

NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY

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TO: VLBA Data Acquisition Group
FROM: Alan E. E. Rogers
Roger J. Cappallo
SUBJECT: Visit to Kodak Datatape

On 3 May 1984 we visited Kodak Datatape Incorporated, 360 Sierra Madre Villa, Pasadena, CA 91109. The members of our team were:

Ray Escoffier	-	NRAO
Benno Rayhrer	-	JPL
Marty Ewing	-	CalTech
Roger Cappallo	-	Haystack
Alan Rogers	-	Haystack,

and the key people we met at Kodak were:

Abe Ispas	-	Vice President, Product Management
Sid Damron	-	Advanced Development
Mike Trcka	-	Recording Technology Engineer.

The Kodak group started by describing the technical details of their digital recording systems. Of most interest to the VLBA were the helical scan recorders because of the very high recording density that has been achieved. They reported some basic technology tests in which recording densities of 27 to 66 Mbits/square inch were studied using a helical scan recorder with one inch wide 3M digital audio tape (3M-265). In this study longitudinal density was held to a maximum of 43 Kbits/inch and track densities of 600 to 1600 tracks/inch were explored. The results of this study encouraged various government agencies to sponsor the development of the following specific systems:

A) "Bluejay-D" (now in production): Has two components, an acquisition system which records for 107 hours at 13Mb/s using a compact low power (15W) recorder, and a rather massive and expensive system which plays and records at 13 Mb/s (1X) or plays (only) at 50 Mb/s (4X). Record density is 37 Mb/sq inch (833 tracks, [1 mil + 0.2 mil (1X) guardband] per inch). We saw a production line of many acquisition units and a few read/write units under production. At 50 Mb/s the Bluejay-D generates one 22 lb reel (18" diam reel of 3M 5198) every 26 hours.

B) "Kittywake" (under development): A system which uses 32 Bosch cassettes, each of which contains 1000 feet of one inch wide tape and weighs two pounds 12 ounces (11.5 oz or 26% tape), and a "juke box" changer. This system will record and playback at 100 Mb/sec but is not yet in production. We examined the 3-axis robot changer with great interest. This changer, made by Bosch, is used in Europe to provide a "one-man" TV station with automated tape changing - it was reported to cost 50K\$.

C) "Mallard" (development to start in October): 100 Mb/s recorder system similar to Bluejay-D but with enhanced data rates.

All three systems use the Bosch (BCN-2-KE-9-E P/N 553341) scanner with modifications by Kodak. A recorder using this scanner apparently tracks well and can record and playback (with recorder interchange) at 37 Mb/square inch. Higher densities are possible but may require tracking adjustments to be made for the playback of tapes from different machines. Metal heads last 1000 hours and ferrite heads at least 3000 hours.

We were given a demonstration of the Bluejay-D record/playback system. As already mentioned, this system is massive. It occupies a rack about 5.5 feet wide, consumes about 2 KW and probably weighs several thousand pounds. The rack is luxuriously equipped with a built-in scope and large control panel (for local control - remote control is via 9600 baud serial communication). The tape path is quite complicated and the tape passes across two scanner drums to allow optimized playback at 13 Mb/s or 50 Mb/s (in future systems one scanner will handle multiple playback rates). Analog performance and eye patterns displayed on the scope looked excellent.

We discussed our requirements with Abe Ispas and Mike Trcka, and came to the conclusion that the large Bluejay-D machine is the only unit which comes close to meeting our requirements, in a realistic time-frame. Since the cost is extremely high (\$500,000 per machine) we discussed methods of reducing cost, such as:

A) Eliminating second scanner,

B) Not purchasing the signal and digital electronics,

C) Procuring only the basic mechanical transport which could be mounted in a single rack like the Honeywell Model 96.

D) The economy of buying 40 units (2 per station + 20 at processor).

I agreed to write to Abe Ispas for cost estimates for the various options above.

Conclusions: It looks like the one inch helical scan recorder may be the way to achieve densities considerably higher than can be achieved with longitudinal systems (Kodak thinks 300 tracks/inch is about the limit of longitudinal recording - even with dynamic tracking).

While Kodak has demonstrated all aspects of the technology needed to meet the VLBA requirement none of their machines presently in production meets all of our requirements. The Bluejay-D for example, does not presently run at 100 Mb/s - although Abe Ispas says they can make it do so.

Future systems from Kodak look exciting but probably will not be available in time for the VLBA. Cost is a major problem, although costs might be greatly reduced if we could "tag along" on other large government orders. In this respect we will have to wait for cost estimates from Abe.