

Notes from AHB visit to Green Bank, December 28 1988

1. Discussion with Dave Westphal, 11:15 am

D.W. has been gathering information on fatigue in steel, following his conversation with Mecklin from external team. D.W. estimates that the telescope slewing history corresponds to about a million "cycles" of the structure, which is about where the fatigue of steel "bottoms out". (Breaking strength decreases for about a million cycles and then does not decrease further).

At Mecklin's suggestion, D.W. has been examining breaks in structure visually, in attempt to characterize them as sudden fractures versus slow, plastic deformations followed by fracture. He believes that he can distinguish these types of failure around the East tower.

2. Discussion with Rick Fisher, 11:45 am

R.F. still does not understand why no "COMMANDED POSITION OUT OF RANGE" messages appeared at the first slew-to-"drift" transition in the observing program. He does not intend to pursue this point unless later developments make it clear that understanding it is critical.

Simulation of control program response to observing program is possible, but not planned yet. R.F. estimates that this would take about a week.

He has spent about 30 min with D.W. examining breaks in the structure, and did not think that he (R.F.) could characterize breaks unambiguously.

3. Interview with Greg Monk, 1:00 pm

Greg stated that as soon as the last slew scan ended, he spent "a few minutes" trying to test a patch he had written for the observing program, hoping to make the "drift.scan" execute as the observers had intended. He waited until the break in the program to do this, to avoid slowing down or crashing the Masscomp. (He remembers seeing the operator screen "beep" and give end-of-scan messages for the end of the slew scan). He ran a "syntax check" on his patch, found errors, and decided after a few minutes to abandon this effort. He then decided to get his "night lunch".

As he was going to the kitchen he heard a "crack", followed by a "rumbling noise like you hear after a jet plane has gone overhead". These noises were followed "just a few seconds later" by structure coming through the roof in front of him. Noises continued for "a few seconds". G.M. was sure that the impact toward the kitchen preceded that on the control room roof. He does not remember any noise continuing after he pushed the STOP button, or any obvious change when he hit the button. He is certain that he heard no more noises from outside after he hit STOP and so believes that the crash was over by the time that he did that.

He did not notice any change in the declination readout as he was hitting the button. He could not recall seeing a declination readout

between the end of the slew scan and when he hit the button. He stated that the slew scans normally turned around at a declination above 75 degrees, but that the readout he saw as he hit the button was definitely 74.7 degrees. This was why he once stated that he thought the telescope had started moving south; he had no evidence for southward motion either from hearing the drive motor or from seeing a change in the declination readout.

After failing to reach the 140-foot control room by telephone, he went outside; he estimates that he left within 40 seconds to a minute of the initial noises. He believes that all was quiet at that point. His car was pointing North, and he recalls seeing debris on and near the ground in his headlights as he pulled out of the parking lot to drive to the 140-ft. He now believes that what he saw fleetingly then is essentially the collapsed structure that is there now, i.e. that the collapse was probably complete when he left. He recalls that at the time he was reluctant to believe that the entire telescope had come down, so may indeed have said only that "something fell off the telescope" when he first got to the 140-foot. He now feels that he was reluctant to accept the possibility that the whole telescope had collapsed, despite having seen collapsed structure north of the control building. He also recalled that the back window of his car was broken when he drove away.

I asked him about the noise level in the control room, and whether he heard any other unusual noises on that shift, especially during the four minutes before the crash. He stated that the normal noise level in the control room (fans, etc.) was high enough that operators usually did not hear cars pull up outside. Also, that the pit microphone was turned off that evening. He had gone outside several times to stretch his legs, watch for deer at sunset, etc. and had heard only the usual creaks and groans from the telescope as it was driving. He had been present when the crew went onto the East tower that afternoon to listen for the noise heard by Bob Viers, so he was aware that there had been concern about noises from the telescope. Nevertheless, everything sounded normal to him on the several occasions that he went outside.

Comments on the above:

(a) the interview was carried out and these notes were written without reference to my notes on Fred's earlier interview with G.M. I have since compared the above with my notes on Fred's interview with G.M. Fred's notes contain the extra fact that G.M. initially left the control building without his car keys and had to return to get them.

(b) G.M.'s recollections appear to me and to him to be consistent with several minutes having elapsed between the end of the slew scan and the crash. I judge that only very loud noises from the telescope would have got his attention for most of that time -- the pit microphone was off, and he was concentrating on trying to check the code patch he had written to get around the "drift.scan" problem that had brought George Seielstad down to the telescope about 30 min earlier.

(c) As he has no recollection of seeing a declination readout other than the final one, he cannot confirm or contradict any of the evidence about the declination history or direction of motion of the telescope just before the crash.

(d) It appears that the major collapse was relatively rapid, perhaps only a few seconds or tens of seconds, and that the travelling feed

assembly hit the control building shortly before the structure was fully down over the south end of the building.

4. Visit to the wreck with Fred Crews and Dave Westphal, 2:15-3:30 pm

The surface has obviously subsided in many places since I first saw it on November 18th. It was windy, probably about 20 mph gusts, when we were at the wreck. Surface panels were visibly and audibly moving in the wind and we felt motion in the structure on the (very few!) occasions when we climbed into it to get above ground level.

F.C. and I climbed into the wreck to view the attachment structure of the west feed leg guy ropes. This structure broke off at the top bolt hole near the lower end of the 14-ft back-to-back angles; the angles are splayed for a few inches above the break. This entire (14-ft minus the part with the lower bolt holes) angle is still attached to the turnbuckles. The whole assembly (turnbuckles, upper plate and "14-ft" angles) has been pulled to within a few yards of the wreckage of the east guy wire attachments. Both the east and west guys appear to be unbroken.

The outside south feed legs are broken off near their bases, in the region where the feed leg structure tapers down. There are clean (i.e. sharply localised) breaks of the legs themselves. There are further breaks where the legs attached to the main dish structure; these appear to be at the welds between the legs and their end plates (but we could see this structure only from about twenty feet underneath it by climbing down into the chain pit, and could not get a close-up view). The north feed legs are intact down to their attachment plates. At least one of these plates appears to have split, so that part of it is still attached to the feed leg and part to the box girder. In that case, the bolts and the plate have broken rather than the weld to the legs. The north legs are slightly bent in the north-south plane a few feet above their lower end. They also bend in what was the east-west plane, to conform to the surface wreckage further some tens of feet to the east. It is hard to form a coherent impression of these bends by visual inspection from the ground.

Neither F.C., D.W. nor I felt we could point to anything that would eliminate a failure of the feed legs or of the west guy wire anchors as the initiator of the collapse. D.W. will estimate what parts of the dish structure would have been struck initially if the feed legs failed first and the vertex swung toward its final position from a telescope at declination 85 degr. It may be worth looking carefully at the wreckage of the likely impact region. I also suggest that we keep the bases of the feed legs, and the regions around their attachments to the box girder, as coherent as possible when the structure is dismantled (until we have a clearer candidate for the cause of the crash).