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IN REPLY REFER TO:

25 Meter Millimeter Wave Telescope
Memo #85

April 8, 1977

Dr. Mark Gordon
National Radio Astronomy Observatory
Suite 100, 2010 N. Forbes Boulevard
Tucson, Arizona 85705

Dear Mark:

Thank you for your frank and candid letter of March 31, 1977 and your attached memorandum on the meeting held at ESSCO on March 30. Since we all sometimes hear and see only that which we desire to hear and see, it is a constructive and beneficial experience to receive a view of ourselves from the "other side of the table". Maybe some day time and circumstances will allow a reciprocal appraisal from our side of the table.

We would, however, like to clarify some minor points raised in your memorandum. Since I do not have access to your Working Group, perhaps you can indicate to that group the following comments as you deem appropriate.

1. University of Massachusetts Reflector Panels:

   We believe we commented to you that the aggregate rms for the panels delivered to the University of Massachusetts was between 55 and 60 μm. By aggregate, we mean the rms of all the measured panel deviations. You seem to have misunderstood this comment by interpreting it to mean that each panel individually had an rms error between 55 and 60 μm. We are equally aware, as you are, that the range of these panels is approximately 38-75 μm.

2. Previous ESSCO Performance vs Contractual Commitments:

   The following table attempts to summarize the results of our performance vs our commitments in as brief a manner as possible.

Program	Total Reflector rms (mm) Contract Requirement	Total Reflector rms (mm) Measured Results	Panel Aggregate rms (mm) Contract Requirement	Panel Aggregate rms (mm) Measured Results
Mackenzie-Brazil (13.7m)	0.6	0.35	None	0.25
NRAO (13.7m)	0.75	Unknown	0.3(1)	0.15(1)
Helsinki (13.7m)	0.40	0.31*	None	0.17
Spain (13.7m)	0.25	Unknown	None	0.15
Sweden (20.1m)	0.35	0.20(2)	0.15	0.11
U-Mass. (13.7m)	0.23	0.11(2)	0.13	0.06

(1) Requirement was 0.3 mm rms for 90% of surface. For 100% of the surface, Total Panel Aggregate rms was 0.22 mm.

(2) Based on mechanical measurements -- radiometric results expected this year.

* We believe these systems have not been set as well as they could be and that the Helsinki measurements may have been made with a substantially de-focussed subreflector. We are presently attempting to be of assistance in re-setting efforts that may prove beneficial.

We would add that an important feature is the pointing accuracy which is not mentioned in the table, but which also came out quite well. If our expectations for the performances of the Onsala telescope and the University of Massachusetts telescope are realized, the figures of merit ($D \div \varepsilon$) should be approximately 100,000 and 125,000 respectively. Compared to the chart you sent me, these expected results appear significant. We do, however, stand corrected relative to our comments that ESSCO has performed better by a factor of 2 than our contractual commitments. In defense, if that be allowed, we usually do not attach decimal accuracy in those rare moments when we have an opportunity to "toot our own horn".

3. ESSCO's Current Policy Regarding NSF:

Please be advised that we have never told Buck Peery of a "10-page letter" which allegedly was sent to NSF or somebody close to NSF.

The "letter" that Buck refers to was an internal memorandum reviewing the NRAO 25-meter proposal distributed among our own ESSCO staff summarizing some of our thoughts. In fact, the memorandum was 5 pages long, has never left the premises of ESSCO, and has never been seen by NSF. We would add that it is impossible for ESSCO to completely ignore NSF since we must indirectly come in contact with that organization through other organizations to which we supply information and data on our equipment. In essence, we therefore have no control over, or knowledge of, what others may say to NSF about ESSCO or anybody else.

4. ESSCO Panel Measurements vs. Barry Turner's Comments in Grenoble:

You state that ESSCO's measurements of 40 μm originally reported on the ESSCO panel and 57 μm recorded much later vindicates Barry Turner, and further suggest that an apology is due from Cohen to Turner for Cohen's angry protest to Dave Heeschen. You might ask yourself why a vindication is necessary in the first place. I would further call to your attention that NRAO and ESSCO have just recently analyzed our measurement differences. Our protest was not an angry one, but one of slight embarrassment since the contractual understanding recorded in our correspondence with NRAO was simply to keep each other aware of the experimentation, and certainly not a public debate. As Chairman of the session at Grenoble, it would have been appropriate if you had made some comments at that time indicating that (1) the results were very preliminary; (2) the measuring facilities were different; (3) a possibility of damage during shipment may have existed; (4) our definitions of rms may not be identical, and (5) NRAO intended to make additional measurements and coordinate the results with ESSCO. Perhaps this is an example of two independent filters hearing and seeing what they really want to hear and see. We believe that Barry Turner's comments were not intended to be maliciously harmful to ESSCO and in that respect were innocent enough, but were nonetheless inappropriate, not timely, and inaccurate.

With regard to using this issue as a lever to obligate NRAO into additional contracts with ESSCO, let me assure you that such is not the case. For one thing, we would never delude ourselves into thinking that a strategy of that sort would form a basis for a meaningful, mutually beneficial relationship. Further, we sincerely believe that ESSCO's measurements were honestly recorded at the time they were made, that a plausible explanation of the difference between the 40 μm original measurement and the 57 μm

subsequent measurement involves panel damage in shipment to NRAO the first time, and that we in no way desired or expected to enter a long debate on this subject. What is the phenomenon called when one organization can see the faults of another so very clearly but cannot see any of its own? We believe that Barry made a slight error, but the subsequent defenses have blown it completely out of proportion. Had I suspected that this issue would have been so magnified, we probably would have remained silent. In any event, I intend to contact Barry to express my sincere regrets for the subsequent and counterproductive escalation.

5. Funding by NRAO to ESSCO:

I understand that we have received a total of approximately $251,000 in funding by NRAO over the last five years, for which you received a 45 foot telescope (whose cost was closer to $350,000), and a panel which in retrospect was probably better left at ESSCO. Your RFQ for a subreflector initially appeared beyond our scope of interest and abilities. As has been the custom in the past, our investment (excess cost) for the 45 foot telescope was beneficial to us in having further advanced our panel developments. As a result, the aggregate rms of the panels delivered under the 45 foot telescope program was approximately 200 μm. It is clear that we were trying to make the best panels possible at that time since I believe the total aggregate rms requirement of the reflector was approximately 750 μm.

The notorious panel contract was for slightly less than $1,000, and I am sure you will appreciate that the time and expense of clarifying the measurement of that panel has far exceeded that contract price. We have, however, benefitted technically from the interaction between our respective groups.

On an optimistic note, we agree that both NRAO and ESSCO share many common goals related to millimeter wave antennas and do indeed possess complementary capabilities, which should be utilized to the fullest extent possible. It is in that light that we expressed our interest to you, during the meeting of March 30, in further developing our panel fabrication techniques, radome membranes and optical setting techniques. By their very nature, the need for these developments indicates that we do not possess all the answers. There is, of course, much to discuss and to work at in these areas, and we can elaborate further when the time is appropriate for these concepts to take hold. We would welcome the opportunity for further discussions of all of these matters, especially optical setting techniques, which offer high potential and which need more time for elaboration. Your

sophisticated mathematical abilities applied to the above projects, and to the refinement of backstructure design, would certainly be more than just helpful to ESSCO.

One last thought: you have visited ESSCO and observed our progress to date, you are familiar with our latest efforts at Onsala and the University of Massachusetts, and you are aware that we are striving to further whatever accomplishments and contributions we have been able to make. It is equally clear that we do not possess all the answers, and hence desire and need further developments to advance the state of the art. In short, we have done some things well and have a reasonable amount of momentum for further development. We therefore believe we can make some contribution to the NRAO 25 meter telescope. We suggest that we both get less defensive and more cooperative. Let's put the past to bed and get on with the job to be done.

Sincerely,

ELECTRONIC SPACE SYSTEMS CORPORATION

Albert Cohen
President

AC/tn

cc: Hein Hvatum

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April 13, 1977

Albert Cohen, President
Electronic Space Systems Corporation
Old Powder Mill Road
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Dear Al:

I very much appreciated your thoughtful and informative letter of April 8, which clarifies my memorandum to Hein Hvatum. I've distributed your letter to our Working Group by including it in our Memorandum series associated with our millimeter-wave project.

I look forward to a happy productive association with ESSCO in the future. Again, I stress that all of us were impressed with what we saw during our recent visit.

Sincerely yours,

Mark A. Gordon

MAG:mt

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