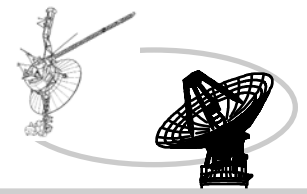**JPL**

JPL VLBI Correlator
(JVC)

Steve Rogstad
Chuck Goodhart, Eric ClarkSue Finley,
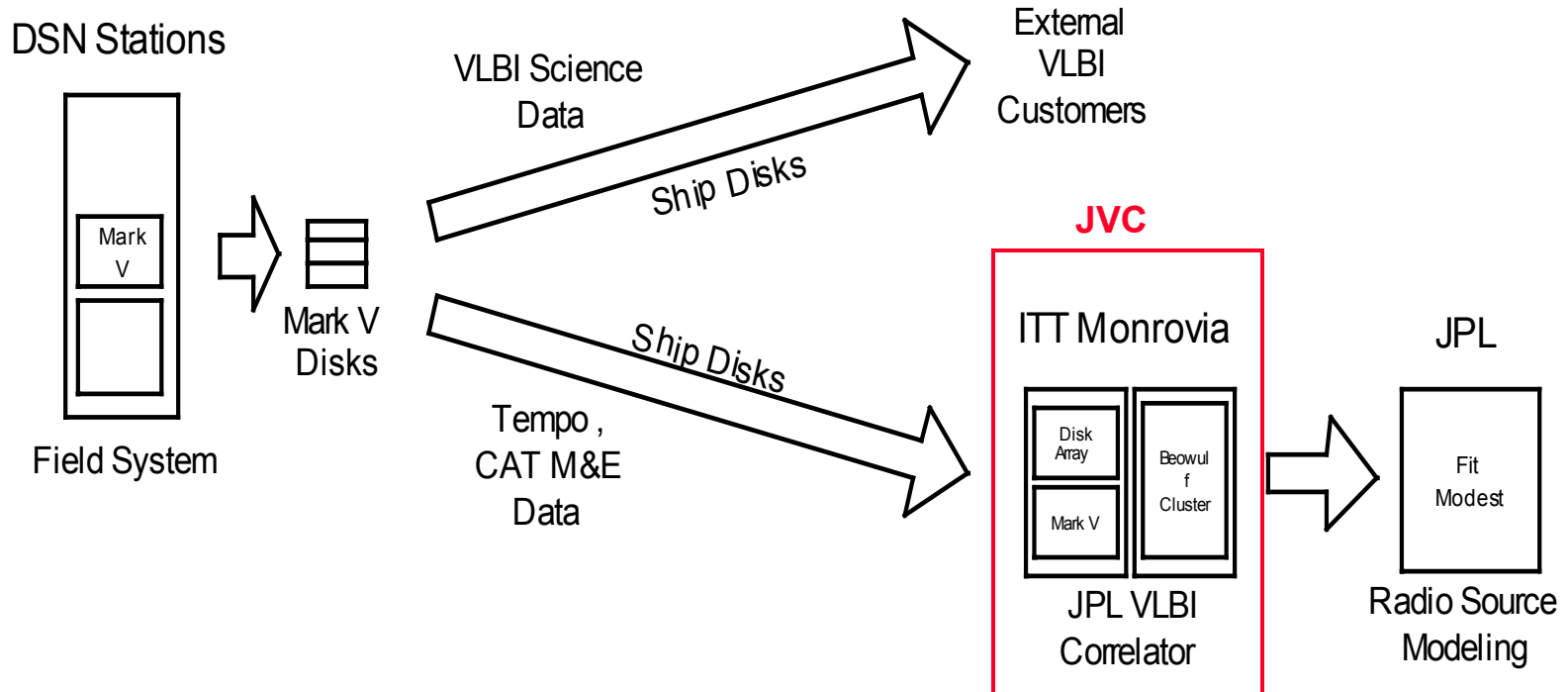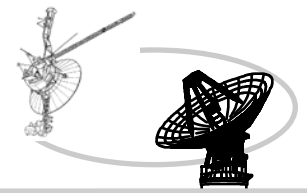**Les White, Gabor Lanyi – Caltech/JPL**

Overview

- **A collection of Commercial Off The Shelf (COTS) hardware and custom software processes that function as a VLBI correlator**

- **Uses SoftC as the correlation engine**

- **Exists in the DSN's Radio Source Observation (RSO) Subsystem**

- **JVC data is used to support JPL spacecraft Navigation**
  - **VLBI Source Catalogue Maintenance and Enhancement Task (CAT M&E)**
  - **Time and Earth Motion Precision Observations Task (TEMPO)**

- **JVC was the replacement for the Block II Correlator**
  - **Requirements were the same – 112MB/sec rate, 24-hour TEMPO etc…**
  - **Software running on COTS, instead of custom, hardware**
  - **Much easier operations and maintenance**
 - **Can process a TEMPO pass up to 4 times faster (~2hr. vs. ~8hr.)**

JVC within the RSO Subsystem

DSN Stations

VLBI Science
Data

External
VLBI
Customers

Ship Disks

JVC

Mark
V

Mark V
Disks

Ship Disks

ITT Monrovia

JPL

Field System

Tempo ,
CAT M&E
Data

Disk
Array

Beowul
f
Cluster

Fit
Modest

Mark V

JPL VLBI
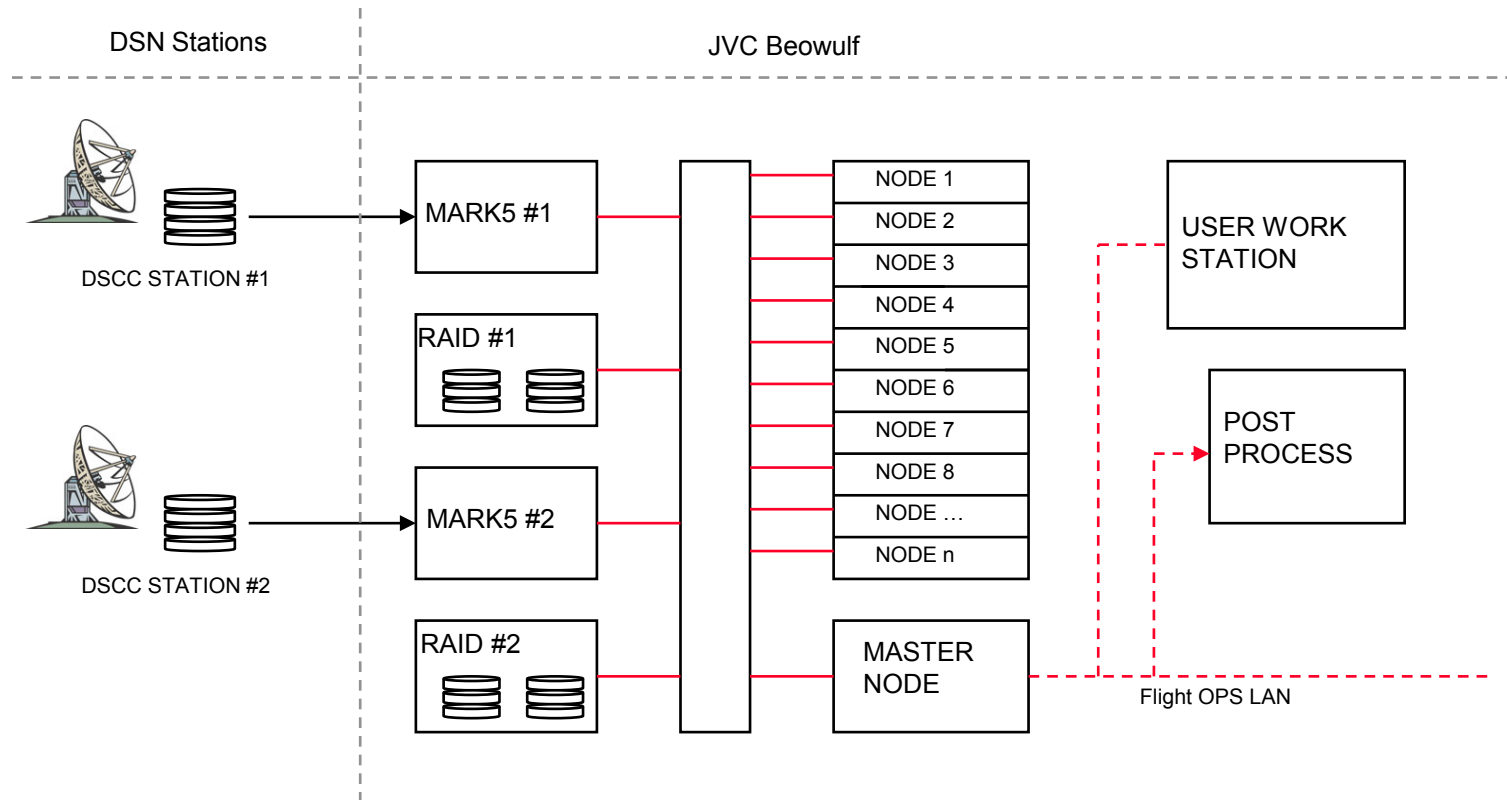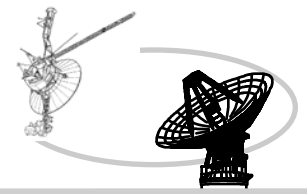Correlator

Radio Source
Modeling

JVC Hardware

- **Mark 5A data system**
  - **Developed by Haystack**
  - **Used in the JPL VLBI Data Acquisition Terminal (DAT)**
  - **Provides the data input to the JVC**

- **RAID storage device**
  - **12x 750GB drives in a RAID 50 configuration (RAID 5 + RAID 0)**
  - **Provides a temporary archive for the Mark 5 data**

- **Processors put together as a 16-node Beowulf cluster**
  - **Beowulf hardware from Professional Service Super Computer (PSSC) Labs**
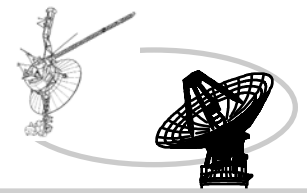 - **Provides the processing power and parallelization for SoftC**
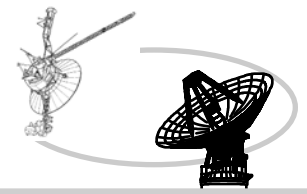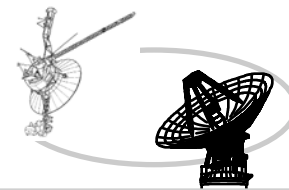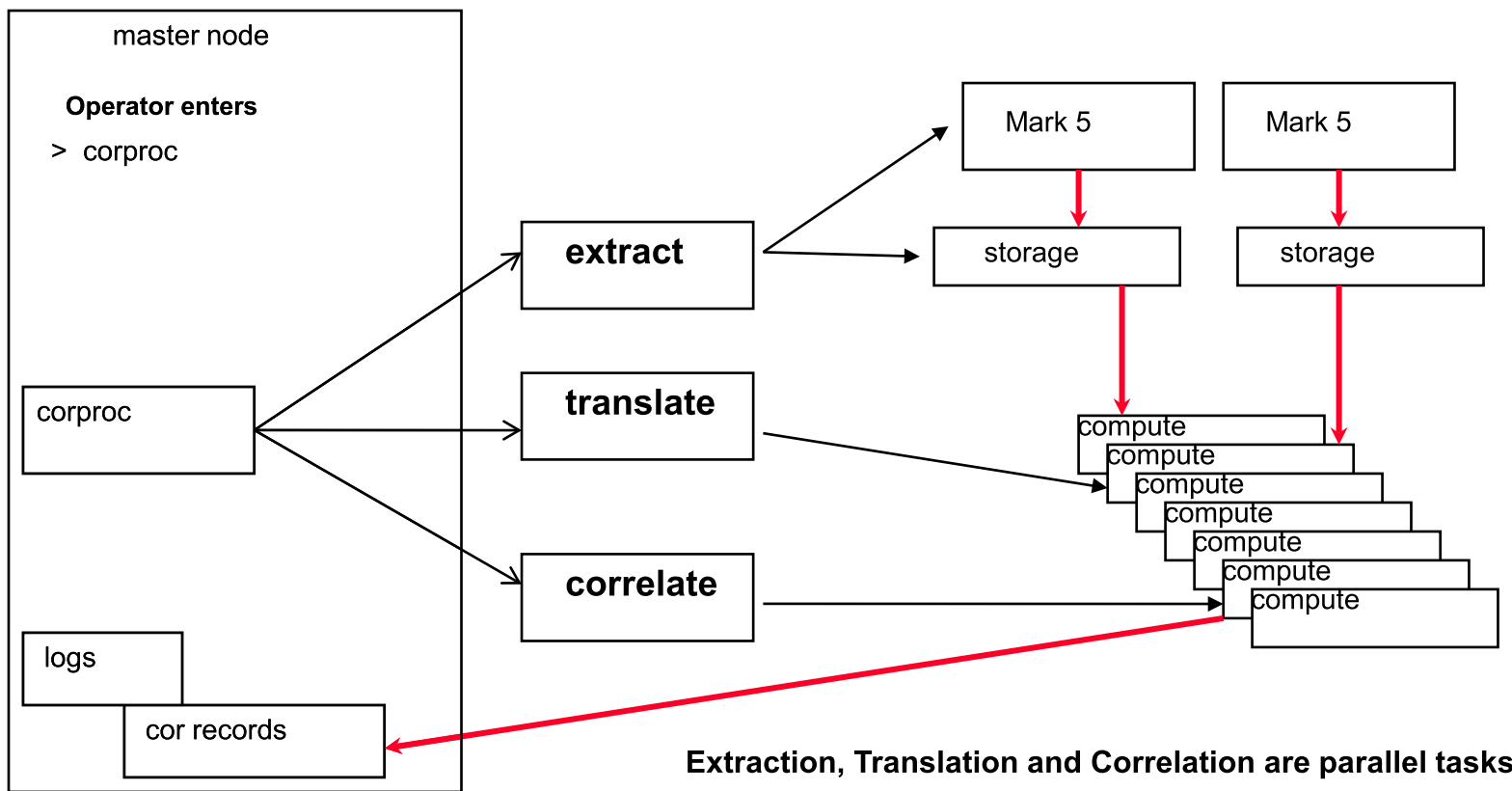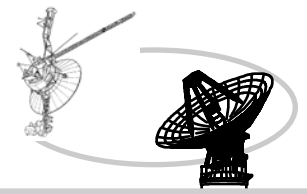
JVC Block Diagram

JVC Photo

JPL

JVC Software

- **JVC delivered to the Deep Space Network (DSN), Sept 2008**
  - **Software at version 1.0.1**
  - **SoftC v1531 for correlation engine**
  - **Mark 5 Data system software version 2.1.0**
  - **Beowulf nodes using Fedora Core 4 Operating System**

- **Developed software consists of:**
  - **SVC Extraction software (Perl code)**
  - **M5a2sdf Translator software (C code)**
  - **Node synchronization software (SQL code)**
  - **Misc. wrapper scripts and utilities (Bash & Perl code)**

JVC Software Process Diagram

master node

Operator enters

> corproc

corproc

extract

translate

correlate

logs

cor records

Mark 5

Mark 5

storage

storage

compute
compute
compute
compute
compute
compute
compute

Extraction, Translation and Correlation are parallel tasks
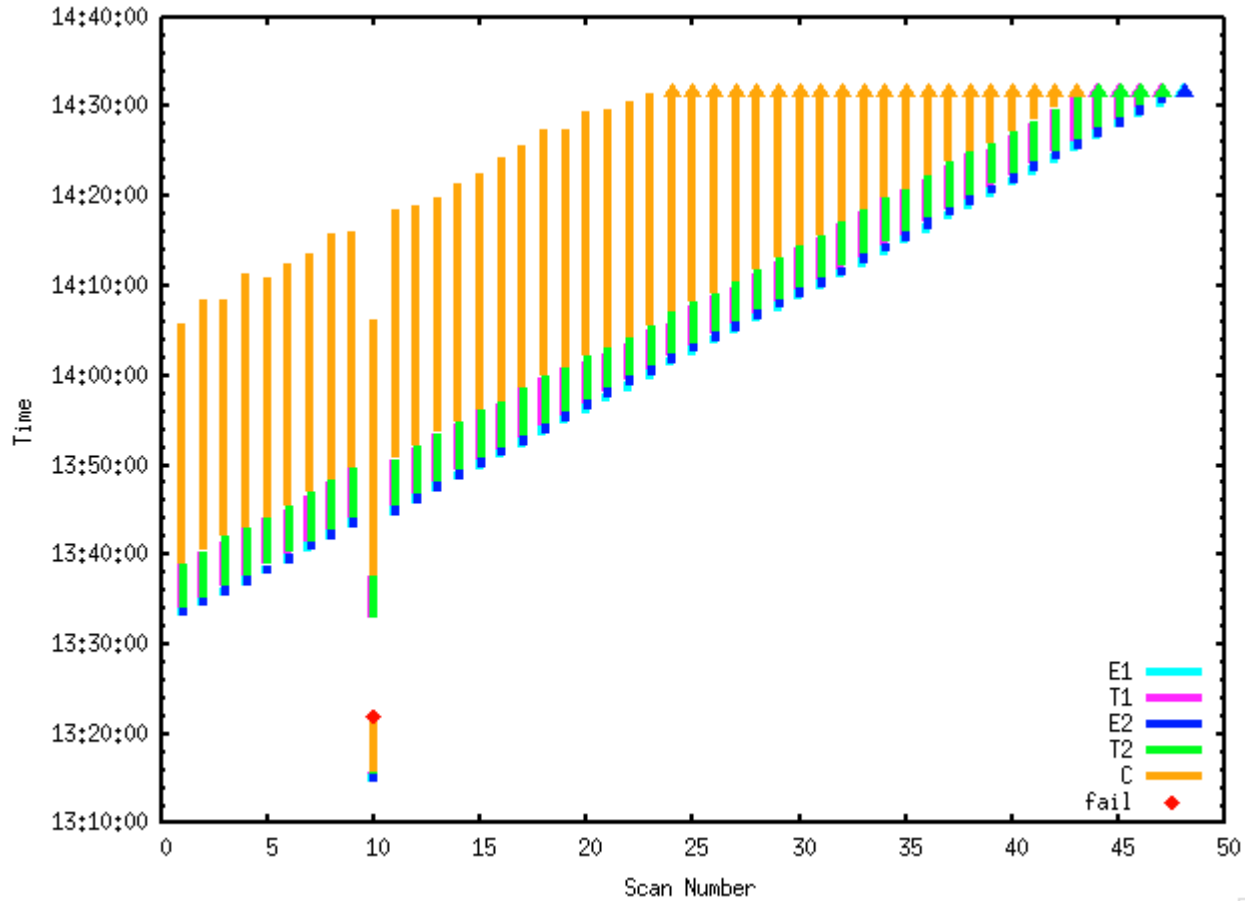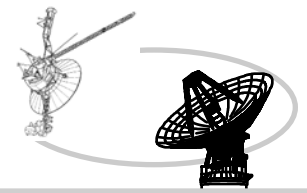
JVC Corstat Display

-8.18155, 2.48188e+08

JPL

Recent JVC Development

- **Version 1.1.0 delivery planned for late FY09 (Summer 2009)**
  - **Fixed phase cal tone anomaly with new version of SoftC (v. 1534)**
  - **Fixed missing scan anomaly with updates to Translator software**
  - **Operations improvements – detecting bad disks, scan ordering, email**
  - **More storage node capacity – 12x1.5TB disks**
  - **JVC is now Gbit rate capable – new Translator software**
  - **Larger SATA-based disk packs pending a Mark 5 software upgrade**

- **Future Development Plans**
  - **Upgrade to Mark5C**
  - **Increase bandwidth capability to 10 GB/sec rates**
  - **Addressing data flow bottlenecks**

6/17/2014