

External Evaluation Committee

Final Review Report of

the FY2023 NAOJ Project Review

for

the Nobeyama Radio Observatory

June 2024

General introduction

The External Evaluation Committee (hereafter the EEC), composed of the members listed in Appendix A [NAOJ-EEC-NRO-001-B], has met online on the following occasions: the kickoff meeting on November 21st, 2023 [NAOJ-EEC-NRO-004-A] led by the NAOJ Project Review Committee Chair, on December 11th, 2023, and January 15th, 2024, to draft the Review Plan [NAOJ-EEC-NRO-009-A].

The EEC has received the documents listed under the List of NRO Review Materials (see Appendix B, last updated on April 1st, 2024).

The EEC met at the Nobeyama Observatory on March 21st and 22nd, 2024, and the meetings followed the agenda outlined in the review plan (NAOJ-EEC-NRO-009-A, Jan 18th, 2024), reported in Appendix C.

This report is structured according to the review items listed in the evaluation plan and provides detailed replies to each charge.

An executive summary is provided to summarise the main recommendations by the EEC.

Executive Summary

The committee thanks the NRO project and NAOJ staff for their time spent providing the committee with documentation, presentations, discussions, and overall support. The committee wishes to congratulate the NRO staff for the achievements of the Observatory despite the reductions in manpower and budget.

Review item 1: Achievement of Observatory Purpose:

The science outcome compared to that of external facilities shows that the number of publications is adequate and perfectly in line with similar worldwide facilities. It is certainly competitive with other similar facilities such as the Green Bank Telescope (GBT), the Large Millimeter Telescope (LMT), and the IRAM 30m telescope, especially when considering normalisation by budget, observing time, funding for development, and staff resources.

The charged time model seems to be successful, but its sustainability is difficult to predict. The committee suggests finding ways to attract new users, particularly younger researchers. A weak point identified is that a supervisor needs to train students to work with the telescope and instrumentation, which can be a significant barrier to entry for new and less experienced users. Efforts should be made to streamline the training process and provide comprehensive support and documentation to encourage broader and more independent use of the facility.

The committee suggests that the minimum working model should be to maintain the current staff and budget, and efforts should be made to avoid further reductions. Ensuring this baseline level of support is crucial to sustaining the operations and scientific productivity of the facility.

In view of the limited resources, the Public Outreach activities are fully adequate. The efforts made to engage with the public and disseminate scientific information are commendable, given the constraints on budget and manpower.

Review item 2: Response to the recommendations from previous reviews

The scientific outcomes of the legacy projects have been quite successful, with one out of three being very successful. While the COMING project did not receive enough observing time due to a collimator breakdown, all three projects have produced good quality papers and are contributing valuable data to the Japanese Virtual Observatory (JVO). The committee suggests efforts to get the pipelined data into the JVO and to advertise the potential for archival research to increase the visibility and impact of these projects.

The call for proposals for Large Programmes appears to be well-structured; however, it is unclear why NRO did not receive enough proposals. The committee

would appreciate the opportunity to review the details of the call to better understand the reasons behind the low response rate.

The number of staff is the bare minimum needed to run the charged time. The observatory is already operating with minimal personnel.

Review Item 3: Outcome of Open-Use and comparison with similar projects

Overall, in view of the severe budget restrictions and the challenges posed by the COVID-19 pandemic, the scientific output from the Open Use time is commendable and adequate. When compared to similar facilities, the scientific outcome is extremely good.

Review Item 4: Future Plan

For the next five years, the budget and staff levels should be maintained (adjusted for inflation) to keep the observatory operations, although the committee was not given an opportunity to evaluate Mizusawa.

Therefore, the needs of the Mizusawa observatory cannot be accurately assessed.

Given the current budget restrictions, it seems challenging to operate the three facilities (i.e., NRO, Mizusawa, and ASTE) at the same level. The committee invites NAOJ management to evaluate whether the scientific outcomes justify maintaining all three facilities at the current level. Different paths, such as shutting down one of the three facilities and reallocating the budget to the other two, should be investigated. Another possible solution is to study a synergy programme where the three facilities share engineers, technicians, and administrative staff, operating at different times of the calendar year (for instance, exploiting the winter season in the Northern and Southern Hemispheres for Nobeyama and ASTE).

Actively search for more possibilities for external funding should be considered.

Review Item [1]: Achievement on Observatory's Purpose

(1-1) Is science outcome of the Nobeyama 45-m telescope competitive in the international standard?... (a, b)

(a: FY2019-2021)

In this time period the operations were carried out in open-use mode. The science outcome is along with what is expected for a facility of this size, budget, personnel. The number of refereed papers is considered to lie between a good and excellent scientific standard and comparable to other similar facilities (number of publications is adequate and perfectly reasonable and in line with other similar facilities (GBT, LMT, IRAM30m), considering the normalisation by budget, observing time, funding for development, staff).

(b: FY2022-2023)

The committee cannot investigate this point deeply due to a lack of sufficient statistics. The charged-time use of the facility has only recently been implemented and has gone through just two calls. While the first two years have been successful in terms of response from the user community, there are not yet enough publications available to make a quantitative evaluation.

The committee suggests evaluating it in the coming 2-3 years.

The committee invites the observatory to carefully monitor the efficiency of this operation mode. There might be the danger that a not efficient operations might constitute a fall back and the charged time might become not so attractive anymore. Downtime due to weather and technical problems (and maintenance) should be kept very low and possibly lower than 50%, roughly 60% of the time should produce good data.

The observatory must make sure that the majority of projects gets publishable (useful) data, otherwise the charged time model might not be attractive to users in the near future.

(1-2) Is the operation of the Nobeyama 45-m telescope, for which observation time has been charged since FY2022, appropriate and what kind of feedback has the observatory received from users? (b)

How sustainable is the charged model is difficult to predict even though now it looks like it is easy to find money.

The committee has been made aware that users can easily cover the cost of the charged time with their grants.

The committee invites the observatory to make sure that users get their data.

Access to feedback from the users has been limited to the few interviewed people and from the report of the Director. The responses from young researchers (2 postdocs and a PhD student) were all positive.

Proposals for charged time do not go through a proposal review at the observatory because of lack of staff. The Director stated that the proposals are part of funding proposals which do go through a peer review, which may be sufficient.

Overall, the model seems to work now but the question arises on how to attract new users, especially the younger generation. Attracting non-expert PIs is difficult with the concept of charged time. This may however not be important considering the limited lifetime of the observatory.

During the interviews it turned out that the student process is very welcome and appreciated, however there are two caveats: a better advertisement to reach a larger number of students and a weak point could be because the supervisors have to train the students before working with the telescope and its instrumentation.

(1-3) Do the "Nobeyama development programs" work appropriately and does the observatory support the program at decent level?....(a, b)

After receiving further feedback from the NRO Director, the committee corrected a previous comment related to the development programme.

Originally the Nobeyama Observatory Development Programme aimed to develop facility instruments. However, it is now open to any development using the 45m telescope as test bench for new instruments, observing modes, and other innovations. Moreover, the Nobeyama campus can also be used to install new instruments. All this has the aim to promote Japanese radio astronomy.

HINOTORI, which allows simultaneous observations in three frequency bands (H22+H40+TZ) in single-dish mode, has been accepted as a new observatory facility instrument and is now available for the charged telescope time. The HINOTORI team is currently working to deliver it for VLBI mode.

However, the current focus of the development programme is not on improving the observatory's capabilities. Instead, it is used by the community for developing and

testing instrumentation intended for other telescopes. While this generates some income for the observatory, it is not a significant contribution. Additionally, the programme is used to cultivate technologies for future projects planned by the community.

The 7BEE project (proposed by observatory staff and funded externally) will be used as a facility instrument and can also make some contribution to the funding of operations. The committee applauds this initiative and strongly suggests that priority should be given to this project.

The eQ receiver which is part of a development project could also be used as a facility instrument, and the observatory should give some thought to implement this.

(1-4) Has the observatory successfully obtained external funds and achieved appropriate scientific results with those funds? (a, b)

The charged time can be considered small external funds for operations. The only big projects are the eQ and the 7BEE receivers, which however have not yet achieved science results.

(1-5) Has the observatory contributed to university education, including graduate school? (a, b)

The committee acknowledges the good will by the observatory to reach educational institutions in general and the programme offered, despite the limited budget and personnel, seems to run well. Several lectures are delivered each year at a few universities.

The committee has been shown that roughly six master theses / year are carried out with data acquired at the observatory. In addition some data are linked to PhD papers

(1-6) Has the observatory performed appropriate public outreach and education activities with Minamimaki village in line with MoU between the local Minamimaki village and NRO? (a, b)

The committee received a very good impression by the outreach programme offered by the observatory to visitors and the connection to the Minamimaki village seems to work very well.

(1-7) Are the Observatory's public relations activities, including the scientific results of the Nobeyama 45-m telescope, appropriate? (a,b)

The committee was informed that the observatory activities and research are regularly reported in local and national (popular and scientific) newspapers. A list of articles is among the documentation provided by the project.

(1-8) Are the observatory budget and staffing (including young researchers) adequate? ... (a, b)

The observatory operates on a very low budget and minimal maintenance costs, maintaining a delicate balance. The committee advises against further cuts to the budget and manpower. At the very least, the current staff and budget should be maintained. It is particularly important not to reduce the scientific staff, which should consist of at least two people.

The small number of young staff members raises concerns about future knowledge transfer and the ability to attract the next generation of users.

The observatory should aim to run at least 3000h/year, further reductions of operations is not advisable. If this turns out to be unfeasible the committee invites the management to seriously consider the hypothesis of shutting down the entire facility.

Review Item [2]: Response to the recommendations from previous reviews held in FY 2017 (the NRO 45m Legacy Project Review) and FY 2018 (overall review)

(2-1) Did the "NRO 45m Legacy Projects" produce sufficient scientific outcome? (a)

The three legacy projects are FOREST Unbiased Galactic plane Imaging survey with Nobeyama 45-m telescope (FUGIN), Star Formation, and CO Multi-line Imaging of Nearby Galaxies (COMING).

The committee listened to the presentations by two of the three PIs of the Legacy projects (Dr. Nakamura, and Dr. Sorai) and by Dr. Nishimura, who took over from the former PIs (Drs. Kuno, Umemoto and Minamidami) for the FUGIN project. The slides of the presentations were made available to the committee after the presentations.

The committee agrees that the scientific outcome of all three projects is excellent with the FUGIN project exceeding expectations.

All three legacy project PIs have followed the recommendations made by the review in FY 2017 and tried to publish a large number of scientific papers and when possible, to make the data available to the community.

FUGIN success is very likely due to the good quality of the data and to their

availability to the scientific community. This led to a huge exploitation of the data with many refereed papers (82 at present, April 2024), ten master studies and four PhD theses.

The legacy project COMING was unable to complete data acquisition due to the breakdown of the master collimator in 2017. Despite this setback, the project has published most of the data and produced eight refereed publications. The authors are still completing data analysis and aim to continue publishing their findings. The star formation project has produced dozens of refereed papers, combining NRO 45m data with interferometric data from CARMA, and has extracted a significant amount of scientific insight from the data.

All three projects have produced good quality papers and are contributing valuable data to the Japanese Virtual Observatory (JVO). The committee suggests efforts to get the pipelined data into the JVO and to advertise the potential for archival research to increase the visibility and impact of these projects.

(2-2) Did the Observatory support the Legacy Projects sufficiently? (a)

The presentations and the interviews with the Legacy Project PIs make the committee agree that the observatory personnel have supported the observations of all Legacy Projects and helped them financially with the publication fees.

(2-3) Has the Observatory responded to the recommendation for future large projects similar to the Legacy Projects? (a,b)

In response to the recommendations of the 2017 NRO Legacy Project Review Report (NAOJ-NRO-0007-B), the observatory issued calls for large programmes (LPs) on August 1st of 2018, 2019, and 2020, which were posted on the Astronomical Society of Japan's mailing list. There were no calls for LPs in 2021.

The LPs (2018-present), peer-reviewed by the International TAC, were allocated 300-400 hours spread over 2-3 years. Principal Investigators (PIs) were required to provide progress reports. In total, two LPs were carried out:

- 1 PI: Ken Tatematsu, "The onset of star formation in widely different environments" (deuterated molecules), with 350 hours allocated and 250 hours successfully utilised, completed in 2017-2019.
- 2 PI: Shunya Takekawa, "Complete Imaging of the Dense and Shocked Molecular Gas in the Central Molecular Zone" (Galactic Center), with 400 hours allocated and 310 hours successfully utilised, completed in 2019-2021.

The NRO director claims that time compensation for technical and weather issues was appropriately applied. Several scientific publications resulted from these two programmes.

The provided documentation, the web proof for the 2018 call for proposal, states that there was an open competition and peer review to select the two LPs. The overall oversubscription rate in proposal number was 2.

It is understood that operations were severely underbudgeted and understaffed, necessitating a reduction in the number of hours offered. The Director states that with the present staff is hard to run in parallel more than two LPs in addition to a good number of regular programmes.

The NRO Director informed the committee that the LP started its season after the Legacy projects were over and terminated in 2020-2021 because of the changed policy of charged time observations.

It appears that the observatory accepted LPs from scientific groups that had received substantial grants, assuming these grants had undergone peer review and thus were eligible for observing time as well.

With double the budget and staffing (200 million yen and 25 staff members), it would be possible to revert to the traditional peer review system. This system would facilitate open competition within the community and could potentially increase the number of applications for large programmes.

(2-4) Is the operational policy and staffing of the Observatory appropriate after the termination of Open-Use?

The committee shares the concerns of the observatory that the number of the scientific staff is very low. The committee suggests that at least two scientist positions will be kept even with an offer of 1700h.

However, the committee invites the NAOJ management to consider whether it is worth to maintain the observatory under a very low number of hours offered in operations (~1700h).

(2-5) Does the Observatory go well towards the primary scientific goals defined in the SG&M? (a,b)

In the way the primary scientific goals have been defined in the SG&M it looks like they were fulfilled. However, the completion of the 7BEE project is key and mandatory to achieve them.

Review Item [3]: Outcome of Open-User and comparison with similar projects

(3-1) Has the Nobeyama 45-m telescope achieved sufficiently competitive results through Open-Use? (a)

Operations in period a (2019-2020 and in 2020-2021) were reduced from 3000 to 1700 h and the number of submitted proposals were subsequently reduced from 60-70 (accepted 40) to 20-26 (accepted 10-13).

Operations run from December to March, downtime due to weather and technical failures is as large as 30-40%.

Overall, in view of the severe restrictions in budget and due to covid19 pandemic the scientific outcome from the Open Use time is respectful and adequate.

(3-2) Are the science outcomes of (1-1), (2-1), (2-5), and (3-1) competitive with similar foreign single-dish radio telescopes? (a, b)

The Nobeyama Director has shown carefully collected statistics about the refereed papers published based on data taken with the 45m antenna. These statistics were compared with similar ones from data taken with the Large Millimetre Telescope (LMT), the Green Bank 90m telescope (GBT) and the IRAM 30m Telescope. Statistics, however, cannot be compared one-to-one as each facility has different types of publication reports.

For instance IRAM publishes (<https://iram-institute.org/research/publications/>) publications of the entire IRAM scientific staff many of which relate to different facilities and not strictly those based on IRAM 30m data only.

LMT cannot trace meaningful statistics over the last years because the facility was not stable due to unexpected failure on the infrastructure (a fire, electrical storm and COVID19 travel restrictions). The number of observed hours was not made public available. The number of refereed papers (<http://lmtgtm.org/science/list-of-publications/>) is low and largely driven by its involvement in the Event Horizon Telescope (EHT) project.

GBT's statistics report a very large time on sky (almost 80%) with some regular shutdown for testing every two years (roughly). Number of refereed papers, 73, normalised to the number of observing time (4800h each year) and over two years, makes roughly 8 papers/1000 observing h.

This number is lower than the numbers reported by the Nobeyama Director (67 papers in these years with much less observing time, i.e. 3400h in the same period), i.e. 19/1000 observing h.

Overall, the scientific outcome when compared to other similar facilities is extremely good.

Review Item [4]: Future Plan

(4-1) Advise how does the NAOJ operate NRO, Mizusawa, and ASTE projects efficiently because they are independently operated as of today.

This is a very complicated question to answer. The committee was not given any opportunity to evaluate Mizusawa, and its needs cannot be gauged. Given the current budget restrictions, it seems challenging to operate the three facilities at the same level. The committee invites NAOJ management to evaluate whether the scientific outcomes justify maintaining all three facilities at the current level. Different paths, such as shutting down one of the three facilities and reallocating the budget to the other two, should be investigated. Another possible solution is to study a synergy programme where the three facilities share engineers, technicians, and administrative staff, operating at different times of the calendar year (for instance, exploiting the winter season in the Northern and Southern Hemispheres for Nobeyama and ASTE).

The committee invites the project and the NAOJ management to have better cooperation with the other projects/centres of NAOJ, such as Advanced Technology Centre and Astronomical Data Centre.

(4-2) Evaluate the future plan of the Nobeyama Radio Observatory.

The Nobeyama Director presented a plan for operations and development for the next five to ten years. A fresh approach is necessary to attract students and early-career researchers.

The committee invites the project team to evaluate the probability of antenna failure and the lifetime of other equipment. There is concern that the antenna and control system might require major refurbishment, necessitating a significant budget investment.

The committee encourages the Nobeyama management to continue development projects if they generate sufficient income and are beneficial for operating the telescope. Additionally, alternative funding sources beyond just charged time should be explored to support the facility's operation over the next five to ten years.

Appendix A

External Evaluation Committee (EEC) members

Name		Affiliation
Dr. Paola Michela Andreani	Chair	Visiting professor at Fukui University of Technology, University of Thessaloniki (Greece) and University of Oslo (Norway); Astronomer at European Southern Observatory (ESO)
Dr. Lars-Åke Nyman		Professor Emeritus, Onsala Space Observatory/Chalmers University of Technology; Retired Astronomer at ESO
Dr. Tomoharu Oka		Professor, Department of Physics, Faculty of Science and Technology, Keio University
Dr. Sachiko Okumura †		Professor, Department of Mathematical and Physical Sciences, Faculty of Science, Japan Women's University
Dr. Yoichi Tamura		Professor, Astrophysics Laboratory, Graduate School of Science, Nagoya University

† Also a member of the Project Review Committee.

Appendix B

List of NRO Review Documents

Applicable Documents: (from Secretariat)				
ID	Doc #	Doc Title	File Name	# of Pages
AD01	NAOJ-EEC-NRO-001-B	List of the External Evaluation Committee (EEC) Members	[AD01] EEC Members List for FY2023 NRO Review rev2.pdf	1
AD02	NAOJ-EEC-NRO-002-A	Scientific Goals and Missions - Nobeyama Radio Observatory	[AD02] Scientific Goals and Missions - Nobeyama Radio Observatory_NAOJ.pdf	1
AD03	NAOJ-EEC-NRO-003-B	FY2023 NAOJ Project Review: Review Charges of the Nobeyama Radio Observatory	[AD03] ReviewCharges_NRO_20230725_v2.pdf	3
AD04	NAOJ-EEC-NRO-004-A	Kick-off meeting of the EEC-NRO on Nov 21, 2023	[AD04] NRO Reivew overview (20231121 kick-off meeting).pdf	8
AD05	NAOJ-EEC-NRO-009-A	2023 JFY NAOJ Project Review Plan for Nobeyama Radio Observatory	[AD05] Review Plan for EEC-NRO 20240118_v2.pdf	14

Reference Documents (From Secretariat)				
ID	Doc #	Doc Title	File Name	# of Pages
RD01	NAOJ-EEC-NRO-005-A	Source: Annual Report of the National Astronomical Observatory of Japan FY2019-2022 Nobeyama Radio Observatory	[RD01] Annual Report of NRO 2019-2022e.pdf	10
RD02	NAOJ-EEC-NRO-006-A	出典：国立天文台年次報告 2019-2022年度 野辺山宇宙電波観測所	[RD02] Annual Report of NRO 2019-2022j.pdf	10
RD03	NAOJ-RESO-0015-A	国立天文台平成30年度プロジェクト評価報告書 野辺山宇宙電波観測所 (平成31年3月)	[RD03] FY2018 NAOJ Project Review Report - NRO - NAOJ-RESO-0015-A(20190719).pdf	11
RD04	NAOJ-EEC-NRO-007-A	FY2018 NAOJ Project Review Report – Nobeyama Radio Observatory (March 2019) *English translation of RD03	[RD04] FY2018 NAOJ Project Review Report - NRO - NAOJ-RESO-0015-A(20190719)-E.pdf	10
RD05	NAOJ-NRO-0007-B	2017 NRO Legacy Project Review Report (with English translation for reference)	[RD05] NAOJ-NRO-0007-B - (with English translation).pdf	12
RD06	NAOJ-EEC-NRO-010-A	JSAC response to the NAOJ charge on scientific prioritization of ALMA, NRO 45-m telescope, and ASTE (March 31, 2019)	[RD06] JSACreport_20190331.pdf	3
RD07	NAOJ-EEC-NRO-011-A	NRO 45m open-use report 2019-2020 (2020 May 22, JSAC)	[RD07] FY2019_NRO_Open-use2019-2020_R020522TU_KT.pdf	2
RD08	NAOJ-EEC-NRO-012-A	NRO 45m Open-use 2020-2021 (2021 May 17, JSAC)	[RD08] FY2020_NRO_Open-use2020-2021_R030512-KT_TU.pdf	4
RD09	NAOJ-EEC-NRO-013-A	NRO 45m Open-use 2021-2022 (2022 Jun. 20, JSAC)	[RD09] FY2021_NRO_Open-use2021-2022_R040616.pdf	4

RD10	NAOJ-EEC-NRO-014-A	Charge for the Nobeyama 45m Telescope Time from June, 2022 (5 Dec 2023)	[RD10] 20231205_Charge for the Nobeyama 45m Telescope Time.pdf	4
RD11	NAOJ-EEC-NRO-015-A	Proposal Guideline for Development in Nobeyama Campus (June 2023)	[RD11] nro45_develprop_guideline2023.pdf	3
RD12	NAOJ-EEC-NRO-016-A	Nobeyama Charged Telescope Times (JFY2022_2023)	[RD12] NobeyamaChargedTelescopeTime JFY2022_2023.pdf	3
RD13	NAOJ-EEC-NRO-018-A	Memorandum of Understanding for Cooperation Project of Osaka Prefecture University 1.85m Radio Telescope at Nobeyama Radio Observatory, NAOJ (21 Feb 2023)	[RD13] MoU_OsakaMetropolitanUniv_2023 0401- (with English translation).pdf	5
RD14	NAOJ-EEC-NRO-019-A	Agreement on Mutual Cooperation between Nobeyama Radio observatory and Minamimaki Village (March 27, 2019)	[RD14] Agreement with MinamimakiVillage_20190327-(with English translation).pdf	3
RD15	NAOJ-EEC-NRO-020-A	National Astronomical Observatory of Japan Facility Use Contract (June 10, 2019)	[RD15] Contract with MinamimakiVillage_20190610-(with English translation).pdf	6
RD16	NAOJ-EEC-NRO-021-A	News articles about NRO	[RD16] newspaper.pdf	105
RD17	NAOJ-EEC-NRO-023-A	<u>ALMA/45m/ASTE Users Meeting 2021</u> NOBEYAMA LARGE PROGRAM REPORT I: DEUTERIUM FRACTIONS IN SCUBA-2 CORES IN PLANCK COLD CLUMPS Ken TATEMATSU (NRO, NAOJ), et al.	[RD17] Science_UM2021_NobeyamaReportLargeProgram1_20240313.pdf	9
RD18	NAOJ-EEC-NRO-024-A	<u>ALMA/45m/ASTE Users Meeting 2021</u> Nobeyama Large Program Report II: Galactic Center Shunya Takekawa (Kanagawa Univ.)	[RD18] Science_UM2021_NobeyamaReportLargeProgram2_ShunyaTakekawa.pdf	23
RD19	NAOJ-EEC-NRO-025-A	<u>ALMA/45m/ASTE Users Meeting 2022</u> GC Filaments and Buried SNRs : Solving SN-SF Rate Contradiction Yoshiaki SOFUE (U. Tokyo)	[RD19] Science_UM2022_2022-nro-sofue.pdf	37
RD20	NAOJ-EEC-NRO-026-A	<u>ALMA/45m/ASTE Users Meeting 2023</u> Nobeyama-CIRCUS project: Predicting reliable H2 column density maps from molecular line data using machine learning Yoshito SHIMAJIRI (Kyushu Kyoritsu Univ.)	[RD20] Science_UM2023_20231221_UsersMeeting_YoshitoSHIMAJIRI.pdf	8
RD21	NAOJ-EEC-NRO-027-A	<u>ALMA/45m/ASTE Users Meeting 2023</u> Detection of CO(1-0) emission at the tips of the tidal tail in the Antennae galaxies with NRO 45m Fumiya Maeda (IoA, U Tokyo)	[RD21] Science_UM2023_Maeda_20231222_ALMAUM_v2.pdf	13
RD22	NAOJ-EEC-3PROJECTS-002-A	Operation Expenses Grants allocated to NAOJ (Tsuneta)	[RD22] NAOJ_Operation_Expenses_Grants_v2.pdf	8

Deliverable Documents (From NRO):				
ID	Doc #	Doc Title	File Name	# of Pages
DD01	NAOJ-EEC-NRO-008-A	NRO Member List	[DD01] NRO_Member_List_v2.pdf	2
DD02	NAOJ-EEC-NRO-017-A	RADIO ASTRONOMY RESEARCHES WITH THE NOBEYAMA45 M TELESCOPE AND THE STATE-OF-THE-ART RECEIVERS (5 Mar 2024)	[DD02] ResearchPlanProposal_Nobeyama202311b_short.pdf	34
DD03	NAOJ-NRO-0022-A	2023JFY NAOJ Project Review Material by the Nobeyama Radio Observatory	[DD03] NAOJ-NRO-0022-A_NobeyamaReviewMaterial_20240306.pdf	65

Presentation Slides (From NRO):				
ID	Doc #	Doc Title	File Name	# of Pages
PS02	NAOJ-EEC-NRO-022-A	Review Material by the observatory	[PS02] ReviewMaterialKenTatematsu20240310_2in1.pdf	47
PS03_rev	NAOJ-EEC-NRO-030-B	Development Proposals on the NRO 45m Telescope 2019 – 2022	[PS03_rev] Development_Proposals_NRO45m(2019-2022)_CMiya.pdf	13
PS04	NAOJ-EEC-NRO-029-A	Observation toward M17 SW Giant Molecular Cloud using 7BEE receiver installed on NRO 45m (Nishimura)	[PS04] ScienceOutcomes2_Nishimura_nenkai2024a-7bee-en.pdf	13
PS05	NAOJ-EEC-NRO-023-A	Science outcomes (Digest of RD17 to RD21)	[PS05] ScienceOutcomes1_AbstractSciencePP T.pdf	30
PS06	NAOJ-EEC-NRO-031-A	Development of Seven BEam Equipment (7BEE) for the Nobeyama 45-m Telescope (Nishimura)	[PS06] Development7BEE_aprim2023.7bee.nro-review.pdf	14
Presentation Slides (From Directorate):				
PS01	NAOJ-EEC-3PROJECTS-001-A	Optimization of radio projects in NAOJ	[PS01] 2024MaryMizNROASTE.pdf	6
Presentation Slides (From Interviewee):				
PS07	NAOJ-EEC-NRO-032-A	Star Formation Legacy Project PI: Fumitaka Nakamura (NAOJ)	[PS07] LegacyProject_NROreview-SF-nakamura.pdf	14
PS08	NAOJ-EEC-NRO-033-A	風神 FUGIN: FOREST Unbiased Galactic plane Imaging survey with the Nobeyama 45-m telescope	[PS08] LegacyProject_nro-review_fugin.pdf	4
PS09	NAOJ-EEC-NRO-034-A	CO Multi-line Imaging of Nearby Galaxies (COMING)	[PS09] LegacyProject_COMING_NRO_Review_240321.pdf	12

Appendix C

NRO Review meeting timetable

Day 1 Date: Thursday, March 21, 2024 9:00–17:30	
Place: NAOJ NRO Campus, Observing Building, Meeting Room B	
◆Advance Meeting (Closed)	
09:00 – 09:35	EEC meeting
◆Interview (1) (Closed)	
09:30 – 10:00	Interview with a PhD student @ Chile (zoom)
◆Mutual Introductions (Open)	
10:00 – 10:08	Introduction of the project members to the EEC; Introduction of the EEC members to the attendees and of the agenda of this Review meeting.
◆Presentation from NRO (1) (Open)	
10:08 – 10:47	Introduction of the project
10:47 – 10:54	(Break)
10:54 – 12:14	Presentation from the project for Review Items [1] [2] + Q&A
12:14 – 13:15	(Lunch Break)
◆Presentation from NRO (2) (open)	
13:15 – 13:55	Presentation from the project for Review Items [1] [2] + Q&A (continued)
◆Observatory Tour	
13:55 – 15:00	Observatory Tour (45-m Radio Telescope and Exhibition Room)
◆Interview (2) (Closed)	
15:00 – 15:30	Interview with postdocs (zoom)
15:30 – 16:30	Interview with project members : all PIs of the Legacy Projects (zoom)
◆Discussion (Closed)	
16:30 – 17:30	EEC meeting

Day 2 Date: Friday, March 22, 2024 9:00–15:28	
Place: NAOJ NRO Campus, Observing Building, Meeting Room B	
◆Discussion (Closed)	
09:00 – 09:25	EEC meeting

◆Presentation from NRO (3) (Open)	
09:25 – 11:00	Presentation from the project for Review Items [1] [2] [3] + Q&A
11:00 – 11:10	(Break)
11:10 – 11:40	Presentation from the project for Review Items [4] + Q&A
◆Interview (3) (Closed)	
11:40 – 12:05	Interview on NRO partnership activities with Minamimaki Village
12:05 – 13:00	(Lunch Break)
13:00 – 14:00	Interview with NAOJ Executive of NRO and NRO director
◆Discussion (closed)	
14:00 – 15:17	EEC meeting
◆Closing (Open)	
15:17 – 15:28	Executive Summary (Briefing to the project members)

Note:

- Open = open to the project members (not public)
- EEC = External Evaluation Committee, NRO = Nobeyama Radio Observatory

Review Items

- [1] Achievement on Observatory's Purpose
- [2] Response to the recommendations from previous reviews held in FY 2017 (the NRO 45m Legacy Project review) and FY 2018 (overall review)
- [3] Outcome of Open-Use and comparison with similar projects
- [4] Future Plan