NATIONAL RADIO ASTRONOMY OBSERVATORY
Edgemont Road, Charlottesville

8 March 1984

TO: Ken Kellermann, Craig Walker

FROM: Alan Bridle

RE: New CLBA option and the Washington VLBA site

I attended a meeting of the CLBA Planning Committee in Toronto last week. The Canadians have been told informally but authoritatively that their full nine-element CLBA is unlikely to be funded soon, particularly if the VLBA start is approved by Congress this year. At the same time, they have been told that a scaled-down (less expensive) proposal may have a good chance of being funded. They are now studying a plan by which they would (at least initially) construct only four 32-m antennas. These would have three main goals: (1) to work as a stand-alone array for geodesy and astrometry, (2) to work with the VLBA in a 14-element array with good sensitivity on its outer baselines, (3) to work as a major component of the ground array for QUASAT (or other orbiting VLBI antennas). This more modest CLBA would maximise its compatibility with the VLBA, and its correlator would be big enough to process continuum data from 14 stations and an orbiting antenna. It would be a very attractive partner for the VLBA as it would double the number of dedicated North American VLBI baselines at wavelengths longer than 1cm, concentrate extra sensitivity in the outer (u,v) plane where sources are more resolved, and provide further correlator capacity.

The four-antenna CLBA configuration is now being studied by the Canadian group, but it is very likely that they will recommend antennas at Penticton, Algonquin, Yellowknife and at a site in Newfoundland. I have therefore taken a look at how this configuration interacts with ours, particularly as it might affect the choice of our antenna site in the North-west.

Figure 1 plots the presently proposed VLBA's coverage at nine declinations, with a maximum scale of 8000km on each axis. The station in the Northwest is assumed to be Oroville, WA, as on Craig's earlier plots. Figure 2 shows how the coverage is enhanced by adding the four Canadian stations. The Newfoundland and Yellowknife stations double the average density of tracks beyond the 4000km circle at northern declinations, and provide some extra resolution. Several sizeable holes in the VLBA stand-alone coverage at 2000km projected baselines are nicely filled. The doubling of the number of baselines greatly increases the density of coverage between 500km and 4000km.

Figures 3 and 4 show these same arrays with 4000km maximum on each axis, demonstrating more clearly how the track density is improved by adding the four Canadian antennas. Closer inspection now shows one almost-redundancy we might try to avoid, however - Oroville and Penticton are so close that the tracks involving them on this scale are too close compared to the average track separation. Figure 5 shows the improvement we would get by siting the VLBA antenna near Brewster, WA (where the possibility of local support by Comsat has previously been discussed). This splits the double tracks quite staisfactorily on this scale, giving more coverage in many parts of the (u,v) plane.

Selecting the Brewster site also provides an improvement on short baselines, as shown in Figures 6 and 7. These display the coverage of an array using four VLA antennas from the A configuration (AN9, AE9, AW9, AW3) when used with the "Brewster VLBA" alone (Figure 6) and with the "Brewster VLBA" plus Penticton (Figure 7). Between +30 and -06 declination, our "stand-alone" coverage has a serious gap around the v axis at 50-150 km. The Brewster-Penticton baseline nicely bisects this gap (Figure 7). The coverage inside 100 km is still very bare (and would remain so until we get the proposed three further antennas in New Mexico) but the Brewster-Penticton baseline certainly improves the situation.

This may add a new ingredient to our forthcoming selection of the VLBA site in Washington. Brewster may now have two advantages -- the possible local support from Comsat and the better (u,v) coverage when it used with the four-element CLBA. Oroville has one -- its higher elevation (4000ft instead of 1100ft, I believe).

As I mentioned above, the Canadian group is still studying the four-antenna option, so this analysis cannot be taken as final. I do however conclude that we should hold off on the final decision on our exact Washington site as long as possible, so that we can consider any such adaptation to the final Canadian configuration. I am still officially a member of the Canadian configuration group, so liaison with them should be trivial !

ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
OROVILE	48.90	119.75
HAWAII	19.80	155.50

Scale in km
kilometers x 10^3)

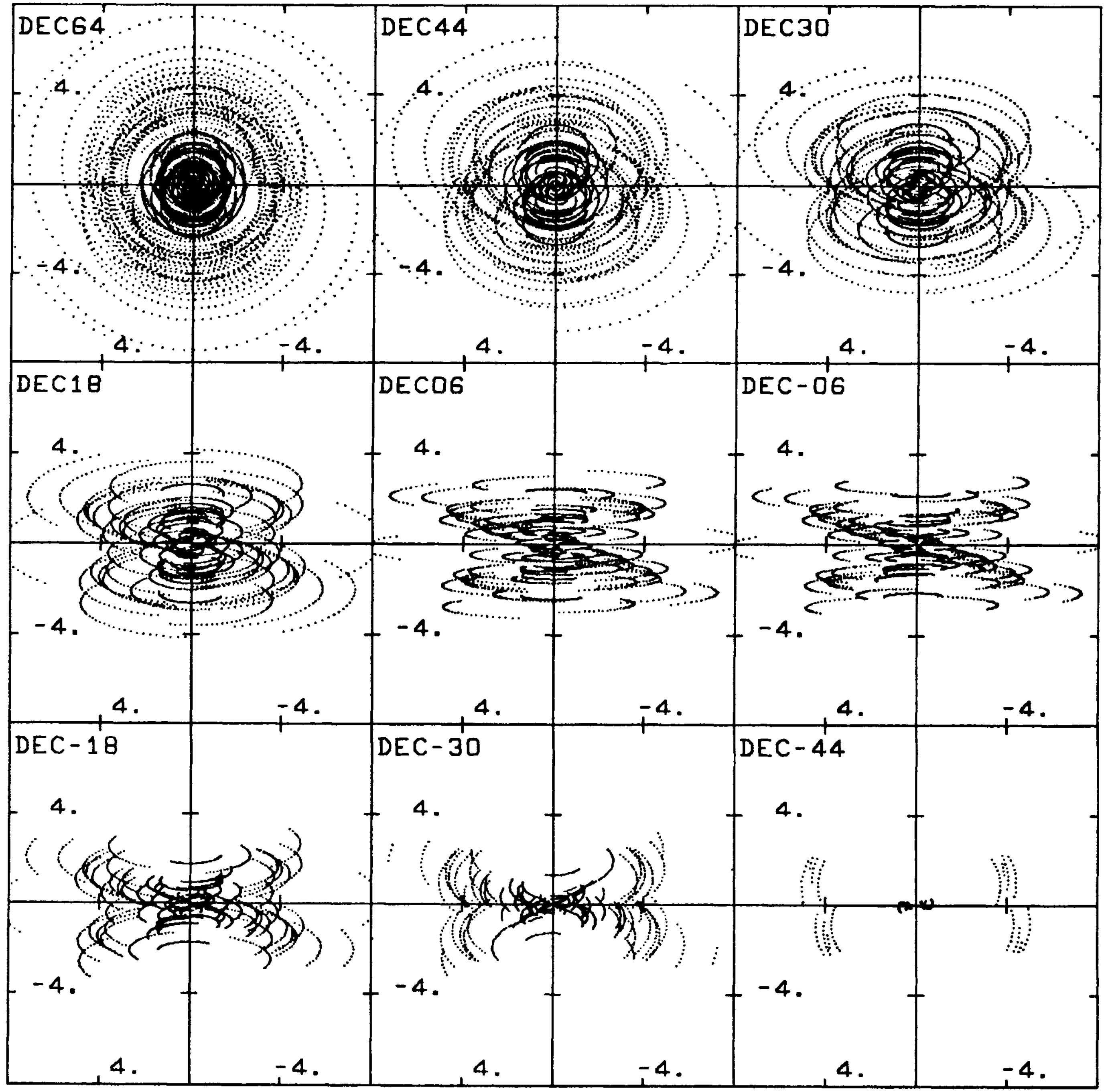


Figure 1

VLBA alone

8000 km max

Oroville, WA station

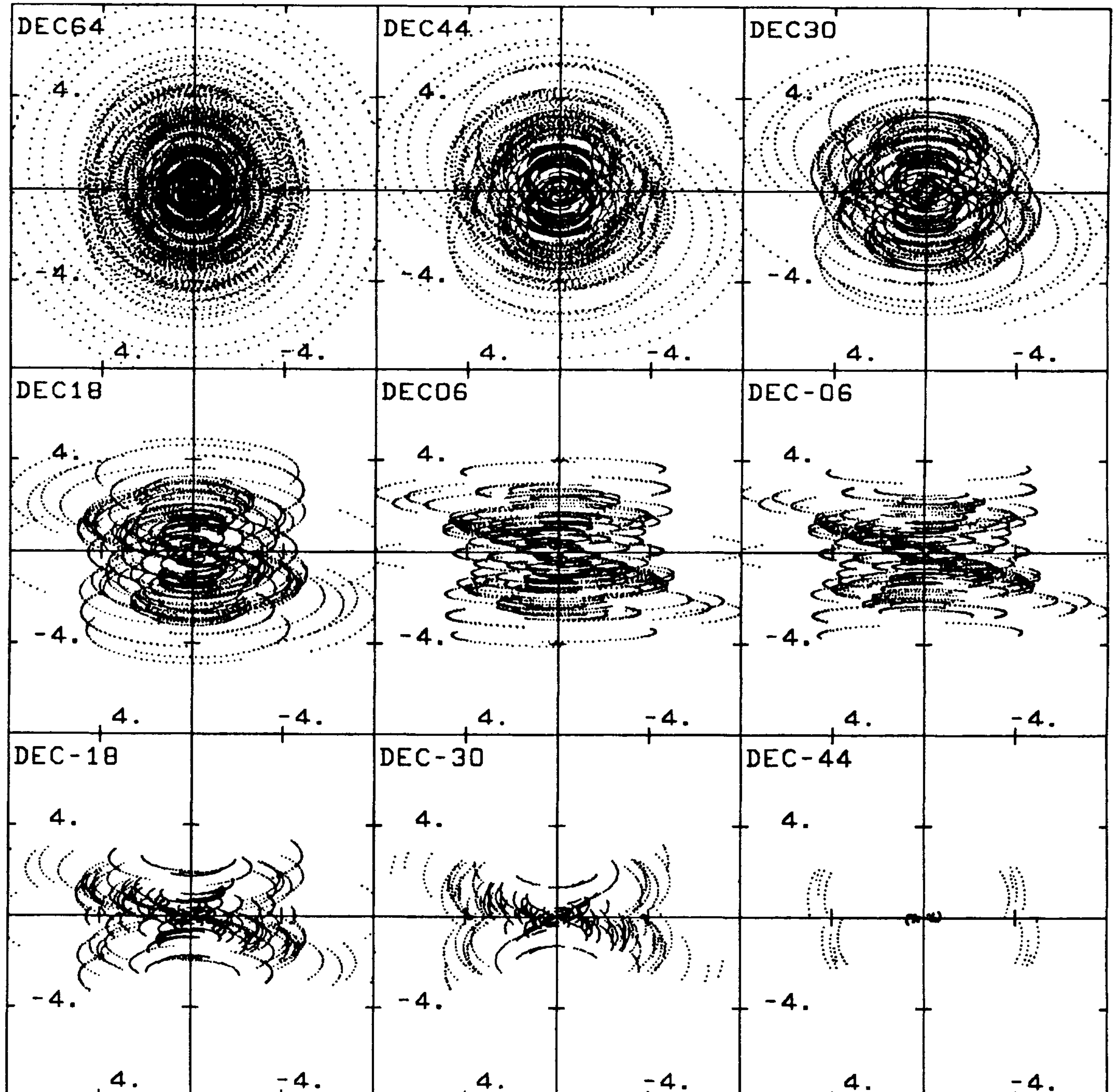
ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
OROVILE	48.90	119.75
HAWAII	19.80	155.50
PENT	49.30	119.60
YELKNF	62.70	114.50
ARO	45.95	78.07
P10G4-1	48.30	54.11

Scale in km
(kilometers x 10^3)

Figure 2

VLBA + 4-element CLBA
8000km max

Oroville WA station



ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
FIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
OROVILE	48.90	119.75
HAWAII	19.80	155.50

Scale in km
kilometers x 10^3)

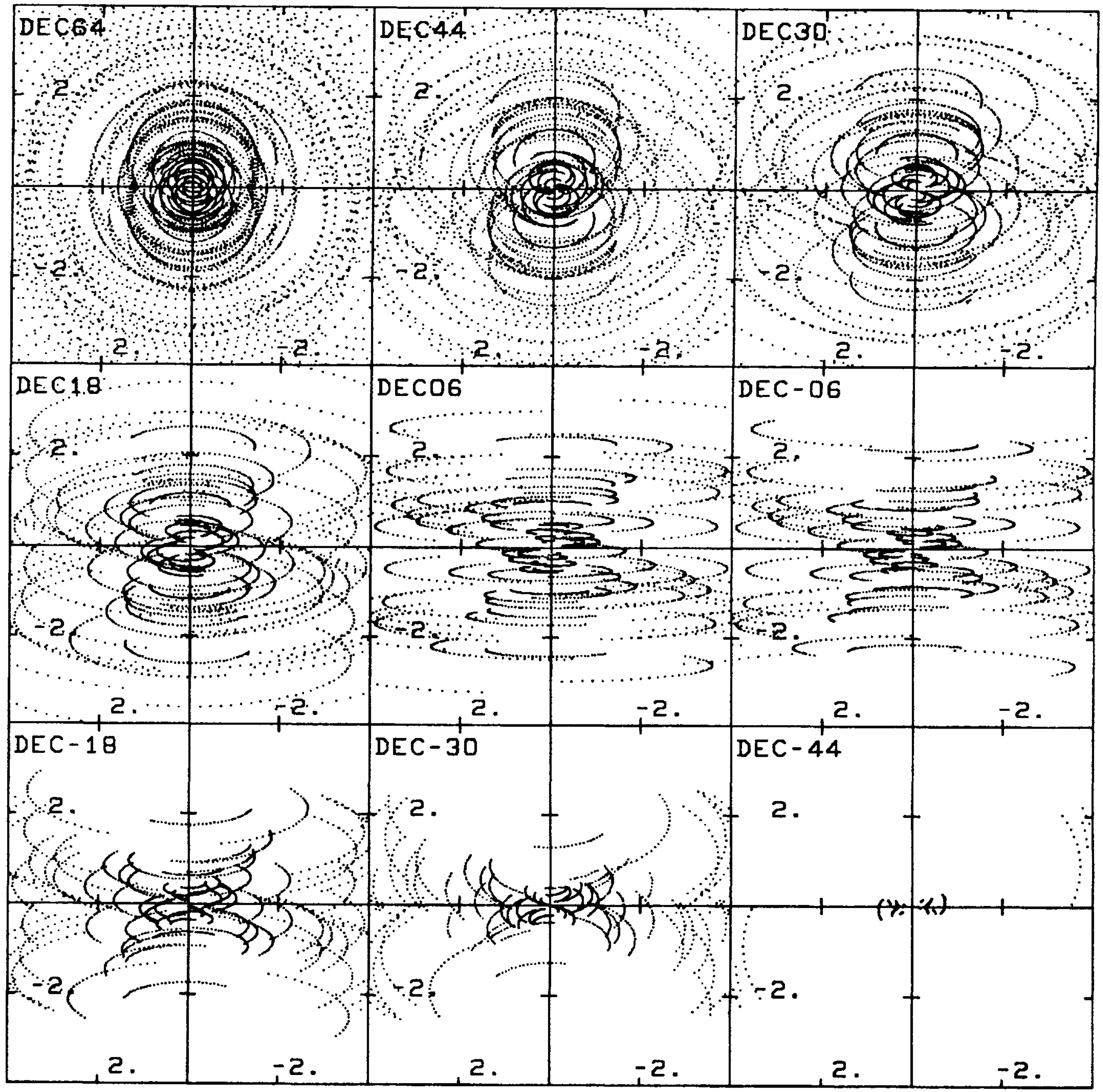


Figure 3

VLBA alone

4000 km max

ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108:14
KITT	31.96	111.60
OVRO	37.05	118.28
OROVILE	48.90	119.75
HAWAII	19.80	155.50
PENT	49.30	119.60
YELKNF	62.70	114.50
ARO	45.95	78.07
P10G4-1	48.30	54.11

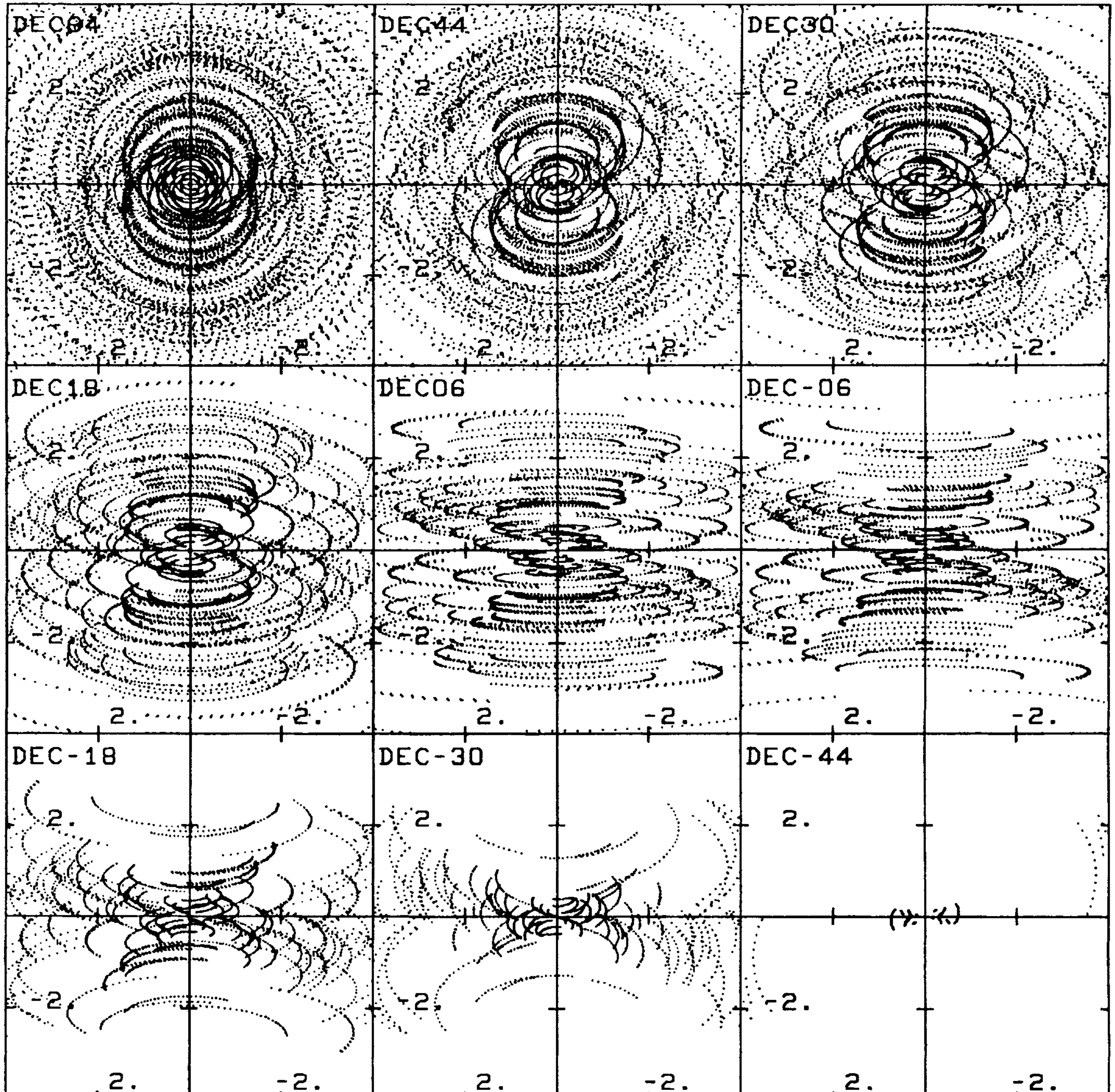
Scale in km
(kilometers x 10^3)

Figure 4

VLBA + 4-element CLBA

4000 km max

Oroville, WA station



ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
BREWST	48.15	119.80
HAWAII	19.80	155.50
PENT	49.30	119.60
YELKNF	62.70	114.50
ARO	45.95	78.07
P10G4-1	48.30	54.11

Scale in km
(kilometers x 10^3)

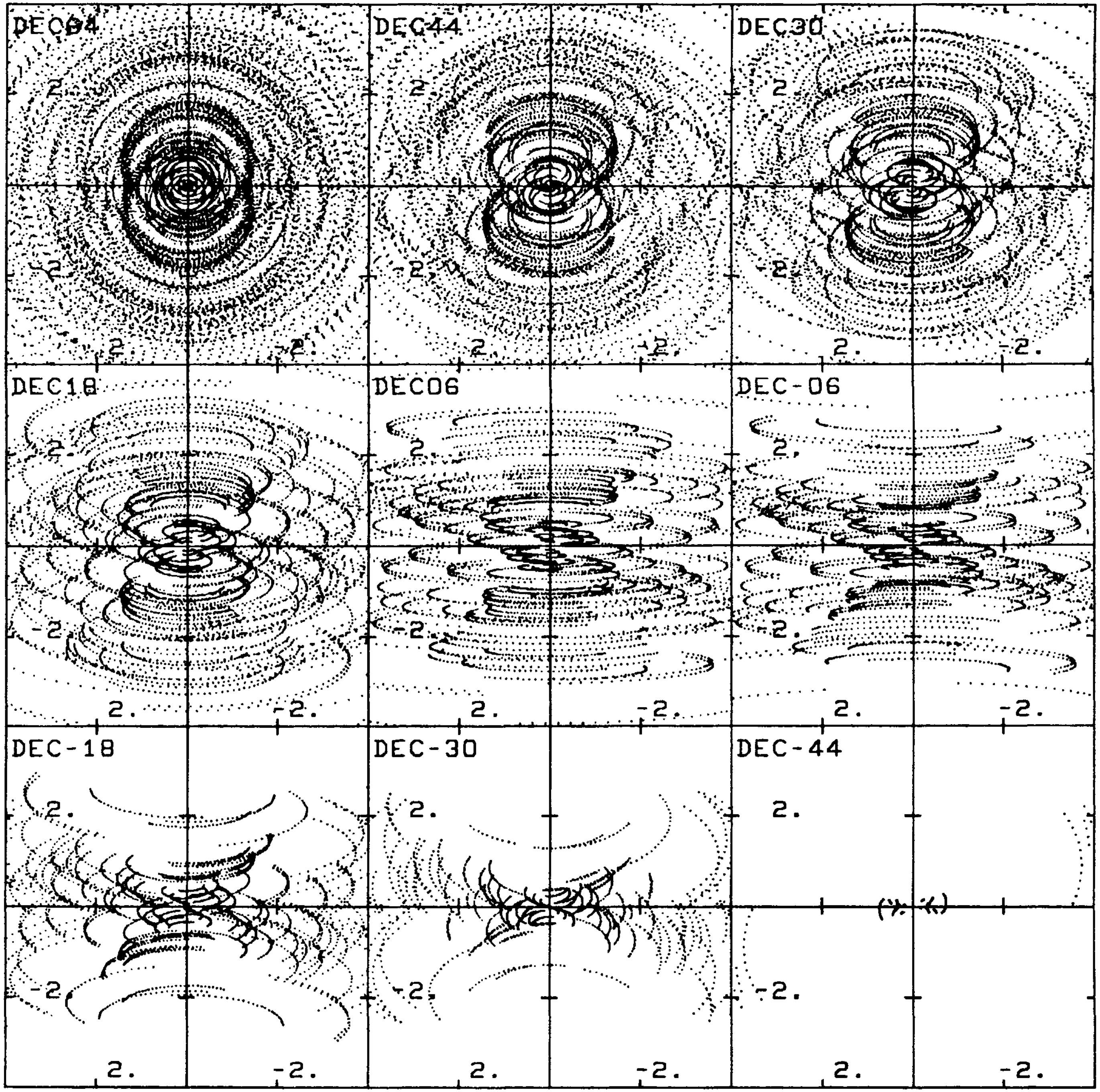


Figure 5

VLBA + 4-element CLBA

4000 km max

Brewster, WA station

ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
BREWST	48.15	119.80
HAWAII	19.80	155.50
AN9	34.24	107.63
AE9	34.00	107.41
AW9	33.97	107.81
AW3	34.06	107.64

Scale in km
(kilometers x 10^2)

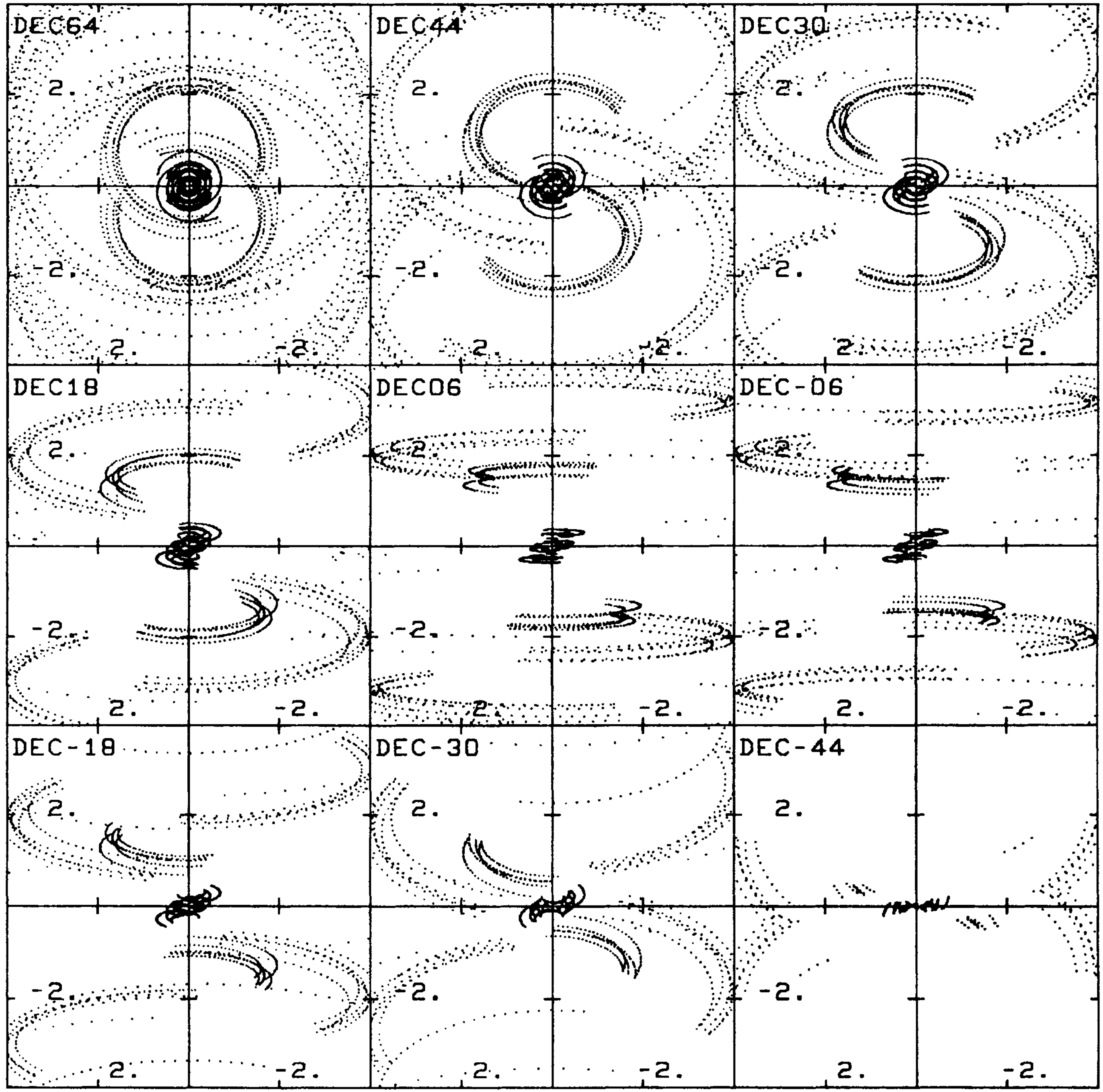


Figure 6

VLBA (Brewster)
4 VLA antennas

400 km max

ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
BREWST	48.15	119.80
HAWAII	19.80	155.50
PENT	49.30	119.60
YELKNF	62.70	114.50
ARO	45.95	78.07
P10G4-1	48.30	54.11
AN9	34.24	107.63
AE9	34.00	107.41
AW9	33.97	107.81
AW3	34.06	107.64

Scale in km
(kilometers x 10^2)

Figure 7

VLBA (Brewster)
4 VLA antennas
Pervicron

400 km max