The MONSOON Image Acquisition System: Availability to the Astronomical Community

Draft, Subject to Revision

1. Purpose. The purpose of this document is to describe the terms under which the MONSOON image acquisition system will be made available to programs or individuals outside of NOAO.

2. Description of MONSOON. MONSOON is a modular (or layered), extensible and highly configurable detector image acquisition system that is intended to exploit the total potential of any given detector. Various components of the overall MONSOON system can be linked together to control arbitrarily large numbers of pixels as needed for individual applications. The basic MONSOON architecture is structured in three levels: Detector Head Electronics, Pixel Acquisition Node, and MONSOON Supervisory Layer.

> **Detector Head Electronics (DHE).** The Detector Head Electronics provide input clock and voltage signals to the detector(s), and to receive the analog output of the detector(s) and convert that output to digital signals. The DHE encompasses both the hardware on the boards and the firmware encoded into the programmable components on the boards. The DHE designs are sufficiently flexible to work as well with future detectors that provide some or all of their own control and analog/digital conversion on-chip (e.g., through ASICs designs).
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> **Pixel Acquisition Node (PAN).** The Pixel Acquisition Node consists of a set of computer programs and libraries running on a personal computer under the Linux operating system. The PAN provides the intelligence for controlling the functions of the DHE, including the basic engineering level commands for a user to test the detector(s) and record images. The PAN receives the digital signals from the DHE and converts them into the desired format for storage on disk or delivery directly to a data reduction pipeline. One PAN is required for each DHE. One PAN-DHE pair constitutes the basic MONSOON system node for controlling one or more detectors up to the maximum number of video channels available in the DHE (currently 144, subject to possible change in future developments).
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> **MONSOON Supervisory Layer (MSL).** The MONSOON Supervisory Layer also consists of a set of computer programs and libraries running on a personal computer under the Linux operating system. The MSL provides the top-level control for synchronizing multiple PAN-DHE pairs (MONSOON System nodes) in systems requiring large numbers of video channels.

3. MONSOON as a Service to the Astronomical Community. MONSOON was developed by NOAO primarily to serve the needs of its own projects. The next generations of astronomical instruments will require much larger, and more complex, focal planes to achieve their science goals. These larger and more complex focal planes will in turn require control systems that are highly flexible, to adapt to different needs,

and scalable, to expand to larger instruments without requiring significant redesign. Although the MONSOON development was driven by its own needs, NOAO recognizes that this technology may be valuable to other astronomical institutions in connection with other projects.

As part of its mission of service to the astronomical community, NOAO intends to make the MONSOON technology available to the entire community. This technology can be most helpful to the community if it is freely available for others to copy or modify as they need. Accordingly, in return for the investment of national resources in developing this technology, NOAO does not intend to patent these designs or otherwise restrict access to them, except in the very limited ways noted below.

4. Open Source Availability and Licensing Issues. NOAO intends to make MONSOON technology publicly available as "open source" designs. NOAO will therefore make available without charge to the public all engineering information generated by NOAO, including without limitation:

- System architectural documents
- DHE designs, including:
  - Circuit Schematics
  - Circuit board layouts
  - Component lists
  - Firmware source codes
- PAN source codes
- PAN device libraries
- MSL source codes and libraries
- Documentation and manuals for any of the above
- List of circuit board fabricators with whom NOAO has done business

The only restriction placed on availability of this information is that no user may attempt to patent the designs or otherwise restrict the freedom of access by third parties to the information. For this reason, it may be necessary for NOAO to impose some kind of licensing on the information, akin to the "general public license" commonly used on publicly available open source software. This sort of license is simply a means of obtaining an agreement from all who use the information that they will not claim any ownership rights in the information itself.

Except in the context of collaborations described in Section 6 below, NOAO will not in general provide engineering services or support to parties who wish to modify the MONSOON designs for their own needs. The design information described above will be available solely "as is," with no implied warranty, and users who wish to modify it may do so only at their own risk and expense.

5. Community Interest in MONSOON. Individuals at several universities and observatories have already expressed interest in obtaining MONSOON systems. The range of such inquiries illuminates the possible different levels of involvement by the astronomical community in the MONSOON system: from an instrument building team

that simply wants a fast, reliable controller as a complete subsystem for an instrument, to a group that will be doing detailed detector characterization and needs to "get under the hood" of the controller software but prefers to forego the effort and risk of duplicating the hardware. NOAO therefore needs a policy flexible enough to accommodate these and still other approaches.

The current requests can be accommodated by inclusion in the FY2005 NOAO Program Plan due at NSF December 31, 2004. They can be considered collaborations that result in upgrades to equipment on telescopes operated by NOAO. Both revenue from the collaborating institutions and expenditure of manpower by NOAO will be shown in the Program Plan in the usual way. These cases would be templates for future MONSOON transactions in the context of collaborative research and development.

6. Collaborations Regarding MONSOON Components or Systems. In addition to allowing open-source access to the designs, NOAO may from time to time engage in collaborations with other institutions for research, development or delivery of MONSOON systems where such collaborations can be structured to serve the interests of both collaborators. Such collaborations will be included in the NOAO Program Plans for the fiscal years in which the work is to be done, showing both the expenditures of manpower by NOAO and any revenue from the collaborating institutions in the usual manner. NOAO's role in each collaboration will be determined by the needs of the collaborating institution and the benefits to be derived by NOAO and its collaborator(s). This role may vary from testing standard components or systems prior to delivery, to assisting with novel applications of standard systems, to research, design and delivery of new capabilities. Because collaborations may begin at any time during the fiscal year (not in phase with the annual cycle of Program Plans), NOAO may include one or more generic collaborative MONSOON projects in its Program Plan to ensure that resources are available if such collaborative opportunities arise.

7. Approach to Costing. In the collaborations outlined above NOAO will recover the costs of MONSOON components or systems delivered to collaborators, including the cost of purchased parts and the cost of labor to test and integrate the specific components or systems sold. The cost of purchased parts will include standard general and administrative overheads. The cost of labor for test and integration will include full benefits and full labor overhead ("burden") rates applicable at the time the collaborative agreement is entered into.

When appropriate to simplify arrangements for all concerned, NOAO may distribute MONSOON components or systems under fixed price contracts, where the fixed price is set to approximate as closely as possible the actual total costs as described above. NOAO acknowledges that this may in some cases result in revenues from collaborators that do not exactly match its costs, for example when test and integration labor runs above or below the estimate. However, NOAO will endeavor to minimize these differences over the long run so as to have the revenues match its costs as nearly as practical, while at the same time realizing the administrative convenience of fixed-price contracts.

The costs recovered from collaborators will not include any recovery of NOAO's design or development costs to date, but may include recovery of some or all of the design and development costs incurred in connection with the collaboration.

8. Warranties. Because NOAO is providing MONSOON components and systems to collaborators at direct cost, NOAO cannot offer any warranty or guarantee of performance for the MONSOON components or systems sold. If the collaborator is unable to make the components or systems work properly, NOAO will in good faith use its best efforts to work with the collaborator to achieve a satisfactory resolution of the problem, but NOAO will be under no obligation to replace failed components, adjust system parameters, or resolve any incompatibilities with the collaborator's detectors, computers, or any other equipment or software that may affect the performance of the overall MONSOON system.