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Powering the SKA: An Industry Briefing

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The Office of the SKA Organisation
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Presentation Overview



- What is the Square Kilometre Array (SKA)?
- Where will the SKA be located?
- What are we powering?
- Technical Challenges in Power
- Industry Engagement
- Roles for Industry
- Practical Engagement

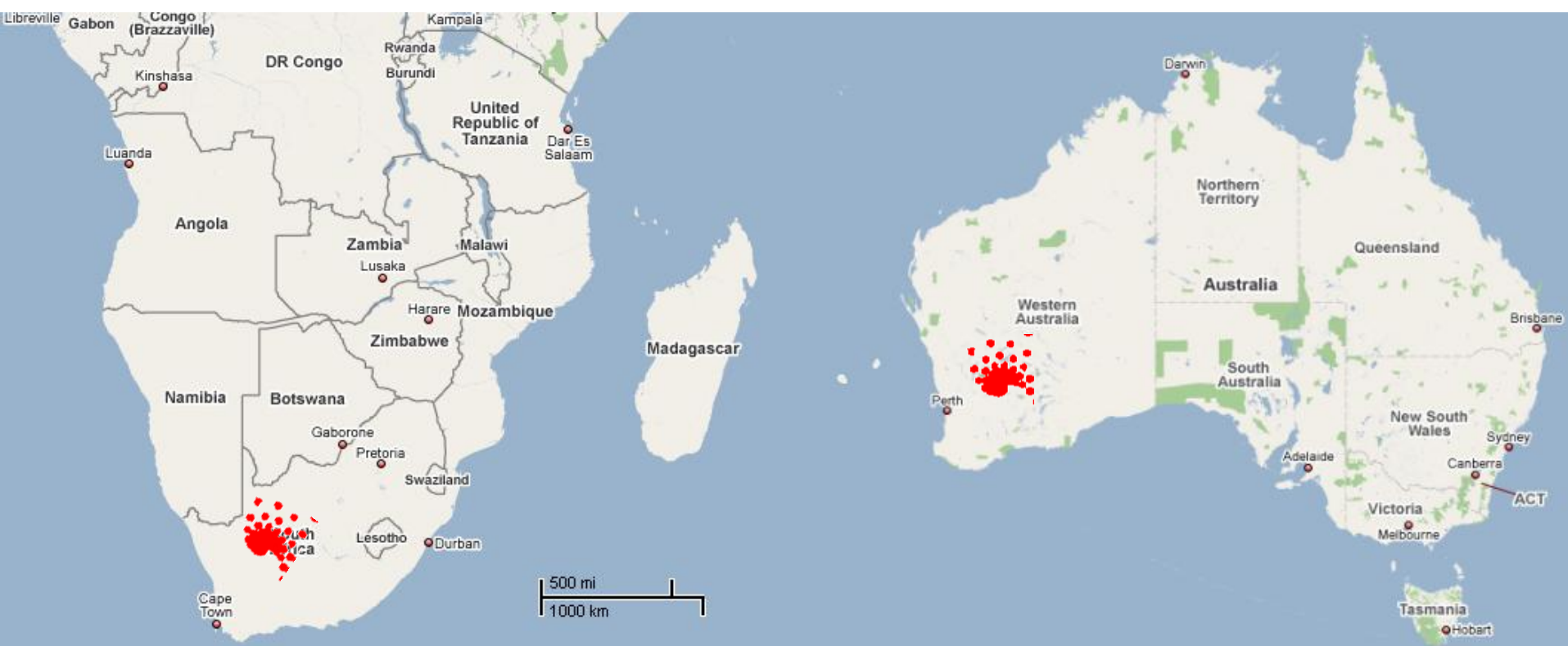
SKA Overview



The Square Kilometre Array

SKA Locations

Distributed Power for SKA₁



Dual Site for SKA



Qty	SKA1	
280	SKA1_LOW Sparse AA	AUS
250	SKA1_MID (dishes)	RSA
60	SKA1_SURV EY (dish & PAF)	AUS

Qty	SKA2	
280	SKA2_LOW Sparse AA	AUS
2500	SKA2_MID (dishes)	RSA
280	SKA2_AA (mid Freq dense AA)	RSA

Power demand estimates – SKA₁



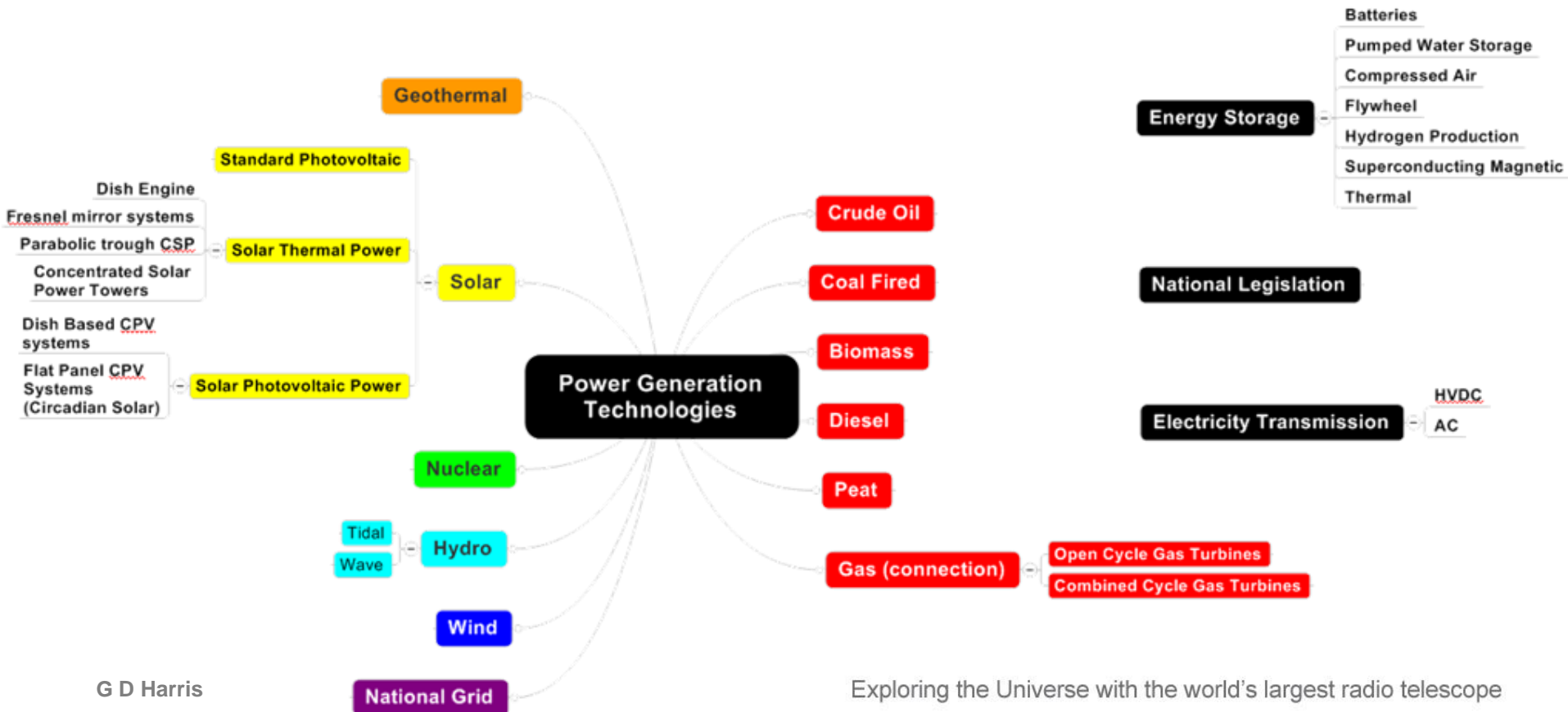
	RSA	AUS
Sparse Arrays		3.36 MW
Dishes	1 MW	
Dishes with PAFs		0.12 MW
On-site Computing	4.7 MW	1.32 MW
Totals per site	5.7 MW	4.8 MW
But for SKA ₂	~40 MW	~40 MW
Off-site Computing	SKA1 = 30 MW?	SKA2 = 40-50 MW?

Source data – SOWG report

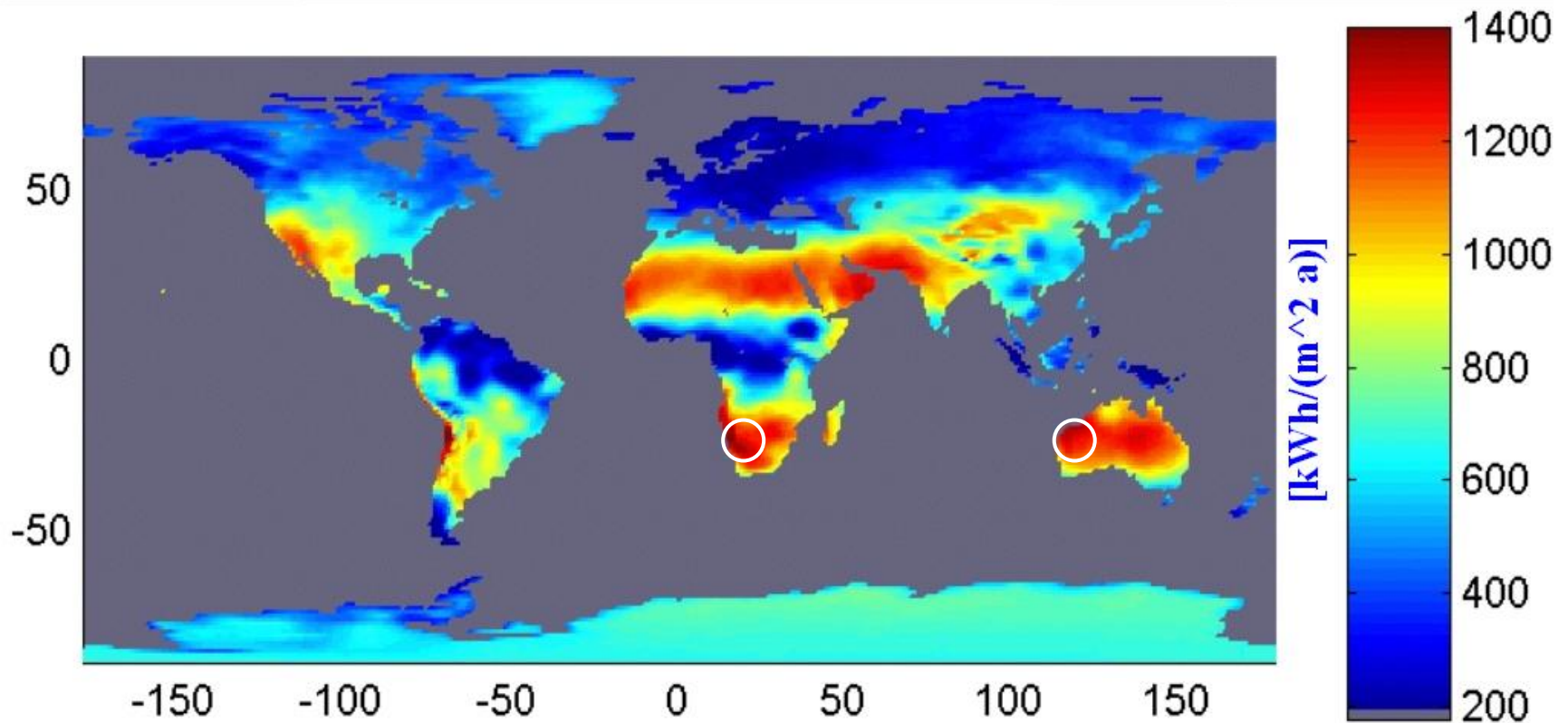
Power Options



- Power Supply to the SKA
 - Economic Analysis of Generation options for the Lifetime of the SKA
 - Potential Siting of Generation Systems in Relation to SKA



SKA Location – Solar Energy Resource



Technical Challenges – Power



- Application of 'Smart Grid' Technology
 - Optimise reticulation at core site
- Development of Remote Station Power Block
 - Off Grid Generation Options
 - Voltage / Current Conversion / Regulation
 - Energy Storage – what forms?
 - Maintenance costs
 - Scalability SKA₁ to SKA₂
 - Supply continuity



Technical Challenges – Power



- Distribution
 - Low EMI and RFI Transmission
 - Network Topology – redundancy in design
 - Effective Earthing
- Power Monitoring and Control
- Elegant shutdown & startup
- Environmental / Ecological Impact of Power Provision

Technical Challenges

– Power and Infrastructure



Radio Frequency Interference

- EMI **Standards** need to be examined carefully
- Development of testing techniques and standards may be necessary for **“SKA Compliance”**
- The **complexity and cost** of RFI mitigation on power generation and reticulation **are significant** to the project



- **Testing and verification** will be required throughout development and commissioning (RFI / EMI Policeman)
- **Continuous RFI monitoring** should be used throughout SKA rollout of infrastructure
- **Lightning protection** (low soil conductivity)



Industry Engagement with the SKA

Overall Aims of SKA Industry Engagement



The purpose of the Industry Engagement Strategy is to:

- establish a framework that sets out the challenges and opportunities of the SKA project
- encourage engagement and practical participation with collaborators and industry (currently for SKA₁.)
- to describe how the SKA Office will communicate opportunities to industry, and encourage industrial relationships.
- foster and develop longer term industry capability through specific innovation in SKA-related areas, and
- maybe leading to 'spin-off' benefits



Why get engaged now?



SKA Industry engagement is anticipated to fall broadly into three areas:

- **Strategic positioning** (specialist exchanges and training, technology mapping, programmatic information and tools); **NOW**
- **Industry development** (business creation, IP generation, teaming, supply chain development); **SOON**
- **Industry participation**; (contracts awarded, jobs and skills maintained and expanded, industry collaboration with academia). **LATER**

And there's real money:

- **Pre-Construction Phase - €70 million**
- **SKA (Phase 1) - €350 million**
- **SKA (Phase 2) - €1.5 billion (estimate)**

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Domains of Engagement in SKA



Broadband, active, phased arrays for aperture and focal plane applications
Decade bandwidth feed antennas for dishes
High dynamic range image formation using sparsely-sampled Fourier plane data
High-speed (Tb/s) digital fibre optic links for distance regimes extending from 100 m to >3000 km
High-speed digital signal processing engines (Pb/s) and ultra-fast supercomputing (at exaflop rates)
Low-cost, high-speed (Gs/s) analogue to digital converters
Low-cost, mass manufacturing of small to medium diameter dishes
Low-noise, highly integrated, receivers for both cryogenic and uncooled applications
Outreach and public education
Power design and Engineering
Project Management
Radio-frequency interference mitigation using coherent and incoherent techniques
Site studies and infrastructure engineering
SKA scheduling, operations and maintenance models
Software engineering for robust, intelligent, array control and data processing
System Engineering

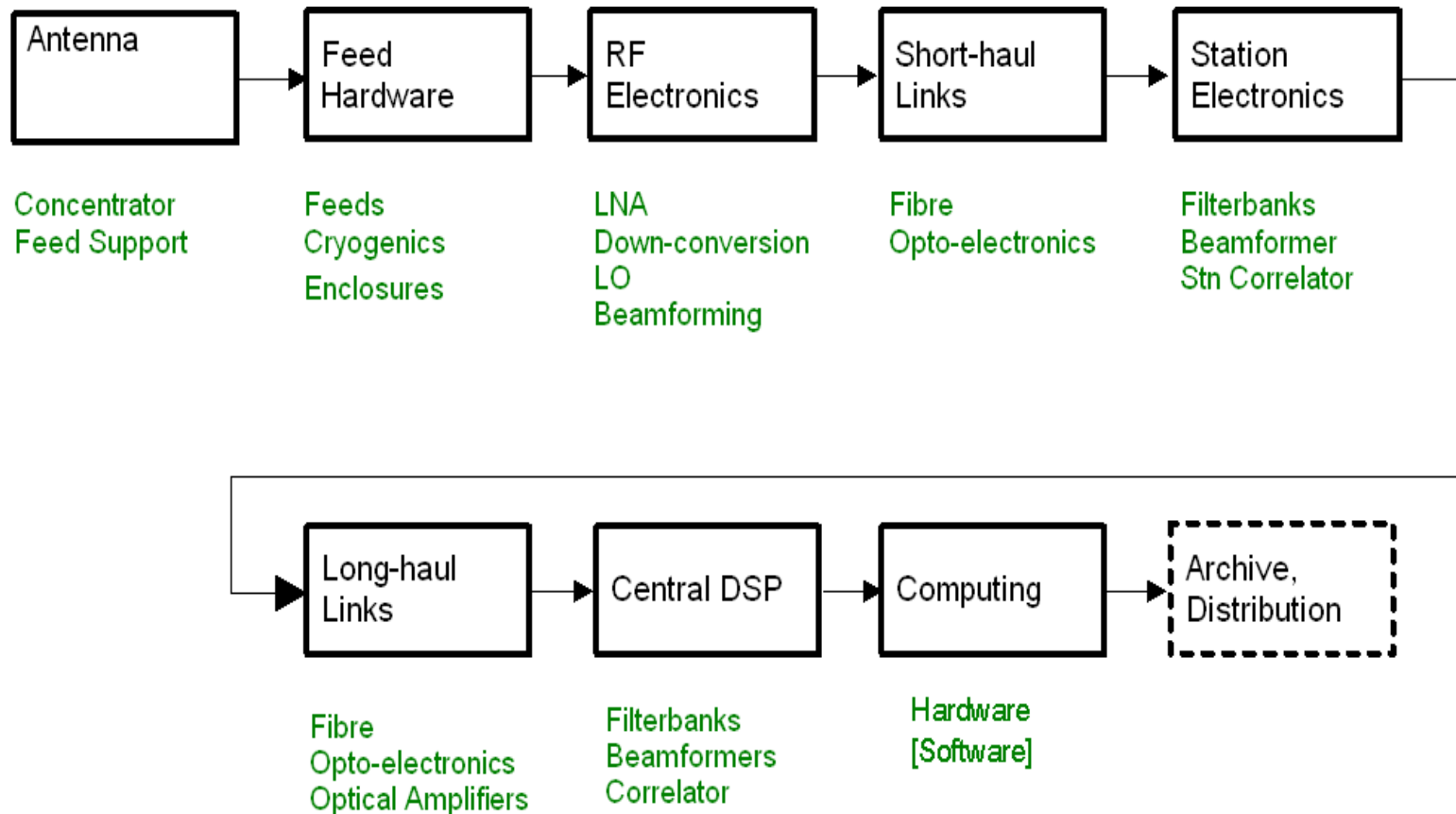
Potential Roles for Industry In the Pre-construction stage



- **Managerial**
 - Project management systems
 - Procurement management tools
 - Contract execution and consultancy
 - Mission & Quality Assurance
- **Technical**
 - Site operations
 - Design modelling and proofing
 - Carrying out some project management tasks
 - Design for manufacture
 - Detailed design work
 - Verification program components
 - Assembly of production data-packs
 - Power system consultation

Potential Roles for Industry

By Signal path



Work Packages (from the EoI)

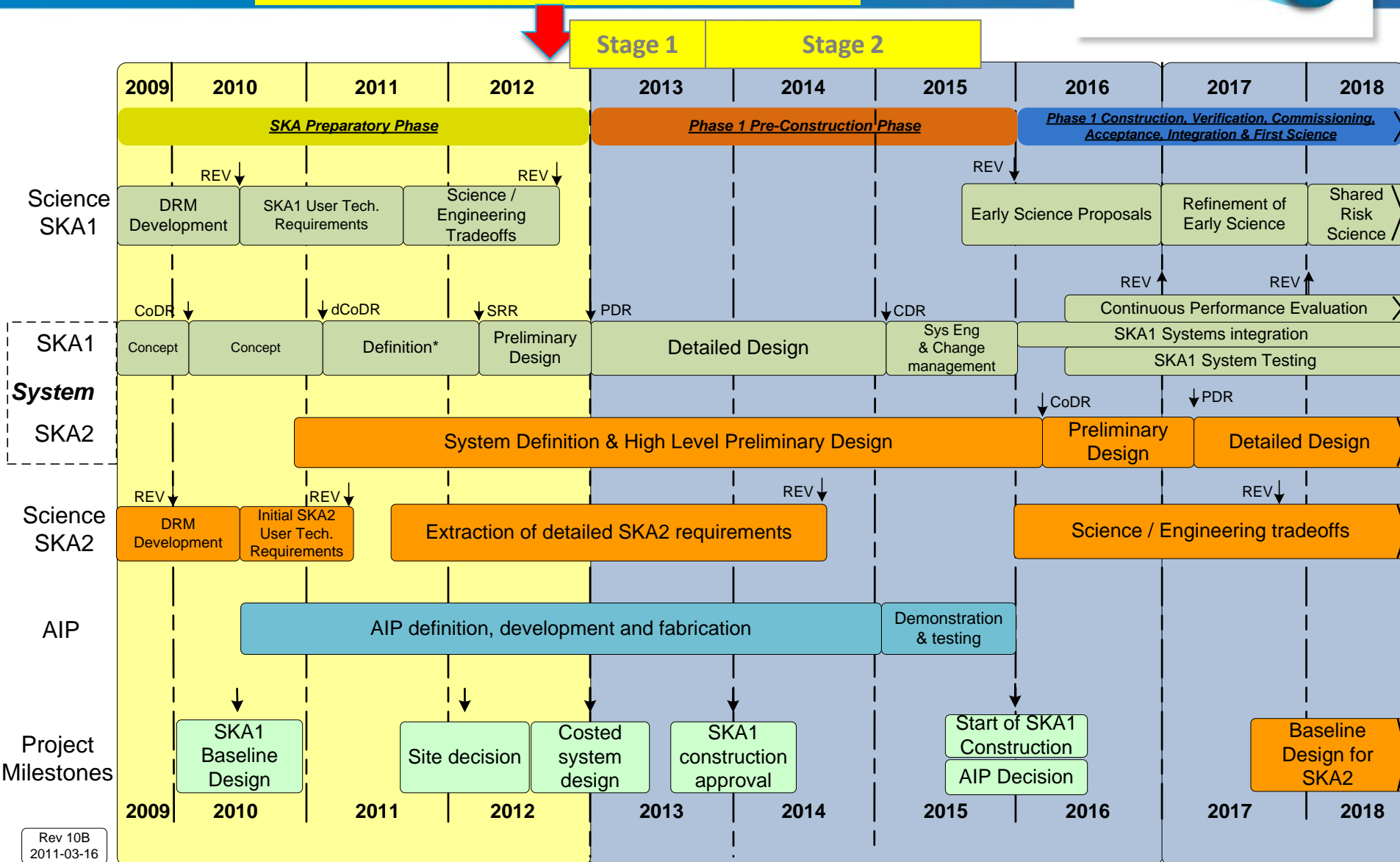


- SKA Project Office (SPO)
 1. Management
 2. Science
 3. System
 4. Maint / support
- Anticipated Work Package
 5. Dish Array
 6. Aperture array
 7. Signal Transport, networks and timing
 8. Central Signal Processing
 9. Software and Computing
 10. Power
 11. Site engineering (infrastructure).

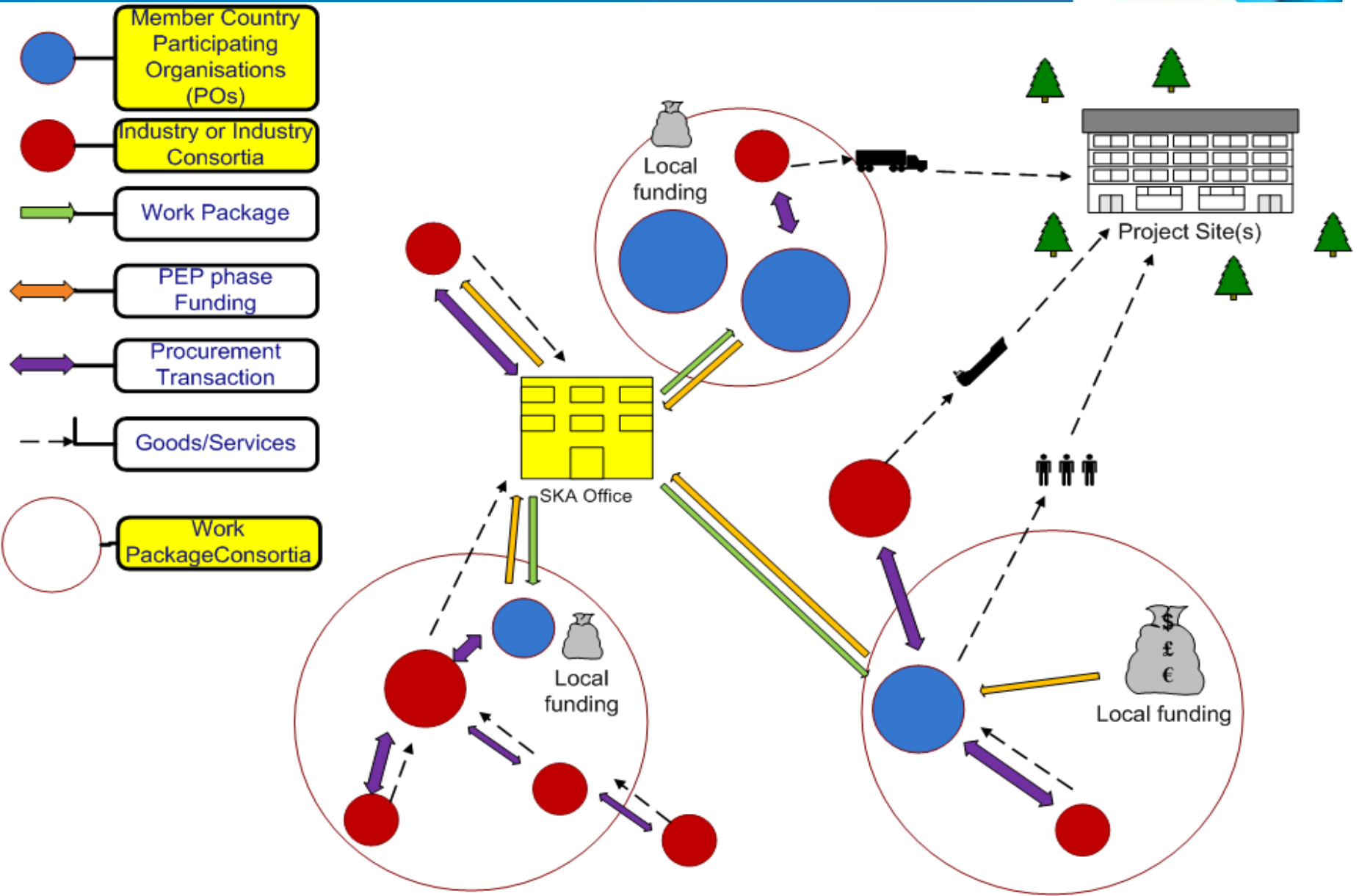
Where the project is...



Here. EoI ended, RfP to come for Stage 1



Who are the 'players'?



Principles & Assumptions for SKA Pre-Construction Phase



The main activities of the SKA Office will be:

- Design authority for the SKA
- Interaction channel between SKA Project, Member Institutions, and industry;
- Run project management, system engineering design, risk management, and schedule and budgetary control
- Integration of the project activities and Work Package deliverables; and
- Definition of procurement arrangements for SKA design and pre-construction, conducted by the WPCs.

- The PO & Industry hold the best knowledge to build the SKA
- Requirements will be developed collaboratively
- Contractual procurements will be between the POs & Industry
- The SKA demands rigorous quality, and best-of-breed design
- Procurement will be transparent, fair, and consistent with world standards

‘Plugging in’ at the Pre-Construction Phase



Strategic Engagement:

- Contact the SKA Office – niche capability, specialist placements, tools, joining-up requests

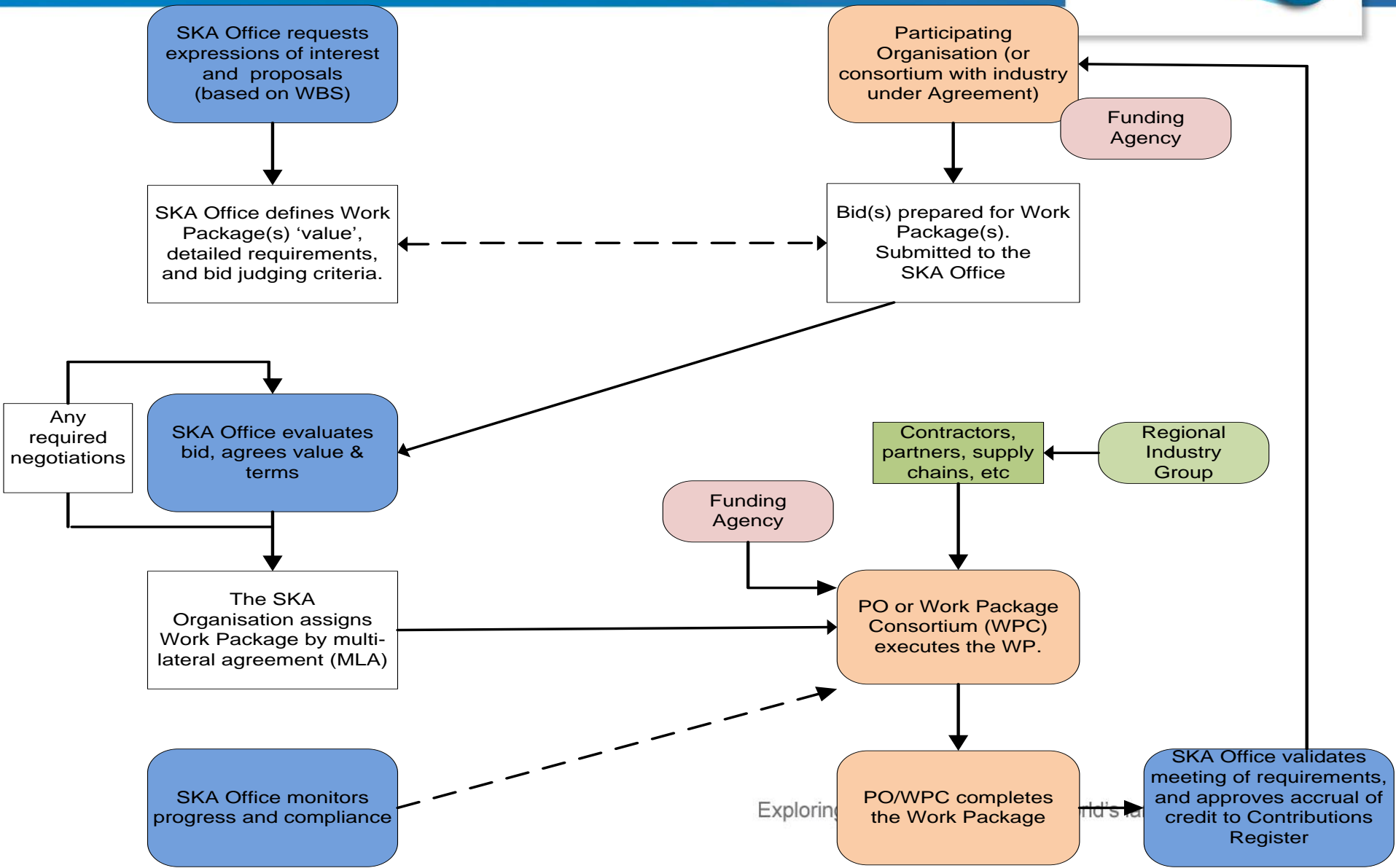
Regional Collaborations:

- Make contact with local POs, joining local industry groups, pre-teaming for capacity (self-assembly)

Project Participation:

- Participate in Eols, & RfPs.
- Position for winning, and executing contracts

Practical Participation in Pre-Construction Phase



Communicating Opportunities



The SKA Organisation's main communications are via:

- Regular updates posted on the SKA Organisation website (www.skatelescope.org)
- Promotion through newsletters, and media releases
- Posting of public tenders on appropriate websites
- Direct emails

And the SKA Office may also use...

- Project briefings to industry
- Early release of indicative technical specifications to guide R&D
- Support of meetings and workshops with industry groups
- General communication via this Industry Engagement Strategy.

Industry should keep in touch via:

- Regular contact with local SKA POs
- Attendance at a local, or SKA Office organised, briefings
- Announcements in an SKA newsletter or website material
- Public advertising of business opportunities (EoI, RfP, etc)
- Direct approach by an SKA stakeholder, PO, or person;
- Membership of an industry group, e.g. SKA industry consortium; and
- Encouragement by your local Government agencies.

A 'WORK-IN-PROGRESS'

The SKA Project – Industry Participation landscape ver 3.1





Thank you

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