



## AENEAS – H2020 – 731016

# European SKA Regional Centre Requirements

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#### Abstract

The top level (level 0 in System Engineering terminology) requirements of the network of SKA Regional Centres will be collected in this document. These level 0 requirements will be translated to more detailed lower level constraints. Collectively these requirements will guide the design of the (global) network of SKA Regional Centres.

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## II. DELIVERY SLIP

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## III. DOCUMENT LOG

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2	2019-01-24	Corrections in Sections 3.6 and 3.7	M.P. van Haarlem
3	2019-01-25	Following 2 day f2f SRC Design Meeting	M.P. van Haarlem
4	2019-02-13	Incorporating changes from WP leads	M.P. van Haarlem
5	2019-03-24	Incorporating notes from discussion during Manchester All-Hands Meeting	M.P. van Haarlem
6	2019-07-22	Incorporating comments and suggestions provided between March and July 2019.	M.P. van Haarlem

## IV. APPLICATION AREA

This document is a formal deliverable for the GA of the project, applicable to all members of the AENEAS project, beneficiaries and third parties, as well as its collaborating projects.

## V. TERMINOLOGY

- **AENEAS** - Advanced European Network of E-infrastructures for Astronomy with the SKA
- **SKA** - Square Kilometre Array
- **SRC** - SKA Regional Centre
- **ESRC** - European SKA Regional Centre, a distributed facility composed of nodes that provide relevant functionality.
- **Node** - each location of the ESRC network which hosts data, processing capacity or another element that plays a material role in the network e.g. providing human support.
- **User** - any person who is interested in scientific use of SKA data, whether as individual or as part of a collaboration. Note that users can be involved in original observing proposals, but also include data scientists that access the SKA data archive, either for research or (software/hardware) development purposes.
- **TO** - the reference date on which approval of the Construction proposal is granted by the SKA Council and funds are released. It is anticipated to be early-2021.
- **SRC Alliance** – the SRCs will collaborate closely to provide their users a seamless, uniform and reliable service. The term “Alliance” has been used previously to describe the organisation of this distributed, federated collective of regional centres, although no decisions have been taken what this means. In the absence of further guidance we will use the term Alliance for now, but acknowledge that in future a different term may be used.
- **ODP** – Observatory data product, produced by the Science Data Processor at the telescope sites.
- **ADP** – Advanced data product, produced at the SRCs.

A complete project glossary is provided at the following page: <http://www.aeneas2020.eu/glossary/>

## VI. LIST OF FIGURES

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## VII. LIST OF TABLES

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## VIII. PROJECT SUMMARY

The objective of the AENEAS project is to develop a concept and design for a distributed, federated European SKA Regional Centre (ESRC) to support the astronomical community in achieving the scientific goals of the Square Kilometre Array (SKA). The scientific potential of the SKA radio telescope is unprecedented and represents one of the highest priorities for the international scientific community. By the same token, the large scale, rate, and complexity of data the SKA will generate, present challenges in data management, computing, and networking that are similarly world-leading. SKA Regional Centres (SRC), including the ESRC, will be a vital resource to enable the community to

take advantage of the scientific potential of the SKA. Within the tiered SKA operational model, the SRCs will provide essential functionality which is not currently provisioned within the directly operated SKA facilities. AENEAS brings together all the European member states currently part of the SKA project as well as potential future EU SKA national partners, the SKA Organisation itself, and a larger group of international partners including the two host countries Australia and South Africa.

## IX. EXECUTIVE SUMMARY

The top level (level 0 in System Engineering terminology) requirements of the network of SKA Regional Centres will be collected in this document. These level 0 requirements will be translated to more detailed lower level constraints. Collectively these requirements will guide the design of the (global) alliance of SKA Regional Centres.

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# 1. Introduction

Every observatory has to decide up to what level of data processing and analysis it will support its users. The further it goes, the greater the cost to the observatory. The Board of the SKA Organisation has decided that the Science Data Processor (SDP) centres in the two telescope host countries (in Perth, Australia for SKA-Low and Cape Town, South Africa for SKA-Mid) will produce a set of standard Observatory Data Products (ODPs). These data products will be delivered to the users through a global network of SKA Regional Centres (SRCs). Users will process and analyse the considerable volume of data from the SKA telescopes in these SRCs, yielding Advanced Data Products (ADPs). The SDP centres in the host countries will not be accessible to users.

The SRC Alliance will be a collaboration of facilities on a global scale, intended to facilitate the full scientific exploitation of SKA data. The Regional Centres collectively will provide the primary SKA Science Archive, a central repository that will store both the Observatory and Advanced Data Products. Processing capacity and user support will also be essential elements of the SRCs. Furthermore, in order to receive the data from the SKA Host Countries and distribute the data between the SRCs, high speed internet connectivity will be an important component of the SRC Alliance. The model adopted by the SKA Board suggests, but does not explicitly state, that all SKA members will take part in the SRC network.

A further key decision taken by the SKA Board was that funding of the network of SRCs falls outside the scope of the SKA Observatory. Initial construction costs required to set up and prepare the SRCs will therefore not be paid from the 691 M€ cost cap. Similarly, the annual operational costs will not come from the Observatory's operations budget.

Over the past 18 months, planning for the development and design of the SRC Alliance has been overseen by the SRC Coordination Group (SRCCG). This is shortly to be replaced by a new body, the SRC Steering Committee (SRCSC) with representatives from each of the SKA member states, which will report to the Director-General of the SKA Organisation. It is expected that the SRC Alliance will be operated as a partnership between the SKA Observatory and the SRCs themselves.

The next phase will see planning for the development and construction of the SRCs intensify. The fact that both SKA-Low and SKA-Mid are interferometric radio telescopes means an early start of commissioning and (shared risk) early science observations from approximately 2022-2023 - well before completion of the full phase 1 deployment of the two telescopes, which is expected in 2027-2028. The SRCs are expected to play a major role in these early phases of commissioning, testing and optimising the pipelines and workflows that will produce the Observatory Data Products. That leaves us approximately four years to prepare an initial SRC capability that can grow as the telescopes are constructed.

## 2. Purpose of this Document

This document sets out the high-level requirements for the network of SKA Regional Centres, where necessary in particular from the perspective of a European SKA Regional Centre. Its main purpose is twofold: 1) to facilitate a discussion with the SKA Observatory and its future users on the function and priorities of the SRC Alliance, and 2) to provide boundary conditions and constraints on the (high-level) design of a network of SKA Regional Centres that the AENEAS project will be undertaking as part of Work Package 2. An important early goal of the design work is to allow us to produce cost estimates for the SRC Alliance - which will help achieve an acceptable balance between cost and performance and inform governance arrangements that may be set up between the partners and with the SKAO. The process of producing a coherent set of high-level requirements, together with a design and a cost estimate will be iterative. It will involve many stakeholders, most notably:

- the future users of the SKA, currently organised in a number of Science Working Groups - evolving at some stage into teams that will carry out the SKA's Key Science Projects,
- the organisational entities (typically national observatories or science funding organisations) responsible for coordinating the effort towards establishment of the nodes of the SRC Alliance,
- the various service providers that will supply the computing, storage, network services and/or user support that form the backbone of the regional centre network,
- (most likely) the funding agencies and ministries that will fund, or at least be involved in funding, the SRC Alliance.

## 3. Collecting SKA Regional Centre Requirements

The starting point for the requirements is the SKA Regional Centre Requirements and Goals produced by the SRCCG (SKA-TEL-SKAO-0000735, revision 02). Their primary focus is on the needs of the Observatory, so the user perspective is somewhat underrepresented. In revision 02, we note that the focus has shifted to the early operations phase (2022-2027), which is not representative of the steady-state operations phase when the major SKA surveys will be underway. In the following, the original SRCCG requirements and goals are labelled REQ-SRC-xxx and GOAL-SRC-xxx respectively. We adopt the same categories for grouping the requirements and goals in sections 3.1 – 3.6, and add a category for user support and access in section 3.7.

We have modified or added requirements and goals where we believe there is a gap in those provided by the SRCCG, and have also added specific requirements and goals concerned with the operation of a European SRC. The AENEAS contributions are labelled REQ-AENEAS-xxx and GOAL-AENEAS-xxx.

This version of the AENEAS SRC requirements includes notes (*in italics*), which provide context and describe the source of the requirement and whether it has been changed by us.

### 3.1. Governance

#### **REQ-AENEAS-01-01**    SRC designation

SRC designation will be awarded if a prospective SRC meets all the criteria set out in appropriate MoUs and Accreditation criteria.

*Source: derived from REQ-SRCCG-01 but split and modified*

#### **REQ-AENEAS-01-02**    SRC Accreditation Review

The ability of each SRC to meet its accreditation criteria, and the criteria themselves will be reviewed annually (TBC).

*Source: derived from REQ-SRCCG-01 but split and modified*

*Note: In Europe there is a possible organisational hierarchy: 1) ESRC, 2) national SRCs, 3) nodes. A decision has not been taken on the relationship between the national SRCs and the role of an ESRC. This will be an important item for the discussions on governance. In principle, accreditation is possible at the highest (ESRC) level or at the national level. Which form is chosen has repercussions for the visibility and autonomy of the national SRCs, it may also change the European representation on a global Alliance of Regional Centres.*

*There will be agreements (e.g. MOUs) between the SRCs in the various countries. These might also form a hierarchy – with an extra level of organisation at the European level. Lessons from the WLCG suggest that these agreements (MOUs) should not be too detailed. Whether individual nodes of the network should be involved in these agreements remains to be seen. The objective, from a user perspective, is seamless operation (involving movement of data between nodes and countries) and distributed processing. The objective of the agreements is to ensure this is possible, obviously while respecting the relevant access policies.*



**REQ-AENEAS-01-03** Graceful exit of SRC

The SRC agreements shall define how an SRC or a node can withdraw. In preparation for a withdrawal, an SRC shall take every reasonable effort to ensure that all data products and software tools it holds are available elsewhere in another SRC or node.

*Source: Derived from REQ-SRCCG-02 modified*

**REQ-AENEAS-01-04** SRC to SKAO interface

Interfaces between each SRC and the SKAO will be compliant with policies agreed between the SRCs and the SKAO.

*Source: Derived from REQ-SRCCG-04 modified*

**REQ-AENEAS-01-05** SRC to SRC interfaces

Interfaces between SRCs will be compliant with policies agreed by the SRC Alliance.

*Source: Derived from REQ-SRCCG-05 modified*

**REQ-AENEAS-01-06** Contributions to the SRCs

Each country will contribute to the resourcing of the European network of SRCs in proportion to their share of contributions to the SKA.

*Source: new AENEAS requirement*

*Note: This is an assumption that will allow us to provide an estimate of the relative share each country will have of the total cost of the ESRC. Maintaining the same level of relative contribution also provided for construction and operation seems the easiest way. If this isn't the case, then it would strengthen the argument that an SRC contribution should count towards a country's share of the SKA - provided the global network is open and serves the SKA community without restrictions and national considerations. There are of course obvious drawbacks to this model, not least the fact that it would lock a country into a contribution level which it could only escape from by withdrawal. Alternative scenarios include a pledging model adopted by the Worldwide LHC Computing Grid for CERN's Large Hadron Collider (LHC).*

**REQ-AENEAS-01-07** Coordination at European level

Resources and services provided by the countries of the European SKA Regional Centre shall be coordinated at the European level.

*Source: new AENEAS requirement*

*Note: The meaning of "coordinate" in this requirement is not immediately clear. It may depend on the degree of organisation at European level (see REQ-AENEAS-01-02) and for example whether targets such as GOAL-AENEAS-03-05 are maintained.*

**REQ-AENEAS-01-08**    Implementation of SRC policies

The European SKA Regional Centre will determine how the policies agreed between the SKAO and the SRCs are to be implemented.

*Source: new AENEAS requirement*

*Note: Interoperability between SRCs must be preserved, so the ESRC may not be able to act unilaterally here*

**REQ-AENEAS-01-09**    SRC involvement in SKAO developments

The SRCs will be involved in any decisions on Observatory developments that have significant implications for SRC resourcing and operations.

*Note: this includes enhancements, new instruments, observing modes etc. Basically anything that increases (or decreases) the data rates, amount of processing or user support levels in the SRCs.*

*Source: new AENEAS requirement*

## 3.2. Science Archive

**REQ-AENEAS-02-01**    SRC Data Policies

Each SRC will preserve, curate and make available to users Observatory Data Products, in compliance with SKAO data access policies and data security standards.

*Source: Derived from REQ-SRCCG-06*

*Note: This requirement expresses the principle, which includes making data products (and other resources) available for users outside the SKA Member countries – for example as a result of Open Skies access to the SKA, allocated in accordance with the SKA Access Policy. Once the initial resources (computing, storage and network capacity) needed to meet this requirement are exceeded, access will be restricted in some way, e.g. in the form of a proposal submission and resource allocation process. It is assumed that PI/KSPs will be allocated SRC resources as part of the Telescope Time Allocation process that will allow them to process their data.*

**REQ-AENEAS-02-02**    Advanced Data Products Policies

The Alliance will set policies for the preservation, curation and distribution of Advanced Data Products.

*Source: new AENEAS requirement*

*Note: A global data management policy will be needed that is aligned with the policy set out in this requirement.*

**REQ-AENEAS-02-03** SRC Data Sharing

Each SRC will, when required, distribute the SKA data products (both ODPs and ADPs) to other SRCs.

*Source: Derived from REQ-SRCCG-07*

**GOAL-AENEAS-02-04** Minimise data transfer between SRCs

Data products will be located within the alliance of SRCs such that any transfers between individual SRCs are minimised.

*Source: Derived from GOAL-SRCCG-08*

**REQ-AENEAS-02-05** Open Access

Published and non-proprietary data must be publicly available.

*Source: Derived from REQ-SRCCG-09*

*Note: Meaningful access to publicly available data must also include access to computing. Availability of data does not mean providing unlimited access to SRC resources, as noted above in REQ-AENEAS-02-01.*

**REQ-AENEAS-02-06** Data Provenance

The SRCs will provide full traceability to openly accessible Observatory and Advanced Data Products.

*Source: new AENEAS requirement*

**REQ-AENEAS-02-07** Reproducibility: Provenance and workflow preservation

Each SRC must be capable of saving the complete workflow and provenance associated with any ADP in such a way that these can be queried and viewed.

*Source: Derived from REQ-SRCCG-10;*

*Note: Such information should be stored in the Archive as meta-data or/and in a code repository. SRCs should enable open science and facilitate reproducibility of workflows, but we foresee that it is the responsibility of the user to make it possible (e.g through versioned containerisation). Although SRCs must be able to save the complete workflow, they will not be required to do so for every ADP. The cost of providing reproducibility over a long time may prove excessive.*

**GOAL-AENEAS-02-08** Advanced data product regeneration

Each SRC must be able to save, curate and maintain all components required to recreate an ADP.

*Source: Derived from GOAL-SRCCG-11*

*Note: this is an ambitious goal, not a requirement. See comment on cost above. Traceability may be a more achievable goal than reproducibility.*

**REQ-AENEAS-02-09** Data product index

Collectively, the SRCs will maintain and provide access to a catalogue of all science data products (including observatory data products and advanced data products), capable of showing the location(s) of each one.

*Source: REQ-SRCCG-12; unchanged*

*Note: Each data product should be uniquely identifiable, e.g. through a global name space.*

**REQ-AENEAS-02-10** Allocation of Resources

The SRCs, either collectively or individually, must have the ability to regulate access to resources, especially in response to heavy demand, while recognising the SKA Observatory's allocations of resources.

*Note: a new requirement to make explicit that heavy demand for resources may mean that an SRC, or even a node, may have to take measures in response to exceptionally heavy demand. This may of course include moving or copying data to other nodes.*

### 3.3. Storage Capacity

**REQ-AENEAS-03-01** Overall archive storage capacity of the SRCs

The SRCs and SKAO will set the storage capacity and its projected growth annually.

*Note: In aggregate, current projections are that the SRCs will be required to provide the following storage capability:*

*T0+2: 5 PB (TBC) in total, all to be online*

*T0+3: At least 28 PBytes, of which at least 25 PBytes to be online*

*T0+4: At least 155 PBytes, of which at least 30 PBytes to be online*

*T0+5: At least 375 PBytes, of which at least 125 PBytes to be online*

*T0+6: At least 900 PBytes, of which at least 375 PBytes to be online*

*T0+7: At least 1400 PBytes, of which at least 700 PBytes to be online*

*T0+8: At least 1.7 ExaBytes, of which at least 700 PBytes to be online*

*Thereafter increasing at an annual rate of around 1 EB*

*The SRC resources will be used for commissioning, early science as well as development and testing of user/KSP software & workflows. The relative fraction of the usage of SRC resources will evolve over time.*

*Online storage is data not on tape (cold storage) and in proximity to available processing resources (check).*

*Source: Derived from REQ-SRCCG-13*

**REQ-AENEAS-03-02** Type of data storage

Agreements on storage capacity developments will set out the nature and performance requirements of the storage provision.

*Note: As part of regular (e.g. annual) discussions on evolution of the ESDC specify how much on-line, near-line or off-line storage to be provided. Possibly including guidance on the storage technology to be used. Performance requirements can include information on the medium term archival and the long-term preservation of data. From a user perspective it may be more useful to provide information on the time it takes to deliver a data product in the right location so that processing/analysis can start. Also see REQ-AENEAS-04-06 Response time below. This requires further engagement with the SWGs, in order to obtain a uniform picture.*

*Source: new AENEAS requirement*

**REQ-AENEAS-03-03**    Data Integrity

Collectively, the SRCs will ensure data integrity with monitoring of the level of integrity.

*Source: Derived from REQ-SRCCG-015*

**REQ-AENEAS-03-04**    SRC Data Availability

Placeholder (TBD)

*Source: REQ-SRCCG-016*

**GOAL-AENEAS-03-05**    European Storage Capacity

The collective European SRC (network) will store a full copy of the SKA output data

*Note: The European countries make up about half the total SKA membership. If the global alliance stores 2 copies of the Observatory Data then this would follow.*

*The export of SKA data from the host countries over two 100 Gbit/s links does not allow Europe to store a full, second, copy of the data. It may however be possible if a second (backup/redundant) route is procured. Extra costs may be incurred to make this possible.*

*Source: new AENEAS requirement*

**REQ-AENEAS-03-06**    Compliance with EU Regulations

Placeholder (TBD)

*Note: what do we do if EU legal requirements (e.g. on Open Data) are more stringent than those widely adopted by the other SRCs. Or does the IGO status prevent this from happening? There must be flexibility in the collaboration to cope with local/regional requirements.*

*Note: add FAIR principles here, perhaps a separate requirement or goal*

*Source: new AENEAS requirement*

## 3.4. Accessibility and Software Tools

### **REQ-AENEAS-04-01**    Common Software Environments

Each SRC shall support and maintain a set of common software environments across all SRCs agreed by the SRC Alliance.

*Source: Derived from REQ-SRCCG-017*

### **REQ-AENEAS-04-02**    Software tools available at SRCs

The Alliance will develop guidelines and procedures for the qualification, certification, maintenance and adoption of all software tools available at the SRCs (including those contributed by users).

*Source: new AENEAS requirement*

*Note: We leave open the question whether code used to produce (advanced) data products is made available along with the data. The SRCs will be ready for this, in principle, but the degree to which it is required depends on developments e.g. in relation to open access and reproducibility of scientific results.*

### **REQ-AENEAS-04-03**    Science Gateway

Each SRC will host a single Science Gateway used by all SRC users, compliant with SKAO policies on user access interface.

*Note: the Science Gateway will be an interactive interface and allows the user to query the Archive, support requests from the Archive, run the distributed or their personal software/routines, access the documentation and get human support. What the gateway provides should be the same everywhere, but that doesn't mean every activity has to go through a single location*

*Source: REQ-SRCCG-019*

### **REQ-AENEAS-04-04**    External software

The SRCs will enable users to develop and run software in the SRCs.

*Source: Derived from REQ-SRCCG-020*

### **REQ-AENEAS-04-05**    Time Sensitive Requests

The SRCs will have the capability to provide support for time sensitive requests in accordance with policy.

*Note: this refers to response to triggers and alerts.*

*Source: new AENEAS requirement*

### **REQ-AENEAS-04-06**    Response time

The SRCs will provide information on timing and prioritisation of all requests for data and processing.

Source: new AENEAS requirement

## 3.5. Data Processing Capacity

### **REQ-AENEAS-05-01**     Overall processing capability of the SRCs

The SRCs and SKAO will set the processing capability and its projected growth annually.

*Note: In aggregate, the SRCs will provide an annual average of:*

*AENEAS numbers:*

*T0+2: 7 PFlops*

*T0+4: minimum 13 PFlops*

*T0+8: minimum 26 PFlops*

*SKAO numbers (assumes SRCs run similar processing pipelines to SDP):*

*T0+2: at least 10 (TBC) PFlops (peak)*

*T0+4: 35 (TBC) PFlops (peak)*

Source: Derived from REQ-SRCCG-021

*Note: We need to move away from Flops to benchmarks.*

## 3.6. Network Connectivity

### **REQ-AENEAS-06-01**     Global Connectivity

The SRCs and SKAO will set the global connectivity and capability that is required to move the data from the telescopes to the SRCs. The parties will review the projected growth on an annual basis.

*Note: This is expected to be up to 100 Gbit/s per telescope site by 2025.*

Source: new AENEAS requirement

### **REQ-AENEAS-06-02**     Connectivity within Global SRC Network

The SRCs will set the connectivity and capability that is required to move the data between the SRCs. The parties will review the projected growth on an annual basis.

Source: new AENEAS requirement

### **REQ-AENEAS-06-03**     Regional Connectivity

Each SRC will decide on the regional connectivity and capability that is required to ingest the Observatory Data and to move data between its nodes. The parties will review the projected growth on an annual basis.

Source: new AENEAS requirement

*Note for previous three requirements:*

*Consideration should be given to providing redundancy on critical routes.*

*The meaning of parties differs in each case in the above three requirements*

**REQ-AENEAS-06-04**    Data Management System

Each SRC must be capable of supporting a common federated data management and transfer system.

*Note: The functionality to be provided will typically include DMZ, High Performance Data Transport Nodes, Public Access to the data, data movement and file transfer provisions. This does not prevent a site or a node from using Cloud technology.*

*Source: new AENEAS requirement*

**REQ-AENEAS-06-05**    Network Monitoring

The SRCs will regularly monitor the end-to-end performance of all network links.

*Source: REQ-SRCCG-023*

**REQ-AENEAS-06-06**    Observatory data product ingest rate

The SRC Alliance will ensure that it can support the transfer rate at which SKA Observatory Data Products are dispatched.

*Note: the observatory will be responsible for initiating the transfer based on its policies and the availability of the destinations. The aggregate transfer rate is expected to be up to 100 Gbit/s per telescope site by 2025.*

*Source: Derived from REQ-SRCCG-023*

**REQ-AENEAS-06-07**    Data integrity

Each SRC will use data transfer tools and protocols that ensure data integrity during data replication on all connections.

*Source: Derived from REQ-SRCCG-025*

## 3.7. User Support and Access

**REQ-AENEAS-07-01**    User policy

The SRC Alliance shall define and commit to a user policy that states the reciprocal roles & duties and the services that define the interaction with the user community.

*Note: Such a policy should clarify the procedures for user access, the available resources and the limits of the SRC operations, as well as the rights of the different classes of users (e.g. PI, co-I, archive user, SKA partners, or non-partners, ...). It should also clarify what is expected from the users (including*



*specific needs of Key Science Projects). The user policy will be updated in accordance with SKA policies or in order to reflect network/telescope evolution.*

*Source: new AENEAS requirement*

**REQ-AENEAS-07-02**    User access and identification

The user shall be able access the services provided by the SRC through the Science Gateway.

*Note: The Gateway must provide access in accordance with accessibility and diversity requirements.*

*Source: new AENEAS requirement*

**REQ-AENEAS-07-03**    Global AAAI

A global federated AAAI (authentication, authorisation, accounting, infrastructure) system with single sign-on will be in place.

*Note: For some tasks a registration may be required. The SRC will adhere to applicable laws regarding storage of personal information.*

*Source: new AENEAS requirement*

*Note: Should be easy to use and access. User friendly also for non-radio astronomers [Manchester 03-19]*

**REQ-AENEAS-07-04**    Resources

The Science Gateway will allow each user to access the storage and computational facilities most suitable for their needs, and to obtain support, subject to defined resource allocations.

*Source: new AENEAS requirement*

*Note: Perhaps it should be possible for simple requests to be processed directly by the Gateway, bypassing the SRCs. Also: how are resources shared. [Manchester 03-19]*

**REQ-AENEAS-07-05**    Condition of Resources

Each node will publish the details and the availability of the resources and services, and the condition under which these are provided.

*Note: The publication of these details must comply with the agreed SRC. The condition of the resources must be declared publicly.*

*Source: new AENEAS requirement*

**REQ-AENEAS-07-06**    Helpdesk and knowledgebase

A helpdesk system will be provided to facilitate the interaction between users and the SRCs. A knowledgebase with relevant information and documentation will be maintained.

*Source: new AENEAS requirement*

**REQ-AENEAS-07-07** Distribution of Requests

Requests will be distributed to the nodes based on user needs, the services offered by the nodes and proximity to the user.

*Note: A knowledgebase could be built on the basis of the most common requests and made publicly available. Other user interaction tools (forums, chats, ...) could be considered on local/regional basis.*

*Source: new AENEAS requirement*

**GOAL-AENEAS-07-08** Access to non-SKA data

The SRC should allow access to non-SKA data. The SRCs should strive for interoperability with other standards and services.

*Note: One service to be considered is the Virtual Observatory. The value of the SKA Archive will increase significantly if it can be combined with other scientific/astronomical data. Such data would in most cases be stored elsewhere, but there are likely to be repercussions in terms of processing, data transport etc. This may be very appealing to the (astronomical) community and support for it could be incorporated into the agreements that cover resourcing of the SRCs [Manchester 03-19]*

*Source: new AENEAS requirement*

**REQ-AENEAS-07-09** Documentation and information

The SRC must create and maintain the documentation describing its functionalities and make it publicly accessible through the Science Gateway.

*Source: new AENEAS requirement*

**REQ-AENEAS-07-10** SKA Telescope Information

The SRCs shall make available the information regarding the telescope, its observational procedures and the processing systems relevant for the users.

*Source: new AENEAS requirement*

*Note: no requirement/recommendation on provision of service management system.*

*Note: storage and processing of non-SKA data: how can a user ask for such data to be stored/hosted on the SRC.*

## 4. Conclusion

The top level (level 0 in System Engineering terminology) requirements of the network of SKA Regional Centres were collected in this document. The work and outcome have made full use of the requirements drafted to date by the SRCCG.

These high-level requirements are for the network of SKA Regional Centres, where necessary in particular from the perspective of a European SKA Regional Centre. This is not a final document. During the iterative design and costing exercise, these requirements will be revisited and possibly changed, as they could be found unmanageable, outdated, or overruled, due to new information, or new stakeholder positions.

## 5. Further activities

These level 0 requirements will be translated to more detailed lower level constraints. Collectively these requirements will guide the design of the (global) network of SKA Regional Centres.

These are not only level 0 requirements as in high level, but also as in being the first iteration in the process as many boundary conditions are not fixed and many stakeholders will change in constitution or in readiness to contribute to the discussion:

- the SRC Coordination Group will shortly be replaced by a new body, the SRC Steering Committee (SRCSC) with representatives from each of the SKA member states, which will report to the Director-General of the SKA Organisation.
- Each SRC will have its own requirements. These requirements will be brought together by the SRCSC in order to arrive at a common set for the entire SRC network, Observatory and the interface between the two.
- the future users of the SKA, currently organised in a number of Science Working Groups will evolve at some stage into Key Science Teams that will carry out the SKA's major science programmes.
- the funding agencies and ministries that will fund, or at least be involved in funding, the SRC network, once they join the SKA Organisation.
- readiness of the telescopes and availability of data.
- readiness and availability of pipelines and workflows.
- timeliness and availability of funding streams for construction and operation of the SRCs.

The next phase will see planning for the development and construction of the SRC network intensify.

An important early goal of the design work is to allow us to produce cost estimates for the SRC network in order to achieve an acceptable balance between cost and performance and inform governance arrangements that may be set up between the partners and with the SKAO.

## X. REFERENCES

SKA-TEL-SKAO-0000735, revision 02 - SKA Regional Centre Requirements and Goals