

## GNIRS

WBS	Name
<b>5</b>	<b>GNIRS</b>
<b>5.1</b>	<b>Management &amp; Reporting</b>
5.1.1	Program Management
5.1.2	Program Planning and Control
5.1.3	Review Preparation
<b>5.1.4</b>	<b>Reviews</b>
5.1.4.1	Concept Design Review
5.1.4.2	Interim Review
5.1.4.3	Restart Review
5.1.4.4	Pre-Fab Review
5.1.4.5	Mid-Fab Review
<b>5.1.5</b>	<b>Project Weekly Meetings</b>
<b>5.1.6</b>	<b>Monthly Reports</b>
5.1.7	Cost Estimate
5.1.8	AA Support
<b>5.2</b>	<b>Systems Engineering</b>
5.2.1	Requirements Flowdown
5.2.2	System Design Notes
5.2.3	Software Requirements
5.2.4	Optical Alignment Plan
5.2.5	Optics Error Budget
<b>5.2.6</b>	<b>Analyses</b>
5.2.6.1	Thermal
5.2.6.2	Structural
<b>5.2.7</b>	<b>Mechanism Drive Prototyping</b>
5.2.7.1	Fab and Test Linear Motor Drive
5.2.7.2	Fab and Test Rotary Motor Drive
<b>5.2.8</b>	<b>Mechanism Test</b>
5.2.8.1	Mechanism Test Plan
5.2.8.2	Slit/Decker/Filter Assembly
5.2.8.3	Prism Turret
5.2.8.4	Grating Turret
5.2.8.5	Camera Turret
5.2.8.6	Acquisition Mirror
5.2.8.7	Camera Focus
5.2.8.8	Environmental Cover Mechanism
<b>5.2.9</b>	<b>Mechanism Test Fixtures</b>
5.2.9.1	Design
5.2.9.2	Fabrication
<b>5.2.10</b>	<b>Telescope Simulator</b>
5.2.10.1	Design
5.2.10.2	Fabrication/Test
<b>5.2.11</b>	<b>ICD's</b>
5.2.11.1	IFU ICD
5.2.11.2	Wavefront Sensor ICD
5.2.12	Handling Procedure
5.2.13	Configuration & Weight Management
5.2.14	Sustaining Engineering
<b>5.3</b>	<b>Mechanical</b>
<b>5.3.1</b>	<b>Preliminary Design</b>
5.3.1.1	Preliminary Mechanical Design
5.3.1.2	Update Optics Design
<b>5.3.2</b>	<b>Fore Optics Assembly</b>
<b>5.3.2.1</b>	<b>Housing Assembly</b>
5.3.2.1.1	Design
5.3.2.1.2	Fabrication
5.3.2.1.3	Assembly
<b>5.3.2.2</b>	<b>Pick Off Mirror Assembly</b>
5.3.2.2.1	Design
5.3.2.2.2	Fabrication
<b>5.3.2.3</b>	<b>Offner Assembly</b>
5.3.2.3.1	Design
5.3.2.3.2	Fabrication
<b>5.3.3</b>	<b>OIWFS Assembly</b>
<b>5.3.3.1</b>	<b>OIWFS Bench</b>

GNIRS

WBS	Name
5.3.3.1.1	Design
5.3.3.1.2	Fabrication
5.3.3.1.3	Assembly
<b>5.3.3.2</b>	<b>Wavefront Sensor Hardware</b>
5.3.3.2.1	Design
5.3.3.2.2	Fabrication
<b>5.3.4</b>	<b>Slit/Decker/Filter Assembly</b>
<b>5.3.4.1</b>	<b>Housing Assembly</b>
5.3.4.1.1	Design
5.3.4.1.2	Fabrication
5.3.4.1.3	Assembly
<b>5.3.4.2</b>	<b>Filter Wheel</b>
5.3.4.2.1	Design
5.3.4.2.2	Fabrication
5.3.4.2.3	Assembly/Test
<b>5.3.4.3</b>	<b>Decker Slide</b>
5.3.4.3.1	Design
5.3.4.3.2	Fabrication
5.3.4.3.3	Assembly/Test
<b>5.3.4.4</b>	<b>Slit Module</b>
5.3.4.4.1	Design
5.3.4.4.2	Fabrication
5.3.4.4.3	Assembly/Test
<b>5.3.5</b>	<b>Spectrograph Bench Assembly</b>
<b>5.3.5.1</b>	<b>Spectrograph Optical Bench</b>
5.3.5.1.1	Design
5.3.5.1.2	Fabrication
5.3.5.1.3	Assembly
<b>5.3.5.2</b>	<b>Prism Turret</b>
5.3.5.2.1	Design
5.3.5.2.2	Fabrication
5.3.5.2.3	Assembly/Test
<b>5.3.5.3</b>	<b>Grating Turret</b>
5.3.5.3.1	Design
5.3.5.3.2	Fabrication
5.3.5.3.3	Assembly/Test
<b>5.3.5.4</b>	<b>Collimator Assembly</b>
<b>5.3.5.4.1</b>	<b>Collimator Truss</b>
5.3.5.4.1.1	Design
5.3.5.4.1.2	Fabrication
5.3.5.4.1.3	Assembly
<b>5.3.5.4.2</b>	<b>Collimator Mount</b>
5.3.5.4.2.1	Design
5.3.5.4.2.2	Fabrication
5.3.5.4.2.3	Assembly
<b>5.3.5.4.3</b>	<b>Collimator Cover Box</b>
5.3.5.4.3.1	Design
5.3.5.4.3.2	Fabrication
5.3.5.4.3.3	Assembly
<b>5.3.5.5</b>	<b>Acquisition Mirror Assembly</b>
5.3.5.5.1	Design
5.3.5.5.2	Fabrication
5.3.5.5.3	Assembly/Test
<b>5.3.6</b>	<b>Camera Assembly</b>
<b>5.3.6.1</b>	<b>Camera Housing Assembly</b>
5.3.6.1.1	Design
5.3.6.1.2	Fabrication
5.3.6.1.3	Assembly/Test
<b>5.3.6.2</b>	<b>Short Red camera</b>
5.3.6.2.1	Design
5.3.6.2.2	Fabrication
5.3.6.2.3	Assembly
<b>5.3.6.3</b>	<b>Short Blue Camera</b>
5.3.6.3.1	Design
5.3.6.3.2	Fabrication

## GNIRS

WBS	Name
5.3.6.3.3	Assembly
<b>5.3.6.4</b>	<b>Long Red Camera</b>
5.3.6.4.1	Design
5.3.6.4.2	Fabrication
5.3.6.4.3	Assembly
<b>5.3.6.5</b>	<b>Long Blue Camera</b>
5.3.6.5.1	Design
5.3.6.5.2	Fabrication
5.3.6.5.3	Assembly
<b>5.3.6.6</b>	<b>Camera Focus Assembly</b>
5.3.6.6.1	Design
5.3.6.6.2	Fabrication
5.3.6.6.3	Assembly/Test
<b>5.3.7</b>	<b>Fixed Assemblies</b>
<b>5.3.7.1</b>	<b>Bulkhead Radiation Shield Assembly</b>
5.3.7.1.1	Design
5.3.7.1.2	Fabrication
5.3.7.1.3	Assembly
<b>5.3.7.2</b>	<b>Detector Mount Assembly</b>
5.3.7.2.1	Design
5.3.7.2.2	Fabrication
<b>5.3.7.3</b>	<b>Dewar Mount Truss Assembly</b>
5.3.7.3.1	Design
5.3.7.3.2	Fabrication
<b>5.3.7.4</b>	<b>Bulkhead Assembly</b>
5.3.7.4.1	Design
5.3.7.4.2	Fabrication
<b>5.3.7.5</b>	<b>Optical Bench Mount Assembly</b>
5.3.7.5.1	Design
5.3.7.5.2	Fabrication
<b>5.3.7.6</b>	<b>Thermal Enclosure Mount Assembly</b>
5.3.7.6.1	Design
5.3.7.6.2	Fabrication
<b>5.3.7.7</b>	<b>Vertical Installation Frame Assembly</b>
5.3.7.7.1	Design
5.3.7.7.2	Fabrication
<b>5.3.7.8</b>	<b>Horizontal Installation Frame Assembly</b>
5.3.7.8.1	Design
5.3.7.8.2	Fabrication
<b>5.3.7.9</b>	<b>Thermal Distribution Connector Assembly</b>
5.3.7.9.1	Design
5.3.7.9.2	Fabrication
<b>5.3.7.10</b>	<b>Cryo Cooler Assembly</b>
5.3.7.10.1	Design
5.3.7.10.2	Fabrication
<b>5.3.7.11</b>	<b>Front Dewar Shell Assembly</b>
<b>5.3.7.11.1</b>	<b>Front Dewar Shell</b>
5.3.7.11.1.1	Design
5.3.7.11.1.2	Fabrication
<b>5.3.7.11.2</b>	<b>Environmental Cover Assembly</b>
5.3.7.11.2.1	Design
5.3.7.11.2.2	Fabrication
<b>5.3.7.11.3</b>	<b>Entrance Window Assembly</b>
5.3.7.11.3.1	Design
5.3.7.11.3.2	Fabrication
<b>5.3.7.11.4</b>	<b>Front Radiation Shield Assembly</b>
5.3.7.11.4.1	Design
5.3.7.11.4.2	Fabrication
<b>5.3.7.12</b>	<b>Rear Dewar Shell Assembly</b>
<b>5.3.7.12.1</b>	<b>Rear Dewar Shell</b>
5.3.7.12.1.1	Design
5.3.7.12.1.2	Fabrication
<b>5.3.7.12.2</b>	<b>Rear Radiation Shield Assembly</b>
5.3.7.12.2.2	Design
5.3.7.12.2.1	Fabrication

## GNIRS

WBS	Name
<b>5.3.8</b>	<b>Handling Cart</b>
5.3.8.1	Design
5.3.8.2	Fabrication
<b>5.4</b>	<b>Electronics</b>
<b>5.4.1</b>	<b>Preliminary Design</b>
5.4.1.1	System Design
5.4.1.2	Test Dewar Support
5.4.1.3	Cold Motor Testing & Evaluation
<b>5.4.2</b>	<b>Systems Design &amp; Support</b>
5.4.2.1	electronics oversight
5.4.2.2	electronics systems design
<b>5.4.3</b>	<b>Spectrograph Thermal Enclosure</b>
<b>5.4.3.1</b>	<b>Ancillary Control Chassis</b>
5.4.3.1.1	Wire List & Schematic
5.4.3.1.2	Receipt of IFA Furnished Items
5.4.3.1.3	Mechanical Assembly & Wiring
5.4.3.1.4	Test & Programming Verification
<b>5.4.3.2</b>	<b>VME Chassis Wiring &amp; Assy</b>
<b>5.4.3.2.1</b>	<b>Temperature monitor board (VME) spare</b>
5.4.3.2.1.1	stuff bd
5.4.3.2.1.2	program Xilinx chip
5.4.3.2.1.3	test bd
5.4.3.2.2	Chassis Wire List & Schematic
5.4.3.2.3	Design rear connector panel
5.4.3.2.4	Machine Rear Connector Panel
5.4.3.2.5	Wire Chassis
<b>5.4.3.3</b>	<b>Motor Drive / Cryohead Control Chassis</b>
5.4.3.3.1	Wire List & Schematic
5.4.3.3.2	Chassis Component & Procurement (NOAO Stock)
5.4.3.3.3	Mechanical Assembly & Wiring
5.4.3.3.4	Test
<b>5.4.3.4</b>	<b>Spectrograph [Optical Bench] Thermal Control</b>
5.4.3.4.1	Design Controller
5.4.3.4.2	Purchase Control Unit
5.4.3.4.3	Mechanical Assembly & Wiring
5.4.3.4.4	Program & Test Controller
<b>5.4.3.5</b>	<b>Thermal Enclosure Internal Cabling &amp; Connections</b>
5.4.3.5.1	Wire List & Schematic
5.4.3.5.2	design rear connector panel
5.4.3.5.3	fab rear connector panel
5.4.3.5.4	install TE chassis
5.4.3.5.5	wire TE
5.4.3.5.6	test & de-bug TE electronics/wiring
<b>5.4.3.6</b>	<b>Boards &amp; Assemblies</b>
<b>5.4.3.6.1</b>	<b>Ancillary Functions PC Board</b>
5.4.3.6.1.1	design
5.4.3.6.1.2	layout PCB
5.4.3.6.1.3	vendor fab PCB
5.4.3.6.1.4	stuff & test
<b>5.4.4</b>	<b>External Instrument Wiring &amp; Cables</b>
5.4.4.1	Wire Lists & Design of External Cabling
5.4.4.2	Connector & Cabling Procurement
5.4.4.3	Cabling Fabrication & Test
<b>5.4.5</b>	<b>Dewar Internal Connectors &amp; Cabling</b>
<b>5.4.5.1</b>	<b>temperature sensors</b>
5.4.5.1.1	Assemble and Calibrate Temp Sensors
5.4.5.1.2	make wire lists for all cables
5.4.5.1.3	Mechanical Design Coordination & Cable Lengths
5.4.5.1.4	fab Internal cable sets
5.4.5.1.5	Wire Spectrograph Mechanisms
5.4.5.1.6	install cables into dewar
5.4.5.1.7	install IR detector mount and cables
<b>5.4.5.2</b>	<b>Dewar Connector Interface Boards</b>
5.4.5.2.1	design
5.4.5.2.2	layout PCB

GNIRS

WBS	Name
5.4.5.2.3	vendor fab PCB
5.4.5.2.4	install boards on connectors
<b>5.4.6</b>	<b>dewar warm-up controller</b>
5.4.6.1	design dewar warm-up controller
5.4.6.2	procure parts
5.4.6.3	Mechanical Assembly & Wiring
5.4.6.4	Test Controller
<b>5.4.7</b>	<b>wavefront sensor electronics</b>
5.4.7.1	receive IFA WFS electronics
5.4.7.2	rack mount electronics into TE
5.4.7.3	Fab & Install Internal TE WFS Cables
5.4.7.4	Fab External WFS Cables
5.4.7.5	Fab & Install Internal Dewar WFS Cables
<b>5.4.8</b>	<b>electronics documentation</b>
5.4.8.1	schematic cleanup
5.4.9	Mechanism Test Set
<b>5.5</b>	<b>Software</b>
5.5.1	Engineering Software
5.5.2	System Software
<b>5.6</b>	<b>Alignment and Integration</b>
5.6.1	Integration Test Plan/Procedure
5.6.2	Fore Optics Assembly
5.6.3	Wavefront Sensor Assembly
5.6.4	Collimator assembly
5.6.5	Prism Turret
5.6.6	Grating Turret
5.6.7	Camera Turret
5.6.8	Focus and Detector
5.6.9	Acquisition Mirror
5.6.10	Warm Alignment/Test
5.6.11	Cold Testing
5.6.12	T&E
<b>5.7</b>	<b>Deliverables</b>
<b>5.7.1</b>	<b>Instrument Hardware</b>
5.7.1.1	Pre-ship Acceptance Test
5.7.1.2	Ship to Hilo Base Facility
5.7.1.3	Final Acceptance Test
<b>5.7.2</b>	<b>Training</b>
5.7.2.1	indent only
<b>5.7.3</b>	<b>Documentation</b>
<b>5.7.3.1</b>	<b>Test plans</b>
5.7.3.1.1	Pre-ship Acceptance Test Plan
5.7.3.1.2	Pre-commission Test Plan
5.7.3.1.3	Commission Test plan
<b>5.7.3.2</b>	<b>Manuals</b>
5.7.3.2.1	Draft Software Maintenance Manual
5.7.3.2.2	Draft Service and Calibration Manual
5.7.3.2.3	Draft User's Manual
5.7.3.2.4	Final Manuals
<b>5.7.3.3</b>	<b>As-built Fabrication Drawings</b>
5.7.3.3.1	indent only
<b>5.8</b>	<b>Procurement</b>
5.8.1	Contract Labor
5.8.2	Vendor Sub-Contract
<b>5.8.3</b>	<b>Mechanical</b>
5.8.3.1	Radiation Shields
5.8.3.2	Optical Bench Assembly
5.8.3.3	Spectrograph Bench Assembly
5.8.3.4	Prism Turret Assembly - 5.3.5.2.2
5.8.3.5	Grating Turret Assembly - 5.3.5.3.2
5.8.3.6	Slit/Decker/Filter Assembly - 5.3.4.1.2
5.8.3.7	Pickoff/Fold Mirror Assembly
5.8.3.8	Camera Turret Hub Assembly
5.8.3.9	Offner Assembly - 5.3.3.1.2
5.8.3.10	Collimator - 5.3.5.4.2.2

GNIRS

WBS	Name
5.8.3.11	Spectrograph Bench - 5.3.5.1.2
5.8.3.12	Forward Optics Bench - 5.3.2.1.2
5.8.3.13	OIWFS Bench
5.8.3.14	Spectrograph Bench Cover
5.8.3.15	Front Dewar Shell - 5.3.7.11.1.2
5.8.3.16	Rear Dewar Shell - 5.3.7.12.1.2
<b>5.8.4</b>	<b>Electronics</b>
5.8.4.1	Components
5.8.4.2	PCB's
<b>5.8.5</b>	<b>Optics</b>
5.8.5.1	RMI Optics - 5.8.3.1
5.8.5.2	II-VI Mirrors - 5.8.3.2
5.8.5.3	Mirrors - 5.8.3.3
5.8.5.4	Filters - 5.8.3.4
5.8.5.5	Prisms - 5.8.3.5
5.8.5.6	Gratings - 5.8.3.6
5.8.5.7	Slits - 5.8.3.7
5.8.5.8	Deckers -5.8.3.8
<b>5.8.6</b>	<b>Components</b>
5.8.6.1	Cryo Heads
5.8.6.2	Vacuum Valve
5.8.6.3	Health Sensors
5.8.6.4	Helium Lines
5.8.6.6	Shipping Containers
5.8.7	Shop Materials
5.8.8	Liquid Nitrogen
5.8.9	Spares
5.8.10	Miscellaneous
<b>5.8.11</b>	<b>Travel</b>
5.8.11.1	Plane fare
5.8.11.2	Lodging
5.8.11.3	Food