MCS Documentation for LWA-1 PDR
Ver. 4
S. Ellingson
Feb 25, 2009

MCS is defined in the following documents:

- S. Ellingson, "MCS Subsystem Definition," Ver. 2, LWA Engineering Memo MCS0004, Feb. 23, 2009. [online] http://www.ece.vt.edu/swe/lwavt/.
- S. Ellingson, "MCS Architecture," Ver. 3, LWA Engineering Memo MCS0007, Feb 25, 2009. [online] http://www.ece.vt.edu/swe/lwavt/.

The following document defines the "MCS Common ICD" which is the basis for passing of command and status information between MCS and other LWA-1 Level-1 subsystems:

- S. Ellingson, "MCS Common ICD," Ver. 0.2, Long Wavelength Array Engineering Memo MCS0005, Feb. 23, 2009. [online] http://www.ece.vt.edu/swe/lwavt/.

The following additional documents also pertain to the operation of MCS:

- S. Ellingson and A. Cohen, "Beam Dwell and Repointing Time Requirements Derived from Memo 128 Considerations," LWA Memo 146, Dec 7, 2008. [online] http://www.phys.unm.edu/~lwa/memos. (Also known as Engineering Memo MCS0003.)
- S. Ellingson, "Beam Dwell and Repointing," LWA Memo 144, Nov 25, 2008. [online] http://www.phys.unm.edu/~lwa/memos. (Also known as Engineering Memo MCS0002.)

MCS Components, Cost, and Power Consumption

MCS not including Data Recording (MCS-DR):

Item	Description	Power	Cost	Vertical Rack Space
Scheduler	computer	600W	$2000	6U (tower case mounted sideways)
Executive	computer	600W	$2000	6U (tower case mounted sideways)
Task Processor	computer	600W	$2000	6U (tower case mounted sideways)
Gateway	managed switch	100W	$1500	2U
Command Hub	managed switch	100W	$1500	2U
Other (see below)	(misc)	_____	$1000	2U
	TOTAL	2 kW	$10k	24U

MCS-DR (minus LTO tape drives):

Item	Description	Power	Cost	Vertical Rack Space
Data Recorder #1	computer	700W	$2000	6U (tower case mounted sideways)
Data Recorder #2	computer	700W	$2000	6U (tower case mounted sideways)
Data Recorder #3	computer	700W	$2000	6U (tower case mounted sideways)
Data Recorder #4	computer	700W	$2000	6U (tower case mounted sideways)
Data Recorder #5	computer	700W	$2000	6U (tower case mounted sideways)
10GbE NICs (5 @ $595 each)			$2975	(in computers)
CXP4 cables (5 @ $105 each)			$525	
Additional TB-class drives (5 @ $200 ea.)			$1000	(in computers)
Other (see below)	(misc)	_____	$1000	6U
	TOTAL	3.5 kW	$15.5k	36U

LTO Tape Drives for MCS-DR (optional, but recommended):

Item	*Power*	*Cost*	*Vertical Rack Space*
LTO tape drives (5 @ 35W & $3k/drive)	175W	$15,000	(shelf space in user-accessible area)
Initial supply of 100 tapes @ $30/tape		$3,000	
TOTAL	175W	$18k	

Notes:

1. "Other" includes cables, cable management, power strips, rackmount hardware (but not racks), and TCD interface hardware.
2. Power source in all cases are 110VAC.
3. All power estimates and vertical rack space estimates are believed to be conservative.
4. Assumed 10GbE NIC is Myricom 10G-PCIE-8A-C.

Estimated Schedule for MCS Procurement

It is recommended that procurement of MCS components be conducted in three phases:

Phase 1: *Components needed for development leading to CDR.* These should be procured by the Project Office as soon as possible after being specified by Virginia Tech. The specification of these items will be one of the first tasks immediately following PDR.

MCS not including Data Recording (MCS-DR):

Item	Description	Cost
Scheduler	computer	$2000
Gateway	managed switch	$1500
Command Hub	managed switch	$1500
One half of "Other"		$500
	TOTAL	$5500

MCS-DR (minus LTO tape drives):

Item	Description	Cost
Data Recorder #1	computer	$2000
Data Recorder #2	computer	$2000
10GbE NICs (2 @ $595 each)		$1190
CXP4 cables (2 @ $105 each)		$110
Additional TB-class drives (2 @ $200 ea.)		$400
One half of "Other"		$500
	TOTAL	$6200

LTO Tape Drives for MCS-DR (optional, but recommended):

Item		*Cost*	
1 ea. LTO tape drive		$3000	
5 ea. tapes @ $30/tape		$150	
	TOTAL	$3150	PHASE 1 TOTAL: $14,850

Phase 2: *Components required to achieve station IOC.* These should be procured by the Project Office as soon as possible after the proposed "DP + MCS" CDR.

MCS not including Data Recording (MCS-DR):

Item	Description	Cost
Executive	computer	$2000
Task Processor	computer	$2000
Other half of "Other"		$500
	TOTAL	$4500

MCS-DR (minus LTO tape drives):

Item	Description	Cost	
Data Recorder #3	computer	$2000	
Data Recorder #4	computer	$2000	
Data Recorder #5	computer	$2000	
10GbE NICs (3 @ $595 each)		$1785	
CXP4 cables (3 @ $105 each)		$330	
Additional TB-class drives (3 @ $200 ea.)		$600	
Other half of "Other"		$500	
	TOTAL	$9215	PHASE 2 TOTAL: $13,715

Phase 3: *Components not critical to station IOC.* These should not be procured by the Project Office until it is clear that all IOC-critical costs are covered and that these devices can be productively employed upon arrival. By waiting until the "last minute" to purchase these items, it may be possible to take advantage of the steep downward price trend of these items.

LTO Tape Drives for MCS-DR:

Item	*Cost*	
LTO tape drives (4 @ $3k/drive)	$12,000	
95 tapes @ $30/tape	$2850	
TOTAL	$14,850	PHASE 3 TOTAL: $14,850

Estimated Schedule for Installation and Integration

Estimated date of readiness for the proposed DP + MCS CDR: To determine this, the following assumptions are made: (1) The currently-scheduled funding halt of March 2009 for current (FY07) funds is extended, (2) FY08 funds are received at Virginia Tech prior to the expiration of FY07 funds, (3) Phase 1 procurement items can be delivered to Virginia Tech by June 1, 2009, (4) Complete and "frozen" specification of all subsystem interfaces intending to use the "MCS Common ICD" (including MIBs and command message syntax) by April 6, 2009, (5) Complete and "frozen" specification of the DP to MCS-DR interface by June 1, 2009, and (6) Completion of the proposed "all but DP+MCS" CDR by June 1, 2009. Given these assumptions, MCS will be ready for the proposed DP + MCS CDR by October 1, 2009.

Estimated date of readiness for the proposed "limited operational capability" (DP installed with 10-20 stands) milestone: To determine this, the following additional assumptions are made: (6) The currently-scheduled funding halt of September 2009 (end date of planned (FY08) funds) is extended, and (7) Phase 2 procurement items are obtained by the Project Office by January 2010. Given these assumptions, MCS will be ready for this milestone by February 1, 2010. To be specific: by this date UNM will be in possession of all materials, equipment, and information necessary to install MCS in

LWA-1, and to begin integration activities including rudimentary support for the 10-20 stand system.

Estimated date of readiness for LWA-1 IOC: Remaining VT activities on MCS following the Feb 2010 "limited operational capability" milestone will be primarily on the completion and testing of application software pertaining to observation scheduling, diagnostics, and other high-level functions pertaining to the operation of the station. Given assumptions (1)-(7), this activity will be complete to the level of LWA-1 IOC readiness by October 1, 2010 (i.e., the same as the date currently specified for LWA-1 station-wide IOC.)

Version History

Feb 25, 2009 (Ver. 4):
- Updated to reflect new MCS architecture document (i.e., MCS0007 is now Ver. 3).
- Updated schedule discussion to reflect agreement with the project office (J. Craig) that ICDs affecting MCS would not be frozen at PDR, but instead would be completed and then frozen.

Feb 23, 2009 (Ver. 3):
- Updated costs to reflect 10GbE NIC selection and cost of CXP4 cables.
- Pointed out schedule risk associated with delay in finalizing monitor/control and data transfer interfaces with DP.
- Fixed typo in year ("2009" where it should have been "2010" in some places).