ODP 81- 893
10 July 1981

MEMORANDUM FOR: Chairman, Building Planning Committee

STAT FROM: [redacted]
DDA Representative

SUBJECT: Facilities for Computing Equipment

As I mentioned in ODP's response to your initial set of questions on building requirements, ODP engineers have assembled some recommendations and suggestions which we feel would be applicable in the design of any new structure. Having designed, configured and maintained computer oriented facilities for almost twenty years has given us unique insights and experiences in this area. We hope you find the attachment useful.

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Att

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ITEMS TO BE CONSIDERED WHEN BUILDING A NEW COMPUTER FACILITY

1. FLOOR

Should be rigid grid construction with 2' length stringers capable of being walked upon. Floor height should be minimum of 18" but not more than 24". A floor height greater than 24" makes changes which require laying in new cables, removing cables or rerouting cables more difficult for those who do this work. Also, as height is increased, lateral stability of the floor decreases and this is important when moving heavy equipment on the floor.

I would suggest that a bi-level floor design be investigated. This could be a series of parallel beams which would permit a 12", 18" or 24" raised floor above the beams and a space below the beams of 12" or 18" or 24". The lower space would be used for utilities such as chilled water piping, electrical conduits, communications cables, etc. Beams would only need run in one direction and would be set on 24" centers. Beam width would be 4" which will provide adequate surface for the placement of pedestals to support the computer room raised floor consisting of 24" square panels and their rigid grid. Panels could be fabricated which would rest on the beams and provide a separate deck or covering of the lower area. (See attached sketches of one idea for a bi-level floor). With a bi-level floor, an upper level space may only need a 12" clearance, and a 12" clearance might be sufficient for the lower or utility level. Floors in computer areas could be planned to be level with corridor floors by having sunken slabs on which to construct a bi-level or single level raised floor and thus eliminate the need for ramps, which saves floor space and reduces problems encountered in moving equipment in or out.

Floor load rating should be 150 lbs. live load minimum. ?

2. COLUMNS

Our present computer centers have columns which vary in size from 20" square to 33" square with about 90% being located on 20' centers. An ideal computer center would be columnless, however, columns on 50' centers, or greater than 50' should be specified, if columns are necessary. Columns are detrimental to the placement of equipment in that gate swing clearances of equipments located adjacent to them must be independent, since that space cannot be shared with the gate swing clearances of other equipments which is the case in the placement of machines in areas not encumbered by columns.

Columns are not totally undesirable none-the-less, since they provide surfaces on which electrical distribution panels, emergency lights, telephones, fire extinguishers, annunciator panels, etc., can be mounted. What we are really saying here is that columns on 20' centers are not good for computer areas housing large scale computers which is the case for ODP, and we would like to see considerably greater spans between columns.

3. PIPE-CHASES

Pipe-chases are vertical enclosures which contain various types of piping running vertically between floors in a building. They usually are built immediately adjacent to columns which greatly adds to the consumption of floor space. Very often they are 3' to 4' in length and are as wide as the column they abut. In effect they are, to us, the same as columns and affect us similarly, therefore, as with columns, we would prefer that they be eliminated or minimized as much as possible in a computer center.

4. AIR-CONDITIONING

The original GC-03 computer center was provided its air-conditioning from an independent set of four chillers (one was back-up) and a fan-coil room located in the Director's driveway. Air entered the room via ducts in the ceiling of the Director's driveway which discharged the cool air under the computer center raised floor. This is the ideal way to provide air conditioning in a computer center since there is no chilled-water piping under the raised floor and there are no air-handlers in the computer center occupying valuable floor space. An effort should be made to provide this type of air-conditioning in any new computer center in a new building. Air-handlers which are located on the computer room floor should be avoided. As an alternative, if an ideal system cannot be provided, we would prefer the use of suspended air-handlers hung in the computer area ceiling. Also, regardless of how the cool air is delivered to the computer room, dedicated chillers, with back-up chillers should be the source of the required chilled-water. These dedicated chillers and the fan-coil units which deliver the conditioned air also should have their own auto-start back-up diesel generator, as a secondary power source. There should also be valving provided in the chilled water system to obtain chilled-water from the building chillers in the event the dedicated system fails. Additionally, power should be obtainable from another source other than the back-up diesel generator in the event the back-up fails. Total B.T.Us dissipated will have to be calculated in order to design an adequate HVAC system.

5. CEILING

A suspended ceiling should be provided and have a height of 9'6" above the top of the raised floor. Ceiling panels should be sealed, non-dusting type.

6. POWER

Power is probably the most important and costly single element to be considered in the design of a new computer center. We presently have four U.P.S. systems, two supply 60HZ, 208 volt power and two supply 415HZ, 208VPower. SAFE has one large 60HZ, 208V UPS. For the building, there are five large back-up automatic start, diesel generators, three are rated at 2,5000K.W. and two at 2,000K.W. Power requirements for a new center will have to be calculated in predicating the power design. The power system design will have to make certain that there will be adequate availability of back-up power from the diesel generators to a new building and its computer areas. Also, provision of 60HZ and 415HZ UPS systems will be required.

UPS ?

We have had a vast amount of experience with power, some good and some bad. There has been more experience on the good side to indicate that we should continue to have OPS systems. From what we have learned over the years, we should consider multiple, switchable UPS systems with a least one standby unit of both 60 HZ and 415 HZ types. We want a switching matrix that will provide full and complete switching from any primary power source or back-up power source to any load. Also, dual, switchable feeders from the compound's power plant to the building vault or vaults and dual, switchable feeders from the building vault or vaults to the computer area or areas.

For several years 415HZ power to GC-47 has been supplied from two solid state frequency converters which are powered from the large Emerson 1300KVA, 60HZ UPS. This method of obtaining 415HZ power, while less efficient than via an independent 415HZ UPS, has been exceptionally reliable. Plus factors for this method are: it is automatically a UPS since it is powered by a 60HZ UPS and it automatically continues supplying 415HZ power to GC-47 when the Emerson 60HZ UPS goes to by-pass. An independent 415HZ UPS cannot go to by-pass. When it fails 415HZ power is lost. In view of this, we might want to consider generating all 415HZ power in a new computer center this way. Advantages for this technique are, in addition to the two already mentioned: only 60HZ type UPS systems will be needed which should reduce maintenance capability and spare-parts requirements; stand-alone frequency converters appear to be the most highly reliable of all the solid-state equipments. Another factor which might influence our thinking in considering frequency converters driven by a 60HZ UPS for 415HZ power is the fact that 415HZ power requirements have decreased dramatically: for example, the 415HZ requirement for an IBM 3033 is 57KVA but for the new IBM 3081 it is only 23KVA. As stated earlier, the only negative factor is it is less efficient, meaning it consumers more input power which increases our electric bill. This additional expense, however, can be offset for a considerable time period in view of the fact that there would be no investment in a separate 415HZ UPS.

Back-up for 415HZ power will be necessary. We have two choices for doing this: one method is to use stand-by solid state frequency converters and the other is to use rotary type motor-generator sets. The pros and cons of which alternative is to be selected will have to be reviewed when planning gets to that point. Regardless of which method is employed, we must make certain that a switching matrix will be provided which will enable us to supply any equipment requiring 415HZ power from any back-up power source.

When 60HZ UPS systems fail totally, they switch automatically to what is termed "By-Pass Mode". This means that the load is shifted to raw VEPCO power. In the activities which follow this type of 60HZ UPS failure, namely trouble shooting and repairing the failed system, it often becomes necessary to switch the load to another VEPCO source which is termed "Maintenance By-Pass". This is done to make it possible to disconnect all input power from the failed UPS for safety during the repair time and also, to make possible independent testing of an UPS system. At the present time, we do this in a make-shift or improvised manner. In a new computer environment, we should plan for doing this by a simple prescribed method utilizing transfer switches designed to perform this function which will enable us to do this without keeping our fingers crossed.

Line Drop Compensators (LDCs) are new items which we are presently planning to install in our existing centers. These units are designed to automatically control the output voltages being delivered to the computers. An adequate number of LDCs should be included in the electrical power planning and included in the electrical facilities design.

A "Load Bank" should be planned. Load Banks are large resistance units which are connected to various power sources when tests are conducted. UPS systems are items which are tested or checked under load utilizing load banks to provide the load. The load Bank or Banks should be on casters in order that they can be moved easily to the UPS locations.

A maintenance facility for UPS maintenance should be planned. This facility should have a complete set of test instruments, meters, calibration devices, back-up equipment, etc., necessary to diagnose and repair UPS systems. The UPS maintenance facility should have a storage area for spare parts complete with bins, cabinets, etc., for keeping the spare parts in an orderly manner.

Recent conversations with UPS vendors and users indicate there is a trend toward the use of mini or micro computers for monitoring the operations of UPS systems, compiling various operational records of the units and alerting the operational and maintenance personnel of the functional status of each system. It is possible that we might incorporate some ideas of this nature in our planning.

Convenience outlets (120V) throughout the computer area and also in some remote terminal and RJE areas should be fed from a 60HZ UPS system.

7. PATCH PANELS

Patch panels are used in our centers as the nerve centers of the communication network linking the computers with terminals and other remotely located equipments outside of the computer room. These units require expansion periodically and since there is a very large concentration of signal cables centering in these locations, which radiate to remote areas, careful planning should be done in determining their location, keeping in mind expansion space for them as well as the avenues and methods by which their cables will be brought to them.

8. LOUNGE AREAS

At present, we have lounge areas in our computer rooms. Plans for a new building should incorporate lounge areas in or immediately adjacent to computer rooms. Lounges should be furnished with comfortable chairs, a sofa, at least one table, a magazine rack, a kitchen consisting of a sink with hot and cold water, a counter, cabinets, a microwave oven, coffee maker and a refrigerator. The lounge should be attractively appointed. Also, small lockers and coat racks should be included.

9. MULTI-LEVEL COMPUTER FACILITIES

Many computer centers today are multi-level vertically including one of ours. Some are two level and some are three level. Large centers with multiple CPUs, utilizing complex interface switching networks, encounter problems in connecting various I-O devices because of cable length limitations imposed upon them by the vendors. The multi-level computer center has developed as the answer to solving this problem. A three level computer center appears to provide the best solution with CPUs and channels being located on the mid level and I-O equipments installed on the lower and upper levels. It appears that we must think in terms of multi-level computer areas.

With multi-level computer areas it will be necessary to plan vertical cable-ways between levels. Currently, in our Ruffing Center, we have eleven cable-ways and ultimately will have additional cable-ways.

Another item which must be planned in a multi-level environment is personnel access between levels via either stairways or elevators. Present plans for the Ruffing Center call for the construction of a stairway between its two levels. This planned stairway design, unfortunately, is larger than we would like, requiring an opening of about 10'x8' as opposed to a small two passenger elevator which can be accommodated in a 5'x4' opening. Spiral stairways would require less space and, therefore, should be considered. The point being made here is to keep in mind the fact that we think in terms of obtaining as much floor space as we can in a computer room.

10. LOADING DOCK

The new building should have a loading dock with a vertical clearance of 14 feet to receive large semi-trailers. A heavy duty adjustable ramp is required and a loading platform 20 feet or more in depth is needed.

11. CORRIDORS

Corridors from loading dock area to computer room should be at least six feet in width and be even wider at the computer room main entry points in order that equipment being moved into or out of a computer room can be turned when being moved in or out of the room without becoming jammed in the corridor.

12. FREIGHT ELEVATORS

In the case of a multi-level computer environment we will have to make certain that freight elevators of adequate size be installed and also that the area in front of the elevator is large enough to permit easy loading of equipment on the elevator.

13. SOUND SYSTEM

Our existing centers are equipped with sound systems which are used for music and for paging. Any new computer areas should have sound systems for music and paging.

14. CLOCKS

Clocks, such as those in use in the Ruffing Center are necessary in a new computer center.

15. ACOUSTICS

Provision should be made to suppress noise in a computer area. Usually walls and columns are covered with "Pan Tile" as was done in 1D16. Some computer rooms have used carpeting on walls and columns. Ceiling panels, even the non-dusting type have acoustical quality. Carpeted floor panels also are use, but they have some bad characteristics so we have avoided using them.

16. PHYSICAL SECURITY

There are needs for varying degrees of physical security in a computer center. Counters are used to block unwanted access, gates which are operated from badge readers are used, receptionists are employed, automatic sliding doors actuated by badge readers, walls of partial and full height are also used. Security alarm systems as well as fire, smoke and water detection systems also are needed. Vault doors, steel clad doors with dead bolts have been used widely and must be planned for, remembering that they must be high enough and wide enough at certain points to admit equipment movement through them.

17. POINT AREAS

Point areas are the locations where computer output users and others make contact with computer room personnel. Points are usually at the main entrance to a computer room. Periodically, during the day, traffic at the Point becomes heavy, sometimes with people pushing carts, therefore, there must be sufficient space planned to accommodate the traffic. Counters and rack type bins are needed at the Point for paper handling. Ideas for a post office box arrangement at the Point with individual boxes being assigned to users with each user having a key, which could be the magnetic stripe on his badge, to open his box have been discussed. Computer room supervisory personnel usually have offices at the Point, therefore, this should be planned.

18. SUPPLIES STORAGE

Currently we have no really planned supplies storage areas. Supplies storage is a large problem and adequate storage areas convenient to the computer operations should be planned.

19. STAGING AREAS

For a number of years we have talked about providing some space in computer centers which we call staging areas. These areas have been thought of as being approximately 1,000 sq. ft. and would be utilized to receive and unpack new equipments being installed and as space in which equipments being removed can be parked and packed awaiting shipment to some other place. Some space for a staging area should be provided in a new center.

20. C.E. SPACE

Customer Engineers of the various vendor organizations require space which they use as office space and spare-parts storage. Space for C.E.s is specified in the contracts we have with the vendors, therefore, this type of space either within the computer area or adjacent will have to be planned.

21. SAFETY

The usual fire, smoke and water detection system will have to be provided as well as sprinkler systems (which we dislike) and Halon systems (which we like). Other safety aspects must also be planned, such as fire extinguishers, exit signs, alarms, annunciator panels, status panels, etc.

22. PHYSICAL SECURITY

Currently our centers have vault doors and also metal clad doors with combination locks. Other metal clad doors have dead-bolts with combination padlocks. Centers also are equipped with sonic alarm systems. Windows are metal covered. Similar measures will need to be provided in the new centers.

23. LIGHTING

Florescent lighting should be provided, with fixtures being flush mounted in the ceiling grid.

24. VACUUM SYSTEM

Currently, we do not have a central vacuum system in any centers and, therefore, use conventional industrial type portable vacuum cleaners to do our cleaning, much of which is the cleaning of the under floor area. A central vacuum system, with ports into which vacuum hoses can be plugged should be planned. Ports should be located on 30' centers making it possible to plug in hoses approximately of 20' length in order to cover the entire area in any computer room.

A vacuum system for removing dirt brought into a computer room on the shoes of people entering the area might be incorporated in the plan as a grid at the entrances which would pull the dirt off of shoes as people walked over it when entering the computer area.

25. MULTIPLE CENTERS

It might be a good idea to build more than a single center or at least compartmentize a single center by erecting masonry or fireproof walls which would isolate major areas from each other. The idea being to reduce the impact of fire, flooding, smoke damage, explosion, etc., to the overall operation of the computer systems in the event of any such calamity and allow at least some operations to continue. The idea of multi-level computer rooms, mentioned earlier, has a degree of isolation built in.

26. MISCELLANEOUS

It might be a good idea to delegate one or two people to visit periodically other computer installations of both other users and vendors to obtain a first hand awareness of what is happening in computer centers around the country, from the physical aspect. It may be of benefit to us to take advantage of any new ideas or innovations that might be observed.

STAT

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FORWARD

~~XXXXX~~ NOTE: OL Registry said when logging in a document, only the covering memo is necessary for the OL Reader. We were given 2 cys and only the covering memo is going to OL Reader. * Xtra attachment in MasterPlan

* Or - Santa file on computing facilities?