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To: Paul Vanden Bout, Bob Brown

From: John Webber jcw

Subject: SIS mixer development plans

The accompanying memo from Tony Kerr lays out a more detailed plan for SIS mixer development than we have had in the past. It takes us from the current regime of supporting Tucson and doing minimal development as time permits to the level of effort required to build prototypes for the MMA. It does not address construction of MMA hardware—that's an even larger plan. It does not include the details of what is needed to develop more 4K test stations, other test equipment, *etc.*

This schedule assumes that we will have adequate resources applied to mixer and receiver development. It will help that Richard Bradley is going to start back on multiplier development as we look at the possibility of using conventional LO chains for the MMA. However, the present personnel assigned to mixer development consists of:

Kerr
Pan
Horner
D. Boyd
Crady
Johnson (about half time)

We also support at UVA 1/3 of Arthur Lichtenberger and ¾ of his assistant. Arthur is desperate for another pair of hands at the technician level, for which I have submitted a personnel requisition. This would move a lot of our projects up in the UVA fabrication queue.

We definitely need two more engineers (one already experienced in SIS mixer design) by the end of the year, of whom one is needed right now for instrumentation development, for whom I have submitted a personnel requisition. We also will need one or two more technicians by the end of the year (when MMA funding is assured).

To give a concrete example of why we need more help in mixer development, consider the case of the tunerless 200-300 GHz mixer under development now. There are two adjustable parameters in this design: the input tuning stub lengths and the size of the series capacitor which is part of the matching network. Since each wafer is a little different, it is necessary to make several different versions of the mixer (12 different designs on the present wafer) and test them to determine which works best. Presently, only one of the designs has been tested and another is being mounted for testing. The major obstacle to rapid progress is that it takes five days to

assemble and test a single mixer. The data are recorded mostly by hand and the numbers are entered into spreadsheets and other analysis programs by hand. If we had automated testing, it could proceed much faster (the five days could be reduced to three days) and development would be speeded correspondingly. The problem is that if we invest the time to develop automated testing, it subtracts from the time available to do manual testing and drags out the mixer development. If, on the other hand, we invest all resources in manual testing to speed present development, we will always be too slow because automation will never get done.

You will notice on Tony's schedule that an enormous amount of work needs to get done in 1997 in preparation for 1998 when MMA funding should be available. Even with this schedule, we have only two MMA bands ready by the end of MMA development. If we do not get more help now, all development will be pushed even farther out and we will have no MMA mixers ready at the time we are seeking construction funds.

In addition to personnel, we need space which we can get be re-arranging things a bit at Ivy Road. We also need some equipment money which will show up both in my M&S and in my RE proposed budgets for 1997.