Atacama Large Millimeter/submillimeter Array

ALMA operations start lessons learned

ngVLA workshop

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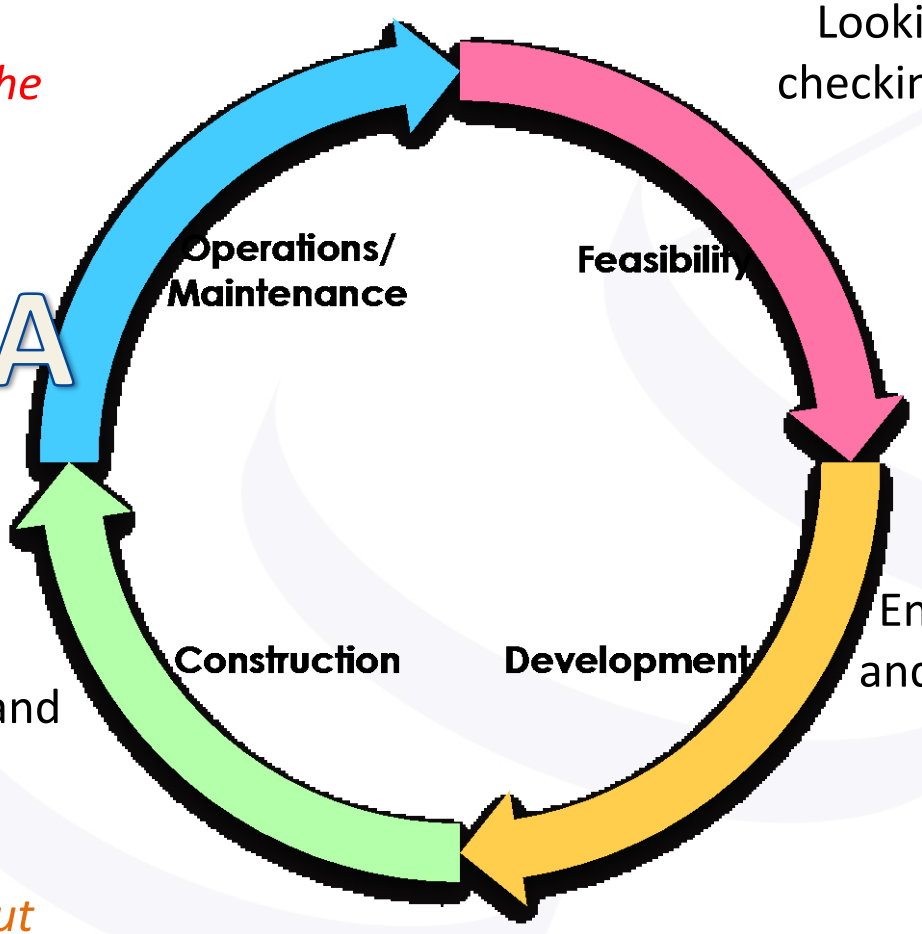
- Project – risks and legacy
- Reality specific difficulties
- Consequences
- Ongoing actions
- Lessons learned

Project – risks and legacy

High expectation in the production!

Looking for funds and checking technical critical feasibility



ALMA

Turn over

Operations is not a top priority at this stage

Ensuring performance and budget compliance, trying to shape operations

Managing time and money

Operations is a priority but construction completion is stronger: De-scoping …

Operations is often understood as maintenance

Project – risks and legacy

- During development, the objective has been to:
  - Maximize MTBFs of critical/prototypes subsystems to increase reliability and reduce maintenance effort
  - Minimize maintenance and operations staff expertise needs (on delicate subsystems mainly)

  ➢ *All operations plans have been based on the above hypothesis*

- During construction, the objective has been to:
  - Keep the budget and schedule under control
  - Reach acceptance of subsystems to be delivered

  ➢ *Who is the customer? Future operating crews or/and project stakeholders?*
  ➢ *Where is the operational model consolidated at observatory system level?*

At inauguration everything has to run – at least once……

Reality specific difficulties

- Partnership complexity (3 executives +JAO, different cultures, distance) and challenging project
  - Tough project negotiations leave burnt people who will have to live together during operations for a long time
- Project de-scoping effects on operations (as foreseen and as performed)
  - Maintenance model differ from foreseen one and de-scoping has unexpected consequences:
    - High reliability maintained in scheduled way at low altitude versus permanent attention at high altitude
    - Processes and tools criticality maybe different
- The machine has to work every day
  - But it remains a prototype…..
- The hardware is not behaving as expected
  - Several technologies are not commonly used in this environment at least for OTS hardware

Reality specific difficulties

- The trivial subsystems are essential
  - The best possible antenna needs power, communication….
  - State of the art technology can also become a prototype in specific conditions
- Staff turn over partly invalidates the training effort
  - Project people are often not funded for routine operations (and may not be suited)
  - People have grown along the long project and like it
- Providers/stakeholders also re-assign knowledgeable people (in depth knowledge becomes difficult to access)
  - Once the deliverable is accepted, high profile people are needed on the next burning issue
- If you do not suffer, you often do not care much
  - Human nature

Consequences

- The ramp up is slower than expected
  - Maintenance procedures and tools have to be re-assessed
  - Maintenance approach requires remote troubleshooting and (de-scoped) means re-implementation
  - Project backlog has to be finished even if focus is optimized to real conditions
  - All originally serialized transition steps have to be performed in parallel with relevant risks (training, troubleshooting, upgrading, and maintaining, in all areas, not only engineering)
- The critical subsystems perform well but the trivial ones suffer “fast track finishing”, de-scoping and lack of global operational vision
  - Basically an immediate upgrade project phase
- Staff turn over, including management, is a sort of “start from scratch”!
  - But also a new opportunity as some good people were burnt along the way

Ongoing actions

- Recovering a trustful relationship with all stakeholders around a unique objective – science production
- Aligning community expectation to realistic goals
  - Plan functionalities and performance targets ramp up
- Trying to understand the best path towards operations efficiency
  - No perfect path but learning curve
  - Iterative resources needs/spending exercises
- Separating staff assignment when priorities are incompatible
  - Troubleshooting
  - Preventative maintenance
  - Remaining project work
- Work share and skillset/ownership re-evaluation
  - Optimize cost and reaction time versus distance, cost, people availability and skillset

Lessons learned

- Can all this be avoided in our kind of activity?
  - Not if project phases and organization does not evolve significantly
    - The projects remain very ambitious and risky versus available budget
    - As the size increases, the number of partners grows and culture is still scientific/evolutive
    - There are solutions but based on other models (space…)
  - MTBF approach… is sound

- Similar project lessons learned is already challenging/difficult
  - The project size has political implications
  - These project frequency is low in astronomy and industrial environment evolve
  - ……..

- Can this tough transition phase, from project to operations, be mitigated
  - YES!

Lessons learned

- No magic solution during project phase
  - and build up a systems team (observatory level) with adequate system level technical budgets
  - Try to involve as early as possible experienced operation people in reviews
  - Avoid re-inventing warm water and subcontract to real experts
  - During construction de-scoping, involve future operating teams (balanced evaluation)
  - Allow to think that your hardware is not perfect and consider alternatives/contingency
  - Do not over play warranty – could become a trap

- Acceptance and operations start
  - The project as such shall have an end although there is remaining work
  - Approach completion task lists realistically by separate teams evaluation
  - Do not de-mobilize experts to fast (condition based maint/training)
  - Consider cultural aspect (international to local, project to operators)
  - Avoid overselling success and start up speed
    - be humble and put real effort in managing expectations

Lessons learned

- Keep money….. and expect to spend it
  - Budgets and resources forecasts still will require iterations

- Face first problems…. with philosophy
  - The ramp up requires transparency for objective risks assessment and optimized decisions
  - The efforts coordination require trust, furthermore in complex, new organizations
  - The operational world is pretty different from the project one and not obvious to approach for people who do lived this experience