

Nov. 13, 1981

To: ULBA Proposal Working Group

From: R.M. Hjellming

Subj: Critique of Feb. 1981 ULBA Design Study

In the spirit of the request for comments on the Feb. 1981 ULBA Design Study the following are suggestions for consideration.

General Considerations

There are four major points or comments of a general nature that I would like to make.

The ULBA proposal should not be quite so Radio Astronomy Uber Alles. This is both because it is good politics to appear cooperative rather than combative and because some of the statements in the Design Study are not completely correct. Although I cannot recall the reference at the moment, I recently read a letter to the editor in a magazine which criticized a discussion of the ULBA for claiming exclusive ownership of m.a.s. resolution capability. This letter mentioned some optical interferometry developments in progress, particularly in France. In addition, the theoretical resolution of the space telescope is of the order of a m.a.s. and it may come close to achieving this capability. The ULBA proposal would not be harmed at all by emphasizing the importance of combined radio and optical studies at m.a.s. resolution. As we have seen in recent decades, some of the best science is multi-wavelength in nature.

I believe it would be very advantageous to emphasize the correspondence between the proposed ULBA and the 50 United States. A better name for the instrument emphasizing the U.S.

aspect of things would help. For example, one could simply call it the U. S. Array or the U. S. Radio Astronomy Array. I would think that such an approach toward the name of the instrument would be politically advantageous.

The Proposal could be improved by having either a better definition or introduction to radio astronomy/VLBI jargon. Much of the proposal is aimed at fellow radio astronomers, and indeed that is necessary; however, I think a better job of communicating with non-radio astronomers, or even non-astronomers would be valuable. Certainly both the preface, summary, and scientific goals sections could be aimed at, say, the average physicist. I would then recommend that sections like III-VI be described early on as oriented towards technical considerations and radio astronomers, and that a final chapter summarize the contents of the technical sections aiming at the knowledgeable non-astronomer.

Finally, the only major technical flaw that I would speak strongly about in the Design Study is the reliance upon a single array control computer. We have always found ourselves in trouble, once an instrument is finished (and the current VLA is no exception) by not having either a backup on-line computer system or an on-line computer system with sufficient capacity and characteristics so that software development can be easily carried on in parallel with normal operation. I would strongly recommend that we propose either a duplicate 11/44-like control computer system or a larger (VAX-like?) control computer in which both control and continuous software development can be carried on at all times. With the latter approach, and sub-array capabilities, one can have a combination of effective operation and continued development. NRAO should stop kidding itself that the first complete set of on-line software programs for a system is the last set.

Comments on Details

Preface p. i: The sentence saying only radio astronomy will every have this level of resolution should be modified in the light of the abovementioned considerations.

Preface p. ii: the concept of not needing to measure individual interferometer phases should be more properly phrased as not needing to have absolute calibration of antenna phase.

Preface p. iii: One of the important reasons for co-locating with the ULA that is not mentioned here, or anyplace else in the Design Study, is that of having the short stations in the geometric center of the U. S. Array so that H.A. coverage is optimized and time zone problems minimized. The H.A. coverage argument is mainly a reason for not putting the short spacings on the East coast.

Preface p. iv: Change first sentence of first full paragraph to "The ULB (or U.S.) array represents the practical limit to the resolution that radio astronomy can achieve from the surface of the Earth".

Ia. The first paragraph should emphasize the U.S. array in some way, "covering the entire United States including Alaska and Hawaii" with a stronger allusion to the concept of a U.S. Radio Astronomy Array.

I-3. The matching of VLBA and space telescope resolutions should be included here, not making radio astronomy so dominant.

II-10. The name of the star Beta Persei should be spelled correctly.

I believe it would be very effective to include a figure such as the sequence of 5 maps in my article on SS433 in the fall issue of the Observer. This explicitly shows, without requiring a great deal of imagination, the mapping of an expanding source. One could comment both that this could be done on m.a.s levels for galactic sources, and that it is a scaled example of what one wants to do for extra-galactic VLBI sources.

II-11. Second Paragraph. "explosive novae, flare stars, and binary stars". In the following sentence work in the fact that VLBI observations of Algol have shown that stellar radio emission can be on the size scale of the binary (Roche lobe) system.

II-12. Just before the Interstellar Medium section, put a short paragraph on the direct resolution of the Cyg X-3 quasar-like source when it is undergoing strong flaring. With a distance of 10 kpc, these observations mean the VLBA would have a new capability to map expanding synchrotron sources of the Cyg X-3 type.

II-13. With some homework that I have not done yet, I believe one could argue for some interesting VLBA observations of radiating particles participating in some of the types of plasma instabilities occurring on the Sun. I know that kink instabilities which may be involved in solar events have time scales of the order of 0.01 seconds and size scales just at the limit of VLA high frequency resolution. This means that one may be able to get detailed mapping information about solar plasma instabilities using the VLBA.

II-15. As part of the other applications discussion, the U.S. Array nature of the VLBA can be specifically mentioned in the context of U.S. geodesy.

III-5. Add

14) Short spacing antennas should be in a zone near the geometric center of the U.S. array.

and 3) The main concentration of stations should be in the Southwest to take advantage of the southern latitude, the high dry sites, the proximity to the VLA, and the need for short spacing antennas in the center of the array.

III-7. After discussing the approach of inspection of the u-v plane we should explicitly mention that before final antenna locations are made, more detailed approaches will be used.

Fig. III-6n. Add u-v coverage with an antenna in

southern Mexico.

III-46. Suggest different control computer approach as mentioned above.

U-13. Between sections on Canadian and European antennas, add a section on a possible Mexican Antenna.