



cherenkov
telescope
array

Swiss CTA Observatory Day

December 13th, 2023

Status and Future of CTAO

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Today's Discussion



- Only a little bit on status
- Current changes and a new direction
- Where we are heading
- Why we do this – science return
- Communication

Examples of Recent Top Level Achievements



- Successful demonstration of ACADA on LST-1
 - Paves the way for developing increased functionality
- Reached two major hardware milestones – tenders started for
 - SST mechanical Structure and Mirrors
 - LST-South
- Progress on qualification activities
 - SST Camera
- Progressing on the South Infrastructure preparation
 - Foundation design SST, and MST
- Several reviews successful (effort of IKC teams) or moving forward
 - LST CDR is closed
 - MST Structure CDMR passed
 - FlashCam CDMR in preparation
 - NectarCAM TRR in work

CTAO Has Made Progress But Needs to Do More



- Building the observatory is a complex structured effort
 - Many stakeholders and interfaces
 - Much larger than existing observatories
 - Needs to operate remotely with minimal support
 - Last 30 years requiring high reliability
- Need to supply more support
 - Interactions with IKC
 - Building infrastructure and software
- CTAO gGmbH minimal funding over the last years
 - Waiting for ERIC
 - Staff size getting smaller, CTAO not effective – **now critical**
 - Difficult to hire new people
 - No significant infrastructure preparation beyond in-kind

CTAO Is Taking On A New Direction



- Waiting approach couldn't continue given more ERIC delays
- Separate project from organization (in the short term)
 - Don't wait for ERIC to provide funds (where possible)
 - Not a long-term solution but can make progress
- Emphasize collaborative work
 - Everyone is short-staffed (and people work on other projects)
 - Increasing CTAO staff directly working with IKC
- Need to be flexible on having interim array configurations
 - Early science and discovery of problems; science data pipeline
 - Investigating how we do that without risking alpha configuration

Obtained Funds For A New Start



- Approved budget and commitments for 2024
 - € 9.4 M to support hiring 29 new people, other expenses
 - € 20.6 M commitment to build south site infrastructure
- Estimate based on what is required to move project forward
 - Assumes new organizational structure and ERIC staff rules/policies
- Hiring is the minimal level that can adequately support the IKCs, define interfaces and requirements, ensure safety, and develop software. *Staffing levels to date have been inadequate.*
- Infrastructure needed now to avoid IKC telescopes currently under development being put into containers

CTAO Will Be Growing and Changing



- Hiring guided by CTAO's mission:
 - Provide project leadership and management
 - Technical leadership: systems engineering, software development, IKC support
 - Infrastructure development

- Hiring goals
 - Replace retiring / leaving personnel (PM, Lead Systems Eng., Dir of Admin)
 - Increase systems engineering and computing
 - *Candidates need to be flexible and understand a scientific instrument development environment while also having formal skills*

- Increasing Telescope Element group to provide one-stop interface for each major IKC group

- Hiring is progressing well
 - Making offer to senior HR manager
 - Screened list of candidates for Project Manager
 - Starting interviews of Lead Systems Engineer

Example - New Hires Will Support North Site Continued Development



- LST efforts moving forward quickly
 - Significant progress by IAC developing foundations
 - Successful ACADA demonstration working with LST-1

- Need to jointly work with IKC on integration/acceptance of LST
 - Identify and work together on any issues
 - Systems engineering is key

- Work with IAC and MST IKC to support schedule development

- Hiring plan to meet these needs – new personnel:
 - South site interface manager
 - Engineering, safety, administration personnel
 - LST interface/eng. lead (Telescope group)
 - MST interface/eng. lead (Telescope group)
 - Systems engineer(s)
 - Software eng. to support LST (Software group)



Example - Preparing to Accept LST-1



- LST-1 is most mature telescope and should be accepted first
 - Need to work together to ensure meets requirements
 - LOTS of work for both teams
- LST-1 is expected to be ready for acceptance in 9 months to 1.5 years
- CTAO needs to recruit the people needed to support acceptance and then operate LST-1
 - Need to identify and start this process this year
 - Will be hiring several people this year but will need to replan to hire operators
- Other items such as ACADA need to be available
- Need to develop joint Acceptance and Operations approach
 - Full costs were not in the cost book – needs to be fixed

Observatory Goals for the Year



- Increase Communication
 - Bi-directional CTAO-IKC communication; communication between IKC
 - Project communication / engagement with the science community and public
 - Work together to finalize necessary documentation and reviews

- Strengthen Planning and Organizational Development
 - Hire 29 people
 - Develop integrated resource loaded plan
 - Develop LST-1 Acceptance and Operations plan
 - Facilitate MST efforts on La Palma
 - Transition organization to ERIC or determine alternative path

- Advance Development Efforts
 - Infrastructure efforts at both sites
 - SW, especially building on ACADA integration success

- Structure Agreements and Science Return
 - Negotiate IKC agreements as far as possible
 - Facilitate update of consortium MOU

Developing A Longer Term Plan...

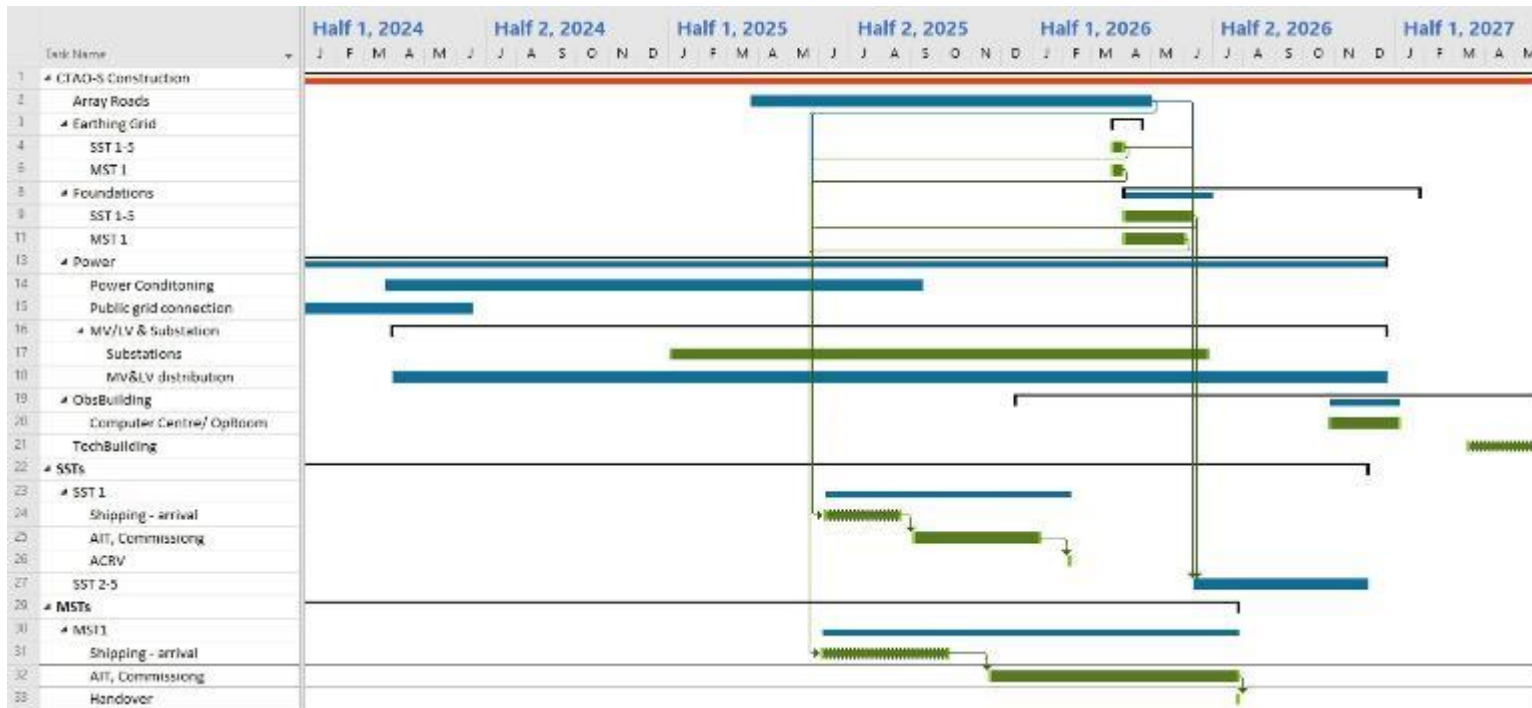


- Currently no integrated plan across all teams. Unable to:
 - Determine when we could move to full operations and science
 - Have an interim array configuration
 - Prepare for acceptance of telescopes at the sites
 - Rephase the Cost Book to get appropriate funding
- Currently bringing together infrastructure and IKC teams schedule input
 - Going well but will need to iterate several times
- End goal – integrated approach we can all plan to or at least realize where/when we have problems
 - E.g. what are the priorities for software development?

In Process – South Site Example



- Have initial input from many teams (several things missing)



- Possible interim configuration by end 2026 / early 2027
 - Depends on infrastructure re-ordering; possible stop-gaps
 - Depends on funding...

Increasing Overall Construction Focus – CTAO/CTAC Berlin Meeting



- Different meeting emphasis – focus primarily on construction
 - Attended by ~200 people
- Variety of construction-oriented meetings
 - Technical meetings (with smaller groups)
 - Schedule and planning meetings for infrastructure & IKCs
 - “Plenary” session focussed on actions and plans forward
 - Several productive side sessions
- Stressed that communication is essential for a successful project
- Will alternate construction and science meetings going forward on six month intervals – next April Science Symposium in Bologna with general and gamma-ray community sessions

Construction is Fun But End Product is Science

Science Access vs Phase

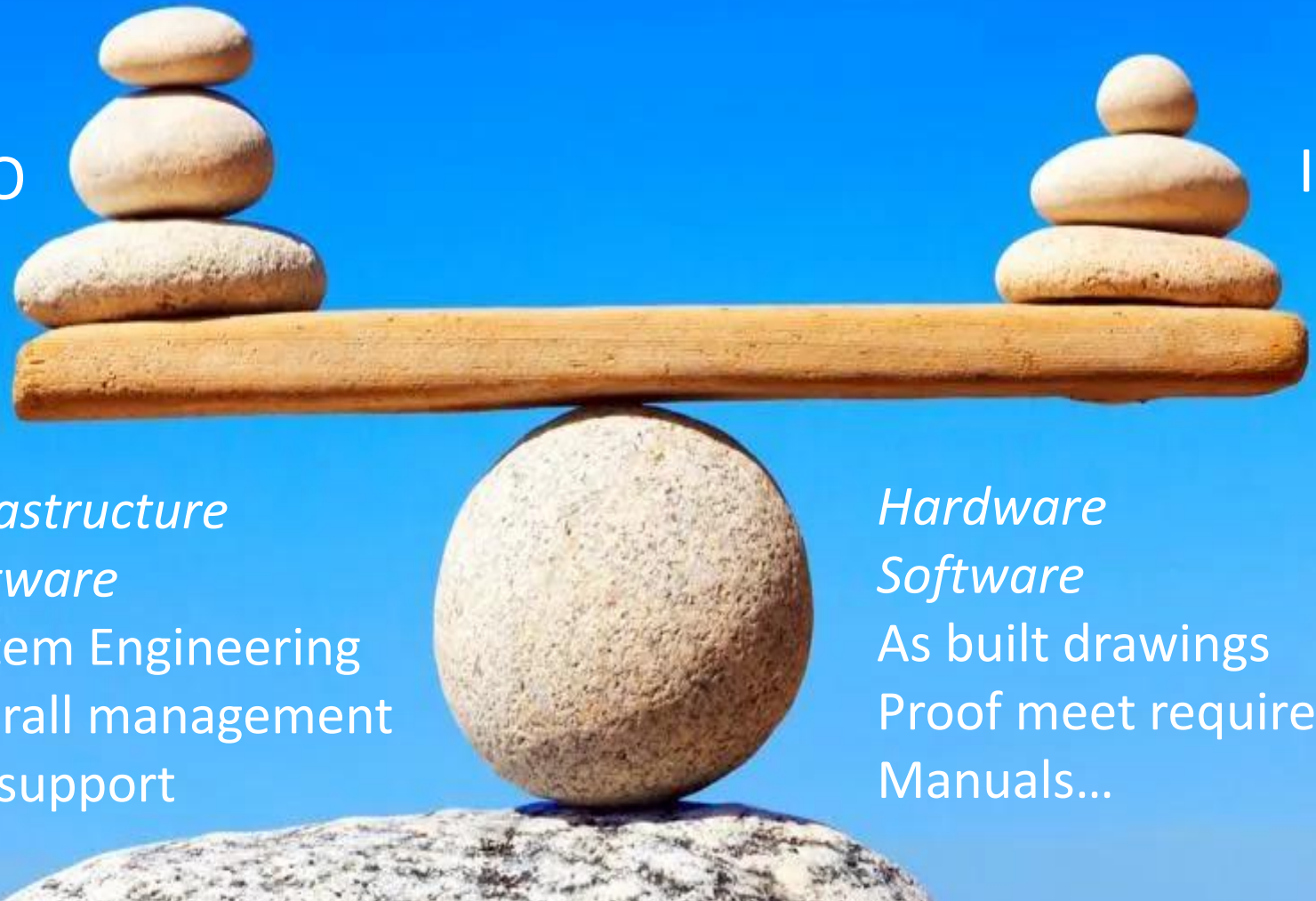
In-Kind Contributions

CTAO

IKCs

Infrastructure
Software
System Engineering
Overall management
IKC support

Hardware
Software
As built drawings
Proof meet requirements
Manuals...



Finalizing The Organizational Type Shouldn't Stop Agreement Progress



- ERIC has been delayed by EC objections about the involvement of strategic partners and IGOs (ESO)

- Plan to develop IKC agreements under gGmbH to the point where they are complete but for final signature
 - Increased annual observatory budget enables hiring of staff to support process

- Agreements need to be binding
 - IKC consortia need to identify who is the main party
 - If there is a significant delay, investigate having MOUs

Why Are Agreement's Needed Now?



- Only contractual document that captures details of agreements and *any exceptions*
 - Technical
 - Programmatic (schedule, value, management relationship)
 - Product Assurance

- Need to define baseline for project
 - Schedule
 - Science access
 - *I am sure there are a lot of misunderstandings*

- Forms basis of construction cost book update later in the year

- Forms basis for definition of short-term operational budget
 - Activities start before the Alpha configuration is complete

What Is The IKC Process and Timeline?



- Need to agree on plan over next 2 months

- Iterative process as depends on many efforts
 - Updating documents
 - Scope details
 - Schedule
 - Definition of interim configurations; early science access and how driven by early deliverables

- Nominal approach
 - Now – January Complete agreement template
 - February Start discussions
 - Late summer/autumn Finished but for signature

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- Significant work by everyone (esp. Vitor) to develop MOU defining role of science collaboration going forward
 - Different views on KSPs / PI roles / members
 - Recognition of everyone's contributions to date (some significant without in-kind recognition) versus required funding from contributing parties
 - Convening committee to bring these together
 - Build on work to date embodied in existing MOU
 - Representatives from contributing parties
 - Representative from collaboration
 - Start in new year coordinated by Project Scientist and me

Long Term Organizational Structure



- gGmbH works in the short term but does not allow broad involvement nor is it a good platform for long term support
 - gGmbH extended by three years only
- ESO working on multiple paths to resolve EC Legal Services objection and demand to use European Court of Justice
- If ERIC cannot be approved, need to quickly move to some broadly acceptable alternative structure
 - Should not be distracted but should be prepared
 - BUT should set a timeline by when we start looking at alternatives
 - Reconfirms our commitment to make CTAO work as a broadly international effort in a tangible way and will avoid losing time

Communication is Critical for Our Future



- Historically, poor communication for many reasons
- Given the number of organizations, as well as technical interfaces, lack of communication is major threat to project
- CTAO recognizes issue
 - Hiring staff to be interfaces between observatory and IKC
 - Increasing system engineering personnel
 - Will continue to work with IKC on reviews/documentation etc
- Documentation etc ensures good communication
 - Need to balance workload but...
 - Only way to ensure observatory will continue (we won't be there)
 - Scientist/engineers come and go – need to preserve knowledge
- **Need to plan and work together**
 - Work out how to minimize problems, have interim science/risk reduction, eventual alpha configuration

Discussion and Questions