Center for Industrial Technological Information, by providing necessary technological information to domestic companies can contribute to reduce the considerable cost of data collection. Further, the Center can grasp domestic needs for technological information and promote technological exchange and information exchange among local firms and finally, it would be possible to industrialize the whole country. This effect applies not only to industrial fields but also to laboratories and universities, thus greatly contributing to an improvement in communications.

(5) Effects on Basic Research Activities

Although the environment for research and development activities has not been fully developed among companies in the Republic of Indonesia, the needs will surely increase as industrialization is realized. PUSPIPTEK-Serpong is indeed useful to support research and development activities in the Republic of Indonesia. Therefore, the Center for Industrial Technological Information can contribute to the technological development of companies by linking each laboratory in PUSPIPTEK-Serpong and companies outside by the provision of technological information.

(6) Internationalization

Through increase in the competitive ability opportunities to merge with overseas companies, technological exchange, joint development, etc. will be increased. Internationalization of companies and a competitive position will be created in the international market.

4.3 Effects on PUSPIPTEK-Serpong

(1) Effective Use of Technological Information

Centralizing the management function of technological information by the Center helps individual institutes not to spend unnecessary duplicated labor for gathering information and for managing of an information system.

As needed, they can obtain information from the Center for more efficient research work. Further, recycling of information would improve and enhance both the quality and quantity of research activities in the

laboratories.

(2) Facilitation of Technological Development

Verification of elemenary technologies, technological development and assessment can be carried out relatively easily by the Center's computer, which is capable of processing various applications.

(3) Effects on Communication

When a data communication network is established among the laboratories around the Center, communication exchange among the laboratories and technological exchange among their researchers will be strongly driven.

Forums and other formal gatherings will also provide favorable communication among the laboratories.

(4) Internationalization

The creation of an advanced computing environment attained through research exchange among various fields and through an inflow of foreign researchers will encourage international exchange in the field of science and technology.

(5) Supporting to Firms

By offering computer services to companies, the Center can give support to private firms so that they can carry out optimization, simulation and verification of the safety necessary for effective designs.

PART VII

CONCLUSIONS AND SUGGESTIONS

Prior to concluding this study report, we would like to summarize the achievements of this study, list problems related to the future achievements of the Center and offer suggestions to these problems.

(1) Achievements of This Study

1) It has been recognized that PUSPIPTEK-Serpong has started to develop as a new complex for interdisciplinary research in conjunction with the progress of industrial technology of the Republic of Indonesia and that it is indispensable to have the functions of the Center for Industrial Technological Information in order to achieve effective promotion of the current research and development and step-by-step progress for the future.

The PUSPIPTEK projects have as their target, the formation of a laboratory complex in which encompassing a variety of fields backed by different governmental organizations such as BPPT, LIPT and BATAN, serving as a parent organizations, will be gathered together in a progressive environment that will be conducive to the carrying on of research and development activities. PUSPIPTEK-Serpong, which was begun as the first of these projects, is currently still under construction. For promotion of activities aimed at basic and application type research and development in major industrial fields, the utilization of engineering databases and software/hardware for techinical analysis, and the functions like those of the Center for Industrial Technological Information, which has necessary personnel for such utilization, have not developed enough.

These functions have already been in operation in industrialized nations for 20 to 30 years, where they have proven to be indispensable. Even in an industrializing country such as the Republic of Korea, such means are being established and further developed.

It was apparent from the oral interviews and questionnaire results obtained form the staff of each of the organizations visited by the study team that such functions as these are indispensable for the stimulation of research and the improvement of the level of activity in each laboratory of PUSPIPTEK-Serpong.

2) This study has focused on ① the collection and the utilization of technological information through databases and communication technology, ② the analytical means such as sumulation with technical analysis

software and ③ the possibilities for application of a general-purpose computer to be a central function of the above ① and ②, all of the three items which the Center for Industrial Technological Information should have as a common facility. This survey has shown that such an application is possible, if certain requirements are met, and that the net effect of this application would be quite substantial.

3) We have presented the function of the so-called Center for Industrial Technological Information and we have also demonstrated an example of a realistic development.

As a result of estimation of personnel and cost for the Center, taking various conditions into account, it will be necessary to have 40 persons and the maintenance and operation cost of about 230 million rupiahs in early stages and thereafter, 67 persons and those costs of about 1,550 million rupiahs for smooth operation of the Center.

(2) Problem to be Solved

As the conclusion of the feasibility study, securing the routine budget (1.2 billion rupiahs per year) incurred after the third year from the service start and reserving the necessary staff (40 personnel) at the initial stage of the Center service are the mandatory conditions to realize to establish the Center. In addition to this mandatory conditions, the following matters should be taken into account.

1) This study has prepared a conceptual design for the Center for Industrial Technological Information which has as its core function the providing of hardware and software material and the analysis of technological information. This facility would be the first of its kind in the Republic of Indonesia.

To make this Center possible it will be necessary to foster the use of the application software system and the construction of database system and to conducta basic design.

2) The collection and use of information and the means of data analysis can all be achieved with currently available technologies. It will be necessary, however, to select the method for collecting and arranging various data, the hardware and the software for analysis and the operating methods.

(3) Suggestions

The follow-up period for this study will be critical to the ultimate achievement of the establishment of the Center. The following means are suggested to assure that this follow-up will be done.

The following five items are suggested to realize and promote operation of the Center for Industrial Technological Information, based on the current situation of industrial technology and research and development in the Republic of Indonesia as well as the concept and problems in developing the functions of the Center.

1) Following the conceptual design, BPPT, which is the primarily promotive body, should arrange staffing and funding. Fellowship overseas program will give a great help to early staffing.

2) The research and development personnel associated with the related industrial technologies should gather opinions on how the Common Information Center should be set up. These personnel should also establish a common objective for the growth and development of the Center through continuing collaboration with the related staff.

3) The personnel of the goverment agencies and budgetary administration who are involved in the realization and operation of the Center must be made aware that considerable efforts, the necessary budgetary allocation (1200 million rupiahs per year) and staffing at initial stage (40 staff) are required. They should also emphasize the efficiency in the collection of technological information and the elimination of redundant research effort.

4) The personnel responsible for research and development of industrial technology must come to recognize the current lack of a systematic accumulation and exchange of technological information and the means of appropriate analysis of advanced information. These leaders need to understand and exhibit enthusiasm for the concept of the Center and cooperate in improving the quality of information as well as the accumulation and proper utilization of such information, so that the ultimate aim of the Center, the development of the nation, will be achieved.

In order to effectively realize above in early stage, it is necessary to invite specialists from overseas.

5) The government and the head administrator of the Center must continue to stress the importance of the wide use of the functions of the Center at each and every level in PUSPIPTEK-Serpong in order to maximize its potential for future technological development. In so doing, the Center will become recognized as a primary source of Industrial Technological Information and will become a model for similar information centers that will be needed for the governmental and private sectors in the future.

ATTACHMENT A. MEMBERS LIST OF THE STUDY TEAM

Mr. Mayuki TAKENO	Team Leader
Mr. Mitsuyasu YANAGISAWA	Hardware System
Mr. Hiroshi UDA	Network System
Mr. Kiyoshi SUGAWARA	Telecommunication and Network
Mr. Kiichi KOBAYASHI	Building and Facility
Dr. Hiroyuki KADOTANI	Technical Calculation
Mr. Tatsuhiko AONO	Education and Training
Mr. Yasuo HASHIZUME	Database
Mr. Masami WADA	Software System
Mr. Hiroshi TOGO	Infrastructure and Project Coordination

ATTACHMENT B. COUNTERPART MEMBER LIST

1.	Dr. Ing. Wardiman Djojonegoro	Deputy Chairman for Administration, BPPT
2.	Ir. Imam Sudarwo	Director for the Assessment of Technology in Electronics and Informatics, BPPT
3.	Ir. Firman Siregar	Staff of the Directorate for the Assessment of Technology in Electronics and Informatics, BPPT
4.	Ir. Dasaad Mustafa	Staff of the Directorate for the Assessment of Technology in Electronics and Informatics, BPPT
5.	Ir. Santoso	Staff of the Directorate for the Assessment of Technology in Electronics and Informatics, BPPT
6.	Ir. Lolly Amalia Quigley, Msc.	Staff of the Directorate for the Assessment of Technology in Electronics and Informatics, BPPT

ATTACHMENT C. INSTITUTES AND FIRMS VISITED BY STUDY TEAM

1. LABORATORIES IN PUSPIPTEK-Serpong

(1) RESEARCH & DEVELOPMENT CENTER FOR CALIBRATUION, INSTRUMENTATION AND METROLOGY (KIM)

TEL: 516165 TELEX: 45512 PPIT IA

(2) MULTIPURPOSE REACTOR AND ITS SUPPORTING LABORATORIES (RSG-LP)

(3) R&D CENTER FOR APPLIED CHEMISTRY (LKT)

TEL: 516165 TELEX: 45512 PPT IA

(4) RESEARCH AND DEVELOPMENT CENTER FOR APPLIED PHYSICS (LFT)

TEL: 81052 TELEX: 28491 KOLIN BD

(5) AERODYNAMICS, GASDYNAMICS, AND VIBIRATION LABORATORY (LAGG)

(6) ENERGY AND ENERGY RESOURCES LABORATORY (LSDE)

TEL: 516165

(7) STRENGTH OF MATERIALS, COMPONENTS AND STRUCTURES LABORATORY (LUK)

TEL: 515772 TELEX: 45512 PPIT IA

(8) THERMODYNAMICS, ENGINE AND PROPULSION SYSTEM LABORATORY (LTMP) — (Not Established)

(9) APPLIED ELECTRONICS LABORATORY (LET)

(00) APPLIED METALLURGY LABORATORY (LMT) — (Under Construction)

(11) PROCESS TECHNOLOGY LABORATORY (LTP) — (Not Established)

(12) NATURAL DISASTERS MITIGATION LABORATORY(LMBA) — (Not Established)

(13) THE NATIONAL CENTER FOR RECEARCH SCIENCE AND TECHNOLOGY PROJECT (CENTER OFFICE)

TEL: 515772 TELEX: 45512 PPIT IA

2. GOVERNMENTAL INSTITUTES (INCLUDING UNIVERSITIES)

(1) UNIVERSITY OF INDONESIA-COMPUTER SCIENCE CENTER

Jalan Salemba 4, P.O.Box : 3442 Jakarta Pusat

TEL: 335766 TELEX: 45680 UI JKT

(2) BIRO PUSAT STATISTIK (CENTRAL BUREAU OF SISTISTICS)

Jl. Dr. Sutomo 8, Jakarta 10710

TEL: 372808

(3) BADAN PERENCANA PEMBANCUNAN NASIONAL (BAPPENAS)

2 Taman Suropati Jakarta,

TEL: 334973

(4) POSTS AND TERLECOMMUNICATIONS (POSTEL)

Jl. Kebon Sirin 37 Jakarta 10340

TEL: 358061

(5) CENTER FOR SCIENTIFIC DOCUMENTATION AND INFORMATION (PDII)

Jl. Gatot Subroto 10, P.O. Box: 3065 /JKT Jakarta,10002,

TEL: 511063

(6) MINISTRY OF INDUSTRY

Jl. Gatot Subroto Kav. 52-53

TEL: 515509

(7) INSTITUTE OF TECHNOLOGY BANDUNG (ITB)

Jl. Ganesha 10, Bandung 40132

(8) INSTITUT PERTANIAN BOGOR (IPB)

Jl. Raya Pajajaran

TEL: 23081

(9) SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY (ITS)

Kampus ITS Keputih Sukolilo Surabaya,

TEL: 60651

(10 PERUSAHAAN PERTAMBANGAN MINYAK DAN GAS BUMI NEGARA (PERTAMINA)

Jl. Merdeka Timur 1 A/JI Perwira 6, Jakarta

(11) PERUSAHAAN UMUM LISTRIK NEGARA (PLN)

Jl. Trunojoyo Blok M 1/135 Kebayoran Baru Jakarta Selatan

TEL: 7397765

(12) MINISTRY OF EDUCATION AND CULTURE (MOEC)

Jakarta

(13) AGENCY FOR THE ASSESSMENT AND APPLICATION OF TECHNOLOGY (BPPT)

Jl. M.H. Thamrin No.8 Jakarta Pusat

TEL: 321845 TELEX: 61321 BPPT IA

(14) BADAN KOORDINAST SURVAY DAN PEMETAAN NASIONAL (BAKOSURTANAL)

Jl.Raya Jakarta-Bogor KM 46 Cibinong PO. Box 46 /CBI

TEL: 82062

(15) COMPUTER USERS ASSOCIATION

Jl. Veteran 17, Jakarta

TEL: 374508

3. FIRMS (INCLUDING STATE-RUN ENTERPRISES)

(1) INDOSAT

Wisma Antara 4th floor 17, Medan Merdeka Selatan PO. Box 2905 Jakarta 10110,

TEL: 346984 TELEX: 4406 INDOSAT IA

(2) NUSANTARA AIRCRAFT INDUSTRIES LTD. (P.T. IPTN)

Jl. Pajajaran No.154 Bandung,

TEL: 611081

(3) P.T. KRAKATAU STEEL

Jl. Industri No.3-5, P.O. Box 14- Cilegon 42434

TEL: 345632 TELEX: 45595 KSCLG IA

(4) P.T. INDUSTRI TELEKOMNIKASI INDONESIA (P.T. INTI)

Jl. Raya Dayeuhkolot 225 Bandung

TEL: 51139

(5) P.T. PAL INDONESIA

Surabaya

TEL: 324063 TELEX: 61331 ATPJKT

(6) P.T. PUSAT INFORMATIKA

Wisma Metropolitan II 8th Floor, Jl. Jenderal Sudirman P.O. Box 3351, Jakarta

TEL: 5781258

(7) P.T. GRAHA INFORMATIKA NUSANTARA (GRATIKA)

Setiabudi Building II Lt. I , Jl. H.R. Rasuna Said. Kuningan, Jakarta 12920.

TEL: 516085

(8) SEKOLAH TINGGI TEKNIK KOMPUTER TERAPAN INDONESIA

Jl. Kiai Tapa No. 216 A, P.O. Box: 531/JAK, Jakarta 11450,

TEL: 592455 TELEX: 46947 GUNTURIA

(9) P.T. BOMA BISMA INDRA (P.T. BBI)

Jl. Dr. Sutomo 22,S

TEL: 67423

(10) AKADEMI COMPUTER & SISTEM INFORMASI

Jaran Melawai X II / X III No.207A, Kabayoran Baru, Jakarta

TEL: 710224

(11) WIRATMAN & ASSOCIATES

Jl. Bend Hilir Raya Kav. 36A Block B No.14-18

TEL: 583407 TELEX: 44773 WIRAS IA FAX: 583769

(12) NTT, Jakarta

Nusantara Bldg. 7th Fl. Jl. M.H. Thamrin No59, Jakarta

TEL: 331543 TELEX: 61181 NTT JKT FAX: 324322

ATTACHMENT D. REFERENCE DOCUMENT LIST

No.	from	Name of printing/report/pamphlet	language
1	KIM	· Research and Development centre for Calibration, Instrumentation and meteology	E
2		· LEMBAGA ILMU PEGETAHUAN INDONESIA VOL.1. No3	I
3		· = = = = VOL.1. No4	I
4		· WARTA KIM Mei 1988	I
5	LFT	· Proceeding:KURSUS MICRO CDS/ISIS DALAM PENGELOLAAN INFORMASI Bandung. 16 - 20 Maret 1987	I
6		· INDONESIAN INSTITUTE of SCIENCES R & D CENTER FOR APPLIED PHYSICS 1986	E
7		· TEKNOLOGI INDONESIA DESEMBER 1986	I
8	BATAN	· PENGANTAR METOD NUMERIK (Introduction of Numerical Methode) M. Bunjamin	I
9	LKT	· RESEARCH AND DEVELOPMENT CENTRE FOR APPLIED CHEMISTRY	E
10	LUK	· KATALOG BUKU (book catalogue)	E
11	LSDE	· BPPT LSDE UPT/LSDE PUSPIPTEK-SERPONG	I
12	POSTEL	· LAPORAN HASIL PERAKSANAAN TUGAS TIM KOMUNIKASI	I
13		· JKT OPTICAL FIBER CABLE JUNCTION NETWORK IN 1992	E
14		· Packet Switching Network(SKDP) in Indonesia	E
15	Univ I	· UNInet, Jaringan Antar Kampus di Indonesia (UNInet, network between campus in Indonesia)	I
16		· Report on UNInet's first development stage	E
17		· INDONESIA GATEWAY UUCP LOGFILE (1 sheet)	E
18		· AUSEAnet A computer-network linking Australia and ASEAN	E
19	BPPT	· KALIBRASI INSTRUMENTASI METROLOGI	I
20	INDOSAT	· SKDP	E
21		· International Dedicated Circuits	E
22		· ORACLE general information manual	E
23	BPS	· Data Available for user's Access	E
24		· Komputer	I
25		· Organization Structure of Central Bureau of Statistics Republic of Indonesia	E
26	PDII	· PDII-LIPI Achievement And Future Challanges in the Information Era	E
27	PT GRAHA	· P.T. Graha Information Nusantara	E
28		· General Insurance Integration Information System	I

29	PERTAMINA	· (system configuration chart 3 pages)	
30	KRAKATAU STEEL	· (system configuration chart 5 pages)	
31	PLN	· (Software list/facility list/application :form)	I
32	BPPT	· "THE APPLICATION OF SOPHISTICATED TECHNOLOGIES IN DEVELOPING COUNTRIES: THE CASE OF INDONESIA" Dr. Ing. B. J. Habibie	E
33	BPS	· Statistik Indonesia 1987 (year book)	I/E
34	Ministry of Industry	· (system configuration chart 3 pages)	
35		· BUKU PEDOMAN Pendidikan dan latihan pemakai komputer mikro/terminal angkatan 2/ 1988	I
36		· BUKU PEDOMAN Pendidikan dan latihan pemrograman komputer dengan bahasa COBOL tingkat pemula 1988	I
37	BPPT	· HASIL PENGOLAHAN DATA KUISIONER INFOMATIKA PADA RAKORNAS RISET DAN TEKNOLOGI KE V	I
38	BAKOSURTANAL	· (system configuration chart 1 page)	
39		· 17 TAHUN BAKOSURTANAL Badan Koordinasi Survey dan Pemetaan Nasional	I
40	IPTN	· Brief Historical Background and Progress of P.T. IPTN (3 pages)	E
41		· (product guide)	E
42		· A BRIEF HISTORY OF IPTN (broche)	E
43	ITB	· Center of computer science and information system	I
44		· PIKSI PS 52 MANAJEMEN PROYEK (Project management)	E
45		· SISTEM INSTRUMENTASI DAN KONTROL BERBASIS KOMPUTER	I
46		· PUSAT ILMU KOMPUTER DAN SISTEM INFORMASI	I
47		· KOMPUTER DAN WIRUSAHA	I
48	PT PAL	· (General guidance)	E
49	ITS	· INSTITUT TEKNOLOGI SEPULUH NOPEMBER	I
50		· MASTER PLAN OF THE DEVELOPMENT OF ITS 1984-1994	E
51	PT BBI	· BBI facilities, products and activities	E
52		· BBI pablik motor diesel Pertama di Indonesia	I
53	BATAN	· (Software list in BATAN)	E
54	BPPT	· DIKLAT PENGANTAR PROGRAMMING FORTRAN DAN APLIKASI KOMPUTER	I
55		· LAPORAN TAHUNAN 1987/1988	I
56	BPPT	· ARCHITEN BATAN	E
57		· SISTEM DOKUMENTASI/PERPUSTAKAAN LSDE	I
58		· Organization & Members National Research Council Indonesia	I
59		· ENGINEERING AND MACHINE TOOL INDUSTRIES	E
60		· Workshop and conference on SCIENCE AND TECHNOLOGY INFORMATION SERVICES	E

61	Ministry of Ed & Cul	· Development of INTEGRATED Information · of Education and Culture Republic of Indonesia	E
62		· Flow off Annual Questionnaires Distribution and Data Collection Ministry of Education and Culture Indonesia	E
63		· PETUNJUK PENENGAH TAHUN AJARAN 1986/1987	I
64		· Guide to the Implementation of the Data Processing Culture Data in the Framework Planning, Promotion, and Development of Culture Ministry of Education and Culture	I
65		· Integrated Information System for Policy Formulation and Planning	E
66	KIM	· TERM OF REFERENCE: PROJECT PROPOSAL FOR The Improvement of the Computing Facilities at PUSLITBANG KIM LIPI	E
67	BPPT	· 10 TAHUN BPP TEKNOLOGI 1978--1988	I
68		· COMPANY PROFILE OF PT INTI (PERSERO)	E
69	UI	· CADLAB UI:Equipment List	E
70	BPPT	· THE ROLE OF TECHNOLOGY TRANSFER IN INDONESIAN DEVELOPMENT PLANS	E
71	BPPT	· PROCESS TECHNOLOGY LABORATORY per master plan	E
72	INDOSAT	· LAPORAN TAHUNAN 1986 INDOSAT	I
73	Ministry of I	· MICROECONOMIC PROSPECT FOR REPELITA 4	E
74	BPS	· Statistik Indonesia 1987	I
75		· Indikator Ekonomi (Monthly stat bulletin)	I/E
76		· Raporan Pereconomian Indonesia 1986	I
77		· Statistik Pembangunan Perumahan Indonesia	I
78		· Statistik Air Minum 1986 (Water supply)	I
79		· Sensus Ekonomi 1986: Electricity Stat for non gvmnt El Co	I/E
80		· Statistik Listrik Non PLN 1985	I
81		· Keadaan Buruh/Penkerja di Indonesia: Labour/employee situation in Indonesia	I/E
82	PRE-STUDY TEAM	· Technical Operating Unit-Laboratory for Strength of Materials Components omponents and Construction	
83		· INDONESIAN Low Speed Tunnel	E
84		· Lembaga Ilmu Pengetahuan Indonesia	E
85		· IPTEKnet a Teledocumentation of Scientific and Technical	E
86		Information Network IPTEKnet	
87		· Report on UNInet's First Development Stage	E
88		· Some Thoughts Concerning a Strategy for the Industrial Transformation of Developing Country	E
89		· Fundamental Technical Plan Indonesia	E
90		· Strategic Development Plan Indonesia	E

91		· The Minister of Stage for Research and Technology of the Republic of Indonesia The National Center for Research, Science and Technology, Serpong	E
92		· Proceedings of ISASTI the International Symposium on Aeronautical Science and Technology of Indonesia	E
93		· Badan Pengkazian Dan Penerapan Teknologi	E
94		· Basic Survey Report of Strategic Industries in Indonesia	E
95		· "The Application of Sophisticated Technologies in Developing Countries : The Case of Indonesia"	E
96		· Implementation Plan science and Technology Manpower Development Program (STMDP)	E
97	PUBLISHMENT	· James C. Almond, "Requirements and Strategies for the Success of a state-Supported Center for High Performance Computing", September, 1988, the JSME Senior, Tokyo	E
98		· Christopher Lazou, "Supercompujting in The 1990's for British Universities", ditto.	E
99		· Jack Worlton, "Thechnology Forecasting for Supercomputers", ditto.	E

E : IN ENGLISH

I : IN INDONESIAN

ATTACHMENT E. GLOSSARY

application engineer	Application engineer can explain the use of programs and perform tasks such as demonstration and public relations for programs or package softwares.
application software	Software designed for a specific purpose.
C	A systems programming language developed for implementation of the UNIX operating system, and widey used for software development in the UNIX environment.
CAD/CAM	Abbreviations of computer-Aided Design / Computer-Aided Manufacturing. General term applied to the efforts being made to automatic design and manufacturing operations. **Computer Aided Design** is the process of applying computer technology to design, so that a designer uses a computer terminal as a window to necessary data, a draughting board, a tolerance analysis tool. **Computer Aided Manufacturing** is a computer-based system of integrating a number of manufacturing system, so that inventory control, manpower scheduling, order processing, etc. are integrated with design and process control.
COBOL ; Cobol	Acronym of common business-oriented language. A programming language that was developed by CODASYL and is a de facto standard for commercial data processing.
computational science	This is to analize natural phenomena and engineering problem by simulation using computers(especially super computers), and it represents the most advanced application of computers today.
database management system; DBMS	An integrated software system that has facilities for defining the logical and physical structure of data in a database and for accessing, entering, and deleting data. Increasingly, formal methods are used for the description of the data format and semantics.
data entry	The process in which an operator uses keyboard or other devices to input data directly into a system or a recording media.

electronics bulletin board	Public space (computer file) to permit message to be entered and made accessible without restriction, to all user.
electronic mail	(computer mail) Messages sent from one user of a computer system to one or more recipients (or the conveyance of such messages), the computer system being used to hold and transport messages. Sende and receivers need not be on-line at the same time, or even on the same computer, to communicate.
finite element method	A numerical method to solve different equations based on the various principles. The region of solution is devided into small areas. The coefficients of these equations are determined to satisfy the original equations.
FORTRAN ; fortran	Acronym for formula translation. A programming language widely used for scientific computation.
general purpose computer	A computer capable of operating on different programs for the solution of a wide variety of problems.
hardware	Physical equipment such as electric, magnetic, and mechanical devices, constrast with software.
interface	1. A common boundary between two systems, devices, or programs. 2. The signal connection and associated control circuit that are used to connect devices. 3. Specification of communication between two program units.
I S D N	Abbreviation of Integrated Services Digital Network. A proposed international all digital communication network that will carry voice, video, facsimile, and computer data, plus other services, using common derlying facilities and interfaces.
I T U	abbreviation for International Telecommunication Union
laboratory automation ; L A	Gathering and managing real-time data from experimental test equipments
L A N	Abbreviation of local Area Network. A privately owned communications system that links computers, terminals, word processing stations , and other devices located within a compact area such

	as office building or a campus.
mainframe	1. Central processing unit of computer system. 2. Any large multipurpose computer system.
monitoring	Observing the progress of work by a computer system.
network system ; network	A network is a combination of interconnected equipmentsand programs used for moving information between points where it may be generated, processed, stored and used.
numerical analysis	The study of mathmatical method for solving problems numerically and ascertaining the bound of errors in the results.
office automation ; OA	The application of computers to office tasks. This may involve the use of electronic filing system, word, processing systems, computer graphic systems, electronic mail or telecommunication systems.
online programming	A method of programming by which the programmer inputs program statements directly to the computer by means of a terminal. Program statements are checked for validity as they are input, and the programmer controls the compilation and execution of the program by means of commands from the terminal.
OS	Abbreviation for Operating System.
packaged program	Software Package.
packet switching	A technique by which communication resources are allocated dynamically to multiple communicating entities. Messages between entities are partitioned into segments with a fixed maximum size. The segments, or packets, are passed through a store-and-forward switching network until they reach their destination (or are discoverd to be undeliverable). The packets are reassembled, if necessary, into complete messages when they reach their destination.
personal computer	A single user microcomputer designed to be operated by one person at a time.

PERUMTEL PELITA IV	The forth five-year masterplan of PERUMTEL.
protocol	Any agreement that governs the procedures used exchage information between cooperating entities. The agreement usually included how much information is to be sent, how often itis sent, how to recover from transmission errors, and who is to receive the information.
S D I	Selective dissemination of information.
Simulation	Imitation of the behavior of some exisiting or intended system, or some aspect of that behavior.
software	A set of programs, documents, procedures, and, routines associated with the operation of a computer system. Contrast with hardware.
software package ; application package ; packed program	A suit of programs or modules that is directed at some generic application and can be tailored to needs of a specific instance of that application.
S O P	Standard operation procedure.
source data	The data that user prepaired the input data to be entered into the computer.
stand alone	Denoting a computer system or subsystem that is capable of operation without being connected to any other computer system or subsystem.
supercomputer	Usualy, a class of very powerful computers that are capable of performing over 100 MFLOPS (million floating-point operations per second).
system analyst; S A	An information specialist who is knowledgeable about the technical aspects of analyzing, designing and implementing computer-based processing system.
system engineer; S E	General articule on system analyst and system designer.
transponder	Radio frequency (R F) transciever installed on communications satellite.

TSS	Abbreviations of time sharing system. A system in which a particular device is used for two or more concurrent operations. Thus the device operates momentarily to fulfil one purpose then another, returns to the first, and so on in succession until the operation are complete.

ATTACHMENT F. ABBREVIATIONS

AI artificial intelligence

ASCII American Standard Cord for Information Interchange

ARPAnet Advanced Research Projects Agency computer network

ASEAN Association of South-East Asian Nations

BAKOSURTANAL Badan Koordinasi Survey dan Pemetaan Nasional ;(Coordinating Board of Survey and National Mapping)

BAPPENAS Badan Perencanaan Pembangunan Nasional

BATAN Badan Tenaga Atom Nasional;(The National Atomic Agency)

BBI P.T. Boma-Bisma-Indra

BMDP Biomedical Program

BMUNG Basic Multi-User & Network Gateway

bpi bit per inch

BPPT Badan Pengkajian dan Penerapan Teknologi ; (Agency for the Assessment and Application of Technology)

BPP Teknologi Badan Pengkajian dan Penerapan Teknologi ; (Agency for the Assessment and Application of Technology) =BPPT

BPS Biro Pusat Statistik ; (Central Bureau of Statistics)

bps bit per second

CAD computer aided design

CADD computer aided drafting and design

CAE computer aided engineering

CAM computer aided manufacturing

CASE computer assisted software engineering

CAT computer aided testing

CBX computerized branch exchange

CCITT International Telegraph and Telephone Consultative Committee

CD-ROM compact disk-read only memory

CG computer graphics

CITI The Center for Industrial Technology Information

CPU central processing unit

CVCF constant voltage constant frequency power supply

DB database

DBMS database management system

DEC Digital Equipment Corporation

DG Data General

DIN Deutscher Industrie Norm

DSS decision support system

EBCDIC extended binary coded decimal interchange code

FD floppy disk

FEM finite element method

GB giga bite

GDP gross domestic product

GFLOPS giga floating-point operations per second

GNP gross national product

GRATICA PT. Graha Informatika Nusantara

ha hectare

HP Hewlett-Packard

Hz herz

IBM International Business Machines Corporation

IC integrated circuit

ICL International Computers Ltd.

ID identification

IDF intermediate distributing frame

IMSL International Mathmatical and Statistical Libraries

IPTEKnet (Computer-based Teledocumentation Network for Science and Technology Information Services)

IPTN PT. Industri Pesawat Terbang Nusantara; (P. T. Nusantara Aircraft Industries Ltd.)

ISDN integrated service digital network

ITB Institut Teknologi Bandung

ITS Institut Teknologi Sepuluh Nopember ; (Sepuluh Nopember Institute of Technology)

ITU International Telecommunication Network

JCL job control language

JETRO Japan External Trade Organization

JIS Japanese Industrial Standards

KB kilobyte

KIM Puslitbang kalibrasi, Instrumentasi dan Metrologi ; (Research & Development Center for Calibration, Instrumentation and Metrology)

km kilometer

KS P. T. Krakatau Steel

kVA kilovolt-ampere

LA laboratory automation

LAGG Laboratorium Aerodinamika, Gas dan Getaran ; (Aerodynamics, Gasdynamics and Vibra Laboratory)

LAN local area network

LAPAN Lembaga Penerbangan dan Antariksa Nasional ; (The Indonesian National Institute of Aeronautics and Space)

LEN Pusat Laboratorium Enjiniring Nasional ; (National Center for Engineering Laboratories)

LET Laboratorium Elektroteknika Terapan ; (Applied Electronics Laboratory)

LFT Pusat Penelitian dan Pengembangan Fisika Terapan ; (Recearch and Development Center for Applied Physics)

LIPI Lembaga Ilmu Pengetahuan Indonesia ; (The Indonesian Institute of Sciences)

LKIM Laboratorium Kalibration, Instrumentasi, Metrolosi = KIM

LKT Pusat Penelitian dan Pengembangan Kimia Terapan; (Research and Deplopment Center for Applied Cemistry)

LMBA Laboratorium Mitigasi dan Boneana Alam ; (Natural Disasters Mitigation Lobratory)

LMT Laboratorium Metalurgi Terapan; (Applied Metallurgy Laboratory)

LSDE Laboratorium Sumber Daya dan Energi ; (Energy and Energy Resources Lobratory)

LTMP Laboratorium Thermodinamika, Motor dan Propulsi ; (Thermodynamics, Engine and Propulsion Systems Laboratory)

LTP Lobratorium Teknologi Prosesing ; (Process Technology Laboratory)

LUK Laboratorium Uji Konstruksi ; (Strength of Materials, Components and Structures Laboratory)

m meter

m^2 square meter

m^3 cubic meter

MB megabyte

MDF main distributing frame

MFLOPS million floating-point operations per second

MHD magnetohydrodynamics

MIPS million instructions per second

m^3/s cubic meter per second

MT magnetic tape

MW megawatt

NAS National Advanced Semiconductor

NCRST National Center for Research, Science and Technology = PUSPIPTEK

NEC NEC Corporation

OA office automation

OJT on the job training

OR operations research

OS operating system

PBX private branch exchange

PC personal computer

PDII Pusat Dokumentasi dan Informasi Ilumiah ; (Center for Scientific Documentation and Information)

PLN Perusahaan umum Listrik Negara

POSTEL Posts and Telecommunications

PSDN packet switched digital network

PSTN public switched telephone network

PUSPIPTEK Proyek Pusat Penelitan Ilmu Pengetahuan & Teknologi;(National Center for Research, Science and Technology)

QC quality control

R&D research & development

RCS remote computing sevice

Rp Rupiah

RSG-LP Reaktor Serba Guna dan Laboratorium Penundgang ; (Multipurpose Reactor and its Supporting Laboratories)

SA system analyst

SDI selective dissemination of information

SE system engineer

SII Standar Industri Indonesia

SIMNAS Sistem Informasi Managemen Nasional ; (The Future National Information System)

SKDP Sambugan Komunikasi Data Packet

SOP standard operating procedure

SPSS Statistical package for social science

STI Science and Technology Information (Service)

STMDP Implimentation Plan Science and Technology Manpower Development Program

S/W scope of work

TSS time sharing service

UI Universitas Indonesia ; University of Indonesia

UNInet Indonesia Inter-University Computer Network

US$ dollar

V volt

VA volt-ampere

¥ yen

% percent