Summary of ATC Deliverables and Test Condition

ATC Document number AOW/GEN/RAH/11.0/03/98/ATC Deliverables and Test Status

wht-naomi-30 **Draft version date: 12 March 1998**

1.0 Introduction

This document lists the items, including documentation, to be delivered to NAOMI by the ATC and it summarises the tests that should be performed on the hardware items prior to system integration at Durham University. The document covers tests of components, the subsystems, e.g. the wavefront sensor (WFS), and the OMC/WFS/NCU as an integrated assembly. Note that not all tests listed need be performed at the ATC. Tests may be performed by a component supplier if more expedient and cost effective. Measures should be taken by the ATC to verify that the supplier's tests are satisfactory. If appropriate, some component tests may be performed as part of the subsystem or integrated assembly tests provided there is little risk involved in this approach.

2.0 Components and Subsystems

Table 1 below lists the OMC components that will be delivered to NAOMI and provides a summary of test requirements. Additional tests performed at the subsystem level are also listed. References to the applicable WPD sections are also given. Tables 2 and 3 are similar tables for the NCU and WFS respectively.

Table 1. OMC Deliverables and Test Status

Component or subsystem	Summary of Test Requirements	WPD Section
Combined fast steering mirror and off-axis paraboloid(OAP).	Measure optical characteristics of OAP. Measure tip/tilt range. Determine open-loop transfer function, resolution, static jitter, repeatability, linearity, pivot stability, resonances. Verify satisfactory fit of mirror cover.	1.1.5 , 2, 2.2.2, 2.2.5, 2.2.6 2.2.3 2.2.4 2.2.9
FSM electronics	Verify function and reliable operation.	2.2.1, 7
VME enclosure and cards for component control	Verify function and reliable operation.	7
Deformable mirror x-y stage	Demonstrate stage motions under EPICS control.	2.1.11

	Verify range, resolution and accuracy.	2.1.11
Plane fold mirror	Measure optical characteristics. Verify mechanical fit and positional repeatability.	1.1.5, 1.1.8, 1.1.11
Imaging off-axis paraboloid (OAP2)	Measure optical characteristics including spectral reflectance and transmittance.. Verify mechanical fit and positional repeatability.	1.1.5, 1.1.8, 1.1.11
Dichroic assembly Dichroic ass'y (continued)	Measure optical characteristics. Verify mechanical fit, positional stability and repeatability.	1.1.5, 1.1.8, 1.1.11, 1.1.2, 1.2, 1.3.2
Baseplate	Verify registration, mechanical fit of all mounts. Confirm ease of handling.	1.1.3, 1.3.2 1.1.3
Alignment fixtures	Demonstrate satisfactory operation	1.1.14, 6.1
Spare components (TBD)	Verify fit and satisfactory operation.	7
Cleaning procedures	Demonstrate on witness samples prior to use on OMC optics.	1.3.3
OMC subsystem (tests not covered above).	Perform safety audit. Confirm space envelope satisfied. Verify beam height is satisfactory. Measure transmission and spectral bandwidths in two operating modes. Measure wavefront errors. Measure plate scale. Determine that scattered light and all ghost images are within acceptable limits. Confirm satisfactory operation, stability and repeatability with repeated cycling and temperature changes.	1.1.18 1.2 1.1.16 1.1.4, 1.1.5, 1.1.6 1.1.11 3 1.1.3 1.3.1 1.3.2
Shipping containers	Verify mechanical fit of OMC and adequacy of protection against damage.	10.0, 1.1.18

Table 2. NCU Deliverables and Test Status

Component or subsystem	Summary of Test Requirements	WPD Section
Integrating sphere with broadband visible/IR source	Determine spectral characteristics and uniformity. Confirm upgrade capability.	6.2.2
Integrating sphere system controller	Verify function and reliable operation.	7
Lamp power supply	Verify function and reliable operation.	7
Variable attenuator control	Verify function and reliable operation.	7
VME enclosure and cards for component control	Verify function and reliable operation.	7
Cables	Verify fit, function and reliability.	7
Tip/tilt mirror	Measure open-loop transfer function. Verify that mirror does not introduce unacceptable vibration.	6.2.2 1.3.2
Tip/tilt mirror electronics	Verify function and reliable operation.	7
Relay optics	Determine output f-number, focus and beam direction	6.2.2
Diffraction-limited K-band source	Verify source size and positional repeatability.	6.2.2
Diffraction-limited visible source	Measure spectral characteristics and output f-number.	6.2.2
Array of off-axis sources	Determine array accuracy, insertion repeatability and source sizes.	6.2.5
On-axis non-diffraction limited (1 arcsec) source	Verify source size and positional repeatability.	6.2.1
Neutral density and spectral filters (3 of each)	Provide data on spectral transmission. Verify mechanical fit and no adverse effects on optical performance.	6.2.2
He-Ne laser	Determine output f-number, direction and brightness.	
He-Ne laser power supply	Verify satisfactory operation and reliability.	7
Pupil mask	Determine size including central obscuration. Verify mechanical fit, position and repeatability.	6.2.3
Aberration generator	Measure aberration. Verify mechanical fit and repeatability.	6.2.6
Alignment beam splitter	Measure transmission/reflectivity, optical quality, alignment and repeatability.	6.2.1
Pre-correction camera and electronics (project furnished)	Verify mechanical fit, optical alignment and satisfactory performance.	6.2.4, 7

Cleaning procedures for optics	Demonstrate on witness samples prior to use on NCU optics.	1.3.3
Spare components (TBD)	Verify fit and satisfactory operation.	7
Shipping containers	Verify fit of NCU and adequacy of protection against damage.	10.0, 1.1.18
Sub-system (tests not covered above).	Perform safety audit. Verify mechanical/optical interfaces with OMC. Confirm satisfactory operation, stability and repeatability with repeated cycling and temperature changes.	1.1.18 6.2.1 1.3.1 1.3.2

Table 3. WFS Deliverables and Test Status

Component or subsystem	Summary of Test Requirements	WPD Section
WFS pick-off mirror	Measure size and optical characteristics	2.1
Field selector assembly	Measure range, step size, accuracy, repeatability and speed.	1.2
Stepper controllers with encoder feedback	Verify function and reliability.	9.0
VME chassis with microprocessor and PSUs	Verify function and reliability.	9.0
Collimating lens	Measure optical characteristics.	2.1
Lenslet arrays (3)	Measure optical characteristics including focal length, spot sizes and displacements.	2.2
Filters (3 spectral, 2ND)	Measure spectral transmission and optical quality	2.3
Atmospheric dispersion corrector (AtDC)	Determine residual dispersion and pupil shift. Measure optical quality.	2.4 2.4
Relay optics	Measure optical characteristics.	2.2
Beamsplitter	Measure optical characteristics.	2.2 (?)
Optics for single CCD operation	Measure optical characteristics	2.2 (?)
CCD cameras and controllers (2)	Verify all required operating modes, e.g. windowing, binning, and output formats. Determine quantum efficiency. Determine readout noise vs. pixel rate.	1.1, 3.0 3.0 3.0

WFS calibration source	Measure optical characteristics including spectral bandwidth, radiant intensity and f-number. Verify mechanical fit and position.	5.1 5.1
Power supply for calibration source	Verify function and reliability.	9.0
Remote control shutter	Verify function, shutter speed and mechanical fit.	2.5
Single-axis stages for fore-optics and relay-lens/CCD modules	Verify ranges, positioning accuracy repeatability using the independent control module with engineering level software.	1.2
Limit switches	Verify function and reliable operation.	1.6
Temperature sensors (4)	Verify performance.	?
Lifting frame and covers	Demonstrate mechanical fit and functionality	1.6
Independent control module	Verify functions and control signals prior to use with the WFS.	6.0
Spare components (TBD)	Verify fit and satisfactory operation.	9
WFS subsystem (tests not covered above).	Perform safety audit. Confirm space envelope satisfied. Measure spectral transmission. Determine that scattered light and all ghost images are within acceptable limits. Determine phase measurement accuracy and range. Confirm satisfactory operation, stability and repeatability with repeated cycling and temperature changes.	1.6 1.2 2.1 2.1 1.4 7.1, 7.2
Shipping containers	Verify mechanical fit of WFS and adequacy of protection against damage.	11.0, 1.6

3.0 Testing of integrated OMC, NCU and WFS subsystems

These tests are covered in more detail in the document number AOW/GEN/RAH/10.0/02/98/OMC/WFS Integration Approach and thus this section is provided mainly for information purposes. Table 4 primarily lists tests of the integrated

assembly that have not already been covered above. Although there may appear to be some duplication, the intent is to verify that the OMC, NCU and WFS function satisfactorily as an integrated assembly, e.g. there are no crosstalk or induced-vibration problems. The section numbers in this table refer to AOW/GEN/RAH/10.0/02/98/OMC/WFS Integration Approach.

Table 4. Summary of ATC Integration Tests

Test Summary	Integration document section number
Verify that all mechanical interfaces are satisfactory.	3.1
Perform safety audit (where not covered above)	3.2
Verify all basic functions with engineering software and WFS independent control module.	3.3
Perform open-loop tests of FSM and NCU tip/tilt mirror.	3.4
Measure non-dynamic WFS transfer function using WFS and NCU calibration sources.	3.5
Determine WFS Hartmann spot offsets with WFS and NCU calibration sources.	3.6
Measure simple static wavefronts using WFS and aberration generator.	3.7
Perform distortion mapping of WFS field with NCU point-source array.	3.8
Assess DM/WFS alignment technique using simulation of a DM segment.	3.9
Evaluate assembly's sensitivity and repeatability to temperature cycling.	3.10
Perform limited measurements of non-common-path aberrations.	3.11

4.0 Software

Software must be provided for testing/trouble-shooting of all individual remote controlled components and the use of the WFS independent control module. Note that Electra software will be provided by Durham University for some integration tests, e.g. measurement of static wavefronts. All deliverable software must meet ING standards.

5.0 Documentation

All documentation must meet ING standards. At the time of writing these are under review and thus this document only indicates the anticipated basic requirements.

5.1 Engineering Drawings

A complete set of dimensioned assembly and detailed drawings sufficient to fabricate any component (excluding commercially-available parts) shall be provided. Both hard copies and AutoCad files are expected to be required. Where commercial parts are used sufficient information shall be provided to order replacement parts. For the electronics a block diagram detailing signal flow, major subsystems and functions shall be provided. Cable layout drawings and information on interconnections are expected to be required.

5.2 Operating Manuals

ATC-TroubleDoc:

Trouble shooting document

ATC-EngDiagDoc:

Engineering Diagrams document

ATC-MaintProcDoc:

Maintenance document

5.3 User Document

ATC-UserDoc:

user document

5.4 Tool List

A list of all specialized tools for required for maintenance or adjustment shall be provided.

6.0 Spare Components

A list of spare components to be delivered by the ATC is not available at the time of writing. Where electronic components are not already in use at the ING, at least one spare of each type must be supplied in accordance with Clause 19.

7.0 Special Tools and Handling Equipment

Details of special tools and handling equipment, if any, to be provided by the ATC were not available at the time of writing.