

● Spring 1981

Jipdec Report

**Japan Information Processing
Development Center**

**1980 Trends in Japan's Computer Industry
Some Examples of Typical Japanese Applications**



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1980 Trends in Japan's Computer Industry Expanding Market and Greater Competition

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The Most & More, Inc.

Trillion Yen Computer and Semiconductor Industries

1980 marked the emergence of two trillion-yen industries in Japan, computers and semiconductors. To be more precise, computer industry production amounted to 1.1 trillion yen in 1979, and is estimated at 1.3 trillion yen in 1980. Semiconductor industry production was 600 billion yen in 1979, will probably be 900 billion yen in 1980, and 1.2 trillion yen in 1981.

A number of people in the business see the achievement of the trillion yen mark as proof of the amazing growth and scale of these fields. Both industries are still young. Computer production started around 1960, while in the case of the semiconductor industry, production of transistors began in the late 1950s, followed by ICs ten years later, and then LSIs, so it took the industry a period of a little more than 20 years to reach its present state. Both industries see the 1980s as a period of full-scale expansion, and as future mainstay industries of Japan, much hope rests on their growth.

The reason they are considered promising is that with the development of VLSIs, etc. the integration of computers and semiconductors will allow even more rapid growth than before, bring about more social benefits and have an even greater impact on society as a whole.

On the other hand, the scale of the Japanese market is another thing that must be

taken into consideration along with production. Market size can be calculated from production, export and import figures. These figures show that in 1979, the Japanese computer market was approximately 1.2 trillion yen, and the semiconductors market approximately 650 billion yen. In both industries, imports exceeded exports. In conventional trillion yen industries, such as steel, automobiles, and consumer electronics, etc., there is a strong tendency toward reliance on exports whereas in the computer and semiconductor industries, at least at the present time, the market structure is more balanced.

Behind this is the strong competition that exists in these fields, especially the powerful sales offensives on the attractive Japanese market made by American firms, in particular.

Japanese Market Growth of 70% in 5 Years

As stated, the computer market here was 1.2 trillion yen in 1979. Industry figures for 1974, five years earlier, were: production, 589 billion yen; imports, 144.8 billion yen; and exports, 18.8 billion yen, so the market was 715 billion yen. In the ensuing five-year period, therefore, the market grew by approximately 70%, a rapid rate of growth. In 1975, all restrictions (relating to computers) on foreign capital and imports and imports of technology were lifted, and

foreign firms were given free access to the Japanese market. Some American mainframe firms already had Japanese bases, and in addition independent peripheral equipment firms, software houses, minicomputer and SBC (Small Business Computers) makers, and the like, who up till then had only had branch offices or agents in Japan, began setting up wholly-owned subsidiaries and actively marketing their products.

However, Japan's large computer makers such as Fujitsu, Hitachi, NEC, etc., in combination have, on a smaller scale, the corporate characteristics of IBM, DEC, and TI. Fujitsu, NEC and Oki Electric make communications equipment, and Hitachi, Toshiba, and Mitsubishi Electric produce heavy electrical equipment and consumer appliances, making them general electronic enterprises. When their affiliated firms and financing groups are included, the extent of their activities is considerable and their business base strong. In addition to this, office equipment firms such as Ricoh, Canon and Casio have begun active participation on the SBC market, intensifying the competition.

The majority of domestic makers, having a better understanding of the situation in Japan, are in a superior position. It took more than 10 years of hard work before Japanese consumer electronic products and automobiles were accepted on the American and European markets.

If a company's timing in producing what suits Japanese users' needs is good and its products are price and performance competitive, the huge scale of the market means that even a foreign capital firm has a good chance of success. In fact, there are some importers, Memorex Japan being one, with annual sales around 10 billion yen. Sales of imported software are also growing.

However, it must be said that foreign firms are rather slow in catching on to Japanese

users' needs, in general. Sometimes it is obvious that they are having trouble keeping up with the rapid market changes here.

Right now, Japanese-language information processing systems are gaining popularity on the market.

The modern computer was first developed in the United States, and used the Latin alphabet. Later, computers that could handle the katakana syllabary in addition to the alphabets made their appearance.

At the beginning of the 1970s, stand-alone Kanji processing systems were developed, but with a price tag of over 100 million yen, they were only used in a few financial institutions, securities firms, government offices, and computing centers.

However, with the technical advancements and dramatic cost-reductions made possible by semiconductors, it became possible by 1978 to make a small business computer priced at 6 million yen, that could handle 6,000 kanji characters. This was Toshiba's TOSBAC System 15. With a 6,000 kanji capacity, more than 98% of everyday Japanese could be handled. This development meant that information processing technology utilizing computers was released from its conventional form and given the means to integrate with Japanese culture. From the Japanese point of view, this is nothing short of revolutionary.

Focus on Japanese Language Processing Technology

Considerable research was carried out in 1979 and 1980 on distributed data processing, data bases, and data communications, and user interest started increasing. In my opinion, however, such interest was always posited on Japanese-language processing being possible.

In 1979, three firms, Fujitsu, NEC, and IBM Japan, unveiled general purpose Japanese information processing systems, for incorporation in an operating system. These were

followed by other mainframe makers, such as Hitachi, Ltd., Mitsubishi Electric, Nippon Univac, Burroughs, and NCR. One example, a system called JEF, produced by Fujitsu, consists of a laser kanji printer, and kanji display. On Fujitsu's M Series, the JEF is being operated by more than 200 users. Also, at the Tokyo head office of the Asahi Shimbun, with the cooperation of IBM Japan, they have managed to do away with "hot-lead" in the production of morning and evening newspapers (about 40 pages per each day) by using a cold type system (CTS) formed by linking a computer to a phototypesetting machine. The system was put into full operation from October, 1980.

This surging interest in computers dealing with the Japanese language comes at the same

time as an almost feverish boom in office automation, and the interaction between the two has given it a firm base. All domestic mainframes and closely related distributed data processing systems (equivalents to the IBM 8100) that have been unveiled since 1979 have been equipped with Japanese-language processing capabilities.

Also, as shown in Figure 1, new products developed from 1978 to 1980 stress kanji capabilities: For example, of the 45 domestic SBCs which were brought out in 1979, 18 could handle kanji, and this rose to 28 out of 46 in 1980. The price of Japanese-language SBCs is 20% to 30% higher, but already account for half of some manufacturers' shipments.

The same is true in the case of word processors, which are a necessity in office auto-

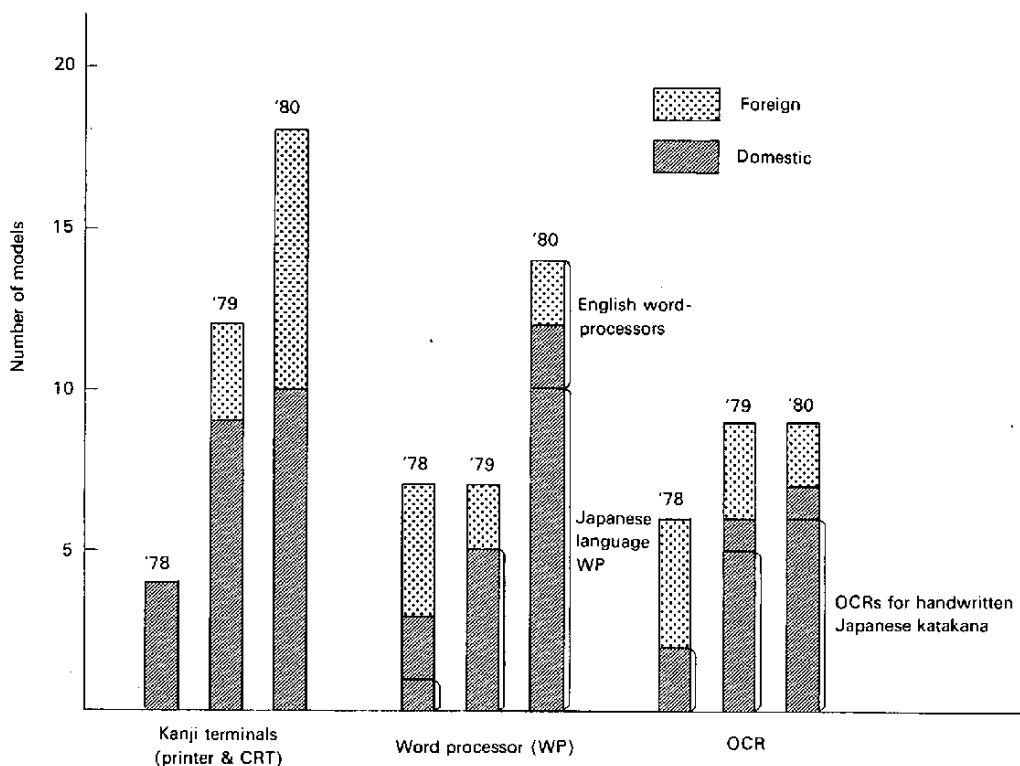


Fig. 1 Kanji terminals, word-processors and OCRs marketed in 1978-1980

mation. All five of the domestic word processors brought out in 1979, and ten of those brought out in 1980, used the Japanese language. In 1978, the year in which Japanese-language word processors were first put on sale, the Japan Business Machine Industry Association predicted a 10 billion yen market for them by 1983, but with 4 billion yen expected for 1980, the 10 billion yen mark is more likely to be passed by 1981. 1980 is said to mark the beginning of the 'Age of Office Automation,' and domestic producers are setting up special development and sales divisions for office automation, making models showing the relationship between computers and terminal equipment and starting an overall approach to strategy.

At any meeting of users, one can hear questions about office automation, and there is no doubt that interest in the subject is very high. However, there are also those who fear that office automation may go the way of the MIS (Management Information Systems) boom that came and went so quickly in the latter half of the 1960s.

As far as Japanese language processing is concerned, in office automation and other fields, there arise many technical problems which are not encountered with conventional alphabetic processing, and which have yet to be solved. Also, it is necessary for Japanese-language processing to meet the requirements of typical Japanese business methods and customs. The end result of the realization of these goals is considered to be something quite different from the information processing methods that are sometimes termed the Latin or IBM culture, that have been in use up to now. Japanese-language information processing technology would have to be based on independent Japanese technology, and may be a good chance for Japanese companies to obtain bargaining power in the field of information processing. As such, Japanese-language

processing technology is a field that holds bright hopes for the industry.

Foreign Companies Under Pressure to Meet Japanese Users' Needs

By and large, foreign companies that are marketing in Japan have not been able to respond sufficiently to Japanese-language information processing requirements. IBM Japan is the only mainframe producer that has provided Japanese-language handling capability in an operating system. With this, the processor can print out kanji, like an ordinary line printer. Univac has an off-line kanji printer for this. NCR and Burroughs have no kanji printers faster than 1,000 LPM. All they have are some terminals with Japanese capability, one range of Japanese SBCs. Nippon Univac is selling three Japanese SBC models made by Mitsubishi Electric under an OEM agreement.

All three firms are working on a kanji system subordinate to their operating systems, but will probably need a little more time until they are able to start shipments.

Other than mainframers, Data General Japan, and Wang have also brought out Japanese-language systems. As can be seen from the figure, in 1979 and 1980 combined, there were only five foreign-made SBCs with Japanese-language capability, and no foreign-made Japanese-language word processors. The number of foreign kanji terminals was also low. The market requirements are for OCRs that can recognize handwritten katakana, but there were no such foreign products.

Whether it because foreign companies do not have the organization to accurately gauge Japanese users' needs, or because their sales organization is lacking is not clear, however there is a definite need for them to research the Japanese market comprehensively and improve their sales systems. The fact is that methods which increase sales in the United States will not necessarily have the same result in Japan

when applied in exactly the same way. But Japanese-language processing technology may be a prerequisite to penetrating the Japanese market.

Foreign Mainframers Rush Response to Japanese Market

A feature of 1980 was the number of foreign companies, mainly mainframers, which set up research and development centers and manufacturing facilities in Japan. IBM Japan started work on expanding its Fujisawa Plant with the ultimate aim to roughly double in its present scale, and it has also reinforced its Yasu Plant to increase production of its 4300 Series and start production of its 3081 Processor. It is also said to be preparing for the integrated production of semiconductors beginning in 1983. For this, outside financing is being considered for the first time in the company's history. Japanese firms are making much use of the agency system for SBCs, to cover the whole market, and at GBG they are considering developing a similar agent store system, which includes office automation equipment.

Nippon Univac is selling the Univac Series 80 (OUK Series 80), which is produced here by Oki Univac, a joint venture of Oki Electric and Sperry Univac. Also, as Sperry Univac's production base, Oki Univac is exporting discs and data input devices, and has started talks with Sperry on producing the Univac's large 1100 Series in Japan. The company may build a separate plant, and wants to be able to bring out new or modified products that meet the needs of the Japanese market, promptly and with good timing.

In 1979 and 1980, Burroughs opened two small development centers, mainly for software, while one was opened by Burroughs Japan. When Michael Blumenthal, Burroughs chairman, came to Japan in November 1980 (when he was still vice-chairman), he announced at a press conference that early in the

1980s the company intended to build in Japan a computer and semiconductor plant possessing R & D facilities. He intends to come to Japan again in March 1981, for more concrete talks, and a decision may also be taken on a site. Burroughs is thinking of establishing a production base in Japan, Like IBM Japan, to export its products throughout the world.

NCR Japan already has a plant in Oiso, and is to start production there mainly of terminals suited to the particular needs of the American market.

In July 1968 DEC set up a branch office in Japan to handle sales, and it is said the company plans to establish a wholly-owned corporation in Japan in the summer of 1981. In the fall of 1979 Data General put money into Japan Mini-computer, which is February 1980 changed its name to Data General Japan and beefed up its Gyoda plant, in line with a policy to increase production of the Eclipse and other systems it makes here, so as to respond to the needs of users. Other companies which have set up Japanese corporations include Prime, which has a line of 32-bit minicomputers, and Cray, which specializes in super-computers. CDC Japan opened up a center in Japan's highest building, Sunshine 60, for its Cybernet scientific and technological remote computing service, and started providing this service in July. And in November, in a move to strengthen sales, the CALL service, which had previously been operated by DSFE (Data Services Far East), was organized by CDC Japan to form an integrated marketing system. It has also started development work on Plato, a Japanese-language system aimed at education-conscious Japan. At the end of 1981 the Cybernet Center is scheduled to install the Cyber 205, the world's most powerful system, which will be used to provide a service specializing in design calculations relating to nuclear power, electric power and construction.

Thus, foreign mainframe manufacturers and

related enterprises are firming up their plans to build up organizations aimed at the lucrative Japanese market of the 1980s.

IBM Japan's 3081 Price Pressure

A major announcement of 1980 was that of IBM Japan's 3081 processor. IBM's move started with the 1979 announcement of the E series (4300) and wound up in 1980 with the H series. That is, for these two years, other mainframers making corresponding machines were knocked off balance by the E and H series. The 4300 series was so low-priced that the impact on plug-compatible CPU makers was considerable, sinking Intel and hitting Amdahl hard, to name but two. In addition to this there was a boomerang effect on IBM itself, causing a drop in the company's profits for the first time in 18 years.

It was probably because of this, it is said, that a slightly higher price was announced for the 3081 than for the 4300. On a MIPS basis, equivalent processors worked out at about \$324,000, or about 30% more than the 4300's \$250,000. The 3033 was also about 30% more expensive than the 3081.

This all refers to America. In Japan the situation was slightly different to that of the States. With the variations in the dollar-yen exchange rate, the price in Japan varies depending on the dollar rate decided on.

Looking back, though, what it amounted to was that IBM Japan set a price for Japan that was very aggressively competitive. That is, the price was fixed very close to the Stateside dollar rate. Also, as the prices of the 303X were not reduced, from the viewpoint of 303X users the 3081 was a very cheap, attractive computer.

In Japan, surveys show that close to 60% of IBM systems are rented or leased, so outright purchasers (including thirdparty leasing) are a minority. Furthermore, according to a user who ordered two 24MB 3081 processor models, the monthly leasing charges came to ¥49.9 million, whereas the 12MB and 8MB 3033Us they were replacing cost ¥61.72 million, so the 3081s, with far more channels and a much greater memory capacity, cost them ¥11.82 million less per month. As a result one month after the announcement IBM had well over a hundred back orders.

A comparison of cost performance between the 8MB 3033 and the 16MB 3081, on an outright purchase basis, shows a ratio in America of 1:1.3, whereas in Japan it is 1:2, a considerable difference. This is because in Japan the price of the 303X was not reduced, and when the 3033 came out the price in Japan was 24% cheaper, as the exchange rate at that time, \$1=¥220, was used to calculate this price; also, compared to this model, the 16MB 3081 was cheaper on a purchase or a 4-year lease basis.

With regard to the domestic makers' response to the 3081, two months before the 3081 announcement NEC announced its ACOS system 1000, which has a better performance. On a MIPS basis Hitachi's M-200H and Fujitsu's M-200 outperform the 3081, but it seems they are hard put to compete pricewise, and seem very likely to announce new models by the middle of 1981. Both companies look forward to the realization of a low-priced giant computer, which will stimulate the market to greater growth and, viewed in the long term, will be to the advantage of the industry.

Table 1 Mainframes marketed in 1979-1980

Target	Models marketed in 1979		Models marketed in 1980		Mar-keted	Shipped	Memory capacity (MB)	Price (¥1,000/month)
4331-1	ACOS	250-60			2.79	7.79	0.256~1	545
	IBM	4331-1			3.79	6.79	0.5, 1	389
	FACOM	M-130F			4.79	6.79	0.5, 1	400
	FACOM	M-140F			4.79	7.79	0.5~2	765
	NCR	8455			5.79	11.79	0.384~1	280
	NCR	8555M			5.79	8.79	0.5~2	500
	HITAC	M-140H			6.79	1.80	0.5~2	650
			OUK	80-50	4.80	12.80	0.256~1	
4331-2	MELCOM	COSMO700S			2.79	8.79	1~2	1,400
	FACOM	M-150F			4.79	12.79	1~4	1,490
	NCR	8565M			5.79	1.80	1~3	730
	NCR	8575M			5.79	11.79	2~4	1,250
	Burroughs	B2930			5.79	6.80	0.5~1	
	HITAC	M-150H			6.79	1.80	1~6	926
	Univac	1100-60B			6.79	12.79	2~4	
	ACOS	350			10.79	7.80	1~4	900
			IBM	4331-2	5.80	12.80	1~4	986
4341-1	MELCOM	COSMO700III			2.79	8.79	2~4	3,400
	IBM	4341-1			3.79	6.80	2, 4	1,468
	FACOM	M-160F			4.79	12.79	1~6	2,340
	NCR	8585M			5.79	12.79	2~6	2,090
	Burroughs	B3950			5.79	7.80	2~5	
	HITAC	M-160H			6.79	1.80	1~6	1,732
	Univac	1100-61			6.79	12.79	2~4	
	ACOS	450			10.79	7.80	2~6	1,740
			Univac	1100-61E	10.80	6.81	2~4	
4341-2	ACOS	550			10.79	1.80	4~8	5,500
			Univac	1100-62E	7.80	6.81	4~8	
			IBM	4341-2	9.80	9.81	2~8	2,210
			Burroughs	B5930	10.80	8.81	1.5~6.2	
			FACOM	M-170F	11.80	2.81	4~16	
303X	Univac	1100-62			6.79	12.79	4~8	
	IBM	3033N			10.79	3.80	4~16	15,749
	MELCOM	COSMO900II			12.79	1.81	2~8	7,000
			IBM	3033AP	6.80	7.80	4~16	34,971
			Burroughs	B6920	7.80	4.81	2.3~6.3	
			Burroughs	B6930	7.80	4.81	3.1~6.3	
"H"			ACOS	1000	9.80	10.81	8~64	23,000
			IBM	3081	11.80	12.81	16, 24, 32	25,575

Price is the rental price of the basic processor with basic memory (which may include channels).

Source: Computer Dynamic Report

Table 2 Very large computers

	NEC ACOS1000	IBM 3081	Fujitsu M-200	Hitachi M-200H	IBM 3033	Amdahl 5860
Announcement	80.9	80.11	78.1	78.9	77.3	80.11
Shipped	81.10	81.40	78.12	80.1	78.6	82.4
MIPS	15	10	7.5	8	5	12
Number of processors	1~4	2	1~4	1~4	1, 2	1, 2
Logic element	LSI	LSI	LSI	LSI	MSI	LSI
a. Gates/chip	200	704	100	550	50~60	400
b. Speed (ns)	0.5	1~2	0.7	0.7		
Buffer memory (KB)	128	64(32 × 2)	64	64	64	64(32 × 2)
Main memory UP	8~64	16, 24, 32	2~32	4~16	4~16	16, 24, 32
(MB) MP	8~64		4~64	8~16	8~32	16, 24, 32
Bits/chip	64	16	16	16	4	
Maximum number of channels	64	24	64	48	16	36
Channel throughput (MB/S)	30	72	20	26	20	50
Pipeline control	○	×	○	○	○	○
Incorporated array processor	○	×	×	○	×	×
	(Standard)			(Option)		
Disc/Cash	○	×	×	×	×	×

Table 3 IBM Japan's dollar rate

Model	Marketed	Rate vis-a-vis U.S. IBM's price (yen)	Exchange rate at time of announcement (yen)	Rate difference
3033	March 1977	290	281	3.2 %
3031	October 1977	280	256	9.4
8100	October 1978	240	184	30.4
4300	March 1979	230	206	11.7
3081	November 1980	220	213	3.3

Table 4 Principal New Products of Mainframe Companies in 1980

Month	Company	Details
January	IBM Burroughs NEC	5280 intelligent data system to replace 3740. B90 small business computer (SBC), B1900. N6370L OCR usable as N6300-50N intelligent terminal work station.
February	Hitachi NEC Hitachi Mitsubishi Electric IBM	Japanese-language information processing system KEIS, H8172 2,700 lpm laser printer, T560-20 kanji display system. Japanese-language processing SBCs, the NEAC system 150II, 100II, 50II. OCR, the HT5503-12, capable of reading hand-written kana. POS system, MELPOS. 5120 SBC.
March	Hitachi Mitsubishi Electric IBM Univac Mitsubishi Electric IBM Univac	8-inch disc DK801 series, for OEM. Japanese-language processing SBCs, MELCOM 80 series models 18, 28, 38. In the 3850 MSS, 12 new 3851 MSF models. Japanese-language processing SBC, Series 8 (hardware purchased from Mitsubishi Electric on an OEM basis). Japanese-language processing system, M8270 3,700 lpm kanji printer, image-processor with built-in CPU. 12M and 16M models of 3033-N processors.
April	Hitachi Univac NEC Fujitsu IBM Burroughs NCR Fujitsu Oki Electric Fujitsu Toshiba NEC NEC	UTS 5000 kanji display system, 0793-02/03 14,000 lpm laser kanji printer (developed jointly with Mitsubishi Electric). Automatic voice synthesizer system for use in elevators. OUK Series 80 small computer (Univac Series 80). N6300-50N intelligent terminal with Japanese-language word processing function (cluster word processor), NWP-20 Japanese-language word processor (stand-alone type). FACOM 2740J Japanese-language intelligent terminal. Model 4331-2 processor. Japanese-language information processing system, Burroughs Modular Terminal (BMT) equipped with Japanese-language printer and display, the B90 Japanese-language processing SBC. NCR 2140-7000 POS terminal. OASYS 100 Japanese-language word processor. Letter Mate 8 Japanese-language word processor. SBC with 8-inch disc—the FACOM System 80 Model 5. JW-10II Japanese-language word processor. General disc cash memory (16M-32M MOS memory) which allows data access from disc to be speeded up by up to ten times. Voice recognition device which can recognize the speech of non-specified speakers over the telephone. The first user, Sumitomo Bank, will use it for account balance enquiries.
May		

Month	Company	Details
June	CDC	Cyber-205 and Cyber 170-740 super computers.
	IBM	3033AP, 3380, 3375 disc, MVS/SP.
	Fujitsu	FACOM V-850 (having Japanese-language and word processing capability), designed to compete with IBM's S/38.
	Hitachi	APL terminal T560-20 display.
	Fujitsu	Graphic display FACOM 9430.
July	Toshiba	Japanese-language processing SBC—TOSBAC System 15 Models 15, 25, 35, 45.
	Burroughs	B6900 large computer.
	IBM	Addition of Japanese word processing function to its Japanese-language information processing system.
	Univac	1100-62E multi-processor system.
	NCR	Comten 3650, 3690 (compatible with IBM 3705).
August	Fujitsu	Computer and terminal software for NTT's data packet switching service.
	Hitachi	IBM 3380 compatible disc, the H8598.
	NEC	N7384 3,300 lpm laser kanji printer.
	Univac	POS system UNIPOS 6000 (OEM purchase from Mitsubishi Electric).
	Fujitsu	FACOM 6315A & 6312E OCRs, capable of reading handwritten kana.
September	Hitachi	HR-200 voice recognition device, capable of recognized linked words of non-specified speakers.
	Toshiba	TOSBAC DP-8 distributed data processing system, which is compatible with the IBM 8100. (Can also handle Japanese-language processing.)
	NEC	ACOS System 1000 giant computer, with a maximum memory of 64MB.
	Hitachi	HITAC E800 series 32-bit minicomputer (sold by Hitachi as a distributed processing system like the IBM 8100).
	Fujitsu	1-megabit FBM 545 bubble memory.
October	IBM	Model 4341-2 processor.
	Hitachi	HITAC L-320, models 30H & 50H SBCs with Japanese-language and word processing capability.
	Burroughs	B5900 and B900 small computer.
	NCR	NCR I-8140, I-8151 SBC.
	Mitsubishi Electric	M2860 8-inch disc.
November	Toshiba	MK80F 8-inch disc.
	Fujitsu	FACOM M-170F, competitive with IBM 4341-2.
	Fujitsu	FACOM 4900, competitive with IBM 8100.
	NEC	NEAC System model 150, competitive with IBM S/38. (Japanese-language processing also possible.)
	NEC	N6370S handwritten kana OCR.
December	IBM	3081 processor.
	Burroughs	CP9500 communication processor.
	NCR	Japanese-language information processing system, I-8290
	Hitachi	Japanese-language processing SBC.
	HIS	Japanese word processor.
December	Fujitsu	Dps 8/62, 44D.
	NEC	FACT II series automatic cash transaction unit.
	Univac	MS70 32-bit minicomputer.
	NCR	UTS400 Kanji display system.
		NCR2950 intelligent terminal.

Japanese-Language Information Processing Systems: Present and Future

Shohei Nishida. Computopia

The most important event in the EDP business in Japan in 1980 was the practical introduction of information processing in the Japanese language.

Japanese-language information processing means that data can be input, files stored and output printed in sentences written in the mixture of Chinese characters and Japanese syllabary which is in everyday use in Japan. This may seem only natural, but in actual fact, since the introduction of computerization to Japan, with a few exceptions, this type of processing has not been possible.

Before elaborating on the reasons for this here, we must first touch on some of the special characteristics of the Japanese language itself.

Written Japanese is composed of ideographic Chinese characters (kanji) and the phonetic Japanese syllabary (kana). These kanji and kana are both kinds of ideograms. While it is possible to write using only the 46 kana (48 if we include the old forms as well), they have the drawback of being extremely difficult to read rapidly. On the other hand, kanji are so numerous that it is said that there is no dictionary large enough to hold them all (the largest dictionary extant contains about 60,000 different characters). Furthermore, each character is not limited to only one reading, but normally has at least 2 or 3 different readings.

There are also two types of kana: hiragana

for writing everyday expressions, and katakana for writing words such as those of foreign origin. Consequently Japanese is an exceedingly complicated language, and not readily suitable for computer processing.

As a result, the EDP in Japan began with kana (katakana) and English letters and numerals, and while users were somewhat dissatisfied, they put up with the situation. Of course, special kanji systems did exist in those fields where kanji were absolutely necessary, but they were very expensive and lacked compatibility with the general purpose system. Newspaper and publishers were among the first users of these special kanji system. The introduction of kanji processing systems then spread to local governments and to the financial world (life insurance companies, trust banks, securities firms, etc.). The introduction of kanji systems into computer centers has also been actively promoted in an effort to obtain contracts for information processing for such users.

Kanji processing on the part of these users is suitable for such tasks as processing of information about citizens (issuance of resident cards, printing of tax notices, etc.), direct mailing, directories, securities agents, personnel management, etc. In brief, kanji processing systems have developed in those fields through necessity from a legal or operational stand-

point, or from the viewpoint of customer service.

Naturally, however, there had also been continual calls from other users in general for a kanji processing system (EDP processing in Japanese written in the combination of Chinese characters and Japanese syllabary normally used*). Setting aside the unpleasant feelings on the part of the public at receiving direct mail advertising printed in kana, and the nuisance of having one's name printed incorrectly in kana on one's license and then being told that it cannot be helped because it was processed by computer, there was also the possibility that even if an enterprise went to the trouble of introducing a computer and carrying out management information control, computing power would not be fully exploited, as management would not look through material printed only in kana.

This explains the need for a general purpose Japanese-language EDP system.

Other reasons for the sudden heightened interest in Japanese-language processing were the spread of distributed systems and the beginnings of an office automation boom. Distributed systems expanded the circle of people involved in EDP from EDP room personnel, who took kana processing systems for granted, to on-the-job workers (sales and office staff) who were averse to kana and took kanji processing for granted. Moreover, office automation pointed the way to a combination of data processing and word processing using the normal Japanese language. The need for Japanese-language processing increased rapidly owing to these people who were becoming involved with EDP for the first time.

*The terms 'kanji processing system,' 'Japanese-language processing system,' 'Japanese processing system,' etc. used hereafter have the same meaning.

Japanese-language Information Processing Began with Small Business Computers

Proof of this is the fact that general purpose Japanese-language processing systems first become a reality in (small business computers). That is, in the same way that EDP was spread to on-the-job workers by the use of distributed processing systems, the spread of small business computers down to the ranks of the smaller enterprises produced a new type of user—people who up until then had had absolutely no connection with computers. In contrast to EDP personnel in major enterprises who accepted kana processing modes because it gave them a certain kind of exclusivity, or who were resigned to its use, these new users were strongly opposed to kana processing. In addition, many of the smaller enterprises which made up this new sector of user were in the retail and service industries, and so there was a strong demand for kanji processing customer information control, which has top priority in any business strategy.

It was these needs together with the advances made in kanji processing technology that resulted in the appearance of (small business computers with a kanji processing function). In November 1977 Japan Business Computer Co. Ltd., which was originally a dealer, put on the market the first kanji small business computer, the "JBC Series-1 Kanji," followed in May 1978 by Toshiba's "TOSBAC Kanji System 15," thus opening up the way for a boom in kanji small business computers. At this stage many manufacturers still doubted whether use of kanji small business computers would become widespread, because of the cost involved, the slow printer speed, and other such problems. However, stimulated by the number of orders received by the first two companies, from early 1979 other manufacturers such as Fujitsu, Uchida Yoko, Oki Electric Industry, Sharp Corporation, Casio, Canon Inc., and

Matsushita Electric entered the kanji small business computer market.

The appearance of kanji small business computers was delayed owing to the following reasons:

1. A high-precision dot matrix printer was considered necessary in order to print complex kanji.
2. Input modes involved a number of difficulties (the problem mentioned above of how to input written material using at least several thousand kanji, and up to several tens of thousands if an attempt is made to cover all kanji).
3. Preparing dot patterns for so many kanji was very difficult.
4. The fact that memorizing these dot patterns would necessitate an enormous memory capacity.
5. Software had to be reappraised.
6. Carrying out the above measures would increase the cost.

These main difficulties were solved as follows:

1. Electromechanical means resulted in advances in printer technology and lower costs.
2. Single stroke kanji input using the book system.
3. Completion of preparation of dot patterns.
4. A striking reduction in memory-related costs and an increase in capacity (higher-density), a result of the lower cost of IC memories, increases in floppy disk capacity, and the appearance of 8-inch Winchester disks.

The cost is approximately twenty per cent higher than that of kana systems, but, encouraged by users' emphasis on quality rather than cost, kanji computers are rapidly replacing out the kana computers of the past.

Bringing Computers to the Public

From the above it is clear that the move towards Japanese information processing star-

ted with distributed processing systems and office computers. However, kanji computers are stand-alone systems and while there is no doubt that they will have a greater impact than the special kanji systems, mentioned earlier, which are used in the newspaper and printing industries and in the financial world, the scale is not enough to revolutionize Japan's EDP business in general.

This brings us to a discussion of the main topic of this article, general purpose Japanese-language information processing systems: it is these systems which will revolutionize Japan's EDP business. To put it another way, computers have taken real root in Japan for the first time through the appearance of Japanese-language information processing systems, and computer utilization by the Japanese-language information processing system has finally given the nation the technology which until now it had to borrow from America, even though Japan ranks second in the world in the number of computers it has.

To be exact, the system described here refers to Japanese-language information processing system architecture—that is, the supporting architecture which integrates the whole system, from the mainframe (host computer) to the terminal, the network, data base, etc. The Japanese language information processing system has replaced the former flow of kana information with ordinary Japanese (meaning a mixture of kanji and the Japanese syllabary).

The reasons this system took so long to appear are virtually identical to those cited in the section on kanji small business computers, high hardware costs, I/O system problems, and the lack of software.

Fujitsu was the first to solve these problems and introduce a general purpose Japanese-language processing system. The JEF (Japanese processing Extended Feature) released by Fujitsu in April 1979 opened up a new era in general purpose Japanese-language infor-

mation processing systems.

Previously if one wanted to process in Japanese (kanji) using a general purpose computer rather than a special purpose kanji processing system or subsystem, the only way to do it was to make up application and utility programs. The JEF system covers everything from hardware and basic software to the application program, and has made it possible to easily deal with kanji data in the Japanese language as an extension of existing data processing modes using English alphanumerics and kana. Its main feature was the fact that its operating system incorporated a Japanese-language processing function.

Since the Japanese-language information processing systems of other companies described below adopt an approach similar to this JEF, I would now like to comment further on the JEF as a typical such system.

The JEF is given all-round support by the

"OS IV/F4, X8, F2" operating system of Fujitsu's general purpose M series computer. As shown in Figure 1, Japanese language (kanji) support is given in the basic software, from the control program to the language processing and service programs. In previous kanji processing systems, kanji support was limited to the service programs shown in the figure. This Japanese language support for the whole of the basic software made it possible to deal as easily with Japanese language data as alphanumeric and kana data.

Let us look in a little more detail at the functions listed on the right side. The service program is exclusively for kanji. The control and language processing programs can be considered as an upgraded version of a usual operating system, with the improved functions being for use in Japanese-language processing.

As far as the functions of each element are concerned, ADJUST (Advanced Japanese User

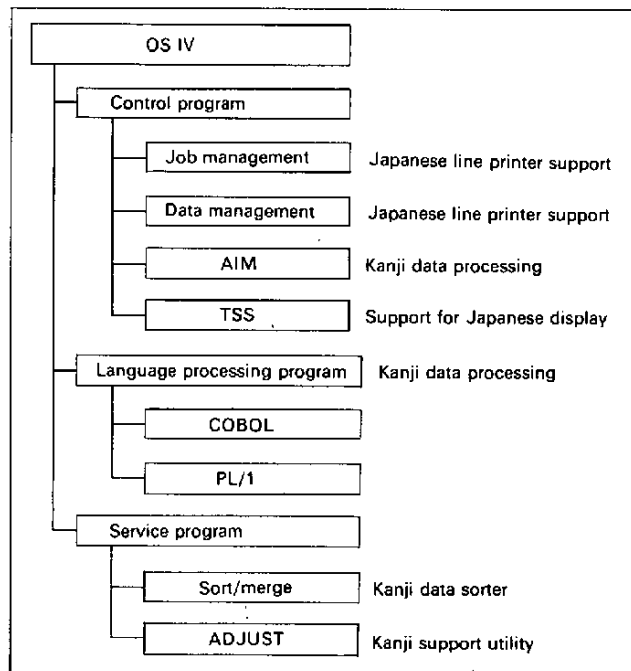


Fig. 1 Basic JEF Software

Support Software) is a utility program designed specifically for kanji, and handles the preparation and maintenance of files in Japanese. In response to the great number of kanji mentioned earlier and the fact that one kanji has several readings, there are kanji sorters for on-reading (Chinese reading), kun-reading (Japanese reading), radical and total number of strokes.

Japanese language support in language processing programs means that a pre-compiler for kana-kanji conversion has been added so as to expand the grammar of COBOL and PL/1. With the expanded grammar, if 'Japanese-language data' is specified in the data statement unit, read-out, copying and printing from the Japanese-language data file are possible.

The addition of kana-kanji conversion functions to control programs made possible Japanese-language support. Kana-kanji conversion refers to the automatic conversion into kanji of material (data) written (or keyed-in) in kana. Because of the number of kanji homonyms and multiple readings, kana-kanji conversion faced difficulties, but with advances in structural analysis and memorization of which kanji (or homonyms) appear most frequently, the kana-kanji conversion rates increased to a

point where it became suitable for practical use. Putting this kana-kanji conversion into practical use has made an important contribution to solving the input problem, which was one of the major obstacles involved in Japanese-language information processing systems.

JEF also offers the application programs shown in Figure 2.

In the JEF system the software role described above is important; also, though, many new hardware products which actually carry out the input/output have been announced, such as the FACOM 6715D Line Printer (laser beam mode), FACOM 6650 Display Subsystem and the FACOM 6803A Data Entry System. The fact that such hardware can now be offered at a considerably lower price than in the past is one factor that has led to general purpose Japanese-language information processing systems being put on the market and winning acceptance by users.

The cost of the software and hardware involved is about ten to twenty percent more than alphanumeric and kana systems. This applies not only to JEF, but also to all the other companies' Japanese-language information processing systems.

A further problem related to Japanese-

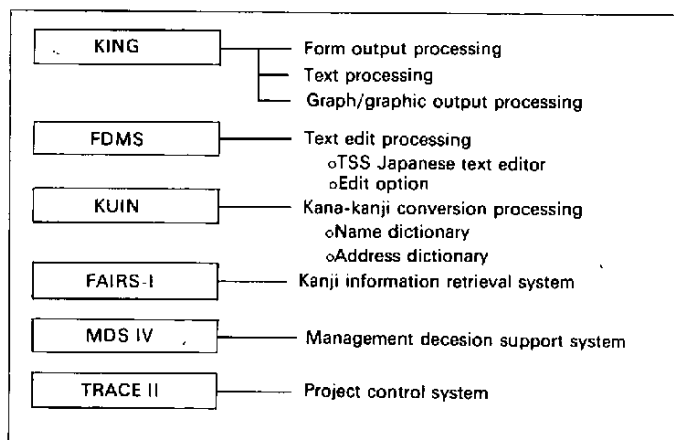


Fig. 2 JEF Application Programs

language systems involves the conversion from existing systems. This is no problem to enterprises which are introducing computer systems for the first time, but what about when present users adopt a Japanese-language system? The man in charge of JEF development at Fujitsu says that 'Our most difficult task was simplifying conversion and reducing the necessary time and outlay.'

This means keeping down to several percent changes (i.e. debugging) to the user's program needed by the conversion process, i.e. providing the operating system with a Japanese-language processing function. Even then, when possible, conversion in one go is avoided; instead, Japanese-language processing is gradually extended from specific jobs. It seems that this gradual conversion is welcomed by users.

Manufacturers' Response to the Need for Japanese-language Information Processing Systems

This article has concentrated so far on JEF, but many other companies have also been motivated by this to offer general purpose Japanese-language information processing systems. Table 1 shows the systems that have been announced so far. Since the operating system must be modified, initially some overseas manufacturers felt that it would be difficult to offer a specifically Japanese processing system as their strategy was more global in nature. However, such a system became a prerequisite to strengthen their position in the Japanese market, so they are now entering this field, led by IBM Japan. Though it is not yet shown on the table, NCR Japan has already started a development program. Oki Electric Industry is offering a Japanese-language processing system using minicomputers. Toshiba, which has withdrawn from the mainframe field, has already built up a solid base in kanji systems in the small business computer field. Nippon Data General, has announced a kanji data expansion

system called KDEF for use in the ECLIPSE and CS systems. These companies believe it will be impossible to compete in the computer market in the 1980s unless they develop a Japanese-language information processing system.

The following is a brief outline of each company's system:

***JEF (Fujitsu Ltd.):** Announced in April 1979 together with the FACOM M Series F models (designed to compete with IBM's E Series), and shipments commenced from the end of March 1980. At present it has a good lead over its competitors. (As of the end of September 1980, 290 orders had been received.)

***IBM Kanji Information System (IBM Japan):** Announced in September 1979, this is JEF's main rival. In October 1979 the General Systems Division (GSD) announced its IBM Kanji System/34, the Japanese-language processing version of its System/34. Then in July 1980, IBM reinforced its kanji information system software support, and announced the IBM Japanese Language Document Processing System, thus signifying its intention to emphasize Japanese-language processing.

***JIPS (NEC Ltd.):** Announced in October 1979 at the same time as models 350, 450 and 550 of the ACOS series. The company's policy is initially to only support the ACOS-4 operating system, its intermediate mainframe model, and to then gradually expand from there.

***Mitsubishi Japanese Language Processing System (Mitsubishi Electric Corporation):** Announced in March 1980. Processes Japanese-language text, and image data, using facsimiles.

***KEIS (Hitachi, Ltd.):** Announced in February 1980. Whereas at this stage other companies have not extended their Japanese-language processing systems to small business computers, Hitachi's KEIS is notable for the fact that it does also cover small business

Table 1 Main Japanese-Language Processing Systems

Manufacturer	Model	Announced	Shipments	Remarks
Fujitsu	JEF	April 79	Mar. 80	Forerunner of Japanese language processing systems
IBM Japan	IBM Kanji Information System	Sep. 79	1980 1Q-4Q	IBM Kanji System/34 put on sale in Oct. 79. Added Japanese-Language Document Processing System July 80
NEC	JIPS	Oct. 79	July 80	Announced at same time as ACOS 350, 450, 550. Support from ACOS-4 of OS (July 80).
Mitsubishi Electric Corp.	Japanese-Language Processing System	March 80	Aug. 80	Provides text editor and covers up to text processing.
Hitachi	KEIS	Feb. 80	Dec. 80	Intended for models L-330 and up.
Burroughs	JBIS	May 80	1981 1Q	Module of Burroughs Comprehensive Processing System (BIS)

Table 2 Types of Japanese-Language Processing Systems

Manufacturer	Model	Remarks
Fujitsu (JEF)	FACOM V Series (V-830, V, V-850) FACOM M Series (all models)	Has System 80 (models 5, 7) as kanji office computers
IBM Japan (Kanji Information System)	S/370 4300 303X	GSD sells Kanji System/34
NEC (JIPS)	ACOS Series But initially only ACOS-4 models	NEAC System 50II/100II/150II as kanji office computers Sells Japanese-language ones separately (Feb. 80)
Mitsubishi Electric Corporation (Japanese Language Processing System)	MELCOM-COSMO Series MELCOM 80 Series (office computers) MELCOM 70 Series (Minicomputers) M2350 Series (intelligent terminal)	Expands and supports Japanese language processing in the OS of MELCOM 80, 70 and M2530.
Hitachi (KEIS)	HITAC L-330 All M Series models	L-320 has kanji display only.
Burroughs (JBIS)	B Series computers (incl. B90)	B-90 Japanese-Language Information Processing System put on sale at same time.

computers.

***JBIS (Burroughs):** The Burroughs Engineering Center, established in Yokohama in April 1980 under the direct control of the U.S. Burroughs Corporation, was responsible for

system development. JBIS is the Japanese-language information processing module of Burroughs' comprehensive image processing system (BIS).

The above is an outline. The basic concepts

of these companies' systems are virtually identical, so differences in the cost, quality and range of hardware, and in the quantity and quality of software such as service programs, application programs, and tableware are the main factors in determining the relative merits of any one system.

The establishment of kanji standards by JIS (Japanese Industrial Standards) in January 1978 was another factor leading to the appearance of Japanese-language information processing systems. These standards specified and coded a total of 6,349 kanji. These were divided into two groups ('levels'), the first group containing the 2,965 most frequently used kanji, and the other group the 3,384 less frequently used kanji. Code systems, which until then had varied greatly among manufacturers and users, started to conform to this JIS code, and this provided system-to-system data compatibility enabling exchanges of data among the various systems to take place and facilitating the increased use of such systems.

Promising Future

It is natural enough for there to be demand for Japanese-language information processing systems in Japan. These systems have also brought about a number of benefits.

In the first place, manufacturers now have new devices to sell, such as Japanese-language printers. Another advantage is that it has become possible to sell computers to countries which use scripts other than the non-alphabetic orthographies, such as Chinese, Korean and Arabic. With Fujitsu having already extended the Japanese-language processing concept to include other languages, it is actively working towards a multilingual information processing system. The reason IBM used its Japanese and American facilities to develop its Japanese-

language processing system was undoubtedly that it is strongly aware of the need to expand to languages other than Japanese.

The advantage for users is that the introduction of a Japanese-language information processing system enables them to collect information more efficiently, and simplifies the establishment of management information systems and office automation. In that sense the Japanese-language word processors which appeared at about the same time as Japanese-language information processing systems were also a major achievement, as they promote office automation and integrate the data processing and word processing functions.

These systems are the real beginning of information processing in Japan. The future will probably see the reduction or elimination of the 10-20 percent cost differential and the development of a simpler Japanese-language input modes (e.g. voice input).

A need has been felt for Japanese programming language, ever since computers first appeared here. The Customer Oriented Application Program Development System (CORAL) announced by Hitachi in September 1980 is the first step in this direction. CORAL automatically generates a COBOL program from a design format specification written in Japanese (katakana). It is also possible for system development information which is input in Japanese to be registered in that form in a CORAL data base, and for development and maintenance and upgrading to be carried out in Japanese.

Such systems using the Japanese language are absolutely essential if users are to develop and maintain programs more efficiently. Japanese-language information processing is on the verge of a period of rapid development in the 1980s.

Hospital Information Systems in Japan

—State of development and specific example—

Hiroshi Miyake,*
M.D., D. Med. Sc.

The subject of medical services has recently been attracting the interest of large numbers of people outside the medical profession and, as a result, a wider range of opinions on the functions of hospitals is being heard from non-medical circles. In most cases, however, these opinions and the discussions they generate are premised on a view of the hospital as having only a single medical function and rarely go beyond an analysis of this function, its economic aspects and the effectiveness of medical treatment. In fact, however, anyone who looks at hospitals from the inside will have to admit that they possess an internal structure and organization of a complexity that cannot be easily explained on the basis of a single, undifferentiated medical function. This is particularly true of general hospitals, which are expected to provide highly sophisticated medical services. To a great extent, such differences in the way people think of hospitals derive from the fact that each person has his own definition for the term "medical services" and that each has different expectations concerning what these services should be in concrete terms. This in turn means that the general hospital is expected

to be capable of providing various medical services in response to differing individual needs while combining these services to obtain optimum effect and efficiency. The hospital is thus a composite institution made up of a large number of functional units. Not only are these individual functional units required to operate precisely and effectively, they are also required to tie together to provide each individual patient with complete medical care. That is, the individual medical functions must be precisely coordinated so as to assure smooth, unhindered operation of the hospital as a composite whole.

Most persons who come to a hospital for examination and treatment are aware that the hospital's operations encompass both a series of clerical tasks beginning at the reception desk and ending at the cashier, and numerous medical jobs such as the physical examination which is conducted primarily through a dialog with the doctor and the nurses either in the consulting room or in one of the hospital wards, the tests conducted by the technicians, nurses or doctors, and the work of filling out prescriptions that is carried on in the pharmacy. In spite of this awareness, however, few patients think of the total of the time spent on these jobs as being the time spent on medical examination. To most, the time spent on medical examination is the time spent on actual physical

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examination, particularly the time spent in direct contact with the doctor. Because of this, patients frequently complain that they have to wait three hours to see the doctor for three minutes.

Those who work at medical tasks within the hospital have a different view of things. They know that the fundamental information which will serve as the basis for medical treatment arises out of the doctor's examination of the patient, but they are also easily able to perceive that hospitals are characterized by the fact that a great share of the work performed is, in terms of both time and volume, accounted for by the preparations required for the examination, the various test procedures carried out under the instructions of the doctor, the cleaning up after tests and the preparation of reports. Still, very few of these same people would be able to give a clear answer if asked what should be done regarding the processing of the information generated by these various medical procedures so as to assure that the hospital's work proceeds smoothly and precisely. This is because the various medical functions of a hospital are not independent of one another but can fulfill their respective roles only when information is re-

ceived from other sectors, which is to say that the hospital is a composite entity made up of numerous interdependent functional units. In other words, the hospital is so organized that it can effectively perform its overall function only when there is an interaction of information.

The division of jobs and functional relationships at hospitals

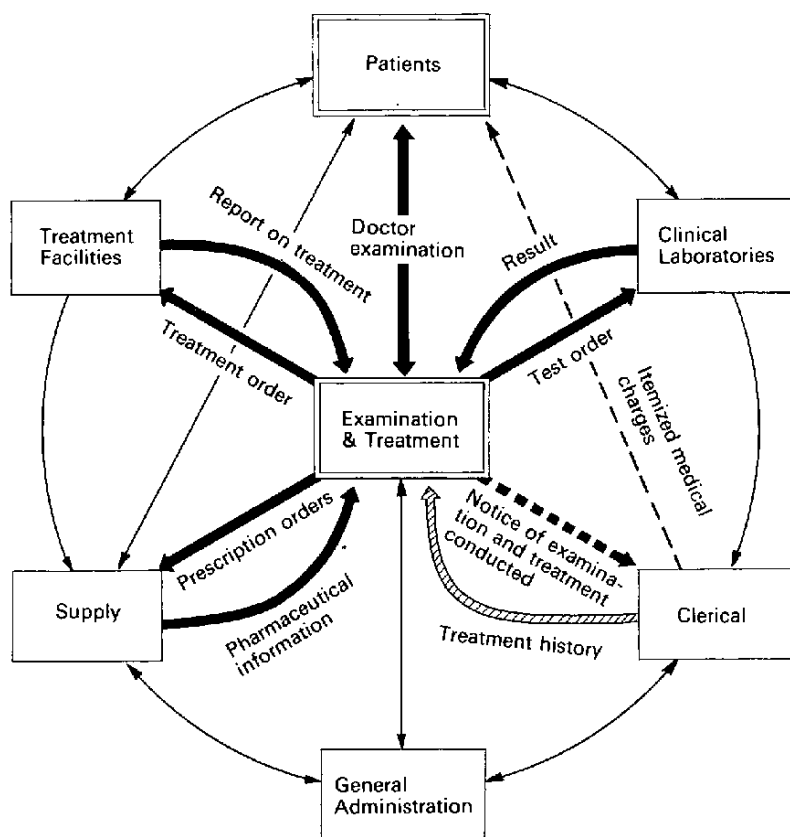
A very wide variety of jobs is performed within a hospital. Although the hospital is organizationally divided into divisions, departments and sections for the purpose of administering the various types of work that must be done, I would here like to look at how the work involved in medical examination and treatment is divided up from a functional point of view.

Every hospital has an administration division for overseeing the hospital's activities as a whole. This, however, is something separate from the hospital's medical functions. From the point of medical activities, it is possible to break a hospital into six sectors starting with the outpatient sector and ending with the clerical sector as shown in Table 1.

As shown parenthetically, a number of independent activities can further be found within

Table 1 Functional Breakdown of Medical Examination and Treatment

Division of Work within a Medical Institution (Breakdown by Sector)	
Hospital Administration	(Administration Dept. General Affairs Dept., Supply Dept. Building Management Dept.)
Outpatients Clinics	(Over 20 specialized fields of outpatient examination and treatment, Emergency Section)
Inpatients Wards	(Surgery Ward, Internal Medicine Ward, Pediatric ward, etc.)
Clinical Laboratories	(Examination of specimens: Biochemical, hematological, bacteriological, pathological, etc.)
Treatment Facilities	(Physical examination: Physiological, RI, radiological, etc.) (Surgery Dept., Radiotherapy Dept., Physiotherapy Dept.) (Rehabilitation)
Supply	(Pharmacy, Blood Transfusion Dept., Central Supply Dept., Dietary Dept.)
Clerical	(Medical Records Administration Dept., Medical Accounting Dept., etc.)



- ← Flow of information directly required for medical examination/treatment (Main data)
- ← Flow of information helpful for carrying out medical activities (Auxiliary data)
- ← Same as above.
- ← Clerical information on medical work (Clerical data)

Fig. 1 Flow of Medical Information

each functional sector. Although these subdivided activities are not common to all hospitals, it can be said that every hospital has at least these seven functional sectors. Also, it is easy to see that a patient visiting the hospital will of necessity come in direct contact with at least two of these sectors before completion of his examination and treatment.

The flow of data (information) among these functional divisions is as shown in Fig. 1.

A person visiting the hospital to obtain medical care first comes to the reception desk, one

part of the clerical sector. Here the information required prior to examination is recorded and the patient is then referred to the outpatient sector or the inpatient sector. At this stage, the only data on the patient that is recorded and forwarded is his data of birth, address, occupation, type of medical insurance and other such fixed data required for clerical processing. The work of obtaining the information on the patient required for examination and treatment begins at the outpatient/inpatient sector. Then the in-

structions and information issuing from the outpatient/inpatient sector are used as the basic information for initiating medical jobs in the other sectors of the hospital. In other words, the other sectors begin their work only after obtaining this basic information. The outpatient/inpatient sector at this time awaits early receipt of the reports and time schedules on the work it has commissioned, and upon receiving a response, issues instructions on the next medical job to be undertaken. This is what is meant by the interaction of information centering on medical examination and treatment. The clerical sector must grasp the content and volume of this flow of information in order to calculate the medical charges and compile and store medical records on the patient. In addition to the data passing between the sectors, these records of course also include the information exchanged between the doctor and the patient, information the doctor has obtained on the patient in the course of the examination, and various other information not directly related to the charges and fees.

If the sectors shown in Fig. 1 were not themselves constituted of numerous subdivisional activities, each sector could be handled as a single unit and the problem of processing the data flow would not be so complex. However, in the case of a general hospital where the outpatient and inpatient sectors are divided into ten or more specialized departments, the work of forwarding the instructions and information from each of these specialized departments to the appropriate sectors and of controlling report information traffic, that is to say, the work of information exchange and processing, swells to huge proportions.

Moreover, the reports generated by the various sectors on the basis of the medical instructions and information generally exceed the volume of the initial information by a factor of several times by the time they return to the sectors that requested them. This situation is

further complicated by the fact that the report for any given patient will be constituted of integrated data indicative of contents differing in nature from day to day. Because of this, the methods used for compressing data for production and stock control in commerce and industry which rely on classification and integration to reduce volume are not so effective when applied to the storage and transmission of medical information.

For this reason, it is necessary in considering data processing within a hospital to divide this work into the following three major categories:

- (1) Processing of work within the individual sectors;
- (2) Information flow among the sectors;
- (3) Accumulation, storage and administration of medical information.

A clear awareness of the high degree of interrelation among these three categories is also essential.

Changes in hospital data processing procedures

Up to this point I have concentrated on the interrelation among the various hospital sectors in the processing of medical information, and from what has been said so far, it would seem that processing is possible independently of exterior data and information. In fact, however, if one examines the actual work that is carried on, he will discover that the logic of processing medical information is constantly being modified by data and information flowing in from the outside. (Fig. 2)

No one can dispute the fact that the computer would indeed be a highly effective information processing device for handling the huge amounts of data generated in a hospital every day if only it were possible to establish processing procedures not requiring modification over fixed periods of time. The processing procedures would be fixed in the form of an application program which would allow the com-

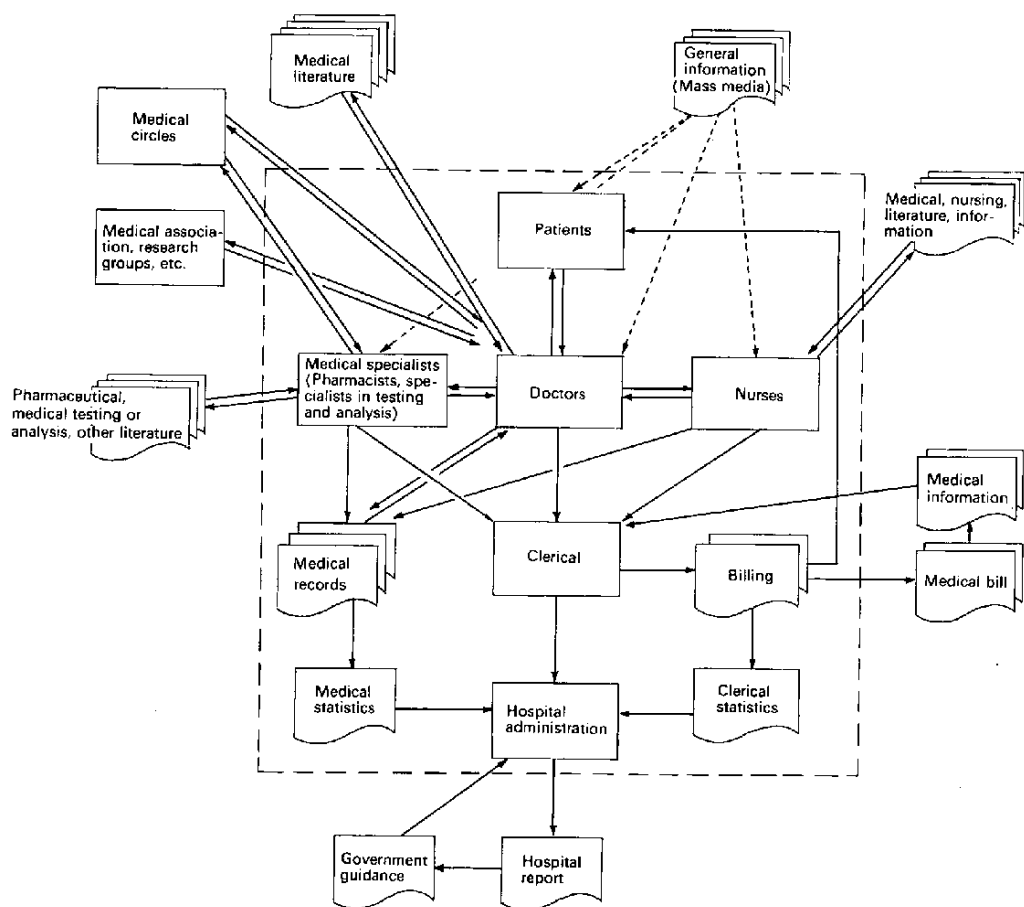


Fig. 2 Flow of Information within Hospital and Exterior Information having Effect on Information Processing (Judgments)

puter to carry out fast, large-volume processing and, through the establishment of fixed storage procedures, the data could be compiled and stored with high efficiency.

The fact is, however, that in medical data processing (which can be equated to medical thinking), though large and rapid changes in medical thinking as a whole are rare, medical thinking as it pertains to actual application in the hospital advances daily. The degree of change each day may be small, but when these changes are accumulated over the course of a year, they become quite substantial. By way of

example, consider the book titled *Clinical Neurology* which I have on my shelf. Each year, the publisher of this book sends me about 400 pages of changes and additions. This is equivalent to around 10% of the book's total of about 4,000 pages. Such information received from the outside translates into changes in processing methods and logic. What is more, changes of this type are by no means limited to the fields with which doctors are directly concerned but also take place in a wide range of other medical fields including pharmacy, clinical testing, nursing and medical equipment. Even in the

area of clerical processing which one is apt to consider as being quite stable, changes in thinking accumulate to the point where they must be taken into account. Specific examples can be seen in shifts brought about by medical progress in the interpretation of questionable points under the health insurance program and in the directives issued by the Ministry of Health and Welfare.

These changes in procedure and thinking made necessary by the direct effect of external information are absorbed into the hospital work almost without problem insofar as the medical tasks center on manual work backed up by person-to-person communication. This process of absorption is, however, made considerably more difficult where information processing is conducted according to fixed patterns using the combination of a computer system and a large-scale application program. Even in ordinary fixed computer use modes outside the medical field, software has come to account for 80% of total computer utilization costs as a result of advances in hardware technology and lower equipment prices. In particular, the fact that a major portion of the cost is attributable to compilation and maintenance of the application program means that the biggest problem to be solved in application of computers to medicine lies in finding ways to minimize the application program maintenance fees required because of program changes.

Stages in hospital information systems and state of utilization

The utilization of hospital information systems for rationalizing and speeding up hospital work and information flow can, as mentioned earlier, be divided into stages.

Stage 1: Arrangement of the information flow system and rationalization of the accumulation, storage and utilization of medical data

This stage is not necessarily premised on

computer utilization. For computer utilization, however, it is necessary to carry out the organizational and rationalization work implied by this stage. Of all Japanese hospitals, less than 30% have as of the present time reached this stage and of those hospitals having 100 or more beds, less than 50% are now thought to be at this level.

Stage 2: Rationalization of the collection, utilization and processing of medical information in the individual sectors

The work entailed in reaching this stage is in many cases carried out as a prerequisite to computer utilization. At Japanese hospitals, an overwhelming 80% of all computer utilization is in the area of clerical operations particularly in the field of medical bill processing. Other fields with high utilization rates are pharmacy stock control and clinical test data processing. Examples of computer application to clinical data administration and processing can be found only in a few isolated cases at Automated Multiphasic Health Testing Services and in applications directed to research into special diseases. Data processing at this stage is handled by small personal computers and minicomputers, and as processing is limited to within a single sector, there is no interaction with other sectors so that utilization is simple. On the other hand, however, systems at this level do not contribute directly to an improvement or rationalization of inter-sector information flow and for this reason cannot be expected to have a significant effect on promoting effective utilization of information or labor saving. Most Japanese hospital information systems are presently at this stage and efforts toward reaching the third stage are just starting at some hospitals.

Stage 3: Joint usage of internal medical information through centralized information administration and utilization of information for rationalization of processing work in individual sectors

At this stage, the object is to realize an overall improvement in the data flow among the sectors of the hospital. At the same time, it becomes possible to extract from the accumulated data various materials that can be used for improving hospital administration and work procedures.

Most of the hospitals which have reached this stage use medium or small general purpose computers for compiling administrative materials by batch processing and the major part of the medical information is obtained from the on-line, real-time processing of medical charges in the medical accounting sector. This can be seen as a further development on the type of processing within the clerical sector mentioned in connection with stage 2.

On the other hand, there are a small number of cases where, from the beginning, the aim was to improve the flow of information within the hospital by forming a comprehensive hospital information system. These use medium or larger sized general purpose computers and are centered on on-line, real-time processing. They have undergone development and improvement over several years and are aimed at development into the fourth stage as full-fledged general hospital information systems. In such cases, the scale of the processing program is so large as to make application to on-line, real-time processing at a single hospital economically difficult and for this reason, the trend is toward joint use among a number of hospitals.

Stage 4: Speeding up medical examination and treatment and contributing to the improvement of medical care through the immediate application of medical data and internal medical information etc. to hospital work

This is the stage of a full-fledged general hospital information systems. Most of these are composite systems centered on a large computer with on-line, real-time processing and data base administration capability and en-

compassing minicomputers located in the respective sectors of the hospital. At present none of these systems has yet reached completion. Still, in view of recent progress in data processing and the progress that is being made in a number of hospitals toward the completion of the groundwork, some of these systems can be expected to make a rapid advancement toward perfection. In all likelihood, a single system will provide services to several tens of hospitals.

Although a hospital will not necessarily proceed from stage 1 to stage 4 exactly as described here, it is a fact that most hospitals have advanced from stage 1 to stage 2, although a survey conducted by the Hospital Information Center of the Japan Hospital Association reveals that in some cases plans for progressing to stages 2 and 3 have been implemented almost simultaneously. (Fig. 3)

Moreover, a comparison of the results of three similar surveys conducted over a period of four years (1975, 1977 and 1979) shows that, as is clear from Table 2, in-house and external on-line computer utilization increased rapidly between 1977 and 1979, and this fact, together with the increase in the number of non-users who answered that they had no plans to computerize, indicates that the position of hospitals regarding computer utilization is becoming quite clear.

The reasons of non-users for not having computerized as of the end of 1979 are summarized in Table 3.

From the results, it seems likely that hospital information systems will in the near future be advancing to the third and fourth stages through the utilization of composite systems combining sector-by-sector processing by means of small computers (minicomputers and microcomputers) with on-line processing utilizing large-scale computer systems operated by external centers.

Next, as a concrete example, a description will be given of the development of the hospital

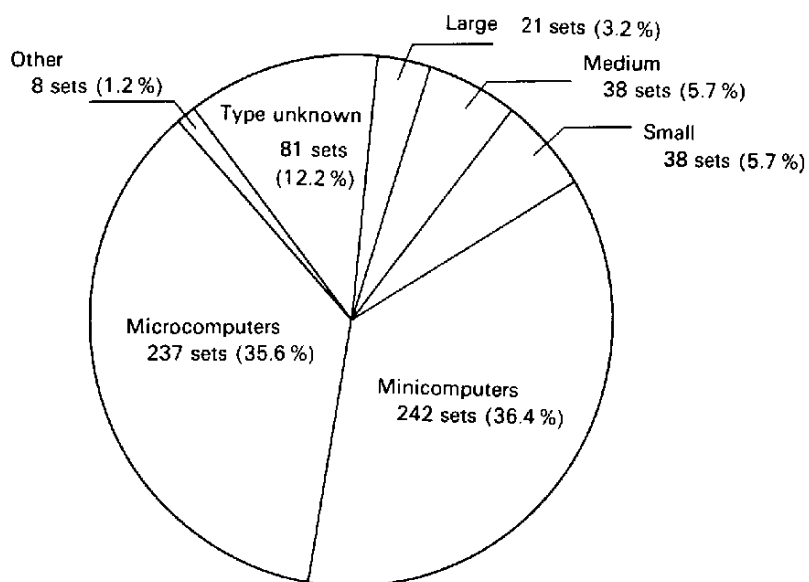


Fig. 3 Computer Systems in Use at Hospitals (As of December 1979)
 (From data on 378 hospitals with computer installations)
 (Source: Hospital Information Center, Japan Hospital Association)

Table 2 Survey on Hospital Computer Utilization
 (Source: Hospital Information Center, Japan Hospital Association)

		1975	1977	1979
Computerized	In-house	165	185	378
	Ext. on-line	115	104	38
	Ext. off-line			131
Plan to computerize	Within 1 year	95	56	67
	Within 2 years		42	67
	Ext. computer		35	40
	Other		63	47
Non-user	Considering	101	248	151
	No plans	369	270	461
Number of hospitals responding		845	954	1331

Table 3 Reasons for Not Computerizing (As of December 1979)
(Source: Hospital Information Center, Japan Hospital Association)

No. of beds	Considering computerization	Too early	Not required	Once used but stopped	Rising costs	Difficulty of operation	Financial problems	Need guidance	Other	Total
20-99	55(17.6%)	80(25.6%)	100(31.9%)	4(1.3%)	26(8.3%)	8(2.6%)	17(5.4%)	13(4.1%)	10(3.2%)	313(100.0%)
100-299	60(22.6%)	83(31.3%)	48(18.1%)	4(1.5%)	19(7.2%)	6(2.3%)	11(4.2%)	12(4.5%)	22(8.3%)	265(100.0%)
300-499	29(28.4%)	24(23.5%)	13(12.8%)	2(2.0%)	9(8.8%)	5(4.9%)	7(6.9%)	3(2.9%)	10(9.8%)	102(100.0%)
500-	7(28.0%)	7(28.0%)	1(4.0%)	0(0.0%)	1(4.0%)	0(0.0%)	2(8.0%)	1(4.0%)	6(24.0%)	25(100.0%)
Total	151(21.4%)	194(27.5%)	162(23.0%)	10(1.4%)	55(7.8%)	19(2.7%)	37(5.3%)	29(4.1%)	48(6.8%)	705(100.0%)

information system at the Kanto Teishin Hospital where the writer is presently employed.

Development of information system at Kanto Teishin Hospital

The hospital information system employed at the Kanto Teishin Hospital was started the plan in 1967 and has been in operation for thirteen years. Today the system continues to undergo development with the aim of increasing its contribution to the improvement of medical care at the hospital. The fundamental policies for system development were laid down in 1968 and have been consistently pursued ever since:

1. Realization of a medical system for providing improved services to the sick and for raising medical standards;
2. Realization of an improved system of health administration capable of responding to changes in the disease structure;
3. Promotion of the modernization of hospital operation;
4. Strengthening of the ties among the various medical organizations

The design of the hospital information system was based on the results of a two-year analysis of the jobs within the hospital to be computerized conducted in line with the aforementioned fundamental policies. Computer processing relating to patient registration and medical records administration was commenced in 1972. In the following years, the scope and the functions of the system were expanded step by step.

Then, from 1974 onward, design and development work was begun on DUCOM (Dendenkosha Computer Utility for Comprehensive Medical System), a system to serve as the basis for the restructuring of comprehensive hospital information systems and one intended to provide a large number of hospitals with support for their medical operations through shared on-line, real-time

processing. First-stage operation of DUCOM was begun at the Kanto Teishin Hospital in September of 1979, and from that time on services have been expanded gradually. The Kanto Teishin Hospital has also been providing knowhow regarding system design in connection with a joint-use type hospital information system called SHIS (Shared Hospital Information System) which is being developed by Nippon Telegraph and Telephone Public Corporation (NTT) upon request of the Medical Information System Development Center for use by national hospitals as well as by private hospitals.

In the following, an outline will be given of the development of the hospital information system at Kanto Teishin Hospital as well as of the present state of the system now in operation and plans for its future development.

History of the development of the Kanto Teishin Hospital System

From the early 1960's, progress started to be made within the hospital toward centralized administration of inpatient medical records, the standardization of outpatient medical history formats and in other areas related to the joint administration and mutual utilization of medical records. Then as the need for systematically applying medical knowledge to medical practice came under increasingly active discussion, there were brought to light concrete examples of cases where duplication of clinical testing and drug administration had occurred within the various specialized medical departments.

It was in 1967 that studies were begun mainly by the hospital's doctors to determine the advantages and disadvantages of employing a computer system as a means for satisfying the hospital's need for centralized administration and mutual utilization of medical information and for providing the required administrative and processing capability to cope with a rapidly

increasing volume of medical information.

Then in 1968, following about one year of surveys, research and studies which led to the adoption of a fundamental plan to commence positive development of medical information processing technology (an undeveloped field at the time) for application to the hospital's medical activities, a team of information system engineers from NTT were brought in to make a system analysis of the hospital's operations.

As shown in Table 4, the plan can be divided into the following four blocks in accordance with the nature of the hospital's operations:

- (I) DUCOM business office system, a shared on-line system for processing medical clerical work,
- (II) Front-end processing and stand-alone processing on-line system employing minicomputers, for use by the clinical test divisions and in medical research,
- (III) Clinical information system, a shared, batch-type medical record data base control system employing a large computer located within the hospital information processing center, primarily for storage and retrieval of medical records,
- (IV) DUCOM order communication system, a shared on-line system, for supporting daily medical activities by controlling the flow of information deriving from doctor orders.

The steps followed in the development of computer use modes were as shown in Table 5. It will be noted that at the time operation was initiated in 1972, batch processing, mainly of case history data, was carried out by the Kantei computer.

From the changes in the scale of the center computer and the changes in the types of jobs handled by minicomputers, it can be seen that advances in computer technology have been paralleled by changes in the types of computerized jobs and the range of the data processed, and in this way have had a direct

Table 4 Development of DUCOM at Kanto Teishin Hospital

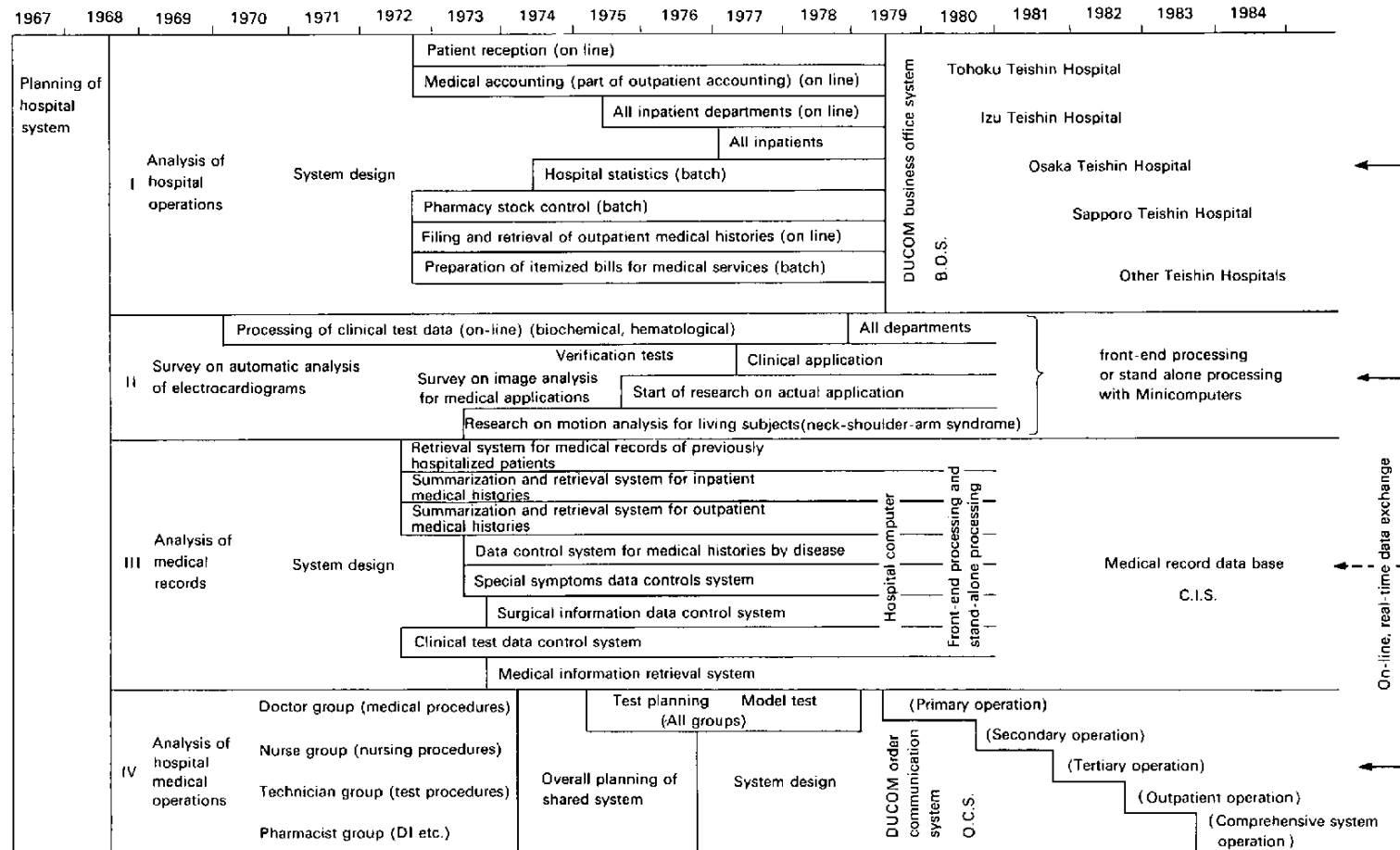


Table 5 System Operation and Hardware Changes at Kanto Teishin Hospital (Kantei)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Kantei Center DUCOM Center													
	HITAC 8400 (262KB)				HITAC 8450 (393KB +524KB)				HITAC 8450 (393KB)				
											DIPS-11-10 (4MBX2)		
* Summarization of inpatient medical histories (batch) -----													
* Retrieval of outpatient medical histories (batch) -----													
* Test data control (batch) -----													
Pharmacy stock control (batch) -----											D (On-Line)		
* Patient registration (on-line) -----											D (On-Line)		
Medical charge computation (on-line) -----											D (On-Line)		
Medical billing (batch) -----											D (Batch)		
Bed management (batch) -----											D (On-Line)		
* Retrieval of medical records of previously hospitalized patients (batch) -----													
Special disease data control (batch) -----													
Management of case history data by disease (batch) -----													
Medical information retrieval (batch) -----											D (On-Line)		
Surgical information control (batch) -----											D (On-Line)		
Model test											Order communication system		
Medical information (on-line)											D (On-Line) -----		
											See table 6		

Kantei Minicomputer System

JEC-5 (4KW) biochemical	HITAC10-II (12KW) + hematological	HITAC 10-2 (16KW)	MS-50 (448KW) biochemical, hematological, physiological, pathological, bacteriological, etc. (Test data system)
	HITAC 10-2 (16KW) hematological	*	
	CT	ACTA-100	ACTA-200
	Image processing	NEAC3200-70 (32KW)	
Research on movement of living subjects	HITAC10-2 (32KW)		
* Research on medical logic program	DEMOS-E TSS Terminal		
	Retrieval of medical literature	JOIS TSS Terminal	
* Statistical research by individual doctors	PERSONAL COMPUTER		

* System related to medical history information

Model test	Object was to develop model test system with various command inputs, medical opinion input, medical information retrieval, work information output, test result output, drug administration output, along with other inputs and outputs as well as medical logic.
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D (on-line).....On-line processing by DIPS-11-10; some jobs the same as those of SHIS

Order communication system.....Details shown in table 6.

influence on the scale of the hospital information system.

As a result of the initiation of the planning of DUCOM in 1974, the computer within the hospital was upgraded in 1976. Shortly after this, a model on-line medical information system was put into test operation and plans were pressed forward for switching over from the already operating on-line business office system to DUCOM. This in turn contributed greatly to setting the basic parameters for the on-line order communication system. In the area of minicomputers, the first system to start was a biochemical system in the clinical testing department used mainly for processing within the department. This initial system expanded rapidly until finally in 1979 it had developed into a laboratories information system employing a super minicomputer and had come to encompass the whole of the clinical testing department. During this same period, the business office system and the order communication system were connected up with the DUCOM Center computer so as to permit these systems to engage in on-line, real-time processing.

The Kanto Teishin Hospital Information System Today

From what was said in the preceding chapter, the reader will understand that as of 1980 the Kanto Teishin Hospital information system is still under development. I would, however, like to describe the jobs to which the system has at this stage already been applied.

The systems to be described here do not operate independently of each other at various points throughout the hospital but are linked together so as to be able to exchange data with one another and in this way fully manifest their respective capabilities. At the present time, however, inter-computer data exchange still remains short of completion and in some cases the exchange of data is carried out via the

medium of magnetic tape, punched cards etc.

(1) DUCOM (a shared medical information system)

DUCOM is used via data communication circuits connecting with a large computer at the Center so as to provide on-line, real-time processing of data handling and exchange requests concerning data common to all hospitals. As for data processing capability, the system not only has a program for processing data common to all hospitals but also has tailored data processing programs designed to match the needs of the individual hospitals. Data storage management is assured by providing a separate, securely protected, medical data base for each hospital concerned.

(A) BUSINESS OFFICE SYSTEM (BOS)

This system provides on-line, real-time processing of the flow of hospital clerical procedures starting at the reception desk. The system includes the registration of first-time patients visiting the hospital, as it is the reception work which is the key to information processing within the hospital. The patient number assigned at this time is affixed to succeeding data concerning the patient to be handled by the hospital information system.

(i) Patient reception (including filing and retrieval of out-patient record)

The first time a patient visits the hospital he is assigned a patient number, and his date of birth, address and occupation and data concerning his health insurance are recorded. Any of this information which is subject to change is reconfirmed each time the patient comes to the reception desk thereafter so as to keep his basic data file up to date at all times. The system also provides for management of the filing and retrieval of medical records and makes it possible to inquire about past consultations by the patient.

(ii) Cashier window operations (including preparation of account processing materials)

In the future, when the major part of the information concerning examination and treatment will be input on the spot using an on-line, real-time system, this aspect of BOS will be used mainly for retrieving data for the purpose of confirmation. At present, however, since most of the data on examination and treatment is received on data slips, it is used mainly for data input. A logical check of the particular combination of examinations and treatments is conducted by the center program. The type and amount of medicine prescribed is also input, and this data is used to run a check for the purpose of precluding overdosages and duplicated drug administration. It is also here that the accounting data is totaled and the data on the examination and treatment summed up.

(iii) Billing (including various kinds of bills)

The system prepares itemized slips on the medical services received by a total of just under thirty thousand outpatients and slightly less than 1000 inpatients each month and outputs these separately for each party to be billed

in accordance with a standard format. The automation of this work eliminates the need for sorting, recording and totaling three hundred thousand slips per month.

(iv) Pharmacy stock control (including order placement)

Over two thousand kinds of medicine are used at the hospital each day. The annual amount in terms of value runs to considerably higher than one billion yen. Therefore, proper stock control is not only important from the point of economy but is also essential from a medical point of view since depletion of the supply out of a particular medicine may slow down the work of the doctors or even endanger the life of a patient. As deliveries from the pharmaceutical houses are in large cartons whereas administration is in tablets, grams and ampoules, the system provides data which is highly useful for determining use levels and forecasting future trends.

(B) ORDER COMMUNICATION SYSTEM

This system provides assistance for day-to-day medical activities by facilitating data ex-

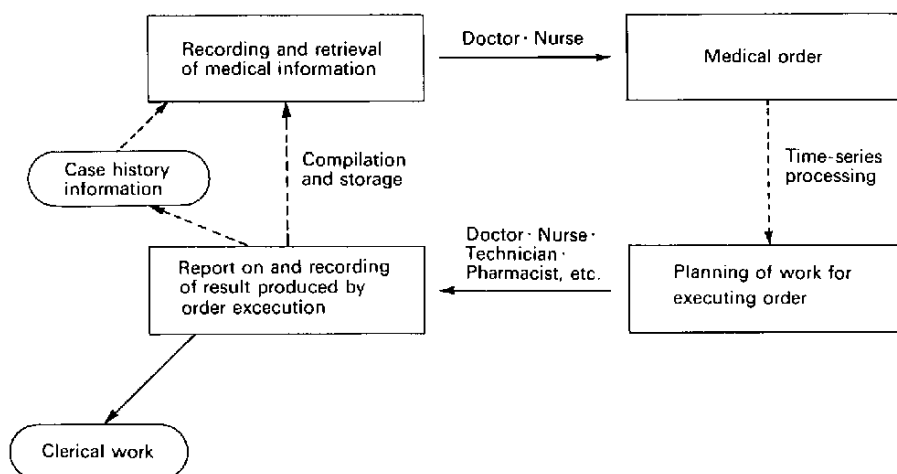


Fig. 4 Order Communication System in the hospital practices

change, providing retrieval of medical data, and compiling job procedures for systematically carrying out medical work to be conducted in accordance with the doctor's orders. It thus helps to assure that the work of caring for the inpatients twenty-four hours a day, every day of the week, as well as that of caring for 1300 outpatients, who are never the same persons on two consecutive days, can be carried out smoothly.

Thus, the loop contains the following six major job categories. (A breakdown of the tasks involved in these categories is given in Table 6.)

(i) Issuance of orders

Most of the orders are issued by doctors concerning medical procedures in line with an examination and treatment program. As a consequence, the work is in principle carried out directly by the doctor so that the person operating the computer terminal is the doctor himself. Naturally, in the case of work to be carried out by a nurse, it is the nurse who operates the terminal.

(ii) Receipt of orders

The order data is extracted as a time series program by all specialists of the medical staff who are responsible for its execution. Thus, all personnel are required to operate the computer terminals in order to obtain the data that they require.

(iii) Order related

As it is necessary for the patient concerned to be registered before the job which was ordered can be put into action, provisional registration outside of office hours, registration of hospital personnel and registration of personal passwords is carried out.

Table 6 Breakdown of OCS Jobs

Issuance of orders

Prescription
Test
Injection
Treatment
Surgery
Diet
Discharge
Department transfer

Order acceptance

Prescription
Test
Diet
Work schedule sheet formation
Preparation of drug administration schedule
Discharge and transfer order list

Order related

Registration of prescription check data
Medical personnel registration
Inpatient information input
Urgent measures for emergency patients

Input of results of examination and treatment

Input of test results
Input of confirmation of order execution
Surgery information input
Input of confirmation of order execution
Measured data input

Examination and treatment data output

Output on state of drug administration
Test result output
Output on state of injection
Output on state of diet
Hospitalization and discharge output
Output on state of all orders
Record output on surgery patient
Diagnosed ailment output
Measured data output

Ward administration

Input of daily ward report information
Output of daily ward report
Ward administration dairy output
Ward inquiry

It should be noted that these job categories are not independent of one another.

(iv) Input of results of examination and treatment

In the case of inputting a record of the results of the examination, where dialog-type input in accordance with the job procedure is carried out or where, as in the case of test data, quality

control is required, the input can be performed at one time after the job is completed.

(v) Examination and treatment data output

When it is desired to know how the examination and treatment are proceeding or what stage they have reached, it is possible to retrieve the medical data in any desired combination and display it on the terminal device or have it printed out as hard copy.

(vi) Ward administration

The condition of in patients can be inputted and outputted separately for each ward, reports can be compiled and inquiries can be made regarding work progress.

Although the intended system capability is as outlined in the foregoing, because of the tremendous amount of software development required, actual operation at present includes only patient hospitalization, discharge and interdepartment transfer orders, prescription related matters and test result related matters. Other aspects of the system are presently under development. It will be several years more before all systems are completed and data exchange and compilation can be carried out freely.

(2) Clinical information system

As DUCOM is an on-line, real-time processing system used to support day-to-day medical activities and hospital clerical work, all of the data is stored in memories amenable to on-line processing. To store all data relating to medical records in this form would, however, not be economical. Moreover, as such data especially after discharge the patient is not subject to frequent use or required on very short notice, greater freedom of use and better efficiency are obtained by editing data of over a particular age in accordance with the purpose it is expected to serve and storing it on magnetic tape and then, when the necessity arises, incorporating

the data into the hospital's on-line data base. Because of this, the data which have been accumulated by BOS and OCS are each day recorded on magnetic tape within the hospital and then sent to the hospital's internal information center for editing.

In addition, medical data not presently handled by BOS or OCS and the summaries prepared from the detailed records written out by the doctors are recorded on ordinary or punched slips which are collected together at the internal information center. As shown in Table 4 above, this medical data is used in various applications ranging from examination and treatment to research, via a total of 8 systems ranging from one for retrieving the medical histories of previously hospitalized patients to one for retrieving medical data. It is also used in the compilation of monthly and yearly medical statistics and materials for use in hospital administration.

(3) Systems using minicomputers

(i) Laboratory information system

As can be noted from Table 5, the laboratory information system started as one in which reports were prepared by processing the data output by automatic multichannels biochemical analyzer. The system has now advanced to one capable of compiling worksheets for manual tests and directly receiving manual measurement data as input. The computer scale has expanded accordingly. In 1975, input and output for automatic hematological testing equipment and for data related to microscopic morphological tests were, along with quality control procedure, transferred to separate processing systems. In the end, however, all five laboratory departments were consolidated under a single on-line data processing system using a super minicomputer (448 K W). Each of the departments employs an intelligent terminal having a microcomputer and a simple memory device. Microcomputers also play a

major role in connecting up with the automatic testing equipment.

The super minicomputer is used for overall management of the clinical testing work, as well as for data quality control and the day-to-day compilation of test data reports. The day-to-day test data which has been subjected to quality control is electrically transmitted to the DUCOM Center via inter-computer on-line connection and put into the BOS, OCS data bases (medical data input) from which the test results can be retrieved for each patient on a time-series basis upon an inquiry by the doctor. (on-line inquiry into test results) Through the connection with BOS as well, various general administration information is also made available.

(ii) Automatic electrocardiogram analysis system

The biochemical testing department operates an automatic electrocardiogram system for compiling reports based on the analysis of scalar and vector electrocardiograms and in this way supplies data on electrocardiogram analysis for use in everyday medical practice.

(iii) Medical image analysis system

When carried out manually, X-ray image measurement and *in vivo* three-dimensional measurement require tremendous amounts of time and labor. The minicomputer is a great aid in carrying out this measurement work automatically and in the formation of data bases through storage of the measured data. At present, X-ray analysis data base management is used in everyday medical work in the field of orthodontics where long-term planning and follow-up are essential. The time required for completion of the measurements in manual procedure on the X-ray film used to be 60 minutes. Now this work can be completed and a display obtained in less than 1 minute. Also, it has now become easy to obtain comparisons of

timeseries data and to compute and display differences between the measured data and standard data.

In the area of three dimensional measurement, automatic measurement of three-dimensional photographic representations using moire fringes is being used in obtaining *in vivo* cross-sections, and in calculating surface areas and volumes. For this, however, it is still necessary to upgrade processing efficiency by connecting into a very large computer.

(iv) System for research into analysis of the movement of living subjects

In diagnosing and treating ailments relating to body movement functions, it is important, particularly in cases where movement of the arms or walking movement is concerned, to record and analyze large volumes of electromyographic data and three-dimensional motion data.

Research into the motion of living subjects is being carried out at Kanto Teishin Hospital in connection with diagnosis, therapy and rehabilitation planning and evaluation with special emphasis on ailments falling within the field of orthopedics.

(v) System supporting statistical research by individual doctors

In their individual research work, doctors require a wide range of processing services including medical analysis of small amounts of medical data, forecasting, and compilation of research-oriented data bases, and for this reason a research support system employing personal computers has been developed.

(4) Utilization of large TSS data communication service

In the case of infrequently used data bases or where a large computer is required for complex statistical processing, it is more economical to employ external data communication services.

(i) Medical literature retrieval service (JOIS)

Japan Information Center of Science and Technology (JICST), a special corporation in the science and technology field, offers on-line access via telephone circuits to the following files, Monday through Friday, between 10 a.m. and 5 p.m.:

JISCT science and engineering file, CAS Chemical Abstract file, MEDLARS medical file, TOXLINE toxic substances file, domestic research project file and U.S. research project file.

Any member of the hospital staff is free to access these files to retrieve required information via a terminal which has been set up in the hospital library.

(ii) Scientific and technological computation service (DEMOS-E)

DEMOS-E, a public data service run by NTT, allows users to compile programs using such program languages as BASIC, FORTRAN, COBOL and PL/I. The service has a wide selection of statistical processing program packages (referred to as library programs). The service is used via a terminal in the research department for R & D into medical theory programs and for the analysis of large volumes of medical data in connection with experimental and research work.

The advantage of this system lies in the fact that it is a public data communication service, making it possible for hospitals throughout the

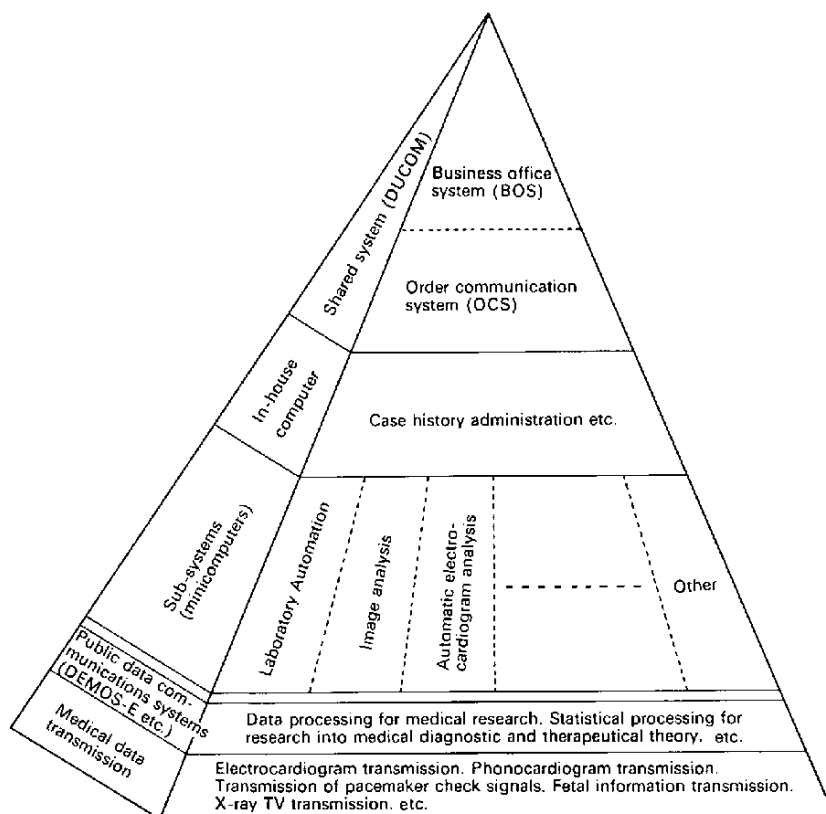


Fig. 5 Hospital Computerization Concept

country to exchange and share data and programs. Because of this, the service can be used with particularly high effect in medical research projects which require joint use of a computer by doctors at a number of hospitals.

At present, work is progressing on forming the various Kanto Teishin Hospital systems introduced in the foregoing into a composite system that will allow the individual systems to work in cooperation and supplement one another.

Future Plans for the Kanto Teishin Hospital System

As was mentioned earlier, an efficient hospital system can be realized only through the integration of numerous individual computer

systems. The required structural relationship among these individual systems is easily understood from Figs. 5 and 6 which were drawn up by Dr. Hirotsugu Sawasaki, Director of the Kanto Teishin Hospital.

Fig. 5 shows the hospital computer utilization structure, which spreads gradually downward in the shape of a pyramid. Fig. 6, on the other hand, relates to the development and operation of the various systems and shows the concepts and interrelations involved.

Conclusion

After ten years of actual operation, Japanese hospital information systems have at last entered an era of rapid development. At the

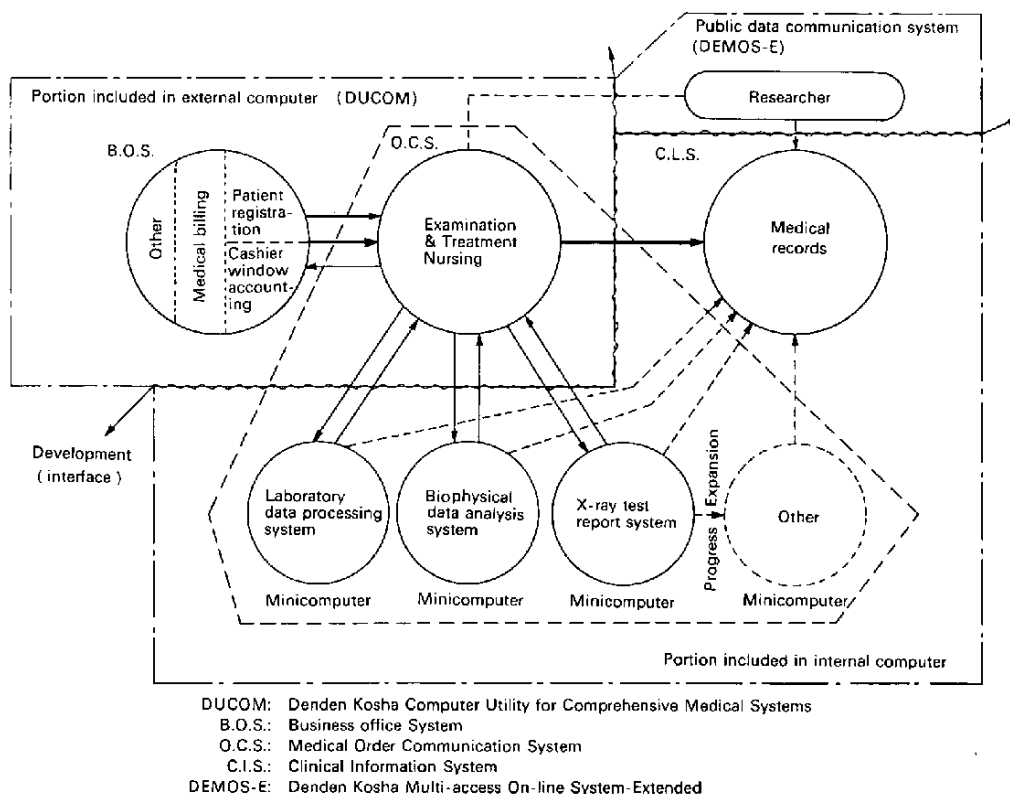


Fig. 6 Future Concept for Computerization of the Kanto Teishin Hospital

beginning of 1980 it is estimated that about 25% of Japanese hospitals and about 10% of the clinics use data processing, but in most of these, computer utilization is limited to merely one part of the clerical work at the hospital or clinic. Now, however, there is a new trend, a fact that is particularly noticeable in the changing attitude of medical personnel. As was outlined in the foregoing, computers are now coming into wider use in medical work itself, for controlling the flow of information and processing data, and all indications are that interest in applying computers to medical examination, diagnosis and therapy will continue to rise rapidly.

The information system of the Kanto Teishin

Hospital, Japan's pioneer in this field, has been introduced here as one example of hospital information systems in Japan. Several years will no doubt be required for the hospital's progress in system development to filter through to other hospitals located in various parts of Japan.

In closing, I would like to mention that this article was prepared on the basis of long and careful studies by the entire staff of the Kanto Teishin Hospital from the Director on down. Emphasis was at all times placed on practicality, with special consideration to making medical care both more effective and more economical.

My Trial Development of an Electronic House

Takeaki Yoshida
President, All System, Ltd.

I Introduction

The computer age at long last seems about to involve the home. About five years ago, after some twenty years of involvement with computers, I thought I'd try to see what a full-scale computerization of a house was, and for this I set to work on the necessary development.

There was nothing like this at the time and there were limitations in a number of areas. Despite this I pushed on with this development, so as to accumulate all the data. Now that the overall project is 99% complete and in operation, I would like to give a general outline of it here.

What started me thinking about developing this system was that, while individual technologies and systems were being developed, the absence of any overall, integrated arrangement always made me feel that something was lacking.

My reason for setting to work on developing the system was that I wanted to see what kinds of problems would crop up when it was in actual operation.

In fact a variety of problems were encountered in the system's implementation. Linking a number of different devices on-line, for example, meant that different types of signals had to be connected together, and the

intersignal adjustment this involved was a very difficult task. I was also made to realize that, on a number of matters, persuading the various people concerned was a greater problem.

Starting from these initial intentions, all I/O systems were covered as far as possible.

1. System features

A General

- 1) Includes all possible appliances in a house.
- 2) For both information and control functions, it merges differing signal modes, such as analog and digital.
- 3) System format allows these to be used simultaneously.
- 4) As all systems are general-purpose rather than specialized, they can be taken anywhere and used with any device.
- 5) The entire system is designed for practical utilization; it is not a temporary show-piece.
- 6) Considerable effort has gone into back-up safety measures.
- 7) It is connected with ordinary external systems.
- 8) The kanji displays used are easy to understand, even for someone unacquainted with the system.



- ① Solid state speakers
- ② Radio
- ③ Cassette Deck
- ④ Record Player
- ⑤ Amplifier
- ⑥ Video Tape Recorder
- ⑦ Magnetic Tape Recorder
- ⑧ Television Signal Receiver
- ⑨ Timer (The household electrical appliances are controlled by setting this clock)
- ⑩ Central Control Unit (This is the "Heart" of the system which distributes signals from the various mechanisms to the terminals)



- ⑪ Terminal Control Unit (The 'Controller' for all the household appliances)
- ⑫ Floor Heater
- ⑬ Color Monitor Braun Tube
- ⑭ Main Braun Tube
- ⑮ Monitor Braun Tube
- ⑯ Animation Printer (A print can be made of a single television image)
- ⑰ Atmospheric pressure, temperature, hygrometer, ion generator
- ⑱ Speaker (All the sounds from the T.V., radio, stereo, tape recorder, etc., come from this speaker.)
- ⑲ All Channel Monitor (Capable of monitoring 8 different channels simultaneously.)
- ⑳ Wide Band Short Wave Receiver (Capable of picking up broadcasts from all over the world on 24 bands.)

B Input Features

- Switchover to manual.
- Local automation.
- Centrally-controlled automatic operation.
- On-line operation via special terminals which use public telephone lines.
- On-line operation using ordinary telephones as the terminals.
- In-line operation using internal wired format.
- On-line operation using radio means, such as a pocket bell.
- Indoor on-line operation using simple radio.
- Communication system facility using external data base (Captains viewdata system).
- Business system facility provides link with stores (telecenter unattended message reception system).
- Operating flexibility that includes the ability to switch on the computer from an external location.
- System for enabling the various devices to be started or stopped from an external location, via the computer.
- Device parameter automation.
- Multiple control using clock-timers.
- Interval control using clock-timers.
- Interlocking with various sensors (for sound, temperature, illumination, objects).
- Interlocking with voice synthesizing and recognition devices (at present, connections are still under development).

C Output Features

Outputs are on-line and in-line throughout, and there is a back-up system for all off-line controls. Output controls extend to all electrical means of communication using telephone circuits. The voltages involved range from the very high down to the very low, and control of ordinary circuits as well as leased lines is possible. In all, controls extend to some 240 types of input and output.

II Utilization Formats: System Formation and Problems

The system I'm now developing is a kind of private trial house, but if in future it is going to become part of the ordinary home, it will probably be of a fairly high order, and is of interest as being an image of the home of the future.

To digress for a moment, there are certain norms, or accepted criteria for doing things, and before one realizes it these norms have become standards. Unless at some point such criteria are toppled, we have to go on relying on the old ways and formats. The problem is to decide just when this is to be done. It is my hope that this Electronic^o House will topple some things now accepted as norms; when this happens, then will the next era arrive.

Considered on an overall basis, this Electronic House costs a very considerable sum of money, but if it is implemented in stages the amounts involved would not be impossible, by any means. I'll explain this point in outline in the following pages.

1. System Television

With regard to the use of television, two image modes have to be considered, still and moving (or static and dynamic).

1) Still Pictures

Still pictures are used to utilize information. In this regard a lot of publicity is being given to use of a) data base systems, b) man-machine systems, c) processing systems and d) communication systems.

As a monitor for the Captains system, I am making full use of the system's data base. For man-machine systems, I get a lot of entertainment from a number of TV games which use control keyboards, etc. As for a processing system, I use my telephone to feed data into a small business computer located in a distant

office for analysis and to process the household budget, without any human intervention. The communication system function is fulfilled by using a telecenter (unmanned message receiving unit) to communicate with other parties and for automatic message transmissions.

2) Moving Pictures

Connected up to my TV set are a video recorder, a motion analyzer and a hard-copy printer. In order to hard-copy from ordinary TV broadcasts and the video playback, as well as of still images, a memory capability is needed. I/O interfacing of the two types of video signal system was a problem. Multiterminals are necessary to handle the number of output signals, but it is obviously asking too much to expect to find these on ordinary TVs. And hard-copying a moving image is not the same as hard-copying a still one; there are problems involved in the hue hierarchy display, such as the need for many memories, an image freeze unit, a high number of display dots, etc. Needless to say, the cost of the devices for all this is much higher than for still pictures.

2. System Telephone Utilization

1) Data Base Utilization

The indications are that the newspaper of the future will be brought into the home via data transmitted through the telephone line, displayed onto the TV screen and output as hard copy. An approximation of such a system is possible today by taking hard copies of the data provided by the Captains system. Still image applications often mentioned include cooking instructions, housing information, sports news, airline seat reservation information and stock prices and performance. Technically speaking, this is all just straightforward extraction of information from the data bank; in fact, a much more important point concerns maintenance of the data bank file. Therefore such applications are only limited by the size of the

data bank—the bigger the data bank, the more the applications; but as far as hardware is concerned, all systems must be considered as being similar.

2) Telecenter

Using a telephone to punch in data, e.g. for the household budget, for processing by a remotely located computer poses no problems as far as business purposes go, but for a home the CPU would be too expensive. This is because it would be an on-line system, not like an in-line microcomputer system inside a home. Used at present is a simple electronic exchange system that has been scaled down to a household level. While it can be called cheap for what it is, it is still very expensive for home use.

However, it is a system that can be used for many things. For example, it means you don't have to specially purchase terminals to enable you to use the home telephone; also, it allows unmanned interchange of data with other households to be carried out. Therefore messages can be handled even in the middle of the night and, unlike the case with facsimiles, the data feeds directly into the computer.

3) Data Transcription

A system which uses telephones to transmit data can be used for communicating with external parties. My system has such a feature. Specifically, it means, for example, that you can take your time, in the evening, over the next day's menu, accessing the necessary data in the data bank and tap your order in to a shop, using your phone, and even if the shop is already closed your message will be processed automatically and the goods delivered the following day. Or to take another example, information sent to your place of work (as from a customer) will be delivered, even if you have already gone home. As this only requires that each party has a phone, it can be set up very cheaply, with the only thing needed being a

centralized controller.

Such a system is in a very similar position right now to that of the automatic vending machines or credit cards of a while ago. Back when automatic venders were not in wide use, a fair amount of PR effort was needed to promote them, and the same is true of credit cards. The telecenter has a number of points in common, such as a) need for a lot of initial PR b) their widespread, popular use will revolutionize distribution practices, c) they are meaningless unless large numbers of people participate in their use, and d) they are cheap and simple to use. The implications reach far beyond confines of the Electronic House.

4) System Implementation

With regard to the role of the telephone in the setting-up of the system, there are five areas of telephone and computer control: control signals, picture signals, alphanumeric data communications (digital), sound signals, and pushbutton phone signals. For control signals, the telephone is directly linked to operate the computer systems, and for picture signals it is used with the Captains system. For alphanumeric data communications, the computer link is by on-line terminal. For sound signals, in addition to the usual twenty or so types of telephone function, other functions have been added, such as automatic response, automatic recording, recording while conversing, remote listening, automatic message playback using radio, automatic sound amplification, and automatic message switching. With pushbutton phones in each room and an internal auto-interchange function, the system can also be used as an interphone. And finally, the pushbutton phone signals are used, for sending and receiving orders, as described above, using an inexpensive controller.

3. Sound Equipment System

1) Interfacing

Technically speaking, there is nothing difficult about automatically transferring sound signals being put out by the equipment as desired, among the various I/O devices, or the automatic transfer of such sounds to units in any particular room. This is attracting widespread interest because of the convenience it offers. However, a problem is that while most of the system's component devices are available on the market, many of them are designed for industrial applications. Not generally available on the market, though, are connection controllers allowing the various devices to be connected up in any required combinations, so such controllers have to be made specially. This requires a thorough knowledge of the size, power requirements and rated performances of the audio devices which are to be coupled into the system. Specialized knowledge of the internal wiring and input/output terminals is also needed. While televisions, stereos and the like may seem the same to a layman, to the expert they are completely different. Hooking up all these into an on-line system requires a considerable amount of inter-device interface adjustment. Also, linking these up to the room broadcast systems requires something completely different from the separate products on the market. This is more true in the case of only system, because in addition to providing these functions telephone and microphone input is also possible.

2) Multiple System Format

Multiple components and devices enable sound equipment to be used extensively and flexibly. My system uses multiple devices throughout—cassette tape decks, videocorders, etc. At the beginning, people involved in this laughed at me, saying that in this sense, multiple only meant backup, and was therefore meaningless. I convinced them about my idea

and this method was finally implemented five years ago. Recently now, multiple cassette tapedecks have been appearing on the market one after another.

Multiple sound and video cassette decks offer a number of advantages, big ones being deck-to-deck format conversions and editing capability; or if one is used as the main unit and the other as the sub, recordings can be mixed in with a mike on the sub and then fed into the main; during replacement there is no idle-time; and, of course, it's a useful measure against loss of system capability caused by breakdowns.

3) All Functions

In the system I am developing, sound equipment includes record-players, TV, stereo (including FM, short and medium wave), and cassette, video and open-reel tape. The system allows switchover to any of these components as well as recording and mixing. Telephone input/output is also possible, plus mike mixing, and distribution to each room.

While audio components are unifunctional, a number of composite formats are being exhibited as the systems of the future, but they only offer a part of the functions possessed by my system. The reason is that they are only manufacturers' products, and not systems in the broad sense of the word. No matter how much effort the particular department of the enterprise concerned expends, they are unavoidably limited by this.

It was really through my work as the chairman of the Terminal Technology sub-committee of the Electronic Machine Industry Association's computer technology committee that I was able to gain knowledge about a wide range of terminal device and to arrange these together to produce this Electronic House.

I think you'll readily understand that for the liberal use of amplifiers and junctions, considerable amounts of wiring have been installed, more than is actually needed. With

regard to audio devices, the most difficult thing was selecting the most suitable functions and types for combining into the overall system. In the end, products from nearly all the manufacturers were included in the system, which really goes to show that each maker's products have their own particular features.

4. Water and Gas Systems

1) Water

The kitchen system alone has over ten water taps. Some of these supply acidic water (good for low blood pressure) and others alkaline water is sterilized and filtered. The taps also have different flow rates (strong, weak) and supply water of different temperatures (cold, warm, hot).

Each appliance requiring water (dish washer, washing machine, refrigerator, etc.) has its own separate automatic supply, and the clothes drier, microwave oven, etc. are served by automatic drainage systems. When the other automatic water supply systems such as that for the bath tub are also included, the total number of water control systems becomes considerable.

In particular, since parallel hot-water and electrical systems are used for air conditioning, water pressure control is indispensable. Also, as floor heating and ordinary-type heating are combined according to the circumstances, a computer is used for controlling the automatic hot water circulation. Even the pumps are centrally controlled.

In connection with water control, it will be necessary to give the utmost attention to water-proofing so as to preclude damage from water leakage etc.

2) Gas

Among the various gas appliances, those used in the bathroom require the greatest attention. Consideration must be given to all types of safety preservation and nuisance prevention facilities in connection with electrical shorting,

gas leakage, sparking of control devices, waterproofing, noise prevention, static noise generation, heat insulation etc. Control of water pressure, electrical voltage and gas pressure is especially troublesome since these are affected by a very complex combination of factors including the situation at other indoor and outdoor outlets as well wind direction, location of the outlet and the angle of incident sunlight. In connection with the bath, for example, if water level, rewarming and temperature are all to be controlled automatically it is essential to take these factors into consideration. This is even truer if sound equipment, ventilation fans and various other devices are also to be installed in the bathroom. It further goes without saying that very detailed consideration must be given to the mixing of hot and cold water.

At any rate, the bathroom differs from the other rooms in that not even the smallest mistake can be tolerated. As a countermeasure against possible computer malfunction, the present system gives maximum attention to fire prevention, ventilation and numerous other safety measures. The cost of building the bathroom is correspondingly high, over twenty times the usual amount. This is not only because of the money required for the control facilities and also because of the more than adequate investment in safety equipment required to obtain the approval of the officials concerned. Even with such elaborate precautions, however, it will still be necessary for the user to operate the system with care. Bathroom automation must be approached very cautiously.

Where gas is used, its application will not be limited to the bathroom but will extend to the air conditioning and hot-water systems and to other gas appliances throughout the house. Various types of controls are required for everything from the pilot burners to the automatic burner lighting system. Because of the

possible need for repair, therefore, it is important to arrange the control panels for each of these serially in accordance with the control route and to clearly indicate the points to be given first priority when something goes wrong. In this system, an exclusive gas control device is closely integrated with the central control unit and an individual processing device is further provided at each gas appliance. In addition, the control system of each gas appliance is connected to control terminals provided internally.

These controls are not just pieces of gadgetry dreamed up by microcomputer buffs. Each was installed by an authorized specialist after it had been approved by the officials concerned. Under no circumstances should an amateur tinker with any of these practical, sophisticated devices and systems. This is mentioned since the microcomputer boom has blurred the distinction between hobby systems and practical systems. There have even been cases in which complaints were made about noise interference caused by someone using a toy transmitter in a practical system.

5. Electrical Appliances

1) Lighting Control

In lighting control, it is necessary to take into account illumination control, line current control etc. Any attempt to go beyond simple, centralized computer control and into complex control systems involving complicated interactions among various sensors, multi-switches and the computer is, however, runs into problems due to the limitations of currently available equipment.

Various measures have, of course, been devised to cope with these problems, some of which were quite unexpected and related to the more interesting aspects of the system. For example, the difference between incandescent and fluorescent lighting, two-period switches, three-point switches and analog lumination control all presented snags where none had

been expected.

More interesting than illumination control itself are the causes which make control necessary. The present system is able to cope with any kind of situation since it is responsive to a variety of interrelated factors that include not only wired control but also sound and wireless control as well as illumination, the movement of persons or objects, warmth, etc.

Probably the biggest headaches in connection with lighting are where to put the control panels, how to run the wires for interconnecting the panels, how to deal with the intermediate switch problem how to keep the need for numerous switches from overcomplicating the signal line system, how to minimize the required diameter of the line pipes and how to prevent interference between signal lines. The list might be continued to include the problem of space vs. illumination, location, ceiling reinforcement, the electrical system, the quality of the cable lines, and many, many others. Those mentioned here are only the tip of the iceberg.

In all cases, what is important is to take these problems into consideration at the time the building is being constructed. And for this, it is essential to have a good three-dimensional concept of what is required.

My system encompasses the construction stage and takes these problems into full account. When completed, the house does not appear at a glance to be different from any other. This is because the wiring etc. is not exposed to view. An essential feature of a house system is that it be fully integrated with the house itself. A "system" that has its wires etc. exposed just for show cannot really be called a system at all.

2) Control of electric cooking appliances

Electric cookers, toasters, hot plates etc. are designed to be moved about and therefore must be made controllable wherever used. In some

cases, a number of such cooking appliances are used simultaneously; in others; their operation may have to be controlled serially. In addition to devices for automatic power source switchover, automatic heating, automatic shut-off etc., these appliances also, of course, require auxiliary safety devices.

With small appliances of this type there is a tendency to ignore the power source requirements. As a result, there is a tendency to use lines with power ratings that are too small, which may lead to fires or blown fuses, or to use lines with excessively large ratings, which is apt to push basic monthly charges so high as to make the system impractical. Unless the optimum combination of lines in terms of rating, purpose and time is obtained, the system may well become a system only in name. This is one of the most difficult points in realizing a practical system.

3) Air Conditioning Control

Although air cooling and heating devices have built-in automatic regulators, these are not capable of providing truly systematic temperature control. The regulation they provide can best be called simple auto-control.

As air conditioning devices use a variety of energy sources, it is necessary to employ an integrated control system encompassing the electric power supply, gas, water, pumps and fans. Especially, in view of the fact that a variety of electric power sources is required, a good deal of thought ordinarily goes into obtaining the best combination of these. When a large capacity power source is used, it becomes particularly important to implement various safety measures for preventing damage should the system happen to run out of control. The idea of carrying out various kinds of control by computer is fine, but it should be remembered that in the case of a general purpose unit the switching procedure becomes quite complicated, and for this reason it is important to

provide automatic locking in the case of a misoperation.

6. Curtains, Doors, Air Conditioning System

Motor-driven systems are used for the curtains and doors.

The operation of these systems is naturally closely related to the number of daylight hours, the movement of the house occupants and whether the lights are on or off. Differently, from the lighting, the curtains cannot be controlled effectively by a simple on-off system since there is also a directional factor involved. Moreover, there are problems of a totally architectural nature such as the optimum curtain drawing speed and the need to consider the amount of curtain friction. Further, since it is necessary to consider both appearance and function, what is needed is not a system exclusively for the curtains (like the automatic systems used in theaters), but a system that can be used anywhere, anytime; one that is simple enough for home use and that has good compatibility with the other automatic facilities. It is by no means easy to satisfy all these requirements.

Still, the present system goes far towards meeting these needs. Unfortunately, however, the general reaction to the system is usually simply surprise that the curtains move by themselves, and it is difficult to gain appreciation for the numerous other features that have been incorporated. The system makes it possible to draw the curtains to any position regardless of where they are put up and is therefore capable of wide application.

2) Air control and conditioning is carried out by ventilating fans, air cleaners, ion generators (both of the type built into blankets and of the type for treating air only), humidifiers, dehumidifiers, etc. These regulate the air temperature, humidity and ion concentration to levels that may not be absolutely perfect but

which are very close to optimum conditions from a hygienic standpoint.

The control of these devices can be carried out by computer so that each remains in operation for a predetermined period of time. It is, of course, necessary to time the operation of each device to match concurrent activities. As the operation time is limited to the minimum required, the system is energy efficient.

III Conclusion

1. Development Economics

Up to this point I have described the devices and how they are formed into the system, the problems involved, focusing mainly on the output system, and some of the applications. In addition, though, there are, among the audio devices, TVs with a world-wide reception capability, five ultra-sensitive antenna clusters for these TVs, automatically orienting directional antennas, ultrasonic object detectors, infrared object detectors, automatic indoor radio message units, automatic outdoor radio message units, mike mixers, etc.—all high-performance equipment, system-integrated and connected up to the computer. This is an important point. Also, nearly all were designed for industrial use. There are also sauna cleaners and water purifiers (not included on the list) for a grand total of some 240 types of input/output devices coupled together, and put into actual operation. Suitable power sources were provided beforehand. An important point is that back-up circuits were also provided. For these systems more thought is needed for various measures to guard against exceptional cases, fire and misoperation, than on surface aspects. Helping in the system design were factory development engineers specializing in computers, controllers, motors, sound equipment, TVs, wired systems, radio systems, civil engineering, construction (design and earthworks), and utility companies (gas, electricity and water). The construction engineers were also drawn from a

wide range of specializations. The devices were used as components rather than products, and as they had to be connected together, engineers of the various makers concerned were involved in the related consultations. It was truly a large-scale project, involving more than 200 people.

I myself oversaw the design, development and construction of this system, and all of the building plans (three-dimensional and two-dimensional), wiring plans, piping plans, electrical capacity calculation sheets, design drawings for the concealing furniture and the device enclosures, controller wiring diagrams, selection of terminal devices and internal control elements were original, prepared just for this purpose; these were checked and double-checked in great detail, with extensive consultations being conducted.

Nearly every day I went to the construction site (which is quite near, diagonally across from this company's office), checking things at every stage, from the placing of the reinforced concrete to the final completion. For all who participated in the project, it was, of course, their first experience of such a system, and many mistakes were made, including some by people from major corporations, but in the end everything somehow settled into place.

On site, there were repeated modifications when the initial plans and the actual technology didn't match; right to the last, in an effort to get ever greater potential, new devices were being incorporated; days were consumed in persuading people about various points, and so on, until completion. Even when these were overcome, there were problems of the final costs (climbing higher), problems of fire-prevention, problems of compensation should anything go wrong. Completion first became possible when I assumed full responsibility, with the fact that I was the developer and would be the user

settling things.

2. Towards the Next Step

Work started on this system five years ago, and it was completed three years ago; improvements have been made constantly since then and the equipment has been brought completely up-to-date. However, there have been a number of problems, such as relating to the number of years the devices can stand up to use, the balance among the devices, the gap between device capability and utilization, the overheating of motors, switch problems, etc. However, at this stage, where I have mastered it, it is fully capable of being mass-produced and practically applied. Voice recognition and synthesizing units are to be added soon, which will complete this first step.

There are a number of specific plans for the next step, such as automatic variations to match an individual's situations, links relating to distributive functions, energy-saving, assistance for everyday tasks, and night-meals, robots, with house operations, and weather conditions. While a start is planned for the near future, no completion schedule has been fixed.

This type of system requires an overall system manager. Just piling up individual technologies does not result in a system. I think a slightly different type of system concept is a necessity. I do of course think that doing it in parts enables it to be carried out quite cheaply, and the makers who participated in this project have incorporated such individual system technologies.

But whatever the way, it is a full-scale system that is to be built, and what is involved is not the same as when making a single device, so the most important things will be to keep in mind after-service and the user's situation (capability etc.), to avoid any undue hastiness.

News in Brief

Government and Information Organizations

SEPTEMBER 1980

The Ministry of Posts and Telecommunications (MPT) formally announced on the 26th that the developmental work on the CCIS two-way video information system in use on an experimental basis in Tama New Town, Tokyo, will be completed by the end of October. The Ministry played the central role in the development and testing of the system.

The city of Hino, Tokyo, proposed, in September's ordinary meeting of the city council which opened on the 12th, to establish regulations with regard to the management of the city's computer system in order to protect its citizens against invasions of privacy.

OCTOBER 1980

Nippon Telegraph and Telephone Public Corporation (NTT) has decided to enter into a long-term agreement with IBM (U.S.) for the purchase of computer peripheral devices on a continuing basis.

NTT on the 9th filed an application with MPT for permission to market the "Data telephone," a push-button phone capable of displaying the number being called, as well as of storing a number and calling it back.

MPT decided on the 13th to establish a discussion group as part of its efforts to formulate a telecommunications policy. The group, which will be made up mainly of representatives of various fields in the private sector, will serve as a private advisory council to the Minister of Posts and Telecommunications.

Ministry of International Trade and Industry (MITI) on the 23rd, decided on the contents of its "Outlook and Problems regarding Industrial Structure in the 1980's" which is to deal with the problem of what kind of industrial structure Japan should aim for during this decade.

NOVEMBER 1980

The Software Industry Association plans to send two executive level members of its technical committee to the U.K. between the 19th and 30th of November in a move towards materializing plans pending for three years to set up an Anglo-Japanese software joint-venture with CSA, British information processing service association.

MPT on the 17th announced its plans to set up a research group made up of experts from the private sector and Ministry officials. The group's purpose will be to evaluate the Captain System and present opinions on plans for putting the system into practical use.

MPT and NTT have decided to begin commercial operation of the Captain System starting in 1982. The Captain System has been under test operation in some of Tokyo's 23 wards since last December.

Industrial Structure Council opened general and subgroup meetings on the 28th at which a report on problems and prospects concerning Japan's industrial structure during the 1980's was approved for submission to Mr. Tanaka, Minister of International Trade and Industry.

Computer Systems

OCTOBER 1980

Fujitsu recently concluded negotiations for an agreement with The Tientsin Scientific Committee (Tientsin, China) for the joint development of a Chinese language information system. The agreement will be signed at the end of October.

Hitachi on the 23rd announced its business results for the first half of 1980 (April—September). Sales, at ¥977.6 billion, exceeded those for the same period in 1979.

Fujitsu on the 27th announced its business results for the first half of 1980. Sales for the first half of 1980 were ¥274 billion and both sales and profits were higher than for the same period in 1979.

Nippon Univac, in order to firm up its position in office automation, a projected growth industry for the 1980's, has decided to adopt a policy of cooperation in the OA field with its new subsidiary, Sperry Univac, as well as with two other companies it has tied up with, Oki Electric Industry Co. and Mitsubishi Electric.

NEC on the 28th announced its business results for the first half of 1980. Sales rose to ¥408 billion. Profits were also higher.

Toshiba announced on November 11 that, in accordance with the company's plan for vigorous expansion of OA operations, it will expand its office automation operations planning office. A general section for OA operations will also be set up.

NCR Japan has recently completed the development, a Japanese language data processing system, a success achieved by a project team organized jointly by NCR (Japan) and its parent company NCR (U.S.).

Fujitsu recently began marketing two newly developed series in the MB8850 MOS 4-bit one-chip microcomputer family. They are the MB8850A series and the MB8850L series.

Prime Computer (U.S.) has decided to launch a full-scale campaign to advance into the Japanese market. Presently, the company is considering the establishment of a Japanese subsidiary under the name of Prime Computer Japan.

Hitachi plans to invest ¥60 billion in R & D during its last half-year period. Together with the ¥50 billion for R & D invested in the first half, the total for the year will come to ¥110 billion.

DEC (Japan branch) announced that in November it will launch a vigorous campaign to

expand sales of its VAX-11/750, a simplified version of the super minicomputer VAX-11/780 series. The company's aim is to establish leadership in the 32-bit machine market.

NOVEMBER 1980

Oki Electric Industry Co. on the 31st announced its business results for the first half-year period. Sales came to ¥92 billion.

The five domestic computer manufacturers have all announced their business results for the first half of 1980 and all had a good half-year, showing substantial growth in their computer-related divisions.

DEC (Japan branch) announced on the 5th that it will begin marketing its VAX-11/750 32-bit super minicomputer.

Software and Computer Services

OCTOBER 1980

Computervision (U.S.) announced on the 2nd that, in order to strengthen its sales strategy in the Japanese as well as other Asian markets, it has established a new company in Japan, Computervision Asia, Ltd. Operations will begin in mid-October.

Maruzen's MARUNET information retrieval system, a service operated under a tie-up with Lockheed of the U.S., is enjoying increasing popularity. Customers are using the system close to eight times as many hours now as they did at this time last year.

NACCS will use a computer for the general supervision of customs clearance of incoming cargo at the Osaka International Airport. An air cargo clearance data processing system has already been installed and operation will start on November 11th.

NOVEMBER 1980

NTT has begun work on the development of a teleconferencing system, utilizing a com-

munications satellite.

ITT World Communications announced that it will tie up its Universal Data Transfer Service with KDD's International Computer Access Service.

Toronto University will sign an agreement with Maruzen on the 20th in Toronto, under which the university is to provide Maruzen with its automated library system services.

Japan Information Service, Ltd. will enter into a joint venture with Comshare (U.S.) with the aim of setting up an international network service.

December 1980

Hitachi Software Engineering will begin marketing the integrated business information system of SAS Institute in the U.S. from December.

Maruzen will, from the beginning of 1981, expand its DIALOG system through the addition of MEDLINE, a documentary information system in the medical field.

JIPDEC

Japan Information Processing Development Center