



EUROPEAN ARC
ALMA Regional Centre

The European ALMA Regional Centre network

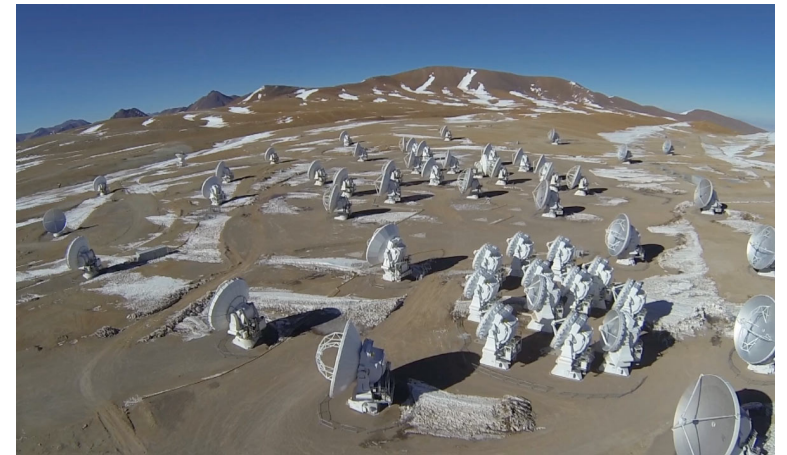
Challenges and lessons for the SRCs

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Atacama Large Millimeter/submillimeter Array: ALMA — Some facts

- International partnership of
 - **ESO** (European Organisation for Astronomical Research in the Southern Hemisphere)
 - **NSF** (U.S. National Science Foundation)
 - **NINS** (National Institute of Natural Sciences of Japan)
 - in cooperation with the Republic of Chile.
- 66 antennas at 5000m altitude in northern Chile
- ALMA construction budget: ~1.5 billion USD
- ALMA yearly operations budget ~ SKA yearly operations budget
- ALMA user base: ~8000 registered users
 - ~500 unique European PIs and 1700 unique PIs or cols per Cycle



The ALMA Regional Centres (ARCs)

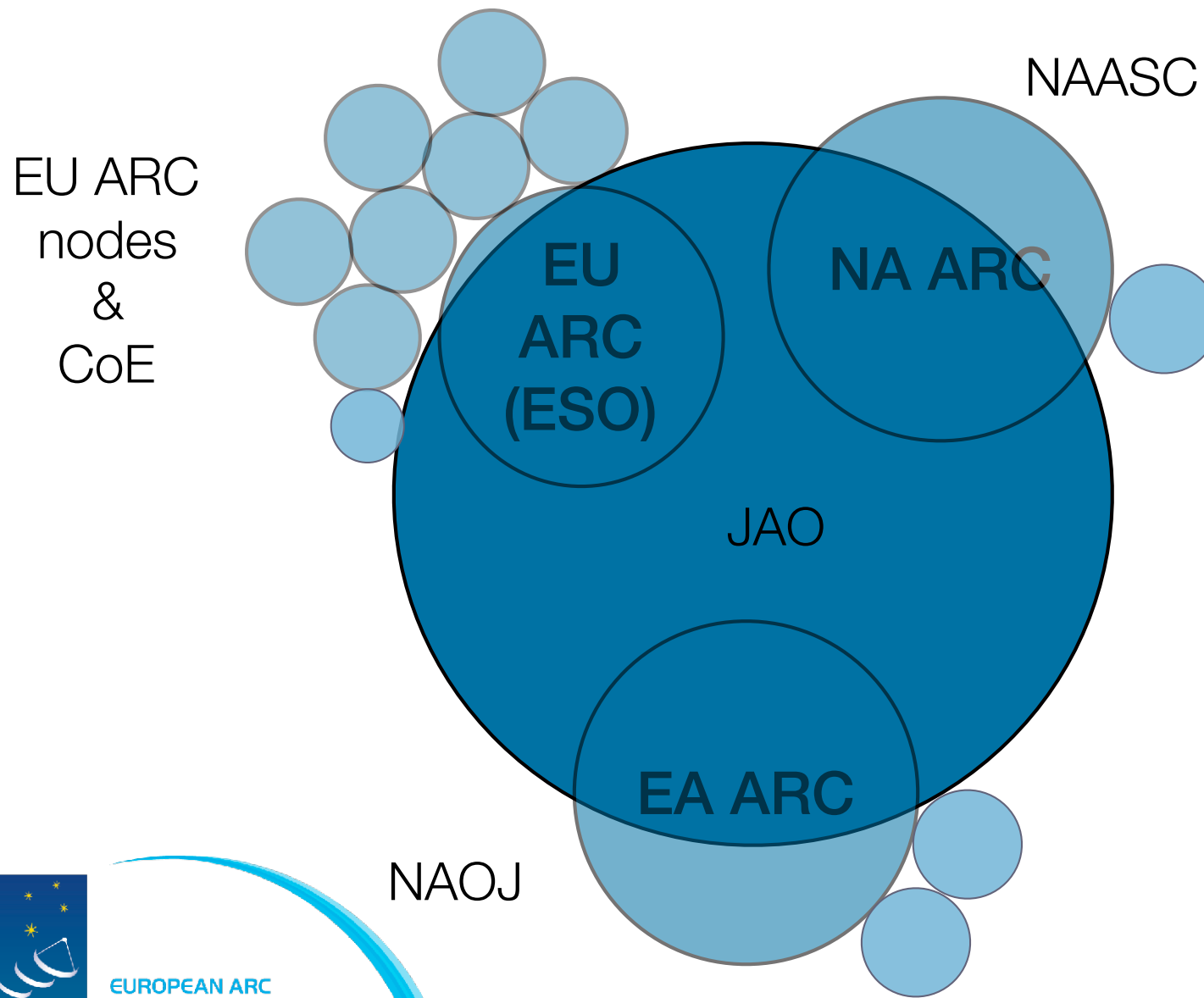
- The ALMA Regional Centres (ARCs) are the interface between the user communities and the observatory
- There is one ARC for each executive
 - Europe, North America, East Asia
- The ARCs provide **operationally critical services** to ALMA Operations in Chile and their regional user communities
- Close links with the Department of Science Operations (DSO) in Chile

The ARC is the One Stop Shop for ALMA users



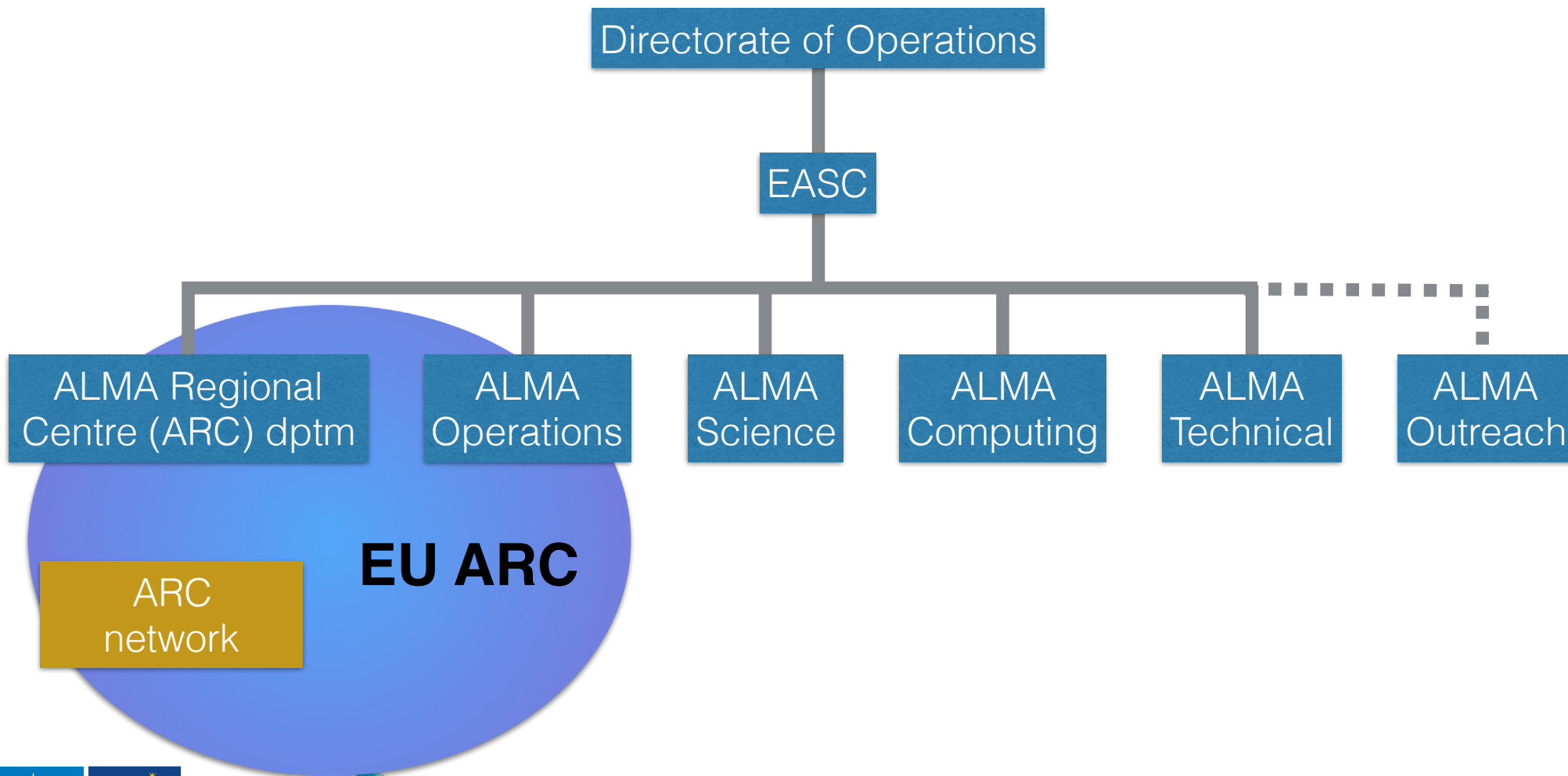
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The ALMA Regional Centres (ARCs)



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The European ALMA Support Centre



Geographical distribution of the EU ARC network



The European ARC network

- The ARCs are the interface between the user communities and the observatory
- The European ARC is unique for having a **distributed network of ARC nodes**
- These ARC nodes
 - **have close ties with the community** (active research environments)
 - **host many of the mm/sub-mm experts** in Europe
 - **are actively involved in ALMA** commissioning and optimisation



European ARC network concepts

Contracts:

- No contractual obligations between ESO or ALMA and the ARC nodes
- Collaboration is based on trust and Memorandum of Understanding

Finance:

- ESO does not provide financial support for the ARC nodes
- ARC nodes seek their own funding

Mandates:

- ranging from '*ARC nodes can only do user support*' to '*ARC nodes should support ALMA*'
- ranging from '*just support ALMA users*' to '*be part of general support body (LOFAR, NOEMA, SKA, ...)*'



EU ARC network management

- **ARC Coordinating Committee (ACC):** representatives of each node, the head of the ESO ARC Department and the European ARC network coordinator
- **Head of ESO ARC** responsible for successful operation of European ARC
- **ARC network Coordinator** responsible for overall coordination of network activities, maintaining communications, acts as contact person for all ARC staff
- Decisions within the European ARC network are taken by the ACC through **consensus decision-making**
- ARC informs the ALMA ESAC, a sub-committee of the ESO Scientific Technical Committee (STC)
- The ACC, via the ESO ARC, also passes information regarding the network to the JAO, the ALMA Management Team and the Science Operations Team.

Task distribution between central ARC and ARC nodes

- **ARCs:** observation preparation, quality assurance, scientific overview of software development, archive operations, science operations, policies, astronomer-on-duty, running Helpdesk, commissioning
- **ARC nodes:** face-to-face support, quality assurance, enhanced archive and data reduction support, community development, contact scientists, advanced software development, Helpdesk support, commissioning

Face-to-face support is an ALMA core function delegated to the ARC nodes

The ALMA Operations Plan and the European ARC Implementation Plan were written in 2007. Many tasks have changed/evolved since then



Challenges and lessons



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Challenge: **diversity**

(Within the European ARC)

Each **ARC node** operates under

- Different local structure
 - Organisation, embedded in observatory/university etc
- Different funding structure
 - Conditions from funding agencies, funding horizons etc
- Different mandates
 - Varies from just value-added to fully engage in operations and enhancement

Tasks, responsibilities and timelines must
be harmonised and synchronised
throughout network

Challenge: **diversity**

(Between different regional centres)

- Homogeneity is a major challenge
 - **ALMA:**
 - Somewhat guaranteed because ARCs inside baseline ALMA
 - Yet, different cultures, different structures at the different executives
 - **SKA:**
 - Each SRC has its own set-up, different management structure, different computing platforms, ...
- Localised expertise at SRCs... users travel to get the expert help they need
- Only partly worked for ALMA... funding agencies just want users to go to local support centre

Tasks, responsibilities and timelines must be harmonised and synchronised throughout project

Challenge: **funding**

Most ARC node activities are supported through **local funding agencies**

- Funding levels likely to continue for next few years
- Funding agencies expect high quality support to regional users
- Funding agencies may expect type of support to evolve
- ARC nodes need large user base!

ARC nodes continuously need to apply for funding, **funding horizon varies**

ARC nodes need to **adapt to local needs** to be eligible for funding

Continuous need to convince governing bodies, funding agencies and users of the benefits of a distributed network



Some additional notes on ARC/SRC, critical mass, and funding

- ALMA produced ~1600 refereed publications (>30 Nature papers)
 - European ARC supports ~100-150 successful projects per year, ~150 papers per year
 - ALMA produces about 0.1 refereed publication per hour of observing time
- Larger programs do not produce more publications per observing time
 - ALMA Large Programs are 50-100 hours
 - We know from e.g. ESO/VLT that #publications/hour goes down with program observing time
- How many publications per year per SRC are you expecting? Are funding agencies going to support that?



Challenges: **communications**

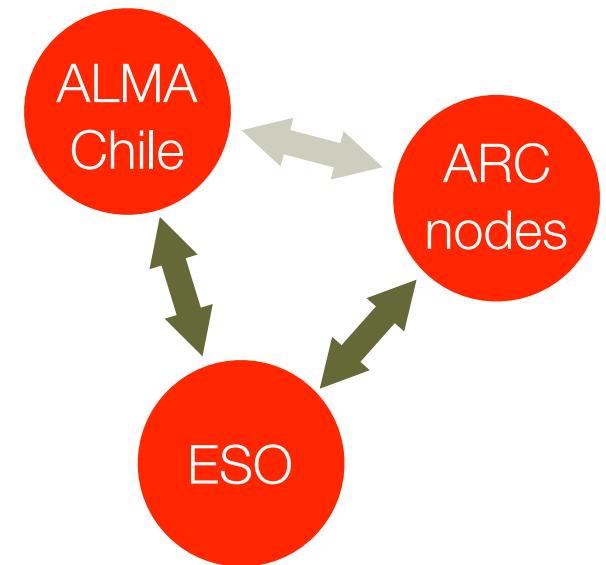
Interactions more challenging in distributed teams

Information flow:

- ARC nodes one extra step removed from observatory: **build direct links**
- Keep misunderstandings to a minimum and resolve rapidly those that arise

Trust

- Difficult to build - easy to destroy
- Everyone needs to feel/be part of the project



Continuous investment



Challenge: **adapt to changes**

Internal factors:

- Operational model evolves: tasks shift from observatory to ARC to nodes (and back)
- Use as an opportunity, but can cause tension with funding agencies etc

External factors:

- Needs of scientific community change
- Funding agencies' requirements change
- Landscape changes

Need to be flexible and
inventive in order to remain
attractive



Challenge: **shifting responsibilities**

- Example: pipelines and quality assurance
 - ALMA experienced serious challenges
 - Pipeline not ready in time
 - FTEs for quality assurance underestimated by one order of magnitude
 - Concerns in community about delays in getting data to users
 - Quality assurance moved from observatory to ARCs to ARC nodes
 - Found problems in imaging software used for delivered data.. huge re-processing effort

Some major problems can
turn into great
opportunities...
but it is not for free



Challenge: **collaboration and ownership**

Global ALMA project must consider ARC nodes an integral part of ALMA

- Involvement in commissioning activities
- Involvement in observatory activities
- Development programs (new receivers, software, etc)
- Direct links between observatory and ARC nodes!

Recurrent issue.
Direct links are
essential



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Challenge: **integration in (science) operations**

ARCs are integrated in Science Operations

- ARC managers plus Head of Science Operations in Chile form the integrated science operations team
- ARC hosts ‘subsystem scientists’ for ALMA
- ARCs and ARC nodes help with commissioning and optimisation

This is very important to keep the link between Science Operations and regional centres



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Create links between RCs
and science operations

Challenge - **trust in data products**

- Advanced data products
 - ALMA is working on plans to provide ADPs
 - ALMA not considering ingesting user-provided ADPs, except for LPs
 - Although the standards for these products are very 'light', PIs are already complaining
 - Observatory has no control over this once the data has been delivered
- Data products: users are were used to have full control.
 - Still working on this for ALMA.
 - ALMA is halfway between traditional model and what SKA wants to do.
 - **Missed opportunity by ALMA to not involve community more.**

Involve community in
data processing early on

The future of the EU ARC network

The mission: Provide support of the highest standards to all European ALMA users and strengthen the European ALMA community

Commitment: Continue the contribution in shaping ALMA, providing expert assistance towards EOC activities and tools to users and the observatory

Support: Moving towards becoming more science-oriented

ESO: committed to continuing supporting the European ARC network at the current levels and for as long as there is a need and an interest

Nodes: Basing ALMA support structures within broader user support centres

Informal network of interferometric centres of expertise (ICE)

(NICE: network of ICEs)



Closing remarks

- EU ARC network was set up as an experiment but turned out to be very successful: **a model for future facilities?**
- **Optimal use of existing expertise**
- **Recognition** of skills and effort is essential
- In an ever-changing landscape, **those that adapt survive**





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