GENERAL ELECTRIC

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Information Systems
Information Systems Equipment Division

DEPT. Large Systems

ADDRESS Phoenix, DVPP COPIES See Attached

SUBJECT Trip Report - MIT
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Systems Reliability

Introduction

At the request of R. F. Montee, 605/645 Program Manager, we visited the 645 site at MIT. This request was based upon intermittent system performance, op-not-completes, random system hangups, and a rash of unexplainable system problems. The LSD people at MIT asked if we would make a site survey relative to radiated noise being the cause of the problems. As a result of this noise hunt, we requested the site people to obtain a wide band (0-100 Mhz) analyzer for our use. We supplied to necessary antenna hardware and field probes from Phoenix.

Trip Specifics

Arrived on site at 0930 Monday, 1/26/70. Met with John Ammons, LSD, and was informed that the system was up and running with no apparent problems. We were also informed that the system had run quite well for the past 4 - 5 days.

We spent the entire day of Monday staring at the spectrum analyzer, looking at DC logic buses in the GIOC, and walking a rod antenna and field probes throughout the room. Using the local FM radio stations as a base of reference, we were unable to detect any noise that exceeded the FM peaks. These peaks were measured at 0.7 mv/meter in the 80-100 Mhz region.

All during the day, and until midnight Monday, the system ran properly. At no time were we able to detect any strange glitches in the air, or on DC logic buses.

On Tuesday we continued to monitor the spectrum analyzer and also reviewed the power and ground distribution system. With the exception of seeing and detecting some fluorescent lights being turned on and off in an adjacent room, we drew a blank with the noise search. At 3:37 PM on Tuesday a system error was detected. We were unable to detect any increase or change in the ambient noise level at this time. The software people were going to review a dump in an attempt to determine if the 3:27 PM error was hardware or software oriented.

We spent sufficient time looking at the power and ground system to determine that it could use some improvement.

The motor generator set is a 62.5 KVA unit operating at about 80% of full load. We measured the Ø and neutral currents and found that the neutral return wire is carrying about 17.5 amps. I don't know what the phase balance is for 645 equipments, but I believe the loads could be balanced better than they are. A 635 system of this size can be balanced out to less than 5 amps of neutral return current.

Power distribution from the wall panels to the equipment is in conduit. The conduit is not isolated from the equipment at the cabinet end, or from each other. The frame ground system for the main frames and peripherals is daisy chained together at the wall panels. A five wire (3 Ø's, neutral, ground) power system was not used between the M. G. set and the wall panels. A four wire system (no frame ground wire) was used. The central system frame ground return is via the daisy chain connection between the main frame and peripheral power panels. There is unused conduit laying across active conduits.

As a result of the manner in which the power and ground system was implemented, the central system equipments multipily share ground, and ground currents, with the peripheral devices.

The primary frame ground return current is "breathing" at about a (1) second rate, from 0 to 2.0 amps. We have seen this on 635 systems before, but have not yet determined where the current comes from, or why it fluctuates. We are working this problem in Phoenix. The peripheral equipments are on building power and not isolated with a transformer.

The 645 main frames use an isolated ground system between frame ground and signal ground. We looked across the two ground systems with a high frequency (150 Mhz) scope and saw some logic noise glitches. These were in the order of 200 MV P-P, every 5.5 usec.

We looked at power lines, ground lines, logic lines, radiated noise ambients, manually cycled compressors on 270's, under the floor and over the ceiling. No excessive noise and no system hangups. From a noise standpoint, we did not find anything conclusive. Unfortunately (for us) the system ran all the time we were there, and was "spook free."

Dave Selway returned to the site Wednesday morning to conclude the noise hunt. I returned to Phoenix.

Prior to my departure, John Ammons asked me for a list of recommendations that the LSD people at MIT could review and hopefully implement. We submit the following recommendations -

NOISE HUNT

* Continue to monitor the spectrum analyzer in an attempt to correlate any system failures with a change in ambient noise level. Note the amplitude and frequency.

* Install a fast response voltage recorder on the peripheral power bus. I will check with the GE equipment pool in Schenectady to see what is available.

* If the system should go through "spook time" again, look at the ± 6V DC logic bus in the GIOC with a type 454 scope to determine if it is staying stable.

POWER & GROUND SYSTEM

* Rebalance the loads on the motor generator set for minimum current in the neutral wire.

* Add a 5th wire between the M. G. set ground reference (at the M. G. set) and the main frame distribution panel ground bus. Then, and only then, remove the wire between the main frame ground bus and the peripheral ground bus. This will permit some degree of isolation between the peripheral ground system and the main frame ground system.

* At each main frame equipment isolate the conduit from the frame of the equipment with a rubber/plastic bushing. Insure that a green wire safety ground exists between each unit and the ground bus in the wall panel.

* Remove all unused conduit from the sub-floor.

* Replace all flickering fluorescent lights in the computer room.

* Install an isolation transformer between the peripheral power bus (which is building power) and the peripheral distribution panels. Keep the wall outlets on building power. The KVA rating of the transformer will have to be determined.

MISCELLANEOUS

* Revise the general housekeeping procedures such that they are compatible with good computer installation practices. The sub-floor should be completely vacuumed out, after removing the debris which is too large to vacuum.

* If the 645's should ever be moved, or relocated, utilize the 635 installation spec. (M50EB00545, Rev. F) as a working guide.

Both the LSD and FED people were most helpful and cooperative during our visit. We would like to be advised as to the outcome of the noise hunt vs. system spooks.

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