NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

June 18, 1976

25 Meter - Millimeter Wave Telescope
Memo #44

MEMORANDUM

To: D. S. Heeschen

From: W. B. Burton and H. S. Liszt

Subj: Possible sites for the 25-meter telescope

During the course of discussion on where to place the 25-meter telescope, the question of site latitude seems to have gotten relatively little attention except in the context of the atmospheric absorption suffered by lower-declination sources. We think that the site latitude is a very important consideration. Here we remark on the possible site latitudes in terms of galactic morphology and the main uses of millimeter wavelength observations.

At the 36-foot telescope in Tucson, the most coveted observing time occurs during the late winter and spring when the center of the Galaxy rises above 15° elevation for some six hours each night and galactic longitudes as low as 345° are accessible for at least one hour. Observations of the molecular cloud Sgr B_2 near $\ell = +1°$, used for detection of new molecules, compete with large mapping programs of the galactic center, galactic plane, and inner-galaxy HII regions. For practical reasons, only the two oldest millimeter-wavelength telescopes (our 36 foot and the 5-meter dish in Texas) are capable of observing the galactic center; none of the newer instruments presently planned or under construction lie at sufficiently low latitude to allow observation of much of the crucial inner galaxy.

These arguments can be made more quantitatively using the attached figure. There we show the length of time during which lower galactic longitudes are above 15° elevation at Mauna Kea ($\sim$20° latitude), Kitt Peak ($\sim$32°), and Cerro Gordo ($\sim$37°). A number of points might be made. First, Sgr B_2 will be accessible for $7^{1/2}$ hours each day from Mauna Kea, against 6 hours and $5^{1/4}$ hours for Kitt Peak and Cerro Gordo. Second, during this time, if viewed from the low-latitude site, the inner-galaxy spends much more time at the favorable high elevations. Third, we can compare, for the different sites, the lowest galactic longitude which rises above 15° elevation long enough to be observed (1 hour). In this context, the difference between Cerro Gordo and Mauna Kea is $\sim$23° of longitude, or more than 4 kpc of the inner galaxy.

It is now known that all of the compressed constituents of the interstellar medium are confined to large extent to the inner-galaxy ($|\ell| \lesssim 35°$). It is also known that the portion of the inner-galaxy at $\ell < 360°$ contains more of this material. Thus, for example, the distribution of HII regions shows a marked preference for the fourth longitude quadrant. The histogram at the top of the figure shows this. Of the sites being considered, only Mauna Kea allows access to most of this important section of the Galaxy.

This discussion may be summarized as follows:

1. Mauna Kea is intrinsically the most valuable site of those considered because it affords the opportunity to investigate a much larger portion of the galaxy.

2. Mauna Kea will permit a more equitable and satisfying distribution of scheduling between studies of chemistry and kinematics in the galactic center.

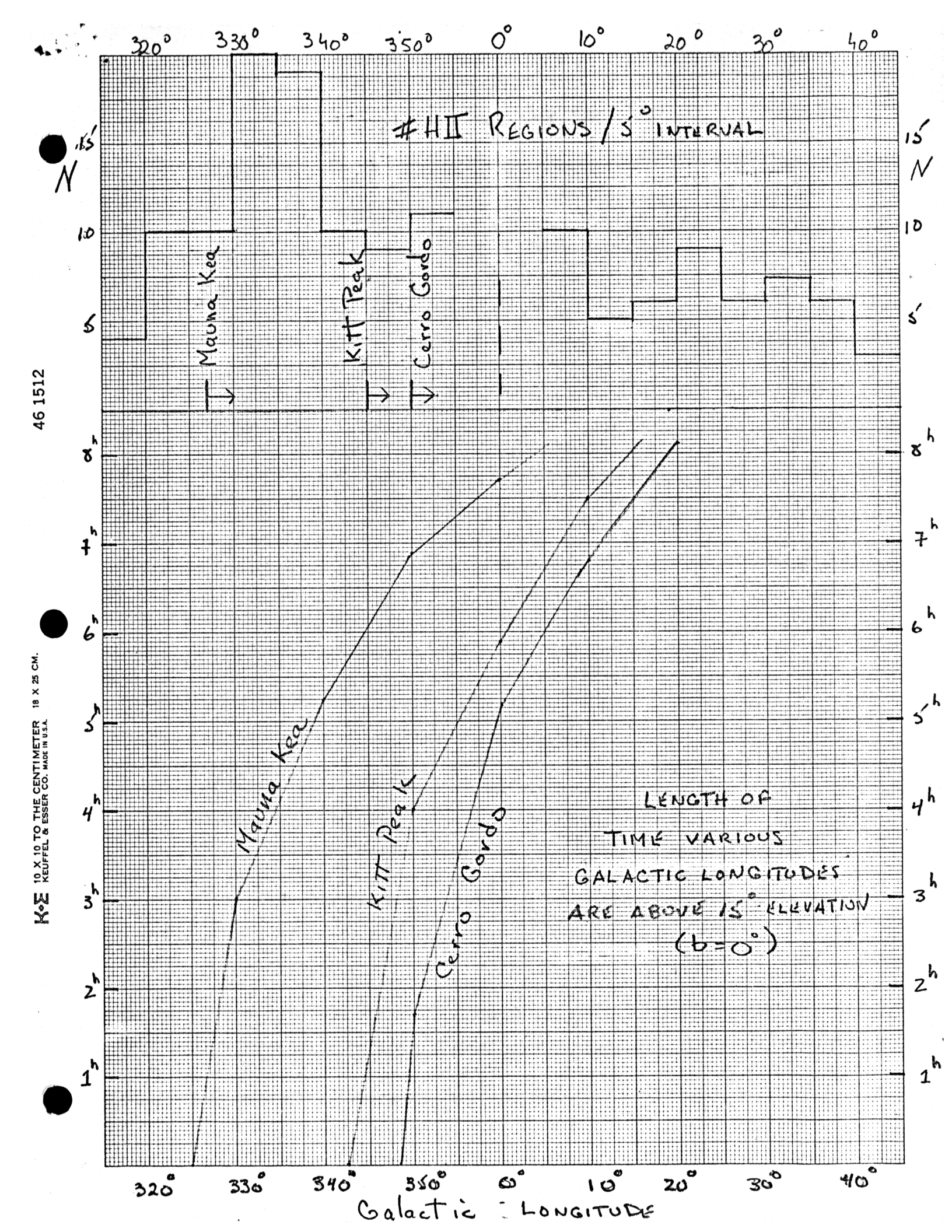
3. Because the NRAO can mount a project which is not feasible for everyone else, it would be unfortunate if the utility of the 25-meter telescope is restricted due to unnecessarily high site latitude.

WBB/pj

cc: Steering Committee

[Figure caption: Botton: Number of hours the galactic plane is above 15° elevation at three possible sites.

Top: Histogram of the number of HII regions per 5° interval of galactic longitude (from a compilation by Lockman). Marked at bottom are the limiting longitudes at the three sites.]


320° 330° 340° 350° 0° 10° 20° 30° 40°
#HII REGIONS / 5° INTERVAL
15' N
10
5'
Mauna Kea
Kitt Peak
Cerro Gordo
8h 7h 6h 5h 4h 3h 2h 1h
LENGTH OF TIME VARIOUS GALACTIC LONGITUDES ARE ABOVE 15° ELEVATION (b=0°)
Galactic LONGITUDE
46 1512
K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.