LOGISTICS AND DIRECTIONS

EVLA Correlator System—General Installation Plan

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Table of Contents

List of Tables

1 Revision History

Revision	Date	Changes/Notes	Author
DRAFT	Sept. 15, 2006	Initial DRAFT release for review. Plan and personnel estimates require feedback from NRAO.	B. Carlson

2 Introduction

This document describes the general plan and timeline for installation of the EVLA correlator at the VLA site Central Electronics Building. It does not include specifics of any wiring or cable installation, but rather it outlines the logistical plan for installation of the correlator, including expected timelines as of the date of this writing, and on-site personnel estimates.

The correlator resides entirely within the new screened room built for the purpose of housing the correlator. For further detailed information on correlator room requirements, refer to document A25012N0000, "EVLA Correlator Room, Requirements and Functional Specifications".

Heavy reliance is made on NRAO personnel[1] for installation, and indeed this plan relies on availability of such personnel, although it does not rule out provision for NRC technical personnel to help with installation. This plan will attempt to estimate, as best as possible, the number of person-days required for installation of each aspect of the system, based on approximately 5 hours of useful work per day. NRC will provide one or more engineers on-site to assist with installation of various aspects of the system when requested by NRAO, and/or deemed necessary by NRAO/NRC. Most importantly, NRC will strive to provide all of the material, subsystems, and documentation so that installation may proceed in as straightforward a manner as possible. This includes any preparation of material (cables, racks, connection points) and "kitting" of material and documentation to facilitate installation.

This document does not contain any plans or reference for installation and test of the prototype correlator for on-the-sky tests. That plan is contained in the separate document A25010N0005.

[1] Defined as those technical personnel who normally work at the VLA site. It does not include other NRAO or NRC engineering/correlator development personnel that may be required for assistance/consultation.

3 General Installation Plan and Schedule

The general plan for the installation of the correlator is described in the following sub-sections.

3.1 –48 VDC Power Plant Installation

The –48 VDC power plant is a COTS (Commercial Off-The-Shelf) system that provides mains DC power for all of the correlator "**S**" (Station) and "**B**" (Baseline) racks. This system is in the tendering/bidding stage, with the bid process closing on September 19, 2006. Depending on the length of time to select a supplier and sign a contract, it is expected that this system will be delivered to the VLA site by the end of calendar year 2006, or early in 2007.

Estimate 40 person days of NRAO on-site technical effort for electrical wiring and system check out.

3.2 Hi-speed Inter-rack Cable Installation

Inter-rack high speed cabling is in the purchase/evaluation stage. Depending on prototype board delivery and testing, it is expected that this cabling will be available for installation in Q2 or Q3 2007. These cables are installed before the correlator racks arrive, and a detailed installation plan is now available A25005N0001. In total, 512 cables have to be installed under the correlator room computer floor.

Estimate 0.5 person hours for each cable x 512 cables ~= 51 days.

3.3 Correlator Rack Installation

Correlator racks will be outfitted and tested as much as possible in Penticton. A specification for outfitting these racks exists (A25017N0005). It is expected that these racks will be shipped to the VLA site in Q4 2007 or Q1 2008.

Correlator racks are installed in the correlator screened room in Q4 2007/Q1 2008. These racks are fully tested in Penticton, and installation involves moving each rack with a pallet lifter and bolting it into place (each rack is bolted and shipped on a 4 ft x 4 ft pallet). Once the racks are secured, installation of the high-speed inter-rack cabling ends coming out of the floor into the S and B racks termination points can be performed. This step will more than likely require on-site assistance by NRC engineering. Some additional S rack-to-S rack high-speed cable must be installed as well. A separate plan for installation of these cables will be made available in advance of installation.

Estimate 1 person day to move and bolt into place each rack for a total of 24 person days.

3.4 Overhead Cable Tray Installation

Once the racks are installed, overhead cable trays can be installed. NRAO has indicated that the racks are used to support the cable trays, and hole locations in the four corners of the roofs of the racks exist for this purpose (Figure 4-2, A25012N0000). There are two sets of overhead trays; one set for the purposes of –48 VDC power cabling, and one set for the purposes of signal cabling.

Estimate 10 person days for overhead cable tray installation.

3.5 –48 VDC Power Cabling Installation

Once overhead trays are installed, -48 VDC power cabling can be installed and connected from the –48 VDC breaker panel outputs to bolting locations in the racks' breaker panels. There is one pair of wires for each rack, and it is NRAO's responsibility for the purchase and preparation of these wires for installation. Wires should be sized for 200 A capacity for each rack (-48 VDC system breakers are 200 A); sizing specifications are given in A25012N0000 and bolting connections specifications are TBD (once the –48 VDC power plant supplier is chosen, and the distribution breaker bolt size is known).

Estimate 1 person hour to prepare each cable pair for installation (cut to length, crimp), and 1 person hour to install each cable pair. Total estimated effort is 24 x 2 hrs ~= 10 person days.

3.6 Overhead Communications and M&C Wires

Overhead communications and M&C wires are installed next. Two 100-wire power M&C cables and two category 5E Ethernet cables are routed from each correlator rack to the Control Racks. Ten category 5E Ethernet cables are routed from each of the B racks to the CBE racks' Ethernet switches. (Additional category 5E cables will likely route from the S racks to the CBE switches to facilitate Station Board data transfer to Fast Formatter computers, if required—see D25028R0001)

The M&C cables are custom built to length and therefore NRC will develop a detailed model of the room, racks, overhead trays and Control Racks to ensure that lengths are correct. The category 5E Ethernet cables (using RJ-45 connectors on either end) will likely be custom cut to length and installed on site, since cutting and crimping tools for this purpose are widely available. If the Control Racks and the CBE racks are not yet installed at this time, the cable ends (into those racks) can be left un-terminated, or terminated with enough cable slack to guarantee they are long enough to plug into equipment once the racks are in place.

Estimate 1 person hour for cutting, end crimping, labeling, and installation of each Ethernet cable. Estimate 1 person hour for installation of each M&C cable. Total estimated effort is 216 hours + 48 hours ~= 53 person days.

3.7 Control Rack Installation

There are two 19" COTS correlator Control Racks. They contain COTS components (two rack-mount PCs and a switch), and are described in A25026N0000. These are installed near the correlator racks. Each Control Rack requires two 15 A, 110 VAC circuits with standard 110 VAC plugs. The 110 VAC supply must be battery-backed, with ~½ hour capacity[2]. Control Racks are fully assembled and tested in Penticton, and shipped to the site ready for power and signal cable installation. These Control Racks will likely be ready and shipped with correlator racks in Q4 2007.

Estimate 5 person days to install and check out these Control Racks.

3.8 CBE Installation

The array of CBE computers and Gbit Ethernet switches are installed next. Several possible CBE configurations and network topologies are shown in D25028R0002. To maximize performance and minimize price, CBE computers will be purchased and installed at the latest possible date (i.e. shortly before production correlator boards are installed), likely in mid 2008. It is possible the CBE will be spec'd and purchased as a complete system. Final CBE configuration (No. of racks, power per rack, performance) is TBD.

Estimate 20 person days for installation, wiring, and basic system checkout.

3.9 Production Board Install, Test, and Commissioning

Incremental installation and test of correlator boards will likely happen in two stages:

(a) Stage 3 production (16 Station Boards, 16 Baseline Boards, and necessary Fanout Boards) followed by

(b) Stage 4 (full) production. Stage 3 boards are expected in mid 2008, stage 4 boards are expected at the beginning of 2009.

Note that if a Baseline rack is partially populated, each unpopulated slot must be filled with an "HM Gbps Termination Board" to maintain signal integrity from the Fanout Boards. NRC will develop and build a number of these termination boards to facilitate incremental installation and test of correlator boards.

The length of time required for installation and test depends, of course, on care and diligence in previous testing. The current schedule allows for nearly one full year for this phase, ending in Q1, 2010 with the turning off the old correlator and relying on the new

[2] The battery-backup capacity must be greater than the correlator –48 VDC battery backup, under power saving conditions. ½ hour is a reasonable estimate. If this can't be achieved with the mains AC backup, then a Control Rack-mount secondary backup may be required, as described in A25026N0000.

correlator for full operations. This phase likely does not require any specific on-site NRAO personnel effort.

4 Summary Table of Deliverables, Timelines, and Site Personnel Requirements Estimates.

A summary table of installation deliverables, timelines, and site personnel requirements is shown in the following table. Personnel estimates are for NRAO site personnel only and do not include correlator development engineering support provided by NRC and NRAO; it can be assumed that development engineering support will be provided as and when requested by NRAO and/or deemed necessary by NRAO/NRC.

Section	Description	Expected delivery/ installation	Existing Relevant Document(s)/ Plan(s)	Estimated NRAO Site Personnel (person-days)
3.1	-48 VDC power plant.	Q4-06/Q1-07	A25012N0000	40
3.2	Inter-rack hi-speed cabling (512 cables)	Q2/Q3-07	**A25005N0001**	51
3.3	Correlator racks.	Q4-07/Q1-08	A25017N005	24
3.4	Overhead cable trays.	Q1-08	A25012N0000	10
3.5	Overhead -48 VDC power cabling to correlator racks	Q1-08	A25012N0000	10
3.6	Overhead M&C and Ethernet communications wiring	Q1/Q2-08	D25028M0001	53
3.7	Control Racks	Q1/Q2-08	A25026N0000	5
3.8	Correlator Back End (CBE)	Q2/Q3-08	D25028R0002	20
3.9(a)	Stage 3 production; incremental board install and test.	Q2/Q3-08		
3.9(b)	Stage 4 (full) production; incremental board install and test.	Q1-09		
Total NRAO personnel requirements (person-days)				213

Table 4-1 Summary table of deliverables, timelines, and site personnel requirements estimates.

Note that document numbers in the above table in **boldface** are complete installation plans ready for use.