Strategies and Philosophies
Cost Estimation

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Objectives

Present the SKA Costing Strategy

- Principles
- Practicalities

Contents

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Costing Strategy - Document

- Costing Strategy Published October 2010
- ‘How To’ Manual Published November 2010
- Costing Strategy Contents
  - Objectives & Working Principles
  - Description of the components of a costed design
  - Process of Cost Collection
    - Methodologies, Assessment and Verification
  - Modelling
  - Communications & Reporting

What is the Cost Strategy?

Due diligence undertaken in PrepSKA to generate cost estimates of the SKA System.

Description of what will be done in PrepSKA to collect and model costs.

Method of communicating common policies and a dictionary of terms to widely distributed contributing groups.

What are the basic principles?

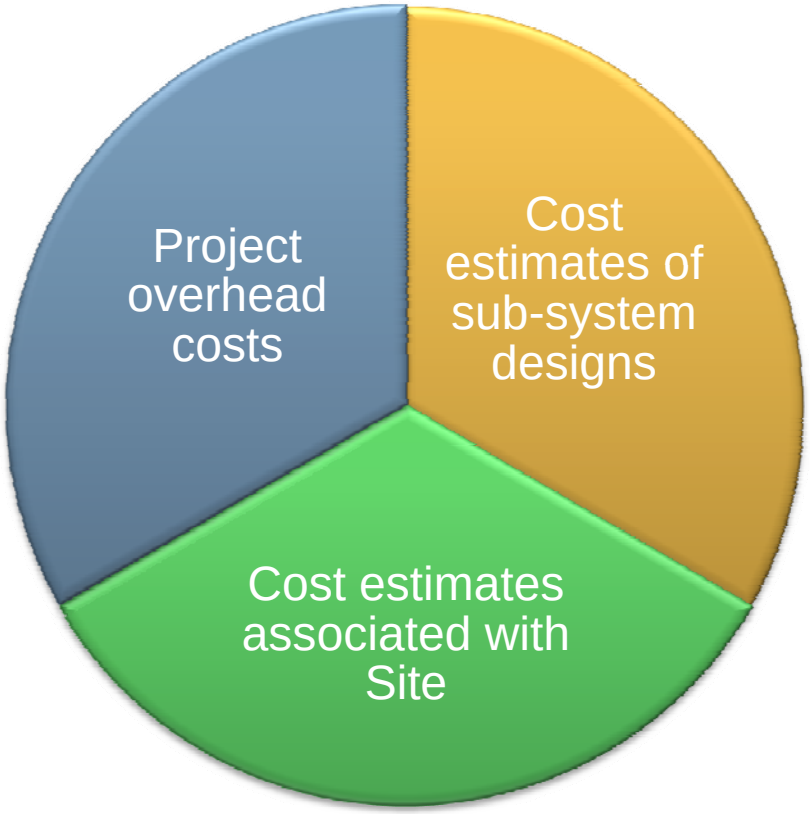
Cost estimation is an ongoing and iterative process

Confidence levels attributed to cost estimates depend on

- Maturity of the design
- Quality of the substantiating evidence

What is included in the Cost estimate ?

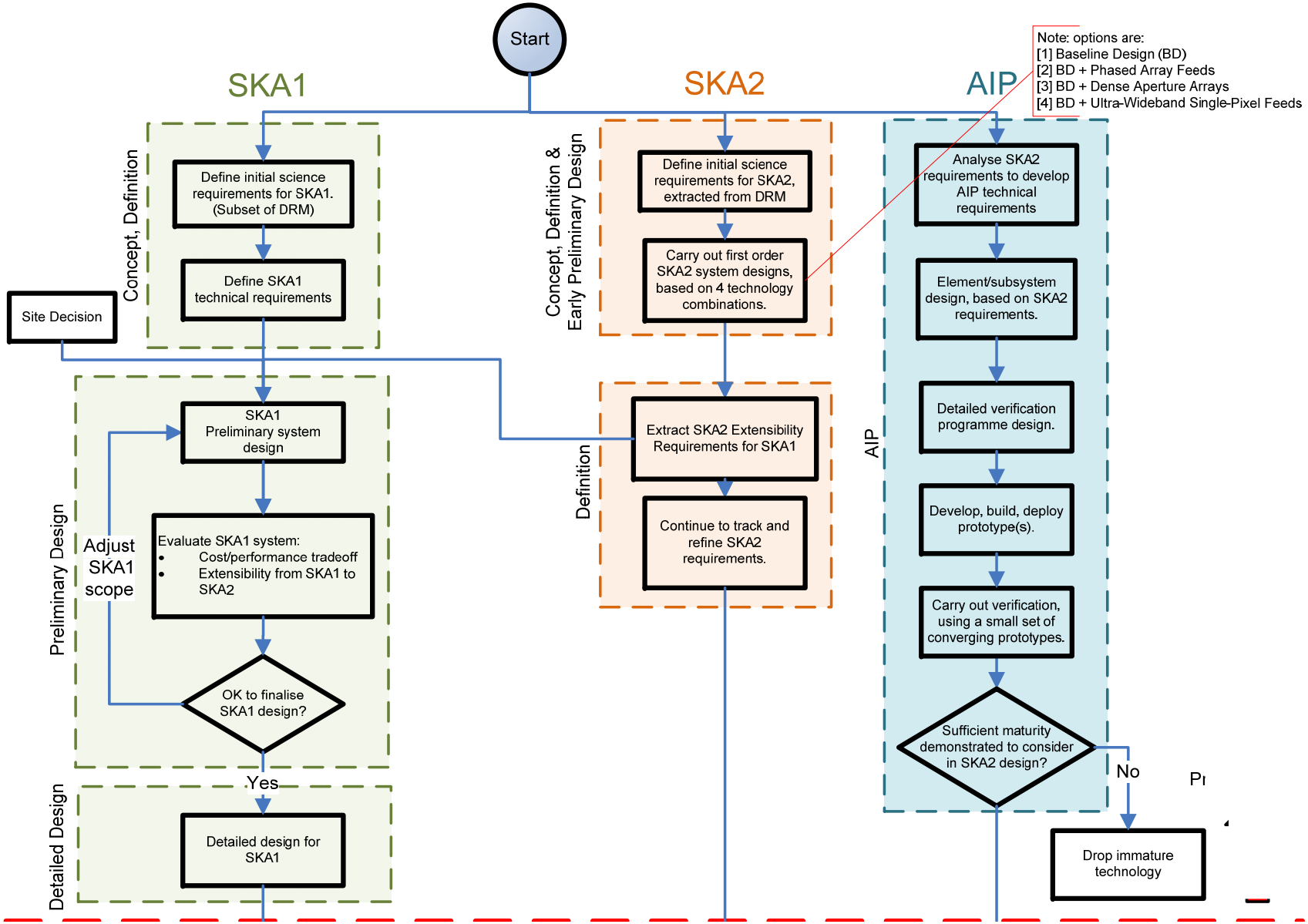
In PrepSKA the costed system design will have three parts:



10 year cost of ownership will be used as a means of including operations costs in comparisons.

List of cost components generated for 'comprehensive' cost coverage

A Phased Approach to Design & Cost



Important Exclusions

- Outreach, local communities and environment
- Users, operators and scientists
- Corporate infrastructure
- Interaction with industry,
- Performing science whilst construction is proceeding
- Decommissioning

Process

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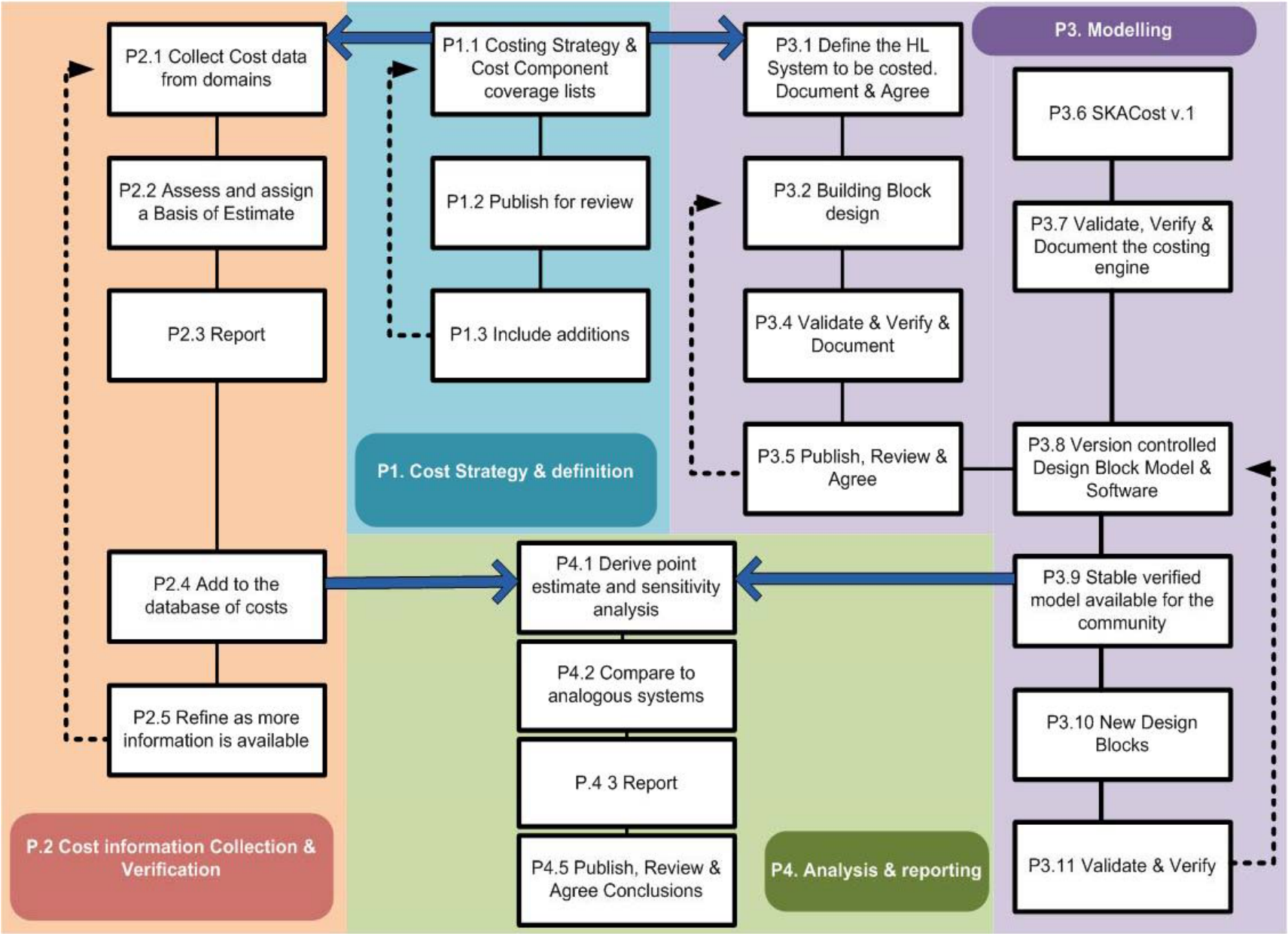


Cost Reports for Cost Collection

- Description of the subsystem costed
  - *Block Diagram, Interface descriptions*
  - *Estimate of number of units required for SKA_1 , AIP & SKA_2*
- Project plan, groups involved & contacts
- Cost estimate (10 year cost of ownership)
  - *Included :cost components, significant items, scaling laws and spares.*
- Supporting evidence

Cost Collection - assessment

Basis of Estimate Confidence level assigned to the estimate based on:

- Design stage of the project
- Completeness of estimate (when compared to the cost component list)
- Associated documentation

Modelling Costs

Cost Modelling involves a multitude of models

Analogous Costing

- Top Down

Parametric Modelling

- Bottom Up

Modelling Software Development Costs

- Special Case

Modelling Costs

Analogous Costing

- Precursor, Pathfinder & other analogous projects
- Particularly important for addressing project overhead costs
- Plans to address this in the PEP

SKACost

- Parametric modelling of designs, looking at trade-offs and comparisons
- Depends on effective cost collection & model definition

Costing Software – An Exceptional Case

- Software development is mainly labour intensive, and all the tasks associated with developing it are nonrecurring—there is no production phase.
- Costs depends on;
  - the nature of the software to be developed,
  - the development effort to accomplish it
  - and the schedule for delivery.

What is the software costing strategy?

Gather metrics about past size-effort-costs for developing software in (i) radio astronomy - (ii) physics - (iii) science generally

Estimate the sizes and kinds of codes to be acquired or developed; and the integration effort likely to be required

Use both (1) COCOMO II [an open source parametric software cost estimation tool]; and (2) expert judgement together to convert estimates of sizes to estimates of required efforts, times and costs

Accepting Bias

"Bias" - refers to any consistent tendency based on human perspective for estimates to be lower or higher in reality.

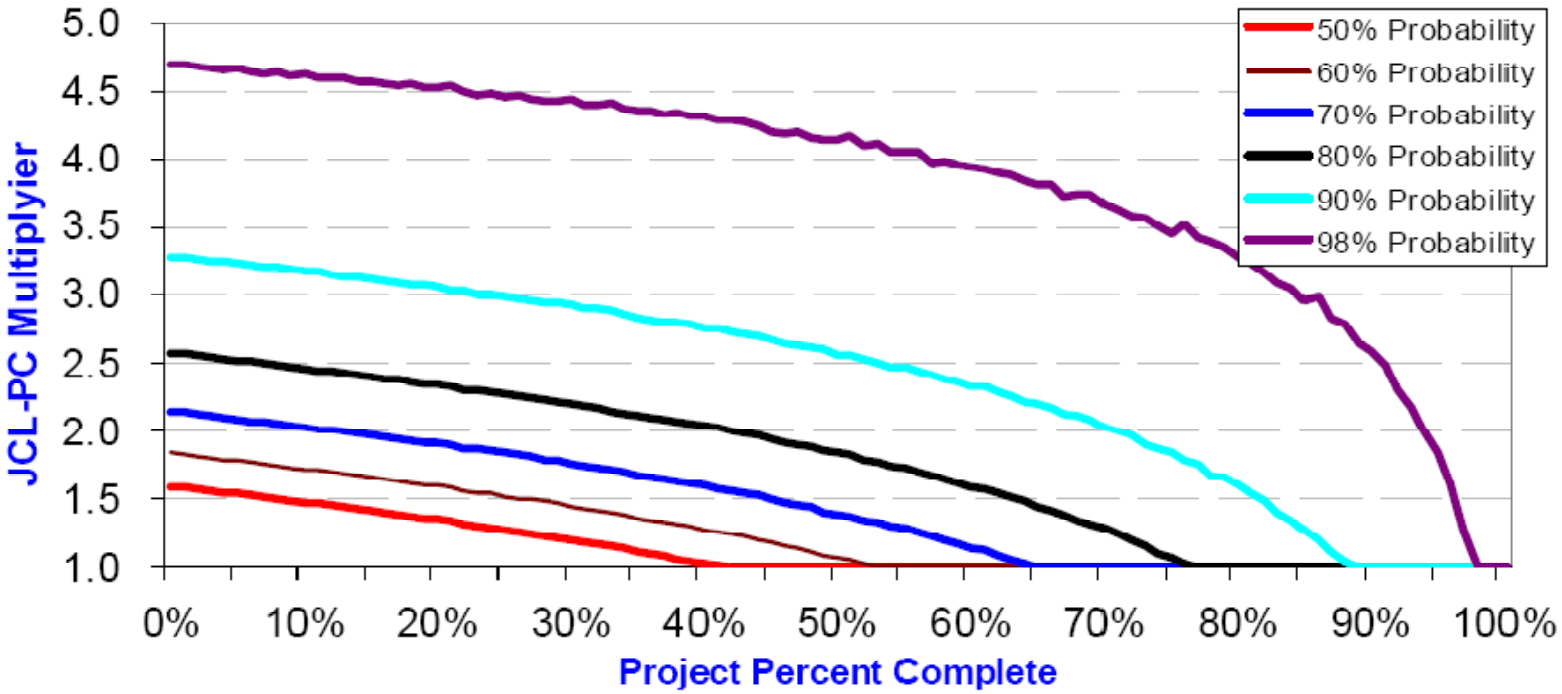
- Costs were underestimated in 9 out of 10 large projects.*
- Cost estimates for projects containing only "modest technical advances" tended to be more accurate than those projects which were more ambitious**

* Mega Projects and Risk – An anatomy of ambition, Bent Flyvbjerg, Nils Bruzelius, and Werner Rothengatter, Cambridge University Press.

** NASA's Joint Confidence Level Paradox - A History of Denial, Glenn Butts, NASA Cost symposium 2009.

Accepting Bias

- Why? – Because pressures on costs in projects are almost *all* inflationary.
- Recognise that technical risk must translate to contingency.



Questions of Contingency

- Contingency levels will be set by funding bodies
- In a globally distributed project, differences in how contingency is set.
- Project responsibility to report technical risk to inform the contingency levels for the project.
- One way or another, some contingency (or reserves) must be built in

Summary I

- Costing Strategy Published
- Basic Principles are:
  - Cost estimation is an ongoing and iterative process. Confidence Levels attributed to cost estimates are predicated on the maturity of the design and quality of the substantiating evidence to support them.
- Cost estimates need to be as complete as possible.
  - A cost component list has been assembled to identify all those cost components that should be included.

Summary II

- Cost Modelling involves a multitude of models
- Software Development Cost estimation – a special case
- Bias happens - pressures on project costs will be inflationary.
- Contingency (reserve) must be built into the project budgets.

Questions