NATIONAL RADIO ASTRONOMY OBSERVATORY
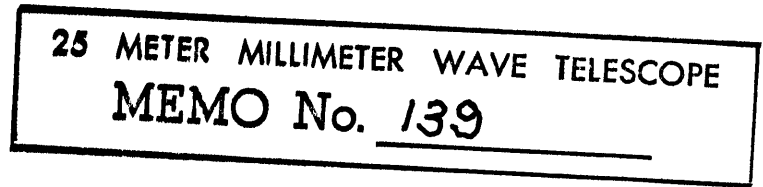## TUCSON, ARIZONA

March 2, 1981

To: Bill Horne

From: J. Payne

Subject: Further thoughts on paint

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│ 25 METER MILLIMETER WAVE TELESCOPE           │
│ MEMO No. 139                                  │
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I'd like to make a comment on Sebastian's memo.

I think that painting the surface of the 25-m (or the 36') may be even more damaging than is suggested by the loss measurements. On many a night while sitting on the surface of the 36' telescope pondering some electronic problem I have noticed that the surface seemed far colder than the ambient air temperature. It turns out that the paint used on the surface is virtually black at a wavelength of 10 microns and at night the telescope surface cools by radiating to the cold sky. Bobby Ulich at the MMT has made measurements on plates painted with this paint and has measured a ΔT of greater than $10^{\circ}F$ between the front and back surfaces due to this effect.

c: S. von Hoerner
      Buck Peery

Dear John,

Thanks for your letter, and for your Memo to Bill Horne of March 2. Yes, it seems we need more "further thoughts on paint" than I had thought. I am just packing suitcases for a longer trip, thus I can only answer short and in a hurry.

In my Memo 138, it was silly to mention absorption regarding the loss of reflectivity, but to forget about the resulting longer pathlength within the paint. This is what you mention in your letter, and also Rick Fisher pointed this out meanwhile. Only, if I increase the pathlength by a factor of $\sqrt{5}$, as you suggest, then the discrepancy of Fig. 3 of my Memo is not corrected but heavily overcorrected, and actually a factor of about $\sqrt{2.5}$ would fit best.

You also mention that this increase of the pathlength also increases any pathlength differences caused by paint thickness differences, which then acts as a surface degradation. I agree that this could be critical. Should we plan some experimental tests, in order to measure all that?

My comparison between painted and blank surface was based on observations in sunshine, where the blank one gets 8 times hotter (ΔT above air) than the painted one. And I implied that inside a dome one would again have a factor of eight between the two (smaller ΔT for both than in sunshine, but the blank ΔT again 8 times larger than the painted ΔT). On second thoughts, this raises two questions. Is this implication valid, regarding the different colors of sun and dome? Even if the factor of 8 is true, is the deformation of the blank surface still tolerable?

Maybe we should plan another test with "Plates in Tent", including a simulation of the open dome, by leaving one side of the tent open for half the time, say.

Would the observers be complaining if they cannot observe the sun? How is that with the 36-ft?