Application of computer in fire service

The word computer comes from the Alan verb " Computer" which means to reckon r think. Thus a computer is a machine which reckons or thins. Although it is often asserted that a machine cannot think. This is more a philosophical matter than a technical one. The first escalating electronic computer was the Electric Numerical Integrator and Calculator or MANIAC but in 1946 at the University of Pennsylvania. The IAC used 18, 000 vacuum tubes as storage elements. It occupied 4. 000 cue Ft (mm) of space and cost $ 480. 000. Today's desktop moor computers are faster, more powerful and easier to use.

Vacuum tubes used in calculating machines, became the second generation. This was followed by the chip or integrated Circuit, whereby an entire electron circuit of transistors. Resistors, capacitors and other devices could be etched on a tiny bit of silicon. These educated grains of sand represent the third generation. Now as a fourth generation, are very large scale integrated (VEILS) circuits. These chips contain logic circuits which have given rise to sophisticated hand calculators and most recently, microcomputers. All the computing circuitry of MANIAC is now available an a single chip.

This is the technology that made the personal computer a household ark and for many, a household appliance. In commerce and industry, the microcomputer has become a standard business too. Characteristic of this developments is a geometric Increase in speed of operation. Today, computer functions take place in a time span of a few nanoseconds. A nanosecond, consider that electrical impulses in a computer travel at the speed of light (186, 000 MPH or 300. 000 kip). A nanosecond is about how

long it takes electricity to travel one foot. Thus, computer components which are several feet apart can double the time of a computer operation.

These speeds may increase even more s new materials like gallium arsenide or Josephs Junctions replace silicon in the next generation of computer chips. 2. COMPUTER PRINCIPLES: To understand how a computer performs its many tasks, it is necessary to be aware of some fundamental operating principles. Computers function by reducing all information, no matter how complex, to simple electrical signals grouped together in ' bits', ' bytes' and ' words'. Bit : Computer operations are performed with ' bit' (contraction of Binary digit). A bit holds one of two pieces of information-either a one or a zero.

This information is tore as an electric charge on a piece of semiconductor material. If the charge is positive, the bit has a value of one ; if the charge is negative, then the value of the bit is zero. A bit may also be thought of as an electronic switch that is either on or off. On indicates a value of one and off indicates zero. Computers manipulate numbers in the binary system. In a sequence of four bits each bit represents a value of an where n corresponds to the position of the bit. That is, the first or right most bit indicates a value of 1 if it is ' on' or a value of O if it is ' off.

The next bit corresponds to 2′ if ' on' and O if ' off. Similarly, the value 4 is associated with the third bit and 23= 8 for the left most of the four bits. Adding these values allows the computer to represent the numbers from zero (0000) to fifteen (1 1 1 1) using Just four bits. For example, the number four is 0100 and the number nine is 1001 ; adding these together gives 1101

or thirteen. All of the operations in a computer are performed in this manner, by combing values of electronic switches which are either on or off.

BINARY 0100 1001 1101 DECIMAL 4 13 Byte : While four bits are adequate to represent decimal digits, more are with a computer. Most often, a string of eight bits is used for this purpose and is referred to as a ' byte'. Thus each character in the memory of a computer uses eight bits or one byte. Storage capacity of computers is measured in bytes . Since most computers can hold thousands of bytes, the common term for expressing memory size is the ' Kilobyte," indicated by the symbol K. A kilobyte is defined as 210 = 1024 bytes. For example, a ASK memory has the capacity of hold 64 x 1024 = 65, 536 characters or bytes (524, 288 electronic switches).

Word :- A computer " word" is the number of bits that it can handle at one time. Most of the first popular micro computers used eight bits or one byte at a time. Later modes used a 16 bit word which means they can handle 16 bits or two bytes at a time. Minicomputers use 32 or 64 bit words. In as much as the size of the word is an important factor affecting the speed of operation of a computer, it is likely that bit word or larger microcomputers will become prevalent. 3. GENERAL PURPOSE APPLICATIONS SOFTWARE . One of the principal causes of the microcomputer revolution is the widespread availability of general purpose software.

These packages serve many applications within their specific functional areas. Compared to software available on mainframes or minicomputers, they are easy to learn, hence have the descriptive phrase " user friendly'. The primary areas of general purpose applications are word processing,

electronic spreadsheets, data base management, telecommunications and graphics. (a) Word processing Word processor packages create, revise, edit and print Just about any type of document-correspondence, reports, form letter, mailing labels, invoices, and even large handbooks.

They speed up processing of paperwork saving time and money for clerical effort. These savings result from the ability of word processors to store and did electronically rather than on paper. Word processing is particularly applicable to updating fire safety inspection surveys. Standard recommendations can be added or deleted with a few key strokes. Proposals, specifications and procedures can be similarly updated with ease. For instance, word processing has greatly facilitated the National Fire Protection Association's standards making procedures. B) Electronic Spreadsheets No factor is more responsible for the proliferation of microcomputers among small businesses than the " electronic spreadsheet. " These programs emulate the lump as page of many rows and columns referred to by accountants as a spreadsheet. The intersection of each row and column, called a cell, can contain written text, numbers or a formula. The appeal is the almost immediate calculation of all cell values when any one cell value is altered. While there are many applications a simple ; matter to make changes, additions, or deletions of budget items and have all the totals and subtotals recomputed automatically.

With an electronic spreadsheet, experiments with reallocations can be done quickly and easily. In project management, spreadsheet analysis is commonly used to estimate costs. Many types of engineering applications, from hydraulic calculations to code requirements, have been adapted to a

spreadsheet program. The full range of applications is limited only the user's imagination. (c) Date Base Management Data Base management programs provide a means of storing, retrieving and rearranging large amounts of similar data.

A " data base" is a collection of information that has been assembled, organized, and presented to serve some specific purpose. Data base management software helps create more orderly, manageable record storage and retrieval systems. Files become instantly accessible and easy to update. Records of inspections, inventory, personnel, customers, training, maintenance, etc, become useful management tools rather than Just requirements. Computer data base management provides capability to sort data in any sequence, select specific categories of items and generate reports with totals, subtotals, and various statistical measures. D) Telecommunications Telecommunications is a process by which computers transmit data from one to another using telephone lines, satellites, or other transmission devices. Telecommunications requires both special hardware and special software. The hardware required is a " modem" a contraction of Modulator-DEModulator. This device converts (modulates) a computer's digital signal into analog signals which can be transmitted like a telephone call to another modem, which then demodulates the signal for the receiving computer.

Communicating computers may be located in the same room or at opposite sides of the world. Special communications software controls the modem and facilitates the use of telecommunications for many purposes. (e) Graphics Computer graphics consist of visual displays of data composed of a series of

Asia entities such as line segments. The graphic is a representation of digital information and is made up of many small parts. These features are associated with the two most important applications of computer graphics : business graphics and computer aided design. Video displays, paper transparencies, or slides.

Because images communicate faster and more dramatically than reams of computer printout, using graphics effectively c an mean a dynamic increase in productivity and impact. Until recently, it was costly and time consuming to produce business graphics ; now, with microcomputers, they an be produced in the office quickly, easily and cost effectively. Computer aided Design or CAD is the generic term for any system using computer graphics as a replacement for the traditional pen of a designer/drafter. CAD produces plans, detailed layouts, drawings, and visualization.

In the design of structures and mechanical systems. CAD may include interfaces with engineering routines for various load, stress, and sizing calculations. Visualization may include static views or dynamic simulations in two and three dimensions. A number of limited CAD programs are now available for microcomputers. As memory and speed increase. CAD will become a more common application. CAD has significant potential use in the drawing of fire risk analysis diagrams and the layout of fire protection systems (Note :- In fire service terminology CAD is also used to mean Computer Aided Dispatch. 4. SPECIAL PURPOSE FIRE PROTECTION SOFTWARE : As use of microcomputers become more widespread, an increased number of specific fire protection applications are developing. These programs may be revised from main frame and minicomputer versions

or may be new applications simulated by the availability of microcomputers. Specialized fire protection software can be categorized by three areas of application, research, management and engineering. (a) Research :- Computers have long played an essential part in fire research, on both mainframes and minicomputers.

Now, significant computing power is more readily available to researchers, and the computational capability to conduct research is extended to any microcomputer user. For example, a microcomputer's capacity to produce sophisticated statistical analyses increases the importance of the collection of meaningful data in areas such as human behavior in fires. Fire dynamics ND deterministic ; fire modeling is an area of research that has been heavily dependent on computers, perhaps best characterized by the Harvard Fire Code (Miter 1985).

Another similar type of fire model is used in the computer program ASSET (Available Safe Egress Time) (Cooper AAA). Originally a research project on a mainframe computer, ASSET is now available for microcomputers and will develop into an engineering design tool (Walton AAA). A computer program has been written to analyze fire fighting turnout coats and other items of protective clothing (Veggie and Smelled 1982). The program considers environmental climate, underclothing, hysterical workload, and thermal workload.

The power of a computer is illustrated by the capability of this program to consider more than 700 variable combinations of (b) Management :- Management applications of microcomputers in fire protection are, at

present, mostly adaptations of business software. However, the available computational power will likely be utilized to develop better means of strategic planning for firedrakes. One example is in the health care area, where fire protection has been combined with economic analysis in a computer program to provide a management decision making tool (NAP 101 ; Chapman 1985).

A more sectional generalized approach to fire safety decision support is also under development (Watts 1985). In the area of code enforcement computers have not yet made a very great impact (Klein). The potential, however, is very great. One of the most active areas of computer science is artificial intelligence (AY). This area includes such topics as natural languages, robotics, and expert systems. The practice of fire protection is an expert system. Using a microcomputer to assist in this practice can reduce much of the routine effort expended in the application of firedrakes codes and standards. 5. FIRE SERVICE APPLICATIONS .

Nowhere has the impact of computers on fire protection been more widely felt than in the fire service. The computer has been compared with the internal combustion engine, the centrifugal pump, and the radio as a technological development to improve fire department operations. A study by the Consortium of Western Fire Agencies on Integrated Information Systems (CASUAL 19882) indicates fire service involvement with computers is already extensive in large fire departments. With time, the low cost availability of microcomputers will enable even the smallest of volunteer fire departments to become " computerized".

In addition to typical management functions such as payroll, inventory and budget preparation, data base management systems have been developed to provide tactical information on high risk buildings (Osaka 1983), track the number and types of fires that occur, evaluate Emergency Medical Service (MS) advanced life support systems (Hicks 1982), and myriad other fire service functions. Among the more pronounced applications in fire departments are computer aided dispatching fire prevention activities and training. A) Computer Aided Dispatch : One of the early applications of computers to fire apartment operations was Computer Aided (or Assisted) Dispatch (CAD)). Basically, a CAD system uses the speed and storage capabilities of the computer to monitor fire apparatus location and to dispatch the closest units to the scene of an emergency. Experience with CAD has generally been very good, resulting in reduced dispatcher workload, savings in personnel costs, and fast response to major fires and simultaneous accidents. CAD is not limited to large main frame computers or even minicomputers but has been ; successfully implemented on microcomputers. Middling large amounts of data and scheduling. Merging these abilities enables a ire department to greatly enhance its fire prevention activities. The computer can keep tract of deficiencies and violations, and schedule properties for follow-up or periodic inspections. Interconnected with a CAD system, the dispatcher can be informed of uncorrected conditions which may influence decisions by the fire ground offer in an emergency. In a less technical application, there are educational computer games which emphasize firedrakes. C) Training :- Fire Service Training provides one of the most interesting applications of microcomputers. Computer Assisted Instruction (CIA)- also know as

Computer Band Training (CAB)- has significant advantages to fire service personnel. Advantages include freeing the instructor to concentrate on field exercises, letting students progress at their own pace, and providing reinforcement. Some of the variety of applications that have been implemented include (1) Emergency Medical Technician (MET) case studies of victim care, (2) Familiarization with the building code, (3) fire hydraulics drills, and (4) fire ground simulation.

Interactive training programs may use computers along or they may be interconnected with video tape players or with laser disk players. The Federal Emergency Management Agency (FEM.) is actively supporting the evolution of microcomputer technology in the fire service. This support is in the form of courses at the National Fire Academy (Weaver 1983) and studies sponsored by the United States Fire Administration. These studies include a hazardous materials indent simulation and development demonstration program in eight different fire departments to reassures usefulness of computer generated management information.

Some fire department pampers are already equipped with microprocessors for data communications, computer graphic displays and pumping information. Future applications will include interaction of microcomputers with satellites for dispatch and vehicle location. (e) Engineering :- One of the most commercial areas of microcomputer applications in fire protection is the development of system design and evaluation software. This is particularly the case with automatic sprinkler systems.

More than two dozen commercial programs are available for sprinkler system design and/or evaluation and an even larger number of privately developed and used programs. These packages come in many forms and capabilities for various hardware configurations ; some even come bundles with their own hardware system. There are minimal programs written in relatively slow running interpretive BASIC, and more complex programs written in standard FORTRAN and newer microcomputer languages. Certain programs will interface with plotters to produce working drawings of sprinkler installations.

Some are used to merely check plans, while others have the capacity to optimize pipe sizes to design a minimum cost system. Available for microcomputers. Hallo systems, for example, rely on fluid dynamics that vary with the manufacturer's equipment, and design programs are generally proprietary. In the area of static or passive protection, there are computer programs for the sign/evaluation of fire endurance of protected and unprotected steel and reinforced concrete structural assemblies.

Like the special hazard extinguishing systems, they are not widely available for microcomputers. EVACUEE : is a computer program to plan and evaluate the evacuation of large buildings. Originally written for a mainframe, it has been adapted for microcomputer use. New microcomputer software to aid in providing fire safety in buildings, other structures, transportation facilities, mines, forests and outer space is in various stages of development and application.