

The VLA Expansion Project

System Requirements

Revision History

Date	Revision	Description	Contributors
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1 Introduction

This draft of the System Requirements Specification (SyRS) is an initial draft, for internal circulation. Let it be understood from the outset that virtually all of the requirements will be raw rather than well-formed. Additionally, this document will include items other than requirements – speculations, pointers toward areas needing further investigation, etc. It is hoped that at least some portions of this document will be seized upon by the readers and developed in more detail. An attempt will be made to highlight those areas that are clearly not requirements by using italic type in those sections.

1.1 Document Purpose & Scope

This document is not intended to be an outline of the scientific requirements of the VLA Expansion Project. Rather it is meant to be a repository for the issues and items that must be addressed by the computing system in order to achieve both the transition to the Expanded VLA and the goals of the Expanded VLA

The intended audience for this document is those responsible for review of the project, system analysts, and software developers.

1.2 Definitions, Acronyms, & Abbreviations

EVLA – the Expanded VLA

MCB – monitor & control bus

Operator – An individual who has been granted command privileges with respect to the array.

Raw Requirement – A statement of a requirement that has not been analyzed and formulated as a well-formed requirement. (IEEE Std 1233-1996)

Validation – The process of evaluating a system or component during or at the end of the development process to determine whether a system or component satisfies specified requirements. (IEEE Std 610.12-1990)

VLA Operator – An NRAO employee, located at the VLA control building, whose job is to insure the correct operation of the array during an observing program, and to assist in satisfying the day-to-day operational requirements of the array.

Well-Formed Requirement – A statement of system functionality (a capability) that can be validated, must be met or possessed by the system to meet the system objectives, is qualified by measurable conditions, and is bounded by constraints. (IEEE Std 1233-1996)

1.3 References

1. The VLA Expansion Project proposal, Phase I, The Ultrasensitive Array, Feb, 2000
2. IEEE Std 1233-1996, IEEE Guide for Developing System Requirements Specifications.
3. Can Ethernet be Real Time?, Schneider, Stan, Pardo-Castellote, Gerardo, Hamilton, Mark, November, 1998, Real-Time Innovations, Inc.

4. Fault Detection and Handling in the Caltech Millimeter Array, Finch, R.P., Scott, S.L., Owens Valley Radio Observatory, California Institute of Technology, P.O. Box 968, Big Pine, CA, 93513, published by The Astronomical Society of the Pacific, August, 1996

1.4 System Purpose & Scope

TBD

1.5 System Overview

TBD

2 Proposal Generation & Submission

This section may or may not fall within the scope of this document. If proposal generation and submission is defined in a manner that requires the development of software, then requirements for that software must be written. If said software is to be developed by the same group currently charged with developing the computing systems for the EVLA, then those requirements probably do belong in this document.

3 Scheduling

Scheduling is taken to be the allocation of time for use of the array. Scheduling may be dynamic or fixed time allocation. The EVLA will use both. *As with “Proposal Generation & Submission”, it is not yet clear that scheduling will fall within the scope of this document.*

The types of scheduling to be supported are:

- *Goal-oriented scheduling*
- *Dynamic scheduling*
- *Fixed time allocation*

It will be required of the computing system to provide feedback for use by the scheduling system. The types of feedback so far considered include:

- Weather data
- Water vapor data
- Ionosphere data
- Feedback from the Imaging Pipeline concerning the quality & usefulness of the data so obtained.

4 Real-Time Monitor & Control

4.1 Observing Modes

The new control system must support

- All current observing modes
- Enhanced capabilities in mosaicing, fast-switching, and subarray modes
- Total power measurements
- On-the-fly mapping
- User monitoring of current observations on timescales of minutes

- Goal-oriented scheduling
- Interactive observing
- Remote observing

These requirements are taken from section 6.3.1, “Principal Requirements”, of the VLA Expansion Project proposal.

4.2 Array control

Section 1.3.2, “Science with Phase II – the New Mexico Array” of The VLA Expansion Project plan presents three operating modes:

1. An array of 37 antennas consisting of the current 27 VLA antennas, 8 new antennas and two VLBA antennas
2. A standalone array of 10 – 14 antennas consisting of 8 new antennas, the two VLBA antennas at Los Alamos and Pie Town, and up to 4 VLA antennas
3. A continental array consisting of the 8 new antennas, the existing ten VLBA antennas, and some VLA antennas

This description of possible operating modes does much to indicate the degree of flexibility that will be required of the control system. Presumably, for modes 1 and 2 the array would function as a real-time, connected element array, while for mode 3 it would operate as an array for which correlation was done off-line.

From the beginning, the architecture and design of the control system must allow for all anticipated modes of operating the array.

4.2.1 Subarrays

Section 3.1, “The Capabilities of the Ultrasensitive Array”, subsection “Correlator” of The VLA Expansion Project plan states that support for 10 subarrays and three simultaneous operating modes is required. An examination of the surrounding text seems to imply that the phrase “three simultaneous operating modes” refers to the number of polarization products per baseline. There should be no limitations, other than those that may be imposed by the correlator hardware, on intermixing correlator modes such as spectral line vs. continuum among subarrays.

A few words about software design. These statements do not belong in a requirements document, but I cannot resist the temptation offered by a podium. The current software for the VLA includes many “magic numbers” such as 5 for the number of subarrays, and 27, 28, or 29 for the number of antennas. It is hoped that we can completely avoid introducing magic numbers into the EVLA software. For the case of subarrays, the design of the software should be such that the effective number of subarrays is a function of system resources such as processor speed and the amount of available memory, with NO hard coded limits or dependencies. If the availability of needed resources changes, the software should adapt, as a function of the design, to the changes in the resources.

4.3 Antenna Control

4.3.1 Antenna Drive Control

Section 3.1 of the VLA Expansion Project plan, in the subsection entitled “Antenna Drive/Control” gives the following goals:

- Stop-and-shoot imaging on 10 second timescales for mosaicing, with on-source integration of at least 7 seconds for offset movements less than 30 arcminutes
- Continuous raster-scan interferometric observing with rms pointing accuracy of ≤ 10 arcseconds for drive rates of ≤ 2.5 deg/min
- Blind pointing accuracy (1 sigma, calm night conditions) of 6 arcseconds
- Reference pointing accuracy (1 sigma, best conditions) of 2 arcseconds
- Antenna efficiency exceeding 60% at the lowest six Cassegrain frequency bands, and exceeding 40% for the highest two bands

Some of these goals, such as the goals for antenna efficiency, have little or nothing to do with software or the computing system. Others, such as the goal for reference pointing accuracy, do impose software requirements.

4.3.2 Antenna Types

During the transition from the current VLA to the EVLA, four different types of antennas will exist –

- The current VLA antennas
- Upgraded VLA Antennas
- VLBA antennas
- New antennas for the New Mexico Array configuration

The software written for the EVLA must be capable of supporting multiple antenna types.

4.3.3 Number of Antennas

The current draft of the VLA Expansion Project proposal calls for a correlator capable of handling 40 antennas. Forty was chosen as the first multiple of eight that is equal to or greater than the number of antennas expected for the New Mexico Array. The maximum number of antennas actively contributing data at any one time is not expected to exceed 37 – 27 antennas on the VLA Wye, 2 VLBA antennas, and 8 new antennas. Additionally, there is always one VLA antenna in the service barn.

The two VLBA antennas are located at Pie Town and Los Alamos. The Pie Town antenna can already function as a member of the array. The software must support the Pie Town antenna, and must be based on an architecture and design that includes provisions for antennas yet to be added to the array.

The eight new antennas (New Mexico Array) will be located at distances of from 50km to 250km from the VLA Wye. The current plan is to use dedicated fiber optic

communications for the real-time transmission of data and other signals from these remote antennas.

Clearly, the software must support the anticipated number of antennas. As with subarrays, the best approach is to design the software in a manner that does not depend upon any built-in limit. Rather, it should be able to handle any number of antennas, and any mixture of antenna types subject to system resource restrictions such as the amount of available memory.

4.3.4 Antenna Pads

The present VLA contains a total of 74 physical pads on the Wye, including one maintenance pad and one master pad. *(Need more info on the maintenance & master pads.)* The two VLBA antennas will contribute two additional pads, and the eight new antennas will contribute eight pads. The ultracompact E configuration, planned for Phase II of the Expansion project, will contribute a yet to be determined number of additional pads on the Wye.

From the statements made in the foregoing paragraph it follows that the EVLA must be able to:

- Support a number of pads whose final total is not known at this time, and may be not be known at the time the software is designed and written.
- For antennas on the Wye, establish a correspondence between antennas and pads.

It would be desirable to explore the possibility of a “self-configuring” capability for antennas on the Wye, i.e., a combination of software and hardware that would automatically establish the association between a pad and antenna.

4.3.5 Antenna Setup Times

The goal is to achieve a scan reconfiguration time of 1 second, at the antenna. This figure is not meant to be additive. For example, it is not meant to imply a total reconfiguration time of 27 seconds for the 27 antennas on the Wye. Rather, it is meant to indicate the time it will take an antenna to respond to a set of reconfiguration parameters, once the parameters have arrived at the antenna.

4.3.6 Ancillary Antenna Functions

In addition to the functionality required to point and track, it will be necessary to provide software support for:

- Stowing and parking an antenna
- Correct positioning of an antenna to provide maximum safety during periods of high wind speeds
- Positioning of an antenna to handle high snow loads

Operations on an antenna that remove it as a contributor to one or more data streams must result in a reconfiguration of the software that uses, displays, archives, or otherwise examines or manipulates those data streams.

4.4 Monitor Data

4.4.1 Current & New Communications Schemes

The current VLA uses a synchronous, time-multiplexed, half-duplex, waveguide based communications scheme for receiving monitor data from the antennas and for sending commands to the antennas. The expanded VLA will use commercially available networking technology for the communication of monitor data and commands between the antennas and control computers. The software written for the EVLA must support both methods of communication.

4.4.2 Monitor & Control Bus

A fieldbus will be used within the antenna, and, possibly, as a means of communicating with control interfaces on the correlator, and with devices such as the samplers and RFI filters. Two possibilities are under consideration for the fieldbus - CAN (controller area network), and a modified version of the MCB (monitor & control bus) used in the VLBA antennas.

Within an antenna there may be more than one physical bus, and more than one protocol. For example, all devices except the device responsible for total power may be on one fieldbus. Total power may use a separate bus, perhaps running the same protocol, and if a requirement for video from a camera mounted on the antenna arises, it may use a third bus with a protocol that is neither CAN nor the modified VLBA MCB. These two or three separate busses would then converge onto/interface to the network used to communicate monitor data from the antenna to a monitor and control computer in the control building.

4.4.3 Device Characteristics

TBD

4.4.4 Device Complement

TBD

4.4.5 Monitor Points & Data Rates

Engineering/Electronics has begun work on developing a list of monitor points, data rates, and any required timings. In the meantime, a few initial estimates can be taken from Table 6.1 that can be found in section 6.3.1 of the VLA Expansion Project plan. These figures will experience substantial re-analysis and revision.

Data Type	Requirement
Antenna Monitor Data Rate	1700 bytes/sec/antenna
Avg. Antenna Command Data Rate	1300 bytes/sec/antenna
Pointing Command Rate	20 Hz

Once a reasonably complete set of monitor points, data rates, and required timings has been formulated, a rate monotonic analysis or the equivalent thereof should be performed

to insure that the wire and software protocol(s) chosen for the MCB can meet the data rate and timing requirements.

4.5 Error Reporting & Warning Messages

A systematic approach to the issue of warning and error messages must be included in the design of the system. An example of such an approach is embodied in reference [4], “Fault Detection and Handling in the Caltech Millimeter Array”.

I suspect that the Warning & Error Reporting System will prove troublesome. Of necessity, the system will cut an upward directed vertical slash through the horizontal layering of the software. It may prove difficult to keep the Warning & Error Reporting System well modularized and isolated. It would probably be wise to heed the warning implicit in the closing statement of the Caltech paper – “We would consider investigating fault tree design tools (cf. CAFTA and Elliot 1994) before attempting another error system of this magnitude.” The references mentioned in the parenthesis are as follow: CAFTA 1995, Automated Fault Tree Tools (San Diego, Science Applications International Corp.

Elliot, M.S. 1994, IEEE Trans. Reliability, 43, 112

Warning and error messages should:

- Be identified as a warning or as an error (fault).
- Be marked with a severity indicator
- Identify the consequences of the error especially for the case of possible data loss or data corruption
- Identify the root cause of the warning or error
- Suggest corrective action

The degree to which error cascades are a problem is unclear and requires investigation. One clear fault of most error reporting systems is too much chaff, i.e. errors and warnings that are not meaningful in the context of current system activity, and must be ignored. A strong effort must be made to reduce or eliminate warnings and errors that are not meaningful and must be ignored.

Candidate areas for warning & error messages:

- Loss of communication with a subsystem
- Device errors
- Out of range monitor points
- Invalid device commands
- Network failures
- Errors reported by software applications, i.e. I/O errors, math errors, etc.

4.6 Data Flagging

Data determined by the system must be flagged or suppressed. The user interface must alert users/operators that flagging or suppression is occurring, and must present an

indication of why the data has been determined to be invalid. Archived data must contain the same alerts and indicators. The amount of data flagged or suppressed, the time period over which data has been flagged or suppressed, and, possibly, other factors such as affected observing programs, must be logged.

4.7 System Tests & Tuning

Currently, some 20+ tests are run by the VLA operators. In some cases, the purpose of the test is simply to verify that some aspect of the system functions correctly. For example, a stow test is run on a quarterly basis to check auto-stow functionality. Other tests are run, often on a “per request” basis, to measure some characteristic of the system, often hardware characteristics, and may or may not result in changes to the system – perhaps tweaking on the next maintenance day, or perhaps a modification of a module design. An example would be the F3 test, run upon request, to check the phase lock of the oscillator to the standard system frequencies. Finally, there are a number of tests that are run on a regularly scheduled basis which are expected to result in the adjustment of parameters which are maintained in files read by the system for each and every observation performed. An example of this type of test would be a pointing run intended to yield a check on and adjustment to the coefficients of the pointing model as maintained in the system pointing file.

The VLA Expansion system must provide support for all types of tests. It must support the scheduling of periodic and aperiodic tests, perhaps with a priority that overrides the observing schedule. It must archive system parameters at the time of the test, and archive and distribute test results. The results of the tests, and the system parameters at the time of the test, must be available in a form that allows them to be readily and easily used as inputs to analysis programs. Mechanisms for adjusting system parameters based on change sets produced by analysis of test results must exist. Finally, the tests must be easy to run.

Appendix A1 gives a list of the tests currently run. Appendix A2 gives a description of the logic and data flow for tests that are expected to result in the adjustment of system parameters.

Real-Time Data Acquisition & Processing

4.8 Interferometer Model

An initial draft of principal (scientific) requirements will be produced on a March-April, 2000 timeline. For the most part, attempts to formulate system requirements for the interferometer model will wait until the principal requirements have been prepared.

A few initial estimates can be taken from Table 6.1 that can be found in section 6.3.1 of the VLA Expansion Project plan.

Data Type	Requirement
Lobe Rotator Phase/Rate Update Interval	50 milliseconds
Lobe Rotator Phase Precision	0.5 degree of phase

Delay Model Update Interval	50 milliseconds
Delay Model Precision	15.625 picosec

4.9 Correlator

4.9.1 Current correlator

TBD

Items to be characterized include:

- *Record sizes*
- *Data rates*
- *Correlator modes*
- *Integration times*
- *Continuum mode*
- *Spectral line capabilities*

4.9.2 EVLA Correlator

TBD

Items to be characterized include:

- *Record sizes*
- *Data rates*
- *Correlator modes*
- *Integration times*
- *Continuum mode*
- *Spectral line capabilities*

The issue of whether or not the EVLA computer system will be required to control both the current correlator and the new correlator depends on the anticipated delivery date of the new correlator.

4.10 Imaging Pipeline

TBD

5 User Monitor & Control

5.1 Introduction

The EVLA will be deployed as a distributed system. The basic model for monitor and control of the array will be a network connected workstation running GUI based software. Remote observing and maintenance capabilities are to be built into the system from the start. Ideally, what appears to the user as a single interface will be used for end-to-end observability and control of the array both from the VLA site and from Internet based locations. The user interface must be as platform independent as possible.

5.2 Workstation Operating Systems

The VLA Operators will use Sun Solaris based workstations, as will the majority of AOC based operators and users. It is anticipated that the majority of other users will be using either Linux or Windows based machines. The UI software must support all of these platforms. Java and/or a browser-based approach may offer the needed multi-platform capabilities.

5.3 Special Considerations

After hours operational problems will require remote login by software and hardware engineers and technicians for first order problem diagnosis. Support of this requirement may necessitate that either an ASCII interface be developed, or that all personnel who may receive trouble calls be equipped with a computer system whose hardware and software support the interfaces developed for remote interaction with the array. If the latter route is taken, personnel unfamiliar with such equipment must be trained, and the needed hardware and software must be purchased and supported.

5.4 Maintenance Interfaces

It is likely that subsystems at the antenna, the correlator, the D-racks and other locations will include diagnostic/maintenance ports that will accept connection of a laptop or similar device to be used for troubleshooting. Development of and support for the software running both in the subsystem and on the laptop will be required.

5.5 Operators, Operations, Remote Observing

The VLA Operators occupy a special position with respect to the conduct of observations and day-to-day operations. The monitor and control capabilities needed for remote, internet-based observing constitute a subset of the capabilities needed by the VLA Operators.

Interface capabilities must honor the concept of “privilege”, i.e. certain capabilities of the interface can be used only by those individuals who have been granted the appropriate level of privilege. For example, an observer may request and receive command & control privileges, but it should not be possible for an observer to grant or revoke levels of privilege to other users. All components of the user interface must check and respect levels of privilege. The user interface should include a means to grant, change, and revoke levels of privilege to other users by those who have a level of privilege sufficient to do so.

If access to monitor data and data products, the queuing of commands, and other functionality can be prioritized, then the VLA Operators and those with an equivalent level of privilege should have the highest priority access. Observers with command privilege should have the next highest level of privilege. Access priority should be modifiable by those who possess the correct level of privilege.

5.6 Interface Functionality

Below, a list is given of some items that should be available via user interfaces. Interface items that may be associated with restricted access are given in **bold**. Some of the displays/interfaces will require an awareness of subarrays.

- All monitor point values, current and historical
- Status of current observing program(s), by subarray, including:
 - name of current observe file(s)
 - current observing mode(s)
 - current correlator mode(s)
 - antenna complements
 - worst case position error(s)
- Quality of data displays
- Data flagging
- Weather, for all antenna sites
- Errors & Warnings
- Operator log entry (for both VLA Operators & Observer/operators)
- Antenna information such as:
 - receiver complement
 - pad location
 - quality of pointing
 - current subarray affiliation
 - current observing program affiliation
- **Command interfaces for all user controllable devices**
- **A means to manipulate the current observing schedule**
- **A method for granting, revoking, and changing levels of privilege**
- **A method for terminating a login session**
- **A method for blocking login sessions**
- Network status

The interface should possess the ability to transfer data among various windows, especially the ability to transfer information from any given window into the operator's log.

5.7 Command Logging

An issue that needs examination is whether or not commands issued to the system are to be logged. All commands? At what level will command capture be done?

Certainly, all logged information, commands or otherwise, must be date/time stamped. For commands, should there also be a tag indicating the source of the command, i.e. the session/login associated with the issuance of the command?

6 Data Archive

At this point in time (2/2000) the term “data archive” is used in a very general sense. It is meant to include data that is stored in memory, on disk, on tape, and perhaps on other media such as CD-ROMS & DVDs. There is no implication that all of the data is on-line, and there is no implication that all of the data is located at one physical location.

6.1 Data Products

6.1.1 Current Data Products

The data products currently produced by the VLA include:

- Visibility data
- Monitor data
- Reference pointing data
- Tipping data
- VLBI calibration data
- Antsol (calibrator) data
- Scan archive data
- Maintenance workorders/requests
- RFI (radio frequency interference reports)
- Test output, some of the more notable being
 - Pointing data used for model analysis
- Baseline data

6.1.2 New Data Products

For the EVLA, the data to be archived will include all of the data currently archived, plus numerous new data products. The new data products will include (see ref 1, section 6.3.1, the subsection entitled “Standard data products”):

- Proposal cover sheet
- Observing schedule and operator log
- Data from ancillary instruments
- Flagging information
- System configuration information
- Derived calibration instrument
- Default images
- Interferometer model accountability information
- Repeatable, documented processing script in AIPS++

This list of new data products is not exhaustive. It must be accepted that no list of data products will be exhaustive &/or final. The expectation is that new data products will be added over time, some old data products may be removed, and that the formats in which the data products are stored and retrieved will change. The EVLA data archive - software, hardware, and operational procedures, must be designed to deal with the fact that data products are evolving, changing entities.

6.1.3 Data Storage & Retrieval Formats

No standard format has been specified for the storage of data in the data archive. One or more standard formats for the delivery of data retrieved will be specified. FITS and AIPS++ tables are likely retrieval formats. The storage formats and retrieval formats need not be the same.

6.1.4 Modifications to Current Data Products

In the current VLA, the first channel of the frequency spectrum is replaced by the spectrum average. For the EVLA, the full frequency spectrum will be retained to allow resampling of the spectrum and the application of smoothing functions. This requirement is called out explicitly in The VLA Expansion Project plan, section 3.2.3, "Reduction of Systematic Errors."

7 Data Distribution

TBD

8 System Security

8.1 Introduction

Security will have several components. At a minimum, a policy or policies defining access to the array (any type of login), access to current data products, and levels of privilege will be required. From the beginning, the software must support these concepts.

8.2 Logins

It must be possible to:

- Require a user IDs for a login
- Require at least one level of password protection for logins
- Associate a level of privilege with a login
- Terminate a login session
- Block logins from specified sources
- Block logins associated with specified user Ids
- *Block logins associated with specified passwords*
- Block all remote logins
- Determine all current logins and the attributes, if any, associated with the logins/sessions.

8.3 Levels of Privilege

The concept of privilege has been introduced as a means of discussing control and security mechanisms. Privilege per se need not be the mechanism chosen, but it is clear that a means must be implemented for restricting some operations to users who have been designated as authorized to perform those operations. Some of the restricted operations would include:

- *The ability to issue commands to the array*
- *Access to some data products, especially current data*
- *Access to components of the security system such as password files, user ID files, etc*
- *The ability to grant, revoke, &/or change the level of privilege held by a user*

The VLA Operator will always have the highest level of privilege. It must be possible for other individuals, including those working remotely, to also possess the highest level of privilege.

9 Network Requirements

At this point in time, network requirements have not been given a great deal of thought. For the majority of the system, it is likely that IP over Ethernet will be sufficient. This statement will probably hold true even for the real time portions of the network. Most of the real time communication requirements are not excessively demanding - millisecond requirements rather than microsecond. Studies and papers such as reference [3] provide guidelines for estimating the suitability of Ethernet for a particular real-time application.

Having said IP over Ethernet leaves a great deal unsaid. 10Mbit? 100Mbit? Gigabit? Different portions of the system will require different network capacities. Switching. It will be necessary to isolate some portions of the network from the effects of loading in other areas. Gateways. An approach for limiting and otherwise controlling traffic coming from off-site locations may be required.

IP over ATM and raw ATM may need to be investigated. The Quality of Service (QoS) capability of ATM may be either desirable or actually needed in some portions of the system. Networking approaches that allow prioritization of data streams, either actual prioritization or network configuration that gives the same effect may be needed.

Fibre channel may need to be examined as a candidate technology for handling the correlator output and for portions of the data archive. Front Data Port (FDP) over fibre channel is likely to be the interface presented by the output of the ALMA correlator. Storage Area Network (SAN) &/or IP over fibre channel may be good candidate technologies for some of the problems presented by the data archive. Raw fibre channel & FDP over fibre channel has already reached speeds of 100Mbytes/second, and are likely to reach 200Mbytes/second within a few years.

Network management issues require examination. What sort of network monitoring will be done, what tools will be purchased and written to assist in this task? How will network failures be handled when they do arise? What is the reliability spec required of various portions of the network? For areas where very high reliability is required, how will that requirement be satisfied?

10 Environmental & Physical Considerations

10.1 Site Attributes

Give info on site altitude, temperature range, and other important characteristics.

10.2 Antenna

10.2.1 Pedestal Room

Give quantitative & qualitative factors – i.e. the room is temperature controlled, it is a dusty environment, and there is a risk of oil and grease contamination because it is located below the motors & gearing. Does the room move in azimuth? (Yes?) Does it move in elevation? (No?) Give room dimensions & shape? Give present disposition and complement of equipment located in the present VLA & VLBA antennas?

10.2.2 Vertex Room

Basically, the same questions and issues that are raised for the pedestal room must be raised and answered for the vertex room.

10.3 D-Rack Room

TBD

10.4 Control Room

TBD

10.5 Correlator Room

TBD

10.6 Other Locations

TBD

Appendix A1, System Tests as of 01/2000

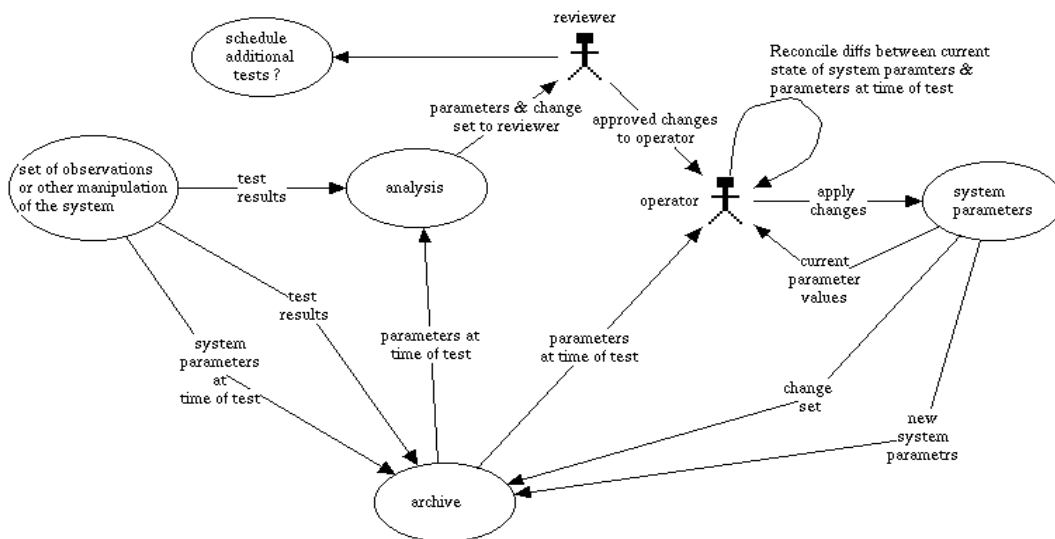
The tests given below are taken from a table that is distributed by the VLA Operations Supervisor (Phillip Hicks). The tests are scheduled by VLA Operations. All tests are available upon request. Subsets of these tests are also run in test sub-arrays during reconfiguration and re-commissioning of antennas.

Test	Division	Frequency	Purpose	Analysis	Duration
Anemometer	Antenna Servo	Quarterly	Detect malfunctions	Frost/Van Horn	10 minutes
Baselines	Operations/Computer	Mnthly/Moves	Correct baselines	Analysts/Ops/Cmptr	> 4.5 hours
Correl	Correlator	Weekly	Correlator check	Ferraro/Revnell	70 mins/band
Cross-hand delays	Operations	Wkly, Startup	Set delays	VLA Operator	30 mins/band
Delays	Operations	Wkly, Startup	Check delays	VLA Operator	~ 4 hours
DVStart	Operations	Monthly	Fringe check	Van Horn	30 minutes
F12 Test	LO/IF	By request	Test F12 lock	Mertely	20 minutes
F3 Test	Front End (FE)	By request	Check F3 locks	Mertely	45 minutes
Focus Test	Operations	1 band/Startup	Test focus settings	VLA Operator/Van Horn	15min/band
L6 Test	LO/IF	By request	Test L6 lock	Cotter	30 minutes
LRFI	Scientific Services	Monthly	Check for RFI	Amendariz et al.	0.5 – 5 hours
Modcal	Operations	Wkly, Startup	Scale F/D10 display	VLA Operator	20 minutes
Moon	Front End (FE)	By request	Measure Tcal/Tsys	Mertely	6 hours
PN3DB	Operations	Monthly	Find tracking errors	Analysts	45 minutes
Pointing	Ops/Analysts/Cmptr	BiMnthly/Moves	Det pointing constants	Analysts/Ops/Cmptr	2 – 5 hours
Standard Field Observations	Scientific Services	C Configuration	Correlator checkout	G. Taylor	9 hours
Stow Test	Antenna Servo	Weekly	Check auto stow	Van Horn/Frost	45 minutes
SysRelay	LO/IF	By request	Test Fluke relay	Cotter	15 minutes
SysTest	FE/Smith/Cotter	Wkly, Startup	FE test	Mertely	45 minutes
Tipping Curve	Front End (FE)	By request	Measure Extinction	Mertely	30 minutes
Tsys	FE/Mertely	Wkly, Startup	Find system temps	VLA Operator/Van Horn	20 minutes

Appendix A2, System Tuning

The following is a generalized description of the procedures for tests used to adjust system parameters. Details for specific tests will vary.

A set of observations or other manipulations of the system is performed. Relevant system parameters, including, but probably not limited to, those targeted for change are captured (archived) at the time of the test run. The results of the test are archived, distributed and analyzed. It is likely that the system parameters at the time of test, in addition to the test results, will be required for the analysis. Usually, some portion or all of the analysis process is performed using software that has been written specifically for the tests in question. Often, the analysis program is run by someone trained to use the software, but who is not otherwise an expert on the analysis performed. The analysis produces a set of suggested changes &/or a set of updated system parameters. The original parameters and the set of suggested changes are submitted to a resident expert for review. The review process can result in the approval or rejection of some or all of the suggested changes. The results of the analysis and review may necessitate the scheduling of additional tests. If at least some of the changes are approved, they are sent to the VLA operators. The VLA operators compare the current state of the system parameters to be changed to their state at the time of the test run. If the two states are not identical, differences must be reconciled, and the impact of the differences on the suggested changes must be evaluated. Finally, all changes still considered valid are applied to the system parameters. The change set and the new values of the system parameters are archived.



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