Preliminary System Architecture

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Status: **RELEASED**

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Change Record

Version	Date	Author	Notes/Changes
01	2018-02-28	RJS	Started first draft of MagicDraw SysML model export
02	2018-03-29	RJS	Number of corrections outside of the CSW work package; focus on BDDs and Context IBDs
03	2018-03-29	RJS	Added Back End Enclosure Assembly DWG
04	2018-08-15	RJS	Major edit after MagicDraw training; recast as functional, logical, and structural models
05	2018-08-16	RJS	Clean-up to match current Reference design; elaboration of CSW logical architecture, added DSP domain, added DBE IBD, etc.
06	2018-10-08	RAH, RJS	Export for Internal Pre-Decadal Review; updated CSW Architecture in both logical and structural model; other updates throughout
07	2019-02-08	RAH, RJS	Updates to SciOps model by RAH, reflecting latest CSW architecture; revised export format from DWG set to document, and restricted export to the highest-level drawings only
08	2019-03-29	RJS, RAH	Added documentation for major drawings included in restricted export
09	2019-04-01	RJS	Added Digital Signal Processing Domain Drawing
10	2019-04-03	RJS	Added 18m Reflector Antenna Scope DWGs
11	2019-04-04	RJS	Added logical system IBD to show interfaces at subsystem level
12	2019-04-15	RJS	Fixed cover for workflow; fixed paragraph alignment. Ready for workflow
A	2019-07-09	Lear	Incorporated minor edits by M. McKinnon; prepared document for approvals and release

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1 Introduction

1.1 Purpose

This document presents a preliminary architecture of ngVLA that should guide the development of the facility. The system-level architecture model is implemented in the Systems Modeling Language (SysML). This document is an export from that model and provides an abbreviated description of the system architecture. This document is intended as a primer, with the full details captured in the SysML model.

1.2 Scope

The scope of this document is the entire ngVLA project over its full lifecycle. This includes not just the scientific facility, but the supporting infrastructure and personnel, with input at all stages of development from design, to operations, and disposal.

2 Related Documents

2.1 Applicable Documents

The following documents are applicable to the extent specified.

Reference No.	Document Title	Rev / Doc. No.
AD01	ngVLA Requirements Management Plan	020.10.15.00.00-0001-PLA
AD02	Science Requirements	020.10.15.00.00-0001-REQ
AD03	Reference Observing Program	020.10.15.05.10-0001-REP
AD04	Stakeholder Requirements	020.10.15.01.00-0001-REQ
AD05	System Requirements	020.10.15.10.00-0003-REQ
AD06	Antenna Electronics Front End Enclosure Block Diagram	020.30.00.00.00-0002-BLK
AD07	Antenna Electronics Pedestal Enclosure Block Diagram	020.30.00.00.00-0003-BLK
AD08	Product Breakdown Structure	020.10.10.05.00-0001-LIS
AD09	Requirements Verification Traceability Matrix	020.10.15.00.00-0002-REQ
AD10	Operations Concept	020.10.05.00.00-0002-PLA
AD11	Computing & Software Reference Design Architecture	020.50.00.00.01-0002-DSN

3 Overview of the System Architecture

This document is generated from the Systems Modeling Language (SysML) ngVLA architecture model and provides an abbreviated description of the system architecture. The full model includes over 100 diagrams that represent lower-level details of the architectural design, and the model should be inspected when seeking these lower-level details. This document aims to provide a high-level view of both the structure of the model and the system architecture it represents.

The model is structured with the long-term goal of providing sufficient definition of each system element to enable implementation by a domain expert/engineer. In most cases, this entails defining for each element:

1. the requirements it must satisfy,
2. the activities it must perform, and
3. the interfaces to other elements.

With this level of definition of each major system element, various implementations can be explored as part of the system conceptual design. The requirements allocation process and interface definition also allows traceability for verification, at both the system level and the element level.

Considering these goals, the model structure includes

1. the requirements for the system, their flow-down, and allocation to system elements;
2. a logical model that has the necessary elements to satisfy the functional requirements; and
3. a structural model that fully defines the proposed design for implementation.

The logical model intends to define the system behaviors and elements that are necessary to satisfy the requirements. This is a "black box" model that focuses solely on inputs, operations and outputs, without dictating any specific implementation of the element.

The structural model by necessity imposes an architectural solution, satisfying the functions identified in the logical model. The structural model is one solution among many, and as the design matures, multiple structural models may be built for specific subsystems as part of their trade studies. A complete structural model defines all the deliverables that make up the system.

The system architecture aims to be

1. loosely coupled, with high cohesion within subsystems, to enable parallel development with clean interfaces (i.e. elements that strongly depend on each other are aggregated into subsystems, and interfaces between subsystems aim to be well-defined and relatively simple);
2. flexible, scalable, and extensible to adjust to evolving requirements and programmatic constraints as the design progresses. As stated in the Science Requirements [AD02], "The primary science requirement for the ngVLA is to be flexible enough to support the breadth of scientific investigations that will be proposed by its creative scientist-users over the decades-long lifetime of the instrument"; and
3. maintainable over the lifetime of the instrument. Maintenance and operations activities are considered early in the design of the system, with flow-down from the maintenance concept [AD10] to the stakeholder requirements [AD04] and to the logical model.

The structural model presently describes an architecture that is consistent with the product breakdown structure (PBS) [AD08] of the ngVLA reference design. The architecture will continue to be developed

and elaborated through the conceptual design phase of the project. Alternative structural models (i.e. implementations) will be explored at the subsystem level as part of the conceptual design of the facility.

This document is best read in conjunction with [AD11], [AD06], and [AD07]. These documents provide additional details on the architecture of the software and computing systems and the antenna electronics. These documents should be considered incorporated by reference.

4 Model Structure

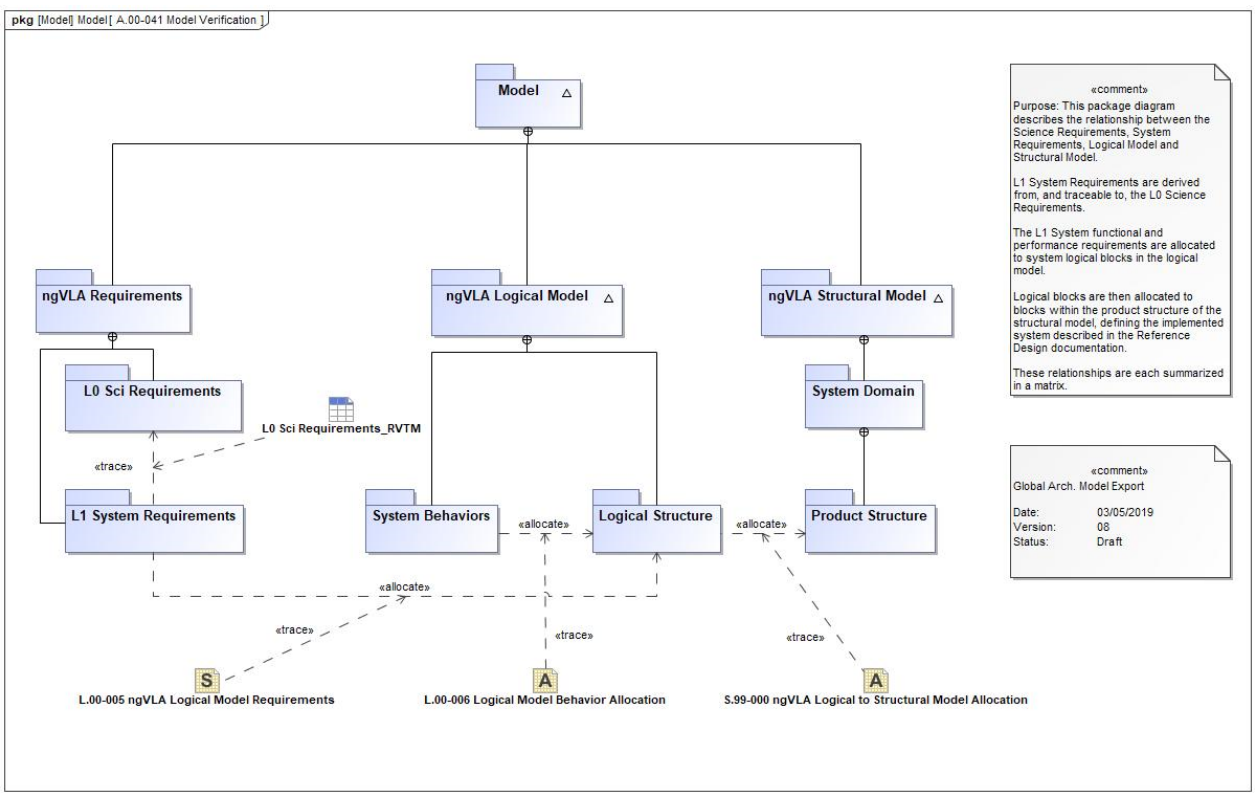
4.1 Diagram: A.00-041 Model Verification

Verification and traceability are integral to this architectural model. This package diagram describes the relationship between the Science Requirements, System Requirements, Logical Model and Structural Model.

The L1 System Requirements are derived from, and traceable to, the L0 Science Requirements. This traceability is captured in the Requirements Verification Traceability Matrix (RVTM) [AD09]. The L1 System functional and performance requirements are linked to system logical blocks in the logical model that must satisfy each requirement.

The functions of logical blocks are then allocated to blocks within the product structure of the structural model, defining the implemented system described in the design documentation. This maintains a separate implementation-agnostic logical structure and behavior model, while also documenting the implementation described in the design documentation (captured in the product structure of the structural model).

These relationships are each summarized in a "satisfy" or "allocation" matrix as appropriate. Any gaps in the current requirements flow down or allocation within the model are evident in these matrices and can be used as a metric for current design completeness and as a guide for future verification activities as the design matures. All three verification matrices are included in Appendix 8.2.



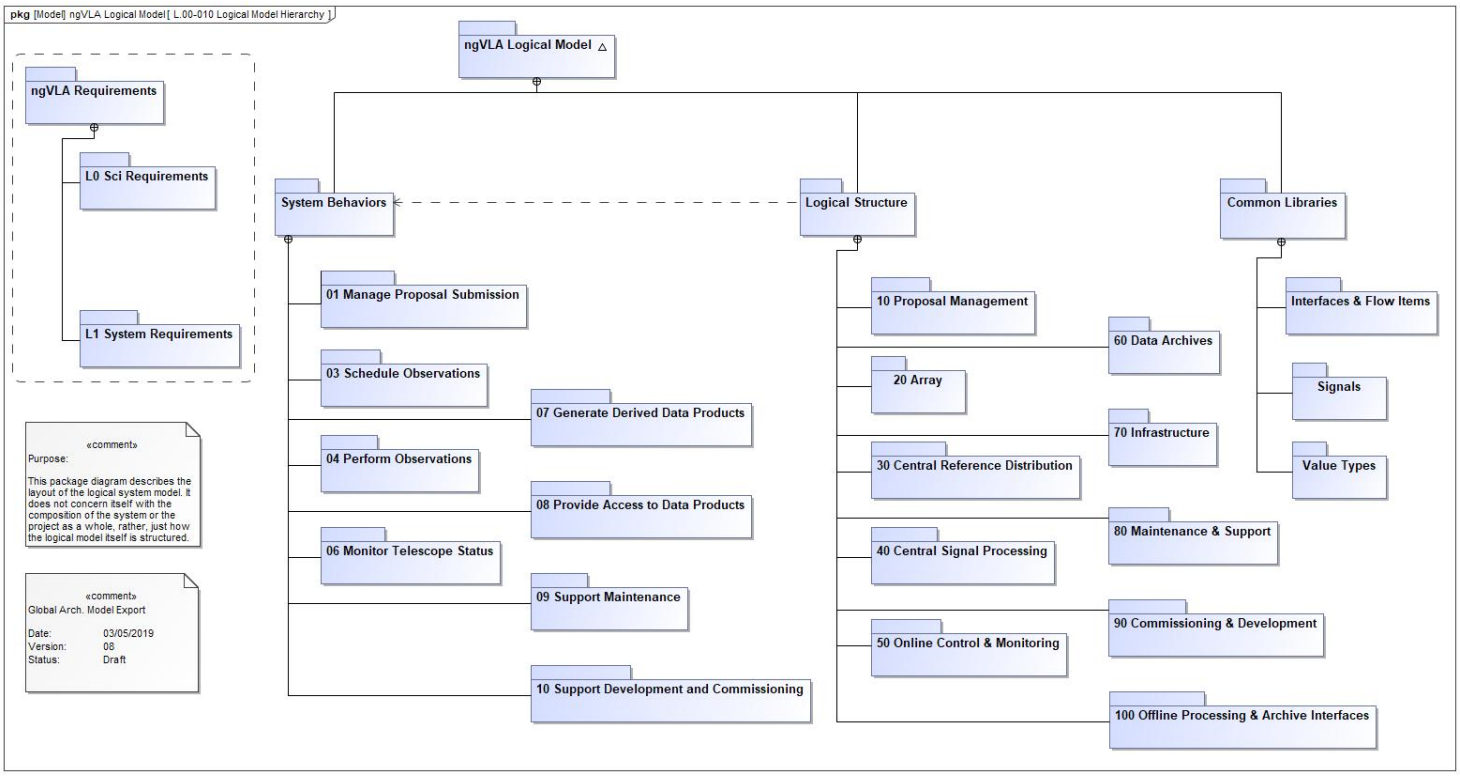
5 Logical Model

5.1 Diagram: L.00-010 Logical Model Hierarchy

As described previously, the logical model is an abstraction, identifying the system behaviors that are required to support the identified use cases from the life cycle models (maintenance, operation, commissioning, etc.) and science use cases.

The behaviors the system must perform are contained within the system behaviors package, and are aggregated into the various stages of a proposal's life from submission through execution and the delivery of data products. Support functions identified in the lifecycle concepts are also included, with an emphasis on maintenance, development and commissioning activities.

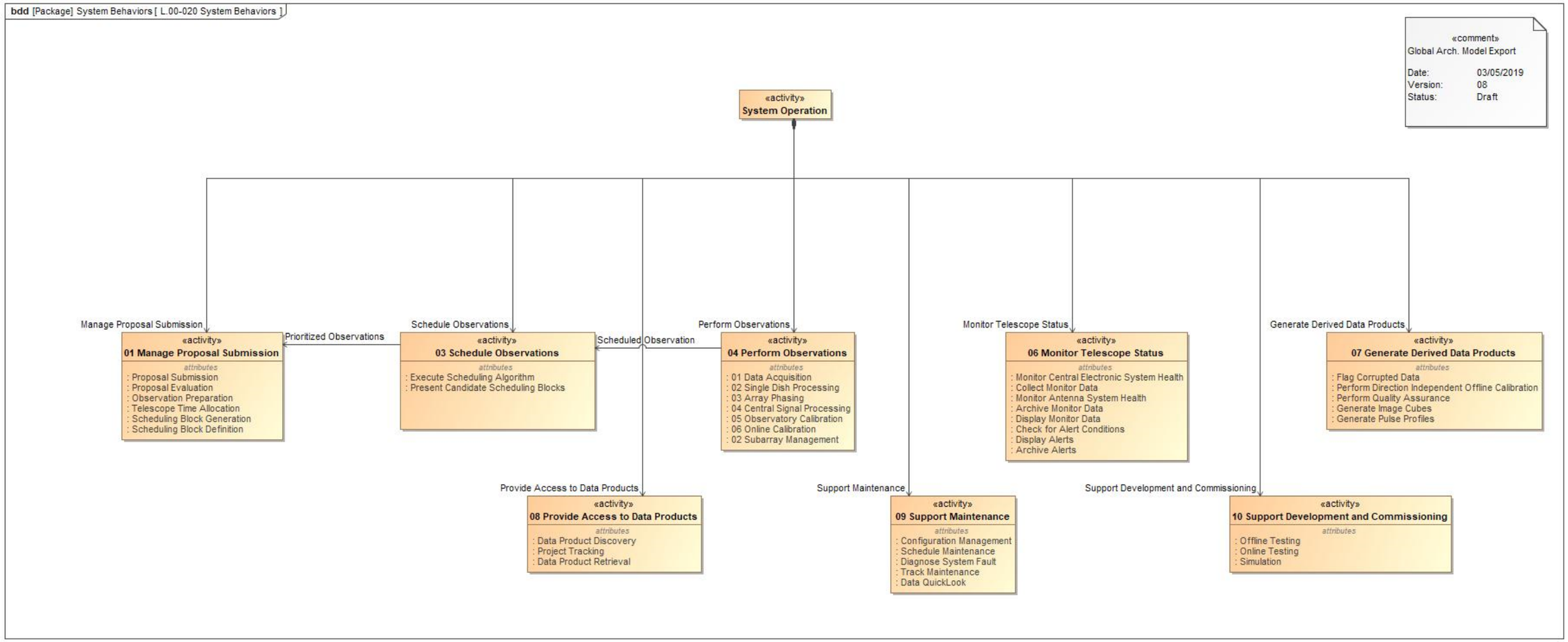
The logical structure includes packages tailored to performing the identified behaviors. At this level of abstraction, the implementation is not defined, solely that a system element must perform the identified action to complete the use case. This aids in the identification of functional blocks required within the system.



5.2 Diagram: L.00-020 System Behaviors

This block definition diagram describes the high-level activities that must be performed by the system in operation, starting with the various stages of a proposal's life from submission through execution and the delivery of data products. Support functions identified in the life cycle concepts (e.g., operations and maintenance concepts) are also described.

Each major activity is then decomposed into its respective sub-tasks. For example, the major activity "Manage Proposal Submission" includes the sub-tasks "Proposal Submission," "Proposal Evaluation," "Telescope Time Allocation," and so on. This hierarchical decomposition of activities continues until the lowest-level activities can be allocated to a single functional block in the logical architecture.



Selected elements:

Manage Proposal Submission: This activity addresses the preparation and submission of proposals by PIs, and the evaluation of proposals by Observatory staff. The process starts with the proposal data compilation and ends with a prepared observation(s) that has been approved for scheduling.

Schedule Observations: This activity concerns the scheduling of prepared observations based on established criteria such as the scientific priority, system configuration requirements, system status, and environmental conditions. It ends with the delivery of scheduling blocks for execution by the system.

Perform Observations: This activity accepts the delivered scheduling blocks and executes them. Multiple observations may be conducted simultaneously as determined by the scheduler through the use of sub-arrays. This high-level activity includes the entire data capture and processing chain. Processing may be single-dish or central (such as the summed array output or cross-correlation), and additional array phasing and on-line (near real-time) calibration activities are also included. This activity ends with the generation of fundamental data products, such as visibility data or summed array voltage streams.

Monitor Telescope Status: This activity includes the monitoring of system health and the environment, as well as the collection, archiving and display of this monitor data. The monitoring activity includes the processing of monitor data to identify values meaningful to operators and engineers through system alerts.

Generate Derived Data Products: This activity accepts the fundamental data products from activity block Perform Observations and combines these with monitor data to produce data flags and additional quality assurance corrections. These quality-assured data products are then processed to generate higher level data products such as image cubes or pulse profiles depending on operating mode.

Provide Access to Data Products: This activity provides access to fundamental or derived data products to users. This includes the search and discovery of relevant data products as well as their delivery.

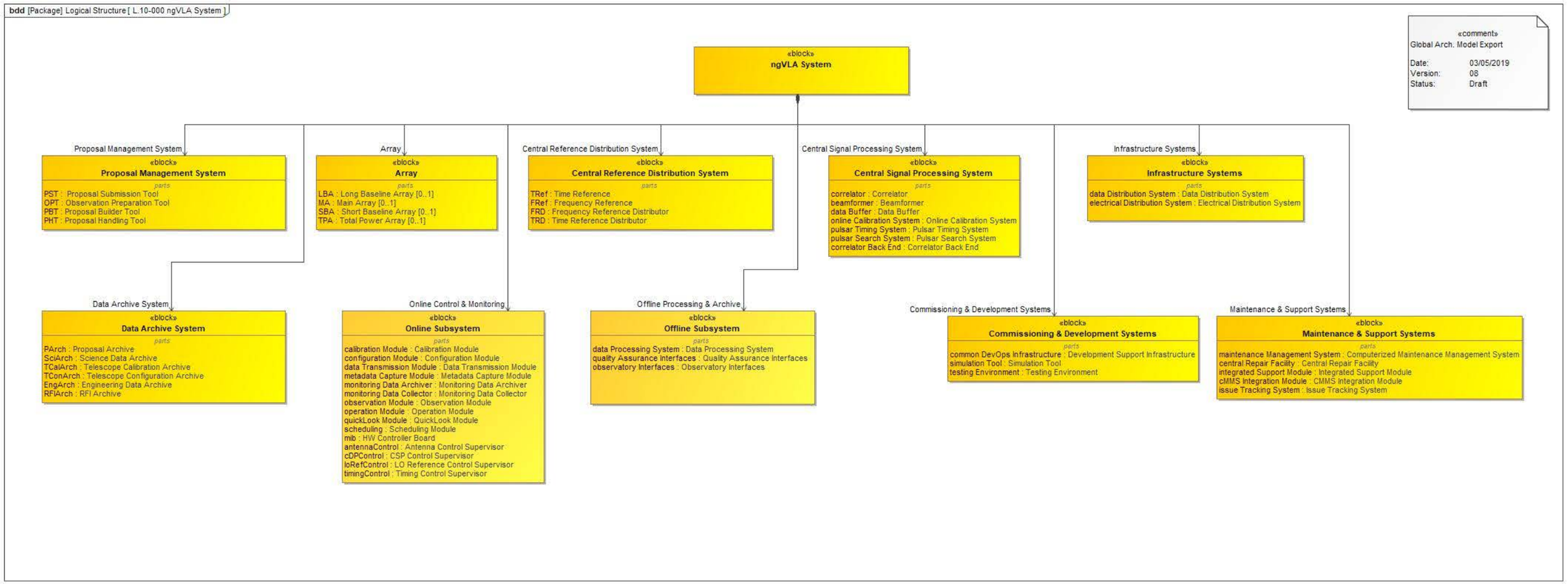
Support Maintenance: In addition to the functional operational activities, the system must support maintenance by operations and maintenance personnel. This activity block includes all ancillary activities necessary for system maintenance, such as tracking the system configuration status, scheduling maintenance activities, tracking maintenance activities, and diagnosing system faults.

Support Development and Commissioning: Development and commissioning activities are distinct from maintenance, and this activity block includes online and offline testing activities, and the simulation of observations.

5.3 Diagram: L.10-000 ngVLA System

This block definition diagram shows the major logical blocks of the system. Logical model blocks are allocated the behaviors described in diagram L.00-020 and its subordinates, ensuring that the lowest-level identified activities are completed by a single logical block. Complex activities may then be performed by composite assemblies (made up of multiple low-level blocks).

The logical architecture is structured in a parallel way to the activities, with proposal management activities performed by a proposal management system, and so on. The mapping from behaviors to logical model blocks is summarized in an allocation matrix, L.00-006, located in the appendix.



Selected elements:

Proposal Management System: The proposal management system and its sub-components execute the activities of the Manage Proposal Submission activity block.

Array: The array is the collection of antennas that perform the data acquisition and single dish processing activities within the Perform Observations activity block. It includes the currently defined major sub-arrays: the main array, the short baseline array and the long baseline array.

Central Reference Distribution System: The central reference distribution system provides the time and frequency references necessary to perform the array phasing within the Perform Observations activity block.

Central Signal Processing System: The central signal processing system performs the summed array, cross-correlation and other processing activities that manipulate multiple array elements in tandem. These activities are a subset of the Perform Observations activity block.

Infrastructure Systems: The infrastructure systems supply services, such as electrical power, to the array and central signal processing system.

Data Archive System: The data archive system stores the fundamental and derived data products and makes them available to users by performing the activities within the Provide Access to Data Products activity block.

Online Control & Monitoring: The online subsystem performs the Monitor Telescope Status activities, and the Generate Derived Data Products sub-activities that must be performed in near real-time.

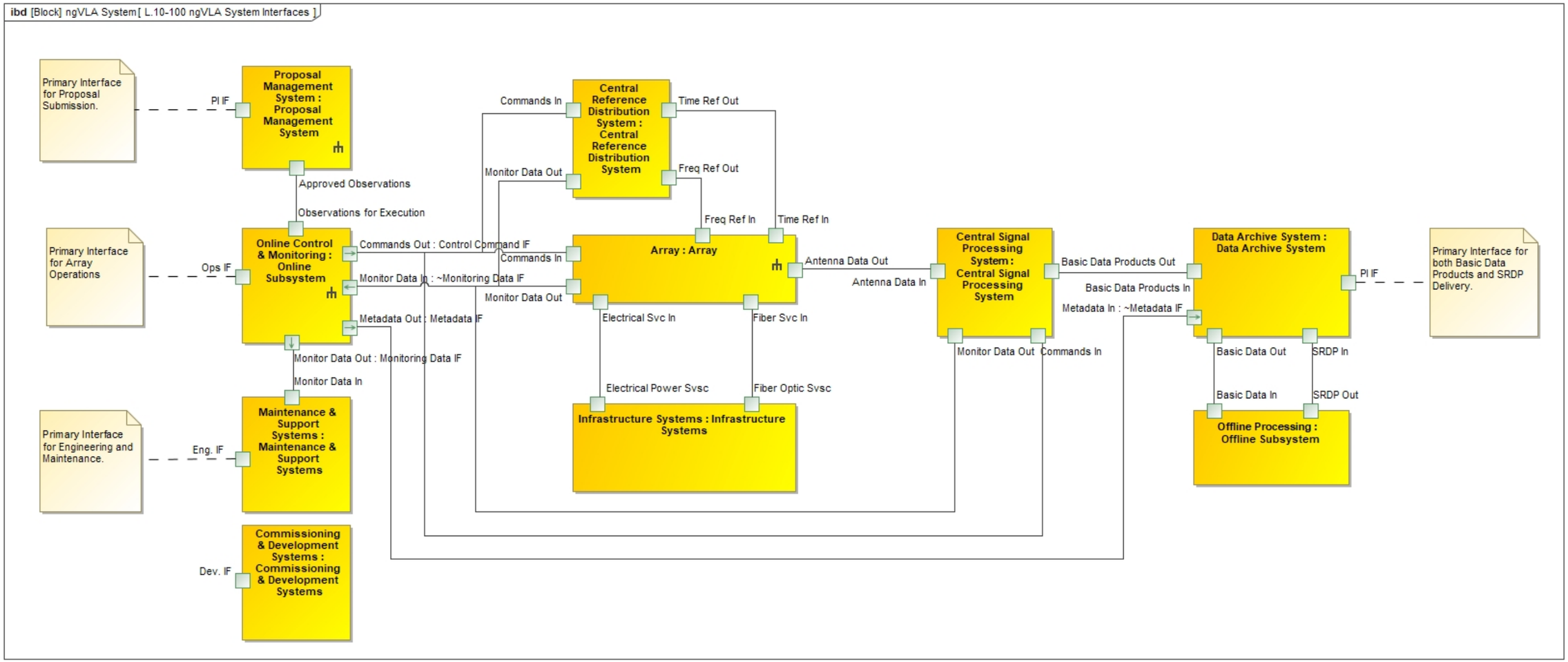
Offline Processing & Archive: The offline subsystem performs the Generate Derived Data Products sub-activities that can be performed post-facto from recorded data. This includes the generation of higher-level data products such as image cubes or pulse profiles depending on operating mode.

Commissioning & Development Systems: The commissioning and development system components execute the activities of the Support Development and Commissioning activity block.

Maintenance & Support Systems: The components of the maintenance and support systems block execute the activities of the Support Maintenance activity block.

5.4 Diagram: L.10-100 ngVLA System Interfaces

This internal block diagram identifies the interfaces between each major subsystem of the logical model. At this level of abstraction, the interfaces are clean and simple, with a high degree of containment within each subsystem and a minimal number of interactions. The primary input to the system are proposals in the upper left, with data products delivered to users at the far right. Operations and Maintenance group interfaces are also shown on the left hand side of the diagram.



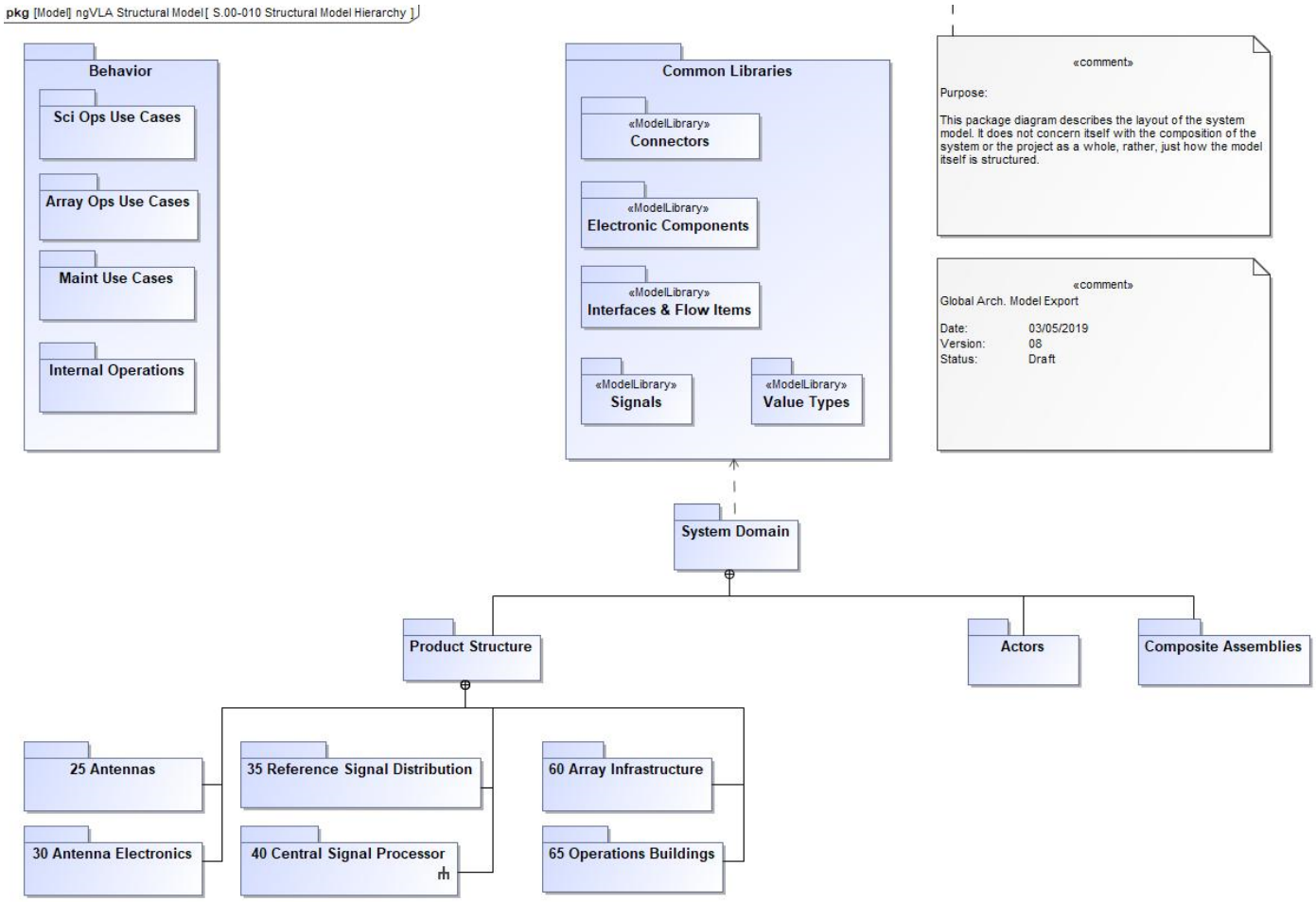
6 Structural Model

6.1 Diagram: S.00-010 Structural Model Hierarchy

This package diagram shows the layout of the structural model. This model best describes the proposed physical architecture. Rather than abstractions (like the logical model), each block in the structural model is a project deliverable (either hardware or software).

The structural model is representative of the implemented design and its lower levels are consistent with the Product Breakdown Structure (PBS). The Product Structure section of the model matches the organization of the project, with packages first sorted by IPT and then individual work packages from the PBS shown at the next level of the hierarchy.

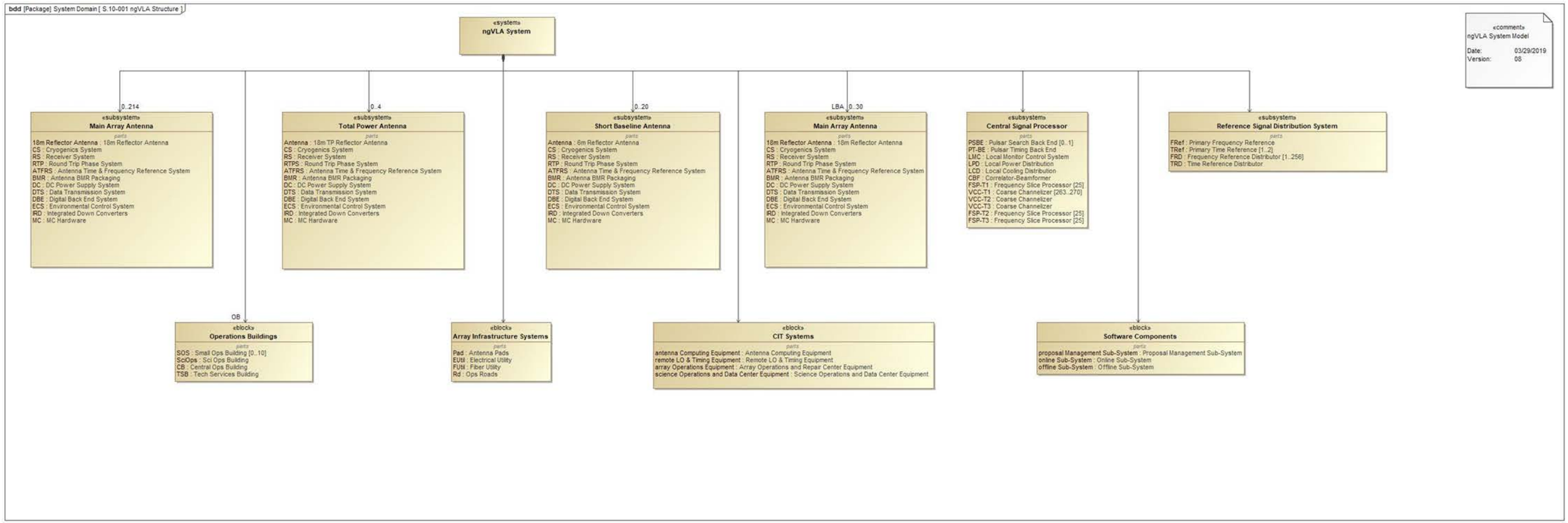
The model also includes actors who interact with the system (such as principal investigators, operators, maintenance technicians and engineers) and composite assemblies. The latter describe aggregated components in the system that are made up of deliverables from multiple work packages. An example is an array element, made up of the antenna, and each work package within the antenna electronics IPT (Front End, Cryogenics, Integrated Receiver Digitizer, etc.).



6.2 *Diagram: S.10-001 ngVLA Structure*

This block definition diagram is the highest-level view of the ngVLA System. It shows all components (both hardware and software) that make up the functioning facility in operation. Within each major block, individual components that are aggregated into the assembly are noted as parts. For example, a "Main Array Antenna" is made up of an 18m reflector antenna, a cryogenic system, a receiver system, and so on. Each of these parts is in-turn made up of many sub-components in the structural model hierarchy.

Where multiple copies of a part may exist in the architecture, this is shown with the multiplicity of the composition arrow. For example, anywhere from 0 to 214 Main Array Antennas could be included in an operational instance of the ngVLA system.



Selected elements:

MAA: All the antennas within the array share a common high-level architecture. They also share common receiving and single dish processing requirements in the current implementation. The Main Array Antenna consists of an 18m antenna structure and all electronics and embedded software necessary for antenna motion, data acquisition, and single-dish data processing.

TPA: The total power antenna shares the same overall architecture as the Main Array Antenna, but is designated with a different antenna structure, the TP Reflector Antenna. While this part differs in the model it is hoped that its requirements can be achieved with the 18m reflector antenna of the main array.

SBA: The short baseline array antenna shares the overall architecture of the Main Array Antenna with the exception of the antenna structure, which is replaced by a 6m reflector antenna.

LBA: The long baseline array antenna presently shares the architecture and parts of the main array antenna.

CSP: The Central Signal Processor block is the realization of the Central Signal Processing System in the logical model. It includes the NRCC FSA Correlator-Beamformer, a pulsar engine, and ancillary systems necessary for operation.

RSD: The reference signal distribution system is the realization of the Central Reference Distribution System in the logical model. It provides time and frequency references to the antennas in the array as well as to the central signal processor.

CIT: The scientific computing and information technology systems are the physical hardware on which the online and offline systems run. It also includes the necessary IT infrastructure to support the monitor and control system.

SW: The SW components are the realization of the Proposal Management system, Online System, and Offline System within the logical model. It includes both the software systems, compute resources and IT infrastructure necessary to execute the allocated activities.

OB: The operations buildings implement a subset of the Infrastructure Systems of the logical model that provide services to the central electronics (central signal processor, reference signal distribution system), along with other necessary buildings to satisfy the operations and maintenance concept.

AIS: The array infrastructure systems implement a subset of the Infrastructure Systems of the logical model that provide services to the antennas within the array such as power and fiber optic connectivity.

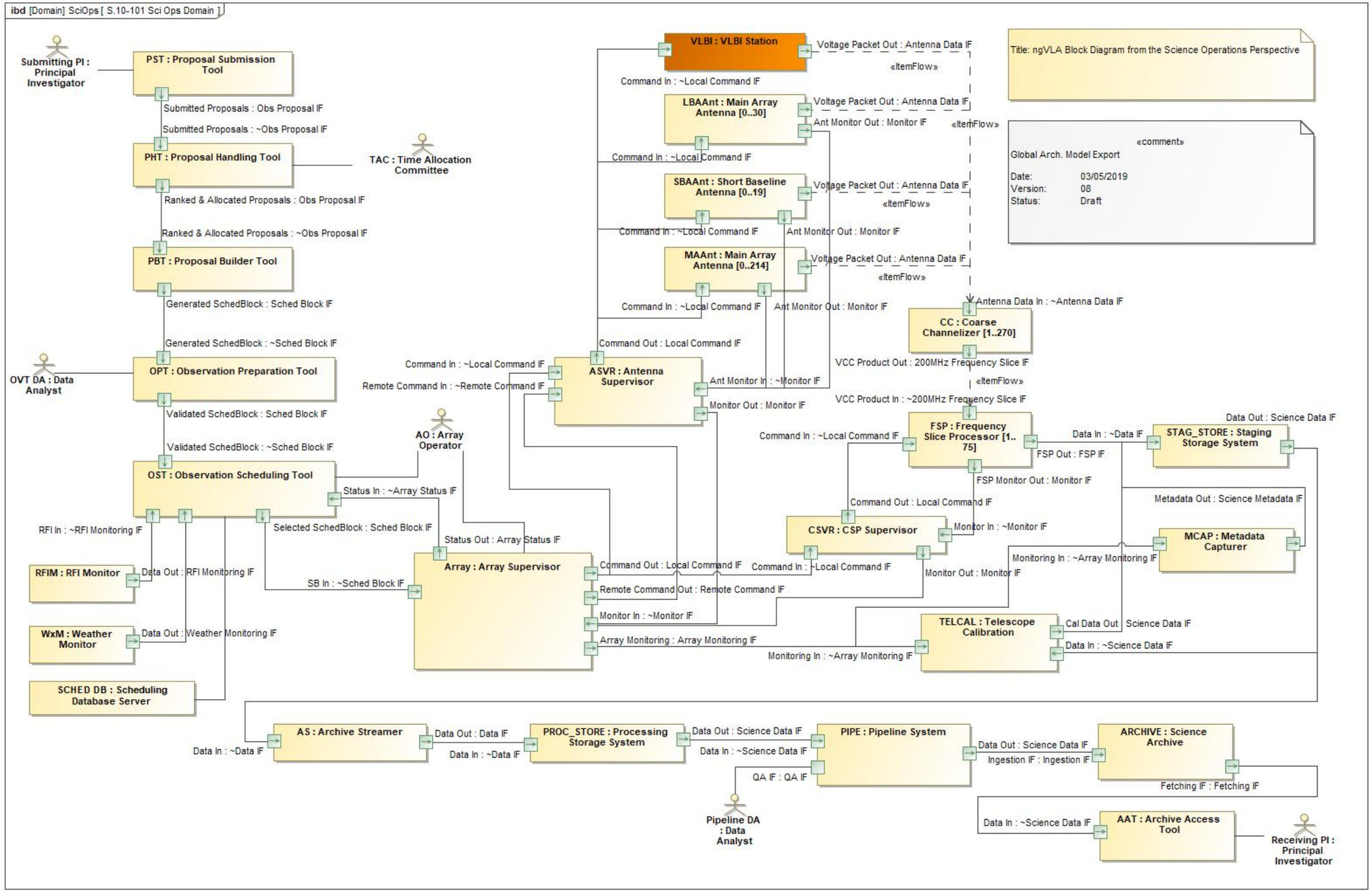
6.3 Diagram: S.10-101 Sci Ops Domain

Within the structural model, the architecture can be represented for individual domains. This internal block diagram shows the Science Operations Domain, i.e. how the system looks from a science operations perspective, including the actors that are relevant to the science operations of the system.

The diagram provides an end-to-end view of the system starting with the submission of a proposal by a Principal Investigator (PI) using the Proposal Submission Tool, and ending with the PI accessing their science ready data products through the Archive Access Tool.

Proposals progress through a Time Allocation Committee and technical review, are built into suitable observations with QC checks, and are processed by a scheduling tool. An array supervisor configures the various array elements and the central signal processor, executes the observation, and stages the low-level data for archiving. Post processing systems prepare the high-level user data products that are stored in the same archive.

The interfaces shown note the directionality of flow from one system to another, and the definition of each interface. For example, "submitted proposals" flow from the PST to the PHT over an "Obs Proposal" Interface. These interfaces are proxy ports (abstractions) on this diagram for simplicity and readability, but lower levels of the architecture will include definitions of both the physical ports that provide interfaces and data definitions where appropriate. The model may be used for interface definition at more mature stages of the design.


ibd [Domain] SciOps [S.10-101 Sci Ops Domain]
Submitting PI : Principal Investigator
PST : Proposal Submission Tool
Submitted Proposals : Obs Proposal IF
Submitted Proposals : ~Obs Proposal IF
PHT : Proposal Handling Tool
TAC : Time Allocation Committee
Ranked & Allocated Proposals : Obs Proposal IF
Ranked & Allocated Proposals : ~Obs Proposal IF
PBT : Proposal Builder Tool
Generated SchedBlock : Sched Block IF
Generated SchedBlock : ~Sched Block IF
OVT DA : Data Analyst
OPT : Observation Preparation Tool
Validated SchedBlock : Sched Block IF
Validated SchedBlock : ~Sched Block IF
OST : Observation Scheduling Tool
AO : Array Operator
Status In : ~Array Status IF
RFI In : ~RFI Monitoring IF
Selected SchedBlock : Sched Block IF
Status Out : Array Status IF
RFIM : RFI Monitor
Data Out : RFI Monitoring IF
SB In : ~Sched Block IF
Array : Array Supervisor
WxM : Weather Monitor
Data Out : Weather Monitoring IF
SCHED DB : Scheduling Database Server
VLBI : VLBI Station
Voltage Packet Out : Antenna Data IF
«ItemFlow»
Command In : ~Local Command IF
LBAAnt : Main Array Antenna [0..30]
Ant Monitor Out : Monitor IF
SBAAnt : Short Baseline Antenna [0..19]
MAAnt : Main Array Antenna [0..214]
Command Out : Local Command IF
Remote Command In : ~Remote Command IF
ASVR : Antenna Supervisor
Ant Monitor In : ~Monitor IF
Monitor Out : Monitor IF
Remote Command Out : Remote Command IF
Monitor In : ~Monitor IF
Array Monitoring : Array Monitoring IF
Title: ngVLA Block Diagram from the Science Operations Perspective
«comment»
Global Arch. Model Export
Date: 03/05/2019
Version: 08
Status: Draft
Antenna Data In : ~Antenna Data IF
CC : Coarse Channelizer [1..270]
VCC Product Out : 200MHz Frequency Slice IF
VCC Product In : ~200MHz Frequency Slice IF
FSP : Frequency Slice Processor [1..75]
FSP Out : FSP IF
FSP Monitor Out : Monitor IF
Data In : ~Data IF
STAG_STORE : Staging Storage System
Data Out : Science Data IF
Metadata Out : Science Metadata IF
CSVR : CSP Supervisor
MCAP : Metadata Capturer
Monitoring In : ~Array Monitoring IF
TELCAL : Telescope Calibration
Cal Data Out
Science Data IF
Data In : ~Science Data IF
AS : Archive Streamer
PROC_STORE : Processing Storage System
PIPE : Pipeline System
QA IF : QA IF
Pipeline DA : Data Analyst
ARCHIVE : Science Archive
Ingestion IF : Ingestion IF
Fetching IF : Fetching IF
AAT : Archive Access Tool
Receiving PI : Principal Investigator

Selected elements:

Submitting PI: The submitting PI is a principal investigator who prepares and submits a proposal for an observation. They interact with the proposal submission tool.

PST: The proposal submission tool is the primary tool for a principal investigator to prepare a proposal, in a standardized format, for evaluation.

PHT: The proposal handling tool retrieves proposals submitted by PIs and makes them accessible to the time allocation committee for evaluation. Its outputs are ranked and time-allocated proposals.

TAC: The TAC is the time allocation committee. This actor represents a member of the TAC who interacts with submitted proposals for evaluation purposes through a proposal handling tool.

PBT: The proposal builder tool takes the ranked and time-allocated proposals and parses the projects into scheduling blocks for execution.

OPT: The observation preparation tool allows a data analyst to verify and modify the scheduling blocks generated by the PBT and validate them prior to scheduling.

OVT DA: The Observation Validation Team Data Analyst evaluates the scheduling blocks generated by the PBT using an observation preparation tool, resulting in validated scheduling blocks than can be scheduled for observation.

OST: The observation scheduling tool takes the validated scheduling blocks and dynamically schedules their execution. The scheduling algorithm accounts for the expected presence of RFI during the observation, the weather conditions, the array status, and the project status.

RFIM: The RFIM block is the online processing system that catalogs known interferers in the accessible sky, their ephemerides, and signal properties.

WxM: The WxM is the collection of weather stations, the atmospheric phase interferometer, any ancillary environmental metrology systems, and associated monitoring software used to determine atmospheric conditions across the extent of the array.

SCHED DB: The scheduling database server provides the status of all approved projects, which scheduling blocks have been completed, which remain, and relevant metadata to prioritize scheduling blocks for execution.

Array: The array supervisor executes the scheduling blocks provided by the OST. It provides array status information to both the OST and the Array Operator, the latter through a GUI interface. Commands are issued to array antennas and other systems necessary for online operation.

AO: The array operator is the human supervisor of the array. The operators interact with both the observation scheduling tool to manipulate in progress or pending observations, as well as with the array supervisor software system to establish array status through a GUI interface.

ASVR: The antenna supervisor receives high-level commands from the array supervisor, determines the required configuration of the antenna subsystems, and dispatches local commands within the antenna.

MAAnt: The MAAnt is an instantiation of the main array antenna. Multiple antennas may be present in the array as indicated by the multiplicity property.

SBAAnt: The SBAAnt is an instantiation of the short baseline array antenna. Multiple antennas may be present in the array as indicated by the multiplicity property.

LBAAnt: The LBAnt is an instantiation of the main array antenna at a long baseline array site. Multiple antennas may be present in the array as indicated by the multiplicity property.

VLBI: The VLBI block is a representation of external resources (e.g., the GBT) that may be cross-correlated with the ngVLA in real time.

CC: The CC is a representation of a Very Coarse Channelizer in the Correlator-Beamformer of the Central Signal Processor.

FSP: The FSP is a representation of a Frequency Slice Processor node in the Correlator-Beamformer of the Central Signal Processor.

CSVR: The CSP Supervisor receives high-level commands from the array supervisor and turns them into to low-level commands for execution by the CSP subsystems such as the VCC and FSP blocks.

TELCAL: The telescope calibration system computes the near-real-time calibration solutions necessary for array phasing.

STAG_STORE: The staging storage system is a buffer system that ingests the high data rate delivered by the central signal processor and delivers it to the archive. Its input bandwidth is set by the highest data rate supported in a standard observing mode, while its output rate is matched to the average data rate expected across all modes.

MCAP: The metadata capture system captures ancillary data from the array monitoring system that is necessary for data calibration or verification and combines this metadata with the science data before storage.

AS: The archive streamer performs the necessary data formatting for ingestion.

PROC_STORE: The processing storage system is a buffer system that recovers projects from the archive and makes the data available to the pipeline system for processing.

PIPE: The pipeline system prepares the high-level (derived) data products that satisfy the proposal.

ARCHIVE: The science archive hosts both the low-level data products (visibilities) along with the high-level data products delivered by the pipeline system.

AAT: The archive access tool provides an online graphical interface to search for, and retrieve, data products from the archive.

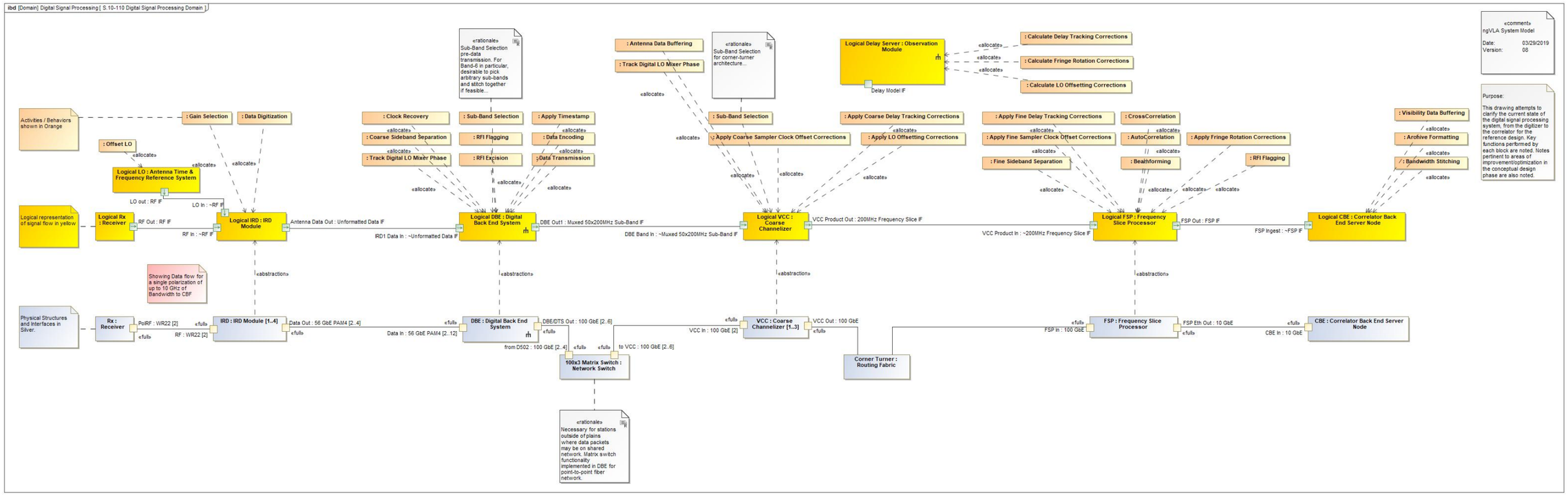
Receiving PI: The receiving principal investigator retrieves their data products from the archive access tool. These may be data products requested via a proposal, or based on a search of the public archive.

6.4 Diagram: S.10-110 Digital Signal Processing Domain

This internal block diagram shows the Digital Signal Processing Domain, i.e., how the system looks from a digital signal processing perspective, with an emphasis on operations/functions performed by each block, that block's logical inputs and outputs, and the physical interface that transports those inputs and outputs.

The diagram focuses on the signal flow from the digitizer through the correlator back end where the basic data products are delivered to the archive and post processing system. The diagram has three basic swim lanes, with the first noting activities/behaviors from the logical model, the second row providing a logical representation of the signal flow, and the third row showing the physical structures and interfaces that transport those data flows. E.g., while the data flow out from an Integrated Receiver Digitizer (IRD) is unformatted data, it is implemented on a 56 GbE PAM4 interface. Both these interfaces are shown in their respective swim lane, as are the functions the IRD performs from the logical model (Gain Selection & Data Digitization).

The signal flow shown is for a single polarization of up to 10 GHz of bandwidth. Future versions of this diagram may extend to include meta data capture and data formatting for the archive.



Selected elements:

Rx: The receiver captures the RF signal collected by the antenna and amplifies it for downconversion and digitization by the IRD module. Its main signal flow is an RF output, implemented over a coaxial SMA or rectangular waveguide interface depending on frequency band (WR22 shown on this drawing).

IRD: The integrated receiver digitizer performs gain selection and data digitization. It transmits data to the digital back end in an unformatted serial stream, with two streams per polarization implemented on a 56 GbE PAM4 link.

DBE: The digital back end recovers the clock from the unformatted data stream and deserializes the data. It performs a set of functions necessary for bandwidth selection and requantization before data encoding and transmission over a fiber network. The network may include commercial fiber links so an Ethernet interface is implemented.

VCC: The VCC is the coarse channelizer of the NRCC frequency slice architecture. It is intended to perform all band-specific processing functions as well as coarse channelization to 200 MHz frequency slices that are processed by the FSP. The VCC also provides a passive fiber routing fabric that forms the corner turner to the FSP. As can be seen in this figure, there is some overlap in functionality between the DBE and VCC that will be an area for optimization in the conceptual design stage.

FSP: The Frequency Slice Processor ingests the 200 MHz frequency slice provided by the VCCs (from all antennas in that sub-array) and produces a single VCC product—typically cross correlations or phased array beams consistent with its operating mode. It also performs a number of corrections that can only be done at the fine channelization stage of the FFX architecture.

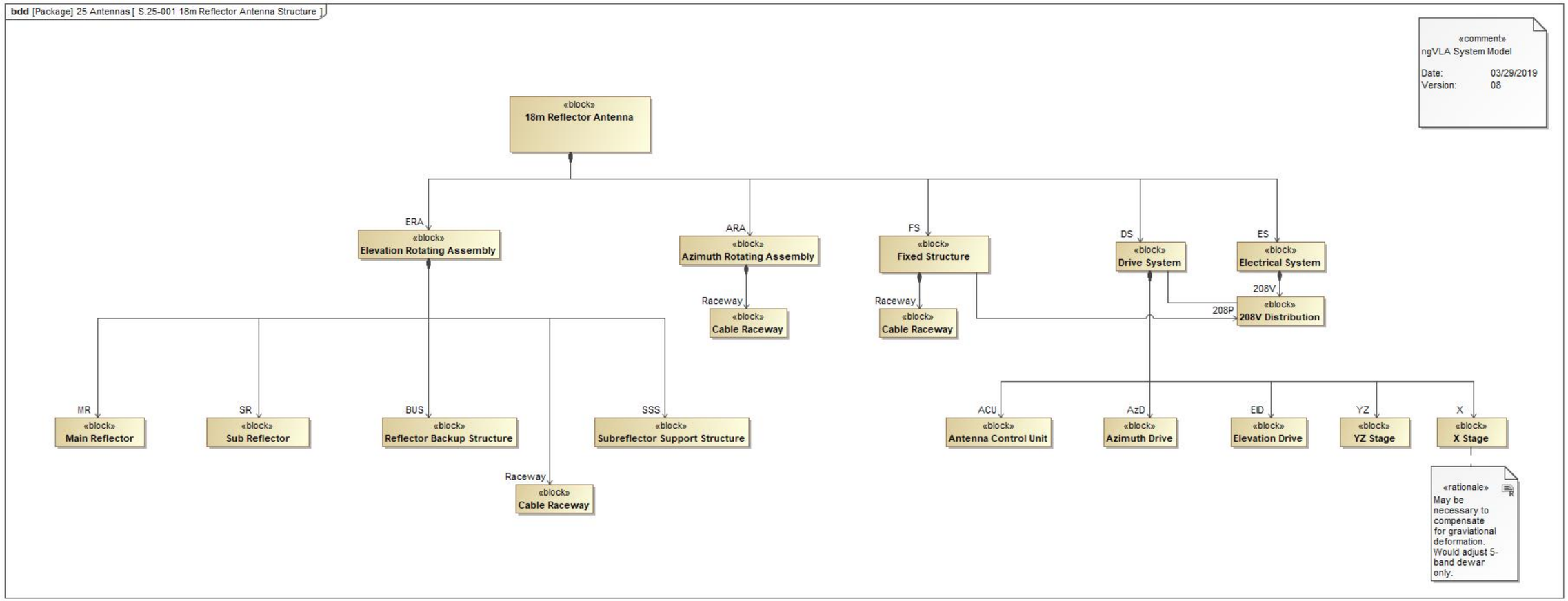
7 Subsystem Scope Definition

One of the goals with the development of this model is to define the scope of each work package to a sufficient degree to permit design elaboration by a domain engineer. For each major work package in the product structure of the structural model, a set of scope drawings will be developed to define the scope of the system within the structural model, the roles the subsystem or its components must satisfy in the logical model, their associated behaviors, and relevant L1 system requirements they must help satisfy.

This section of the report will be expanded as the design progresses with a goal of providing this definition for all subsystems by the conceptual design review.

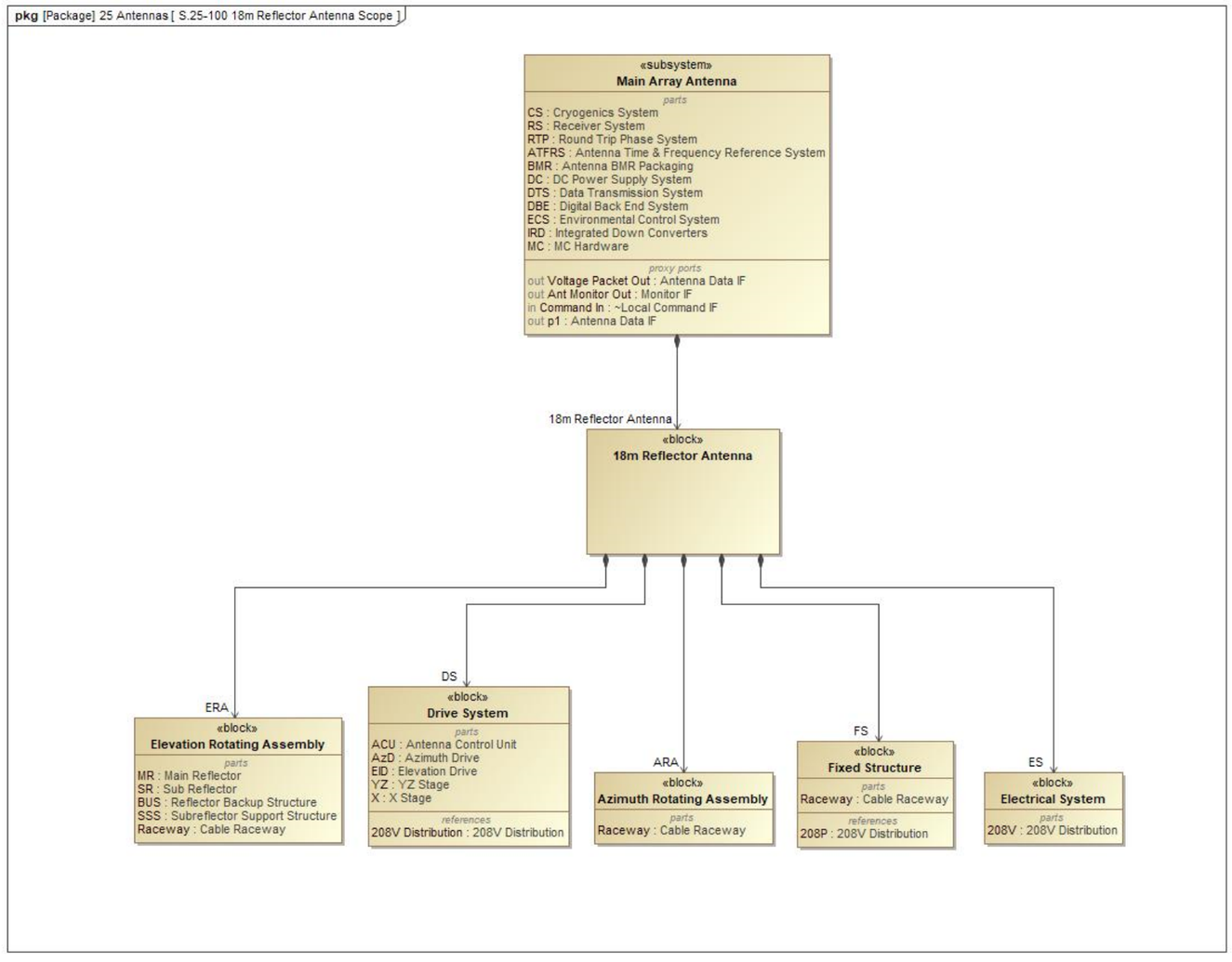
7.1 Diagram: S.25-001 18m Reflector Antenna Structure

This block definition diagram shows the components of the 18m reflector antenna in the structural model. In order to provide an initial architecture that is implementation agnostic, the structure is decomposed into an elevation rotating assembly, an azimuth rotating assembly, and a fixed portion of the structure. Such an architecture can accommodate both a wheel and track mount and various backup structure concepts. In addition to the structural elements the reflector antenna includes the drive system and the AC electrical distribution system necessary for antenna motion. The receiving electronics and all signal processing are outside the scope of this model element.



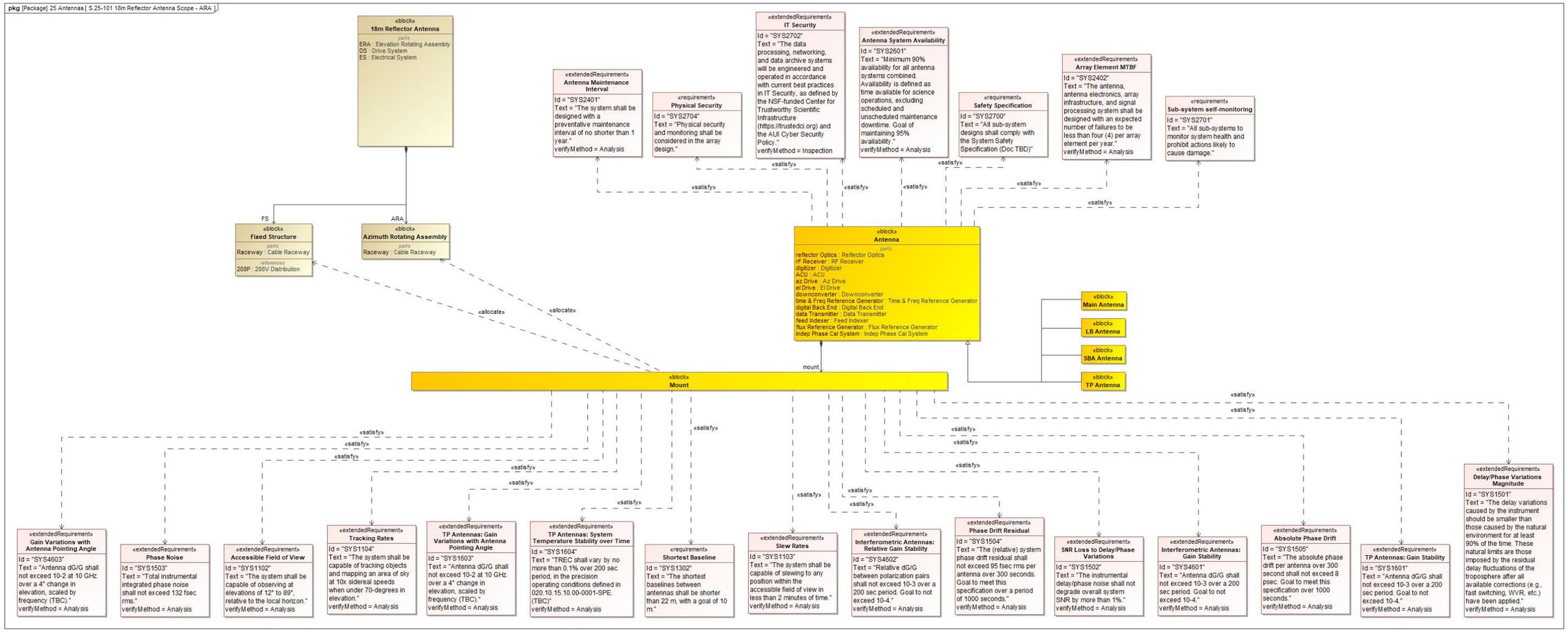
7.2 Diagram: S.25-100 18m Reflector Antenna Scope

This diagram and its subsidiaries show the scope of the 18m reflector antenna. The 18m reflector antenna has its constituent parts as shown on the preceding block definition diagram, and it is also a component itself of the Main Array Antenna Element. The 18m reflector antenna block has no direct relationships to the logical model, its behaviors, or requirements.



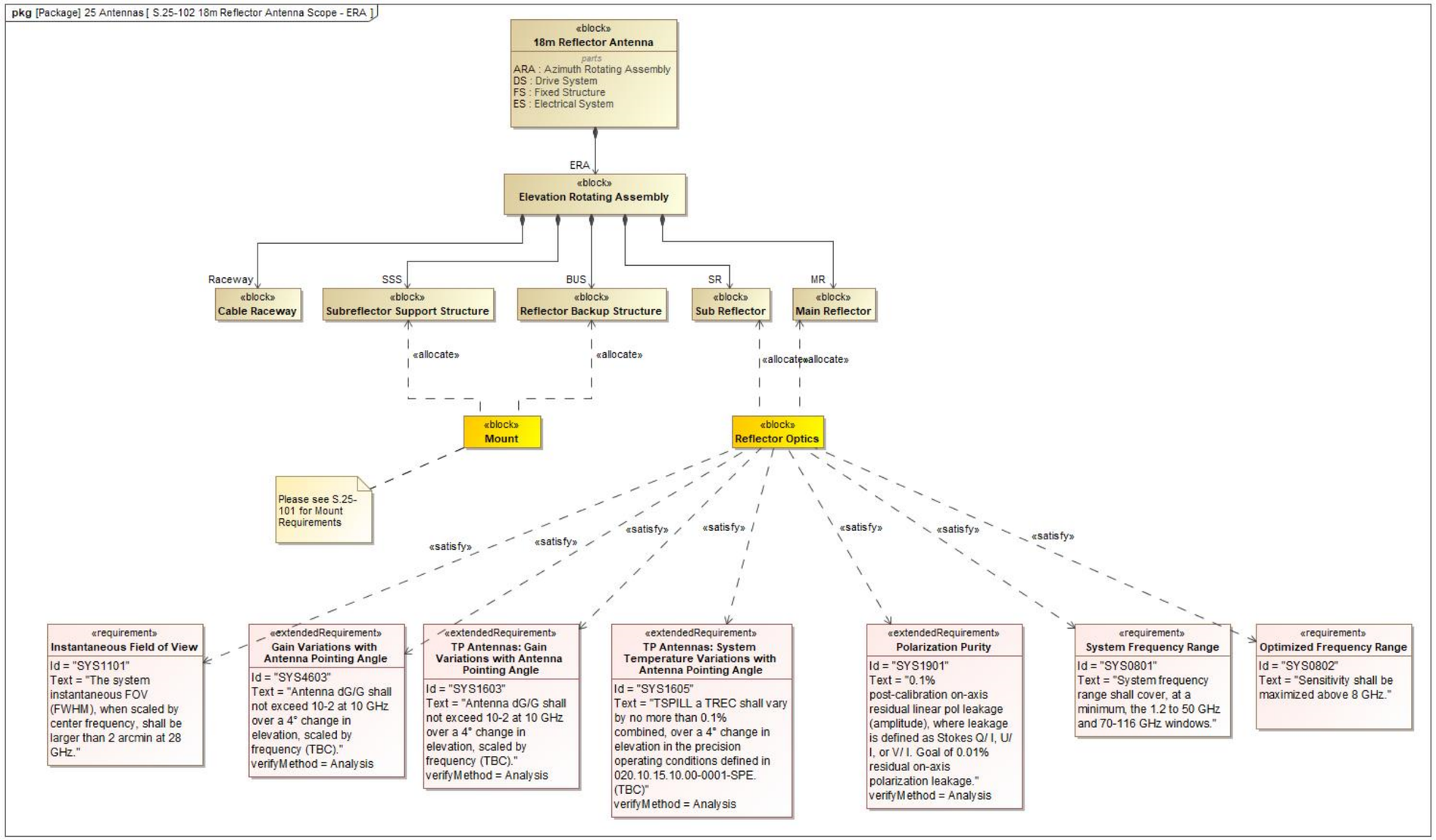
7.3 Diagram: S.25-101 18m Reflector Antenna Scope - ARA

This diagram depicts the scope of the Azimuth Rotating Assembly and Fixed Structure. Both are allocated the role of the mount in the logical model. The mount has a number of L1 requirements it must satisfy directly, noted at the bottom of the drawing. It is also a component of the Antenna block, which is a generalization of the four antenna types in the array. The antenna must satisfy a subset of requirements directly, which are noted above it. These requirements require flow-down to the lower elements of the model.



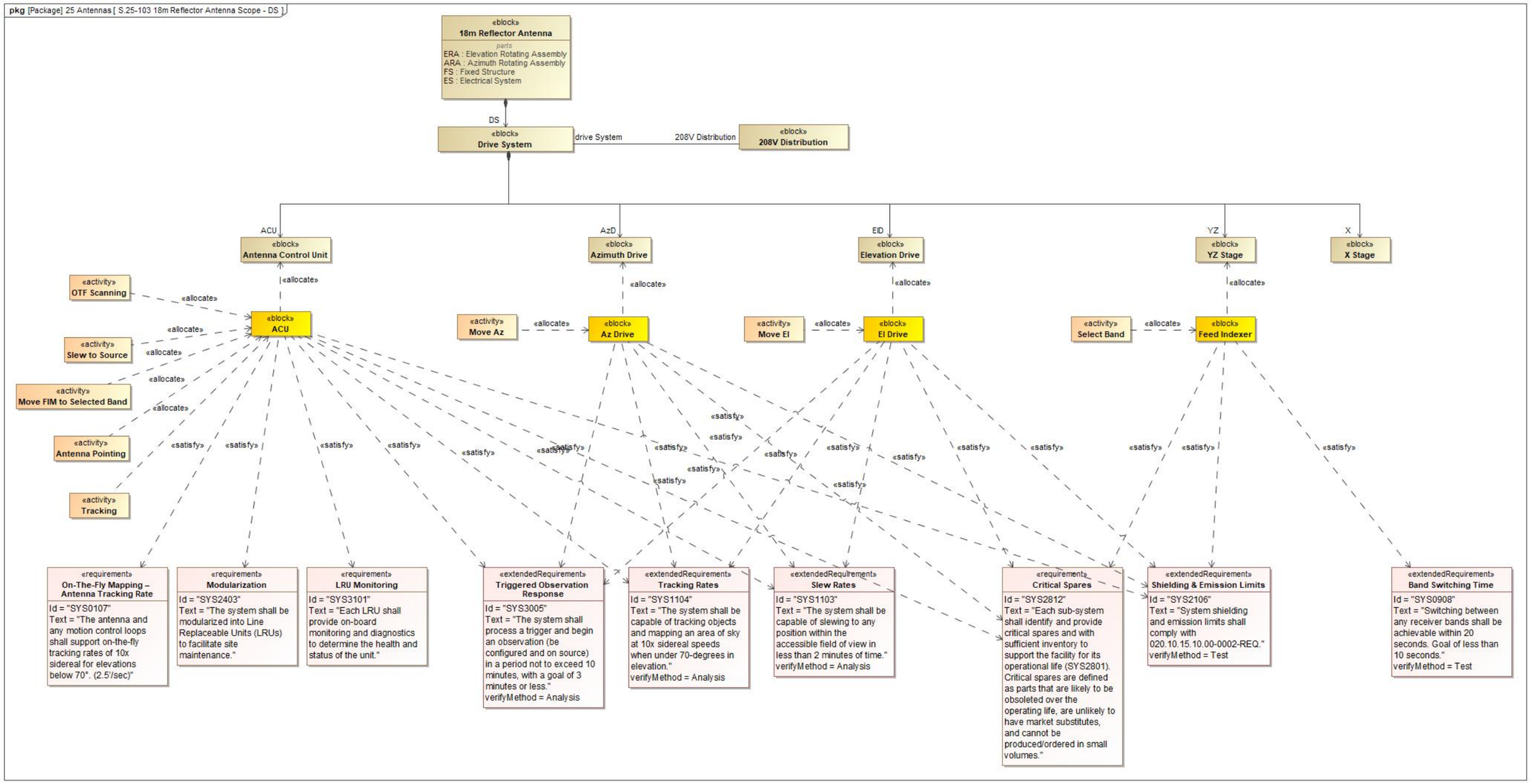
7.4 Diagram: S.25-102 18m Reflector Antenna Scope - ERA

This diagram focuses on the scope of the Elevation Rotating Assembly. As with the Azimuth Rotating Assembly and Fixed Structure, this must also perform the functions of the Mount from the logical model. The associated requirements are shown on figure S.25-101 rather than repeated here. The Sub Reflector and Main Reflector must fulfill the role of the reflector optics whose associated requirements are shown at the bottom of the figure.



7.5 Diagram: S.25-103 18m Reflector Antenna Scope - DS

This diagram presents the scope of the Drive System and its subcomponents. The mapping from the drive system components to blocks in the logical model is shown with the allocate relationship. The activities each logical block must perform are also displayed, as are the L1 requirements with a satisfy relationship to each logical element.



8 Appendix

8.1 Abbreviations and Acronyms

Acronym	Description
AD	Applicable Document
CSP	Central Signal Processor
CSW	Computing and Software
DA	Data Analyst
FSA	Frequency Slice Architecture
FSP	Frequency Slice Processor
GBT	Green Bank Telescope
GUI	Graphical User Interface
HPC	High Performance Computing
IF	Interface (not Intermediate Frequency)
IPT	Integrated Product Team
LO	Local Oscillator
ngVLA	Next Generation VLA
NRAO	National Radio Astronomy Observatory
NRCC	National Research Council of Canada
OST	Observation Scheduling Tool
OVT	Observation Validation Team
PBS	Product Breakdown Structure
PBT	Proposal Builder Tool
PI	Principal Investigator
PHT	Proposal Handling Tool
PST	Proposal Submission Tool
QC	Quality Control
RD	Reference Document
RFI	Radio Frequency Interference
rms	Root Mean Square
RSS	Root of Sum of Squares
SRDP	Science Ready Data Products
TAC	Time Allocation Committee
TBC	To Be Confirmed
TBD	To Be Determined
TP	Total Power
VCC	Very Coarse Channelizer
VLA	Jansky Very Large Array
VLBI	Very Long Baseline Interferometry
WVR	Water Vapor Radiometer

8.2 Notes

The following materials are included in this appendix. These matrices provide the model verification described in drawing **A.00-041 Model Verification**.

L.00-005 ngVLA Logical Model to Requirements Satisfy Matrix: This matrix has the L1 System Requirements in each column and the logical structure elements in each row. "Satisfy" relationships are shown, indicating which elements of the logical model have a role in satisfying a given requirement. The requirement may be satisfied directly by a part or may have an implied relationship: if a component of a system satisfies the requirement the relationship to the system is also shown. The distinction between direct and implied relationships can be seen directly in the architecture model if desired. The "Satisfy Relationships" row and column provide a verification summary, demonstrating that each requirement is satisfied by at least one element of the logical model. Most model elements are expected to satisfy a requirement, but this is not necessary for ancillary systems that support other elements of the model.

L.00-006 Logical Model Behavior Allocation Matrix: This matrix has the logical structure elements in each column and the system behaviors in each row. Behaviors are allocated to blocks within the system. The table shows both direct relationships and implied relationships: if a component of a system is allocated a behavior, this relationship is implied for the larger system too. This distinction can be seen in the architecture model if desired. The "Allocate Relationships" row and column provide a verifications summary, showing that each activity is allocated to at least one block in the model.

S.99-000 ngVLA Logical to Structural Model Allocation Matrix: This matrix has the elements of the structural model in each column and the elements of the logical model in each row. Where an element of the structural model is fulfilling the behaviors and requirements allocated to an element of the logical model, this allocation is shown. As with the previous two matrices, both implied and direct relationships are shown in this table. Given the added complexity of the structural model and the inclusion of ancillary systems necessary for complete operation, the structural model has additional elements and sub-components. Verification that the logical model is fully implemented by the structural model can be seen in the "Allocate Relationships" column, which shows that each logical element is allocated to at least one structural model element.

L.00-005 Logical Model to Requirements - Satisfy Matrix		SATISFY RELATIONSHIPS	SYS2401 Antenna Maintenance Interval	SYS2402 Array Element MTBF	SYS2403 Modularization	SYS2405 Predictive and Self-Diagnostic Function	SYS2406 Configuration Monitoring	SYS2407 Engineering Console	SYS2408 Engineering Database	SYS2303 Calibration Automation	SYS2304 Self-Calibrating Antenna	SYS2305 Single Baseline Data Display	SYS2306 Calibration Data Display	SYS2307 Operator Console	SYS1061 Calibration Efficiency	SYS1062 Calibration Parallelization	SYS1063 Calibration Recall	SYS1064 Relative Flux Scale Calibration Efficiency	SYS1065 Polarization Calibration Efficiency	SYS1066 Bandpass Calibration Efficiency	SYS1067 Gain Calibration Efficiency	SYS1068 Phase Calibration Efficiency	SYS0761 Data Analysis Resources	SYS0731 Archive Period	SYS0732 Archive Products	SYS0733 Proprietary Data Rights	SYS0734 Archive Batch Reprocessing	SYS0735 Archive Backup	SYS0736 Archive User Reprocessing	SYS0738 Proprietary Period	SYS0751 Data Processing Resources	SYS0752 Throughput & Latency	SYS0753 Heterogeneous Arrays	SYS0703 Calibration Pipeline	SYS0721 Imaging Pipeline	SYS0701 Uncalibrated Data	SYS0702 Flagged Data Table	SYS0741 Pulsar Timing Data Product	SYS0742 Pulsar Search Data Product	SYS1501 Delay/Phase Variations Magnitude	SYS1502 SNR Loss to Delay/Phase Variations	SYS1503 Phase Noise	SYS1504 Phase Drift Residual	SYS1505 Absolute Phase Drift
SATISFY RELATIONSHIPS			11	11	30	8	5	6	6	9	3	3	3	3	5	3	7	16	16	20	17	3	6	3	7	3	9	3	7	3	4	4	3	4	4	9	9	3	3	19	18	15	19	19
Logical Structure::10 Proposal Management	Proposal Submission Tool	2																																											
Logical Structure::10 Proposal Management	Observation Preparation Tool	4																																											
Logical Structure::10 Proposal Management	Proposal Builder Tool	2																																											
Logical Structure::10 Proposal Management	Proposal Handling Tool	2																																											
Logical Structure::10 Proposal Management::Views	SciOps	6																																											
Logical Structure::20 Array::Antenna Structure	ACU	8			->																																								
Logical Structure::20 Array::Antenna Structure	Az Drive	5																																											
Logical Structure::20 Array::Antenna Structure	Data Transmitter	5			->																																								
Logical Structure::20 Array::Antenna Structure	Digital Back End	12			->																																								
Logical Structure::20 Array::Antenna Structure	Digitizer	23			->															->	->																			->	->	->	->	->
Logical Structure::20 Array::Antenna Structure	Downconverter	24			->															->	->																			->	->	->	->	->
Logical Structure::20 Array::Antenna Structure	El Drive	5																																											
Logical Structure::20 Array::Antenna Structure	Feed Indexer	3																																											
Logical Structure::20 Array::Antenna Structure	Flux Reference Generator	9																->			->																								
Logical Structure::20 Array::Antenna Structure	Indep Phase Cal System	7			->																																			->	->		->	
Logical Structure::20 Array::Antenna Structure	Mount	15																																						->	->	->	->	->
Logical Structure::20 Array::Antenna Structure	Reflector Optics	7																																											
Logical Structure::20 Array::Antenna Structure	RF Receiver	27			->														->	->	->																			->				->
Logical Structure::20 Array::Antenna Structure	Time & Freq Reference Generator	15			->																																			->	->	->	->	->
Logical Structure::20 Array::Antenna Types	Antenna	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array::Antenna Types	LB Antenna	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array::Antenna Types	Main Antenna	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array::Antenna Types	SBA Antenna	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array::Antenna Types	TP Antenna	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array::Env Monitors	Atm. Delay Monitor System	4																				->																						
Logical Structure::20 Array::Env Monitors	Weather Monitor System	6																																											
Logical Structure::20 Array	Long Baseline Array	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array	Main Array	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array	Short Baseline Array	61	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::20 Array	Total Power Array	62	->	->	->													->	->	->	->																			->	->	->	->	->
Logical Structure::30 Central Reference Distribution	Frequency Reference	5			->																																						->	->
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor	10			->																																			->	->		->	->
Logical Structure::30 Central Reference Distribution	Time Reference	4			->																																							
Logical Structure::30 Central Reference Distribution	Time Reference Distributor	7			->																																							
Logical Structure::40 Central Signal Processing	Beamformer	17			->																																							
Logical Structure::40 Central Signal Processing	Correlator	28			->																																							
Logical Structure::40 Central Signal Processing	Correlator Back End	6			->																																							
Logical Structure::40 Central Signal Processing	Data Buffer	4																																										
Logical Structure::40 Central Signal Processing	Online Calibration System	3																																										
Logical Structure::40 Central Signal Processing	Pulsar Search System	9			->																																							
Logical Structure::40 Central Signal Processing	Pulsar Timing System	12			->																																							
Logical Structure::50 Online Control & Monitoring	Calibration Module	8								->					->	->	->	->	->	->																								
Logical Structure::50 Online Control & Monitoring	Configuration Module	1					->																																					
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor	10				->		->		->	->																																	
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor	26				->		->		->																																		
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor	6				->		->		->																																		
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor	6				->		->		->																																		
Logical Structure::50 Online Control & Monitoring	Data Transmission Module	3																																										
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board	2																																										
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module	2																																		->	->							
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver	3							->																																			
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector	6							->																											->	->							

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SATISFY RELATIONSHIPS	SYS2401 Antenna Maintenance Interval	SYS2402 Array Element MTBF	SYS2403 Modularization	SYS2405 Predictive and Self-Diagnostic Function	SYS2406 Configuration Monitoring	SYS2407 Engineering Console	SYS2408 Engineering Database	SYS2303 Calibration Automation	SYS2304 Self-Calibrating Antenna	SYS2305 Single Baseline Data Display	SYS2306 Calibration Data Display	SYS2307 Operator Console	SYS1061 Calibration Efficiency	SYS1062 Calibration Parallelization	SYS1063 Calibration Recall	SYS1064 Relative Flux Scale Calibration Efficiency	SYS1065 Polarization Calibration Efficiency	SYS1066 Bandpass Calibration Efficiency	SYS1067 Gain Calibration Efficiency	SYS1068 Phase Calibration Efficiency	SYS0761 Data Analysis Resources	SYS0731 Archive Period	SYS0732 Archive Products	SYS0733 Proprietary Data Rights	SYS0734 Archive Batch Reprocessing	SYS0735 Archive Backup	SYS0736 Archive User Reprocessing	SYS0738 Proprietary Period	SYS0751 Data Processing Resources	SYS0752 Throughput & Latency	SYS0753 Heterogeneous Arrays	SYS0703 Calibration Pipeline	SYS0721 Imaging Pipeline	SYS0701 Uncalibrated Data	SYS0702 Flagged Data Table	SYS0741 Pulsar Timing Data Product	SYS0742 Pulsar Search Data Product	SYS1501 Delay/Phase Variations Magnitude	SYS1502 SNR Loss to Delay/Phase Variations	SYS1503 Phase Noise	SYS1504 Phase Drift Residual	SYS1505 Absolute Phase Drift
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Logical Structure::50 Online Control & Monitoring	Operation Module	20											->	->																														
Logical Structure::50 Online Control & Monitoring	QuickLook Module	1										->																																
Logical Structure::50 Online Control & Monitoring	Scheduling Module	4																																										
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Logical Structure::60 Data Archives	Proposal Archive	1																																										
Logical Structure::60 Data Archives	RFI Archive	1																																										
Logical Structure::60 Data Archives	Science Data Archive	11																						->	->	->	->	->	->	->						->	->	->	->					
Logical Structure::60 Data Archives	Staging Storage	1																																										
Logical Structure::60 Data Archives	Telescope Calibration Archive	4								->							->			->																								
Logical Structure::60 Data Archives	Telescope Configuration Archive	2				->	->																																					
Logical Structure::70 Infrastructure	Central Electronics Building	1																																										
Logical Structure::70 Infrastructure	Data Distribution System	1																																										
Logical Structure::70 Infrastructure	Electrical Distribution System	1																																										
Logical Structure::80 Maintenance & Support	Central Repair Facility	1																																										
Logical Structure::80 Maintenance & Support	CMMS Integration Module	0																																										
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System	0																																										
Logical Structure::80 Maintenance & Support	Integrated Support Module	1																																										
Logical Structure::80 Maintenance & Support	Issue Tracking System	0																																										
Logical Structure::90 Commissioning & Development	Development Support Infrastructure	1																																										
Logical Structure::90 Commissioning & Development	Simulation Tool	1																																										
Logical Structure::90 Commissioning & Development	Testing Environment	1																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources	3																					->				->																		
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools	8													->		->	->	->	->	->	->	->																						
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Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System	19																					->		->		->		->		->	->	->	x	x	x	x								
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Logical Structure	Central Signal Processing System	51			->																																							
Logical Structure	Commissioning & Development Systems	5																																										
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Logical Structure	Maintenance & Support Systems	6																																										
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Logical Structure	Offline Subsystem	23																					->		->		->		->		->	->	->	->	->	->	->								
Logical Structure	Online Subsystem	60				->	->	->	->	->	->	->	->	->	->	->	->	->	->	->																->	->							
Logical Structure	Proposal Management System	9																																										

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SYS1201 Input Dynamic Range	SYS1202 Gain Calibration System Dynamic Range	SYS1203 Provision of Variable Attenuators	SYS1204 Input Protection	SYS1205 High-Noise Path	SYS2501 Weather Monitoring	SYS2502 Safety Weather Monitoring	SYS2503 Weather Archive	SYS0801 System Frequency Range	SYS0802 Optimized Frequency Range	SYS0803 Freq. Span A:	SYS0804 Freq. Span B:	SYS0805 Freq. Span C:	SYS0806 Continuity of Frequency Coverage	SYS0001 Functional Modes	SYS0002 Interferometric Mode	SYS0003 Phased Array Mode	SYS0004 Pulsar Timing Mode	SYS0005 Pulsar and Transient Search Mode	SYS0006 VLBI Mode	SYS0007 Total Power Mode	SYS0008 On The Fly Mapping Mode	SYS0009 Solar Observing Mode	SYS0202 Concurrent Interferometric and Phased Array Mode	SYS4601 Interferometric Antennas: Gain Stability	SYS4602 Interferometric Antennas: Relative Gain Stability	SYS4603 Gain Variations with Antenna Pointing Angle	SYS4801 Gain Calibration Reference	SYS1601 TP Antennas: Gain Stability	SYS1603 TP Antennas: Gain Variations with Antenna Pointing Angle	SYS1604 TP Antennas: System Temperature Stability over Time	SYS1605 TP Antennas: System Temperature Variations with Antenna Pointing Angle	SYS1801 TP Antennas: Gain Calibration Reference	SYS0101 Variable Spectral Resolution	SYS0102 Polarization Products	SYS0103 Autocorrelation Products	SYS0104 Commensal Processing	SYS0105 Commensal Low-Frequency System	SYS3001 Standard Observing Modes	SYS3002 Number of Standard Observing Modes	SYS3003 Non-Standard Observing Modes	SYS3004 Triggered Observations	SYS3005 Triggered Observation Response
SATISFY RELATIONSHIPS		**13**	**12**	**13**	**12**	**12**	**1**	**1**	**8**	**13**	**13**	**12**	**12**	**12**	**16**	**4**	**7**	**7**	**8**	**8**	**7**	**7**	**8**	**6**	**9**	**15**	**15**	**17**	**12**	**15**	**16**	**15**	**14**	**12**	**14**	**3**	**3**	**3**	**15**	**5**	**5**	**5**	**3**	**19**
Logical Structure::10 Proposal Management	Proposal Submission Tool																																											
Logical Structure::10 Proposal Management	Observation Preparation Tool																																											
Logical Structure::10 Proposal Management	Proposal Builder Tool																																											
Logical Structure::10 Proposal Management	Proposal Handling Tool																																											
Logical Structure::10 Proposal Management::Views	SciOps																																											
Logical Structure::20 Array::Antenna Structure	ACU																																											->
Logical Structure::20 Array::Antenna Structure	Az Drive																																											->
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Logical Structure::20 Array::Antenna Structure	Downconverter	->		->											->											->	->	->		->	->	->											
Logical Structure::20 Array::Antenna Structure	El Drive																																											->
Logical Structure::20 Array::Antenna Structure	Feed Indexer																																											
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Logical Structure::20 Array::Antenna Structure	Reflector Optics									->	->																	->			->		->											
Logical Structure::20 Array::Antenna Structure	RF Receiver	->			->	->				->	->	->	->	->	->											->	->	->		->	->	->	->											
Logical Structure::20 Array::Antenna Structure	Time & Freq Reference Generator														->																													
Logical Structure::20 Array::Antenna Types	Antenna	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array::Antenna Types	LB Antenna	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array::Antenna Types	Main Antenna	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array::Antenna Types	SBA Antenna	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array::Antenna Types	TP Antenna	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array::Env Monitors	Atm. Delay Monitor System																																											
Logical Structure::20 Array::Env Monitors	Weather Monitor System						->	->	->																																			
Logical Structure::20 Array	Long Baseline Array	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array	Main Array	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array	Short Baseline Array	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::20 Array	Total Power Array	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure::30 Central Reference Distribution	Frequency Reference																																											
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor																																											
Logical Structure::30 Central Reference Distribution	Time Reference																																											
Logical Structure::30 Central Reference Distribution	Time Reference Distributor																																											
Logical Structure::40 Central Signal Processing	Beamformer																	->	->	->	->				->																			
Logical Structure::40 Central Signal Processing	Correlator																->					->	->		->										->	->	->	->	->					
Logical Structure::40 Central Signal Processing	Correlator Back End																																											
Logical Structure::40 Central Signal Processing	Data Buffer																																											
Logical Structure::40 Central Signal Processing	Online Calibration System																																											
Logical Structure::40 Central Signal Processing	Pulsar Search System																			->																								
Logical Structure::40 Central Signal Processing	Pulsar Timing System																		->						->																			
Logical Structure::50 Online Control & Monitoring	Calibration Module																																											
Logical Structure::50 Online Control & Monitoring	Configuration Module																																											
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor																						->	->																				->
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor																->	->	->	->	->	->	->	->	->																			->
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor																																											
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor																																											
Logical Structure::50 Online Control & Monitoring	Data Transmission Module																																											
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board																																											
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module																																											
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver								->																																			
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector								->																																			

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SYS1201 Input Dynamic Range	SYS1202 Gain Calibration System Dynamic Range	SYS1203 Provision of Variable Attenuators	SYS1204 Input Protection	SYS1205 High-Noise Path	SYS2501 Weather Monitoring	SYS2502 Safety Weather Monitoring	SYS2503 Weather Archive	SYS0801 System Frequency Range	SYS0802 Optimized Frequency Range	SYS0803 Freq. Span A:	SYS0804 Freq. Span B:	SYS0805 Freq. Span C:	SYS0806 Continuity of Frequency Coverage	SYS0001 Functional Modes	SYS0002 Interferometric Mode	SYS0003 Phased Array Mode	SYS0004 Pulsar Timing Mode	SYS0005 Pulsar and Transient Search Mode	SYS0006 VLBI Mode	SYS0007 Total Power Mode	SYS0008 On The Fly Mapping Mode	SYS0009 Solar Observing Mode	SYS0202 Concurrent Interferometric and Phased Array Mode	SYS4601 Interferometric Antennas: Gain Stability	SYS4602 Interferometric Antennas: Relative Gain Stability	SYS4603 Gain Variations with Antenna Pointing Angle	SYS4801 Gain Calibration Reference	SYS1601 TP Antennas: Gain Stability	SYS1603 TP Antennas: Gain Variations with Antenna Pointing Angle	SYS1604 TP Antennas: System Temperature Stability over Time	SYS1605 TP Antennas: System Temperature Variations with Antenna Pointing Angle	SYS1801 TP Antennas: Gain Calibration Reference	SYS0101 Variable Spectral Resolution	SYS0102 Polarization Products	SYS0103 Autocorrelation Products	SYS0104 Commensal Processing	SYS0105 Commensal Low-Frequency System	SYS3001 Standard Observing Modes	SYS3002 Number of Standard Observing Modes	SYS3003 Non-Standard Observing Modes	SYS3004 Triggered Observations	SYS3005 Triggered Observation Response
Logical Structure::50 Online Control & Monitoring	Observation Module															->	->	->	->	->	->	->	->	->	->														->	->	->	->	->
Logical Structure::50 Online Control & Monitoring	Operation Module															->	->	->	->	->	->	->	->	->	->																		->
Logical Structure::50 Online Control & Monitoring	QuickLook Module																																										
Logical Structure::50 Online Control & Monitoring	Scheduling Module																																										
Logical Structure::60 Data Archives	Engineering Data Archive								->																																		
Logical Structure::60 Data Archives	Proposal Archive																																										
Logical Structure::60 Data Archives	RFI Archive																																										
Logical Structure::60 Data Archives	Science Data Archive																																										
Logical Structure::60 Data Archives	Staging Storage																																										
Logical Structure::60 Data Archives	Telescope Calibration Archive								->																																		
Logical Structure::60 Data Archives	Telescope Configuration Archive																																										
Logical Structure::70 Infrastructure	Central Electronics Building																																										
Logical Structure::70 Infrastructure	Data Distribution System																																										
Logical Structure::70 Infrastructure	Electrical Distribution System																																										
Logical Structure::80 Maintenance & Support	Central Repair Facility																																										
Logical Structure::80 Maintenance & Support	CMMS Integration Module																																										
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System																																										
Logical Structure::80 Maintenance & Support	Integrated Support Module																																										
Logical Structure::80 Maintenance & Support	Issue Tracking System																																										
Logical Structure::90 Commissioning & Development	Development Support Infrastructure																																										
Logical Structure::90 Commissioning & Development	Simulation Tool																																										
Logical Structure::90 Commissioning & Development	Testing Environment																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System																																						->	->	->		
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces																																										
Logical Structure	Array	->	->	->	->	->				->	->	->	->	->	->											->	->	->	->	->	->	->	->	->	->				->					->
Logical Structure	Central Reference Distribution System																																										
Logical Structure	Central Signal Processing System																->	->	->	->	->	->	->		->									->	->	->	->	->					
Logical Structure	Commissioning & Development Systems																																										
Logical Structure	Data Archive System								->																																		
Logical Structure	Infrastructure Systems																																										
Logical Structure	Maintenance & Support Systems																																										
Logical Structure	ngVLA System	->	->	->	->	->			->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->
Logical Structure	Offline Subsystem																																						->	->	->		
Logical Structure	Online Subsystem								->							->	->	->	->	->	->	->	->	->	->														->	->	->	->	->
Logical Structure	Proposal Management System																																										

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SYS3006 Trigger Override	SYS0201 Phased Aperture	SYS0203 Number of Beams	SYS1901 Polarization Purity	SYS2700 Safety Specification	SYS2701 Sub-system self-monitoring	SYS2702 IT Security	SYS2704 Physical Security	SYS2221 Observation Preparation – Standard Observing Modes	SYS2222 Observation Preparation - Non-Standard Observing modes	SYS2223 Observation Scheduling GUI	SYS2224 Observation Interrupt	SYS2225 Observation Preparation – Standard Observing Mode Flexibility	SYS2302 Observation Scheduling	SYS2211 Proposal Submission – standard observing modes	SYS2212 Proposal Submission – non-standard observing modes.	SYS2213 Scientific Proposal Evaluation	SYS2214 Technical Proposal Evaluation	SYS2201 Provision of Software Tools	SYS1001 Effective Area / Tsys Ratio	SYS1301 Longest Baseline	SYS1302 Shortest Baseline	SYS1303 Zero Spacing / Single Dish Total Power	SYS1304 Integration Time Ratios	SYS1306 Fraction of Occupied Cells	SYS1308 Distribution and Weighting of Visibilities	SYS1401 Highest Spectral Resolution	SYS1402 Number of Spectral Channels	SYS1403 Flexible Spectral Resolution	SYS1404 Doppler Corrections	SYS2104 Self-Generated Spurious Signal Power Level	SYS2105 LO Frequency and Sampler Clock Offsets	SYS2106 Shielding & Emission Limits	SYS0601 Sub-Array Capabilities	SYS0602 Phase Preservation	SYS0603 Sub-Array Composition	SYS0604 Sub-Array Operating Modes	SYS0605 Sub-Array Operating Mode Commensality	SYS0606 Sub-Array Configuration	SYS2601 Antenna System Availability	SYS2602 Centralized Systems Availability	SYS0901 Front End Bandwidth Ratio	SYS0902 Instantaneous Digitized Bandwidth
SATISFY RELATIONSHIPS		**3**	**3**	**3**	**15**	**18**	**18**	**20**	**11**	**5**	**5**	**3**	**3**	**6**	**3**	**4**	**4**	**3**	**9**	**6**	**2**	**2**	**12**	**3**	**2**	**2**	**2**	**5**	**7**	**7**	**7**	**14**	**13**	**31**	**11**	**7**	**10**	**7**	**7**	**13**	**11**	**6**	**12**	**12**
Logical Structure::10 Proposal Management	Proposal Submission Tool															->	->																											
Logical Structure::10 Proposal Management	Observation Preparation Tool									->	->			->					->																									
Logical Structure::10 Proposal Management	Proposal Builder Tool									->	->																																	
Logical Structure::10 Proposal Management	Proposal Handling Tool																	->	->																									
Logical Structure::10 Proposal Management::Views	SciOps									->	->			->		->	->		->																									
Logical Structure::20 Array::Antenna Structure	ACU																																	->										
Logical Structure::20 Array::Antenna Structure	Az Drive																																	->										
Logical Structure::20 Array::Antenna Structure	Data Transmitter																																	->										
Logical Structure::20 Array::Antenna Structure	Digital Back End																																	->										
Logical Structure::20 Array::Antenna Structure	Digitizer																															->	->	->										->
Logical Structure::20 Array::Antenna Structure	Downconverter																															->		->										
Logical Structure::20 Array::Antenna Structure	El Drive																																	->										
Logical Structure::20 Array::Antenna Structure	Feed Indexer																																	->										
Logical Structure::20 Array::Antenna Structure	Flux Reference Generator																																	->										
Logical Structure::20 Array::Antenna Structure	Indep Phase Cal System																																	->										
Logical Structure::20 Array::Antenna Structure	Mount																						->																					
Logical Structure::20 Array::Antenna Structure	Reflector Optics				->																																							
Logical Structure::20 Array::Antenna Structure	RF Receiver				->																													->									->	
Logical Structure::20 Array::Antenna Structure	Time & Freq Reference Generator																															->	->	->										
Logical Structure::20 Array::Antenna Types	Antenna				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array::Antenna Types	LB Antenna				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array::Antenna Types	Main Antenna				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array::Antenna Types	SBA Antenna				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array::Antenna Types	TP Antenna				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array::Env Monitors	Atm. Delay Monitor System																																	->										
Logical Structure::20 Array::Env Monitors	Weather Monitor System																																	->										
Logical Structure::20 Array	Long Baseline Array				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array	Main Array				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array	Short Baseline Array				->	->	->	->	->														->									->	->	->							->		->	->
Logical Structure::20 Array	Total Power Array				->	->	->	->	->														->	->								->	->	->							->		->	->
Logical Structure::30 Central Reference Distribution	Frequency Reference																																											
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor																																	->	->		->							
Logical Structure::30 Central Reference Distribution	Time Reference																																											
Logical Structure::30 Central Reference Distribution	Time Reference Distributor																																	->	->		->							
Logical Structure::40 Central Signal Processing	Beamformer		->	->																															->	->	->	->	->	->				
Logical Structure::40 Central Signal Processing	Correlator																											->	->	->	->				->	->	->	->	->	->				
Logical Structure::40 Central Signal Processing	Correlator Back End																																											
Logical Structure::40 Central Signal Processing	Data Buffer																																											
Logical Structure::40 Central Signal Processing	Online Calibration System																																											
Logical Structure::40 Central Signal Processing	Pulsar Search System																																											
Logical Structure::40 Central Signal Processing	Pulsar Timing System																																											
Logical Structure::50 Online Control & Monitoring	Calibration Module				->																																							
Logical Structure::50 Online Control & Monitoring	Configuration Module																																											
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor																																							->				
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor																											->	->	->	->				->	->	->	->	->	->				
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor																																							->				
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor																																							->				
Logical Structure::50 Online Control & Monitoring	Data Transmission Module																																							->				
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board																																											
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module																																											
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver																																											
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector																																											

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SYS3006 Trigger Override	SYS0201 Phased Aperture	SYS0203 Number of Beams	SYS1901 Polarization Purity	SYS2700 Safety Specification	SYS2701 Sub-system self-monitoring	SYS2702 IT Security	SYS2704 Physical Security	SYS2221 Observation Preparation – Standard Observing Modes	SYS2222 Observation Preparation - Non-Standard Observing modes	SYS2223 Observation Scheduling GUI	SYS2224 Observation Interrupt	SYS2225 Observation Preparation – Standard Observing Mode Flexibility	SYS2302 Observation Scheduling	SYS2211 Proposal Submission – standard observing modes	SYS2212 Proposal Submission – non-standard observing modes.	SYS2213 Scientific Proposal Evaluation	SYS2214 Technical Proposal Evaluation	SYS2201 Provision of Software Tools	SYS1001 Effective Area / Tsys Ratio	SYS1301 Longest Baseline	SYS1302 Shortest Baseline	SYS1303 Zero Spacing / Single Dish Total Power	SYS1304 Integration Time Ratios	SYS1306 Fraction of Occupied Cells	SYS1308 Distribution and Weighting of Visibilities	SYS1401 Highest Spectral Resolution	SYS1402 Number of Spectral Channels	SYS1403 Flexible Spectral Resolution	SYS1404 Doppler Corrections	SYS2104 Self-Generated Spurious Signal Power Level	SYS2105 LO Frequency and Sampler Clock Offsets	SYS2106 Shielding & Emission Limits	SYS0601 Sub-Array Capabilities	SYS0602 Phase Preservation	SYS0603 Sub-Array Composition	SYS0604 Sub-Array Operating Modes	SYS0605 Sub-Array Operating Mode Commensality	SYS0606 Sub-Array Configuration	SYS2601 Antenna System Availability	SYS2602 Centralized Systems Availability	SYS0901 Front End Bandwidth Ratio	SYS0902 Instantaneous Digitized Bandwidth
Logical Structure::50 Online Control & Monitoring	Observation Module																																			->					->				
Logical Structure::50 Online Control & Monitoring	Operation Module	->																																	->	->	->	->	->	->				
Logical Structure::50 Online Control & Monitoring	QuickLook Module																																												
Logical Structure::50 Online Control & Monitoring	Scheduling Module											->	->		->																									->				
Logical Structure::60 Data Archives	Engineering Data Archive																																												
Logical Structure::60 Data Archives	Proposal Archive																			->																									
Logical Structure::60 Data Archives	RFI Archive																		->																										
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Logical Structure::90 Commissioning & Development	Development Support Infrastructure																																												
Logical Structure::90 Commissioning & Development	Simulation Tool																																												
Logical Structure::90 Commissioning & Development	Testing Environment																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System																												->	->	->														
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources																																												
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces													->					->																										
Logical Structure	Array				->	->	->	->	->												->	->	x	x	->	->	->					->	->	->							->		->	->
Logical Structure	Central Reference Distribution System					->	->	->																										->	->		->					->		
Logical Structure	Central Signal Processing System		->	->		->	->	->																				->	->	->	->				->	->	->	->	->	->		->		
Logical Structure	Commissioning & Development Systems					->	->	->																																				
Logical Structure	Data Archive System					->	->	->											->	->																						->		
Logical Structure	Infrastructure Systems					->	->	->																										->								->		
Logical Structure	Maintenance & Support Systems					->	->	->																																				
Logical Structure	ngVLA System	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->
Logical Structure	Offline Subsystem							->						->					->	->									->	->	->														
Logical Structure	Online Subsystem	->			->	->	->	->				->	->		->					->								->	->	->	->				->	->	->	->	->	->		->		
Logical Structure	Proposal Management System							->		->	->			->		->	->	->	->	->																									

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SYS0903 Total Instantaneous Processed Bandwidth	SYS0904 Sub-Bands	SYS0905 Frequency Tunability	SYS0906 Fixed Analog Tunings	SYS0907 Sub-Band Step Size	SYS0908 Band Switching Time	SYS0909 Contiguous Bandwidth	SYS1101 Instantaneous Field of View	SYS1102 Accessible Field of View	SYS1103 Slew Rates	SYS1104 Tracking Rates	SYS2811 Test Fixtures	SYS2812 Critical Spares	SYS2813 System Verification Tools	SYS2801 Design Life	SYS2802 Cost Optimization	SYS2803 Sustainability	SYS3101 LRU Monitoring	SYS3102 LRU Alerts	SYS3103 Monitor Archive	SYS3104 Sub-System Monitoring Screens	SYS3105 Fast Read-Out Modes	SYS0106 On-The-Fly Mapping – Data & Control Rates	SYS0107 On-The-Fly Mapping – Antenna Tracking Rate	SYS2001 Temporal Resolution	SYS2002 Temporal Accuracy	SYS0401 Search Capabilities	SYS0402 Search Sys. Bandwidth	SYS0403 Search Sys. Frequency Resolution	SYS0404 Search Sys. Time Resolution	SYS0405 Polarization	SYS0301 Timing Capabilities	SYS0302 Timing Sys. Bandwidth	SYS0303 Timing Sys. Frequency Resolution	SYS0304 Pulse Profile Bins	SYS0305 Polarization	SYS0306 Pulse Period	SYS0307 Dump Rate	SYS0501 VLBI Recording Capabilities	SYS0502 eVLBI Capabilities
SATISFY RELATIONSHIPS		**17**	**14**	**14**	**13**	**12**	**12**	**15**	**12**	**12**	**15**	**15**	**5**	**43**	**5**	**3**	**1**	**1**	**37**	**7**	**4**	**7**	**3**	**9**	**12**	**4**	**7**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**5**	**4**
Logical Structure::10 Proposal Management	Proposal Submission Tool																																								
Logical Structure::10 Proposal Management	Observation Preparation Tool																																								
Logical Structure::10 Proposal Management	Proposal Builder Tool																																								
Logical Structure::10 Proposal Management	Proposal Handling Tool																																								
Logical Structure::10 Proposal Management::Views	SciOps																																								
Logical Structure::20 Array::Antenna Structure	ACU										->	->		->					->						->																
Logical Structure::20 Array::Antenna Structure	Az Drive										->	->		->																											
Logical Structure::20 Array::Antenna Structure	Data Transmitter													->					->																						
Logical Structure::20 Array::Antenna Structure	Digital Back End	->	->	->		->		->						->					->																						
Logical Structure::20 Array::Antenna Structure	Digitizer							->						->					->																						
Logical Structure::20 Array::Antenna Structure	Downconverter			->	->			->						->					->																						
Logical Structure::20 Array::Antenna Structure	El Drive										->	->		->																											
Logical Structure::20 Array::Antenna Structure	Feed Indexer						->							->																											
Logical Structure::20 Array::Antenna Structure	Flux Reference Generator													->																											
Logical Structure::20 Array::Antenna Structure	Indep Phase Cal System													->					->																						
Logical Structure::20 Array::Antenna Structure	Mount									->	->	->																													
Logical Structure::20 Array::Antenna Structure	Reflector Optics								->																																
Logical Structure::20 Array::Antenna Structure	RF Receiver													->					->																						
Logical Structure::20 Array::Antenna Structure	Time & Freq Reference Generator			->	->			->						->					->																						
Logical Structure::20 Array::Antenna Types	Antenna	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array::Antenna Types	LB Antenna	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array::Antenna Types	Main Antenna	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array::Antenna Types	SBA Antenna	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array::Antenna Types	TP Antenna	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array::Env Monitors	Atm. Delay Monitor System													->					->																						
Logical Structure::20 Array::Env Monitors	Weather Monitor System													->					->																						
Logical Structure::20 Array	Long Baseline Array	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array	Main Array	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array	Short Baseline Array	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::20 Array	Total Power Array	->	->	->	->	->	->	->	->	->	->	->		->					->						->																
Logical Structure::30 Central Reference Distribution	Frequency Reference													->					->																						
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor													->					->																						
Logical Structure::30 Central Reference Distribution	Time Reference													->					->								->														
Logical Structure::30 Central Reference Distribution	Time Reference Distributor													->					->								->														
Logical Structure::40 Central Signal Processing	Beamformer	->												->					->																						
Logical Structure::40 Central Signal Processing	Correlator	->	->											->					->					->		->	->														->
Logical Structure::40 Central Signal Processing	Correlator Back End													->					->					->		->	->														
Logical Structure::40 Central Signal Processing	Data Buffer													->					->					->																->	
Logical Structure::40 Central Signal Processing	Online Calibration System													->					->					->																	
Logical Structure::40 Central Signal Processing	Pulsar Search System													->					->									->	->	->	->	->									
Logical Structure::40 Central Signal Processing	Pulsar Timing System													->					->														->	->	->	->	->	->	->		
Logical Structure::50 Online Control & Monitoring	Calibration Module																																								
Logical Structure::50 Online Control & Monitoring	Configuration Module																																								
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor																			->		->																			
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor																			->		->																		->	
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor																			->		->																			
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor																			->		->																			
Logical Structure::50 Online Control & Monitoring	Data Transmission Module																			->		->																			
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board																		->				->																		
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module																																								
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver																				->																			
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector																		->		->																			

	L.00-005 Logical Model to Requirements - Satisfy Matrix	SYS0903 Total Instantaneous Processed Bandwidth	SYS0904 Sub-Bands	SYS0905 Frequency Tunability	SYS0906 Fixed Analog Tunings	SYS0907 Sub-Band Step Size	SYS0908 Band Switching Time	SYS0909 Contiguous Bandwidth	SYS1101 Instantaneous Field of View	SYS1102 Accessible Field of View	SYS1103 Slew Rates	SYS1104 Tracking Rates	SYS2811 Test Fixtures	SYS2812 Critical Spares	SYS2813 System Verification Tools	SYS2801 Design Life	SYS2802 Cost Optimization	SYS2803 Sustainability	SYS3101 LRU Monitoring	SYS3102 LRU Alerts	SYS3103 Monitor Archive	SYS3104 Sub-System Monitoring Screens	SYS3105 Fast Read-Out Modes	SYS0106 On-The-Fly Mapping – Data & Control Rates	SYS0107 On-The-Fly Mapping – Antenna Tracking Rate	SYS2001 Temporal Resolution	SYS2002 Temporal Accuracy	SYS0401 Search Capabilities	SYS0402 Search Sys. Bandwidth	SYS0403 Search Sys. Frequency Resolution	SYS0404 Search Sys. Time Resolution	SYS0405 Polarization	SYS0301 Timing Capabilities	SYS0302 Timing Sys. Bandwidth	SYS0303 Timing Sys. Frequency Resolution	SYS0304 Pulse Profile Bins	SYS0305 Polarization	SYS0306 Pulse Period	SYS0307 Dump Rate	SYS0501 VLBI Recording Capabilities	SYS0502 eVLBI Capabilities
Logical Structure::50 Online Control & Monitoring	Observation Module																																									
Logical Structure::50 Online Control & Monitoring	Operation Module																																									
Logical Structure::50 Online Control & Monitoring	QuickLook Module																																									
Logical Structure::50 Online Control & Monitoring	Scheduling Module																																									
Logical Structure::60 Data Archives	Engineering Data Archive																																									
Logical Structure::60 Data Archives	Proposal Archive																																									
Logical Structure::60 Data Archives	RFI Archive																																									
Logical Structure::60 Data Archives	Science Data Archive																																									
Logical Structure::60 Data Archives	Staging Storage																								->																	
Logical Structure::60 Data Archives	Telescope Calibration Archive																																									
Logical Structure::60 Data Archives	Telescope Configuration Archive																																									
Logical Structure::70 Infrastructure	Central Electronics Building																																									
Logical Structure::70 Infrastructure	Data Distribution System	->																																								
Logical Structure::70 Infrastructure	Electrical Distribution System																																									
Logical Structure::80 Maintenance & Support	Central Repair Facility															->																										
Logical Structure::80 Maintenance & Support	CMMS Integration Module																																									
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System																																									
Logical Structure::80 Maintenance & Support	Integrated Support Module														->																											
Logical Structure::80 Maintenance & Support	Issue Tracking System																																									
Logical Structure::90 Commissioning & Development	Development Support Infrastructure														->																											
Logical Structure::90 Commissioning & Development	Simulation Tool												->																													
Logical Structure::90 Commissioning & Development	Testing Environment												->																													
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources													->																												
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools																																									
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management																																									
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines																																									
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System													->										->																		
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces																																									
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools																																									
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources													->																												
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources													->																												
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces																																									
Logical Structure	Array	->	->	->	->	->	->	->	->	->	->	->		->					->						->																	
Logical Structure	Central Reference Distribution System													->					->								->																
Logical Structure	Central Signal Processing System	->	->											->					->					->		->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->
Logical Structure	Commissioning & Development Systems												->		->																											
Logical Structure	Data Archive System																																									
Logical Structure	Infrastructure Systems	->																																								
Logical Structure	Maintenance & Support Systems												->		->	->																										
Logical Structure	ngVLA System	->	->	->	->	->	->	->	->	->	->	->	->	->	->	x	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->
Logical Structure	Offline Subsystem													->										->																		
Logical Structure	Online Subsystem																		->	->	->	->	->																	->	->
Logical Structure	Proposal Management System																																									

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Proposal Submission Tool	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	SciOps	ACU	Az Drive	Data Transmitter	Digital Back End	Digitizer	Downconverter	El Drive	Feed Indexer	Flux Reference Generator	Indep Phase Cal System	Mount	Reflector Optics	RF Receiver	Time & Freq Reference Generator	Antenna	LB Antenna	Main Antenna	SBA Antenna	TP Antenna	Atm. Delay Monitor System	Weather Monitor System	Long Baseline Array	Main Array	Short Baseline Array	Total Power Array	Frequency Reference	Frequency Reference Distributor	Time Reference	Time Reference Distributor	Beamformer	Correlator	Correlator Back End	Data Buffer	Pulsar Search System	Pulsar Timing System	Calibration Module	Configuration Module	Antenna Control Supervisor	CSP Control Supervisor	LO Reference Control Supervisor	Timing Control Supervisor	Data Transmission Module	HW Controller Board	Metadata Capture Module	Monitoring Data Archiver	Monitoring Data Collector	Observation Module	Operation Module	QuickLook Module	Scheduling Module
ALLOCATE RELATIONSHIPS			4	4	5	3	6	20	16	13	26	14	14	16	18	14	15	0	0	13	16	50	50	50	50	50	4	17	50	50	50	50	1	14	1	1	33	36	26	14	16	16	32	3	49	28	25	5	4	32	4	7	7	54	20	4	20
System Behaviors	01 Manage Proposal Submission	7	->	->	->	->	->																																																		
System Behaviors::01 Manage Proposal Submission	Observation Preparation(context Observation Preparation Tool)	4		->			->																																																		
System Behaviors::01 Manage Proposal Submission	Proposal Evaluation(context Proposal Submission Tool)	4	->				->																																																		
System Behaviors::01 Manage Proposal Submission	Proposal Submission(context Proposal Submission Tool)	4	->				->																																																		
System Behaviors::01 Manage Proposal Submission	Scheduling Block Definition(context Observation Preparation Tool)	4		->			->																																																		
System Behaviors::01 Manage Proposal Submission	Scheduling Block Generation(context Proposal Builder Tool)	3			->																																																				
System Behaviors::01 Manage Proposal Submission	Telescope Time Allocation(context Proposal Handling Tool)	3				->																																																			
System Behaviors::02 Subarray Management	Allocate Central Signal Processing Resources	4																																											->									->			
System Behaviors::02 Subarray Management	Allocate Subarray Antennas	4																																										->									->			
System Behaviors::02 Subarray Management	Allocate Subarray Resources(context Observation Module)	7																																										->	->	->							x	->		
System Behaviors::02 Subarray Management	Configure Central Signal Processing Resources	4																																											->									->			
System Behaviors::02 Subarray Management	Configure Required Software Modules(context Observation Module)	3																																																			->			
System Behaviors::02 Subarray Management::Configure Subarray Antennas	Configure Downconverters	4																																										->									->			
System Behaviors::02 Subarray Management::Configure Subarray Antennas	Move FIM to Selected Band	16						->							->							->	->	->	->	->			->	->	->	->												->									->			
System Behaviors::02 Subarray Management::Configure Subarray Antennas	Tune LOs	4																																												->								->			
System Behaviors::02 Subarray Management	Configure Subarray Antennas(context Observation Module)	17						->							->							->	->	->	->	->			->	->	->	->												->		->							x			
System Behaviors::02 Subarray Management	Configure Subarray Resources(context Observation Module)	18						->							->							->	->	->	->	->			->	->	->	->												->	->	->							x			
System Behaviors::02 Subarray Management	Create sub-array partition schedule	4																																																				->		->
System Behaviors::02 Subarray Management	Free Subarray Resources	8																																										->	->	->							->	->		->
System Behaviors::02 Subarray Management	Instantiate Required Software Modules	7																																										->	->	->							->	->		
System Behaviors	02 Subarray Management	20						->							->							->	->	->	->	->			->	->	->	->												->	->	->							x	x		->
System Behaviors::03 Schedule Observations	Evaluate Atmospheric Conditions	8																									->	->																->												->
System Behaviors::03 Schedule Observations	Evaluate Observation Priorities	5																																																						->
System Behaviors::03 Schedule Observations	Evaluate RFI Risk	5																																																						->
System Behaviors::03 Schedule Observations	Evaluate System Configuration	5																																																						->
System Behaviors::03 Schedule Observations	Execute Scheduling Algorithm(context Scheduling Module)	11																									->	->																->												x
System Behaviors::03 Schedule Observations	Present Candidate Scheduling Blocks(context Proposal Builder Tool)	3			->																																																			
System Behaviors	03 Schedule Observations(context Scheduling Module)	13			->																						->	->																->												x
System Behaviors	04 Perform Observations	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::04 Perform Observations::01 Data Acquisition	Antenna Pointing	18						->	->					->								->	->	->	->	->			->	->	->	->												->					->				->			
System Behaviors::04 Perform Observations::01 Data Acquisition	Data Digitization	16										->										->	->	->	->	->			->	->	->	->												->					->				->			
System Behaviors::04 Perform Observations::01 Data Acquisition	Data Encoding	16									->											->	->	->	->	->			->	->	->	->												->					->				->			
System Behaviors::04 Perform Observations::01 Data Acquisition	Data Transmission	16								->												->	->	->	->	->			->	->	->	->												->					->				->			
System Behaviors::04 Perform Observations::01 Data Acquisition	Frequency Tuning	17											->								->	->	->	->	->	->			->	->	->	->												->					->				->			
System Behaviors::04 Perform Observations::01 Data Acquisition	Gain Selection	17										->	->									->	->	->	->	->			->	->	->	->												->					->				->			
System Behaviors::04 Perform Observations::01 Data Acquisition	Provide Frequency Offsets	16																			->	->	->	->	->	->			->	->	->	->		->													->									
System Behaviors::04 Perform Observations::01 Data Acquisition	RF Signal Reception	17													->					->		->	->	->	->	->			->	->	->	->												x					x				x			
System Behaviors::04 Perform Observations::01 Data Acquisition	Select Band	16													->							->	->	->	->	->			->	->	->	->												->					->				->			

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Proposal Submission Tool	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	SciOps	ACU	Az Drive	Data Transmitter	Digital Back End	Digitizer	Downconverter	El Drive	Feed Indexer	Flux Reference Generator	Indep Phase Cal System	Mount	Reflector Optics	RF Receiver	Time & Freq Reference Generator	Antenna	LB Antenna	Main Antenna	SBA Antenna	TP Antenna	Atm. Delay Monitor System	Weather Monitor System	Long Baseline Array	Main Array	Short Baseline Array	Total Power Array	Frequency Reference	Frequency Reference Distributor	Time Reference	Time Reference Distributor	Beamformer	Correlator	Correlator Back End	Data Buffer	Pulsar Search System	Pulsar Timing System	Calibration Module	Configuration Module	Antenna Control Supervisor	CSP Control Supervisor	LO Reference Control Supervisor	Timing Control Supervisor	Data Transmission Module	HW Controller Board	Metadata Capture Module	Monitoring Data Archiver	Monitoring Data Collector	Observation Module	Operation Module	QuickLook Module	Scheduling Module
ALLOCATE RELATIONSHIPS			4	4	5	3	6	20	16	13	26	14	14	16	18	14	15	0	0	13	16	50	50	50	50	50	4	17	50	50	50	50	1	14	1	1	33	36	26	14	16	16	32	3	49	28	25	5	4	32	4	7	7	54	20	4	20
System Behaviors::04 Perform Observations	01 Data Acquisition	28						->	->	->	->	->	->	->	->					->	->	->	->	->	->	->			->	->	->	->					->	->							->					->				->			
System Behaviors::04 Perform Observations	02 Single Dish Processing	24									->										->	->	->	->	->	->			->	->	->	->		->			->	->							->	->	->			->				->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Apply Frequency Dependent Gain Corrections	15									->											->	->	->	->	->			->	->	->	->													->									->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Apply Timestamp	15									->											->	->	->	->	->			->	->	->	->													->									->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Clock Recovery	15									->											->	->	->	->	->			->	->	->	->													->									->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Coarse Sideband Separation	15									->											->	->	->	->	->			->	->	->	->													->									->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	FFT(context Digital Back End)	12									->											->	->	->	->	->			->	->	->	->																										
System Behaviors::04 Perform Observations::02 Single Dish Processing	Fine Sideband Separation	7																																			->	->								->									->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	High Power RFI Excision(context Digital Back End)	12									->											->	->	->	->	->			->	->	->	->																										
System Behaviors::04 Perform Observations::02 Single Dish Processing	Offset LO	18																			->	->	->	->	->	->			->	->	->	->		->											->		->							->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Provide Timestamp(context Time Reference Distributor)	3																																		->																						
System Behaviors::04 Perform Observations::02 Single Dish Processing	Requantization	14									->											->	->	->	->	->			->	->	->	->													->												
System Behaviors::04 Perform Observations::02 Single Dish Processing	RFI Excision	8																																			->	->								->												
System Behaviors::04 Perform Observations::02 Single Dish Processing	RFI Flagging	12																																			->	->	->				->																
System Behaviors::04 Perform Observations::02 Single Dish Processing	Sideband Separation(context Digital Back End)	19									x											->	->	->	->	->			->	->	->	->					->	->							->	->								->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Sub-Band Selection	16									->											->	->	->	->	->			->	->	->	->													->					->				->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Total Power Measurement	19									->											->	->	->	->	->			->	->	->	->						->							->	->				->				->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Coarse Delay Tracking Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Coarse Sampler Clock Offset Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Delay Tracking Corrections	4																																			x	x																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Doppler Tracking Correction	6																																			->	->																	->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Fine Delay Tracking Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Fine Sampler Clock Offset Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Fringe Rotation Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply LO Offsetting Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Sampler Clock Offsetting Corrections	4																																			x	x																				
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Timing Synchronization Corrections	4																																			->	->																				
System Behaviors::04 Perform Observations::03 Array Phasing	Calculate Delay Tracking Corrections	6																																								->													->			
System Behaviors::04 Perform Observations::03 Array Phasing	Calculate Fringe Rotation Corrections	4																																								->													->			
System Behaviors::04 Perform Observations::03 Array Phasing	Calculate LO Offsetting Corrections(context Observation Module)	3																																																					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Track Digital LO Mixer Phase(context CSP Control Supervisor)	3																																											->												
System Behaviors::04 Perform Observations	03 Array Phasing	9																																			->	->					->											->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Antenna Data Buffering	4																																					->	->																	
System Behaviors::04 Perform Observations::04 Central Signal Processing	Archive Formatting(context Correlator Back End)	3																																					->																		

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Proposal Submission Tool	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	SciOps	ACU	Az Drive	Data Transmitter	Digital Back End	Digitizer	Downconverter	El Drive	Feed Indexer	Flux Reference Generator	Indep Phase Cal System	Mount	Reflector Optics	RF Receiver	Time & Freq Reference Generator	Antenna	LB Antenna	Main Antenna	SBA Antenna	TP Antenna	Atm. Delay Monitor System	Weather Monitor System	Long Baseline Array	Main Array	Short Baseline Array	Total Power Array	Frequency Reference	Frequency Reference Distributor	Time Reference	Time Reference Distributor	Beamformer	Correlator	Correlator Back End	Data Buffer	Pulsar Search System	Pulsar Timing System	Calibration Module	Configuration Module	Antenna Control Supervisor	CSP Control Supervisor	LO Reference Control Supervisor	Timing Control Supervisor	Data Transmission Module	HW Controller Board	Metadata Capture Module	Monitoring Data Archiver	Monitoring Data Collector	Observation Module	Operation Module	QuickLook Module	Scheduling Module
ALLOCATE RELATIONSHIPS			4	4	5	3	6	20	16	13	26	14	14	16	18	14	15	0	0	13	16	50	50	50	50	50	4	17	50	50	50	50	1	14	1	1	33	36	26	14	16	16	32	3	49	28	25	5	4	32	4	7	7	54	20	4	20
System Behaviors::04 Perform Observations::04 Central Signal Processing	AutoCorrelation(context Correlator)	3																																				x																				
System Behaviors::04 Perform Observations::04 Central Signal Processing	Bandwidth Stitching(context Correlator Back End)	3																																					->																			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Beamforming(context Beamformer)	3																																			->																				
System Behaviors::04 Perform Observations::04 Central Signal Processing	Correlation(context Correlator)	3																																				->																				
System Behaviors::04 Perform Observations::04 Central Signal Processing	CrossCorrelation(context Correlator)	3																																				x																				
System Behaviors::04 Perform Observations::04 Central Signal Processing	Data Decoding	4																																			->	->																				
System Behaviors::04 Perform Observations::04 Central Signal Processing	Pulsar Searching(context Pulsar Search System)	3																																							->																		
System Behaviors::04 Perform Observations::04 Central Signal Processing	Pulsar Timing(context Pulsar Timing System)	3																																								->																	
System Behaviors::04 Perform Observations::04 Central Signal Processing	Visibility Data Buffering	4																																					->	->																			
System Behaviors::04 Perform Observations	04 Central Signal Processing	8																																			->	->	->	->	->	->																	
System Behaviors::04 Perform Observations::05 Calibrations	Apply IQ Sideband Gain Coefficients	15									->											->	->	->	->	->			->	->	->	->					->	->																					
System Behaviors::04 Perform Observations::05 Calibrations	Calculate Geometric Delay	5																																					->				->															
System Behaviors::04 Perform Observations::05 Calibrations	Determine Antenna Positions(context Calibration Module)	3																																									->															
System Behaviors::04 Perform Observations::05 Calibrations	Determine Electronic Delay	5																																					->				->															
System Behaviors::04 Perform Observations::05 Calibrations	Determine Gain Calibration Coefficients	5																																					->				->															
System Behaviors::04 Perform Observations::05 Calibrations	Determine Pointing Model Ciefficients(context Calibration Module)	3																																									->															
System Behaviors::04 Perform Observations::05 Calibrations	Determine Primary Beam Patterns(context Offline Calibration Tools)	2																																																								
System Behaviors::04 Perform Observations::05 Calibrations	Determine TCals(context Offline Calibration Tools)	2																																																								
System Behaviors::04 Perform Observations::05 Calibrations	Estimate Atmospheric Delay	18															->					->	->	->	->	->		->	->	->	->	->							->				x												x			
System Behaviors::04 Perform Observations::05 Calibrations	Estimate WVR Atmospheric Delay Component	15															->					->	->	->	->	->			->	->	->	->											->												->			
System Behaviors::04 Perform Observations::05 Calibrations	Inject Flux Scale reference(context Flux Reference Generator)	12														->						->	->	->	->	->			->	->	->	->																											
System Behaviors::04 Perform Observations::05 Calibrations	Measure Flux Scale Reference(context Correlator Back End)	3																																					->																				
System Behaviors::04 Perform Observations::05 Calibrations	Optimize Antenna Surface(context Offline Calibration Tools)	2																																																								
System Behaviors::04 Perform Observations::05 Calibrations	Optimize Focus and Collimation	7																																									->															
System Behaviors::04 Perform Observations::05 Calibrations	Perform Delay Calibration	22															->					->	->	->	->	->		->	->	->	->	->							->				x												->			
System Behaviors::04 Perform Observations::05 Calibrations	Perform Gain Calibration	20														->						->	->	->	->	->			->	->	->	->							->				->															
System Behaviors::04 Perform Observations::05 Calibrations	Perform Polarization Calibration	7																																									->															
System Behaviors::04 Perform Observations::05 Calibrations	Perform Referenced Pointing Calibration	5																																									->															
System Behaviors::04 Perform Observations::05 Calibrations	Perform Tsys Calibration	7																																									->															
System Behaviors::04 Perform Observations	05 Observatory Calibration	22									->											->	->	->	->	->			->	->	->	->					->	->	->				->															
System Behaviors::04 Perform Observations	06 Online Calibration	23														->	->					->	->	->	->	->		->	->	->	->	->							->				->												->			
System Behaviors::04 Perform Observations	08 Data Recording	4																																																								
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	Move Az(context Az Drive)	12							->													->	->	->	->	->			->	->	->	->																											
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	Move El(context El Drive)	12												->								->	->	->	->	->			->	->	->	->																											

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Proposal Submission Tool	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	SciOps	ACU	Az Drive	Data Transmitter	Digital Back End	Digitizer	Downconverter	El Drive	Feed Indexer	Flux Reference Generator	Indep Phase Cal System	Mount	Reflector Optics	RF Receiver	Time & Freq Reference Generator	Antenna	LB Antenna	Main Antenna	SBA Antenna	TP Antenna	Atm. Delay Monitor System	Weather Monitor System	Long Baseline Array	Main Array	Short Baseline Array	Total Power Array	Frequency Reference	Frequency Reference Distributor	Time Reference	Time Reference Distributor	Beamformer	Correlator	Correlator Back End	Data Buffer	Pulsar Search System	Pulsar Timing System	Calibration Module	Configuration Module	Antenna Control Supervisor	CSP Control Supervisor	LO Reference Control Supervisor	Timing Control Supervisor	Data Transmission Module	HW Controller Board	Metadata Capture Module	Monitoring Data Archiver	Monitoring Data Collector	Observation Module	Operation Module	QuickLook Module	Scheduling Module
ALLOCATE RELATIONSHIPS			4	4	5	3	6	20	16	13	26	14	14	16	18	14	15	0	0	13	16	50	50	50	50	50	4	17	50	50	50	50	1	14	1	1	33	36	26	14	16	16	32	3	49	28	25	5	4	32	4	7	7	54	20	4	20
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	OTF Scanning(context ACU)	18						x	->					->								->	->	->	->	->			->	->	->	->													->					->				->			
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	Tracking(context ACU)	18						x	->					->								->	->	->	->	->			->	->	->	->													->					->				->			
System Behaviors::04 Perform Observations	Archive Ingestion	9																																														->								
System Behaviors::04 Perform Observations	Metadata Capture	5																																																->						
System Behaviors::04 Perform Observations	Quality Assurance	5																																																					->	
System Behaviors::04 Perform Observations	Shift Logging	5																																																			->		
System Behaviors::05 Configure System	Apply Configuration Parameters	10																																									->	->	->	->	->		->							
System Behaviors::05 Configure System	Define Configuration Parameters	5																																									->													
System Behaviors::05 Configure System	Provide Frequency Reference(context Frequency Reference)	3																														->																								
System Behaviors::05 Configure System	Provide Timing Reference(context Time Reference)	3																																->																						
System Behaviors	05 Configure System	10																																									->	->	->	->	->		->							
System Behaviors::06 Monitor Telescope Status	Archive Alerts	6																																																	->	->				
System Behaviors::06 Monitor Telescope Status	Archive Monitor Data	6																																																	->	->				
System Behaviors::06 Monitor Telescope Status	Check for Alert Conditions	4																																																	->	->				
System Behaviors::06 Monitor Telescope Status	Collect Monitor Data(context Metadata Capture Module)	3																																																->					
System Behaviors::06 Monitor Telescope Status	Display Alerts(context Operation Module)	3																																																				->		
System Behaviors::06 Monitor Telescope Status	Display Monitor Data(context Operation Module)	3																																																				->		
System Behaviors::06 Monitor Telescope Status	Measure Analog Monitor Point(context HW Controller Board)	3																																															->							
System Behaviors::06 Monitor Telescope Status	Monitor Antenna System Health	6																																									->					->		->	->				
System Behaviors::06 Monitor Telescope Status	Monitor Central Electronic System Health	9																																										->	->	->	->	->		->	->				
System Behaviors::06 Monitor Telescope Status	Read Digital Register(context HW Controller Board)	3																																														->							
System Behaviors	06 Monitor Telescope Status(context ngVLA System)	14																																									->	->	->	->	->	->	->	->	->		->		
System Behaviors::07 Generate Derived Data Products	De-Disperse Spectra	11																																					->	->															
System Behaviors::07 Generate Derived Data Products	Flag Corrupted Data	10																																							->														
System Behaviors::07 Generate Derived Data Products	Generate Image Cubes	8																																																					
System Behaviors::07 Generate Derived Data Products	Generate Pulse Profiles(context Pulsar Timing System)	11																																					->	x															
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Bandpass Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Flux Scale Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Gain Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Phase Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Polarization Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Tsys Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products	Perform Direction Dependent Offline Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products	Perform Direction Independent Offline Calibration	8																																																					
System Behaviors::07 Generate Derived Data Products	Perform Quality Assurance	9																																																					
System Behaviors	07 Generate Derived Data Products(context ngVLA System)	14																																					->	->	->															
System Behaviors::08 Provide Access to Data Products	Data Product Analysis(context Data Analysis Tools)	1																																																					
System Behaviors::08 Provide Access to Data Products	Data Product Discovery(context Observatory Interfaces)	3																																																					
System Behaviors::08 Provide Access to Data Products	Data Product Retrieval(context Observatory Interfaces)	3																																																					
System Behaviors::08 Provide Access to Data Products	On-demand Post-processing	8																																																					
System Behaviors::08 Provide Access to Data Products	Project Tracking	5																																																					
System Behaviors	08 Provide Access to Data Products(context ngVLA System)	5																																																					

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Proposal Submission Tool	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	SciOps	ACU	Az Drive	Data Transmitter	Digital Back End	Digitizer	Downconverter	El Drive	Feed Indexer	Flux Reference Generator	Indep Phase Cal System	Mount	Reflector Optics	RF Receiver	Time & Freq Reference Generator	Antenna	LB Antenna	Main Antenna	SBA Antenna	TP Antenna	Atm. Delay Monitor System	Weather Monitor System	Long Baseline Array	Main Array	Short Baseline Array	Total Power Array	Frequency Reference	Frequency Reference Distributor	Time Reference	Time Reference Distributor	Beamformer	Correlator	Correlator Back End	Data Buffer	Pulsar Search System	Pulsar Timing System	Calibration Module	Configuration Module	Antenna Control Supervisor	CSP Control Supervisor	LO Reference Control Supervisor	Timing Control Supervisor	Data Transmission Module	HW Controller Board	Metadata Capture Module	Monitoring Data Archiver	Monitoring Data Collector	Observation Module	Operation Module	QuickLook Module	Scheduling Module
ALLOCATE RELATIONSHIPS			4	4	5	3	6	20	16	13	26	14	14	16	18	14	15	0	0	13	16	50	50	50	50	50	4	17	50	50	50	50	1	14	1	1	33	36	26	14	16	16	32	3	49	28	25	5	4	32	4	7	7	54	20	4	20
System Behaviors::09 Support Maintenance	Configuration Management(context Telescope Configuration Archive)	5																																																							
System Behaviors::09 Support Maintenance	Data QuickLook(context QuickLook Module)	3																																																					->	
System Behaviors::09 Support Maintenance	Diagnose System Fault	3																																																						
System Behaviors::09 Support Maintenance	Perform Tier 2 Repairs(context Central Repair Facility)	3																																																						
System Behaviors::09 Support Maintenance	Report Current Configuration	5																																																						
System Behaviors::09 Support Maintenance	Schedule Maintenance(context Computerized Maintenance Management System)	3																																																						
System Behaviors::09 Support Maintenance	Track Historical Configuration(context Telescope Configuration Archive)	3																																																						
System Behaviors::09 Support Maintenance	Track Issues(context Issue Tracking System)	3																																																						
System Behaviors::09 Support Maintenance	Track Maintenance(context Computerized Maintenance Management System)	3																																																						
System Behaviors	09 Support Maintenance(context ngVLA System)	11																																																					->	
System Behaviors::10 Support Development and Commissioning	Offline Testing	4																																																						
System Behaviors::10 Support Development and Commissioning	Online Testing(context ngVLA System)	1																																																						
System Behaviors::10 Support Development and Commissioning	Provide Development Environment(context Development Support Infrastructure)	3																																																						
System Behaviors::10 Support Development and Commissioning	Simulation(context Simulation Tool)	3																																																						
System Behaviors	10 Support Development and Commissioning(context ngVLA System)	5																																																						
System Behaviors::11 Provide Services	Transport Data(context Data Distribution System)	3																																																						
System Behaviors::98 Observations by Intent	Observe Flux Scale Calibrator(context ngVLA System)	1																																																						
System Behaviors::98 Observations by Intent	Observe Gain Calibrator(context ngVLA System)	1																																																						
System Behaviors::98 Observations by Intent	Observe Phase Calibrator(context ngVLA System)	1																																																						
System Behaviors::98 Observations by Intent	Observe Polarization Calibrator(context ngVLA System)	1																																																						
System Behaviors::98 Observations by Intent	Observe Science Targe(context ngVLA System)	1																																																						
System Behaviors::98 Observations by Intent	Observe Source(context ngVLA System)	1																																																						
System Behaviors::98 Observations by Intent	Slew to Source	14						->														->	->	->	->	->			->	->	->	->													->												
System Behaviors::99 Observing Modes	L.03-031 Perform Single Field Synthesis Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform Beamforming Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform Interferometric Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform On The Fly Mosaic Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform Pulsar Search Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform Pulsar Timing Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform Single Field Continuum Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform Spectral Line Single Field Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors::99 Observing Modes	Perform VLBI Observation(context ngVLA System)	48						->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->		->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->			->				->	->		->
System Behaviors	System Operation	83	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->			->	->	->	->	->	->	->	->	->	->	->	->	->		->			->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->	->	->	->	->

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Engineering Data Archive	Proposal Archive	RFI Archive	Science Data Archive	Staging Storage	Telescope Calibration Archive	Telescope Configuration Archive	Central Electronics Building	Data Distribution System	Electrical Distribution System	Central Repair Facility	CMMS Integration Module	Computerized Maintenance Management System	Integrated Support Module	Issue Tracking System	Development Support Infrastructure	Simulation Tool	Testing Environment	Computational Resources	Data Analysis Tools	Data Processing Management	Data Processing Pipelines	Data Processing System	Observatory Interfaces	Offline Calibration Tools	Processing Resources	Processing Storage Resources	Quality Assurance Interfaces	Array	Central Reference Distribution System	Central Signal Processing System	Commissioning & Development Systems	Data Archive System	Infrastructure Systems	Maintenance & Support Systems	ngVLA System	Offline Subsystem	Online Subsystem	Proposal Management System
ALLOCATE RELATIONSHIPS			**8**	**4**	**6**	**6**	**1**	**21**	**11**	**0**	**1**	**0**	**3**	**4**	**4**	**3**	**3**	**3**	**4**	**3**	**16**	**17**	**17**	**17**	**33**	**6**	**16**	**16**	**15**	**5**	**50**	**17**	**54**	**5**	**45**	**1**	**9**	**177**	**38**	**100**	**10**
System Behaviors	01 Manage Proposal Submission	7																																				->			->
System Behaviors::01 Manage Proposal Submission	Observation Preparation(context Observation Preparation Tool)	4																																				->			->
System Behaviors::01 Manage Proposal Submission	Proposal Evaluation(context Proposal Submission Tool)	4																																				->			->
System Behaviors::01 Manage Proposal Submission	Proposal Submission(context Proposal Submission Tool)	4																																				->			->
System Behaviors::01 Manage Proposal Submission	Scheduling Block Definition(context Observation Preparation Tool)	4																																				->			->
System Behaviors::01 Manage Proposal Submission	Scheduling Block Generation(context Proposal Builder Tool)	3																																				->			->
System Behaviors::01 Manage Proposal Submission	Telescope Time Allocation(context Proposal Handling Tool)	3																																				->			->
System Behaviors::02 Subarray Management	Allocate Central Signal Processing Resources	4																																				->		->	
System Behaviors::02 Subarray Management	Allocate Subarray Antennas	4																																				->		->	
System Behaviors::02 Subarray Management	Allocate Subarray Resources(context Observation Module)	7																																				->		->	
System Behaviors::02 Subarray Management	Configure Central Signal Processing Resources	4																																				->		->	
System Behaviors::02 Subarray Management	Configure Required Software Modules(context Observation Module)	3																																				->		->	
System Behaviors::02 Subarray Management::Configure Subarray Antennas	Configure Downconverters	4																																				->		->	
System Behaviors::02 Subarray Management::Configure Subarray Antennas	Move FIM to Selected Band	16																													->							->		->	
System Behaviors::02 Subarray Management::Configure Subarray Antennas	Tune LOs	4																																				->		->	
System Behaviors::02 Subarray Management	Configure Subarray Antennas(context Observation Module)	17																													->							->		->	
System Behaviors::02 Subarray Management	Configure Subarray Resources(context Observation Module)	18																													->							->		->	
System Behaviors::02 Subarray Management	Create sub-array partition schedule	4																																				->		->	
System Behaviors::02 Subarray Management	Free Subarray Resources	8																																				->		->	
System Behaviors::02 Subarray Management	Instantiate Required Software Modules	7																																				->		->	
System Behaviors	02 Subarray Management	20																													->							->		->	
System Behaviors::03 Schedule Observations	Evaluate Atmospheric Conditions	8	->																																->			->		->	
System Behaviors::03 Schedule Observations	Evaluate Observation Priorities	5		->																															->			->		->	
System Behaviors::03 Schedule Observations	Evaluate RFI Risk	5			->																														->			->		->	
System Behaviors::03 Schedule Observations	Evaluate System Configuration	5							->																										->			->		->	
System Behaviors::03 Schedule Observations	Execute Scheduling Algorithm(context Scheduling Module)	11	->	->	->				->																										->			->		->	
System Behaviors::03 Schedule Observations	Present Candidate Scheduling Blocks(context Proposal Builder Tool)	3																																				->			->
System Behaviors	03 Schedule Observations(context Scheduling Module)	13	->	->	->				->																										->			->		->	->
System Behaviors	04 Perform Observations	48						->														->			->		->				->	->	->		->			->	->	->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Antenna Pointing	18																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Data Digitization	16																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Data Encoding	16																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Data Transmission	16																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Frequency Tuning	17																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Gain Selection	17																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Provide Frequency Offsets	16																													->	->						->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	RF Signal Reception	17																													->							->		->	
System Behaviors::04 Perform Observations::01 Data Acquisition	Select Band	16																													->							->		->	

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE REATIONSHIPS	Engineering Data Archive	Proposal Archive	RFI Archive	Science Data Archive	Staging Storage	Telescope Calibration Archive	Telescope Configuration Archive	Central Electronics Building	Data Distribution System	Electrical Distribution System	Central Repair Facility	CMMS Integration Module	Computerized Maintenance Management System	Integrated Support Module	Issue Tracking System	Development Support Infrastructure	Simulation Tool	Testing Environment	Computational Resources	Data Analysis Tools	Data Processing Management	Data Processing Pipelines	Data Processing System	Observatory Interfaces	Offline Calibration Tools	Processing Resources	Processing Storage Resources	Quality Assurance Interfaces	Array	Central Reference Distribution System	Central Signal Processing System	Commissioning & Development Systems	Data Archive System	Infrastructure Systems	Maintenance & Support Systems	ngVLA System	Offline Subsystem	Online Subsystem	Proposal Management System
ALLOCATE RELATIONSHIPS			8	4	6	6	1	21	11	0	1	0	3	4	4	3	3	3	4	3	16	17	17	17	33	6	16	16	15	5	50	17	54	5	45	1	9	177	38	100	10
System Behaviors::04 Perform Observations	01 Data Acquisition	28																													->		->					->		->	
System Behaviors::04 Perform Observations	02 Single Dish Processing	24																													->	->	->					->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Apply Frequency Dependent Gain Corrections	15																													->							->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Apply Timestamp	15																													->							->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Clock Recovery	15																													->							->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Coarse Sideband Separation	15																													->							->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	FFT(context Digital Back End)	12																													->							->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Fine Sideband Separation	7																															->					->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	High Power RFI Excision(context Digital Back End)	12																													->							->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Offset LO	18																													->	->						->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Provide Timestamp(context Time Reference Distributor)	3																														->						->			
System Behaviors::04 Perform Observations::02 Single Dish Processing	Requantization	14																													->							->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	RFI Excision	8			->																												->		->			->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	RFI Flagging	12			->																			->	->								->		->			->	->	->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Sideband Separation(context Digital Back End)	19																													->		->					->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Sub-Band Selection	16																													->							->		->	
System Behaviors::04 Perform Observations::02 Single Dish Processing	Total Power Measurement	19																													->		->					->		->	
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Coarse Delay Tracking Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Coarse Sampler Clock Offset Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Delay Tracking Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Doppler Tracking Correction	6																															->					->		->	
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Fine Delay Tracking Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Fine Sampler Clock Offset Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Fringe Rotation Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply LO Offsetting Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Sampler Clock Offsetting Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Apply Timing Synchronization Corrections	4																															->					->			
System Behaviors::04 Perform Observations::03 Array Phasing	Calculate Delay Tracking Corrections	6						->																											->			->		->	
System Behaviors::04 Perform Observations::03 Array Phasing	Calculate Fringe Rotation Corrections	4																																				->		->	
System Behaviors::04 Perform Observations::03 Array Phasing	Calculate LO Offsetting Corrections(context Observation Module)	3																																				->		->	
System Behaviors::04 Perform Observations::03 Array Phasing	Track Digital LO Mixer Phase(context CSP Control Supervisor)	3																																				->		->	
System Behaviors::04 Perform Observations	03 Array Phasing	9						->																									->		->			->		->	
System Behaviors::04 Perform Observations::04 Central Signal Processing	Antenna Data Buffering	4																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Archive Formatting(context Correlator Back End)	3																															->					->			

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Engineering Data Archive	Proposal Archive	RFI Archive	Science Data Archive	Staging Storage	Telescope Calibration Archive	Telescope Configuration Archive	Central Electronics Building	Data Distribution System	Electrical Distribution System	Central Repair Facility	CMMS Integration Module	Computerized Maintenance Management System	Integrated Support Module	Issue Tracking System	Development Support Infrastructure	Simulation Tool	Testing Environment	Computational Resources	Data Analysis Tools	Data Processing Management	Data Processing Pipelines	Data Processing System	Observatory Interfaces	Offline Calibration Tools	Processing Resources	Processing Storage Resources	Quality Assurance Interfaces	Array	Central Reference Distribution System	Central Signal Processing System	Commissioning & Development Systems	Data Archive System	Infrastructure Systems	Maintenance & Support Systems	ngVLA System	Offline Subsystem	Online Subsystem	Proposal Management System
ALLOCATE RELATIONSHIPS			8	4	6	6	1	21	11	0	1	0	3	4	4	3	3	3	4	3	16	17	17	17	33	6	16	16	15	5	50	17	54	5	45	1	9	177	38	100	10
System Behaviors::04 Perform Observations::04 Central Signal Processing	AutoCorrelation(context Correlator)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Bandwidth Stitching(context Correlator Back End)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Beamforming(context Beamformer)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Correlation(context Correlator)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	CrossCorrelation(context Correlator)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Data Decoding	4																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Pulsar Searching(context Pulsar Search System)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Pulsar Timing(context Pulsar Timing System)	3																															->					->			
System Behaviors::04 Perform Observations::04 Central Signal Processing	Visibility Data Buffering	4																															->					->			
System Behaviors::04 Perform Observations	04 Central Signal Processing	8																															->					->			
System Behaviors::04 Perform Observations::05 Calibrations	Apply IQ Sideband Gain Coefficients	15																													->		->					->			
System Behaviors::04 Perform Observations::05 Calibrations	Calculate Geometric Delay	5																															->					->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Determine Antenna Positions(context Calibration Module)	3																																				->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Determine Electronic Delay	5																															->					->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Determine Gain Calibration Coefficients	5																															->					->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Determine Pointing Model Ciefficients(context Calibration Module)	3																																				->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Determine Primary Beam Patterns(context Offline Calibration Tools)	2																				->				->														
System Behaviors::04 Perform Observations::05 Calibrations	Determine TCals(context Offline Calibration Tools)	2																				->				->														
System Behaviors::04 Perform Observations::05 Calibrations	Estimate Atmospheric Delay	18																													->		->					->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Estimate WVR Atmospheric Delay Component	15																													->							->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Inject Flux Scale reference(context Flux Reference Generator)	12																													->							->			
System Behaviors::04 Perform Observations::05 Calibrations	Measure Flux Scale Reference(context Correlator Back End)	3																															->					->			
System Behaviors::04 Perform Observations::05 Calibrations	Optimize Antenna Surface(context Offline Calibration Tools)	2																				->				->														
System Behaviors::04 Perform Observations::05 Calibrations	Optimize Focus and Collimation	7						->														->				->									->			->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Perform Delay Calibration	22						->																->							->		->		->			->	->	->	
System Behaviors::04 Perform Observations::05 Calibrations	Perform Gain Calibration	20						->																->							->		->		->			->	->	->	
System Behaviors::04 Perform Observations::05 Calibrations	Perform Polarization Calibration	7						->																->											->			->	->	->	
System Behaviors::04 Perform Observations::05 Calibrations	Perform Referenced Pointing Calibration	5						->																											->			->		->	
System Behaviors::04 Perform Observations::05 Calibrations	Perform Tsys Calibration	7						->																->											->			->	->	->	
System Behaviors::04 Perform Observations	05 Observatory Calibration	22						->														->				->					->		->		->			->		->	
System Behaviors::04 Perform Observations	06 Online Calibration	23						->																->							->		->		->			->	->	->	
System Behaviors::04 Perform Observations	08 Data Recording	4				->	->																												->			x			
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	Move Az(context Az Drive)	12																													->							->			
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	Move El(context El Drive)	12																													->							->			

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Engineering Data Archive	Proposal Archive	RFI Archive	Science Data Archive	Staging Storage	Telescope Calibration Archive	Telescope Configuration Archive	Central Electronics Building	Data Distribution System	Electrical Distribution System	Central Repair Facility	CMMS Integration Module	Computerized Maintenance Management System	Integrated Support Module	Issue Tracking System	Development Support Infrastructure	Simulation Tool	Testing Environment	Computational Resources	Data Analysis Tools	Data Processing Management	Data Processing Pipelines	Data Processing System	Observatory Interfaces	Offline Calibration Tools	Processing Resources	Processing Storage Resources	Quality Assurance Interfaces	Array	Central Reference Distribution System	Central Signal Processing System	Commissioning & Development Systems	Data Archive System	Infrastructure Systems	Maintenance & Support Systems	ngVLA System	Offline Subsystem	Online Subsystem	Proposal Management System
ALLOCATE RELATIONSHIPS			8	4	6	6	1	21	11	0	1	0	3	4	4	3	3	3	4	3	16	17	17	17	33	6	16	16	15	5	50	17	54	5	45	1	9	177	38	100	10
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	OTF Scanning(context ACU)	18																													->							->		->	
System Behaviors::04 Perform Observations::99 Pointing Modes & Actions	Tracking(context ACU)	18																													->							->		->	
System Behaviors::04 Perform Observations	Archive Ingestion	9				->																	->		->					->					->			->	->	->	
System Behaviors::04 Perform Observations	Metadata Capture	5				->																													->			->		->	
System Behaviors::04 Perform Observations	Quality Assurance	5																												->								->	->	->	
System Behaviors::04 Perform Observations	Shift Logging	5	->																																->			->		->	
System Behaviors::05 Configure System	Apply Configuration Parameters	10							->																										->			->		->	
System Behaviors::05 Configure System	Define Configuration Parameters	5							->																										->			->		->	
System Behaviors::05 Configure System	Provide Frequency Reference(context Frequency Reference)	3																														->						->			
System Behaviors::05 Configure System	Provide Timing Reference(context Time Reference)	3																														->						->			
System Behaviors	05 Configure System	10							->																										->			->		->	
System Behaviors::06 Monitor Telescope Status	Archive Alerts	6	->																																->			->		->	
System Behaviors::06 Monitor Telescope Status	Archive Monitor Data	6	->																																->			->		->	
System Behaviors::06 Monitor Telescope Status	Check for Alert Conditions	4																																				->		->	
System Behaviors::06 Monitor Telescope Status	Collect Monitor Data(context Metadata Capture Module)	3																																				->		->	
System Behaviors::06 Monitor Telescope Status	Display Alerts(context Operation Module)	3																																				->		->	
System Behaviors::06 Monitor Telescope Status	Display Monitor Data(context Operation Module)	3																																				->		->	
System Behaviors::06 Monitor Telescope Status	Measure Analog Monitor Point(context HW Controller Board)	3																																				->		->	
System Behaviors::06 Monitor Telescope Status	Monitor Antenna System Health	6																																				->		->	
System Behaviors::06 Monitor Telescope Status	Monitor Central Electronic System Health	9																																				->		->	
System Behaviors::06 Monitor Telescope Status	Read Digital Register(context HW Controller Board)	3																																				->		->	
System Behaviors	06 Monitor Telescope Status(context ngVLA System)	14	->																																->			x		->	
System Behaviors::07 Generate Derived Data Products	De-Disperse Spectra	11																			->		->	->	->		->	->				->						->	->		
System Behaviors::07 Generate Derived Data Products	Flag Corrupted Data	10																			->		->	->	x		->	->										->	->	->	
System Behaviors::07 Generate Derived Data Products	Generate Image Cubes	8																			x		x	x	x		->	x										->	->		
System Behaviors::07 Generate Derived Data Products	Generate Pulse Profiles(context Pulsar Timing System)	11																			->		->	->	->		->	->				->						->	->		
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Bandpass Calibration	8																			->		->	->	x		->	->										->	->		
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Flux Scale Calibration	8																			->		->	->	x		->	->										->	->		
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Gain Calibration	8																			x		x	x	x		->	x										->	->		
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Phase Calibration	8																			->		->	->	x		->	->										->	->		
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Polarization Calibration	8																			->		->	->	x		->	->										->	->		
System Behaviors::07 Generate Derived Data Products::Offline Calibrations	Apply Tsys Calibration	8																			->		->	->	x		->	->										->	->		
System Behaviors::07 Generate Derived Data Products	Perform Direction Dependent Offline Calibration	8																			->		->	->	x		->	->										->	->		
System Behaviors::07 Generate Derived Data Products	Perform Direction Independent Offline Calibration	8																			x		x	x	x		->	x										->	->		
System Behaviors::07 Generate Derived Data Products	Perform Quality Assurance	9																			->		->	->	->		->	->	->									->	->		
System Behaviors	07 Generate Derived Data Products(context ngVLA System)	14																			->		->	->	->		->	->	->			->						x	->	->	
System Behaviors::08 Provide Access to Data Products	Data Product Analysis(context Data Analysis Tools)	1																				->																			
System Behaviors::08 Provide Access to Data Products	Data Product Discovery(context Observatory Interfaces)	3																								->												->	->		
System Behaviors::08 Provide Access to Data Products	Data Product Retrieval(context Observatory Interfaces)	3																								->												->	->		
System Behaviors::08 Provide Access to Data Products	On-demand Post-processing	8																			->		->	->	->	->		->										->	->		
System Behaviors::08 Provide Access to Data Products	Project Tracking	5				->																				->									->			->	->		
System Behaviors	08 Provide Access to Data Products(context ngVLA System)	5				->																				->									->			x	->		

L.00-006 Logical Model Behavior Allocation - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Engineering Data Archive	Proposal Archive	RFI Archive	Science Data Archive	Staging Storage	Telescope Calibration Archive	Telescope Configuration Archive	Central Electronics Building	Data Distribution System	Electrical Distribution System	Central Repair Facility	CMMS Integration Module	Computerized Maintenance Management System	Integrated Support Module	Issue Tracking System	Development Support Infrastructure	Simulation Tool	Testing Environment	Computational Resources	Data Analysis Tools	Data Processing Management	Data Processing Pipelines	Data Processing System	Observatory Interfaces	Offline Calibration Tools	Processing Resources	Processing Storage Resources	Quality Assurance Interfaces	Array	Central Reference Distribution System	Central Signal Processing System	Commissioning & Development Systems	Data Archive System	Infrastructure Systems	Maintenance & Support Systems	ngVLA System	Offline Subsystem	Online Subsystem	Proposal Management System
ALLOCATE RELATIONSHIPS			8	4	6	6	1	21	11	0	1	0	3	4	4	3	3	3	4	3	16	17	17	17	33	6	16	16	15	5	50	17	54	5	45	1	9	177	38	100	10
System Behaviors::09 Support Maintenance	Configuration Management(context Telescope Configuration Archive)	5							x					->																					->		->	->			
System Behaviors::09 Support Maintenance	Data QuickLook(context QuickLook Module)	3																																				->		->	
System Behaviors::09 Support Maintenance	Diagnose System Fault	3														->																					x	->			
System Behaviors::09 Support Maintenance	Perform Tier 2 Repairs(context Central Repair Facility)	3											->																								->	->			
System Behaviors::09 Support Maintenance	Report Current Configuration	5							->					->																					->		->	->			
System Behaviors::09 Support Maintenance	Schedule Maintenance(context Computerized Maintenance Management System)	3													->																						->	->			
System Behaviors::09 Support Maintenance	Track Historical Configuration(context Telescope Configuration Archive)	3							->																										->			->			
System Behaviors::09 Support Maintenance	Track Issues(context Issue Tracking System)	3															->																				->	->			
System Behaviors::09 Support Maintenance	Track Maintenance(context Computerized Maintenance Management System)	3													->																						->	->			
System Behaviors	09 Support Maintenance(context ngVLA System)	11							->				->	->	->	->	->																		->		->	x		->	
System Behaviors::10 Support Development and Commissioning	Offline Testing	4																	->	->														->				->			
System Behaviors::10 Support Development and Commissioning	Online Testing(context ngVLA System)	1																																				->			
System Behaviors::10 Support Development and Commissioning	Provide Development Environment(context Development Support Infrastructure)	3																->																->				->			
System Behaviors::10 Support Development and Commissioning	Simulation(context Simulation Tool)	3																	->															->				->			
System Behaviors	10 Support Development and Commissioning(context ngVLA System)	5																->	->	->														->				x			
System Behaviors::11 Provide Services	Transport Data(context Data Distribution System)	3									->																									->		->			
System Behaviors::98 Observations by Intent	Observe Flux Scale Calibrator(context ngVLA System)	1																																				x			
System Behaviors::98 Observations by Intent	Observe Gain Calibrator(context ngVLA System)	1																																				x			
System Behaviors::98 Observations by Intent	Observe Phase Calibrator(context ngVLA System)	1																																				x			
System Behaviors::98 Observations by Intent	Observe Polarization Calibrator(context ngVLA System)	1																																				x			
System Behaviors::98 Observations by Intent	Observe Science Targe(context ngVLA System)	1																																				x			
System Behaviors::98 Observations by Intent	Observe Source(context ngVLA System)	1																																				->			
System Behaviors::98 Observations by Intent	Slew to Source	14																													->							x		->	
System Behaviors::99 Observing Modes	L.03-031 Perform Single Field Synthesis Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform Beamforming Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform Interferometric Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform On The Fly Mosaic Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform Pulsar Search Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform Pulsar Timing Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform Single Field Continuum Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform Spectral Line Single Field Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors::99 Observing Modes	Perform VLBI Observation(context ngVLA System)	48						->														->			->		->				->	->	->		->			x	->	->	
System Behaviors	System Operation	83	->	->	->	->		->	->				->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->	->

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Barometric Pressure	Frozen Water	Liquid Water	Public Networks	PWV	RFI	Sources	Temperature	VLBI Station	Weather	Wind	Back End Assembly	Front End Assembly	Main Array Antenna	Short Baseline Antenna	Total Power Antenna	Digital Signal Processing	ngVLA System	ngVLA System Context	Azimuth Rotating Assembly	Antenna Control Unit	Azimuth Drive	Elevation Drive	X Stage	YZ Stage	Drive System	Primary Backup Structure	Primary Reflector	Secondary Reflector	Secondary Support Structure	Elevation Rotating Assembly	Fixed Structure	6m Reflector Antenna	Cable Raceway	Azimuth Rotating Assembly	Antenna Control Unit	Azimuth Drive	Elevation Drive	X Stage	YZ Stage	Drive System	208V Distribution	Electrical System	Elevation Rotating Assembly	Cable Raceway	Main Reflector	Reflector Backup Structure	Sub Reflector	Subreflector Support Structure	Fixed Structure	Cable Raceway	18m Reflector Antenna	18m Reflector Antenna Context	18m TP Reflector Antenna	Band1Feed	Band2Feed	Band3Feed	Band4Feed	Band5Feed	Band6Feed	Bias Supply
ALLOCATE RELATIONSHIPS			0	0	0	0	0	0	0	0	0	0	0	0	0	24	19	18	14	93	93	12	12	12	12	0	12	15	12	12	12	12	13	12	12	0	12	12	12	12	0	12	15	0	0	13	0	12	12	12	12	12	0	17	18	0	0	0	0	0	0	0	0
Logical Structure::10 Proposal Management	Proposal Submission Tool	2																		->	->																																											
Logical Structure::10 Proposal Management	Observation Preparation Tool	2																		->	->																																										
Logical Structure::10 Proposal Management	Proposal Builder Tool	2																		->	->																																										
Logical Structure::10 Proposal Management	Proposal Handling Tool	2																		->	->																																										
Logical Structure::10 Proposal Management::Views	SciOps	2																		->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	ACU	9														->				->	->		->					->									->					->										->	->									
Logical Structure::20 Antenna Array::Antenna Structure	Az Drive	9														->				->	->			->				->										->				->										->	->									
Logical Structure::20 Antenna Array::Antenna Structure	Data Transmitter	5														->	->	->		->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	Digital Back End	6														->	->	->	->	->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	Digitizer	6														->	->	->		->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	Downconverter	6														->	->	->		->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	El Drive	9														->				->	->				->			->											->				->										->	->									
Logical Structure::20 Antenna Array::Antenna Structure	Feed Indexer	9														->				->	->						->	->													->	->										->	->									
Logical Structure::20 Antenna Array::Antenna Structure	Flux Reference Generator	12														->	->	->		->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	Indep Phase Cal System	1																																																													
Logical Structure::20 Antenna Array::Antenna Structure	Mount	17														->	->			->	->	->							->			->	->	->	->		->									->			->		->	->		->	->									
Logical Structure::20 Antenna Array::Antenna Structure	Reflector Optics	11														->				->	->									->	->		->													->		->		->				->	->									
Logical Structure::20 Antenna Array::Antenna Structure	RF Receiver	14														->	->	->	->	->	->																																										
Logical Structure::20 Antenna Array::Antenna Structure	Time & Freq Reference Generator	6														->	->	->	->	->	->																																										
Logical Structure::20 Antenna Array::Antenna Types	Antenna	48														->	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array::Antenna Types	LB Antenna	48														x	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array::Antenna Types	Main Antenna	48														x	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array::Antenna Types	SBA Antenna	48														->	x	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array::Antenna Types	TP Antenna	48														->	->	x	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array::Env Monitors	Atm. Delay Monitor System	2																		->	->																																										
Logical Structure::20 Antenna Array::Env Monitors	Weather Monitor System	2																		->	->																																										
Logical Structure::20 Antenna Array	Long Baseline Array	48														->	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array	Main Array	48														->	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array	Short Baseline Array	48														->	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::20 Antenna Array	Total Power Array	48														->	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->		->		->	->	->	->	->		->	->									
Logical Structure::30 Central Reference Distribution	Frequency Reference	2																		->	->																																										
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor	2																		->	->																																										
Logical Structure::30 Central Reference Distribution	Time Reference	2																		->	->																																										
Logical Structure::30 Central Reference Distribution	Time Reference Distributor	2																		->	->																																										
Logical Structure::40 Central Signal Processing	Beamformer	2																		->	->																																										
Logical Structure::40 Central Signal Processing	Correlator	2																		->	->																																										

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Barometric Pressure	Frozen Water	Liquid Water	Public Networks	PWV	RFI	Sources	Temperature	VLBI Station	Weather	Wind	Back End Assembly	Front End Assembly	Main Array Antenna	Short Baseline Antenna	Total Power Antenna	Digital Signal Processing	ngVLA System	ngVLA System Context	Azimuth Rotating Assembly	Antenna Control Unit	Azimuth Drive	Elevation Drive	X Stage	YZ Stage	Drive System	Primary Backup Structure	Primary Reflector	Secondary Reflector	Secondary Support Structure	Elevation Rotating Assembly	Fixed Structure	6m Reflector Antenna	Cable Raceway	Azimuth Rotating Assembly	Antenna Control Unit	Azimuth Drive	Elevation Drive	X Stage	YZ Stage	Drive System	208V Distribution	Electrical System	Elevation Rotating Assembly	Cable Raceway	Main Reflector	Reflector Backup Structure	Sub Reflector	Subreflector Support Structure	Fixed Structure	Cable Raceway	18m Reflector Antenna	18m Reflector Antenna Context	18m TP Reflector Antenna	Band1Feed	Band2Feed	Band3Feed	Band4Feed	Band5Feed	Band6Feed	Bias Supply
ALLOCATE RELATIONSHIPS			0	0	0	0	0	0	0	0	0	0	0	0	0	24	19	18	14	93	93	12	12	12	12	0	12	15	12	12	12	12	13	12	12	0	12	12	12	12	0	12	15	0	0	13	0	12	12	12	12	12	0	17	18	0	0	0	0	0	0	0	0
Logical Structure::40 Central Signal Processing	Correlator Back End	2																		->	->																																											
Logical Structure::40 Central Signal Processing	Data Buffer	2																		->	->																																										
Logical Structure::40 Central Signal Processing	Pulsar Search System	2																		->	->																																										
Logical Structure::40 Central Signal Processing	Pulsar Timing System	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Calibration Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Configuration Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Data Transmission Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Observation Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Operation Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	QuickLook Module	2																		->	->																																										
Logical Structure::50 Online Control & Monitoring	Scheduling Module	2																		->	->																																										
Logical Structure::60 Data Archives	Engineering Data Archive	2																		->	->																																										
Logical Structure::60 Data Archives	Proposal Archive	2																		->	->																																										
Logical Structure::60 Data Archives	RFI Archive	2																		->	->																																										
Logical Structure::60 Data Archives	Science Data Archive	2																		->	->																																										
Logical Structure::60 Data Archives	Staging Storage	2																		->	->																																										
Logical Structure::60 Data Archives	Telescope Calibration Archive	2																		->	->																																										
Logical Structure::60 Data Archives	Telescope Configuration Archive	2																		->	->																																										
Logical Structure::70 Infrastructure	Central Electronics Building	2																		->	->																																										
Logical Structure::70 Infrastructure	Data Distribution System	2																		->	->																																										
Logical Structure::70 Infrastructure	Electrical Distribution System	2																		->	->																																										
Logical Structure::80 Maintenance & Support	Central Repair Facility	2																		->	->																																										
Logical Structure::80 Maintenance & Support	CMMS Integration Module	2																		->	->																																										
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System	2																		->	->																																										
Logical Structure::80 Maintenance & Support	Integrated Support Module	2																		->	->																																										
Logical Structure::80 Maintenance & Support	Issue Tracking System	2																		->	->																																										
Logical Structure::90 Commissioning & Development	Development Support Infrastructure	2																		->	->																																										
Logical Structure::90 Commissioning & Development	Simulation Tool	2																		->	->																																										

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Barometric Pressure	Frozen Water	Liquid Water	Public Networks	PWV	RFI	Sources	Temperature	VLBI Station	Weather	Wind	Back End Assembly	Front End Assembly	Main Array Antenna	Short Baseline Antenna	Total Power Antenna	Digital Signal Processing	ngVLA System	ngVLA System Context	Azimuth Rotating Assembly	Antenna Control Unit	Azimuth Drive	Elevation Drive	X Stage	YZ Stage	Drive System	Primary Backup Structure	Primary Reflector	Secondary Reflector	Secondary Support Structure	Elevation Rotating Assembly	Fixed Structure	6m Reflector Antenna	Cable Raceway	Azimuth Rotating Assembly	Antenna Control Unit	Azimuth Drive	Elevation Drive	X Stage	YZ Stage	Drive System	208V Distribution	Electrical System	Elevation Rotating Assembly	Cable Raceway	Main Reflector	Reflector Backup Structure	Sub Reflector	Subreflector Support Structure	Fixed Structure	Cable Raceway	18m Reflector Antenna	18m Reflector Antenna Context	18m TP Reflector Antenna	Band1Feed	Band2Feed	Band3Feed	Band4Feed	Band5Feed	Band6Feed	Bias Supply
ALLOCATE RELATIONSHIPS			0	0	0	0	0	0	0	0	0	0	0	0	0	24	19	18	14	93	93	12	12	12	12	0	12	15	12	12	12	12	13	12	12	0	12	12	12	12	0	12	15	0	0	13	0	12	12	12	12	12	0	17	18	0	0	0	0	0	0	0	0
Logical Structure::90 Commissioning & Development	Testing Environment	2																		->	->																																											
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources	2																		->	->																																										
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces	2																		->	->																																										
Logical Structure	Array	48														->	->	->	->	->	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->			->		->	->	->	->	->		->	->								
Logical Structure	Central Reference Distribution System	2																		->	->																																										
Logical Structure	Central Signal Processing System	2																		->	->																																										
Logical Structure	Commissioning & Development Systems	2																		->	->																																										
Logical Structure	Data Archive System	2																		->	->																																										
Logical Structure	Infrastructure Systems	2																		->	->																																										
Logical Structure	Maintenance & Support Systems	2																		->	->																																										
Logical Structure	ngVLA System	48														->	->	->	->	X	->	->	->	->	->		->	->	->	->	->	->	->	->	->		->	->	->	->		->	->			->		->	->	->	->	->		->	->								
Logical Structure	Offline Subsystem	2																		->	->																																										
Logical Structure	Online Subsystem	2																		->	->																																										
Logical Structure	Proposal Management System	2																		->	->																																										

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	NoiseDiodeAssy-Band1	NoiseDiodeAssy-Band2	NoiseDiodeAssy-Band3	NoiseDiodeAssy-Band4	NoiseDiodeAssy-Band5	NoiseDiodeAssy-Band6	Receiver	Receiver System	Receiver System Context	Receiver-Band1	Receiver-Band2	Receiver-Band3	Receiver-Band4	Receiver-Band5	Receiver-Band6	Compressor	Cryogenics System	Cryogenics System Context	Dewar A	Dewar B	Helium	Helium Fitting	Refrigerator	Vacuum Pump	Vacuum Valve	Integrated Down Converters	Integrated Down Converters Context	IRD Module	IRD-2SB4	IRD-2SB5	IRD-2SB6	IRD-2SB7	IRD-2SB8	IRD-2SB9	IRD-2SB10	IRD-2SB11	IRD-2SB12	IRD-SSB-N1	IRD-SSB-N2	IRD-SSB-N3	Digitizer-Serializer ASIC	SFP	Step Attenuator	Channelizer	Clock Recovery	Complex Mixer	Data Aligner	Data Heuristics	DBE Data Receiver	DBE Framework	DBE Optical Combiner	DBE Processing	DeMux	Digital Back End System	Digital Back End System Context	FFT	Formatter	IQ Sideband Bandpass Corrections	IQ-UL Converter	Multiplexer	Network Switch	Oversampling Polyphase Filter Bank	Requantizer	Resampler
ALLOCATE RELATIONSHIPS			12	12	12	12	12	12	12	13	0	12	12	12	12	12	12	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Logical Structure::10 Proposal Management	Proposal Submission Tool	2																																																																
Logical Structure::10 Proposal Management	Observation Preparation Tool	2																																																																
Logical Structure::10 Proposal Management	Proposal Builder Tool	2																																																																
Logical Structure::10 Proposal Management	Proposal Handling Tool	2																																																																
Logical Structure::10 Proposal Management::Views	SciOps	2																																																																
Logical Structure::20 Antenna Array::Antenna Structure	ACU	9																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Az Drive	9																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Data Transmitter	5																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Digital Back End	6																																																				->										
Logical Structure::20 Antenna Array::Antenna Structure	Digitizer	6																									->																																							
Logical Structure::20 Antenna Array::Antenna Structure	Downconverter	6																									->																																							
Logical Structure::20 Antenna Array::Antenna Structure	El Drive	9																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Feed Indexer	9																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Flux Reference Generator	12	->	->	->	->	->	->		->																																																								
Logical Structure::20 Antenna Array::Antenna Structure	Indep Phase Cal System	1																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Mount	17																																																																
Logical Structure::20 Antenna Array::Antenna Structure	Reflector Optics	11																																																																
Logical Structure::20 Antenna Array::Antenna Structure	RF Receiver	14							->	x		->	->	->	->	->	->																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Time & Freq Reference Generator	6																																																																
Logical Structure::20 Antenna Array::Antenna Types	Antenna	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array::Antenna Types	LB Antenna	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array::Antenna Types	Main Antenna	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array::Antenna Types	SBA Antenna	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array::Antenna Types	TP Antenna	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array::Env Monitors	Atm. Delay Monitor System	2																																																																
Logical Structure::20 Antenna Array::Env Monitors	Weather Monitor System	2																																																																
Logical Structure::20 Antenna Array	Long Baseline Array	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array	Main Array	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array	Short Baseline Array	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::20 Antenna Array	Total Power Array	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																												->										
Logical Structure::30 Central Reference Distribution	Frequency Reference	2																																																																
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor	2																																																																
Logical Structure::30 Central Reference Distribution	Time Reference	2																																																																
Logical Structure::30 Central Reference Distribution	Time Reference Distributor	2																																																																
Logical Structure::40 Central Signal Processing	Beamformer	2																																																																
Logical Structure::40 Central Signal Processing	Correlator	2																																																																

	S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix	ALLOCATE RELATIONSHIPS	NoiseDiodeAssy-Band1	NoiseDiodeAssy-Band2	NoiseDiodeAssy-Band3	NoiseDiodeAssy-Band4	NoiseDiodeAssy-Band5	NoiseDiodeAssy-Band6	Receiver	Receiver System	Receiver System Context	Receiver-Band1	Receiver-Band2	Receiver-Band3	Receiver-Band4	Receiver-Band5	Receiver-Band6	Compressor	Cryogenics System	Cryogenics System Context	Dewar A	Dewar B	Helium	Helium Fitting	Refrigerator	Vacuum Pump	Vacuum Valve	Integrated Down Converters	Integrated Down Converters Context	IRD Module	IRD-2SB4	IRD-2SB5	IRD-2SB6	IRD-2SB7	IRD-2SB8	IRD-2SB9	IRD-2SB10	IRD-2SB11	IRD-2SB12	IRD-SSB-N1	IRD-SSB-N2	IRD-SSB-N3	Digitizer-Serializer ASIC	SFP	Step Attenuator	Channelizer	Clock Recovery	Complex Mixer	Data Aligner	Data Heuristics	DBE Data Receiver	DBE Framework	DBE Optical Combiner	DBE Processing	DeMux	Digital Back End System	Digital Back End System Context	FFT	Formatter	IQ Sideband Bandpass Corrections	IQ-UL Converter	Multiplexer	Network Switch	Oversampling Polyphase Filter Bank	Requantizer	Resampler
ALLOCATE RELATIONSHIPS			12	12	12	12	12	12	12	13	0	12	12	12	12	12	12	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Logical Structure::40 Central Signal Processing	Correlator Back End	2																																																																
Logical Structure::40 Central Signal Processing	Data Buffer	2																																																															
Logical Structure::40 Central Signal Processing	Pulsar Search System	2																																																															
Logical Structure::40 Central Signal Processing	Pulsar Timing System	2																																																															
Logical Structure::50 Online Control & Monitoring	Calibration Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Configuration Module	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring	Data Transmission Module	2																																																															
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board	2																																																															
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver	2																																																															
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector	2																																																															
Logical Structure::50 Online Control & Monitoring	Observation Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Operation Module	2																																																																
Logical Structure::50 Online Control & Monitoring	QuickLook Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Scheduling Module	2																																																															
Logical Structure::60 Data Archives	Engineering Data Archive	2																																																															
Logical Structure::60 Data Archives	Proposal Archive	2																																																															
Logical Structure::60 Data Archives	RFI Archive	2																																																															
Logical Structure::60 Data Archives	Science Data Archive	2																																																															
Logical Structure::60 Data Archives	Staging Storage	2																																																															
Logical Structure::60 Data Archives	Telescope Calibration Archive	2																																																															
Logical Structure::60 Data Archives	Telescope Configuration Archive	2																																																															
Logical Structure::70 Infrastructure	Central Electronics Building	2																																																															
Logical Structure::70 Infrastructure	Data Distribution System	2																																																															
Logical Structure::70 Infrastructure	Electrical Distribution System	2																																																															
Logical Structure::80 Maintenance & Support	Central Repair Facility	2																																																														
Logical Structure::80 Maintenance & Support	CMMS Integration Module	2																																																															
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System	2																																																															
Logical Structure::80 Maintenance & Support	Integrated Support Module	2																																																															
Logical Structure::80 Maintenance & Support	Issue Tracking System	2																																																															
Logical Structure::90 Commissioning & Development	Development Support Infrastructure	2																																																															
Logical Structure::90 Commissioning & Development	Simulation Tool	2																																																															

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S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	NoiseDiodeAssy-Band1	NoiseDiodeAssy-Band2	NoiseDiodeAssy-Band3	NoiseDiodeAssy-Band4	NoiseDiodeAssy-Band5	NoiseDiodeAssy-Band6	Receiver	Receiver System	Receiver System Context	Receiver-Band1	Receiver-Band2	Receiver-Band3	Receiver-Band4	Receiver-Band5	Receiver-Band6	Compressor	Cryogenics System	Cryogenics System Context	Dewar A	Dewar B	Helium	Helium Fitting	Refrigerator	Vacuum Pump	Vacuum Valve	Integrated Down Converters	Integrated Down Converters Context	IRD Module	IRD-2SB4	IRD-2SB5	IRD-2SB6	IRD-2SB7	IRD-2SB8	IRD-2SB9	IRD-2SB10	IRD-2SB11	IRD-2SB12	IRD-SSB-N1	IRD-SSB-N2	IRD-SSB-N3	Digitizer-Serializer ASIC	SFP	Step Attenuator	Channelizer	Clock Recovery	Complex Mixer	Data Aligner	Data Heuristics	DBE Data Receiver	DBE Framework	DBE Optical Combiner	DBE Processing	DeMux	Digital Back End System	Digital Back End System Context	FFT	Formatter	IQ Sideband Bandpass Corrections	IQ-UL Converter	Multiplexer	Network Switch	Oversampling Polyphase Filter Bank	Requantizer	Resampler
ALLOCATE RELATIONSHIPS			12	12	12	12	12	12	12	13	0	12	12	12	12	12	12	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Logical Structure::90 Commissioning & Development	Testing Environment	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces	2																																																															
Logical Structure	Array	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																													->										
Logical Structure	Central Reference Distribution System	2																																																															
Logical Structure	Central Signal Processing System	2																																																															
Logical Structure	Commissioning & Development Systems	2																																																															
Logical Structure	Data Archive System	2																																																															
Logical Structure	Infrastructure Systems	2																																																															
Logical Structure	Maintenance & Support Systems	2																																																															
Logical Structure	ngVLA System	48	->	->	->	->	->	->	->	->		->	->	->	->	->	->											->																													->										
Logical Structure	Offline Subsystem	2																																																															
Logical Structure	Online Subsystem	2																																																															
Logical Structure	Proposal Management System	2																																																															

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Return to Phase Monitor	RFI Detector / Exciser	Timestamp Generator	Data Transmission System	Data Transmission System Context	DTS Optical Mux	DTS Transmitters	Optical Amplifiers	Antenna Time & Freq Reference System Context	Antenna Time & Frequency Reference System	LO Generator	Primary Reference Generator	Sampler Clock Generator	Antenna Round Trip Phase System Context	Optical Reflector	Round Trip Phase System	RTP Monitor	MC Hardware	MC Hardware Context	MC Interface Board	MC Interface Module	48V Supply	DC Distribution Module	DC Power Supply System	DC Power Supply System Context	Antenna BMR Packaging	Antenna BMR Packaging Context	Back End Bin	Back End Environmental Enclosure	Back End Rack	BE Fiber Bulkhead	BE Rack Bulkhead	Coax Splitter/Combiner	FE Fiber Bulkhead	Front End Environmental Enclosure	Front End Fixed Platform	IRD Bin A	IRD Bin B	MC Bin	WR10-Splitter	WR22-Splitter	Back End Thermal Regulator	Environmental Control System	Environmental Control System Context	Front End Thermal Regulator	WVR Feed	WVR Receiver	WVR Reflector	WVR Spectrometer	WVR System	Frequency Reference Distributor	Primary Frequency Reference	Primary Time Reference	Reference Signal Distribution System	Reference Signal Distribution System Context	Time Reference Distributor	Central Signal Processor	Central Signal Processor Context	Coarse Channelizer	Correlator-Beamformer	Frequency Slice Processor	Local Cooling Distribution	Local Monitor Control System	Local Power Distribution	Network Switch
ALLOCATE RELATIONSHIPS			0	0	0	12	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	3	3	6	34	3	6	17	0	4	0	0	0	0	0
Logical Structure::10 Proposal Management	Proposal Submission Tool	2																																																																					
Logical Structure::10 Proposal Management	Observation Preparation Tool	2																																																																				
Logical Structure::10 Proposal Management	Proposal Builder Tool	2																																																																				
Logical Structure::10 Proposal Management	Proposal Handling Tool	2																																																																				
Logical Structure::10 Proposal Management::Views	SciOps	2																																																																				
Logical Structure::20 Antenna Array::Antenna Structure	ACU	9																																																							->												
Logical Structure::20 Antenna Array::Antenna Structure	Az Drive	9																																																						->												
Logical Structure::20 Antenna Array::Antenna Structure	Data Transmitter	5				->																																																	->			->								
Logical Structure::20 Antenna Array::Antenna Structure	Digital Back End	6																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Digitizer	6																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Downconverter	6																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	El Drive	9																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Feed Indexer	9																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Flux Reference Generator	12																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Indep Phase Cal System	1																																																		->												
Logical Structure::20 Antenna Array::Antenna Structure	Mount	17																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Reflector Optics	11																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	RF Receiver	14																																																					->												
Logical Structure::20 Antenna Array::Antenna Structure	Time & Freq Reference Generator	6										->																																										->												
Logical Structure::20 Antenna Array::Antenna Types	Antenna	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array::Antenna Types	LB Antenna	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array::Antenna Types	Main Antenna	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array::Antenna Types	SBA Antenna	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array::Antenna Types	TP Antenna	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array::Env Monitors	Atm. Delay Monitor System	2																																																																		
Logical Structure::20 Antenna Array::Env Monitors	Weather Monitor System	2																																																																		
Logical Structure::20 Antenna Array	Long Baseline Array	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array	Main Array	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array	Short Baseline Array	48				->						->																																							->				->			->								
Logical Structure::20 Antenna Array	Total Power Array	48				->						->																																							->				->			->								
Logical Structure::30 Central Reference Distribution	Frequency Reference	2																																																			->		->	->	->			->								
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor	2																																																			->		->	->	->			->								
Logical Structure::30 Central Reference Distribution	Time Reference	2																																																				->	->	->	->		->								
Logical Structure::30 Central Reference Distribution	Time Reference Distributor	2																																																					->	->	->	->		->								
Logical Structure::40 Central Signal Processing	Beamformer	2																																																						->		->			->								
Logical Structure::40 Central Signal Processing	Correlator	2																																																						->		->			->								

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Return to Phase Monitor	RFI Detector / Exciser	Timestamp Generator	Data Transmission System	Data Transmission System Context	DTS Optical Mux	DTS Transmitters	Optical Amplifiers	Antenna Time & Freq Reference System Context	Antenna Time & Frequency Reference System	LO Generator	Primary Reference Generator	Sampler Clock Generator	Antenna Round Trip Phase System Context	Optical Reflector	Round Trip Phase System	RTP Monitor	MC Hardware	MC Hardware Context	MC Interface Board	MC Interface Module	48V Supply	DC Distribution Module	DC Power Supply System	DC Power Supply System Context	Antenna BMR Packaging	Antenna BMR Packaging Context	Back End Bin	Back End Environmental Enclosure	Back End Rack	BE Fiber Bulkhead	BE Rack Bulkhead	Coax Splitter/Combiner	FE Fiber Bulkhead	Front End Environmental Enclosure	Front End Fixed Platform	IRD Bin A	IRD Bin B	MC Bin	WR10-Splitter	WR22-Splitter	Back End Thermal Regulator	Environmental Control System	Environmental Control System Context	Front End Thermal Regulator	WVR Feed	WVR Receiver	WVR Reflector	WVR Spectrometer	WVR System	Frequency Reference Distributor	Primary Frequency Reference	Primary Time Reference	Reference Signal Distribution System	Reference Signal Distribution System Context	Time Reference Distributor	Central Signal Processor	Central Signal Processor Context	Coarse Channelizer	Correlator-Beamformer	Frequency Slice Processor	Local Cooling Distribution	Local Monitor Control System	Local Power Distribution	Network Switch
ALLOCATE RELATIONSHIPS			0	0	0	12	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	3	3	6	34	3	6	17	0	4	0	0	0	0	0
Logical Structure::40 Central Signal Processing	Correlator Back End	2																																																																
Logical Structure::40 Central Signal Processing	Data Buffer	2																																																																
Logical Structure::40 Central Signal Processing	Pulsar Search System	2																																																				->		->								
Logical Structure::40 Central Signal Processing	Pulsar Timing System	2																																																				->		->								
Logical Structure::50 Online Control & Monitoring	Calibration Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Configuration Module	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor	2																																																															
Logical Structure::50 Online Control & Monitoring	Data Transmission Module	2																																																															
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board	2																																																															
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver	2																																																															
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector	2																																																															
Logical Structure::50 Online Control & Monitoring	Observation Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Operation Module	2																																																															
Logical Structure::50 Online Control & Monitoring	QuickLook Module	2																																																															
Logical Structure::50 Online Control & Monitoring	Scheduling Module	2																																																															
Logical Structure::60 Data Archives	Engineering Data Archive	2																																																															
Logical Structure::60 Data Archives	Proposal Archive	2																																																															
Logical Structure::60 Data Archives	RFI Archive	2																																																															
Logical Structure::60 Data Archives	Science Data Archive	2																																																															
Logical Structure::60 Data Archives	Staging Storage	2																																																															
Logical Structure::60 Data Archives	Telescope Calibration Archive	2																																																															
Logical Structure::60 Data Archives	Telescope Configuration Archive	2																																																															
Logical Structure::70 Infrastructure	Central Electronics Building	2																																																															
Logical Structure::70 Infrastructure	Data Distribution System	2																																																															
Logical Structure::70 Infrastructure	Electrical Distribution System	2																																																															
Logical Structure::80 Maintenance & Support	Central Repair Facility	2																																																															
Logical Structure::80 Maintenance & Support	CMMS Integration Module	2																																																															
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System	2																																																															
Logical Structure::80 Maintenance & Support	Integrated Support Module	2																																																															
Logical Structure::80 Maintenance & Support	Issue Tracking System	2																																																															
Logical Structure::90 Commissioning & Development	Development Support Infrastructure	2																																																															
Logical Structure::90 Commissioning & Development	Simulation Tool	2																																																															

	S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix	ALLOCATE RELATIONSHIPS	Return to Phase Monitor	RFI Detector / Exciser	Timestamp Generator	Data Transmission System	Data Transmission System Context	DTS Optical Mux	DTS Transmitters	Optical Amplifiers	Antenna Time & Freq Reference System Context	Antenna Time & Frequency Reference System	LO Generator	Primary Reference Generator	Sampler Clock Generator	Antenna Round Trip Phase System Context	Optical Reflector	Round Trip Phase System	RTP Monitor	MC Hardware	MC Hardware Context	MC Interface Board	MC Interface Module	48V Supply	DC Distribution Module	DC Power Supply System	DC Power Supply System Context	Antenna BMR Packaging	Antenna BMR Packaging Context	Back End Bin	Back End Environmental Enclosure	Back End Rack	BE Fiber Bulkhead	BE Rack Bulkhead	Coax Splitter/Combiner	FE Fiber Bulkhead	Front End Environmental Enclosure	Front End Fixed Platform	IRD Bin A	IRD Bin B	MC Bin	WR10-Splitter	WR22-Splitter	Back End Thermal Regulator	Environmental Control System	Environmental Control System Context	Front End Thermal Regulator	WVR Feed	WVR Receiver	WVR Reflector	WVR Spectrometer	WVR System	Frequency Reference Distributor	Primary Frequency Reference	Primary Time Reference	Reference Signal Distribution System	Reference Signal Distribution System Context	Time Reference Distributor	Central Signal Processor	Central Signal Processor Context	Coarse Channelizer	Correlator-Beamformer	Frequency Slice Processor	Local Cooling Distribution	Local Monitor Control System	Local Power Distribution	Network Switch
ALLOCATE RELATIONSHIPS			0	0	0	12	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	3	3	6	34	3	6	17	0	4	0	0	0	0	0
Logical Structure::90 Commissioning & Development	Testing Environment	2																																																																
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources	2																																																															
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces	2																																																															
Logical Structure	Array	48				->						->																																								->					->			->							
Logical Structure	Central Reference Distribution System	2																																																	->	->	->	x	->	->		->							
Logical Structure	Central Signal Processing System	2																																																						->		x			->					
Logical Structure	Commissioning & Development Systems	2																																																																
Logical Structure	Data Archive System	2																																																																
Logical Structure	Infrastructure Systems	2																																																																
Logical Structure	Maintenance & Support Systems	2																																																																
Logical Structure	ngVLA System	48				->						->																																								->	->	->	->	->	->	->	->	->		->					
Logical Structure	Offline Subsystem	2																																																																
Logical Structure	Online Subsystem	2																																																																
Logical Structure	Proposal Management System	2																																																																

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Pulsar Search Back End	Pulsar Timing Back End	PWR	COTS Integration	COTS Software	CMMS	CMMS Integration Module	Issue Tracking System	Support Module	Offline Sub-System	Workflow Manager	Pipeline System	Archive Access Tool	QA Tool	Archive Ingestor	Archive Streamer	Data Fetcher	Fetching IF	Ingestion IF	QA IF	Science Archive	Online Sub-System	Telescope Calibration	Antenna Supervisor	Array Monitoring IF	Array Monitoring Packet	Array Supervisor	CSP Supervisor	Metadata Capturer	Science Metadata	Science Metadata IF	RFI Monitor	Weather Monitor	RFI Monitoring Data Packet	RFI Monitoring IF	Observation Scheduling Tool	Weather Data Packet	Weather Monitoring IF	Proposal Management Sub-System	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	Proposal Submission Tool	Software Components	Antenna Computing Equipment	Antenna Network	Antenna Rack Power Distribution	Antenna Supervisory Computer	Antenna Switch	Module Interface Board	Array Operations and Repair Center Equipment	Calibration Support Server	CMMS Server	Configuration Database Server	Correlator Back End Server Node	Correlator Back End Switch	Correlator Back End System	CSP Supervisory Computer	Dark Fiber Antenna Switch	Engineering Database Server	General Services Server	ISP Antenna Switch	LO and Timing Supervisory Computer	Maintenance and Support Server	Monitoring Server
ALLOCATE RELATIONSHIPS			3	3	0	3	4	3	3	3	3	4	0	2	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7	4	3	3	4	12	5	0	0	4	0	3	31	5	3	6	0	0	4	4	0	6	0	0	5	3	3
Logical Structure::10 Proposal Management	Proposal Submission Tool	2																																							->				->	->																						
Logical Structure::10 Proposal Management	Observation Preparation Tool	2																																							->	->				->																						
Logical Structure::10 Proposal Management	Proposal Builder Tool	2																																							->		->			->								->													
Logical Structure::10 Proposal Management	Proposal Handling Tool	2																																							->			->		->																						
Logical Structure::10 Proposal Management::Views	SciOps	2																																							->	->			->	->																						
Logical Structure::20 Antenna Array::Antenna Structure	ACU	9																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Az Drive	9																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Data Transmitter	5																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Digital Back End	6																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Digitizer	6																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Downconverter	6																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	El Drive	9																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Feed Indexer	9																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Flux Reference Generator	12																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Indep Phase Cal System	1																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Mount	17																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Reflector Optics	11																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	RF Receiver	14																																																																	
Logical Structure::20 Antenna Array::Antenna Structure	Time & Freq Reference Generator	6																																																																	
Logical Structure::20 Antenna Array::Antenna Types	Antenna	48																																																																	
Logical Structure::20 Antenna Array::Antenna Types	LB Antenna	48																																																																	
Logical Structure::20 Antenna Array::Antenna Types	Main Antenna	48																																																																	
Logical Structure::20 Antenna Array::Antenna Types	SBA Antenna	48																																																																	
Logical Structure::20 Antenna Array::Antenna Types	TP Antenna	48																																																																	
Logical Structure::20 Antenna Array::Env Monitors	Atm. Delay Monitor System	2																																																																	
Logical Structure::20 Antenna Array::Env Monitors	Weather Monitor System	2																																																																	
Logical Structure::20 Antenna Array	Long Baseline Array	48																																																																	
Logical Structure::20 Antenna Array	Main Array	48																																																																	
Logical Structure::20 Antenna Array	Short Baseline Array	48																																																																	
Logical Structure::20 Antenna Array	Total Power Array	48																																																																	
Logical Structure::30 Central Reference Distribution	Frequency Reference	2																																																																	
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor	2																																																																	
Logical Structure::30 Central Reference Distribution	Time Reference	2																																																																	
Logical Structure::30 Central Reference Distribution	Time Reference Distributor	2																																																																	
Logical Structure::40 Central Signal Processing	Beamformer	2																																																																	
Logical Structure::40 Central Signal Processing	Correlator	2																																																																	

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Pulsar Search Back End	Pulsar Timing Back End	PWR	COTS Integration	COTS Software	CMMS	CMMS Integration Module	Issue Tracking System	Support Module	Offline Sub-System	Workflow Manager	Pipeline System	Archive Access Tool	QA Tool	Archive Ingestor	Archive Streamer	Data Fetcher	Fetching IF	Ingestion IF	QA IF	Science Archive	Online Sub-System	Telescope Calibration	Antenna Supervisor	Array Monitoring IF	Array Monitoring Packet	Array Supervisor	CSP Supervisor	Metadata Capturer	Science Metadata	Science Metadata IF	RFI Monitor	Weather Monitor	RFI Monitoring Data Packet	RFI Monitoring IF	Observation Scheduling Tool	Weather Data Packet	Weather Monitoring IF	Proposal Management Sub-System	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	Proposal Submission Tool	Software Components	Antenna Computing Equipment	Antenna Network	Antenna Rack Power Distribution	Antenna Supervisory Computer	Antenna Switch	Module Interface Board	Array Operations and Repair Center Equipment	Calibration Support Server	CMMS Server	Configuration Database Server	Correlator Back End Server Node	Correlator Back End Switch	Correlator Back End System	CSP Supervisory Computer	Dark Fiber Antenna Switch	Engineering Database Server	General Services Server	ISP Antenna Switch	LO and Timing Supervisory Computer	Maintenance and Support Server	Monitoring Server
ALLOCATE RELATIONSHIPS			3	3	0	3	4	3	3	3	3	4	0	2	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7	4	3	3	4	12	5	0	0	4	0	3	31	5	3	6	0	0	4	4	0	6	0	0	5	3	3
Logical Structure::40 Central Signal Processing	Correlator Back End	2																																																	->						->								
Logical Structure::40 Central Signal Processing	Data Buffer	2																																																	->						->								
Logical Structure::40 Central Signal Processing	Pulsar Search System	2	->																																																														
Logical Structure::40 Central Signal Processing	Pulsar Timing System	2		->																																																													
Logical Structure::50 Online Control & Monitoring	Calibration Module	2																							->																												->	->													
Logical Structure::50 Online Control & Monitoring	Configuration Module	2																																																	->			->											
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor	2																								->																					->			->																	
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor	2																												->																							->							->							
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor	2																																																	->												->		
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor	2																																																	->												->		
Logical Structure::50 Online Control & Monitoring	Data Transmission Module	2																																																	->														
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board	2																																												->					->															
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module	2																																																	->														
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver	2																																																	->									->					->
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector	2																																												->			->			->							->					->		
Logical Structure::50 Online Control & Monitoring	Observation Module	2																																																	->														
Logical Structure::50 Online Control & Monitoring	Operation Module	2																																																	->														
Logical Structure::50 Online Control & Monitoring	QuickLook Module	2																																																	->														
Logical Structure::50 Online Control & Monitoring	Scheduling Module	2																																																	->														
Logical Structure::60 Data Archives	Engineering Data Archive	2																																																	->									->					
Logical Structure::60 Data Archives	Proposal Archive	2																																																	->														
Logical Structure::60 Data Archives	RFI Archive	2																																																	->									->					
Logical Structure::60 Data Archives	Science Data Archive	2																																																															
Logical Structure::60 Data Archives	Staging Storage	2																																																	->														
Logical Structure::60 Data Archives	Telescope Calibration Archive	2																																																	->			->											
Logical Structure::60 Data Archives	Telescope Configuration Archive	2																																																	->			->											
Logical Structure::70 Infrastructure	Central Electronics Building	2																																																															
Logical Structure::70 Infrastructure	Data Distribution System	2																																																															
Logical Structure::70 Infrastructure	Electrical Distribution System	2																																																															
Logical Structure::80 Maintenance & Support	Central Repair Facility	2																																																															
Logical Structure::80 Maintenance & Support	CMMS Integration Module	2				->			->			->																																		->																					
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System	2					->	->																																						->							->		->											->	
Logical Structure::80 Maintenance & Support	Integrated Support Module	2									->	->																																		->																					
Logical Structure::80 Maintenance & Support	Issue Tracking System	2					->			->																																				->																					
Logical Structure::90 Commissioning & Development	Development Support Infrastructure	2																																																															
Logical Structure::90 Commissioning & Development	Simulation Tool	2																																																															

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Pulsar Search Back End	Pulsar Timing Back End	PWR	COTS Integration	COTS Software	CMMS	CMMS Integration Module	Issue Tracking System	Support Module	Offline Sub-System	Workflow Manager	Pipeline System	Archive Access Tool	QA Tool	Archive Ingestor	Archive Streamer	Data Fetcher	Fetching IF	Ingestion IF	QA IF	Science Archive	Online Sub-System	Telescope Calibration	Antenna Supervisor	Array Monitoring IF	Array Monitoring Packet	Array Supervisor	CSP Supervisor	Metadata Capturer	Science Metadata	Science Metadata IF	RFI Monitor	Weather Monitor	RFI Monitoring Data Packet	RFI Monitoring IF	Observation Scheduling Tool	Weather Data Packet	Weather Monitoring IF	Proposal Management Sub-System	Observation Preparation Tool	Proposal Builder Tool	Proposal Handling Tool	Proposal Submission Tool	Software Components	Antenna Computing Equipment	Antenna Network	Antenna Rack Power Distribution	Antenna Supervisory Computer	Antenna Switch	Module Interface Board	Array Operations and Repair Center Equipment	Calibration Support Server	CMMS Server	Configuration Database Server	Correlator Back End Server Node	Correlator Back End Switch	Correlator Back End System	CSP Supervisory Computer	Dark Fiber Antenna Switch	Engineering Database Server	General Services Server	ISP Antenna Switch	LO and Timing Supervisory Computer	Maintenance and Support Server	Monitoring Server
ALLOCATE RELATIONSHIPS			3	3	0	3	4	3	3	3	3	4	0	2	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7	4	3	3	4	12	5	0	0	4	0	3	31	5	3	6	0	0	4	4	0	6	0	0	5	3	3
Logical Structure::90 Commissioning & Development	Testing Environment	2																																																																			
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources	2																																																																		
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools	2																																																			->	->															
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management	2																																																																	
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines	2												->																																																				
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System	2												->																																																				
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces	2																																																																	
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools	2																																																		->	->															
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources	2																																																																	
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources	2																																																																	
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces	2														->																																																	
Logical Structure	Array	48																																																																	
Logical Structure	Central Reference Distribution System	2																																																																	
Logical Structure	Central Signal Processing System	2	->	->																																																->						->									
Logical Structure	Commissioning & Development Systems	2																																																																	
Logical Structure	Data Archive System	2															->	->																																		->			->						->					
Logical Structure	Infrastructure Systems	2																																																																	
Logical Structure	Maintenance & Support Systems	2				->	->	->	->	->	->	->																																	->							->		->												->
Logical Structure	ngVLA System	48	->	->		->	->	->	->	->	->	->																												->	->	->	->	->	->	->			->		->	->	->	->	->			->	->		->			->	->	->
Logical Structure	Offline Subsystem	2																																																																	
Logical Structure	Online Subsystem	2																																												->			->		->	->	->		->				->		->			->		->
Logical Structure	Proposal Management System	2																																						->	->	->	->	->	->							->															

S.99-000 Logical Model to Structural Model Mapping - Allocate Matrix

		ALLOCATE RELATIONSHIPS	Observation Execution Server	Observation Support Server	Operations Console	Other Networking Equipment	Scheduling Database Server	Staging Storage Infiniband Switch	Staging Storage Node	Staging Storage System	CIT Systems	Remote LO & Timing Equipment	LO and Timing Supervisory Computer	Science Operations and Data Center Equipment	Archive Services Server	Continuous Integration Server	General Services Server	Infiniband Switch	Metadata Database Server	Observatory Interfaces Server	Other Networking Equipment	Permanent Storage System	Processing Cluster	Processing Cluster Node	Processing Management Server	Processing Storage Node	Processing Storage System	Proposal Management Database Server	Proposal Management Server	Quality Assurance Support Server	Science Archive Servers	Software Configuration Management Server	Software Development Services Server	Software Test Server	Antenna Foundation	Electrical Interface	Fiber Interface	Antenna Pads	Array Infrastructure Systems	Array Infrastructure Systems Context	Electrical Utility	Fiber Utility	Ops Roads	API	Env Monitor System	RFI Monitor	Weather Station	Chiller Loop	Shielded Chamber	Shielded Chamber HVAC	Shielded Chamber UPS	Central Ops Building	Central Ops Building Context	Central Repair Building	Operations Buildings	Sci Ops Building	Small Ops Building	Tech Services Building	SciOps
ALLOCATE RELATIONSHIPS			**3**	**7**	**3**	**0**	**5**	**0**	**3**	**3**	**51**	**4**	**4**	**25**	**4**	**3**	**0**	**0**	**3**	**4**	**0**	**3**	**6**	**5**	**4**	**5**	**5**	**9**	**7**	**5**	**3**	**3**	**3**	**5**	**0**	**0**	**0**	**0**	**4**	**22**	**3**	**3**	**0**	**1**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**10**	**3**	**4**	**0**	**0**	**0**	**44**
Logical Structure::10 Proposal Management	Proposal Submission Tool	2									->			->														->	->																															->
Logical Structure::10 Proposal Management	Observation Preparation Tool	2									->			->														->	->																															->
Logical Structure::10 Proposal Management	Proposal Builder Tool	2					->				->			->														->	->																															->
Logical Structure::10 Proposal Management	Proposal Handling Tool	2									->			->														->	->																															->
Logical Structure::10 Proposal Management::Views	SciOps	2									->			->														->	->																															->
Logical Structure::20 Antenna Array::Antenna Structure	ACU	9																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	Az Drive	9																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	Data Transmitter	5																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	Digital Back End	6																																																									->
Logical Structure::20 Antenna Array::Antenna Structure	Digitizer	6																																																									->
Logical Structure::20 Antenna Array::Antenna Structure	Downconverter	6																																																									->
Logical Structure::20 Antenna Array::Antenna Structure	El Drive	9																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	Feed Indexer	9																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	Flux Reference Generator	12																																																									->
Logical Structure::20 Antenna Array::Antenna Structure	Indep Phase Cal System	1																																																									
Logical Structure::20 Antenna Array::Antenna Structure	Mount	17																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	Reflector Optics	11																																						->																				->
Logical Structure::20 Antenna Array::Antenna Structure	RF Receiver	14																																																									->
Logical Structure::20 Antenna Array::Antenna Structure	Time & Freq Reference Generator	6																																																									->
Logical Structure::20 Antenna Array::Antenna Types	Antenna	48																																						->																				->
Logical Structure::20 Antenna Array::Antenna Types	LB Antenna	48																																						->																				->
Logical Structure::20 Antenna Array::Antenna Types	Main Antenna	48																																						->																				->
Logical Structure::20 Antenna Array::Antenna Types	SBA Antenna	48																																						->																				->
Logical Structure::20 Antenna Array::Antenna Types	TP Antenna	48																																						->																				->
Logical Structure::20 Antenna Array::Env Monitors	Atm. Delay Monitor System	2																																										->	->															
Logical Structure::20 Antenna Array::Env Monitors	Weather Monitor System	2																																											->		->												
Logical Structure::20 Antenna Array	Long Baseline Array	48																																						->																				->
Logical Structure::20 Antenna Array	Main Array	48																																						->																				->
Logical Structure::20 Antenna Array	Short Baseline Array	48																																						->																				->
Logical Structure::20 Antenna Array	Total Power Array	48																																						->																				->
Logical Structure::30 Central Reference Distribution	Frequency Reference	2																																																									
Logical Structure::30 Central Reference Distribution	Frequency Reference Distributor	2																																																									
Logical Structure::30 Central Reference Distribution	Time Reference	2																																																									
Logical Structure::30 Central Reference Distribution	Time Reference Distributor	2																																																									
Logical Structure::40 Central Signal Processing	Beamformer	2																																																			->						
Logical Structure::40 Central Signal Processing	Correlator	2																																																			->						

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		ALLOCATE RELATIONSHIPS	Observation Execution Server	Observation Support Server	Operations Console	Other Networking Equipment	Scheduling Database Server	Staging Storage Infiniband Switch	Staging Storage Node	Staging Storage System	CIT Systems	Remote LO & Timing Equipment	LO and Timing Supervisory Computer	Science Operations and Data Center Equipment	Archive Services Server	Continuous Integration Server	General Services Server	Infiniband Switch	Metadata Database Server	Observatory Interfaces Server	Other Networking Equipment	Permanent Storage System	Processing Cluster	Processing Cluster Node	Processing Management Server	Processing Storage Node	Processing Storage System	Proposal Management Database Server	Proposal Management Server	Quality Assurance Support Server	Science Archive Servers	Software Configuration Management Server	Software Development Services Server	Software Test Server	Antenna Foundation	Electrical Interface	Fiber Interface	Antenna Pads	Array Infrastructure Systems	Array Infrastructure Systems Context	Electrical Utility	Fiber Utility	Ops Roads	API	Env Monitor System	RFI Monitor	Weather Station	Chiller Loop	Shielded Chamber	Shielded Chamber HVAC	Shielded Chamber UPS	Central Ops Building	Central Ops Building Context	Central Repair Building	Operations Buildings	Sci Ops Building	Small Ops Building	Tech Services Building	SciOps
ALLOCATE RELATIONSHIPS			**3**	**7**	**3**	**0**	**5**	**0**	**3**	**3**	**51**	**4**	**4**	**25**	**4**	**3**	**0**	**0**	**3**	**4**	**0**	**3**	**6**	**5**	**4**	**5**	**5**	**9**	**7**	**5**	**3**	**3**	**3**	**5**	**0**	**0**	**0**	**0**	**4**	**22**	**3**	**3**	**0**	**1**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**10**	**3**	**4**	**0**	**0**	**0**	**44**
Logical Structure::40 Central Signal Processing	Correlator Back End	2									->																																																		
Logical Structure::40 Central Signal Processing	Data Buffer	2							->	->	->																																																	->
Logical Structure::40 Central Signal Processing	Pulsar Search System	2																																																			->							
Logical Structure::40 Central Signal Processing	Pulsar Timing System	2																																																		->							
Logical Structure::50 Online Control & Monitoring	Calibration Module	2									->																																																->
Logical Structure::50 Online Control & Monitoring	Configuration Module	2									->																																															
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Antenna Control Supervisor	2									->																																															->
Logical Structure::50 Online Control & Monitoring::Control Supervisors	CSP Control Supervisor	2									->																																															->
Logical Structure::50 Online Control & Monitoring::Control Supervisors	LO Reference Control Supervisor	2									->	->	->																																													
Logical Structure::50 Online Control & Monitoring::Control Supervisors	Timing Control Supervisor	2									->	->	->																																												
Logical Structure::50 Online Control & Monitoring	Data Transmission Module	2		->							->																																														
Logical Structure::50 Online Control & Monitoring::Hardware Controllers	HW Controller Board	2									->																																														
Logical Structure::50 Online Control & Monitoring	Metadata Capture Module	2		->							->																																													
Logical Structure::50 Online Control & Monitoring	Monitoring Data Archiver	2									->																																													
Logical Structure::50 Online Control & Monitoring	Monitoring Data Collector	2									->																																													
Logical Structure::50 Online Control & Monitoring	Observation Module	2	->	->							->																																													
Logical Structure::50 Online Control & Monitoring	Operation Module	2			->						->																																													
Logical Structure::50 Online Control & Monitoring	QuickLook Module	2		->							->																																													
Logical Structure::50 Online Control & Monitoring	Scheduling Module	2		->							->																																													
Logical Structure::60 Data Archives	Engineering Data Archive	2									->																																														
Logical Structure::60 Data Archives	Proposal Archive	2					->				->			->														->																														->
Logical Structure::60 Data Archives	RFI Archive	2									->																																														
Logical Structure::60 Data Archives	Science Data Archive	2									->			->					->			->								->																											->
Logical Structure::60 Data Archives	Staging Storage	2							->	->	->																																															->
Logical Structure::60 Data Archives	Telescope Calibration Archive	2									->																																														
Logical Structure::60 Data Archives	Telescope Configuration Archive	2									->																																														
Logical Structure::70 Infrastructure	Central Electronics Building	2																																					->												->	->		->			
Logical Structure::70 Infrastructure	Data Distribution System	2																																				->	->		->											->					
Logical Structure::70 Infrastructure	Electrical Distribution System	2																																				->	->	->												->					
Logical Structure::80 Maintenance & Support	Central Repair Facility	2																																																			->	->			
Logical Structure::80 Maintenance & Support	CMMS Integration Module	2																																																						
Logical Structure::80 Maintenance & Support	Computerized Maintenance Management System	2									->																																													
Logical Structure::80 Maintenance & Support	Integrated Support Module	2																																																						
Logical Structure::80 Maintenance & Support	Issue Tracking System	2																																																						
Logical Structure::90 Commissioning & Development	Development Support Infrastructure	2									->			->		->																->	->	->																						
Logical Structure::90 Commissioning & Development	Simulation Tool	2									->			->																				->																						

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		ALLOCATE RELATIONSHIPS	Observation Execution Server	Observation Support Server	Operations Console	Other Networking Equipment	Scheduling Database Server	Staging Storage Infiniband Switch	Staging Storage Node	Staging Storage System	CIT Systems	Remote LO & Timing Equipment	LO and Timing Supervisory Computer	Science Operations and Data Center Equipment	Archive Services Server	Continuous Integration Server	General Services Server	Infiniband Switch	Metadata Database Server	Observatory Interfaces Server	Other Networking Equipment	Permanent Storage System	Processing Cluster	Processing Cluster Node	Processing Management Server	Processing Storage Node	Processing Storage System	Proposal Management Database Server	Proposal Management Server	Quality Assurance Support Server	Science Archive Servers	Software Configuration Management Server	Software Development Services Server	Software Test Server	Antenna Foundation	Electrical Interface	Fiber Interface	Antenna Pads	Array Infrastructure Systems	Array Infrastructure Systems Context	Electrical Utility	Fiber Utility	Ops Roads	API	Env Monitor System	RFI Monitor	Weather Station	Chiller Loop	Shielded Chamber	Shielded Chamber HVAC	Shielded Chamber UPS	Central Ops Building	Central Ops Building Context	Central Repair Building	Operations Buildings	Sci Ops Building	Small Ops Building	Tech Services Building	SciOps
ALLOCATE RELATIONSHIPS			3	7	3	0	5	0	3	3	51	4	4	25	4	3	0	0	3	4	0	3	6	5	4	5	5	9	7	5	3	3	3	5	0	0	0	0	4	22	3	3	0	1	2	0	1	0	0	0	0	1	10	3	4	0	0	0	44
Logical Structure::90 Commissioning & Development	Testing Environment	2									->			->																				->																										
Logical Structure::100 Offline Processing & Archive Interfaces	Computational Resources	2									->			->									X	->																																			
Logical Structure::100 Offline Processing & Archive Interfaces	Data Analysis Tools	2									->			->																X																														
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Management	2									->			->											->																																			
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing Pipelines	2									->			->									->																																				->
Logical Structure::100 Offline Processing & Archive Interfaces	Data Processing System	2									->			->									->	->	->	->	->																																->
Logical Structure::100 Offline Processing & Archive Interfaces	Observatory Interfaces	2									->			->	->					->																																							
Logical Structure::100 Offline Processing & Archive Interfaces	Offline Calibration Tools	2									->			->																->																														
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Resources	2									->			->									X	X		->	->																																->
Logical Structure::100 Offline Processing & Archive Interfaces	Processing Storage Resources	2									->			->												->	->																																->
Logical Structure::100 Offline Processing & Archive Interfaces	Quality Assurance Interfaces	2									->			->						->										->																														
Logical Structure	Array	48																																						->																			->
Logical Structure	Central Reference Distribution System	2																																																										
Logical Structure	Central Signal Processing System	2							->	->	->																																										->						->
Logical Structure	Commissioning & Development Systems	2									->			->		X																->	->	->																									
Logical Structure	Data Archive System	2					->				->			->	->				->			->						->			X																												->
Logical Structure	Infrastructure Systems	2																																					X	->	->	->											->						
Logical Structure	Maintenance & Support Systems	2									->																																											->	->				
Logical Structure	ngVLA System	48	->	->	->		->				->	->	->	->	->	->			->	->		->	->	->	->	->	->	->	->	->	->	->	->	->					->	->	->	->										->	->	->				->
Logical Structure	Offline Subsystem	2									->			->	->					->			->	->	->	->	->			->																													->
Logical Structure	Online Subsystem	2	->	->	->						->	->	->																																														
Logical Structure	Proposal Management System	2					->				->			->														->	->																														->