Announcement of Opportunity

Membership of the NIRSpec Instrument Science Team James Webb Space Telescope

Issued 17 March, 2004

Deadline for submission of proposals:

26 April 2004

1) Introduction and Background

James Webb Space Telescope (JWST) is a collaborative project between NASA, ESA and the Canadian Space Agency, scheduled for launch in 2011. NIRSpec is one of the main instruments of the payload complement carried by the JWST. NIRSpec is a near infrared multi-object spectrometer that will be constructed by European industry under ESA funding.

The present Announcement of Opportunity (AO) solicits proposals for membership of the Instrument Science Team (IST) for NIRSpec.

Further background information on ESA's participation in the JWST mission and its scientific advisory structure can be found in the ESA JWST Science Management Plan (SMP; ESA/SPC(2004)11, rev. 1) included in this AO as Attachment A.

Interested parties are in particular referred to sections 3.3.1, 4.1, and 5.1.1 for details on the composition, specific responsibilities, terms of membership of the NIRSpec IST and access to Guaranteed Time Observations. Appendix A of the SMP gives the particulars of this solicitation.

The salient points are as follows:

- This AO aims to appoint six European members of the NIRSpec IST, whose primary role is to advise and assist the ESA Project Scientist in providing scientific oversight during the development and commissioning of the NIRSpec instrument.

- The AO is open to scientists employed by universities and research institutions in all ESA Member States (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom).

- Applicants with expertise in especially the following areas are sought: optical and cryogenic instrument design and fabrication, instrument calibration, operations and data processing, multi-object near-IR spectroscopy, large spectrographic surveys, formation and evolution of galaxies, and galaxy spectral synthesis.

- Membership of the NIRSpec IST carries with it the right to participate in the Guaranteed Time Programme for NIRSpec.

- NIRSpec IST members will receive support from ESA to attend IST meetings, but are expected to rely on institutional or national funding in support of their NIRSpec and JWST related duties (postdocs, additional travel, etc.).

- Selection will take place in consultation with the standing scientific advisory bodies of the ESA Science Programme. Successful applicants will be appointed by the ESA Director of Science for an initial period of three years, with the possibility of renewal.

To supplement the information contained in the SMP, a short introductory overview of the NIRSpec instrument is provided in Attachment B.

2) Proposal Preparations and Submission

Proposals submitted in response to this AO should be no more than 5 pages in length and contain the following information:

First page:

- Name, affiliation and complete contact information.
- A brief CV listing a few selected relevant publications.

Up to three pages:

- Description of the experience and expertise of the applicant in one or more of the areas specified in section 4.1 of the SMP.
- Short description of the main areas of scientific interest of the applicant along with brief suggestions for how NIRSpec might be applied to these problems.

Last page:

- Statement giving the fraction of his or her time the applicant is able to commit to the NIRSpec and JWST project.
- Statement listing the institutional or national resources available to the candidate in support of NIRSpec IST membership (postdocs, technical support, additional travel etc.).

Proposals should be submitted electronically (plain text, Word or PDF format) to the following address:

NIRSpec_IST@rssd.esa.int by the **closing date of 26 April 2004**

Applicants will receive confirmation upon successful receipt of their proposals.

It is intended that proposers will be informed of the outcome of the selection process in the June 2004 timeframe in advance of the start of the NIRSpec Implementation Phase and the announcement of the NIRSpec Prime Contractor.

3) Further Information

Queries concerning the contents of this AO should be directed to one of the following individuals:

Dr. S. Volonte, Astronomy Missions Coordinator, ESA HQ
tel/fax: +33 1 5369 7103/7236
email: Sergio.Volonte@esa.int

Dr. P. Jakobsen, ESA JWST Project Scientist, ESTEC
tel/fax: +31 71 565 3614/4690
email: pjakobsen@rssd.esa.int

ATTACHMENT A
ESA/SPC(2004)11, rev. 1

James Webb Space Telescope
ESA Science Management Plan

1. Scope

This document describes the Science Management Plan for ESA's participation in the James Webb Space Telescope (JWST), and the present and future involvement of the ESA scientific community in the project.

The following topics are covered:

- The overall scientific advisory structure of the JWST mission
- Scientific oversight of the NIRSpec and MIRI instruments
- The Announcement of Opportunity for membership of the NIRSpec Instrument Science Team.
- European participation in the JWST Guaranteed Time Observer (GTO) programme
- European participation in the JWST General Observer (GO) programme

2. JWST Overview

2.1 Introduction

The James Webb Space Telescope (JWST) is a collaborative project between NASA, ESA and the Canadian Space Agency (CSA). Although radically different in design, and emphasizing the infrared part of the electromagnetic spectrum, JWST is widely seen as the successor to the Hubble Space Telescope (HST). Indeed, the framework of the collaboration between ESA and NASA on JWST, with its approximately equal contributions to payload and non-payload components to the mission, builds heavily on the highly successful HST model. The same holds for the approach to science utilization and science management for the JWST mission described in this document. The ESA participation in JWST was approved by the Science Programme Committee at its February 2003 meeting.

JWST's shift to longer infrared wavelengths compared to its predecessor is first and foremost driven by the primary scientific objective of mapping the evolution of galaxies back in time and redshift to the birth of the very first stars. Nonetheless, the capabilities enabling this objective to be pursued also make JWST a general purpose observatory capable of addressing a wide range of astrophysical problems. The science objectives are further described in Section 2.2

The JWST observatory will consist of a deployable 6.6 meter passively cooled telescope optimized for infrared wavelengths. It will carry three main scientific instruments: a near-infrared camera (NIRCam) and a near-infrared spectrograph (NIRSpec) covering the 0.6 - 5 μm spectral region, and a combined mid-infrared camera/spectrograph (MIRI) covering 5 - 28 μm. In addition, the Fine Guidance Sensor (FGS) will carry a Tunable Filter Module with narrow-band near-infrared imaging capability. Further details of the JWST mission are given in Section 2.3.

As described in ESA/SPC(2003)8, of these payload components, ESA is responsible for providing NIRSpec from ESA funds, and approximately half of MIRI through special contributions from the member states. As its non-instrument contribution, ESA will provide the Ariane 5 launcher that will place the JWST observatory in an orbit around the anti-Sun Earth-Sun Lagrangian point, L2.

Responsibility for scientific operation of JWST lies with the Space Telescope Science Institute (STScI) in Baltimore, working under contract to NASA. A yet to be negotiated number of ESA staff will be posted at STScI in support of the European payload components as ESA's contribution to JWST operations.

The JWST observing programme will be determined by the astronomical community on the basis of periodic competitive peer reviews organized by the STScI. The overriding motivation for ESA's partnership in the JWST mission is to secure ESA member state scientists full access to compete for time on JWST on an equal footing with their US and Canadian counterparts.

The main elements of the science management structure of the JWST mission were laid out in the NASA Announcement of Opportunity (AO) for the JWST observatory (AO 01-OSS-05) which was issued in January 2001. The community response to this AO resulted in the

selection of the NIRCam Science Team, the US members of the MIRI Science Team, and the Interdisciplinary Scientists in June 2002.

This document describes in more detail the science advisory and science management structure of the JWST mission (Section 3) and programme participation (Section 4) as it pertains to ESA and the European contributions to the project.

2.2 Science Objectives and Requirements

The scientific objectives of the JWST mission trace back to the 1996 report of the "HST and Beyond" Committee chaired by A. Dressler, and have been further refined by the Ad Hoc Science Working Group in the so-called Design Reference Mission (DRM), a collection of mock JWST observing proposals giving the scientific justifications and detailed observations required of each programme. The scientifically ranked proposals of the DRM, in turn, formed the metric for defining the requirements of the JWST instrument suite.

Most recently, the JWST Science Working Group (SWG; Section 3.2) has updated the science objectives contained in the DRM and reformatted them into the formal JWST Science Requirements Document (JWST-RQMT-002558).

The scientific goals of the JWST mission as formulated by the SWG can be sorted into four broad themes:

- First Light (after the Big Bang)
- Assembly of Galaxies
- Birth of Stars and Protoplanetary Systems
- Planetary Systems and the Origins of Life

Although the first two of these themes are extragalactic in nature and concerned with exploring the formation of stars and galaxies in the remote Universe at the earliest times, they are intimately linked to the latter two mainly galactic themes, which aim at understanding the detailed process of star and planet formation in our own galaxy.

The driving scientific objectives of the JWST observatory are captured succinctly in the formal (Level 1) Mission Success Criteria:

- Measure the space density of galaxies to a 2 μm flux density limit of 1.0×10^{-34} W $m^{-2}Hz^{-1}$ via imagery within the 0.6 to 27 μm spectral band to enable the determination of how this density varies as a function of their age and evolutionary state.

- Measure the spectra of at least 2500 galaxies with spectral resolutions of approximately 100 (over 0.6 to 5 μm) and 1000 (over 1 to 5 μm) and to a 2 μm emission line flux limit of 5.2×10^{-22} Wm^{-2} to enable determination of their redshift, metallicity, star formation rate, and ionization state of the intergalactic medium.

- Measure the physical and chemical properties of young stellar objects, circumstellar debris disks, extra-solar giant planets, and Solar System objects via spectroscopy, and imagery within the 0.6 to 27 μm spectral band to enable determination of how planetary systems form and evolve.

These top-level science objectives drive the capabilities of the JWST observatory and its three main instruments. Specifically, the second and third objectives respectively prescribe that NIRSpec be a high efficiency multi-object spectrograph, and that the mid-IR instrument, MIRI have both imaging and spectroscopic capabilities.

Further details of the JWST science objectives and their history may be found by consulting JWST Science Requirements Document (JWST-RQMT-002558)

2.3 Mission Description

The JWST observatory consists of four main components:

- The Optical Telescope Element (OTE) consisting of the deployable 6.6 m telescope and its support structure
- The large deployable sun shade
- The spacecraft
- The Integrated Science Instrument Module (ISIM)

The scientific instruments contained in the ISIM are:

- NIRCam: a wide field (2.2' x 4.4') near-IR camera covering wavelengths 0.6 - 5 μm
- NIRSpec: a wide field (3.5' x 3.5') multi-object near-IR spectrometer covering wavelengths 0.6 - 5 μm at spectral resolutions of R~100, R~1000 and R~3000
- MIRI: a combined mid-IR camera (1.4' x 1.9') and spectrograph (R~3000) covering wavelengths 5 - 27 μm

In addition, the Fine Guidance System (FGS) will include a near-IR tunable filter imaging capability (2.3' x 2.3'; R~100) covering wavelengths 0.6 - 5 μm.

The OTE and ISIM are both cooled in bulk to ~37 K – a temperature set by the operating temperature of the HgCdTe detector arrays employed in NIRCam, NIRSpec and the FGS. This level of cooling is attained through passive means by keeping the OTE and ISIM in perpetual shadow by means of the deployable sun shade and placing the observatory in the thermally stable conditions provided by an orbit around L2. A solid hydrogen cryostat further cools the Si:As detector arrays of MIRI to their required ~7 K operating temperature. The design lifetime of the MIRI cryostat coincides with the nominal JWST mission life of 5 years.

The OTE is specified to provide diffraction-limited performance at wavelengths above 2 μm. Fine pointing is achieved by means of a fast steering mirror controlled by the FGS. In order to maintain the OTE image quality, the 16 hexagonal segments of the primary mirror are individually adjustable in orbit.

The 0.6 μm short wavelength limit of the JWST observatory is set by the gold coating of the telescope and instrument optics and the degraded image quality of the segmented telescope at short wavelengths. The primary source of stray light seen by the JWST instruments is thermal radiation emitted from the back side of the sun shield and scattered off the largely unbaffled primary mirror. The intensity of this stray light contribution is required to be kept below that of the Zodiacal light at wavelengths shorter than 10 μm. The extreme long wavelength limit of the JWST observatory is set by the sensitivity cutoff of the MIRI detectors at ~27 μm.

Launch will take place on an Ariane 5 (ECA). In order to fit into the shroud of the Ariane 5 launcher, the primary mirror is folded along two cords and is deployed in orbit along with the secondary mirror and the sun shield. Transfer to the L2 orbit will take approximately 3 months with deployment and the 6 month duration Commissioning Phase starting during the cruise phase already a few days after launch.

The overall schedule for the JWST programme is given in Table 1.

2.4 Participation of the Scientific Community

The general scientific community from ESA member states will be invited to participate in the JWST mission in various ways:

- by becoming members of the NIRSpec Instrument Science Team through an AO process
- by providing elements of the European contribution to the MIRI instrument
- through submission of General Observer (GO) proposals in response to periodic calls to be issued by the STScI
- by accessing data in the JWST data archive after the propriety period has expired

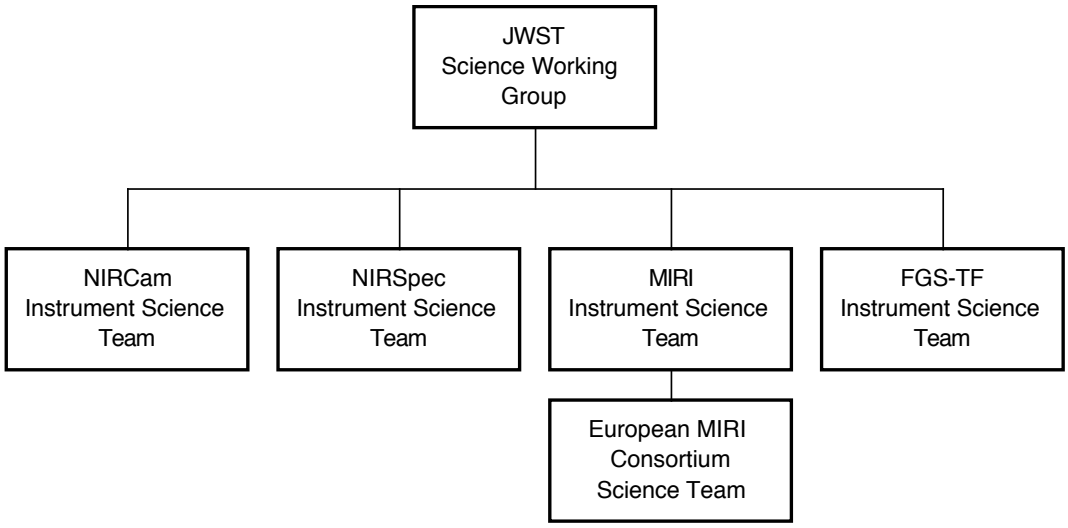

Figure 1: JWST Scientific Advisory Structure during development

3. Science Management

3.1 Overview

In describing the science management approach of the JWST mission, it is useful to distinguish between the development phase and the routine operations phase. The development phase is described in the present section whereas the routine phase is addressed in section 5.

The Development Phase of the JWST mission extends through launch up to and including successful commissioning of the observatory. The scientific advisory structure during the Development Phase is shown in Figure 1. The individuals who currently make up these groups are listed in Appendix B.

3.2 JWST Science Working Group

Overall scientific oversight of the JWST observatory during the Development Phase is provided by the JWST Science Working Group (SWG). The SWG is chaired by the NASA Senior Project Scientist for JWST and reports to the JWST Program Scientist at NASA HQ. Its membership comprises representatives for each of the four Instrument Science Teams, a total of six Interdisciplinary Scientists, a Telescope Scientist, and the Project Scientists from NASA, ESA, CSA and STScI (Appendix B).

The external members of the SWG were competitively selected through the NASA JWST AO. Two of the JWST Interdisciplinary Scientists are from ESA member states and are sponsored by ESA in the sense that ESA covers their travel expenses when attending SWG and related meetings. ESA also covers the travel expenses of the European MIRI Consortium Principal Investigator (3.3.2) and the NIRSpec Science Representative (3.3.1) when attending SWG meetings.

3.3 Instrument Science Teams

Below the Science Working Group are the four Instrument Science Teams (ISTs) that provide scientific oversight to each of the JWST science instruments. Specific responsibilities of the ISTs during the Development Phase include monitoring the predicted scientific performance of the instruments, planning and participating in the ground calibration campaigns, and working with the STScI on defining the operational and data processing procedures for the instruments. The Instrument Science Teams will also be responsible for the Science Verification stages of the on-orbit instrument commissioning campaigns, as well as defining and executing the Guaranteed Time Observer Programme of the instruments (5.1.2).

Due to the different manner in which the instruments are being procured on JWST, the solicitation processes for each of the instrument teams also vary considerably.

3.3.1 NIRSpec Instrument Science Team

NIRSpec will be procured by ESA with ESA funds, as approved by SPC at its February 2003 meeting. NIRSpec will be constructed in European Industry under ESA Project leadership.
The NIRSpec instrument has been the subject of ESA-sponsored industrial Definition Studies since early 2002 and is scheduled to enter the Implementation Phase in mid 2004.

Two key hardware components of NIRSpec will be provided by NASA: the MEMS-based Micro Shutter Array (MSA) and the near infrared detector array or Focal Plane Assembly (FPA).

Science oversight of the NIRSpec during the Implementation Phase will be provided by the NIRSpec Instrument Science Team (IST). The NIRSpec IST will be chaired by the ESA JWST Project Scientist (PS). The PS will coordinate the activities of the IST and will have the responsibility to safeguard the scientific interests and maximize the scientific return of the

NIRSpec instrument during all phases of the JWST mission. Within ESA, the PS will liaise with the Project Manager and the Project Team during the development phase and will advise them on technical matters when these affect scientific performance.

The NIRSpec IST will comprise up to six external members from the ESA scientific community to be selected on a competitive basis in response to an AO to be issued by ESA. Applicants will be selected on the basis of pertinent technical and scientific expertise, as well as their ability to commit time to the project. Details on the AO process and the selection procedure are given in Section 4 and Appendix A.

The Selected external European NIRSpec IST members will be appointed for an initial term of 3 years but there will be the possibility of extension for further terms. Their travel costs and other related expenses to attend IST meetings will be paid by ESA, but all other activities will be expected to rely on institutional and national sources for support.

Reflecting the collaborative nature of the NIRSpec instrument, the NIRSpec IST will also include three US scientists among its members: the lead NASA MSA and FPA Scientists, and the STScI Instrument Scientist for NIRSpec. A Canadian representative to be appointed by the CSA will also be a member.

The NIRSpec IST will appoint one of its external European members to represent NIRSpec on the JWST Science Working Group, together with the ESA Project Scientist.

The ESA Project Scientist, in consultation with the Astronomy Working Group, will have the initiative to adjust the composition of the NIRSpec IST as the character of the tasks and the commitment of its members evolve during the different phases of the project.

The NIRSpec IST has no executive power. It will be expected to monitor and advise on all aspects which affect the scientific performance of the instrument. Members of the NIRSpect IST will support the PS in major project reviews and perform scientific tasks as needed or requested by the PS during the development and operation phases. Specifically, the NIRSpec IST will be responsible for:

- supporting the PS in maximizing the scientific return of the NIRSpec instrument
- acting as a focus for the interest of the scientific community in NIRSpec and JWST
- assisting the PS in reviewing and refining the scientific goals of NIRSpec
- monitoring and advising on the scientific aspects of the development of NIRSpec
- advising the PS the operational and calibration strategies for NIRSpec
- advising PS on the requirements for the data analysis system for NIRSpec
- assisting the PS in defining and overseeing the ground calibration campaign of NIRSpec
- assisting the PS in defining and overseeing the on-orbit Science Verification programme of NIRSpec
- assisting the PS in defining and carrying out the Guaranteed Time Programme of NIRSpec
- promoting public awareness of JWST and supporting ESA in its communication efforts

In fulfillment of their tasks, members of the NIRSpc IST will have the right to participate in the guaranteed observing time programme for NIRSpec as described in section 5.1.2.

The NIRSpec IST will remain in existence for the duration of the Development Phase and completion of the JWST Guaranteed Time programme (nominally 2.5 years after launch).

3.3.2 Joint MIRI Instrument Science Team

As detailed in ESA/SPC(2003)9, the Optics Module of MIRI will be provided by a European MIRI Consortium funded by the ESA member states. NASA, working through the Jet Propulsion Laboratory (JPL), will provide the remainder of the instrument, notably the detector and cryostat subsystems.

The joint MIRI Instrument Science Team (IST) provides overall scientific oversight of the MIRI instrument development. The composition of the IST is shared between US and European members. The US members of the MIRI IST were selected as part of the NASA JWST AO process and consist of the MIRI Science Lead, one external scientist, the JPL Project Scientist and the STScI MIRI Instrument Scientist. The IST is co-chaired by The US MIRI Science Lead and the European MIRI Consortium Principal Investigator.

The European membership of the MIRI IST consists of the European MIRI Consortium Principal Investigator, two members of the MIRI European Consortium Science Team (3.3.2.1), and the ESA MIRI Instrument Scientist.

European members of the MIRI IST will rely on institutional and national resources to cover their participation in MIRI IST meetings.

3.3.2.1 MIRI European Consortium Science Team

Immediately below the joint MIRI IST is the MIRI European Consortium Science Team (ECST), which is responsible for providing scientific oversight of all activities relating to MIRI. The ECST membership consists of its chair, the European Consortium PI (from the UK), and the co-PIs from each of the remaining ESA member states that provide the funding to the European Consortium. The ESA MIRI Instrument Scientist is also a member of the ECST. The ECST is already in place but awaits formalization from the approval by ESA and the participating member states of the multilateral agreement governing the provision of the European contribution to MIRI (optics module).

Together with the European Consortium PI and the ESA Instrument Scientist, the ECST will appoint two of the other members to represent the ECST on the joint MIRI IST.

ECST members will rely on institutional and national resources to cover their activities. The members of the ECST have responsibilities as set out in the Consortium Programme Management Plan (MIRI-PL-00003-AEU).

In fulfillment of their task, members of the ECST will have the right to participate in the MIRI guaranteed observing time as described in section 5.1.2.

3.3.3 NIRCam Instrument Science Team

NIRCam is a conventional NASA Principal Investigator (PI) led instrument with no formal ESA involvement. The NIRCam PI and associated Science Team were selected through the

NASA JWST AO. The NIRCam Science Team does contain a European member whose participation is sponsored by the relevant member state. The NIRCam IST also includes a number of Canadian members.

3.3.4 FGS Instrument Science Team

The Fine Guidance Sensor along with its Tunable Filter Modules will be provided by Canada. The FGS will also have a Science Team associated with it to be selected by the CSA. ESA has no formal involvement in the FGS.

4. Programme Participation in the Development Phase

European scientists can participate in the development of JWST either through the AO process for membership in the NIRSpec IST or as de-facto members of the MIRI ECST. The following section provides information on participation through responding to AO for membership in the NIRSpec IST. Participation of the scientific community at large in the open General Observer programme during the Routine Operations Phase is described in section 5.1.3

4.1 Announcement of Opportunity (AO) for the NIRSpec Instrument Science Team

The AO for membership in the NIRSpec IST will be released after approval of the Science Management Plan by the SPC (cf. Table 2). The AO will be open to applicants from the scientific community within the ESA member states. The specific elements of the proposals will be detailed in the AO which will also contain pointers to sources of relevant background information on the JWST mission and the NIRSpec instrument.

A detailed schedule for the NIRSpec IST AO process is given in Table 2. The selection and appointment of the NIRSpec IST is intended to coincide with the start of the Implementation Phase of the NIRSpec instrument in mid-2004.

Details on the selection procedure and the proposal evaluation criteria are given in Appendix A.

NIRSpec IST members shall be scientists with pertinent technical and scientific expertise who are prepared to commit a significant amount of time to the project. The NIRSpec IST membership needs to span a range of competencies covering the areas of:

- Optical design and fabrication
- Cryogenic instrument design and fabrication
- Instrument calibration, operations and data processing
- Multi-object near-IR spectroscopy
- Large spectrographic surveys
- Formation and evolution of galaxies
- Galaxy spectral synthesis

It is planned to appoint a total of 6 external members. However, in case some tasks are not fully covered or if new areas of expertise require attention during the course of the programme, membership of the IST may be increased according to ESA standard procedures.

5. Observing Time and Science Data Products

5.1 Routine Operations Phase

The Routine Operations Phase starts at the end of commissioning approximately 6 months after launch, through the nominal 5 year mission life, and possibly beyond if the mission is extended.

Following successful commissioning of the observatory, responsibility for the JWST scientific instruments will be formally handed over to STScI and the Routine Operations Phase will start.

JWST will operate autonomously 24 hours per day with one daily ~8 hour duration ground contact. The mission requirements stipulate that a science observing efficiency of >70% be achieved during Routine Operations.

There will initially be two categories of JWST users, the Guaranteed Time Observers (GTOs) consisting of the ISTs and the Interdisciplinary Scientists who have participated in the Development Phase of the observatory, and the General Observers (GOs) who compete for the majority of the JWST observing time through the annual review process.

5.1.1 Guaranteed Time Observers

As stipulated in the NASA JWST AO, the JWST Instrument Science Teams will each receive a total of 900 hours of GTO time (450 hours for the FGS Team) to be executed early in the mission following successful commissioning of the observatory. The GTO allocations of the Instrument Science Teams are not solely restricted to use of their own instrument. An additional 900 hours of GTO time are distributed among the Telescope and Interdisciplinary Scientist members of the Science Working Group. At the nominal observing efficiency of ~70%, the JWST GTO programme represents ~13% of the total observing time available during the nominal 5 year mission life.

The responsibility for constructing a scientifically sound and timely GTO Programme that showcases the capabilities of the JWST observatory and its instruments rests with the Science Working Group and the Instrument Science Teams.

According to the NASA AO, the GTO allocation for the MIRI Consortium is to be divided equally between the US and European parties, with the European Consortium Science Team being responsible for 50% of the available time.

In the case of NIRSpec, the GTO allocation will not be allocated on an ad personum basis, but held collectively by the NIRSpec IST whose members will advise the ESA Project Scientist on its scientifically optimal use.

Given that the prime scientific objective of JWST is to explore early galaxy evolution, it is anticipated that there will be considerable collaboration between the Instrument Teams and Interdisciplinary Scientists, and that a significant fraction of the JWST GTO Time will be pooled so as to allow exploratory deep surveys utilizing all four instruments.

All GTO programmes must be completed no later than 30 months after launch, after which the observatory will be exclusively devoted to carrying out GO programmes.

5.1.2 General Observer Time

GO time will be allocated to the general community, including GTO observers, on the basis of proposals submitted in response to calls for open observing time. This process will start approximately a year before launch, when STScI will issue to the worldwide astronomical community the first competitive Announcement of Opportunity for observing time on JWST. Additional proposal cycles will be initiated periodically for the life of the mission on a yearly basis.

It is anticipated that the first call for proposals will solicit proposals for large "Legacy" survey programmes to be executed early in the mission. The STScI is also expected also to instigate procedures for submitting unsolicited proposals for Targets of Opportunity and Director's Discretionary Time in the customary manner.

As is the case for HST, all European astronomers will apply directly to the AOs issued by the STScI and there will be no vetting of European observing proposals by ESA. ESA will, however, sponsor European representation at all levels of the selection structure.

ESA member state applicants will have the guarantee of ESA receiving a minimum of 15% of the total JWST observing time over the duration of the mission. However, based on HST experience, it is anticipated that European proposals will routinely win a larger fraction of the available observing time without the need to invoke this clause.

Successful European GOs will interact directly with STScI for support of their proposals. They will also be expected to rely on institutional and national resources for financial support if required by their programmes.

5.2 Data Access and Data Rights Policy

ESA member state JWST observers will receive their data directly from STScI. In accordance with NASA and ESA policy, the data will become public after a proprietary period of 12 months has elapsed since the scientifically validated data have been provided to the observer. All JWST data will be archived by STScI and be made freely available to all interested astronomers once the proprietary period has elapsed.

5.3 Science advisory structure during routine operations

The science advisory structure during the Routine Operations Phase of JWST has not yet been finalized, but is expected to follow the HST model closely.

A JWST Users Committee consisting of external JWST users will oversee the scientific exploitation of the JWST observatory. The Space Telescope Institute Council and the STScI Visiting Committee will oversee the functioning of the STScI itself. As for HST, the ESA JWST Project Scientist will be responsible for organizing and sponsoring the appropriate level of European representation on all relevant advisory committees.

Appendix A: Announcement of Opportunity (AO) for NIRSpec IST membership

A.1 Selection procedure

The proposals for membership in the NIRSpec Instrument Science Team will be evaluated and reviewed by a committee agreed to by the Astronomy Working Group, consisting of AWG representatives, ESA JWST Project personnel and additional external scientists representing the ESA JWST user community. The AWG and the Space Science Advisory committee will make recommendations to the ESA Executive regarding the selection of candidates. The ESA Director of Scientific Programme will appoint the NIRSpec IST members for a fixed (but renewable) term of 3 years. The selection procedure will be carried out so as to eliminate conflicts of interest.

A.2 Responsibilities

The specific tasks of the NIRSpec IST have been described in section 3.3.1. The selected IST members are expected to:

- establish and maintain close contact with the instrument development via the Project Scientist
- attend all meetings or the IST and take full and active part in its work
- participate in major instrument reviews and other meetings as agreed with or required by the Project Scientist

A.3 Evaluation criteria

The following criteria will be used in assessing the individual proposals:

- demonstrated experience of proposer in one or more areas as specified in section 4.1
- stated commitment of time to the project
- merit of proposed general contribution to NIRSpec

Appendix B: Science Who's Who on JWST

B.1 JWST Science Working Group

John Mather (GSFC) – NASA Senior Project Scientist (Chair)
Jonathan Gardner (GSFC) – NASA Deputy Project Scientist
Matt Greenhouse (GSFC) – NASA ISIM Project Scientist
Heidi Hammel (Space Science Institute, Boulder)– Interdisciplinary Scientist
John Hutchings (HIA/DAO) – Canadian Project Scientist, FGS Science Lead
Peter Jakobsen (ESTEC) – ESA Project Scientist, NIRSpec Science Lead
Simon Lilly (ETH, Zurich) – Interdisciplinary Scientist*
Jonathan Lunine (LPL Arizona) – Interdisciplinary Scientist
Mark McCaughrean (AIP, Potsdam) – Interdisciplinary Scientist*
Matt Mountain (Gemini Observatory, Hilo) – Telescope Scientist
George Rieke (University of Arizona) – MIRI Science Lead
Marcia Rieke (University of Arizona) – NIRCam Principal Investigator
Massimo Stiavelli (STScI) – Interdisciplinary Scientist
Pete Stockman (STScI) – STScI Project Scientist
Rogier Windhorst (Arizona State University) – Interdisciplinary Scientist
Gillian Wright (UK-ATC, Edinburgh) – European MIRI Consortium PI*
TBD – NIRSpec Science Representative*

*ESA sponsored

B.2 NIRSpec Instrument Science Team

Peter Jakobsen (ESTEC) – ESA Project Scientist (Chair)
Harvey Moseley (GSFC) – NASA MSA Scientist
Bernie Rauscher (GSFC) – NASA FPA Scientist
Mike Regan (STScI) – NIRSpec Instrument Scientist
TBD – External European Scientist
TBD – External European Scientist
TBD – External European Scientist
TBD – External European Scientist
TBD – External European Scientist
TBD – External European Scientist
TBD – Canadian Scientist

B.3 Joint MIRI Instrument Science Team

George Rieke (University of Arizona) – Science Lead (Chair)
Thomas Greene (NASA Ames)
Margaret Meixner (STScI)
Mike Ressler (JPL) – JPL Instrument Scientist

Gillian Wright (UK-ATC, Edinburgh) – European Consortium PI and Science Co-Lead (co-Chair)
Torsten Böker (ESTEC) – ESA MIRI Instrument Scientist
Ewine van Dishoeck (Sterrewacht Leiden)*
Christoffel Waelkins (Leuven)*

* 2 year rotating appointment

B.4 MIRI European Consortium Science Team

Gillian Wright (UK-ATC, Edinburgh) – European Consortium PI (Chair)
Torsten Böker (ESTEC) – ESA MIRI Instrument Scientist
Luis Colina (CSIC, Madrid)
Ewine van Dishoeck (Sterrewacht Leiden)
Manuel Güdel (ETH, Zurich)
Thomas Henning (MPIA, Heidelberg)
Pierre-Olivier Lagage (CEA, Saclay)
Hans-Ulrik Nørgaard-Nielsen (DSRI, Copenhagen)
Göran Olofsson (Stockholm Observatory)
Tom Ray (Institute for Advanced Studies, Dublin)
Christoffel Waelkens (Leuven)

B.5 NIRCam Science Team

Marcia Rieke (University of Arizona) – Principal Investigator (Chair)
Stefi Baum (STScI)
Chas Beichman (JPL)
David Crampton (HIA/DAO)
René Doyon (Université de Montréal)
Daniel Eisenstein (University of Arizona)
Tom Greene (NASA Ames)
Klaus Hodapp (University of Hawaii)
Scott Horner (Lockheed Martin)
Doug Johnstone (HIA/DAO)
Simon Lilly (ETH Zurich)
Peter Martin (University of Toronto)
Don McCarthy (University of Arizona)
Michael Meyer (University of Arizona)
George Rieke (University of Arizona)
Tom Roellig (NASA Ames)
John Stauffer (SIRTF Science Center, Caltech)
John Trauger (JPL)
Erick Young (University of Arizona)

B.6 FGS-TF Science Team

John Hutchings (HIA/DAO) – Canadian Project Scientist (Chair)
Bob Abraham (University of Toronto)
René Doyon (Université de Montréal)
Marcin Sawicki (HIA)
TBD additional members

Table 1: JWST Overall Programme Schedule

Approval of Science Management Plan by SPC	11-12 February 2004
Issue of NIRSpec IST AO	February/March 2004
Selection of NIRSpec IST members	May/June 2004
Selection of NIRSpec Prime Contractor	July 2004
NIRSpec and MIRI Implementation Phase	2004 - 2009
NIRSpec and MIRI delivery	2009
Issue of first call for GO proposals	2010
Launch	2011
End of nominal mission	2016

Table 2: Schedule for NIRSpec IST AO process

Recommendation of SMP by AWG/SSAC	15-22 January 2004
Approval of SMP by SPC	11-12 February 2004
Issue of AO	February/March 2004
Proposals due	April 2004
Proposal evaluation and selection	April/May 2004
AWG/SSAC recommendation	May 2004
Appointment of NIRSpec IST	June 2004

ATTACHMENT B

Brief Description of NIRSpec

The NIRSpec instrument has been the subject of ESA-sponsored industrial assessment and definition studies since 1998, and is scheduled to enter its Implementation Phase in mid-2004.

NIRSpec is a state-of-the-art near-IR multi-object spectrograph, designed to be capable of obtaining the near-IR spectra of 100 or more astronomical sources simultaneously at a spectral resolution of R~100 over the 0.6 - 5 micron wavelength range, or at a spectral resolution of R~1000 over 1 - 5 micron. The R~100 mode employs a single prism as its dispersive element and is intended for measuring the redshifts and continua spectra of faint galaxies. The R~1000 mode utilizes three diffraction gratings to cover the 1 - 5 micron spectra region, and is primarily intended for detailed follow-up observations using conventional nebular emission lines as astrophysical diagnostics. Lastly, three R~3000 gratings also covering 1 - 5 micron will allow kinematic studies of individual galaxies to be carried out in single object mode.

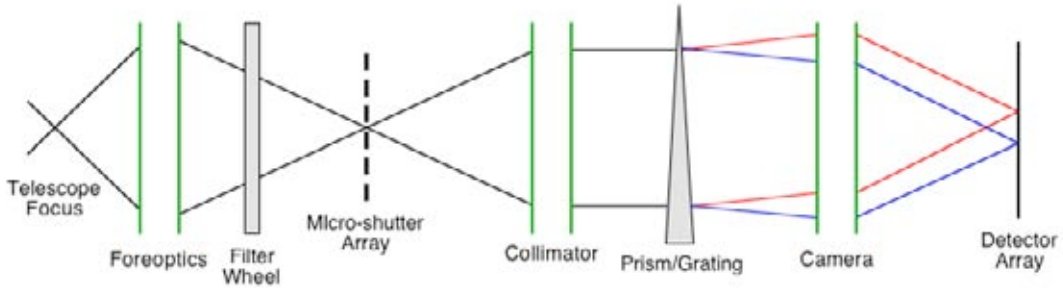

Figure 1: Schematic of the NIRSpec optical system.

The NIRSpec design employs all reflective optics, with most of its optical and structural elements manufactured out of modern ceramic materials (SiC and/or C-SiC). The optical chain (Figure 1) has three main components. The foreoptics re-image and magnify the focal plane image of the JWST telescope proper onto the slit selection mechanism. The collimator converts the light emerging from each slit into a parallel beam and projects it onto the grating wheel which carries the six (flat) reflective gratings, the (dual pass reflective) prism and a mirror flat for target acquisition. The camera finally focuses the dispersed collimated light coming off the grating onto the detector array. A filter wheel located in an internal pupil of the foreoptics carries the requisite order separation filters for the diffraction gratings and also serves as the instrument shutter.

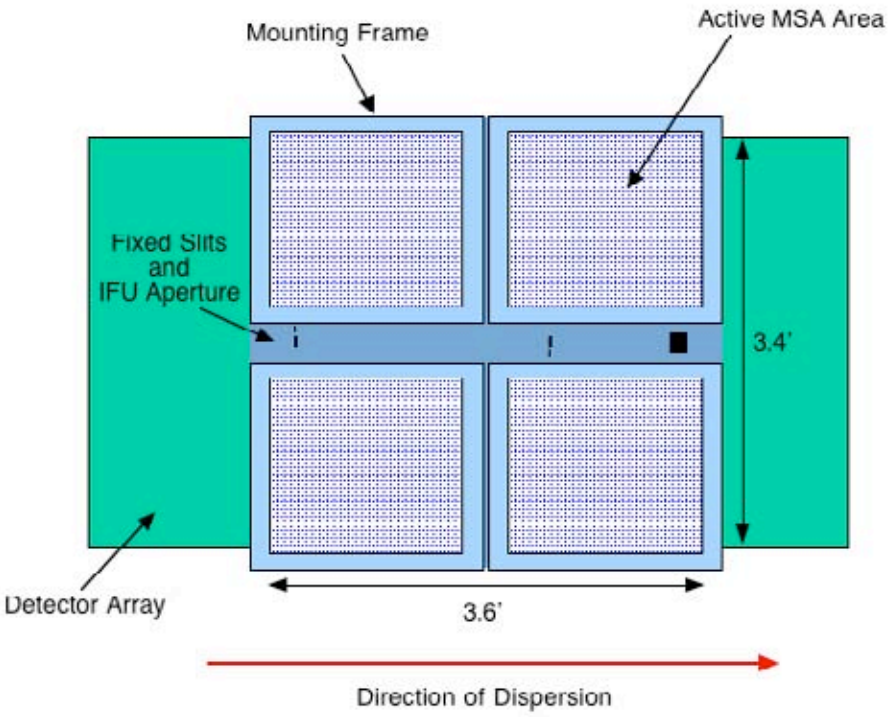

Figure 2: Schematic layout of the NIRSpec slit mask overlaid the detector array.

The NIRSpec slit selection mechanism (Figure 2) is a programmable Micro Shutter Array (MSA) to be provided by NASA. The MSA is made up of four 384 x 175 sub-arrays of individually programmable shutters. The open area of each shutter is 200 mas wide and 450 mas long. The active area of the whole MSA spans a field of view measuring 9 square arcminutes on the sky. In addition to the programmable micro shutters, the MSA also carries several fixed slits that can be used for high contrast observations of single objects at any of the three spectral resolutions. Resources permitting, a passive small field (~3" x 3") Integral Field Unit (IFU) may also be included for use with the three R~3000 gratings.

The NIRSpec detector system consists of two butted 2k x 2k Rockwell HgCdTe detector arrays, which will also be provided by NASA. In order to optimize the detector noise limited faint-end sensitivity of NIRSpec, the detector samples the spectra at a relatively coarse 100 mas per pixel.

NIRSpec is expected to be capable of reaching continuum fluxes approaching ~125 nJy at S/N~10 in t~10^4 s in R~100 mode, and line fluxes as faint as ~5 x 10^{-19} erg s^{-1} cm^{-2} at S/N~10 in t~10^5 s in R~1000 mode.