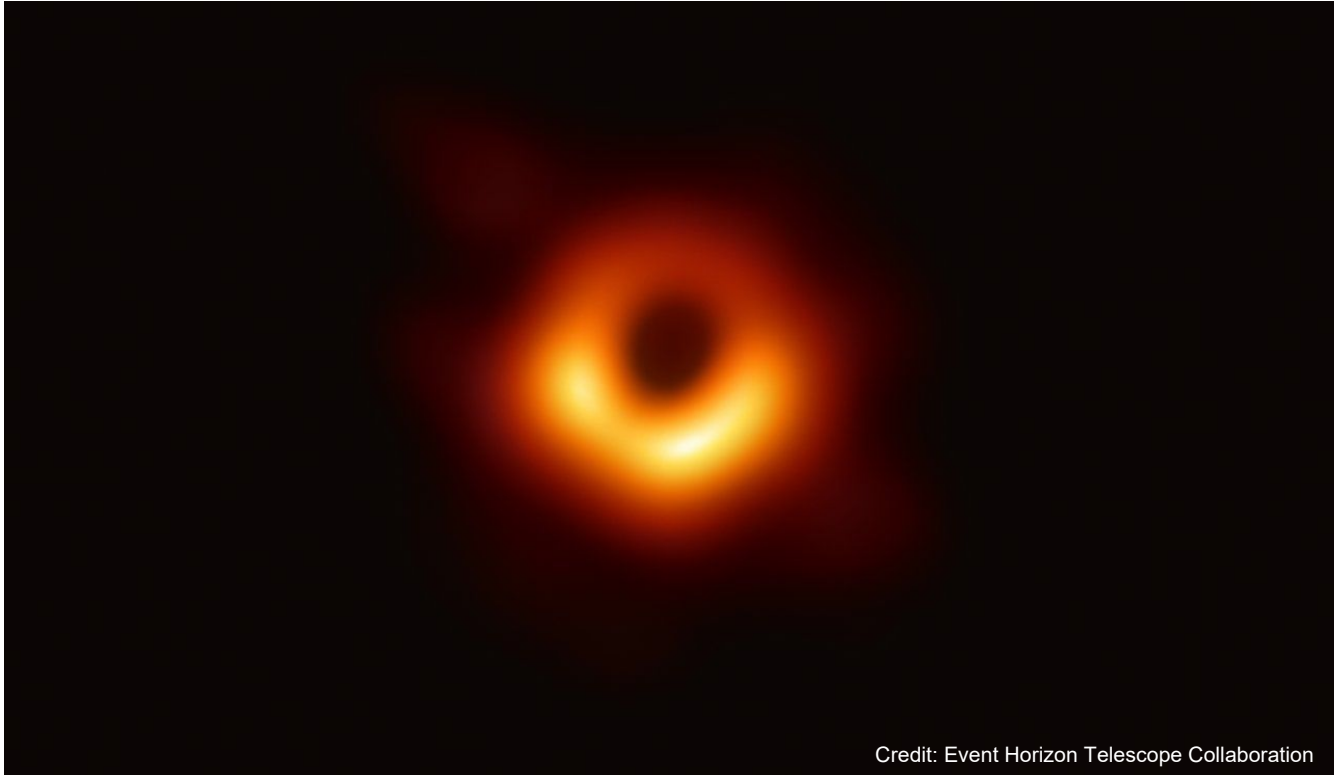


Report for the 2020 NAOJ PRC Review



PRC International Visiting Committee:
Mr. Lars Lindberg Christensen (Chair)
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Executive Summary

In the opinion of the PRC International Visiting Committee (PRCIVC), the NAOJ Public Relations Center (PRC) fully passes the 2020 review.

The PRC is the leading astronomy Education and Public Outreach (EPO) office in Japan and also has a goal to improve the reputation and knowledge of NAOJ internationally. The PRC is more than just a public relations center for the NAOJ; it serves an important set of rather diverse service functions for NAOJ and fulfills hugely societal functions, the importance of which cannot be overstated.

The PRC is commended for its huge progress and we offer 30 specific recommendations for the charges from NAOJ on page 8, which we hope may serve as suggestions for how to adapt to the changing needs of internal audiences and external pressures stemming from a changing society with different priorities than in the past:

1. **Recommendation 1:** We encourage PRC staff to keep up the current rate of producing publications and to ensure that these publications are recognized internally and externally as part of the NAOJ publications records. This is cost-neutral.
2. **Recommendation 2:** Consider incorporating the Subaru Telescope, TMT, and ALMA EPO efforts into the PRC, thereby enabling a closer collaboration and synergy especially in the areas of news production and community relations in Hawai'i and Chile. As also partly mentioned in the 2008 evaluation, the PRCIVC recommends enhancing the synergy between the Subaru Telescope, ALMA, TMT, and the PRC in order to better reach the desired target groups, ideally merging these EPO groups into the PRC. This is cost-neutral.
3. **Recommendation 3:** It is important for NAOJ to consider setting up a small internal communication team to share the most important organizational information and news in Japanese and English with staff at all sites (including the Subaru Telescope, ALMA and others). We recognize that this cannot be done without extra resources.
4. **Recommendation 4:** It may be beneficial for NAOJ to include communication with the community of scientific users of all NAOJ-related telescope and computing facilities in the PRC's remit and to set up a small user communications team for this. We recognize that this cannot be done without extra resources.
5. **Recommendation 5:** A continuation of the push for English translations would be valuable to NAOJ and the PRC and the hard-working individuals should be congratulated. This is cost-neutral.
6. **Recommendation 6: (a)** Find a way to capitalize on the big Galaxy Cruise development effort and in the longer run develop other projects based on NAOJ data. This includes making sure that the project lead and web designer are supported and given creative opportunities. **(b)** In order to keep Galaxy Cruise in the public eye, issue additional press releases upon reaching various milestones such as 10,000 objects classified, 100,000 classifications by citizens, etc.
7. **Recommendation 7:** To improve the distribution of the NAOJ images, videos and texts by removing the existing complicated terms of use and replace them with a [Creative Commons Attribution](#) license. By making the assets available more freely without barriers NAOJ can better follow the needs of especially younger audiences. This is cost-neutral.

8. **Recommendation 8:** Synergies could possibly be gained by merging everyone dealing with external (non-media) questions by phone, social media, email etc. into the same unit in the Outreach Office. The PRC is encouraged to consider slimming down the workflow and finding the least time-intensive way to answer questions. Promoting the existing FAQs could be one way. This could be cost-saving.
9. **Recommendation 9:** Make a focused effort (in-house or outsourced, perhaps to well-respected amateur astrophotographers) to produce color images from data from all NAOJ telescopes (including the Subaru Telescope and ALMA). This would require a limited amount of extra resources.
10. **Recommendation 10:** If it does not already exist, set up a well-documented process for deciding on press releases contained within the PRC, with the press officers advising on the “public appeal”, an on-team scientist advising on the scientific importance and a clear decision point (possibly the Head of PRO). Make sure that the last decisions on press releases are made by the science communicators. This is cost-neutral.
11. **Recommendation 11:** In addition to reporting the number of attendees and the number of media companies represented in the Astronomy Lectures for Science Journalists program, it would be interesting to assess how many of the attendees have subsequently reported on NAOJ science results. This could be done at no charge using Google News or at modest cost using a media-monitoring service such as Meltwater or Cision.
12. **Recommendation 12:** In some cases it would be beneficial if the above lectures are promoted a bit more, to increase their visibility. Targeted promotion plans ought to be made for each project. This would require a limited amount of extra resources.
13. **Recommendation 13:** The PRCIVC recommends that NAOJ continue allowing open access to the Mitaka campus as much as possible. With the decreasing use of the on-site domes for research work, opening a larger part of the campus garden to the public could even be considered, as long as this does not demand extra resources from the Outreach Office.
14. **Recommendation 14:** Investigate the possibility of finding amateur astronomers to repair and/or upgrade the 50-cm telescope in exchange for telescope time. This could be cost-neutral.
15. **Recommendation 15:** If the Subaru Telescope, TMT, and ALMA EPO efforts are merged into the PRC as recommended in recommendation 2 above, support for the Maunakea problem locally on the Big Island should be intensified, for instance, by engaging more with the local communities. It could provide synergies for everyone involved to join some of the existing outreach programs on the Big Island, including [Journey through the Universe](#). This will require extra resources but may be necessary to maintain long-term access to Maunakea for the Subaru Telescope, as well as to maintain a chance that TMT is placed there.
16. **Recommendation 16:** Find at least one additional person who can help with the ephemeris work and eventually be a candidate to lead the team’s efforts. Because the calculation of ephemerides is fundamental to NAOJ, it is important to train astronomers and/or engineers who can properly do the calculations and provide predictions of astronomical phenomena. This will require extra resources.
17. **Recommendation 17:**
 - (a) There are numerous free online star-charting and planetarium programs such as Stellarium, WorldWide Telescope or even Aladin Lite. We recommend that the ECO contact the providers of these programs to find out whether they have an API that the ECO could use to generate

more modern, attractive, and user-friendly graphical displays without having to create an all-new Sky Viewer. This will require a small effort for research and possibly a modest effort for implementation.

(b) The PRCIVC realizes that the current Sky Viewer has a lot of functionality built into it, and the general public likes it, as the access statistics of the Sky Viewer website show. Since the tool has a lot of functionality built into it, it would benefit from better instructions on how to use it. These recommendations would require a limited extra effort upfront, but could lead to savings long-term.

18. **Recommendation 18:** The PRCIVC considers that the library is a very important research tool and should be maintained. However, since the library accounts for about 60% of the total supply costs of the PRC it does not seem sustainable to subscribe to nearly all available astronomical journals. Reducing the costs for the library is not straightforward, and due investigation of the impact on the research activities at NAOJ should be made. The PRCIVC also recommends that the budget for the library is split from the PRC budget and that NAOJ deals with the budget for the library independently of the budget of the PRC. It may be useful to align the journal offer across all NAOJ sites (Mitaka, Nobeyama, Hawai'i, etc.) to reduce the total costs for the journal subscriptions, but this is a scientific decision, not a PRC decision. This recommendation is cost-saving.
19. **Recommendation 19:** The maintenance for the air-conditioned storage (e.g., for air conditioners) may have to be renewed in the near future since they have already been in use for 20 years.
20. **Recommendation 20:** Perhaps the English edition of the NAOJ Annual Report should be electronic only, to avoid the high cost of low-volume printing; instead, it could be made available for download by the small number of people who need access to it. The same might be said for some of the office's other materials and publications in languages other than Japanese, to be assessed on a case-by-case basis. This should be cost-saving.
21. **Recommendation 21:** Given the amount of content in *Rika-Nenpyo*, we feel that serious consideration should be given to raising the price, perhaps by a modest increment each year to avoid a decline in sales. This should be cost-saving (or, more accurately, revenue-positive).
22. **Recommendation 22:**
 - (a):** When considering whether to produce a publication, either a new edition of an earlier publication or an entirely new publication, staff should consider the following questions: What is the purpose of this publication? Who is our target audience (and do we have a clear distribution plan, including contact info/addresses)? If our target audience goes beyond Japan and will require one or more international translations/editions, is there a sufficiently large audience to justify printing these editions, or should they be digital only? Would it be reasonable to charge for the publication, and if so, how much? In short, decisions on what to produce, and what to print, should be based on realistic expectations, preferably based on sales figures or other data. This should be cost-saving or, in some cases, revenue-positive.
 - (b):** The Publications Office should consider whether there are any new publications it could produce and sell to the astronomy-interested Japanese public (i.e., the general public or certain segments of it, such as teachers, students, amateur astronomers) that would further the mission of the PRC while at the same time generating significant revenue. This might require additional resources, but these could be more than offset by additional revenue.

23. **Recommendation 23:** We recommend that NAOJ more fully embrace the OAO as an integral part of the PRC and take more credit for its successes, even though the OAO is also part of the IAU. Where possible and appropriate, the NAOJ logo should appear wherever the OAO logo itself appears (e.g., on publications, in social media). OAO's global network of National Outreach Contacts (NOCs) should be recognized as a valuable resource and put to better use to publicize NAOJ projects. Most importantly, there should be more collaboration/partnership, as appropriate and useful, between OAO staff and other PRC staff. This is cost-neutral.
24. **Recommendation 24:** Take a close look at what has been translated to assess the degree to which this material does, or does not, advance the mission of the OAO specifically and the PRC generally. If many of the materials are education-related, perhaps some of the Translation Network work should be managed by the PRC's Outreach and Education Office, which would alleviate the strain on the OAO. If the work of the Translation Network is found mostly to fall outside the remit of the OAO and/or the PRC, then we would recommend seeking a new home for it elsewhere, preferably within the IAU, for example, at the new IAU Office of Astronomy for Education, or outside the IAU, for example, at Astronomers Without Borders or some other organization with a global membership. This recommendation is cost-saving, or at least cost-neutral.
25. **Recommendation 25:** As noted elsewhere in this report, the offices within the PRC should communicate slightly better with each other and cooperate/collaborate more effectively (for instance to distribute important policy advocacy information). This is cost-neutral.
26. **Recommendation 26:** Concerning a replacement for the Head of SMO, who will be retiring within three years, if there are truly no other Japanese radio astronomers sufficiently interested in spectrum management, NAOJ should consider recruiting an individual from another country to join the staff of NAOJ and assume responsibility for spectrum management. This recommendation ought to be nearly cost-neutral.
27. **Recommendation 27:** PRCIVC recommends the PRC to find a sustainable way to continue the 4D2U Dome Theater.
28. **Recommendation 28:** It is recommended that the PRC write a short, clear NAOJ EPO strategy, ideally including as many of the PRCIVC recommendations as possible in order to think longer term, and articulate the strategic thinking.
29. **Recommendation 29:** To include the very nice impact metrics shared with the PRCIVC into the regular workflows, to make fact-based cost/benefit analyses of the work using metrics and to prioritize the projects. This is cost-neutral.
30. **Recommendation 30:** If it is decided that fundraising would be helpful to contribute to the PRC's budget in order to continue must-have projects, we offer the following guidance and ideas:
- Reduce the number of library journal subscriptions: a small reduction in some of the least-read journals would lead to a substantial saving.
 - External funding sources could possibly be tapped into, like philanthropists or science-interested foundations, which may invite grant proposals. This, however, would require personnel.
 - A "support NAOJ" button could be added on the web. Maybe offer a way to get tax breaks for qualified donors.
 - It would be reasonable to charge a nominal entrance fee for some of the visitor activities.

- A volunteer program could contribute with person-power (but also requires a fraction of a staff member to run it).
- Consider increasing the income made from publications (see Charge 5 above).
- Move the library office out of the PRC, at least in terms of the budget. The personnel costs are fixed, and the library costs have so far been considered very “inelastic”, so any PRC savings make an outsize impact on the rest of the budget.

This recommendation is cost-saving.

As experienced in other parts of the world, funding is limited and the scope of public-facing tasks for science organizations keeps expanding in line with changes taking place in society.

The 2020 PRC International Visiting Committee Review

The PRC International Visiting Committee (PRCIVC) is an important advisory body to the Director General of NAOJ.

The review took place on 27–28 February 2020. The PRCIVC members are:

1. Mr. Lars Lindberg Christensen (Chair)
2. Dr. Richard Tresch Fienberg
3. Dr. Hideyo Kawakita
4. Dr. Chisato Ikuta

Charges for Assessment

Within the broad assessment, the PRCIVC was asked to assess and comment specifically on the following charges:

1. Does the **Public Relations Office** adequately carry out its functions, such as issuing press releases and organizing publicity activities on research results with cooperating NAOJ's projects or other institutes/universities, within its limited resources?
2. Are the outreach activities led by the **Outreach and Education Office** appropriate, in terms of its role as the National Center of Astronomy?
3. Is the **Ephemeris Computation Office** working effectively within its limited resources?
4. Is the **Library** maintained properly?
5. Is the **Publications Office** working effectively to publish various publications such as the Chronological Scientific Tables (Rika-Nenpyo) and Annual Reports of NAOJ?
6. Is NAOJ, as an organization, making appropriate contributions to the **international community** by maintaining the Office for Astronomy Outreach?
7. Is the establishment of the **Spectrum Management Office** in 2019 within the PRC appropriate, in terms of the functions of the PRC?
8. To what degree do you feel the PRC is achieving against each of its missions, **from the global standard point of view**?
9. What activities of the PRC can be identified as **unique, from a global perspective**? Are there any visibly distinct activities of the PRC which stand out and can be recognized from other countries.?
10. How do you evaluate the effort and advancement made by the PRC to overcome issues that were raised by the international **review evaluations held in 2008 and 2015**?
11. What do you expect from the PRC in **the next ten years**?

In the following text we have dedicated one section per charge numbered 1-11, and one section for the PRC in general (section 0). Each subsection is numbered according to its recommendation number.

Introduction

NAOJ is one of the world's largest and most prominent national astronomical observatories. Scientifically it fulfills the very important missions of designing, building, and operating observatories and computational facilities. But NAOJ also has a very important social remit, including "to bring benefits to society through astronomy public outreach" and "to make our research outcomes widely known to society and pass on our dreams to future generations". The NAOJ Public Relations Center (PRC) fulfills this important part of the remit.

Science and technology have a major impact on society, and their impact is growing. By making life easier, science has given humans the chance to pursue societal concerns such as ethics, aesthetics, education, and justice, to create cultures, and to improve human conditions. It has a specific role, as well as a variety of functions for the benefit of our society: creating new knowledge, improving education, and increasing the quality of our lives.

Science communication and education are vital parts of every science organization. They not only serve to provide a stronger understanding of current research and its wider relevance to society but help to build support, which, at a practical level, may lead to a better justification for research and funding. One of the simplest ways to increase awareness of an organization is through outreach materials, or assets, whose exploitation can be efficiently increased by allowing people to use them as widely as possible.

The societal changes that have taken place over the last decade push strongly in the direction of co-creation, co-ownership, interaction, and engagement. Our audiences want to take part and be involved in the work we do. This bilateral engagement is important, especially with our local communities at the observing sites. This is of vital importance today, underscored by the current challenges at the site on Maunakea and the social unrest in Chile.

0. The NAOJ Public Relations Center

The PRC is the leading astronomy Education and Public Outreach (EPO) office in Japan and also has a goal to improve the reputation and knowledge of NAOJ internationally. The PRC is more than just a public relations center for the NAOJ; it serves an important set of rather diverse service functions for NAOJ and fulfills hugely important societal functions, including calculating and publishing an annual astronomical ephemeris and maintaining visits and open access to the Mitaka Campus, including to the 4D2U planetarium, a museum for historical astronomical instruments and books, a library for scientists and the public alike, and star parties and other events. The PRC also functions as a call center for astronomical questions, serves as protector of the night and radio sky, and also makes significant contributions to science communication research, education research, and astronomy research. Overall this makes the PRC's functions very rich but also gives it a somewhat fragmented scope. The PRCIVC, however, sees this more as a strength — a “feature” rather than a “bug”.

The present PRC consists of the eight offices with roughly 18 full-time and 19 part-time staff (including 6 tenured staff):

1. Public Relations
2. Outreach and Education
3. Ephemeris Computation
4. Publications
5. Library
6. Spectrum Management
7. The IAU-NAOJ Office for Astronomy Outreach
8. General Affairs

The PRCIVC understands the PRC's mission to be:

- Share Latest Astronomy Findings with Public
- Offer People Astronomy Information Relevant to Society and Research
- Enrich Lives of People Through More Familiar Relationship with Astronomy

The PRC is headed by the PRC director, who provides unified leadership and management of the PRC operations. Each of the offices under the PRC has an office head who is responsible for its management.

Before addressing the specific charges to the PRCIVC, we have some general observations and recommendations:

0-1. PRC research publications

The PRC members have maintained a very prolific and important publications record in science communication, education, and astronomical research giving rise to many important publications every year in peer-reviewed and gray literature. The PRCIVC recognizes this important work and the PRC is commended for making time for this, and also to train themselves and others.

Recommendation 1: We encourage PRC staff to keep up the current rate of producing publications and to ensure that these publications are recognized internally and externally as part of the NAOJ publications records. This is cost-neutral.

0-2. Merging the PRC with ALMA, TMT, and Subaru Telescope EPO

The Subaru Telescope and ALMA EPO efforts work somewhat independently from the PRC. The PRCIVC believes that there are synergies to be gained by a closer collaboration with these premier NAOJ observational facilities.

Recommendation 2: Consider incorporating the Subaru Telescope, TMT, and ALMA EPO efforts into the PRC, thereby enabling a closer collaboration and synergy especially in the areas of news production and community relations in Hawai'i and Chile. As also partly mentioned in the 2008 evaluation, the PRCIVC recommends enhancing the synergy between the Subaru Telescope, ALMA, TMT, and the PRC in order to better reach the desired target groups, ideally merging these EPO groups into the PRC. This is cost-neutral.

0-3. Internal communication

In times of social change and active social movements, people feel motivated to have greater participation in the decision-making of their social, labor, and national groups. Organizations adapt to being prepared to receive and address the concerns of their employees in this area by communicating more intensely *internally* and facilitating a diverse and inclusive work environment.

Recommendation 3: It is important for NAOJ to consider setting up a small internal communication team to share the most important organizational information and news in Japanese and English with staff at all sites (including the Subaru Telescope, ALMA and others). We recognize that this cannot be done without extra resources.

0-4. User communication

The way that communication is done with the astronomical community of NAOJ-facility users was not discussed in detail during the review, but the PRCIVC recognizes that many of the same skills, tools and techniques used in other outreach efforts can be deployed to reach this target group as well.

Recommendation 4: It may be beneficial for NAOJ to include communication with the community of scientific users of all NAOJ-related telescope and computing facilities in the PRC's remit and to set up a small user communications team for this. We recognize that this cannot be done without extra resources.

1. Public Relations Office

Charge 1: Does the **Public Relations Office (PRO)** adequately carry out its functions, such as issuing press releases and organizing publicity activities on research results with cooperating NAOJ's projects or other institutes/universities, within its limited resources?

The PRO is congratulated on substantial and in some cases outstanding media relations successes, for instance, gravitational wave follow-up, and the Event Horizon Telescope (EHT) release and press conference. Overall, the PRO is considered to adequately carry out its functions.

1-5. Internationalization of NAOJ and the PRC

In general, there has been a big push for more English materials, also on the web. The new PRC [website](#) is really nice and describes the different areas well. This is a big step forward for the internationalization of NAOJ and the PRC is commended for this important work!

Recommendation 5: A continuation of the push for English translations would be valuable to NAOJ and the PRC and the hard-working individuals should be congratulated. This is cost-neutral.

1-6. Galaxy Cruise

As mentioned in the Introduction, the expectation of modern science consumers is to be able to co-create and interact with the science. The PRCIVC was very pleased to see the launch of the Galaxy Cruise citizen-science project, which was produced under a collaboration between the PRC and the Subaru Telescope. By having both Japanese and English versions, Galaxy Cruise will surely attract wide participation both throughout Japan and internationally.

We admit to some surprise that Galaxy Cruise was coded internally rather than developed using an existing platform such as Zooniverse, but at the same time we do not think this has created any problems; Galaxy Cruise appears to work extremely well and is very user-friendly. At this point, with the software already developed, the challenge is to see if it can be used with other NAOJ data sets (e.g. ALMA) to create additional citizen-science projects.

Many citizen-science projects have resulted in peer-reviewed journal articles announcing scientific discoveries enabled by citizen efforts. There is every reason to expect that Galaxy Cruise will join these other projects and produce one or more scientific papers. We look forward to that.

Recommendation 6: (a) Find a way to capitalize on the big Galaxy Cruise development effort and in the longer run develop other projects based on NAOJ data. This includes making sure that the project lead and web designer are supported and given creative opportunities. (b) In order to keep Galaxy Cruise in the public eye, issue additional press releases upon reaching various milestones such as 10,000 objects classified, 100,000 classifications by citizens, etc.

1-7. Image and video licensing

It is difficult for the users of images and videos to figure out whether the NAOJ assets can be used for their various purposes, and what seems to be a ban on commercial use seems counterproductive. Having complex rules, or enforcing questions, registration, and online forms before allowing assets to be downloaded, can put off users, thus restricting how widely the assets are distributed. Without such hoops to jump through, users can redirect their efforts away from copyrights and permissions and towards creativity with the assets. These measures, however, often require considerable control over the materials to be relinquished, allowing for adaptations, and even commercial exploitation, of the materials.

Recommendation 7: To improve the distribution of the NAOJ images, videos and texts by removing the existing complicated terms of use and replace them with a [Creative Commons Attribution](#) license. By making the assets available more freely without barriers NAOJ can better follow the needs of especially younger audiences. This is cost-neutral.

1-8. New Astronomical Objects and other requests

It is not clear to the PRCIVC why the staff members who work in the New Astronomical Objects area are separate from those who answer questions from the public and perhaps even different from those who manage NAOJ's social media activities.

Recommendation 8: Synergies could possibly be gained by merging everyone dealing with external (non-media) questions by phone, social media, email etc. into the same unit in the Outreach Office. The PRC is encouraged to consider slimming down the workflow and finding the least time-intensive way to answer questions. Promoting the existing FAQs could be one way. This could be cost-saving.

1-9. Production of color images

The magnificent observations from the many NAOJ telescopes have a huge potential to excite the different audiences and this is already exploited. However, the production of images deserves targeted attention to streamline the production and enable a team to also produce images on short timescales.

Recommendation 9: Make a focused effort (in-house or outsourced, perhaps to well-respected amateur astrophotographers) to produce color images from data from all NAOJ telescopes (including the Subaru Telescope and ALMA). This would require a limited amount of extra resources.

1-10. Press release decision process

To the PRCIVC it appears that the process for deciding on press releases is somewhat complex and involves higher-level staff outside the PRC, who may or may not be able to react on short timescales. There could be improvements to the speed and efficiency of workflows and the decision-making process by streamlining and in-sourcing this process.

Recommendation 10: If it does not already exist, set up a well-documented process for deciding on press releases contained within the PRC, with the press officers advising on the "public appeal", an

on-team scientist advising on the scientific importance and a clear decision point (possibly the Head of PRO). Make sure that the last decisions on press releases are made by the science communicators. This is cost-neutral.

1-11. Outcome of Astronomy Lectures for Science Journalists program

Recommendation 11: In addition to reporting the number of attendees and the number of media companies represented in the Astronomy Lectures for Science Journalists program, it would be interesting to assess how many of the attendees have subsequently reported on NAOJ science results. This could be done at no charge using Google News or at modest cost using a media-monitoring service such as Meltwater or Cision.

1-12. Promotion

The PRC are producing magnificent outreach and communication products, but in order to come full cycle and increase the return on investment, a small increase in the promotion effort is recommended.

Recommendation 12: In some cases it would be beneficial if the above lectures are promoted a bit more, to increase their visibility. Targeted promotion plans ought to be made for each project. This would require a limited amount of extra resources.

2. Outreach and Education Office

Charge 2: Are the outreach activities led by the **Outreach and Education Office** appropriate, in terms of its role as the National Center of Astronomy?

The activities led by the Outreach and Education Office are deemed appropriate, but the funding situation is threatening its well-functioning activities.

2-13. Campus visits

The NAOJ Campus serves a very important societal function in the Chofu, Mitaka and Osawa area with free access for citizens to walk in the lush gardens — which year by year have been taken better and better care of by NAOJ's facility people — or to visit some of the many historical domes. Over the years there has been a very impressive increase in the number of visitors to around 50,000, which is remarkable, especially in light of the fact that the available budget for these activities has been significantly reduced in recent years.

Recommendation 13: The PRCIVC recommends that NAOJ continue allowing open access to the Mitaka campus as much as possible. With the decreasing use of the on-site domes for research work, opening a larger part of the campus garden to the public could even be considered, as long as this does not demand extra resources from the Outreach Office.

2-14. The 50-cm telescope

The materials we reviewed included this statement: “The 50-cm Telescope for Public Outreach built in 1995 is wearing out; in the near future a replacement of the electrical system or maybe renovation of the controller will become necessary. Securing the funds for these projects will become an issue.” Similar issues have arisen at public observatories in other countries, and their experience offers a potential solution: invite local amateur astronomers with relevant engineering expertise to make the repairs and/or upgrades at their own expense in exchange for telescope time, that is, regular access to the telescope for their own observing and imaging projects when the telescope is not otherwise being used for NAOJ activities and programs.

Recommendation 14: Investigate the possibility of finding amateur astronomers to repair and/or upgrade the 50-cm telescope in exchange for telescope time. This could be cost-neutral.

2-15. Local engagement issues in Hawai‘i and in Chile

Recommendation 15: If the Subaru Telescope, TMT, and ALMA EPO efforts are merged into the PRC as recommended in recommendation 2 above, support for the Maunakea problem locally on the Big Island should be intensified, for instance, by engaging more with the local communities. It could provide synergies for everyone involved to join some of the existing outreach programs on the Big Island, including [Journey through the Universe](#). This will require extra resources but may be necessary

to maintain long-term access to Maunakea for the Subaru Telescope, as well as to maintain a chance that TMT is placed there.

3. Ephemeris Computation Office

Charge 3: Is the **Ephemeris Computation Office** working effectively within its limited resources?

The PRCIVC finds the performance of the Ephemeris Computation Office (ECO) to be excellent even within its limited resources. ECO plays a unique role in the calculation of an annual ephemeris, prediction of astronomical phenomena, and providing useful information that is required by the general public. The pageviews (PVs) of the ECO website vastly exceed those of the top page of the NAOJ, clearly showing that the general public requires and appreciates the information provided by ECO.

Some of the predictions of astronomical phenomena by ECO are utilized by the Outreach and Education Office to create attractive content for the general public such as the Night Sky Guide, one of the web features that are most popular among the general public.

In addition to its popularity, calculating ephemerides and providing the results to the general public is one of the two primary missions of NAOJ and should therefore be sustained.

3-16. Succession planning

Recommendation 16: Find at least one additional person who can help with the ephemeris work and eventually be a candidate to lead the team's efforts. Because the calculation of ephemerides is fundamental to NAOJ, it is important to train astronomers and/or engineers who can properly do the calculations and provide predictions of astronomical phenomena. This will require extra resources.

3-17. Sky Viewer

The PRCIVC is impressed by the popularity of the Sky Viewer, even if its graphical display is primitive by modern standards and its instructions sparse.

Recommendation 17:

(a) There are numerous free online star-charting and planetarium programs such as Stellarium, WorldWide Telescope or even Aladin Lite. We recommend that the ECO contact the providers of these programs to find out whether they have an API that the ECO could use to generate more modern, attractive, and user-friendly graphical displays without having to create an all-new Sky Viewer. This will require a small effort for research and possibly a modest effort for implementation.

(b) The PRCIVC realizes that the current Sky Viewer has a lot of functionality built into it, and the general public likes it, as the access statistics of the Sky Viewer website show. Since the tool has a lot of functionality built into it, it would benefit from better instructions on how to use it.

These recommendations would require a limited extra effort upfront, but could lead to savings long-term.

4. Library

Charge 4: Is the **Library** maintained properly?

The review committee considers that the Library is maintained properly, possibly even too well given the funding situation. The Library Unit collects and sorts scientific journals and books and those books and journals are open even for non-NAOJ personnel including researchers, students and citizens. Although the budget situation is very severe owing to the increase of prices of online journals (almost constantly increasing by about 5% a year), the Library Unit is trying to reduce costs, especially for journals, by working on the contracts with publishers (also in a bigger consortium with other organizations). Still, the Library costs are high (around 5 times the equivalent of the US National observatory).

4-18. Library budget

Recommendation 18: The PRCIVC considers that the library is a very important research tool and should be maintained. However, since the library accounts for about 60% of the total supply costs of the PRC it does not seem sustainable to subscribe to nearly all available astronomical journals. Reducing the costs for the library is not straightforward, and due investigation of the impact on the research activities at NAOJ should be made. The PRCIVC also recommends that the budget for the library is split from the PRC budget and that NAOJ deals with the budget for the library independently of the budget of the PRC. It may be useful to align the journal offer across all NAOJ sites (Mitaka, Nobeyama, Hawai'i, etc.) to reduce the total costs for the journal subscriptions, but this is a scientific decision, not a PRC decision. This recommendation is cost-saving.

4-19. Rare books and items

The rare books and other items (e.g., glass plates) are stored carefully and properly in the library.

Recommendation 19: The maintenance for the air-conditioned storage (e.g., for air conditioners) may have to be renewed in the near future since they have already been in use for 20 years.

5. Publications Office

Charge 5: Is the **Publications Office** working effectively to publish various publications such as the Chronological Scientific Tables (*Rika-Nenpyo*) and Annual Reports of NAOJ?

The Publications Office is definitely working effectively to publish what it is publishing, including the NAOJ Annual Reports and *Rika-Nenpyo*. But the question asked in the charge may not be the right question to ask. Perhaps a better question is this: Is the Publications Office publishing what it *should* be publishing? Certainly, it makes sense to continue publishing the NAOJ Annual Reports, and for archival purposes the Japanese edition of *Rika-Nenpyo* should continue to be printed.

5-20. Publications in English

A more general, and important, consideration for the Publications Office is the degree to which it can reasonably expect to succeed in the international market. Yes, NAOJ should continue its efforts to have an impact beyond Japan, but whether that should be achieved through publications — as opposed to, say, press releases — is not clear/obvious.

Recommendation 20: Perhaps the English edition of the NAOJ Annual Report should be electronic only, to avoid the high cost of low-volume printing; instead, it could be made available for download by the small number of people who need access to it. The same might be said for some of the office's other materials and publications in languages other than Japanese, to be assessed on a case-by-case basis. This should be cost-saving.

5-21. The *Rika-Nenpyo*

We understand the importance of continuing to produce the Japanese edition of *Rika-Nenpyo*, which is an important NAOJ publication for both historical and contemporary reasons.

Recommendation 21: Given the amount of content in *Rika-Nenpyo*, we feel that serious consideration should be given to raising the price, perhaps by a modest increment each year to avoid a decline in sales. This should be cost-saving (or, more accurately, revenue-positive).

5-22. Fact-based decision-process for publications

Recommendation 22:

(a): When considering whether to produce a publication, either a new edition of an earlier publication or an entirely new publication, staff should consider the following questions: What is the purpose of this publication? Who is our target audience (and do we have a clear distribution plan, including contact info/addresses)? If our target audience goes beyond Japan and will require one or more international translations/editions, is there a sufficiently large audience to justify printing these editions, or should they be digital only? Would it be reasonable to charge for the publication, and if so, how

much? In short, decisions on what to produce, and what to print, should be based on realistic expectations, preferably based on sales figures or other data. This should be cost-saving or, in some cases, revenue-positive.

(b): The Publications Office should consider whether there are any new publications it could produce and sell to the astronomy-interested Japanese public (i.e., the general public or certain segments of it, such as teachers, students, amateur astronomers) that would further the mission of the PRC while at the same time generating significant revenue. This might require additional resources, but these could be more than offset by additional revenue.

6. NAOJ & the International Community Through OAO

Charge 6: Is NAOJ, as an organization, making appropriate contributions to the **international community** by maintaining the Office for Astronomy Outreach?

NAOJ gets some of its widest international exposure and has a very important impact through the activities of the OAO. The CAPjournal is well regarded by science communicators worldwide. The enormous success of the CAP 2018 Conference has resulted in widespread interest in future CAP Conferences, and the excellent IAU Symposium 358 hosted by the OAO at NAOJ raised the profile of both organizations within the international astronomical community. The enthusiastic IAU100 celebration held across the globe has drawn favorable comparisons with the International Year of Astronomy 2009, the unprecedented global event that eventually led the IAU to create the OAO.

Despite all this, we have identified some areas where improvements are possible.

6-23. OAO and NAOJ

Recommendation 23: We recommend that NAOJ more fully embrace the OAO as an integral part of the PRC and take more credit for its successes, even though the OAO is also part of the IAU. Where possible and appropriate, the NAOJ logo should appear wherever the OAO logo itself appears (e.g., on publications, in social media). OAO's global network of National Outreach Contacts (NOCs) should be recognized as a valuable resource and put to better use to publicize NAOJ projects. Most importantly, there should be more collaboration/partnership, as appropriate and useful, between OAO staff and other PRC staff. This is cost-neutral.

6-24. OAO Translation Network

We have some concerns about the OAO Translation Network, which certainly advances NAOJ's globalization effort but which doesn't seem sustainable given the level of effort required to coordinate it.

Recommendation 24: Take a close look at what has been translated to assess the degree to which this material does, or does not, advance the mission of the OAO specifically and the PRC generally. If many of the materials are education-related, perhaps some of the Translation Network work should be managed by the PRC's Outreach and Education Office, which would alleviate the strain on the OAO. If the work of the Translation Network is found mostly to fall outside the remit of the OAO and/or the PRC, then we would recommend seeking a new home for it elsewhere, preferably within the IAU, for example, at the new IAU Office of Astronomy for Education, or outside the IAU, for example, at Astronomers Without Borders or some other organization with a global membership. This recommendation is cost-saving, or at least cost-neutral.

7. Spectrum Management Office

Charge 7: Is the establishment of the **Spectrum Management Office** in 2019 within the PRC appropriate, in terms of the functions of the PRC?

Establishment of the Spectrum Management Office (SMO) at NAOJ sends a strong message to Japanese society concerning the need to preserve the astronomical observation environment. The Public Relations Center seems a reasonable place to put the SMO, assuming that “public” is meant to include “government” and “business/industry,” since those are the two segments of society most concerned with spectrum management. But we are nevertheless slightly concerned that the PRC is becoming the place at NAOJ where projects that have no other obvious home are put. It may make more sense to include spectrum management within the PRC if the PRC were also more directly involved in dark-sky protection and other efforts to preserve the environment for astronomy. We do note, however, that the OAO is involved in dark-sky protection through its association with such efforts within the IAU.

7-25. The Spectrum Management Office in the PRC

Recommendation 25: As noted elsewhere in this report, the offices within the PRC should communicate slightly better with each other and cooperate/collaborate more effectively (for instance to distribute important policy advocacy information). This is cost-neutral.

7-26. Spectrum Management Office succession planning

Recommendation 26: Concerning a replacement for the Head of SMO, who will be retiring within three years, if there are truly no other Japanese radio astronomers sufficiently interested in spectrum management, NAOJ should consider recruiting an individual from another country to join the staff of NAOJ and assume responsibility for spectrum management. This recommendation ought to be nearly cost-neutral.

8. From the global standard point of view

Charge 8: To what degree do you feel the PRC is achieving against each of its missions, **from the global standard point of view?**

To address this charge we need to define what we mean by “global standard.” The PRCIVC agrees with the PRC that a reasonable definition is provided by the IAU Strategic Plan 2020–2030. That document lists five goals:

1. The IAU leads the worldwide coordination of astronomy and the fostering of communication and dissemination of astronomical knowledge among professional astronomers.
2. The IAU promotes the inclusive advancement of the field of astronomy in every country.
3. The IAU promotes the use of astronomy as a tool for development in every country.
4. The IAU engages the public in astronomy through access to astronomical information and communication of the science of astronomy.
5. The IAU stimulates the use of astronomy for teaching and education at school level.

Replacing “The IAU” with “NAOJ” or “The NAOJ PRC” leads us to dismiss the first goal as not applicable, as worldwide leadership is exclusively the IAU’s domain. The other four goals still make sense, at least if “in every country” in the second and third goals is replaced with “in Japan and, where sensible, beyond Japan.”

The PRCIVC applauds the PRC’s efforts in advancing the second and third goals by organizing and convening IAU Symposium 358, “Astronomy for Equity, Diversity and Inclusion” in Mitaka. Being awarded an IAU Symposium is a badge of honor and respect among the global astronomy community, and the great success of the conference in attracting attendees from all over the world showed that the PRC, NAOJ, and Japan are not just meeting the global standard, but *helping to define it*.

Moreover, IAU Symposium 358 directly contributed to the PRC’s achievement of two of its three missions: to offer astronomy information relevant to society and to enrich people’s lives through a more familiar relationship with astronomy. Much the same can be said about the PRC’s efforts to improve inclusivity at NAOJ Mitaka’s visitors area, with its campus guidebook now available in several languages as well as in Braille, with its audio guide now augmented with sign-language videos on the companion website, and with Braille labels added to the Solar System Walk.

Many of the PRC’s programs advance its first mission — to share the latest astronomy findings with the public — and at the same time support the fourth and fifth IAU goals. These include much of the work of the PRO, OEO, OAO, ECO, and the Publications Office. In the opinion of the PRCIVC, this work is all being done consistent with the global standard defined by the IAU.

In short, the answer to the question posed in charge 8 is “yes.” We have no recommendations related to this charge other than to continue as many of the PRC’s programs as can be continued in light of the current budget challenges.

9. What are the PRC's unique activities from a global perspective ?

Charge 9: What activities of the PRC can be identified as **unique, from a global perspective**? Are there any visibly distinct activities of the PRC, which stand out and can be recognized from other countries.?

Many of the PRC activities are distinctive and stand out in the international landscape. Especially noteworthy activities are Galaxy Cruise, the 4D2U theater and Mitaka software, the Subaru Telescope and ALMA press releases, the Ephemeris work, the spectrum management and the FUREAI program.

Of the many outstanding results reported above it is especially commendable how closely connected the PRC is with the Japanese public through their websites (in particular, the Sky Viewer of ECO), Open Campus, star-gazing parties, astronomy call center and other activities. This is in the PRCIVC's view unique.

10. Review evaluations held in 2008 and 2015

Charge 10: How do you evaluate the effort and advancement made by the PRC to overcome issues that were raised by the international **review evaluations held in 2008 and 2015**?

The PRC has, in general, overcome the issues raised in the evaluations held in 2008 and 2015 (and in some cases, clearly surpassed them). The best achievement may be that the PRC has found a solution, social media, to the problem of how to reach the notoriously difficult demographic of 15–30-year-olds.

Internationalization is also a noteworthy achievement of the past five years. The PRC regularly publishes press releases in both Japanese and English at the same time, and many other materials are available in both English and Japanese. The PRCIVC highly respects the PRC's successful efforts to promote internationalization.

The 2015 international review report recommended considering a new way of doing public engagement and mentioned the Zooniverse as an example. The PRCIVC applauds the launch of NAOJ's first citizen-science project, Galaxy Cruise, and expects this appealing website will promote citizen science based on the data obtained from the cutting-edge observational instrument. It seems to be too early to judge whether Galaxy Cruise helps to establish public engagement when this report is written. The PRCIVC expects the PRC to keep updating the website by analyzing the behavior of the visitors and hearing the users' voices sincerely. Through such two-way communication, the Galaxy Cruise project will be able to provide great user experiences and truly establish public engagement.

Recommendations about the production of PR images and the licensing of images and videos were pointed out in the 2008 international review report. These issues have already been mentioned in sections 1.9 and 1.7, respectively, and are not repeated here.

10-27. 4D2U

The PRC has successfully enhanced the public dissemination of the 4D2U activities and the Mitaka software (produced by the 4D2U Project in the Center for Computational Astrophysics, CfCA¹), but continuity is now at stake owing to the deterioration of the equipment. The PRCIVC understands the PRC is under pressure to reduce the cost of outreach activities. However, the 4D2U Dome Theater² stimulates the interest of the public in the Universe. It would be regrettable if the operations and updating were halted.

Recommendation 27: PRCIVC recommends the PRC to find a sustainable way to continue the 4D2U Dome Theater.

¹ <https://4d2u.nao.ac.jp/t/var/about/member.html>

² <https://prc.nao.ac.jp/4d2u/>

11. The next ten years

Charge 11: What do you expect from the PRC in **the next ten years**?

Most functions of the PRC are appropriate to be maintained with the current level of activities unless there is a limitation of the PRC's budget and human resources. All activities are relevant and of high quality and there is no doubt about the importance of those activities of the PRC. However, the number of tenured staff is likely to decrease in the next several years because of retirements and the budget situation. It is not in the PRCIVC's scope to provide solutions for this issue, and the PRC will have to consider sharing personnel more across the Offices based on their skills (e.g., web, drawing illustrations, producing video clips, and translations) and also may have to reduce some activities. As mentioned the PRC is very diverse and has been expanding its scope. It may be required to take a close strategic look at its activities. In order to prioritize activities, it is critical to think holistically alongside all projects in NAOJ and to consider "what is the benefit for NAOJ as a national center for astronomy in Japan". It is hard to prioritize activities; however, the library is clearly one of the most important for NAOJ itself. And activities for press releases, ephemeris calculation and spectrum management are also essential for NAOJ (especially with an integrated press-release function for all projects including ALMA and the Subaru Telescope).

11-28. Strategy development

The PRC's efforts over the past years to develop a clearer mission are applauded, as is its research-oriented approach to science communication and education — i.e., focusing on measurable outcomes, continuously improving the flow of public communication according to the outcome and finally publishing and promoting its experiences. However, the PRCIVC sometimes got the impression that it would be beneficial to make the direction of all offices within the PRC a bit more strategically aligned to follow joint objectives, targets, and guidelines.

Recommendation 28: It is recommended that the PRC write a short, clear NAOJ EPO strategy, ideally including as many of the PRCIVC recommendations as possible in order to think longer term, and articulate the strategic thinking. It should as a minimum contain:

- The PRC mission and vision
- Definition of the target audiences
- Definition of objectives office by office
- Consider making a service layer, or office, for horizontal services like web, drawing illustrations, producing video clips, and translations
- Define a 3-year plan with milestones for the biggest projects and initiatives, year by year (annual planning is not sufficient for big EPO projects)
- Ideally cascade the Office Objectives down to the (SMART) goals of each individual

- Use and maintain the excellent impact statistics delivered to the PRCIVC in the daily work and reporting and for fact-based decision-making

We advise that everyone doing NAOJ EPO is involved in the writing and participates in plenary discussions. Use this strategy to set up workflows for each of the areas that have productions that repeat. Considerable parts of the review documentation can be used as the basis for the strategy document. This is cost-neutral.

11-29. Funding situation

As in so many other areas of society, we realize that there is a need in NAOJ and the PRC to scrutinize the scope of the work and balance it with the resources.

Recommendation 29: To include the very nice impact metrics shared with the PRCIVC into the regular workflows, to make fact-based cost/benefit analyses of the work using metrics and to prioritize the projects. This is cost-neutral.

11-30. Fundraising

Recommendation 30: If it is decided that fundraising would be helpful to contribute to the PRC's budget in order to continue must-have projects, we offer the following guidance and ideas:

- Reduce the number of library journal subscriptions: a small reduction in some of the least-read journals would lead to a substantial saving.
- External funding sources could possibly be tapped into, like philanthropists or science-interested foundations, which may invite grant proposals. This, however, would require personnel.
- A "support NAOJ" button could be added on the web. Maybe offer a way to get tax breaks for qualified donors.
- It would be reasonable to charge a nominal entrance fee for some of the visitor activities.
- A volunteer program could contribute with person-power (but also requires a fraction of a staff member to run it).
- Consider increasing the income made from publications (see Charge 5 above).
- Move the library office out of the PRC, at least in terms of the budget. The personnel costs are fixed, and the library costs have so far been considered very "inelastic", so any PRC savings make an outsize impact on the rest of the budget.

This recommendation is cost-saving.

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