VIA-SKA

The Spanish VIA-SKA project

an Iberian Industry-Academia example

PI. Lourdes Verdes-Montenegro
PM. Juande Santander-Vela
(IAA-CSIC)

CTAER, Fractal
23/11/2012

The Square Kilometer Array: a large Scale ESFRI Infrastructure, From the Cosmos to the Cities of the future

Lisbon, Portugal, 30th November 2012

The Spanish VIA-SKA project

Feasibility study of the Spanish Technological Participation in the SKA

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SKA - SPAIN

Scientific Network (J. C. Guirado, Univ. Valencia)

Acción Complementaria para Red Española SKA

UV, IAA, CAB, OAN, UB, IEEC, UGR, UJ, IAC, IFCA, UPTC

June 2011: kick-off meeting in CSIC showed broad and strong scientific interest of Spanish researchers in SKA

High-priority in MICINN document

"Building the science of XXI century"

September 2011: MICINN request Spain to participate in SKA as an Observer

SKA - SPAIN

Industry Participation (L. Verdes-Montenegro, IAA-CSIC)

Feasibility study of the Spanish technological participation in SKA (VIA-SKA)

Granted with 75.000€ in November 2011

Subprogram for International Scientific Infrastructures

Ministry for Economy and Competitiveness

http://www.via-ska.es/ska/

VIA-SKA Members

- **Participants**

  CSIC: IAA, CAB, ICE, IFCA

  IGN - OAN

  Instituto de Astrofísica de Canarias

  Universities of Granada, Barcelona, Cantabria, Valencia, Jaén, Carlos III, and Politécnica de Cartagena

  National Institute for Aerospace Technology (INTA)

- **In collaboration with**

  CTAER (Advanced Technological Center for Renewable Energies)

  FRACTAL SLNE

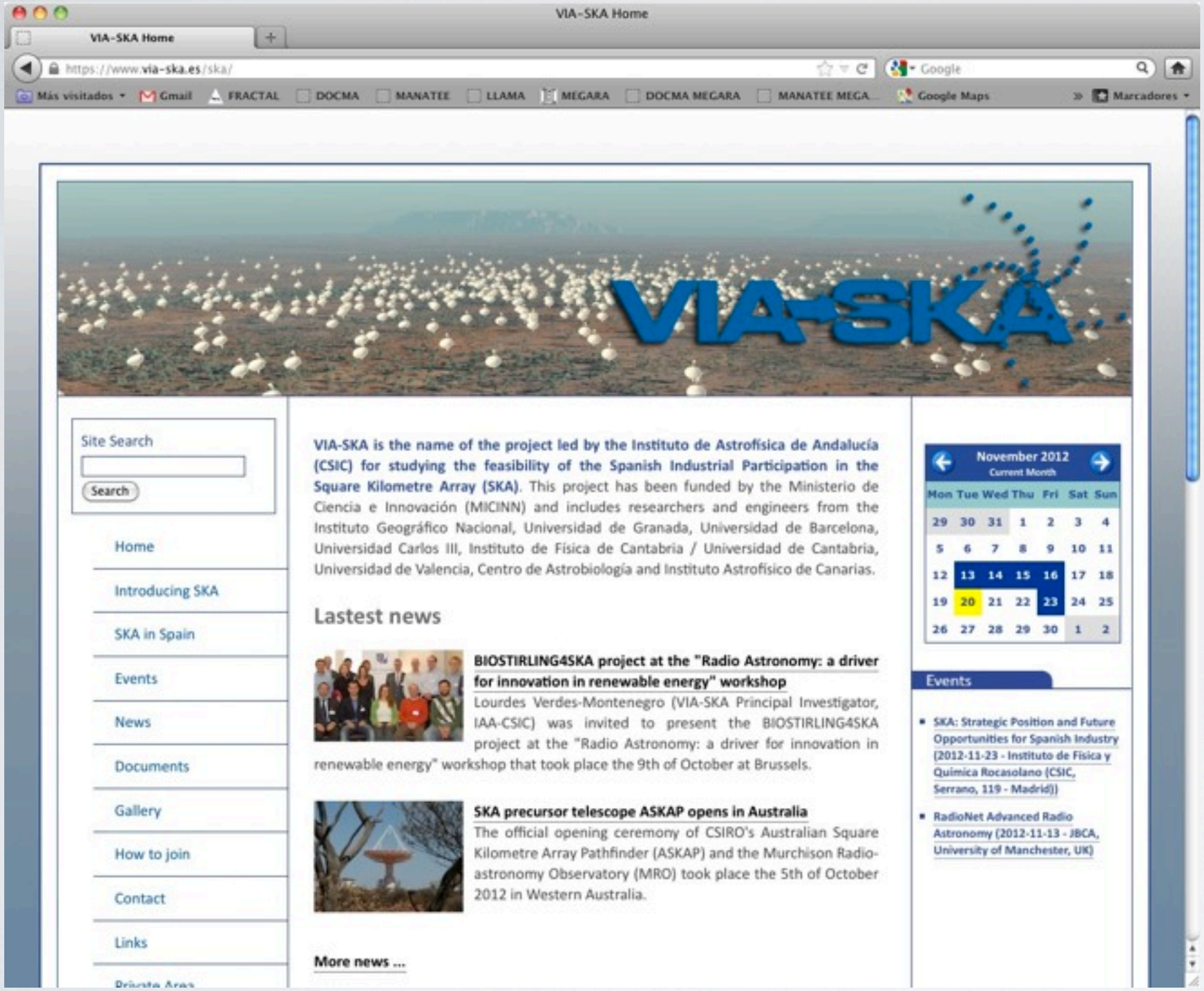
MoU for SKA-Spain in preparation by

Universidad de Valencia

Vicepresidence for Science and Technology (CSIC)

INFORMATION AND DISSEMINATION

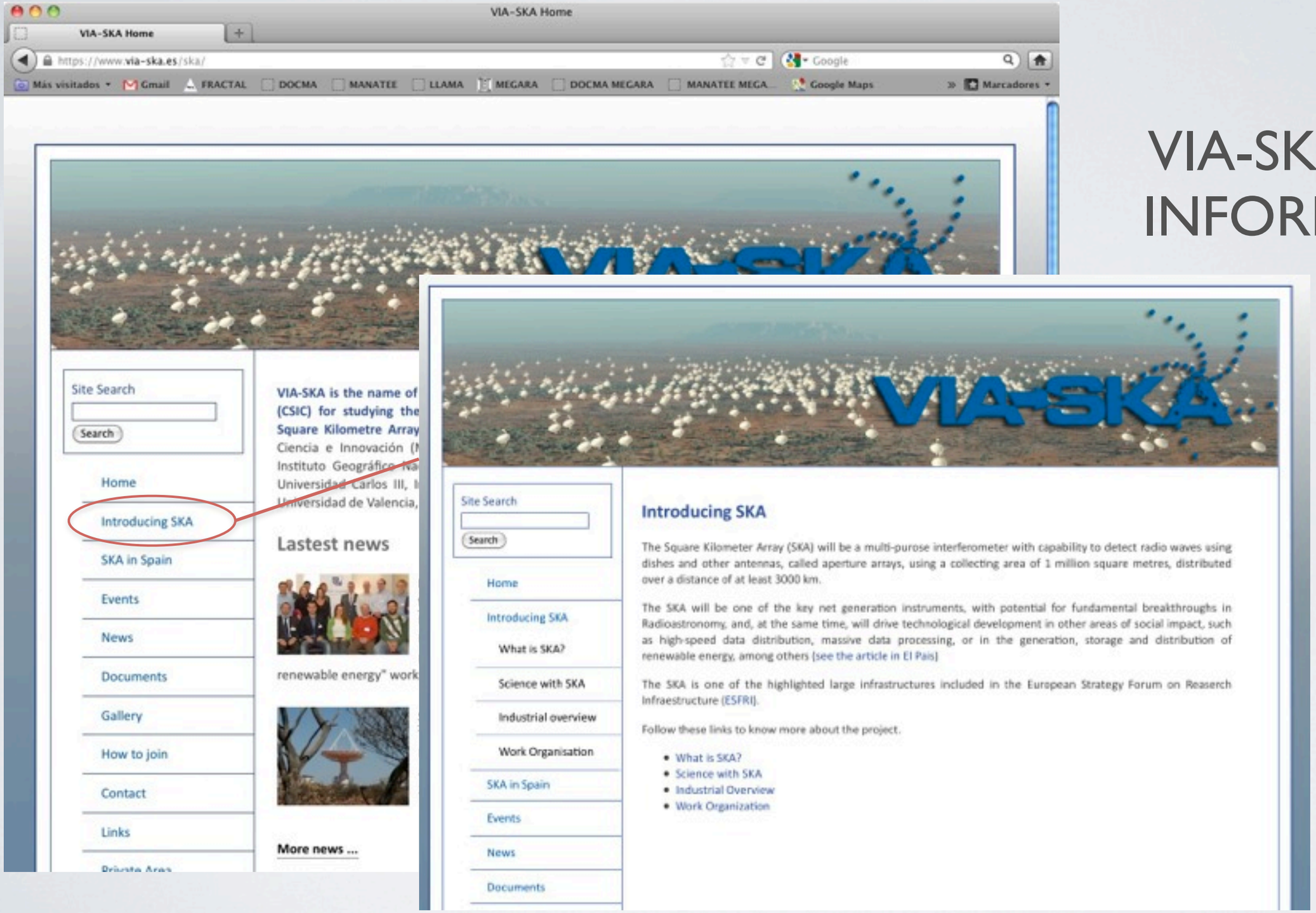
VIA-SKA ACTIVITIES



VIA-SKA + SKA INFORMATION

INFORMATION AND DISSEMINATION

VIA-SKA ACTIVITIES



VIA-SKA + SKA INFORMATION

INFORMATION AND DISSEMINATION

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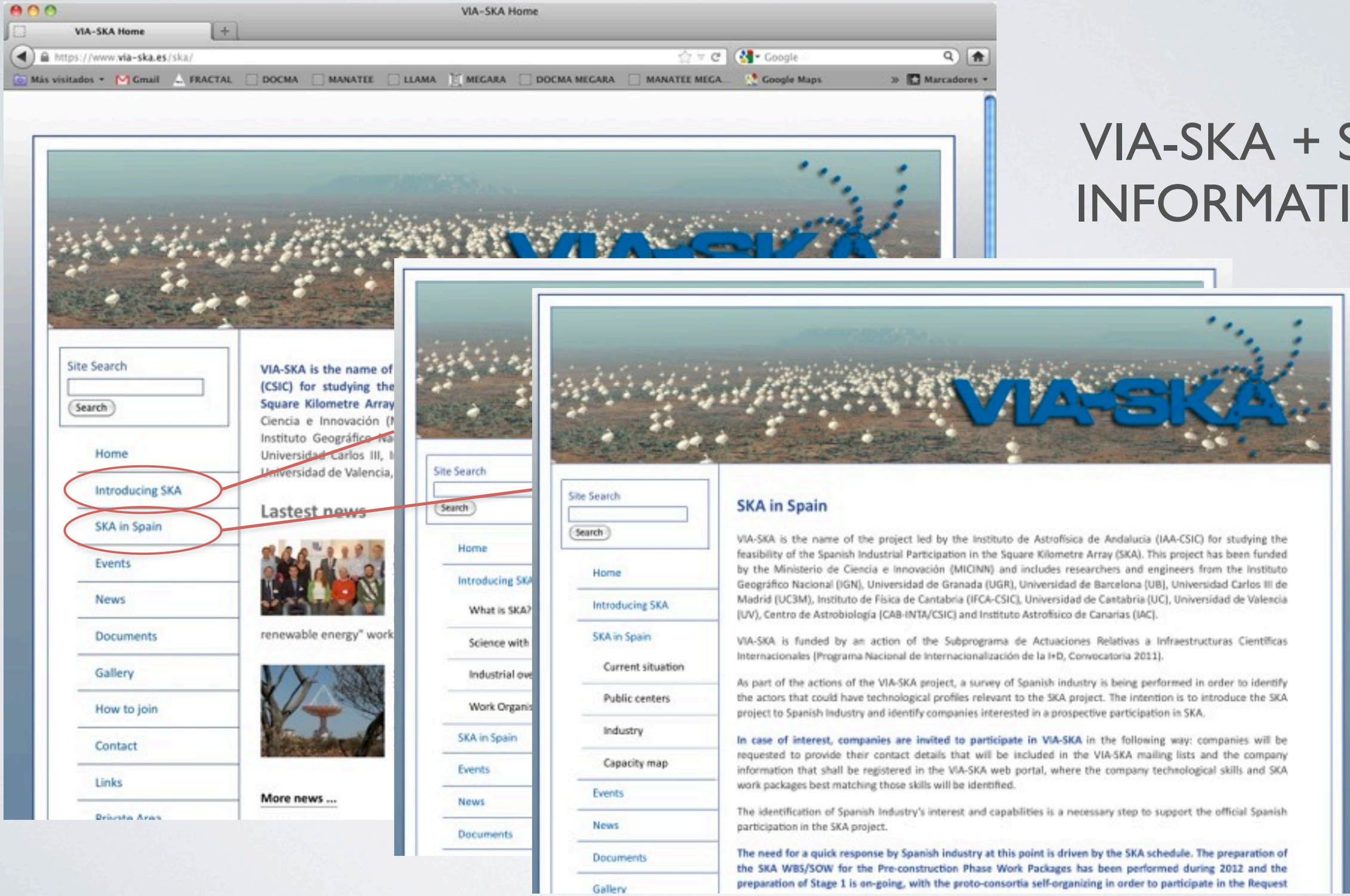
VIA-SKA + SKA INFORMATION



DOSSIER FOR INDUSTRY

- SKA Project
- Schedule
- Goals of VIA-SKA
- How to participate

Distributed to > 80 companies with technological profiles of interest

VIA-SKA: Estudio de viabilidad de la participación industrial española en el SKA

What is SKA?

The **Square Kilometre Array (SKA)** will be a multi-purpose interferometer of thousands of antennas linked together to provide a collecting area of one square kilometre and distributed in an area nearly the size of a continent. The SKA will be 50 times more sensitive than any other radio instrument and will survey the sky at least 10.000 times faster than the best current-day telescopes. Signals from separated antennas shall be combined via high-speed data links to a central processor, providing an angular resolution equivalent to that of a telescope with a diameter of more than 3000 km.

In order to achieve both high sensitivity and high-resolution images of the radio sky, the antennas of the SKA will be densely distributed in the central region of the array, and then logarithmically positioned in groups (more spaced at extremes) along several spiral arms extending up to 3000 km from the central core.

Three antenna types, high-frequency dishes and mid & low-frequency aperture arrays, will be used to provide continuous frequency coverage from 70 MHz to 10 GHz. In the lower (70-450 MHz) and middle (450-1400 MHz) part of the frequency band, two different types of antenna, aperture arrays, will act as a radio wide-angle lens and will be used to observe very large areas of the sky simultaneously. In the higher (1.2-10 GHz) part of the frequency band, the SKA will use 3000 dish antennas, each about 15 m wide, which will operate as a radio camera to provide high quality images.

The signal from the receiving elements will be transported back by optical fibres carrying up to 420 Gb/sec per dish and 16 Tb/sec per aperture array to a central processing engine where the data will be handled to form images and time series, and to combat the effect of radio frequency interference (RFI) signals.

Frequency Range	70 MHz To 10 GHz
Sensitivity Area / System Temp	5000 m²K (400 μJy in 1 minute) between 70 And 300 MHz
Survey Figure-Of-Merit	4×10^{7} – 2×10^{10} $m^4K^{-2}deg^2$ depending on sensor technology and frequency
Field-Of-View	200 square degrees between 70 And 300 MHz 1-200 square degrees between 0.3 And 1 GHz 1 square degree maximum between 1 And 10 GHz
Angular Resolution	<0.1 arcsecond
Instantaneous Bandwidth	Band Centre ± 50%
Spectral (Frequency) Channels	16384 per band per baseline
Calibrated Polarisation Purity	10000:1
Synthesised Image Dynamic Range	>1000000
Imaging Processor Computation	~10^{17} operations/second
Final Processed Data Output	10 Gb/second

Two locations are under consideration: Southern Africa and Australia–New Zealand. In Australia the SKA would stretch all the way to New Zealand, and in Southern Africa it would stretch to the Indian Ocean islands. The final site decision will be made in 2012 and will be based on several factors including the operating and infrastructure costs, as well as levels of radio interference.

The SKA will be one of the key net generation instruments, with potential for fundamental breakthroughs in Radioastronomy, and, at the same time, will drive technological development in other areas of social impact, such as high-speed data distribution, massive data processing, or in the generation, storage and distribution of renewable energy, among others.

The total target cost for SKA is 1500 M€.

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CAPACITY MAP OF SPANISH INDUSTRY

To identify technological niches for Spanish Contributions to SKA WPs

January 2012: List of Spanish companies and technological centres with capacities for SKA

Companies with the relevant experience or that have participated in other large infrastructures such as CERN, ESRF, ITER, ESO & CTA
More than 80 companies were identified

First contact e-mail to introduce VIA-SKA and request confirmation to be kept in the distribution list

May 2012: Intersted companies interested sent the information to be registered in the VIA-SKA web portal

VIA-SKA

The complete list of registered public institutions and companies can be displayed

Site Search

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- Contact

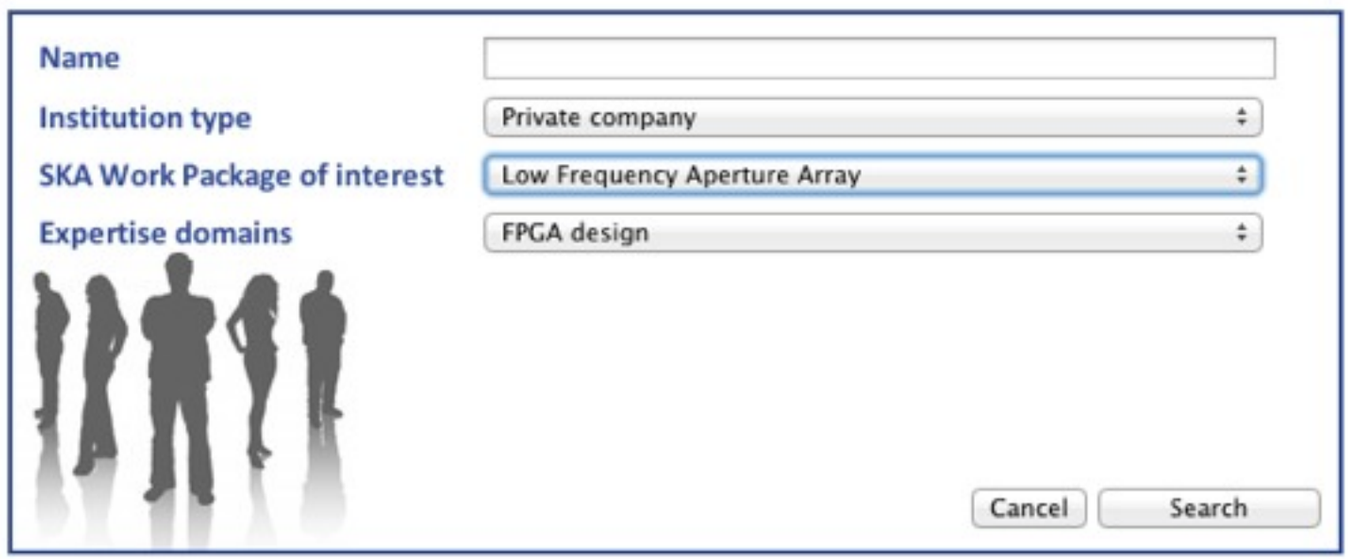
The following form allows obtaining very easily the list of public and/or private org
that have expressed their interest in a particular Work Package and/or could
(expertise domain).

The list of Work Packages includes the Work Packages, as defined by the SKA Projec

The list of expertise domains includes all the capacities that shall be required for ca
Packages.

Each organization registered in the VIA-SKA web portal has identified their interes
and their technical capabilities, providing also an overview about previous projects that this organization has carried out. All provided information has been reviewed before being registered. This form facilitates the access to the registered data, filtering organizations by Work Packages and/or areas of expertise in order to quickly map the capabilities of the registered organizations.

Capacity map form



Form allowing an easy search of public and/or private organizations registered in VIA-SKA filtering by WP or Expertise domains

Site Search

Search

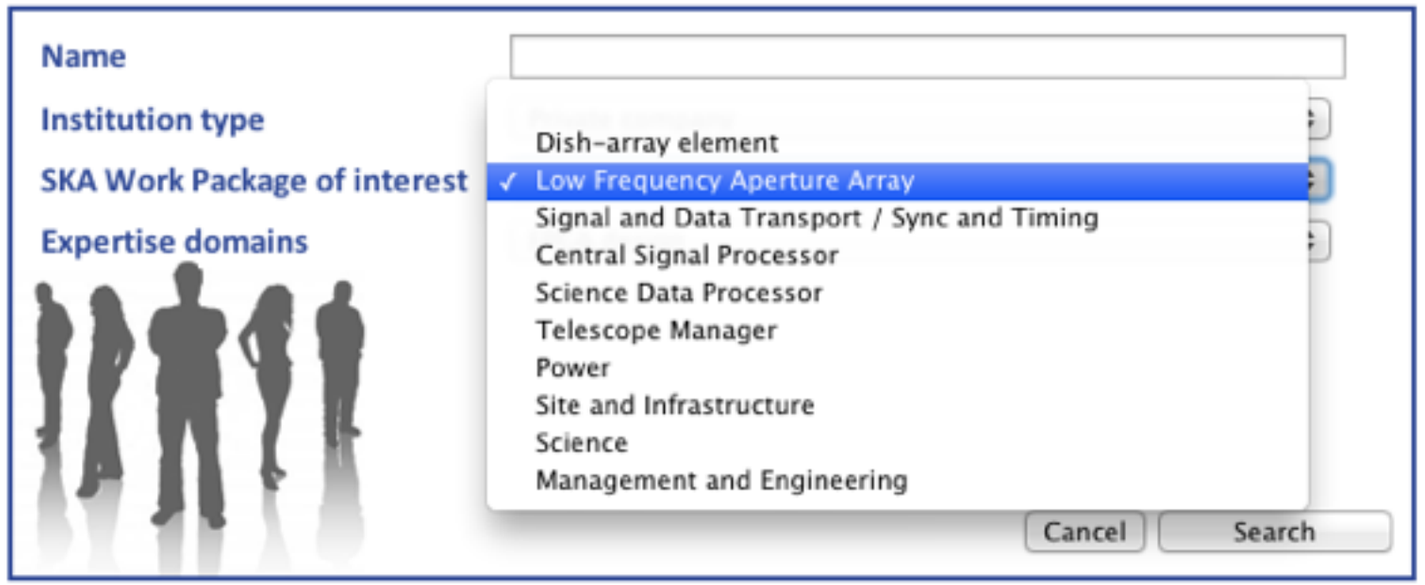
The following form allows obtaining very easily the list of public and/or private organizations registered in VIA-SKA that have expressed their interest in a particular Work Package and/or could provide a determinate capacity (expertise domain).

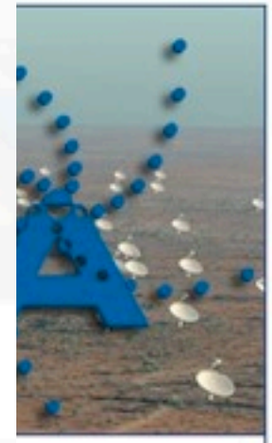
The list of Work Packages includes the Work Packages, as defined by the SKA Project Office, for the SKA Stage 1.

The list of expertise domains includes all the capacities that shall be required for carrying out the SKA Stage 1 Work Packages.

Each organization registered in the VIA-SKA web portal has identified their interest in the different Work Packages and their technical capabilities, providing also an overview about previous projects that this organization has carried out. All provided information has been reviewed before being registered. This form facilitates the access to the registered data, filtering organizations by Work Packages and/or areas of expertise in order to quickly map the capabilities of the registered organizations.

Capacity map form





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The list of Work Packages includes the V

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registered data, filtering organizations
capabilities of the registered organizatic

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capacity

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ge 1 Work

Packages
as carried
ess to the
map the

Capacity map form

Name

Institution type

SKA Work Package of interest

Expertise domains

Analog ASIC design
Analog beamforming hardware
Analog beamforming software
Analog filterbank design
Analog sensors
Analog signal processing
Antenna system beam profile measurement
Antenna system sensitivity measurement
Cabling
Civil engineering
Control system design
Cooling: Cryogenics
Cooling: Heat recovery
Cooling: Thermal insulation
Cost modelling
Cryogenic LNAs (450MHz–2GHz)
Digital ASIC design
Digital beamforming
Digital Fieldbuses
Digital filterbank design
Digital sensors
Digital signal processing
Digital signal transport networks
Dipole antenna array construction
Dipole antenna array design
Dish antenna construction
Dish antenna design
Electro-magnetic compatibility design
FFT digital signal processing
FPGA computing
✓ FPGA design
High Performance Computing: event-based computing
High Performance Computing: GPU computing
High Performance Computing: grid computing
High-accuracty timing systems
High-voltage electrical engineering
Logistics engineering
Low-RFI Power conversion
Mecatronics
Mechanical engineering
Mechanical tooling
Monitoring software and systems
Non-cryogenic LNAs (70MHz–450MHz)
Photovoltaic solar thermal energy
Power engineering
Power engineering: budgeting

CAPACITY MAP

ÁREAS TECNOLÓGICAS / EMPRESAS	ACTURIS	AIDO	ALTRAN INNOVACIÓN	ARIEMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	EMPRESARIOS AGRUPADOS	FRACTAL	GMV	GTD	HTS	IDOM	IK4-TEKNIKER	INSA	INTEGRASYS	ISOFOTON	IXION Industry & Aerospace	IEMA	LIDAX	PROCOM SYSTEMS	SCHWARTZ-HAUTMONT	SENER	SEVEN SOLUTIONS	TAFCO METAWIRELESS	TECNOBIT	TELSTAR Vacuum Solutions	THARSIS TECHNOLOGY	TTI	VINCI ENERGIA	VLC Photonics
Analog ASIC design						x																					x					
Analog beamforming hardware																																x
Analog beamforming SW																x																
Analog filterbank design																x																
Analog sensors		x													x	x									x							
Analog signal processing						x									x	x	x								x							
Antenna system beam profile measurement	x																x															
Antenna system sensitivity measurement	x																x															
Cabling						x			x																							
Civil engineering									x					x										x								
Control system design	x					x				x		x		x	x		x		x			x		x		x			x	x		
Cooling: Cryogenics						x	x						x	x	x					x								x			x	
Cooling: Heat recovery									x				x	x	x					x								x			x	
Cooling: Thermal insulation							x						x	x						x								x				
Cost modelling														x	x	x																
Cryogenic LNAs (450MHz-3GHz)													x			x				x											x	
Digital ASIC design						x																					x					
Digital beamforming						x										x															x	
Digital Fieldbuses						x																x										
Digital filterbank design															x	x																
Digital sensors		x				x									x	x									x							
Digital signal processing		x				x					x				x	x	x								x						x	
Digital signal transport networks						x					x				x																	
Dipole antenna array construction	x				x				x				x	x																	x	
Dipole antenna array design	x								x				x	x																	x	
Dish antenna construction	x	x			x				x					x																	x	
Dish antenna design	x								x				x	x																	x	
Electro-magnetic compatibility design						x			x						x																	
FFT digital signal processing						x					x				x	x									x						x	
FPGA computing						x					x				x	x			x			x			x						x	
FPGA design						x					x				x	x			x			x			x							
High Performance Computing: event-based computing								x			x	x													x	x						
High Performance Computing: GPU computing								x			x	x					x								x							
High Performance Computing: grid computing								x			x	x			x																	
High-accuracy timing systems						x		x			x	x			x	x									x							
High-voltage electrical engineering						x											x								x							
Logistics engineering														x											x							
Low-RFI Power conversion																															x	
Mecatronics		x	x									x	x	x	x							x				x							
Mechanical engineering	x	x	x						x				x	x	x							x				x							
Mechanical tooling	x	x	x										x	x	x							x				x							
Monitoring SW and systems	x	x				x		x		x	x	x			x				x													
Non-cryogenic LNAs (706MHz-850MHz)																x															x	
Photovoltaic solar thermal energy	x	x													x			x		x												
Power engineering				x		x		x				x		x						x						x						x	
Power engineering: budgeting				x		x			x	x				x												x							
Power management		x		x		x		x			x	x	x	x	x					x						x		x				x	
RF engineering 0,03-0,15 m (2-10GHz)													x			x	x											x				x	
RF engineering 0,12-0,30 m (1b-2.5GHz)																x	x											x				x	
RF engineering 0,15-0,7 m (450MHz-2GHz)																x	x															x	
RF engineering 0,7-4 m (70-450MHz)																x	x									x						x	
RF engineering: risk assesment																x																x	
RF Interference measurement																	x															x	
RF Interference sensitivity																	x															x	
RF optical design		x														x																	x
RF optical simulation		x														x										x							x
RF system simulation																x																x	
RFI shielding						x										x																x	
Risk assesment						x		x					x		x	x																	
Sensor networks													x			x									x	x	x	x					
SW engineering		x				x		x		x	x	x			x		x			x					x	x	x	x					
SW engineering: behavioural modelling						x		x				x	x				x																
SW engineering: data modelling						x		x				x	x				x																
SW engineering: high-performance computing algorithms						x		x				x	x				x								x	x							
SW engineering: human-computer interaction		x				x		x				x	x				x								x								
SW engineering: quality assurance						x		x				x	x				x									x							
SW engineering: requirements analysis						x		x				x	x				x								x	x							
SW engineering: risk assesment						x		x				x	x				x									x							
SW engineering: structural modelling		x				x		x				x	x				x	x															
SW engineering: system simulation		x				x		x				x	x				x	x															
Synchronisation and timing equipment						x									x				x														
System engineering		x	x			x		x		x	x			x	x	x	x			x					x	x							
Thermal electric compatibility						x														x													
Wavelet digital signal processing																																	
Wideband receiver design															x											x							

Areas of expertise and SKA WPs of the registered companies

SKA Work Packages / EMPRESAS	ACTURIS	AIDO	ALTRAN INNOVACIÓN	ARIEMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	EMPRESARIOS AGRUPADOS	FRACTAL	GMV	GTD	HTS	IDOM	IK4-TEKNIKER	INSA	INTEGRASYS	ISOFOTON	IXION Industry & Aerospace	IEMA	LIDAX	PROCOM SYSTEMS	SCHWARTZ-HAUTMONT	SENER	SEVEN SOLUTIONS	TAFCO METAWIRELESS	TECNOBIT	TELSTAR Vacuum Solutions	THARSIS TECHNOLOGY	TTI	VINCI ENERGIA	VLC Photonics
Dish-array element		x	x		x		x		x				x	x	x						x				x				x		x	
Low Frequency Aperture Array			x		x		x		x				x	x	x	x					x				x				x			
Signal and Data Transport / Sync and Timing						x								x			x	x						x		x	x	x				x
Central Signal Processor		x				x		x				x	x				x	x						x	x	x	x		x	x		
Science Data Processor						x		x		x	x	x					x			x				x								
Telescope Manager	x							x		x	x	x						x	x													
Power		x		x	x	x							x		x				x		x								x		x	
Site and Infrastructure		x							x					x		x								x								
Science																																
Management and Engineering	x		x			x			x	x	x	x							x	x									x			

VIA-SKA

CAPACITY MAP

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ÁREAS TECNOLÓGICAS / EMPRESAS	ACTURRI	AIDO	ALTRAN INNOVACIÓN	ARIEMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	EMPRESARIOS AGRUPADOS	FRACTAL	GMV	GTD	HTS	IDOM	IK4-TEKNIKER	INSA	INTEGRASYS	ISOFOTON	IXION Industry & Aerospace	JEMA	LIDAX	PROCON SYSTEMS	SCHWARTZ-HAUTMONT	SENER	SEVEN SOLUTIONS	TAFCO METAWIRELESS	TECNOBIT	TELSTAR Vacuum Solutions	THARSIS TECHNOLOGY	TTI	VINCI ENERGIA	VLC Photonics
Analog ASIC design						x																										
Analog beamforming hardware																																
Analog beamforming SW																																
Analog fiberbank design																																
Analog sensors		x																														
Analog signal processing						x																										
Antenna system beam profile measurement	x																															
Antenna system sensitivity measurement	x																															
RFI shielding						x																										
Risk assessment						x		x																								
Sensor networks																																
SW engineering		x				x		x																								
SW engineering: behavioural modelling						x		x																								
SW engineering: data modelling						x		x																								
SW engineering: high-performance computing algorithms						x		x																								
SW engineering: human-computer interaction		x				x		x																								
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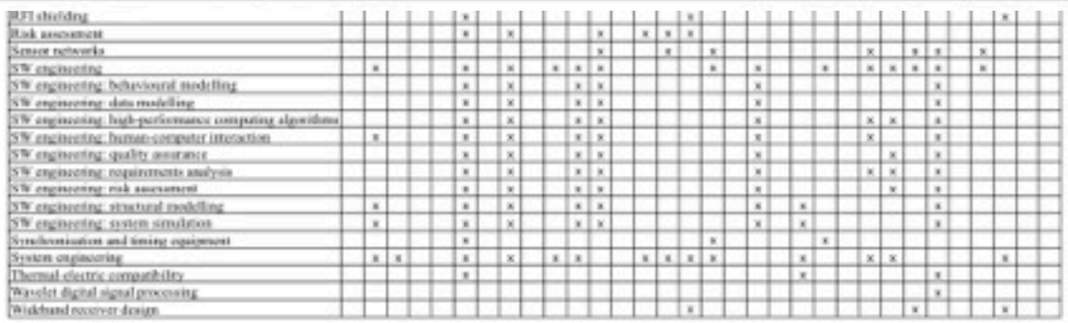
SW engineering: requirements analysis						x		x																								
SW engineering: risk assessment						x		x																								
SW engineering: structural modelling		x				x		x																								
SW engineering: system simulation		x				x		x																								
Synchronization and timing equipment						x																										
System engineering		x	x			x		x																								
Thermal-electric compatibility						x																										
Wavelet digital signal processing																																
Wideband receiver design																																

SKA Work Packages / EMPRESAS	ACTURRI	AIDO	ALTRAN INNOVACIÓN	ARIEMA	ASTURFEITO	CRISA	CRYOVAC	DEIMOS	EMPRESARIOS AGRUPADOS	FRACTAL	GMV	GTD	HTS	IDOM	IK4-TEKNIKER	INSA	INTEGRASYS	ISOFOTON	IXION Industry & Aerospace	JEMA	LIDAX	PROCON SYSTEMS	SCHWARTZ-HAUTMONT	SENER	SEVEN SOLUTIONS	TAFCO METAWIRELESS	TECNOBIT	TELSTAR Vacuum Solutions	THARSIS TECHNOLOGY	TTI	VINCI ENERGIA	VLC Photonics
Dish-array element		x	x		x		x		x				x	x	x						x		x	x		x				x		x
Low Frequency Aperture Array			x		x		x		x				x	x	x	x					x					x				x		
Signal and Data Transport / Sync and Timing						x						x				x	x					x		x	x		x	x	x			x
Central Signal Processor		x				x		x			x	x				x	x							x	x	x	x		x	x		
Science Data Processor						x		x		x	x	x				x			x					x		x	x					
Telescope Manager	x							x		x	x	x			x	x			x													
Power		x		x	x	x						x		x				x		x									x		x	
Site and Infrastructure		x							x					x		x								x			x					
Science																																
Management and Engineering	x		x			x		x	x	x	x		x	x		x	x							x				x			



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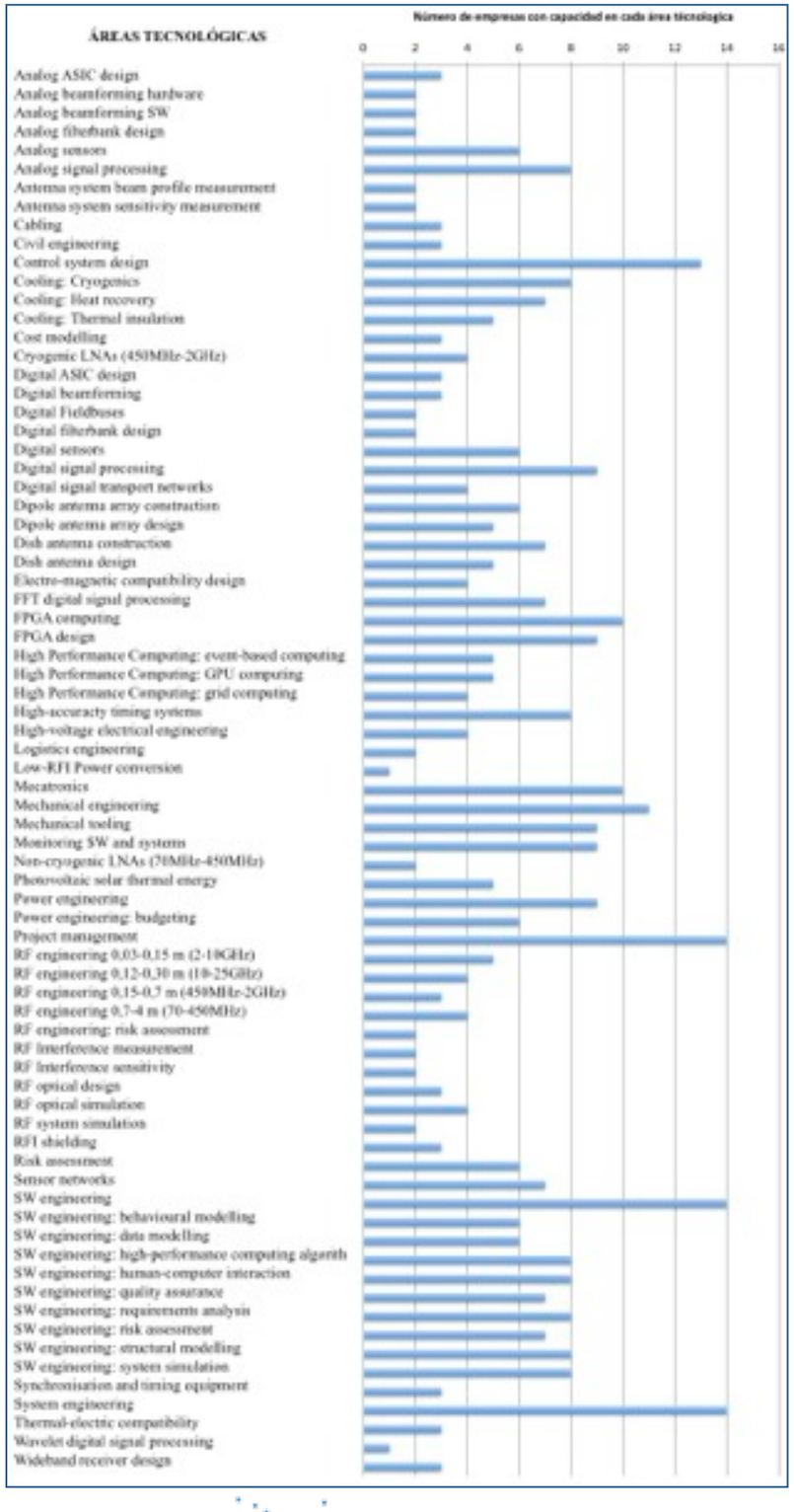
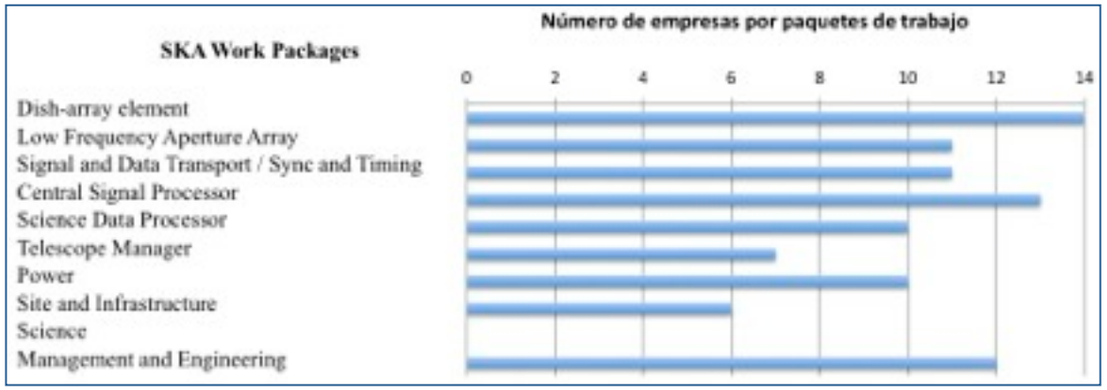
Analog ASIC design						x																					x		x			
Analog beamforming hardware																													x			x
Analog beamforming SW																x													x			
Analog filterbank design																x											x					
Analog sensors		x													x	x									x		x		x			
Analog signal processing						x									x	x	x							x	x		x		x			
Antenna system beam profile measurement	x																x															
Antenna system sensitivity measurement	x																x															
Cabling						x			x																				x			
Civil engineering									x					x										x								
Control system design	x					x				x		x		x	x		x		x			x		x			x		x	x		
Cooling: Cryogenics						x	x						x	x	x						x							x		x		
Cooling: Heat recovery									x				x	x	x						x							x		x		
Cooling: Thermal insulation							x						x	x							x							x				
Cost modelling														x	x	x																
Cryogenic LNAs (450MHz-2GHz)													x			x					x									x		
Digital ASIC design						x																					x		x			
Digital beamforming						x										x														x		
Digital Fieldbuses						x																x										
Digital filterbank design																x											x					
Digital sensors		x				x									x	x									x		x					
Digital signal processing		x				x					x				x	x	x								x		x			x		
Digital signal transport networks						x					x				x												x					
Dipole antenna array construction	x				x				x				x	x																x		
Dipole antenna array design	x								x				x	x																x		
Dish antenna construction	x	x			x				x					x									x							x		
Dish antenna design	x								x				x	x																x		
Electro-magnetic compatibility design						x			x						x												x					
FFT digital signal processing						x					x				x	x								x			x			x		
FPGA computing						x					x				x	x			x			x		x	x		x			x		
FPGA design						x					x				x	x			x			x		x	x		x					
High Performance Computing: event-based computing								x			x	x													x	x						
High Performance Computing: GPU computing								x			x	x							x						x							
High Performance Computing: grid computing								x			x	x				x																
High-accuracty timing systems						x		x			x	x				x	x								x				x			

FPGA design								x				x	x			x			x		x	x	x					
High Performance Computing: event-based computing					x			x	x													x					
High Performance Computing: GPU computing					x			x	x							x						x					
High Performance Computing: grid computing					x			x	x				x														
High-accuracty timing systems					x			x	x				x	x								x			x		
High-voltage electrical engineering																	x				x				x		
Logistics engineering											x										x						
Low-RFI Power conversion																										x	
Mecatronics	x								x	x	x	x						x			x			x	x		
Mechanical engineering	x					x				x	x	x						x			x			x	x		
Mechanical tooling	x									x	x	x						x			x			x			
Monitoring SW and systems	x				x		x	x	x			x				x											
Non-cryogenic LNAs (70MHz-450MHz)													x													x	
Photovoltaic solar thermal energy	x											x			x		x										
Power engineering		x				x			x		x						x				x		x				x
Power engineering: budgeting		x				x	x				x										x						
Project management	x	x			x			x	x	x	x	x	x					x			x					x	
RF engineering 0,03-0,15 m (2-10GHz)										x			x	x												x	
RF engineering 0,12-0,30 m (10-25GHz)													x	x												x	
RF engineering 0,15-0,7 m (450MHz-2GHz)													x	x												x	
RF engineering 0,7-4 m (70-450MHz)													x	x								x				x	
RF engineering: risk assessment													x													x	
RF Interference measurement														x												x	
RF Interference sensitivity														x												x	
RF optical design	x												x														x
RF optical simulation	x												x														x
RF system simulation													x													x	
RFI shielding													x													x	
Risk assessment					x				x		x	x	x														
Sensor networks									x			x		x							x		x		x		
SW engineering	x				x		x	x	x					x		x			x		x	x	x		x		
SW engineering: behavioural modelling					x			x	x							x							x				
SW engineering: data modelling					x			x	x							x							x				
SW engineering: high-performance computing algorithms					x			x	x							x					x	x	x				
SW engineering: human-computer interaction	x				x			x	x							x					x		x				
SW engineering: quality assurance					x			x	x							x						x	x				
SW engineering: requirements analysis					x			x	x							x					x	x	x				
SW engineering: risk assessment					x			x	x							x						x	x				
SW engineering: structural modelling	x				x			x	x							x		x					x				
SW engineering: system simulation	x				x			x	x							x		x					x				
Synchronisation and timing equipment														x					x								
System engineering	x				x		x	x			x	x	x	x				x			x	x				x		
Thermal-electric compatibility																		x					x				
Wavelet digital signal processing																							x				
Wideband receiver design													x													x	

CAPACITY MAP



Number of companies per expertise area and SKA WP



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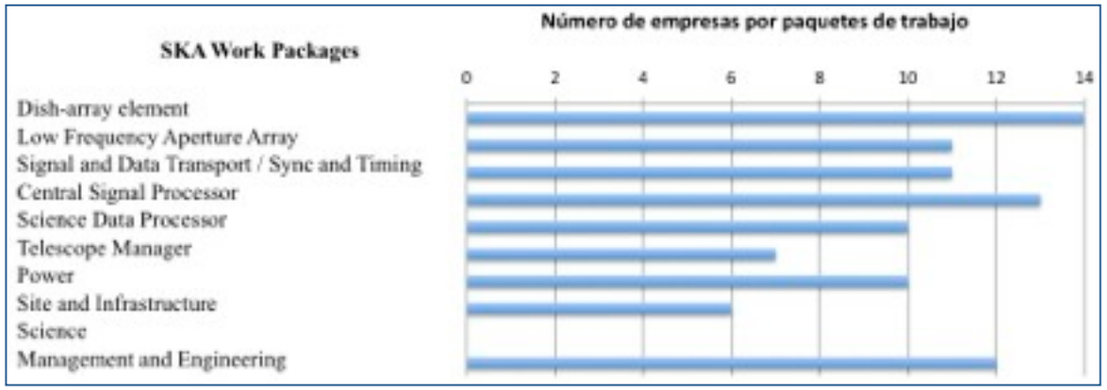
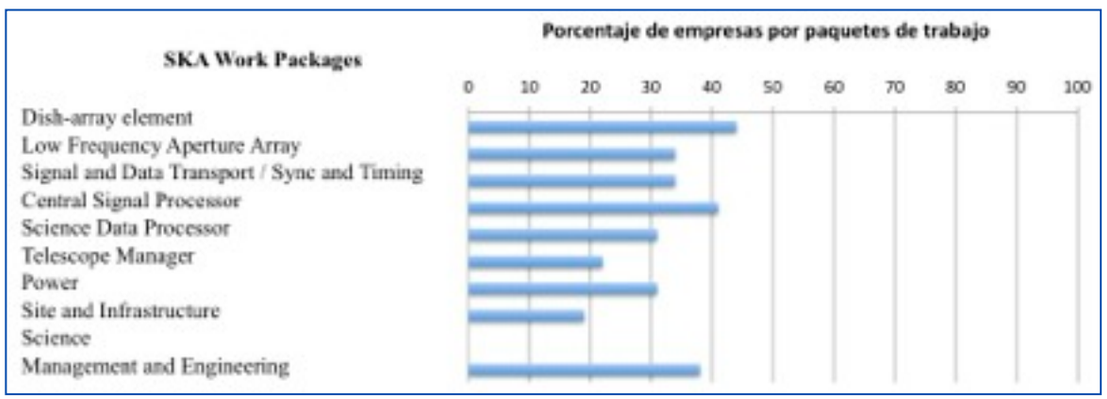
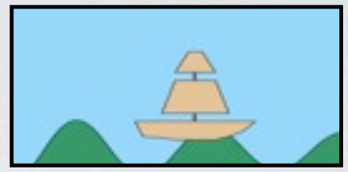


% of companies (regarding the total number) per expertise area and SKA WP



VIA-SKA ACTIVITIES

Interaction with international consortia for strategic alliances



- Active presence in virtually all SKA events
- **Membership to ESKAC** (European SKA Consortium):

  Netherlands, UK, France, Italy, Germany, Portugal, Sweden, Radionet, now Spain

- Membership to AERAP

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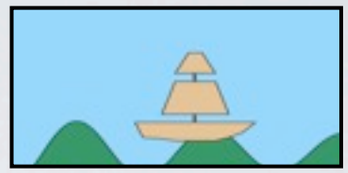

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  Netherlands, UK, France, Italy, Germany, Portugal, Sweden, Radionet, now Spain

- **Membership to AERAP**

Promotion of participation/leadership in WPs

- Participation in preparation of WBS/SoW: the SKA Project Office

  accepted to include **9 VIA-SKA members in the WBS Working Groups**

VIA-SKA ACTIVITIES

Expression of Interest (EoI)

Date	Description
10 to 27 April	SKA Office prepare Expression of Interest (EoI) documentation, review and update.
30 April	SKA Office issue EoI
14 May	SKA Office receives EoI responses
25 May	Report the results of EoI process to the Interim Director General and the Board of the SKA Organisation for consideration
June	SKA Office facilitates consortium forming and addresses gaps that have been identified from the results of the EoI process.

SKA.TEL.DSH (Dish Arrays)	IFCA-CSIC/DICOM-UC, NTE-SENER

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SKA.TEL.LFAA (Low Frequency Aperture Arrays)	IFCA-CSIC/DICOM-UC, UC3M
SKA.AI.MFAA (Medium Frequency Aperture Arrays)	IFCA-CSIC/DICOM-UC, UC3M
SKA.AI.PAF (Phased Array Feeds)	IFCA-CSIC/DICOM-UC
SKA.AI.WBSPF (WIde-Band Single Pixel Feeds)	IFCA-CSIC/DICOM-UC

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SKA.AI.WBSPF (WIde-Band Single Pixel Feeds)	IFCA-CSIC/DICOM-UC
SKA.TEL.SDP (Science Data Processor)	IAA-CSIC, IFCA-CSIC/DICOM-UC

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SKA.AI.WBSPF (WIde-Band Single Pixel Feeds)	
SKA.TEL.SDP (Science Data Processor)	
SKA.TEL.PWR (Power)	**CTAER, IAA-CSIC**

+ IT (Portugal), ASTRON, Fraunhofer, MPIfR (Germany)

Support letter from Abengoa, Isofotón, Ariema

SKA Working Packages

Spanish Participation in proto-consortia

- Science
- Management
- System Engineering & Requirements
- Dish Arrays
- Aperture Arrays
- Signal & Data Transport
- Sync & Timing
- Central Signal Processor
- Science Data Processor
- Telescope Manager
- Power
- Site & Infrastructure

VIA-SKA

VIA-SKA Activities

- **Participation in proto-consortia:**

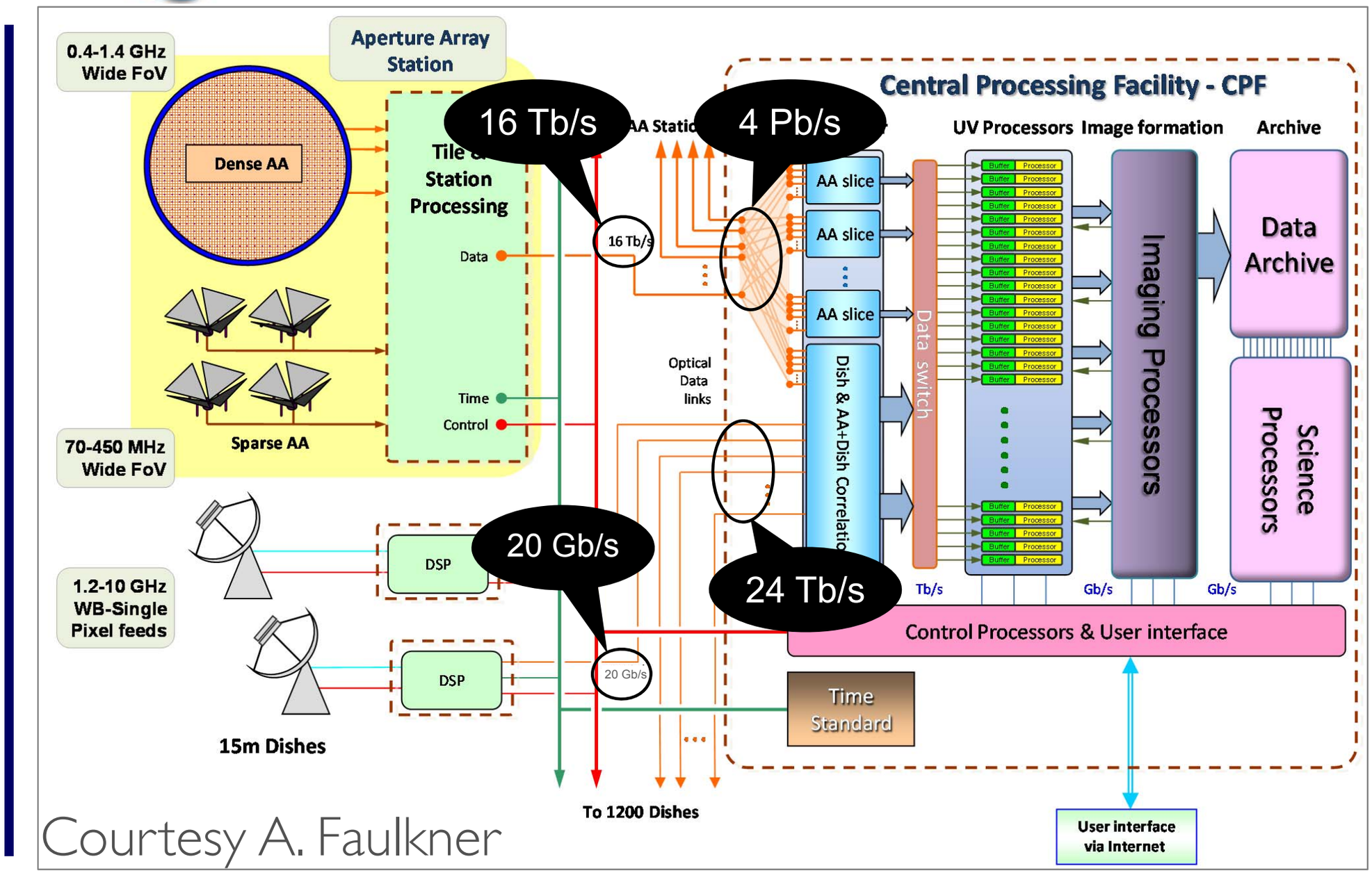
MeerKAT

  - Dishes (IFCA/DICOM-CSIC, SENER?) ---- Coordinated by Australia
  - Aperture Arrays Low and Mid (UC3M and IFCA-CSIC/DICOM) ---- Netherlands
  - Science Data Processor (IAA-CSIC) ---- UK (Univ. Cambridge)
  - Signal and Data Transport (Univ. Granada, 7 Solutions) ---- UK (UMan)
  - Synchronization & Timing (Univ. Granada, 7 Solutions) ---- UK (UMan)
  - Telescope Manager (GTD) ----- India (telecon right now!)
  - POWER EoI

ICTs
&
POWER

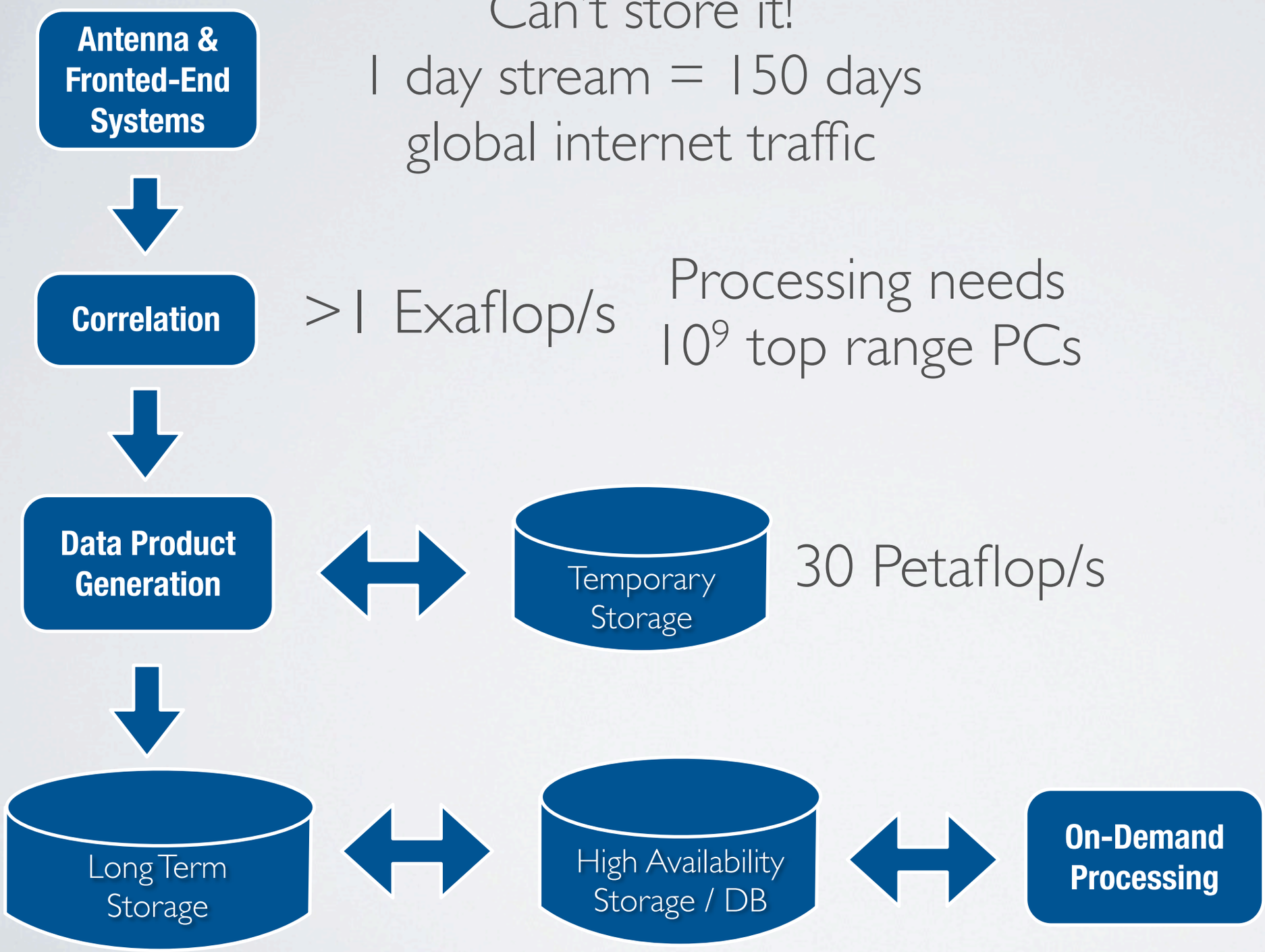
Massive Data Flow, Storage & Processing

SKA_2 wide area data flow



Courtesy A. Faulkner

Massive Data Flow, Storage & Processing



Massive Data Flow, Storage & Processing

Antenna & Fronted-End Systems

Can't store it!
1 day stream = 150 days global internet traffic

Correlation

>1 Exaflop/s

Processing needs 10^9 top range PCs

Data Product Generation

Temporary Storage

30 Petaflop/s

Long Term Storage

High Availability Storage / DB

On-Demand Processing

30 Petaflop/s

BUT A NEW CHALLENGE STARTS HERE

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1 day stream = 150 days
global internet traffic

A disruptive change in the methodology is required
e-Science

Antenna & Fronted-End Systems

Correlation

Data Product Generation

Temporary Storage

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But a New Challenge Starts Here

Long Term Storage

High Availability Storage / DB

On-Demand Processing

30 Petaflop/s

IAA-CSIC CONTRIBUTION

Workflow 4Ever

EU FUNDED FP7 STREP PROJECT
DECEMBER 2010 – DECEMBER 2013

1. **Intelligent Software Components (iSOCO, Spain)**
2. University of Manchester (UNIMAN, UK)
3. Universidad Politécnica de Madrid (UPM, Spain)
4. Poznan Supercomputing and Networking Centre (PSNC, Poland)
5. University of Oxford (OXF, UK)
6. Instituto de Astrofísica de Andalucía (IAA, Spain)
7. Leiden University Medical Centre (LUMC, NL)

Technological **infrastructure** for the **preservation** and **efficient retrieval** and **reuse** of scientific workflows in a **range of disciplines**

Goals

Archival, classification, and indexing of **scientific workflows** and their associated materials in scalable semantic repositories

Creation of scientific communities to collaboratively share, reuse, and evolve workflows and their parts

Core Competencies (Tech)

- Digital Libraries
- Workflow Management
- Semantic Web
- Integrity & Authenticity
- Provenance
- Information Quality

Case Studies

- Astronomy (IAA-CSIC)
- Genome-wide Analysis and Biobanking

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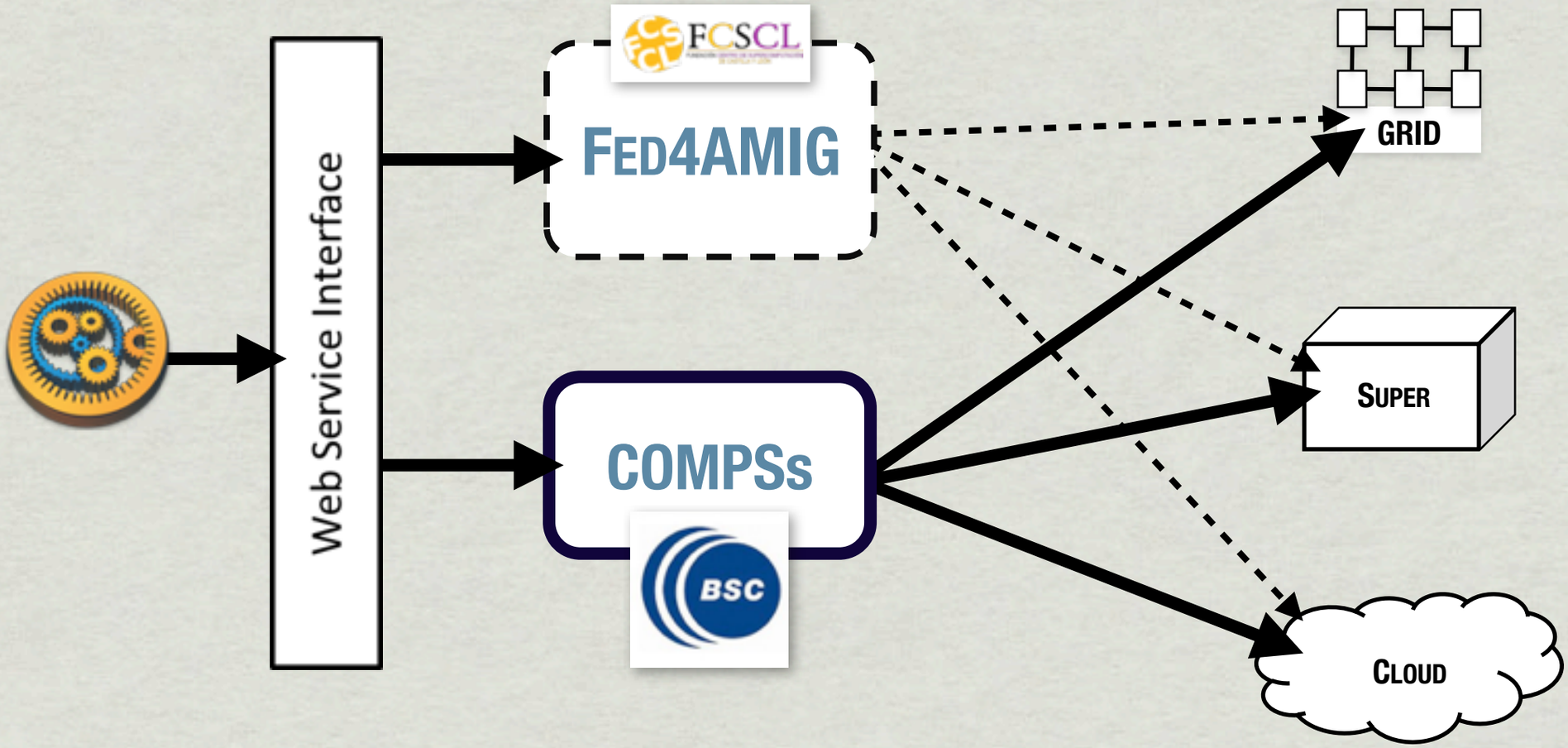
Targeting Already Established Communities: myExperiment, Virtual Observatory

AMIGA4GAS

AMIGA for the **G**TC, **A**LMA, and **S**KA Pathfinders

In Partnership With
BSC, FCSCL

CLOSE COLLABORATION WITH THE PORTUGUESE IBERGRID INITIATIVE



- Porting the Taverna workflow engine to supercomputing environments
- Development of an integration layer for automatic workflow deployment

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JUNE 2012

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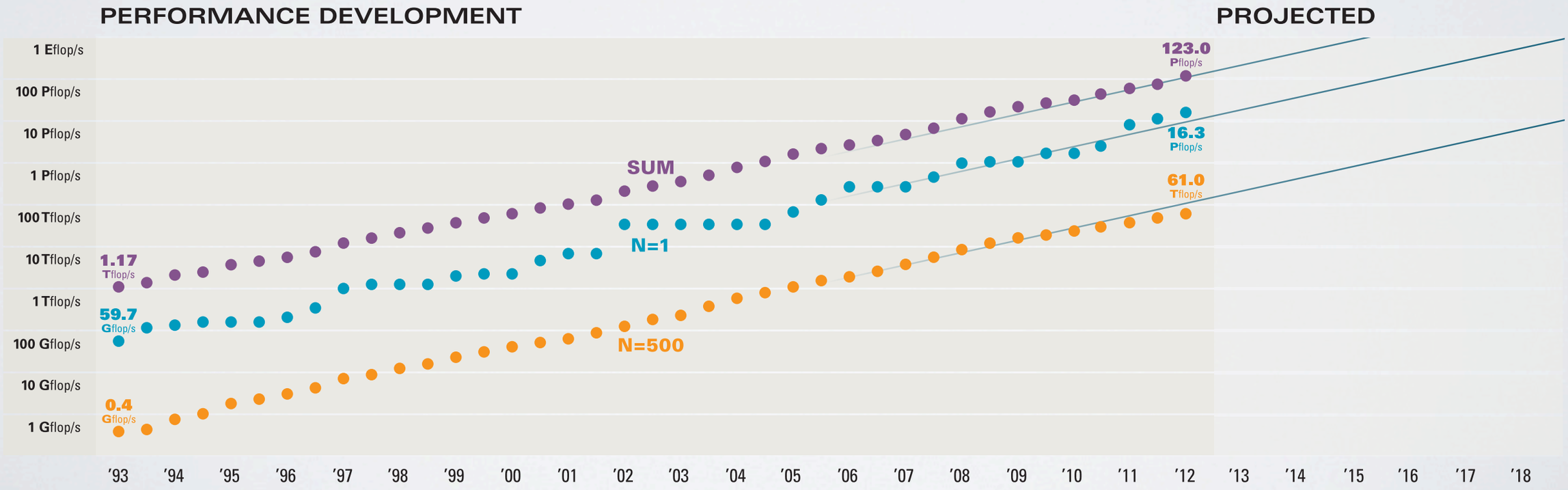
FIND OUT MORE AT www.top500.org

	NAME	SPECS	SITE	COUNTRY	CORES	R_{max} Pflop/s
1	**Sequoia**	IBM BlueGene/Q, Power BQC 16C 1.60 GHz, Custom interconnect	DOE / NNSA / LLNL	USA	1,572,864	16.33
2	**K computer**	Fujitsu SPARC64 VIIIfx 2.0GHz, Tofu interconnect	RIKEN AICS	Japan	705,024	10.51
3	**Mira**	IBM BlueGene/Q, Power BQC 16C 1.60 GHz, Custom interconnect	DOE / SC / ANL	USA	786,432	8.153
4	**SuperMUC**	IBM iDataPlex DX360M4, Xeon E5-2680 8C 2.70GHz, Infiniband QDR	Leibniz Rechenzentrum	Germany	147,456	2.897
5	**Tianhe-1A**	NUDT YH MPP, Xeon X5670 6C 2.93 GHz, NVIDIA 2050	NUDT/NSCC/Tianjin	China	186,368	2.566

PERFORMANCE DEVELOPMENT



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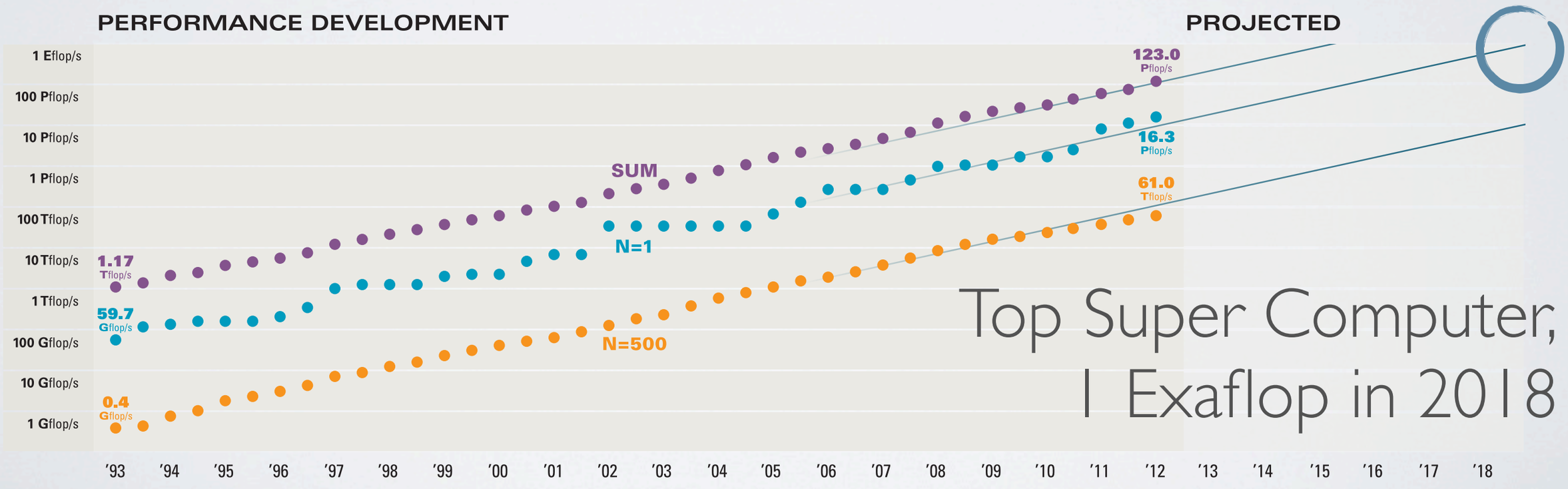


Top Super Computer, 1 Exaflop in 2018

1 Gigaflops = 0,5W 1 Exaflops = 500MW

Target: 100MW

NOT ONLY HOW MUCH, BUT HOW

1 Gigaflops = 0,5W 1 Exaflops = 500MW

Target: 100MW

NOT ONLY HOW MUCH, BUT HOW

- Far from man-made radio frequency emission (hence power supplies)
- Geographically distributed
- 24/7 operation
- Cooling of digital electronic
- Sustainable
- Reliable
- Affordable
- Projections from pathfinders and precursors: SKA will be power limited

With Renewable Energy

- **Direct transfer of technology**
  - Computational resources consumme 1.5% of power in the World
  - 1600 millions people with no access to electric power
- **Demostrator for Sustainable Mega Science Infraestructuras with 0% carbon footprint**

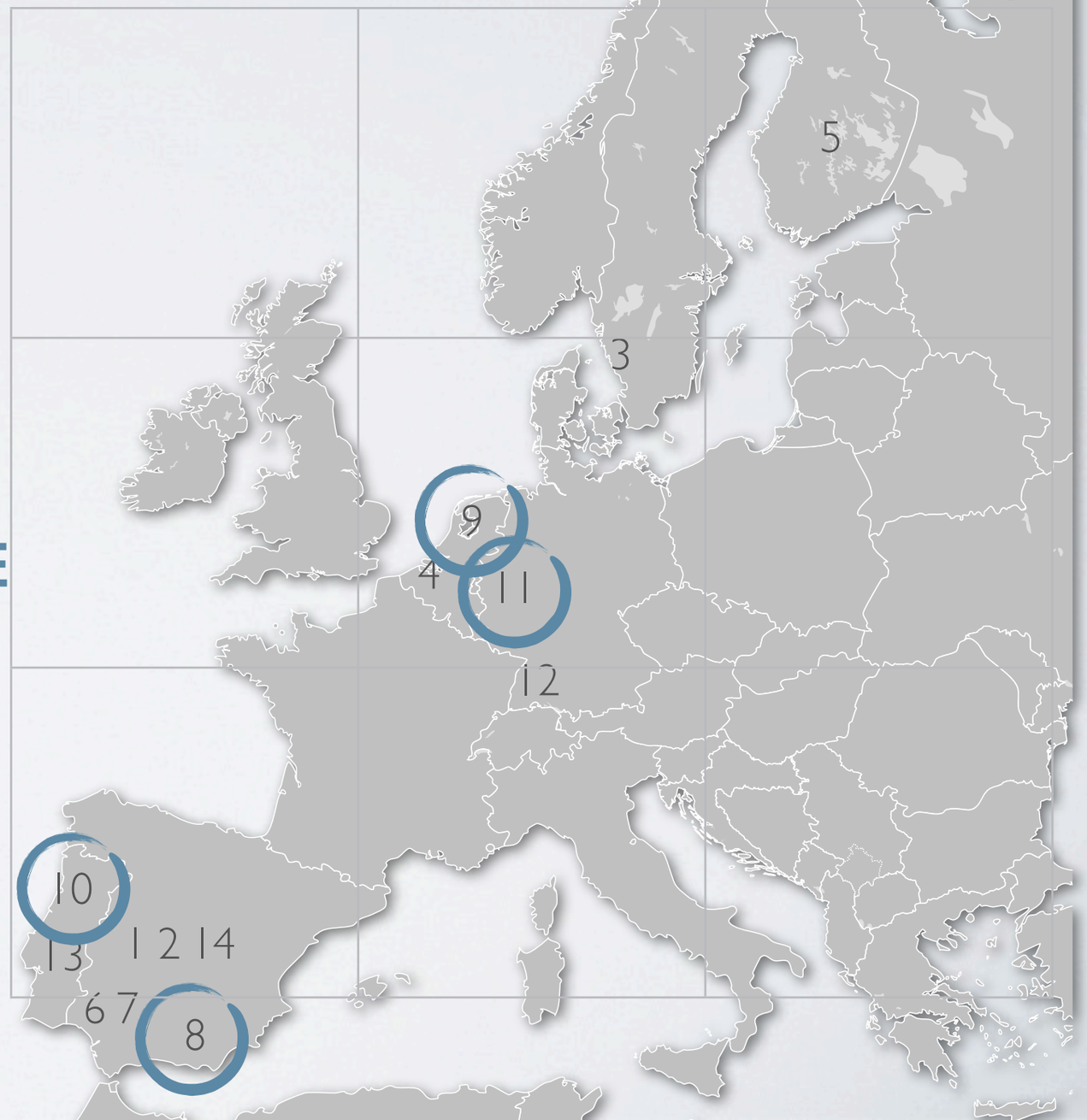
VIA-SKA ACTIVITIES

- **Positioning of Spanish industry at international level**

Link of BIOSTIRLING proposal to SKA **BIOSTIRLING4SKA**

Dish Stirling systems for SKA. FP7-ENERGY-2012-1 Collaborative Project

1. GESTAMP RENEWABLE INDUSTRIES (GRI)
2. ALENER SOLAR
3. CLEANERGY
4. AGC GLASSEUROPE
5. UNIVERSITY OF JYVÄSKYLÄ (JYU)
6. CENTRO TECNOLOGICO AVANZADO DE ENERGIAS RENOVABLES (CTAER)
7. U. SEVILLE (US)
8. CSIC-IAA
9. ASTRON
10. IT AVEIRO
11. MPIfR
12. FRAUNHOFER-ISE
13. LÓGICA
14. GESTAMP SOLAR STEEL (GSS)



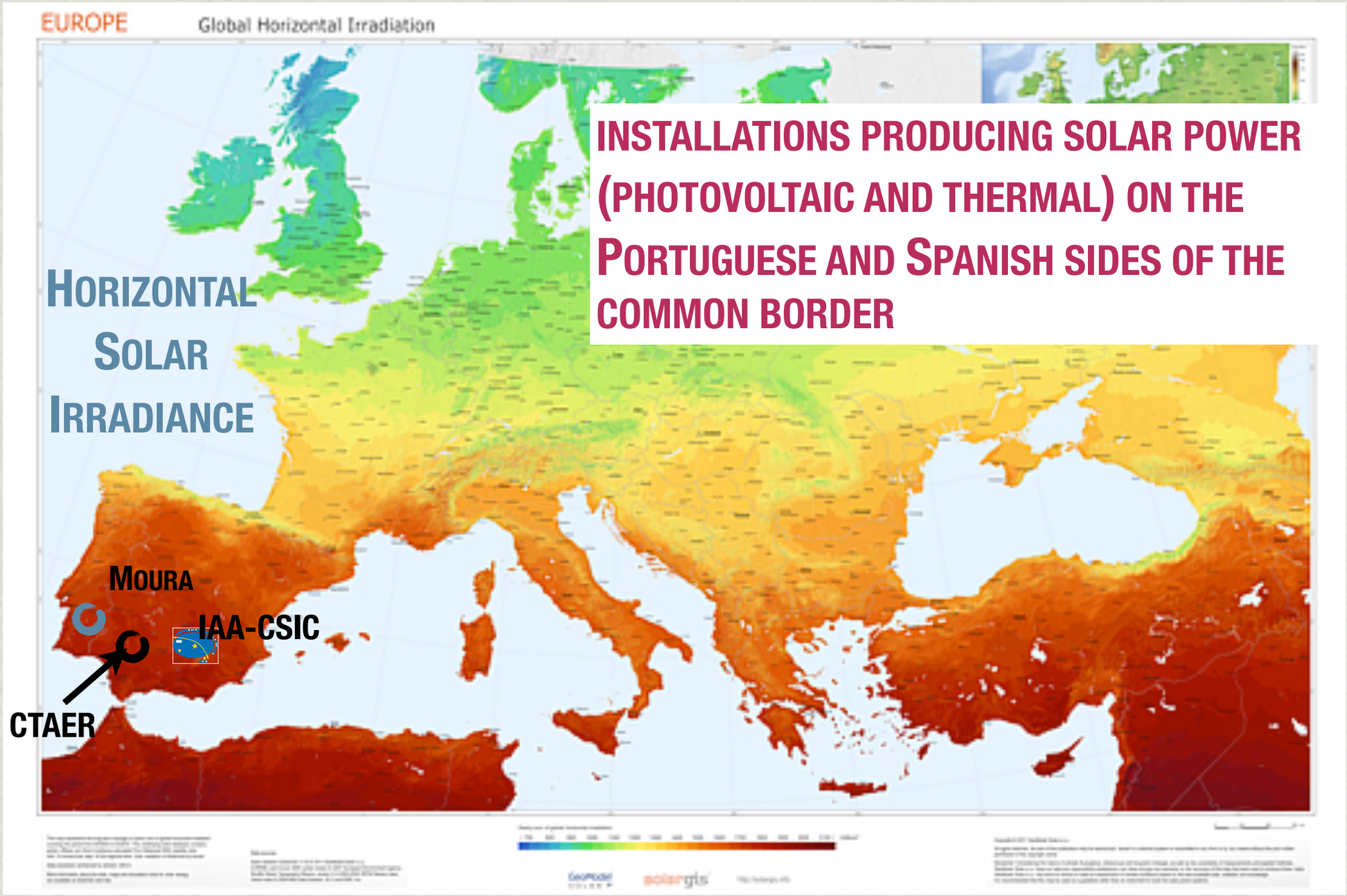
POWER

- **Positioning of Spanish industry at international level**
  - Link of BIOSTIRLING proposal to SKA **BIOSTIRLING4SKA**
  - Invitation to present BIOSTIRLING in AERAP event:
    - Special mention by Britta Thomsen, Eurodeputy, Vice-chair of the European Parliament's Committee on Industry, Research and Energy
  - Visits to Sevilla
    - SKA Project Office (May2012)
    - Co-organizers of Workshop

The Power Challenges of Mega-Science Infrastructures:

the example of SKA

Moura, Portugal and Sevilla, Spain
20th-21st June 2012

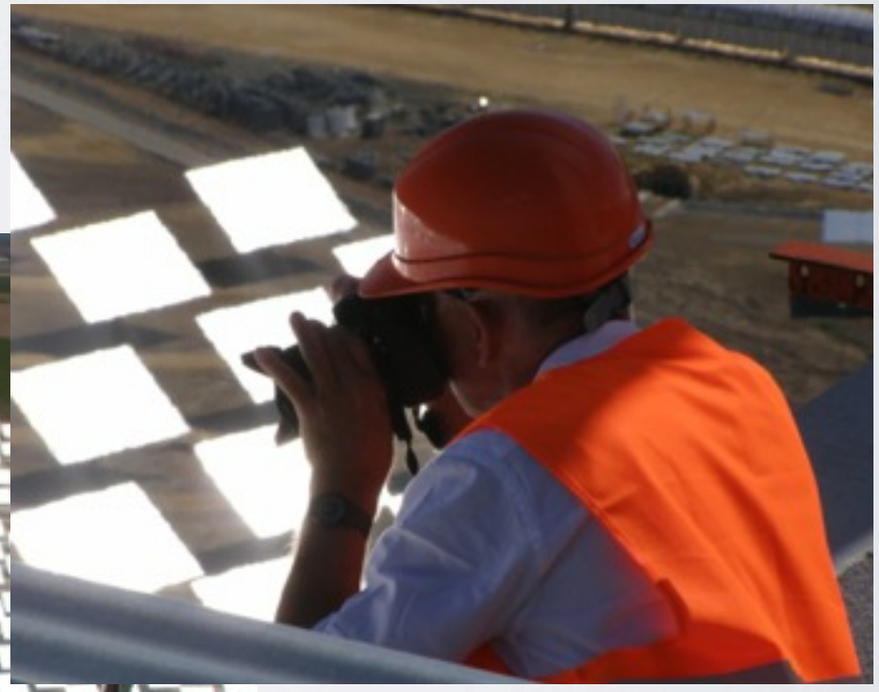


INTEREG funds with Portugal (Moura SKA demonstrator 200 km from Sevilla)

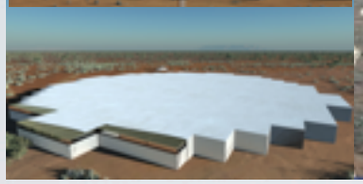
SKA Project Office Visit to Abengoa Solar Facilities (PS10, PS20) in Sevilla

28th May 2012

- SKA Org. Office: Georgina Harris and Robert Millenaar



- Jose Ramón Sánchez (MINECO)
- Maria Luisa Revilla y Borja Izquierdo (CDTI)
- Representantes de ABENGOA
- Miguel Ángel Vázquez (ISOFOTON)
- Rafael Luque (ARIEMA)
- Domingos Barbosa (IT Aveiro)
- André van És (ASTRON)
- Matilde Fernández (IAA - CSIC)
- Lourdes Verdes-Montenegro Atalaya (VIA-SKA, IAA-CSIC)
- Ana Pérez (VIA-SKA; FRACTAL)
- Valeriano Ruiz, Gonzalo Lobo, Manuel Silva, Sol Luca de Tena (CTAER)



SKA:
Strategic Position & Future Opportunities for Spanish Industry

Instituto de Química Física Rocasolano, CSIC
Madrid
23/11/2012

Universidad Carlos III de Madrid

INSTITUTO GEOGRÁFICO NACIONAL

VNIVERSITAT DE VALÈNCIA

ugr Universidad de Granada

inducIencia astro

CTAER Centro Tecnológico Avanzado de Energías Renovables ANDALUCIA

70+ participants

MINISTERIO
DE ECONOMÍA
Y COMPETITIVIDAD

INSTITUTO de ASTROFÍSICA de ANDALUCÍA
CSIC
IAA

CSIC
Consejo Superior de Investigaciones Científicas

CAB
Asociado al NASA Astrobiology Institute

INTA

Instituto de Astrofísica de Canarias
IAC

Universitat de Barcelona

IFCA
Instituto de Física de Cantabria
UC
Universidad de Cantabria

Universidad
Carlos III de Madrid

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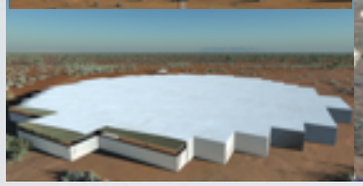
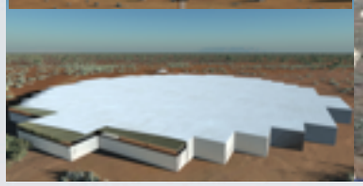


Strategic position in SKA roadmap
Results of capacity map

Daniel Segovia (Carlos III University. AAs)

Academic centers in the consortia



Georgina Harris (SKA Organization Office)

SKAO Office Q&A

Manuel Gallas

Abengoa NT

15 Presentations from companies

VIA-SKA

The Spanish VIA-SKA project

THANK YOU FOR YOUR ATTENTION

The Square Kilometer Array: a large Scale ESFRI Infrastructure, From the Cosmos to the Cities of the future

Lisbon, Portugal, 30th November 2012