GBT Science Working Group
Minutes, May 14, 1991

Participating: Aller, Backer, Bania, Davis, Moran, Schloerb

1) Status Report

Seielstad gave brief reports on (a) the May 1 GBT Groundbreaking Ceremony, (b) RSi's slow entry into the field, and (c) NRAO's receipt of the foundation design.

2) Spectrometer Discussion

Seielstad described a three-stage approach: (a) determine what capabilities astronomers want in a spectrometer, (b) have engineers determine how the capabilities can best be provided, and (c) seek the money, people, and time to build a spectrometer. The SWG discussion was at Stage 1.

The basis for discussion was a memo by Haynes, with responses to it from Heiles, Dickey, Giovanelli, Backer, and Kulkarni. (A memo was received from Wootten after the SWG teleconference but before these minutes were prepared.)

Issues discussed included:

a) Is it wiser to construct a single do-everything machine or a few machines, each addressing a single need?

Aller pointed out that designs to do everything often run away: too many extras are added, at considerable cost in time and complexity. He suggested targeting a few specifics. Bania mentioned that it may be incrementally cheaper to knock off objectives one at a time.

Davis urged that we concentrate on Stage 1, a compilation of what the scientists would like; then let engineers determine whether the needs and wishes can best be met serially or in parallel (Stage 2). Lockman added similar comments. Aller lobbied for close liaison between astronomers and engineers even during Stage 2, or else a particularly expensive component might be purchased to meet one specification when astronomers were flexible on that particular specification.

Romney pointed out that this same issue re-occurs during every discussion of instrumentation for a broad scientific community and that the tendency borders on inevitable that we will try to fulfill as many needs as possible with one spectrometer.

b) Which type of spectrometer is preferred, an autocorrelator, a Fourier transformer, or an acousto-optic device?

AOS's elicited limited support. Davis reported that Arecibo operated a well-made, inexpensive French AOS, but for a limited purpose only, namely studies of flare stars. He did not think an AOS had the flexibility to meet the GBT's needs. Schloerb reported use of the CSO AOS, which does indeed work reasonably well. Frequency calibration is not trivial, however, since channel widths vary across the total band and the signature of the variation changes from night to night. Liszt commented that the single-dish FITS standardization community had requested that all data be equally gridded. Bania summarized some inherent inflexibilities: inability to change bandwidths without changing entire Bragg cell and difficulty (impossibility?) of building 16,000 or more channels. Nevertheless, an AOS may have some applicability to the GBT when operated at its highest frequencies where BWs of hundreds of MHz will be desired. Crane commented that AOS's are analog devices and therefore will have limited dynamic range.

FFT devices had considerable support. One major advantage was in preventing a narrow but strong spike of interference from ruining an entire spectrum instead of just a few channels. FFTs also permit arbitrary smoothing functions to be applied. This helps, because Hanning smoothing almost halves the resolution of adjacent channels (by smoothing them together). Furthermore, FFT technology has already supplied wide bandwidths. At Haystack, for example, a spectrometer with four 160-MHz IF chunks and one 320-MHz chunk is about to be put on line. The Japanese have also built an extraordinarily wideband FFT backend.

This discussion expanded to a call for a summary of spectrometers under construction or planned. A quick listing, in addition to the Haystack and Nobeyama examples, brought out

devices being developed at Berkeley (for pulsars), NASA-Ames and JPL (different approaches, both for SETI), and UMass (for spectroscopy).

A third issue debated whether a single continuous bandwidth or multiple sub-spectrometers flexibly arrayed was preferred? The answer depended on the type of science. Those observing weak, broad lines, or surveying in frequency space, were suspicious that multiple small bands could be "pasted" side-by-side without discontinuities. Emerson and others pointed out that the hybrid spectrometer at the 12m telescope provided a chance to test this suspicion, unless Romney is correct that the frequencies used at the 12m present different problems than the ones the GBT will use. A strong argument in favor of having several settable IF windows is their use with arrays of receivers. (Other arguments are discussed in the memos referred to above.) Crane also pointed out that interfering signals from satellites may be so strong that even FFT "filtering" may not be adequate to save contaminated spectra, whereas individual sub-spectrometers would permit salvaging part of the band.

3) Archiving Data

Seielstad asked if astronomers wanted to make a strong case for archiving, since it was recognized that it was technically possible. The issue is, should resources (money and people) be devoted to preserving old data when those same resources could be devoted to acquiring new data? A memo by Seielstad had been circulated in advance, as had responses by Crane and Giovanelli.

Aller spoke in favor of archiving in principle, but recognized the expense of carrying out the principle. He offered a compromise that would save data for at least two years. Crane said the GBT would not have to develop its own system, since the VLA and VLBA were developing archiving systems that could be copied. Bania wondered, however, if the same solution that satisfies arrays can apply to single dishes. Romney said that the only difference was, array data goes through a single funnel, a correlator, while single dish data passes through various backends. Moran stated the GBT should archive. Schloerb said it a format to store data has been designed, then the data might as well be kept. Davis repeated Giovanelli's assertion that we were building a telescope, not a library. He said that Arecibo does not archive and does not plan to.

The discussion enlarged to other issues. One was about mega-projects: Condon's all-sky survey was cited as an example. Wells stated that the problem of disseminating large amounts of data differed from the one of saving data. Distribution on CD ROMs was a suitable means for the former problem. Crane raised the issue of to whom the data belongs. Traditionally NRAO has believed the data belongs to the original observers, but that may need reconsideration with GBT data. Aller suggested that the archiving problem could perhaps be solved by requiring individual observers to archive their projects. Bania thought the SWG was too small to reach a decision on archiving, because too many issues were involved, e.g., the issue of proprietary data.

4) The next teleconference is scheduled for Tuesday, June 11, 1991 at 16:00 Eastern Daylight Time. Call (913) 749-9665, ID#A54D. Teleconferences will be suspended in July and August. You will be polled for suitable days and times when the SWG resumes in September.