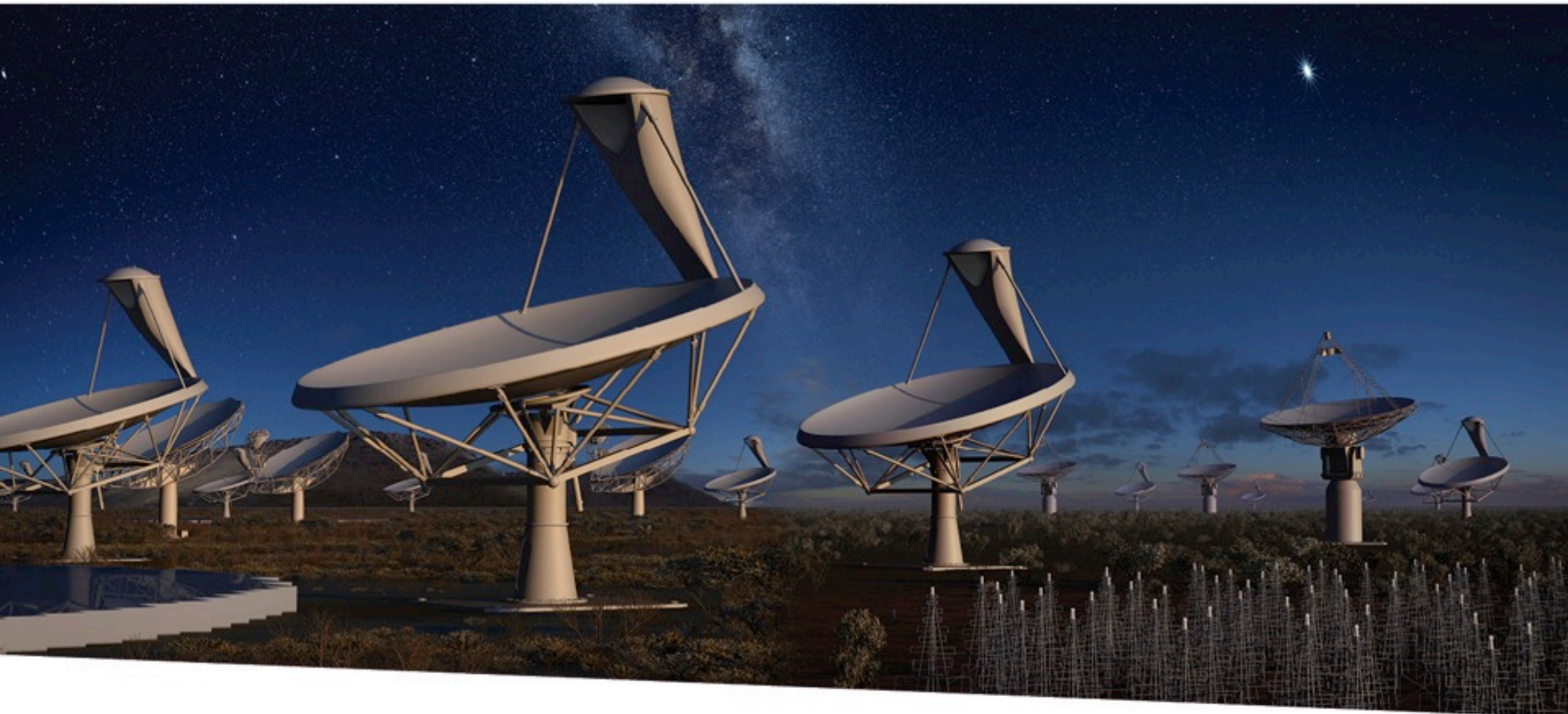


SKA status @ NGVLA



SQUARE KILOMETRE ARRAY

Exploring the Universe with the world's largest radio telescope

Philip Diamond, Director-General
January 2015

SKA Science

- SKA: will be one of the great physics machines of 21st Century and, when SKA2 complete, one of the world's engineering marvels.
- Science goals:
 - Fundamental physics: Gravity, Dark Energy, Cosmic Magnetism
 - Astrophysics: Cosmic Dawn, First galaxies, galaxy assembly and evolution; proto-planetary discs, biomolecules, SETI + much more
 - The unknown: transients; +...????

SKA Phase 1



2 sites (South Africa, Australia); HQ in UK
3 telescopes, one Observatory; building on precursors.

Frequency range SKA1: 50 MHz – 24 GHz:
- 3 of 5 frequency bands outfitted

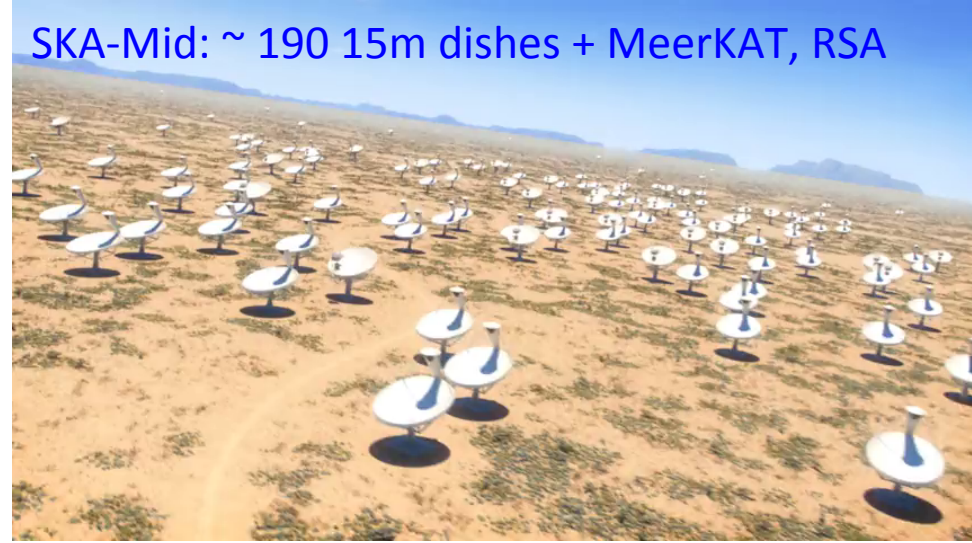
Cost-cap: €650M

Construction: 2017 – 2023

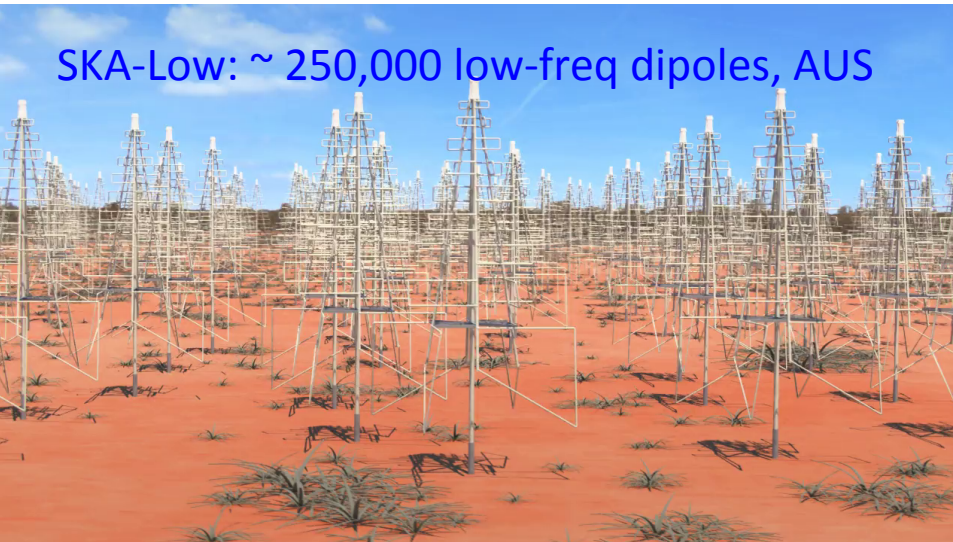
Early science: 2020

Full SKA: 2023 - 2030

SKA-Mid: ~ 190 15m dishes + MeerKAT, RSA



SKA-Low: ~ 250,000 low-freq dipoles, AUS



SKA-Survey: ~ 60 15m dishes + ASKAP, AUS



SKA Phase 1



2 sites (South Africa, Australia); HQ in UK

SKA Phase 2

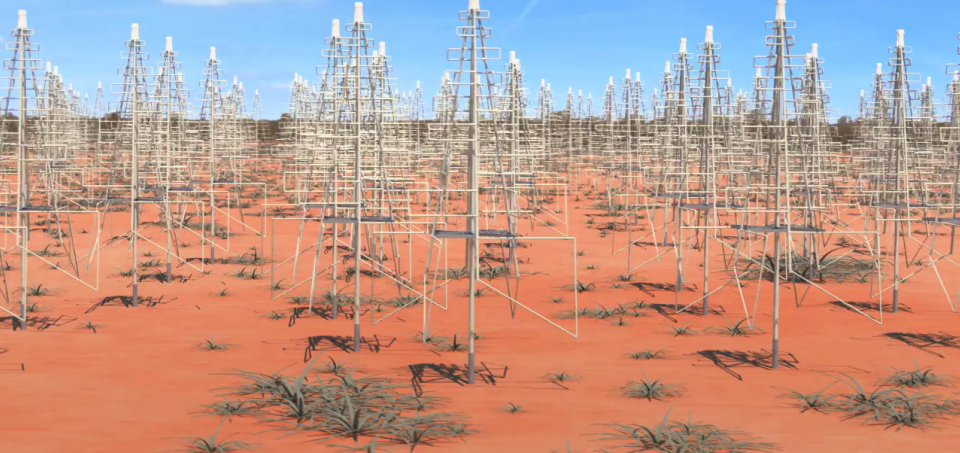
~2500 dishes, baseline lengths up to 3500km
~ 10^6 dipoles, baseline lengths ~few hundred km
~250 dense aperture array stations

Construction: 2023 – 2030
~ LHC scale

SKA-Mid: ~ 190 15m dishes + MeerKAT, RSA



SKA-Low: ~ 250,000 low-freq dipoles, AUS



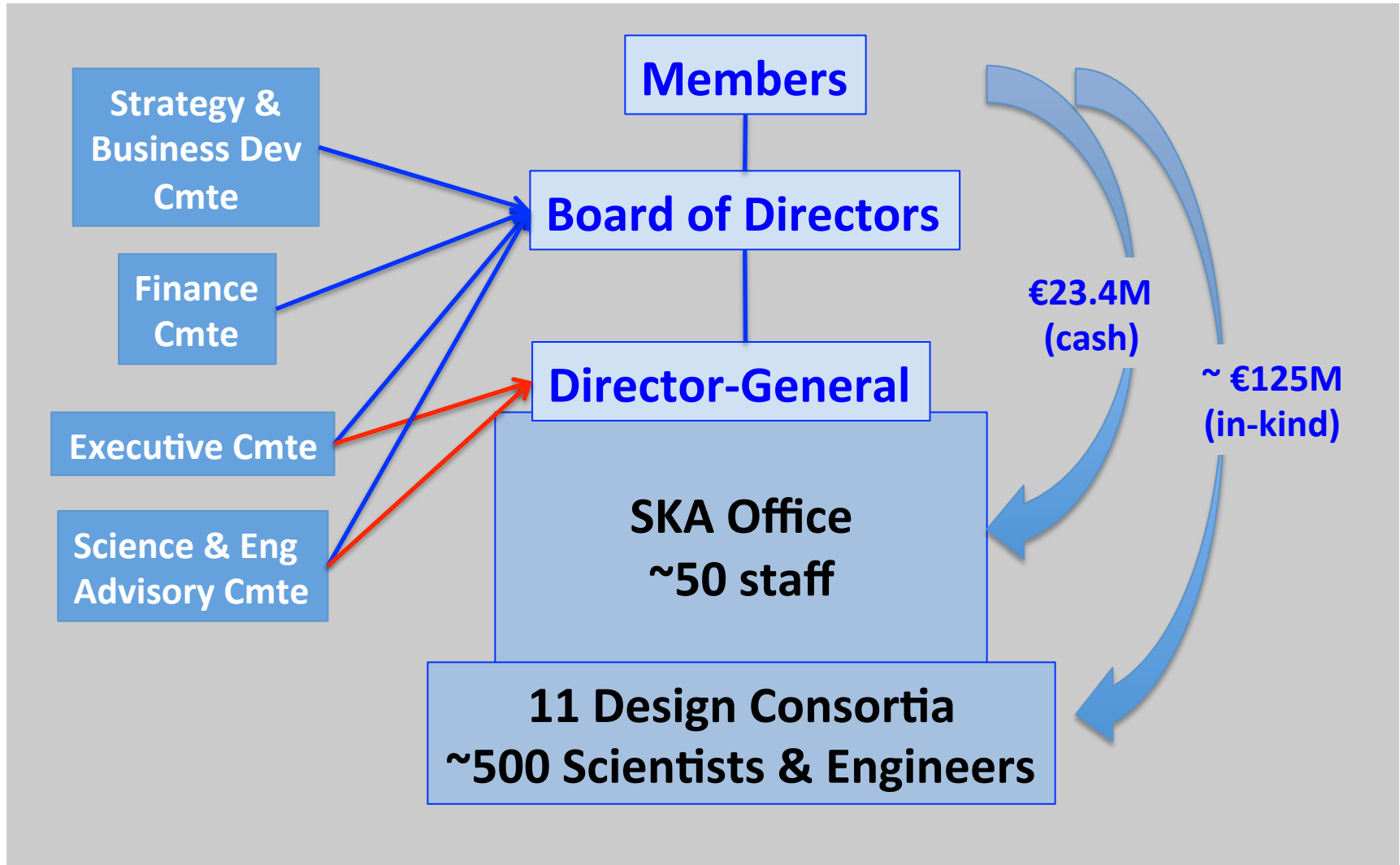
SKA-Survey: ~ 60 15m dishes + ASKAP, AUS



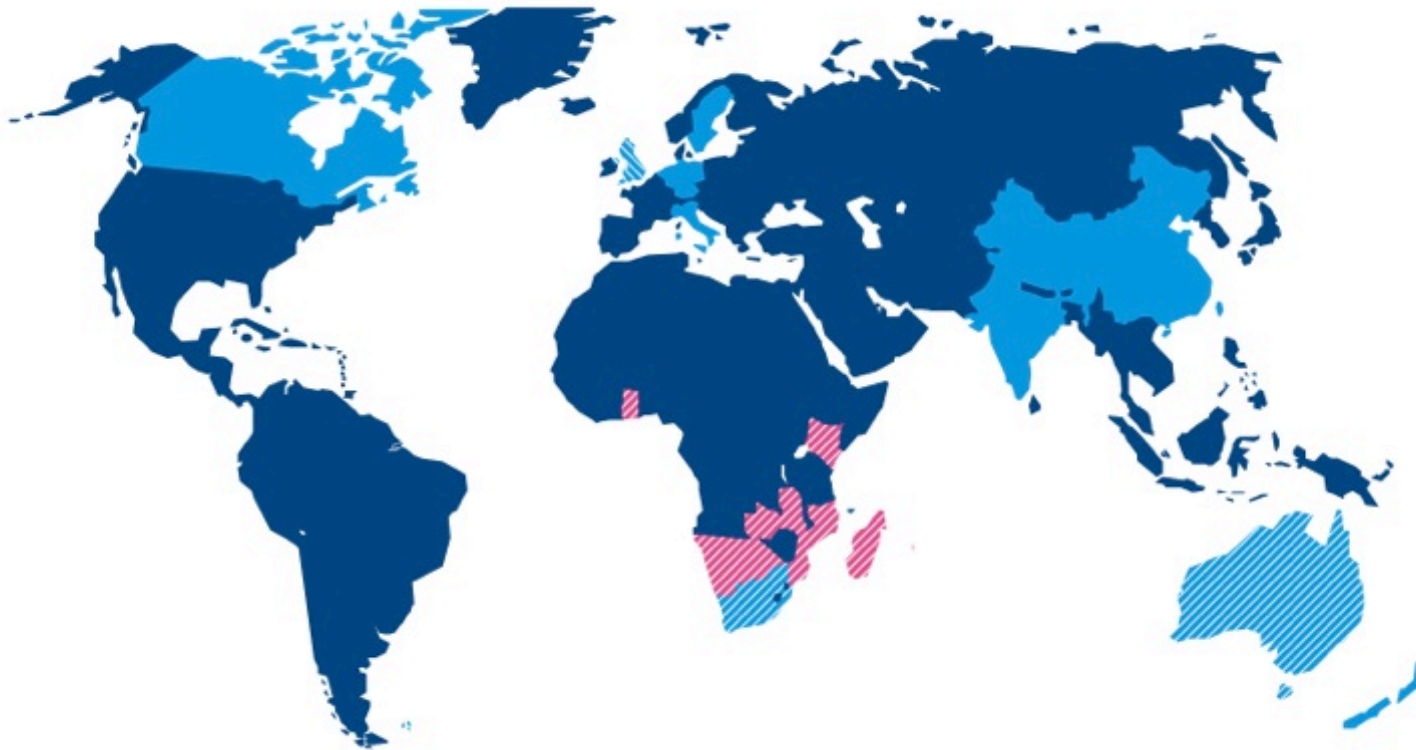
SKA: Driving development

- Dishes, feeds, receivers ($N=250 \rightarrow 2500$)
- Low and mid aperture arrays ($n=250k \rightarrow 1000k$)
- Signal transport ($\sim 1 \text{ Pb/s} \rightarrow 10 \text{ Pb/s}$)
- Signal processing (exa-MACs)
- Software engineering and algorithm development
- High performance computing (exa-flop capability)
- Data storage (exa-byte capacity)
- (Distributed) power requirements ($10 \rightarrow 50\text{MW}$)

SKA Governance + current funding



SKA Organisation



- Full members
- ▨ SKA Headquarters host country
- ▨ SKA Phase 1 and Phase 2 host countries



- ▨ African partner countries (non-member SKA Phase 2 host countries)

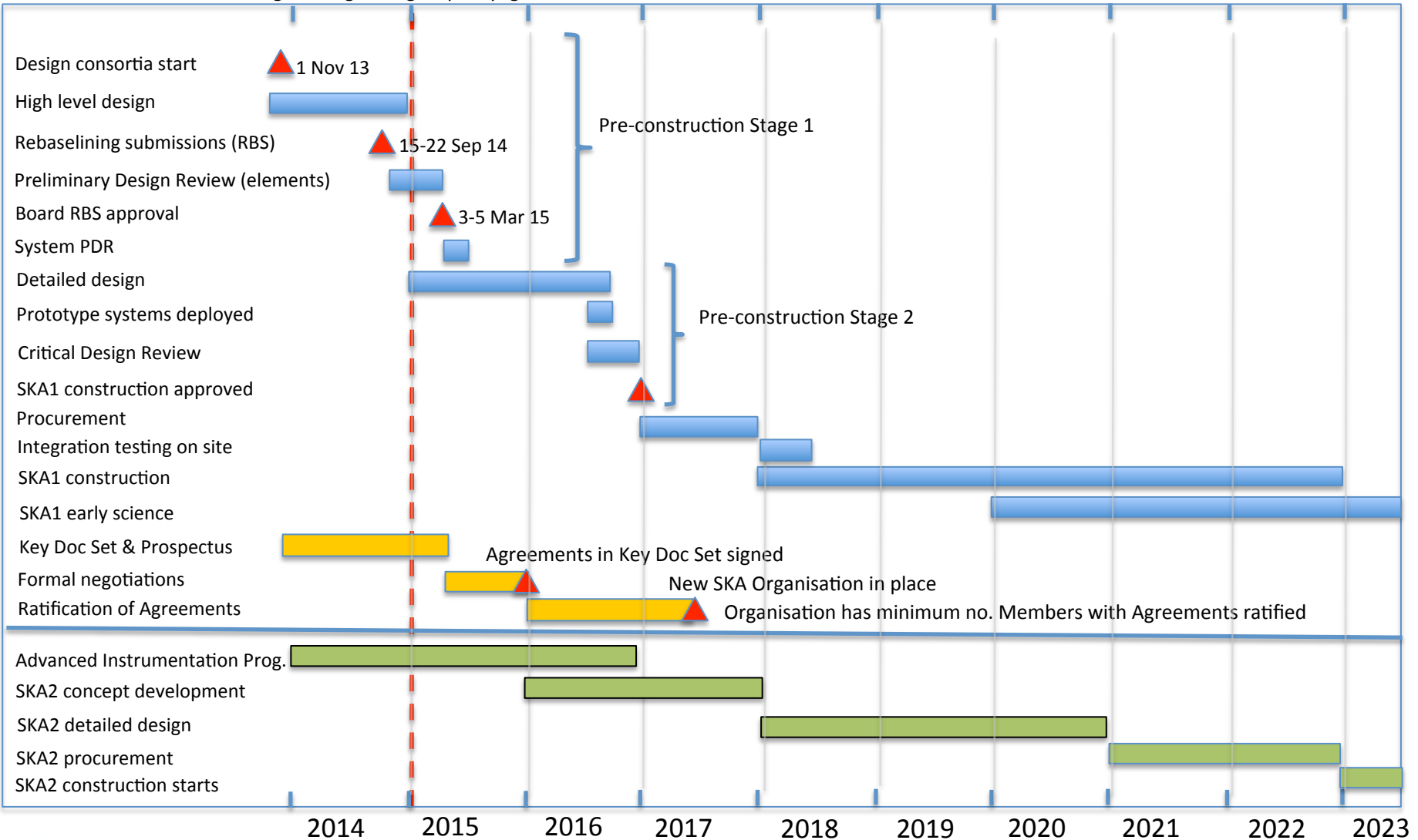
This map is intended for reference only and is not meant to represent legal borders



High-level SKA1 Schedule



KEY: Blue = SKA1 science & engineering; orange = policy; green = SKA2



Key events

- March 2014: UK Science Minister announces £100M (€125M) for SKA1 construction
- May 2014: BMBF announces Germany's intention to withdraw by June 2015
- June 2014: SKA Science meeting, Sicily – refreshing science case
- August 2014: India becomes Full Member of SKAO
- Sept 2014: SKA rated as top priority new project in French 5-year astronomy infrastructure planning – essential step to participation in SKA.
- Sept 2014: Science prioritisation complete.
- 15 Sept 2014: Re-baselining submissions delivered to SKAO from design consortia.
- Oct 2014: all-hands engineering meeting, Fremantle, Aus
- Dec 2014: PDRs begin; Central Signal Processing complete

Recent Developments

- Dec 2014: UK releases its 10-year Science and Technology strategy:



George Osborne
Chancellor of the Exchequer

Vince Cable
Secretary of State for
Business, Innovation and
Skills

Greg Clark
Minister of State for
Universities, Science and
Cities

SKA prominent within the document

- Today (22 Dec) the Italian Parliament has approved a final amendment to the Stability Law which provides for funding amounting to 30 M€ for the period 2015-2017. This substantial support, granted to INAF on the basis of a proposal for the development of industrial astronomy, is specifically aimed at SKA and CTA. This important step demonstrates unequivocally the support that the government intends to offer to the Italian participation in SKA through INAF in the coming years.*

Recent and forthcoming Developments

- Dec 2014: Portugal releases its national research infrastructure roadmap: SKA present
- Jan 2015: Kramer & Diamond appearing in front of German parliamentary budget committee
- Feb/Mar 2015: France to place SKA on its national roadmap
- Feb 2015: India to transfer SKAO membership from NCRA to Department of Atomic Energy
- 28th February: several SKAO governments to have signed 'Letter of Intent' to negotiate establishment of SKA treaty organisation.

International Design Teams

- Project Management and System Engineering Team based at Jodrell Bank Observatory, Manchester, UK
- ~500 scientists & engineers in institutes and industry in 11 Member countries of the SKA



3 dish prototypes all in testing



Exploring the Universe with the world's largest radio telescope

3 dish prototypes all in testing



3 dish prototypes all in testing



Exploring the Universe with the world's largest radio telescope

Preliminary Design Reviews

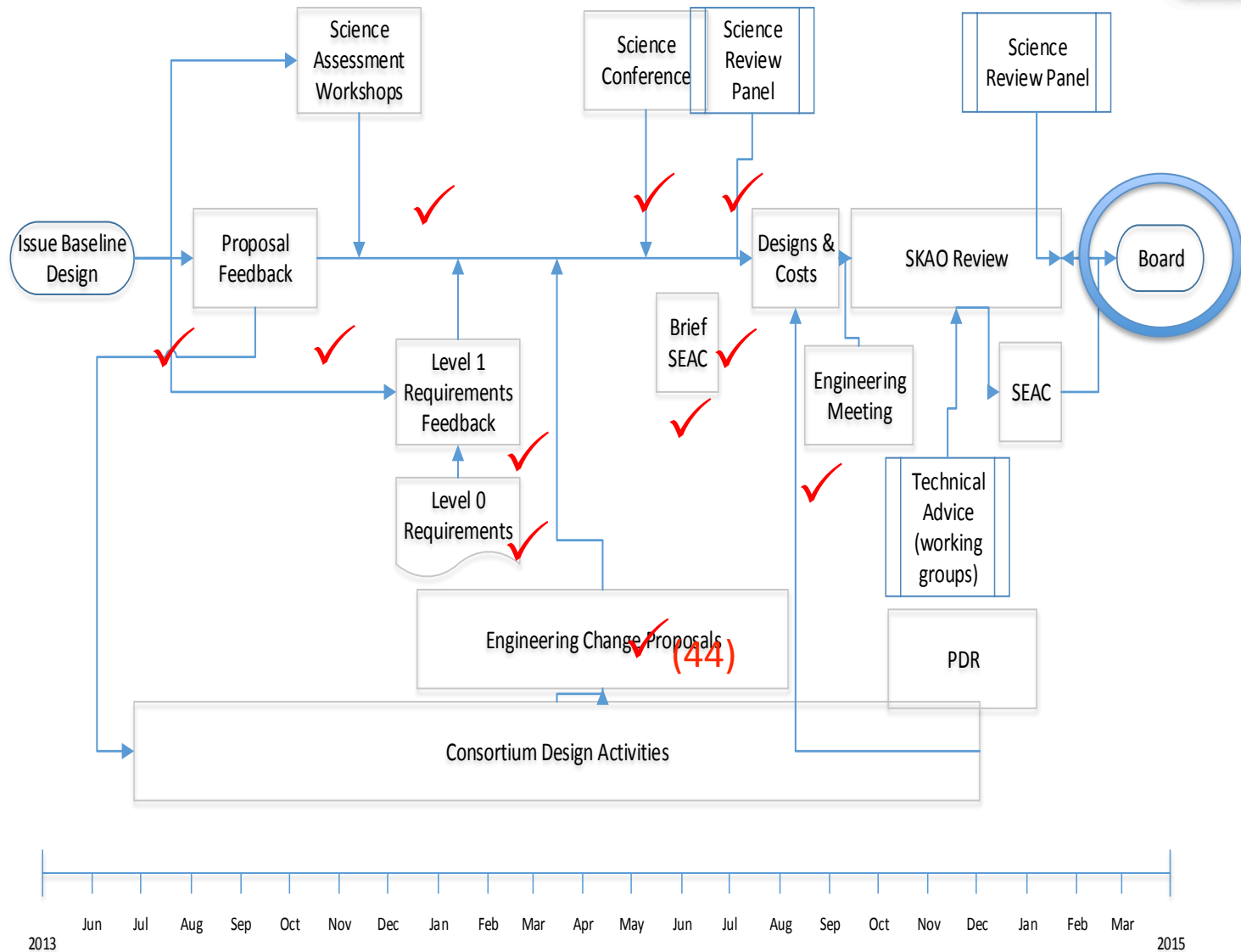
Meeting Order	Element	Dates
1	CSP	17-18 Dec 2014
2	TM	7 -8 Jan 2015
3	SaDT	14 – 15 Jan 2015
4	LFAA	26 – 27 Jan 2015
5	DSH	9 – 10 Feb 2015
6	INFRA SA	16 – 17 Feb 2015
7	INFRA AUS	18 – 19 Feb 2015
8	AIV	23 – 24 Feb 2015
9	SDP	18 – 19 Mar 2015



Re-baselining: Principles

- The revised baseline should deliver:
 - Transformational Science
 - Design optimised with high priority science
 - Deviation from Baseline Design & Technologies must be justified with risk assessment & TRL
 - Designs/Technologies incorporated take into account cost & risk
 - Must sit within cost cap (€650M)
 - Traceability to previous agreements & decisions

Process

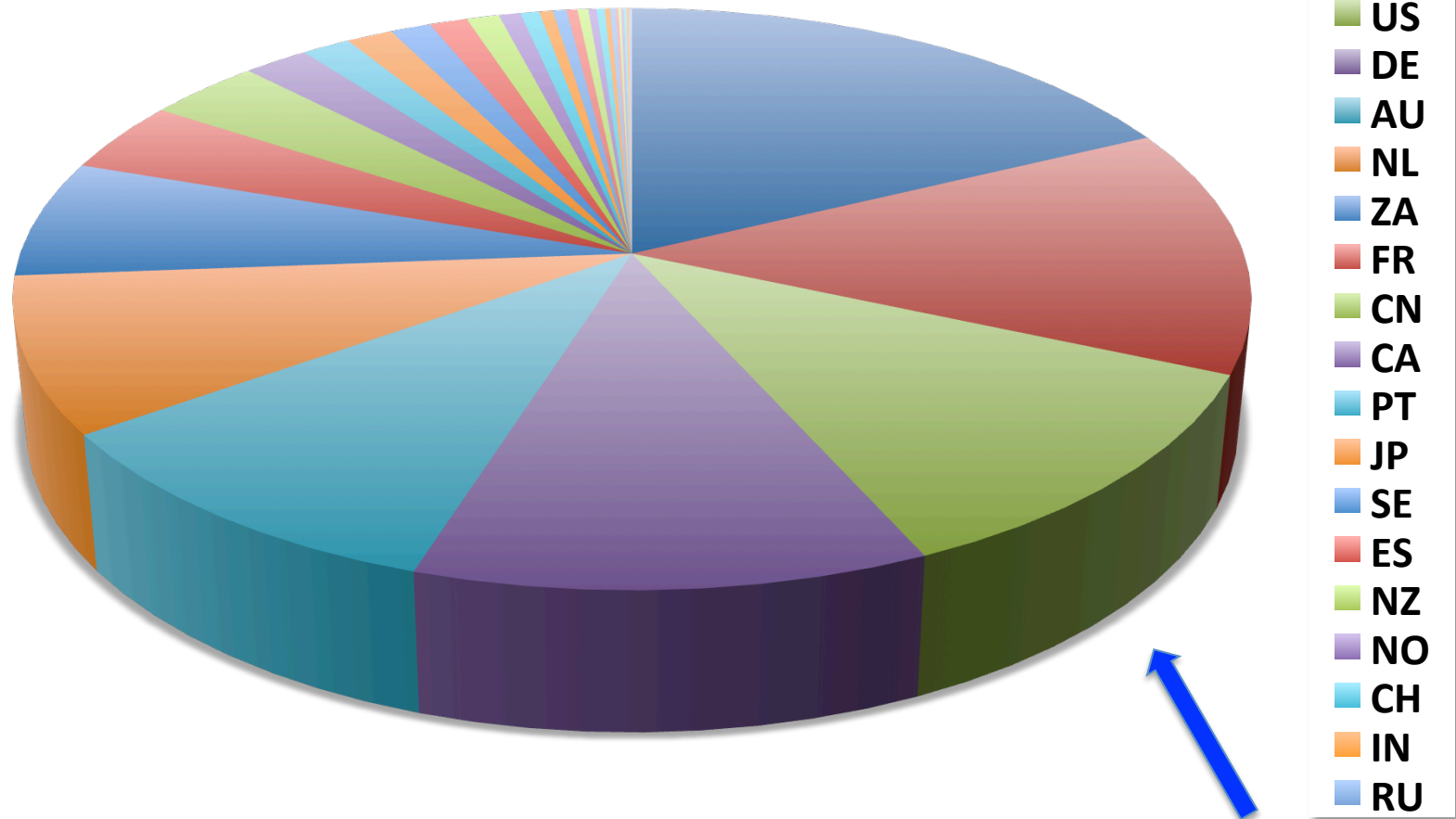


US Engagement

- US participants in SKA design consortia, e.g. MIT, JPL
- US industry heavily involved: IBM, Nvidia, CISCO, Intel, GD Satcom, Amazon, Google.....
- US engineers/scientists participating in advisory/review panels, PDRs, etc
- Contract with NRAO to develop first-order SKA operations model
- Above all, science engagement.....

SKA Science Book:

Total Author Affiliations by Country



Closing thoughts

- Very pleased to see this meeting – demonstrates start of strategic planning for Astro2020. Excellent to have thinking start early
- Urge you to engage with broader community: cosmologists, dark energy people, gravitational physicists, exoplanet community.....
- You must think big, have a major vision. You will be competing with a larger OIR community. Emphasise the science.
- Remember: US originally planned its own MMA, we now have ALMA – an international project. Look at what the rest of the world is doing as you formulate your plans.
- SKA stands willing to assist as you develop your strategy

SKA Splinter Session

Wednesday: 12:30 –
3:30, Room 4C-4

Lunch provided

The SKA Telescope:
Global Project,
Revolutionary Science,
Extreme Computing
Challenges

Exploring the Universe with the world's largest radio telescope



SPLINTER SESSION

The SKA telescope:
global project, revolutionary
science, big data and HPC challenge

Date: Wednesday, 7 January, 12.30pm — 3.30pm

Location: Room 4C-1 at the Seattle Convention Center

The SKA will be the world's largest radio telescope and promises to deliver transformational science.

Come along to this splinter session to hear from influential speakers about:

- The transformational science the SKA will tackle
- The science already being delivered by SKA pathfinder and precursor telescopes: LOFAR, JVLA, MeerKAT, ASKAP, MWA
- The challenges faced such as big data and high-performance computing
- Technology developments and roadmaps towards the SKA proposed by Intel, Nvidia, SGI, AWS

Buffet will be served and open to all participants.

www.skatelescope.org

Square Kilometre Array @SKA_telescope The Square Kilometre Array