

Some Notes on the Proposed Mauna Kea Site

by
Jon Spargo

While on vacation on the island of Hawaii during December 1983 I had the opportunity to speak at length with personnel at the United Kingdom Infrared Telescope (UKIRT). Realizing that one of the proposed VLBA antenna sites is the summit of Mauna Kea, I asked many questions regarding UKIRT's experience both on the mountain and in Hawaii. The following paragraphs relate my findings on a wide range of topics cogent to locating a VLBA antenna on Mauna Kea.

Antenna Location

The Eastern Ridge of the summit area is full. Virtually all of the acceptable sites are occupied. The valley, between the East Ridge and the Western summit of Puu Poliahu, is where British-Dutch millimeter telescope is now under construction. In this valley is also a site designated for Cal-Tech and the old NRAO 25 meter site. All of these sites I have marked on a topo map which I gave to Cam Wade. The major problem with any site in this valley is hour angle coverage to the East. The East Ridge horizon limits the HA to about 3.5 to 4 hrs East. This would clearly put severe restrictions on baselines involving antennas in the Eastern U.S. and Puerto Rico.

The Western summit named Puu Poliahu is currently empty. It is only 4100 ft lower in elevation than the East Ridge and far enough to the west so as to pose no problems for HA coverage to the East. However this summit is one of the proposed locations for the 15 meter (10?) NNT. It is currently instrumented for micro-meteorology studies. These tests are under the supervision of Fred Forbes at KPNO.

Weather

Attached you will find a copy of environmental specifications for the UK-NL millimeter telescope. I am informed that conditions are somewhat less severe in the valley area, particularly regarding wind and ice. However these specifications would indeed apply to the Puu Poliahu summit. Icing conditions can be particularly bad at times. Free structures, such as weather towers, which are exposed to the wind can accumulate a 6 to 12 inch buildup of radial ice. The max ice loading expected is 60 lbs/ft². I was also informed that the East slope inversion layer is usually at 6 to 7k ft elevation during normal NE trade wind conditions.

The west slope inversion layer is less precisely known. The best guess is that it may at times be as high as 9k ft due to dryer air.

Earthquakes

In late November 1983 the island of Hawaii had a magnitude 6.6 quake with the epicenter located under Mauna Loa. As far as I know none of the instruments on Mauna Kea suffered any damage. This is largely due to design considerations. For example, the UKIRT telescope is designed so that metal pins will shear at a certain stress level and allow the entire telescope assembly to "float." When this happens it takes about 40 minutes to realign the telescope, install new pins and put the instrument back on the air.

Power

Currently, electrical power at the summit is still provided by diesel powered generators. UKIRT people estimate that within 2 years full 3 phase commercial power should be available at the summit through buried cables. Needless to say it will be expensive power. At present the biggest stumbling block seems to be the environmentalists. I'm told that they are in the process of being placated and then technical problems for burying a cable to the summit have been largely solved.

Communications

Currently a microwave communication link provides direct phone and data service to the summit through the Hilo exchange. This link has proven to be very reliable. UKIRT has remotely operated their telescope from Edinburgh, Scotland through this link. Also UKIRT programmers regularly access the on-line computer at the telescope from their downtown Hilo office. Communication to the way station at Hale Pohaku are still limited to two radio-telephone links to the summit. It is estimated that within 2 years the microwave link at the summit will be expanded to include the way station. Here again however, the environmentalists are in the process of being placated.

Summit Road

The summit road is still not paved and probably never will be. It is maintained on a regular basis by road grades. It is nevertheless a very hazardous road and many accidents occur. Tourists are allowed to drive to the summit! Also, 4 wheel drive vehicles tend to have short wheelbases and are easy to roll over on sharp turns. This has happened several times even to seasoned drivers. The road has not been impassable in the past two years but it has been. One danger is posed by storms coming from the West. The road is cut into the west slope of

the summit and can fill up with snow and become impassable very quickly. This only happens rarely, however at the first sign of bad weather "everyone" leaves the summit within 15 minutes to prevent being trapped.

Daily Support

Reports are that daily support at way station and summit are now very good since it became unified under an organization known as MKSS (Mauna Kea Support Services). It is essentially an independent organization that ultimately derives its funding from the University of Hawaii. The MKSS chief is Tom Krieger who is an old hand on Mauna Kea and has "seen it all."

Equipment Environment

UKIRT has had many problems with electronic equipment at the summit, particularly with computers. Disks crash often and adequate cooling is also a problem. This argues for a pressurized control room. It also turns out DEC is the only computer company that will sign a maintenance contract to service equipment at the summit. HP recently would not renew a service contract for the summit with CFH. CFH must now bring their HP computer down from the summit to have it serviced or repaired.

Visual Pollution

In the past so called "Visual Pollution" has been an impediment to putting new instruments on the summit. This has become more or less a non-issue due to the fact astronomy has become big business on the island. For example, Astronomy recently passed guava production in terms of money pumped into the island economy. However, it is still necessary to pay ones "dues" in that proper protocol must still be paid to local officials.

Employee Contentment

UKIRT's experience has been that local hires among technical and support staff seem to be happy and loyal with little turnover. Scientific and engineering staff is another story. Those affiliated with the Royal Observatory in Edinburgh are rotated to the islands for various lengths of time. Other staffers do have problems and turnover is a problem. Some of the problems include the high cost of living, suitable housing and the island version of "cabin fever" among wives. Families with children suffer because of poor schools which the state government does not seem to want to support very well. There are two excellent private schools, Hawaii Preparatory Academy in Waimea and St. Joseph's Catholic in Hilo. Both have long, long waiting lists.

Logistics/Personnel

The industrial-technical base of the local economy has grown considerably in the past few years. It is now possible, with a little planning, to easily and routinely obtain materials needed for daily operation. Even helium is available (UKIRT has recently installed a helium production plant). People with various technical skills are also available for hire, in limited quantities. UKIRT has had no problem finding good technical people. There are even local construction companies who have gained enormous experience building on the summit. Construction bids typically show huge differentials. Usually bids are either very high or seemingly very low with few in between. Believe the low ones as they are submitted usually by local firms that have experience on the summit.

The Bottom Line

For any NRAO personnel planning future visits to Hawaii for VLBA purposes, I would strongly urge that you contact and visit with the people at UKIRT. They now have over 5 years experience on the summit and if they can't answer all questions they will surely find someone who can. Additionally they are presently responsible for the construction of the British-Dutch millimeter telescope and as a result are currently dealing with the very problems we are most interested in.

I would suggest first contacting the director Dr. Terry Lee and ultimately the second in command Dr. David Beattie. David is the engineer who makes their whole operation go and has the most knowledge about things of interest to us. He expressed his willingness to help directly to me and even seems eager to do it. He said that he would arrange for us to meet with Tom Krieger of MKSS and put us in contact with anyone else we would need to talk to. I feel we should take him up on his offer. Lee and Beattie can be reached at:

UKIRT
900 Letlani St.
Hilo, Hawaii 96720

Phone: 808-961-3756 (Hilo Office)
808-935-4332 (after hours recorder)
808-961-6091 (telescope at summit)

JS/cw

1/18/84

British-Dutch Millimeter Telescope

Description of Site and Access thereto

Wind	200 km/h averaged over 3 secs once every 50 years
Precipitation	Mean yearly rainfall 380 mm
Relative Humidity	10% to 100%
Ice	Maximum ice build-up 300 mm on slender members (Ground lying snow can be significant) (60 lbs/sq ft max ice loading)
Temperature	-10° C to +20° C
Air Pressure	600 to 700 mb
Earth Movements	50 year maximum 0.3 g lateral acceleration 0.1 g vertical

The site is, generally, of volcanic deposits and is accessible via a metalled road up to about 2,700 metres and thereafter by an unmetalled road.

The Contractor is to provide all necessary route, directional, warning and similar signs, both on and off the site.

Inspection of Site and Drawings

The Contractor is advised to make himself thoroughly conversant with the nature of the site, the facilities for access, the local conditions, the full extent and character of the operations, the supply of and conditions affecting labour and all other matters affecting his tender and the execution of the Works.

The Contractor is also advised to examine the Superintending Officer's general and detail drawings carefully in order to ascertain the character of the work and the manner in which the Works are to be carried out.

The general and detail drawings shall be read as a whole. If any details whatsoever be not clearly shown or specified, the Contractor shall ask for instructions and if any work be wrongly executed it shall, if the Superintending Officer so directs, be removed and re-executed at the Contractor's expense.