

The SKA Story: Parts 1 and 2

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Meeting on The History of the SKA: 1980s to 2012
SKAO HQ, Jodrell Bank, 3 April 2019

Pre-SKA

Part 1. 1993 – 2005: The Grass-roots Era

From Working Group to Global Radio Astronomy Collaboration

Part 2. 2006 – 2012: The Transition Era

From Global Collaboration to Legal Entity

Part 3. 2012 – 2020: The Pre-construction era

is still being written

Aim of the talk: sketch historical flow of the SKA project up to 2012

Topics

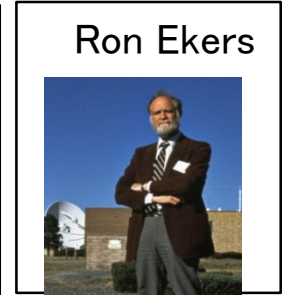
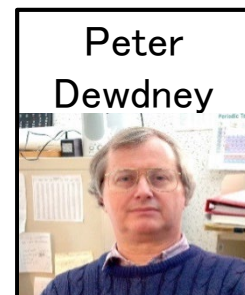
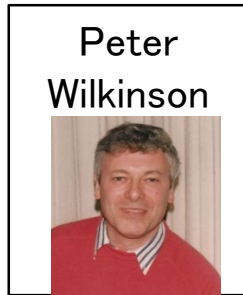
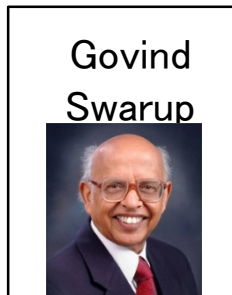
- ❑ Evolution of central project management and governance
- ❑ Science and engineering management
- ❑ Site selection process
- ❑ Key decisions and events for the SKA

Where did the idea for the SKA come from?

1960s–70s Proposals for big radio telescopes were made:

Multiple parallel cylinders, **Arecibo**, Benelux Cross, Cyclops, Giant Equatorial Radio Telescope

1980s Semi-independent suggestions for a Large Radio Telescope in USSR, India, UK, Canada and the Netherlands



1990 Visions merged, more or less by chance, at IAU Colloquium 131 at NRAO Socorro → we need a million sq m of collecting area
Peter Wilkinson's paper on the Hydrogen Array

1993 [Ekers, Swarup] Resolution passed at URSI General Assembly to establish a **Large Telescope WG** (Chair: Braun) → **Start of SKA**

SKA was conceived as an international/global project from the start

Evolution of SKA Governance

Funding Agencies

Scientific Community

European Commission

1993

WG

Grass-roots Era

1999

International SKA
Steering Committee

2005

2006

Informal Funding
Agencies Group

Transition Era

2008

Agencies SKA
Group

SKA Science &
Engineering Committee

EC FP7
PrepSKA Board

2011

Founding Board

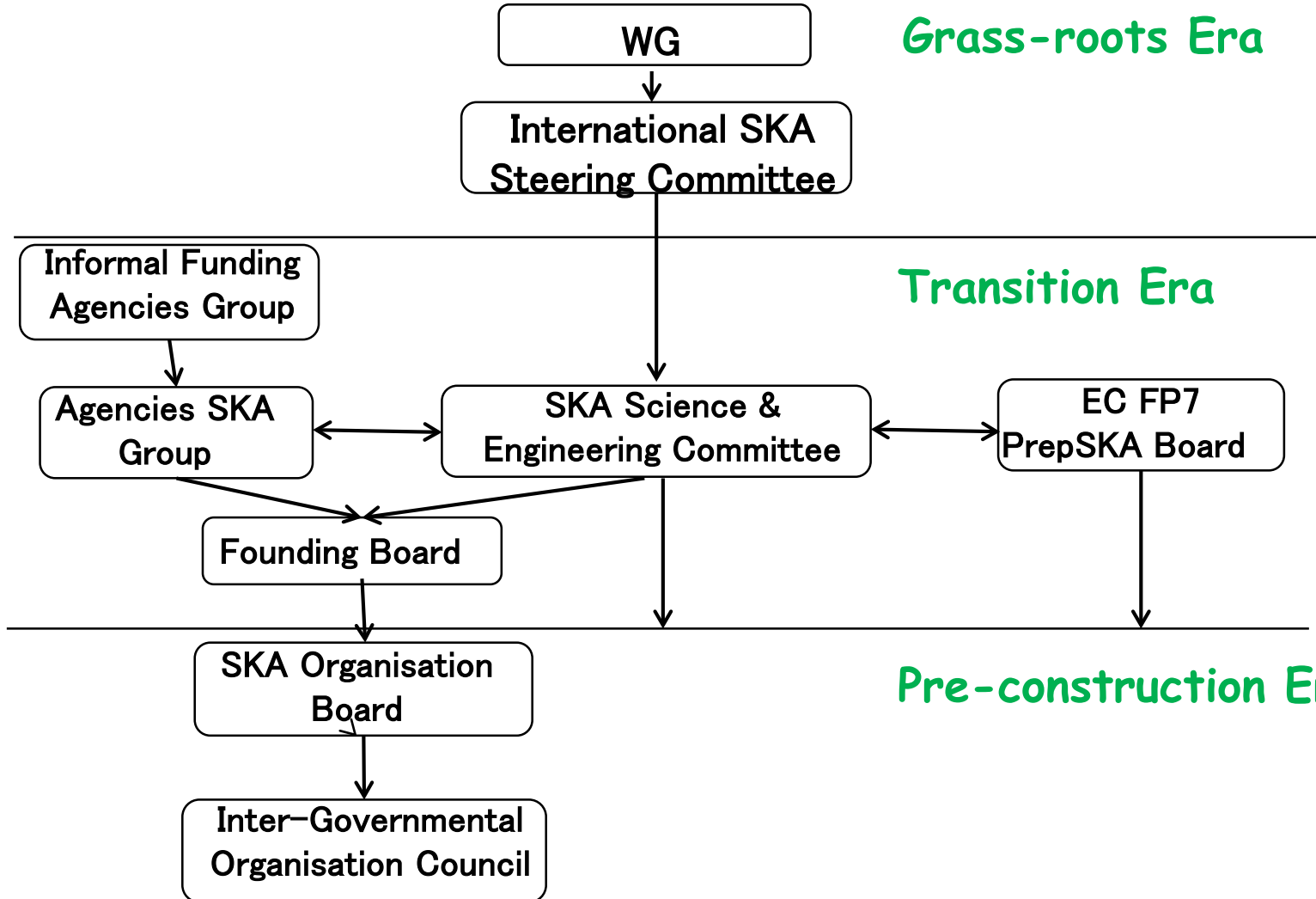
2012

SKA Organisation
Board

Pre-construction Era

2020

Inter-Governmental
Organisation Council



Project management and governance in the Grass-roots era, 1993–2005

Working groups

- 1993 URSI LTWG – start of SKA
- 1994 IAU WG on Future Large Scale Facilities
Chairs (1994–2003); Butcher, Ekers, Schilizzi
First contacts with the OECD Mega-Science Forum

National/ Regional Consortia, Global Steering Committee

- 1999, 2000 SKA Consortia formed in US and Europe
- 1999 First meeting of a “self-appointed” global SKA Steering Committee
(12 members from institutes in AU, CA, NL, US) Chair: Ekers
(start of construction 2010)

Project management and governance in the Grass-roots era, 1993–2005

2000 MoU International SKA Steering Committee

18 members representing 11 countries

- 6 European (UK, DE, NL, SE, IT, PL)
- 6 United States
- 2 Canada
- 2 Australia
- 1 China
- 1 India
- 2 at large members

} RoW



International SKA Secretariat established

Executive Secretary: Russ Taylor

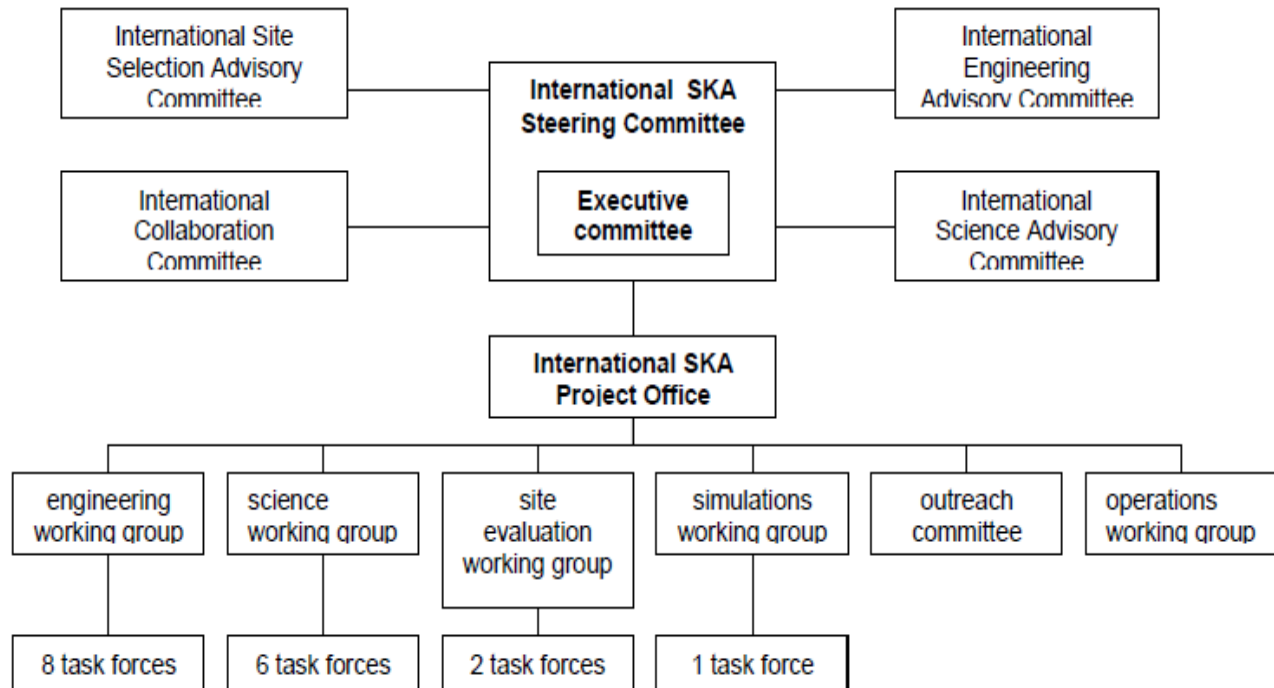
**Signed at IAU General Assembly in
Manchester**



Project management and governance in the Grass-roots era, 1993–2005

- 2003 International SKA Director (Schilizzi) appointed by ISSC
- 2004 International SKA Project Office (ISPO) established in Dwingeloo, NL.
International Project Engineer (Hall) appointed
- 2005 Updated Memorandum of Agreement to Collaborate in the Development of the SKA, ISSC 18→21 members; ISPO formally recognised

2005 International management structure

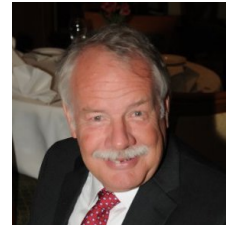


June 2005, the start of the Transition Era

Funding Agencies first discuss the SKA at Heathrow airport in June 2005

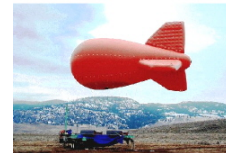
Richard Wade, chair (PPARC), Wayne van Citters, vice-chair (NSF)

ISSC presentation by Phil Diamond on SKA



FA comments on SKA

- science case strong;
- ELT ahead of the SKA in technological readiness and priority
- SKA technological readiness immature
- Site selection in September 2006 [by ISSC] premature, FAs must be involved



“The agencies do not want to take “ownership” of the SKA yet because the project is not sufficiently mature.”

ISSC response:

1) ISPO-led Tiger Team established to down-select technology

→ Reference Design → ISSC approval

2) Site selection: rank 4 contenders, and select one



→ FAs

Funding Agencies

2006 (Informal) Funding Agencies Group (IFAG) formed (chair: Wade).
Selection of one site not approved, un-ranked short list required

2006–11 IFAG → FAWG (chair: Womersley) → Agencies for SKA (ASG, chair: Womersley)

2010–12 In preparation for pre-Construction Phase

- *Post-Preparatory Phase WG* (ASG/SSEC/SPDO)
- *Joint Implementation Group* (ASG/SSEC)
- *Schedule Team* (ASG/SSEC/SPDO), and
- *SKA Siting Group* (ASG/SSEC/SPDO)



Astronomy community

2008–11 ISSC → SSEC (MoA); Chairs: Boyle, Kellermann, Garrett
ISPO → SPDO (MoA); Director: Schilizzi
SPDO reported to SSEC, ASG and PrepSKA Board

PrepSKA (EC FP7 Preparatory Phase for the SKA)

2008–12 PrepSKA Board (chair: Vincent), reporting to the EC (Righi-Steele)
European FAs led WPs on governance options (Vogel), procurement/ industry engagement (Perna), and funding options (Berry)

March

SKA Founding Board established with members from ASG and SSEC

“tasked with developing a **legally constituted governance structure and an adequately resourced SKA Organisation** for the pre-construction phase from 2012 to 2015”

ASG dissolved



November

SKAO established as a “**Company limited by Guarantee**” in the UK, with Members (one per country) and Board (two per country) representing AU, CN, IT, NL, NZ, RSA, UK

Chair. John Womersley

Interim D-G: Michiel van Haarlem

SSEC dissolved

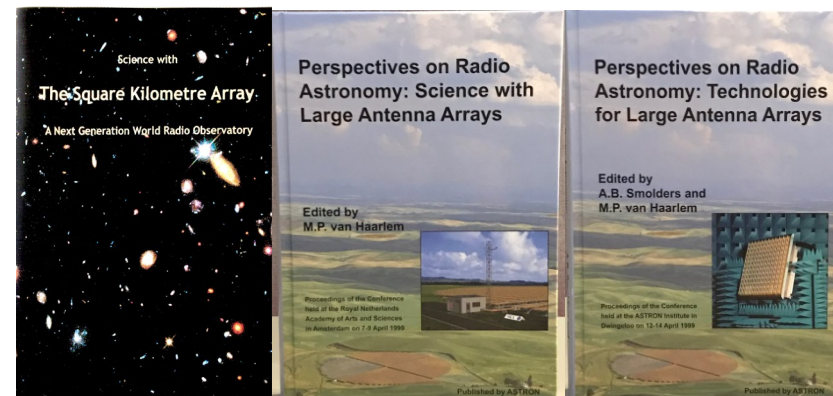


Mostly national efforts on engineering design

- 1995 First funding for SKA technology research and prototyping in NL (Aperture Arrays, Arnold van Ardenne). Other national and regional funding followed.
- 1996 First engineering meeting in Delft
MoU to Cooperate in a Technology Study Program Leading to a Future Very Large Radio Telescope (8 institutes, 5 countries, led by Butcher)
- 1997 First combined science and engineering meeting in Sydney

Books

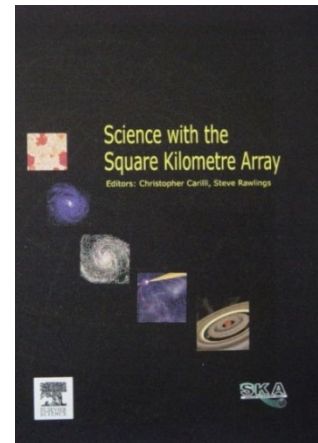
- 1998 First SKA science book (eds. Taylor & Braun)
- 1999 Second science book (ed. Van Haarlem)
 First SKA engineering book
 (eds. Smolders & van Haarlem)



- 2000–4 (International) Engineering Management Team (Chair: Hall)
 - played an important role in focussing on enabling technologies
 - concept descriptions, and White Papers, critique
- 2000–4 (International) Science Advisory Committee (Chairs: Taylor, Carilli)
- 2003 Selection of five Level 0 (→ Key Science) Projects
 - science–engineering compliance matrix analysis
- 2004 LOFAR Project funded
- ISSC: SKA to be built in 3 Phases:
5% demonstrator, full SKA, SKA–hi
- 2005 SKADS – first multi–national funding for SKA engineering development (PI: van Ardenne)
- Technology down–select → Reference Design
Small dishes and “smart” feeds/ mid–frequency AAs/ and EoR array (full SKA only)

More books

- 3rd SKA Science Book (eds. Carilli and Rawlings), 2004
- 2nd SKA technology book (ed. Hall), 2005



THE SQUARE KILOMETRE ARRAY:
AN ENGINEERING PERSPECTIVE

Edited by
Peter J. Hall



2006 → Large precursor projects begin on the two short-listed sites, ASKAP, MeerKAT

2008–12 PrepSKA era

SKA design efforts around the world were coordinated by SPDO and national Liaison Engineers. Meetings were held...



2007 → Associated funding for technology development (€60M)

Europe (PrepSKA, PI: Phil Diamond → Paul Alexander),

SKADS → AAVP

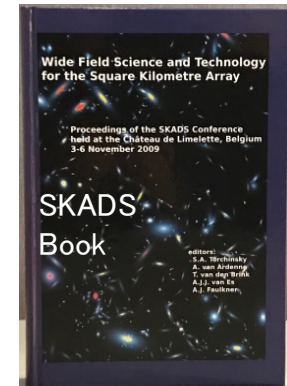
USA (TDP, PI: Jim Cordes)

Australia (ASKAP, PI: Dave De Boer)

South Africa (MeerKAT, PI: Bernie Fanaroff)

Canada (SKA, PI: Peter Dewdney → Sean Dougherty)

China (FAST, PI: Nan Rendong)



2010 External Review of Conceptual System Design recommended further science and technology down-select to reduce project ambition

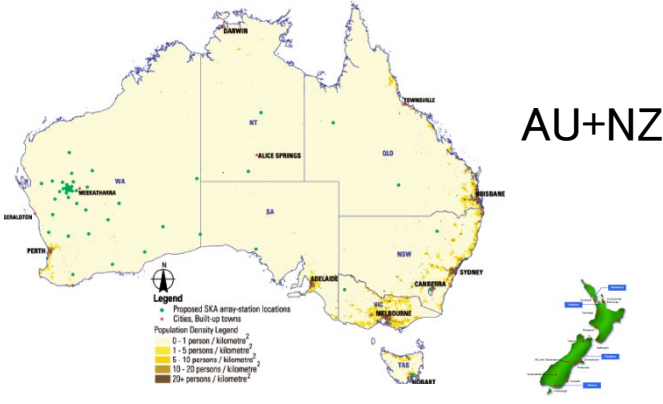
SSEC sub-Committee → “Baseline Design” + “Advanced Instrumentation Program” (SKA Memo 125)

Project Execution Plan prepared by a Project-led Tiger Team. Has stood the test of time.

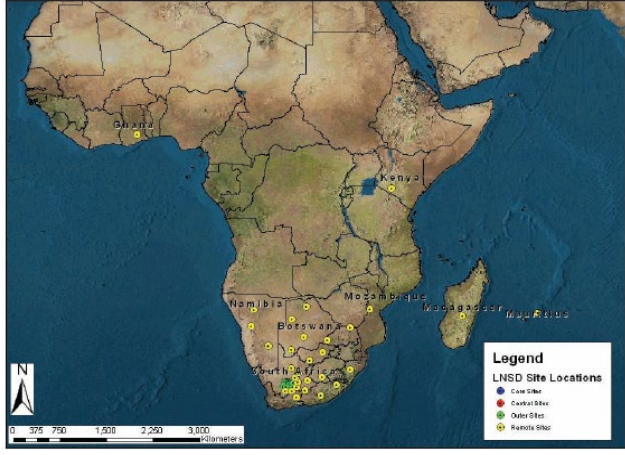
Site selection (2002–2012)

- 2001 Site Evaluation and Selection Committee formed by ISSC
- 2002 Open request by ISSC to global radio astronomy community for [Expressions of Interest](#) in siting SKA
- 2003 [Call for Initial Site Analyses](#) from Australia, South Africa, Argentina/Brazil, China, USA
- 2004 [Call for Proposals](#) to Host the SKA. USA did not respond
- 2005 RFI measurements at the four competing sites
31 December: [Proposals submitted](#)

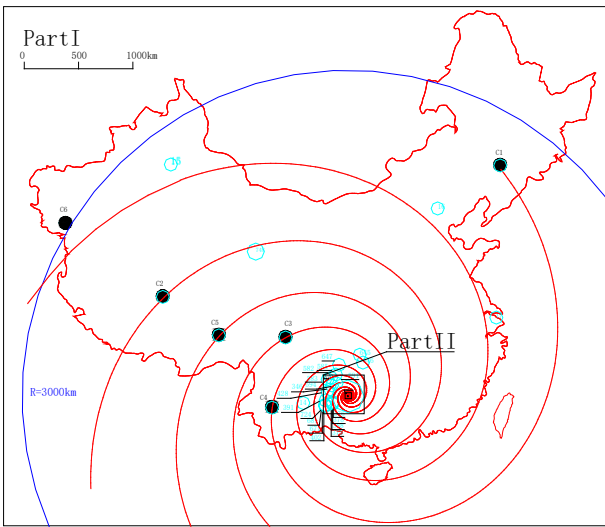
The site contenders in 2006



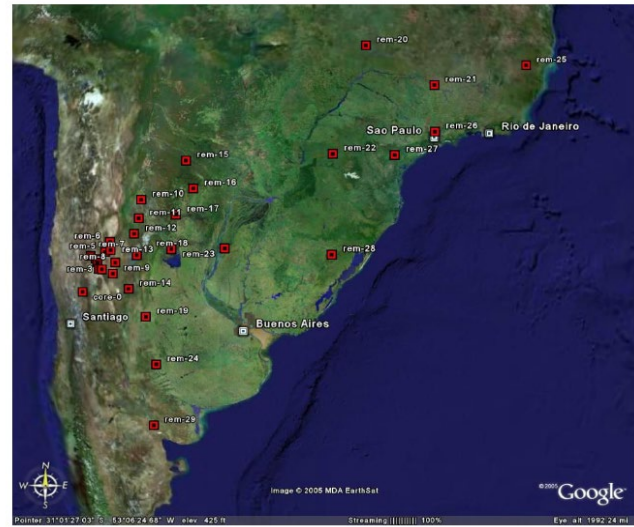
AU+NZ



RSA +
7 countries



CHINA



ARG+BR

- 2006** FAWG decision to require an unranked site shortlist, negotiations and "blood on the floor"
 - ISSC shortlisted Australia+NZ and Southern Africa with advice from the International SKA Site Advisory Committee
(chair: Richard Hills, members: Moran, Baars et al)

- 2006** Ratified by Funding Agencies

- 2008–2011** RFI measurement campaign in both countries based on an MoU (SPDO–AU–RSA)
Tropospheric measurement campaign

- 2010** ASG & SSEC establish SKA Siting Group (SSG) to oversee selection process

- 2011** Request for Information from the sites
 - Evaluation of submissions by expert panels, consultants, SPDO

- 2011 Nov** – Independent review of all material by SKA Site Advisory Committee
- 2012 Feb** *chair: Moran, members: Baars, Corbett, Michalowski, Tindemans et al*

Site selection 2012

- Feb** **SSG report and SSAC report submitted to SKAO Board**
-Site selection process had been properly followed (SSG)
-Both sites were acceptable as sites for the SKA, but Southern Africa was preferred (SSAC)
- Feb-Mar** Comments on SSAC advice by Australia+NZ and South Africa
- Mar** **SKAO Board meeting** decided not to reopen the work done by the SSAC; decision passed to the Members of the Company
- Apr** **SKAO Members meeting** established Site Options WG (SOWG) to investigate the feasibility of a **dual-site implementation** option (or options)
- May** **SKAO members meeting** discussed SOWG recommendations
Full array: SKA-mid – Africa; Low freq AA – ANZ; Mid freq AA - RSA or ANZ
SKA 1: SKA-mid - RSA; Low freq AA -- AU; Survey Telescope -- AU
Members adopted SOWG recommendations
- Oct** SKAO Board meeting Recommended formal decision by Members on dual site implementation
- Nov** **SKAO members meeting** Formal decision taken

International profile raising

- **URSI** General Assemblies 2003→
- **OECD** →Task Force on Radio Astronomy 1994, 1996, 2001
acted as “banker” for annual contributions to SPDO (except USA) 2005–8
- **IAU WG Future Large Scale Facilities** meetings at GAs 1997, 2000, 2003
- **ESFRI** Inclusion as an ESFRI Research Infrastructure 2006
- **AstroNet** Science and Technology Roadmaps (European Funding Agencies) 2008 **SKA**
equal priority with ELT. First major affirmation of the **SKA** science case
- **US Decadal Survey** 2008–10
- **Political lobbying at high level by the short-listed sites** 2006–12

Key decisions and events in SKA

-
- 1993** URSI Large telescope WG established → start of SKA
 - 1996**
 - First funding for innovative SKA engineering design in NL
 - MoU to Cooperate in a Technology Study Program Leading to a Future Very Large Radio Telescope (8 institutes/6 countries)
 - 1996** First international engineering meeting in Delft
 - 2000** International SKA Steering Committee formed
 - 2002** Site selection begins
 - 2003**
 - International SKA project Office established
 - Key-science projects identified, drive engineering development
 - 2004** ISSC decision to stage SKA construction as Phase 1, Phase 2 and Phase 3
 - 2005**
 - Funding Agencies first discuss the SKA
 - Technology down-select → Reference Design for the SKA

Key decisions and events in SKA

- 2006**
 - Decision on a short-list of two possible locations for the SKA telescope: Australia and Africa (led by South Africa)
 - South Africa and Australia start SKA Pathfinder projects
 - SKA on European Strategic Forum for Res. Infrastructures (ESFRI) list
- 2007** Decision on **location of SKA Program Development Office** → Manchester
- 2008** **EC-FP7 Preparatory Phase for SKA (PrepSKA) begins**
SKA equal-top scientific priority for future European research facilities
- 2010** Further technology down-select to “baseline design” and “advanced instrumentation program”

US begins withdrawal from SKA project following national review of astronomy
- 2011** Decision on **location of SKA Project Office in the Pre-Construction Era**
→ Manchester

Legal entity for SKA Organisation established
- 2012** Decision to locate telescope in both Africa and Australia

The end