committee of the USA Standards Institute. The standard includes the physical specifications of embossed plastic credit cards, specs for the dimensions and locations of embossed data, the type style(s) to be used for embossing the account number line, and the account numbering system.

The proposed standard, recommended by the X4-A11 subcommittee, headed by Tom Deere of Data Card Corp., was based on work with airlines, petroleum distributors, banks, retailers and travel/entertainment organizations representing almost 200-million credit cards.

The proposed "standard" really comprises several standards. For instance, it proposes the "large" card used by the airlines, banks, gasoline peddlers and travel/entertainment people, but notes that the "small" card beloved of retailers is "used on 77% of 101 million cards issued" and represents a *de facto* standard. The report of X4-A11 suggests that "retail stores that desire or intend to accept other cards ... should give full consideration to the advantages of issuing their own cards according to Standard Number One" (the "big" card).

Showing equal friendliness on standards for the embossed account number line, the report endorses USA Standard OCR-C, but "recognizes" the Farrington 7B1 font, and notes that "many OCR machines can read both styles." Later: "The variety of the coding techniques illustrated and the lack of wide acceptance of any of them indicate there is no basis for standardization of machine-sensible encoding of credit cards at this time."

The report recommends that the account numbering system assign the first digit to the issuing industry, the next three to the issuing company, with between 8 and 11 digits to be used for the individual account number, A final check digit is also provided.

Publication and letter ballot were scheduled to take place in September, with 60 days allotted for the comments of the edp and credit worlds.

FACILITIES MANAGEMENT POPS UP EVERYWHERE

Facilities management is gaining adherents daily, although most of them seem to be companies hoping to emulate Ross Perot and Electronic Data Systems. Among the latest is Cambridge Computet Corp., currently in the process of going public.

True to industry form, Cambridge has yet to turn a profit although it has generated some revenue since beginning operation in July 1968. The revenue amounted to $92,608 as of April 30. Losses at that time were $230,213.

Principals in Cambridge are Norman and Stanley Rubinson, Stanley Posnack and Edwin Hammerle. Posnack is 28 and a onetime IBM systems engineer. Hammerle was national marketing program administrator for the wholesale and retail drug industry at IBM when he left in December.

People from IBM's marketing operations are in strength at Cambridge. Its subsidiary, Cambridge Computer of New York, Inc., is headed by John Kehoe, ex-IBM publishing industry branch manager, and Frank Triola, ex-marketing manager, manufacturing industries. Others among the company's 30-odd staffers have IBM experience in the publishing, food processing, grocery chain, retailing and distribution industries.

Cambridge's revenue producing activities are dominated by Drug Distribution Data, Inc. (DDD). It owns 20% of the company, which is developing a data bank and reporting service for the wholesale drug distributors. The National Wholesale Drug Association, 60% owner in DDD, is supporting the program.

So far Cambridge has done a system study for DDD, loaned it $145,000 and got a 10 month contract from the company to establish and operate a computer center and manage the program. As of April 30 DDD had paid Cambridge $74,700 in gross receipts. Extension of the contract and the program will depend on the approval of seven drug wholesalers who now receive the reports.

The company has also done system studies for an OCR system for a drug wholesaler, a marketing information program for the ski equipment industry, an Instant Vehicular Information system for state governments, and an electrical parts distributor. In addition it does consulting, edp training and is developing a data input terminal.

WESTINGHOUSE AT WORK ON FIFTH GENERATION LSI

The beam of light used in the photographic processes for fabricating miniature devices and integrated circuits cannot be made small enough for the work being done by Westinghouse Electric Corp. scientists, so they have turned to electron beams instead. Using a device called an imaging tube, they are directing electron beams at targets as small as a few millionths of an inch on a side. Wavelengths of light can not be compressed enough to use light beams on these targets — not even laser light beams.

With the thin electron beam, the Westinghouse designers are producing circuits tinier than any ever made before, circuits with as many as 4,000,000 devices squeezed into a one inch square area. In contrast, large scale integration techniques employing light beams were used in the creation of IBM's newest super computer, the 360/195. The packing density realized in that machine's components was "only" 53,000 devices per square inch. Clearly, the Westinghouse developed circuits can be as much as two orders of magnitude smaller.

To create their tiny circuits, the Westinghouse technicians first make masks of the elements to be included. These are etched, in actual size, onto a light-sensitive metallized surface by an electron microscope driven by a computer-created magnetic tape. The tape is created with the same kinds of plotting commands used for driving a pen plotter.

The masks are placed in an imaging tube, a three-inch long and three-inch in diameter device surrounded by electromagnets. Inside the tube each mask acts as the negative electrode. Electrons driven from the mask surface by ultraviolet light strike a silicon wafer at the anode end of the tube. After each bombardment, the wafer is chemically treated. The process is repeated for as many masks as needed until the wafer contains all the patterns of the finished circuit.

Although the process is currently limited to wafers two inches in diameter, larger tubes can be made for larger surfaces. What will this lead to? One speculation is a hypothetical "computer on a wafer."

LUNAR MODULE COMPUTER PROBLEMS (CONTINUED)

The Lunar Module guidance computer, which caused the big scare by giving out a warning of overloading during the moon landing (Sept., '69, p. 145) is a real-time minicomputer. It was handling, in time-shared fashion, the constant updating of a series of instrument scans, navigational computations, engine control, etc., some of which had to occur as frequently as ten times each second. It was also handling the communications and, perhaps most importantly of all, was providing the astronauts with the computation and information they called for in those last moments of the descent.

The computer's performance handling all this activity is critical because of its real-time characteristics. If it does not get through its workload in time some of the real-time work can be spoiled completely, and the mission may have to be aborted in order

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to save the astronauts (the abort systems are carefully kept in another computer, so that they would still be functional). This nearly happened on Apollo 11. As it was, the astronauts were told not to use some of the facilities which had been provided for their use — just when they might have been most needed!

After the scare was over, NASA gave two explanations of its cause. The radar rendezvous instrument was on, they said, and this took 15% of the computer's capacity and so caused the overload. Then, later, it was said to be due to a "dithering" electric current. The performance of the actual hardware and of the Luminary 1A software was said to have been perfect.

While either or both of these reasons may well have been the immediate cause of the computer scare, a more basic reason appears to be that the computer simply was not powerful enough for its job. The Lunar Module computer, in fact, was quite unusually slow for a 1969 real-time minicomputer of any type. Its basic cycle time of 12 microseconds, while perhaps impressive to lay audiences, limited it to less than one-tenth of the power of many standard computers. Last March, for instance, DATAMATION surveyed the real-time minicomputer field, and found no system with such a slow cycle time.

Many had 10 times as much basic power or more. These included the PDP-9, CDC 1700, Date-Mate 16, Decade 70/2, EMR 6130, DDP 416 and 516, ITI 4900, Interdata Models 2 & 3, MAC 16, Raytheon 706, SCC 4700, Sigma 2, Tempo 1 and Micro-Linc. The fastest of them all was Systems Engineering Laboratories' 810B, with a cycle time of 0.75 microseconds, just 16 times faster than that of the Lunar Module's guidance computer. Outside the ones surveyed by DATAMATION, the slowness of the module's computer also stood out. Memory Technology, Inc., a manufacturer who also makes computer memories by weaving programs into them during the manufacture (in the same fashion the Luminary 1A software was woven into the module's guidance computer), currently lists systems with speeds of 300 nanoseconds — or 40 times the power of the one used on the moon trip.

Clearly, if a more powerful computer had been used, then the chances of overload would have been greatly reduced. The radar rendezvous system, for instance, instead of providing a loading of 15% might well have been cut back to 3%. The Autopilot routines, which use up to 25 milliseconds every 100 milliseconds, could have been cut down to about the same . . . as could the other operations. Then there would have been plenty of computer power left for the astronauts to be able to ask the system whatever questions they chose, without being restricted.

The present computer style was only quite recently adopted, in preference to a system which had even less capability and which was larger. In the present system, a single NAND gate is packaged into an aspirin-size unit, which allowed for the size reduction. Current technologies, however, have been packaging these gates much smaller for some time.

Perhaps the reason for the slowness of the computer lies in the length of time which the Apollo program has taken. The contracts for the guidance computers were awarded to Raytheon back in 1962. NASA says that practically all the design work was completed in 1965. At that time a 12 microsecond computer might well have been the best choice, but a more up-to-date system installed in the 1969 Apollo 11 mission would have allowed the astronauts an easier journey, and the world to have breathed easier as they landed.

LABOR DEPT. RELEASES EDP SALARY STATISTICS

The Labor Department's Bureau of Labor Statistics has completed an edp salary survey based on the period September '68 to April '69 and covering 10 urban areas. The jobs surveyed were systems analysts, programmers, and computer operators, rated A, B, and C, according to the level of job complexity.

Top pay for an A systems analyst is in the Los Angeles area, where the average weekly salary is $275.50, compared to the lowest, in Jacksonville, Fla., at $203 a week. Chicago pegs it at $251; Boston at $240; Cleveland, $231.50; Cincinnati, $224; Dallas, $223; and St. Louis, $222.

Class A programmers go for $228 weekly average in Los Angeles, again the top area, followed by Boston at $212.50; Chicago, $202.50; Cleveland, $201.50; Dallas, $194.50; New Orleans, $190.50; St. Louis, $189.50; Buffalo, $179.50; Jacksonville, $172; and Cincinnati lags, $164.

The computer operators in the Labor Department's A classification pick up $159.50 weekly in Chicago, the leader, as Los Angeles comes in second with $158. St. Louis pays $152.-50; Jacksonville, $148; Cleveland, $147.50; Cincinnati, $145.50; Boston, $140; Buffalo, $135; and Dallas is low, with a niggardly $133.50.

The BLS said that men accounted for for than three-fourths of the workers in the classifications studied in all but a few instances, and that women were most frequently employed at the lower levels.

MORE REACTIONS, REBUTTALS, RESENTMENT TO UNBUNDLING

Still trying to assess the cost implications of Numero Uno's unbundling announcement, many users resemble a bunch of chicken littles as lack of hard information from IBM ties those already locked into budgets through June '70 in knots. And users trying to project budgets beginning in January '70 aren't much better off.

Meanwhile, IBM is pushing some customers hard to sign their Field Engineer and Systems Engineer contracts, although unable to tell them what level of SE will appear. Users are grumbling, too, over a hardnosed, one-way contract that says the user will pay for an FE even if he doesn't find the source of a glitch. That's bad news to users like one who, a couple of years ago, spent seven weeks trying to solve a tape problem.

One independent consultant advises his clients to ask their "friendly IBM salesman" a couple of basic questions: What would the charges for this installation have been for the first half of '69 for SE, FE, and training? What will be the cost of Type 1 software in the first half of '71 or '72 under the new licensing?

If System/3 charges are any indication, users are in for unhappy surprises. Basic software for the /3 is roughly 30% of minimum hardware costs. And that's before training and SE support are added on.

Some users are annoyed by other provisions of IBM's systems engineering and program product agreements — especially the continuance of the "what's yours is mine" policy. That is, the SE agreement says that work done for the customer belongs to him, but the user grants IBM an "irrevocable, nonexclusive, unrestricted, worldwide and royalty-free license, with the unrestricted right to sublicense others with respect to all such material and under any discoveries, ideas, inventions, or improvements disclosed therein and made solely by IBM employees or jointly by IBM employees and customer personnel."

Further, IBM will be free to disclose this material in "any way" deemed "appropriate." Presumably, the user could end up being in competition with IBM in the sale of the products of this work. It is reliably reported that members of SHARE, the IBM users group, have agreed to boycott the