**Work package 3: Additional site studies**

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| **Work package number** | WP3 | | **Start date or starting event:** | | | | T+0 months | | |
| **Work package title** | Additional site studies | | | | | | | | |
| **Activity Type[[1]](#footnote-1)** | SUPP | | | | | | | | |
| **Participant id** | 22 | 7 | | 9 | 10 | 15 | |  |  |
| **Person-months per beneficiary:** | (3) | (36) | | 36 | (9) | (54) | |  |  |

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| **Objectives**  To inform the decision making process leading to final selection of the SKA site   * carry out further measurements and studies of the characteristics of the two sites short-listed by the International SKA Steering Committee, * investigate infrastructure deployment costs and timescales, and * carry out an analysis of scientific, technical and operational risks associated with locating the SKA at each of the short-listed sites |

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| **Description of work** (possibly broken down into tasks), and role of participants  A Site Characteristics Working Group will be formed to coordinate the additional studies of the two sites. It will be chaired by the SPDO site engineer and comprise representatives of the sites in Australia (CSIRO) and South Africa (NRF) and other participants from Europe (ASTRON, JIVE, OBSPAR) and the USA (Cornell (TDP)), together with the chairs of the SPDO Site Evaluation Working Group (SEWG), Operations Working Group (OWG), Engineering Working Group (EWG), and Simulations Working Group (SimWG). Eight tasks will be carried out in WP3.  **WP3.1: Investigate the RFI environment by carrying out deep integrations at the central site and selected remote sites**  Measure the radio frequency spectrum down to as close to the ITU-specified levels as possible according to the High Sensitivity Protocol for Candidate SKA Sites, 1) in continuum and line mode across the spectrum between 100 MHz and 1.42 GHz, and 2) in continuum and line mode in the six RA frequency bands between 1.4 and 22.3 GHz. 3) Following a simplified 2003 SKA protocol, measure the radio frequency environment for 3 years in order to look for any long-term trends in RFI. Results from regional pathfinders ASKAP and MeerKAT will also be incorporated into RFI results and conclusions.  Participants: ASTRON will lead this task, it will receive a contract from the SPDO for the acquisition and preparation of the RFI measurement equipment, and will coordinate and supervise the RFI measurements in Australia and South Africa, as well as be responsible for the analysis and reporting of the results. The CSIRO and NRF will support and carry out the measurements in Australia and South Africa respectively.  **WP3.2: Make preparations for the establishment of a Radio Quiet Zone (RQZ) for the central region of the array**  The two sites are pursuing the establishment of RQZs individually. They will keep the SPDO informed of the expected end result and progress in its achievement. The SPDO/SEWG Regulatory Affairs Task Force will provide comments on the individual RQZ processes when requested. The SPDO/SEWG Task Force will participate in international efforts to have the RQZ issue brought to the attention of the International Telecommunications Union with the aim of obtaining an ITU Recommendation on the longer term. Protection for remote array-stations will also be considered and assessed.  Participants: The NRF and CSIRO will be responsible for contacts with their local telecommunications authorities and for informing the SPDO of progress, on a regular basis. OBSPARIS will lead the international effort to obtain ITU recognition of RQZs.  **WP3.3: Carry out detailed studies of ionospheric fluctuations pertaining to the two sites**  Obtain models of the scintillation index, S4, as a function of elevation, azimuth, time of day, and solar cycle at the central and selected remote sites to better characterise the ionosphere. Acquire detailed statistics on the size, velocity and occurrence of Travelling Ionospheric Disturbances (TIDs) for solar maximum and minimum.  Participants: UMAN (SPDO-CDIT) will lead this task. UMAN, will contract external consultants to provide the primary information.  **WP3.4: Carry out studies of the effects of tropospheric turbulence on high frequency observations.**  Study the high-frequency limits of phase-referencing and self-calibration, and determine the implications for the SKA design.  Participants: UMAN (SPDO-CDIT) will lead this task and draw on the knowledge in the radio astronomy community for the report.  **WP3.5: Optimize the array configuration**  Study the ideal configurations for the SKA for the different Key Science Projects and determine the single configuration that optimises the total return from the Key Science Projects. Match the “ideal” configuration to the geographical realities of the two short-listed sites in order to determine the optimum configuration for each site. This task will draw on the work done in SKADS DS2T2 to provide the primary information on the ideal configuration.  Participants: UMAN (SPDO-CDIT) will lead this task and, through the SimWG, will interface with JIVE (representing SKADS), CSIRO (including Curtin University of Technology) and NRF.  **WP3.6: Determine the influence of the site physical characteristics on the telescope design, operations, and costs**  The characteristics of the sites (e.g. ambient temperature, wind levels, level of RFI) are likely to have an influence on the telescope design. Information from the Pathfinder telescopes and from the European SKADS DS3T1 and US TDP studies will be gathered to address this issue and its potential influence on the costs.  Participants: UMAN (SPDO-CDIT) will lead this task, consult with NRF and CSIRO, and integrate the SKADS and TDP results in the design considerations.  **WP3.7: Investigate infrastructure deployment costs and timescales, operational models**  *1) Deployment costs based on uniform designs and standards*  Develop uniform designs and standards for estimating the costs of the infrastructure and its decommissioning.  *2) Timescales for the deployment of the telescope infrastructure*  Refine current estimates of the timescale for infrastructure deployment for each of the sites specifically, in consultation with the sites.  *3) Operational models*  Develop the “ideal” operational model for the SKA which can then be applied to the two sites individually and adapted to the local realities, liaising with WP2.1.3, WP 2.1.4 and WP2.1.5. Provide draft operations agreements for remote stations in other countries, where appropriate.  Participants: This task will be led by UMAN (SPDO-CDIT) who will engage external consultants for the infrastructure cost and timescale studies. The SPDO/OWG and SPDO/EWG will generate the operational model in consultation with NRF and CSIRO. CSIRO and NRF will be responsible for the operations agreements for remote stations.  **WP3.8: Sustainability of the science environment in the face of potential RFI threats**  Acquire additional demographic studies of the regions surrounding the central array and the remote stations to refine estimates of the future RFI threat. Analyse the potential consequences of any mining or other development interests near the central sites.  Participants: This task will be led by UMAN (SPDO-CDIT) who will contract external consultants to supply the demographic and other information required. |

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| **Deliverables** (brief description and month of delivery)  1) Report on ionospheric scintillation and TIDs for Australia and Southern Africa (WP3.3). Type: Report. Delivery: T + 6 months  2) Deliver RFI hardware and software (WP3.1). Type: Other. Delivery: T + 12 months  3) Report on phase referencing and self-calibration for SKA measurements at high frequencies (WP3.4). Type: Report. Deliver: T + 12 months  4) Report on the optimum configuration for the SKA (WP3.5). Type: Report. Delivery: T + 18 months  5) Report on the influence of the physical characteristics of the sites on telescope design, operations, and costs (WP3.6). Type: Report. Delivery: T + 36 months  6) Report on the infrastructure deployment timescales, costs and operational models (WP3.7). Type: Report. Delivery: T + 30 months  7) Report on the risk analysis of the science environment (WP3.8). Type: Report. Delivery: T + 30 months.  8) Report on RFI measurements in Australia (WP3.1). Type: Other. Delivery : T + 33 months  9) Report on RFI measurements in South Africa (WP3.1). Type: Other. Delivery: T + 33 months  10) Report on progress and prospects for Radio Quiet Zones for the short-listed SKA sites (WP3.2). Type: Report. Delivery: T + 36 months  11) Final report. Type: Report. Delivery: T + 36 months |

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