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NAOJ Project Review Report

for

Astronomy Data Center

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External Evaluation Committee for ADC

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Executive Summary

The ADC is a highly capable and deeply committed organization that has delivered exceptional long-term value to the astronomical community through stable, reliable, and well-curated data archive services and shared-use data analysis computing systems. The ADC is recognized nationally and internationally as a highly reliable and valued infrastructure provider that has made appropriate and sincere efforts to respond to community expectations, particularly in operational support and long-standing collaborations. ADC works with major and smaller project partners to provide the data storage, stable archives, computing resources, and analysis environments these astronomy projects require.

ADC now stands at a critical transition point: data preservation and access are now as critical to the success of astronomy research programs as they ever have been, and that importance is likely to grow enormously in the coming 5 years. There are growing demands for data archiving and computing near the data that ADC will struggle to meet without achieving streamlined and efficient operations.

The EEC finds that ADC services have necessarily evolved through service- and project-specific teams with clear responsibilities. This structure has enabled ADC to respond effectively to the technical and operational requirements of particular scientific projects and community needs. At the same time, the resulting partially independent operational model creates overlapping responsibilities in hardware and system maintenance, limits systematic knowledge sharing, and can obscure service-wide prioritization. Some redundant data holdings are appropriate and necessary for data preservation, and tracking and auditing that duplication is critical; the concern is not redundancy itself, but the need for a clearer center-wide model that distinguishes the necessary preservation copies from avoidable duplication of systems, effort, or user-facing pathways.

Restructuring the ADC teams and strengthening cross-service coordination would provide a more efficient basis from which to build the next generation of science-enabling tools. The ADC is close to having such a structure. Tools developed within specialized services could have broader scientific impact if the data archive and computing infrastructure enabled them, where appropriate, to be used across facilities and wavelengths. For example, FITSWebQL is developed within the JVO framework, while QuickDB is being developed as a feature of the HSC Science Platform. These tools are currently optimized for the requirements of their respective services and are not immediately general-purpose utilities; nevertheless, they illustrate the potential benefits of a more uniform archive and science-platform infrastructure over the longer term.

The EEC recommends that, with the appropriate support, particularly in the form of targeted increases in staffing across technical, scientific, administrative, and leadership functions, together with continued system modernization efforts, the ADC transitions to operating as a coherent policy-driven uniform archive and shared-computing service such that it remains a leading data center within the international astronomy community.

The EEC recommends that NAOJ work with ADC to develop and execute a community-informed roadmap that transforms ADC from a collection of successful project-oriented services into a coherent, policy-driven scientific data infrastructure, supported by clear governance, institutional data policies, and targeted staffing growth.

1. Current Status (Operations and Development) and Achieved Results of ADC

1-1 Shared-Use Data Analysis Computer Systems (MDAS, LSC)

1-1-1 Overall Evaluation

The Shared-Use Data Analysis Computer Systems (MDAS and LSC) at the Astronomy Data Center (ADC) function as an essential national infrastructure that **supports the broad educational and research base of the Japanese astronomical community**. By providing standardized, high-quality analysis environments to a wide spectrum of users—regardless of their institutional scale—the ADC effectively fosters an inclusive and robust research ecosystem. **Their operational efforts in sustaining this nationwide support under severe resource constraints deserve high international recognition.**

However, the systems are currently in a **"precarious" state**. The following assessment against the specific evaluation items reveals a critical disconnect between the high quality of service provided and the structural fragility of the underlying infrastructure.

1-1-2 Assessment Based on Evaluation Criteria

Criterion 1: Meeting Demand and Appropriate Updates (incl. 2023–2024 Renewal)

- **Strengths and Renewal Challenges**: The 2024 MDAS update successfully addressed the **strongest demand from the community** by providing a high-speed Lustre file system of 4.2 PB. However, it must be noted that this was achieved only after a highly disruptive renewal process. Excessive budget constraints and specification cuts led to an **initial tender failure in 2023,** forcing an emergency extension of the previous contract and a scaled-back system configuration in 2024. While the team managed the crisis admirably,

this highlights the extreme vulnerability of the procurement process to rigid budget ceilings.

- **Risk for LSC**: In contrast, the **aging LSC system** has not been appropriately updated due to budget rejections. This disparity **poses a significant risk of becoming a performance bottleneck** for large-scale projects like Subaru HSC/PFS as data volumes continue to grow.

Criterion 2: Expected Evolutions in Demand and Technology (Future Investment)

- **Challenges**: The "Data Explosion" from next-gen projects (Rubin, Roman, etc.) and the surging demand for **GPU-accelerated AI/machine learning** tasks require substantial future investment.
- **Strategic Requirement**: To ensure long-term service continuity, **it is essential to begin the design process for the 2029 replacement by 2027**. A delay in this transition could lead to a **severe risk of service discontinuity**, as the gap between aging hardware and evolving research demands becomes unbridgeable.

Criterion 3: Stability of System Operation

- Uptime: The team has maintained impressive service availability (reported as consistently >99% until the recent replacement phase), effectively managing typical hardware failures. The EEC understands that this figure reflects continuity of shared-use service as a whole, and does not necessarily include periods when user experience may have been degraded by high load or reduced performance.
- **Critical Facility Vulnerabilities**: Continuous operation is under direct threat from **outdated infrastructure**. Both the aging **large-scale air conditioning (A/C)** units and the **Uninterruptible Power Supply (UPS)**systems have reached critical failure points. A breakdown in the A/C would necessitate an immediate system shutdown, while failing UPS units pose a severe and imminent risk to data integrity and system stability during power instability.

Criterion 4: System Configuration (Cost and Maintainability)

- **Assessment**: The strategic shift from a pure rental model to a hybrid model (leasing and purchased hardware) was intended to optimize costs.
- **Maintainability Crisis**: However, this shift has inadvertently created a **management overload**. Without a corresponding increase in specialized IT staff, the burden of maintaining in-house hardware has surpassed the capacity of the current team, making long-term maintainability unsustainable.

Criterion 5: Research & Development and Application Testing

- **Achievement**: Despite severe resource constraints, the team has successfully conducted vital R&D for service improvement. Notable technical initiatives include exploring **Lustre Metadata Server (MDS) replication** for enhanced throughput, evaluating **containerized environments (Apptainer/Docker)** to support portable and reproducible research workflows, and studying migrations to **virtualization platforms (Proxmox VE)**.
- **Deficit**: However, due to budget shortages, there is a **critical lack of dedicated staging/testing environments**. Because modifications must often be tested on production-adjacent systems, the ability to safely deploy these R&D outcomes is severely hampered.

Criterion 6: Separation of Hardware, System, and Service Operations

- Significant Structural Risk: The ADC's self-evaluation explicitly answered 'No' to this criterion, acknowledging that researchers and data scientists are also required to perform routine hardware and system maintenance. The evaluation panel recognizes that this dual-tasking model is an unavoidable 'second-best' solution under NAOJ's current institutional staffing shortages.
- Panel Assessment: Nevertheless, insufficient organizational separation remains a significant structural risk. It creates overlapping responsibilities across specialized teams and reduces the actual Full-Time Equivalents (FTE) available for high-level data science, service design, and strategic R&D. The panel urges NAOJ and ADC to address this through an institute-wide approach to common infrastructure operations, while preserving ADC's responsibility for scientific service requirements, user-facing data services, and data-management expertise.

1-1-3 Risks and Recommendations

Summary of Risks

1. **Facility and Infrastructure Collapse**: Aging A/C units and UPS systems pose an immediate and severe threat to system safety and continuity. The EOL hardware of the LSC system further exacerbates the risk to long-term service reliability.
2. **Resource Depletion**: Operational staff are overextended by routine maintenance, procurement, coordination, documentation, and support activities, leading to a decline in proactive R&D and high-level support.
3. **Vulnerability in Operations**: The lack of dedicated testing environments increases the risk of instability during system updates or maintenance.

Recommendations

1. **Prioritize Emergency Budget for Facility Infrastructure (A/C and UPS)**: Secure **immediate emergency funding for the upgrade and maintenance of large-scale air conditioning (A/C) and Uninterruptible Power Supply (UPS) systems,** as these fundamental components are critical to preventing catastrophic system failure and ensuring data integrity.
2. **Establish Institutional Direction for Large-Scale Analysis (LSC)**: The responsibility for the aging LSC system should not rest solely on the ADC. The **NAOJ executive board must proactively collaborate with the ADC to determine a clear strategic direction** for supporting future large-scale data analysis projects (e.g., Subaru HSC/PFS). Necessary measures and budgetary provisions should be finalized as soon as possible based on this unified institutional vision.
3. **Strategic 2027 Design Phase**: Formally authorize and fund the **proactive design process starting in 2027** for the next generation of computing resources.
4. **Shared Infrastructure Operations Function within the ADC**: Establish a shared center-wide infrastructure operations function to take over common server and hardware management tasks where appropriate. This function could support server provisioning, monitoring, security patching, virtualization/container platforms, storage operations, procurement support, and backup procedures across ADC and other relevant projects or centers. ADC should retain responsibility for defining scientific service requirements, archive functions, and user-facing data-analysis services. This arrangement would allow specialized researchers and data-service staff to focus more effectively on data science, interoperability, and core service development.
5. **Modernize Data Retention**: Implement strict **storage lifecycle management** (automated purging and retention policies) to manage the chronic storage shortage on high-performance analysis disks.

1-2 Scientific Operation of Observational Data

1-2-1 Overall Evaluation

The EEC recognizes that the ADC has achieved a r**emarkably high and sustained level of operational success** in the scientific operation of observational data over the past ~25 years. Through systems such as SMOKA and MASTARS, the ADC has established **stable and reliable archive services** that are widely used by the astronomical community and that have made substantial contributions to scientific productivity. The **long-term continuity** of these services, together with the absence of known data loss incidents, represents a significant institutional achievement.

The ADC has demonstrated strong capabilities not only in preserving observational data, but also in curating and enhancing datasets through metadata verification, quality control, and provision of supporting information required for scientific reproducibility and reuse. These efforts have enabled archived datasets to remain scientifically valuable over extended periods and have supported a broad range of research activities across multiple observatories and projects.

The EEC further notes the **exceptional dedication, technical competence, and professionalism of the ADC staff**. The current level of operational performance has been achieved despite **substantial limitations in staffing and budgetary resources**, and reflects the strong commitment of the ADC team to supporting the Japanese and international astronomy communities.

At the same time, the ADC is approaching a critical transition point. While the current ecosystem of archive and data services is functionally effective and scientifically productive, it has evolved in a partially fragmented manner, with differing operational models, policies, and technical architectures across systems and projects. Increasing data volumes, growing demands for science-ready products and large-scale analysis environments, and the need for long-term sustainability now **require a transition toward a more coherent, policy-driven, and scalable data infrastructure.**

Overall, the EEC evaluates the ADC very highly in terms of operational stability, reliability, and long-term scientific contribution. However, important issues remain regarding system integration, policy clarity, sustainability, and future scalability, and these issues require strategic institutional attention.

1-2-2 Assessment Based on Evaluation Criteria

Criterion 1: Data Contents and Service Functions

- The ADC archive systems provide scientifically valuable and widely utilized services to the community. Systems such as SMOKA support sustained data access at the level of multiple terabytes per month and have contributed to hundreds of refereed publications. The ADC archives preserve not only observational datasets themselves, but also associated metadata, logs, calibration information, and environmental parameters, thereby enabling **reproducibility and long-term scientific reuse**.
- The EEC particularly recognizes the **high quality of the ADC's data curation activities**. Archived data are actively validated and enhanced through procedures including FITS header verification and correction, addition of WCS information, and inclusion of quality-related metadata. These activities substantially increase the scientific usability of the archived data products.
- At the same time, the provision of higher-level, science-ready data products remains uneven across projects and scientific domains. Definitions of "science-ready" data products differ among facilities and are often dependent on project-specific practices rather than a unified institutional framework. As modern astronomy increasingly depends on large-scale, data-intensive analysis, this inconsistency may limit the long-term scientific impact and accessibility of ADC services.

Criterion 2: Stability and Reliability of Service Operation

- The ADC has demonstrated excellent long-term operational stability. Core archive systems have remained **continuously operational for decades, with no evidence of significant data loss or major service disruption**. These achievements are particularly notable given the increasing scale and complexity of the archived datasets.
- The ADC has also implemented strong data preservation practices, including controlled procedures for modifying archived data and policies intended to ensure long-term accessibility and integrity. These practices provide an important foundation for scientific reliability and institutional trust.
- However, the EEC notes that the long-term strategy for redundancy, off-site backup, and disaster recovery is not yet fully articulated. Although multiple copies of datasets are maintained, approaches for geographically distributed preservation and recovery from catastrophic failure remain under development. As archive sizes continue to expand, clearer institutional strategies for redundancy management and disaster recovery will become increasingly important for ensuring long-term data security and service continuity.

Criterion 3: Data Preservation, Quality Control, and Release Policies

- The ADC has established a strong culture of long-term data stewardship and quality control. **The preservation of observational datasets over multi-decade timescales, together with systematic metadata validation and curation, represents one of the ADC's major institutional strengths**.
- Nevertheless, the EEC finds that **the operational implementation of data policies remains insufficiently unified and transparent**. While high-level policies defining observational data as long-term scientific assets exist, the criteria governing operational decisions are not always clearly documented or consistently applied across projects. This includes uncertainties regarding:
    - which datasets are preserved indefinitely,
    - levels of processing and calibration provided,
    - responsibilities for reprocessing and updated releases,
    - and ownership and lifecycle responsibilities for archived data.
- The EEC further notes that formal agreements governing responsibilities among ADC, observatories, projects, and external partners are not consistently defined or broadly applied across all activities. Some examples of formal agreements exist, but operational practices still vary substantially across systems and facilities, including differences in support models between optical and radio archives. This heterogeneity complicates long-term planning and introduces ambiguity regarding responsibility boundaries and future service evolution. This cannot be resolved by the ADC alone and must be addressed by NAOJ as a whole.

Criterion 4: Research and Development for Future Scientific Data Operations

- The ADC is actively engaged in important development efforts aimed at modernizing and improving future archive systems. Ongoing activities include the development of modular next-generation architectures such as STARS3, preparation for HSC/PFS data services, and service-aligned developments using external funding to explore integration with Rubin and Euclid data in ways that reinforce HSC and PFS data utilization. These efforts are being pursued in alignment with existing open-use development and operations, including HSC archive operations, science platforms, database development, and preparation for accepting PFS data, while discussions through the NAOJ Science Roadmap and related study groups continue to define their mid- to long-term positioning as ADC services.
- The EEC considers these activities highly valuable and strategically important. In particular, the transition toward modular and loosely coupled architectures represents

an essential step toward improving scalability, maintainability, and resilience against dependence on individual technical experts.
The EEC also notes the value of service-specific tools developed within ADC activities. FITSWebQL, developed within the JVO framework, and QuickDB, being developed as a feature of the HSC Science Platform, provide useful examples. These tools are currently optimized for their respective service contexts and should not be assumed to be immediately general-purpose. However, as the ADC develops a more coherent archive and science-platform architecture, it would be valuable to identify which such tools can be generalized, exposed through common interfaces, or reused across services.

- However, substantial technical and organizational challenges remain. Existing systems continue to rely partly on legacy architectures that limit extensibility and make adaptation to modern workflows --- including large-scale analysis and AI-based methodologies --- more difficult. In addition, modern architectural expertise remains concentrated among a limited number of staff members, creating sustainability risks and constraining the pace of modernization.
- The EEC also notes that prioritization frameworks for future development are not yet sufficiently transparent. Mechanisms for balancing community requests, scientific priorities, available resources, and institutional strategy should be more clearly defined in order to support sustainable long-term planning.

Criterion 5: Sustainability and Organizational Structure

- The ADC currently operates under significant staffing and organizational constraints. Multiple systems are maintained by small teams with limited Full-Time Equivalent (FTE) support, while demands arising from increasing data volumes, expanding services, and growing user expectations continue to increase.
- The present organizational structure has resulted in project-specific systems with limited integration of methods and responsibilities across systems and projects. Individual archive teams are often responsible simultaneously for hardware management, system administration, software maintenance, and scientific operations. This service-specific model has been effective in meeting the needs of individual projects and should be recognized as a strength. However, it also creates overlapping operational responsibilities, substantial workload pressures, and some avoidable duplication where common infrastructure or shared methods could be developed.
- The EEC considers the sustainability of the current operational model to be a major long-term concern. In particular, dependence on a limited number of highly specialized staff members introduces risks for continuity, maintainability, and future scalability. The ongoing transition toward modular architectures is therefore strongly encouraged, as it

may help reduce dependence on individual expertise and improve long-term operational resilience.

1-2-3 Risks and Recommendations

Summary of Risks

1. **Project-Specific Systems and Organizational Complexity:** The current ecosystem consists of multiple partially independent systems with differing policies, operational models, and technical architectures. This specialization has enabled effective service to particular projects, but it also reduces efficiency, complicates long-term planning, and creates ambiguity regarding responsibilities and data ownership when common service layers are not clearly defined.
2. **Sustainability Risks Due to Staffing Constraints**: The heavy operational burden placed on a limited number of staff members reduces capacity for innovation and modernization while increasing dependence on individual expertise.
3. **Scalability Challenges**: Rapid growth in data volumes and increasing demand for science-ready products and large-scale analysis capabilities may exceed the capacity of existing architectures and operational models.
4. **Insufficiently Defined Policy and Responsibility Frameworks:** Lack of consistently documented operational policies and broadly applied formal agreements introduces uncertainty regarding data lifecycle management, long-term preservation responsibilities, and prioritization of future services.
5. **Long-Term Preservation and Disaster Recovery Risks**: The absence of a fully articulated redundancy and disaster recovery strategy may introduce vulnerabilities as archive sizes and operational complexity continue to increase.

Recommendations

1. **Develop a Coherent, Policy-Driven Data Architecture:** The ADC should prioritize the transition from a collection of partially independent systems toward a more unified and policy-driven archive ecosystem with clearly defined responsibilities, reduced avoidable duplication, and improved coordination among services, while retaining service-specific capabilities where they are scientifically necessary.
2. **Clarify and Operationalize Data Policies**: Clear institutional policies should be established and consistently implemented regarding: 1) data ingestion and retention, 2) levels of processing and calibration, 3) data ownership and lifecycle responsibilities, and 4) release and reprocessing procedures.

3. **Formalize Responsibilities Through Institutional Agreements**: Expand the use of formal agreements (e.g., MOUs) between ADC, observatories, projects, and external partners in order to clarify responsibilities for archiving, curation, long-term preservation, and associated funding models.
4. **Strengthen Preservation and Disaster Recovery Strategies**: The ADC should establish comprehensive strategies for redundancy management, off-site backup, and disaster recovery, including evaluation of geographically distributed and cloud-based preservation approaches.
5. **Expand Support for Science-Ready Data and Modern Analysis Workflows**: Future development should emphasize improved support for higher-level data products, in-situ analysis environments, and modern data-intensive research methodologies.
6. **Improve User-Facing Clarity and Standardization**: Documentation and interfaces should more clearly communicate relationships among archive systems, distinctions between raw and processed data products, and the authoritative locations of datasets. Greater adoption of standardized metadata models and interoperability frameworks, including stronger integration of IVOA standards, is also encouraged.
7. **Establish Transparent Prioritization Frameworks**: The ADC should develop clear mechanisms for prioritizing datasets, processing levels, and resource allocation, incorporating scientific impact, community input, and alignment with NAOJ strategic priorities.
8. **Accelerate Modularization and Modernization Efforts**: The ongoing transition toward modular and loosely coupled architectures should be accelerated in order to improve maintainability, scalability, and organizational resilience.
9. **Provide Targeted Increases in Staffing Resources**: The EEC strongly recommends targeted increases in staffing to support modernization, integration of services, policy implementation, and long-term sustainability. Similar concerns have been identified in previous evaluations, and the limited progress to date increases the urgency of this recommendation.

2. Response to Expectations and Requests from Inside and Outside NAOJ.

2-1 Response to Issues Identified in the Previous Project Evaluation (FY2016)

2-1-1 Overall Evaluation

The EEC finds that the ADC has made **meaningful but uneven progress** in addressing the issues identified in the previous project evaluation conducted in FY2016. The ADC has clearly **recognized the major themes and concerns raised in the earlier review** and has undertaken practical efforts in several important areas, particularly in maintaining stable operations under constrained conditions, responding to evolving community needs, and initiating development of next-generation systems and services.

At the same time, the EEC finds that many of the structural and strategic issues identified in the 2016 review remain partially addressed. In several areas, progress has been incremental, project-specific, or informal rather than systematic and institutionally coordinated. In particular, the absence of a comprehensive strategic roadmap, limited coordination across systems and teams, incomplete implementation of data policy frameworks, and persistent staffing constraints remain significant concerns. Several of these issues require action not only by ADC, but also by NAOJ management and relevant facilities or projects.

Overall, the EEC evaluates the ADC response to the FY2016 review as moderate to good: the ADC has demonstrated clear awareness of the previous recommendations and has achieved meaningful progress in several operational and technical areas, but important strategic and organizational issues remain insufficiently resolved.

2-1-2 Assessment of Responses to the FY2016 Recommendations

Areas of Progress

1. Maintenance of Stable Operations Under Resource Constraints

The ADC has successfully maintained stable archive and shared-use services despite declining budgets, limited staffing levels, and increasing technical demands. **The sustained operation of major systems and continued support for a large user community represent substantial achievements** and directly address the 2016 recommendation emphasizing the importance of maintaining effective operations under constrained resources.

The EEC considers this long-term operational continuity to be one of the ADC's major accomplishments during the review period.

2. Increased Attention to User Needs and Community Feedback

The ADC has taken visible steps to incorporate user feedback into system development and operations. Shared-use systems such as MDAS and LSC have been adapted to evolving user requirements, and the ADC has demonstrated continued responsiveness to the needs of the research community.

These efforts indicate a constructive response to the 2016 recommendation to strengthen engagement with users and improve the alignment of services with scientific needs.

3. Development of Next-Generation Systems and Services

The ADC has initiated several important modernization efforts, including:

- conceptual design of next-generation archive systems,
- development of science platforms and Jupyter-based analysis environments,
- integration of archive and analysis capabilities,
- and development of database-oriented scientific infrastructures.

The EEC views these activities positively as evidence of **forward-looking planning and recognition of future challenges** associated with increasing data volumes and modern data-intensive research methods.

In particular, efforts to integrate archive systems with analysis environments represent an important evolution toward more advanced scientific data platforms.

4. Recognition of the Need for Prioritization and Structural Reform

The ADC has acknowledged the need for stronger prioritization of future-oriented projects and improved coordination across activities and systems. **The EEC recognizes this institutional self-awareness as an important response to the earlier review**, which emphasized the need for clearer strategic direction and coordination.

However, although awareness of these issues is evident, implementation has progressed only partially and remains insufficiently formalized.

Areas Where Progress is Limited or Incomplete

Lack of a Formal Roadmap and Strategic Framework

One of the central recommendations of the FY2016 review was the establishment of clear institutional priorities and a comprehensive strategic direction for ADC activities. The EEC finds that substantial progress in this area remains limited.

In particular:

- **no comprehensive and formally adopted roadmap has yet been established**,
- implementation of recommendations has proceeded largely **on a project-by-project basis**,
- and prioritization mechanisms remain insufficiently transparent.

Discussions during the review process explicitly noted the absence of a formal roadmap for implementing recommendations. The EEC considers this to be one of the most significant unresolved issues from the previous review.

Project-Specific Systems and Cross-Team Coordination

The FY2016 review emphasized the importance of improving coordination and integration across ADC projects and systems. While some progress has been made, the EEC finds that independently evolved project-specific systems and teams remain a major issue for cross-service coordination.

Challenges continue to exist in:

- coordination among archive systems,
- alignment of technical activities across teams,
- and consolidation of infrastructure and operational responsibilities.

The persistence of partially independent systems and operational models continues to reduce efficiency and complicate long-term planning where common infrastructure, service layers, or decision processes are not clearly defined.

Incomplete Implementation of Data Policy Frameworks

Although the importance of institutional data policy was recognized in previous reviews, the EEC finds that progress toward a fully operational and consistently implemented framework has been limited.

Review discussions indicated that draft policy efforts existed **but were never fully formalized or institutionally implemented**. As a result, inconsistencies remain in:

- data management practices,
- responsibility frameworks,

- and operational standards across systems and projects.
  The EEC emphasizes that **data policy should not be regarded solely as an ADC-specific issue, but rather as an institute-wide issue requiring coordinated institutional commitment across NAOJ.**

Limited Progress on Staffing and Resource Challenges

The FY2016 review highlighted **the importance of aligning staffing and resources with growing operational demands. The EEC finds that many of these concerns remain largely unresolved.**

Multiple systems continue to operate with minimal staffing levels, and operational burdens remain concentrated among a limited number of staff members. These conditions constrain:

- innovation and modernization,
- strategic planning,
- and integration activities.

The EEC considers the continued mismatch between operational responsibilities and available resources to be a major long-term sustainability concern.

Ongoing Difficulty in Balancing Operations and Research Activities

The previous review also emphasized the importance of maintaining research activity within the ADC. The EEC finds that operational demands continue to dominate staff workloads, limiting the ability of staff members to sustain scientific research activities alongside operational responsibilities.

The review discussions confirmed that maintaining research productivity under current operational conditions remains difficult. The EEC considers this issue important not only for staff development and morale, but also for maintaining the ADC's scientific vitality and long-term innovation capability.

2-1-3 Remaining Issues and Recommendations

Remaining Issues

1. **Absence of a Comprehensive Strategic Roadmap**: Despite recognition of the need for prioritization and coordination, a formal implementation roadmap with clear milestones and institutional alignment has not yet been established.
2. Persistent Organizational and Technical Coordination Gaps: Coordination across systems, projects, and teams remains incomplete, creating inefficiencies and avoidable duplication where common service layers or shared infrastructure approaches could be developed.
3. **Incomplete Operationalization of Data Policy**: Data governance frameworks remain inconsistently implemented across systems and projects, and institutional responsibilities are not always clearly defined.
4. **Insufficient Staffing and Resource Alignment**: Operational demands continue to exceed available staffing capacity, limiting modernization efforts and long-term sustainability.
5. **Difficulty Maintaining Research Activities Within ADC:** Heavy operational and coordination workloads, including procurement, committee work, documentation, and support to other projects or centers, continue to constrain scientific research activities by ADC staff.

Recommendations

Develop a Formal, Community-Aligned Strategic Roadmap: The ADC should establish a comprehensive roadmap that:

- defines priorities across projects and services,
- aligns with NAOJ strategic objectives,
- incorporates community input,
- and includes clear milestones and timelines.

1. **Formalize and Implement Data Policy Frameworks**: NAOJ, together with the ADC, should finalize and operationalize institute-wide data policies with clearly defined standards, responsibilities, and governance structures. The EEC emphasizes that data policy should be treated not as an ADC-specific issue, but as an institute-wide responsibility requiring coordinated commitment across all NAOJ facilities and projects.
2. **Strengthen Organizational Coordination and Cross-Project Planning**: Mechanisms should be established to improve coordination across teams and systems through integrated planning, service layer and infrastructure strategies.
3. **Address Staffing and Resource Gaps**: The EEC reiterates the need for increased staffing resources and improved alignment between strategic priorities and operational capacity in order to support modernization and long-term sustainability.

4. **Support Research Activities Within ADC**: The ADC should establish mechanisms that allow staff members to maintain meaningful research activity alongside operational responsibilities, thereby supporting scientific innovation and staff development.

2-2 Response to Community Expectations and Requests

2-2-1 Overall Evaluation

The EEC recognizes that the ADC is highly regarded by the Japanese astronomy community as a **stable, reliable, and technically capable provider of essential scientific infrastructure**. Through its archive systems, shared-use computing environments, and operational support activities, the ADC has made sustained and substantial contributions to the research activities of the community, including users at the University of Tokyo and major observational facilities and projects associated with NAOJ.

Based on interviews and supporting materials, the EEC finds clear evidence that the ADC has made **sincere and appropriate efforts** to respond to expectations and requests from the community. In particular, the ADC is widely trusted for its operational reliability, technical competence, responsiveness to facility requirements, and long-standing collaborative relationships with observatories and scientific projects.

At the same time, the EEC finds that many of the mechanisms through which community expectations are addressed remain relatively informal and operationally driven. While the ADC responds effectively to immediate needs and requests, there is more **limited evidence of systematic frameworks for capturing community input, translating feedback into strategic prioritization, and communicating how recommendations and requests influence long-term development decisions.**

As astronomical research increasingly depends on large-scale, cross-facility, and data-intensive science, the EEC considers it important for the ADC to evolve from a primarily service-oriented infrastructure provider **toward a more strategically coordinated scientific data organization with clearer governance, prioritization, and partnership frameworks.**

2-2-2 Assessment of Responses to Community Expectations and Requests

1. Response to Facility and Operational Needs

The EEC recognizes that the ADC has established **strong and trusted relationships** with observatories, facilities, and scientific projects that depend on its services. Interviews and discussions during the review indicate that:

- operational support is **timely and dependable**,
- ADC staff demonstrate **high levels of technical competence and commitment**,
- and data ingestion, management, and delivery processes are generally **well aligned with facility requirements**.

These findings indicate that the ADC functions effectively as a **core infrastructure provider** for the astronomy community and that operational expectations from facility partners are being addressed successfully in practice.

However, the EEC also notes that these interactions appear to be **driven primarily by operational and project-specific needs**. There is more limited evidence of **formal mechanisms through which operational feedback is systematically incorporated into broader strategic planning and prioritization processes**.

2. Engagement with the Broader User Community

The ADC provides services that are **widely utilized and highly valued** by the research community, and user support is generally regarded as **responsive and constructive.**

At the same time, feedback obtained during the review suggests that engagement with users is **often reactive rather than proactive**. Mechanisms for systematically collecting, synthesizing, and evaluating user needs are **not always clearly visible**, and the relationship between community feedback and the **evolution or prioritization of services is not always transparent**.

As astronomy moves increasingly toward **data-intensive and cross-facility scientific workflows**, the EEC considers it desirable for the ADC to adopt **more structured and proactive approaches** to community engagement. Improved mechanisms for incorporating user perspectives into long-term planning would strengthen both transparency and alignment between services and evolving scientific requirements.

3. Contributions to Community Research Activities

The ADC has made **essential contributions** to community research through:

- provision of long-term archive infrastructure,
- stewardship and preservation of observational datasets,
- and support for access to major observational programs and facilities.

These activities are recognized by the EEC as foundational contributions to the national astronomical research infrastructure and have enabled a broad range of scientific activities within the Japanese astronomy community.

Nevertheless, the ADC's role is currently perceived primarily as supportive rather than strategically leading in the development of next-generation scientific data environments. Expectations from the community are increasingly shifting toward:

- integrated science platforms,
- advanced analysis environments,
- and support for large-scale and data-intensive research methodologies.

While the ADC has initiated important modernization efforts, the response to these emerging expectations appears incremental rather than guided by a clearly articulated long-term strategic framework. Further development in this direction would strengthen the ADC’s scientific leadership role and its contribution to future astronomy research infrastructures.

4. Response to Advisory Committees and Formal Recommendations

The EEC recognizes that the ADC has taken steps to respond to recommendations and requests from the former NAOJ Astronomy Data Committee and the current Science Strategy Committee. Positive progress is evident in areas including **operational stability, archive services, and improvements in data management practices**.

However, the EEC finds that the relationship between committee recommendations and implemented actions is not always clearly documented or communicated. The EEC understands that this reflects not only ADC's internal response mechanisms, but also incomplete NAOJ-wide procedures for following up committee reports, assigning responsibilities to projects and centers, and maintaining dialogue among committees, executive management, and individual facilities. In particular:

- traceability between recommendations and outcomes is limited,
- prioritization processes are not always transparent,
- and several strategic recommendations, including those related to modernization and interoperability, appear only partially implemented.

The EEC therefore considers it desirable for NAOJ, together with ADC and relevant projects or centers, to strengthen governance and reporting mechanisms so that responses to advisory recommendations can be tracked more clearly and evaluated more systematically.

5. Partnership Development and Governance

The ADC maintains **long-standing and highly constructive relationships with major facilities and projects**. These collaborations are characterized by **mutual trust, responsiveness, and continuity**, and they have enabled effective operation of many existing archive and infrastructure services.

At the same time, the EEC finds that **partnership development and governance processes remain relatively informal**. Existing collaborations appear to rely significantly on historical relationships and individual interactions rather than on consistently defined institutional frameworks.

In particular, there is limited evidence of:

- **formal processes** for establishing new partnerships,
- clearly defined **criteria for prioritizing collaborations**,
- standardized **partnership or service-level frameworks**,
- or structured mechanisms for **reviewing and evolving existing collaborations**.

Similarly, mechanisms for:

- escalation of operational or strategic issues,
- alignment of expectations across partners,
- and management of resource allocation among competing collaborations

do **not appear to be fully formalized**.

The EEC considers this informality manageable under the current scale of operations, but potentially problematic as the complexity and scale of data-intensive astronomy continue to increase. More structured partnership governance frameworks would improve transparency, scalability, fairness, and strategic coherence across ADC activities.

2-2-3 Remaining Issues and Recommendations

Remaining Issues

1. **Limited Formalization of Community Engagement Processes**: Community interactions are generally effective but remain largely reactive and operationally driven, with limited systematic mechanisms for collecting and integrating user feedback into strategic planning.
2. **Insufficient Transparency in Prioritization and Decision-Making**: The linkage between community requests, advisory recommendations, and implemented actions is not always clearly documented or communicated.

3. **Incremental Rather Than Strategic Evolution of Services**: Although modernization efforts are underway, development of next-generation scientific data platforms and analysis environments remains only partially coordinated within a broader strategic framework.
4. **Informal Partnership and Governance Structures**: Long-standing collaborations function effectively but rely heavily on informal relationships and historical practices rather than formal governance structures and clearly articulated partnership frameworks.

Recommendations

1. **Establish More Structured Community Engagement Mechanisms**: The ADC should develop proactive and transparent mechanisms for collecting, synthesizing, and prioritizing community input, including clearer communication regarding how user feedback influences service evolution and strategic planning.
2. **Improve Transparency and Traceability of Responses to Advisory Recommendations:** NAOJ, together with ADC and relevant projects or centers, should strengthen governance and reporting processes to provide clearer documentation of how recommendations from advisory committees and stakeholders are evaluated, assigned, prioritized, and implemented.
3. **Develop a More Strategic Vision for Next-Generation Scientific Services**: The ADC should further develop long-term plans for advanced data platforms, integrated analysis environments, and support for large-scale data-intensive science in alignment with evolving community expectations.
4. **Formalize Partnership Development and Governance Processes**: The ADC should establish clearer institutional frameworks for partnerships and collaborations, including:
    - criteria for prioritization,
    - clarification of responsibilities and expectations,
    - and mechanisms for long-term review and coordination.
5. **Strengthen Alignment Between Partnerships and Strategic Objectives**: Future partnership decisions and resource allocations should be more explicitly aligned with NAOJ strategic priorities and long-term scientific infrastructure goals.

3. Future Plans: Roadmap of Risks and Opportunities

3-1 Overall Evaluation

The EEC considers that the ADC is entering an important transition phase. While the ADC has established itself as a highly reliable and valuable infrastructure provider for the Japanese astronomy community, future scientific and technical demands will require a transition toward a more integrated, scalable, and strategically coordinated data infrastructure.

The EEC recognizes that the ADC has already initiated important modernization efforts, including development of next-generation archive systems and integration of analysis environments. However, long-term success will require clearer strategic prioritization, stronger institutional coordination, and additional support in staffing and infrastructure planning.

ADC has accumulated responsibilities beyond traditional archive operations without a corresponding increase in staffing or development of a cross-team governance structure that would enable improved coordination, this must now be addressed.

3-2 Future Direction of the ADC

Criterion 1: Positioning of ADC's Role Within Japan and Within NAOJ

- The EEC considers the ADC to be a core national infrastructure for astronomy in Japan and an increasingly important component of NAOJ's long-term scientific strategy. In the future, the ADC should strengthen its role not only as an archive and operational support organization, but also as a strategic scientific data center supporting:
    - integrated archive and analysis environments,
    - large-scale and data-intensive science,
    - and interoperability with international data ecosystems.
- The EEC further emphasizes that long-term issues such as data policy, preservation strategy, and infrastructure planning should be addressed within a coordinated institute-wide framework involving both ADC and NAOJ management.

Criterion 2: Personnel Structure and Budget Allocation

- The EEC finds that current staffing and budget levels are insufficient to sustainably support the increasing scale and complexity of ADC activities. Continued dependence on a limited number of highly specialized staff members poses risks to long-term sustainability and modernization efforts.

Criterion 3: Contribution to Research Activities Leveraging ADC Strengths

- The ADC possesses important expertise in scientific data management, archive systems, interoperability, and large-scale analysis environments. These strengths position the ADC to contribute not only operationally, but also scientifically and technically to future astronomy research infrastructure development.
- At the same time, heavy operational workloads currently limit opportunities for research and innovation activities by ADC staff. These workloads include not only day-to-day system and data operations, but also procurement, committee participation, coordination, document preparation, and support provided to other projects and centers. The EEC encourages the establishment of organizational conditions that allow staff members to maintain meaningful scientific and technical research activities alongside these operational responsibilities.

3-3 Personnel Utilization, Staff Development, and Human Resource Sustainability

The EEC recognizes the exceptional dedication and technical competence of the ADC staff. However, the current staffing structure creates significant sustainability risks, including strong dependence on individual expertise and limited capacity for long-term development.

The EEC considers it important to strengthen:

- long-term staff development,
- recruitment of personnel with modern data-science and infrastructure expertise,
- and institutional recognition of the dual operational and scientific roles of ADC personnel.

The ongoing transition toward modular and maintainable system architectures is also viewed positively, as it may improve sustainability and reduce dependence on individual staff members.

3-4 Key Strategic Priorities

1. **Establish a Long-Term Strategic Roadmap**: ADC and NAOJ management should jointly define long-term priorities, modernization plans, staffing strategies, and infrastructure development timelines.
2. **Strengthen Institutional Support for Core Infrastructure**: Archive and analysis systems supporting national astronomy activities should be treated as institute-level strategic infrastructure.

3. **Promote Sustainable Staffing and Human Resource Development**: Additional staffing, broader distribution of expertise, and sustainable career paths are necessary for long-term operational continuity and innovation.
4. **Accelerate Integration and Modernization of Scientific Data Platforms**: Future development should prioritize integrated archive-analysis environments, scalable architectures, interoperability, and support for data-intensive science

Appendix A

List of ADC Evaluation Materials

Applicable **D**ocuments:

ID	Doc #	Doc Title	File Name	# of Pages
AD01	NAOJ-EEC-ADC-001-A	List of the External Evaluation Committee (EEC) Members	[AD01]EEC_Members_List_FY2025_ADC_Review.pdf	1
AD02	NAOJ-EEC-ADC-003-C	External Evaluation of Astronomy Data Center (ADC), NAOJ - kick-off meeting -	[AD02] ADC Reivew kick-off meeting_20251125_v4.pdf	25
AD03	NAOJ-EEC-ADC-004-A	FY2025 NAOJ Project Review: ADC Review Charges	[AD03] ReviewCharges_ADC_20250xxx.pdf	4
AD04	NAOJ-EEC-ADC-011-A	2025JFY NAOJ Project Review Plan for Astronomy Data Center	[AD04] EEC-ADC_Review_Plan_20260121.docx	12
AD05	NAOJ-EEC-ADC-053-A	EEC Work Timeline	[AD05] EEC_Work_Timeline.pdf	1

Reference **D**ocuments

ID	Doc #	Doc Title	File Name	# of Pages
RD01	NAOJ-RESO-0003-A	国立天文台平成28年度プロジェクト評価報告書　天文データセンター（平成 29 年 2 月）(in Japanese)	[RD01] FY2016 NAOJ Project Review Report - ADC - NAOJ-RESO-0003-A(20180228).pdf	7
RD02	NAOJ-EEC-ADC-002-A	FY2016 NAOJ Project Review Report - Astronomy Data Center (English Version) February 2017 *English version of RD01	[RD02] FY2016 NAOJ Project Review Report - ADC - NAOJ-RESO-0003-A(20180228)-E.pdf	8
RD03	NAOJ-EEC-ADC-005-A	Annual Report of NAOJ (Astronomy Data Center) FY2017-2024 *English version of RD04	[RD03] Annual_Report_of_ADC_2017-2024e.pdf	17

RD04	NAOJ-EEC-ADC-006-A	国立天文台年次報告（天文データセンター）2017–2024 年度 (in Japanese)	[RD04] Annual_Report_of_ADC_2017-2024j.pdf	16
RD05	NAOJ-EEC-ADC-007-A	Current Status and Future of Astronomy Data Center (ADC) George KOSUGI (NAOJ Future Planning Symposium 2022)	[RD05] NAOJFutureSympo2022-Kosugi.pdf	20
RD06	NAOJ-EEC-ADC-008-A	Strategies to support the NAOJ future projects: Astronomy Data Center (ADC) George KOSUGI (NAOJ Future Planning Symposium 2023)	[RD06] NAOJFutureSympo2023-Kosugi.pdf	19
RD07	NAOJ-EEC-ADC-009-A	Development of ADC world-standard data science platform for large-scale multi-wavelength observation data Hisanori Furusawa (NAOJ Future Planning Symposium 2024)	[RD07] NAOJFutureSympo2024-Furusawa.pdf	25
RD08	NAOJ-EEC-ADC-010-A	Current Status of Astronomy Data Center (ADC) & Comments on SRM resource demands Hisanori Furusawa (NAOJ Future Planning Symposium 2025)	[RD08] NAOJFutureSympo2025-Furusawa.pdf	44
RD09	NAOJ-EEC-ADC-054-A	Number of ADC Publications by FY	[RD09] 20260319 ADC_papers.pdf	1

Deliverable **D**ocuments（From ADC）

ID	Doc #	Doc Title	File Name	# of Pages
DD01	NAOJ-EEC-ADC-012-A	Astronomy Data Center Staff and Roles (as of January 2026)	[DD01] ADC_current_staff_and_JD_list_20260206.pdf	5
DD02	NAOJ-EEC-ADC-013-B	Representatives of Facilities Collaborating with the ADC	[DD02] ADC-Collaborating-Facilities_20260303.pdf	2
DD03	NAOJ-EEC-ADC-014-E	Core slides for ADC introduction and information for evaluation items	[DD03] ADC_Intro_EvaluationItems_20260325.pdf	118

DD04	NAOJ-EEC-ADC-015-A	Status of facilities & infrastructure and maintenance	[DD04] ADC_computer-rooms+system_layout.pdf	13
DD05	NAOJ-EEC-ADC-016-A	Team status report (shared-computer MDAS)	[DD05] MDAS_review.pdf	22
DD06	NAOJ-EEC-ADC-017-A	Team status report (shared-computer LSC)	[DD06] LSC_ver1_260224.pdf	18
DD07	NAOJ-EEC-ADC-018-A	Team status report (MASTARS)	[DD07] MASTARS_review(en).pdf	9
DD08	NAOJ-EEC-ADC-019-A	Science Results（2000-2025） - Team status report (MASTARS, Appendix, supplemental information)	[DD08] MASTARS_review_appendix_Science_Results_2000-2025.pdf	260
DD09	NAOJ-EEC-ADC-020-A	New Opt/IR data archive system - Team status report (Next-gen. Opt-IR archive)	[DD09] NewOptIRArchive_ExternalReview_20260223.pdf	17
DD10	NAOJ-EEC-ADC-021-A	Multi-Extension FITS(MEF) - investigation of Subaru FITS MEF(Next-gen Opt-IR archive)	[DD10] MEF_review(en).pdf	3
DD11	NAOJ-EEC-ADC-022-A	STARS3 概念設計素案 004 2025/06/04（やぎ編集） - Draft design of New archive (in Japanese)	[DD11] draft_design004(OptIR_NewSArchive).pdf	35
DD12	NAOJ-EEC-ADC-023-A	Policy and Procedure for FITS File Correction - Policy of FITS data correction of Subaru FITS data (Next-gen Opt-IR archive)	[DD12] Policy and Procedure for FITS File Correction_20250904(OptIR_NewArchive).pdf	3
DD13	NAOJ-EEC-ADC-024-A	Questions to Subaru for STARS3 - Q and A about STARS3 (Next-gen Opt-IR archive)	[DD13] Q_and_A_20250605(OptIR_NewArchive).pdf	6
DD14	NAOJ-EEC-ADC-025-A	SMOKA (Subaru Mitaka Okayama Kiso Archive system) - Team status report (SMOKA)	[DD14] SMOKA_review.pdf	17
DD15	NAOJ-EEC-ADC-026-A	International Review FY2025 HSC/PFS and Science Platform - Team status report (HSC/PFS/SciencePlatform)	[DD15] HSC_IntlReview_FY2025.pdf	35
DD16	NAOJ-EEC-ADC-027-A	High-Speed Database project - Team status report (High-Speed Database/Tsurugi project)	[DD16] Tsurugi_ADCExternalReview_20260224.pdf	25
DD17	NAOJ-EEC-ADC-028-A	JVO project - Team status report (JVO)	[DD17] JVO project.pdf	24

DD18	NAOJ-EEC-ADC-029-A	Nobeyama-45m / ASTE Science Data Archive - Team status report (Radio archive)	[DD18] ADC_EEC_RadioArch_Minamidani.pdf	19
DD19	NAOJ-EEC-ADC-030-A	Estimate of fractional costs of individual project subsystems in the current rental system contract	[DD19] RentalSystemCostEstimate20260108.xlsx	1 sheet
DD20	NAOJ-EEC-ADC-031-A	Facility (A/C, Humidifier, electricity/UPS) maintenance and Development plan	[DD20] long-term_facility_mentenance_plan+operating_status.pdf	2
DD21	NAOJ-EEC-ADC-032-A	国立天文台の観測データポリシーについて - Policy draft for NAOJ observational data by the former astronomical data committee (in Japanese)	[DD21] ADC_Data_policy_20140522.pdf	6
DD22	NAOJ-EEC-ADC-033-A	平成 26-27 年度国立天文台天文データ専門委員会からの答申 平成 28 年 6 月 30 日 - 2016 Report to the Director General on the NAOJ data operations by the former astronomical data committee (in Japanese)	[DD22] Committee_report(天文データ専門委員会答申)20160630.pdf	2
DD23	NAOJ-EEC-ADC-034-A	提言 国立天文台における観測データの公開とその更なる利活用 - 2016 Recommendations on the NAOJ data operations the former astronomical data committee (in Japanese)	[DD23] Committee_recommendation(天文データ専門委員会提言)20160630.pdf	13
DD24	NAOJ-EEC-ADC-035-A	答申「国立天文台における観測データの公開とその更なる利活用」実現への具体的方策、およびプロジェクトと天文データセンターの関係について - 2018 Report to the Director General on the NAOJ data operations by the former astronomical data committee (in Japanese)	[DD24] Committee_report(天文データ専門委員会答申)20180629.pdf	9
DD25	NAOJ-EEC-ADC-036-A	答申 - 2022 Report to the Director General on the NAOJ data operations by the data archive WG under the NAOJ science strategy committee (in Japanese)	[DD25] SSC_report_答申20220331v1（科学戦略委員会データアーカイブWG）.pdf	8
DD26	NAOJ-EEC-ADC-037-A	レンタルシステム - Summary of 2016 user hearing for FY2018 rental system design (in Japanese)	[DD26] ADC2018SystemReplace_HearingSummary.pdf	16

DD27	NAOJ-EEC-ADC-038-A	List of achievements during the review period by ADC-employed staff	[DD27] ADC_achievements_by_ADC_staff.xlsx	13 sheets
DD28	NAOJ-EEC-ADC-039-A	HSC 及び PFS データ解析・公開における協力関係の覚え書き ver.20180727 - MOUs between ADC and Subaru Telescope for HSC task promotion agreed and updated in 2014 and 2018 (in Japanese)	[DD28] MOUs_with_SubaruTelescope_HSC_2014to2018.pdf	9

Presentation **S**lides（From ADC）

ID	Doc #	Doc Title	File Name	# of Pages
PS01	NAOJ-EEC-ADC-040-B	Astronomy Data Center Introduction	[PS01] ADC_Evaluation_Item_1_presentation_20260317.pdf	69
PS02	NAOJ-EEC-ADC-041-A	Evaluation Item 2. Response to Expectations and Requests from Inside and Outside NAOJ (Community)	[PS02] ADC_Evaluation_Item_2_presentation_20260316(shared_version).pdf	50
PS03	NAOJ-EEC-ADC-042-B	Evaluation Item 3. Future Plans	[PS03] ADC_Evaluation_Item_3_presentation_20260319.pdf	37
PS04	NAOJ-EEC-ADC-043-A	Shared-Use System The Multi-wavelength Data Analysis System (MDAS) Current Status and Overview	[PS04] MDAS_review_presentation.pdf	8
PS05	NAOJ-EEC-ADC-044-A	Large-scale Data analysis system (LSC)	[PS05] LSC_presen_v260311.pdf	11
PS06	NAOJ-EEC-ADC-045-A	Computer rooms managed by ADC	[PS06] ADC_facilities_presentation.pdf	6
PS07	NAOJ-EEC-ADC-046-A	Nobeyama-45m / ASTE Science Data Archive(Radio Science Data Archive; Radio Archive)	[PS07] ADC_EEC_RadioArch_Minamidani.pdf	19
PS08	NAOJ-EEC-ADC-047-A	MASTARS (Mitaka Advanced Subaru Telescope Archive System)	[PS08] MASTARS_review_present.pdf	12
PS09	NAOJ-EEC-ADC-048-A	SMOKA (Subaru Mitaka Okayama Kiso Archive system)	[PS09] SMOKA_review_presentation.pdf	12

PS10	NAOJ-EEC-ADC-049-A	New Opt/IR data archive system	[PS10] NewOptIRArchive_Review_Presentation20260313.pdf	18
PS11	NAOJ-EEC-ADC-050-A	International Review FY2025HSC/PFS and Science Platform	[PS11] HSC_PFS_SP_Review_Presentation_1.pdf	16
PS12	NAOJ-EEC-ADC-051-A	Services related to PFS, Science Platform, etc	[PS12] HSC_PFS_SP_Review_presentation_2.pdf	17
PS13	NAOJ-EEC-ADC-052-A	JVO project	[PS13] JVO_presen_260316.pdf	12

Appendix B

ADC Review meeting timetable

Day 1	Date: Tuesday, March 17, 2026 9:00–17:00 Place: Lecture Room, Mitaka Campus at NAOJ
◆Advance Meeting (Closed)	
09:10 – 09:35	EEC meeting
◆Opening & Introductions (Open)	
09:35 – 09:55	Opening remarks by NAOJ, Mutual introductions between the EEC and the ADC members, Introduction of the meeting agenda by the EEC Chair
09:55 – 10:30	ADC Project Overview
10:30 – 10:40	(Break)
◆Presentation from ADC (1) (Open)	
10:40 – 12:15	Presentation from the project for Evaluation Item [1] + Q&A
12:15 – 13:05	(Lunch Break and Meeting with the Director General)
13:05 – 14:05	Presentation from the project for Evaluation Item [1] (cont'd) + Q&A
◆Interview with ADC members (Closed)	
14:05 – 15:34	– Group A (JVO, SMOKA, Radio Archive, MASTARS)
	– Group B (HSC)
	– Group C (Tsurugi)
	– Group D (Shared-Use computer)
◆Discussion (Closed)	
15:34 – 17:00	EEC meeting

Day 2	Date: Wednesday, March 18, 2026 9:00–17:00 Place: Large Conference Room, Mitaka Campus at NAOJ
◆Presentation from ADC (2) (Open)	
09:00 – 10:30	Presentation from the project for Evaluation Item [2] + Q&A
10:30 – 10:40	(Break)
10:40 – 12:00	Presentation from the project for Evaluation Item [2] (cont'd) + Q&A

12:00 – 13:00	(Lunch Break and Meeting with the ADC Director and Deputy Director)
◆Interviews with Representatives of Facilities Collaborating with the ADC (Closed)	
13:00 – 15:30	– Group A (NAOJ: Subaru, Okayama, Nobeyama, ASTE)
	– Group B (NAOJ: ALMA, VERA, Hinode, Gaia)
	– Group C (Outside NAOJ: Seimei, Nishi-Harima, Higashi-Hiroshima, MITSuME)
◆Discussion (Closed)	
15:30 – 17:00	EEC meeting

Day 3	Date: Thursday, March 19, 2026 9:00–17:00 Place: Large Conference Room, Mitaka Campus at NAOJ
◆Presentation from ADC (3) (Open)	
09:00 – 12:00	Presentation from the project for Evaluation Item **[3]** + Q&A
12:00 – 13:00	(Lunch Break)
◆Campus Tour	
13:00 – 14:25	Campus Tour: ADC Open-use computer rooms and the 4D2U Theater †
14:25 – 14:30	Group Photo
◆Interviews with ADC (Closed)	
14:30 – 15:00	Interview with ADC Director
15:00 – 15:05	(Break)
15:05 – 15:35	Interview with NAOJ Executive responsible for ADC
◆Discussion (Closed)	
15:35 – 16:35	EEC meeting
◆Closing (Executive Summary) (Open)	
16:35 – 17:00	Executive Summary : Briefing for all project members and NAOJ

- Review Style: "open" –all project members are welcome; "closed" – invitation-only (by EEC).
- † Note : The 4D2U Theater visit is arranged in cooperation with the Public Relations Center and is not part of the review program.

Review Items

[1] Current Status (Operations and Development) and Achieved Results of ADC

[2] Response to Expectations and Requests from Inside and Outside NAOJ

[3] Future Plans

Appendix C

Astronomy Data Center Staff and Roles

1) Main staff primarily working for ADC

Name	Title	Roles in ADC	Memberships to each team activity
Hisanori Furusawa	Associate Professor	ADC Director, Leadership member, HSC/PFS/SP team leader, SMOKA team leader	ADC Leadership, HSC/PFS/SP, SMOKA, Tsurugi DB, Next-gen archive, Shared-use operations
Tadafumi Takata		ADC Deputy Director, Leadership member, Tsurugi DB development team leader, Next-gen Opt-IR archive development team leader	ADC Leadership, Tsurugi DB+HSC/PFS/SP, Next-gen archive, Shared-use operations
Yuji Shirasaki	Assistant Professor	Leadership member, JVO team leader, Computer technology development team leader	ADC Leadership, JVO, Computer tech, Shared-use operations, Next-gen archive
Masafumi Yagi		MASTARS team leader	MASTARS, Next-gen archive, Computer tech, Subaru Telescope duties
Michitaro Koike	Research Engineer	HSC/PFS/SP team sub-leader	HSC/PFS/SP, Computer tech, Subaru Telescope duties (PFS etc)
Sogo Mineo		HSC/PFS/SP team sub-leader	HSC/PFS/SP, Computer tech, Subaru Telescope duties (PFS etc)
Shin'ichiro Makiuti	Senior Specialist	Shared-use Computer System Operations team leader	Shared-use operations, HSC/PFS/SP, Computer tech
Mizuki Isogai		Computer technology development team sub-leader	Shared-use operations, Computer tech, CfCA duties
NobuhiroTanaka		Shared-use Computer System Operations team sub-leader	Shared-use operations, Computer tech, CfCA duties
Chihiro Kitada			MASTARS+Next-gen archive, Shared-use operations, HSC/PFS/SP
Takeaki Ozawa			Shared-use operations, SMOKA, Computer tech, Next-gen archive
Yasushi Nakajima		SMOKA team sub-leader	SMOKA, Next-gen archive
Junko Furusawa		Tsurugi DB devepment team sub-leader	Tsurugi DB, SMOKA+Next-gen. archive, HSC/PFS/SP
Christopher Zapart		JVO team sub-leader	JVO, Subaru Telescope duties
Shuhei Koyama	Project Researcher		SMOKA, research etc
Tianfang Zhang	Project Researcher (grant-project dedicated)		Grant project (related to HSC/PFS/Rubin/Eucild), research etc
Masafumi Niwano			Grant project (related to HSC/PFS/Rubin/Eucild), research etc
Kunihisa Seki	Research Supporter		Shared-use operations
Akira Keida	Research Supporter (grant-project dedicated)		Grant project (for Tsurugi DB)

Misako Abe	Administrative Supporter		Administration

Note: Review participants highlighted in green.

2) Cross-appointed staff with smaller/secondary duties in ADC

Name (primary affiliation)	**Title**	**Roles in ADC**	**Memberships to each team activity**
Tetsuhiro Minamidani (ALMA)	Associate Professor	Radio archive team leader	Radio archive
Eisuke Morita (ALMA)	Associate Senior Research Engineer		Computer tech, Radio archive, Next-gen archive
Makoto Shizugami (ALMA)	Research Engineer		Radio archive, Computer tech
George Kosugi (ALMA)	Professor		Radio archive
Kazuyoshi Yamashita (SKA-1, Nobeyama)	Senior Specialist		Radio archive, Computer tech, HSC/PFS/SP
Takashi Ito (CfCA)	Associate Professor (Senior Lecturer)		Computer tech+Shared-use operations
Ken Takahashi (VLBI)	Engineer		Computer tech+Shared-use operations
Eiichiro Kokubo (CfCA)	Professor		Computer tech
Masumi Shimojo (ALMA)	Associate Professor		Shared-use operations
Hiroyuki Maehara (Okayama/Subaru)	Assistant Professor		Shared-use operations
Jun'ichi Noumaru (TMT)	Associate Professor		Shared-use operations

Note: Review participants highlighted in green.

Appendix D

Review Meeting Participants

1) Group Interviews: Representatives of Facilities Collaborating with the ADC

Internal (NAOJ) Participants	Satoshi Miyazaki (Subaru Telescope)	Subaru Telescope (STARS, HSC, PFS)
	Akito Tajitsu (Subaru Telescope/Okayama Branch)	Okayama 188-cm Reflector Telescope, SEIMEI Telescope
	Atsushi Nishimura (Nobeyama Radio Observatory)	Nobeyama 45m Radio Telescope
	Seiichi Sakamoto (NAOJ Chile)	ASTE
	Eisuke Morita (ALMA Project)	ALMA
	Tomoya Hirota (Mizusawa VLBI Observatory)	VLBI (VERA, EAVN, EHT)
	Yukio Katsukawa (Solar Science Observatory)	SDAS (Hinode, NoRP, Solar Flare Telescope etc.)
External Participants	Yoshiyuki Yamada (Kyoto University)	Gaia
	Kouji Ohta (Kyoto University)	SEIMEI Telescope
	Koji Kawabata (Hiroshima University)	Higashi-Hiroshima Observatory
	Satoshi Honda (University of Hyogo)	Nishi-Harima Astronomical Observatory
	Yoichi Yatsu (Institute of Science Tokyo)	MITSuME Project

2) Interview with NAOJ Executives

Mamoru Doi	Director General
Yoshinori Uzawa	Review Coordinator, Director of Engineering
Masao Saito	Chair of Project Review Committee, Vice-Director General (on Finance)