Concept of Operations for the SKA

Douglas Bock
Chair, SKA Operations Working Group

Assistant Director – Operations
CSIRO Astronomy and Space Science

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Purpose and Scope of the ConOps

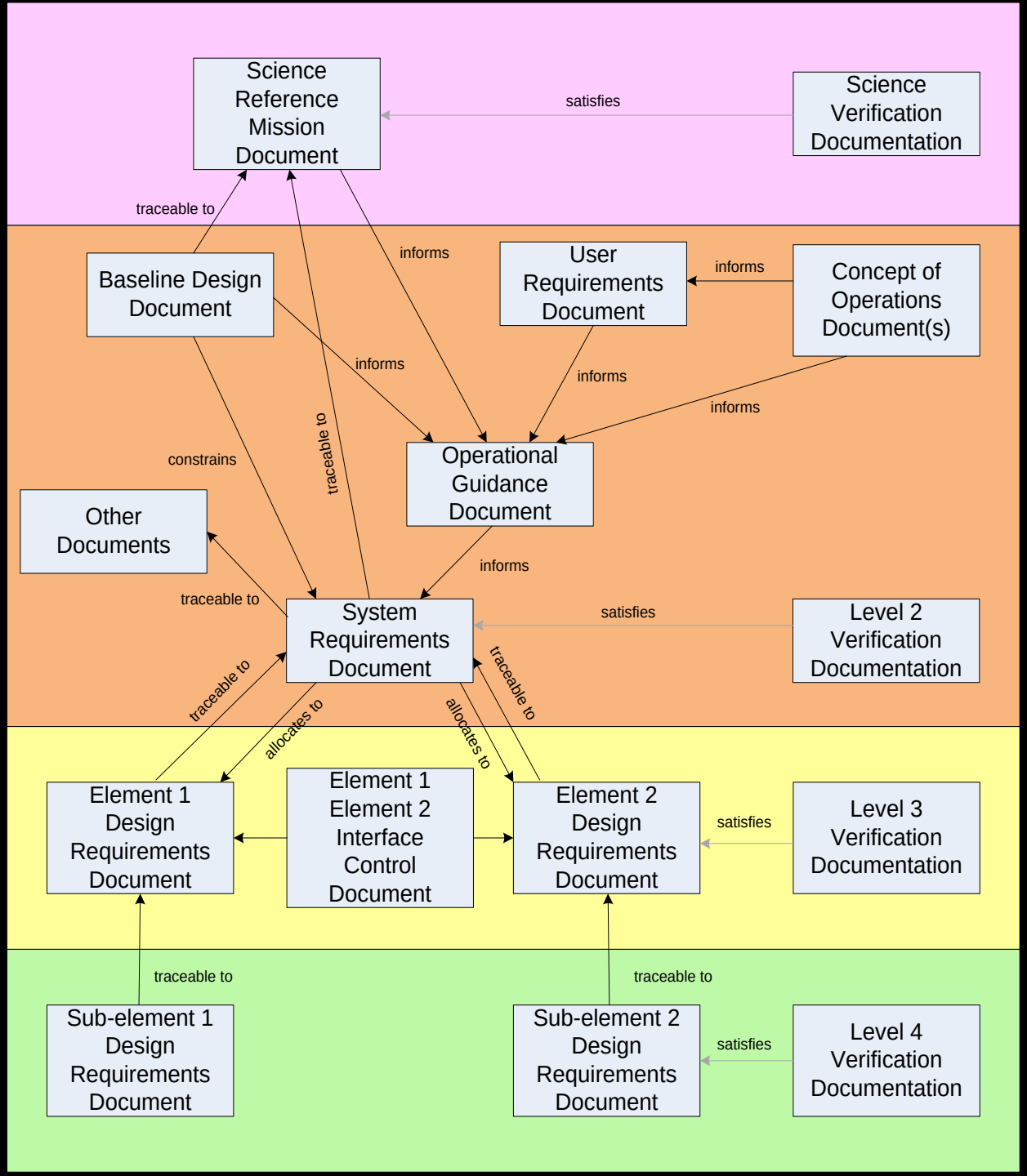
Describes *how* (organisationally) the SKA will be operated

Covers (defines) the entire SKA Observatory

- Global HQ
- Host Country HQs
- User support and data delivery
- Regional Activities

Implicitly makes organisational design decisions

➔ SKA design (telescopes and observatory [e.g. project and hosting agreements])


Science Reference Mission Document
satisfies
Science Verification Documentation
traceable to
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User Requirements Document
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Concept of Operations Document(s)
Baseline Design Document
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Element 1 Element 2 Interface Control Document
Element 2 Design Requirements Document
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Level 3 Verification Documentation
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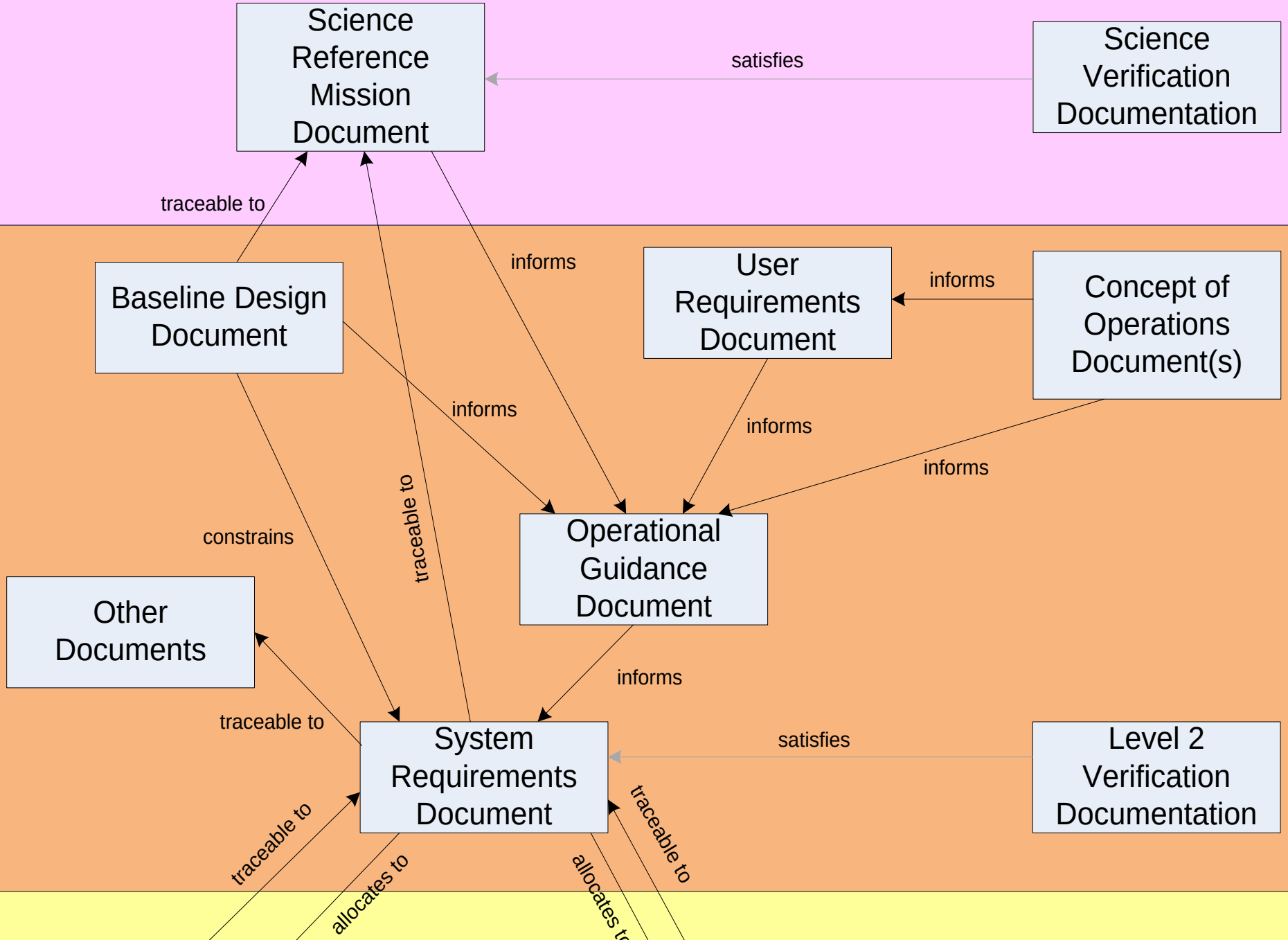
Sub-element 1 Design Requirements Document
Sub-element 2 Design Requirements Document
satisfies
Level 4 Verification Documentation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ConOps TOC

1. Purpose and Scope of the Document
2. Purpose and Scope of the SKA Observatory
3. Science Projects
4. Science Operations
5. Engineering Operations
6. Management and Administration
7. From Construction to Operations
8. Operational Modes
9. Cost of Operations
10. Upgrading the SKA

ConOps TOC

8. Operational Modes and Functions
    1. Normal observing
    2. Time-critical overrides
    3. Custom experiments
    4. Commensal observing
    5. Collaborative & coordinated (e.g. VLBI)
    6. Maintenance
    7. Telescopes and subarrays

“Top-level” Principles of the ConOps

- Distilled from the ConOps
- Agreed by the Board
- Complete ConOps will describe the context and implications

- Board direction focussed on top-level questions of purpose, scope, and structure

The SKA Observatory

- A single organisation consisting of telescopes, necessary local activities, data processing & archive, Global HQ
- Purpose
  - Enable scientists to pursue world-leading programs with SKA
  - Organise and conduct upgrades
  - Ensure protection of SKA sites (SKA and future)
- Scope
  - Provide, commissioning, maintain, upgrade SKA Telescopes
  - Deliver, support, curate data
- Primary success metric
  - Significance of role in making fundamental scientific discoveries and facilitating overall scientific progress

Structure of the Observatory

- Director-General and Board of Directors
- Global Headquarters
- Host country presences for controlling infrastructure and conducting operations
- External advisory body to advisor Director-General
- SKA Operations = Centrally-managed activities that are neither part of SKA Construction Project nor planning

Detailed definition still required:

- Boundary of telescope and observatory
- Regional activities; delivery of user support

Definitions

SKA Construction Project – Everything defined in the capital project plan

SKA Planning activities – activities leading up to the capital project plan and operations plan (including preconstruction); SKA1 and SKA2

Definitions

SKA Operations – everything else centrally managed … what is this?

[cf. SKA Observatory defined earlier– broader scope not centrally managed, but to agreed standards. E.g., additional computing, user support.**]**

Telescope vs Observatory

- Telescopes – essentially defined by the construction cost cap
- Operations – defined by the available operating budget
- Observatory – Could be broader – to agreed standards

Definitions

SKA Telescope - A single scientific instrument of the SKA that can operate as a coherent system independently of other telescopes, but which may share resources, including software, with other telescopes.

[OWG: Each telescope will include the necessary hardware (including data storage) and software to produce quality controlled data products capable of being distributed to users.

cf. Archive: Long-term storage facility for delivered science data products]

Science Operations

- Access policy (observations & archive access) yet to be determined
- Mix of large programmes (KSPs) and smaller PI-driven programmes
- Observatory to deliver “science-ready” data and a system to support data-intensive astronomy – where?
- User support and tools to be delivered – where?
- Director-General the final authority for time allocation

SKA Lifetime

The expected lifetime of the SKA Telescopes is 50 years

[OWG: The facilities have to be designed to be operated for this period: maintenance, replacements, etc]

An explicit requirement will be provided.

Radio-quiet sites

- Host countries responsible for protection from outside emissions and other telescopes

- SKA responsible for control of self-interference [and presumably impact on other telescopes]

Should you believe this?

- Board has approved top-level principles
- Beyond that, this presentation “indicative” of current thinking

- ConOps & requirements to WPCs: T0
- Change control anticipated by T0+12

Top-level Principles of the SKA Concept of Operations

This document describes a set of high-level principles that would govern the operation of the SKA Observatory as it moves into the commissioning and operational phases of the project. It is envisaged that the current SKA Organisation would evolve into the SKA Observatory.

The SKA Observatory

1. The SKA Observatory will consist of SKA Telescopes[1], local activities necessary for their operation, data processing and archive facilities and a Global Headquarters.
2. The SKA Observatory will be operated as a single organization.
3. The purpose of the SKA Observatory will be to enable scientists to pursue world-leading scientific programmes, to organise and conduct improvements and upgrades of the SKA telescopes in order to provide and maintain facilities that are at the forefront of science and technology and to ensure the protection of the SKA sites for the SKA and future radio telescopes.
4. The scope of the SKA Observatory will be to provide, commission, maintain, and upgrade the SKA Telescopes, and to deliver, support and curate scientifically viable data from the telescopes.
5. The SKA Telescopes will be located within radio quiet zones provided by the Host Countries of South and Southern Africa and Australia.
6. The expected lifetime of the SKA Telescopes is 50 years.
7. The SKA Observatory will be the technical design authority for the SKA Telescopes.
8. The primary success metric for the SKA Observatory will be the significance of its role in making fundamental scientific discoveries and facilitating overall scientific progress, expressed as high impact, peer-reviewed scientific papers using SKA data.
9. The scope of the Concept of Operations (ConOps) is the entire SKA Observatory.

Structure of the SKA Observatory

10. The SKA Observatory shall be led by a Director-General, who reports to the SKA Board of Directors.
11. The SKA Observatory shall operate a Global Headquarters (GHQ), which will have overall responsibility for the SKA Observatory.
12. The SKA Observatory shall establish a presence in the two Host Countries for the purpose of controlling SKA infrastructure and conducting SKA Operations in the Host Countries.
13. The SKA Board shall appoint an external body to provide independent advice to the Director-General on the planning and conduct of SKA operations and science. The members will be appointed on the basis of their scientific expertise and experience.
14. The SKA Board will control the SKA brand and the GHQ will implement policies on such branding.

[1] *SKA Telescope:* A single scientific instrument of the SKA that can operate as a coherent system independently of other telescopes, but which may share resources, including software, with other telescopes.

SKA Operations

15. SKA Operations is the sum of all SKA activities that are centrally managed, and which are neither part of the SKA Construction Project,[2] nor Planning Activities.[3] For this purpose, managed activities include those contracted out, provided in kind by agreement, or similar.
16. The host countries will have an obligation to protect the radio quiet zones for the SKA and future telescopes from outside transmissions and other telescopes on site to agreed standards. The SKA Observatory will have responsibility for control of self-interference from SKA telescopes.
17. The SKA Board will define the SKA Access Policy governing the right to propose for observations and to have access to archived data.
18. The Director-General will retain the final authority for time allocation, within the policy framework set by the Board.
19. The SKA Observatory will be designed to accommodate a mix of large co-ordinated observations proposed by large teams and short PI-driven programmes.
20. The SKA Observatory will calibrate SKA data and make science-ready data and ancillary products available to the users.
21. The SKA Observatory will provide an archive with a data management system to support data-intensive astronomy.
22. The SKA Observatory will provide user support and tools to enable exploitation of SKA data.

Incorporation of Precursors

23. Maximal use will be made of the precursor telescope sub-systems, infrastructure and components, based on cost-benefit analyses.
24. Disruption to the precursor science programmes will be minimised while expediting the build-out of SKA Phase 1 at both sites.

[2] *SKA Construction Project*: Everything defined in the capital project plan. Anything not explicitly in the capital project plan is not part of Construction.
[3] *SKA Planning Activities*: The activities leading to the definition of the capital project plan (or a major phase of the plan), and the operations plan. Planning includes project definition, system engineering and design. It includes the Preparatory and Pre-Construction phases of the project schedule, and any of the planning activities that are required for SKA2.!

Current thinking

Calibration to “science-ready” to agreed standards; unless a special case is made and agreed

Allocate time rather than “sensitivity”

KSPs and other special projects will need to configure the SDP

User support& tools aimed at a “professional astronomer”. Observatory will provide essential “special” tools

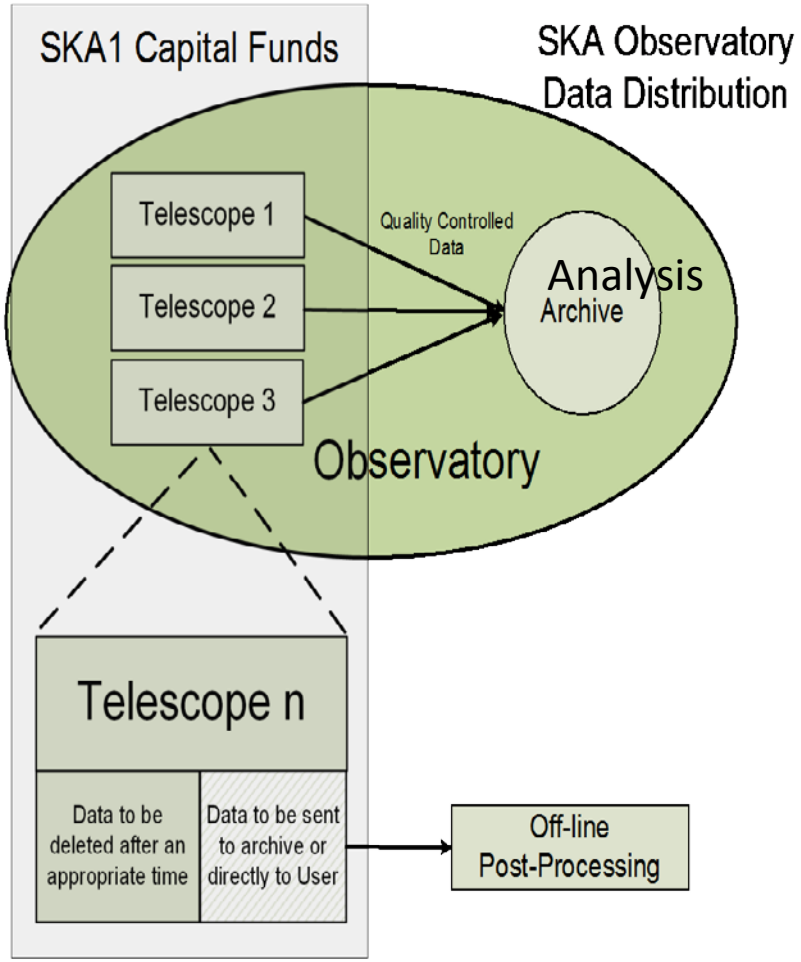
Service/queue/dynamically schedule observations normal

Current thinking

Commensal observing *not* the *responsibility* of the observatory – need a science team (with own resources)

“1s” trigger capability for rapidly schedule observations

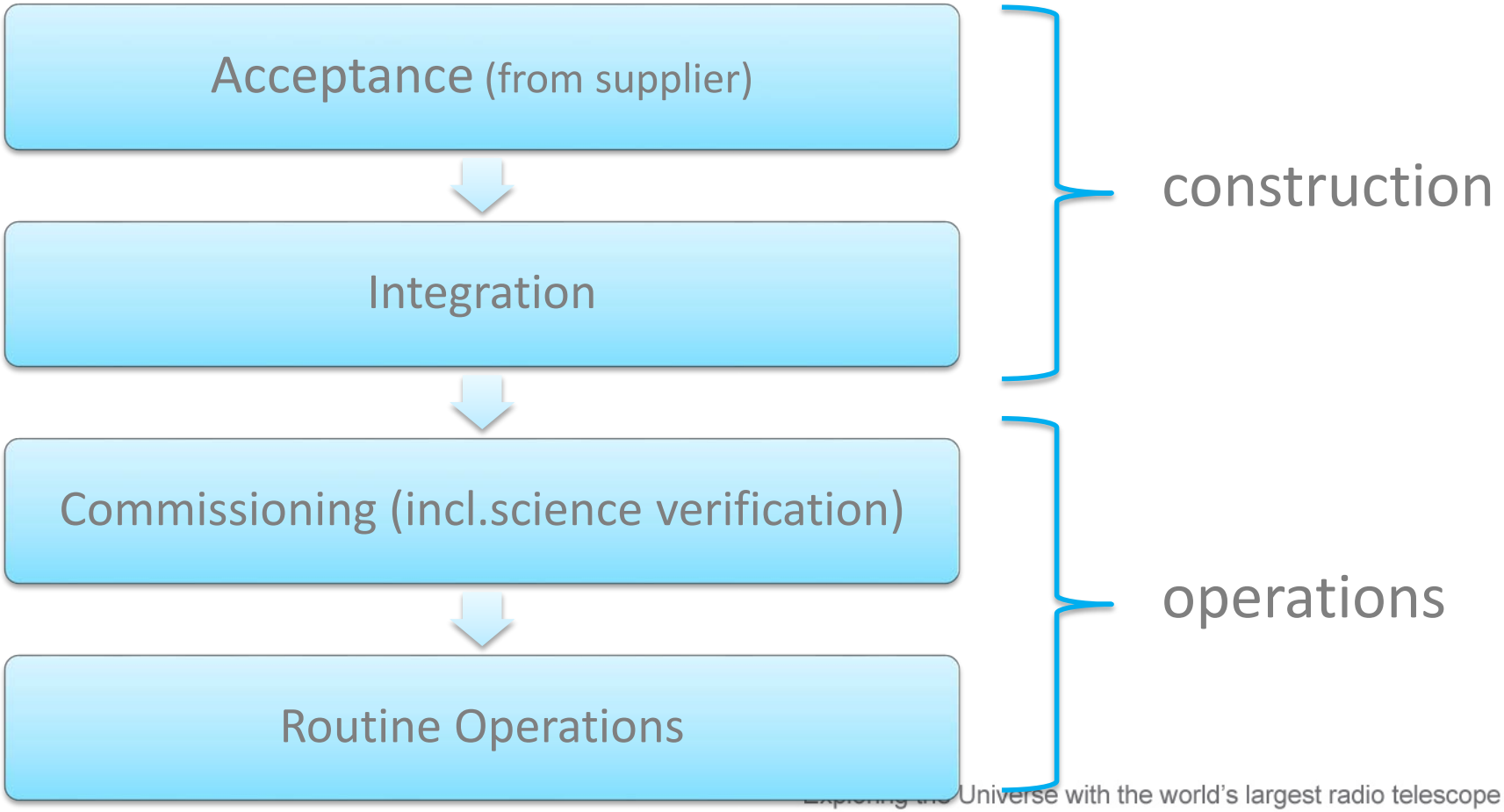
Telescope vs Observatory



archive

Transition to Operations

Operations begins early in construction period



Some Open Questions

- Is a centrally operated post-processing centre required? Where?
- What does “science ready” data mean?
- Provision of observatory functions required (proposal preparation; time allocations; user databases, project generation/scheduling)

Some Open Questions

- What are the rights to commensal data or unexpected discoveries?

- How much user support will be provided?

Operations Plans & Costs

The cost and manner (plan) of operations and maintenance is part of the **design**

There will be operational/capital cost [or scope] tradeoffs in every part of the system

Approach will be to monitor operating cost during the design phases for consistency with reasonable funding expectations. Element-level budgets in limited cases (e.g. power)

We must build a telescope we can afford to operate.

From Consortia

What do you need to know?

Pressing requirements?

Operations Working Group

- ConOps
- Operations requirements
- Ongoing work
  - Conduct of science programs (w/SWG)
  - Provision of user support (w/SWG)
  - Interaction with the SKA Construction Project
  - Cost of operations
  - Boundary/scope of the observatory
  - Structure of the observatory

Operations Working Group

- Douglas Bock (CSIRO)
- Peter Dewdney (SKA)
- Jasper Horrell (SKA South Africa)
- Simon Garrington (Univ. Manchester/Jodrell Bank Observatory)
- René Vermeulen (ASTRON/LOFAR)
- Andreas Wicenec (Univ. Western Australia/ICRAR)

- Presently increasing IT expertise