INTRODUCTION

This document attempts to define the structure and scope of activities for the detector group at the ING Observatory. It is intended to serve as a platform for collaboration and discussion that will lead to the generation of a future document; the 'Magna Carta - Detectum'. This new document will establish the following criteria for the detector group ING:

1. Scope of responsibility for the group,
2. Personnel and space requirements,
3. Equipment and material resources required.

The OBJECTIVES of the detector group are:

1. To provide visiting astronomers to the observatory with optical and ir detectors sufficiently capable of enhancing the opportunity of scientific gain. This is to say, provide detectors that are not limiting to the scientific objectives of any program.
2. To reduce to a minimum the number of hard and soft failures of the detectors that affect data quality and time lost to observing.
3. To introduce a scheme of quality and configuration control that, coupled to the previously stated objectives, will increase the confidence of visiting astronomers towards the quality of data produced and towards the observatory in general.

The JUSTIFICATION for these objectives can be stated as:

1. The utility and indeed the very existence of an observatory depends on the scientific contribution that can be made from information obtained from astronomical observations. The quality and quantity of information derived from observational data is of prime importance to the degree and reliability of the contribution. The processes involved in capturing, detecting and quantizing photons are fundamentally involved in deriving the maximum of information from observational data, therefore, these processes must be continually refined to maintain the utility of the observatory to the astronomical community.
2. Given the number of natural variables that can affect any given program of observations and the tight scheduling imposed by the over subscription of each telescope, any loss of time or loss of data quality through equipment failure is not acceptable. Given the diverse number of systems and their combined complexity, every effort must be made to make the equipment reliable.

A proposed METHODOLOGY to arrive at the objectives is given below:

There should be two levels of RESPONSIBILITY given to the detector group, the prime responsibility of the group should be for any photon detecting system which would encompass CCDs, IR detectors, field, finder and guide cameras, etc. This responsibility would include the shutter mechanism, the detector housing, mounting and cooling, detector cabling and control electronics, and the low level controller software. This prime responsibility would end at the data produced being accepted by the acquisition system. The degree of responsibility for this level would be the specification of the systems, sub systems and components, their integration to other systems (instrument, telescope, acquisition, etc.), their installation, maintenance and optimization, and their characterization and quality control. The secondary responsibilities of the group would be for the systems and equipment to which the detectors are associated and / or attached. These would include - actual and planned - instruments, acquisition systems, autoguiders, image display devices, and any high level software that communicates with the detector systems. The degree of responsibility

would be to assure compatibility between the systems and to interact to provide a
seamless knowledge base of the complete 'macro' system. (If other groups, as for example, instrument, telescope, optics, are established; they too would overlap to continue the seamless quality of knowledge within the observatory. This model also provides that for each system, at least two groups / people have applicable and up to date knowledge of it).

To support these responsibilities the detector group will need to form a STRUCTURE within itself which needs to be sufficiently rigid to define, for each member of the group, their priorities and daily duties and yet at the same time be a structure flexible enough to accommodate the reduced manpower that the group
has to work with. The structure needs to accommodate the following functions.

Administration of manpower.
- Scheduling of daily duties based on detector requirements (instrument changes, astronomer requirements, etc.).
- Scheduling of daily duties based on detector faults and problems (fault data base, night time logs, etc.).
- Scheduling of daily duties based on detector maintenance schedule (quality control testing).
- Scheduling of manpower assignments for short or long term projects (Instrument commissioning, upgrading and optimization).
- Scheduling of manpower for night duty, holidays, training, etc.

Administration of material resources.
- Generation and allocation of budget for detector acquisition.
- Generation and allocation of budget for detector testing.
- Generation and allocation of budget for detector group training.
- Generation and allocation of budget for detector systems repair.
- Generation and allocation of budget for detector group projects.

Reporting.
- Generation of detector group operations report (monthly ?) (activities, progress, problems, planning).
- Generation of detector performance documentation. (Web accessible ?)
- Generation of project definition / requirements documents.
- Generation of usage and procedure norms for detector operations. (Web accessible ?)

As well the group will require specific SKILLS and techni ques to accomplish the required objectives. These can be loosely described by the following criteria:
- Solid state electronics at the theoretical understood level.
- Analog electronics at design level.
- Digital electronics at design level.
- Optical practices at applications level.
- Software at the practicing level for required systems and languages.
- Systems engineering at applications level.
- Vacuum and Cryogenics at applications level.
- Administration and leadership to highest level possible.

With the indicated skill levels mentioned above, the detector group, in some cases in
conjunction to other groups, will be capable of providing the following services to
the ING Observatory:
- Be able to assess the detector requirements for general and specific scientific programs and optimize these requirements generally across observatory priorities, this in conjunction with other groups.

- Be able to determine detector suitability for program requirements.

Be able to adapt and optimize existing detector systems towards specific and evolving requirements.

Be able to assess specific detector performance and analyze its limits of use.

Be able to identify areas of detector systems that can be upgraded to better meet the objectives of the group. Be able to design and implement the upgrade and assess its performance increase (hopefully !)

Be adept at identifying and rectifying detector specific problems and faults with the minimum impact on observing time.

Be able to interact with other groups to provide detector related knowledge and absorb knowledge relating to associated instruments, equipment and systems.

Be adept at acting as duty engineer and supporting the observatory on a roster basis.

Given the assignation of the proposed responsibilities, structure and skills, the group will need resources to work with in providing the services to obtain the objectives of the detector group. These resources can be described as:

People - members assigned to the detector group whose prime concerns are detectors.

Space - working, testing and storage space, apt for detector environments.

Time - and access to detectors to achieve through effort the required objectives.

Materials - and equipment to support the group, coffee machine, etc.

Discussing these resources one by one:

The PEOPLE assigned to the detector group and their pertinent skill ratings are:

Andy Ridings - Andy, please give yourself a rating on your strengths and weaknesses here based on the above skill criteria.

Solid state
Analog electronics
Digital electronics
Optical practices
Software
Systems
Vacuum and Cryogenics
Admin and leadership

Guy Woodhouse - Guy, could you do the same please ?

Solid state
Analog electronics
Digital electronics
Optical practices
Software
Systems
Vacuum and Cryogenics
Admin and leadership

Peter Moore - Solid state reasonable
Analog electronics good
Digital electronics best
Optical practices poor
Software good
Systems reasonable
Vacuum and Cryogenics good
Admin and leadership reasonable

The group should be synergetic in the sense that all members should contribute their knowledge in whatever skill level that they possess to each other in the group. This implies a horizontal working structure within the group that supports a generally coherent skill level backed up by specialized knowledge by individuals within the group.

The SPACE requirements for the detector group are driven by the different activities that the group must do to reach the requirements. These activities are:

Detector to cryostat integration / disassembly and cleaning - Clean room facility.

Detector characterization and testing - Dark room facility

Detector system repair / development - Electronics laboratory, Office environment.

Detector preparation areas - vacuum / cryogenic facilities.

Detector group administration / reporting - Office environment.

They ideal would be a homogenous space plan to facilitate efficient group work and reduce the time spent moving and traveling between the distinct spaces. However, given the current distribution of space at the observatory site, this would not be possible without uprooting current facilities. I would suggest the following provisions:

INT Building

Clean room facility - 2nd floor, shared with optics, currently in construction.

Vacuum / cryo lab - 3rd floor, old ipcs preparation area.

Office environment - 1st floor, somewhere, ideally one space for all.

WHT Building

Electronics lab - 3rd floor WHT building (currently old electronics lab) as exclusive detector group area.

Dark Room - 3rd floor adjoining electronics lab.

Vacuum / cryo lab - 3rd floor, incorporated with electronics lab.

JKT Building

Vacuum / cryo lab - 1st floor, original dark room or plate room (although 2nd floor would be better).

Sea Level Office

Electronics lab - 3rd floor, Shared with electronics group.

Dark Room - 3rd floor, partitioned off from electronics space.

Generally all detector materials and spares would be concentrated at the WHT laboratory with

the exception of detectors integrated within instruments and detectors in use. The preparation
of detectors would take place in the cryo lab at the telescope on which they are to be used and
would be the exclusive responsibility of the detector group. Detector storage, testing and
characterization would be done at the WHT lab. In any circumstance that a detector cryostat
needed to be opened, this would always occur in the clean room. Off-line activities, such as
design, electronic development, board repair, reporting, etc. can be done best at the sea level
office. Given these rules, the allocation (home) of most equipment is fixed and reduces to a
minimum the time required to "set up" for any particular job and reduces the chance of lost or
'borrowed' equipment.

The absolute amount of TIME available to complete the work required, enabling the objectives
to be reached is limited by: The constraint of budget, the reduction of effective time by travel
to and from the observatory, holidays, personal administrative time, etc. The detector group must
rely on scheduling and planning to make efficient use of it's time. This can only be effective if
time estimates for planned work are real and that work loads do not cause an accumulative loss of
schedule. If resources would allow, the detector group should be assigned a vehicle that allows
the group to recover some lost travel time by traveling together and gives the group more
autonomy in its movements on site. A group account should be set up on the Sparc cluster to
support the detector group activities. This account will be used for all image analysis done in
the group using a directory system to facilitate easy navigation and access to specific data on
individual detectors. This has the aim of reducing to a minimum the uncertainty of detector status
and "streamlining" the process of group communications. Every effort should be made to maintain
each group member informed of all information relevant to the detector systems. The detector
group's activities, plans and findings should be visible to inspection via web pages (as are the
CFG currently) to reduce time spent on informing other members of the ING, to induce interaction
with these same people and to simultaneously facilitate archival storing of detector information.

MATERIALS and EQUIPMENT are required to support the detector group technically. These items are
listed with reference to their specific job function.

Detector to cryostat integration / disassembly and cleaning.

- Laminar flow cabinet - Okay, in construction
- Plastic or metal bench with drawers -
- Dry air / nitrogen supply - Okay, considered in clean room design
- Anti-static air gun (ionizing) -
- High power loupe or wide field microscope -

Dewar stand and spacer blocks -
Metal high stool -
Set of 'clean' hand tools -
Clean lint free / anti-static overcoats, gloves, hairnets, shoe covers -
Methanol, Acetone, Freon, swabs, optical tissues, optical brushes -
Set of "Tupperware" containers -

Detector characterization and testing.
Dimmer controlled lighting -
Access to network -
Small optical table -
Selection of test targets, mirrors, light sources, filters -
Integrating sphere, lenses, pinholes, telescope / projector -
Test equipment storage space -
Sturdy wood / plastic bench space -
High stool -
"Jelly rig" spectral source - Okay, undergoing refurbishing.
Picoameter - Okay, with jelly rig (possibility of computer interface ?)
local acquisition system - for ccd controllers (see note 1).
Black out cloth -
Sparc station - (see note 2)
IRAF - Main diagnostic tool for detectors
IDL - For building image analysis programs
GNU C - General programming language
Tcl - General control language, interface to IDL
Motif - Windows and control package for C

Detector system repair / development.
Electronics work benches -
Hand tools -
Light power tools -
Oscilloscope 300 MHz -
Function generator -
Video generator -
Power Supplies -
Current load -
Multimeters -
VT220 Terminal -
XTerminal -
Soldering equipment -
Storage cabinets -
Book cases -

Detector preparation areas.
UPS power source - Alternatively, self sealing valves on vac pump LP side.
Vacuum pump - Okay but may need servicing.
Vacuum gauge(s) - Need calibration.
Vacuum lines, couplings, adapters, seals -
Storage space for above -
Cold trap for vacuum pump -
Low bench or dewar stands -
Lens cleaning kit -
Dry air / nitrogen supply -
Cold trap heater power supply -
Dewar heater tape and controller -
Helium leak detector - Okay, may need servicing, only one required.
Small helium tank with valve and nozzle -
Access to N2 dewars -

Detector group administration / reporting.
Personal computer -

MS Office - General office packet
Autocad / Orcad - Mechanical / PCB layout packages
Spice - Electrical simulation package
VB4 - General programming / windows language
Access 2 - With VB4 a powerful database system
WebSite - (?) Local web server for interactive forms, dbase lookup, etc.
HotDog - Web publishing editor (HTML)
Chameleon - Xterm for the PC.

XTerminal -
Desks + chairs -
Network access -
Filing cabinets -
Book cases -

Notes :
1. Currently there are three different ccd image acquisition systems in use:
WHT - fiber -> FOX -> DMS -> VAX(ICL)
INT - fiber -> FOX -> Datacell -> SUN(DAS) except Prime Focus
JKT - cable -> Perkins Elmer(ADAM)
and yet another, as yet unspecified, system for the up coming IR spectrometers / Imagers.
I propose that the detector group invests in a two pronged attack to this problem of diverse systems. The first requirement is to design and construct a small image acquisition system (box) that will take from the ccd controllers the required image data, format a FITS file and store this locally enabling it to serve images (via ftp) to a Sparc system. This system can then be used off-line by the detector group to test and characterize ccd detectors, independently of the on-line systems. The second prong is then to consult and coordinate with the involved groups the upgrading and optimization of the on-line (telescope) acquisition chains into one system. This effort should also consider the integration of the planned finder / guider camera upgrades with the view to "standardize", without performance compromise, the systems as much as possible.

2. The Sparc station lpss14 should become, if at all possible, one of the machines administered within the CFG's proposed cluster. This would eliminate the (tedious) low level administration tasks required to maintain the system functional and compatible with the rest of the ING. This implies that this machine would not be 'removable' for use as a specific engineering machine but would support a protected base of users, predominantly, engineering staff. This would have no influence on the detector group who then would use lpss14 via XTerms, providing of course that sufficient net bandwidth is available.