



**Atacama
Large
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Array**

ALMA Integrated Computing Team Implementation Plan

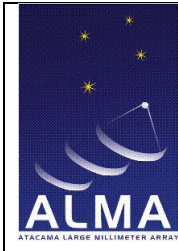
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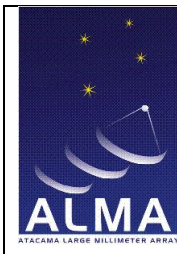
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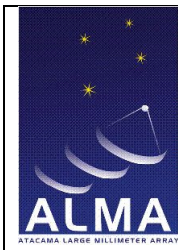
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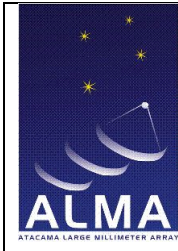
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1 Introduction

1.1 Purpose

This document defines the implementation plan of the Integrated Computing Team (ICT) for the operations phase of the ALMA observatory. Following the successful delivery of ALMA software by the trilateral ALMA Computing IPT (CIPT) and the creation of the Software Group within the JAO ALMA Department of Computing (ADC) this plan describes the set up of a strong quadrilateral team that brings together these units in a single entity.

1.2 Scope

This document describes the plan for the quadrilateral Integrated Computing Team for the operations phase of ALMA, its core responsibilities, management structure and external interfaces within the ALMA observatory.

The baseline budget of the ICT staff from the Executives is formed by OFF-003 (originally described in the ALMA Operations Plan, version D [RD4] as OFF-004 and OFF-005), and in Chile corresponds to the Software Group staffing plan considered in the ADC operations budget.

The ICT can carry out ALMA development projects following the agreed principles and approval process.

The ICT will define standards for software components of all ALMA development projects, including such projects that are not carried out by the ICT, to ensure that the software can interoperate with ALMA software and be maintained as necessary by ALMA staff.

1.3 References

The following documents contain additional information and are referenced in this document.

Reference	Document title	Document ID
[RD1]	Principles for ALMA Development Program	AEDM 2011-023-O (Rev2)
[RD2]	Principles for ALMA Maintenance	<i>Not yet known</i>
[RD3]	ALMA Software Delivery Process	COMP-70.05.00.00-0012-C-PLA
[RD4]	ALMA Operations Plan, Version D	ALMA-00.00.00.00-002-D-PLA.A
[RD5]	ALMA Computing Software Requirements Management Plan	COMP-70.05.00.00-0026-C-PLA
[RD6]	ALMA Integrated Computing Team Implementation Plan version A	COMP-70.05.00.00-0025-A-PLA



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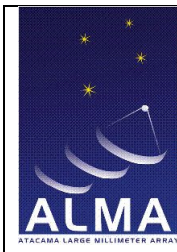
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1.4 Abbreviations and Acronyms

The following list explains the acronyms used in this document. This is limited to commonly used acronyms within the ALMA project.

ACA	Atacama Compact Array
ACS	ALMA Common Software
ADC	ALMA Department of Computing at JAO
AEM	Consortium composed of Thales Alenia Space, European Industrial Engineering, and MT-Mechatronics
ALMA	Atacama Large Millimeter/submillimeter Array
AMT	ALMA Management Team
AOS	Array Operations Site
ARC	ALMA Regional Center (Europe, North America and East Asia)
CASA	Common Astronomy Software Applications
CCB	ALMA Change Control Board
CIPT	Computing IPT
CL	Chile
DSO	JAO Department of Science Operations
EA	East Asia
EAASC	East Asian ALMA Support Center
EASC	European ALMA Support Center
ESO	European Southern Observatory
EU	Europe
FTE	Full-Time Equivalent
ICT	Integrated Computing Team
IET	Integrated Engineering Team
iSOPT	Integrated Science Operations Team
IPT	Integrated Product Team
IT	Information Technology
JAO	Joint ALMA Observatory
LO	Local Oscillator
MELCO	Mitsubishi Electronics Corporation
NA	North America



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NAASC	North American ALMA Science Center
NAOJ	National Astronomical Observatory of Japan
NGAS	Next Generation Archive System
NRAO	National Radio Astronomy Observatory (USA)
OSF	ALMA Operations Support Facility
SCCB	Software Change Control Board
SCO	ALMA Santiago Central Office
SE	Software Engineering
TelCal	Telescope Calibration
TMCDB	Telescope Monitoring and Configuration Database
VLBI	Very Large Baseline Interferometry



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2 Definitions and Assumptions

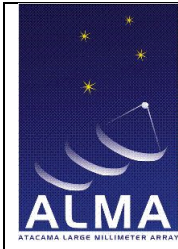
2.1 Definitions

1. **Construction Phase:** Defines the whole period where the Computing IPT was fully or partially funded from the ALMA construction budget. This is the period from 2001 to 31 December 2012.
2. **Operations Phase:** Defines the period started 1 January 2013 where all of Computing is fully funded from the ALMA operations budget. There is currently no time limit on when this phase will end.
3. **Integrated Computing Team (ICT):** The ALMA Computing team for the operations phase, consisting of the **Regional ICTs** from the three Executives and the ADC Software Group from the JAO. The Regional ICT from each Executive is known as **ICT-EA**, **ICT-EU** or **ICT-NA**, and the one from JAO as **ICT-CL**, sometimes, if the context is clear, also just as **EA**, **EU**, **NA** or **CL**.
4. **ICT Head:** The head of one of the Regional ICTs.
5. **ICT Management:** The four ICT Heads.
6. **ICT Lead:** The appointed lead of the ICT Management.
7. **ICT Group:** A functional unit within ICT that is responsible for a certain area or aspect of the ALMA software.
8. **ICT Group Lead:** The appointed lead of one of the ICT Groups.
9. **ALMA Subsystem:** A particular part of the ALMA software. This grouping was established during construction. In operations each ICT Group is responsible for one or more ALMA software subsystems.

2.2 Assumptions

1. **Offsite Operations – Software Development and Maintenance:** The two budget lines formerly known as OFF-004 and OFF-005 were combined in 2012 into a single budget line named **OFF-003 - Offsite Operations – Software Development and Maintenance** that funds the Regional ICTs from the three Executives exclusively from 1 January 2013. Under the current 2015 staff cost and exchange rates (where applicable), based on the current Operations Plan (version D) [RD4] we assume as of January 2015 a total FTE count of 17.5¹ for ICT-EU, 18.5 for ICT-NA and 12.6 for ICT-EA. These numbers will change in the future according to cost and exchange rates.

¹ ICT-EU numbers given here include regular staff overheads (e.g. training, administrative tasks, etc.). The position of the ICT-EU Head (1.0 FTE) is not included here, as it is not funded by this budget line.



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2. **ADC Software Group – Software Operations Support:** A fraction of the ADC Software Group (ADC/SG) staffing budget foreseen in the overall JAO staffing plan will fund the ICT-CL group. With the current staff profile projection for 2015 onwards this corresponds to a total FTE count of 14 in 2015 for the ICT-CL. The ICT Head (CL) is not included in these numbers.
3. **Continuity of Staff:** We assume that each Regional ICT will ensure continuity of staff and expertise, and that departures and rotations will happen gradually.
4. **ALMA Management Team:** AMT is the controlling entity for ICT (and all other Integrated Teams) in operations. We assume that the direct managers of the ICT Heads will participate in AMT meetings when required.
5. **Integrated Science Operations Team:** We assume that iSOPT is the controlling instance for all science operations groups, including DSO and the ARCs. We further assume that the Head of iSOPT and the Head of DSO is the same person.
6. **Integrated Engineering Team:** We assume that IET is the coordinating instance for all the ALMA-wide expert engineering groups at the Executives and the JAO. We further assume that the Array Lead Engineer at the JAO leads this team.
7. **IT Support:** We assume that general IT support for ICT staff (personal computer OS installations, printing, commercial applications, etc.) will be provided by the employee's Executive or JAO outside of the ICT budget (like any other administrative function). IT support peculiar to the deliverables of the ICT (e.g., STE administration, real-time kernel configurations) are the responsibility of the ICT.



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3 Integrated Computing Team Concepts

3.1 Core Concepts

In the operations phase of ALMA the Integrated Computing Team (ICT) is the successor of the Computing IPT (CIPT). The Regional ICTs from the three Executives, namely East Asia (EA), Europe (EU) and North America (NA), and the software group within the JAO ALMA Department of Computing (ADC), including the Head of Department, compose the ICT.

Each of the four Regional ICTs has a share of responsibilities and authority within the ICT. While each Regional ICT has its clearly defined responsibilities and interfaces to the stakeholders, one important concept is that the ICT appears as a single unit within the ALMA observatory, openly shares information within and speaks with one voice on important matters.

ICT staff is located chiefly at the main sites of the three Executives and at the OSF and SCO in Chile. It is at the discretion of the Executives to outsource certain activities to institutes and contractors within or outside their region.

All four Regional ICTs ensure continuity in staff, and hence experience and expertise, wherever possible to guarantee smooth computing operations (see section 1).

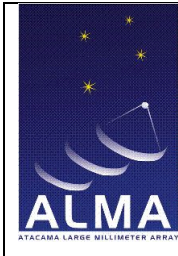
The ICT's main responsibilities are the on-going software support, maintenance and internally funded feature development for all delivered ALMA Subsystems. The two core principles are that responsibility for maintenance stays with the Executive who was responsible for the same deliverables during construction (see section 6.4), and that ICT-CL is responsible for all operational matters, first level support and diagnostics, and the ALMA software release process (see [RD3]).

Maintenance is considered to include corrective, adaptive, perfective and preventive tasks for the delivered software [RD5]. For example, it is anticipated that the details of the dynamic scheduling and automated pipeline processing will require significant updates as operational experience with ALMA is acquired. This is separate from significant changes in scope (VLBI capability, new bands, significant changes in data rate), which would be considered separately, possibly as part of the ALMA Development Program or another externally funded program.

Hardware components (computers and network equipment) of the observatory, both in Chile and the ARCs, are not deliverables of the ICT. Each partner carries them within a local budget. The ICT is however responsible for defining reasonable hardware standards to which the partners must conform, to ensure that the ICT software will run at all locations. JAO and the ARCs can propose to add new standards after verifying that the relevant ICT software works on the proposed hardware or a compatible prototype.

The list of acceptable standards should be brought up-to-date periodically and cover current popular technologies or architectures so that the hardware can be renewed when needed.

Each Regional ICT will arrange and pay for its own software licenses. These include database and software development tools. If it is necessary due to the licensing structure or significantly less expensive for one Regional ICT to procure all licenses, this can be considered on a case-by-



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case basis. Costs, including any procurement or other overheads, would be reimbursed pro-rated by the number of licenses distributed to each Regional ICT.

3.2 ICT Management

A management team consisting of one representative from each Regional ICT (ICT-CL, ICT-EA, ICT-EU and ICT-NA) leads the ICT. They are collectively known as the ICT Management and each of the members is known as an ICT Head (CL/EA/EU/NA).

Every ICT Head appoints a Deputy ICT Head, who represents him or her in case of absence or conflicting appointments.

ICT Management appoints the ICT Head (CL) as the official ICT Lead. This role empowers him or her to represent the views and decisions of ICT Management with the various stakeholders at the observatory. Each ICT Head represents ICT in their own organization and region, including participation and presentation to various committees. The ICT Lead role does not give any authority over the staff or budget from another Regional ICT. ICT Management might (in the future) recommend to AMT that another member of ICT Management be appointed as the ICT Lead.

Further details can be found in 4.1.

3.3 ICT Groups

ICT Groups take over responsibility of one or more subsystems in the construction phase. Each ICT Group also carries forward the responsibilities of the relevant CIPT Group from the construction phase.

Each ICT Group has a responsible Regional ICT that also provides the ICT Group Lead and the majority, if not all of the staff for the ICT Group. Members from other Regional ICTs can contribute to an ICT Group at a full-time or part-time level. This is especially true of the ICT Groups directly associated with ARC operations and science activities (i.e., Data Processing ICT Group), and those having close connections to the whole ALMA software system (i.e., Integration & Release Management ICT Group), involving staff members from all Regional ICTs. It is the responsibility of ICT Management to ensure good coordination and cooperation within these distributed ICT Groups.

The following diagram shows an overview of the ICT Groups and management structure. ICT Groups with a double line border indicate staff contributions from two or more Regional ICTs, a single line border indicates groups staffed from the main responsible only. Names in brackets in the ICT group boxes represent the corresponding acronym used to refer to them in short. Further details can be found in 4.2.

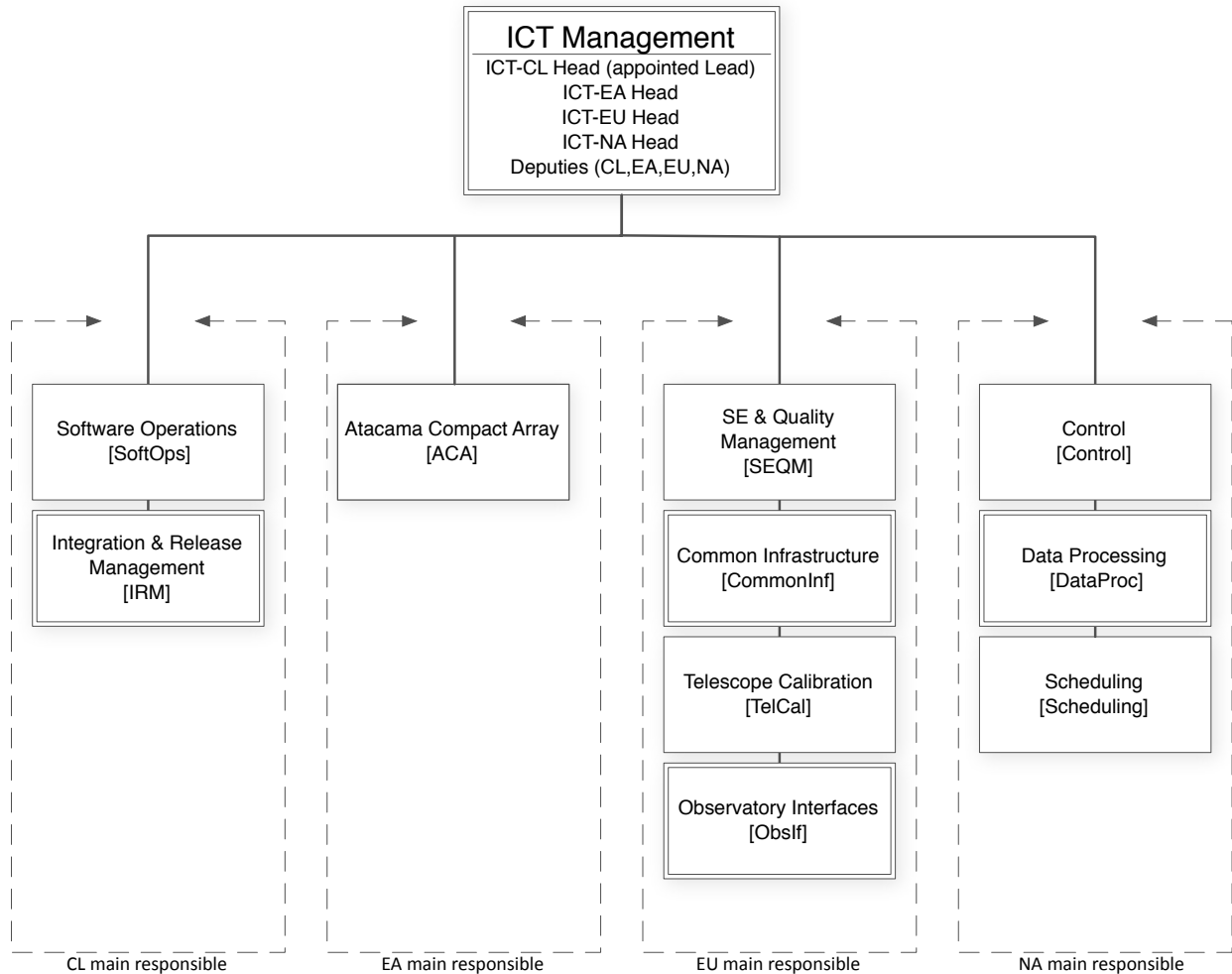
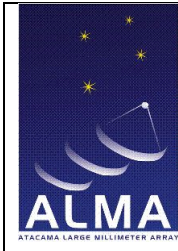


Figure 1: High-Level Organization Chart for ICT

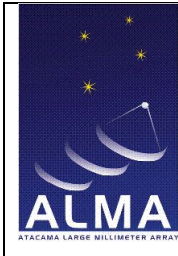
3.4 Reporting Lines

ICT Heads report directly to their immediate supervisor at their respective organization. Specifically this means:

- The ICT Head (CL) reports to the ALMA Director(s)
- The ICT Head (EA) reports to the Head of the EAASC
- The ICT Head (EU) reports to the Head of the EASC
- The ICT Head (NA) reports to the Head of NRAO Data Management

ICT Group Leads report to the local ICT Head.

Each member of an ICT Group reports to the ICT Group Lead on technical matters within the scope of the ICT Group, but to the local ICT Head on all other matters.



3.5 Location of Personnel

ICT staff members basically reside in their affiliate institute (Executive or external). However, it is possible that some staff work at other Regional ICTs temporarily if the ICT Group consists of members from two or more Executives or the JAO.

ICT staff members may work on projects other than ALMA at their institute for a certain percentage of their time. The local ICT Head should try to ensure that both projects mutually benefit from such an arrangement.

ICT Management shall encourage missions of members from different Regional ICTs to the JAO or one of the Executives to work together, and with members of other JAO departments or the ARCs, on well-defined tasks, including integration, test and support activities.

3.5.1 ICT-CL Organizational Structure

ICT-CL is under the management of JAO in Chile. The ICT Head (CL) manages the JAO ALMA Department of Computing, which comprises the Software Group (ADC/SG), the Information Technology Group (ADC/IT) and the Archive and Pipeline Operations Group (ADC/APO). Only the head of the department and ADC/SG participate in the ICT-CL, but services from the other groups in ADC may be required.

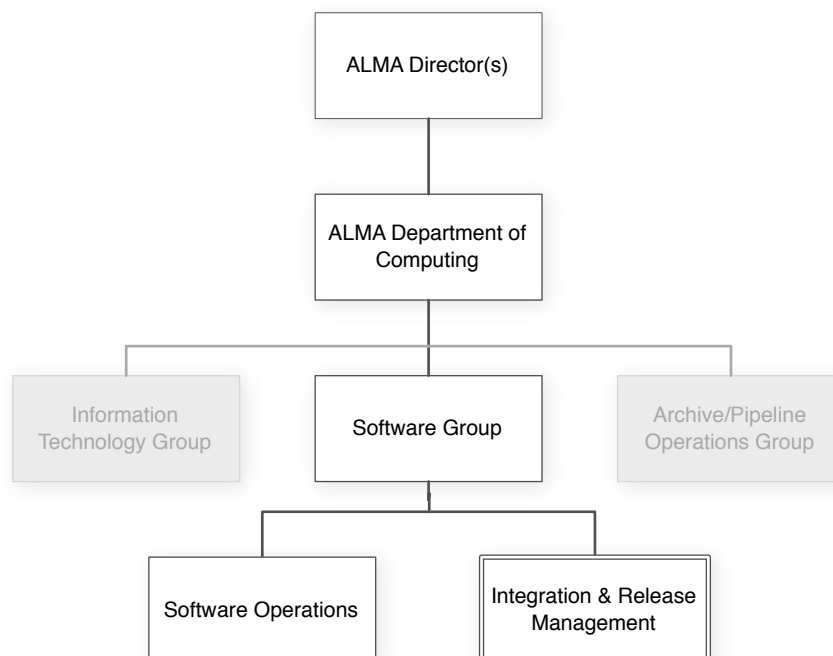
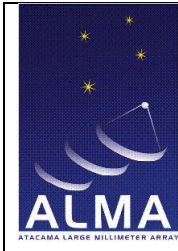


Figure 2: ICT-CL Organizational Structure



3.5.2 ICT-EA Organizational Structure

The following diagram shows the reporting structure of ICT-EA. The ICT Head (EA) manages not only ICT-EA, but also ARC Database (EA), which is a main body of archive operation. Dashed arrows indicate that some staff working at NAOJ contribute to other ICT Groups.

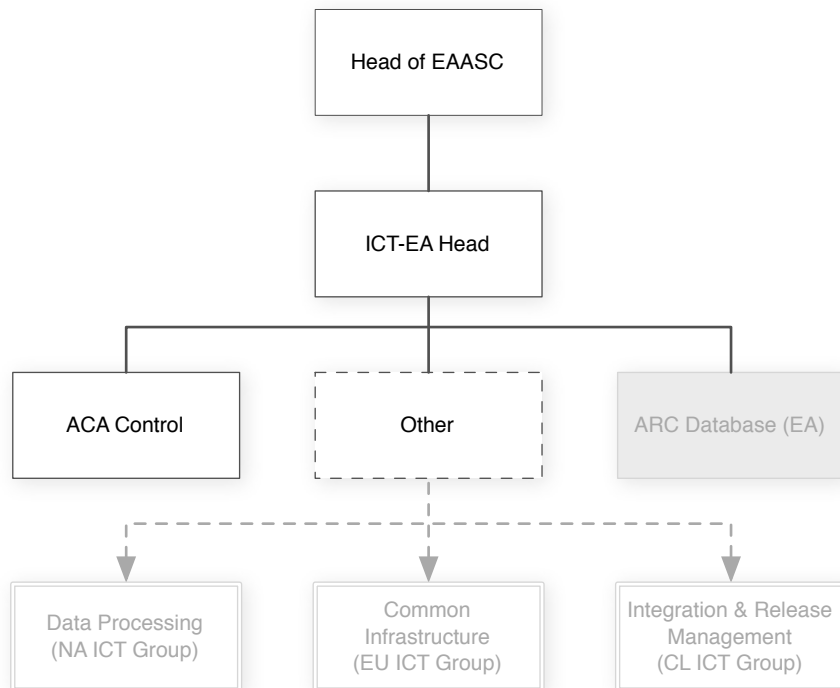
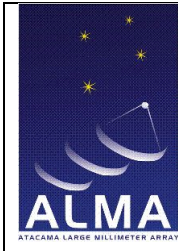


Figure 3: ICT-EA Organizational Structure



3.5.3 ICT-EU Organizational Structure

The following diagram shows the reporting structure of ICT-EU. Dashed arrows indicate that some ICT-EU staff contribute to other ICT Groups.

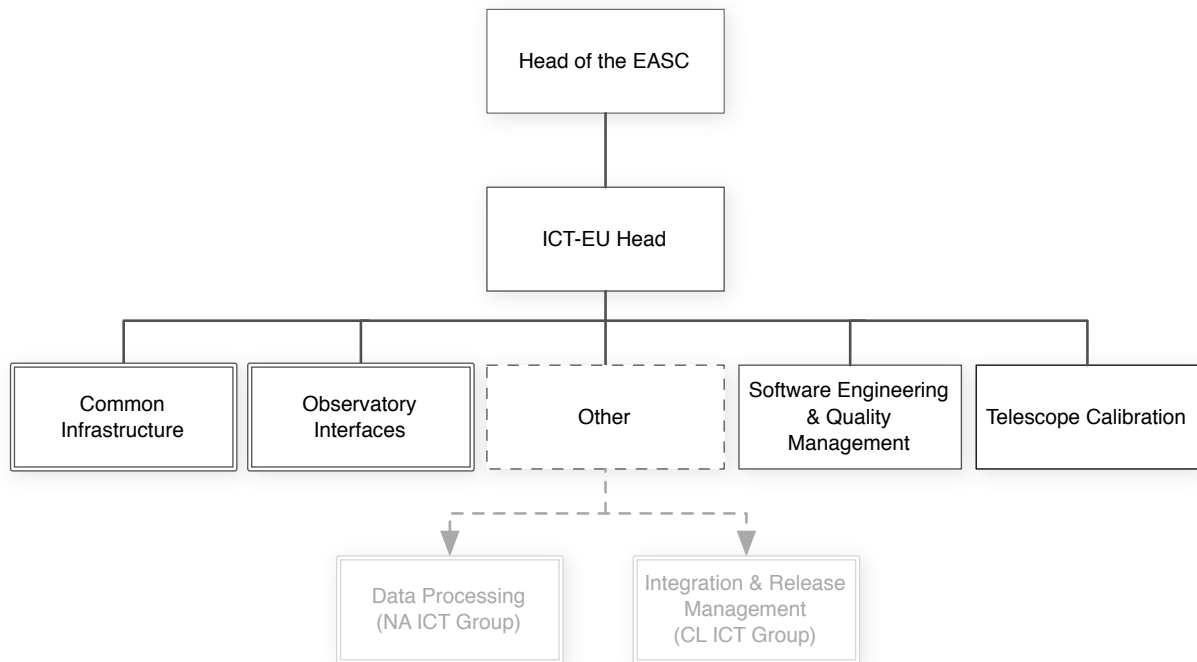
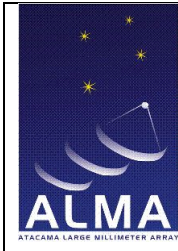


Figure 4: ICT-EU Organizational Structure



3.5.4 ICT-NA Organizational Structure

The following diagram shows the reporting structure of ICT-NA. Dashed arrows indicate that some ICT-NA staff contribute to other ICT Groups.

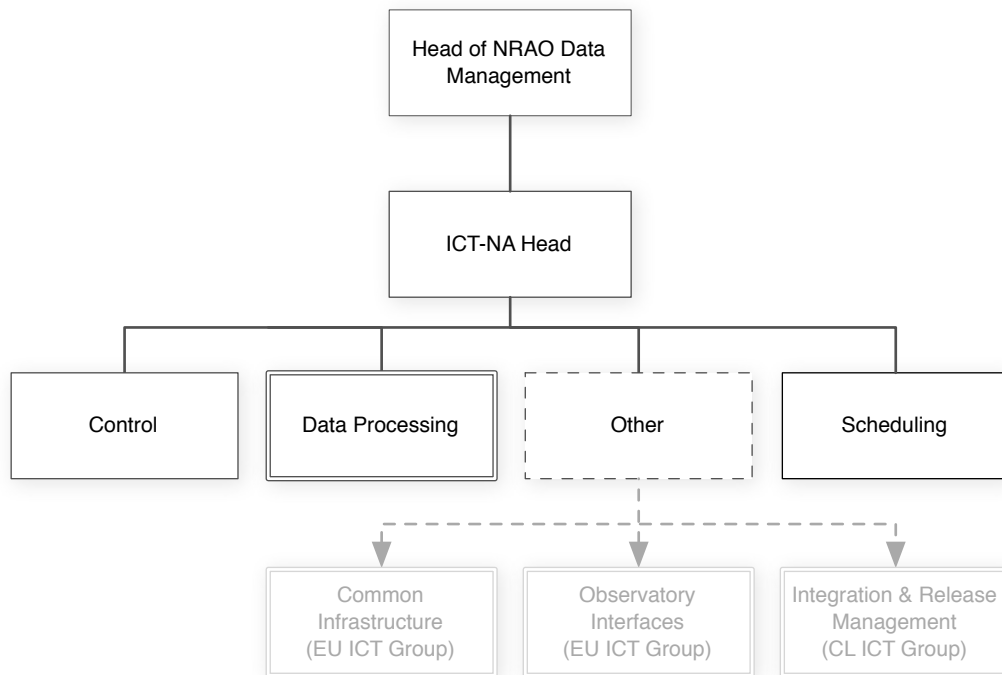



Figure 5: ICT-NA Organizational Structure

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4 Tasks, Responsibilities and Staffing Requirements

4.1 ICT Management

The ICT is managed and controlled by the ICT Management team. Decisions are made by consensus², whereby each member of ICT Management makes every effort to support both the goals of his or her own Regional ICT, including the goals from the local institution, and the overarching goals of the ICT as a whole. If in doubt, the goals of the whole ICT shall take preference over local interests.

The ICT Lead does not have the authority to change the scope of responsibilities or budget of any partner in the ICT. These are defined with the stakeholders in the various planning and coordination meetings (section 5.3). When there is no consensus on an internal (to the ICT) technical matter, it is the responsibility of the ICT Lead to propose a solution. If the regional ICT Heads do not accept this proposal, they can appeal through the escalation path outlined in section 5.1. These appeals are expected to be infrequent if the ICT is performing as intended.

Deputies are not part of the decision making process, unless the ICT Head is absent and has specifically nominated the deputy to act on his or her behalf on a certain topic.

The wider ICT Management, including the deputies and the Release Manager, holds regular teleconferences to discuss important issues, share information across groups and make strategic decisions. In addition ICT Management meets at least twice per year face-to-face. Video conferencing can be used as an alternative if deemed suitable.

4.1.1 Administrative Support and Secretarial Duties

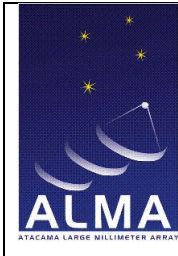
There is no ICT wide administrative support. Each Regional ICT is assumed to provide the administrative support necessary for the ICT to function effectively (purchasing, meeting organization, IT support, and similar).

4.2 ICT Groups for Maintenance and Development

The core activities undertaken by the ICT Groups are in the following categories (see also [RD5]):

1. Software maintenance:
 - a. Corrective maintenance
 - b. Adaptive maintenance
 - c. Perfective maintenance

² Consensus is the group resolution when opposing parties set aside their differences and agree on a decision that is agreeable to all, even if only barely. It is not a majority vote, i.e. all members must give their consent, before a consensus can be reached.



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- d. Preventive maintenance
2. Further development on deliverables:
 - a. Completion of construction features
 - b. Internally funded features
 - c. Externally funded features
3. Release planning, integration and testing
4. Software fault tracking (troubleshooting, analysis, and diagnosis)
5. Software operations support

The ICT Groups at the Executives are primarily responsible for categories 1 and 2, each one for their software deliverables in construction; and the ICT Group in Chile is primarily responsible for categories 3 to 5, as well as 1a, where corrective maintenance may be limited to providing quick fixes.

Externally funded features (category 2c) typically mean new or increased scope for ICT, in particular concerning maintenance. Unless ICT Management agrees that the required work can be absorbed in the existing staffing levels, the external funding must also include long-term maintenance by either providing the required resources externally or by funding additional staff within the ICT. The required effort for long-term maintenance, applying the same rules as for ICT or CIPT developed software, is in the order of 10% of the total development effort.

The organization chart in section 3.3 defines the major functional and non-functional (process) groups of the ICT, including the organization which holds the primary responsibility for that group. It is important, however, to understand that the effort for a given group is often split between organizations. For example, the Data Processing group is under the overall responsibility of NA (NRAO), however, important contributions to it are made from EA and EU.

ICT Management defines staff assignments for each ICT Group and reviews them regularly. The ICT Group Leads are then responsible for the detailed allocation of tasks to group members consistent with these high-level assignments.

The high-level staff assignments and areas of responsibility at the time of the writing of this document are specified in the appendix. However the authoritative version will be maintained separately as we anticipate that it will be updated more frequently than this document.

The ICT Group Leads will maintain the detailed planning for their group separately. Both the detailed ICT Group planning and the more general ICT allocation of ICT Group membership and areas of responsibility are subject to the regular planning and coordination meetings described in section 5.3. The goal is to provide the best service possible to our stakeholders within the overall budget envelope provided by the observatory.

If a Regional ICT is unable to support the staff allocations or areas of responsibility agreed within the ICT (for example, due to a staff resignation), the regional ICT Head will inform the whole ICT Management team so that a mitigation strategy can be agreed (or it is escalated to



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senior management if necessary). The mitigation strategies should take into account that in operations each partner has a fixed budget envelope.



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5 External Interfaces

5.1 External Reporting Lines and Escalation Paths

The ICT as a whole reports to AMT. It is the responsibility of AMT to resolve escalation requests brought forward from any of the ICT Heads and to review the working and effectiveness of the ICT on a regular basis.

AMT also holds the sole authority to request and approve structural changes to the ICT and to approve transition of major responsibilities from one ICT Group to another one.

Should there be any issues that cannot be resolved by AMT, they may be further escalated to the ALMA Directors Council as the final institution to resolve these issues.

5.2 Stakeholders

5.2.1 ALMA Director(s)

The head of DSO shall normally represent the views and interests of the ALMA Director(s).

The ALMA Director(s) can request from the ICT to present status and plans at various meetings and review boards.

ICT shall invite the ALMA Director(s) to all their planning, coordination and review meetings.

5.2.2 Integrated Science Operations Team (iSOPT)

The Integrated Science Operations Team (iSOPT) is the main customer of the ICT. The Department of Science Operations (DSO) shall centrally coordinate all requirements from the iSOPT, including those from the ARCs and Executives.

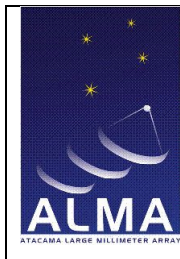
5.2.2.1 Department of Science Operations (DSO)

Science Operations should only use accepted software for conducting observatory functions. If DSO uses unaccepted software it assumes the risk associated with this choice. DSO opinions should generally be given considerable preference in setting the planning priorities for all software in routine use at the observatory, in particular at the SCCB and planning/coordination meetings. For subsystems in use outside the observatory (i.e., at the ARCs and by users) DSO is responsible for developing a common position amongst all stakeholders and will provide requirements to ICT in written form.

5.2.2.2 Head of iSOPT

The head of the iSOPT (and DSO) is ultimately responsible for providing prioritized requirements to the ICT, accepting software releases for operations, and to sign off new and changed requirements to the ICT.

The head of the iSOPT may escalate to AMT any disputes with ICT Management.



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5.2.2.3 Subsystem Scientists

The head of the iSOPT may nominate so-called Subsystem Scientists at the JAO, or request the ARCs or the Executives to provide such experts, to act on his or her behalf for particular areas. These nominations must be well known to ICT Management and the relevant ICT Groups. Nominations shall be officially communicated to the ICT by the head of the iSOPT.

Subsystem Scientists are experts in their fields and work directly with the ICT Group Leads and development teams to refine requirements and functionality in agreement with the priorities defined by the iSOPT.

5.2.2.4 ALMA Regional Centers

The three ALMA Regional Centers (ARCs) shall interface with the ICT through the iSOPT. The head of the iSOPT shall consolidate their prioritized requirements.

ARC Managers can request that the local ICT Head presents status and plans at various meetings and review boards.

ICT shall invite the ARC Managers to all their planning, coordination and review meetings.

5.2.3 Software Acceptance Manager

The Software Acceptance Manager is responsible for organizing, chairing, and documenting the Test Report Reviews ahead of a software acceptance. This role interfaces with the ICT through the appointed Software Release Manager. The Software Acceptance Manager recommends to the head of DSO to accept a particular software version for operations.

5.2.4 Engineering Services Group

The Engineering Services Group is a stakeholder in defining ICT planning priorities, with a particular interest in issues related to equipment monitoring, diagnostics, and interfaces.

5.2.5 ALMA Array Lead Engineer

The ALMA Array Lead Engineer is the appointed Integrated Engineering Team (IET) Lead and represents the engineering interests of the observatory. The Array Lead Engineer is the main contact point between ICT and the IET.


ICT shall invite the Array Lead Engineer to all their planning, coordination and review meetings.

5.2.6 ALMA Chief Scientist and Program Scientists

The ALMA Chief Scientist and the Program Scientists from the Executives represent the scientific interests of the observatory. They interface with ICT through the iSOPT.

5.2.7 Archive and Pipeline Operations Group

The Archive and Pipeline Operations Group is responsible for managing daily operations and administration of both the archive and pipeline systems, including further development of operational procedures and checklists. The group is also the single contact point for Oracle

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licenses and support contracts and is in charge of aligning versions and patches between the ALMA main archive in the SCO and the ALMA Regional Centers.

The group is a stakeholder providing operations metrics and proposing improvements regarding both systems to the ICT, interfacing with the respective Archive and Pipeline Group leads on this subject.

5.2.8 Archive and Pipeline Operations Manager

The Archive and Pipeline Operations Manager leads the Archive and Pipelines Operations Group and chairs the ALMA wide database technical coordination group. He or she is also the appointed Deployment Manager responsible for coordinating the deployment of ICT delivered software at the ARCs after its acceptance.

ICT shall invite the Archive and Pipeline Operations Manager to all their planning, coordination and review meetings.

5.2.9 Executives

Since the Executives provide the funding for their respective Regional ICT as well as the JAO ICT (via cost sharing), they have a keen interest in the effective functioning of the ICT, in particular for their own Regional ICT. The local ICT Head acts as the interface between senior management at his or her Executive and the ICT.

Requirements and tasks that are specific to a particular Executive (e.g., “beyond the ARC”) are outside the scope of the ICT. An Executive can, however, provide additional resources for such work to be done and managed within the local or global ICT. Even when not subject to ICT control, ICT Management should be informed about all ALMA software activities, even if strictly regional.

5.3 Planning, Coordination and Review Meetings


The ICT will hold regular meetings with its stakeholders to guarantee an effective information flow and functioning of the team. The dates given for the various meetings below are indicative only and will be aligned with the relevant dates of the corresponding observing cycles.

5.3.1 ICT Planning and Coordination Meeting

This meeting shall be held annually in November at the ALMA SCO to review the progress of software development and maintenance in all areas and to adjust priorities as required. The focus of this meeting is on the mid to long-term priorities of the ICT.

ICT Management provides a status update to stakeholders, and ICT Group Leads in collaboration with Subsystem Scientists present the strategic planning for their respective areas with a strong focus on high-impact and cross subsystems items.

All ICT Heads, their deputies and ICT Group Leads participate in this meeting. This meeting requires strong participation of ICT stakeholders. The head of iSOPT is responsible for ensuring the presence of iSOPT, in particular iSOPT management and key Subsystem Scientists.

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The meeting is open to all stakeholders and is organized by the ICT Head (CL).

5.3.2 ICT Leads Meeting

This meeting shall be held annually in May in one of the ALMA facilities (SCO/OSF) or at one of the Executives to discuss intermediate progress, technical difficulties facing on cross-ICT-Groups developments, introduction and adoption of new technologies, and future prospects.

The meeting is internal to ICT, although stakeholders may be invited to participate for particular discussion topics, and is organized by the local ICT Head.

5.3.3 ICT Review Meetings

Either ICT Management or a stakeholder can call an ICT Review Meeting to review the progress or functionality of a particular area of ALMA software. Review meetings shall normally be held at the premises of the responsible ICT Group.

Review meetings are open to all interested stakeholders and are organized by the local ICT Head.

5.3.4 ICT/iSOPT Management Meetings

ICT Management requires regular interaction with iSOPT Management, i.e. the Head of DSO and the ARC Managers. Regular interaction shall be conducted via email, but any member can call teleconferences if required. Both groups shall meet face to face at least once per year in addition to the ICT Planning and Coordination Meeting.

5.3.5 Requirements Gathering and Progress Meetings

ICT and iSOPT shall facilitate regular meetings to discuss detailed requirements and development progress in key areas, involving key experts from all areas. Examples are the Observing Modes Meetings, the Pipeline Working Group or the Control System Coordination Group.

5.4 Release and Acceptance Process

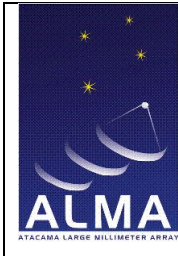
ICT follows a strict and well-defined release and acceptance process for delivering software to the ALMA observatory.

The ICT Release Manager appointed by ICT Management and the JAO Acceptance Manager appointed by the Head of DSO organize this process.

The process is fully defined in [RD3]. It will be reviewed regularly at the ICT planning and coordination meetings and adjusted accordingly.

5.5 Change Request Process

All requests for change in requirements or scope for ICT software are dealt with by the Software Change Control Board (SCCB) described in [RD5].



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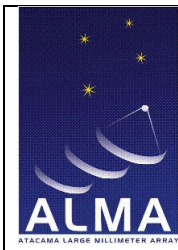
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6 Appendix: ICT Staff Allocations and Responsibilities

As discussed in section 4.2, ICT staff allocations and ICT Group responsibilities between the partners are defined by ICT Management. The version in this appendix presents the current status for 2015 and an outlook for 2020, but it will be subject to regular updates arising from decisions of the planning and coordination meetings. ICT Management can provide the in-force version upon request.

Staffing levels in the following tables are based on the current budget and FTE-cost projections. If these change or are incorrect the FTEs will be adjusted to meet the budget rather than vice versa.



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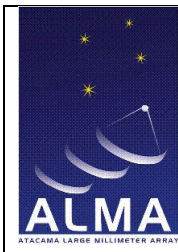
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6.1 Staff Allocations for 2015

	CL ³	EA	EU ⁴	NA	Total:
Management	0.5	0.8	1	0.5	2.8
Software Operations	8	0	0	0	8
Integration and Release Management	6	1	1	1	9
ACA Control	0	5.8	0	0	5.8
Software Engineering and Quality Management	0	0	2	0	2
Common Infrastructure	0	0.5	4.5	1.3	6.3
Telescope Calibration	0	0	1	0	1
Observatory Interfaces	0	0	5.25	1	6.25
Control	0	0	0	6	6
Data Processing	0	4.5	3.75	7.7	15.95
Scheduling	0	0	0	1	1
Total:	14.5	12.6	18.5	18.5	64.1

³ Head of ICT-CL is funded by JAO/ADC staffing budget foreseen in the overall staffing plan

⁴ Head of ICT-EU is funded by the EASC



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6.2 Staff Allocations Outlook for 2020

	CL ⁵	EA	EU ⁶	NA	Total:
Management	0.5	0.8	1	0.5	2.8
Software Operations	6	0	0	0	6
Integration and Release Management	8	1	1	1	11
ACA Control	0	5.8	0	0	5.8
Software Engineering and Quality Management	0	0	2	0	2
Common Infrastructure	0	0.5	5.5	1.3	7.3
Telescope Calibration	0	0	1	0	1
Observatory Interfaces	0	0	4.75	1	5.75
Control	0	0	0	6	6
Data Processing	0	4.5	3.25	7.7	15.45
Scheduling	0	0	0	1	1
Total:	14.5	12.6	18.5	18.5	<u>64.1</u>

⁵ Head of ICT-CL is funded by JAO/ADC staffing budget foreseen in the overall staffing plan

⁶ Head of ICT-EU is funded by the EASC

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6.3 Group Responsibilities

6.3.1 ICT Management

This is a shared responsibility between all partners.

6.3.2 Software Operations (SoftOps)

CL has full responsibility for software operations. Staff members from other ICT Groups are required to support Software Operations, particularly in debugging problems and supporting issues that arise in the initial deployment.

6.3.3 Integration and Release Management (IRM)

CL is responsible for managing the overall effort, including staging features for release and providing final integration and testing on the ALMA production environment. EA, EU, and NA are responsible for providing northern hemisphere initial integration and testing with a particular emphasis for integration testing of software from their own region.

6.3.4 ACA Control (ACA)

EA is responsible for all ACA software (ACA Correlator software and MELCO specific antenna software) and NAOJ holography receiver software.

6.3.5 Software Engineering and Quality Management (SEQM)

Software Engineering and Quality Management is the responsibility of EU.

6.3.6 Common Infrastructure (CommonInf)

Common Infrastructure is the responsibility of EU.

6.3.7 Telescope Calibration (TelCal)

EU is responsible for all Telescope Calibration software.

6.3.8 Observatory Interfaces (ObsIf)

Observatory Interfaces are the responsibility of EU with a contribution from EA, and NA at an additional contribution to be negotiated as part of the annual planning cycle.

6.3.9 Control

NA is responsible for Control (including the baseline correlator) management and the bulk of the support activities. NA is responsible for the TMCDB explorer. EU is responsible for the AEM specific antenna software and the total power processor.

6.3.10 Data Processing (DataProc)

NA is responsible for the overall management of the Data Processing (CASA and Pipeline) software, and much of the development. EA is responsible for single-dish software. EU is



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responsible for the Interferometric pipeline heuristics. Other areas will be divided according to the interests and capabilities of the partners and requirements of the stakeholders.

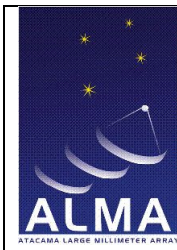
6.3.11 Scheduling

NA is responsible for all Scheduling software.

6.4 ICT Products and Services

The following list shows in alphabetical order the products and services the ICT is responsible for, ordered by ICT Groups:

- **ACA Control:**
 - ACA 7m/12m Antenna Software
 - ACA Correlator Software
 - ACA DMC Software
 - NAOJ Holography receiver Software
- **Common Infrastructure:**
 - ACS GUIs, Tools and Utilities
 - ACS Manager, Component, Container, Client
 - ACS Third Party Products
 - Alarm System and Monitoring
 - ALMA Science Archive Query Interface
 - ALMA Science Data Model
 - Archive Online Chain
 - Archive Pipeline Integration
 - Bulk Data Handling
 - Data Packer
 - Data Tracker
 - Harvester
 - Logging and Error System
 - Monitor Data Store
 - NGAS Archive
 - Notification Channel
 - Oracle Archive
 - Project Code Generator
 - Request Handler
 - Source Catalog
 - TMCDB
- **Control:**
 - Antenna, LO and Timing Hardware
 - Baseline Correlator Software
 - Data Capturer
 - Hardware Configuration Database
 - Hardware Monitor and Control Points, Alarms
 - Quick Look



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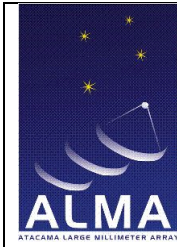
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- **Data Processing:**
 - CASA
 - Science Pipeline
- **Integration and Release Management:**
 - ALMA Software Build Procedures
 - Release Management
 - Standard Test Environment
 - Standard Web Environment
- **Observatory Interfaces:**
 - ALMA Dashboard
 - ALMA Quality Assurance (AQUA)
 - Integrated Reporting
 - Internal Infrastructure
 - Observing Project Lifecycle
 - Observing Tool (OT)
 - Operator Master Console (OMC)
 - Phase 1 Manager (Ph1M)
 - Project Tracker
 - Registration
 - Science Portal
 - Sensitivity Calculator
 - Shift Log Tool
 - Single Sign-On
 - Submission Service
 - User Registry
 - Web Shift Log Tool
- **Scheduling:**
 - Scheduling Planning Tool
- **Software Engineering and Quality Management:**
 - Auxiliary Services (NRI, Twiki, JIRA)
 - Computing Standards
 - Makefile and Build System
 - Operating System, Packages and Utilities
 - Software Repository, Site Replication
 - Standard Test Environment Support
 - User Accounts and Mailing Lists
- **Software Operations:**
 - Hardware Monitoring
 - Operations Software Support
- **Telescope Calibration:**
 - Antenna Positions
 - Delay Scan Results
 - Holography



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- Online and Offline Corrections
- Pointing Models
- WVR Corrections