Upgrading Control Systems at Gemini Telescopes

Experiences and lessons learned
Gemini Control Systems in a nutshell

- Observatory Control System
  - Adaptive Optics Systems
  - Telescope Control Systems
  - Instrument Systems
  - Data Handling System

Numbers:
- 3
- 12
- 4
- 1
Gemini Control Systems in a nutshell

Adaptive Optics Systems

Telescope Control Systems

Observatory Control System

Data Handling System

3

12

4

1
Why?
ICD 13—Standard Controller

Bret Goodrich, Andrew Johnson and Corinne Boyer

ICD-13/05

This document describes the VME hardware and software which makes up a Gemini Standard Controller.
Starting at 0x100000...
Attached TCP/IP interface to dc unit 0
Attaching network interface lo0... done.
Loading symbol table from icarus:/gemini/external/vxWorks/tornado2.0/mv2700/vxWorks.sym ... done

VxWorks Development System

VxWorks version 5.4.2
KERNEL: WIND version 2.5
Copyright Wind River Systems, Inc., 1984-1999

CPU: Motorola MVME2700 - MPC 750, Processor #0.
Memory Size: 0x4000000. BSP version 1.2/0.
WDB: Ready.

Executing startup script /gemini/GEM8.5/tcs/V9-11-3/bin/ppc604_long/startupTCS1 ...
```bash
sbfsr1% cd /usr/local/epics/
 sbfsr1% ls -l
 total 136
 drwxr-xr-x 15 epics epics 4096 Sep 7 2009 ./
 drwxr-xr-x 58 root  sysadmin 8192 Sep 7 2011 ../
 -rw-r--r--  1 epics epics 320 Feb 4 2003 Distfile.config
 drwxr-xr-x 5 epics staff 4096 Feb 27 2004 epics3.12.2GEM5/
 drwxr-xr-x 5 epics staff 4096 Feb 22 2000 epics3.12.2GEM6/
 drwxr-xr-x 5 epics staff 4096 Feb 27 2004 epics3.12.2GEM6T/
 drwxr-xr-x 4 epics epics 4096 Jun 23 2001 epics3.13.4GEM7/
 drwxr-xr-x 4 epics epics 4096 May 14 2002 epics3.13.4GEM8.4/
 drwxr-xr-x 4 epics epics 4096 Dec 18 2003 epics3.13.9GEM8.5/
 drwxr-xr-x 4 epics epics 4096 Feb 26 2004 epics3.13.9GEM8.6/
 drwxr-xr-x 4 epics epics 4096 Sep 4 2007 epics3.14.6GEM9/
 drwxr-xr-x 11 epics epics 4096 Sep 4 2007 epics3.14.6GEM9.1/
 drwxr-xr-x  2 root  other 4096 Jul  5 2000 old/
```

“This software is unfortunately no longer available for download from this website. If you need a copy, you'll have to ask on tech-talk for anyone who still has a copy of the tarfile.”

–EPICS web page in reference to CapFast Tools
The Upgrades

Development System

uXWorks version 5.3.1
KERNEL: WIND version 2.5
Copyright Wind River Systems, Inc. 1984-1997

Embedded With
RTEMS
www.rtems.com
The Upgrades

EPICS

3.14.12
The Upgrades

+COMMON CODE LIBRARIES AND DRIVERS!!!

3.14.12
The Upgrades

Observatory Control System

Telescope Control Systems

Adaptive Optics Systems

Instrument Systems

Data Handling System
Upgrade Strategy

Upgraded Systems

Common Code Base

Application Development Environment

Standards
Application Development Environment

- Operating Systems
- Development Tools
- Support Packages
- Build Environments
- Configuration Control

Develop → Release → Test → Deploy
Application Development Environment
ADE Development Overview

Start

- gem-start-new-module
- gem-vendor-import
- gem-checkout-module

Develop in Home

- svn-commit

Promote to Work

- gem-checkout-module

Test and Modify

Release

- Release Ready

Yes

- gem-release
- configure-ioc

No
Recommendations

• Create a **common development framework** and **process**
• Choose **current** and **well supported** software packages and tools
• Don’t reinvent the wheel
• Use **experts**
Upgrade Strategy

- Common Code Base
  - Upgraded Systems
  - Application Development Environment
- Standards
- **Update** modules that have evolved
- **Move** copies of modules into libraries
- **Manage** customization
Lessons Learned

• **Analyze** your current situation
• **Consolidate** and merge changes in different modules
• **Manage customization**
• Plan for **hardware inventory** needed for testing
• Create **consistent** set of **requirements** and **test plans**
Upgrade Strategy

Upgraded Systems

Common Code Base

Application Development Environment

Standards
How to start?

Complexity = No CCB Dependencies
How to start?

Telescope Sequencer

Telescope Control IOC

Complexity = No CCB Dependencies
How to test?
How to test?

Use Cases → Requirements → TEST PLANS
Making sure it works: Lab and Live Testing

• Porting
• Test Plan: Lab Environment
• Test Plan: Live Environment
Making sure it works: Lab and Live Testing

• Porting
• Test Plan: Lab Environment
• Test Plan: Live Environment
Making sure it works: Lab and Live Testing

- Porting
- Test Plan: Lab Environment
- Test Plan: Live Environment
Current Status

Telescope Sequencer

Telescope Control IOC

- Calibration Unit IOC
- Telescope Mount IOC
- Primary Mirror IOC
- Secondary Mirror IOC
- Acquisition & Guiding IOC
- Wavefront Sensor IOC
- Cassegrain Rotation IOC
- Enclosure Control IOC
- Weather System IOC
- Plant Room IOC
- Safety & Interlock IOC

Easy

Hard

Easy

Easy

Hard

Hard

Easy

Hard

Easy

Hard

Easy
Lessons Learned

• Start with **simple systems first**
• Develop comprehensive **test plan** and procedures
• Functional requirements are important, but don’t forget about **performance**
• **Communicate** the change and impact
• Have **contingency plans**
Future Work

• Completion of systems upgrades by April 2018
• Standards updated by end of Q2/2018
• Upgrade of other telescope infrastructure:
  • Reflective Memory
  • Secondary Control System hardware
  • CPU Upgrades
Conclusions

• Don’t be afraid – things will be better
• Use experts – don’t do it all by yourself
• Focus on simple things first
• Create comprehensive test plans
• Communicate extensively your plans
• Update standards, so this work can be sustained in the future
• Include obsolescence management right off the bat
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Experiences and lessons learned

Thank you!

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Ricardo Cárdenes
Tim Gaggstatter
Pedro Gigoux
Matt Rippa
Roberto Rojas
Michael Westfall

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