FRONT-END DATA LINK MEMO NO. 1

October 1, 1987

MEMORANDUM

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From: R. Norrod

Subject: Front-end Data Link

Attached is a document discussing some issues dealing with telescope cables and how we might go about phasing in fiber-optic links.

I would like each of you to sit on an informal committee (meaning a committee without meetings) to consider these issues. It would be helpful, I think, if you put your thoughts on paper and pass them to me. I will have Carolyn give copies to the others and keep all on file.

I don't have in mind a fixed date as to when something must be done, but hopefully we could determine a reasonable approach this winter and begin implementing it next year.

FRONT-END DATA LINK

Roger D. Norrod

October 1, 1987

I've been thinking about how we could phase out the multi-conductor telescope cables and Bendix connectors in favor of a fiber-optic system. The issue is complicated, the options many, and I don't know how best to proceed. So, I thought I would put some thoughts on paper, pass it around, and hope for inspiration from others.

The FEDAL system that Rich did a few years back is a good place to start the thinking. It can send 32 Analog and 32 Digital signals up and the same down, using two twisted-pairs (plus two redundant pairs if desired). The problems I've had in using this system in my front-ends are:

1. Time dependent digital signals can't be transmitted through it because of the time delay built in. This is usually a relatively minor problem because CAL and SIG/REF are the only critical signals in most systems and could be sent up over coax if nothing else. One case in which it isn't so minor is multi-channel detected total power signals (e.g. the 7-feed, 4.8 GHz receiver).

2. It is difficult to find room in the prime-focus boxes for the FEDAL in the present package. It is packaged in a standard 19-inch chassis taking about 1260 cubic inches.

I should note that the 2-5 receiver sucessfully uses the FEDAL in spite of these problems. However, if we start thinking of retro-fitting existing front-ends, then Problem 2 is serious. Problem 1 becomes serious if we want to use fiber-optics exclusively, for lightning protection.

It first occurred to me that perhaps we should build a FEDAL into the telescopes, so to speak, with added circuitry to get around Problem 1. There is probably plenty of room at the 300-foot focal point for the rack mounted package, and you could imagine strapping a weatherproof box onto a 140-foot feed-support leg similar to the way the subreflector drive electronics is done. The revised FEDAL would support fiber-optic links between the control room and the focal point, and provide outputs on our standard Bendix connectors (say, two 30-conductor and two 15-pair connectors) for the receiver rack and the FEB. Two systems would have to be built into the 300-foot to support both the Sterling mount and traveling feed front-ends.

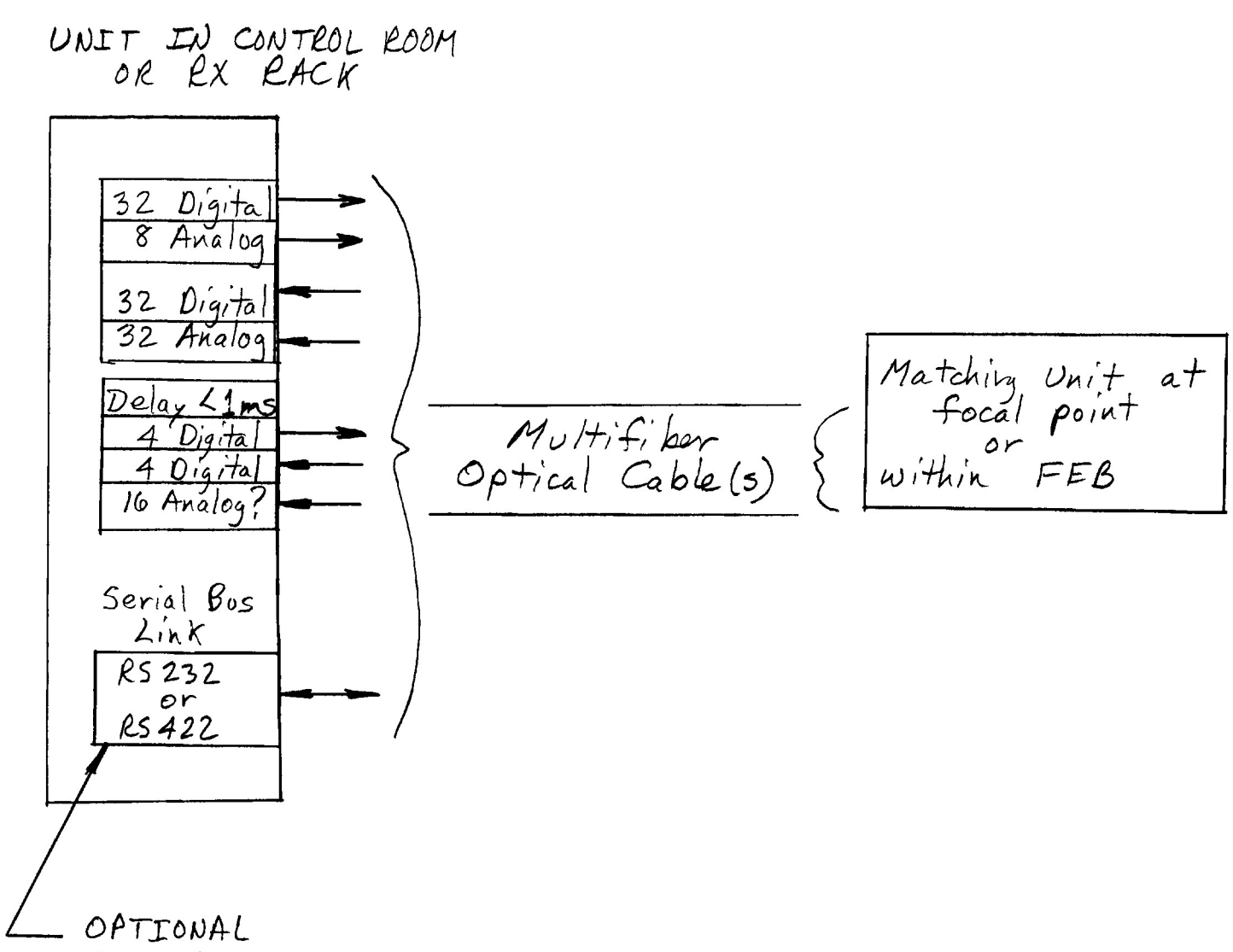
Some advantages of this approach are that the data link becomes a black box, and the room and money to include the circuitry in each FEB would not have to be found. The fiber-optic cable could be semi-permenantly connected and would not have to be disconnected each time the FEB was changed. It would probably be possible to design things so that if the FEDAL-fiber optic system went down, we could switch back to the multiconductor cables and run temporarily on them.

However, disadvantages immediately come to mind. The built-in FEDAL becomes a critical system and would have to be super reliable. The reliability of the Bendix jumpers between the FEDAL and the FEB or receiver rack would be suspect, and would form a conduction path for lightning into the FEB. It seems a shame to go to all this trouble and still wind up wrestling with (and paying for) the Bendix connectors and multiconductor cables.

So, let us also consider a second approach. Problem 2 seems to be the most serious impediment to using the FEDAL in most front-ends. Would it be possible to re-package the FEDAL into, say, 120 cubic inches (e.g. 5 X 8 X 3 inches), exclusive of power supplies and meters? We could probably give up some features to help reduce the size. For example, I suspect that we could restrict the number of Analog outputs at the FEB to eight, eliminating 24 D/A converters. On the other hand, some new features would be desirable. A second communications channel, with less than one millisecond delay, should be added for the time critical digital signals. Of course, optical fiber drivers would also be necessary. Another feature that I suspect would be useful for future front-ends would be serial bus support. By that, I mean circuitry that would accept a standard RS-232 or RS-422 serial port at each end and spit it out at the opposite end of the fiber cable. This function might be better broken out into completely separate modules, but is worth considering while we're dreaming.

A problem with this second approach is that the fiber connectors would have to be connected and disconnected often (whenever the FEB was changed). I suspect that after some not too lengthy time, the fiber ends would become damaged. It might be possible to devise a method using easily replaced feed-thrus or short jumpers that would be workable. The Australian Telescope will face this problem and we may be able to get useful information from them.

So, the attached figure summarizes my thoughts on what could be done. I would appreciate your opinions, positive, negative, or alternative.


UNIT IN CONTROL ROOM
OR RX RACK
32 Digital
8 Analog
32 Digital
32 Analog
Delay <1ms
4 Digital
4 Digital
16 Analog?
Serial Bus
Link
RS232
or
RS422
Multifiber
Optical Cable(s)
Matching Unit at
focal point
or
within FEB
OPTIONAL
DRIVERS FOR CABLE ONLY
SUPPORTS DATA RATE
UP TO 58 KBAUD

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