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Gemini Controls Group Report

An engineering back-door for Gemini instruments

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Engineering developers have asked for a way to access engineering-specific information within Gemini instruments. This report addresses this issue.

1.0 Introduction

Their are some fundamental concepts embodied in the Gemini control system. These concepts include:

- The control system is comprised of a network of cooperating, ‘principal’ systems, each capable of maintaining its own internal state. Thus control information between these principal systems is comprised of the information (attribute sets) needed to move the target system into a new configuration. All details on how that new configuration is achieved are the responsibility of the target system.
- The OCS, which provides overall direction to the control system, should know as little as possible about the details of the other principal systems - ideally, the same functional interface should be present between the OCS and the other principal systems as well as between any of the principal systems.
- The information presented to the users (SSA’s and Observers) should be confined to only that information that is necessary to ensure correct operation of the system.

These, and other, design concepts led to the development of a simple, unified strategy for treating all command and status information that needs to flow between the principal systems. These interfaces are defined in ICD’s 1 and 2, respectively. These two documents describe how any command and status information is to be transferred between the principal systems.

In addition to the above concepts, one additional design concept is important to this report:

- Because it is difficult to predict in advance (especially since the lifetime of some system components is quite long and since people are always dreaming up new ways

to use the system (particularly the instruments)) the precise set of information that needs to be made available to the SSAs and Observers - all status information and all controllable parameters for a principal system should be available through the above interface.

This last concept is important, it is what allows the system to operate in an environment with a large set of attributes (multiple simultaneous instruments and telescope subsystems) and to be adapted quickly to changes (new instruments, changes to other components or changes resulting from better understanding of the system in operation).

2.0 The problem in strict enforcement

However, software developers often have difficulty achieving the goal implied by this last concept, for a variety of reasons:

- The EPICS implementation of this interface (the APPLY/CAD/CAR/SIR record combination) is not without development cost.
- Some information that could be available for engineering and diagnostics is not of a nature that it would ever be presented to the SSA's and Observers during operation, but would only be useful to engineering and development staff.
- The performance requirement on the Status/Alarm database (update at most once per second) does not lend itself to some useful engineering displays (gauge displays, strip charts, etc.)

One apparent consequence is that instrument designers would rather omit some of the functionality that would be useful for engineering/diagnostic than provide it using the ICD 1/2 interfaces. Constants are being designed in to the systems instead of parameters, rarely needed features supporting robust operation are provided by recompilation instead of switch setting, and tools (often scripts) used during development are omitted from the package deliverables.

Losing this type of access to an instrument is not desirable.

3.0 How to resolve the conflict

To help solve the problem, this report presents a method for accepting instruments that provide some portion of their interface outside the constraints of ICDs 1 and 2, while preserving the intent expressed in the above concepts as much as possible.

Some rules:

3.1 Preserve principal system communication

Any and all information that might be useful if shared between principal systems, including with the OCS, must be done through the interfaces specified in ICDs 1/2. There are no exceptions.

3.2 Out-of-band information

Information that is clearly specific to engineering and development (an example might be control required only during instrument cool-down or warm-up [not a good example, perhaps, since instruments really should be able to cool-down and warm-up without an EPICS system attached!]) may be made available outside the APPLY/CAD/CAR interface, but still must be available through the EPICS database. Any information accessible this way must be documented in the User Manual for the instrument, in a section on Engineering Interface. It must be made clear that this information is not part of the normal interface into the system. For example, it must not appear as part of the OCS/ICS interface.

None of this information is allowed to be required during normal operation, including nightly startup, shutdown, or restarts. Further, it must be possible to ascertain that the instrument is operating properly without resorting to checking any out-of-band information - while a diagnostic analysis may ultimately result in the support staff having to consult such information, all faults and warnings must be reported through the standard interface using the health and alarm hierarchies.

No other principal system is allowed to use this out-of-band information.

3.3 Deciding which is which

To help ensure that information that might prove useful for inter-principal system functions isn't left in the engineering-only class when it should be part of the OCS/ICS interface, approval for all items provided 'out-of-band' must be given by the following people:

- the instrument scientist for the instrument
- the Gemini Instruments Project Scientist
- the Gemini Software and Controls Group Manager

These people are cautioned that the process of moving out-of-band information into the interface so that it becomes available to the other principal systems may be non-trivial in some cases and to consider the cost of having to do this after it is discovered to be needed versus the cost of building to the interface to begin with.

There is no need for this approval process to be heavily formalized, nor do the items require a detailed description to be put into the process. A simple email exchange should be sufficient for most items, where the above people can request additional information about specific items if they feel they need more information.