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OPTICAL
ASTRONOMY
OBSERVATORY

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NOAO

Glossary of Terms and Acronyms

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Revision History

Version	Date Approved	Sections Affected	Remarks
1.0	2/13/2002	All	First draft
2.0	8/7/2006	All	Reformat and edit – aro. Add terms to acronym list and glossary. Add two terms to Standard Terminology.
2.1	9/28/2007	2.1 and 2.2	Added items to both sections. Added items are highlighted - aro
2.2	12/16/2008	2.1	Added items to acronym list, deleted "DELUGE" from list. Added items are highlighted - aro
2.3	2/1/2010	2.1 and 2.2	Added items to both sections. Added items are highlighted - aro

Table of Contents

List of Figures

2.1 Introduction

This document defines common terms used in NOAO development efforts. Reference should be made to this document in all NOAO Requirements, Architecture, Design and User Documents that use these terms.

Figure 1 is an Observatory System Reference Model. This figure illustrates a logical model of a typical modern astronomical observatory using a layered reference model. The model is included here to allow common usage of terms across each area of development. The Observatory System Reference model attempts to represent the current NOAO framework.

The functional entities shown in this model are often grouped together in various physical implementations. For instance, while this model illustrates, at the lowest level, the types or classes of components used at a typical observatory, it does not address the physical communication networks supporting these functional entities, nor does it detail the computer used to support the function.

This model shows an idealized architecture, displaying the major components of the system, and providing a means to discuss significant features in the system. Supporting text will be required to fully understand the use of such a model. The model serves as a means to discuss different logical subsystems and their interconnections. It is not intended to be used as a route to implementation since it does not show system data or control flows. To interpret this model it is important to understand that:

- Each layer can have multiple components at the same level.
- Each layer may have multiple internal layers.
- Model uses abstraction (information hiding) to ease understanding of the overall picture.
- Each layer only interfaces to layers above and below.

The model is physically organized to illustrate the system components and their relation to each other. It is also organized to show the information flow in the observatory. We advance the premise that the observatory should be viewed as an integrated system that exists solely to acquire photons as efficiently as possible within the constraints of available resources and technology. The end product of the observatory is high-quality data products (calibrated image data) that can be used to advance fundamental scientific research. The photons logically move through the observatory from left to right, through the dome captured by the telescope, passed through the instrument and focused on the detector. Data from the detector then flows upward through the layers to the image acquisition system and are passed to the image handling system where they are processed, displayed and passed outside of the observatory through some data archiving path.

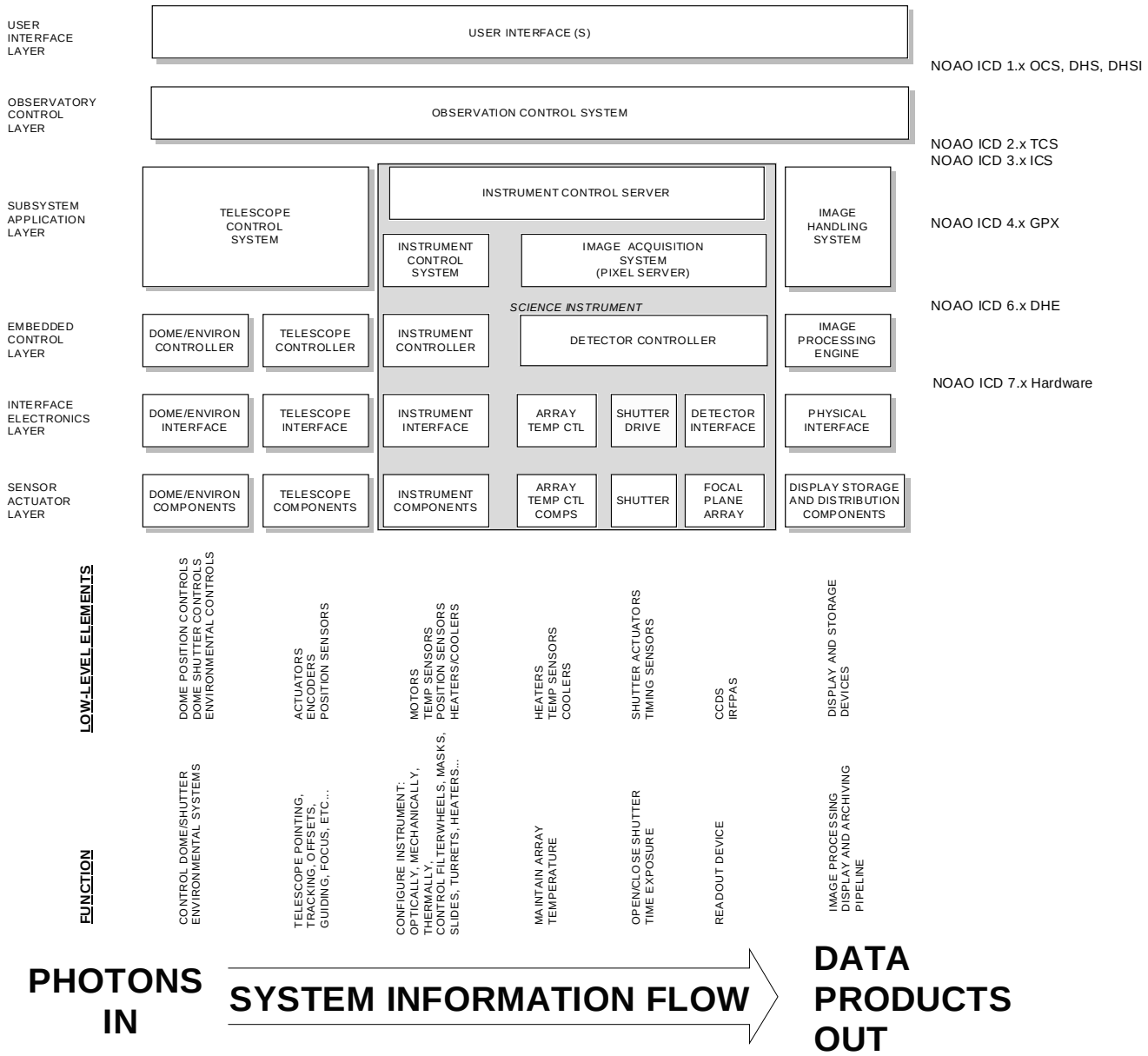
The use of the shaded bounding box illustrates the logical boundaries of a generic science Instrument. The boxes internal to the instrument may or may not be physically connected into a single monolithic object.

The model is also organized in vertical columns where the lowest level components are listed at the bottom of a column along with the overall column function. Information flows vertically within the column structure until it reaches a bridging layer. Each layer is required to know only how to interface to the layer above and below it, promoting modularity and component independence.

One significant area where up and down layer interface is violated is in regards to image data. The Image Acquisition System will be tightly coupled to the Image Handling System for performance reasons.

NOTE: On the right side of the model a number of NOAO ICDs are shown. These ICDs define the key interfaces between the layers and are either currently in draft form or should be developed as projects progress.

OBSERVATORY SYSTEM REFERENCE MODEL



Observatory System Reference Model
Figure 1

2.0 Acronyms and Glossary

2.1 Abbreviations and Acronyms

12C	A high speed serial communication bus
AC	Acquisition Camera
ADC	Analog to Digital Converter
AFE	Analog Front End (CCD or IR)
BORG	Basic Observer Response GUI
CCD	Charge Coupled Device
CCDACQ	CCD Acquisition Board
CDS	Correlated Double Sampler
CLKBRD	Clock and Bias Board
COTS	Commercial Off the Shelf
CPCI	Compact PCI
CPLD	Complex Programmable Logic Device
CTC	Command To Convert
DAC	Digital to Analog Converter
DCS	Detector Controller System (software)
DHE	Detector Head Electronics
DHS	Data Handling System
DOP	Data Output Port
DTR	Data Transfer Request
ECS	Enclosure Control System
EEPROM	Electrically Erasable Programmable Read Only Memory
EIDN	Electronic Identification Number
EM	Electromagnetic
EMI	Electromagnetic Interference
ES	Embedded System
FITS	Flexible Image Transport System
FP	Focal Plane
FPA	Focal Plane Array
FPDP	Front Panel Data Port -
FPGA	Field Programmable Gate Array
FPM	Focal Plane Module
GPX	Generic Pixel Server
HV	High Voltage. In this application that is +30V or -30V.
IAS	Image Analysis System
IC	Integrated Circuit
ICD	Interface Control Document
ICS	Instrument Control System
ID	Identifier
IDPS	Image Data Preprocessor System
IR	Infrared
JTAG	The usual name used for the IEEE 1149.1 standard entitled ***Standard Test Access Port and Boundary-Scan Architecture***

2.1 Abbreviations and Acronyms (Cont.)

KOSMOS	Kitt Peak Ohio State Multi-Object Spectrograph
LAN	Local Area Network
LCB	Local Control Board
MCB	Master Control Board
MEC	MONSOON Engineering Console
MHz	MegaHertz
MONSOON	Not an acronym
MOP	MONSOON Observer Platform
MSL	MONSOON Supervisory Layer
N/A	Not Applicable
NICD	NOAO Interface Control Document
NOCS	NEWFIRM Observation Control System
OCS	Observatory Control System
ODI	One Degree Imager
OTA	Orthogonal Transfer Array
PAN	Pixel Acquisition Node
PCB	Printed Circuit Board
PDF	Parameter Description File
PDT	Parameter Description Table
PRE	Pre-amp Board (resides in the transition module)
PSM	Power Supply Module
PWM	Pulse Width Modulated
QUOTA	Quad Orthogonal Transfer Arrays
RAM	Random Access Memory
ROI	Region of Interest
SCA	Sensor Chip Assembly
SUS	Status Update System
SYSTRAN	A high speed fibre optic communications board made by Systran.
TBD	To Be Decided
Torrent	Not an acronym
TPA	Transition Pre-amp Board
TSM	Transition Module
TUB	Transition Utility Board
UDP	User datagram Protocol
UTIL	Utility Board (Control for shutter, temperature, etc. reside in transition module)
VHDL	Verilog Hardware Description Langauge

2.2 Glossary

.asm File	A text file containing the assembly language program for a sequencer program to control a particular detector or focal plane segment.
.cgf File	A colon separated value file used by Torrent systems to describe the hardware attributes provided by the FPGA firmware. Read at run time to assist in the automatic creation of the .csv file for the detector system being run.
.csv File	Comma separated value file used by MONSOON and Torrent systems to describe the hardware and software attributes accessible to the GPX clients that control the pixel acquisition system through the GPX interface. Also sued by Torrent systems to describe the desired attribute layout by page, column and positions for each attribute to be displayed.
.dsc File	A colon separated value file used by the Torrent focal planes configuration system to describe arrays, connectors and dewars and the common connections between them.
.mod File	Mode file, which is a text file containing a list of attribute setting commands to be sued to put a MONSOON or Torrent system into a particular readout mode.
.txt File	A plain text file that contains lists of GUI categories or attributes either created at PAN process startup or read from the DHE and PAN to be stored in the attribute tables in a MONSOON formatted FITS file in the before and after housekeeping ASCII table extents.
.ucd File	A microcode file. A text file containing the sequencer memory addresses and hex values to be stored in that address. The values represent the machine language output of the asm5 program used to create a detector control sequencer program for a MONSOON or Torrent system from an .asm file.
.vhd File	A firmware source code file read by assimilate to create the .cfg files required to describe the Torrent firmware. Also used to describe the PAN level software attributes used by the PAN processes.
Byte	Eight bits
Command	An instruction requiring a system to start some action. The action may result in a voltage changing or some internal parameters being set to particular values. A command may have command parameters (arguments) that contain the details of the instruction to be obeyed.
Data Array	The data, while it is stored in data processing memory, which resulted from one or more readouts of an IR array or CCD detector.

Glossary (Cont.)

Data Set	A self-contained collection of data generated as a result of a Pixel Server obeying a *gpxStartExp* command. Each *gpxStartExp* command results in one and only one data set.
Detector Head Electronics	The lowest level hardware system. It is normally closely connected to the photon detector and coupled to the dewar in which the detector resides.
Exposure	The name used to describe the process and the data resulting from the process of resetting/clearing a detector, exposing it to photons and then reading one or more frames to determine the photon levels. These frames are processed into a data array, called an exposure, which may be further processed. (For example, an exposure would be the data array that results when a single Reset-Readout-Integrate-Readout cycle is performed on an IR detector or a single CCD Clear-Integrate-Readout cycle.)
Exposure Sequence	The process by which valid data is produced. Various levels of exposure sequencing occur during an observing run. At the lowest level there are the Reset-Readout-Integrate-Readout or Clear-Integrate-Readout cycles that result in a single IR or OUV exposure. At the highest level are the observing sequences that move the telescope, configure the instrument and take a series of exposures that create an observation.
Focal Plane	The geometrical plane where the image from an optical instrument is formed. This is the physical location of the detector device.
Focal Plane Segment	A collection of one or more detectors arranged to collect photons from an instrument. A Focal Plane Segment is controlled by a single Pixel Acquisition Node (PAN).
Frame	The result of one or more readouts of an array averaged pixel by pixel. Each frame represents the signal values obtained from reading the entire ROI being read out of the detector. Multiple frames may be processed into a single exposure.
Generic Pixel Server	A pixel server that conforms to the GPX Interface description.
Guide Core	The software routines that calculate the centroids and image shifts required for controlling an Orthogonal Transfer Array (OTA).
Guide Map	An array of eight bytes that have a 1 in each position corresponding to an orthogonal transfer array (OTA) cell that will be used in the guide calculation.

Glossary (Cont.)

Guide Region	A portion of an OTA guide cell as defined by the Guide Mapthat contains a guide star.
Image	The array of detector pixel and description data representing a science or diagnostic image or spectrum. An *image* is capable of being displayed or processed as a discrete entity. The values in the array may be stored in memory or on disk and are related to the data taken by the detector by some processing algorithm, (for example an *image* may consist of all the coadded and averaged exposures in one beam of a chop mode *gpxStartExp* command).
Image Acquisition System	A system of software and hardware capable of producing images from a focal plane on command.
Image Server	See Image Acquisition System.
MONSOON Image Acquisition System	A Generic Pixel Server. An extensible, modular Image Acquisition System. The system design is, to the extent possible, independent of the hardware being used in a particular implementation. Each component of the system should be capable of replacement by a similar component without having to redesign the rest of the system. Each component of the software is, as far as possible, independent of the underlying hardware and as modular as possible.
MONSOON Star Date	A date/time value that gives a unique ID to exposures in MONSOON systems. The MSD is formed using the JulianDay + TimeOfDay (to the nearest 86.4 ms .000001 of a day). The exposure ID is calculated to the nearest ms but on display is truncated to six decimal places.
Observation	The process of exposing the focal plane to photons in one or more exposures. The result of an observation is an image.
Pixel Acquisition Node	The computer that handles the interface to the detector head electronics and the image pre-processing of the data stream from the *Detector Head Electronics.*
Pixel Server	A system which produces pixel values when requested to do so by some client system.
Pixel Server System	The combination of the *Detector Head Electronics* and a *Pixel Acquisition Node* which are coordinating the task of taking exposures and archive the resulting *data set.*

Glossary (Cont.)

Read	When used as a noun to describe instrument data, this refers to a single read of a pixel on the detector. A read may consist of several A/D conversions of the pixel data that are averaged or processed in some other way to produce a single integer output value for the pixel. A Readout is made up of one read of each pixel in the detector ROI being read.
Readout	When used as a noun to describe instrument data, this refers to a single read of every pixel in the detector. One or more readouts can be averaged pixel by pixel to create a frame.
Region of Interest	A sub-array of the available detector area. There are two types of sub-arrays that can be defined. The Sequence ROI is on the active surface of the array used to increase the frequency of the Array readout. The Data Reduction ROI is an arbitrary rectangle of any size that fits on the Array. Data Reduction ROIs are defined to reduce the volume of data sent to the disk or DHS even when the entire array is being read out.
Supervisory Node	A computer capable of controlling multiple Image Acquisition systems. The computer that runs the software that conforms to the GPS interface.
Value	The value associated with an “attribute”.
Word	Four bytes or 32 bits.

3.0 Standard Terminology

To avoid confusion and to make very clear what the requirements for compliance are, many of the paragraphs in this standard are labelled with keywords that indicate the type of information they contain. The keywords are:

- RULE
- RECOMMENDATION
- SUGGESTION
- PERMISSION
- OBSERVATION
- REQUIREMENT
- GOAL

These keywords are used as follows:

RULE

<Paragraph Number> Subject Describing Text **RULE**

Rules form the basic framework of this draft standard. They are sometimes expressed in text form and sometimes in the form of figures, tables or drawings. All rules shall be followed to ensure compatibility between components. All rules use the “shall” or “shall not” words to emphasize the importance of the rule.

RECOMMENDATION

<Paragraph Number> Subject Describing Text **RECOMMENDATION**

Wherever a recommendation appears, designers would be wise to take the advice given. Doing otherwise might result in some awkward problems or poor performance. It is possible to design a system that complies with all the rules but has poor performance. Recommendations found in this standard are based on this kind of experience and are provided to designers to speed their traversal of the learning curve. All recommendations use the “should” or “should not” words to emphasize the importance of the recommendation.

SUGGESTION

<Paragraph Number> Subject Describing Text **SUGGESTION**

A suggestion contains advice that is helpful but not vital. The reader is encouraged to consider the advice before discarding it. Some design decisions that should be made are difficult until experience has been gained. Suggestions are included to help a designer who has not yet gained this experience.

PERMISSION

<Paragraph Number> Subject Describing Text **PERMISSION**

In some cases, a rule does not specifically prohibit a certain design approach, but the reader might be left wondering whether that approach might violate the spirit of the rule or whether it might lead to some subtle problem. Permissions reassure the reader that a certain approach is acceptable and will cause no problems. All permissions use the “may” word to emphasize the importance of the permission.

OBSERVATION

<Paragraph Number>Subject Describing Text **OBSERVATION**

Observations do not offer any specific advice. They usually follow naturally from what has just been discussed. They spell out the implications of certain rules and bring attention to things that might otherwise be overlooked. They also give the rationale behind certain rules so that the reader understands why the rules shall be followed.

REQUIREMENT

<Paragraph Number>Subject Describing Text **REQUIREMENT**

Requirements are expressed as a minimum acceptable value that will allow the performance characteristics of the system to be met. This term differs from the definition of a RULE in that a requirement specifies a ‘quantity’ that does not connect to anything (i.e. is not an interface) but rather provides a measure of the level of performance of a component of the interface.

GOAL

<Paragraph Number>Subject Describing Text **GOAL**

Goals are expressed as a desired improvement to a requirement that would enhance the system level performance in a significant way.