Interoffice

COG Memo No. 16

National Radio Astronomy Observatory

Charlottesville, Virginia

December 23, 1981

To: R. Burns

From: A. Shalloway

Subject: Selection of a Data Communications System

This is a review of the bids received in response to RFP No. 232. I recommend that we consider only two of the answering companies: Codex and DCA. This is based mainly on the ability of their equipment to share bandwidth with asynchronous channels; that is, when synchronous data is not being transmitted, more asynchronous data can be transmitted.

Brief reasons for rejecting the other bids are listed below:

Infotron: Cannot share bandwidth between synchronous and asynchronous unless we build some hardware. Cost $68,080 or $86,112 with Tucson. This system will switch asynchronous channels. This system looks on the verge of being considered. The price is higher than desired, but it includes dial backup; however, I do not believe we could reduce the price greatly and sharing bandwidth appears to be more difficult than Codex or DCA even if we build the hardware.

Racal-Milgo: Did not submit a bid addressing the system we actually wanted.

Timeplex: Excessively expensive and would not share bandwidth. $130,293 and $141,788 with Tucson.

Halcyon: Would not share bandwidth. Expensive - price could be reduced considerably but would still be at least $72,000 without Tucson and still not share bandwidth. $99,744 and $83,917 with Tucson.

Prentice: Requires multiple telephone lines to carry synchronous data. $54,982 and $62,444 with Tucson.

The following will give some of the more important points of the Codex and DCA systems:

Codex

COST: $61,940 without Tucson. $? with Tucson. This cost is based on our supplying four racks at $400 each and six modems (eight if Tucson is included), Gandalf as discussed further on in this memo, at $3000 each.

BANDWIDTH SHARING: Complete bandwidth sharing is provided automatically.

FACSIMILE TRANSMISSION: To transmit facsimile we would have to purchase special software. I can only wildly guess at a price between $5,000 and $10,000 to cover all four sites.

SWITCHING: Switching is inconvenient with some limited capability. It is done by having more than one program in memory at a time (6040 can hold 4 programs at Charlottesville and VLA site, 6030 can hold 2 programs at Green Bank and Socorro) and booting between programs. The boot takes one second or less and is accomplished from a control console in Charlottesville or one predesignated CRT somewhere in the system. During the boot, data transmission is interrupted between all sites. By buying additional ports, a simplified manual switching mode can be made for the word processors.

PROGRAMMING: The program is held in RAM at each site; we have a battery backup which will hold for two days. The program can be reloaded from one site to another. The program can be rewritten by NRAO personnel from the control console in Charlottesville or a predesignated CRT at any location. I presume that to rewrite a program without disturbing communications while writing, one uses one of the two program locations in the 6030 or one of the four locations in the 6040 while the communications operate on the other program location(s) until the new program is completed and booted in.

MISCELLANEOUS: The maximum normal input rate to an asynchronous port is 1200 bps. To go higher (up to 9600 bps) is an additional $140 per dual port.

SERVICE: Service is out of a nearby local office - for example, Richmond or Washington, D.C. for Charlottesville and Albequerque for VLA site, etc.

DCA

COST: $58,828 without Tucson. $71,168 with Tucson. The cost is based on NRAO supplying six (eight if Tucson is included) modems (Gandalf as discussed further on in this memo) at $3,000 each and two 6-foot and two (three if Tucson included) 4-foot racks.

BANDWIDTH SHARING: To share bandwidths we must either put in some manual switches at each site or one microprocessor card which we would design at each site. The microprocessor card

would make it automatic. The cost of the switches is insignificant. The cost of the microprocessor cards would be my time plus about $1,000 total for four sites.

SWITCHING: Any asynchronous port can be switched to any other compatible port by the device wishing to be switched. It is like a data PBX, a number is dialed (typed) on the CRT and it is connected or told that the line is busy. Synchronous data must be switched manually; however, if we desired it would be possible to make the above-mentioned microprocessor also provide remote switching for the word processors and Green Bank fiscal IBM.

PROGRAMMING: The basic program is complex and is done by DCA. It is stored on a data cardridge (3M-100D). Two cartridge machines are supplied with each 355 (Charlottesville and VLA site). If the program is lost, it will be automatically reloaded in about 90 seconds. Minor changes in the program can be made by us. Major changes can be made by DCA or they can supply us the skeleton program (in Z80 assembly language) and we can write the remainder of the program.

MISCELLANEOUS: In February they will be coming out with a Model 120 multiplexor which I would suggest we get in place of the 115's at Socorro and Green Bank. It will be about 5 to 10% more ($85 to $170 more each). It will have the ability to feed 9600 baud maximum into any input, whereas the 115 will take 9600 baud maximum into one input and 4800 baud maximum into the others. It will also have 20,000 characters of memory as opposed to 2,000 characters for the 115 model. This will allow for more buffering at busy times.

SERVICE: All service and installation is out of Atlanta. If a card is diagnosed as bad with the built-in diagnostics, they will ship one out on the next plane. Spares are listed in the bid but they are expensive, $12,679 not counting the modems.

CODEX & DCA

COMMENT: A decision has to be made as to whether complete automatic bandwidth sharing between asynchronous data and synchronous is the most desirable attribute. In which case, Codex wins because we have to build a microprocessor card to make DCA completely automatic. If having an asynchronous data PBX system is important, the DCA system is the most desirable as switching is essentially out with the Codex system. If sending

digital facsimile is important, the cost of the DCA system is insignificant but is considerable (estimate $3,000 to $8,000) in the Codex system. Service is probably good from DCA, but Codex has an advantage with people located relatively nearby at all locations.

The modem I recommend is the Gandalf Super Modem SM9600-01R, revision E, for rack mounting with rack mount and door 9000A. You may be able to get this item for approximately $3,000. Marymor should get a quote from Terminal Networks; their name and number is on our bid list.

REFERENCES: References for Codex are in their bid. I called the FBI. They are using Codex modems and recommend them highly. They are installing some 6040 and 6030 multiplexors but cannot say anything about them yet.

References for DCA are: FBI, Bob Baker, 202-324-4062; INSLAW, Jack McCarthy, 202-828-4556; and Network Institute of Technology, Dave Drace, 516-626-0641. I called Bob Baker at the FBI. They are using DCA's 355's and 115's. Everything has been fine except when they tried to send cryptographic data between 355's and when they tried using the PBX feature for calling from one 355 to the other. DCA is working on these two problems. They have some of the DCA Synchronous Communications Option (SCO) cards which are in our bid from DCA. Bob Baker said the card was designed for them. He said the diagnostics were very good in pinning the problems down to a card and then DCA would send a new card of of Atlanta on the next plane - and the FBI carries spares.

cc: H. Hvatum
M. Marymor

Interoffice

National Radio Astronomy Observatory

Charlottesville, Virginia

December 24, 1981

To: R. Burns

From: A. Shalloway

Subject: Selection of a Data Communications System - Addendum

An alternate to the DCA system would be as follows:

Replace the Synchronous Channel Option (SCO) with a Time Division Multiplexor (TDM) built into the Gandalf modems. The operation would be very similar to the SCO system. The manual switch would be on the back of the modem chassis and if a microprocessor board is made to automate the system, the microprocessor would operate this switch.

This would result in a savings and the DCA prices would then be: cost - $56,428 without Tucson, $71,008 with Tucson. This system gives a little more flexibility if changes are made as there is one spare inopu. There is a technical question on the switching of this modem that I need answered before I can guarantee correct operation. I have the factory checking on this and will know Tuesday, December 29, 1981. The modem specified would be: SM9600-04R, revision E, and 9000A rack mount with door.

cc: H. Hvatum
J. Marymor