TCS3 Project

Replacement of the Telescope Control System for the IRTF

Conceptual Design Review

Aug 2003
Review Topics

• 1. Schedule, Tasks, and Budget
• 2. System Overview
• 3. Computers, Servo Controller, and Servo Simulator
• 4. T3 Electronics
• 5. Encoder
• 6. MCC Replacement
• 7. Facility IO
• 8. Software
• 9. TCS1-TCS3 Switching
• 10. RemoteGUI
• 11. TCS1 Removal
## Schedule

The original TCS3 Schedule given in the NASA proposal

### The New Task oriented T3 Schedule.
Tasks

• 2. Build TCS3 Computer, Servo Controller, and T3 Electronics, Servo Simulator
• 3. Encoder Replacement
• 4. Install MCC Replacement at Summit
• 5. Prototype and Build TO Panel
• 6. TCS1-TCS3 Switch (or Drive the RA, Dec, Dome and Shutter)
• 7. RemoteGUI
• 8. Daytime Test & Servo Tuning
• 9. Night Engineering (Pointing Run)
• 10. Remove TCS1
Task 2 – Build T3 Computer, Servo Controller, and Servo Simulator

- Purchase computer, servo controller.
- Purchase T3 Equipment Rack
- Design and Build T3 Electronics
- Build servo simulator
- Develop TO Panel Prototype
- Control HA, Dec simulator using the computer, controller, and T3 Electronics.
Task3 – Encoder Replacement

- Install new absolute Encoders
- Install new incremental Encoders
- Read current Dome Scanner
- Install T3 computer at the summit.
- Acquire encoder data into T3 computer.
Task 4 – Install MCC Replacement at Summit

- Prep TO area for new T3 Display and TO Panel
- Purchase Facility IO hardware
- Write Facility IO software.
- Install Facility IO at the summit.
- Develop MCC replacement GUI.
- Switch non-critical MCC function to TCS3
Task 5 – Prototype and Build TO Panel

- Development of the TO Panel prototype is preliminary task.
- Construct 2 each TO Panels.
- Install TO Panel in lab and summit system.
Task 6 - TCS1/TCS3 switching

- Install tcs1/tcs3 switch over hardware.
- Develop switch over procedure
- Switch & Test Dome Control
- Switch & Test HA, Dec axis control.
- Install new Shutter JBOX and control using MCC replacements.
Task 7 - RemoteGUI

- Purchase computers to run remoteGUI software
- Implement RemoteGUI software.
Task 8 – Daytime Tests

- Schedule Daytime Engineering Test.
- Switch from TCS1 to TCS3.
- Tune servo for HA, Dec, and Dome control.
- RA, Dec, and Dome performance is acceptable.
Task 9 – Night Engineering

- Take pointing calibration data.
- Reduce and input correction to T3.
- Benchmark pointing performance.
### Task 10 - Remove TCS1

- Decommission TCS1
- Remove TCS1 Equipment
- Remove TCS1-TCS3 switching equipment
- Remove TCS1 APE and Install T3 APE.
- Remove TCS1 Inc. Encoder and relocate T3 Inc. Encoders.
2. Overview

- Identify Major TCS3 components
3. Computer System and Servo Controller, and Servo Simulator

- Computer, with DMC-18x0 PCI Controller
- Servo Simulator
4. T3 Electronics (1)

T3 Electronic are in-house designed and build electronics providing these functions:

- HA and Dec Axis Interface
- Dome Interface
- Safety Circuit
- TO Panel Interface
4. T3 Electronics (2)

- HA and Dec Axis Interface
4. T3 Electronics (3)

- Dome Interface
4. T3 Electronics (4)

- Safety Circuit
4. T3 Electronics (5)

• TO Panel Electronics
5. Encoders

- Keep tcs1 encoders in place until tcs1 is decommissioned.
- Install new absolute encoders at bullgear. “Decrease” resolution to 1 arcsecond.
- Install new increment encoders at bullgear. Increase resolution to 0.01 arcseconds.
- After tcs1 is decommission, remove Inc. & Abs Encoders.
- Relocated T3 Incremental Encoder at bullgear.
- Install new APE encoders at old APE location.
- Redirect dome serial data from scanner to T3 computer.
5. Encoders – Our plan is still evolving

- Recently we discovered it may be possible to continue using the current APE in the new system. So APE plan may be modified to:
  - Purchase a spare APE encoder (Mechanical hardware).
  - Purchase new APE electronics.
  - Switch encoder output at yoke from TCS1 to TCS3.
  - TCS1 inductive and resolver data to MCC
  - TCS3 APE Electronic interface to T3 computer.
6. MCC replacement

- Old MCC vs. New T3 Displays
7. Facility IO

Requirements
• 10 Hz update
• Can be easily expanded.
• Good support – widely used.
• Wide variety of IO options.
• Ethernet based interface.

IO Estimate (as of 8/20/03):
Digital In 34
Digital Out 40
Analog In 22
Analog Out 0
Others serial(1)

We have selected the Opto22 SNAP line of devices.
8. Software

- **Software Guideline:**
  - Development and deployment on a Linux OS/x86 system.
  - All application written in C - minimize the use of other computer languages.
  - Astronomy calculations algorithms are done using slalib or TCSpk.
  - Pointing correction to be based on the TPOINT software application.
  - GUI is written using GTK+
  - Use the POSIX API for system and clib calls, shared memory, message queues, scheduling and processing control.
  - Berkeley Socket API and remote procedures call (RPC) are used for network libraries.
8. Software (2)

- Position Table
- Mean-To-Mount Calculations
- Pointing Correction based on TPOINT
- Software Modes
  - Idle, Track, Slew, MP, and MV.
- Dome: Manual or Automatic
- Shutter: Same as current system
- Facility Communication: telnet interface (TCP/IP) or t3io (UDP)
8. Software (3)

- Block diagram of T3 applications
9. TCS1-TCS3 Switching

• Develop hardware and procedure to switch between TCS1 and TCS3.
  • No detail information at this time – should a straightforward job.

• Shutter Control:
  • New J Box connecting to Ethernet IO device.
  • Communications over slip ring using existing X10 devices installed by the IQUP project.
10. RemoteGUI

- Remote GUI is a scaled down T3 GUI used by Summit Observers, Remote Observer, Day Crew.

- Replaces current hardware hand paddle and tcs1_status program. But should be similar in concept to the tcs1_status program.
11. Remove TCS1

• Decommission TCS1
• Remove TCS1 Equipment
• Remove TCS1-TCS3 switching equipment
• Remove TCS1 APE and Install T3 APE.
• Remove TCS1 Inc. Encoder and relocate T3 Inc. Encoders.
The End