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To: Mark 5 Development Group

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Subject: Hard Disks at High Altitude

To prepare for the recording of VLBI data on Mark 5 disk modules at the 13,300-foot altitude of the SMA on the summit of Mauna Kea, and because no disk drives are guaranteed to operate at an altitude greater than 10,000 feet, we have decided tested a variety of disk drives in a Mark 5A system at the summit.

We sent a Mark 5A system and 8 modules to the summit. Each module was populated with 8 disk drives of the same type, with two modules of each type, for a total of 16 drives of each type.

The disk drive types were:

Maxtor 300-GB Model 7L300R0

Seagate 300-GB Model ST3300831A

Western Digital 320-GB Model WD3200SB-01KMA0

Hitachi 250-GB Model HDS722525VLAT80

The modules were tested by using the Conduant StreamStor “conditioning” routine, which performs an end-to-end read and write cycle on all disk drives in a module. Both Western Digital modules failed Conduant’s basic confidence test. The Maxtors failed near the end of the first pass, and then failed the basic confidence test. The Seagates passed a complete read & write cycle, but later failed the basic confidence test. Only the Hitachi modules survived multiple end-to-end read and write cycles.

As a result of these tests, we built enough modules with Hitachi drives to record the VLBI data at Mauna Kea. Data was recorded on 14 modules, and we have not had any problems reading the Hitachi modules recorded at the summit. Also, the two Mark 5A units had 80 GB Hitachi operating system disks, and there were no problems with them.

The modules that failed at the summit were returned to Haystack, and all performed normally, except for one Maxtor drive that needed to be replaced.

The two Western Digital, one Seagate, and 7 Maxtor modules were sent to the 10,720-foot summit of Mt. Graham, and no problems were encountered with recording or playback.

Since there are design differences for different disk drive models within a brand, it is not reasonable to expect other Hitachi Models to be usable at high altitude, or for different models of the other brands to fail at high altitude. Any model of disk drive needs to be tested from end to end before use above 10,000 feet.

Since these early tests were performed in May of 2006, more modules have been tested at the summit of Mauna Kea. The following disk drive models have passed a complete read & write cycle at the summit:

PATA:

Hitachi 250-GB Model HDT722525DLAT80

Seagate 400-GB Model ST3400620A

SATA:

Hitachi 750-GB Model HDS721075KLA330 (Deskstar 7K1000)

Hitachi 1000-GB Model HDE721010SLA330 (Deskstar E7K1000)

Western Digital 1000-GB Model WD1001FALS (Caviar Black)

The following models failed at the summit:

Hitachi 7K1000.B

Western Digital Caviar Blue