

(4) 1989-91年 Long Term Plan

JAPAN-SINGAPORE INSTITUTE OF SOFTWARE TECHNOLOGY

PHASE II PROJECT

LONG TERM PLAN (1989 - 1991)

(Draft)

DATE: 23 MARCH 1989

PHASE II PROJECT
LONG-TERM PLAN (1989 - 1991)

ITEMS

1. Executive Summary
 - The status and trends of IT in Singapore
 - The policy and targets of the Long-Term Plan
 - The Organization Chart and the Development Schedule (all over)
2. The revision of coursework
 - The update, deletion and revision of items in the syllabus
 - The Development Schedule
3. Data Communications
 - The purpose, status and trends
 - The details and the system configuration
 - Manpower allocation, staff assignment
 - The Development Schedule
4. Software Engineering
 - The purpose, status and trends
 - The details and the system configuration
 - Manpower allocation, staff assignment
 - The Development Schedule
5. CAI
 - The purpose, status and trends
 - The details and the system configuration
 - Manpower allocation and the system configuration
 - The Development Schedule
6. Installation of new equipment
 - New equipment List
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 - System Floor Plan
 - The Installation Schedule

1. EXECUTIVE SUMMARY

A long-term plan and the next fiscal year budget plan are prepared for the remaining part of the Phase II co-operation.

In order to make these plans, we surveyed the status and the trends of information technology in Singapore. We also reviewed the terms of the present co-operation. Thereafter, we work on such areas as the long-term policy, the aims of the long-term plan and the long-term schedule.

(1) The status and the trend of "informatization" in Singapore

One of the biggest events in Information Technology that took place in 1988 was perhaps the "Singapore Informatics '88" exhibition, which was held on 8 December 1988.

According to a survey done by the National Computer Board, last year (1988) was a particularly good year for hardware vendors. Their total revenue totalled \$545 million as compared to \$450 million in 1986.

Software companies and service bureaus also did well, with their sales growing to \$245 million.

Dr. Tay Eng Soon, who is the Chairman of the Committee for National Computerisation, was particularly pleased that exports of computer software and services made "a spectacular jump" of 73 per cent, despite stiff competitions from the larger American and Japanese companies.

This result was caused not only by the improvement in the sales but also by the international co-operation efforts which made possible the training of sufficient numbers of information technology (IT) professionals to meet the industry's needs.

The earlier target of 8,000 IT professionals was met by the end of last year - two years ahead of schedule. By 1990, Singapore will have 10,000 IT professionals. As such, in order to promote IT careers, NCB is planning new programmes.

Dr. Hu, the Finance Minister, recently announced a new four-point plan to step up the momentum of computerisation. This involves both the Government and

the business community. It is aimed at propagating the effective use of information technology throughout the economy.

This plan calls for:

- (a) LINKING the computer systems in Government departments to the private sector users and even homes;
- (b) USING nation-wide electronic networks more extensively;
- (c) SPEEDING up the computerization of small local companies; and
- (d) PREPARING Singapore's workforce for "the emerging information economy".

According to this policy, the NCB will shift the main point of the manpower development "from the quantitative to qualitative" training. Hence, the development of the required manpower becomes a crucial condition. Today, Singapore has managed to increase the pool of IT professionals to 8,000. Thus, Singapore is well on the target of having 10,000 IT professionals by 1990, which will be some two years ahead of schedule. Therefore, it is timely for us to refocus our training programmes to the training of IT specialists in areas like:

- (a) Telecommunication Software
- (b) Artificial Intelligence
- (c) Software Engineering
- (d) Computer Integrated Manufacturing
- (e) Real-time Software

In connection with this new focus, the NCB has already started to set up specialised institutes in each of the specialised areas.

In addition to all these, institutes like the JSIST have already begun to work on plans for the future direction. As another example, the CCS (Centre for Compute Studies) is now considering to set up new courses on "Data Communications" and "Software Engineering". The ISS (Institute of Systems Science)

is also shifting to do more research work in the fields of "Software Engineering" and "Artificial Intelligence".

- (2) Setting up the long-term policy, and the long-term targets

Considering the above status, the position and the missions of JSIST in Singapore, we started to discuss the long-term policy and the targets with the counterparts of Singapore from the beginning of November 1988. By the end of December 1988 we were able to come out with the first draft of the long-term plan.

This draft, submitted by Mr. M. Teraoka, the Head of Project of JSIST, was fully endorsed by the members of the Management Council of JSIST on Wednesday, 18 January 1989 at 2.50 pm. The Management Council of JSIST is the top policy making body of JSIST.

Our Institute is constantly progressing with the trend of information technology. This paper summarizes the plans that will lead to the successful completion of the JSIST Phase Two Project by January 1991.

To provide the best possible training environment, our Institute must have five basic characteristics, each starting with a letter ranging from A to E: Attractive, Best, Convenient, Dignified and Expansive.

Let me briefly explain these characteristics:

- (a) **ATTRACTIVE:** By an attractive institute, we are talking about an Institute with attractive equipment, modern and up-to-date facilities. Students are taught by well-trained and experienced lecturers. Lecturers are constantly kept up-to-date by regularly sending them for local and overseas training, as well as attachments to the industry.

The Institute, in order to keep up with the technology trends, will concentrate, in the next two years, on three main areas of technology transfer from Japan. The three areas are Data Communications, CAI and Software Engineering. Technology transfer will also be provided in other areas such as AI and AVA.

a.1 Data Communications:

A Data Communications Laboratory will be set up. The Institute will revise the teaching materials and add in practical sessions on Data Communications. JICA is now exploring the feasibility of sending two more local lecturers to the Okinawa International Centre for training on Data Communications.

a.2 CAI:

A team of experts and local lecturers have been working on CAI for some time now. This team will be enlarged by the addition of more and more local lecturers. The Institute hopes to finish two prototypes on Japanese Language Teaching and on the ATSS by March 1989.

a.3 Software Engineering:

A team of experts and local lecturers have been set up to study the needs of software engineering and to consider the type of short courses that will need to be conducted as part of our continuing education programme.

a.4 Others (AI, AVA):

The AI Laboratory will be enhanced with the arrival of sophisticated AI workstations this March. The Institute will concentrate on Expert Systems. The AI Laboratory will support the teaching of AI in the Advanced Diploma course. This March, JICA will despatch a short-term expert on Education Technology to advise local lecturers on the effective use of Audio-Visual Aids and video technology.

(b) BEST:

To be the best institute of its kind, we will constantly upgrade our training materials, revise our curriculum based on feed back from graduates and the industry. We will also maintain our standards by using the MITI Examinations as a yard-stick. We will also introduce the leading edge technology in IT to our students and the professionals in Singapore through various types of seminars.

(c) CONVENIENT:

To be a convenient Institute, we must be able to offer both full-time and part-time courses, so that it is possible for all those interested in upgrading themselves to join us. Not only must we provide continuing education in IT at different levels, we must also make it very convenient and very easy for the industry to seek our assistance through joint industry development work and consultancies.

(d) DIGNIFIED:

A dignified institute must have external recognition from government bodies and the industry and particularly from reputable overseas Universities. Since 1984, JSIST Diplomas have enjoyed the recognition from many reputable British and Australian Universities for direct entries to Masters courses. In 1988, two JSIST's AP graduates were given the prestigious Commonwealth and Foreign Office Scholarships by the British High Commission. One is for the MSc in Software Engineering at the University of Stirling and the other is for the MSc in Information Technology at the University of Glasgow. In January 1989, two of our Advanced Diploma graduates were given Fellowships by the RMIT to study Masters in Information Technology at RMIT, Melbourne, under advanced standing admission. JSIST will continue to expand its list of "dignified" friends. Hopefully, before the end of this year, JSIST will also receive accreditation from MITI.

(e) EXPANSIVE:

A good institute must be willing to expand to take on greater responsibilities. Since 1987, JSIST has started taking in sponsored students from JICA and the ASEAN countries for training. By next year, JSIST will also provide group training for counterparts under the JICA Third Country Training Programme. JSIST will also assume a bigger international role by providing training to ASEAN countries directly through the Ministry of Foreign Affairs ASEAN desk, provide consultancies to other organizations such as the World Bank Project in China, and helping the World Meteorological Organization in the training of IT professionals. JSIST will, as a centre for computer-based learning, also share its expertise with other organizations that need such assistance. In terms of physical expansion, plans are now on board to move JSIST to its own building by 1991.

The following chart shows the main points of the five characteristics. Items marked with an "*" are those where the Japanese Experts will co-operate as the Phase II technical co-operation.

(3) Long-term schedule and job assignments

According to our long-term policy, we take the period from January 1989 to March 1989 to prepare the two-year schedule. Subsequently, we set up six groups comprising both Japanese Experts and Local Lecturers. Each group will then work out the schedule, job assignments and other details among the group members.

However, at the beginning of January 1989, the job assignments of both the Japanese Experts and the Local Lecturers were changed.

The main reasons for the changes in the schedule and the job assignments are as follows:

- (a) The previous ten groups were reduced and re-organized into eight groups in order to concentrate on the new technology transfer areas.
- (b) The groups on "Data Communications", "Software Engineering", "Mini-Project" and "Course-work" will complete the technical transfer by the end of this Phase II Project.
- (c) The groups on "CAI", "SMS" will complete the technical transfer by the end of 1989.
- (d) The group on "Top Management Seminar" will be disbanded as soon as the Top Management Seminar is over.

The groups of "Short-Term Experts" and that of the "LION" project have ended their work and so they will be disbanded.

A new group on "Evaluation" will be set up at the end of the project.

HOME

IT Week '88

16/12/88

Sales of computer ware hit \$790m last year

1987 especially good for hardware vendors, says NCB survey

By GOH ENG YEOW

SALES of computer hardware, software and services by Singapore companies soared to \$790 million last year, an increase of 21.5 per cent over 1986.

A survey released yesterday by the National Computer Board showed that last year was a particularly good year for hardware vendors whose revenues totalled \$545 million, compared to \$450 million in 1986.

Software companies

and service bureaus also did well with their sales growing to \$245 million.

This was 23 per cent higher than 1986's figure of \$199 million.

Referring to the results in a speech yesterday, Dr Tay Eng Soon, Senior Minister of State (Education), said:

"The industry has benefited from the focus the Government has on Information technology, through the National IT plan and events like the Singapore IT week."

Dr Tay, speaking at the end of IT Week at a prize presentation ceremony

for the national software competition for schools, said the industry's growth rate bettered the previous year's rise of 16 per cent.

It also compared well with the average 13 per cent increase worldwide.

For this year, NCB officials also expect Singapore's IT industry to grow by 15-20 per cent.

Dr Tay, who is also chairman of the Committee for National Computerisation, was particularly pleased that exports of computer software and services made "a spectacular jump" of 73 per cent — despite stiff

competition from large American and Japanese companies.

"Quite a number of local software packages have been launched in the regional and international markets in the past year," he said.

"I am glad to see that significant steps are being taken by local companies towards export of software."

Overall, exports of both hardware and software accounted for \$175 million or 22 per cent of total sales by Singapore companies.

Commenting on the good year for hardware vendors, Dr Tay said: "Perhaps many companies held back from investing in IT during the previous two years when we had the economic slowdown.

"They have come back into the market to equip themselves with new machines and upgrades."

The NCB survey also found that:

• Microcomputers made deeper inroads into the market last year, reflecting a trend towards the use of smaller computers. Their sales of \$238 mil-

lion accounted for 43 per cent of hardware revenues last year, compared to a share of only 24 per cent in 1982.

• Sales of minicomputers rose by a small 4 per cent last year while main-frame sales was up 36 per cent.

Trend towards networking

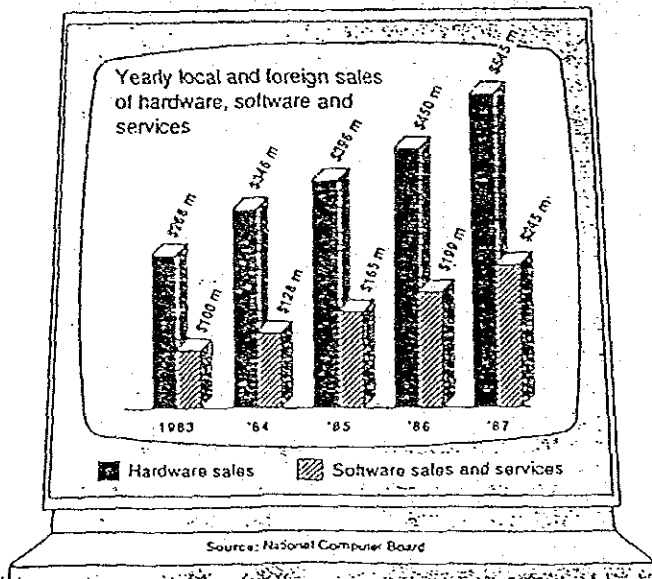
The NCB survey report said the strong showing by microcomputers was partly the result of the trend towards networking and the national effort to get small companies to computerise.

On last week's Singapore Informatics '88 exhibition, Dr Tay described it as "a huge success".

The exhibition, which had 600 exhibitors from 28 countries attracted 93,000 people, he said.

He also announced that next year's IT Week will include two international events — the South-east Asian Regional Computer Confederation Conference and the meeting of the Asian Oceania Computing Industry Organisation.

Sales of computer hardware and software more than doubled in five years



73% rise in exports of software and services		
	1987	1986
Software and services exports	\$142m	Up by 73%
Hardware exports	\$134m	Up by 12%
Total exports	\$176m	Up by 22%

Source: National Computer Board

THE STRAITS TIMES, THURSDAY, DECEMBER 8, 1988

HOME



Singapore IT Week

Enough people trained for industry's needs

Target of 8,000 likely to be met
two years ahead of schedule

SUFFICIENT numbers of information technology (IT) professionals are now being trained to meet the industry's needs, the National Computer Board said in a survey report yesterday.

The earlier target of 8,000 IT professionals will be met this year, two years ahead of schedule.

By 1990, Singapore will have 10,000 IT professionals, the board says.

The report on the findings of a 1987 user survey was released to coincide with the launch of Singapore's IT week today.

IT Week will be launched by Finance Minister Dr Richard Hu this morning when he opens Singapore Informatics, the Republic's premier IT exhibition, at the World Trade Centre.

NCB's general manager, Mr Lim Swee Say, said in the report: "The manpower training programmes have kept pace with technological developments and presently Singapore has a wide range of IT expertise, reflecting well on our young IT professionals whose training and apti-

tude have enabled them to upgrade their expertise and acquire more sophisticated skills."

He said the current strong demand for IT professionals is expected to prevail for the next three years.

The findings suggest that companies are increasingly using advances in IT to sharpen their competitive edge, said Mr Lim.

The survey of IT users is the largest and most in-depth exercise conducted by the board. Over 5,800 companies with 10 and more employees were surveyed.

Highlights of report

Other highlights of the 16-page report are:

- MORE Singapore companies are now using computers — 59 per cent in 1987 compared to only 13 per cent in 1982 and 35 per cent in 1985;

- THE use of microcomputers has shown explosive growth, from a mere 2,000 units in 1982 to 56,000 units last year;

- CUSTOMER satisfac-

tion is high — 85 per cent of companies surveyed were satisfied with the performance of their new computer systems.

This eight-day IT Week is aimed at increasing public awareness of computers and to further promote Singapore as an international centre for IT.

The NCB is jointly organising the event with the Singapore Federation of the Computer Industry, the Singapore Computer Society and Telecoms.

Two conferences will be held during the week. The two-day annual conference of the Singapore Computer Society begins on Dec 12.

This will be followed by IT Works, a local forum for IT professionals here to exchange knowledge, on Dec 14 and 15.

On Dec 15, the last day of IT Week, will see students pitting their computer programming skills in the schools software competition.

To promote IT careers, there will be a students' forum on Saturday, organised by the Singapore Computer Society.

Dr Hu spells out 4-point plan to boost computer use

Singapore IT Week.

Dr Hu looks to future without queues or forms

FINANCE Minister Dr Richard Hu looks forward to the day when companies, and even housewives, will not need to fill forms or queue up at Government departments.

Urging both the civil service and Singapore companies to move faster towards using more nationwide computer networks, Dr Hu wants more of these time-consuming tasks to be done electronically.

His message at the launch of the Singapore IT Week was: Overhaul manual procedures, adopt electronic systems, cut costs and save time.

He said three networks to be introduced soon, covered the trading, health-care and manufacturing sectors.

The first to go on-line will be TradeNet, the electronic clearing house for the trading community.

Come Jan 1, 50 companies will be linked to the computer systems of the Trade Development Board and the Port of Singapore Authority.

Subscription to TradeNet services will be available to all companies from April 1.

By September, the Customs and Excise Depart-

ment, the Civil Aviation Authority of Singapore and 16 other agencies will be connected to TradeNet.

They will offer extra services such as processing customs permits, manifests, and import and export licences and certificates.

A second network will be in the health-care industry, where a steering committee, comprising members from the Health Ministry and the National Computer Board, has been formed to set up MediNet.

This will cover areas like processing of Medi-ware claims and procurement of drugs and medical supplies.

Third network at pilot stage

The committee, chaired by Dr Kwa Soon Bee, permanent secretary of the Health Ministry, will start in-depth studies in the next few months.

A third network, covering the manufacturing and retail sectors, is also at the pilot stage.

A group of manufacturers and retailers, as well as their main suppliers, are now being selected to demonstrate the benefits of the network that will be implemented later.

SINGAPORE still has a long way to go in its computerisation drive although good progress has been made since its launch eight years ago, the Finance Minister, Dr Richard Hu, said yesterday.

He announced a new four-point plan to step up the momentum, involving both the Government and the business community. It is aimed at propagating effective use of information technology (IT) throughout the economy.

The plan calls for:

- LINKING the computer systems in Government departments to private sector users and even to homes;

- USING nationwide electronic networks more extensively;

- SPEEDING up the computerisation of small local companies;

- PREPARING Singapore's workforce for "the emerging information economy".

Describing the plan as a "total approach to exploit information technology", Dr Hu said it represented a large-scale and multi-faceted effort to make IT the competitive advantage for Singapore.

"We are a small and open economy and our economic growth and well-being depend on our international competitiveness," he said.

"We must develop new and better capabilities all the time, so that businesses can derive maximum value for money by operating from Singapore."

He also listed two other economic imperatives for companies here to computerise — Singapore's small labour force and the increasing globalisation of businesses.

Dr Hu was speaking at the opening of the four-day Informatics 1988 exhibition at the World Trade Centre, coinciding with the launch of the Singapore IT Week.

Noting that almost all government departments were now using computers extensively and installing more systems, he said: "To further maximise the benefits of our investment in IT in the civil service, the intention is that these computerised systems will progressively be extended to the private sector and even to homes."

He envisaged that more companies will be able to use their computers to electronically send forms, such as passport applications, to government departments.

They can also retrieve public data, such as company information.

The "Televue" project, for example, now undergoing field trials, would "not only improve the quality of services offered to the public but also reduce drastically the need for the public to queue up at government offices."

On the need for more extensive use of nationwide electronic networks, he said this was a key strength of information technology.

"We must take steps to overhaul manual systems and procedures and use IT to restructure our business sectors," he said, adding that the aim should be to cut costs and speed up business transactions.

The two other prongs in the plan, which Dr Hu described as "energising our small and medium-sized enterprises with informa-



DR HU

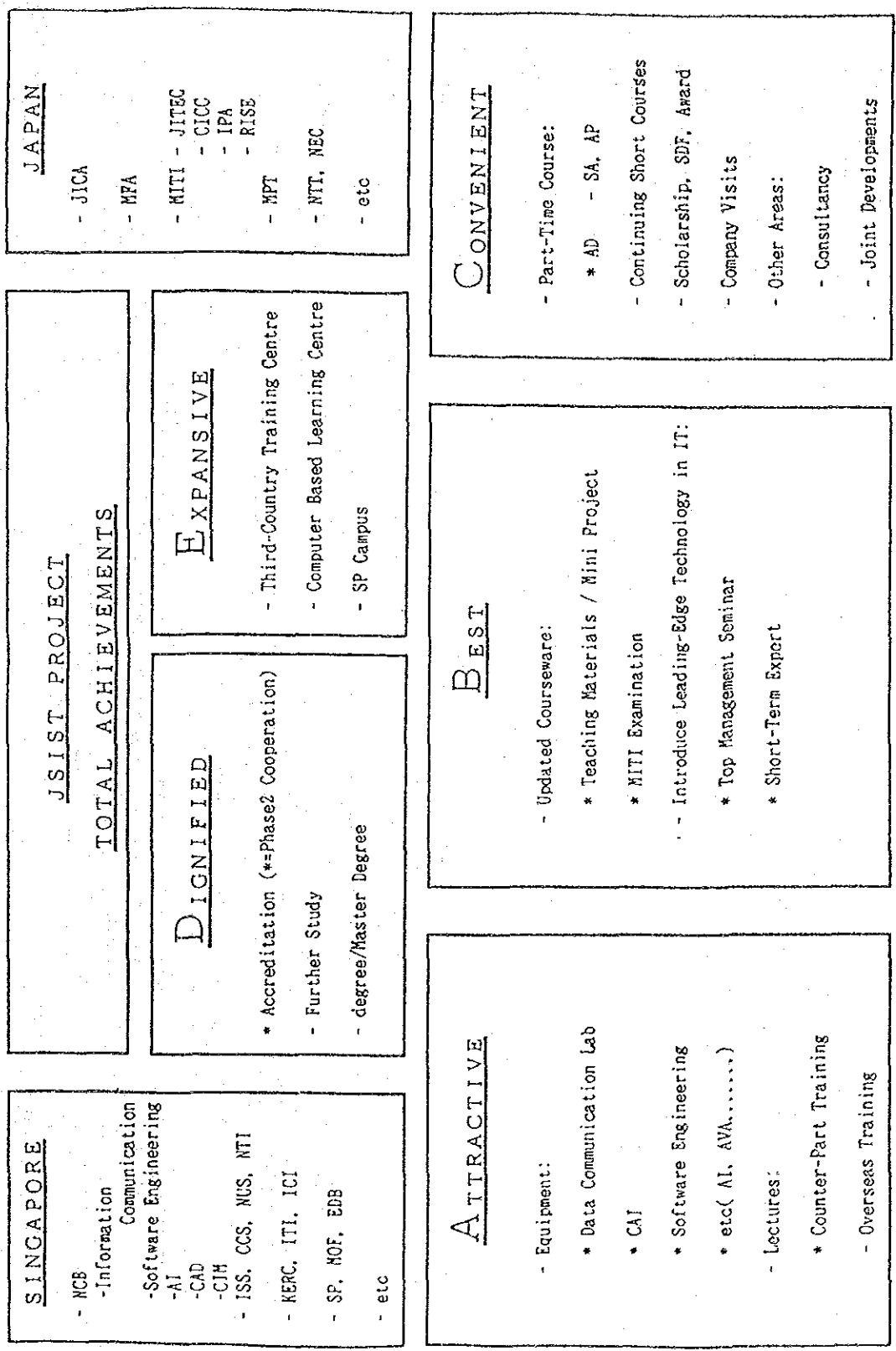
IT can be competitive advantage for Singapore.

tion technology" and training the workforce, would form part of the integrated approach to be co-ordinated by the National Computer Board.

For the board, this signals a new phase since the national computerisation effort began in 1981, a spokesman said.

So far, the board has concentrated on building up the IT infrastructure, such as training institutes and research and development facilities.

Earlier, Dr Tay Eng Soon, Senior Minister of State (Education), who is also chairman of the Committee on National Computerisation, gave away prizes to the winners of the recently-held national software competition.

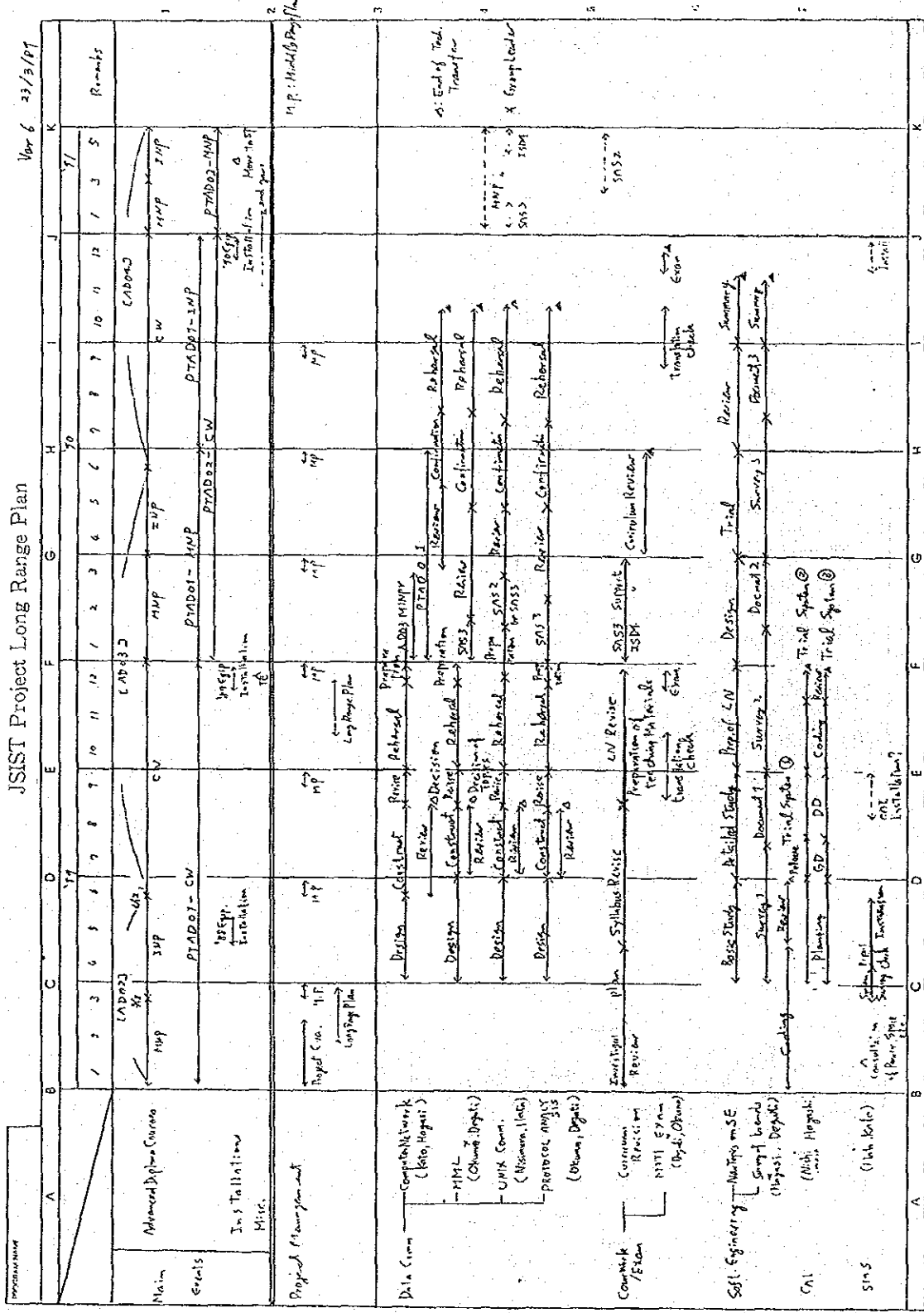


(資料4)

JSIST Project Long Range Plan

Nov 6 33/3/87

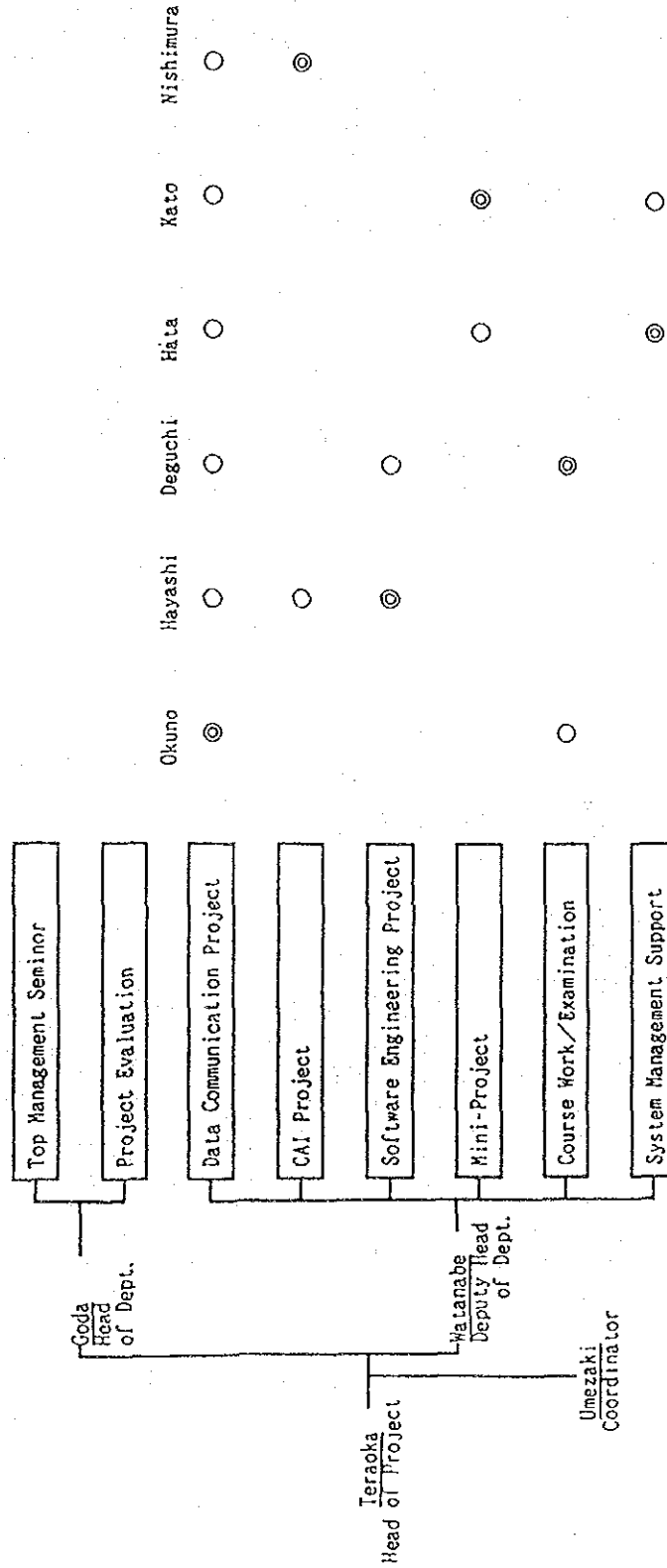
[Appendix 5]



Work Assignment of Japanese Experts

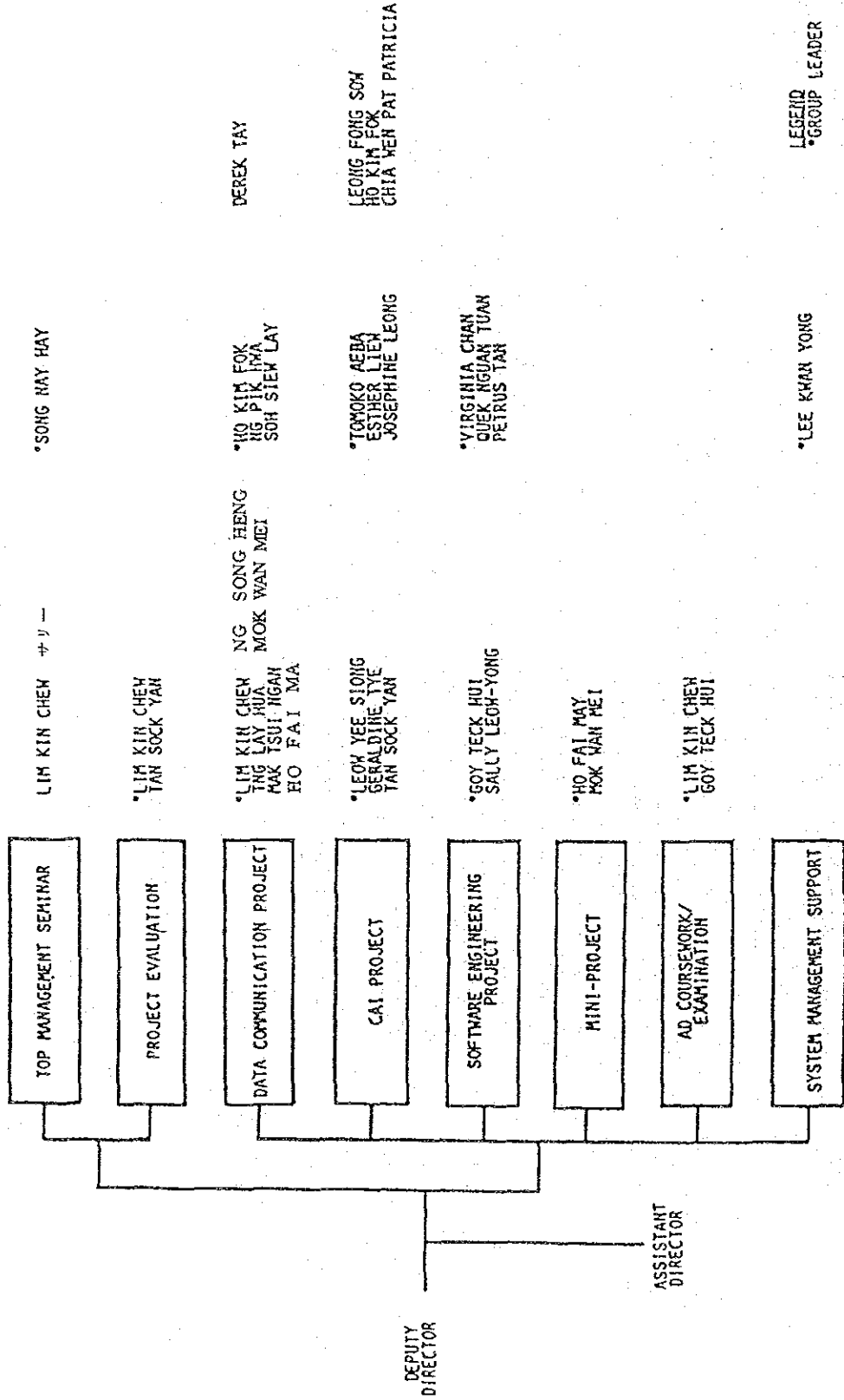
(Version 2, Jan. 11, 1989)

[Legend]
 ⊙ : Group Leader
 ○ : Group Member



(資料6(1))

WORK ASSIGNMENTS OF LOCAL LECTURERS



2. COURSE WORK

2.1 Curriculum Revision

Including the Part-time Advanced Diploma Course, we have now conducted the Advanced Diploma lectures for the third time. It is an appropriate time to review the Advanced Diploma curriculum.

In our procedure of curriculum revision, the local lecturers first review the curriculum. The Japanese experts then give their comments. Finally, all the comments and recommendations are consolidated into a proposal. We hope to come out with the proposal by the end of April 1989.

The detail topics are given in Table 1.

The main points are:

- (1) We examine the areas where there is an overlap and then we consider the need for rearrangement.
- (2) We put emphasis on the practical aspects of Data Communications.
- (3) We consider putting in new topics on Software Engineering.
- (4) We introduce the subject on "Mathematics" in order to conform to MITI's accreditation.

At the same time, we would like to try to rearrange the contents of the Advanced Diploma course. We also hope to come out with a schedule of work chart until August 1989, if it is possible.

2.2 MITI Examinations

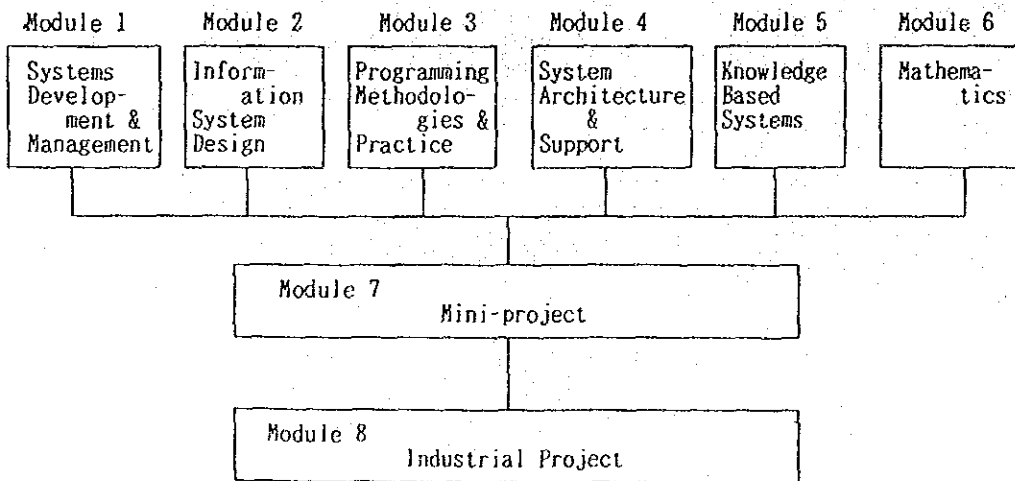
If we need to consider the training of technical experts as a system, then the curriculum forms part of the planning sub-system. The other part of the sub-system is the examination which is considered as the evaluation sub-system. Both these sub-systems have important roles to perform and they have very close relations. Based on this idea, it may be suitable that the results of teaching the curriculum (which is covered by the MITI Examination) is also evaluated by the MITI Examination.

We have already conducted the MITI Examinations twice in the past. We plan to conduct the examination continuously because the results are very useful to estimate the abilities of the students.

Subjects and Periods Proposed by Lecturers

Subject code	Present No. of periods	Proposed No. of periods	Remarks
SDM1	41	-	Delete
SDM2	40	40	
SDM3	24	28	
SDM4	25	28	
ISD1	20	68	
ISD2	48		
ISD3	78	88	
ISD4	24	44	
PMP1	50	48	
PMP2	110	100	
SAS1	28	-	Delete
SAS2	95	96	
SAS3	29	64	
NTG1	35	100	Proposed KBS - Knowledge Based Systems
NTG2	67		
MMF	38	-	Distributed to Other Subjects
MTH	-	48	Proposed MTH - Mathematics
Total	752	752	

Proposed Structure



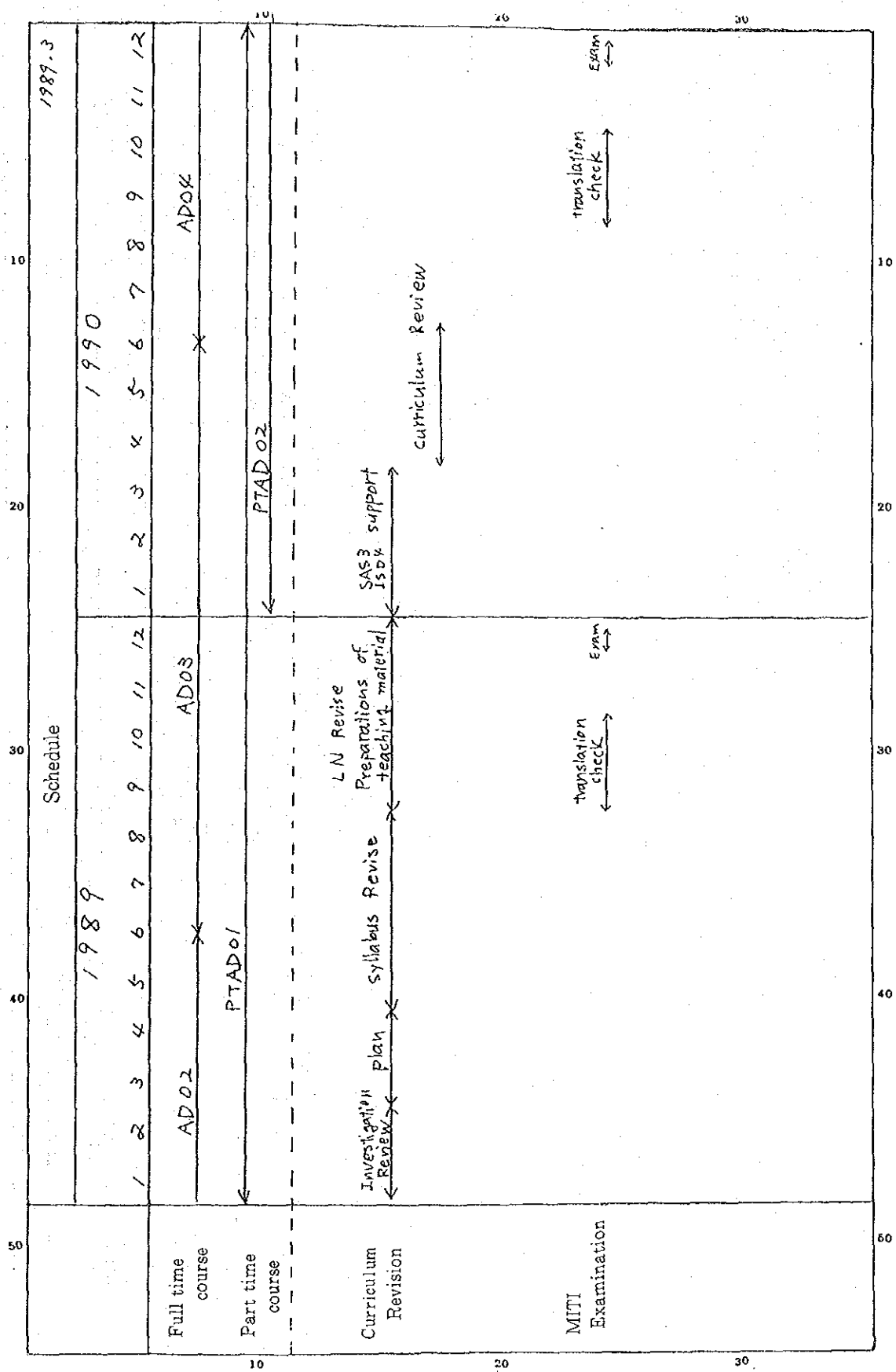


Table 1

Mar 1989

Results of Syllabus Review

Subject code	Review Results of Lecturers		Comments of JEs		
	Desirable Topics to be Added	Topics can be Deleted	periods etc.	Comments	
SDM1	<ul style="list-style-type: none"> ① Incorporated to the other Subjects • Most of the topics covered in this subject are on the introductory level as they are also covered in more detail in the other subjects. • Topics such as "File organization" and "Characteristics of online system" are already taught in detail in the AP course. • AB students are experienced DP professionals, the need for an introductory course appears to be unnecessary. 			<ul style="list-style-type: none"> • We need time to look over the course structure systematically. 	<ul style="list-style-type: none"> • For example, the course outline is introduced at the first period or during orientation.
SDM3	<ul style="list-style-type: none"> ① Software Quality Tools • They can influence the quality of software directly. ② Software Productivity (from PMP 2) • software quality and productivity go hand in hand, each complementing the other ③ Program Quality (from PMP 2) • to provide students with a more complete view of software quality and productivity 		additional 10 periods are needed		
SDM4				<ul style="list-style-type: none"> ① Copyright Law • the depth of coverage may be superficial. • The copyright law of S'pore may not be very relevant to most EDP installations except the software vendors. 	<ul style="list-style-type: none"> • The Copyright Law is becoming important topic. It should be kept.
ISD1	<ul style="list-style-type: none"> ① Data Dictionary • preferably illustrated together with RQSE. ② Structured English/Pseudocode • this ties in with the mini-specific action produced in structured system analysis. 	<ul style="list-style-type: none"> ① Michael Jackson Diagram • the student are not required to use JSP in ISD2. • As this is a program design tool, it should be taught in PMP1. ② Data Structured Diagram • This is not as common as normalization in entity modeling. • This is not used in most methodologies except Information Eng. (IE). ③ Dependency Diagram • This is mainly used in IE and not as popular as the DFD. 	<ul style="list-style-type: none"> • Another 2 to 4 period should be given for the part-time course • Can be incorporated into ISD2? 	<ul style="list-style-type: none"> • There is a need to re-consider the roles of ISD1 and ISD2. 	<ul style="list-style-type: none"> • As a example, Analysis phase * ISD1 Design phase * ISD2
ISD2	<ul style="list-style-type: none"> ① More case studies 		+ 1 2		<ul style="list-style-type: none"> ① Prototyping and practical work ② CASE tools and practical work
ISD3	<ul style="list-style-type: none"> ① Practical exercises on RIQS/TL ② Practical exercises on ADBS • Most of students did not have enough background knowledge and experience 		+ 2		

Subject code	Review Results of Lecturers			Comments of JEXs	
	Desirable Topics to be Added	Topics can be Deleted	periods etc.	Comments	Suggestion
ISD4	① VIS It involves on-line system setup conditions Facilitates Mini-project supervision			It's better that VIS is taught in a intensive course like MMF.	
PMP1	① Composite Design	① Program Design for Graphic Systems	+4 -4	① Software reusability ② HCP notation and practical work	
SAS1	① Relate			Though this subject seems to be necessary, there is a need to reconsider the contents.	
SAS2	① C language can be taught first It's independent of the other topics By the time the student finish learning C they should be quite comfortable in using some of the UNIX commands.	① Document Formatter - cumbersome to use - word processing programs are now easily available on PCs. ② ACOS-4/MVP - It's awkward to have this topic in the subject which is 80% about the UNIX operating system.		The objective should be state clearer. UNIX? Document Formatter is one of the features of UNIX, it can be kept better to be included in MMF. ① UNIX Communication practice ② C language may be separated as another subject.	
SAS3	① practical sessions on protocol analyser LAN and the Integrated Office System.	changing the subject name to "Computer Networking"			
NTG1 NTG2	Combine NTG1 and NTG2 are rename the module to "AI and its Applications"	Knowledge Based Systems			
MMF	① Incorporated into the other subjects main topics covered in MMF are: COROL/S - students don't use COROL/S to code the program instead they use COBOL which they are presumed to be conversant in. IDSP - This is included in PMP2 under program debugging. RIGS/PL - It would be more effective if it is covered under ISD3 since most aspects of RIGS are already included in ISD3. VIS - could be included in ISD4 then students should be able to appreciate the VIS topic more. MMF being a non-examination subject, it isn't well received by the student. ATSS operations may be mastered by following the ATSS user guide.				- VIS-ACOS(OS) Hardware Configurations are taught as a intensive course just before Mini-project.
(MATHS) TICS	Introduce as a new subject in order to conform to MITI exam accreditation requirements				
MIP				any extra periods can be used to increase the number of periods	
Others	① Round the number of periods for every subject to multiples of 4.			The changing of subject name should be done by considering the entire view.	

3. DATA COMMUNICATIONS

3.1 PURPOSE

Currently, topics related to the data communications are taught in several subjects in the AD (Advanced Diploma) course. However, these subjects do not include any practical session except for some exercises using the Local Area Network (LAN).

The purpose of our data communications project is to consider the introduction of practical sessions for these subjects. Through these practical sessions the local lecturers' knowledge on data communications will also be enhanced. In addition, it will also help the students to understand the lectures in those subjects which have elements of data communications.

3.2 CURRENT STATUS AND NEW TRENDS

According to a report in The Straits Times (23 Oct. 1988), a \$50 million training institute would be established by the Singapore Government and the American multinational AT & T. Its intention is to train and develop some 600 telecommunications software experts needed in Singapore over the next five years. This institute is known as the Information Communication Institute of Singapore. Companies in Singapore such as those like banks, software houses and other companies using computers, need information processing professionals who are competent in data communication work.

It is with this intention that JSIST wants to increase the emphasis on the data communication topics in the Advanced Diploma course during the remaining Phase II co-operation period.

The list of the hardware and software required for the data communication practical sessions by the local lecturers is given in Appendix A.

As we consider the topics for enhancement, we will also study the subjects related to data communications. Appendix B indicates the topics where practical sessions can be introduced. For your information, we also checked the subject related to the data communications in the AP course. This is shown in Appendix C. However, we are not looking into the implementation of the practical sessions in the Analyst/Programmer course.

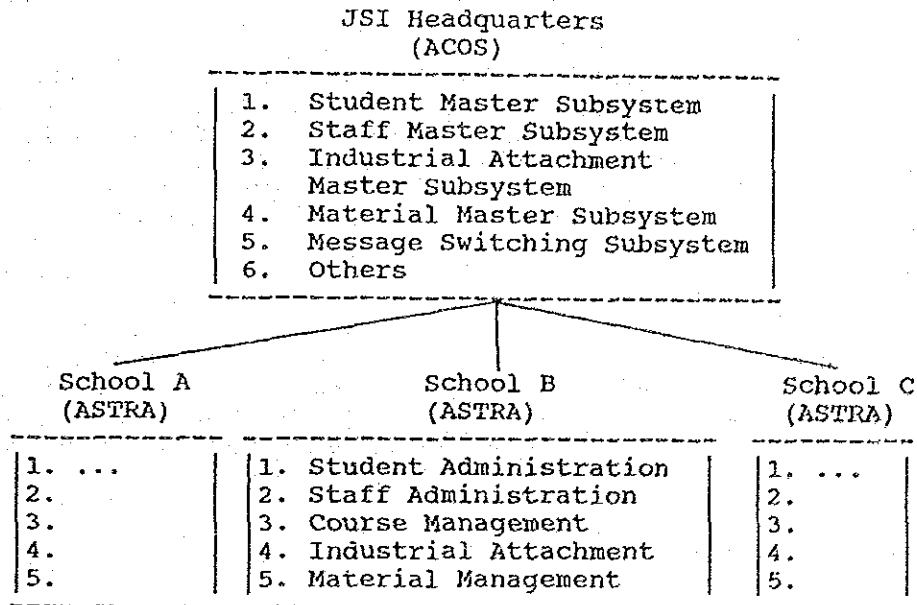
3.3 PROPOSALS OF THE PRACTICAL SESSIONS

Our project team has identified the following four major areas to increase the coverage on the data communications in the Advanced Diploma course. These are as follows:

- (1) COMPUTER COMMUNICATIONS (ACOS-ASTRA)
- (2) MICRO MAINFRAME LINK (ACOS-PC)
- (3) UNIX COMMUNICATIONS (EWS.UNIX-EWS.UNIX)
- (4) ANALYSIS OF THE PROTOCOLS

3.3.1 Computer Communications (ACOS - ASTRA)

Practical aspects of data communications can be carried out by the Advanced Diploma students during the Mini-Project duration. This is when the students will introduce elements of data communications into the planning, design and implementation of the Jupiter-Saturn Institute (JSI) System. The current JSI system is to be modified as follows:



The following are the new functions that would be used by this proposed system:

- 1) File transfer between ACOS and ASTRA (VIS - BFT)
- 2) Program Communication (VIS TPP - ASTRA COBOL)
- 3) VIS Message Switching function

The above system will be developed by both the Local Lecturers and the Japanese Experts some time in August 1989. Thereafter, a decision will be made as to whether the above system can be used for Mini-Project work by the students.

The following are some explanations on the data communication functions to be used in the JSI SYSTEM:

- 1) File Transfer between ACOS and ASTRA (VIS - BFT)
(Versatile Information Service - Batch File Transfer)

The BFT, or Batch File Transfer, is one of the distributed data processing utility programs and is used to transfer file data, load module file data, and volume data in batch mode. The BFT runs under the control of the ASTRA/OS as well as other utility programs. The following are the features of this BFT utility program:

- In addition to transmission of data file (sequential and indexed sequential organizations), such files can be handled as load module files in queued-partitioned organization and source program files in queued-linked organization. Volume transfer is also allowed for floppy disks.
- Up to six data files can be handled in one transfer unit.
- Editing is made to improve transmission efficiency, such as compression of consecutive characters and deletion of trailing blanks in fields. In addition, numeric data can be packed for transmission (packed decimal).
- Specific fields can be specified for transmission, or part of record can be transferred.
- Before/after data transfer, an operator message can be transmitted.
- The BFT utility can run in the NEC Level 2B protocol
- The execution result (history) of BFT can be output to either a printer or a display

- Conversational transmission is available, and can be switched to batch transfer, or vice versa.

2) Program Communication (VIS TPP - ASTRA COBOL)

VIS TPP stands for Versatile Information System Transaction Processing Program. ITOS stands for Interactive Tutorial Operating System. It is the same as the operating system of the ASTRA computer system.

This practical work will allow the students to use the COBOL programs on the ASTRA computers to communicate directly with the VIS TPPs. With such an arrangement, the students can access the ADBS, VSAS, RIQS and the standard files in the ACOS-4 system. They will also get to know how the messages and data are transmitted using the NEC Level 2B and the HDLC protocols.

3) VIS Message Switching Function

VIS is a control subsystem which allows the set up of an online data base system. One of its functions is on data communication control. Data communication control refers to the control of message communication between the terminals and application programs without making it necessary for the concerned application program to identify the terminal with which it is communicating or to know its operating conditions. Under this data communication control, VIS makes all types of message processing possible. These include inquiry, conversation, batch input (collection of messages), switching, distribution, inter-program communication, etc.

3.3.2 Micro-mainframe Link (MML)

We considered the practical sessions of MML based on the following definitions:

DEFINITION 1

It is possible to use the resource and the data on the mainframe from the micro.

DEFINITION 2

It is the distributed system with the advantages of the mainframe and the micro when the micro is linked to the mainframe.

3.3.2.1 DEFINITION 1

The different proposed link level between the micro and the mainframe are :

- (1) The practical session for link level 0 (Terminal Emulation)

For terminal emulation, the micro is linked to the mainframe by the emulator.

At present, JSIST is using the emulator "ETOS52GB" to link the micro, NEC APC III, to the mainframe, NEC System 630.

- (2) The practical session for link level 1 (File Transfer)

This level is for file transfer between the micro and the mainframe. The data stored on the mainframe can be transferred to the micro with its format converted into the micro format.

For the practical session at this level, we use "FILTRANS" for the file transfer software and "FLCNV" and "DATABASE CONVERTER" for the file converter. The following practical sessions are considered to use these software.

- (a) We code the COBOL source program on the micro. It is then converted into the mainframe format and transferred to the mainframe. After that, it is compiled and executed at the mainframe.

- (b) We transfer the relational database on the mainframe to the micro and convert it into a micro database.

After that, we display and edit the data by using the micro software e.g. DBASE II, DBASE III PLUS.

- (3) The practical session for link level 2 (File Converter)

This level is to convert the file format automatically after the data is transferred.

We cannot practice at this level because we cannot find any software corresponding to this level.

- (4) The practical session for link level 3 (Host File Access)

At this level, micro end-users can access the data file or the database on the mainframe without being aware that they are actually accessing data on the mainframe.

For the practical sessions at this level, the Office File function of the IOS can be used. We can make the document by using some software like WORDSTAR 2000. It will be stored in the cabinet file or the mail file on the mainframe automatically. We can also demonstrate the mailing function to mail and edit the data again,

3.3.2.2 DEFINITION 2

We introduce the software program called "EGGEN" which is one of the online distributed processing programs for the practical session of DEFINITION 2.

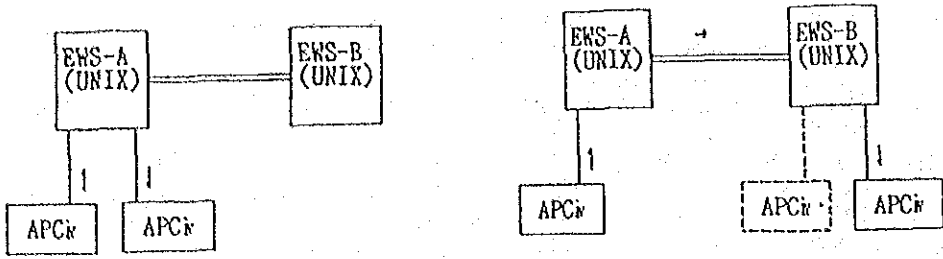
This software can run on the intelligent terminal like NEC APC III and is used when the graph is created by the DS/TQP (Decision System/Table Query Facility).

3.3.3 UNIX COMMUNICATION

For the two NEC EWS (Engineering Work Station) 4800 workstations which are linked, the following practical lessons can be conducted:

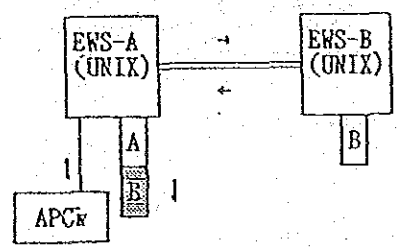
3.3.3.1 Mail facility

This facility allows the user to send messages from one user to another. The users can either be on the same system or on different system. Small amount of data (similar to messages) can also be transferred between users.



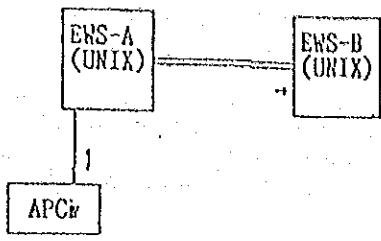
3.3.3.2 UNIX-to-UNIX file transfer

This can be demonstrated by using the UUCP facility. UUCP stands for UNIX-UNIX copy. Files can be copied from one system to another.



3.3.3.3 Remote log-in

A user can log into a local system and at the same time also log onto a remote system connected by a network. Commands entered on the terminal can be executed on a remote computer (in this case, another EWS 4800 workstation)

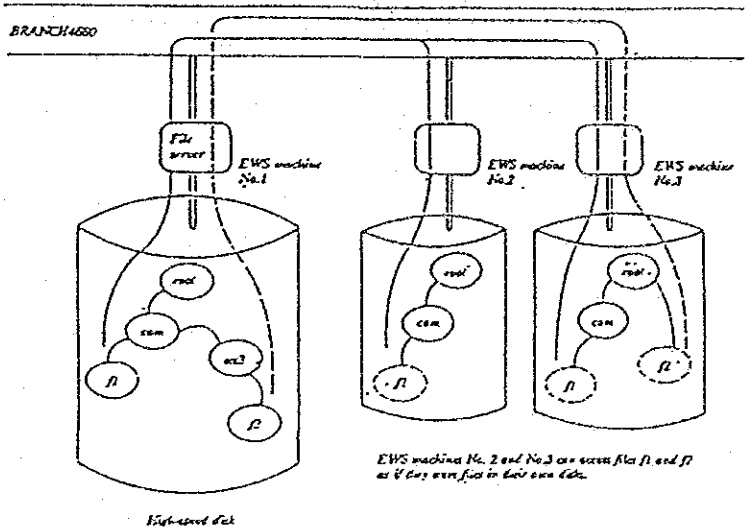


3.3.3.4 NFS (Network Filing System)

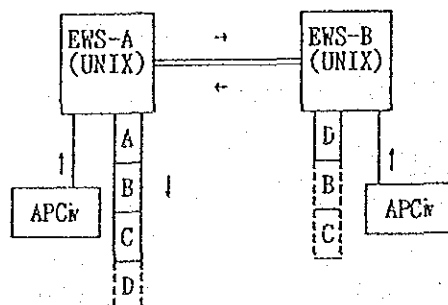
The Network Filing System, or NFS in short, was originally developed by the Sun Microsystems. It has now been released (under licence) to other vendors. The NFS allows the sharing of files, without requiring the transfer of entire copies of the files. It also provides transparent remote access of the system resources in a heterogeneous network environment.

The distributed file system achieves complete transparency. This means that it is possible to make a file system on the remote side look as if it were a file system on the local side.

It is also possible to access a file in the EWS-UX/V of each node connected in a LAN by just designating a file on the remote side following a simple procedure. The disk's cost performance also improves, because it is possible to install high-speed and large-capacity disks exclusively in some machines and to own them commonly via other machines.



The NFS can also make a subtree hierarchy. Also, as the remote side (file server) has no information of the state on the local side (stateless), other machines are hardly affected even if a certain machine in the network fails. There is no need to restore the network management information necessary for maintaining the network.



EWS-B can access file B and file C as if these files were in EWS-B.

EWS-A can access file D as if it were in EWS-A.

3.3.3.5 TCP/IP (Transmission Control Protocol/Internet Protocol)

TCP/IP, or Transmission Control Protocol/Internet Protocol, is a suite of protocols suitable for interconnecting multi-vendor systems. Originally developed by academic researchers for use in the U.S. Department of Defence Advanced Research Projects Agency Network (ARPANET), TCP/IP has been quietly gaining acceptance in government agencies, academic institutions and industry for close to 20 years.

TCP/IP was developed in the 1970's and has been accepted as a standard sometime in 1983/1984. It is very popular on UNIX workstations. It provides a solution for interconnection for multi-vendor computer systems. It also provides functions such

terminal emulation, file conversion and electronic mailing. The set of protocols can be visualized as follows:

TCP/IP Protocol Stack:

USER LAYER PROTOCOLS
TCP/UDP
IP/ICMP
DATA LINK LAYER
PHYSICAL LAYER

TCP/UDP : Transmission Control Protocol/User Datagram Protocol

IP/ICMP : Internet Control Message Protocol

3.3.4 PROTOCOL ANALYSIS

Using the protocol analyzer the various protocols used for the data transfer between the ACOS system, the ASTRA system and the PC can be demonstrated.

We consider the following two major areas for the demonstrations :

- . BASIC procedure
- . High level data link procedure (HDLC procedure)

3.3.4.1 BASIC procedures

We will explain the basic procedures using the NEC standards level 2A and 2B.

(1) Synchronization

The difference between the synchronous data transmission and the asynchronous data transmission will be shown.

(2) ERROR control

The parity bit used for the error detection of the data transmission, the block check character (BCC) and the block check sequence (BCS) will be introduced. The cyclic redundancy check (CRC) will also be introduced.

(3) Communication sequence

We will introduce the communication sequence of the basic procedure by using NEC standards level 2A and 2B.

3.3.4.2 HDLC procedure

(1) Synchronization

We will introduce the flag sequence for the synchronous data of the HDLC as well as the HDLC format.

(2) ERROR control

We will introduce the frame check sequence (FCS) for the error detection check bits.

(3) Sequence control

We will introduce the sequence control by monitoring the sending sequence number and the receiving sequence number in the control part of the frame for the data transfer between ACOS and ASTRA.

(4) Sending confirmation

We will explain the method using P (poll) bit /F (final) bit or RR (Receive Ready) frame.

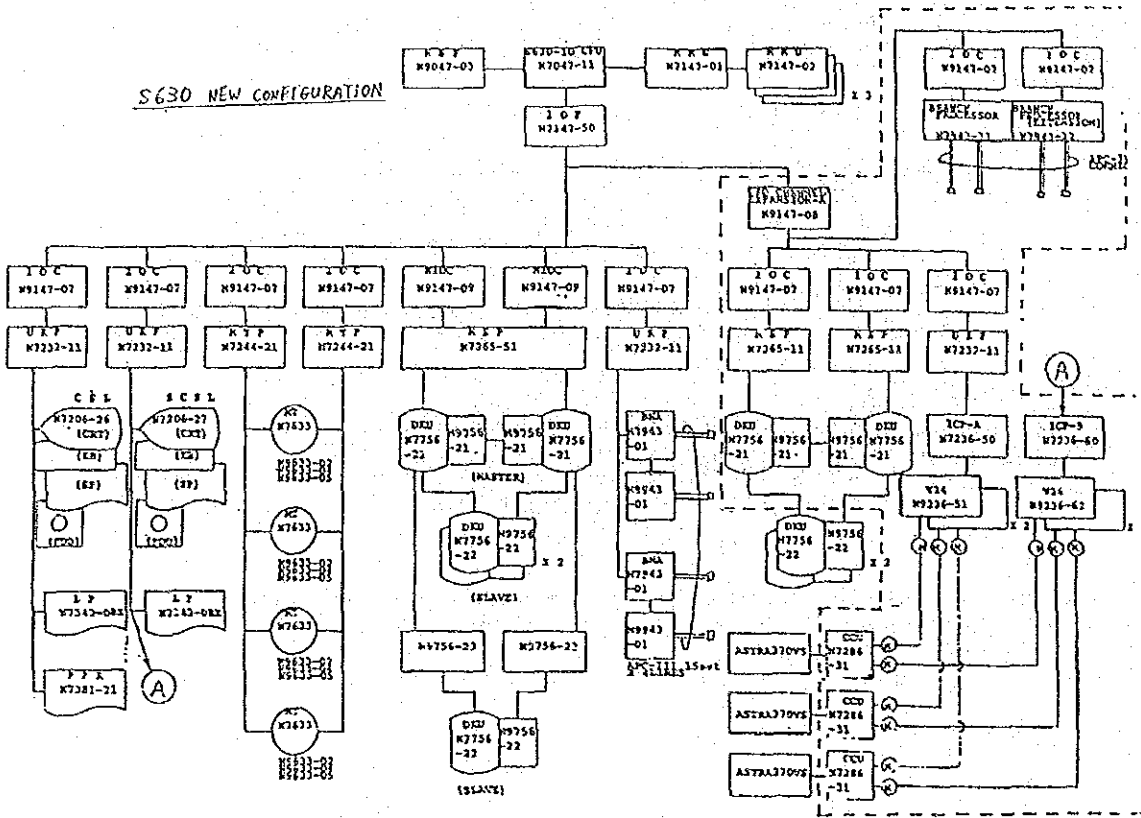
(5) Flow control

We will introduce the flow control by setting up the condition that it can run after changing the window size.

(6) Communication sequence

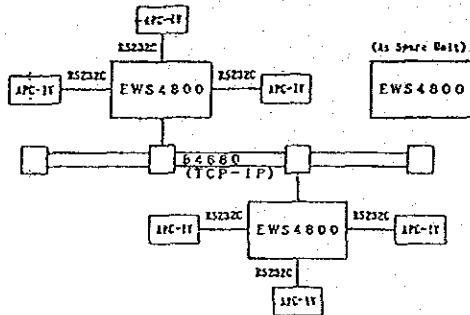
We will introduce the communication sequence of HDLC procedure using NEC standards level 4.

3.4 SYSTEM CONFIGURATION
 3.4.1 HARDWARE CONFIGURATION
 3.4.1.1 S630, ASTRA AND IOS ENVIRONMENT

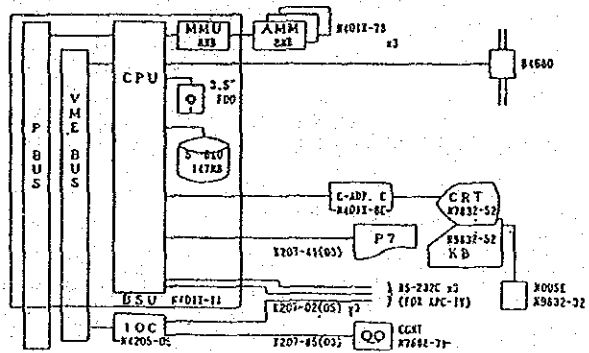


3.4.1.2 EWS ENVIRONMENT

SYSTEM OUTLINE



EWS-4800/XX H/W DIAGRAM



3. 4. 2. SOFTWARE CONFIGURATION
3. 4. 2. 1 S630 (ACOS-4/MVP XE)

DB/DC PACKAGE :

- (1) VIS (REAL TIME PACKAGE)
- (2) IMFD/MFDL
- (3) RIQS
- (4) VSAS
- (5) IDEA
- (6) DD/DS

DECISION SUPPORT PARTNER :

- (1) DS/TQF
- (2) DS/DEF
- (3) EPL

MULTI-MEDIA PACKAGE :

- (1) EGGEN
- (2) EGF (BUSINESS GRAPH FACILITY)

INTERACTIVE PROCESSING PACKAGE :

- (1) ATSS-AF

LANGUAGE PROCESSORS :

- (1) COBOL
- (2) COBOL/S
- (3) C

OFFICE AUTOMATION PACKAGE :

- (1) IOS/SERVER

SOFTWARE DEVELOPMENT TOOL :

- (1) DSP (DEBUG SUPPORT PROGRAM)
- (2) IDSP

3. 4. 2. 2 ASTRA

- (1) COBOL
- (2) RDB
- (3) TEDIT
- (4) MENUM (MENU MAINTENANCE)
- (5) LBM (LIBRARY MAINTENANCE)
- (6) FILEM (FILE MAINTENANCE)
- (7) SFGEN (SCREEN FORMAT GENERATOR)
- (8) BFT

3. 4. 2. 3 EWS

- (1) UNIX

3. 4. 2. 4 PC

- (1) VT/100
- (2) IOS/WS
- (3) ETOS52GB
- (4) ETOS52GDC
- (5) FLCNV (FILE CONVERTER)
- (6) DATABASE CONVERTER
- (7) WORDSTAR 2000
- (8) DBSAE III PLUS

3.5. STAFF ASSIGNMENT

TOPIC AREA	LOCAL LECTURER	JAPANESE EXPERT
COMPUTER NETWORK	MAK TSUI NGAN HO FAI MAY MOK WAN MEI	TAKAAKI KATO YASUHIRO HAYASHI
MML	NG SONG HENG HO KIM FOK DEREK TAY	HIDEYUKI OKUNO KAZUHISA DEGUCHI
UNIX COMMUNICATIONS	TNG LAY HUA NG SONG HENG	RYOICHI NISHIMURA TOSHIO HATA
PROTOCOL ANALYSIS	TNG LAY HUA NG SONG HENG SOH SIEW LAY	HIDEYUKI OKUNO KAZUHISA DEGUCHI

3. 6. DEVELOPMENT SCHEDULE

TITLE		89-90											REV.	DATE	PREPARED BY	APPROVED BY	PAGE	
Data communications		SCHEDULE CHART																
1.	COMPUTER NETWORK	3	5	7	9	11	1	3	5	7	9	11						* End of Tech. Transfer
			Design	Contract	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	
2.	MML		Design	Contract	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	Review	
3.	UNIX COMMUNICATION		ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	
4.	PROTOCOL ANALYSIS		ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	ditto	
COMMENTS																		

APPENDIX. A REQUIREMENTS FROM S' PORE SIDE
FOR DC PROJECT

NETWORK	DETAILS	PURPOSE & USAGE
ACOS - ASTRA	LINK BETWEEN S630 AND 3 ASTRA SYSTEMS	<p>ATSS, VIS, RJE AND OTHER ACOS4 SOFTWARE CAN BE ACCESSED FROM ASTRA TERMINALS</p> <p>FILES CAN BE TRANSFERRED BETWEEN S630 AND ASTRA SYSTEMS</p> <p>THE CONCEPT OF THE FILE TRANSFER FROM THE PC TO THE MAINFRAME THROUGH THE MINICOMPUTER.</p> <p>LLs WANT TO IMPART KNOWLEDGE ON THE USES OF DATA COMMUNICATIONS TO OUR STUDENTS</p>
ACOS - LAN	LINK BETWEEN S630 AND THE LOCAL AREA NETWORK (NOVELL S) (NOVELL S CAN'T BE CONNECTED. IOS WILL BE CONNECTED)	<p>ATSS, VIS, RJE AND OTHER ACOS4 SOFTWARE CAN BE ACCESSED FROM LAN WORKSTATIONS</p> <p>FILES CAN BE TRANSFERRED TO AND FROM S630 AND LAN WORKSTATIONS</p>
ACOS - APC/IV	LINK BETWEEN S630 AND 20 APC/IVs LOCATED IN STAFF ROOM, ADMIN OFFICE AND OP'S PLACE	<p>CENTRAL DATABASE CAN BE INSTALLED IN THE S630 FOR THE OFFICE AUTOMATION SYSTEM AND CAN BE ACCESSED BY STAFF FROM THEIR APC/IV</p> <p>ELECTRONIC MAIL SYSTEM CAN BE IMPLEMENTED FOR THE INSTITUTE</p> <p>ATSS, VIS, RJE AND OTHER ACOS4 SOFTWARE CAN BE ACCESSED FROM THE APC/IV TERMINALS</p>

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	NETWORK	DETAILS	PURPOSE & USAGE
EQUIPMENT	ACOS - APC/IV		FILES CAN BE TRANSFERRED BETWEEN S630 AND ASTRA SYSTEMS
	UNIX COMMUNICATIONS	LINK BETWEEN EWS AND EWS	THE FACILITIES OF UNIX COMMUNICATION CAN BE PRACTISED.
EQUIPMENT	PROTOCOL ANALYSER		TO MONITOR A COMMUNICATION LINE, ANALYSING AND DISPLAYING THE TRAFFIC AND RECORDING CONVERSATIONS FOR SUBSEQUENT REPLY
	MODEMS		TO STUDY THE LINE USAGE STATISTICS & PINPOINT HARDWARE AND SOFTWARE PROBLEMS FOR THE DEMONSTRATION OF COMMUNICATION SOFTWARE TO ACCESS BULLETIN BOARD AND OTHER NETWORKS

APPENDIX. B DC CURRENT COURSEWORK

INVESTIGATION (AD COURSE)

D/C		CURRENT COURSE WORK		DESCRIPTION	PRAC NOW	POSIB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	S	ELEMENTS OF DATA COMMUNICATIONS	PHYSICAL ASPECTS	TRANSMISSION MEDIA SINGHAL REPRESENTATION, MODULATION	N	N		
D	S		DATA COMMUNICATION HARDWARE	MULTIPLIER CONCENTRATOR FWP PROTOCOL CONVERTER	N	N		
	3							
		COMPUTER NETWORK STANDARDS	ISO - OSI REFERENCE MODEL	PHYSICAL, DATA LINK NETWORK, TRANSPORT, SESSION, APPLICATION LAYER	N	N		
			HIGH LEVEL DATA LINK CONTROL	HDLC FRAME FORMAT CLASSES OF PROC	N	P	BY PROTOCOL ANALYZER (P.A.)	ACOS-ASTRA
			X.25 PACKET PROTOCOL		N	N		
		PROPRIETARY NETWORK ARCHITECTURES	IBM'S SNA	LAYERED STRUCTURE OF SNA SDLC	N	N		
			NEC'S DINA	LOGICAL MODEL PROTOCOL & FUNCTION	N	N		
		MICRO TO MAINFRAME LINK			N	P	BY IOS	ACOS-PC

D/C		CURRENT COURSE WORK		DESCRIPTION	PRAC HOW	POSB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	S	LOCAL AREA NETWORK	INTRODUCE LAN	TRANSMISSION MEDIA ACCESS METHODS	N	N		
D	A		PROTEON'S PRONET-10	NETWORK CONFIG. SYSTEM UTILITIES COMMAND LINE UTIL. ELECTRONIC MAIL SYSTEM	N	(P)	(BY IOS)	ACOS-LAK
	I	INTRODUCTION	BACKGROUND TO ONLINE SYSTEMS		N	N		
	S		O/L VS. REALTIME SYSTEM		N	N		
	D		MEANING OF DB/DC AND DISTRIBUTED SYSTEM		N	P	BY DESIGN OF DISTRIBUTED SYSTEM	ACOS-ASTRA, PC
	4	COMMUNICATIONS PROCESSING HARDWARE	SWITCHING UNITS MULTIPLEXERS CONCENTRATORS		N	N		
		DATA COMMUNICATION SOFTWARE	TELEPROCESSING TRANSACTION HANDLERS	BASIC TRANSACTION HANDLERS COMPLEX TRAN. HAND. FOR COMM. NETWORK	N	P	BY DESIGN AND CONSTRUCTION OF DISTRIBUTED DB/DC SYSTEM	ACOS-ASTRA, PC
			COMMUNICATION MONITOR ARCHITECT.	SINGLE-THREAD MULTI-PARTITIONED	N	N		

D/C		CURRENT COURSE WORK		DESCRIPTION	PRAC NOW	POSIB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	I	COMMUNICATION NETWORK DESIGN	OUTLINE OF NETWORK DESIGN		N	N		
D	S		LEASED LINE SERVICE		N	N		
	D		PACKET SWITCHING		N	N		
	4		CIRCUIT CONFIGURATION DESIGN		N	N		
			CALCULATION OF NO. OF TERMINALS		N	N		
		RELIABILITY DESIGN	RELIABILITY CALCULATIONS	MTBF	N	N		
			RECOVERY SERVICE	CAUSES OF FAILURE	N	P	BY DESIGN & COST. OF DISTRIBUTED SYS.	ACOS-ASTRA, PC
		ESTIMATION	QUEUING THEORY		N	N		
			ESTIMATING PROCESSING ABILITY.		N	N		

D/C	CURRENT COURSE WORK	DESCRIPTION	PRAC NOW	POSIB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	INTRODUCTION TO THE UNIX SYSTEM	GETTING STARTED ON UNIX	Y			
D		UNIX FILE SYSTEM	Y			
S		VI EDITOR	Y			
2		UNIX SHELL	Y			
		DOCUMENT FORMATTER	N	P		
	UNIX COMMUNICATION	ELECTRONIC MAIL THE UUCP PROGRAMS USNET	N	P	BY UNIX COMMANDS	EMS. UNIX- EMS. UNIX
	THE C PROGRAMMING LANGUAGE		Y			
	UNIX SYSTEM ADMINISTRATION		N	P		
	UNIX SYSTEM PROGRAMMING		Y			
	ACOS4/MVP.XE	SYSTEM GENERATION	N	N		
		ACOS4 UNIX COMMUN.	N	P	BY ACOS UNIX COMMUN.	ACOS-PC

D/C		CURRENT COURSE WORK		DESCRIPTION	PRAC NOW	POSIB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	S	INFORMATION SYSTEM TRENDS IN S'PORE	FACTORY AUTOMATION(FA)		N	N		
D	D		OFFICE AUTOMATION(OA)		N	P	BY IOS	ACOS-IOS(LAN)
M	M		LOCAL AREA NETWORKING(LAN)		(Y)	P		
	1		DATA COMMUNICATION(DC)		N	P		
		SYSTEM CONFIGURATION	BASIC SYSTEM FOR O/L SYSTEMS		N	N		
			SYSTEM CONFIGURATION OF SPECIFIC SYSTEM	CONFIGURATION FOR FA, OA, LAN AND DC	N	P		ACOS-PC, ASTRA IOS AND LAN

APPENDIX. C DC CURRENT COURSEWORK

INVESTIGATION (AP COURSE)

D/C CURRENT COURSE WORK		DESCRIPTION	PRAC NOW	POSB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	BASIC COMMUNICATIONS THEORY	COMMUNICATIONS THEORY	N	N		
P		TRANSMISSION CODES	N	N		
O		BAUDOT CODE ASCII, EBCDIC	N	N		
L		TRANSMISSION MODES	N	N		
		PARALLEL SERIAL	N	N		
		SYNCHRONIZATION	N	P	BY PROTOCOL ANALYZER	ACOS-ASTRA, PC
		COMMUNICATION LINE	N	N		
	DATA COMMUNICATIONS NETWORK COMPONENTS	MODULATION TECHNIQUE	N	N		
		MODEMS	N	N		
		TERMINALS	N	N		
		DUMB, INTEL. TERM	N	N		
		INTERFACE STANDARD	N	N		
		RS232C, V24	N	N		
		MULTIPLEXERS	N	N		
		CONCENTRATORS	N	N		
		COMMUNICATION CONTROL PROCESSOR	N	N		

D/C		CURRENT COURSE WORK		DESCRIPTION	PRAC HOW	POSIB. TO PRAC	HOW TO PRACTICE	USED ENVIRON.
A	D	ERROR DETECTION & CORRECTION.	PROBLEMS OF LINE COMMUNICATIONS	BANDWIDTH NOISE	N	N		
P	C		ERROR CONTROL	FEEDBACK ERROR CONTROL	N	N		
	O		ERROR DETECTION	PARITY BIT BCC, CRC	N	P	BY P.A.	ACOS-ASTRA, PC
	L		ERROR CORRECTION	RETRANSMISSION	N	N		
		NETWORK PROTOCOL AND LINE CONTROL PROCEDURES	NETWORK CONFIGURATION	STAR, RING, HIERARCHICAL NETWORK	N	N		
			LINE CONTROL PROCEDURES	CONTENTION POLLING, SELECTING	N	P	BY P.A.	ACOS-PC
			BASIC PROCEDURES	HALF DUPLEX PROCEDURE	N	(P)	BY P.A. AND NEC STAND ARD LEVEL 2A, 2B	ACOS-ASTRA, PC
			HDLG PROCEDURES	DUPLEX PROCEDURE	N	P	BY P.A.	ACOS-ASTRA
		COMMUNICATION CARRIER FACILITIES	DIFFERENT NETWORK & SWITCHING SYSTEM	X25, SWITCHING DIGITAL TRANSMISSION	N	N		

4. Software Engineering Project

4.1 Introduction

The term "Software Engineering" was first used in 1968 during a conference organized by NATO countries. During the conference many renowned computer scientists voiced their concern about the "software crisis" - that as software were getting larger and more sophisticated the cost for the production of software was sky-rocketing and the quality of software had left much to be desired. Over the last two decades, the production technology of hardware has undergone many revolutionary changes. Hardware engineers, with automated tools and production techniques that change their way of working, are now able to produce highly reliable hardware with a very small cost. Standardized hardware components can be purchased off the shelf and assembled into products. There is no parallel changes in the production of software. Software engineers (or producers) until recently still use primitive tools - pencil and paper; and write programs in much the same way as before. However, much progress in software engineering has been achieved by researchers all over the world in the last few years.

In 1988, the National Computer Board had identified Software Engineering as one of the five specialized areas (besides telecommunication software, knowledge engineering systems, real-time systems and CAD/CAM) important in realizing the goal of making Singapore a software center. Subsequently, a task force was convened in late 1988 to study, besides other things, the specialized manpower needs for software engineering, and to appraise the current situation in terms of what has been done for software engineering in Singapore.

Some of the findings of the task force for software engineering are of great relevance to the courses conducted at the JSIST. For example, the task force thought that students of the various degree/diploma courses are not sufficiently exposed to CASE tools and rigorous studies of software quality measurement and assurance is lacking, although many of the Software Engineering topics are substantially covered in the courses. Improvements to the existing courses of the JSIST should be considered whenever possible so that our staff and students can benefit from the latest software engineering technology.

4.2 Aim and Objectives Of The Software Engineering Project

Aim : To enable the staff and students of the JSIST to gain more knowledge on the latest software engineering technology.

Objectives

- i. To expose the students and staff to as many new software engineering environments as possible by developing and demonstrating case studies useful in courses;
- ii. To teach the current software engineering methodologies, tools and techniques to students systematically and selectively;
- iii. To study and systematize the software engineering technologies.

4.3 Proposed Activities For The Project

A preliminary list of topics that normally come under software engineering was compiled. The coverage of software engineering by the advanced diploma course is also indicated. The list is by no means complete. However, it can be seen that the scope of software engineering is very broad, and various kinds of prerequisite knowledge that may not be possessed by the staff will be required. It is not quite possible to delve into all the topics by the project members. The following activities are therefore proposed:

(1) To study the following topics on software engineering:

- a. Prototyping technique using 4GL for example;
- b. Object-oriented Programming System and software reusability;
- c. Software Development Support Tools (CASE tools).

For item c, some CASE tools which are available at the institute may be used, although they are not integrated. For example, the POSE software that runs on PC. There are also LEX, YACC, make, SCCS etc on the UNIX.

For items a and b, work stations with the necessary support software such as Smalltalk and database system may be required.

(cf Table1)

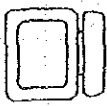
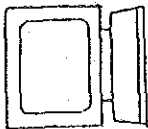


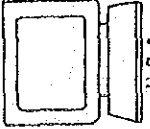
(2) To keep abreast of the major trends in software engineering in countries like Japan and United States. An example is the development of the Sigma Project in Japan.

(3) To document software engineering technology properly so that the knowledge is available to other staff and material may be used in courses.

TABLE. 1 NEW TOPICS ON SOFTWARE ENGINEERING

NO	TOPICS	SUBTOPICS	NOTES	REMARKS
1	<p>PROTOTYPING TECHNIQUE</p>	<p>FOURTH GENERATION LANGUAGES</p>	<p>◆The 4th GLs encompass a broad array of database query and reporting languages, program and application generators, and other very high-level, non-procedural languages. ◆The 4th GLs enable the software engineer to generate executable code quickly, they are ideal for rapid prototyping. Unfortunately the application domain for 4th GLs is currently limited to business information systems.</p>	<p>Theoretical and Practical Work (on PC/WS)</p>
2	<p>SOFTWARE REUSABILITY TECHNIQUE</p>	<p>OBJECT ORIENTED PROGRAMMING SYSTEM</p>	<p>◆OOPS creates a model of the real world that can be realized in software. (Class, Inheritance) ◆Reusability of program components is achieved by creating objects and operations inherited from a class. ◆Reusable software will be created not by building libraries of conventional procedures (subprogram libraries) but rather by building a catalog of "SOFTWARE ICs"-objects. (ex) Smalltalk-80, C++, Objective C</p>	<p>SAME AS ABOVE</p>
3	<p>DEVELOPMENT SUPPORT TOOLS</p>	<p>CASE (COMPUTER AIDED SOFTWARE ENGINEERING)</p>	<p>◆A system for the support of software development. ◆CASE combines software, hardware, and a software engineering database (a data structure containing important information about analysis, design, code, and testing to create a software engineering environment.</p>	<p>SAME AS ABOVE</p>

4.4 SYSTEM CONFIGURATION (Draft)

NO	TOPICS	'89 FY ENVIRONMENT		'90 FY ENVIRONMENT	
		HARDWARE	SOFTWARE	HARDWARE	SOFTWARE
1	Prototyping Technique Using 4GLs	 APC-IV	Micro FOCUS	 WS*	Under UNIX OS (***) Informix-4GL
2	Object Oriented Programming and Software Reusability	 APC-IV	(***) Smalltalk/V	(***) WS* XEROX 6411 UNIX WS HP 9000 (HP-UX) SONY NEWS	(***) Smalltalk-80 Objective-C C**
3	Software Development Support Tools (CASE Tools)	 APC-IV	(***) POSE (Picture Oriented System Environment)	 WS* HP 9000 (HP-UX)	(***) HP Teamwork Stp (Software Through Pictures)

(*This plan is not confirmed)

4.5 STAFF ASSIGNMENT

NO	ITEMS		LLs	JEXs
1	NEW	PROTOTYPING TECHNIQUE BY USING 4GLs	PETRUS TAN	K. DEGUCHI
2	TOPICS ON	SOFTWARE REUSABILITY (OBJECT ORIENTED PROG- RAMMING SYSTEM)	GOY TECK HUI SALLY LEOW YONG	Y. HAYASHI
3	SE	SOFTWARE DEVELOPMENT SUPPORT TOOLS (CASE TOOLS)	GOY TECK HUI VIRGINIA CHAN QUEK NGUAN TUAN	Y. HAYASHI
4	SURVEY AND ANALYSIS ON SE WORLD TREND		ALL LLs(SE-Proj) (*SALLY LEOW YONG)	*K. DEGUCHI Y. HAYASHI
5	SYSTEMATIZATION ON SE		ALL LLs(SE-Proj) (GOY TECK HUI)	*Y. HAYASHI K. DEGUCHI

4.6 Schedule

The Long Term Schedule of SE Project (tentative)

ITEMS	'89 FY												'90 FY												Remarks
	I			II			III			IV			I			II			III						
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12				
Prototyping Technique	Basic Study Detailed Study Preparation of LN (Practical Work)												TRIAL (on WS) Review SUMMARY												☆ End of Technology Transfer
New Topic on SE	Basic Study Detailed Study Preparation of LN (Practical Work)												TRIAL (on WS) Review SUMMARY												
Software Reusability (OOPS)	Basic Study Design of Com. System Preparation of LN (Practical Work)												TRIAL (on WS) Review SUMMARY												
Software Development Support Tools (CASE Tools)	Basic Study Design of Com. System Preparation of LN (Practical Work)												TRIAL (on WS) Review SUMMARY												
Survey and Analysis on SE world Trend	SURVEY 1 DOCUMENT 1 SURVEY 2												DOCUMENT 2 SURVEY 3 DOCUMENT 3 SUMMARY												
Systematization on SE	Topic 1 Topic 2 Topic 3 Topic 4 Topic 5												SYSTEMATIZATION OF SOFTWARE ENGINEERING Topic 6 Topic 7 Topic 8 Topic 9 Topic 10												

[APPENDIX]

(A-1)

(A-1) Topics of Software Engineering Covered In AD Course	Subject	Extent
Software Lifecycle Models COCOMO models	SDM2	
Software Prototyping	SDM1	*(brief)
Project Management	SDM2	
Software Project Planning and Control		
Project Structure	SDM2	**
Functional format		
Matrix format		
Management techniques		
CPM		
PERT	SDM2	***
Project Team Organization	SDM2	
Programming in the small		
Programming in the large		
Chief Programmer Team		
Democratic Team		
Hierarchical Team		
Software Project Cost Estimation		
Software Economics		
Programmer Productivity		
SLOC	PMP2	***
Object code	PMP2	***
Document Volume	PMP2	***
Function Point index		
Cost Estimation Techniques		
Configuration Management	SDM2	***
Software Contract	SDM2	
Software Requirements Analysis		
Structured Analysis	ISD2	***
Software Requirements Specification		
Specification Techniques		
Structured specification	ISD	
Formal Specification		
The Schema Language		
Petri nets		
Software Design Methodology		
Fundamental concepts		
Abstraction		
Information hiding		

Structure		
Modularity		
Concurrency		
Verification		
Coupling and cohesion	PMP1, ISD2	***
Design Techniques		
Structured Design	ISD2	***
Object Oriented Design		
Jackson System Design	ISD2	***
Vienna Design Methodology (VDM)		
Higher Order Software (HOS)		
Design Notations		
Data Flow Diagrams	ISD1	
Structured Charts	ISD1	
HIPO charts		
Procedure Templates		
Pseudocodes		
Structured Flowcharts		
Structured English		
Decision Tables	ISD1	
HOS		
E-R model	ISD1	
Programming		
Stepwise Refinement	PMP1	
Structured Programming	PMP1	**
Jackson Structured Programming		
Warnier-Orr Method		
Concepts		
Programming Language concepts		
Data encapsulation		
GOTO statement		
Recursion	PMP2	***
Programming style		
Program Representation		
Flowcharts		
NS charts		
HIPO chart		
Human Factor Engineering		
User Psychology		
Interface Design		
Graphic		
Icon		
Software Quality		
Software science		
Software Metrics		
Usability		
Reliability		

Complexity		
Testability		
Correctness		
Robustness		
Maintainability		
Portability		
Structuredness		
Reusability		
Modifiability		
Efficiency		
Software Verification and Validation		
Quality Assurance	SDM3	
Software audit		
Walkthrough, inspection	PMP2	***
Documentation		
Correctness Proof		
Input output assertions		
Weakest Preconditions		
Structural Induction		
Software Testing		
Test Plan		
Test Procedure		
Test Methods		
Top-down approach	PMP2	***
Bottom-up approach	PMP2	***
White-box methods	PMP2	***
Black-box methods	PMP2	***
System Testing	PMP2	***
Software Maintenance		
Standards		
IEEE standards, U.S.A		
European Standards		
IEE standards, Britain		
Standards of the Ministry of Defence, Britain		
Standards of Department of Defence, U.S.A		
Software Tools		
Concepts of Programming Environment		
Tools for Systems Analysis		
POSE (Picture Oriented System Environment)		
Execelator		
PSL/PSA		
Tools for Design		
Structured Chart Editor		

Tools for Program Production

Structured Editor

MAKE

PMP2 ***

LEX

YACC

Program code generator

Tools for version control

SCCS

Tools for Program Testing

Test data generator

MMF **

Debugger

PMP2 ***

Program Profiler

Automatic programming/software automation

THE LIST OF TOPICS ON SOFTWARE ENGINEERING

TOPICS NO	ITEMS	CONTENTS
1	SOFTWARE AND SOFTWARE ENGINEERING	<ul style="list-style-type: none"> ·The importance of Software ·Software ·Software Crisis ·Software Engineering Paradigm
2	SYSTEM DEVELOPMENT METHODOLOGY	<ul style="list-style-type: none"> ·The Classic Life Cycle Model ·IE(Information Engineering)
3	MANAGEMENT TECHNIQUE	<ul style="list-style-type: none"> ·Project Planning ·Software Cost Estimation ·Managing Development Process ·Project Team Organization
4	REQUIREMENT ANALYSIS METHODS	<ul style="list-style-type: none"> ·Structured Analysis ·Specification Techniques
5	SOFTWARE DESIGN	<ul style="list-style-type: none"> ·Fundamental Design Concepts ·Design Notations ·Design Techniques
6	IMPLEMENTATION	<ul style="list-style-type: none"> ·Structured Coding Techniques ·Coding Style ·Programming Language Features
7	TESTING	<ul style="list-style-type: none"> ·Testing Techniques ·Testing Strategy
8	SOFTWARE MAINTENANCE AND CONFIGURATION MANAGEMENT	<ul style="list-style-type: none"> ·Enhancing Maintainability ·Managerial Aspects of Software Assurance ·Configuration Management
9	SOFTWARE QUALITY ASSURANCE	<ul style="list-style-type: none"> ·Software Quality And Software Quality Assurance ·Software Quality Metrics ·Software Reliability
10	SOFTWARE ENGINEERING ENVIRONMENT	<ul style="list-style-type: none"> ·Software Engineering Environment Today and in the Future ·The Future of Software Engineering Environments Technology

5. CAI

5. 1. PURPOSE

For the last two years, there have been a tremendous increase in the student population in JSIST under the Singapore Polytechnic umbrella. As a result, it is difficult to achieve close interaction between lecturers and students in a big classroom. So far, JSIST has been very successful in teaching students on how to use computers. However, we have not been doing much in using computer to teach our students. Therefore, there is a necessity to look into CAI (Computer-Assisted Instruction) to complement conventional teaching. As JSIST is itself a computer training institute, our institute should eventually move itself to be a centre of excellence in CAI.

5. 2. CURRENT STATUS AND TRENDS

CAI was only introduced last year, it has created a lot of enthusiasm among the staff. Continued interest among staff is to sustain the success in a CAI project in JSIST. It is also our goal to eventually involve all the lecturers to develop coursewares of their specialties. The use of CAI in JSIST will continue to be supplemented.

JSIST being a computer training institute should develop more expertise in the field of Computer Assisted Instruction. By including the intelligence element, we hope to move aggressively into the field of ICAI

5. 3. SYSTEM CONFIGURATION

Currently, we have four sets of NEC PC-SCAI multimedia systems in which two are authoring systems and two are student systems. This system is versatile in supporting

various media, such as graphics, text, voice and image. The only shortcoming of this PC-SCAI system is that the entire authoring system was written in Japanese. Nevertheless, two coursewares are now being developed, namely Japanese Language and ATSS (Advanced Time Sharing System of NEC System 630 mainframe).

The other authoring system that we have in our institute is SCENARIO which runs on IBM compatible. It basically has graphics and text media. With an interface card (optional), it can be connected to video tape or video disc player. There are more than 90 sets of NEC APCIV IBM compatible in our institute. The subject identified for development on this system is "Introduction to Computer and Data Processing" for the Diploma in Programming and System Analysis Course.

5. 4. LONG-TERM PLAN

A CAI team was formed to implement the CAI project in JSIST. In order to achieve the goal of becoming the centre of excellence for CAI. The following plans were drawn up:

a. Courseware acquisition and improvement

Once the decision is made to use CAI and the objectives have been determined, the most significant question to be answered is whether to purchase the necessary courseware or to try to develop ourselves.

There are several advantages in purchasing CAI courseware. First, courseware is usually reasonable in price. Second, a minimal time is required to acquire and learn to use it.

The disadvantages, unfortunately, are almost as formidable as the advantages are enticing. First and foremost, the quality of courseware available commercially is not uniformly high, and there are few reliable sources from which qualified courseware reviews are available. Secondarily, but still of some importance, is the fact that most programs do not permit users to make modifications. Finally, the courseware

contents may not meet our syllabus requirement.

Developing courseware, of course, also has its advantages and disadvantages. The main advantage is having courseware that meets the specific objectives of a project. Equally important, modifications can be made until the courseware meets specific standards of quality and constantly update the courseware to meet the ever changing information technology.

Developing CAI courseware is a significant undertaking. The tailored courseware, if it is to be of high quality, requires knowledge of the subject matter, learning theory and instructional strategies, principles of motivation, microcomputer design technology, and perhaps computer programming. It is unusual for one person to have sufficient knowledge in all of these areas. Therefore, a team approach composed of specialists in the four areas is usually required.

b. Staff training

The key to success in CAI is staff training. Continued upgrading is a necessity to keep abreast with the current technology.

Training will consist of

- i. lectures given by short-term Japanese experts on CAI;
- ii. attending CAI seminars;
- iii. sending staff to Japan for CAI training (NEC Technical College).

The continued support from the top management is vital to the success of CAI in JSIST.

c. Development and utilization of courseware facilities

To ensure proper implementation of CAI in JSIST, the following management issues must be settled prior to the implementation:

i. Addition of PC-SCAI systems are needed for both authoring system and student system. This is to increase the number of sets to match the machine-student ratio of 1:5.

ii. A CAI-room is required to house the microcomputers.

iii. Since most of the coursewares will be developed by the CAI team, a CAI course development room is recommended for creating a conducive environment to produce high quality coursewares.

iv. Who will be responsible for the courseware, the security of the hardware and course.

d. Documentation

All the CAI coursewares should have the technical documentation. Technical documentation is intended to assist in understanding how the courseware was developed and how it could be modified. Consequently, this could be our methodology on how to develop a good quality courseware.

e. Survey and analysis on CAI technology trend

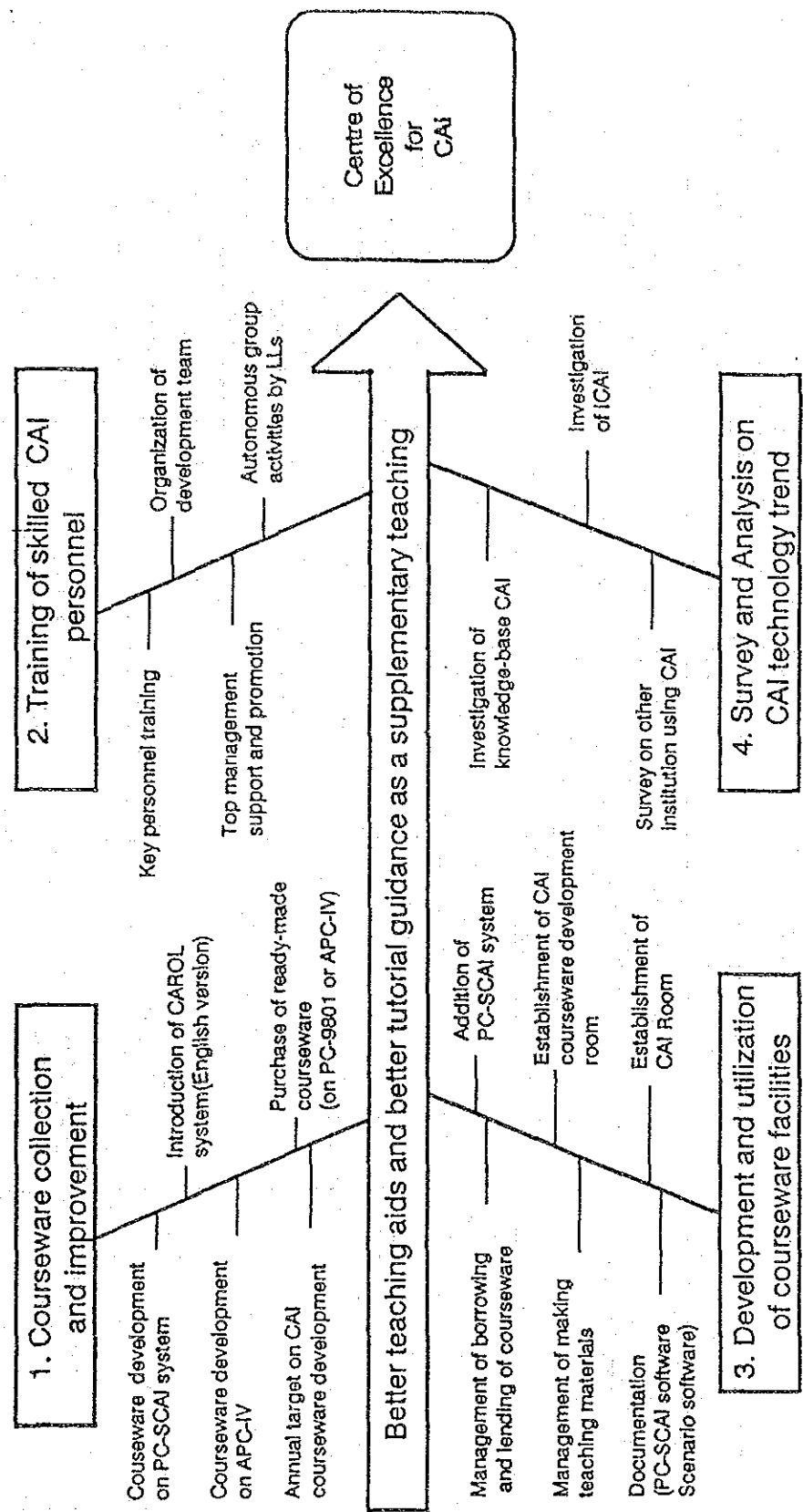
As a consequence of the rapid progress and major new developments that are taking place in artificial intelligence and human-computer interaction techniques, a number of other important areas of CAI have been emerging over the last few years. The most important of these newly emerging areas are ICAI (intelligent CAI); and KBCAI (knowledge-based CAI).

As a centre of excellence in CAI, it is inevitable that the intelligent element be included.

5. IMPLEMENTATION

The two charts follow summaries the implementation plans as proposed by our long-term expert Mr. Hayashi. Dr Sato, a short-term expert in CAI has reviewed these plans and made suggestions.

The Long-term Planning of CAI Project in JSIST



The Planning by Year

No	Item	'88 financial year	'89 financial year	'90 financial year
1	Annual objectives	<ol style="list-style-type: none"> 1. Technical transfer on making courseware 2. Development of prototyped courseware and trial system 3. Key-man training 	<ol style="list-style-type: none"> 1. Courseware collection and improvement on PC-SCAI system and APC-IV 2. Development and utilization of courseware facilities (ex. establishment of CAI room and CAI courseware development room) 3. Training of Skilled CAI personnel 	<ol style="list-style-type: none"> 1. Courseware collection and improvement on PC-SCAI system and APC-IV. 2. Development and utilization of courseware facilities. 3. Training of Skilled CAI personnel
2	CAI courseware collection and improvement making courseware purchasing of courseware	<ol style="list-style-type: none"> 1. Prototype ("ATSS" & "Japanese Language") 2. Trial system ("ATSS" & "Japanese Language") 	<ol style="list-style-type: none"> 1. To make courseware which is useful for improving teaching materials. The number of courseware 1). 3 on PC-SCAI 2). 3 on APC-IV 	<ol style="list-style-type: none"> 1. To make courseware which is useful for improving teaching materials. The number of courseware 1). 3 on PC-SCAI 2). 3 on APC-IV
3	Training of skilled CAI Personnel	<ol style="list-style-type: none"> 1. PLATO (CDC).....1 2. CAROL System...3 <p style="text-align: center;">Number of persons 6 for PC-SCAI 1 for APC-IV Total : 7</p>	<ol style="list-style-type: none"> 1. PLATO (CDC).....3 2. CAROL System...3 (English version) <p style="text-align: center;">Number of persons (additional) 1 for PC-SCAI 8 for APC-IV Accumulated : 14.</p>	<ol style="list-style-type: none"> 1. CAROL System ...3 (not confirmed) (English version) <p style="text-align: center;">Number of persons (additional) 1 for PC-SCAI 5 for APC-IV Accumulated : 20</p>
4	Development and utilization of courseware facilities	<ol style="list-style-type: none"> 1. PC-SCAI 4 sets (2 sets authoring system 2 sets student system) 2. APC-IV 1 set (mainly used for developing courseware) SCENARIO software 	<p><Establishment of CAI room and CAI courseware development room></p> <ol style="list-style-type: none"> 1. Addition of PC-SCAI system (2 authoring sets) 2. Allocate space for CAI room and CAI courseware development room 3. Management of borrowing and lending of courseware 	<p>This matter should be discussed in detail among local lecturers and Japanese experts.</p>
5	Survey and Analysis on CAI technology trend	CAI seminar or meeting by short-term expert.	Survey on other Institutions using CAI	Survey on CAI technology trend

5. 6 WORK ASSIGNMENT

Topic	Name	Remarks
1. Mathematics	Mr. Ho	APC4*
2. COBOL	Ms Esther/Ms Chia/Ms Leong	APC4*
3. Japanese Language	Ms Aeba/Ms Geraldine Tye/Mr. Leow	PC-SCAI
4. Intro to Computer and Data Processing	Ms Josephine Leong	APC4*

*Skool Box

TITLE		SCHEDULE CHART												REV.	DATE	PREPARED BY	APPROVED BY	PAGE					
CAI																							
1.	Trial System ① (1) "JAPANESE" (2) "ATSS"	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
			Coding	Review																			
2.	Trial System ② (1) "COBOL" (2) "Introduction of Computer Processig"																						
3.	Trial System ③ (1) "Japanese (2) "Mathematics																						
COMMENTS																							

6. THE REINFORCE OF COMPUTER SYSTEMS

6.1 OUTLINE OF UTILIZATION

- (1) Magnetic Disk Units, Input/Output Channels and Mass Storage Processors added to ACOS System 630 (S630)

We install Input/Output Channels and Mass Storage Processors in order to prevent terminal response time from becoming longer because of installation of new terminals, APCM Powermate 1'S, and the connection between S630 and ASTRA370VS (ASTRA).

At the same time, Magnetic Disk Units are installed to provide the space for new softwares and teaching materials.

- (2) EWS4800/20 (EWS)

We offer the environment for UNIX communication by means of installing two EWSSs, which have functions based on UNIX System V, and connecting them to BRANCH4680 (branch type LAN based on IEEE802.3, such as Ethernet) in order to reinforce the practice of UNIX. Then connecting 6 existing APC's to two EWSSs, we can use subset of EWS's functions from an APC.

And an EWS is set in JSIST as a spare unit. We must note this EWS can be taken away whenever it is needed to maintain another EWS or itself.

- (3) ACOS softwares

We make it possible to survey the practice concerning applied mathematics by means of installing statistical packages such as SPSS-X and STATPAC, and simulation packages, i.e. GPSS/V and DYNAMO/F, and so on.

- (4) A Unit Record Processor added to S630 and Communication Control Units (CCUs) newly attached to ASTRA.

We make it possible to practice techniques, e.g. communication, system development and project management, concerning development of the system which extends over plural computers. In actual, ASTRAs are connected to S630 and we can communicate on the protocols of NEC level 4 (corresponds to HDLC) or NEC level 2B (corresponds to Basic). Then 3 existing APC's are connected to an ASTRA and communication softwares are installed to them. In future 12 APC's can be connected to 3 ASTRAs.

- (5) BRANCH 4670I (B4670I) and APCM Powermate-1s (APCNP's)

We offer the environment of the development of teaching materials for practice of Micro Mainframe Link function, a case of communication systems.

(6) Japanese word processor "BUNGO 5M"s (BUNGOS).

We try to communicate with S630 from BUNGOS in order to show that BUNGOS can also realize MML function eventhough they are installed for the education of Japanese language.

(7) Protocol analyzer CAS81

CAS81 can be used for certificating contents of lectures about communication protocols by means of monitoring data on line. At this time ,it is installed for preparing teaching materials.

(The above-mentioned is applicable to PH1, PH2.1 and PH2.2. Please refer Long Range Schedule.)

(8) 27 APC# Powermate-1s added to S630

Concerning item (5), these are installed for the practice of students.

(9) 4 protocol analyzer CAS81s

Concerning item (7), these are installed for the practice of students.

(10) PC9801-RX2s(PC9801s) and softwares

PC9801s are used for the development of CAI teaching materials, and softwares, e.g. PLATOs and GENKI, are used for trying to newly develop teaching materials.

(The above-mentioned is on application as PH3 and has not decided.)

*** PHI H/W CONF. LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
N7265-11	MASS STORAGE PROCESSOR	2	ACOS	P2CR
N7756-21E	MAGNETIC DISK UNIT	2	ACOS	P2CR
N9756-21E	DUAL ACCESS FEATURE	2	ACOS	P2CR
N9147-07	INPUT OUTPUT CHANNEL	2	ACOS	P2CR
N9147-08	I/O CHANNEL EXPANSION A	1	ACOS	P2CR
N4014-21	BASIC UNIT	3	EWS	TR3
N4014-76	MAIN MEMORY (8MB)	9	EWS	TR3
N7832-22	CRT (20" COLOR)	3	EWS	TR3
N9832-13A	KEYBOARD	3	EWS	TR3
N9832-32A	MOUSE	3	EWS	TR3
K207-41(03)	PRINTER CABLE	3	EWS	TR3
K207-06(01)	RS232C CABLE	6	EWS	TR3
K207-02(03)	RS232C CABLE	3	EWS	TR3
K207-31(03)	DISK(CGMT) CABLE	3	EWS	TR3
N7689-81	CGMT	3	EWS	TR3
N7376-41	SERIAL PRINTER	3	EWS	TR3
N9376-31	TRACTER FEEDER	3	EWS	TR3
MSG-6000	TAP TRANSCEIVER	3	EWS	TR3
MSG-5418	BRANCH CABLE	3	EWS	TR3
MSG-5189	TRUNK CABLE (10CM)	1	EWS	TR3
MSG-5194	EARTH TAP	1	EWS	TR3
MSG-5192-004	TERMINATOR	2	EWS	TR3
MSG-5192-001	CONNECTOR TYPE N	2	EWS	TR3
N9832-92A	TABLE	3	EWS	TR3
	TRANSFORMER	3	EWS	TR3
N4205-05	IOC	3	EWS	TR3
APC-H4910	RS232C FOR APCIV	6	EWS	TR3, SR

*** PHI S/W CONF. LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
U40701	GPSS/V	1	ACOS	P2CR
U40694	MPS	1	ACOS	P2CR
U42141	TMAIL	1	ACOS	P2CR
U42726-10	DS/POESY	1	ACOS	P2CR
U40697	STATPAC	1	ACOS	P2CR
U40698	CLUSTER	1	ACOS	P2CR
U40699	CROSS	1	ACOS	P2CR
U40704	MDAS	1	ACOS	P2CR
U40702	DYNAMO/F	1	ACOS	P2CR
U47203	SPSS-X	1	ACOS	P2CR
	WSOS10	3	EWS	TR3

*** PH2.1 H/W CONF.LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
N7232-11	UNIT RECORD PROCESSOR	1	ACOS	P2CR
N9147-07	I/O CHANNEL	3	ACOS	P2CR
N7236-60	ICP TYPE B	1	ACOS	P2CR
N7943-11	B4670 II PROCESSOR	1	ACOS	P2CR
N7943-12	B4670 II PROCESSOR(EXT.)	1	ACOS	P2CR
N9236-62	LINE ADAPTER TYPE V24	2	ACOS	P2CR
N9236-51	LINE ADAPTER V24 FOR ICPA	1	ACOS	P2CR
DATAX S19.2 MINI II	MODEM (WITH TRANSFORMER)	12	ACOS	P2CR
MSG-5966	TERMINATOR BOX-A	22	ACOS	P2CR
MSG-5955	BRANCH BOX	60	ACOS	P2CR
MSG-5969	TRUNK CONNECTOR	150	ACOS	P2CR
MSG-5227	TRUNK CABLE (1M)	1500	ACOS	P2CR
APC-H4570	SIF BOARD	12	APCIV	R2
APC-H2010E	APC POWERMATE 1	3	APCIVP	SR
APC-H4370	POWERMATE MULTISYNC II	3	APCIVP	SR
APC-H4100E	KEYBOARD	3	APCIVP	SR
APC-H4450	VGA	3	APCIVP	SR
APC-H4900	PRINTER CABLE	3	APCIVP	SR
N7286-31	CCU	3	ASTRA	R3
N9286-32	CCU CABLE	6	ASTRA	R3
MSG-0840	SIF CABLE (1M)	150	ASTRA	R3
MSG-0841	SIF CONNECTOR	24	ASTRA	R3
N5152-25A	BUNGO 5M	2	JWP	SR, ADM
N5152-26	DISPLAY	2	JWP	SR, ADM
N5155-27	KEYBOARD	2	JWP	SR, ADM
N5153-23	PAGE PRINTER	2	JWP	SR, ADM
N5152-76	OPTION FOR PAGE PRINTER	2	JWP	SR, ADM
N5235-10	MOUSE	2	JWP	SR, ADM
N5152-77	GOTHIC FONT	2	JWP	SR, ADM
N5152-80	MOUHITSU FONT	2	JWP	SR, ADM
N5152-62	OUTLINE FONT	2	JWP	SR, ADM
N5159-04	COMMUNICATION CABLE	2	JWP	SR, ADM
N5266-02	IMAGE READER	2	JWP	SR, ADM
DATAX SP1212AA	MODEM (WITH TRANSFORMER)	3	JWP	SR, ADM
	TRANSFORMER	2	JWP	SR, ADM
CAS-81	PROTOCOL ANALYSER (WITH CASE)	1	OTHERS	N. A.

*** PH2.1 S/W CONF.LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
U42725	RIQS/EPL	1	ACOS	P2CR
U42109	COM-XE	1	ACOS	P2CR
U42703	PC SERVER	1	ACOS	P2CR
U86009-20	APCIV LOCAL WORKSTATION EMULATOR	12	APCIV	R2
U86011-40	APCIV-ASTRA FILE TRANSFER	12	APCIV	R2
	ETOS-52GDC	12	APCIV	R2
U86505	EGGEN	30	APCIVP	TR3
APC-S4300	MS-DOS V3.3	30	APCIVP	TR3
U86005-17	DISTRIBUTED PROCESSING UTILITY	3	ASTRA	R3
U86008-17	ITOS/NET	3	ASTRA	R3
	CLUSTER EMULATOR	3	ASTRA	R3
U16490-95	WORD PROCESSOR SOFT S	2	JWP	SR, ADM
U16490-85	DOCUMENT FILE CONVERTER	2	JWP	SR, ADM
U16490-51B	BUNGO PLAN	2	JWP	SR, ADM
U16490-54B	BUNGO CARD	2	JWP	SR, ADM
U16490-52B	BUNGO DRAW	2	JWP	SR, ADM
U16490-55B	BUNGO IMAGE	2	JWP	SR, ADM
U16490-72	SPELL CORRECTOR DICTIONARY	2	JWP	SR, ADM
U16491-53	BUNGO TRAN II	2	JWP	SR, ADM
U16491-56	BUNGO PC-VAN	2	JWP	SR, ADM

*** PH2.2 H/W CONF.LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
MSG-6144	REPEATER-M	5	ACOS	P2CR
MSG-6146	REPEATER-S	5	ACOS	P2CR
APC-H4550	NETWORK INTERFACE BOARD	30	APCIVP	TR3
APC-H4950	NETWORK INTERFACE CABLE	30	APCIVP	TR3

*** PH2.2 S/W CONF.LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
U86502A	ETOS 52GB	30	APCIVP	TR3
U86521	IOS/WS	30	APCIVP	TR3

*** PH3 H/W CONF. LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
APC-H2010E	APCIV POWERMATE 1	27	APCIVP	TR3
APC-H4370	CRT DISPLAY	27	APCIVP	TR3
P5300	SERIAL PRINTER	27	APCIVP	TR3
APC-H4100E	KEYBOARD	27	APCIVP	TR3
CAS-81	PROTOCOL ANALYSER	4	OTHERS	N.A.
CAS-81-1	FLOPPY DISK	4	OTHERS	N.A.
PC-9801RX2	CPU	3	PC9801	TR3
PC-KD853N	CRT DISPLAY	3	PC9801	TR3
PC-PR201V2	SERIAL PRINTER	3	PC9801	TR3

*** PH3 S/W CONF. LIST 19/03/1989 ***

TYPE	DESCRIPTION	QUAN	GROUP	PLACE
	COOP BASICS	1	OTHERS	N.A.
	COOP X25	1	OTHERS	N.A.
TAPE86	DATA COMMUNICATION	1	OTHERS	N.A.
	PLATO COURSEWARE(PASCAL)	1	PC9801	N.A.
	PLATO COURSEWARE(ADA OVERVIEW)	1	PC9801	N.A.
	PLATO COURSEWARE(ADA PROGRAMMING)	1	PC9801	N.A.
	HD SYSTEM	1	PC9801	N.A.
	GENKI	1	PC9801	N.A.

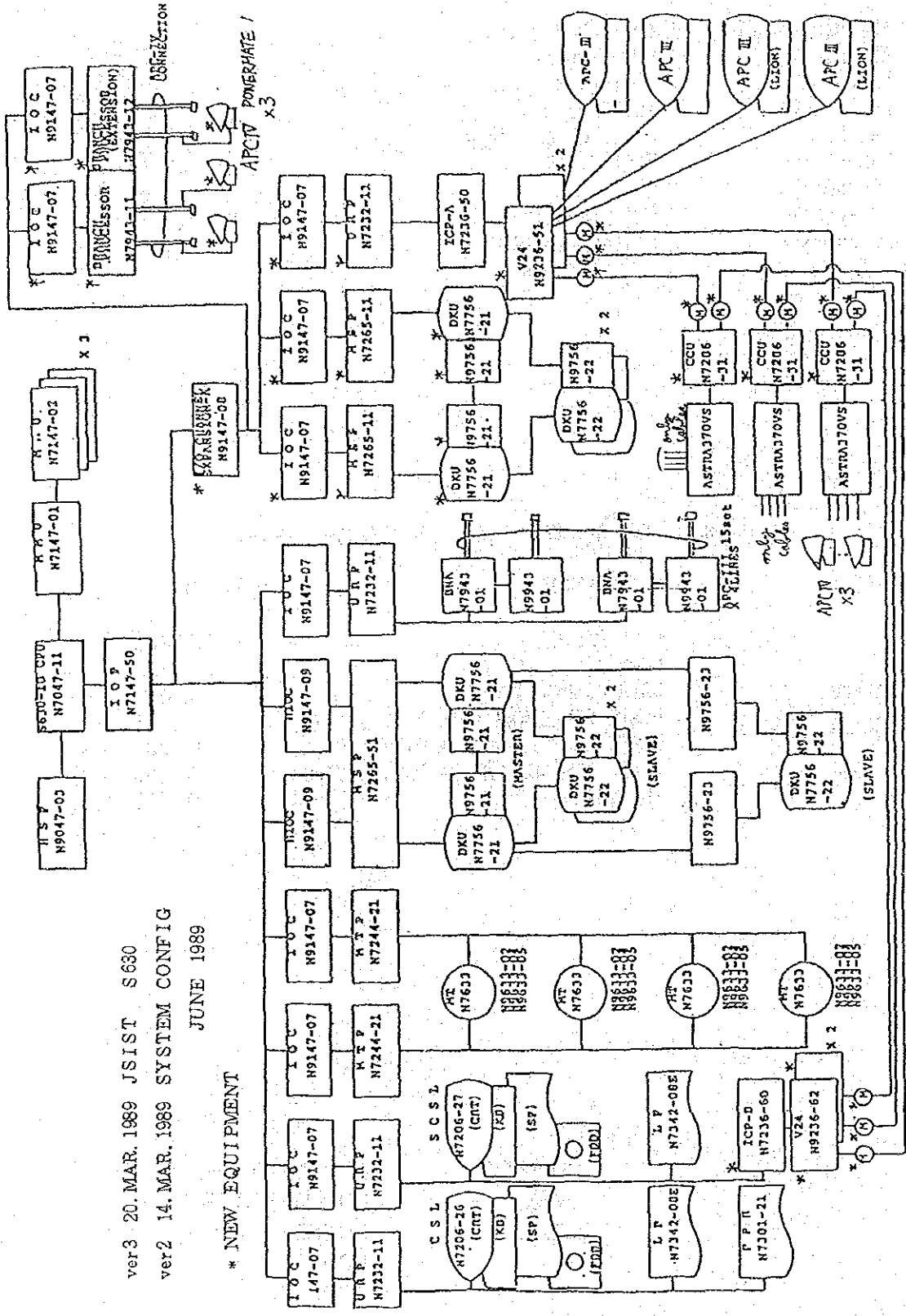
PLACE

ADM
N. A.
P2CR
R2
R3
SR
TR3

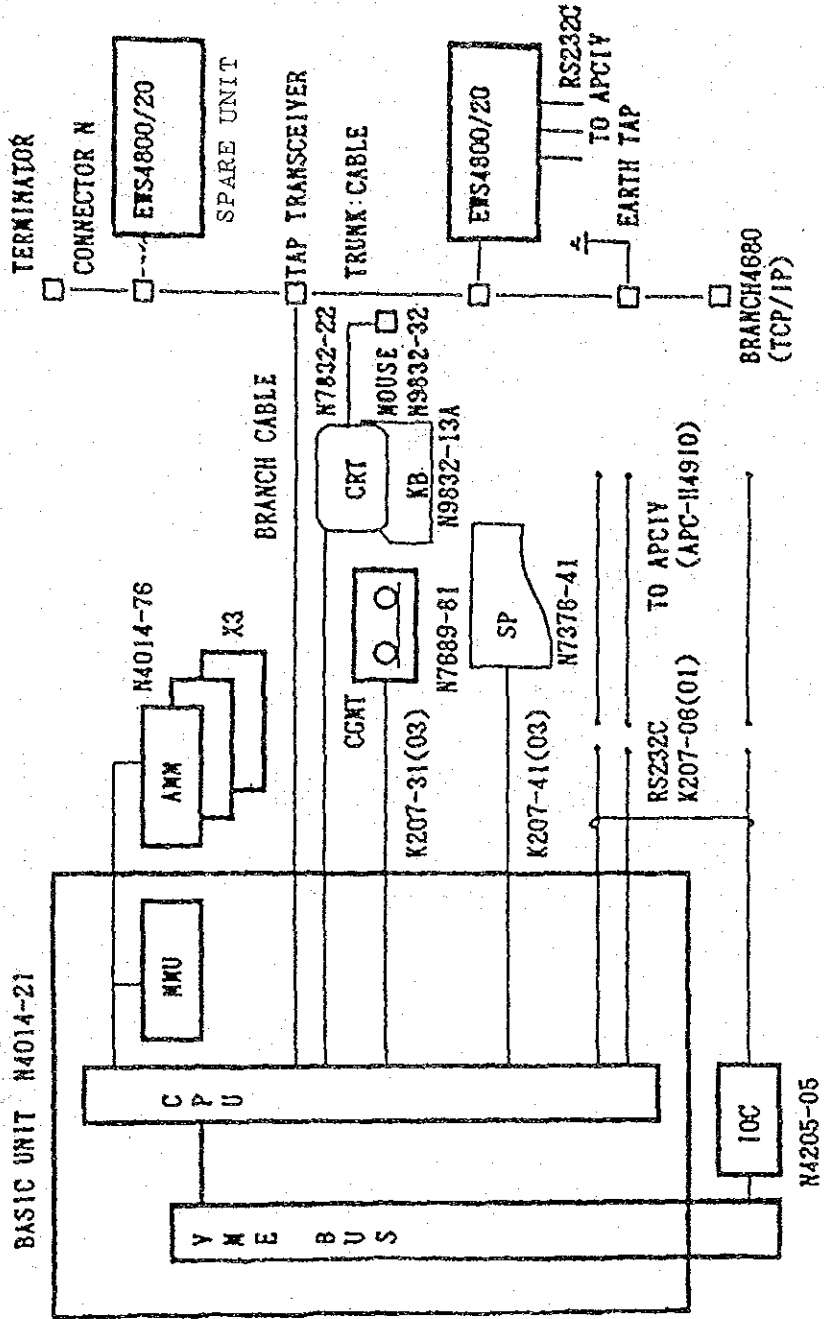
ADMINISTRATION OFFICE
NOT APPLIED
PHASE 1 COMPUTER ROOM
ROOM 2
ROOM 3
STAFF ROOM
TERMINAL ROOM 3

ver3 20. MAR. 1989 JSIST S 630
 ver2 14. MAR. 1989 SYSTEM CONFIG
 JUNE 1989

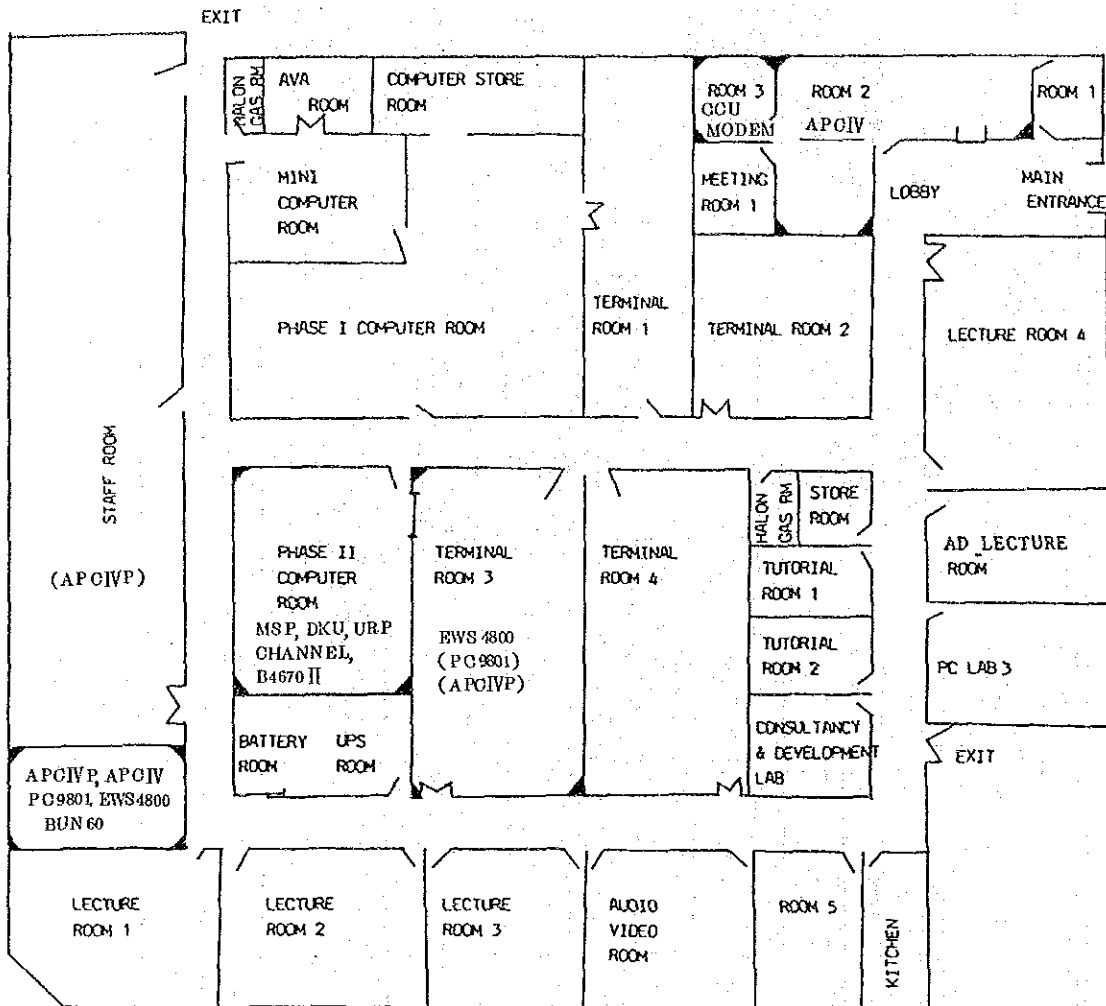
* NEW EQUIPMENT



ENS4800/20 H/W DIAGRAM

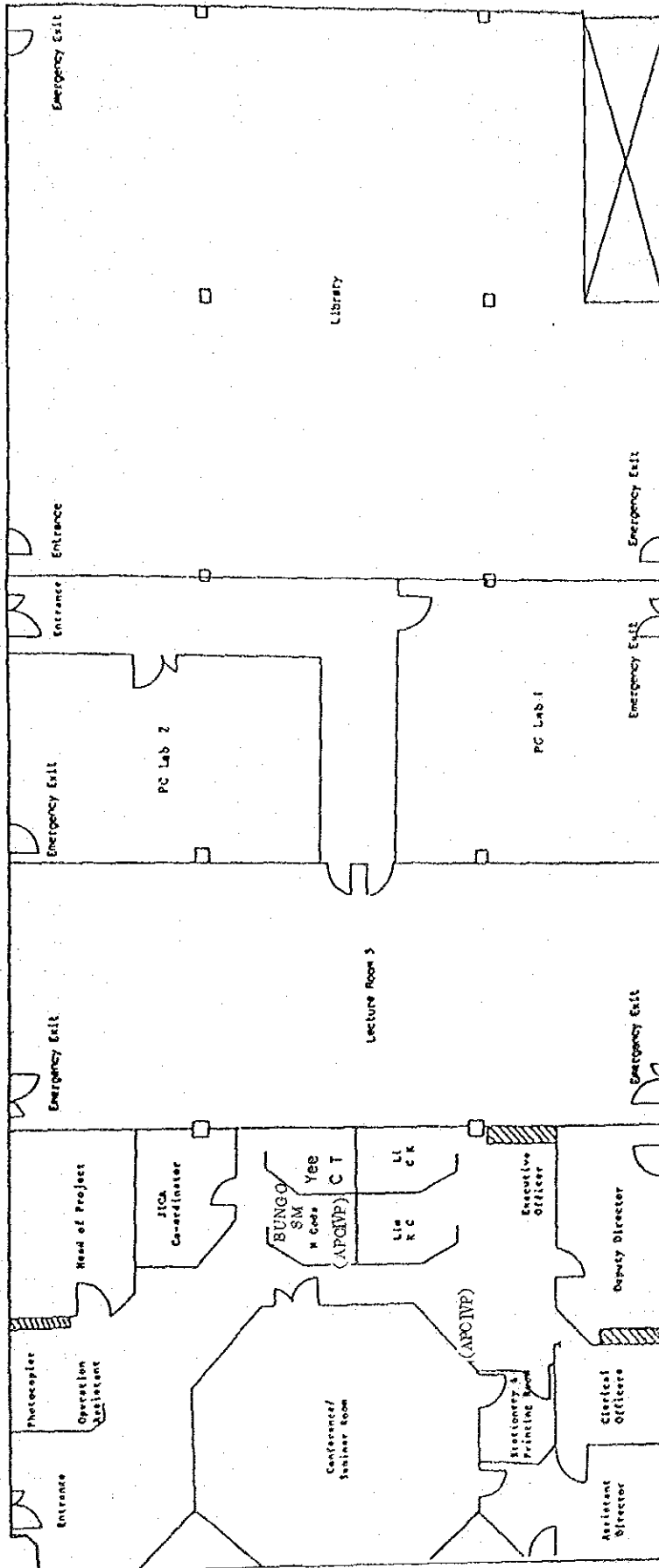


FLOOR PLAN OF JSIST #12-11



— is to be moved in.
 () will be installed at PH3 May be on DEC. 1989

FLOOR PLAN FOR JSIST NEW PREMISES #12-09/15, #12-08/16 & #12-07/17



Long range schedule of donated equipments ver.2 21.MARCH.1989

NO	ITEM	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUAR	MARCH	NOTES
		1	FY'88 Phase 1 Equipments	112	122	112	112	122	112	123	122	112	122	
2	FY'88 Phase 2 Equipments	307	418	529	630	741	852	963	074	185	296	407	518	
3	FY'89 Equipments	← Transportation and installation												
4		← Ditto												
5		← Ditto (CAI)												
6		← Ditto (others)												On applying, not decided
7														
8														
9														
10														
11														
12														
13														
←	The delivery to JICA													← The end of installation