31st July 1997.

Dear Simon and Kieth,

Please find below for your consideration the most relevant modifications and inclusions that we deem necessary to include in your document "Deliverables of the INGRID project". The numbered points follow the same heading - sub heading references as this original document.

Baseline deliverables.

1. MODIFY TO:
A basic working instrument for installation at the Auxiliary Cassegrain port *that complies to the stated scientific specifications in appendix B, section IA, of the PDR review document 1997 May 09.* Note that this appendix B must be by now under change control procedures.

2. NOTES:
2.1. We would hope to have the hard points detailed by the CDR and placed under change control procedures so that ING engineering work can commence in respect to the cassegrain mounting.

3. MODIFY TO:
Handling *Tools that allows full mount, dismount and storage functions to be handled in a safe and secure manner to instrument and personnel. Includes lens caps, static protection devices, and alignment jigs. Must be fitted with castors for 'roll on/off' telescope platform handling and be provided with sling hard points(s) suitable for crane lifting.*

5. MODIFY TO:
Electronic and mechanical spares shall be provided on items that are particularly difficult or complex to reproduce or buy in and that are unique to this instrument. This will include SDSU controller items not available from SDSU directly, vacuum prepared stepper motors, closed cycle cooler head, vacuum seals and fittings, specially made or prepared springs, bearings or gears, etc.

6. NOTES:
6.1. Maximum priority in software effort must be given to understanding and dominating the HAWAII array functionality and optimization. This cannot be stressed too forcefully.

6.2. The ING will supply a template to RGO in respect to the interface required between the SDSU controller and the data acquisition system (DJ). Although the ING concedes that the operation of the array, as delivered, will be controlled through the IRLabs basic software, the ING expects that the RGO developed SDSU controller software shall conform to the following standards:

6.2.1. Be written as to allow simple adaptation to the ING template specifications.

6.2.2. Be thoroughly documented.

6.2.3. Conform to the requirements of the 'Minimum capabilities (stage 2)' so as to support operational modes of points 1, 2, 3, 5, 7, 8, 10, and 11 and items 9, 10 from 'Full system (stage 3)' capabilities.

6.3. All software tools shall be deliverable with the instrument.

7. MODIFY TO:

Motor control electronics will be supplied for all motor actuators. This will include a VME chassis, power supply, motor power amplifiers, EPICS compatible motor controllers for each axis, VME crate controller with sufficient memory capacity for program and data requirements and fitted with two RS232 ports, one Ethernet 10Base5 interface port, and one SCSI-2 wide port. All cables from the instrument to the VME will be provided.

NOTES:

7.1. The EPICS control program will be developed, tested and installed by ING so as to be compatible with the observatory systems. This will be delivered to the RGO and installed by ING staff just after integration and just before alignment and testing begin.

7.2. The expense of the VME hardware will be borne by the project. Please advise us of the electrical and logical configuration by end of August (and before RGO purchase) to facilitate us in achieving commonality within the observatory.

8. MODIFY TO:

Basic filters (3) rather than full set (20). Filter space for up to 20 filters will be included: Unused mounts will be blanked off. *22 sets of filter holder and fixing hardware shall be provided. Any special tools for insertion or extraction of filters will be provided.*

NOTES:

8.1. We are currently investigating a way to buy a more comprehensive filter set for first light. We would expect to have and integrate these filters at the same time as the base set to avoid future disturbances to the cryostat.

9. MODIFY TO:

Closed cycle cooling with ROE anti-vibration mount *supplied with compressor and temperature control and measurement electronics.* Dual mode operation with LN2 dewar for 'silent running'. *The operating temperature of the array is to be nominally 76 Kelvin using the closed cycle cooler. Provision of vacuum measurement via penning gauge to be supplied.*

10. MODIFY TO:
Full documentation to be supplied. This is to include:

10.1. General description of the instrument and its intended use.
10.2. Design specifications of the instrument.
10.3. User documentation on the operation of the instrument (generalized to not include specific user interface details).
10.4. Detailed optical design drawings with element definitions, materials, mounting spaces, tolerances and alignment notes.
10.5. Detailed mechanical drawings of each manufactured piece.
10.6. Detailed electrical drawings of all electric's / electronics in the deliverables with descriptions where relevant.
10.7. Detailed instructions for the cryostat disassembly and assembly including alignment procedures.
10.8. Fully commented source code for any software incorporated into the instrument.
10.9 Detailed list of suppliers and contact names for bought in assemblies and parts used in the instrument.

11. NOTES:
11.1. The ING would like to participate in the integration, alignment and testing phase of the project.

Items Excluded from the Baseline System.
1. NOTES:
1.1. The ING requires as a minimum that the glass be purchased and the optical elements produced and tested. These should be delivered with the instrument and will be held 'in a safe place' until the mechanics can be built for NIOMI. This requires that a thorough and complete optical design be completed and a detailed mechanical and alignment documentation set be provided.

2. NOTES:
2.1 The ING requires that the design and specification of the folding mirror be procured from RGO.

8. NOTES:
8.1 Please refer to the list of documentation to be supplied as per item 10 of the previous section.

9. NOTES:
9.1 All VME hardware related to the motor function control is to be supplied as part of the project.

INGRID Software Implementation.
NOTES:
Agreed. Stage 1 to be supplied with the instrument from RGO. This level of instrument control software is not to limit the SDSU controller low level code which shall be capable of all modes of array control required for the stage 2 level of instrument control (as per item 6 of the first section).

With the detailed modifications to this document we would hope that the level of resources available to the RGO will be concentrated on delivering an optically and mechanically refined and stable instrument. Furthermore we expect that the experience gained with the HAWAII array at RGO will be sufficient to enable the ING to operate the detector with capabilities sufficient to a common user instrument within the guidelines of the ‘stage 2’ specification. The transition from ‘stage 1’ to ‘stage 2’ is expected to take one year from the offering as a common user instrument at the observatory. During this time ING personnel will become sufficiently capable of bringing into reality the requirements for this stage. To re-iterate, INGRID will become a ‘top gun’ of the observatories instrument inventory and as such must be delivered in a stable and operationally fit state. This is the number one priority. The transfer of technology from RGO to the ING with regard to the HAWAII array operation and optimization must also be addressed during the testing and commissioning phases of instrument development.

We look forward to your accordance to this agreement and priority. In keeping with the overall aim of astronomy as is understanding through discovery, we remain sincerely, the ING.

Peter Moore