# A COTS-Hardware Candidate for the Next-Generation VLBI Data System

Alan Whitney
*MIT Haystack Observatory*

Mikael Taveniku
*XCube Systems*

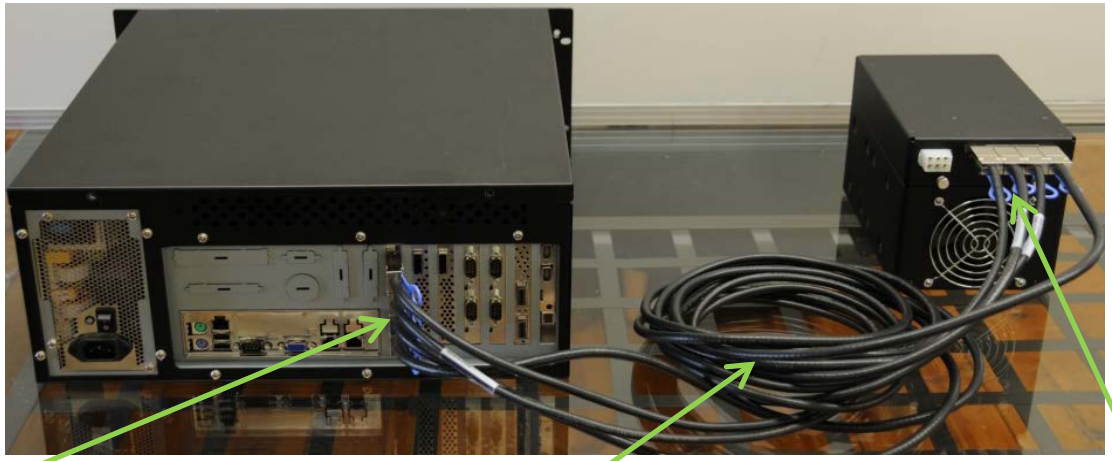
29 March 2011
EVGA meeting
MPIfR, Bonn, Germany

# Xcube data system

- System developed by small company in Nashua, NH for in-automobile monitoring of automated driving systems
- Based on fully COTS hardware
- 8 Gbps sustained recording rate from RDBE demonstrated
- First COTS-hardware system that (to my knowledge) properly handles slow and/or failed disks during recording
- Runs on Linux platform with some modified kernel code and drivers for efficient memory management
- Hardware/software combination is highly tuned for performance
- System currently under evaluation/development at Haystack for VLBI application

# Characteristics

- Two 10GigE data interfaces
- 8Gbps sustained to 16 SATA disks
- >16Gbps capture to internal RAM (up to 128GB)
- Supports inexpensive commodity SATA disks
- Records to standard Linux files
- Can use XCube disk modules (similar to Mark 5 modules) or existing Mark 5 modules modified with new module backplane and front panel (with e-SATA and power connectors)
- Appears to be good fit to two current VLBI projects:
  - VLBI2010 – 16-32Gbps burst capture; average ~3-4Gbps
  - mm-VLBI –8-64Gbps burst capture; sustained 8-64Gbps desired in future

These connections will be fixed until cables are swapped

Can be turned 180 to double lifespan

These connections will used when switching disk packs

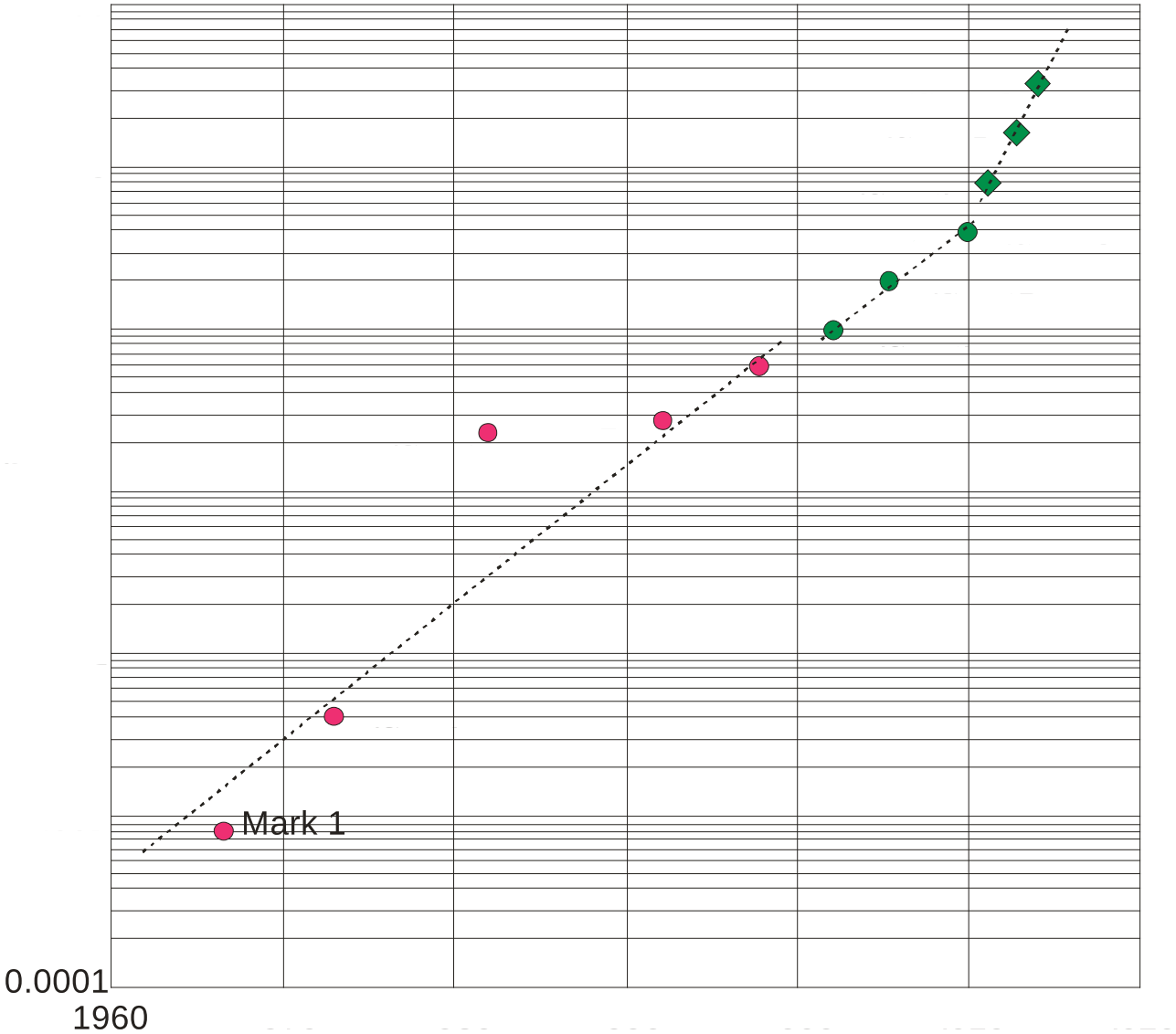
# Demonstrations

- Haystack: Dec 2010
  - Recorded two 10GigE data streams at 4Gbps each (from RDBE) to 20 disks; 8 Gbps sustained for ~10 minutes
  - One 4-disk eSATA cable was disconnected from a module while recording; system transferred load to remaining 16 disks within <1 second
- Socorro: Jan 2011
  - Simultaneously recorded identical 2Gbps data stream from RDBE to both Mark 5C and XCube systems; no problems
  - Cross-correlated Mark 5C vs XCube data with “zerocorr” software by Walter Brisken
    - With exception of minor bookkeeping hiccup, cross-correlation worked perfectly on first try

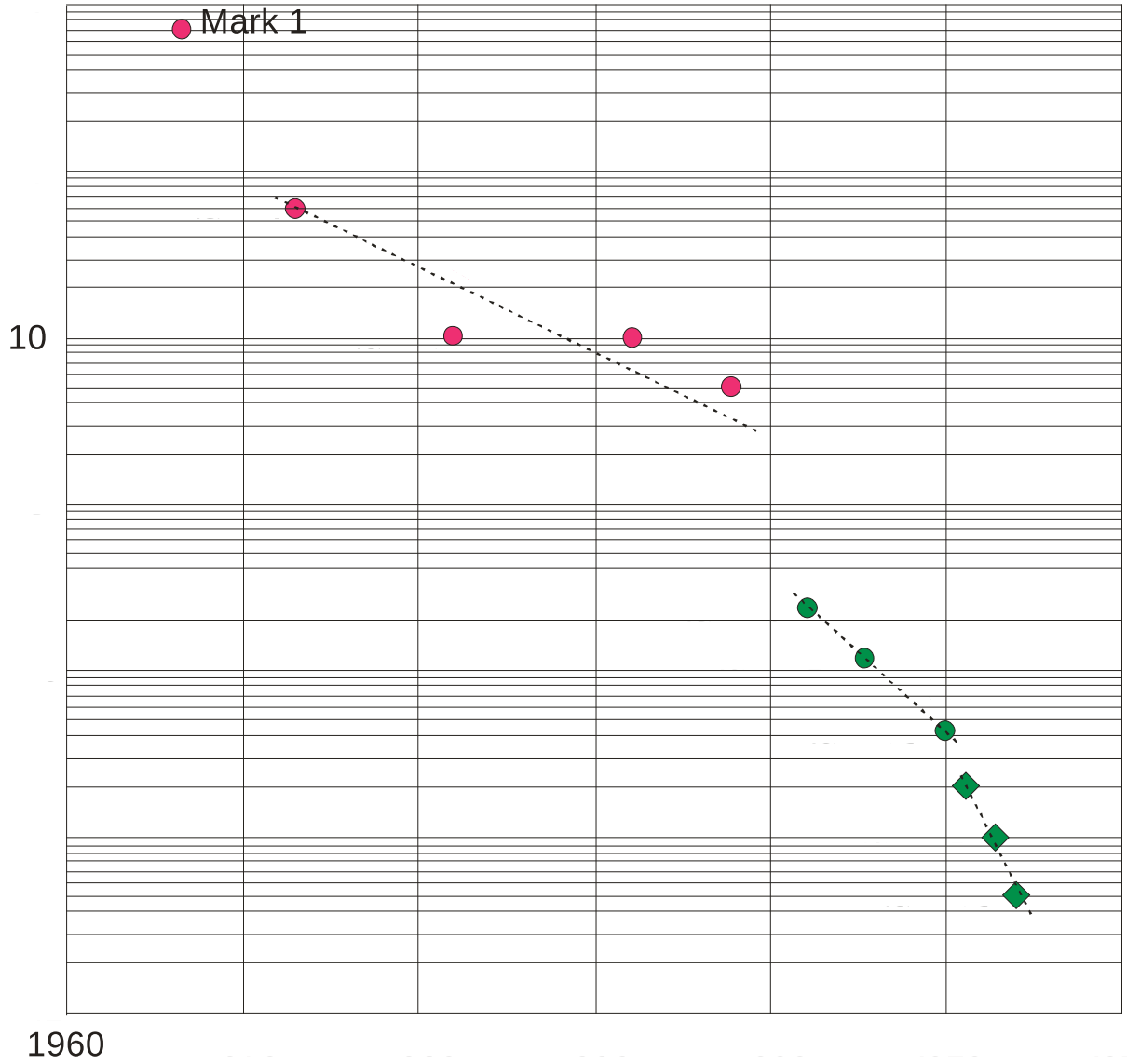
# Work in Progress

- Minor software revisions being made to support several VLBI-specific issues:
  - Permanent module-serial numbers
  - Gather individual disk-performance statistics
  - Allow one disk module to record/playback undisturbed while utility operations are peformed on another (mount/dismount, read VSN, etc)
- VSI-S wrapper for VLBI control/monitor being written

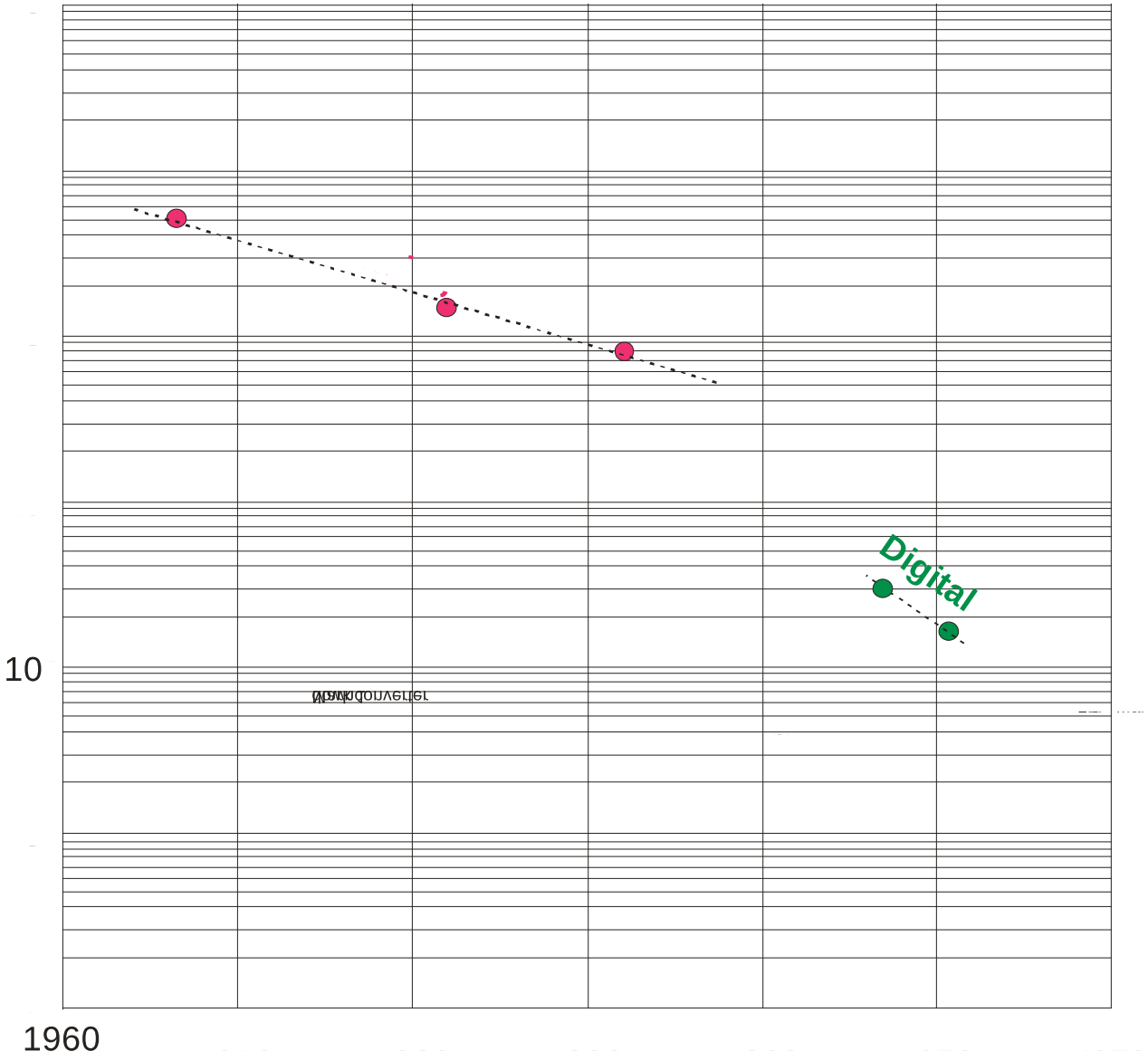
# Recording Rate vs Time



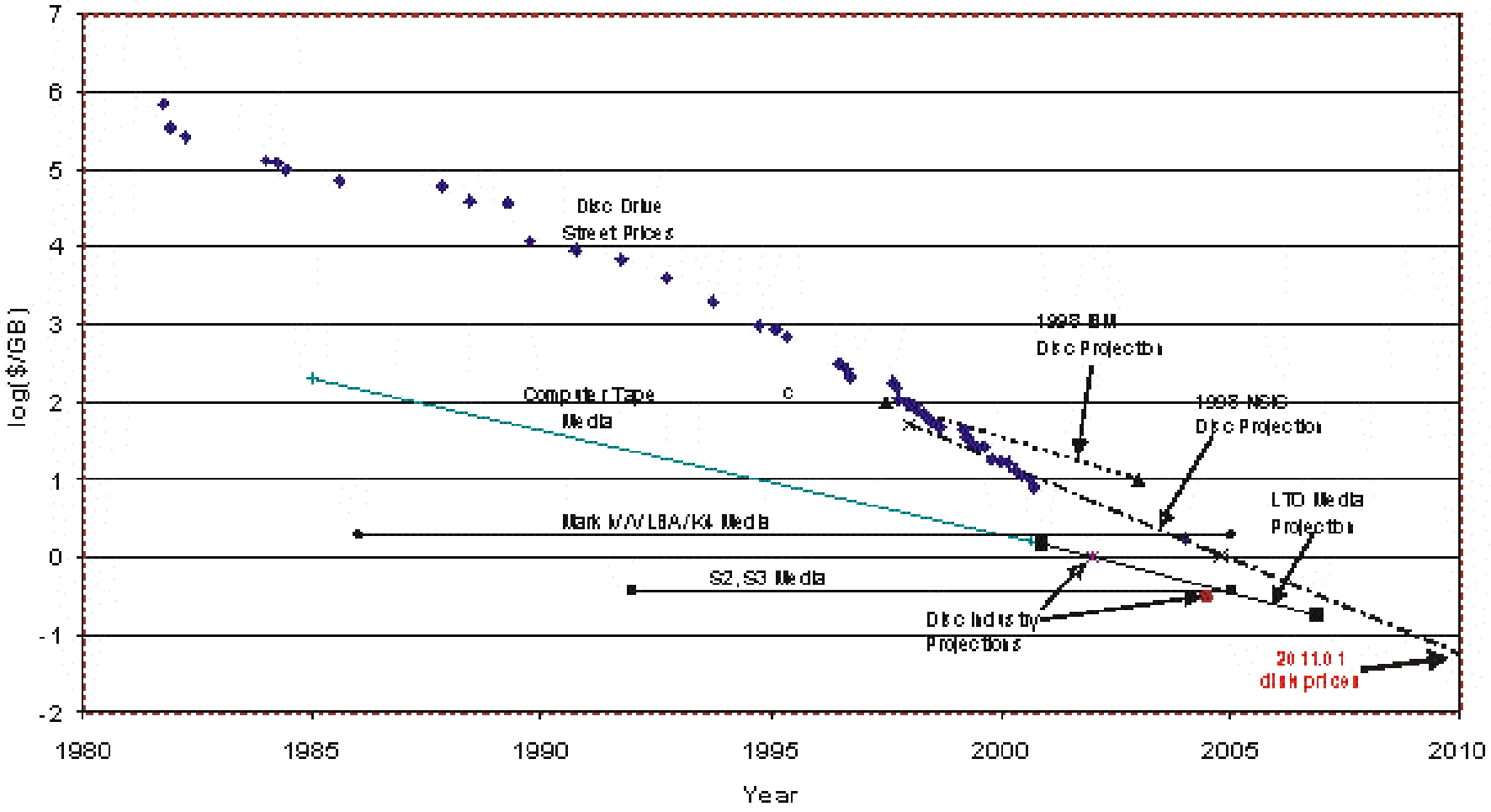
# k$/Gbps vs Time



# Backend-bandwidth price vs time



# Disk price vs time



# Plans

- Complete VSI-S wrapper and integrate into Field System
- Plan to demonstrate XCube system at May 2011 TOW meeting at Haystack
- Design new backplane and front panel to retrofit existing Mark 5 modules for XCube compatibility (though must use only SATA disks); external cooling must be provided by user (can use Mark 5 chassis, for example)
- Put system into regular use as part of further testing
- Future upgrades to ~32Gbps expected over next few years

A comprehensive document by Michael Taveniku about the XCube system for VLBI is available.

# Questions?