



**"Exploring the Universe with the  
world's largest radio telescope"**

**2011**  
**SKA System delta CoDR**  
**Project Management**

**Kobus Cloete**

**23 February 2011**



# Presentation Overview

SPDO

- Large Scale Influences
- Project Phases
- Top level and detailed schedule
- Approach to the work
- Proceeding to the system Definition Phase

- Astronomical priorities (local and international)
  - Priorities can change
  - Competition from other large astronomy projects.
- Technology evolution
  - For SKA1 the science and front end technologies have been narrowed down and focussed, risk has been significantly lowered
  - Still some technologies that are still bleeding edge and high risk (HPC).
  - SKA can be built with quasi-mature technologies, but not all of the science goals would be realized.
- Preferred technologies within particular regions of the world and government funding priorities.
  - The scope and front end technologies for SKA1 have been narrowed down but the technologies for SKA2 still have to be decided.
  - Possibility exists that the eventual funding contributions from countries or regions for SKA2 will be linked to whether the technology they have invested in for many years is part of the SKA2, and to which extent.

- Involvement of industries and procurement policies (juste retour)
  - Countries/regions expect return commensurate with contribution.
  - Must take care that just retour does not lead to inflated contracts or costs.
  - Pre-construction PEP proposed a model.
- Funding availability and timing.
  - SKA is a long-term project requiring momentum to keep going over many years.
  - Large time gaps could have significant implications.
- Identification of the site
  - Beyond a certain point the project cannot continue without identifying a site.
  - Site decision is now likely to take place in mid 2012.

- Preparatory phase (current phase)
- Pre-construction phase
- SKA1 construction, verification, commissioning, acceptance, integration & first science
- SKA2 construction, commissioning, acceptance, integration & first science
- SKA Operations



# SKA Project Phases

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**SKA Preparatory Phase**

2009 - 2012

**Detailed Design,  
Production Engineering  
& Tooling**

2013 - 2015

**Phase 1 Construction,  
Verification,  
Commissioning,  
Acceptance,  
Integration & First  
Science**

2016 - 2019

**Phase 2 Construction,  
Commissioning,  
Acceptance, Integration  
& First Science**

2018 - 2023

**SKA Operations**

2022 onwards



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SKA Operations

2009 - 2012

2013 - 2015

2016 - 2019

2018 - 2023

2022 onwards

SKA Preparatory Phase

Phase 1  
Pre-Construction  
Phase

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# PrepSKA and the Preparatory Phase

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**SKA Preparatory Phase**  
**2009 – 2012**

**Phase 1**  
**Pre-Construction**  
**Phase**

**2013 - 2015**



# PrepSKA and the Preparatory Phase

SPDO

**SKA Preparatory Phase**  
**2009 – 2012**

**PrepSKA**  
**2009 - 2011**

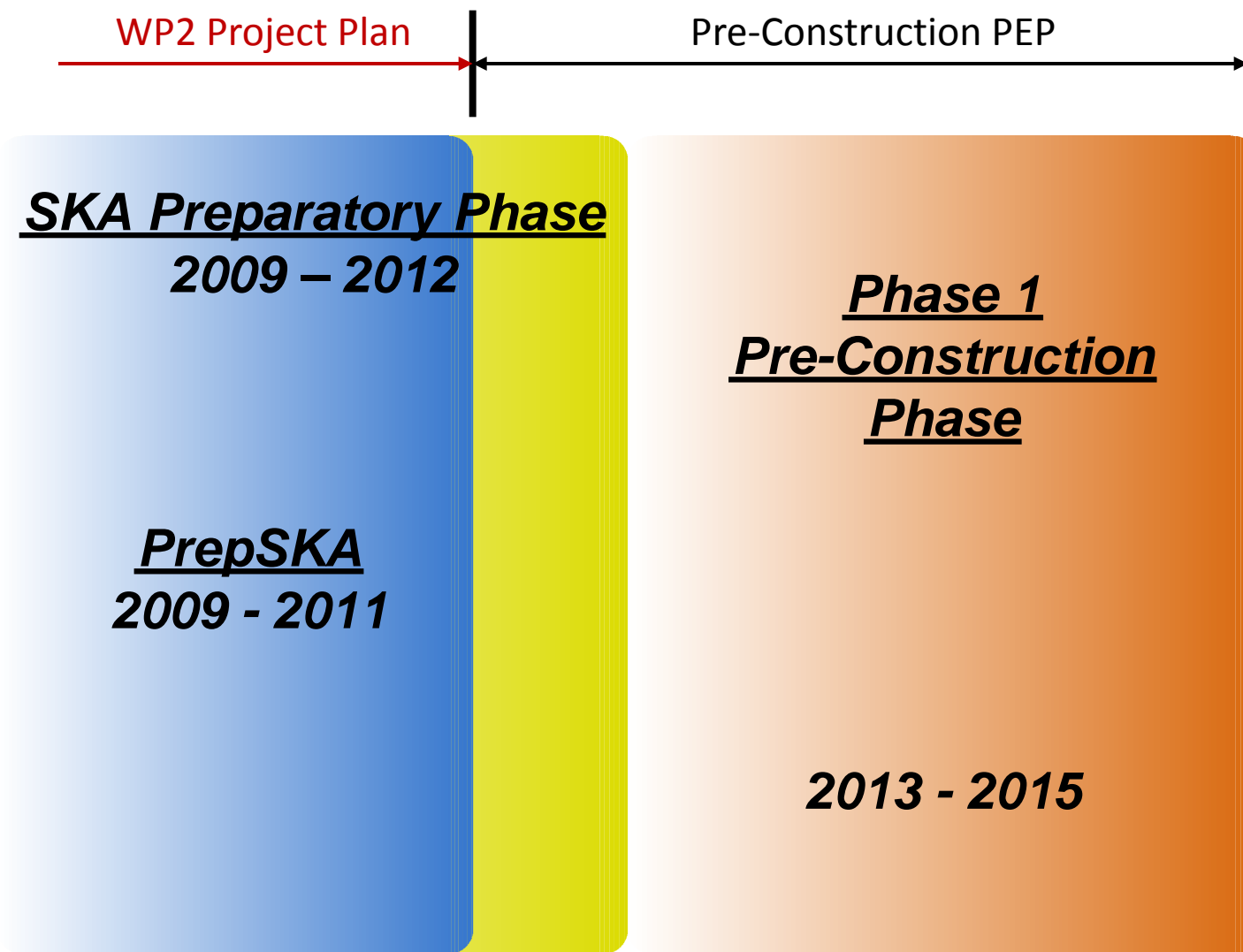
**Phase 1**  
**Pre-Construction**  
**Phase**

**2013 - 2015**



# PrepSKA and the Preparatory Phase

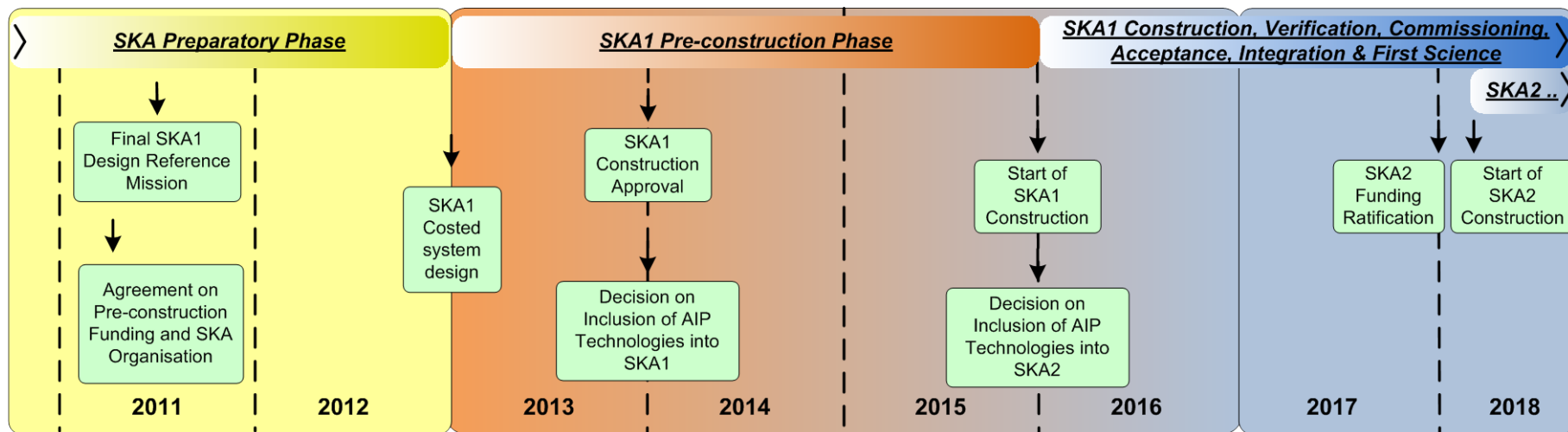
SPDO



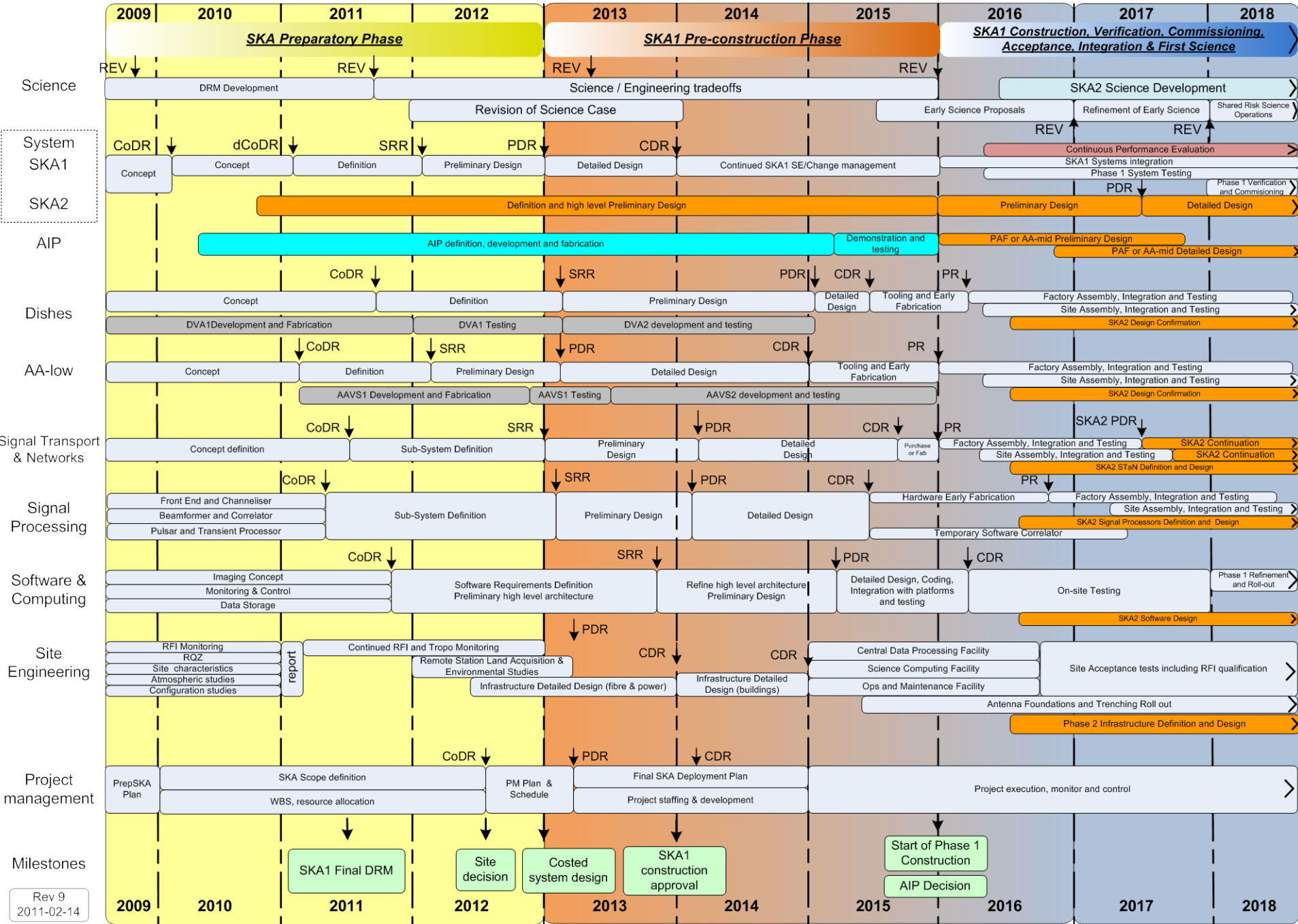
- Within current phase the work has been divided into seven work packages (WP). They are:
  - WP1 – Management of PrepSKA, Coordinator University of Manchester
  - WP2 – SKA System Design, SPDO
  - WP3 – Site Characterisation, SPDO
  - WP4 – Governance, Netherlands Organisation for Scientific Research
  - WP5 – Procurement and Industry Relations, Italian National Institute for Astrophysics
  - WP6 – Funding options, UK Science and Technology Facilities Council
  - WP7 – Socio-economic benefits and Implementation Plan

- WP2 Objectives:
  - to produce a deployment plan for the full SKA, and a detailed costed system design for SKA1,
  - to integrate all of the activities, reports and outputs of the various working groups to form an SKA implementation plan.

# Top Level Milestones



# Detailed Schedule (to 2018)



- PrepSKA
  - Description of Work, Milestones and Deliverables captured in FP7 agreement
  - WP2 Project Plan
    - Objectives of WP2, Approach and Structure (roles and responsibilities)
    - DoW, Milestones and Deliverables, Gantt, Resources
    - Reviews, gaps, Management of WP2, Risk management
- Post PrepSKA
  - Completion of Preparatory Phase and Pre-construction Phase
  - Different SKA Organisation, structure, governance etc.
  - Described in detail in the Pre-construction PEP
- Focus during remainder of WP2 is to ensure that deliverables are met and can flow seamlessly into the next phase and project structure

## List of milestones and deliverables in WP2 Project Plan

Milestone no.	Deliverable No.	Milestone name	Original date	Revised date
<b>WP2.1 SKA System</b>				
MS7		System Concept Design review (CoDR)	T+22	T+22 (Feb 2010)
	D2.1	System CoDR Report	T+23	T+23 (Mar 2010)
MS7		System delta Concept Design review (CoDR)	None	T+34 (Feb 2011) <b>(23 -25 Feb 2011)</b>
	D2.1	System delta CoDR Report	None	T+35 (Mar 2011)
MS8		System Requirements review (SRR)	T+36	T+46 (Feb 2012)
	D2.2	System SRR Report	T+37	T+47 (Mar 2012)
MS9		System Preliminary Design	T+45	T+57 (Jan 2013)
	D2.3	System Preliminary Design Report	T+45	T+58 (Feb 2013)
<b>WP2.2 Dish Verification Programme</b>				
MS35		Dish and Dish Array CoDR	T+26	T+39 (Jul 2011)
	D2.4	Dish and Dish Array CoDR Report	T+27	T+40 (Aug 2011)
MS36		Dish and Dish Array SRR	T+36	T+59 (Mar 2013)
	D2.5	Dish and Dish Array SRR Report	T+36	T+60 (Apr 2013)
		Final Dish Array PrepSKA Wrap up report	None	T+48 (Apr 2012)
<b>WP2.3 Aperture Array Verification Program</b>				
MS59		Aperture Arrays CoDR	T+30	T+36 (Apr 2011) <b>(19-20 Apr 2011)</b>
	D2.6	Aperture Array CoDR Report	T+31	T+37 (May 2011)
MS60		Aperture Array SRR	T+45	T+49 (May 2012)
	D2.7	Aperture Array SRR Report	T+46	T+50 (Jun 2012)
		Final Aperture Array PrepSKA Wrap up report	None	T+48 (Apr 2012)
<b>WP2.4 Signal Transport and Networks</b>				
MS73		Signal Transport & Networks CoDR	T+26	T+39 (Jul 2011) <b>(28-30 Jun 2011)</b>
	D2.8	Signal Transport & Networks CoDR Report	T+27	T+40 (Aug 2011)
MS74		Signal Transport & Networks SRR	T+42	T+55 (Nov 2012)
	D2.9	Signal Transport & Networks SRR Report	T+43	T+56 (Dec 2012)
MS75	D2.10	Final STaN PrepSKA wrap up Report	T+48	T+48 (Apr 2012)
<b>WP2.5 Digital Signal Processing</b>				
MS90		Digital Signal Processing CoDR	T+26	T+36 (Apr 2011) <b>(14-15 Apr 2011)</b>
	D2.11	Digital Signal Processing CoDR Report	T+27	T+37 (May 2011)
MS91	D2.12	Final Digital Signal Processing PrepSKA Wrap up report	T+48	T+48 (Apr 2012)
<b>WP2.6 Software and Computing</b>				
MS104		Software & Computing CoDR	T+33	T+42 (Oct 2011) <b>(12-14 Oct 2011)</b>
	D2.13	Software & Computing CoDR Report	T+34	T+43 (Nov 2011)
MS105	D2.14	Final Software & Computing PrepSKA wrap up report	T+48	T+48 (Apr 2012)
<b>WP2.7 WP2 Design Study Management</b>				
MS128	D2.15	Periodic WP2 progress report 1	T+18	
MS129	D2.16	Periodic WP2 progress report 2	T+36	T+36 (Apr 2011)
MS130	D2.17	Periodic WP2 progress report 3	T+48	T+48 (Apr 2012)
		Annual Project Plans for WP2 tasks	T+21, T+33	T+33 (Jan 2011)

- Application of the System Engineering Approach
  - Integrated and iterative approach
  - Both a top down and bottom up process
  - Development and management of requirements
  - More detailed presentations during this review
- Science-Technology Trade-off Process
  - Although the science goals for SKA1 have been prioritised and the selection of front end technologies has been made, further refinement and trade-offs will have to be made as design matures.
  - Will utilise processes as described in supporting documents (of which the Observing Time Performance Factors is one)
  - Detailed presentation later in review



## Next Phase : System Definition Phase

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- Following the successful completion of the system dCoDR, work will start on the system definition phase.
- Main aim during this phase will be to solicit, develop and analyse the system requirements
  - The aim of the definition phase is primarily to perform requirements analysis and validation to ensure that the complete set of requirements is understood and is present. The initial outcome of this analysis in this phase is the establishment and refinement of one or more architectures.

- Aim will be achieved by:
  - Detailed review and refinement of the SKA1 DRM,
  - Engagement with the scientists and development of use cases for each of the chapters of the SKA1 DRM to understand and extract the technical requirements,
  - Gathering, refining and analysing the system requirements,
  - Further development and refinement of the science and support operations concepts,
  - Gathering of additional information on the site characteristics and the derivation of environmental and regulatory requirements and constraints,
  - Executing and managing the strategies and philosophies,
  - Documenting the requirements and constraints in the SKA1 System Requirement Specification,

- Establishing a preliminary verification plan,
- Conducting a formal System Requirements Review,
- Conducting element Concept Design Reviews,
- Integrating the outputs from the element CoDRs into the system level.
- Establishing a number of Observatory level cost models to assist convergence on an outline full lifecycle cost,
- Using this information for first order evaluation of the science capabilities of various array configurations.
- Development of the first draft SKA1 architectural design document,
- Managing the effort at all levels,
- Identification, analysis, recording and management of risks and risk mitigation efforts.



# Other Activities during 2010/2011

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List of some events that have taken place during the past year:

- International Engineering Advisory Committee (IEAC) Review
- US decadal review (Astro 2010)
- Precursors/Pathfinders/Design Studies
  - Several reviews took place, attended by SPDO and other representatives
  - Documents published (SKADS Whitepaper, SKA Exascale Software Challenges, Scenario for SKA Processing Cost Development of Wide Field Imaging with Aperture Arrays versus Phased Array Feeds, to name but a few)
  - Resources from are involved in Design Groups within domains
- Site selection process initiated
- RFI and tropospheric measurement campaigns in process
- Dish Verification Antenna 1 (DVA1) review



## Feb 2010 CoDR Panel Report (1)

SPDO

- Based on the key recommendations and findings from Feb 2010 CoDR, the project has undergone several changes which will be/has been described in this review
  - Many of the changes were already described in the response to the panel report
  - Not all recommendations were adopted (as reflected in the response to the Feb 2010 Panel Report)
- Brief overview of some of the changes:
  - Science and front end technologies for SKA1 narrowed down (Memo 125) and baseline for SKA1 established,
  - Higher risk front end technologies were moved onto parallel development path aimed for possible inclusion in SKA2,
  - Strategy for focussing on SKA1 while maintaining the extensibility to SKA2 has been developed,



## Feb 2010 CoDR Panel Report (2)

SPDO

- A first draft bottom-up view of the SKA1 system concept was developed (Memo 130),
- A year was added to the Pre-construction Phase,
- The SPDO grew with the appointment of additional resources,
- A Work Package 2 (WP2) Management Team was established and the WP2 project structure was formalised and strengthened,
- A WP2 Project Plan has been developed with milestones and deliverables identified,
- PEP for the completion of the Preparatory Phase and Pre-construction Phase was developed (with project structure, milestones, deliverables and resources identified),
- Points that were not fully addressed in response were:
  - Gaps: Both gaps identified (security of hardware at remote sites and export controls) are being addressed as part of the site selection process

